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NRL Report 8450

Chemical Laser Computer Code Survey

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December 1, 1980



NAVAL RESEARCH LABORATORY
Washington, D.C.

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) A survey of modeling capability for predicting chemical laser performance has been carried out. Optics, kinetics and gasdynamics codes are included in the survey. Seventy-eight separate codes developed at thirteen research centers are covered in this report. Both quick-look summaries and more in-depth summary sheets have been prepared for each code. A supplementary narrative section provides introductory material concerning code features and capabilities as well as explanation of terminology used on the survey forms. This document is intended as a comparison of code features and as an introduction to capabilities of individual codes. Points of contact at each research establishment are (Continues)		

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20. Abstract (Continued)

provided for the reader to pursue a more comprehensive followup to this initial survey material. This report will be updated periodically as these codes evolve in capability.

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CHEMICAL LASER COMPUTER CODE SURVEY

Section I

INTRODUCTION

As part of its program to evaluate novel resonator concepts for high-energy laser applications, the Naval Research Laboratory (NRL) has conducted a survey sponsored by the Defense Advanced Research Projects Agency (DARPA) to determine the features and capabilities of government- and contractor-developed computer codes that model one or more features of hydrogen fluoride/deuterium fluoride chemical laser resonators. The purpose of this survey was to obtain a detailed measure of the extent of the current and near-term state-of-the-art modeling capability for predicting chemical laser performance. Because many diverse chemical laser codes exist, it was recognized that comparisons and evaluations of codes, models, and computational techniques would best be accomplished if each code architect assessed the capabilities, limitations, merits, and demerits of his own code or model for chemical laser resonator analysis and performance.

A code survey form (Appendix A) was prepared to aid in gathering information in three main areas of concern in modeling chemical lasers: optics, kinetics, and gas dynamics. It was recognized that certain codes might in some aspects be more powerful than would be required for analyzing the continuous-wave (CW), supersonic, diffusion-mixing, cold-reaction HF chemical laser. The government is interested in identifying any such extended capabilities. For this reason some generalization of the survey form in each of the three cited areas was attempted. It was also recognized that some aspects of the survey form would probably be too specific or else too general to accommodate all applicable codes and models to which they were addressed. Therefore, respondents were encouraged to cite deficiencies, make recommendations for improvements, and depart from the prescribed format when necessary to describe better the features of their codes or models.

A potential list of recipients for the chemical laser code capability survey was prepared using the following sources:

1. Attendees to the Novel Resonator Mid-Term Review held December 5 and 6, 1978, at NRL
2. Authors of papers presented at the 6th Tri-Service Chemical Laser Symposium held August 28-30, 1979, at the Air Force Weapons Laboratory
3. Attendees to the Intra-Cavity Adaptive Optics (ICAO)/Internal Focal Line Aperture (IFLA) Review held April 10, 1979, at the Air Force Weapons Laboratory
4. Distribution list for Novel Resonators for High Power Chemical Lasers Program provided by NRL.

Manuscript submitted August 6, 1980.

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This list (Appendix B) includes 165 names of researchers and, in some cases, shows their current or recent areas of interest. Rather than attempt to communicate directly with this large number of potential survey recipients, it was decided instead to send several copies of the survey form to key individuals at the various companies and government agencies involved and let them make the internal distributions. This final list included 51 names and is also included in Appendix B.

A significant amount of code development, capabilities, and documentation is considered proprietary to those companies that build them. This report contains no proprietary information. The line of distinction for determining exactly which information about any code marked proprietary is vague and is best answered by the originator of the code.

The remainder of this report is a summary of the responses received from the survey. Top-level summaries and categorical distributions of chemical laser codes are presented in section II. These are intended to provide "quick-look" comparisons of code features. Detailed code capabilities and features are provided in section III.

Section II

CODE SURVEY SUMMARY

The purpose of this chapter is twofold. First, the codes are listed in various ways to aid the reader in determining where a code fits categorically among the various combinations of optics, kinetics, and gasdynamics features. Second, a single-page summary is included for each code (alphabetically by code name). The purpose of this top-level or quick-look summary is to provide a rapid evaluation of a given code's attributes and for cross comparisons before going to the more detailed level of section III.

Table II-1 provides the complete alphabetical listing of all codes included in this survey, * the company or agency that submitted them,† and their proprietary/nonproprietary status (P if proprietary)‡. An alphabetical listing of codes by company/agency, which shows also the general type or use of code (optics, kinetics, gasdynamics), is provided in Table II-2. The following rules were applied in classifying a code as O, K, or G. A code with detailed optics with up to and including a simple saturable gain model, but no detailed kinetics or gasdynamics features, was classified as an optics (O) code. A code with detailed kinetics with up to and including a simple Fabry-Perot optics model, but no detailed optics or gasdynamics, was classified as a kinetics (K) code. A code with detailed mixing or flow modeling capabilities, but without detailed optics or chemistry models, was termed a gasdynamics (G) code. In Table II-3, this categorical approach is used to divide codes into seven categories made possible by codes having different combinations of detailed optics, detailed kinetics, and detailed gasdynamics modeling capabilities. The reader will undoubtedly find many other ways to compare codes; Table II-4 provides one further example.

Some information in a very different format from that used in this survey was provided on 21 codes by Bell Aerospace Textron. Summary sheets have been included for these codes. The original Bell Aerospace inputs have been included as Appendix C.

*Codes without names were arbitrarily given alphanumeric names for reporting consistency; such codes are indicated by a superscript asterisk following the code name.

†Most of the time, but not always, the company or agency submitting a given code was responsible for producing or building the code. Attempts have been made to properly credit the original source where known.

‡None of the information reported here is considered proprietary.

Table II-1 — Alphabetical Listing of Chemical Laser Codes

Code Name	Company/Agency	Proprietary
ABL	TRW	
AEROKNS	Rocketdyne	
AFOPTMNORO	University of Illinois	
ALCHRC*	Rocketdyne	
ALCRRC*	Rocketdyne	
ALFA	AFWL/ALC	
APACHE	AFWL/ALC	
ARM-D	Bell Aerospace	P
ARM-G	Bell Aerospace	P
BAREPL	Rocketdyne	
BCCLC*	AFWL/ALR	
BLAZER	TRW	
BLAZE I	Bell Aerospace	P
BLAZE II	Bell Aerospace	P
BLAZE III	Bell Aerospace	P
BLAZE IV	Bell Aerospace	P
BLAZE V	Bell Aerospace	P
BLAZE VI	Bell Aerospace	P
BLIST	TRW	P
CLOQ	UTRC/P&W	P
CLOQ3D	UTRC/P&W	P
CLSLGM*	SAI	
CNCDE	Bell Aerospace	P
COMOC-SA	Bell Aerospace	P
COMOC-TA	Bell Aerospace	P
COMOC-2DNS	Bell Aerospace	P
COMOC-3DPNS	Bell Aerospace	P
CROQ	TRW	P
DENTAL	AFWL/ALR	
DESALE-5	Aerospace Corporation	
DIFF-2	Bell Aerospace	P
DIFF-3	Bell Aerospace	P
ELNWD2	Aerospace Corporation	
GASSER	TRW	
GCAL	SAI	
GENRING	BDM	
GIM	AFWL/ALC/LOCKHEED	P
GLADV	TRW	P
GOAD	Bell Aerospace	P

*Indicates alphanumeric name generated for this survey.

Table II-1 — Alphabetical Listing of Chemical Laser Codes (Continued)

Code Name	Company/Agency	Proprietary
GOPWR	Rocketdyne	
GURDM	BDM	
HFGOPWR	Rocketdyne	
HFOX	Sandia Laboratories	
IPAGOS	BDM/TRW	
KBLIMP	Aerotherm Division ACUREX	
LAPU-2	LASL	
LOADPL	Rocketdyne	
LS-14RGS*	Rocketdyne	
MCLANC	TRW	P
MNORO	University of Illinois	
MPCPAGOS	BDM	
MRO	TRW	
NCFTDPWE*	LASL	
NORO-I	University of Illinois	P
NORO-II	Bell Aerospace	P
OCELOT	Hughes	P
POLRES	AFWL/ALR	
POLRESH	AFWL/ALR	
POP	Perkin-Elmer	P
PRE-WATSON	Rocketdyne	
QFHT	UTRC/P&W	P
RASCAL	Rocketdyne	P
ROPTICS	University of Illinois	P
ROTKIN	UTRC/P&W	P
SAIC2D	SAI	
SAIC2DV	SAI	
SAIFHT	SAI	
SAIGD	SAI	
SAI1D	SAI	
SAI2D	SAI	
SOS	Aerospace Corporation	
TDLCRC*	Rocketdyne	P
TDWORRC*	Rocketdyne	P
TMRO	TRW	
TWODNOZ	TRW	
URINLA2	TRW	
VIINT	TRW	
WAP*	TRW	

*Indicates alphanumeric name generated for this survey.

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Table II-2 — Alphabetical Listing of Chemical Laser Codes by Company

Company/Agency	Code Name	Proprietary	Type
Aerospace Corporation	DESALE-5		K, G
	ELNWD2		O
	SOS		K
Air Force Weapons Laboratory	ALFA		K
	APACHE		K
	BCCLC		O, K
	DENTAL		O, K, G
	GIM	P	G
	POLRES		O
	POLRESH		O
BDM Corporation	GENRING		O
	GURDM		O
	IPAGOS		O
	MPCPAGOS		O
Bell Aerospace Textron	ARM-D	P	O
	ARM-G	P	O
	BLAZE I	P	G
	BLAZE II	P	G
	BLAZE III	P	K, G
	BLAZE IV	P	K, G
	BLAZE V	P	G
	BLAZE VI	P	O, K, G
	CNDE	P	G
	COMOC-SA	P	K, G
	COMOC-TA	P	K, G
	COMOC-2DNS	P	K, G
	COMOC-3DPNS	P	K, G
	DIFF-2	P	O, G
	DIFF-3	P	O, G
	GOAD	P	O
NORO-II	P	K, G	
Hughes Aircraft Company	OCELOT	P	O
University of Illinois	AFOPTMNORO		O, K
	MNORO		K
	NORO I	P	K
	ROPTICS	P	O, K
Los Alamos Scientific Laboratories	LAPU-2		O
	NCFTDPWE		O
Perkin-Elmer	POP		O

Table II-2 — Alphabetical Listing of Chemical Laser Codes by Company (Continued)

Company/Agency	Code Name	Proprietary	Type
Rocketdyne	AEROKNS		K, G
	ALCHRC		O, K, G
	ALCRRC		O, K, G
	BAREPL		O
	GOPWR		O, K, G
	HFGOPWR		O, K, G
	LOADPL		O
	LS-14RGS		O
	PRE-WATSON		O
	RASCAL	P	O, K, G
	TDLCLRC	P	O, K, G
	TDWORRC	P	O
Sandia Laboratories	HFOX		K
Science Applications, Inc.	CLSLGM		O
	GCAL		K
	SAIC2D		O
	SAIC2DV		O
	SAIFHT		O
	SAIGD		K, G
	SAI1D		O
	SAI2D		O
TRW	ABL		O, K, G
	BLAZER		O, K, G
	BLIST	P	G
	CROQ	P	O, K, G
	GASSER	P	G
	GLADV	P	G
	KBLIMP		G
	MCLANC	P	G
	MRO		O, K, G
	TMRO		O, K, G
	TWODNOZ	P	G
	URINLA2	P	O
	VIINT	P	G
WAP	P	G	
United Technologies Research Center Pratt & Whitney	CLOQ	P	O, K, G
	CLOQ3D		O, K, G
	QFHT	P	O
	ROTKIN	P	K, G

Table II-3 — Comparative Listing of Chemical Laser Codes by General Type

O, K, G*	O, K	O, G	K, G	O	K	G
ABL ALCHRC ALCRRC BLAZER BLAZE VI CLOQ CLOQ 3D CROQ DENTAL GOPWR HFGOPWR MRO RASCAL TDLCLRC TMRO	AFOPTMNORO BCCLC ROPTICS	DIFF-2 DIFF-3	AEROKNS BLAZE III BLAZE IV COMOC-SA COMOC-TA COMOC-2ONS COMOC-30PNS DESALE-5 NORO-II ROTKIN SAIGD	ARM-D ARM-G BARE PL CLSLGM ELNWD2 GENRING GOAD GURDM IPAGOS LAPU-2 LOADPL LS-14 RGS MPCPAGOS NCFTDPWE OCELOT POLRES POLRESH POP PRE-WATSON QFHT SAIC2D SAIC2DV SAIFHT SAI1D SAI2D TDWORRC URINLA2	ALFA APACHE GCAL HFOX MNORO NORO I SOS	BLAZE I BLAZE II BLAZE V BLIST CNDE GASSER GIM GLADV KBLIMP MCLANC TWODNOZ VIINT WAP

*O = optics, K = kinetic, G = gasdynamic.

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Table II-4 — Nonproprietary 2-D Codes as Functions of Basic Level of Detail and Geometry

	Company	Contact	Telephone Number
I. 2-D Wave Optics/Kinetics/Gasdynamics Codes			
Cartesian Blazer CLOQ 3D	TRW DSSG UTRC	Don Bullock Paul E. Fileger	213-535-3484 305-840-6643
Cylindrical ABL CLOQ 3D	TRW DSSG UTRC	Don Bullock	213-535-3484
II. 2-D Wave Optics/Kinetics			
Cartesian BCCLC SAI2D	AFWL/ALR SAI	Capt. Ted Salvi Jerry Long	505-264-0721 404-955-2663
Cylindrical SAIC2D SAIC2DV SAIFHT	SAI SAI SAI	Jerry Long Jerry Long Jerry Long	404-955-2663 404-955-2663 404-955-2663
III. 2-D Wave Optics			
Cartesian CLSLGM	SAI	Robert E. Hodder	305-283-3380
Cylindrical BAREPL GURDM LOADPL PRE-WATSON URINLA2	Rocketdyne BDM Rocketdyne Rocketdyne TRW	Alexander Simonoff Tom Ferguson Alexander Simonoff Phil D. Briggs Don Bullock	213-884-3346 505-264-8568 213-884-3346 213-884-3851 213-535-3484

CODE SUMMARY SHEET

CODE NAME:

ABL

ORIGINATOR/KEY CONTACT:

Name: Donald L. Bullock Phone: (213) 535-3484

Organization: TRW DSSG

Address: R1/1162 One Space Park, Redondo Beach, California 90278

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Models cylindrical lasers used with URINLA2. This is a URINLA2 model with gain. (See URINLA2)

AVAILABLE DOCUMENTATION: Annular Laser Mode Studies Final Report.
Program ABL User Manual, June 1978.

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input type="checkbox"/> None <input checked="" type="checkbox"/> Simple Fabry Perot <input type="checkbox"/> Detailed Resonator	<input type="checkbox"/> None <input checked="" type="checkbox"/> Simple Saturated Gain <input type="checkbox"/> Detailed Kinetics	<input type="checkbox"/> None <input checked="" type="checkbox"/> Simple Flow Model <input type="checkbox"/> Detailed Mixing
TYPE	<input checked="" type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input checked="" type="checkbox"/> CW <input checked="" type="checkbox"/> Pulsed <input type="checkbox"/> HF, DF <input type="checkbox"/> Other	<input type="checkbox"/> Premixed <input checked="" type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other
GEOMETRY	<input checked="" type="checkbox"/> Standing Wave <input type="checkbox"/> Ring <input checked="" type="checkbox"/> Compact <input checked="" type="checkbox"/> Annular	<input checked="" type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cylindrical, Radially Flowing <input type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other
GRID DIMENSION	(Transverse Dimension) <input checked="" type="checkbox"/> 1 D <input checked="" type="checkbox"/> 2 D	<input checked="" type="checkbox"/> 1 D <input checked="" type="checkbox"/> 2 D <input checked="" type="checkbox"/> 3 D	<input checked="" type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D
COORDINATE SYSTEM	<input type="checkbox"/> Cartesian <input checked="" type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input checked="" type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input checked="" type="checkbox"/> Cylindrical <input type="checkbox"/> Other
FEATURES MODELED	<input checked="" type="checkbox"/> Misalignments <input checked="" type="checkbox"/> Aberrations <input type="checkbox"/> Deformable Mirrors <input checked="" type="checkbox"/> Far-Field Performance <input type="checkbox"/> Other	<input type="checkbox"/> Single Line <input checked="" type="checkbox"/> Multiline <input checked="" type="checkbox"/> Line Broadening <input checked="" type="checkbox"/> Other	<input type="checkbox"/> Laminar Flow <input type="checkbox"/> Turbulent Flow <input type="checkbox"/> Boundary Layer <input type="checkbox"/> Shocks <input checked="" type="checkbox"/> Other

CODE SUMMARY SHEET

CODE NAME: AEROKNS

ORIGINATOR/KEY CONTACT:

Name: Jim Vieceli Phone: (213) 884-3851Organization: Rockwell International-Rocketdyne DivisionAddress: 6633 Canoga Ave., Canoga Park, California 91304

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Computation of small signal gain or loaded gain from a radially flowing system for use by annular resonator codes. Package includes aerodynamics for radial flow field.
(Used in LS-14 study, see ALCHRC).

AVAILABLE DOCUMENTATION: Annular Laser Optics Study Final Report (AFWL-TR-77-117); Annular Laser Optics Study User's Manual: Loaded Cavity Codes.

CATEGORY ATTRIBUTE	OPTICS		KINETICS		GASDYNAMICS	
	LEVEL	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Fabry Perot <input type="checkbox"/> Detailed Resonator	<input type="checkbox"/> None <input checked="" type="checkbox"/> Simple Saturated Gain <input type="checkbox"/> Detailed Kinetics	<input type="checkbox"/> None <input checked="" type="checkbox"/> Simple Flow Model <input type="checkbox"/> Detailed Mixing		
TYPE	<input type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input checked="" type="checkbox"/> CW <input checked="" type="checkbox"/> Pulsed <input checked="" type="checkbox"/> HF, DF <input type="checkbox"/> Other	<input type="checkbox"/> Premixed <input checked="" type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other			
GEOMETRY	<input type="checkbox"/> Standing Wave <input type="checkbox"/> Ring <input type="checkbox"/> Compact <input type="checkbox"/> Annular	<input checked="" type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cylindrical, Radially Flowing <input type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other			
GRID DIMENSION	<input type="checkbox"/> (Transverse Dimension) <input type="checkbox"/> 1 D <input type="checkbox"/> 2 D	<input checked="" type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input checked="" type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D			
COORDINATE SYSTEM	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other			
FEATURES MODELED	<input type="checkbox"/> Misalignments <input type="checkbox"/> Aberrations <input type="checkbox"/> Deformable Mirrors <input type="checkbox"/> Far-Field Performance <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Single Line <input checked="" type="checkbox"/> Multiline <input type="checkbox"/> Line Broadening <input type="checkbox"/> Other	<input type="checkbox"/> Laminar Flow <input type="checkbox"/> Turbulent Flow <input checked="" type="checkbox"/> Boundary Layer <input type="checkbox"/> Shocks <input checked="" type="checkbox"/> Other			

CODE SUMMARY SHEET

CODE NAME:

AFOPTMNORO

ORIGINATOR/KEY CONTACT:

Name: L. H. Sentman/T. Salvi (AFWL) Phone: (217) 333-1834
 Organization: Univ. of Illinois, Dept. of Aeronautical & Astronautical Eng.
 Address: Urbana, Illinois 61801

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Predict power spectral per-
formance of CW chemical lasers by coupling an AFWL strip mirror optics
code to a rotational nonequilibrium kinetics - fluid dynamics model
(MNORO). Combined model is called AFOPTMNORO.

AVAILABLE DOCUMENTATION: "An Efficient Rotational Nonequilibrium Model
of a CW Chemical Laser," L. H. Sentman & W. Brandkamp, TR AAE 79-5, UIIU
Eng 79-0505, July 1979. "Users Guide for Programs MNORO and AFOPTMNORO,"
L. H. Sentman, AAE TR 79-7, UIIU Eng 79-0507, October 1979.

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input type="checkbox"/> None <input checked="" type="checkbox"/> Simple Fabry Perot <input type="checkbox"/> Detailed Resonator	<input type="checkbox"/> None <input checked="" type="checkbox"/> Simple Saturated Gain <input type="checkbox"/> Detailed Kinetics	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Flow Model <input type="checkbox"/> Detailed Mixing
TYPE	<input checked="" type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input checked="" type="checkbox"/> CW <input checked="" type="checkbox"/> Pulsed <input checked="" type="checkbox"/> HF, DF <input type="checkbox"/> Other	<input type="checkbox"/> Premixed <input checked="" type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other
GEOMETRY	<input checked="" type="checkbox"/> Standing Wave <input checked="" type="checkbox"/> Ring <input checked="" type="checkbox"/> Compact <input type="checkbox"/> Annular	<input checked="" type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cylindrical, Radially Flowing <input type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other
GRID DIMENSION	<input checked="" type="checkbox"/> (Transverse Dimension) <input type="checkbox"/> 1 D <input type="checkbox"/> 2 D	<input checked="" type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input checked="" type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D
COORDINATE SYSTEM	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other
FEATURES MODELED	<input type="checkbox"/> Misalignments <input type="checkbox"/> Aberrations <input type="checkbox"/> Deformable Mirrors <input type="checkbox"/> Far-Field Performance <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Single Line <input checked="" type="checkbox"/> Multiline <input checked="" type="checkbox"/> Line Broadening <input checked="" type="checkbox"/> Other	<input type="checkbox"/> Laminar Flow <input type="checkbox"/> Turbulent Flow <input checked="" type="checkbox"/> Boundary Layer <input type="checkbox"/> Shocks <input checked="" type="checkbox"/> Other

CODE SUMMARY SHEET

CODE NAME:

ALCHRC*

ORIGINATOR/KEY CONTACT:

Name: Phil Briggs Phone: (213) 884-3851

Organization: Rockwell International-Rocketdyne Division

Address: 6833 Canoga Ave., Canoga Park, California 91304

PRINCIPAL PURPOSE AND APPLICATION OF CODE: LS-14 resonator parameter selection, assess mode control, performance predictions for power extraction and beam quality, set/verify design requirements. Analysis of general HSURIA with reflaxicon. Kinetics and gasdynamics modeled by AEROKNS developed under ALOS program. See AEROKNS.

AVAILABLE DOCUMENTATION: Various.

CATEGORY ATTRIBUTE	OPTICS		KINETICS		GASDYNAMICS	
LEVEL	<input checked="" type="checkbox"/>	None Simple Fabry Perot Detailed Resonator	<input checked="" type="checkbox"/>	None Simple Saturated Gain Detailed Kinetics	<input checked="" type="checkbox"/>	None Simple Flow Model Detailed Mixing
TYPE	<input checked="" type="checkbox"/>	Geometrical Physical	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	CW Pulsed HF, DF Other	<input checked="" type="checkbox"/>	Premixed Scheduled Mixing Other
GEOMETRY	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	Standing Wave Ring Compact Annular	<input checked="" type="checkbox"/>	Annular, Radially Flowing Transversely Flowing Other	<input checked="" type="checkbox"/>	Cylindrical, Radially Flowing Rectangular, Linearly Flowing Other
GRID DIMENSION	<input checked="" type="checkbox"/>	(Transverse Dimension) 1 D 2 D	<input checked="" type="checkbox"/>	1 D 2 D 3 D	<input checked="" type="checkbox"/>	1 D 2 D 3 D
COORDINATE SYSTEM	<input checked="" type="checkbox"/>	Cartesian Cylindrical Other	<input checked="" type="checkbox"/>	Cartesian Cylindrical Other	<input checked="" type="checkbox"/>	Cartesian Cylindrical Other
FEATURES MODELED	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	Misalignments Aberrations Deformable Mirrors Far-Field Performance Other	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	Single Line Multiline Line Broadening Other	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	Laminar Flow Turbulent Flow Boundary Layer Shocks Other

*Axisymmetric Loaded Cavity HSURIA Resonator Code.

CODE SUMMARY SHEET

CODE NAME:

ALCRRC*

ORIGINATOR/KEY CONTACT:

Name: Phil D. Briggs Phone: (213) 884-3851

Organization: Rockwell International-Rocketdyne Division

Address: 6633 Canoga Ave., Canoga Park, California 91304

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Ring resonator parameter selection, assess mode control, performance prediction for power and beam quality, set/verify design requirements. Kinetics and mixing models included - see AEROKNS.

AVAILABLE DOCUMENTATION: Various.

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input type="checkbox"/> None <input checked="" type="checkbox"/> Simple Fabry Perot <input checked="" type="checkbox"/> Detailed Resonator	<input checked="" type="checkbox"/> None <input checked="" type="checkbox"/> Simple Saturated Gain <input checked="" type="checkbox"/> Detailed Kinetics	<input checked="" type="checkbox"/> None <input checked="" type="checkbox"/> Simple Flow Model <input checked="" type="checkbox"/> Detailed Mixing
TYPE	<input checked="" type="checkbox"/> Geometrical <input checked="" type="checkbox"/> Physical	<input checked="" type="checkbox"/> CW <input checked="" type="checkbox"/> Pulsed <input checked="" type="checkbox"/> HF, DF <input checked="" type="checkbox"/> Other	<input checked="" type="checkbox"/> Premixed <input checked="" type="checkbox"/> Scheduled Mixing <input checked="" type="checkbox"/> Other
GEOMETRY	<input checked="" type="checkbox"/> Standing Wave <input checked="" type="checkbox"/> Ring <input checked="" type="checkbox"/> Compact <input checked="" type="checkbox"/> Annular	<input checked="" type="checkbox"/> Annular, Radially Flowing <input checked="" type="checkbox"/> Transversely Flowing <input checked="" type="checkbox"/> Other	<input checked="" type="checkbox"/> Cylindrical, Radially Flowing <input checked="" type="checkbox"/> Rectangular, Linearly Flowing <input checked="" type="checkbox"/> Other
GRID DIMENSION	<input checked="" type="checkbox"/> (Transverse Dimension) <input checked="" type="checkbox"/> 1 D <input checked="" type="checkbox"/> 2 D	<input checked="" type="checkbox"/> 1 D <input checked="" type="checkbox"/> 2 D <input checked="" type="checkbox"/> 3 D	<input checked="" type="checkbox"/> 1 D <input checked="" type="checkbox"/> 2 D <input checked="" type="checkbox"/> 3 D
COORDINATE SYSTEM	<input checked="" type="checkbox"/> Cartesian <input checked="" type="checkbox"/> Cylindrical <input checked="" type="checkbox"/> Other	<input checked="" type="checkbox"/> Cartesian <input checked="" type="checkbox"/> Cylindrical <input checked="" type="checkbox"/> Other	<input checked="" type="checkbox"/> Cartesian <input checked="" type="checkbox"/> Cylindrical <input checked="" type="checkbox"/> Other
FEATURES MODELED	<input checked="" type="checkbox"/> Misalignments <input checked="" type="checkbox"/> Aberrations <input checked="" type="checkbox"/> Deformable Mirrors <input checked="" type="checkbox"/> Far-Field Performance <input checked="" type="checkbox"/> Other	<input checked="" type="checkbox"/> Single Line <input checked="" type="checkbox"/> Multiline <input checked="" type="checkbox"/> Line Broadening <input checked="" type="checkbox"/> Other	<input checked="" type="checkbox"/> Laminar Flow <input checked="" type="checkbox"/> Turbulent Flow <input checked="" type="checkbox"/> Boundary Layer <input checked="" type="checkbox"/> Shocks <input checked="" type="checkbox"/> Other

*Axisymmetric Loaded Cavity Ring Resonator Code.

CODE SUMMARY SHEET

CODE NAME:

ALFA

ORIGINATOR/KEY CONTACT:

Name: N. L. Rapagnani Phone: (505) 844-9836
 Organization: Air Force Weapons Laboratory
 Address: AFWL/ARAC, Kirtland AFB, New Mexico 87117

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Models any chemically pumped mixing laser system including electronic transition types; contains Fabry Perot optics model.

AVAILABLE DOCUMENTATION: ALFA, AFWL-TR-78-19

CATEGORY ATTRIBUTE	OPTICS		KINETICS		GASDYNAMICS	
	LEVEL	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Fabry Perot <input type="checkbox"/> Detailed Resonator	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Saturated Gain <input type="checkbox"/> Detailed Kinetics	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Saturated Gain <input type="checkbox"/> Detailed Kinetics	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Flow Model <input type="checkbox"/> Detailed Mixing	
TYPE	<input checked="" type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input checked="" type="checkbox"/> CW <input checked="" type="checkbox"/> Pulsed <input checked="" type="checkbox"/> HF, DF <input checked="" type="checkbox"/> Other	<input checked="" type="checkbox"/> CW <input checked="" type="checkbox"/> Pulsed <input checked="" type="checkbox"/> HF, DF <input checked="" type="checkbox"/> Other	<input checked="" type="checkbox"/> Premixed <input type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other		
GEOMETRY	<input type="checkbox"/> Standing Wave <input type="checkbox"/> Ring <input type="checkbox"/> Compact <input type="checkbox"/> Annular	<input type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Annular, Radially Flowing <input checked="" type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cylindrical, Radially Flowing <input checked="" type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other		
GRID DIMENSION	<input checked="" type="checkbox"/> (Transverse Dimension) <input type="checkbox"/> 1 D <input type="checkbox"/> 2 D	<input checked="" type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input checked="" type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input checked="" type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D		
COORDINATE SYSTEM	<input checked="" type="checkbox"/> Cartesian <input checked="" type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cartesian <input checked="" type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cartesian <input checked="" type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cartesian <input checked="" type="checkbox"/> Cylindrical <input type="checkbox"/> Other		
FEATURES MODELED	<input type="checkbox"/> Misalignments <input type="checkbox"/> Aberrations <input type="checkbox"/> Deformable Mirrors <input type="checkbox"/> Far-Field Performance <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Single Line <input checked="" type="checkbox"/> Multiline <input checked="" type="checkbox"/> Line Broadening <input checked="" type="checkbox"/> Other	<input checked="" type="checkbox"/> Single Line <input checked="" type="checkbox"/> Multiline <input checked="" type="checkbox"/> Line Broadening <input checked="" type="checkbox"/> Other	<input checked="" type="checkbox"/> Laminar Flow <input checked="" type="checkbox"/> Turbulent Flow <input checked="" type="checkbox"/> Boundary Layer <input checked="" type="checkbox"/> Shocks <input type="checkbox"/> Other		

CODE SUMMARY SHEET

CODE NAME:

APACHE

ORIGINATOR/KEY CONTACT:

Name: N. L. Rapagnani Phone: (505) 844-9836

Organization: Air Force Weapons Laboratory

Address: AFWL/ARAC, Kirtland AFB, New Mexico 87117

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Models any chemically pumped mixing laser system including electronic transition type. APACHE is the same as ALFA except that it is time dependent. Contains Fabry-Perot optics.

AVAILABLE DOCUMENTATION: APACHE, LASL-LA-7427

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input type="checkbox"/> None <input checked="" type="checkbox"/> Simple Fabry Perot <input type="checkbox"/> Detailed Resonator	<input type="checkbox"/> None <input checked="" type="checkbox"/> Simple Saturated Gain <input type="checkbox"/> Detailed Kinetics	<input type="checkbox"/> None <input checked="" type="checkbox"/> Simple Flow Model <input type="checkbox"/> Detailed Mixing
TYPE	<input checked="" type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input checked="" type="checkbox"/> CW <input checked="" type="checkbox"/> Pulsed <input checked="" type="checkbox"/> HF, DF <input checked="" type="checkbox"/> Other	<input type="checkbox"/> Premixed <input type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other
GEOMETRY	<input type="checkbox"/> Standing Wave <input type="checkbox"/> Ring <input type="checkbox"/> Compact <input type="checkbox"/> Annular	<input type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cylindrical, Radially Flowing <input checked="" type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other
GRID DIMENSION	<input checked="" type="checkbox"/> (Transverse Dimension) <input type="checkbox"/> 1 D <input type="checkbox"/> 2 D	<input type="checkbox"/> 1 D <input checked="" type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input type="checkbox"/> 1 D <input checked="" type="checkbox"/> 2 D <input checked="" type="checkbox"/> 3 D, Psuedo
COORDINATE SYSTEM	<input checked="" type="checkbox"/> Cartesian <input checked="" type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cartesian <input checked="" type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cartesian <input checked="" type="checkbox"/> Cylindrical <input type="checkbox"/> Other
FEATURES MODELED	<input type="checkbox"/> Misalignments <input type="checkbox"/> Aberrations <input type="checkbox"/> Deformable Mirrors <input type="checkbox"/> Far-Field Performance <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Single Line <input checked="" type="checkbox"/> Multiline <input checked="" type="checkbox"/> Line Broadening <input checked="" type="checkbox"/> Other	<input checked="" type="checkbox"/> Laminar Flow <input checked="" type="checkbox"/> Turbulent Flow <input checked="" type="checkbox"/> Boundary Layer <input checked="" type="checkbox"/> Shocks <input checked="" type="checkbox"/> Other, Recirculating

CODE SUMMARY SHEET

CODE NAME:

ARM-D

ORIGINATOR/KEY CONTACT:

Name: S. W. Zelazny Phone: (716) 297-1000
 Organization: Bell Aerospace Textron
 Address: P.O. Box 1, Buffalo, New York 14240

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Resonator analysis codes.
Models HSURIA and ring resonators. Uses strip propagator (r,z) in
annular leg and (r, θ , z) propagator in compact leg. (See appendix C,
table 2).

AVAILABLE DOCUMENTATION: _____

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input type="checkbox"/> None <input checked="" type="checkbox"/> Simple Fabry Perot <input type="checkbox"/> Detailed Resonator	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Saturated Gain <input type="checkbox"/> Detailed Kinetics	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Flow Model <input type="checkbox"/> Detailed Mixing
TYPE	<input checked="" type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input checked="" type="checkbox"/> CW <input type="checkbox"/> Pulsed <input checked="" type="checkbox"/> HF, DF <input checked="" type="checkbox"/> Other	<input checked="" type="checkbox"/> Premixed <input checked="" type="checkbox"/> Scheduled Mixing <input checked="" type="checkbox"/> Other
GEOMETRY	<input checked="" type="checkbox"/> Standing Wave <input checked="" type="checkbox"/> Ring <input checked="" type="checkbox"/> Compact <input checked="" type="checkbox"/> Annular	<input checked="" type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cylindrical, Radially Flowing <input type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other
GRID DIMENSION	(Transverse Dimension) <input checked="" type="checkbox"/> 1 D <input checked="" type="checkbox"/> 2 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input checked="" type="checkbox"/> 1 D <input type="checkbox"/> 2 D Quasi 2D <input type="checkbox"/> 3 D
COORDINATE SYSTEM	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other
FEATURES MODELED	<input checked="" type="checkbox"/> Misalignments <input checked="" type="checkbox"/> Aberrations <input checked="" type="checkbox"/> Deformable Mirrors <input checked="" type="checkbox"/> Far-Field Performance <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Single Line <input type="checkbox"/> Multiline <input type="checkbox"/> Line Broadening <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Laminar Flow <input checked="" type="checkbox"/> Turbulent Flow <input type="checkbox"/> Boundary Layer <input type="checkbox"/> Shocks <input type="checkbox"/> Other

CODE SUMMARY SHEET

CODE NAME:

ARM-G

ORIGINATOR/KEY CONTACT:

Name: S. W. Zelazny Phone: (716) 297-1000
 Organization: Bell Aerospace Textron
 Address: P.O. Box 1, Buffalo, New York 14240

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Resonator analysis codes.
Geometric optics code models HSURIA (with waxicons and reflaxicons) and
ring resonators. Same capability as ACCOS-V except can be run
interactively. (See appendix C, table 2).

AVAILABLE DOCUMENTATION: _____

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input checked="" type="radio"/> None <input type="radio"/> Simple Fabry Perot <input type="radio"/> Detailed Resonator	<input type="radio"/> None <input type="radio"/> Simple Saturated Gain <input type="radio"/> Detailed Kinetics	<input type="radio"/> None <input type="radio"/> Simple Flow Model <input type="radio"/> Detailed Mixing
TYPE	<input checked="" type="radio"/> Geometrical <input type="radio"/> Physical	<input type="radio"/> CW <input type="radio"/> Pulsed <input type="radio"/> HF, DF <input type="radio"/> Other	<input type="radio"/> Premixed <input type="radio"/> Scheduled Mixing <input type="radio"/> Other
GEOMETRY	<input checked="" type="radio"/> Standing Wave <input checked="" type="radio"/> Ring <input checked="" type="radio"/> Compact <input checked="" type="radio"/> Annular	<input type="radio"/> Annular, Radially Flowing <input type="radio"/> Transversely Flowing <input type="radio"/> Other	<input type="radio"/> Cylindrical, Radially Flowing <input type="radio"/> Rectangular, Linearly Flowing <input type="radio"/> Other
GRID DIMENSION	<input checked="" type="radio"/> (Transverse Dimension) <input type="radio"/> 1 D <input type="radio"/> 2 D	<input type="radio"/> 1 D <input type="radio"/> 2 D <input type="radio"/> 3 D	<input type="radio"/> 1 D <input type="radio"/> 2 D <input type="radio"/> 3 D
COORDINATE SYSTEM	<input checked="" type="radio"/> Cartesian <input type="radio"/> Cylindrical <input type="radio"/> Other	<input type="radio"/> Cartesian <input type="radio"/> Cylindrical <input type="radio"/> Other	<input type="radio"/> Cartesian <input type="radio"/> Cylindrical <input type="radio"/> Other
FEATURES MODELED	<input checked="" type="radio"/> Misalignments <input type="radio"/> Aberrations <input type="radio"/> Deformable Mirrors <input checked="" type="radio"/> Far-Field Performance <input type="radio"/> Other	<input type="radio"/> Single Line <input type="radio"/> Multiline <input type="radio"/> Line Broadening <input type="radio"/> Other	<input type="radio"/> Laminar Flow <input type="radio"/> Turbulent Flow <input type="radio"/> Boundary Layer <input type="radio"/> Shocks <input type="radio"/> Other

CODE SUMMARY SHEET

CODE NAME: BAREPL

ORIGINATOR/KEY CONTACT:

Name: Alexander M. Simonoff Phone: (213) 884-3346
 Organization: Rocketdyne Division, Rockwell International
 Address: 6633 Canoga Avenue, Canoga Park, California 91304

PRINCIPAL PURPOSE AND APPLICATION OF CODE: The code was designed to model a half-symmetric unstable resonator with an internal axicon (HSURIA). Performance predictions for beam quality and mode loss difference, set/verify design requirements.

AVAILABLE DOCUMENTATION: 3-D Bare Cavity Resonator Code (theory and user manual).

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input type="radio"/> None <input checked="" type="radio"/> Simple Fabry Perot Detailed Resonator	<input checked="" type="radio"/> None <input type="radio"/> Simple Saturated Gain Detailed Kinetics	<input checked="" type="radio"/> None <input type="radio"/> Simple Flow Model Detailed Mixing
TYPE	<input checked="" type="radio"/> Geometrical <input type="radio"/> Physical	<input type="radio"/> CW <input type="radio"/> Pulsed <input type="radio"/> HF, DF <input type="radio"/> Other	<input type="radio"/> Premixed <input type="radio"/> Scheduled Mixing <input type="radio"/> Other
GEOMETRY	<input checked="" type="radio"/> Standing Wave Ring <input checked="" type="radio"/> Compact <input checked="" type="radio"/> Annular	<input type="radio"/> Annular, Radially Flowing <input type="radio"/> Transversely Flowing <input type="radio"/> Other	<input type="radio"/> Cylindrical, Radially Flowing <input type="radio"/> Rectangular, Linearly Flowing <input type="radio"/> Other
GRID DIMENSION	(Transverse Dimension) <input checked="" type="radio"/> 1 D <input type="radio"/> 2 D	<input type="radio"/> 1 D <input type="radio"/> 2 D <input type="radio"/> 3 D	<input type="radio"/> 1 D <input type="radio"/> 2 D <input type="radio"/> 3 D
COORDINATE SYSTEM	<input checked="" type="radio"/> Cartesian <input type="radio"/> Cylindrical <input type="radio"/> Other	<input type="radio"/> Cartesian <input type="radio"/> Cylindrical <input type="radio"/> Other	<input type="radio"/> Cartesian <input type="radio"/> Cylindrical <input type="radio"/> Other
FEATURES MODELED	<input checked="" type="radio"/> Misalignments <input type="radio"/> Aberrations <input checked="" type="radio"/> Deformable Mirrors <input checked="" type="radio"/> Far-Field Performance <input type="radio"/> Other	<input type="radio"/> Single Line <input type="radio"/> Multiline <input type="radio"/> Line Broadening <input type="radio"/> Other	<input type="radio"/> Laminar Flow <input type="radio"/> Turbulent Flow <input type="radio"/> Boundary Layer <input type="radio"/> Shocks <input type="radio"/> Other

CODE SUMMARY SHEET

CODE NAME:

BCCLC*

ORIGINATOR/KEY CONTACT:

Name: Capt. Ted Salvi Phone: (505) 844-0721

Organization: Air Force Weapons Laboratory

Address: AFWL/ALR, Kirtland ARB, New Mexico 87115

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Models lasers with conventional unstable resonators with round, elliptical, or rectangular apertures.
Contains CO₂ GDL kinetics and shock wave phase sheets.

AVAILABLE DOCUMENTATION: None

CATEGORY ATTRIBUTE	OPTICS		KINETICS		GASDYNAMICS	
	LEVEL	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Fabry Perot <input type="checkbox"/> Detailed Resonator	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Saturated Gain <input type="checkbox"/> Detailed Kinetics	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Flow Model <input type="checkbox"/> Detailed Mixing		
TYPE	<input checked="" type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input checked="" type="checkbox"/> CW <input type="checkbox"/> Pulsed <input type="checkbox"/> HF, DF <input type="checkbox"/> Other	<input type="checkbox"/> Premixed <input type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other			
GEOMETRY	<input checked="" type="checkbox"/> Standing Wave <input type="checkbox"/> Ring <input checked="" type="checkbox"/> Compact <input type="checkbox"/> Annular	<input checked="" type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input type="checkbox"/> Cylindrical, Radially Flowing <input type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other			
GRID DIMENSION	<input checked="" type="checkbox"/> (Transverse Dimension) <input type="checkbox"/> 1 D <input type="checkbox"/> 2 D	<input checked="" type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D			
COORDINATE SYSTEM	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other			
FEATURES MODELED	<input checked="" type="checkbox"/> Misalignments <input checked="" type="checkbox"/> Aberrations <input type="checkbox"/> Deformable Mirrors <input type="checkbox"/> Far-Field Performance <input checked="" type="checkbox"/> Other	<input checked="" type="checkbox"/> Single Line <input type="checkbox"/> Multiline <input type="checkbox"/> Line Broadening <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Laminar Flow <input type="checkbox"/> Turbulent Flow <input type="checkbox"/> Boundary Layer <input type="checkbox"/> Shocks <input type="checkbox"/> Other			

*Baumgardner Cartesian coordinate laser code

CODE SUMMARY SHEET

CODE NAME:

BLAZER

ORIGINATOR/KEY CONTACT:

Name: Donald L. Bullock Phone: (213) 535-3484Organization: TRW DSSGAddress: RI/1162, One Space Park, Redondo Beach, California 90278

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Models the optical performance of linear bank CW HF and DF chemical lasers. BLASER is a 3-D model. Used as design tools for BDL, NAACL, MIRACL.

AVAILABLE DOCUMENTATION: The BLAZER and MRO Codes, TRW, June 1978 (theory). BLAZER User Manual (includes use of MRO), TRW, November 1978.

CATEGORY ATTRIBUTE	OPTICS		KINETICS		GASDYNAMICS	
	LEVEL	● None Simple Fabry Perot Detailed Resonator	● None Simple Saturated Gain Detailed Kinetics	● None Simple Flow Model Detailed Mixing		
TYPE	● Geometrical Physical	● CW Pulsed HF, DF Other	● Premixed Scheduled Mixing Other			
GEOMETRY	● Standing Wave ● Ring ● Compact ● Annular	● Annular, Radially Flowing Transversely Flowing Other	● Cylindrical, Radially Flowing Rectangular, Linearly Flowing Other			
GRID DIMENSION	● (Transverse Dimension) 1 D 2 D	● 1 D 2 D 3 D	● 1 D 2 D 3 D			
COORDINATE SYSTEM	● Cartesian Cylindrical Other	● Cartesian Cylindrical Other	● Cartesian Cylindrical Other			
FEATURES MODELED	● Misalignments ● Aberrations ● Deformable Mirrors ● Far-Field Performance Other	● Single Line ● Multiline ● Line Broadening Other	● Laminar Flow Turbulent Flow Boundary Layer Shocks Other			

CODE SUMMARY SHEET

CODE NAME:

BLAZE I

ORIGINATOR/KEY CONTACT:

Name: S. W. Zelazny Phone: (716) 297-1000

Organization: Bell Aerospace Textron

Address: P.O. Box 1, Buffalo, New York 14240

PRINCIPAL PURPOSE AND APPLICATION OF CODE: 1-0 fluid code with general chemistry and no optics. Combustor and cavity analysis. (See appendix C, table 1).

AVAILABLE DOCUMENTATION: _____

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	None Simple Fabry Perot Detailed Resonator	None Simple Saturated Gain Detailed Kinetics	None Simple Flow Model Detailed Mixing
TYPE	Geometrical Physical	CW Pulsed HF, DF Other	● Premixed Scheduled Mixing Other
GEOMETRY	Standing Wave Ring Compact Annular	Annular, Radially Flowing Transversely Flowing Other	Cylindrical, Radially Flowing Rectangular, Linearly Flowing Other
GRID DIMENSION	(Transverse Dimension) 1 D 2 D	1 D 2 D 3 D	● 1 D 2 D 3 D
COORDINATE SYSTEM	Cartesian Cylindrical Other	Cartesian Cylindrical Other	Cartesian Cylindrical Other
FEATURES MODELED	Misalignments Aberrations Deformable Mirrors Far-Field Performance Other	Single Line Multiline Line Broadening Other	Laminar Flow Turbulent Flow Boundary Layer Shocks Other

CODE SUMMARY SHEET

CODE NAME:

BLAZE II

ORIGINATOR/KEY CONTACT:

Name: S. W. Zelazny Phone: (716) 297-1000

Organization: Bell Aerospace Textron

Address: P.O. Box 1, Buffalo, New York 14240

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Detailed mixing code with
general chemistry and Fabry-Perot optics. Combustor analysis and
cavity analysis. (See appendix C, table 1).

AVAILABLE DOCUMENTATION: _____

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input checked="" type="radio"/> None <input type="radio"/> Simple Fabry Perot <input type="radio"/> Detailed Resonator	<input type="radio"/> None <input type="radio"/> Simple Saturated Gain <input type="radio"/> Detailed Kinetics	<input checked="" type="radio"/> None <input type="radio"/> Simple Flow Model <input type="radio"/> Detailed Mixing
TYPE	<input type="radio"/> Geometrical <input type="radio"/> Physical	<input type="radio"/> CW <input type="radio"/> Pulsed <input type="radio"/> HF, DF <input type="radio"/> Other	<input checked="" type="radio"/> Premixed <input checked="" type="radio"/> Scheduled Mixing <input checked="" type="radio"/> Other
GEOMETRY	<input type="radio"/> Standing Wave <input type="radio"/> Ring <input type="radio"/> Compact <input type="radio"/> Annular	<input type="radio"/> Annular, Radially Flowing <input type="radio"/> Transversely Flowing <input type="radio"/> Other	<input checked="" type="radio"/> Cylindrical, Radially Flowing <input checked="" type="radio"/> Rectangular, Linearly Flowing <input type="radio"/> Other
GRID DIMENSION	<input type="radio"/> (Transverse Dimension) <input type="radio"/> 1 D <input type="radio"/> 2 D	<input type="radio"/> 1 D <input type="radio"/> 2 D <input type="radio"/> 3 D	<input checked="" type="radio"/> 1 D <input type="radio"/> 2 D <input type="radio"/> 3 D
COORDINATE SYSTEM	<input type="radio"/> Cartesian <input type="radio"/> Cylindrical <input type="radio"/> Other	<input type="radio"/> Cartesian <input type="radio"/> Cylindrical <input type="radio"/> Other	<input type="radio"/> Cartesian <input type="radio"/> Cylindrical <input type="radio"/> Other
FEATURES MODELED	<input type="radio"/> Misalignments <input type="radio"/> Aberrations <input type="radio"/> Deformable Mirrors <input type="radio"/> Far-Field Performance <input type="radio"/> Other	<input type="radio"/> Single Line <input type="radio"/> Multiline <input type="radio"/> Line Broadening <input type="radio"/> Other	<input checked="" type="radio"/> Laminar Flow <input checked="" type="radio"/> Turbulent Flow <input type="radio"/> Boundary Layer <input type="radio"/> Shocks <input type="radio"/> Other

CODE SUMMARY SHEET

CODE NAME:

BLAZE III

ORIGINATOR/KEY CONTACT:

Name: S. W. Zelazny Phone: (716) 297-1000

Organization: Bell Aerospace Textron

Address: P.O. Box 1, Buffalo, New York 14240

PRINCIPAL PURPOSE AND APPLICATION OF CODE: 2-D mixing code with general chemistry. Combustor nozzle, cavity, diffuser, and ejectors analysis.
No optics. (See appendix C, table 1).

AVAILABLE DOCUMENTATION: _____

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input checked="" type="checkbox"/> None Simple Fabry Perot Detailed Resonator	<input type="checkbox"/> None Simple Saturated Gain Detailed Kinetics	<input checked="" type="checkbox"/> None Simple Flow Model Detailed Mixing
TYPE	<input type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input type="checkbox"/> CW <input type="checkbox"/> Pulsed <input type="checkbox"/> HF, DF <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Premixed <input type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other
GEOMETRY	<input type="checkbox"/> Standing Wave <input type="checkbox"/> Ring <input type="checkbox"/> Compact <input type="checkbox"/> Annular	<input type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input type="checkbox"/> Cylindrical, Radially Flowing <input type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other
GRID DIMENSION	<input type="checkbox"/> (Transverse Dimension) <input type="checkbox"/> 1 D <input type="checkbox"/> 2 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input checked="" type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D
COORDINATE SYSTEM	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other
FEATURES MODELED	<input type="checkbox"/> Misalignments <input type="checkbox"/> Aberrations <input type="checkbox"/> Deformable Mirrors <input type="checkbox"/> Far-Field Performance <input type="checkbox"/> Other	<input type="checkbox"/> Single Line <input type="checkbox"/> Multiline <input type="checkbox"/> Line Broadening <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Laminar Flow <input checked="" type="checkbox"/> Turbulent Flow <input checked="" type="checkbox"/> Boundary Layer <input type="checkbox"/> Shocks <input type="checkbox"/> Other

CODE SUMMARY SHEET

CODE NAME: BLAZE IV

ORIGINATOR/KEY CONTACT:

Name: S. W. Zelazny Phone: (716) 297-1000

Organization: Bell Aerospace Textron

Address: P.O. Box 1, Buffalo, New York 14240

PRINCIPAL PURPOSE AND APPLICATION OF CODE: 2-D mixing code with general chemistry. (See appendix C, table 1).

AVAILABLE DOCUMENTATION: _____

CATEGORY ATTRIBUTE	OPTICS		KINETICS		GASDYNAMICS	
	LEVEL	None Simple Fabry Perot Detailed Resonator	None Simple Saturated Gain Detailed Kinetics	●	None Simple Flow Model Detailed Mixing	
TYPE	Geometrical Physical	CW Pulsed HF, DF Other	●	Premixed Scheduled Mixing Other		
GEOMETRY	Standing Wave Ring Compact Annular	Annular, Radially Flowing Transversely Flowing Other		Cylindrical, Radially Flowing Rectangular, Linearly Flowing Other		
GRID DIMENSION	(Transverse Dimension) 1 D 2 D	1 D 2 D 3 D	●	1 D 2 D 3 D		
COORDINATE SYSTEM	Cartesian Cylindrical Other	Cartesian Cylindrical Other		Cartesian Cylindrical Other		
FEATURES MODELED	Misalignments Aberrations Deformable Mirrors Far-Field Performance Other	Single Line Multiline Line Broadening Other	● ●	Laminar Flow Turbulent Flow Boundary Layer Shocks Other		

CODE SUMMARY SHEET

CODE NAME:

BLAZE V

ORIGINATOR/KEY CONTACT:

Name: S. W. Zelazny Phone: (716) 297-1000

Organization: Bell Aerospace Textron

Address: P.O. Box 1, Buffalo, New York 14240

PRINCIPAL PURPOSE AND APPLICATION OF CODE: 2-D mixing finite difference code used for nozzle, fluid, and thermal analysis. (See appendix C, table 1).

AVAILABLE DOCUMENTATION: _____

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Fabry Perot <input type="checkbox"/> Detailed Resonator	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Saturated Gain <input type="checkbox"/> Detailed Kinetics	<input type="checkbox"/> None <input checked="" type="checkbox"/> Simple Flow Model <input type="checkbox"/> Detailed Mixing
TYPE	<input type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input type="checkbox"/> CW <input type="checkbox"/> Pulsed <input type="checkbox"/> HF, DF <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Premixed <input type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other
GEOMETRY	<input type="checkbox"/> Standing Wave <input type="checkbox"/> Ring <input type="checkbox"/> Compact <input type="checkbox"/> Annular	<input type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input type="checkbox"/> Cylindrical, Radially Flowing <input type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other
GRID DIMENSION	<input type="checkbox"/> (Transverse Dimension) <input type="checkbox"/> 1 D <input type="checkbox"/> 2 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input checked="" type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D
COORDINATE SYSTEM	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other
FEATURES MODELED	<input type="checkbox"/> Misalignments <input type="checkbox"/> Aberrations <input type="checkbox"/> Deformable Mirrors <input type="checkbox"/> Far-Field Performance <input type="checkbox"/> Other	<input type="checkbox"/> Single Line <input type="checkbox"/> Multiline <input type="checkbox"/> Line Broadening <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Laminar Flow <input type="checkbox"/> Turbulent Flow <input checked="" type="checkbox"/> Boundary Layer <input type="checkbox"/> Shocks <input type="checkbox"/> Other

CODE SUMMARY SHEET

CODE NAME:

BLAZE VI

ORIGINATOR/KEY CONTACT:

Name: S. W. Zelazny Phone: (716) 297-1000

Organization: Bell Aerospace Textron

Address: P.O. Box 1, Buffalo, New York 14240

PRINCIPAL PURPOSE AND APPLICATION OF CODE: _____

3-D optics and mixing code using finite difference, FFT, and rotational nonequilibrium models for optics and fluid analysis. (See appendix C, table 1).

AVAILABLE DOCUMENTATION: _____

CATEGORY		OPTICS	KINETICS	GASDYNAMICS
ATTRIBUTE				
LEVEL	<input checked="" type="checkbox"/>	None Simple Fabry Perot Detailed Resonator	None Simple Saturated Gain Detailed Kinetics	None Simple Flow Model Detailed Mixing
TYPE	<input checked="" type="checkbox"/>	Geometrical Physical	CW Pulsed HF, DF Other	Premixed Scheduled Mixing <input checked="" type="checkbox"/> Other
GEOMETRY		Standing Wave Ring Compact Annular	Annular, Radially Flowing Transversely Flowing Other	Cylindrical, Radially Flowing Rectangular, Linearly Flowing Other
GRID DIMENSION	<input checked="" type="checkbox"/>	(Transverse Dimension) 1 D 2 D	1 D 2 D 3 D	<input checked="" type="checkbox"/> 1 D 2 D 3 D
COORDINATE SYSTEM		Cartesian Cylindrical Other	Cartesian Cylindrical Other	Cartesian Cylindrical Other
FEATURES MODELED		Misalignments Aberrations Deformable Mirrors Far-Field Performance Other	Single Line Multiline Line Broadening Other	<input checked="" type="checkbox"/> Laminar Flow <input checked="" type="checkbox"/> Turbulent Flow Boundary Layer Shocks Other

CODE SUMMARY SHEET

CODE NAME:

BLIST

ORIGINATOR/KEY CONTACT:

Name: R. Hughes/D. Haflinger/H. W. Behrens Phone: (213) 536-2757

Organization: TRW DSSG

Address: RI/1038, One Space Park, Redondo Beach, California 90278

PRINCIPAL PURPOSE AND APPLICATION OF CODE: BLIST (Boundary Layer Integral Solution Technique) calculates nonsimilar development of 2-D or axisymmetric compressible laminar boundary layers with wall heat transfer.

AVAILABLE DOCUMENTATION: Internal Report: "A Description of the Laminar Integral Boundary Layer Model," TRW Report, August 1977.

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Fabry Perot <input type="checkbox"/> Detailed Resonator	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Saturated Gain <input type="checkbox"/> Detailed Kinetics	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Flow Model <input type="checkbox"/> Detailed Mixing
TYPE	<input type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input type="checkbox"/> CW <input type="checkbox"/> Pulsed <input type="checkbox"/> HF, DF <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Premixed <input type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other
GEOMETRY	<input type="checkbox"/> Standing Wave <input type="checkbox"/> Ring <input type="checkbox"/> Compact <input type="checkbox"/> Annular	<input type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cylindrical, Radially Flowing <input checked="" type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other
GRID DIMENSION	(Transverse Dimension) <input type="checkbox"/> 1 D <input type="checkbox"/> 2 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input checked="" type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D
COORDINATE SYSTEM	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other
FEATURES MODELED	<input type="checkbox"/> Misalignments <input type="checkbox"/> Aberrations <input type="checkbox"/> Deformable Mirrors <input type="checkbox"/> Far-Field Performance <input type="checkbox"/> Other	<input type="checkbox"/> Single Line <input type="checkbox"/> Multiline <input type="checkbox"/> Line Broadening <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Laminar Flow <input checked="" type="checkbox"/> Turbulent Flow <input type="checkbox"/> Boundary Layer <input type="checkbox"/> Shocks <input type="checkbox"/> Other

CODE SUMMARY SHEET

CODE NAME: CLOQ

ORIGINATOR/KEY CONTACT:

Name: Paul E. Fileger Phone: (305) 840-6643

Organization: United Technologies Research Center

Address: P.O. Box 2691, MX-R48, West Palm Beach, Florida 33402

PRINCIPAL PURPOSE AND APPLICATION OF CODE: _____

The CLOQ code was developed to analyze linear chemical laser systems
using rotational nonequilibrium kinetics.

AVAILABLE DOCUMENTATION: R. J. Hall, "Rotational Nonequilibrium and Line-
Selected Operation in CW DF Chemical Lasers," IEEE JQE, Vol QE-12, p 453
(1976)

CATEGORY ATTRIBUTE	OPTICS		KINETICS		GASDYNAMICS	
	LEVEL	<input type="checkbox"/> None <input type="checkbox"/> Simple Fabry Perot <input type="checkbox"/> Detailed Resonator	<input type="checkbox"/> None <input type="checkbox"/> Simple Saturated Gain <input type="checkbox"/> Detailed Kinetics	<input type="checkbox"/> None <input type="checkbox"/> Simple Flow Model <input type="checkbox"/> Detailed Mixing		
TYPE	<input type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input type="checkbox"/> CW <input type="checkbox"/> Pulsed <input type="checkbox"/> HF, DF <input type="checkbox"/> Other	<input type="checkbox"/> Premixed <input type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other			
GEOMETRY	<input type="checkbox"/> Standing Wave <input type="checkbox"/> Ring <input type="checkbox"/> Compact <input type="checkbox"/> Annular	<input type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input type="checkbox"/> Cylindrical, Radially Flowing <input type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other			
GRID DIMENSION	<input type="checkbox"/> (Transverse Dimension) <input type="checkbox"/> 1 D <input type="checkbox"/> 2 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D			
COORDINATE SYSTEM	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other			
FEATURES MODELED	<input type="checkbox"/> Misalignments <input type="checkbox"/> Aberrations <input type="checkbox"/> Deformable Mirrors <input type="checkbox"/> Far-Field Performance <input type="checkbox"/> Other	<input type="checkbox"/> Single Line <input type="checkbox"/> Multiline <input type="checkbox"/> Line Broadening <input type="checkbox"/> Other	<input type="checkbox"/> Laminar Flow <input type="checkbox"/> Turbulent Flow <input type="checkbox"/> Boundary Layer <input type="checkbox"/> Shocks <input type="checkbox"/> Other			

CODE SUMMARY SHEET

CODE NAME:

CLOQ3D

ORIGINATOR/KEY CONTACT:

Name: Paul E. Fileger Phone: (305) 840-6643
 Organization: United Technologies Research Center
 Address: P.O. Box 2691, MS-R-48, West Palm Beach, Florida 33402

PRINCIPAL PURPOSE AND APPLICATION OF CODE: CLOQ3D is an input scheduled code for analyzing HEL chemical lasers using wave optics coupled to rotational nonequilibrium kinetics or to equilibrium kinetics (HF or DF).

AVAILABLE DOCUMENTATION: User's manual to be published in February 1980.

CATEGORY ATTRIBUTE	OPTICS		KINETICS		GASDYNAMICS	
	LEVEL	<input checked="" type="checkbox"/>	None Simple Fabry Perot Detailed Resonator	<input checked="" type="checkbox"/>	None Simple Saturated Gain Detailed Kinetics	<input checked="" type="checkbox"/>
TYPE	<input checked="" type="checkbox"/>	Geometrical Physical	<input checked="" type="checkbox"/>	CW Pulsed HF, DF Other	<input checked="" type="checkbox"/>	Premixed Scheduled Mixing Other
GEOMETRY	<input checked="" type="checkbox"/>	Standing Wave Ring Compact Annular	<input checked="" type="checkbox"/>	Annular, Radially Flowing Transversely Flowing Other	<input checked="" type="checkbox"/>	Cylindrical, Radially Flowing Rectangular, Linearly Flowing Other
GRID DIMENSION	<input checked="" type="checkbox"/>	(Transverse Dimension) 1 D 2 D	<input checked="" type="checkbox"/>	1 D 2 D 3 D	<input checked="" type="checkbox"/>	1 D 2 D 3 D
COORDINATE SYSTEM	<input checked="" type="checkbox"/>	Cartesian Cylindrical Other	<input checked="" type="checkbox"/>	Cartesian Cylindrical Other	<input checked="" type="checkbox"/>	Cartesian Cylindrical Other
FEATURES MODELED	<input checked="" type="checkbox"/>	Misalignments Aberrations Deformable Mirrors Far-Field Performance Other	<input checked="" type="checkbox"/>	Single Line Multiline Line Broadening Other	<input checked="" type="checkbox"/>	Laminar Flow Turbulent Flow Boundary Layer Shocks Other

CODE SUMMARY SHEET

CODE NAME:

CLSLGM*

ORIGINATOR/KEY CONTACT:

Name: Peter R. Carlson/Robert E. Hodder Phone: (305) 283-3380
 Organization: Science Applications Inc.
 Address: 201 SW Monterey Rd., Suite 30, Stuart, Florida 33494

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Assess optical performance of
MIRACL device before, during, and after acceptance testing.
Essentially same theory/formalism developed by Sziklas
and Siegman for the Pratt & Whitney SOQ codes.

AVAILABLE DOCUMENTATION: "Chemical-Laser Scaling - Law Gain Model
Analysis." P. Carlson and R. Hodder, SAI Technical Memorandum to D.
Finkleman and J. Stregack (September 25, 1979).

CATEGORY/ ATTRIBUTE	OPTICS		KINETICS		GASDYNAMICS	
	LEVEL	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Fabry Perot <input type="checkbox"/> Detailed Resonator	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Saturated Gain <input type="checkbox"/> Detailed Kinetics	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Flow Model <input type="checkbox"/> Detailed Mixing		
TYPE	<input checked="" type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input checked="" type="checkbox"/> CW <input checked="" type="checkbox"/> Pulsed <input type="checkbox"/> HF, DF <input type="checkbox"/> Other	<input type="checkbox"/> Premixed <input type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other			
GEOMETRY	<input checked="" type="checkbox"/> Standing Wave <input checked="" type="checkbox"/> Ring <input type="checkbox"/> Compact <input type="checkbox"/> Annular	<input checked="" type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input type="checkbox"/> Cylindrical, Radially Flowing <input type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other			
GRID DIMENSION	(Transverse Dimension) <input checked="" type="checkbox"/> 1 D <input type="checkbox"/> 2 D	<input checked="" type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D			
COORDINATE SYSTEM	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other			
FEATURES MODELED	<input checked="" type="checkbox"/> Misalignments <input type="checkbox"/> Aberrations <input type="checkbox"/> Deformable Mirrors <input checked="" type="checkbox"/> Far-Field Performance <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Single Line <input type="checkbox"/> Multiline <input type="checkbox"/> Line Broadening <input type="checkbox"/> Other	<input type="checkbox"/> Laminar Flow <input type="checkbox"/> Turbulent Flow <input type="checkbox"/> Boundary Layer <input type="checkbox"/> Shocks <input type="checkbox"/> Other			

*Chemical-Laser Scaling - Law Gain Model

CODE SUMMARY SHEET

CODE NAME: CNCDE

ORIGINATOR/KEY CONTACT:

Name: S. W. Zelazny Phone: (716) 297-1000

Organization: Bell Aerospace Textron

Address: P.O. Box 1, Buffalo, New York 14240

PRINCIPAL PURPOSE AND APPLICATION OF CODE: _____

1-D flow analysis code analysis of combustor, nozzle, cavity, diffuser and ejectors. (See appendix C, table 1).

AVAILABLE DOCUMENTATION: _____

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	None Simple Fabry Perot Detailed Resonator	None Simple Saturated Gain Detailed Kinetics	None Simple Flow Model Detailed Mixing
TYPE	Geometrical Physical	CW Pulsed HF, DF Other	● Premixed Scheduled Mixing Other
GEOMETRY	Standing Wave Ring Compact Annular	Annular, Radially Flowing Transversely Flowing Other	Cylindrical, Radially Flowing Rectangular, Linearly Flowing Other
GRID DIMENSION	(Transverse Dimension) 1 D 2 D	1 D 2 D 3 D	● 1 D 2 D 3 D
COORDINATE SYSTEM	Cartesian Cylindrical Other	Cartesian Cylindrical Other	Cartesian Cylindrical Other
FEATURES MODELED	Misalignments Aberrations Deformable Mirrors Far-Field Performance Other	Single Line Multiline Line Broadening Other	Laminar Flow Turbulent Flow Boundary Layer Shocks Other

CODE SUMMARY SHEET

CODE NAME:

COMOC-SA

ORIGINATOR/KEY CONTACT:

Name: S. W. Zelazny Phone: (716) 297-1000

Organization: Bell Aerospace Textron

Address: P.O. Box 1, Buffalo, New York 14240

PRINCIPAL PURPOSE AND APPLICATION OF CODE:

2-D finite element code for the structural analysis of combustor, nozzle and optics. (See appendix C, table 1.)

AVAILABLE DOCUMENTATION:

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	None Simple Fabry Perot Detailed Resonator	None Simple Saturated Gain Detailed Kinetics	None Simple Flow Model Detailed Mixing
TYPE	Geometrical Physical	CW Pulsed HF, DF Other	Premixed Scheduled Mixing Other
GEOMETRY	Standing Wave Ring Compact Annular	Annular, Radially Flowing Transversely Flowing Other	Cylindrical, Radially Flowing Rectangular, Linearly Flowing Other
GRID DIMENSION	(Transverse Dimension) 1 D 2 D	1 D 2 D 3 D	1 D 2 D 3 D
COORDINATE SYSTEM	Cartesian Cylindrical Other	Cartesian Cylindrical Other	Cartesian Cylindrical Other
FEATURES MODELED	Misalignments Aberrations Deformable Mirrors Far-Field Performance Other	Single Line Multiline Line Broadening Other	Laminar Flow Turbulent Flow Boundary Layer Shocks Other

CODE SUMMARY SHEET

CODE NAME:

COMOC-TA

ORIGINATOR/KEY CONTACT:

Name: S. W. Zelazny Phone: (716) 297-1000

Organization: Bell Aerospace Textron

Address: P.O. Box 1, Buffalo, New York 14240

PRINCIPAL PURPOSE AND APPLICATION OF CODE: _____

2-D thermal analysis (finite element) code used to analyze combustor, nozzle, and optics. (See appendix C, table 1.)

AVAILABLE DOCUMENTATION: _____

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	None Simple Fabry Perot Detailed Resonator	None Simple Saturated Gain Detailed Kinetics	None Simple Flow Model Detailed Mixing
TYPE	Geometrical Physical	CW Pulsed HF, DF Other	Premixed Scheduled Mixing Other
GEOMETRY	Standing Wave Ring Compact Annular	Annular, Radially Flowing Transversely Flowing Other	Cylindrical, Radially Flowing Rectangular, Linearly Flowing Other
GRID DIMENSION	(Transverse Dimension) 1 D 2 D	1 D 2 D 3 D	1 D 2 D 3 D
COORDINATE SYSTEM	Cartesian Cylindrical Other	Cartesian Cylindrical Other	Cartesian Cylindrical Other
FEATURES MODELED	Misalignments Aberrations Deformable Mirrors Far-Field Performance Other	Single Line Multiline Line Broadening Other	Laminar Flow Turbulent Flow Boundary Layer Shocks Other

CODE SUMMARY SHEET

CODE NAME:

COMOC-2DNS

ORIGINATOR/KEY CONTACT:

Name: S. W. Zelazny Phone: (716) 297-1000Organization: Bell Aerospace TextronAddress: P.O. Box 1, Buffalo, New York 14240

PRINCIPAL PURPOSE AND APPLICATION OF CODE: 2-D finite element mixing code with simple chemistry used for cavity and diffuser/ejector analysis (See appendix C, table 1).

AVAILABLE DOCUMENTATION: _____

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	● None Simple Fabry Perot Detailed Resonator	None Simple Saturated Gain Detailed Kinetics	● None Simple Flow Model Detailed Mixing
TYPE	Geometrical Physical	CW Pulsed HF, DF Other	● Premixed Scheduled Mixing Other
GEOMETRY	Standing Wave Ring Compact Annular	Annular, Radially Flowing Transversely Flowing Other	Cylindrical, Radially Flowing Rectangular, Linearly Flowing Other
GRID DIMENSION	(Transverse Dimension) 1 D 2 D	1 D 2 D 3 D	● 1 D 2 D 3 D
COORDINATE SYSTEM	Cartesian Cylindrical Other	Cartesian Cylindrical Other	Cartesian Cylindrical Other
FEATURES MODELED	Misalignments Aberrations Deformable Mirrors Far-Field Performance Other	Single Line Multiline Line Broadening Other	● Laminar Flow ● Turbulent Flow Boundary Layer Shocks Other

CODE SUMMARY SHEET

CODE NAME:

COMOC-3DPNS

ORIGINATOR/KEY CONTACT:

Name: S. W. Zelazny Phone: (716) 297-1000

Organization: Bell Aerospace Textron

Address: P.O. Box 1, Buffalo, New York 14240

PRINCIPAL PURPOSE AND APPLICATION OF CODE: _____

3-D mixing code, finite element with simple chemistry used for combustor and cavity analysis (See appendix C, table 1.)

AVAILABLE DOCUMENTATION: _____

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input checked="" type="checkbox"/> None Simple Fabry Perot Detailed Resonator	<input type="checkbox"/> None Simple Saturated Gain Detailed Kinetics	<input checked="" type="checkbox"/> None Simple Flow Model Detailed Mixing
TYPE	<input type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input type="checkbox"/> CW <input type="checkbox"/> Pulsed <input type="checkbox"/> HF, DF <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Premixed <input type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other
GEOMETRY	<input type="checkbox"/> Standing Wave <input type="checkbox"/> Ring <input type="checkbox"/> Compact <input type="checkbox"/> Annular	<input type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input type="checkbox"/> Cylindrical, Radially Flowing <input type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other
GRID DIMENSION	<input type="checkbox"/> (Transverse Dimension) <input type="checkbox"/> 1 D <input type="checkbox"/> 2 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input checked="" type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D
COORDINATE SYSTEM	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other
FEATURES MODELED	<input type="checkbox"/> Misalignments <input type="checkbox"/> Aberrations <input type="checkbox"/> Deformable Mirrors <input type="checkbox"/> Far-Field Performance <input type="checkbox"/> Other	<input type="checkbox"/> Single Line <input type="checkbox"/> Multiline <input type="checkbox"/> Line Broadening <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Laminar Flow <input checked="" type="checkbox"/> Turbulent Flow <input checked="" type="checkbox"/> Boundary Layer <input checked="" type="checkbox"/> Shocks <input checked="" type="checkbox"/> Other

CODE SUMMARY SHEET

CODE NAME: CROQ

ORIGINATOR/KEY CONTACT:

Name: Donald L. Bullock Phone: (213) 535-3484Organization: TRW DSSGAddress: R1/1162 One Space Park, Redondo Beach, California 90278

PRINCIPAL PURPOSE AND APPLICATION OF CODE:

Models HSURIA and ring resonator with mode rotation. Intended to be a resonator design code for maximizing focusability and power of output beam as a function of gain generator and resonator parameters.

AVAILABLE DOCUMENTATION: Planned. Annual Laser Model Studies (final report for axicon theory, aligned and misaligned).

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<ul style="list-style-type: none"> ● None ● Simple Fabry Perot ● Detailed Resonator 	<ul style="list-style-type: none"> ● None ● Simple Saturated Gain ● Detailed Kinetics 	<ul style="list-style-type: none"> ● None ● Simple Flow Model ● Detailed Mixing
TYPE	<ul style="list-style-type: none"> ● Geometrical ● Physical 	<ul style="list-style-type: none"> ● CW ● Pulsed ● HF, DF ● Other 	<ul style="list-style-type: none"> ● Premixed ● Scheduled Mixing ● Other
GEOMETRY	<ul style="list-style-type: none"> ● Standing Wave ● Ring ● Compact ● Annular 	<ul style="list-style-type: none"> ● Annular, Radially Flowing ● Transversely Flowing ● Other 	<ul style="list-style-type: none"> ● Cylindrical, Radially Flowing ● Rectangular, Linearly Flowing ● Other
GRID DIMENSION	<ul style="list-style-type: none"> ● (Transverse Dimension) ● 1 D ● 2 D 	<ul style="list-style-type: none"> ● 1 D ● 2 D ● 3 D 	<ul style="list-style-type: none"> ● 1 D ● 2 D ● 3 D
COORDINATE SYSTEM	<ul style="list-style-type: none"> ● Cartesian ● Cylindrical ● Other 	<ul style="list-style-type: none"> ● Cartesian ● Cylindrical ● Other 	<ul style="list-style-type: none"> ● Cartesian ● Cylindrical ● Other
FEATURES MODELED	<ul style="list-style-type: none"> ● Misalignments ● Aberrations ● Deformable Mirrors ● Far-Field Performance ● Other 	<ul style="list-style-type: none"> ● Single Line ● Multiline ● Line Broadening ● Other 	<ul style="list-style-type: none"> ● Laminar Flow ● Turbulent Flow ● Boundary Layer ● Shocks ● Other

CODE SUMMARY SHEET

CODE NAME:

DENTAL

ORIGINATOR/KEY CONTACT:

Name: Captain Ted Salvi Phone: (505) 844-0721
 Organization: Air Force Weapons Laboratory
 Address: AFWL/ALR, Kirtland AFB, New Mexico 87115

PRINCIPAL PURPOSE AND APPLICATION OF CODE:

Laser kinetics calculations with strip unstable resonator. Can select
CO₂, HF/DF, or KrF kinetics.

AVAILABLE DOCUMENTATION: None

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input type="checkbox"/> None <input checked="" type="checkbox"/> Simple Fabry Perot <input type="checkbox"/> Detailed Resonator	<input type="checkbox"/> None <input checked="" type="checkbox"/> Simple Saturated Gain <input type="checkbox"/> Detailed Kinetics	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Flow Model <input type="checkbox"/> Detailed Mixing
TYPE	<input checked="" type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input checked="" type="checkbox"/> CW <input checked="" type="checkbox"/> Pulsed <input checked="" type="checkbox"/> HF, DF <input checked="" type="checkbox"/> Other	<input checked="" type="checkbox"/> Premixed <input type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other
GEOMETRY	<input checked="" type="checkbox"/> Standing Wave <input type="checkbox"/> Ring <input checked="" type="checkbox"/> Compact <input type="checkbox"/> Annular	<input type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cylindrical, Radially Flowing <input type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other
GRID DIMENSION	<input checked="" type="checkbox"/> (Transverse Dimension) <input type="checkbox"/> 1 D <input type="checkbox"/> 2 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input checked="" type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D
COORDINATE SYSTEM	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other
FEATURES MODELED	<input checked="" type="checkbox"/> Misalignments <input checked="" type="checkbox"/> Aberrations <input type="checkbox"/> Deformable Mirrors <input checked="" type="checkbox"/> Far-Field Performance <input checked="" type="checkbox"/> Other	<input checked="" type="checkbox"/> Single Line <input type="checkbox"/> Multiline <input type="checkbox"/> Line Broadening <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Laminar Flow <input type="checkbox"/> Turbulent Flow <input type="checkbox"/> Boundary Layer <input type="checkbox"/> Shocks <input checked="" type="checkbox"/> Other

CODE SUMMARY SHEET

CODE NAME: DESALE-5

ORIGINATOR/KEY CONTACT:

Name: M. Epstein Phone: (213) 648-6861
 Organization: Aerophysics Laboratory, The Aerospace Corporation
 Address: P.O. Box 92957, Los Angeles, California 90009

PRINCIPAL PURPOSE AND APPLICATION OF CODE:

Calculation of CW and pulsed chemical laser performance.

AVAILABLE DOCUMENTATION: DESALE-5: A Comprehensive Scheduled Mixing Model for CW Chemical Laser, M. Epstein, Aerospace Corporation Report SAMS0-TR-79-31, May 1, 1979. User Manual, SAMS0 TR-75-60, W. D. Adams, et al, February 20, 1975.

CATEGORY ATTRIBUTE	OPTICS		KINETICS		GASDYNAMICS	
	LEVEL	<input checked="" type="checkbox"/> None Simple Fabry Perot Detailed Resonator	<input checked="" type="checkbox"/> None Simple Saturated Gain Detailed Kinetics	<input checked="" type="checkbox"/> None Simple Flow Model Detailed Mixing		
TYPE	<input checked="" type="checkbox"/> Geometrical Physical	<input checked="" type="checkbox"/> CW <input checked="" type="checkbox"/> Pulsed <input checked="" type="checkbox"/> HF, DF <input checked="" type="checkbox"/> Other	<input checked="" type="checkbox"/> Premixed <input checked="" type="checkbox"/> Scheduled Mixing Other			
GEOMETRY	<input type="checkbox"/> Standing Wave Ring <input type="checkbox"/> Compact Annular	<input type="checkbox"/> Annular, Radially Flowing Transversely Flowing Other	<input checked="" type="checkbox"/> Cylindrical, Radially Flowing <input checked="" type="checkbox"/> Rectangular, Linearly Flowing <input checked="" type="checkbox"/> Other			
GRID DIMENSION	<input type="checkbox"/> (Transverse Dimension) 1 D 2 D	<input type="checkbox"/> 1 D 2 D 3 D	<input checked="" type="checkbox"/> 1 D 2 D 3 D			
COORDINATE SYSTEM	<input checked="" type="checkbox"/> Cartesian Cylindrical Other	<input checked="" type="checkbox"/> Cartesian Cylindrical Other	<input checked="" type="checkbox"/> Cartesian Cylindrical Other			
FEATURES MODELED	<input type="checkbox"/> Misalignments Aberrations Deformable Mirrors Far-Field Performance Other	<input checked="" type="checkbox"/> Single Line <input checked="" type="checkbox"/> Multiline <input checked="" type="checkbox"/> Line Broadening <input checked="" type="checkbox"/> Other	<input checked="" type="checkbox"/> Laminar Flow <input checked="" type="checkbox"/> Turbulent Flow <input checked="" type="checkbox"/> Boundary Layer Shocks <input checked="" type="checkbox"/> Other			

CODE SUMMARY SHEET

CODE NAME: DIFF-2

ORIGINATOR/KEY CONTACT:

Name: S. W. Zelazny Phone: (716) 297-1000

Organization: Bell Aerospace Textron

Address: P.O. Box 1, Buffalo, New York 14240

PRINCIPAL PURPOSE AND APPLICATION OF CODE: _____

2-D unstable resonator optics coupled to mixing model. Optics uses FFT.
Used to analyze optics. (See appendix C, table 1.)

AVAILABLE DOCUMENTATION: _____

CATEGORY ATTRIBUTE	OPTICS		KINETICS		GASDYNAMICS	
	LEVEL	<input checked="" type="checkbox"/> None Simple Fabry Perot Detailed Resonator	<input type="checkbox"/> None Simple Saturated Gain Detailed Kinetics	<input type="checkbox"/> None Simple Flow Model Detailed Mixing		
TYPE	<input checked="" type="checkbox"/> Geometrical Physical	<input type="checkbox"/> CW Pulsed HF, DF Other	<input checked="" type="checkbox"/> Premixed Scheduled Mixing Other			
GEOMETRY	<input type="checkbox"/> Standing Wave Ring Compact Annular	<input type="checkbox"/> Annular, Radially Flowing Transversely Flowing Other	<input type="checkbox"/> Cylindrical, Radially Flowing Rectangular, Linearly Flowing Other			
GRID DIMENSION	<input checked="" type="checkbox"/> (Transverse Dimension) 1 D 2 D	<input type="checkbox"/> 1 D 2 D 3 D	<input checked="" type="checkbox"/> 1 D 2 D 3 D			
COORDINATE SYSTEM	<input type="checkbox"/> Cartesian Cylindrical Other	<input type="checkbox"/> Cartesian Cylindrical Other	<input type="checkbox"/> Cartesian Cylindrical Other			
FEATURES MODELED	<input type="checkbox"/> Misalignments Aberrations Deformable Mirrors Far-Field Performance Other	<input type="checkbox"/> Single Line Multiline Line Broadening Other	<input checked="" type="checkbox"/> Laminar Flow <input checked="" type="checkbox"/> Turbulent Flow Boundary Layer Shocks Other			

CODE SUMMARY SHEET

CODE NAME: DIFF-3

ORIGINATOR/KEY CONTACT:

Name: S. W. Zelazny Phone: (716) 297-1000

Organization: Bell Aerospace Textron

Address: P.O. Box 1, Buffalo, New York 14240

PRINCIPAL PURPOSE AND APPLICATION OF CODE:

Same as DIFF-2 except 3-D mixing. (See appendix C, table 1).

AVAILABLE DOCUMENTATION:

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Fabry Perot <input type="checkbox"/> Detailed Resonator	<input type="checkbox"/> None <input type="checkbox"/> Simple Saturated Gain <input type="checkbox"/> Detailed Kinetics	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Flow Model <input type="checkbox"/> Detailed Mixing
TYPE	<input checked="" type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input type="checkbox"/> CW <input type="checkbox"/> Pulsed <input type="checkbox"/> HF, DF <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Premixed <input type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other
GEOMETRY	<input type="checkbox"/> Standing Wave <input type="checkbox"/> Ring <input type="checkbox"/> Compact <input type="checkbox"/> Annular	<input type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input type="checkbox"/> Cylindrical, Radially Flowing <input type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other
GRID DIMENSION	<input checked="" type="checkbox"/> (Transverse Dimension) <input type="checkbox"/> 1 D <input type="checkbox"/> 2 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input checked="" type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D
COORDINATE SYSTEM	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other
FEATURES MODELED	<input type="checkbox"/> Misalignments <input type="checkbox"/> Aberrations <input type="checkbox"/> Deformable Mirrors <input type="checkbox"/> Far-Field Performance <input type="checkbox"/> Other	<input type="checkbox"/> Single Line <input type="checkbox"/> Multiline <input type="checkbox"/> Line Broadening <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Laminar Flow <input checked="" type="checkbox"/> Turbulent Flow <input type="checkbox"/> Boundary Layer <input type="checkbox"/> Shocks <input type="checkbox"/> Other

CODE SUMMARY SHEET

CODE NAME:

ELNWD2

ORIGINATOR/KEY CONTACT:

Name: John Ellinwood Phone: (213) 648-7391

Organization: The Aerospace Corporation

Address: P.O. Box 92957, Los Angeles, California 90009

PRINCIPAL PURPOSE AND APPLICATION OF CODE: _____

Computer transverse eigenmodes of bare annular resonators. Simple gain model to be added.

AVAILABLE DOCUMENTATION: None

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input checked="" type="radio"/> None <input type="radio"/> Simple Fabry Perot <input type="radio"/> Detailed Resonator	<input checked="" type="radio"/> None <input type="radio"/> Simple Saturated Gain <input type="radio"/> Detailed Kinetics	<input checked="" type="radio"/> None <input type="radio"/> Simple Flow Model <input type="radio"/> Detailed Mixing
TYPE	<input checked="" type="radio"/> Geometrical <input type="radio"/> Physical	<input type="radio"/> CW <input type="radio"/> Pulsed <input type="radio"/> HF, DF <input type="radio"/> Other	<input type="radio"/> Premixed <input type="radio"/> Scheduled Mixing <input type="radio"/> Other
GEOMETRY	<input checked="" type="radio"/> Standing Wave <input type="radio"/> Ring <input type="radio"/> Compact <input type="radio"/> Annular	<input type="radio"/> Annular, Radially Flowing <input type="radio"/> Transversely Flowing <input type="radio"/> Other	<input type="radio"/> Cylindrical, Radially Flowing <input type="radio"/> Rectangular, Linearly Flowing <input type="radio"/> Other
GRID DIMENSION	<input checked="" type="radio"/> (Transverse Dimension) <input type="radio"/> 1 D <input type="radio"/> 2 D	<input type="radio"/> 1 D <input type="radio"/> 2 D <input type="radio"/> 3 D	<input type="radio"/> 1 D <input type="radio"/> 2 D <input type="radio"/> 3 D
COORDINATE SYSTEM	<input checked="" type="radio"/> Cartesian <input type="radio"/> Cylindrical <input type="radio"/> Other	<input type="radio"/> Cartesian <input type="radio"/> Cylindrical <input type="radio"/> Other	<input type="radio"/> Cartesian <input type="radio"/> Cylindrical <input type="radio"/> Other
FEATURES MODELED	<input type="radio"/> Misalignments <input type="radio"/> Aberrations <input type="radio"/> Deformable Mirrors <input type="radio"/> Far-Field Performance <input type="radio"/> Other	<input type="radio"/> Single Line <input type="radio"/> Multiline <input type="radio"/> Line Broadening <input type="radio"/> Other	<input type="radio"/> Laminar Flow <input type="radio"/> Turbulent Flow <input type="radio"/> Boundary Layer <input type="radio"/> Shocks <input type="radio"/> Other

CODE SUMMARY SHEET

CODE NAME: GASSER

ORIGINATOR/KEY CONTACT:

Name: D. Haflinger/P. Lohn Phone: (213) 536-1624Organization: TRW DSSGAddress: R1/1038, One Space Park, Redondo Beach, California 90278

PRINCIPAL PURPOSE AND APPLICATION OF CODE: _____

Inviscid flow code using the method of characteristics and accounts for heat release. It is used for cavity flows with heat release defining shroud contours flow conditions at end of cavity, etc.

AVAILABLE DOCUMENTATION: None

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input checked="" type="checkbox"/> None Simple Fabry Perot Detailed Resonator	<input checked="" type="checkbox"/> None Simple Saturated Gain Detailed Kinetics	<input type="checkbox"/> None Simple Flow Model Detailed Mixing
TYPE	<input type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input type="checkbox"/> CW <input type="checkbox"/> Pulsed <input type="checkbox"/> HF, DF <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Premixed <input type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other
GEOMETRY	<input type="checkbox"/> Standing Wave <input type="checkbox"/> Ring <input type="checkbox"/> Compact <input type="checkbox"/> Annular	<input type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cylindrical, Radially Flowing <input type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other
GRID DIMENSION	<input type="checkbox"/> (Transverse Dimension) <input type="checkbox"/> 1 D <input type="checkbox"/> 2 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input checked="" type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D
COORDINATE SYSTEM	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other
FEATURES MODELED	<input type="checkbox"/> Misalignments <input type="checkbox"/> Aberrations <input type="checkbox"/> Deformable Mirrors <input type="checkbox"/> Far-Field Performance <input type="checkbox"/> Other	<input type="checkbox"/> Single Line <input type="checkbox"/> Multiline <input type="checkbox"/> Line Broadening <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Laminar Flow <input type="checkbox"/> Turbulent Flow <input type="checkbox"/> Boundary Layer <input type="checkbox"/> Shocks <input type="checkbox"/> Other

CODE SUMMARY SHEET

CODE NAME: GCAL

ORIGINATOR/KEY CONTACT:

Name: Kerry E. Patterson Phone: (404) 955-2663

Organization: Science Applications, Inc.

Address: 6600 Powers Ferry Road, Atlanta, Georgia 30339

PRINCIPAL PURPOSE AND APPLICATION OF CODE: To provide extremely efficient single-line gain algorithm which is anchored to available data base for nozzle being studied. Used with SAIGD.

AVAILABLE DOCUMENTATION: HF Laser Subsystem Technology Assessment (DARPA Interim Report), Science Applications, Atlanta, Georgia, July 1979, Section 3.

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	● None Simple Fabry Perot Detailed Resonator	● None Simple Saturated Gain Detailed Kinetics	● None Simple Flow Model Detailed Mixing
TYPE	Geometrical Physical	● CW Pulsed ● HF, DF Other	● Premixed Scheduled Mixing Other
GEOMETRY	Standing Wave Ring Compact Annular	● Annular, Radially Flowing ● Transversely Flowing Other	● Cylindrical, Radially Flowing Rectangular, Linearly Flowing Other
GRID DIMENSION	(Transverse Dimension) 1 D 2 D	● 1 D 2 D 3 D	● 1 D 2 D 3 D
COORDINATE SYSTEM	Cartesian Cylindrical Other	● Cartesian ● Cylindrical Other	● Cartesian Cylindrical Other
FEATURES MODELED	Misalignments Aberrations Deformable Mirrors Far-Field Performance Other	● Single Line Multiline ● Line Broadening Other	● Laminar Flow Turbulent Flow Boundary Layer Shocks Other

CODE SUMMARY SHEET

CODE NAME:

GENRING

ORIGINATOR/KEY CONTACT:

Name: Carl M. Wiggins Phone: (505) 848-5000

Organization: The BDM Corporation

Address: 1801 Randolph Road, S.E., Albuquerque, New Mexico 87106

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Models ring resonators utilizing pairs of linear and nonlinear axicons (reflaxicons, waxicons) to produce an annular gain region. Used in ring resonator candidate trade-off studies, effects of spatial filtering on mode control, and to study concept of (scraper) aperture self-imaging.

AVAILABLE DOCUMENTATION: GENRING: a computer code for Modeling Cylindrical Unstable Ring Resonators With Internal Reflecting Axicons, BDM/TAC-79-152-TR, The BDM Corporation, May 1, 1979.

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Fabry Perot <input type="checkbox"/> Detailed Resonator	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Saturated Gain <input type="checkbox"/> Detailed Kinetics	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Flow Model <input type="checkbox"/> Detailed Mixing
TYPE	<input checked="" type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input type="checkbox"/> CW <input type="checkbox"/> Pulsed <input type="checkbox"/> HF, DF <input type="checkbox"/> Other	<input type="checkbox"/> Premixed <input type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other
GEOMETRY	<input checked="" type="checkbox"/> Standing Wave <input checked="" type="checkbox"/> Ring <input checked="" type="checkbox"/> Compact <input checked="" type="checkbox"/> Annular	<input type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input type="checkbox"/> Cylindrical, Radially Flowing <input type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other
GRID DIMENSION	<input checked="" type="checkbox"/> (Transverse Dimension) <input type="checkbox"/> 1 D <input type="checkbox"/> 2 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D
COORDINATE SYSTEM	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other
FEATURES MODELED	<input checked="" type="checkbox"/> Misalignments <input checked="" type="checkbox"/> Aberrations <input type="checkbox"/> Deformable Mirrors <input checked="" type="checkbox"/> Far-Field Performance <input checked="" type="checkbox"/> Other	<input type="checkbox"/> Single Line <input type="checkbox"/> Multiline <input type="checkbox"/> Line Broadening <input type="checkbox"/> Other	<input type="checkbox"/> Laminar Flow <input type="checkbox"/> Turbulent Flow <input type="checkbox"/> Boundary Layer <input type="checkbox"/> Shocks <input type="checkbox"/> Other

CODE SUMMARY SHEET

CODE NAME:

GIM

ORIGINATOR/KEY CONTACT:

Name: D. W. Lankford Phone: (505) 844 -9836

Organization: Air Force Weapons Laboratory

Address: AFWL/ARAC, Kirtland AFB, New Mexico 87117

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Laser cavity and nozzle analysis. Will eventually combine multidimensional viscous diffusing, time-dependent flows with the chemical kinetics capabilities of ALFA and APACHE codes.

AVAILABLE DOCUMENTATION: To become available.

CATEGORY ATTRIBUTE	OPTICS		KINETICS		GASDYNAMICS	
	LEVEL	<input checked="" type="checkbox"/> None Simple Fabry Perot Detailed Resonator	<input checked="" type="checkbox"/> None Simple Saturated Gain Detailed Kinetics	<input checked="" type="checkbox"/> None Simple Flow Model Detailed Mixing		
TYPE	Geometrical Physical	CW Pulsed HF, DF Other	<input checked="" type="checkbox"/> Premixed Scheduled Mixing Other			
GEOMETRY	Standing Wave Ring Compact Annular	Annular, Radially Flowing Transversely Flowing Other	<input checked="" type="checkbox"/> Cylindrical, Radially Flowing <input checked="" type="checkbox"/> Rectangular, Linearly Flowing Other			
GRID DIMENSION	(Transverse Dimension) 1 D 2 D	1 D 2 D 3 D	<input checked="" type="checkbox"/> 1 D <input checked="" type="checkbox"/> 2 D <input checked="" type="checkbox"/> 3 D			
COORDINATE SYSTEM	Cartesian Cylindrical Other	Cartesian Cylindrical Other	<input checked="" type="checkbox"/> Cartesian <input checked="" type="checkbox"/> Cylindrical Other			
FEATURES MODELED	Misalignments Aberrations Deformable Mirrors Far-Field Performance Other	Single Line Multiline Line Broadening Other	<input checked="" type="checkbox"/> Laminar Flow <input checked="" type="checkbox"/> Turbulent Flow <input checked="" type="checkbox"/> Boundary Layer <input checked="" type="checkbox"/> Shocks <input checked="" type="checkbox"/> Other, Recirculating			

CODE SUMMARY SHEET

CODE NAME: GLADV

ORIGINATOR/KEY CONTACT:

Name: R. Hughes/D. Haflinger/H. W. Behrens Phone: (213) 536-2757

Organization: TRW DSSG

Address: R1/1038, One Space Park, Redondo Beach, California 90278

PRINCIPAL PURPOSE AND APPLICATION OF CODE:

General laser analysis to calculate average flow properties in nozzle and in cavity.

AVAILABLE DOCUMENTATION: None

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Fabry Perot <input type="checkbox"/> Detailed Resonator	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Saturated Gain <input type="checkbox"/> Detailed Kinetics	<input type="checkbox"/> None <input type="checkbox"/> Simple Flow Model <input type="checkbox"/> Detailed Mixing
TYPE	<input type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input checked="" type="checkbox"/> CW <input type="checkbox"/> Pulsed <input type="checkbox"/> HF, DF <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Premixed <input type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other
GEOMETRY	<input type="checkbox"/> Standing Wave <input type="checkbox"/> Ring <input type="checkbox"/> Compact <input type="checkbox"/> Annular	<input type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cylindrical, Radially Flowing <input type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other
GRID DIMENSION	<input type="checkbox"/> (Transverse Dimension) <input type="checkbox"/> 1 D <input type="checkbox"/> 2 D	<input checked="" type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input checked="" type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D
COORDINATE SYSTEM	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other
FEATURES MODELED	<input type="checkbox"/> Misalignments <input type="checkbox"/> Aberrations <input type="checkbox"/> Deformable Mirrors <input type="checkbox"/> Far-Field Performance <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Single Line <input type="checkbox"/> Multiline <input type="checkbox"/> Line Broadening <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Laminar Flow <input type="checkbox"/> Turbulent Flow <input type="checkbox"/> Boundary Layer <input type="checkbox"/> Shocks <input type="checkbox"/> Other

CODE SUMMARY SHEET

CODE NAME: GOAD

ORIGINATOR/KEY CONTACT:

Name: S. W. Zelazny Phone: (716) 297-1000

Organization: Bell Aerospace Textron

Address: P.O. Box 1, Buffalo, New York 14240

PRINCIPAL PURPOSE AND APPLICATION OF CODE: _____

Resonator analysis code. (See appendix C, table 2).

AVAILABLE DOCUMENTATION: _____

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input type="checkbox"/> None <input type="checkbox"/> Simple Fabry Perot <input type="checkbox"/> Detailed Resonator	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Saturated Gain <input type="checkbox"/> Detailed Kinetics	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Flow Model <input type="checkbox"/> Detailed Mixing
TYPE	<input checked="" type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input type="checkbox"/> CW <input type="checkbox"/> Pulsed <input type="checkbox"/> HF, DF <input type="checkbox"/> Other	<input type="checkbox"/> Premixed <input type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other
GEOMETRY	<input type="checkbox"/> Standing Wave <input type="checkbox"/> Ring <input type="checkbox"/> Compact <input checked="" type="checkbox"/> Annular	<input type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input type="checkbox"/> Cylindrical, Radially Flowing <input type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other
GRID DIMENSION	(Transverse Dimension) <input type="checkbox"/> 1 D <input checked="" type="checkbox"/> 2 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D
COORDINATE SYSTEM	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other
FEATURES MODELED	<input checked="" type="checkbox"/> Misalignments <input type="checkbox"/> Aberrations <input type="checkbox"/> Deformable Mirrors <input type="checkbox"/> Far-Field Performance <input type="checkbox"/> Other	<input type="checkbox"/> Single Line <input type="checkbox"/> Multiline <input type="checkbox"/> Line Broadening <input type="checkbox"/> Other	<input type="checkbox"/> Laminar Flow <input type="checkbox"/> Turbulent Flow <input type="checkbox"/> Boundary Layer <input type="checkbox"/> Shocks <input type="checkbox"/> Other

CODE SUMMARY SHEET

CODE NAME:

GOPWR

ORIGINATOR/KEY CONTACT:

Name: Tien Tsai Yang/J. K. Hunting Phone: (213) 884-3346
 Organization: Rockwell International/Rocketdyne Division
 Address: 6633 Canoga Avenue, Canoga Park, California 91304

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Predict optical performance of CW chemical lasers, identify physical parameters affecting power extraction efficiency and gain saturation. (Also see HFGOPWR).

AVAILABLE DOCUMENTATION: GOPWR: A Computational Program to Calculate the Performance of CW Chemical Lasers, AFWL-TR-79-142.

CATEGORY ATTRIBUTE	OPTICS		KINETICS		GASDYNAMICS	
LEVEL	<input checked="" type="checkbox"/>	None Simple Fabry Perot Detailed Resonator	<input checked="" type="checkbox"/>	None Simple Saturated Gain Detailed Kinetics	<input checked="" type="checkbox"/>	None Simple Flow Model Detailed Mixing
TYPE	<input checked="" type="checkbox"/>	Geometrical Physical	<input checked="" type="checkbox"/>	CW Pulsed HF, DF Other	<input checked="" type="checkbox"/>	Premixed Scheduled Mixing Other
GEOMETRY	<input checked="" type="checkbox"/>	Standing Wave Ring Compact Annular	<input checked="" type="checkbox"/>	Annular, Radially Flowing Transversely Flowing Other	<input checked="" type="checkbox"/>	Cylindrical, Radially Flowing Rectangular, Linearly Flowing Other
GRID DIMENSION	<input checked="" type="checkbox"/>	(Transverse Dimension) 1 D 2 D	<input checked="" type="checkbox"/>	1 D 2 D 3 D	<input checked="" type="checkbox"/>	1 D 2 D 3 D
COORDINATE SYSTEM		Cartesian Cylindrical Other	<input checked="" type="checkbox"/>	Cartesian Cylindrical Other	<input checked="" type="checkbox"/>	Cartesian Cylindrical Other
FEATURES MODELED	<input checked="" type="checkbox"/>	Misalignments Aberrations Deformable Mirrors Far-Field Performance Other	<input checked="" type="checkbox"/>	Single Line Multiline Line Broadening Other	<input checked="" type="checkbox"/>	Laminar Flow Turbulent Flow Boundary Layer Shocks Other

CODE SUMMARY SHEET

CODE NAME:

GURDM

ORIGINATOR/KEY CONTACT:

Name: T. R. Ferguson and G. T. Worth Phone: (505) 848-5000

Organization: The BDM Corporation

Address: 1801 Randolph Road, S.E., Albuquerque, New Mexico 87106

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Originally designed to model Pratt & Whitney's intercavity adaptive optics experiments. Models base cavity compact beam resonators with circular and mirrors and one or two internal deformable mirrors. A far-field code includes external deformable mirror, tilt removal, optimum focus, etc.

AVAILABLE DOCUMENTATION: General Unstable Resonator with Deformable Mirrors (Program GURDM), T. R. Ferguson, et al; The BDM Corporation, BDM/TAC-79-193-TR, March 31, 1979.

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input type="checkbox"/> None <input checked="" type="checkbox"/> Simple Fabry Perot <input type="checkbox"/> Detailed Resonator	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Saturated Gain <input type="checkbox"/> Detailed Kinetics	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Flow Model <input type="checkbox"/> Detailed Mixing
TYPE	<input checked="" type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input type="checkbox"/> CW <input type="checkbox"/> Pulsed <input type="checkbox"/> HF, DF <input type="checkbox"/> Other	<input type="checkbox"/> Premixed <input type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other
GEOMETRY	<input checked="" type="checkbox"/> Standing Wave <input type="checkbox"/> Ring <input checked="" type="checkbox"/> Compact <input type="checkbox"/> Annular	<input type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input type="checkbox"/> Cylindrical, Radially Flowing <input type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other
GRID DIMENSION	<input checked="" type="checkbox"/> (Transverse Dimension) <input type="checkbox"/> 1 D <input type="checkbox"/> 2 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D
COORDINATE SYSTEM	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other
FEATURES MODELED	<input checked="" type="checkbox"/> Misalignments <input checked="" type="checkbox"/> Aberrations <input checked="" type="checkbox"/> Deformable Mirrors <input checked="" type="checkbox"/> Far-Field Performance <input checked="" type="checkbox"/> Other	<input type="checkbox"/> Single Line <input type="checkbox"/> Multiline <input type="checkbox"/> Line Broadening <input type="checkbox"/> Other	<input type="checkbox"/> Laminar Flow <input type="checkbox"/> Turbulent Flow <input type="checkbox"/> Boundary Layer <input type="checkbox"/> Shocks <input type="checkbox"/> Other

CODE SUMMARY SHEET

CODE NAME: HFGOPWR

ORIGINATOR/KEY CONTACT:

Name: J. K. Hunting/T. T. Yang Phone: (213) 884-2370Organization: Rockwell International - Rocketdyne DivisionAddress: 6633 Canoga Avenue, Canoga Park, California 91304

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Calculational tool to study the performance of CW chemical lasers and the interaction with the gain medium. Uses geometric optics and quasi-1-D aerokinetics to model HSURIA resonator. Also see GOPWR.

AVAILABLE DOCUMENTATION: Rocketdyne Internal Letter G-SL-77-509, October 5, 1977 (theory); Rocketdyne Internal Letter G-0-78-937, January 24, 1978 (user manual).

CATEGORY ATTRIBUTE	OPTICS		KINETICS		GASDYNAMICS	
LEVEL	<input checked="" type="checkbox"/>	None Simple Fabry Perot Detailed Resonator	<input checked="" type="checkbox"/>	None Simple Saturated Gain Detailed Kinetics	<input checked="" type="checkbox"/>	None Simple Flow Model Detailed Mixing
TYPE	<input checked="" type="checkbox"/>	Geometrical Physical	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	CW Pulsed HF, DF Other	<input checked="" type="checkbox"/>	Premixed Scheduled Mixing Other
GEOMETRY	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	Standing Wave Ring Compact Annular		Annular, Radially Flowing Transversely Flowing Other	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	Cylindrical, Radially Flowing Rectangular, Linearly Flowing Other
GRID DIMENSION	<input checked="" type="checkbox"/>	(Transverse Dimension) 1 D 2 D	<input checked="" type="checkbox"/>	1 D 2 D 3 D	<input checked="" type="checkbox"/>	1 D 2 D 3 D
COORDINATE SYSTEM	<input checked="" type="checkbox"/>	Cartesian Cylindrical Other	<input checked="" type="checkbox"/>	Cartesian Cylindrical Other	<input checked="" type="checkbox"/>	Cartesian Cylindrical Other
FEATURES MODELED	<input checked="" type="checkbox"/>	Misalignments Aberrations Deformable Mirrors Far-Field Performance Other	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	Single Line Multiline Line Broadening Other	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	Laminar Flow Turbulent Flow Boundary Layer Shocks Other

CODE SUMMARY SHEET

CODE NAME:

HFOX

ORIGINATOR/KEY CONTACT:

Name: James B. Moreno Phone: (505) 264-4259

Organization: 4212, Laser Projects Division, Sandia Laboratories

Address: Kirtland AFB, New Mexico 87117

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Predict oscillator and amplifier performance for Sandia Laboratories hydrogen fluoride laser program.

AVAILABLE DOCUMENTATION: AIAA paper 75-36, presented at AIAA 13th Aerospace Sciences Meeting, Pasadena, California, January 20, 1975.
J. B. Moreno, author.

CATEGORY ATTRIBUTE	OPTICS		KINETICS		GASDYNAMICS	
	LEVEL	● None Simple Fabry Perot Detailed Resonator	● None Simple Saturated Gain Detailed Kinetics	● None Simple Flow Model Detailed Mixing		
TYPE	Geometrical Physical	● CW ● Pulsed ● HF, DF Other	Premixed Scheduled Mixing Other			
GEOMETRY	Standing Wave Ring Compact Annular	Annular, Radially Flowing Transversely Flowing Other	Cylindrical, Radially Flowing Rectangular, Linearly Flowing Other			
GRID DIMENSION	(Transverse Dimension) 1 D 2 D	1 D 2 D 3 D	1 D 2 D 3 D			
COORDINATE SYSTEM	Cartesian Cylindrical Other	Cartesian Cylindrical Other	Cartesian Cylindrical Other			
FEATURES MODELED	Misalignments Aberrations Deformable Mirrors Far-Field Performance Other	● Single Line ● Multiline ● Line Broadening ● Other	Laminar Flow Turbulent Flow Boundary Layer Shocks Other			

CODE SUMMARY SHEET

CODE NAME: IPAGOS

ORIGINATOR/KEY CONTACT: *

Name: D. N. Mansell Phone: (505) 848-5000Organization: The BDM CorporationAddress: 1801 Randolph Road, S.E., Albuquerque, New Mexico 87106

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Geometric ray trace analysis of general optical systems; can model nonlinear beam compactors of reflexicon, waxicon, and noneverting waxicon designs.

AVAILABLE DOCUMENTATION: POLYPAGOS, Aerospace Report TR-0059 (6311)-1. Beam Compressor Design and Fabrication Program AFWL-TR-78-77. Geometric Ray Analyses of HSURIA Prototypes, BDM/TAC-79-151-TR; POLYPAGOS Users' Manual, Aerospace TR-0172 (2311)-1.

CATEGORY ATTRIBUTE	OPTICS		KINETICS		GASDYNAMICS	
	LEVEL	● None ● Simple Fabry Perot ● Detailed Resonator	● None ● Simple Saturated Gain ● Detailed Kinetics	● None ● Simple Flow Model ● Detailed Mixing		
TYPE	● Geometrical ● Physical		CW Pulsed HF, DF Other		Premixed Scheduled Mixing Other	
GEOMETRY	● Standing Wave ● Ring ● Compact ● Annular		Annular, Radially Flowing Transversely Flowing Other		Cylindrical, Radially Flowing Rectangular, Linearly Flowing Other	
GRID DIMENSION	● (Transverse Dimension) ● 1 D ● 2 D		1 D 2 D 3 D		1 D 2 D 3 D	
COORDINATE SYSTEM	● Cartesian ● Cylindrical ● Other		Cartesian Cylindrical Other		Cartesian Cylindrical Other	
FEATURES MODELED	● Misalignments ● Aberrations ● Deformable Mirrors ● Far-Field Performance ● Other		Single Line Multiline Line Broadening Other		Laminar Flow Turbulent Flow Boundary Layer Shocks Other	

*Also: Kemp, TRW, One Space Park, Redondo Beach, California.

CODE SUMMARY SHEET

CODE NAME: KBLIMP

ORIGINATOR/KEY CONTACT:

Name: H. Tong/A. C. Buckingham/H. L. Morse Phone: (415) 964-3200

Organization: Aerotherm Division of ACUREX

Address: Mountain View, California

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Boundary layer analysis.
Nonequilibrium chemistry (KINETIC) Boundary Layer Integral Matrix Pro-
gram (KBLIMP).

AVAILABLE DOCUMENTATION: Nonequilibrium Chemistry Boundary Layer Inte-
gral Matrix Procedure, Aerotherm Report, UM7367, July 1973.

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	● None Simple Fabry Perot Detailed Resonator	● None Simple Saturated Gain Detailed Kinetics	● None Simple Flow Model Detailed Mixing
TYPE	Geometrical Physical	● CW Pulsed HF, DF Other	● Premixed Scheduled Mixing Other
GEOMETRY	Standing Wave Ring Compact Annular	● Annular, Radially Flowing Transversely Flowing Other	● Cylindrical, Radially Flowing ● Rectangular, Linearly Flowing Other
GRID DIMENSION	(Transverse Dimension) 1 D 2 D	● 1 D 2 D 3 D	● 1 D 2 D 3 D
COORDINATE SYSTEM	Cartesian Cylindrical Other	● Cartesian Cylindrical Other	● Cartesian ● Cylindrical ● Other
FEATURES MODELED	Misalignments Aberrations Deformable Mirrors Far-Field Performance Other	Single Line Multiline Line Broadening Other	● Laminar Flow ● Turbulent Flow ● Boundary Layer Shocks Other

CODE SUMMARY SHEET

CODE NAME:

LAPU-2

ORIGINATOR/KEY CONTACT:

Name: John C. Goldstein, D. O. Dickman Phone: (505) 667-7281Organization: Los Alamos Scientific LaboratoryAddress: Group X-1, MX-531, LASL, Los Alamos, New Mexico 87545

PRINCIPAL PURPOSE AND APPLICATION OF CODE: _____

Calculation of the propagation of a short pulse down a chain of laser
amplifiers and absorbers including diffraction effects; cylindrical
symmetry assumed.

AVAILABLE DOCUMENTATION: LAPU2: A Laser Pulse Propagation Code with
Diffraction, LASL Report LA-6955.

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input type="checkbox"/> None <input checked="" type="checkbox"/> Simple Fabry Perot <input type="checkbox"/> Detailed Resonator	<input type="checkbox"/> None <input checked="" type="checkbox"/> Simple Saturated Gain <input type="checkbox"/> Detailed Kinetics	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Flow Model <input type="checkbox"/> Detailed Mixing
TYPE	<input checked="" type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input checked="" type="checkbox"/> CW <input type="checkbox"/> Pulsed <input type="checkbox"/> HF, DF <input checked="" type="checkbox"/> Other	<input type="checkbox"/> Premixed <input type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other
GEOMETRY	<input checked="" type="checkbox"/> Standing Wave <input type="checkbox"/> Ring <input checked="" type="checkbox"/> Compact <input type="checkbox"/> Annular	<input type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input type="checkbox"/> Cylindrical, Radially Flowing <input type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other
GRID DIMENSION	<input checked="" type="checkbox"/> (Transverse Dimension) <input type="checkbox"/> 1 D <input type="checkbox"/> 2 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D
COORDINATE SYSTEM	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other
FEATURES MODELED	<input type="checkbox"/> Misalignments <input type="checkbox"/> Aberrations <input type="checkbox"/> Deformable Mirrors <input checked="" type="checkbox"/> Far-Field Performance <input checked="" type="checkbox"/> Other	<input type="checkbox"/> Single Line <input type="checkbox"/> Multiline <input type="checkbox"/> Line Broadening <input type="checkbox"/> Other	<input type="checkbox"/> Laminar Flow <input type="checkbox"/> Turbulent Flow <input type="checkbox"/> Boundary Layer <input type="checkbox"/> Shocks <input type="checkbox"/> Other

CODE SUMMARY SHEET

CODE NAME:

LOADPL

ORIGINATOR/KEY CONTACT:

Name: Alexander M. Simonoff Phone: (213) 884-3346

Organization: Rocketdyne Division, Rockwell International

Address: 6633 Canoga Avenue, Canoga Park, California 91304

PRINCIPAL PURPOSE AND APPLICATION OF CODE: The purpose of this code is to model some of the 3-D phenomenology associated with Half Symmetric Unstable Resonator with Internal Axicon (HSURIA) with a radially flowing gain medium, performance predictions for power extraction and beam quality, set/verify design requirements.

AVAILABLE DOCUMENTATION: Simplified 3-D loaded cavity resonator code, G-0-78-1123, November 1978. Also see bare cavity code BAREPL.

CATEGORY ATTRIBUTE	OPTICS		KINETICS		GASDYNAMICS	
	LEVEL	<input type="checkbox"/> None <input checked="" type="checkbox"/> Simple Fabry Perot <input type="checkbox"/> Detailed Resonator	<input checked="" type="checkbox"/> None <input checked="" type="checkbox"/> Simple Saturated Gain <input type="checkbox"/> Detailed Kinetics	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Flow Model <input type="checkbox"/> Detailed Mixing		
TYPE	<input checked="" type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input type="checkbox"/> CW <input type="checkbox"/> Pulsed <input type="checkbox"/> HF, DF <input type="checkbox"/> Other	<input type="checkbox"/> Premixed <input type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other			
GEOMETRY	<input checked="" type="checkbox"/> Standing Wave <input type="checkbox"/> Ring <input checked="" type="checkbox"/> Compact <input checked="" type="checkbox"/> Annular	<input type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input type="checkbox"/> Cylindrical, Radially Flowing <input type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other			
GRID DIMENSION	(Transverse Dimension) <input checked="" type="checkbox"/> 1 D <input type="checkbox"/> 2 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D			
COORDINATE SYSTEM	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other			
FEATURES MODELED	<input checked="" type="checkbox"/> Misalignments <input checked="" type="checkbox"/> Aberrations <input checked="" type="checkbox"/> Deformable Mirrors <input checked="" type="checkbox"/> Far-Field Performance <input type="checkbox"/> Other	<input type="checkbox"/> Single Line <input type="checkbox"/> Multiline <input type="checkbox"/> Line Broadening <input type="checkbox"/> Other	<input type="checkbox"/> Laminar Flow <input type="checkbox"/> Turbulent Flow <input type="checkbox"/> Boundary Layer <input type="checkbox"/> Shocks <input type="checkbox"/> Other			

CODE SUMMARY SHEET

CODE NAME: LS-14RGS*

ORIGINATOR/KEY CONTACT:

Name: Victor L. Gamiz Phone: (213) 884-3346Organization: Rocketdyne, Laser OpticsAddress: 6633 Canoga Avenue, Canoga Park, California 91304

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Performs an exact ray trace analysis in order to determine the geometric configuration of a HSURIA type resonator with a ray redistributing reflexicon beam compactor assembly.
Provides geometry data to wave optics HSURIA codes.

AVAILABLE DOCUMENTATION: Resonator Geometry Synthesis Code Requirement (V. L. Gamiz); Incorporate General Resonator into Ray Trace Code (W. H. Southwell); Surface Optimization Algorithms and Equations (W. H. Southwell); Equations for Wave Optics Code Parameters (V. L. Gamiz); User Manual; Resonator Geometry Synthesis Code Development (L. R. Stidham).

CATEGORY ATTRIBUTE	OPTICS		KINETICS		GASDYNAMICS	
	LEVEL	<input checked="" type="radio"/> None <input type="radio"/> Simple Fabry Perot <input type="radio"/> Detailed Resonator	<input checked="" type="radio"/> None <input type="radio"/> Simple Saturated Gain <input type="radio"/> Detailed Kinetics	<input checked="" type="radio"/> None <input type="radio"/> Simple Flow Model <input type="radio"/> Detailed Mixing		
TYPE	<input checked="" type="radio"/> Geometrical <input type="radio"/> Physical	<input type="radio"/> CW <input type="radio"/> Pulsed <input type="radio"/> HF, DF <input type="radio"/> Other	<input type="radio"/> Premixed <input type="radio"/> Scheduled Mixing <input type="radio"/> Other			
GEOMETRY	<input checked="" type="radio"/> Standing Wave <input checked="" type="radio"/> Ring <input checked="" type="radio"/> Compact <input type="radio"/> Annular	<input type="radio"/> Annular, Radially Flowing <input type="radio"/> Transversely Flowing <input type="radio"/> Other	<input type="radio"/> Cylindrical, Radially Flowing <input type="radio"/> Rectangular, Linearly Flowing <input type="radio"/> Other			
GRID DIMENSION	<input checked="" type="radio"/> (Transverse Dimension) <input type="radio"/> 1 D <input type="radio"/> 2 D	<input type="radio"/> 1 D <input type="radio"/> 2 D <input type="radio"/> 3 D	<input type="radio"/> 1 D <input type="radio"/> 2 D <input type="radio"/> 3 D			
COORDINATE SYSTEM	<input checked="" type="radio"/> Cartesian <input type="radio"/> Cylindrical <input type="radio"/> Other	<input type="radio"/> Cartesian <input type="radio"/> Cylindrical <input type="radio"/> Other	<input type="radio"/> Cartesian <input type="radio"/> Cylindrical <input type="radio"/> Other			
FEATURES MODELED	<input checked="" type="radio"/> Misalignments <input type="radio"/> Aberrations <input type="radio"/> Deformable Mirrors <input type="radio"/> Far-Field Performance <input type="radio"/> Other	<input type="radio"/> Single Line <input type="radio"/> Multiline <input type="radio"/> Line Broadening <input type="radio"/> Other	<input type="radio"/> Laminar Flow <input type="radio"/> Turbulent Flow <input type="radio"/> Boundary Layer <input type="radio"/> Shocks <input type="radio"/> Other			

*LS-14 Resonator Geometry Synthesizer

CODE SUMMARY SHEET

CODE NAME:

MCLANC

ORIGINATOR/KEY CONTACT:

Name: R. Hughes/H. W. Behrens Phone: (213) 536-1624

Organization: TRW DSSG

Address: R1/1038, One Space Park, Redondo Beach, California 90278

PRINCIPAL PURPOSE AND APPLICATION OF CODE:

Direct simulation Monte Carlo laser analysis code. Models real gas
flow by tracking several thousand simulated molecules. Primarily used
for modeling nozzle flows with large base regions and low pressure regions
in hypersonic wedge wakes.

AVAILABLE DOCUMENTATION:

"Chemical Lazer Nozzle and Cavity Calculation by the Direct Simulation
Monte Carlo Method," T. Sugimura, et. al, presented at AIAA Conference on
High Power Lasers, October 31-November 2, 1978, Cambridge, Massachusetts.

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Fabry Perot <input type="checkbox"/> Detailed Resonator	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Saturated Gain <input type="checkbox"/> Detailed Kinetics	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Flow Model <input type="checkbox"/> Detailed Mixing
TYPE	<input type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input checked="" type="checkbox"/> CW <input checked="" type="checkbox"/> Pulsed <input checked="" type="checkbox"/> HF, DF <input checked="" type="checkbox"/> Other	<input checked="" type="checkbox"/> Premixed <input type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other
GEOMETRY	<input type="checkbox"/> Standing Wave <input type="checkbox"/> Ring <input type="checkbox"/> Compact <input type="checkbox"/> Annular	<input checked="" type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cylindrical, Radially Flowing <input checked="" type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other
GRID DIMENSION	(Transverse Dimension) <input type="checkbox"/> 1 D <input type="checkbox"/> 2 D	<input checked="" type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input checked="" type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D
COORDINATE SYSTEM	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other
FEATURES MODELED	<input type="checkbox"/> Misalignments <input type="checkbox"/> Aberrations <input type="checkbox"/> Deformable Mirrors <input type="checkbox"/> Far-Field Performance <input type="checkbox"/> Other	<input type="checkbox"/> Single Line <input type="checkbox"/> Multiline <input type="checkbox"/> Line Broadening <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Laminar Flow <input type="checkbox"/> Turbulent Flow <input checked="" type="checkbox"/> Boundary Layer <input checked="" type="checkbox"/> Shocks <input checked="" type="checkbox"/> Other

CODE SUMMARY SHEET

CODE NAME: MNORO

ORIGINATOR/KEY CONTACT:

Name: L. H. Sentman Phone: (217) 333-1834Organization: University of Illinois, Dept. of Aeronautical & Astronautical Eng.Address: Urbana, Illinois 61801

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Rotational nonequilibrium kinetics - fluid dynamics model. Used with AFWL strip mirror code to predict power spectral performance of CW chemical lasers.

AVAILABLE DOCUMENTATION: "An Efficient Rotational Nonequilibrium Model of a CW Chemical Laser," L. H. Sentman and W. Brandkamp, TR AAE 79-5, UIIU Eng. 79-0505, July 1979. "Users' Guide for Programs MNORO and AFOPTMNORO," L. H. Sentman, AAE TR-79-7, UIIU Eng. 79-0507, October 1979.

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Fabry Perot Resonator <input type="checkbox"/> Detailed Resonator	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Saturated Gain <input type="checkbox"/> Detailed Kinetics	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Flow Model <input type="checkbox"/> Detailed Mixing
TYPE	<input type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input checked="" type="checkbox"/> CW <input checked="" type="checkbox"/> Pulsed <input type="checkbox"/> HF, DF <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Premixed <input type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other
GEOMETRY	<input type="checkbox"/> Standing Wave <input type="checkbox"/> Ring <input type="checkbox"/> Compact <input type="checkbox"/> Annular	<input checked="" type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cylindrical, Radially Flowing <input type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other
GRID DIMENSION	<input type="checkbox"/> (Transverse Dimension) <input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input checked="" type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input checked="" type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D
COORDINATE SYSTEM	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other
FEATURES MODELED	<input type="checkbox"/> Misalignments <input type="checkbox"/> Aberrations <input type="checkbox"/> Deformable Mirrors <input type="checkbox"/> Far-Field Performance <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Single Line <input checked="" type="checkbox"/> Multiline <input checked="" type="checkbox"/> Line Broadening <input checked="" type="checkbox"/> Other	<input checked="" type="checkbox"/> Laminar Flow <input type="checkbox"/> Turbulent Flow <input checked="" type="checkbox"/> Boundary Layer <input checked="" type="checkbox"/> Shocks <input checked="" type="checkbox"/> Other

CODE SUMMARY SHEET

CODE NAME:

MPCPAGOS

ORIGINATOR/KEY CONTACT:

Name: D. N. Mansell and C. C. Barnard Phone: (505) 848-5000

Organization: The BDM Corporation

Address: 1801 Randolph Road, S.E., Albuquerque, New Mexico 87106

PRINCIPAL PURPOSE AND APPLICATION OF CODE:

Calculates (misalignment) sensitivity coefficients for general optical train. Relates output ray motions to individual optical element motions in six degrees of freedom. Used in conjunction with NASTRAN to predict beam jitter effects through a integrated optics/structures approach.

AVAILABLE DOCUMENTATION:

MPCPAGOS Users' Manual, BDM/TAC-78-727-TR. Final Task Report for Sensitivity Analyses of the ALL Optical Train, BDM/TAC-78-793-TR.

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input type="radio"/> None <input checked="" type="radio"/> Simple Fabry Perot <input type="radio"/> Detailed Resonator	<input checked="" type="radio"/> None <input type="radio"/> Simple Saturated Gain <input type="radio"/> Detailed Kinetics	<input checked="" type="radio"/> None <input type="radio"/> Simple Flow Model <input type="radio"/> Detailed Mixing
TYPE	<input checked="" type="radio"/> Geometrical <input type="radio"/> Physical	<input type="radio"/> CW <input type="radio"/> Pulsed <input type="radio"/> HF, DF <input type="radio"/> Other	<input type="radio"/> Premixed <input type="radio"/> Scheduled Mixing <input type="radio"/> Other
GEOMETRY	<input checked="" type="radio"/> Standing Wave <input type="radio"/> Ring <input checked="" type="radio"/> Compact <input checked="" type="radio"/> Annular	<input type="radio"/> Annular, Radially Flowing <input type="radio"/> Transversely Flowing <input type="radio"/> Other	<input type="radio"/> Cylindrical, Radially Flowing <input type="radio"/> Rectangular, Linearly Flowing <input type="radio"/> Other
GRID DIMENSION	(Transverse Dimension) <input checked="" type="radio"/> 1 D <input type="radio"/> 2 D	<input type="radio"/> 1 D <input type="radio"/> 2 D <input type="radio"/> 3 D	<input type="radio"/> 1 D <input type="radio"/> 2 D <input type="radio"/> 3 D
COORDINATE SYSTEM	<input checked="" type="radio"/> Cartesian <input type="radio"/> Cylindrical <input type="radio"/> Other	<input type="radio"/> Cartesian <input type="radio"/> Cylindrical <input type="radio"/> Other	<input type="radio"/> Cartesian <input type="radio"/> Cylindrical <input type="radio"/> Other
FEATURES MODELED	<input checked="" type="radio"/> Misalignments <input type="radio"/> Aberrations <input type="radio"/> Deformable Mirrors <input type="radio"/> Far-Field Performance <input checked="" type="radio"/> Other	<input type="radio"/> Single Line <input type="radio"/> Multiline <input type="radio"/> Line Broadening <input type="radio"/> Other	<input type="radio"/> Laminar Flow <input type="radio"/> Turbulent Flow <input type="radio"/> Boundary Layer <input type="radio"/> Shocks <input type="radio"/> Other

CODE SUMMARY SHEET

CODE NAME:

MRO

ORIGINATOR/KEY CONTACT:

Name: Donald L. Bullock Phone: (213) 535-3484Organization: TRW DSSGAddress: R1/1162, One Space Park, Redondo Beach, California 90278

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Models the optical performance of linear bands CW, HF, and DF chemical lasers. MRO is similar to BLAZER, except it is a 2-D model. Used as design tool for BDL, NACL, and MIRACL.

AVAILABLE DOCUMENTATION: The BLAZER and MRO Codes, TRW, June 1978 (theory).
BLAZER Users Manual (includes use of MRO), TRW, November 1978.

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<ul style="list-style-type: none"> ● None ● Simple Fabry Perot ● Detailed Resonator 	<ul style="list-style-type: none"> ● None ● Simple Saturated Gain ● Detailed Kinetics 	<ul style="list-style-type: none"> ● None ● Simple Flow Model ● Detailed Mixing
TYPE	<ul style="list-style-type: none"> ● Geometrical ● Physical 	<ul style="list-style-type: none"> ● CW ● Pulsed ● HF, DF ● Other 	<ul style="list-style-type: none"> ● Premixed ● Scheduled Mixing ● Other
GEOMETRY	<ul style="list-style-type: none"> ● Standing Wave ● Ring ● Compact ● Annular 	<ul style="list-style-type: none"> ● Annular, Radially Flowing ● Transversely Flowing ● Other 	<ul style="list-style-type: none"> ● Cylindrical, Radially Flowing ● Rectangular, Linearly Flowing ● Other
GRID DIMENSION	<ul style="list-style-type: none"> ● (Transverse Dimension) ● 1 D ● 2 D 	<ul style="list-style-type: none"> ● 1 D ● 2 D ● 3 D 	<ul style="list-style-type: none"> ● 1 D ● 2 D ● 3 D
COORDINATE SYSTEM	<ul style="list-style-type: none"> ● Cartesian ● Cylindrical ● Other 	<ul style="list-style-type: none"> ● Cartesian ● Cylindrical ● Other 	<ul style="list-style-type: none"> ● Cartesian ● Cylindrical ● Other
FEATURES MODELED	<ul style="list-style-type: none"> ● Misalignments ● Aberrations ● Deformable Mirrors ● Far-Field Performance ● Other 	<ul style="list-style-type: none"> ● Single Line ● Multiline ● Line Broadening ● Other 	<ul style="list-style-type: none"> ● Laminar Flow ● Turbulent Flow ● Boundary Layer ● Shocks ● Other

CODE SUMMARY SHEET

CODE NAME:

NCFTDPWE*

ORIGINATOR/KEY CONTACT: **

Name: F. D. Toppert/John C. Goldstein Phone: (505) 667-7281

Organization: Los Alamos Scientific Laboratory

Address: Group X-1, MS-531, Los Alamos, New Mexico 87545

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Study of wavefront distortions during propagation through amplifying self-focusing materials. Code could be extended to resonator calculations, but does not currently have any optical elements or saturable gain models included.

AVAILABLE DOCUMENTATION: A Numerical Code for the Three-Dimensional Parabolic Wave Equation, John C. Goldstein, LASL, LA-6833-MS.

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	None Simple Fabry Perot Detailed Resonator	None Simple Saturated Gain Detailed Kinetics	None Simple Flow Model Detailed Mixing
TYPE	● Geometrical Physical	CW Pulsed HF, DF Other	Premixed Scheduled Mixing Other
GEOMETRY	● Standing Wave Ring Compact Annular	Annular, Radially Flowing Transversely Flowing Other	Cylindrical, Radially Flowing Rectangular, Linearly Flowing Other
GRID DIMENSION	● (Transverse Dimension) 1 D 2 D	1 D 2 D 3 D	1 D 2 D 3 D
COORDINATE SYSTEM	Cartesian Cylindrical Other	Cartesian Cylindrical Other	Cartesian Cylindrical Other
FEATURES MODELED	● Misalignments Aberrations Deformable Mirrors Far-Field Performance Other	Single Line Multiline Line Broadening Other	Laminar Flow Turbulent Flow Boundary Layer Shocks Other

*Numerical Code for the Three-Dimensional Parabolic Wave Equation.

**Now at University of Miami, Miami, Florida.

CODE SUMMARY SHEET

CODE NAME: NORO-I

ORIGINATOR/KEY CONTACT:

Name: L. H. Sentman/S. W. Zelazny* Phone: (217) 333-1834
 Organization: University of Illinois, Dept. of Aeronautical & Astronautical Eng.
 Address: Urbana, Illinois 61801

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Qualitative Rotational nonequi-
librium kinetics and fluid dynamics model coupled with Bell Aerospace
strip optics code. See ROPTICS.

AVAILABLE DOCUMENTATION: Applied Optics 17, p. 2244 (1978); J. Chem.
Phys. 62, p. 3523 (1975); Applied Optics 15, p. 744, (1976); J. Chem. Phys.
67 p. 966 (1977).

CATEGORY ATTRIBUTE	OPTICS		KINETICS		GASDYNAMICS	
	LEVEL	● None Simple Fabry Perot Detailed Resonator	● None Simple Saturated Gain Detailed Kinetics	● None Simple Flow Model Detailed Mixing		
TYPE	Geometrical Physical	● CW Pulsed ● HF, DF Other	● Premixed Scheduled Mixing Other			
GEOMETRY	Standing Wave Ring Compact Annular	● Annular, Radially Flowing Transversely Flowing Other	● Cylindrical, Radially Flowing Rectangular, Linearly Flowing Other			
GRID DIMENSION	(Transverse Dimension) 1 D 2 D	● 1 D 2 D 3 D	● 1 D 2 D 3 D			
COORDINATE SYSTEM	Cartesian Cylindrical Other	● Cartesian Cylindrical Other	● Cartesian Cylindrical Other			
FEATURES MODELED	Misalignments Aberrations Deformable Mirrors Far-Field Performance Other	● Single Line ● Multiline ● Line Broadening Other	Laminar Flow Turbulent Flow Boundary Layer Shocks Other			

*Bell Aerospace Textron

CODE SUMMARY SHEET

CODE NAME:

NORO-II

ORIGINATOR/KEY CONTACT:

Name: S. W. Zelazny Phone: (716) 297-1000

Organization: Bell Aerospace Textron

Address: P.O. Box 1, Buffalo, New York 14240

PRINCIPAL PURPOSE AND APPLICATION OF CODE: 1-D mixing model coupled to rotational nonequilibrium chemistry and Fabry-Perot models. Used for optical cavity analysis. (See appendix C, table 1).

AVAILABLE DOCUMENTATION: _____

CATEGORY ATTRIBUTE	OPTICS		KINETICS		GASDYNAMICS	
	LEVEL	<input checked="" type="checkbox"/> None Simple Fabry Perot Detailed Resonator	<input type="checkbox"/>	<input type="checkbox"/> None Simple Saturated Gain Detailed Kinetics	<input checked="" type="checkbox"/>	<input type="checkbox"/> None Simple Flow Model Detailed Mixing
TYPE	<input type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input type="checkbox"/>	<input type="checkbox"/> CW <input type="checkbox"/> Pulsed <input type="checkbox"/> HF, DF <input type="checkbox"/> Other	<input checked="" type="checkbox"/>	<input type="checkbox"/> Premixed <input type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other	
GEOMETRY	<input type="checkbox"/> Standing Wave <input type="checkbox"/> Ring <input type="checkbox"/> Compact <input type="checkbox"/> Annular	<input type="checkbox"/>	<input type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input type="checkbox"/>	<input type="checkbox"/> Cylindrical, Radially Flowing <input type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other	
GRID DIMENSION	<input type="checkbox"/> (Transverse Dimension) <input type="checkbox"/> 1 D <input type="checkbox"/> 2 D	<input type="checkbox"/>	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input checked="" type="checkbox"/>	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	
COORDINATE SYSTEM	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/>	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/>	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	
FEATURES MODELED	<input type="checkbox"/> Misalignments <input type="checkbox"/> Aberrations <input type="checkbox"/> Deformable Mirrors <input type="checkbox"/> Far-Field Performance <input type="checkbox"/> Other	<input type="checkbox"/>	<input type="checkbox"/> Single Line <input type="checkbox"/> Multiline <input type="checkbox"/> Line Broadening <input type="checkbox"/> Other	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/> Laminar Flow <input type="checkbox"/> Turbulent Flow <input type="checkbox"/> Boundary Layer <input type="checkbox"/> Shocks <input type="checkbox"/> Other	

CODE SUMMARY SHEET

CODE NAME: OCELOT

ORIGINATOR/KEY CONTACT:

Name: David Fink Phone: (213) 391-0711, X6925
 Organization: Hughes Aircraft Company
 Address: Culver City, California 90230

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Tool to assist with resonator design and mode control. Primarily models optics, but modular constructor allows incorporation of other detailed models.

AVAILABLE DOCUMENTATION: Not available

CATEGORY ATTRIBUTE	OPTICS		KINETICS		GASDYNAMICS	
	LEVEL	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Fabry Perot <input type="checkbox"/> Detailed Resonator	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Saturated Gain <input type="checkbox"/> Detailed Kinetics	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Flow Model <input type="checkbox"/> Detailed Mixing		
TYPE	<input checked="" type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input type="checkbox"/> CW <input type="checkbox"/> Pulsed <input type="checkbox"/> HF, DF <input type="checkbox"/> Other	<input type="checkbox"/> Premixed <input type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other			
GEOMETRY	<input checked="" type="checkbox"/> Standing Wave <input checked="" type="checkbox"/> Ring <input checked="" type="checkbox"/> Compact <input checked="" type="checkbox"/> Annular	<input type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input type="checkbox"/> Cylindrical, Radially Flowing <input type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other			
GRID DIMENSION	<input checked="" type="checkbox"/> (Transverse Dimension) <input type="checkbox"/> 1 D <input type="checkbox"/> 2 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D			
COORDINATE SYSTEM	<input checked="" type="checkbox"/> Cartesian <input checked="" type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other			
FEATURES MODELED	<input checked="" type="checkbox"/> Misalignments <input checked="" type="checkbox"/> Aberrations <input type="checkbox"/> Deformable Mirrors <input type="checkbox"/> Far-Field Performance <input checked="" type="checkbox"/> Other	<input checked="" type="checkbox"/> Single Line <input type="checkbox"/> Multiline <input type="checkbox"/> Line Broadening <input type="checkbox"/> Other	<input type="checkbox"/> Laminar Flow <input type="checkbox"/> Turbulent Flow <input type="checkbox"/> Boundary Layer <input type="checkbox"/> Shocks <input type="checkbox"/> Other			

CODE SUMMARY SHEET

CODE NAME:

POLRES

ORIGINATOR/KEY CONTACT:

Name: William P. Latham Phone: (505) 844-0721
 Organization: Air Force Weapons Laboratory
 Address: AFWL/ALR, Kirtland AFB, New Mexico 87117

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Used for axisymmetric half-symmetric unstable resonator analysis (HSUR); contains two Fourier components for analysis of polarization effects in bare compact beam resonators.

AVAILABLE DOCUMENTATION: None Relevant: G. C. Dente, App. Opt. 18, 2911 (1979), W. P. Latham, "Polarization Effects of Half Symmetric Unstable Resonators with a Coated Rear Cone," App. Opt, (to be published).

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	● None Simple Fabry Perot Detailed Resonator	● None Simple Saturated Gain Detailed Kinetics	● None Simple Flow Model Detailed Mixing
TYPE	● Geometrical Physical	CW Pulsed HF, DF Other	Premixed Scheduled Mixing Other
GEOMETRY	● Standing Wave Ring ● Compact Annular	Annular, Radially Flowing Transversely Flowing Other	Cylindrical, Radially Flowing Rectangular, Linearly Flowing Other
GRID DIMENSION	● (Transverse Dimension) 1 D 2 D	1 D 2 D 3 D	1 D 2 D 3 D
COORDINATE SYSTEM	● Cartesian Cylindrical Other	Cartesian Cylindrical Other	Cartesian Cylindrical Other
FEATURES MODELED	Misalignments Aberrations Deformable Mirrors Far-Field Performance Other	Single Line Multiline Line Broadening Other	Laminar Flow Turbulent Flow Boundary Layer Shocks Other

CODE SUMMARY SHEET

CODE NAME:

POLRESH

ORIGINATOR/KEY CONTACT:

Name: William P. Latham Phone: (505) 844-0721Organization: Air Force Weapons LaboratoryAddress: AFWL/ALR, Kirtland AFB, New Mexico 87117

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Used for axisymmetric half-symmetric unstable resonator with internal axicon analysis (HSURIA); contains two Fourier components for analysis of polarization effects in bare compact and annular beam resonators. Will eventually include rings and simple saturable gain models.

AVAILABLE DOCUMENTATION: None relevant: G. C. Dente, App. Opt 18, 2911 (1979); W. P. Latham, "Polarization Effects of Half Symmetric Unstable Resonators with a Control Rear Cone," App. Opt (to be published).

CATEGORY ATTRIBUTE	OPTICS		KINETICS		GASDYNAMICS	
	LEVEL	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Fabry Perot <input type="checkbox"/> Detailed Resonator	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Saturated Gain <input type="checkbox"/> Detailed Kinetics	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Flow Model <input type="checkbox"/> Detailed Mixing		
TYPE	<input checked="" type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input type="checkbox"/> CW <input type="checkbox"/> Pulsed <input type="checkbox"/> HF, DF <input type="checkbox"/> Other	<input type="checkbox"/> Premixed <input type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other			
GEOMETRY	<input checked="" type="checkbox"/> Standing Wave <input checked="" type="checkbox"/> Ring <input checked="" type="checkbox"/> Compact <input type="checkbox"/> Annular	<input type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input type="checkbox"/> Cylindrical, Radially Flowing <input type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other			
GRID DIMENSION	<input checked="" type="checkbox"/> (Transverse Dimension) <input type="checkbox"/> 1 D <input type="checkbox"/> 2 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D			
COORDINATE SYSTEM	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other			
FEATURES MODELED	<input type="checkbox"/> Misalignments <input type="checkbox"/> Aberrations <input type="checkbox"/> Deformable Mirrors <input type="checkbox"/> Far-Field Performance <input type="checkbox"/> Other	<input type="checkbox"/> Single Line <input type="checkbox"/> Multiline <input type="checkbox"/> Line Broadening <input type="checkbox"/> Other	<input type="checkbox"/> Laminar Flow <input type="checkbox"/> Turbulent Flow <input type="checkbox"/> Boundary Layer <input type="checkbox"/> Shocks <input type="checkbox"/> Other			

CODE SUMMARY SHEET

CODE NAME:

POP

ORIGINATOR/KEY CONTACT:

Name: Peter B. Mumola Phone: (203) 762-4415

Organization: PerlKin-Elmer Corporation

Address: 50 Danbury Road, MS 241, Wilton, Connecticut 06897

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Physical optics analysis of general HEL optical systems and atmospheric propagation. Code can be coupled to variety of detailed kinetics models including CO₂ EDL (pulsed or CW), GDL, and Iodine.

AVAILABLE DOCUMENTATION: Available

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<ul style="list-style-type: none"> ● None ● Simple Fabry Perot ● Detailed Resonator 	<ul style="list-style-type: none"> ● None ● Simple Saturated Gain ● Detailed Kinetics 	<ul style="list-style-type: none"> ● None ● Simple Flow Model ● Detailed Mixing
TYPE	<ul style="list-style-type: none"> ● Geometrical ● Physical 	<ul style="list-style-type: none"> ● CW ● Pulsed ● HF, DF ● Other 	<ul style="list-style-type: none"> ● Premixed ● Scheduled Mixing ● Other
GEOMETRY	<ul style="list-style-type: none"> ● Standing Wave ● Ring ● Compact ● Annular 	<ul style="list-style-type: none"> ● Annular, Radially Flowing ● Transversely Flowing ● Other 	<ul style="list-style-type: none"> ● Cylindrical, Radially Flowing ● Rectangular, Linearly Flowing ● Other
GRID DIMENSION	<ul style="list-style-type: none"> ● (Transverse Dimension) ● 1 D ● 2 D 	<ul style="list-style-type: none"> ● 1 D ● 2 D ● 3 D 	<ul style="list-style-type: none"> ● 1 D ● 2 D ● 3 D
COORDINATE SYSTEM	<ul style="list-style-type: none"> ● Cartesian ● Cylindrical ● Other 	<ul style="list-style-type: none"> ● Cartesian ● Cylindrical ● Other 	<ul style="list-style-type: none"> ● Cartesian ● Cylindrical ● Other
FEATURES MODELED	<ul style="list-style-type: none"> ● Misalignments ● Aberrations ● Deformable Mirrors ● Far-Field Performance ● Other 	<ul style="list-style-type: none"> ● Single Line ● Multiline ● Line Broadening ● Other 	<ul style="list-style-type: none"> ● Laminar Flow ● Turbulent Flow ● Boundary Layer ● Shocks ● Other

CODE SUMMARY SHEET

CODE NAME:

PRE-WATSON

ORIGINATOR/KEY CONTACT:

Name: Philip D. Briggs Phone: (213) 884-3851

Organization: Rockwell International, Rocketdyne Division

Address: 6633 Canoga Avenue, Canoga Park, California 91304

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Evaluate impact on resonator solution of conical element polarization.

AVAILABLE DOCUMENTATION: None. Some papers in open literature.

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Fabry Perot <input type="checkbox"/> Detailed Resonator	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Saturated Gain <input type="checkbox"/> Detailed Kinetics	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Flow Model <input type="checkbox"/> Detailed Mixing
TYPE	<input checked="" type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input type="checkbox"/> CW <input type="checkbox"/> Pulsed <input type="checkbox"/> HF, DF <input type="checkbox"/> Other	<input type="checkbox"/> Premixed <input type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other
GEOMETRY	<input checked="" type="checkbox"/> Standing Wave <input checked="" type="checkbox"/> Ring <input type="checkbox"/> Compact <input type="checkbox"/> Annular	<input type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input type="checkbox"/> Cylindrical, Radially Flowing <input type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other
GRID DIMENSION	<input checked="" type="checkbox"/> (Transverse Dimension) <input type="checkbox"/> 1 D <input type="checkbox"/> 2 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D
COORDINATE SYSTEM	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other
FEATURES MODELED	<input checked="" type="checkbox"/> Misalignments <input type="checkbox"/> Aberrations <input type="checkbox"/> Deformable Mirrors <input type="checkbox"/> Far-Field Performance <input type="checkbox"/> Other	<input type="checkbox"/> Single Line <input type="checkbox"/> Multiline <input type="checkbox"/> Line Broadening <input type="checkbox"/> Other	<input type="checkbox"/> Laminar Flow <input type="checkbox"/> Turbulent Flow <input type="checkbox"/> Boundary Layer <input type="checkbox"/> Shocks <input type="checkbox"/> Other

CODE SUMMARY SHEET

CODE NAME:

QFHT

ORIGINATOR/KEY CONTACT:

Name: Paul E. Fileger Phone: (305) 840-6643

Organization: United Technologies Research Center

Address: P.O. Box 2691, MS-R-48, West Palm Beach, Florida 33402

PRINCIPAL PURPOSE AND APPLICATION OF CODE: The QFHT code was developed as a tool for modeling high Fresnel number annular resonators (will model collimated Fresnel numbers in excess of 200).

AVAILABLE DOCUMENTATION: None. Listings available.

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input type="checkbox"/> None <input checked="" type="checkbox"/> Simple Fabry Perot <input type="checkbox"/> Detailed Resonator	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Saturated Gain <input type="checkbox"/> Detailed Kinetics	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Flow Model <input type="checkbox"/> Detailed Mixing
TYPE	<input checked="" type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input type="checkbox"/> CW <input type="checkbox"/> Pulsed <input type="checkbox"/> HF, DF <input type="checkbox"/> Other	<input type="checkbox"/> Premixed <input type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other
GEOMETRY	<input checked="" type="checkbox"/> Standing Wave <input checked="" type="checkbox"/> Ring <input checked="" type="checkbox"/> Compact <input checked="" type="checkbox"/> Annular	<input type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input type="checkbox"/> Cylindrical, Radially Flowing <input type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other
GRID DIMENSION	<input checked="" type="checkbox"/> (Transverse Dimension) <input type="checkbox"/> 1 D <input checked="" type="checkbox"/> 2 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D
COORDINATE SYSTEM	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other
FEATURES MODELED	<input checked="" type="checkbox"/> Misalignments <input checked="" type="checkbox"/> Aberrations <input checked="" type="checkbox"/> Deformable Mirrors <input checked="" type="checkbox"/> Far-Field Performance <input checked="" type="checkbox"/> Other	<input type="checkbox"/> Single Line <input type="checkbox"/> Multiline <input type="checkbox"/> Line Broadening <input type="checkbox"/> Other	<input type="checkbox"/> Laminar Flow <input type="checkbox"/> Turbulent Flow <input type="checkbox"/> Boundary Layer <input type="checkbox"/> Shocks <input type="checkbox"/> Other

CODE SUMMARY SHEET

CODE NAME:

RASCAL

ORIGINATOR/KEY CONTACT:

Name: Phil D. Briggs Phone: (213) 884-3851Organization: Rockwell International - Rockeddyne DivisionAddress: 6633 Canoga Avenue, Canoga Park, California 91304

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Resonator parameter selection, assess mode control, performance predictions for power and beam quality, resonator perturbation analysis, beam quality, set/verify design requirements. This is a vector code. Kinetics and mixing models included--see AEROKNS.

AVAILABLE DOCUMENTATION: None

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input type="checkbox"/> None <input checked="" type="checkbox"/> Simple Fabry Perot <input type="checkbox"/> Detailed Resonator	<input type="checkbox"/> None <input checked="" type="checkbox"/> Simple Saturated Gain <input type="checkbox"/> Detailed Kinetics	<input type="checkbox"/> None <input checked="" type="checkbox"/> Simple Flow Model <input type="checkbox"/> Detailed Mixing
TYPE	<input checked="" type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input checked="" type="checkbox"/> CW <input checked="" type="checkbox"/> Pulsed <input checked="" type="checkbox"/> HF, DF <input type="checkbox"/> Other	<input type="checkbox"/> Premixed <input checked="" type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other
GEOMETRY	<input checked="" type="checkbox"/> Standing Wave <input checked="" type="checkbox"/> Ring <input checked="" type="checkbox"/> Compact <input checked="" type="checkbox"/> Annular	<input checked="" type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cylindrical, Radially Flowing <input type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other
GRID DIMENSION	<input type="checkbox"/> (Transverse Dimension) <input checked="" type="checkbox"/> 1 D <input type="checkbox"/> 2 D	<input checked="" type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input checked="" type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D
COORDINATE SYSTEM	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other
FEATURES MODELED	<input checked="" type="checkbox"/> Misalignments <input checked="" type="checkbox"/> Aberrations <input checked="" type="checkbox"/> Deformable Mirrors <input checked="" type="checkbox"/> Far-Field Performance <input checked="" type="checkbox"/> Other	<input checked="" type="checkbox"/> Single Line <input checked="" type="checkbox"/> Multiline <input checked="" type="checkbox"/> Line Broadening <input type="checkbox"/> Other	<input type="checkbox"/> Laminar Flow <input type="checkbox"/> Turbulent Flow <input checked="" type="checkbox"/> Boundary Layer <input type="checkbox"/> Shocks <input checked="" type="checkbox"/> Other

CODE SUMMARY SHEET

CODE NAME:

ROPTICS

ORIGINATOR/KEY CONTACT:

Name: L. H. Sentman/S. W. Zelazny (BAT) Phone: (217) 333-1834

Organization: University of Illinois, Dept. of Aeronautical & Astronautical Eng.

Address: Urbana, Illinois 61801

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Study interaction between rotational nonequilibrium kinetics and optical resonator geometry. Bell Aerospace strip optics code (BATOPT) coupled to qualitative kinetic - fluid dynamics model (NORO-I). Combined model is called ROPTICS.

AVAILABLE DOCUMENTATION: Applied Optics 17, p. 2244 (1978); J. Chem. Phys. 62, 3523 (1975); Applied Optics 15, p. 744 (1976); J. Chem. Phys. 67, 966 (1977).

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Fabry Perot <input type="checkbox"/> Detailed Resonator	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Saturated Gain <input type="checkbox"/> Detailed Kinetics	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Flow Model <input type="checkbox"/> Detailed Mixing
TYPE	<input checked="" type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input checked="" type="checkbox"/> CW <input checked="" type="checkbox"/> Pulsed <input type="checkbox"/> HF, DF <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Premixed <input type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other
GEOMETRY	<input checked="" type="checkbox"/> Standing Wave <input checked="" type="checkbox"/> Ring <input type="checkbox"/> Compact <input type="checkbox"/> Annular	<input checked="" type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cylindrical, Radially Flowing <input type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other
GRID DIMENSION	<input checked="" type="checkbox"/> (Transverse Dimension) <input type="checkbox"/> 1 D <input type="checkbox"/> 2 D	<input checked="" type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input checked="" type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D
COORDINATE SYSTEM	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other
FEATURES MODELED	<input type="checkbox"/> Misalignments <input type="checkbox"/> Aberrations <input type="checkbox"/> Deformable Mirrors <input type="checkbox"/> Far-Field Performance <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Single Line <input checked="" type="checkbox"/> Multiline <input type="checkbox"/> Line Broadening <input type="checkbox"/> Other	<input type="checkbox"/> Laminar Flow <input type="checkbox"/> Turbulent Flow <input type="checkbox"/> Boundary Layer <input type="checkbox"/> Shocks <input type="checkbox"/> Other

CODE SUMMARY SHEET

CODE NAME: ROTKIN

ORIGINATOR/KEY CONTACT:

Name: R. J. Hall Phone: (203) 727-7349Organization: United Technologies Research CenterAddress: Silver Lane, E. Hartford, Connecticut 06108

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Prediction of HF/DF chemical laser performance based on coupled rate equation analysis of chemical, vibrational, rotational, and radiative transfer.

AVAILABLE DOCUMENTATION: Listings available. R. J. Hall, "Rotational Nonequilibrium and Line-Selected Operation in CW DF Chemical Lasers." IEEE JQE, Volume QE-12, p. 453 (1976).

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Fabry Perot <input type="checkbox"/> Detailed Resonator	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Saturated Gain <input type="checkbox"/> Detailed Kinetics	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Flow Model <input type="checkbox"/> Detailed Mixing
TYPE	<input type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input checked="" type="checkbox"/> CW <input checked="" type="checkbox"/> Pulsed <input type="checkbox"/> HF, DF <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Premixed <input type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other
GEOMETRY	<input checked="" type="checkbox"/> Standing Wave <input type="checkbox"/> Ring <input checked="" type="checkbox"/> Compact <input checked="" type="checkbox"/> Annular	<input type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cylindrical, Radially Flowing <input checked="" type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other
GRID DIMENSION	<input checked="" type="checkbox"/> (Transverse Dimension) <input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input checked="" type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D
COORDINATE SYSTEM	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cartesian <input checked="" type="checkbox"/> Cylindrical <input type="checkbox"/> Other
FEATURES MODELED	<input type="checkbox"/> Misalignments <input type="checkbox"/> Aberrations <input type="checkbox"/> Deformable Mirrors <input type="checkbox"/> Far-Field Performance <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Single Line <input checked="" type="checkbox"/> Multiline <input checked="" type="checkbox"/> Line Broadening <input checked="" type="checkbox"/> Other	<input checked="" type="checkbox"/> Laminar Flow <input checked="" type="checkbox"/> Turbulent Flow <input type="checkbox"/> Boundary Layer <input type="checkbox"/> Shocks <input type="checkbox"/> Other

CODE SUMMARY SHEET

CODE NAME:

SAIC2D

ORIGINATOR/KEY CONTACT:

Name: Jerry Long Phone: (404) 955-2663

Organization: Science Applications, Inc.

Address: 6600 Powers Ferry Road, Suite 220, Atlanta, Georgia 30339

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Provide capability of modeling high order modes in cylindrical/annular optical resonators.

AVAILABLE DOCUMENTATION: None

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Fabry Perot Resonator <input type="checkbox"/> Detailed Resonator	<input checked="" type="checkbox"/> None <input checked="" type="checkbox"/> Simple Saturated Gain <input type="checkbox"/> Detailed Kinetics	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Flow Model <input type="checkbox"/> Detailed Mixing
TYPE	<input checked="" type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input type="checkbox"/> CW <input type="checkbox"/> Pulsed <input type="checkbox"/> HF, DF <input type="checkbox"/> Other	<input type="checkbox"/> Premixed <input type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other
GEOMETRY	<input checked="" type="checkbox"/> Standing Wave <input checked="" type="checkbox"/> Ring <input checked="" type="checkbox"/> Compact <input checked="" type="checkbox"/> Annular	<input type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input type="checkbox"/> Cylindrical, Radially Flowing <input type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other
GRID DIMENSION	<input checked="" type="checkbox"/> (Transverse Dimension) <input type="checkbox"/> 1 D <input type="checkbox"/> 2 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D
COORDINATE SYSTEM	<input checked="" type="checkbox"/> Cartesian <input checked="" type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other
FEATURES MODELED	<input checked="" type="checkbox"/> Misalignments <input checked="" type="checkbox"/> Aberrations <input checked="" type="checkbox"/> Deformable Mirrors <input checked="" type="checkbox"/> Far-Field Performance <input type="checkbox"/> Other	<input type="checkbox"/> Single Line <input type="checkbox"/> Multiline <input type="checkbox"/> Line Broadening <input type="checkbox"/> Other	<input type="checkbox"/> Laminar Flow <input type="checkbox"/> Turbulent Flow <input type="checkbox"/> Boundary Layer <input type="checkbox"/> Shocks <input type="checkbox"/> Other

+ with GCAL

CODE SUMMARY SHEET

CODE NAME: SAIC2DV

ORIGINATOR/KEY CONTACT:

Name: Jerry Long Phone: (404) 955-2663

Organization: Science Applications, Inc.

Address: 6600 Powers Ferry Road, Suite 220, Atlanta, Georgia 30339

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Provide accurate, cost effective method of cylindrical/annular optical resonator mode and power extraction analysis and determine the effect of various design perturbations on these parameters. This code is a vectorized version of SAIC2D.

AVAILABLE DOCUMENTATION: None

ATTRIBUTE \ CATEGORY	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input type="checkbox"/> None <input checked="" type="checkbox"/> Simple Fabry Perot <input type="checkbox"/> Detailed Resonator	<input checked="" type="checkbox"/> None <input checked="" type="checkbox"/> Simple Saturated Gain <input type="checkbox"/> Detailed Kinetics	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Flow Model <input type="checkbox"/> Detailed Mixing
TYPE	<input checked="" type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input type="checkbox"/> CW <input type="checkbox"/> Pulsed <input type="checkbox"/> HF, DF <input type="checkbox"/> Other	<input type="checkbox"/> Premixed <input type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other
GEOMETRY	<input checked="" type="checkbox"/> Standing Wave <input checked="" type="checkbox"/> Ring <input checked="" type="checkbox"/> Compact <input checked="" type="checkbox"/> Annular	<input type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input type="checkbox"/> Cylindrical, Radially Flowing <input type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other
GRID DIMENSION	<input type="checkbox"/> (Transverse Dimension) <input type="checkbox"/> 1 D <input checked="" type="checkbox"/> 2 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D
COORDINATE SYSTEM	<input checked="" type="checkbox"/> Cartesian <input checked="" type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other
FEATURES MODELED	<input checked="" type="checkbox"/> Misalignments <input checked="" type="checkbox"/> Aberrations <input checked="" type="checkbox"/> Deformable Mirrors <input checked="" type="checkbox"/> Far-Field Performance <input type="checkbox"/> Other	<input type="checkbox"/> Single Line <input type="checkbox"/> Multiline <input type="checkbox"/> Line Broadening <input type="checkbox"/> Other	<input type="checkbox"/> Laminar Flow <input type="checkbox"/> Turbulent Flow <input type="checkbox"/> Boundary Layer <input type="checkbox"/> Shocks <input type="checkbox"/> Other

+ with GCAL

CODE SUMMARY SHEET

CODE NAME: SAIFHT

ORIGINATOR/KEY CONTACT:

Name: Jerry Long Phone: (404) 955-2663

Organization: Science Applications, Inc.

Address: 6600 Powers Ferry Road, Atlanta, Georgia 30339

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Provide accurate, cost effective method of cylindrical/annular optical resonator parametric analysis including power extraction for use in overall system optimization.

AVAILABLE DOCUMENTATION: HF Laser Subsystem Technology Assessment (DARPA Interim Report), Science Applications, Inc., Atlanta, Georgia, July 1979 (CONFIDENTIAL)

CATEGORY ATTRIBUTE	OPTICS		KINETICS		GASDYNAMICS	
	LEVEL	● None ● Simple Fabry Perot ● Detailed Resonator	●+ None ● Simple Saturated Gain ● Detailed Kinetics	None	Simple Flow Model Detailed Mixing	
TYPE	● Geometrical ● Physical	CW Pulsed HF, DF Other	Premixed Scheduled Mixing Other			
GEOMETRY	● Standing Wave ● Ring ● Compact ● Annular	Annular, Radially Flowing Transversely Flowing Other	Cylindrical, Radially Flowing Rectangular, Linearly Flowing Other			
GRID DIMENSION	(Transverse Dimension) ● 1 D ● 2 D	1 D 2 D 3 D	1 D 2 D 3 D			
COORDINATE SYSTEM	● Cartesian ● Cylindrical ● Other	Cartesian Cylindrical Other	Cartesian Cylindrical Other			
FEATURES MODELED	● Misalignments ● Aberrations ● Deformable Mirrors ● Far-Field Performance ● Other	Single Line Multiline Line Broadening Other	Laminar Flow Turbulent Flow Boundary Layer Shocks Other			

+ with GCAL

CODE SUMMARY SHEET

CODE NAME: SAIGD

ORIGINATOR/KEY CONTACT:

Name: Kerry E. Patterson Phone: (404) 955-2663Organization: Science Applications., Inc.Address: 6600 Powers Ferry Road, Suite 220, Atlanta, Georgia 30339

PRINCIPAL PURPOSE AND APPLICATION OF CODE: (1) Correlate and analyze closed cavity data. (2) Optimize operating conditions and geometric configurations. (3) Generate gain algorithm for wave optics analyses. Lasing and chemical kinetics models are included. Generates gas dynamic/kinetic profiles for gain algorithm (see GCAL).

AVAILABLE DOCUMENTATION: HF Laser Subsystem Technology Assessment (DARPA Interim Report), Science Applications, Inc., Atlanta, Georgia, July 1979.

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	● None Simple Fabry Perot Detailed Resonator	● None Simple Saturated Gain Detailed Kinetics	● None Simple Flow Model Detailed Mixing
TYPE	Geometrical Physical	● CW ● Pulsed ● HF, DF ● Other	● Premixed ● Scheduled Mixing ● Other
GEOMETRY	Standing Wave Ring Compact Annular	● Annular, Radially Flowing ● Transversely Flowing ● Other	● Cylindrical, Radially Flowing ● Rectangular, Linearly Flowing ● Other
GRID DIMENSION	(Transverse Dimension) 1 D 2 D	● 1 D ● 2 D ● 3 D	● 1 D ● 2 D ● 3 D Psuedo
COORDINATE SYSTEM	Cartesian Cylindrical Other	● Cartesian ● Cylindrical ● Other	● Cartesian ● Cylindrical ● Other
FEATURES MODELED	Misalignments Aberrations Deformable Mirrors Far-Field Performance Other	● Single Line ● Multiline ● Line Broadening ● Other	● Laminar Flow ● Turbulent Flow ● Boundary Layer ● Shocks ● Other

CODE SUMMARY SHEET

CODE NAME:

SAI1D

ORIGINATOR/KEY CONTACT:

Name: Jerry Long Phone: (404) 955-2663

Organization: Science Applications, Inc.

Address: 6600 Powers Ferry Road, Suite 220, Atlanta, Georgia 30339

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Provide accurate, cost effective method of linear optical resonator mode and power extraction analysis and the effect of various design perturbations on these parameters.

AVAILABLE DOCUMENTATION: None

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Fabry Perot <input type="checkbox"/> Detailed Resonator	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Saturated Gain <input type="checkbox"/> Detailed Kinetics	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Flow Model <input type="checkbox"/> Detailed Mixing
TYPE	<input checked="" type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input type="checkbox"/> CW <input type="checkbox"/> Pulsed <input type="checkbox"/> HF, DF <input type="checkbox"/> Other	<input type="checkbox"/> Premixed <input type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other
GEOMETRY	<input checked="" type="checkbox"/> Standing Wave <input checked="" type="checkbox"/> Ring <input checked="" type="checkbox"/> Compact <input type="checkbox"/> Annular	<input type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input type="checkbox"/> Cylindrical, Radially Flowing <input type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other
GRID DIMENSION	<input checked="" type="checkbox"/> (Transverse Dimension) <input type="checkbox"/> 1 D <input type="checkbox"/> 2 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D
COORDINATE SYSTEM	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other
FEATURES MODELED	<input checked="" type="checkbox"/> Misalignments <input checked="" type="checkbox"/> Aberrations <input type="checkbox"/> Deformable Mirrors <input checked="" type="checkbox"/> Far-Field Performance <input type="checkbox"/> Other	<input type="checkbox"/> Single Line <input type="checkbox"/> Multiline <input type="checkbox"/> Line Broadening <input type="checkbox"/> Other	<input type="checkbox"/> Laminar Flow <input type="checkbox"/> Turbulent Flow <input type="checkbox"/> Boundary Layer <input type="checkbox"/> Shocks <input type="checkbox"/> Other

CODE SUMMARY SHEET

CODE NAME:

SAI2D

ORIGINATOR/KEY CONTACT:

Name: Jerry Long Phone: (404) 955-2663Organization: Science Applications, Inc.Address: 6600 Powers Ferry Road, Atlanta, Georgia 30339PRINCIPAL PURPOSE AND APPLICATION OF CODE: Modeling of rectangular linear resonators and optical trains.AVAILABLE DOCUMENTATION: None

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input type="checkbox"/> None <input checked="" type="checkbox"/> Simple Fabry Perot <input type="checkbox"/> Detailed Resonator	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Saturated Gain <input checked="" type="checkbox"/> * Detailed Kinetics	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Flow Model <input type="checkbox"/> Detailed Mixing
TYPE	<input checked="" type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input type="checkbox"/> CW <input type="checkbox"/> Pulsed <input type="checkbox"/> HF, DF <input type="checkbox"/> Other	<input type="checkbox"/> Premixed <input type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other
GEOMETRY	<input checked="" type="checkbox"/> Standing Wave <input checked="" type="checkbox"/> Ring <input checked="" type="checkbox"/> Compact <input type="checkbox"/> Annular	<input type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input type="checkbox"/> Cylindrical, Radially Flowing <input type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other
GRID DIMENSION	<input checked="" type="checkbox"/> (Transverse Dimension) <input type="checkbox"/> 1 D <input type="checkbox"/> 2 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D
COORDINATE SYSTEM	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other
FEATURES MODELED	<input checked="" type="checkbox"/> Misalignments <input checked="" type="checkbox"/> Aberrations <input checked="" type="checkbox"/> Deformable Mirrors <input checked="" type="checkbox"/> Far-Field Performance <input checked="" type="checkbox"/> Other	<input type="checkbox"/> Single Line <input type="checkbox"/> Multiline <input type="checkbox"/> Line Broadening <input type="checkbox"/> Other	<input type="checkbox"/> Laminar Flow <input type="checkbox"/> Turbulent Flow <input type="checkbox"/> Boundary Layer <input type="checkbox"/> Shocks <input type="checkbox"/> Other

* with GCAL

CODE SUMMARY SHEET

CODE NAME:

SOS

ORIGINATOR/KEY CONTACT:

Name: J. Hough/M. Epstein Phone: (213) 648-6861

Organization: Aerophysics Laboratory, The Aerospace Corporation

Address: P.O. Box 92957, Los Angeles, California 90009

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Calculation of pulsed HF and DF chemical laser performance by solving coupled thermodynamic, chemical kinetic, and radiation transport equations. Utilizes comprehensive chemical kinetics model (including rotational nonequilibrium) and simple Fabry-Perot model.

AVAILABLE DOCUMENTATION: Efficient Model for HF Lasers With Rotational Nonequilibrium, J.J.T. Hough, Aerospace Corp. Repts. SAMSO-TR-78-79, 15 Aug. 1978 and SAMSO-TR-78-84, 14 April 1978.

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Fabry Perot <input type="checkbox"/> Detailed Resonator	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Saturated Gain <input type="checkbox"/> Detailed Kinetics	<input type="checkbox"/> None <input type="checkbox"/> Simple Flow Model <input type="checkbox"/> Detailed Mixing
TYPE	<input checked="" type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input checked="" type="checkbox"/> CW <input checked="" type="checkbox"/> Pulsed <input checked="" type="checkbox"/> HF, DF <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Premixed <input type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other
GEOMETRY	<input type="checkbox"/> Standing Wave <input type="checkbox"/> Ring <input type="checkbox"/> Compact <input type="checkbox"/> Annular	<input type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input type="checkbox"/> Cylindrical, Radially Flowing <input type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other
GRID DIMENSION	(Transverse Dimension) <input type="checkbox"/> 1 D <input type="checkbox"/> 2 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D
COORDINATE SYSTEM	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other
FEATURES MODELED	<input type="checkbox"/> Misalignments <input type="checkbox"/> Aberrations <input type="checkbox"/> Deformable Mirrors <input type="checkbox"/> Far-Field Performance <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Single Line <input checked="" type="checkbox"/> Multiline <input type="checkbox"/> Line Broadening <input type="checkbox"/> Other	<input type="checkbox"/> Laminar Flow <input type="checkbox"/> Turbulent Flow <input type="checkbox"/> Boundary Layer <input type="checkbox"/> Shocks <input type="checkbox"/> Other

CODE SUMMARY SHEET

CODE NAME:

TDLCLRC*

ORIGINATOR/KEY CONTACT:

Name: Victor L. Gamiz Phone: (213) 884-3346
 Organization: Rockwell International, Rocketdyne Division
 Address: 6633 Conoga Avenue, Canoga Park, California 91304

PRINCIPAL PURPOSE AND APPLICATION OF CODE:

Performs 3-D wave optics resonator analysis of a positive branch con-
focal unstable resonator with rectangular spherical mirrors. Has off
axis geometry capability. Kinetics and mixing models included - see
AEROKNS.

AVAILABLE DOCUMENTATION: High Power Testing of Optical Components

(HIPTOC) Technical Proposal Part III, Appendix B (V. L. Gamiz) (theory).

CATEGORY ATTRIBUTE	OPTICS		KINETICS		GASDYNAMICS	
	LEVEL	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Fabry Perot <input type="checkbox"/> Detailed Resonator	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Saturated Gain <input type="checkbox"/> Detailed Kinetics	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Flow Model <input type="checkbox"/> Detailed Mixing		
TYPE	<input checked="" type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input checked="" type="checkbox"/> CW <input checked="" type="checkbox"/> Pulsed <input checked="" type="checkbox"/> HF, DF <input checked="" type="checkbox"/> Other	<input checked="" type="checkbox"/> Premixed <input type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other			
GEOMETRY	<input checked="" type="checkbox"/> Standing Wave <input checked="" type="checkbox"/> Ring <input type="checkbox"/> Compact <input type="checkbox"/> Annular	<input checked="" type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cylindrical, Radially Flowing <input type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other			
GRID DIMENSION	<input checked="" type="checkbox"/> (Transverse Dimension) <input type="checkbox"/> 1 D <input type="checkbox"/> 2 D	<input checked="" type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input checked="" type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D			
COORDINATE SYSTEM	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other			
FEATURES MODELED	<input type="checkbox"/> Misalignments <input type="checkbox"/> Aberrations <input type="checkbox"/> Deformable Mirrors <input type="checkbox"/> Far-Field Performance <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Single Line <input checked="" type="checkbox"/> Multiline <input type="checkbox"/> Line Broadening <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Laminar Flow <input type="checkbox"/> Turbulent Flow <input checked="" type="checkbox"/> Boundary Layer <input type="checkbox"/> Shocks <input checked="" type="checkbox"/> Other			

*3-D Loaded Cavity Linear Resonator Code.

CODE SUMMARY SHEET

CODE NAME:

TDWORRC*

ORIGINATOR/KEY CONTACT:

Name: Victor L. Gamiz Phone: (213) 884-3346
 Organization: Rocketdyne, Laser Optics
 Address: 6633 Canoga Avenue, Canoga Park, California 91304

PRINCIPAL PURPOSE AND APPLICATION OF CODE:

Performs 3-D wave optics resonator analysis of a cylindrical annular ring laser resonator using either a two reflexicon or a two waxicon beam compactor assembly.

AVAILABLE DOCUMENTATION:

See manuals for LS-14 3-D base and loaded HSURIA codes.

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input type="radio"/> None <input checked="" type="radio"/> Simple Fabry Perot Detailed Resonator	<input type="radio"/> None <input checked="" type="radio"/> Simple Saturated Gain Detailed Kinetics	<input checked="" type="radio"/> None <input type="radio"/> Simple Flow Model Detailed Mixing
TYPE	<input checked="" type="radio"/> Geometrical <input type="radio"/> Physical	<input type="radio"/> CW <input type="radio"/> Pulsed <input type="radio"/> HF, DF <input type="radio"/> Other	<input type="radio"/> Premixed <input type="radio"/> Scheduled Mixing <input type="radio"/> Other
GEOMETRY	<input checked="" type="radio"/> Standing Wave <input checked="" type="radio"/> Ring <input checked="" type="radio"/> Compact <input checked="" type="radio"/> Annular	<input type="radio"/> Annular, Radially Flowing <input type="radio"/> Transversely Flowing <input type="radio"/> Other	<input type="radio"/> Cylindrical, Radially Flowing <input type="radio"/> Rectangular, Linearly Flowing <input type="radio"/> Other
GRID DIMENSION	<input checked="" type="radio"/> (Transverse Dimension) <input type="radio"/> 1 D <input checked="" type="radio"/> 2 D	<input type="radio"/> 1 D <input type="radio"/> 2 D <input type="radio"/> 3 D	<input type="radio"/> 1 D <input type="radio"/> 2 D <input type="radio"/> 3 D
COORDINATE SYSTEM	<input checked="" type="radio"/> Cartesian <input type="radio"/> Cylindrical <input type="radio"/> Other	<input type="radio"/> Cartesian <input type="radio"/> Cylindrical <input type="radio"/> Other	<input type="radio"/> Cartesian <input type="radio"/> Cylindrical <input type="radio"/> Other
FEATURES MODELED	<input checked="" type="radio"/> Misalignments <input checked="" type="radio"/> Aberrations <input checked="" type="radio"/> Deformable Mirrors <input checked="" type="radio"/> Far-Field Performance <input checked="" type="radio"/> Other	<input type="radio"/> Single Line <input type="radio"/> Multiline <input type="radio"/> Line Broadening <input type="radio"/> Other	<input type="radio"/> Laminar Flow <input type="radio"/> Turbulent Flow <input type="radio"/> Boundary Layer <input type="radio"/> Shocks <input type="radio"/> Other

* 3-D Wave Optics Ring Resonator Code.

CODE SUMMARY SHEET

CODE NAME: _____

TMRO

ORIGINATOR/KEY CONTACT:

Name: Donald L. Bullock Phone: (213) 535-3484

Organization: TRW DSSG

Address: R1/1162, One Space Park, Redondo Beach, California 90278

PRINCIPAL PURPOSE AND APPLICATION OF CODE: _____

Version of MRO code for toric resonators.

AVAILABLE DOCUMENTATION: No theory manual as such, but (TRW) BLAZER and

MRO code reports (June 1978) contain much information. See BLAZER User

Manual, November 1978.

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input type="checkbox"/> None <input type="checkbox"/> Simple Fabry Perot <input type="checkbox"/> Detailed Resonator	<input type="checkbox"/> None <input type="checkbox"/> Simple Saturated Gain <input type="checkbox"/> Detailed Kinetics	<input type="checkbox"/> None <input type="checkbox"/> Simple Flow Model <input type="checkbox"/> Detailed Mixing
TYPE	<input type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input type="checkbox"/> CW <input type="checkbox"/> Pulsed <input type="checkbox"/> HF, DF <input type="checkbox"/> Other	<input type="checkbox"/> Premixed <input type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other
GEOMETRY	<input type="checkbox"/> Standing Wave <input type="checkbox"/> Ring <input type="checkbox"/> Compact <input type="checkbox"/> Annular	<input type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input type="checkbox"/> Cylindrical, Radially Flowing <input type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other
GRID DIMENSION	<input type="checkbox"/> (Transverse Dimension) <input type="checkbox"/> 1 D <input type="checkbox"/> 2 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D
COORDINATE SYSTEM	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other
FEATURES MODELED	<input type="checkbox"/> Misalignments <input type="checkbox"/> Aberrations <input type="checkbox"/> Deformable Mirrors <input type="checkbox"/> Far-Field Performance <input type="checkbox"/> Other	<input type="checkbox"/> Single Line <input type="checkbox"/> Multiline <input type="checkbox"/> Line Broadening <input type="checkbox"/> Other	<input type="checkbox"/> Laminar Flow <input type="checkbox"/> Turbulent Flow <input type="checkbox"/> Boundary Layer <input type="checkbox"/> Shocks <input type="checkbox"/> Other

CODE SUMMARY SHEET

CODE NAME:

TWODNOZ

ORIGINATOR/KEY CONTACT:

Name: D. Haflinger/P. Lohn Phone: (213) 536-1624

Organization: TRW DSSG

Address: R1/1038, One Space Park, Redondo Beach, California 90278

PRINCIPAL PURPOSE AND APPLICATION OF CODE:

Calculate nozzle flow including boundary layer and inviscid core analysis.

AVAILABLE DOCUMENTATION: None

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input checked="" type="checkbox"/> None Simple Fabry Perot Detailed Resonator	<input checked="" type="checkbox"/> None Simple Saturated Gain Detailed Kinetics	<input type="checkbox"/> None Simple Flow Model Detailed Mixing
TYPE	<input type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input type="checkbox"/> CW <input type="checkbox"/> Pulsed <input type="checkbox"/> HF, DF <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Premixed <input type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other
GEOMETRY	<input type="checkbox"/> Standing Wave <input type="checkbox"/> Ring <input type="checkbox"/> Compact <input type="checkbox"/> Annular	<input type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cylindrical, Radially Flowing <input type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other
GRID DIMENSION	(Transverse Dimension) <input type="checkbox"/> 1 D <input type="checkbox"/> 2 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input checked="" type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D
COORDINATE SYSTEM	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other
FEATURES MODELED	<input type="checkbox"/> Misalignments <input type="checkbox"/> Aberrations <input type="checkbox"/> Deformable Mirrors <input type="checkbox"/> Far-Field Performance <input type="checkbox"/> Other	<input type="checkbox"/> Single Line <input type="checkbox"/> Multiline <input type="checkbox"/> Line Broadening <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Laminar Flow <input checked="" type="checkbox"/> Turbulent Flow <input type="checkbox"/> Boundary Layer <input type="checkbox"/> Shocks <input type="checkbox"/> Other

CODE SUMMARY SHEET

CODE NAME:

URINLA2

ORIGINATOR/KEY CONTACT:

Name: Donald L. Bullock Phone: (213) 535-4384

Organization: TRW DSSG

Address: R1/1162, One Space Park, Redondo Beach, California 90278

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Models cylindrical laser with arbitrary axicon (except noneverting waxicon). Bare resonator code which determines mode control and beam quality.

AVAILABLE DOCUMENTATION: Annular Laser Mode Studies Final Report, March 1980. Program URINLA2 User Manual, June 1978.

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input type="checkbox"/> None <input checked="" type="checkbox"/> Simple Fabry Perot <input type="checkbox"/> Detailed Resonator	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Saturated Gain <input type="checkbox"/> Detailed Kinetics	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Flow Model <input type="checkbox"/> Detailed Mixing
TYPE	<input checked="" type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input type="checkbox"/> CW <input type="checkbox"/> Pulsed <input type="checkbox"/> HF, DF <input type="checkbox"/> Other	<input type="checkbox"/> Premixed <input type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other
GEOMETRY	<input checked="" type="checkbox"/> Standing Wave <input type="checkbox"/> Ring <input checked="" type="checkbox"/> Compact <input checked="" type="checkbox"/> Annular	<input type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input type="checkbox"/> Cylindrical, Radially Flowing <input type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other
GRID DIMENSION	<input type="checkbox"/> (Transverse Dimension) <input checked="" type="checkbox"/> 1 D <input checked="" type="checkbox"/> 2 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input checked="" type="checkbox"/> 3 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D
COORDINATE SYSTEM	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other
FEATURES MODELED	<input checked="" type="checkbox"/> Misalignments <input checked="" type="checkbox"/> Aberrations <input type="checkbox"/> Deformable Mirrors <input checked="" type="checkbox"/> Far-Field Performance <input type="checkbox"/> Other	<input type="checkbox"/> Single Line <input type="checkbox"/> Multiline <input type="checkbox"/> Line Broadening <input type="checkbox"/> Other	<input type="checkbox"/> Laminar Flow <input type="checkbox"/> Turbulent Flow <input type="checkbox"/> Boundary Layer <input type="checkbox"/> Shocks <input type="checkbox"/> Other

CODE SUMMARY SHEET

CODE NAME: VIINT

ORIGINATOR/KEY CONTACT:

Name: J. Ohrenberger Phone: (213) 536-4024

Organization: TRW DSSG

Address: 88/1012, One Space Park, Redondo Beach, California 90278

PRINCIPAL PURPOSE AND APPLICATION OF CODE: Viscid/inviscid interaction program; calculates flow between used gas for hypersonic wedge modeling.

AVAILABLE DOCUMENTATION: Ohrenberger, BMDATC, DASG60-76-C-0043, April 1977 (theory). Computer Program Description and Users Manual of a Near and Far Wake Modeling Analysis for Reentry under Turbulent Boundary Layer Conditions, Ohrenberger, for BMDSC, DASG60-76-C-0043, March 1979. Others.

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	● None Simple Fabry Perot Detailed Resonator	● None Simple Saturated Gain Detailed Kinetics	● None Simple Flow Model Detailed Mixing
TYPE	Geometrical Physical	CW Pulsed HF, DF Other	● Premixed Scheduled Mixing Other
GEOMETRY	Standing Wave Ring Compact Annular	Annular, Radially Flowing Transversely Flowing Other	● Cylindrical, Radially Flowing ● Rectangular, Linearly Flowing Other
GRID DIMENSION	(Transverse Dimension) 1 D 2 D	1 D 2 D 3 D	● 1 D ● 2 D 3 D
COORDINATE SYSTEM	Cartesian Cylindrical Other	Cartesian Cylindrical Other	● Cartesian ● Cylindrical Other
FEATURES MODELED	Misalignments Aberrations Deformable Mirrors Far-Field Performance Other	Single Line Multiline Line Broadening Other	● Laminar Flow ● Turbulent Flow ● Boundary Layer ● Shocks Other

CODE SUMMARY SHEET

CODE NAME:

WAP*

ORIGINATOR/KEY CONTACT:

Name: J. Ohrenberger Phone: (213) 536-4024

Organization: TRW DSSG

Address: 88/1012, One Space Park, Redondo Beach, California 90278

PRINCIPAL PURPOSE AND APPLICATION OF CODE: To determine base flow between laser nozzle. Detailed analysis of base flows, recirculation, and embedded subsonic zone; boundary remnant lip and wake shocks formation are included.

AVAILABLE DOCUMENTATION: Computer Program Description and Users Manual of a Near and Far Wake Modeling Analysis for Reentry under Laminar or Turbulent Boundary Layer Conditions, J. T. Ohrenberger, for BMDATC (DASG60-76-C-0043) April 1977. Others.

CATEGORY ATTRIBUTE	OPTICS	KINETICS	GASDYNAMICS
LEVEL	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Fabry Perot <input type="checkbox"/> Detailed Resonator	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Saturated Gain <input type="checkbox"/> Detailed Kinetics	<input checked="" type="checkbox"/> None <input type="checkbox"/> Simple Flow Model <input type="checkbox"/> Detailed Mixing
TYPE	<input type="checkbox"/> Geometrical <input type="checkbox"/> Physical	<input type="checkbox"/> CW <input type="checkbox"/> Pulsed <input type="checkbox"/> HF, DF <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Premixed <input type="checkbox"/> Scheduled Mixing <input type="checkbox"/> Other
GEOMETRY	<input type="checkbox"/> Standing Wave <input type="checkbox"/> Ring <input type="checkbox"/> Compact <input type="checkbox"/> Annular	<input type="checkbox"/> Annular, Radially Flowing <input type="checkbox"/> Transversely Flowing <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cylindrical, Radially Flowing <input checked="" type="checkbox"/> Rectangular, Linearly Flowing <input type="checkbox"/> Other
GRID DIMENSION	<input type="checkbox"/> (Transverse Dimension) <input type="checkbox"/> 1 D <input type="checkbox"/> 2 D	<input type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D	<input checked="" type="checkbox"/> 1 D <input type="checkbox"/> 2 D <input type="checkbox"/> 3 D
COORDINATE SYSTEM	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Cartesian <input type="checkbox"/> Cylindrical <input type="checkbox"/> Other
FEATURES MODELED	<input type="checkbox"/> Misalignments <input type="checkbox"/> Aberrations <input type="checkbox"/> Deformable Mirrors <input type="checkbox"/> Far-Field Performance <input type="checkbox"/> Other	<input type="checkbox"/> Single Line <input type="checkbox"/> Multiline <input type="checkbox"/> Line Broadening <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Laminar Flow <input checked="" type="checkbox"/> Turbulent Flow <input checked="" type="checkbox"/> Boundary Layer <input checked="" type="checkbox"/> Shocks <input checked="" type="checkbox"/> Other

*Wake Analysis Program

Section III

DETAILED CHEMICAL LASER CODES

This chapter contains, in alphabetical order, the received detailed responses to the survey form (Appendix A). The material has been reformatted somewhat for economy of presentation and ease of comparison. It was not possible to include the 28 codes submitted by Bell Aerospace in this detailed format; for these, the reader should see Appendix C. See Section IV for an explanation of the forms.

CODE NAME:

ABL*

CODE TYPE: Optics, Kinetics, and Gasdynamics

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Models cylindrical lasers used with URINLA2. This is a URINLA2 model with gain.

ASSESSMENT OF CAPABILITIES: See URINLA2.

ASSESSMENT OF LIMITATIONS: See URINLA2.

OTHER UNIQUE FEATURES: Resonator geometries modeled: HSURIA; "HSURIA" with toric back mirror, TURIA.

ORIGINATOR/KEY CONTACT:

Name: Donald L. Bullock Phone: (213) 535-3484

Organization: TRW DSSG

Address: RI/1162, One Space Park, Redondo Beach, California 90278

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T) Annular Laser Mode Studies Final Report; (U) Program ABL User Manual, June 1978; listings available.

STATUS:

Operational Currently?: Yes

Under Modification?: No

Purpose(s): _____

Ownership?: Government

Proprietary?: No

MACHINE/OPERATING SYSTEM (on which installed): AFWL CYBER 176, NOS/BE.

TRANSPORTABLE?: _____

Machine Dependent Restrictions: _____

SELF-CONTAINED?: See MR0/BLAZER

Other Codes Required (name, purpose): _____

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec, CDC 7600)
Small Job:		
Typical Job:		
Large Job:	<u>200K (SCM) + 300K (LCM)</u>	<u>1800</u>
Approximate Number of FORTRAN Lines:	<u>6000</u>	

* Annular BLAZER

CODE NAME:

ABL

OPTICS

BASIC TYPE (√):

Physical Optics: Geometrical: _____

FIELD (POLARIZATION) REPRESENTATION (√):

Scalar: Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: CV Annular Region: CV

TRANSVERSE GRID DIMENSIONALITY (√):

Compact Region:

1D	2D
	✓*
	✓*

Annular Region:

FIELD SYMMETRY RESTRICTIONS?: Half plane

MIRROR SHAPE(S) ALLOWED (√):

Square: _____ Circular: Strip: _____

Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (√):

Fixed, Single Resonator Geometries: _____

Fixed, Multiple Resonator Geometries:

Modular, Multiple Resonator Geometries: _____

PROPAGATION TECHNIQUE (√all that apply):

Fresnel Integral Algorithms:

With Kernel Averaging

Gaussian Quadrature:

Fast Fourier Transform (FFT):

Fast Hankel Transform (FHT):

Gardner-Fresnel-Kirchhoff (GFK):

Other (specify): _____

	COMPACT	ANNULAR
	✓	✓

CONVERGENCE TECHNIQUE (√):

Power Comparison: Field Comparison: _____

Other: _____

ACCELERATION ALGORITHMS USED?: NO

Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (√):

Prony: _____

Other: _____

RESONATOR TYPE (√): Standing Wave:

Traveling Wave (Ring): _____ Reverse TW: _____

BRANCH (√): Positive: Negative: _____

OPTICAL ELEMENT MODELS INCLUDED (√):

Flat Mirrors: Spherical Mirrors: _____

Cylindrical Mirrors: _____ Telescopes:

Scraper Mirrors:

Axicons

Arbitrary:

Linear:

Parabola-Parabola:

Variable Cone Offset:

Other (specify): _____

Deformable Mirrors: _____

Spatial Filters: _____ Gratings: _____

Other Elements: Rear flat, rear cone

HH & HP reflexicons & waxicons,

PP Reflexicons.

GAIN MODELS (√): Bare Cavity Only: _____

Simple Saturated Gain: _____ Detailed Gain:

BARE CAVITY FIELD MODIFIER MODELS (√):

Mirror Tilt: Decentration:

Aberrations/Thermal Distortions:

Arbitrary: _____

Selected (specify): Aberrations only

Reflectivity Loss:

Output Coupler Edges: Rolled: _____

Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (√):

Medium Index Variation: _____

Gas Absorption: _____

Overlapped Beams: _____

Other: _____

FAR-FIELD MODELS (√): Beam Steering Removal:

Optimal Focal Search: Beam Quality:

Other: _____

KINETICS

GAIN REGION MODELED (√):

Compact Region: _____ Annular Region:

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: _____ Annular Region: CV

KINETICS GRID DIMENSIONALITY (√):*

1D	2D	3D
✓	✓	✓

GAIN REGION SYMMETRY RESTRICTIONS:

Gain Vary Along Optic Axes?: Flow Direction?:

PULSED: _____ CW: KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (√):

$$\begin{cases} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{cases}$$

	F	Cl	Br	I
H	✓			
D	✓			

Cold (F + H₂):

Hot (H + F₂): _____ Chain (F + H₂ & H + F₂): _____

ENERGY TRANSFER MODES MODELED (√): Reference

V-T: See MRO/BLAZER

V-R: _____

V-V: See MRO/BLAZER

Other: _____

Single Line Model (√): _____

Multiline Model (√):

Assumed Rotational Population Distribution State (√):

Equilibrium: Nonequilibrium: _____

Number of Laser Lines Modeled: 24

Source of Rate Coefficients Used in Code: N. Cohen

LINE PROFILE MODELS (√):

Doppler Broadening:

Collisional Broadening:

Other (specify): Operation at line center

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (√):

Cylindrical, Radially Flowing:

Rectangular, Linearly Flowing: _____

Other: _____

COORDINATE SYSTEM: cy

FLUID GRID DIMENSION (√): 1D: 2D: _____ 3D: _____

FLOW FIELD MODELED (√):

Laminar: _____ Turbulent: _____

Other: Scheduled mixing

BASIC MODELING APPROACH (√):

Premixed: _____ Mixing: _____

Other (specify): Scheduled mixing

References for Approach Used: See MRO/BLAZER

THERMAL DRIVER MODELED (√):

Arc Heater: _____ Combustor:

Shock Tube: _____ Resistance Heater: _____

Other: _____

F-ATOM DISSOCIATION FROM (√):

F₂: SF₆: _____

Other (specify): NF₃

F-ATOM CONCENTRATION DETERMINED FROM MODEL?: YES

DILUENTS MODELED: He, N₂, CF₄

MODELS EFFECTS ON MIXING RATE DUE TO (√):

Nozzle Boundary Layers: _____ Shock Waves: _____

Prereactions (thermal blockage): _____ Turbulence: _____

Other (specify): Scheduled mixing

MODELS EFFECTS ON OPTICAL MODES DUE TO (√):

Media Index Variations: _____

Other (specify): _____

*See URHILA2 User Manual

CODE NAME:

AEROKNS

CODE TYPE: Kinetics and Gasdynamics

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Computation of small signal or loaded gains from a radially flowing system for use by annular resonator codes. Package includes aerodynamics for radial flow field.

ASSESSMENT OF CAPABILITIES: Allows computation of gain sheet through a radial scan through the middle of the reaction zone. Allowed transitions are $v = 1 \rightarrow 10$, $j = 1 \rightarrow 20$; uses latest γ rate structure available.

ASSESSMENT OF LIMITATIONS: Model does not include rotational nonequilibrium.

OTHER UNIQUE FEATURES:

ORIGINATOR/KEY CONTACT:

Name: Jim Vieceli Phone: (213) 884-3851
 Organization: Rockwell International - Rocketdyne Division
 Address: 6633 Canoga Ave., Canoga Park, California 91304

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T) Annular Laser Optics Study Final Report (AFWL-TR-77-117); (U) Annular Laser Optics Study Users Manual: Loaded Cavity Codes.

STATUS:

Operational Currently?: Yes
 Under Modification?: _____
 Purpose(s): _____

Ownership?: AFWL
 Proprietary?: No

MACHINE/OPERATING SYSTEM (on which installed): CDC Cyber 176

TRANSPORTABLE?: With modification.

Machine Dependent Restrictions: Uses CDC extended core (LCM).

SELF-CONTAINED?: No - is a subroutine package.

Other Codes Required (name, purpose): Requires that a driver code provide intensity-transition matrix.

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec. CDC 7600)
Small Job:		
Typical Job:		8-10 sec CDC 7600
Large Job:		

Approximate Number of FORTRAN Lines: _____

CODE NAME:

AEROKNS

OPTICS

None

BASIC TYPE (✓): None

Physical Optics: _____ Geometrical: _____

FIELD (POLARIZATION) REPRESENTATION (✓):

Scalar: _____ Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: _____ Annular Region: _____

TRANSVERSE GRID DIMENSIONALITY (✓):

1D	2D
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

Compact Region:

Annular Region:

FIELD SYMMETRY RESTRICTIONS?: _____

MIRROR SHAPE(S) ALLOWED (✓):

Square: _____ Circular: _____ Strip: _____

Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):

Fixed, Single Resonator Geometry: _____

Fixed, Multiple Resonator Geometries: _____

Modular, Multiple Resonator Geometries: _____

PROPAGATION TECHNIQUE (✓) (all that apply):

COMPACT	ANNULAR
<input type="checkbox"/>	<input type="checkbox"/>

Fresnel Integral Algorithms:

With Kernel Averaging

Gaussian Quadrature:

Fast Fourier Transform (FFT):

Fast Hankel Transform (FHT):

Gardener-Fresnel-Kirchhoff (GFK):

Other (specify): _____

CONVERGENCE TECHNIQUE (✓):

Power Comparison: _____ Field Comparison: _____

Other: _____

ACCELERATION ALGORITHMS USED?: _____

Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):

Prony: _____

Other: _____

RESONATOR TYPE (✓): Standing Wave: _____

Traveling Wave (Ring): _____ Reverse TW: _____

BRANCH (✓): Positive: _____ Negative: _____

OPTICAL ELEMENT MODELS INCLUDED (✓):

Flat Mirrors: _____ Spherical Mirrors: _____

Cylindrical Mirrors: _____ Telescopes: _____

Scraper Mirrors: _____

Axicons

Waxicons	Reflexicons
<input type="checkbox"/>	<input type="checkbox"/>

Arbitrary:

Linear:

Parabola-Parabola:

Variable Cone Offset:

Other (specify): _____

Deformable Mirrors: _____

Spatial Filters: _____ Gratings: _____

Other Elements: _____

GAIN MODELS (✓): Bare Cavity Only: _____

Simple Saturated Gain: _____ Detailed Gain: _____

BARE CAVITY FIELD MODIFIER MODELS (✓):

Mirror Tilt: _____ Decentration: _____

Aberrations/Thermal Distortions:

Arbitrary: _____

Selected (specify): _____

Reflectivity Loss: _____

Output Coupler Edges: Rolled: _____

Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):

Medium Index Variation: _____

Gas Absorption: _____

Overlapped Beams: _____

Other: _____

FAR-FIELD MODELS (✓): Beam Steering Removal: _____

Optimal Focal Search: _____ Beam Quality: _____

Other: _____

KINETICS

GAIN REGION MODELED (✓):

Compact Region: _____ Annular Region:

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: _____ Annular Region: CY

KINETICS GRID DIMENSIONALITY (✓):

1D	2D	3D
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Compact Region:

Annular Region:

GAIN REGION SYMMETRY RESTRICTIONS:

Gain Vary Along Optic Axes: _____ Flow Direction:

PULSED: _____ CW: KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

$$\begin{cases} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{cases}$$

Cold (F + H₂):

Hot (H + F₂): Chain (F + H₂ & H + F₂):

Other (specify): _____

ENERGY TRANSFER MODES MODELED (✓): Reference

V-T: Cohen

V-R: _____

V-V: Cohen

Other: _____

Single Line Model (✓): _____

Multiline Model (✓):

Assumed Rotational Population Distribution State (✓):

Equilibrium: Nonequilibrium: _____

Number of Laser Lines Modeled: ≤12

Source of Rate Coefficients Used in Code: Handbook of Chemical Lasers

LINE PROFILE MODELS (✓):

Doppler Broadening:

Collisional Broadening:

Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓):

Cylindrical, Radially Flowing:

Rectangular, Linearly Flowing: _____

Other: _____

COORDINATE SYSTEM: CY

FLUID GRID DIMENSION (✓): 1D: 2D: _____ 3D: _____

FLOW FIELD MODELED (✓):

Laminar: _____ Turbulent: _____

Other: Scheduled mixing

BASIC MODELING APPROACH (✓):

Premixed: _____ Mixing:

Other (specify): _____

References for Approach Used: ALOS Final Report

THERMAL DRIVER MODELED (✓):

Arc Heater: _____ Combustor: _____

Shock Tube: _____ Resistance Heater: _____

Other: Not modeled

F-ATOM DISSOCIATION FROM (✓):

F₂: SF₆:

Other (specify): NF₃

F-ATOM CONCENTRATION DETERMINED FROM MODEL?: *

DILUENTS MODELED: He, N₂

MODELS EFFECTS ON MIXING RATE DUE TO (✓):

Nozzle Boundary Layers: Shock Waves: _____

Prereactions (thermal blockage): _____ Turbulence: _____

Other (specify): TriD

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):

Media Index Variations:

Other (specify): _____

* Equilibrium thermochemistry

CODE NAME:

AFOPTMNORO

CODE TYPE: Optics and KineticsPRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Predict power spectral performance of CW chemical laser. Also see MNORO for more detailed kinetics description.ASSESSMENT OF CAPABILITIES: Predict power spectral distribution for unstable and stable resonators. Strip optics code was provided by Capt. T. Salvi, AFWL/ALR. With rotational Nonequilibrium kinetics, code will predict which lines lase.ASSESSMENT OF LIMITATIONS: Need to include rotational non-equalibrium on 1-0 band. study.OTHER UNIQUE FEATURES: Besides power comparison technique to establish convergence, this code compares I(x) on all lines; it also calculates Po/Pc, where Po = total optics power loss and Pc = power available from chemistry.

ORIGINATOR/KEY CONTACT:

Name: L. H. Sentman Phone: (217) 333-1834
Organization: Aeronautical and Astronautical Engineering Dept., University of Illinois
Address: Urbana, Illinois 61801AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T) "An Efficient Rotational Nonequilibrium Model of a CW Chemical Laser," L. H. Sentman and W. Brandkamp, TR AAE 79-5, UILU Eng 79-0505 (July 1979); (U) "Users Guide for Program MNORO and AFOPTMNORO," L. H. Sentman, AAE TR 79-7, UILU Eng 79-0507 (October 1979).

STATUS:

Operational Currently?: Yes

Under Modification?: _____

Purpose(s): _____

Ownership?: AFOSRProprietary?: NoMACHINE/OPERATING SYSTEM (on which installed): CDC Cyber 175TRANSPORTABLE?: Yes

Machine Dependent Restrictions: _____

SELF-CONTAINED?: Yes

Other Codes Required (name, purpose): _____

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec. CDC 7600)
Small Job:		
Typical Job:	<u>100K</u>	<u>150 - 800 sec / iteration</u>
Large Job:	<u>272K</u>	<u>(depending on number of points: about 15 iterations to converge)</u>

Approximate Number of FORTRAN Lines: _____

CODE NAME:

AFOPTMNORO

OPTICS

BASIC TYPE (✓):

Physical Optics: Geometrical: _____

FIELD (POLARIZATION) REPRESENTATION (✓):

Scalar: Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: Ca Annular Region: _____

TRANSVERSE GRID DIMENSIONALITY (✓):

Compact Region:

Annular Region:

1D	2D
<input checked="" type="checkbox"/>	<input type="checkbox"/>

FIELD SYMMETRY RESTRICTIONS?: _____

MIRROR SHAPE(S) ALLOWED (✓):

Square: _____ Circular: _____ Strip:

Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):

Fixed, Single Resonator Geometry:

Fixed, Multiple Resonator Geometries: _____

Modular, Multiple Resonator Geometries: _____

PROPAGATION TECHNIQUE (✓) (Valid that apply):

Fresnel Integral Algorithms:

With Kernel Averaging

Gaussian Quadrature:

Fast Fourier Transform (FFT):

Fast Hankel Transform (FHT):

Gardner-Fresnel-Kirchhoff (GFK):

Other (specify): _____

COMPACT	ANNULAR
<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>

CONVERGENCE TECHNIQUE (✓):

Power Comparison: Field Comparison:

Other: P_{optics}/P_{chem}

ACCELERATION ALGORITHMS USED?: _____

Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):

Prony: _____

Other: _____

RESONATOR TYPE (✓): Standing Wave:

Traveling Wave (Ring): _____ Reverse TW: _____

BRANCH (✓): Positive: Negative:

OPTICAL ELEMENT MODELS INCLUDED (✓):

Flat Mirrors: _____ Spherical Mirrors: _____

Cylindrical Mirrors: Telescopes: _____

Scaper Mirrors: _____

Axicons

Arbitrary:

Linear:

Parabola-Parabola:

Variable Cone Offset:

Other (specify): _____

Deformable Mirrors: _____

Spatial Filters: _____ Gratings: _____

Other Elements: _____

Waxicons	Reflexicons
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

GAIN MODELS (✓): Bare Cavity Only: _____

Simple Saturated Gain: _____ Detailed Gain:

BARE CAVITY FIELD MODIFIER MODELS (✓):

Mirror Tilt: _____ Decentration: _____

Aberrations/Thermal Distortions:

Arbitrary: _____

Selected (specify): _____

Reflectivity Loss: _____

Output Coupler Edges: Rolled: _____

Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):

Medium Index Variation: _____

Gas Absorption: _____

Overlapped Beams: _____

Other: _____

FAR-FIELD MODELS (✓): Beam Steering Removal: _____

Optimal Focal Search: _____ Beam Quality: _____

Other: _____

KINETICS

GAIN REGION MODELED (✓):

Compact Region: Annular Region: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: Ca Annular Region: _____

KINETICS GRID DIMENSIONALITY (✓):

Compact Region:

Annular Region:

1D	2D	3D
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

GAIN REGION SYMMETRY RESTRICTIONS:

Gain Vary Along Optic Axes?: _____ Flow Direction?: _____

PULSED: _____ CW: KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

$$\begin{cases} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{cases}$$

Cold (F + H₂):

Hot (H + F₂): Chain (F + H₂ & H + F₂): _____

Other (specify): _____

X	F	Cl	Br	I
H	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

ENERGY TRANSFER MODES MODELED (✓): Reference

V-T:

V-R:

V-V: _____

Other: Multiquantum V-T, F-atom wall recombination.

Single Line Model (✓): _____

Multiline Model: (✓)

Assumed Rotational Population Distribution State (✓):

Equilibrium: _____ Nonequilibrium:

Number of Laser Lines Modeled: Predicts which lines lase.

Source of Rate Coefficients Used in Code: Cohen's HF/DF rate package, Hinchens

rotational *
LINE PROFILE MODELS (✓):

Doppler Broadening: _____

Collisional Broadening: _____

Other (specify): Voigt profile

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓): None

Cylindrical, Radially Flowing: _____

Rectangular, Linearly Flowing:

Other: _____

COORDINATE SYSTEM: Cartesian

FLUID GRID DIMENSION (✓): 1D: 2D: _____ 3D: _____

FLOW FIELD MODELED (✓):

Laminar: _____ Turbulent: _____

Other: _____

BASIC MODELING APPROACH (✓):

Premixed: _____ Mixing: _____

Other (specify):

References for Approach Used: _____

THERMAL DRIVER MODELED (✓):

Arc Heater: _____ Combustor: _____

Shock Tube: _____ Resistance Heater: _____

Other: _____

F-ATOM DISSOCIATION FROM (✓):

F₂: _____ SF₆: _____

Other (specify): _____

F-ATOM CONCENTRATION DETERMINED FROM MODEL?: _____

DILUENTS MODELED: _____

MODELS EFFECTS ON MIXING RATE DUE TO (✓):

Nozzle Boundary Layers: Shock Waves: _____

Prereactions (thermal blockage): _____ Turbulence: _____

Other (specify):

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):

Media Index Variations: _____

Other (specify): _____

*Relaxation data, Polanyi's pumping distribution

CODE NAME:

ALCHRC*

CODE TYPE: Optics, Kinetics, and GasdynamicsPRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: LS-14; Resonator parameter selection, assess mode control, performance predictions for power extraction and beam quality, set/verify design requirements.ASSESSMENT OF CAPABILITIES: Capable of evaluating any general HSURIA with reflexicon.ASSESSMENT OF LIMITATIONS: Single gain sheet, axisymmetric model precludes resonator azimuthal perturbation analysis.OTHER UNIQUE FEATURES: Resonator geometrics modeled; HSURIA with reflexicon. Axisymmetric mode competition. Twelve fields (combination of transitions and modes).

ORIGINATOR/KEY CONTACT:

Name: Phil Briggs Phone: (213) 884-3581
Organization: Rockwell International-Rocketdyne Division
Address: 6033 Canoga Ave., Canoga Park, California 91304AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T) various.

STATUS:

Operational Currently?: Yes
Under Modification?: No
Purpose(s): _____Ownership?: AFWL
Proprietary?: NoMACHINE/OPERATING SYSTEM (on which installed): CDC Cyber 176TRANSPORTABLE?: With modification.Machine Dependent Restrictions: Uses CDC extended core.

SELF-CONTAINED?:

Other Codes Required (name, purpose): Resonator geometry systems code (for other than P-P reflexicon), axisymmetric far-field code.

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec. CDC 7600)
Small Job:	200K SCM-200K LCM	1000 Octal sec
Typical Job:	200K SCM-250K LCM	2000 Octal sec
Large Job:	200K SCM-600K LCM	10000 Octal sec

Approximate Number of FORTRAN Lines: 3000

* Axisymmetric Loaded Cavity HSURIA Resonator Code

CODE NAME:

ALCHRC

OPTICS

BASIC TYPE (✓):

Physical Optics: _____ Geometrical: _____

FIELD (POLARIZATION) REPRESENTATION (✓):

Scalar: _____ Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: CY Annular Region: CY

TRANSVERSE GRID DIMENSIONALITY (✓):

1D	2D
<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

Compact Region:

Annular Region:

FIELD SYMMETRY RESTRICTIONS: Axisymmetric

MIRROR SHAPE(S) ALLOWED (✓):

Square: _____ Circular: Strip: _____

Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):

Fixed, Single Resonator Geometry:

Fixed, Multiple Resonator Geometries: _____

Modular, Multiple Resonator Geometries: _____

PROPAGATION TECHNIQUE (✓/alt that apply):

	COMPACT	ANNULAR
Fresnel Integral Algorithms:	<input type="checkbox"/>	<input type="checkbox"/>
With Kernel Averaging	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Gaussian Quadrature:	<input type="checkbox"/>	<input type="checkbox"/>
Fast Fourier Transform (FFT):	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Fast Hankel Transform (FHT):	<input type="checkbox"/>	<input type="checkbox"/>
Gardener-Fresnel-Kirchhoff (GFK):	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Fresnel Integral Algorithms:

With Kernel Averaging

Gaussian Quadrature:

Fast Fourier Transform (FFT):

Fast Hankel Transform (FHT):

Gardener-Fresnel-Kirchhoff (GFK):

Other (specify): Midpoint rule: Compact/Annular

CONVERGENCE TECHNIQUE (✓):

Power Comparison: _____ Field Comparison:

Other: _____

ACCELERATION ALGORITHMS USED?:

Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):

Prony: _____

Other: _____

RESONATOR TYPE (✓): Standing Wave:

Traveling Wave (Ring): _____ Reverse TW: _____

BRANCH (✓): Positive: Negative: _____

OPTICAL ELEMENT MODELS INCLUDED (✓):

Flat Mirrors: Spherical Mirrors:

Cylindrical Mirrors: _____ Telescopes: _____

Scraper Mirrors:

Axicons

Arbitrary:

Linear:

Parabola-Parabola:

Variable Cone Offset:

Other (specify): P-P tanh

Deformable Mirrors: _____

Spatial Filters: _____ Gratings: _____

Other Elements: _____

	Waxicons	Reflexicons
Arbitrary:	<input type="checkbox"/>	<input type="checkbox"/>
Linear:	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Parabola-Parabola:	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Variable Cone Offset:	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Other (specify): <u>P-P tanh</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

GAIN MODELS (✓): Bare Cavity Only: _____

Simple Saturated Gain: _____ Detailed Gain:

BARE CAVITY FIELD MODIFIER MODELS (✓):

Mirror Tilt: _____ Decentration: _____

Aberrations/Thermal Distortions:

Arbitrary: Both (radial only)

Selected (specify): _____

Reflectivity Loss: _____

Output Coupler Edges: Rolled: _____

Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):

Medium Index Variation: Radial onlyGas Absorption: Radial only

Overlapped Beams: _____

Other: _____

FAR-FIELD MODELS (✓): Beam Steering Removal: _____

Optimal Focal Search: Beam Quality:

Other: _____

KINETICS

GAIN REGION MODELED (✓):

Compact Region: _____ Annular Region:

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: _____ Annular Region: CY

KINETICS GRID DIMENSIONALITY (✓):

1D	2D	3D
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Compact Region:

Annular Region:

GAIN REGION SYMMETRY RESTRICTIONS:

Gain Vary Along Optic Axes: _____ Flow Direction: PULSED: _____ CW: KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

$$\begin{cases} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{cases}$$

	X	F	Cl	Br	I
H	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Cold (F + H₂): Hot (H + F₂): Chain (F + H₂ & H + F₂):

Other (specify): _____

ENERGY TRANSFER MODES MODELED (✓): Reference

V-T: Cohen

V-R: _____

V-V: Cohen

Other: _____

Single Line Model (✓): _____

Multiline Model (✓):

Assumed Rotational Population Distribution State (✓):

Equilibrium: Nonequilibrium: _____Number of Laser Lines Modeled: ≤ 12Source of Rate Coefficients Used in Code: Handbook of Chemical Lasers

LINE PROFILE MODELS (✓):

Doppler Broadening: Collisional Broadening:

Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓):

Cylindrical, Radially Flowing:

Rectangular, Linearly Flowing: _____

Other: _____

COORDINATE SYSTEM: cyFLUID GRID DIMENSION (✓): 1D: 2D: _____ 3D: _____

FLOW FIELD MODELED (✓):

Laminar: _____ Turbulent: _____

Other: Scheduled mixing

BASIC MODELING APPROACH (✓):

Premixed: _____ Mixing: _____

Other (specify): _____

References for Approach Used: ALOS Final Report

THERMAL DRIVER MODELED (✓):

Arc Heater: _____ Combustor: _____

Shock Tube: _____ Resistance Heater: _____

Other: Not modeled

F-ATOM DISSOCIATION FROM (✓):

F₂: SF₆: Other (specify): NE₃F-ATOM CONCENTRATION DETERMINED FROM MODEL?: *DILUENTS MODELED: He, N₂

MODELS EFFECTS ON MIXING RATE DUE TO (✓):

Nozzle Boundary Layers: Shock Waves: _____

Prereactions (thermal blockage): _____ Turbulence: _____

Other (specify): Trip

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):

Media Index Variations:

Other (specify): _____

*Equilibrium thermochemistry

CODE NAME:

ALCRRRC*

CODE TYPE: Optics, Kinetics, and Gasdynamics.

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Resonator parameter selection, assess mode control, performance predictions for power and beam quality, set/verify design requirements.

ASSESSMENT OF CAPABILITIES: Allows evaluation of general ring geometries with independently specified reflexicons.

ASSESSMENT OF LIMITATIONS: Axisymmetric model precludes resonator azimuthal perturbation analysis.

OTHER UNIQUE FEATURES: Resonator geometries modeled: ring resonator with reflexicon positive/negative branch. Axisymmetric mode competition, 5 gain sheets. Twelve fields (combination of transitions and modes).

ORIGINATOR/KEY CONTACT:

Name: Phil D. Briggs Phone: (213) 884-3851

Organization: Rockwell International, Rocketdyne Division

Address: 6633 Canoga Ave., Canoga Park, California 91304

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T) various.

STATUS:

Operational Currently?: No

Under Modification?: Being developed.

Purpose(s): _____

Ownership?: AFWL

Proprietary?: No

MACHINE/OPERATING SYSTEM (on which installed): CDC Cyber 176

TRANSPORTABLE?: With modification.

Machine Dependent Restrictions: Uses CDC extended core.

SELF-CONTAINED?: _____

Other Codes Required (name, purpose): Axisymmetric far-field code.

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec. CDC 7600)
Small Job:	<u>200K SCM-200K LCM</u>	<u>1000 Octal sec</u>
Typical Job:	<u>200K SCM-250K LCM</u>	<u>2000 Octal sec</u>
Large Job:	<u>200K SCM-600K LCM</u>	<u>10000 Octal sec</u>

Approximate Number of FORTRAN Lines: 3000

* Axisymmetric Loaded Cavity Ring Resonator Code

CODE NAME:

ALCRRC

OPTICS

BASIC TYPE (√):

Physical Optics: Geometrical: _____

FIELD (POLARIZATION) REPRESENTATION (√):

Scalar: Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: CY Annular Region: CY

TRANSVERSE GRID DIMENSIONALITY (√):

Compact Region:

Annular Region:

1D	2D
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

FIELD SYMMETRY RESTRICTIONS: Axisymmetric

MIRROR SHAPE(S) ALLOWED (√):

Square: _____ Circular: Strip: _____

Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (√):

Fixed, Single Resonator Geometry:

Fixed, Multiple Resonator Geometries: _____

Modular, Multiple Resonator Geometries: _____

PROPAGATION TECHNIQUE (√/all that apply):

Fresnel Integral Algorithms:

With Kernel Averaging

Gaussian Quadrature:

Fast Fourier Transform (FFT):

Fast Hankel Transform (FHT):

Gardner-Fresnel-Kirchhoff (GFK):

Other (specify): Midpoint rule:

Compact/Annular

COMPACT	ANNULAR
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

CONVERGENCE TECHNIQUE (√):

Power Comparison: _____ Field Comparison:

Other: _____

ACCELERATION ALGORITHMS USED?: None

Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM: (√):

Prony: _____

Other: _____

RESONATOR TYPE (√): Standing Wave: _____

Traveling Wave (Ring): Reverse TW: _____

BRANCH (√): Positive: Negative:

OPTICAL ELEMENT MODELS INCLUDED (√):

Flat Mirrors: Spherical Mirrors: _____

Cylindrical Mirrors: _____ Telescopes:

Scraper Mirrors:

Axicons

Arbitrary:

Linear:

Parabola-Parabola:

Variable Cone Offset:

Other (specify): P-P tanh

Deformable Mirrors: _____

Spatial Filters: Gratings: _____

Other Elements: _____

Waxicons	Reflexicons
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

GAIN MODELS (√): Bare Cavity Only: _____

Simple Saturated Gain: _____ Detailed Gain:

BARE CAVITY FIELD MODIFIER MODELS (√):

Mirror Tilt: _____ Decentration: _____

Aberrations/Thermal Distortions:

Arbitrary: - Axisymmetric

Selected (specify): _____

Reflectivity Loss:

Output Coupler Edges: Rolled: _____

Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (√):

Medium Index Variation: - Axisymmetric

Gas Absorption: - Axisymmetric

Overlapped Beams: _____

Other: _____

FAR-FIELD MODELS (√): Beam Steering Removal:

Optimal Focal Search: Beam Quality:

Other: _____

KINETICS

GAIN REGION MODELED (√):

Compact Region: _____ Annular Region:

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: _____ Annular Region: CY

KINETICS GRID DIMENSIONALITY (√):

Compact Region:

Annular Region:

1D	2D	3D
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

GAIN REGION SYMMETRY RESTRICTIONS:

Gain Vary Along Optic Axes?: _____ Flow Direction?:

PULSED: _____ CW: KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (√):

$\{ X + Y_2 = YX + Y \}$

$\{ Y + X_2 = YX + X \}$

Cold (F + H₂):

Hot (H + F₂): Chain (F + H₂ & H + F₂):

Other (specify): _____

X	F	Cl	Br	I
<input checked="" type="checkbox"/>				
<input checked="" type="checkbox"/>				
<input checked="" type="checkbox"/>				

ENERGY TRANSFER MODES MODELED (√): Reference

V-T: Cohen

V-R: _____

V-V: Cohen

Other: _____

Single Line Model (√): _____

Multiline Model (√):

Assumed Rotational Population Distribution State (√):

Equilibrium: Nonequilibrium: _____

Number of Laser Lines Modeled: ≤ 12

Source of Rate Coefficients Used in Code: Handbook of Chemical Lasers

LINE PROFILE MODELS (√):

Doppler Broadening:

Collisional Broadening:

Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (√):

Cylindrical, Radially Flowing:

Rectangular, Linearly Flowing: _____

Other: _____

COORDINATE SYSTEM: CY

FLUID GRID DIMENSION (√): 1D: 2D: _____ 3D: _____

FLOW FIELD MODELED (√):

Laminar: _____ Turbulent: _____

Other: Scheduled mixing

BASIC MODELING APPROACH (√):

Premixed: _____ Mixing:

Other (specify): _____

References for Approach Used: ALOS Final Report

THERMAL DRIVER MODELED (√):

Arc Heater: _____ Combustor: _____

Shock Tube: _____ Resistance Heater: _____

Other: Not modeled

F-ATOM DISSOCIATION FROM (√):

F₂: SF₆:

Other (specify): NF₃

F-ATOM CONCENTRATION DETERMINED FROM MODEL?: *

DILUENTS MODELED: He, N₂

MODELS EFFECTS ON MIXING RATE DUE TO (√):

Nozzle Boundary Layers: Shock Waves: _____

Precursors (thermal blockage): _____ Turbulence: _____

Other (specify): Trip

MODELS EFFECTS ON OPTICAL MODES DUE TO (√):

Media Index Variations:

Other (specify): _____

*Equilibrium thermochemistry

CODE NAME:

ALFA

CODE TYPE: KineticsPRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Models any chemically pumped mixing laser system, even electronic transition type. (See also GIM).ASSESSMENT OF CAPABILITIES: 2-D parabolic reactive, viscous flow code. TKE turbulence (2-equation). (Similar to APACHE, except not time-dependent).ASSESSMENT OF LIMITATIONS: Cannot model dP/dY in subsonic flows. Contains only Fabry-Perot (geometric) optics packages.OTHER UNIQUE FEATURES: Besides hot and cold HF and DF kinetics, it also models 3 body recombination $H + F + M \rightarrow HF + M$.

ORIGINATOR/KEY CONTACT:

Name: N. L. Rapagnani Phone: (505) 844-9836
Organization: Air Force Weapons Laboratory
Address: AFWL/ARAC, Kirtland AFB, New Mexico 87117AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T)(U) AFWL-TR-78-19

STATUS:

Operational Currently?: Yes
Under Modification?: No
Purpose(s): _____Ownership?: U.S. Government
Proprietary?: NoMACHINE/OPERATING SYSTEM (on which installed): CRAY, Cyber-176, CDC-7600, CDC-6600, IBM-370TRANSPORTABLE?: YesMachine Dependent Restrictions: NoneSELF-CONTAINED?: NoOther Codes Required (name, purpose): DYNDIM for dynamic dimensioning. Not necessary on CRAY

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec, CDC 7600)
Small Job:	65K	15 sec.
Typical Job:	150K	2-5 min.
Large Job:	230K	15-60 min.

Approximate Number of FORTRAN Lines: 2000-2500

CODE NAME:

ALFA

OPTICS

None

BASIC TYPE (√):
 Physical Optics: _____ Geometrical:

FIELD (POLARIZATION) REPRESENTATION (√):
 Scalar: _____ Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):
 Compact Region: _____ Annular Region: _____

TRANSVERSE GRID DIMENSIONALITY (√):

1D	2D

Compact Region: _____
 Annular Region: _____

FIELD SYMMETRY RESTRICTIONS: _____

MIRROR SHAPE(S) ALLOWED (√):
 Square: _____ Circular: _____ Strip: _____
 Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (√):
 Fixed, Single Resonator Geometry: _____
 Fixed, Multiple Resonator Geometries: _____
 Modular, Multiple Resonator Geometries: _____

PROPAGATION TECHNIQUE (√ all that apply):

COMPACT	ANNULAR

Fresnel Integral Algorithms: _____
 With Kernel Averaging: _____
 Gaussian Quadrature: _____
 Fast Fourier Transform (FFT): _____
 Fast Hankel Transform (FHT): _____
 Gardener-Fresnel-Kirchhoff (GFK): _____
 Other (specify): _____

CONVERGENCE TECHNIQUE (√):
 Power Comparison: _____ Field Comparison: _____
 Other: _____

ACCELERATION ALGORITHMS USED?: _____
 Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (√):
 Prony: _____
 Other: _____

RESONATOR TYPE (√): Standing Wave: _____
 Traveling Wave (Ring): _____ Reverse TW: _____

BRANCH (√): Positive: _____ Negative: _____

OPTICAL ELEMENT MODELS INCLUDED (√):
 Flat Mirrors: _____ Spherical Mirrors: _____
 Cylindrical Mirrors: _____ Telescopes: _____
 Scraper Mirrors: _____

Waxicons	Reflexicons

Axicons: _____
 Arbitrary: _____
 Linear: _____
 Parabola-Parabola: _____
 Variable Cone Offset: _____
 Other (specify): _____

Deformable Mirrors: _____
 Spatial Filters: _____ Gratings: _____
 Other Elements: _____

GAIN MODELS (√): Bare Cavity Only: _____
 Simple Saturated Gain: _____ Detailed Gain: _____

BARE CAVITY FIELD MODIFIER MODELS (√):
 Mirror Tilt: _____ Decentration: _____
 Aberrations/Thermal Distortions: _____
 Arbitrary: _____
 Selected (specify): _____
 Reflectivity Loss: _____
 Output Coupler Edges: Rolled: _____
 Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (√):
 Medium Index Variation: _____
 Gas Absorption: _____
 Overlapped Beams: _____
 Other: _____

FAR-FIELD MODELS (√): Beam Steering Removal: _____
 Optimal Focal Search: _____ Beam Quality: _____
 Other: _____

KINETICS

GAIN REGION MODELED (√):
 Compact Region: Annular Region:

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):
 Compact Region: Annular Region:

KINETICS GRID DIMENSIONALITY (√):

1D	2D	3D

Compact Region: _____
 Annular Region: _____

GAIN REGION SYMMETRY RESTRICTIONS:
 Gain Vary Along Optic Axes?: Flow Direction?:

PULSED: CW: KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (√):

X	F	Cl	Br	I
H				
D				

$\left\{ \begin{array}{l} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{array} \right\}$
 Cold (F + H₂): _____
 Hot (H + F₂): Chain (F + H₂ & H + F₂):

Other (specify): 3-body recombination

ENERGY TRANSFER MODES MODELED (√): Reference
 v-T: Keber and Hough
 v-R: _____
 v-V: _____
 Other: _____

Single Line Model (√):
 Multiline Model (√):
 Assumed Rotational Population Distribution State (√):
 Equilibrium: Nonequilibrium:
 Number of Laser Lines Modeled: Any
 Source of Rate Coefficients Used in Code: Cohen

LINE PROFILE MODELS (√):
 Doppler Broadening:
 Collisional Broadening:
 Other (specify): Voigt

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (√):
 Cylindrical, Radially Flowing:
 Rectangular, Linearly Flowing:
 Other: _____

COORDINATE SYSTEM: Cartesian & cylindrical

FLUID GRID DIMENSION (√): 1D: _____ 2D: 3D: _____

FLOW FIELD MODELED (√):
 Laminar: Turbulent:
 Other:

BASIC MODELING APPROACH (√):
 Premixed: _____ Mixing: _____
 Other (specify):

References for Approach Used: _____

THERMAL DRIVER MODELED (√):
 Arc Heater: _____ Combustor: _____
 Shock Tube: _____ Resistance Heater: _____
 Other: _____

F-ATOM DISSOCIATION FROM (√):
 F₂: _____ SF₆: _____
 Other (specify): _____

F-ATOM CONCENTRATION DETERMINED FROM MODEL?: _____

DILUENTS MODELED: _____

MODELS EFFECTS ON MIXING RATE DUE TO (√):
 Nozzle Boundary Layers: Shock Waves:
 Prereactions (thermal blockage): _____ Turbulence: _____
 Other (specify): _____

MODELS EFFECTS ON OPTICAL MODES DUE TO (√):
 Media Index Variations: _____
 Other (specify): _____

CODE NAME:

APACHE

CODE TYPE: KineticsPRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Models any chemically pumped mixing laser system, even electronic transition type. (See also GIM).ASSESSMENT OF CAPABILITIES: 2-D elliptic, reactive, viscous flow code. TKE turbulence (2-equation). Similar to ALFA, except it is time-dependent.ASSESSMENT OF LIMITATIONS: Contains only Fabry-Perot (geometric) optics packages.OTHER UNIQUE FEATURES: Besides hot and cold HF and DF reactions, it also models 3-body recombination $H + F + M \rightarrow HF(v) + M$.

ORIGINATOR/KEY CONTACT:

Name: N. L. Rapagnani Phone: (505) 844-9836Organization: Air Force Weapons LaboratoryAddress: AFWL/ARAC, Kirtland AFB, New Mexico 87117AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T)(U) LASL-LA 7427

STATUS:

Operational Currently?: YesUnder Modification?: No

Purpose(s): _____

Ownership?: U.S. GovernmentProprietary?: NoMACHINE/OPERATING SYSTEM (on which installed): CRAY, Cyber-176, CDC-7600, CDC-6600, IBM-370TRANSPORTABLE?: YesMachine Dependent Restrictions: NoneSELF-CONTAINED?: NoOther Codes Required (name, purpose): DYNDIM for dynamic dimensioning. Not necessary on CRAY.

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec, CDC 7600)
Small Job:		
Typical Job:	<u>65K/250K ECS</u>	<u>1-2 hours</u>
Large Job:	<u>77K/400K ECS</u>	<u>2+ hours</u>
Approximate Number of FORTRAN Lines:	<u>2000-2500</u>	

CODE NAME:

APACHE

OPTICS

None

BASIC TYPE (✓):

Physical Optics: _____ Geometrical:

FIELD (POLARIZATION) REPRESENTATION (✓):

Scalar: _____ Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: _____ Annular Region: _____

TRANSVERSE GRID DIMENSIONALITY (✓):

Compact Region:

1D	2D

Annular Region:

FIELD SYMMETRY RESTRICTIONS?: _____

MIRROR SHAPE(S) ALLOWED (✓):

Square: _____ Circular: _____ Strip: _____

Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):

Fixed, Single Resonator Geometry: _____

Fixed, Multiple Resonator Geometries: _____

Modular, Multiple Resonator Geometries: _____

PROPAGATION TECHNIQUE (✓all that apply): COMPACT ANNULAR

Fresnel Integral Algorithms:

With Kernel Averaging

Gaussian Quadrature:

Fast Fourier Transform (FFT):

Fast Hankel Transform (FHT):

Gardner-Fresnel-Kirchhoff (GFK):

Other (specify): _____

CONVERGENCE TECHNIQUE (✓):

Power Comparison: _____ Field Comparison: _____

Other: _____

ACCELERATION ALGORITHMS USED?: _____

Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):

Prony: _____

Other: _____

RESONATOR TYPE (✓): Standing Wave: _____

Traveling Wave (Ring): _____ Reverse TW: _____

BRANCH (✓): Positive: _____ Negative: _____

OPTICAL ELEMENT MODELS INCLUDED (✓):

Flat Mirrors: _____ Spherical Mirrors: _____

Cylindrical Mirrors: _____ Telescopes: _____

Scraper Mirrors: _____

Axicons

Waxicons	Reflixicons

Arbitrary: _____

Linear: _____

Parabola-Parabola: _____

Variable Cone Offset: _____

Other (specify): _____

Deformable Mirrors: _____

Spatial Filters: _____ Gratings: _____

Other Elements: _____

GAIN MODELS (✓): Bare Cavity Only: _____

Simple Saturated Gain: _____ Detailed Gain: _____

BARE CAVITY FIELD MODIFIER MODELS (✓):

Mirror Tilt: _____ Decentration: _____

Aberrations/Thermal Distortions:

Arbitrary: _____

Selected (specify): _____

Reflectivity Loss: _____

Output Coupler Edges: Rolled: _____

Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):

Medium Index Variation: _____

Gas Absorption: _____

Overlapped Beams: _____

Other: _____

FAR-FIELD MODELS (✓): Beam Steering Removal: _____

Optimal Focal Search: _____ Beam Quality: _____

Other: _____

KINETICS

GAIN REGION MODELED (✓):

Compact Region: Annular Region:

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: Annular Region:

KINETICS GRID DIMENSIONALITY (✓):

1D	2D	3D

Compact Region:

Annular Region:

GAIN REGION SYMMETRY RESTRICTIONS:

Gain Vary Along Optic Axes?: Flow Direction?:

PULSED: CW: KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

$$\begin{cases} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{cases}$$

Cold (F + H₂):

Hot (H + F₂): Chain (F + H₂ & H + F₂):

Other (specify): 3-body recombination

ENERGY TRANSFER MODES MODELED (✓): Reference

V-T: Kerber and Hough

V-R:

V-V:

Other: _____

Single Line Model (✓):

Multiline Model (✓):

Assumed Rotational Population Distribution State (✓):

Equilibrium: Nonequilibrium:

Number of Laser Lines Modeled: Any

Source of Rate Coefficients Used in Code: Cohen

LINE PROFILE MODELS (✓):

Doppler Broadening:

Collisional Broadening:

Other (specify): Voigt

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓):

Cylindrical, Radially Flowing:

Rectangular, Linearly Flowing:

Other: _____

COORDINATE SYSTEM: Cartesian & cylindrical

FLUID GRID DIMENSION (✓): 1D: _____ 2D: 3D:

FLOW FIELD MODELED (✓):

Laminar: Turbulent:

Other: Recirculating

BASIC MODELING APPROACH (✓):

Premixed: _____ Mixing: _____

Other (specify): _____

References for Approach Used: _____

THERMAL DRIVER MODELED (✓):

Arc Heater: _____ Combustor: _____

Shock Tube: _____ Resistance Heater: _____

Other: _____

F-ATOM DISSOCIATION FROM (✓):

F₂: _____ SF₆: _____

Other (specify): _____

F-ATOM CONCENTRATION DETERMINED FROM MODEL?: _____

DILUENTS MODELED: _____

MODELS EFFECTS ON MIXING RATE DUE TO (✓):

Nozzle Boundary Layers: Shock Waves:

Pre-reactions (thermal blockage): _____ Turbulence:

Other (specify): _____

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):

Media Index Variations: _____

Other (specify): _____

CODE NAME:

BAREPL

CODE TYPE: Optics

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: 3-D Bare Cavity Resonator Code. The code was designed to model a Half-Symmetric Unstable Resonator with an Internal Axicon (HSURIA). Performance prediction for beam quality and mode loss difference, set/verify design requirements.

ASSESSMENT OF CAPABILITIES: General field modifiers. Mirror misalignment, misfigure, struts, deformable mirrors.

ASSESSMENT OF LIMITATIONS: Half-plane symmetry restricted to HSURIA, axisymmetric or 3-D calculation.

OTHER UNIQUE FEATURES: Resonator geometries modeled: HSURIA, unstable P-P waxicon (by updating). General field modifier with deformable mirrors to correct for any aberrations.

ORIGINATOR/KEY CONTACT:
Name: Alexander M. Simonoff Phone: (213) 884-3346
Organization: Rocketdyne, Laser Optics
Address: 6633 Canoga Ave., Canoga Park, California

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T)(U) 3-D bare cavity resonator code.

STATUS:
Operational Currently?: Yes
Under Modification?: No
Purpose(s): _____

Ownership?: AFWL
Proprietary?: No

MACHINE/OPERATING SYSTEM (on which installed): CDC Cyber 176

TRANSPORTABLE?: Yes (with modification)
Machine Dependent Restrictions: Uses CDC extended core.

SELF-CONTAINED?: No, resonator geometry systems code (for other than P-P reflaxicon) 3-D far-field code.
Other Codes Required (name, purpose): _____

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec, CDC 7600)
Small Job:	<250K	300-600 } Octal sec.
Typical Job:	<250K	1500 } Rev. N6
Large Job:	<250K	5000 } CDC 176

Approximate Number of FORTRAN Lines: _____

CODE NAME:

BAREPL

OPTICS

BASIC TYPE (✓):

Physical Optics: Geometrical: _____

FIELD (POLARIZATION) REPRESENTATION (✓):

Scalar: Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: Annular Region:

TRANSVERSE GRID DIMENSIONALITY (✓):

Compact Region: _____

Annular Region: _____

1D	2D
	<input checked="" type="checkbox"/>
	<input checked="" type="checkbox"/>

FIELD SYMMETRY RESTRICTIONS?: _____

MIRROR SHAPE(S) ALLOWED (✓):

Square: _____ Circular: Strip: _____

Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):

Fixed, Single Resonator Geometries: _____

Fixed, Multiple Resonator Geometries: _____

Modular, Multiple Resonator Geometries:

PROPAGATION TECHNIQUE (✓ all that apply):

Fresnel Integral Algorithms:

With Kernel Averaging

Gaussian Quadrature:

Fast Fourier Transform (FFT):

Fast Hankel Transform (FHT):

Gardener-Fresnel-Kirchhoff (GFK):

Other (specify): _____

COMPACT	ANNULAR
	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	

CONVERGENCE TECHNIQUE (✓):

Power Comparison: _____ Field Comparison: _____

Other: Prony method

ACCELERATION ALGORITHMS USED?: _____

Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM: (✓):

Prony:

Other: _____

RESONATOR TYPE (✓): Standing Wave:

Traveling Wave (Ring): _____ Reverse TW: _____

BRANCH (✓): Positive: Negative: _____

OPTICAL ELEMENT MODELS INCLUDED (✓):

Flat Mirrors: Spherical Mirrors:

Cylindrical Mirrors: _____ Telescopes: _____

Scraper Mirrors:

Axicons

Arbitrary: _____

Linear: _____

Parabola-Parabola: _____

Variable Cone Offset: _____

Other (specify): _____

Deformable Mirrors:

Spatial Filters: _____ Gratings: _____

Other Elements: Corner cube by using general field modifier to model.

	Waxicons	Reflexicons
Arbitrary:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Linear:		
Parabola-Parabola:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Variable Cone Offset:		<input checked="" type="checkbox"/>
Other (specify):		<input checked="" type="checkbox"/>

GAIN MODELS (✓): Bare Cavity Only: _____

Simple Saturated Gain: Detailed Gain:

BARE CAVITY FIELD MODIFIER MODELS (✓):

Mirror Tilt: Decentration: _____

Aberrations/Thermal Distortions: _____

Arbitrary: _____

Selected (specify): _____

Reflectivity Loss:

Output Coupler Edges: Rolled: _____

Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):

Medium Index Variation: _____

Gas Absorption: _____

Overlapped Beams: _____

Other: _____

FAR-FIELD MODELS (✓): Beam Steering Removal:

Optimal Focal Search: Beam Quality:

Other: _____

KINETICS

GAIN REGION MODELED (✓): None

Compact Region: _____ Annular Region: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.)

Compact Region: _____ Annular Region: _____

KINETICS GRID DIMENSIONALITY (✓):

1D	2D	3D

Compact Region: _____

Annular Region: _____

GAIN REGION SYMMETRY RESTRICTIONS:

Gain Vary Along Optic Axes?: _____ Flow Direction?: _____

PULSED: _____ CW: _____ KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

$$\left\{ \begin{array}{l} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{array} \right\}$$

Cold (F + H₂): _____

Hot (H + F₂): _____ Chain (F + H₂ & H + F₂): _____

Other (specify): _____

	F	Cl	Br	I
H				
D				

ENERGY TRANSFER MODES MODELED (✓): Reference

V-T: _____

V-R: _____

V-V: _____

Other: _____

Single Line Model (✓): _____

Multiline Model (✓): _____

Assumed Rotational Population Distribution State (✓):

Equilibrium: _____ Nonequilibrium: _____

Number of Laser Lines Modeled: _____

Source of Rate Coefficients Used in Code: _____

LINE PROFILE MODELS (✓):

Doppler Broadening: _____

Collisional Broadening: _____

Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓): None

Cylindrical, Radially Flowing: _____

Rectangular, Linearly Flowing: _____

Other: _____

COORDINATE SYSTEM: _____

FLUID GRID DIMENSION (✓): 1D: _____ 2D: _____ 3D: _____

FLOW FIELD MODELED (✓):

Laminar: _____ Turbulent: _____

Other: _____

BASIC MODELING APPROACH (✓):

Premixed: _____ Mixing: _____

Other (specify): _____

References for Approach Used: _____

THERMAL DRIVER MODELED (✓):

Arc Heater: _____ Combustor: _____

Shock Tube: _____ Resistance Heater: _____

Other: _____

F-ATOM DISSOCIATION FROM (✓):

F₂: _____ SF₆: _____

Other (specify): _____

F-ATOM CONCENTRATION DETERMINED FROM MODEL?: _____

DILUENTS MODELED: _____

MODELS EFFECTS ON MIXING RATE DUE TO (✓):

Nozzle Boundary Layers: _____ Shock Waves: _____

Prereactions (thermal blockage): _____ Turbulence: _____

Other (specify): _____

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):

Media Index Variations: _____

Other (specify): _____

*With update

CODE NAME:

BCCLC*

CODE TYPE: Optics and Kinetics.

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Modeling lasers with conventional unstable resonators with round, elliptical, or rectangular apertures.

ASSESSMENT OF CAPABILITIES:

ASSESSMENT OF LIMITATIONS:

OTHER UNIQUE FEATURES: CO₂ GDL kinetics and shock wave phase sheets. Models conventional unstable resonators. Contains amplifier pass.

ORIGINATOR/KEY CONTACT:

Name: Capt. Ted Salvi or Al Paxton Phone: (505) 844-0721
Organization: Air Force Weapons Laboratory
Address: AFWL/ALR Kirtland AFB, New Mexico 87117

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T) (U) None; listing is commented.

STATUS:

Operational Currently?: Yes
Under Modification?: No
Purpose(s):

Ownership?: Government (AFWL)
Proprietary?: No

MACHINE/OPERATING SYSTEM (on which installed): CDC Cyber 176

TRANSPORTABLE:

Machine Dependent Restrictions: Plot routines; some I/O; ECS.

SELF-CONTAINED?:

Other Codes Required (name, purpose):

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec, CDC 7600)
Small Job:		
Typical Job:		
Large Job:		
Approximate Number of FORTRAN Lines:	<u>2500</u>	

* Baumgardner Cylindrical Coordinate Laser Code

CODE NAME:

BCCLC*

OPTICS

BASIC TYPE (√):
 Physical Optics: Geometrical: _____

FIELD (POLARIZATION) REPRESENTATION (√):
 Scalar: Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):
 Compact Region: Ca Annular Region: _____

TRANSVERSE GRID DIMENSIONALITY (√):

1D	2D
	✓

Compact Region: _____
 Annular Region: _____

FIELD SYMMETRY RESTRICTIONS?: _____

MIRROR SHAPE(S) ALLOWED (√):
 Square: Circular: Strip: _____
 Rectangular: Elliptical: Arbitrary: _____

CONFIGURATION FLEXIBILITY (√):
 Fixed, Single Resonator Geometries: _____
 Fixed, Multiple Resonator Geometries: _____
 Modular, Multiple Resonator Geometries: *

PROPAGATION TECHNIQUE (√ all that apply):

COMPACT	ANNULAR
✓	
✓	

Fresnel Integral Algorithms: _____
 With Kernel Averaging: _____
 Gaussian Quadrature: _____
 Fast Fourier Transform (FFT): _____
 Fast Hankel Transform (FHT): _____
 Gardener-Fresnel-Kirchhoff (GFK): _____
 Other (specify): _____

CONVERGENCE TECHNIQUE (√):
 Power Comparison: _____ Field Comparison: _____
 Other: None

ACCELERATION ALGORITHMS USED?: No
 Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (√):
 Prony: _____
 Other: _____

RESONATOR TYPE (√): Standing Wave:
 Traveling Wave (Ring): _____ Reverse TW: _____

BRANCH (√): Positive: Negative: _____

OPTICAL ELEMENT MODELS INCLUDED (√):
 Flat Mirrors: Spherical Mirrors:
 Cylindrical Mirrors: Telescopes:
 Scraper Mirrors:

Axicons	Waxicons	Reflexicons
Arbitrary: _____		
Linear: _____		
Parabola-Parabola: _____		
Variable Cone Offset: _____		
Other (specify): _____		

Deformable Mirrors: _____
 Spatial Filters: _____ Gratings: _____
 Other Elements: _____

GAIN MODELS (√): Bare Cavity Only:
 Simple Saturated Gain: _____ Detailed Gain:

BARE CAVITY FIELD MODIFIER MODELS (√):
 Mirror Tilt: Decantation: _____
 Aberrations/Thermal Distortions: _____
 Arbitrary:
 Selected (specify): _____
 Reflectivity Loss: _____
 Output Coupler Edges: Rolled: _____
 Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (√):
 Medium Index Variation:
 Gas Absorption: _____
 Overlapped Beams: (two beams)

Other: _____

FAR-FIELD MODELS (√): Beam Steering Removal:
 Optimal Focal Search: Beam Quality:
 Other: _____

KINETICS

GAIN REGION MODELED (√):
 Compact Region: Annular Region: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):
 Compact Region: Ca Annular Region: _____

KINETICS GRID DIMENSIONALITY (√):

1D	2D	3D
		✓

Compact Region: _____
 Annular Region: _____

GAIN REGION SYMMETRY RESTRICTIONS:
 Gain Vary Along Optic Axes?: Yes Flow Direction?: Yes

PULSED: CW: **KINETICS MODELED**

CHEMICAL PUMPING REACTIONS MODELED (√):

$$\begin{cases} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{cases}$$

X	F	Cl	Br	I
H				
D				

Cold (F + H₂): _____
 Hot (H + F₂): _____ Chain (F + H₂ & H + F₂): _____
 Other (specify): CO₂

ENERGY TRANSFER MODES MODELED (√): Reference

V-T: _____
 V-R: _____
 V-V: _____
 Other: _____

Single Line Model (√):
 Multiline Model (√): _____

Assumed Rotational Population Distribution State (√):
 Equilibrium: _____ Nonequilibrium: _____

Number of Laser Lines Modeled: 1
 Source of Rate Coefficients Used in Code: _____

LINE PROFILE MODELS (√):
 Doppler Broadening: _____
 Collisional Broadening:
 Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (√): None

Cylindrical, Radially Flowing: _____
 Rectangular, Linearly Flowing: _____
 Other: _____

COORDINATE SYSTEM: _____

FLUID GRID DIMENSION (√): 1D: _____ 2D: _____ 3D: _____

FLOW FIELD MODELED (√):
 Laminar: _____ Turbulent: _____
 Other: _____

BASIC MODELING APPROACH (√):
 Premixed: _____ Mixing: _____
 Other (specify): _____

References for Approach Used: _____

THERMAL DRIVER MODELED (√):
 Arc Heater: _____ Combustor: _____
 Shock Tube: _____ Resistance Heater: _____
 Other: _____

F-ATOM DISSOCIATION FROM (√):
 F₂: _____ SF₆: _____
 Other (specify): _____

F-ATOM CONCENTRATION DETERMINED FROM MODEL?: _____

DILUENTS MODELED: _____

MODELS EFFECTS ON MIXING RATE DUE TO (√):
 Nozzle Boundary Layers: _____ Shock Waves: _____
 Prereactions (thermal blockage): _____ Turbulence: _____
 Other (specify): _____

MODELS EFFECTS ON OPTICAL MODES DUE TO (√):
 Media Index Variations: _____
 Other (specify): _____

*Limited

CODE NAME:

BLAZER

CODE TYPE: Optics, Kinetics, and Gasdynamics.PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Models the optical performance of linear bank CW HF and DF chemical lasers. MRO is 2D model; BLAZER is 3D model. Used as design tools for BDL, NAEL, MIRACL.ASSESSMENT OF CAPABILITIES: Resonator: Positive or negative branch confocal unstable; arbitrary optical axis position; cylindrical, toric, or spherical mirrors. Gain medium: CW flowing HF* or DF*, strut wake, mirror aberration, thermal distortion, and nonresonant index OPD's

MRO does stable Fabry Perot with geometrical optics.

ASSESSMENT OF LIMITATIONS: Lacks transverse pressure gradient modeling capability, lacks FFT propagation algorithm, uses only single gain sheet, uses only rotational equilibrium description.OTHER UNIQUE FEATURES: Confocal unstable resonator modeled.

ORIGINATOR/KEY CONTACT:

Name: Donald L. Bullock Phone: (213) 535-3484Organization: TRW DSSGAddress: RI/1162, One Space Park, Redondo Beach, California 90278AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T): The BLAZER and MRO Codes, June 1978; (U): BLAZER User Manual, November 1978 (includes MRO); Listings available.

STATUS:

Operational Currently?: YesUnder Modification?: PlannedPurpose(s): Rotational nonequilibrium, FFT propagation algorithm, multiple gain skins, transverse pressure gradient description.Ownership?: GovernmentProprietary?: NoMACHINE/OPERATING SYSTEM (on which installed): Cyber 174-TRW/TSSTRANSPORTABLE?: Needs mods for exportMachine Dependent Restrictions: CDC

SELF-CONTAINED?:

Other Codes Required (name, purpose): VIINT, KBLIMP, ALFA for nozzle exit condition.

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)		Execution Time (Sec, CDC 7600)	
Small Job:	MRO: ----	BLAZER: -	---	---
Typical Job:	151K	165K	400	6500
Large Job:	---	245K	---	15000

Approximate Number of FORTRAN Lines: MRO: 4500 BLAZER: 6000

CODE NAME:

BLAZER

OPTICS

BASIC TYPE (✓):
 Physical Optics: Geometrical: _____

FIELD (POLARIZATION) REPRESENTATION (✓):
 Scalar: Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):
 Compact Region: Ca Annular Region: _____

TRANSVERSE GRID DIMENSIONALITY (✓):

	1D	2D
Compact Region:		<input checked="" type="checkbox"/>
Annular Region:		

FIELD SYMMETRY RESTRICTIONS?: None

MIRROR SHAPE(S) ALLOWED (✓):
 Square: Circular: _____ Strip: _____
 Rectangular: Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):
 Fixed, Single Resonator Geometry: _____
 Fixed, Multiple Resonator Geometries: _____
 Modular, Multiple Resonator Geometries: _____

PROPAGATION TECHNIQUE (✓ all that apply): COMPACT ANNULAR

Fresnel Integral Algorithms:		
With Kernel Averaging		
Gaussian Quadrature: (Modified)	<input checked="" type="checkbox"/>	
Fast Fourier Transform (FFT):		
Fast Hankel Transform (FHT):		
Gardener-Fresnel-Kirchhoff (GFK):		
Other (specify):		

CONVERGENCE TECHNIQUE (✓):
 Power Comparison: Field Comparison: _____
 Other: _____

ACCELERATION ALGORITHMS USED?: No
 Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):
 Prony: _____
 Other: _____

RESONATOR TYPE (✓): Standing Wave:
 Traveling Wave (Ring): Reverse TW: _____

BRANCH (✓): Positive: Negative:

OPTICAL ELEMENT MODELS INCLUDED (✓):
 Flat Mirrors: _____ Spherical Mirrors:
 Cylindrical Mirrors: Telescopes: _____
 Scraper Mirrors:

Axicons

	Waxicons	Reflexicons
Arbitrary:		
Linear:		
Parabola-Parabola:		
Variable Cone Offset:		
Other (specify):		

Deformable Mirrors: _____

Spatial Filters: _____ Gratings: _____

Other Elements: _____

GAIN MODELS (✓): Bare Cavity Only: _____
 Simple Saturated Gain: _____ Detailed Gain:

BARE CAVITY FIELD MODIFIER MODELS (✓):
 Mirror Tilt: Decentration: _____

Abserrations/Thermal Distortions:
 Arbitrary:
 Selected (specify): _____

Reflectivity Loss:

Output Coupler Edges: Rolled: _____
 Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):
 Medium Index Variation:

Gas Absorption: _____

Overlapped Beams: _____
 Other: _____

FAR-FIELD MODELS (✓): Beam Steering Removal: _____
 Optimal Focal Search: _____ Beam Quality:
 Other: EMBLAZON

KINETICS

GAIN REGION MODELED (✓):
 Compact Region: Annular Region: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):
 Compact Region: Ca Annular Region: _____

KINETICS GRID DIMENSIONALITY (✓):

	1D	2D	3D
Compact Region:		<input checked="" type="checkbox"/>	
Annular Region:			

GAIN REGION SYMMETRY RESTRICTIONS:
 Gain Vary Along Optic Axes: Flow Direction:

PULSED: _____ CW: KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

$X + Y_2 = YX + Y$	<input checked="" type="checkbox"/>	F	Cl	Br	I
$Y + X_2 = YX + X$	<input checked="" type="checkbox"/>	H			
Cold (F + H ₂): <input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	D			

Hot (H + F₂): _____ Chain (F + H₂ & H + F₂): _____
 Other (specify): _____

ENERGY TRANSFER MODES MODELED (✓): Reference
 V-T: The BLAZER and MRO Codes
 V-R: _____
 V-V: The BLAZER and MRO Codes
 Other: RR with rot, nonequil.

Single Line Model (✓): _____
 Multiline Model (✓):

Assumed Rotational Population Distribution State (✓):
 Equilibrium: Nonequilibrium: _____

Number of Laser Lines Modeled: 24

Source of Rate Coefficients Used in Code: N. Cohen

LINE PROFILE MODELS (✓):
 Doppler Broadening:
 Collisional Broadening:
 Other (specify): Operation at line center.

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓):
 Cylindrical, Radially Flowing: _____
 Rectangular, Linearly Flowing:
 Other: _____

COORDINATE SYSTEM: Cartesian

FLUID GRID DIMENSION (✓): 1D: 2D: _____ 3D: _____

FLOW FIELD MODELED (✓):
 Laminar: _____ Turbulent: _____
 Other: Scheduled mixing.

BASIC MODELING APPROACH (✓):
 Premixed: _____ Mixing: _____
 Other (specify): Scheduled mixing.

References for Approach Used: The BLAZER and MRO Codes (TRW).

THERMAL DRIVER MODELED (✓):
 Arc Heater: _____ Combustor:
 Shock Tube: _____ Resistance Heater: _____
 Other: _____

F-ATOM DISSOCIATION FROM (✓):
 F₂: SF₆: _____
 Other (specify): NF₃

F-ATOM CONCENTRATION DETERMINED FROM MODEL?: Yes
 DILUENTS MODELED: He, N₂, CF₄

MODELS EFFECTS ON MIXING RATE DUE TO (✓):
 Nozzle Boundary Layers: _____ Shock Waves: _____
 Prereactions (thermal blockage): _____ Turbulence: _____
 Other (specify): Scheduled three stream: fuel, oxidant, mixed.

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):
 Media Index Variations:
 Other (specify): _____

CODE NAME:

BLIST

CODE TYPE: Gasdynamics

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Calculates nonsimilar development of 2-D or axisymmetric compressible laminar boundary layers with wall heat transfer.
 (BLIST: Boundary Layer Integral Solution Technique)

ASSESSMENT OF CAPABILITIES: Yields reliable solutions of boundary layer properties including skin friction, heat transfer rate, and velocity profiles up to separation.

ASSESSMENT OF LIMITATIONS: Will analyze only nonreacting flow.

OTHER UNIQUE FEATURES:

ORIGINATOR/KEY CONTACT:

Name: R. Hughes/D. Haflinger/H. Behrens Phone: (213) 536-2757

Organization: TRW DSSG

Address: R1/1038, One Space Park, Redondo Beach, California 90278

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T) Internal Report: "A Description of the Laminar Integral Boundary Layer Model," TRW Report, August 1977; (U) same; listing proprietary.

STATUS:

Operational Currently?: Yes

Under Modification?: No

Purpose(s):

Ownership?: TRW

Proprietary?: Yes

MACHINE/OPERATING SYSTEM (on which installed): CDC Cyber 174

TRANSPORTABLE?: No

Machine Dependent Restrictions: TRW numerical subroutines are used in BLIST.

SELF-CONTAINED?: No

Other Codes Required (name, purpose): TRW subroutines.

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec, CDC 7600)
Small Job:	53K	10
Typical Job:	53K	50
Large Job:	53K	100

Approximate Number of FORTRAN Lines: 1000

CODE NAME:

BLIST

OPTICS

BASIC TYPE (✓): None
 Physical Optics: _____ Geometrical: _____
 FIELD (POLARIZATION) REPRESENTATION (✓):
 Scalar: _____ Vector: _____
 COORDINATE SYSTEM (Cartesian, cylindrical, etc.):
 Compact Region: _____ Annular Region: _____
 TRANSVERSE GRID DIMENSIONALITY (✓):

1D	2D

 Compact Region: _____
 Annular Region: _____
 FIELD SYMMETRY RESTRICTIONS?: _____
 MIRROR SHAPE(S) ALLOWED (✓):
 Square: _____ Circular: _____ Strip: _____
 Rectangular: _____ Elliptical: _____ Arbitrary: _____
 CONFIGURATION FLEXIBILITY (✓):
 Fixed, Single Resonator Geometry: _____
 Fixed, Multiple Resonator Geometries: _____
 Modular, Multiple Resonator Geometries: _____
 PROPAGATION TECHNIQUE (✓ all that apply):

COMPACT	ANNULAR

 Fresnel Integral Algorithms: _____
 With Kernel Averaging: _____
 Gaussian Quadrature: _____
 Fast Fourier Transform (FFT): _____
 Fast Hankel Transform (FHT): _____
 Gardner-Fresnel-Kirchhoff (GFK): _____
 Other (specify): _____
 CONVERGENCE TECHNIQUE (✓):
 Power Comparison: _____ Field Comparison: _____
 Other: _____
 ACCELERATION ALGORITHMS USED?: _____
 Technique: _____
 MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):
 Prony: _____
 Other: _____

None

RESONATOR TYPE (✓): Standing Wave: _____
 Traveling Wave (Ring): _____ Reverse TW: _____
 BRANCH (✓): Positive: _____ Negative: _____
 OPTICAL ELEMENT MODELS INCLUDED (✓):
 Flat Mirrors: _____ Spherical Mirrors: _____
 Cylindrical Mirrors: _____ Telescopes: _____
 Scraper Mirrors: _____

Waxicons	Reflexicons

 Axicons: _____
 Arbitrary: _____
 Linear: _____
 Parabola-Parabola: _____
 Variable Cone Offset: _____
 Other (specify): _____
 Deformable Mirrors: _____
 Spatial Filters: _____ Gratings: _____
 Other Elements: _____
 GAIN MODELS (✓): Bare Cavity Only: _____
 Simple Saturated Gain: _____ Detailed Gain: _____
 BARE CAVITY FIELD MODIFIER MODELS (✓):
 Mirror Tilt: _____ Decentration: _____
 Aberrations/Thermal Distortions:
 Arbitrary: _____
 Selected (specify): _____
 Reflectivity Loss: _____
 Output Coupler Edges: Rolled: _____
 Serrated: _____ Other: _____
 LOADED CAVITY FIELD MODIFIER MODELS (✓):
 Medium Index Variation: _____
 Gas Absorption: _____
 Overlapped Beams: _____
 Other: _____
 FAR-FIELD MODELS (✓): Beam Steering Removal: _____
 Optimal Focal Search: _____ Beam Quality: _____
 Other: _____

KINETICS

GAIN REGION MODELED (✓): None
 Compact Region: _____ Annular Region: _____
 COORDINATE SYSTEM (Cartesian, cylindrical, etc.)
 Compact Region: _____ Annular Region: _____
 KINETICS GRID DIMENSIONALITY (✓):

1D	2D	3D

 Compact Region: _____
 Annular Region: _____
 GAIN REGION SYMMETRY RESTRICTIONS:
 Gain Vary Along Optic Axes?: _____ Flow Direction?: _____
 PULSED: _____ CW: _____ KINETICS MODELED
 CHEMICAL PUMPING REACTIONS MODELED (✓):
 $\left\{ \begin{array}{l} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{array} \right\}$

X	F	Cl	Br	I
H				
D				

 Cold (F + H₂): _____
 Hot (H + F₂): _____ Chain (F + H₂ & H + F₂): _____
 Other (specify): _____
 ENERGY TRANSFER MODES MODELED (✓): Reference
 V-T: _____
 V-R: _____
 V-V: _____
 Other: _____
 Single Line Model (✓): _____
 Multiline Model (✓): _____
 Assumed Rotational Population Distribution State (✓):
 Equilibrium: _____ Nonequilibrium: _____
 Number of Laser Lines Modeled: _____
 Source of Rate Coefficients Used in Code: _____
 LINE PROFILE MODELS (✓):
 Doppler Broadening: _____
 Collisional Broadening: _____
 Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓):
 Cylindrical, Radially Flowing: _____ ✓
 Rectangular, Linearly Flowing: _____ ✓
 Other: _____
 COORDINATE SYSTEM: Streamline
 FLUID GRID DIMENSION (✓): 1D: _____ 2D: _____ ✓ 3D: _____
 FLOW FIELD MODELED (✓):
 Laminar: _____ ✓ Turbulent: _____
 Other: _____
 BASIC MODELING APPROACH (✓):
 Premixed: _____ Mixing: _____
 Other (specify): _____
 References for Approach Used: Klineberg-Lees
procedure
 THERMAL DRIVER MODELED (✓):
 Arc Heater: _____ Combustor: _____
 Shock Tube: _____ Resistance Heater: _____
 Other: _____
 F-ATOM DISSOCIATION FROM (✓):
 F₂: _____ SF₆: _____
 Other (specify): _____
 F-ATOM CONCENTRATION DETERMINED FROM MODEL?: _____
 DILUENTS MODELED: _____
 MODELS EFFECTS ON MIXING RATE DUE TO (✓):
 Nozzle Boundary Layers: _____ Shock Waves: _____
 Prereactions (thermal blockage): _____ Turbulence: _____
 Other (specify): _____
 MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):
 Media Index Variations: _____
 Other (specify): _____

CODE NAME:

CLOQ

CODE TYPE: Optics, Kinetics, and GasdynamicsPRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: The CLOQ code was developed to analyze linear chemical lasers systems using rotational nonequilibrium kinetics.ASSESSMENT OF CAPABILITIES: The code will model linear resonators with collimated Fresnel numbers of ≤ 100 . (Can model optics phenomena describable in terms of one transverse dimension. This independent variable can be expressed either as a Cartesian coordinate or as a cylindrical coordinate -- apparently.)ASSESSMENT OF LIMITATIONS: Normal limitations of a 2-D analysis. For detailed analysis of specific nozzle types, requires scheduled flow parameters from a code (such as ALFA) having sophisticated gas dynamic calculations.OTHER UNIQUE FEATURES: Models beam/mode rotation. Code employs a schedule mixing model with different mixing lengths for primary and secondary mixing zones. Allows use of linear, exponential, or tabular mixing rates.

ORIGINATOR/KEY CONTACT:

Name: Paul E. Fileger Phone: (305)840-6643Organization: United Technologies Research Center, OATLAddress: P. O. Box 2691, MS-R48, West Palm Beach, Florida 33402AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (RP) R. J. Hall, "Rotational Nonequilibrium and Line-Selected Operation in CW DF Chemical Lasers," IEEE JQE, QE-12, 453 (1976).

STATUS:

Operational Currently?: YesUnder Modification?: No

Purpose(s): _____

Ownership?: UTRCProprietary?: YesMACHINE/OPERATING SYSTEM (on which installed): CDC 176, IBM 370TRANSPORTABLE?: YesMachine Dependent Restrictions: NoneSELF-CONTAINED?: Yes

Other Codes Required (name, purpose): _____

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec, CDC 7600)
Small Job:		60
Typical Job:	All same: 174K	1200
Large Job:		1800

Approximate Number of FORTRAN Lines: _____

CODE NAME:

CLOQ

OPTICS

BASIC TYPE (✓):
 Physical Optics: Geometrical: _____

FIELD (POLARIZATION) REPRESENTATION (✓):
 Scalar: Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):
 Compact Region: Both Annular Region: Both*

TRANSVERSE GRID DIMENSIONALITY (✓):

1D	2D
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Compact Region: Cart. or cy*
 Annular Region: Cart. or cy*

FIELD SYMMETRY RESTRICTIONS?: Yes

MIRROR SHAPE(S) ALLOWED (✓):
 Square: _____ Circular: _____ Strip:
 Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):
 Fixed, Single Resonator Geometry: _____
 Fixed, Multiple Resonator Geometries: _____
 Modular, Multiple Resonator Geometries:

PROPAGATION TECHNIQUE (✓) (✓ all that apply):

	COMPACT	ANNULAR
Fresnel Integral Algorithms:	<input type="checkbox"/>	<input type="checkbox"/>
With Kernel Averaging	<input type="checkbox"/>	<input type="checkbox"/>
Gaussian Quadrature:	<input type="checkbox"/>	<input type="checkbox"/>
Fast Fourier Transform (FFT):	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Fast Hankel Transform (FHT):	<input type="checkbox"/>	<input type="checkbox"/>
Gardner-Fresnel-Kirchhoff (GFK):	<input type="checkbox"/>	<input type="checkbox"/>
Other (specify): _____		

CONVERGENCE TECHNIQUE (✓):
 Power Comparison: Field Comparison:
 Other: _____

ACCELERATION ALGORITHMS USED?: Yes
 Technique: Scheduled gain & field averaging.

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):
 Prony:
 Other: _____

RESONATOR TYPE (✓): Standing Wave:
 Traveling Wave (Ring): Reverse TW: _____

BRANCH (✓): Positive: Negative:

OPTICAL ELEMENT MODELS INCLUDED (✓):
 Flat Mirrors: Spherical Mirrors:
 Cylindrical Mirrors: Telescopes: _____
 Scraper Mirrors:

Waxicons	Reflexicons
<input type="checkbox"/>	<input type="checkbox"/>

Axicons
 Arbitrary:
 Linear:
 Parabola-Parabola:
 Variable Cone Offset:
 Other (specify): _____

Deformable Mirrors:
 Spatial Filters: Gratings: _____
 Other Elements: _____

GAIN MODELS (✓): Bare Cavity Only: _____
 Simple Saturated Gain: _____ Detailed Gain:

BARE CAVITY FIELD MODIFIER MODELS (✓):
 Mirror Tilt: Decentration:

Aberrations/Thermal Distortions:
 Arbitrary: (one dimensional)
 Selected (specify): _____

Reflectivity Loss:
 Output Coupler Edges: Rolled:
 Serrated: Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):
 Medium Index Variation:
 Gas Absorption:
 Overlapped Beams: (arbitrary number)
 Other: _____

FAR-FIELD MODELS (✓): Beam Steering Removal:
 Optimal Focal Search: Beam Quality:
 Other: _____

KINETICS

GAIN REGION MODELED (✓):
 Compact Region: Annular Region:

COORDINATE SYSTEM (Cartesian, cylindrical, etc.)
 Compact Region: Both Annular Region: Both

KINETICS GRID DIMENSIONALITY (✓):

1D	2D	3D
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Compact Region:
 Annular Region:

GAIN REGION SYMMETRY RESTRICTIONS:
 Gain Vary Along Optic Axes?: Flow Direction?:

PULSED: _____ CW: KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

X	F	Cl	Br	I
H	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Cold (F + H₂):
 Hot (H + F₂): _____ Chain (F + H₂ & H + F₂): _____
 Other (specify): _____

ENERGY TRANSFER MODES MODELED (✓): Reference
 V-T:
 V-R:
 V-V:
 Other: _____

Single Line Model (✓):
 Multiline Model (✓):
 Assumed Rotational Population Distribution State (✓):
 Equilibrium: Nonequilibrium:
 Number of Laser Lines Modeled: Up to 20 of 68
 Source of Rate Coefficients Used in Code: _____
ALFA kinetics.

LINE PROFILE MODELS (✓):
 Doppler Broadening:
 Collisional Broadening:
 Other (specify): Voigt

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓):
 Cylindrical, Radially Flowing:
 Rectangular, Linearly Flowing:
 Other: _____

COORDINATE SYSTEM Cartesian or cylindrical
 FLUID GRID DIMENSION (✓): 1D: 2D: _____ 3D: _____

FLOW FIELD MODELED (✓):
 Laminar: Turbulent:
 Other: Scheduled mixing/different length

BASIC MODELING APPROACH (✓):
 Premixed: _____ Mixing:
 Other (specify): Flow properties specified by anchoring to device data using ALFA.
 References for Approach Used: _____

THERMAL DRIVER MODELED (✓):
 Arc Heater: _____ Combustor: _____
 Shock Tube: _____ Resistance Heater: _____
 Other: _____

F-ATOM DISSOCIATION FROM (✓):
 F₂: _____ SF₆: _____
 Other (specify): _____

F-ATOM CONCENTRATION DETERMINED FROM MODEL?: _____
 DILUENTS MODELED: He, N₂

MODELS EFFECTS ON MIXING RATE DUE TO (✓):
 Nozzle Boundary Layers: _____ Shock Waves: _____
 Preactions (thermal blockage): _____ Turbulence: _____
 Other (specify): Specified by ALFA code.

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):
 Media Index Variations:
 Other (specify): _____

*This is a strip code

CODE NAME:

CLOQ3D

CODE TYPE: Optics, Kinetics, and Gasdynamics

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: CLOQ3D is an input scheduled code for analyzing HEL chemical lasers using wave optics coupled to rotational nonequilibrium kinetics or to equilibrium kinetics -- HF or DF. Gasdynamics capabilities include: 1-D, scheduled area, scheduled pressure, all aerodynamics scheduled, and radial flow.

ASSESSMENT OF CAPABILITIES: The code is capable of analyzing a large number of annular or linear, unstable or ring resonator systems having overall collimated Fresnel numbers generally ≤ 30 (single step collimated Fresnel number < 250). Models HSURIA, positive and negative compact unstable confocal resonators, rings, and rings with injection locking, inter-focal line aperture, and inter-focal point aperture.

ASSESSMENT OF LIMITATIONS: Limited to resonators with Fresnel numbers less than 250. Gasdynamics are "generally" provided by ALFA analysis although 1-D, 3 stream scheduled mixing G/D are included in this code.

OTHER UNIQUE FEATURES: Models beam/mode rotation, intra and extra cavity phase correction, and mirror strut supports. Scheduled mixing model used different mixing lengths for primary and secondary mixing zones. Linear, exponential, or tabular mixing rates are available to the flow field model.

ORIGINATOR/KEY CONTACT:

Name: Paul E. Fileger Phone: (305) 840-6643
 Organization: United Technologies Research Center, OATL
 Address: P. O. Box 2691, MS-R-48, West Palm Beach, Florida 33402

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): User's manual publication date is February 1980. (RP) SOQ user's manual.

STATUS:

Operational Currently?: YesUnder Modification?: Yes

Purpose(s): Incorporate vector (polarization) field, incorporate more sophisticated (geometric mapping) axicon model.

Ownership?: USAF/UTRCProprietary?: No

MACHINE/OPERATING SYSTEM (on which installed): CDC-176; kinetics also available on IBM-370.

TRANSPORTABLE?: Yes

Machine Dependent Restrictions: The FFT routine (CPFT) is CDC system dependent.

SELF-CONTAINED?: Yes

Other Codes Required (name, purpose): None for optics; ALFA code is used for gasdynamics inputs.

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec. CDC 7600)
Small Job:		15 sec/iteration
Typical Job:	Same for all 2146K	410 sec/iteration
Large Job:		740 sec/iteration
Approximate Number of FORTRAN Lines:	4300	

CODE NAME:

CLOQ3D

OPTICS

BASIC TYPE (√):

Physical Optics: Geometrical:

FIELD (POLARIZATION) REPRESENTATION (√):

Scalar: Vector: (in progress)

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: Ca Annular Region: CY

TRANSVERSE GRID DIMENSIONALITY (√):

Compact Region: Ca *

1D	2D
	<input checked="" type="checkbox"/>
	<input checked="" type="checkbox"/>

Annular Region: CY

FIELD SYMMETRY RESTRICTIONS: None

MIRROR SHAPE(S) ALLOWED (√):

Square: Circular: Strip:

Rectangular: Elliptical: Arbitrary:

CONFIGURATION FLEXIBILITY (√):

Fixed, Single Resonator Geometry:

Fixed, Multiple Resonator Geometries:

Modular, Multiple Resonator Geometries:

PROPAGATION TECHNIQUE (√ all that apply): COMPACT ANNULAR

Fresnel Integral Algorithms:

With Kernel Averaging:

Gaussian Quadrature:

Fast Fourier Transform (FFT):

Fast Hankel Transform (FHT):

Gardener-Fresnel-Kirchhoff (GFK):

Other (specify): Radial asymptotic

propagator (annular)

CONVERGENCE TECHNIQUE (√):

Power Comparison: Field Comparison:

Other:

ACCELERATION ALGORITHMS USED:

Technique: Scheduled gain & field averaging.

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (√):

Prony:

Other:

RESONATOR TYPE (√): Standing Wave:

Traveling Wave (Ring): Reverse TW:

BRANCH (√): Positive: Negative:

OPTICAL ELEMENT MODELS INCLUDED (√):

Flat Mirrors: Spherical Mirrors:

Cylindrical Mirrors: Telescopes: (geometric)

Scraper Mirrors:

Axicons

Waxicons	Reflexicons
in progress	
<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>

Arbitrary:

Linear:

Parabola-Parabola:

Variable Cone Offset:

Other (specify):

Deformable Mirrors:

Spatial Filters: Gratings:

Other Elements: Misaligned and offset

CONES.

GAIN MODELS (√): Bare Cavity Only:

Simple Saturated Gain: Detailed Gain:

BARE CAVITY FIELD MODIFIER MODELS (√):

Mirror Tilt: Decentration:

Aberrations/Thermal Distortions:

Arbitrary:

Selected (specify):

Reflectivity Loss:

Output Coupler Edges: Rolled:

Serrated: Other:

LOADED CAVITY FIELD MODIFIER MODELS (√):

Medium Index Variation:

Gas Absorption:

Overlapped Beams: (arbitrary no.)

Other:

FAR-FIELD MODELS (√): Beam Steering Removal:

Optimal Focal Search: Beam Quality:

Other: Quadratic phase removal.

KINETICS

GAIN REGION MODELED (√):

Compact Region: Annular Region:

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: Both Annular Region: Both

KINETICS GRID DIMENSIONALITY (√):

1D	2D	3D
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Compact Region:

Annular Region:

GAIN REGION SYMMETRY RESTRICTIONS:

Gain Vary Along Optic Axes?: Flow Direction?:

PULSED: CW: KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (√):

$$\begin{cases} x + y_2 = yx + y \\ y + x_2 = yx + x \end{cases}$$

<input checked="" type="checkbox"/>	F	Cl	Br	I
H	<input checked="" type="checkbox"/>			
D	<input checked="" type="checkbox"/>			

Cold (F + H₂):

Hot (H + F₂): Chain (F + H₂ + H + F₂):

Other (specify):

ENERGY TRANSFER MODES MODELED (√): Reference

V-T:

V-R:

V-V:

Other:

Single Line Model (√):

Multiline Model (√):

Assumed Rotational Population Distribution State (√):

Equilibrium: Nonequilibrium:

Number of Laser Lines Modeled: Up to 68 (select any 20)

Source of Rate Coefficients Used in Code: ALFA code

for DF; Polyani-Woodall to HF;

others

LINE PROFILE MODELS (√):

Doppler Broadening:

Collisional Broadening:

Other (specify): Voight

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (√):

Cylindrical, Radially Flowing:

Rectangular, Linearly Flowing:

Other:

COORDINATE SYSTEM: Ca or cy

FLUID GRID DIMENSION (√): 1D: 2D: 3D:

FLOW FIELD MODELED (√):

Laminar: Turbulent:

Other: Scheduled mixing with different

mixing lengths

BASIC MODELING APPROACH (√):

Premixed: Mixing:

Other (specify): Flow properties specified

by anchoring to device data using

ALFA code.

References for Approach Used:

THERMAL DRIVER MODELED (√):

Arc Heater: Combustor:

Shock Tube: Resistance Heater:

Other:

F-ATOM DISSOCIATION FROM (√):

F₂: SF₆:

Other (specify):

F-ATOM CONCENTRATION DETERMINED FROM MODEL?:

DILUENTS MODELED: He, N₂

MODELS EFFECTS ON MIXING RATE DUE TO (√):

Nozzle Boundary Layers: Shock Waves:

Pre-reactions (thermal blockage): Turbulence:

Other (specify): Specified by ALFA code.

MODELS EFFECTS ON OPTICAL MODES DUE TO (√):

Media Index Variations:

Other (specify):

*cylindrical in progress

CODE NAME:

CLSLGM*

CODE TYPE: Optics

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Assess optical performance of MIRACL device before, during, and after acceptance testing without "breaking the bank."

ASSESSMENT OF CAPABILITIES: Very flexible because of modular programming approach; faster run time due to empirical gain modeling approach. Gain is modeled via empirical "fit" to BLAZER predictions.

ASSESSMENT OF LIMITATIONS: Not suitable for cylindrical problems; gain medium device specific (i.e., not a design code). Detailed kinetic/gas dynamics are not calculated from first principals, but instead are empirically modeled.

OTHER UNIQUE FEATURES: Currently configured for MIRACL resonator (spherical on-axis unstable resonator) but easily adaptable to other geometries due to modular code philosophy.

ORIGINATOR/KEY CONTACT:
Name: Peter R. Carlson/Robert E. Hodder Phone: (305) 283-3380
Organization: Science Applications, Inc.
Address: 201 S.W. Monterey Rd., Suite 30, Stuart, Florida 33494

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T) (Essentially same formalism as developed by Sziklas and Siegman at Pratt and Whitney for their SOO codes); (RP) P. Carlson and R. Hodder, "Chemical-Laser Scaling-Law Gain Model Analysis," SAI technical memorandum to D. Finkleman and J. Stregack dated September 25, 1979.

STATUS:
Operational Currently?: Yes - but limited.
Under Modification?: Yes
Purpose(s): Under development. The intent is to model the entire optical path to the calorimeter at CTS (including aerowindow and beam path conditioning ducts).

Ownership?: Government
Proprietary?: No

MACHINE/OPERATING SYSTEM (on which installed): CDC 175/NOS

TRANSPORTABLE?: Probably
Machine Dependent Restrictions: Line printer, disc storage.

SELF-CONTAINED?: Yes
Other Codes Required (name, purpose): _____

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec, CDC 7600)
Small Job:	_____	_____
Typical Job:	_____	_____
Large Job:	_____	_____

Approximate Number of FORTRAN Lines: ~1400

* Chemical Laser Scaling-Law Gain Model

CODE NAME:

CLSLGM

OPTICS

BASIC TYPE (✓):
 Physical Optics: Geometrical: _____

FIELD (POLARIZATION) REPRESENTATION (✓):
 Scalar: Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):
 Compact Region: Annular Region: _____

TRANSVERSE GRID DIMENSIONALITY (✓):
 Compact Region: 128 X 128
 Annular Region: _____

1D	2D
	<input checked="" type="checkbox"/>

FIELD SYMMETRY RESTRICTIONS: _____

MIRROR SHAPE(S) ALLOWED (✓):
 Square: Circular: Strip: _____
 Rectangular: Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):
 Fixed, Single Resonator Geometries: _____
 Fixed, Multiple Resonator Geometries: _____
 Modular, Multiple Resonator Geometries:

PROPAGATION TECHNIQUE (✓ all that apply):

COMPACT	ANNULAR
<input checked="" type="checkbox"/>	

Fresnel Integral Algorithms: _____
 With Kernel Averaging _____
 Gaussian Quadrature: _____
 Fast Fourier Transform (FFT):
 Fast Hankel Transform (FHT): _____
 Gardener-Fresnel-Kirchhoff (GFK): _____
 Other (specify): _____

CONVERGENCE TECHNIQUE (✓):
 Power Comparison: _____ Field Comparison:
 Other: Monitor rms change over crosshair*

ACCELERATION ALGORITHMS USED?: Yes
 Technique: Field and/or gain averaging.

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):
 Prony: _____
 Other: _____

RESONATOR TYPE (✓): Standing Wave:
 Traveling Wave (Ring): _____ Reverse TW: _____

BRANCH (✓): Positive: Negative: _____

OPTICAL ELEMENT MODELS INCLUDED (✓):
 Flat Mirrors: Spherical Mirrors:
 Cylindrical Mirrors: _____ Telescopes:
 Scraper Mirrors:

Waxicons	Reflexicons

Axicons _____
 Arbitrary: _____
 Linear: _____
 Parabola-Parabola: _____
 Variable Cone Offset: _____
 Other (specify): _____

Deformable Mirrors: * _____
 Spatial Filters: _____ Gratings: * _____
 Other Elements: Transmission functions
only developed for DM and grating.*

GAIN MODELS (✓): Bare Cavity Only:
 Simple Saturated Gain: Detailed Gain: +

BARE CAVITY FIELD MODIFIER MODELS (✓):
 Mirror Tilt: _____ Decentration: _____

Aberrations/Thermal Distortions:
 Arbitrary: _____
 Selected (specify): _____
 Reflectivity Loss:

Output Coupler Edges: Rolled:
 Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):
 Medium Index Variation:
 Gas Absorption: in "gain" model.

Overlapped Beams:
 Other: _____

FAR-FIELD MODELS (✓): Beam Steering Removal: _____
 Optimal Focal Search: _____ Beam Quality:
 Other: _____

KINETICS

GAIN REGION MODELED (✓): None
 Compact Region: _____ Annular Region: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.)
 Compact Region: _____ Annular Region: _____

KINETICS GRID DIMENSIONALITY (✓):

1D	2D	3D

Compact Region: _____
 Annular Region: _____

GAIN REGION SYMMETRY RESTRICTIONS:
 Gain Vary Along Optic Axes?: _____ Flow Direction?: _____

PULSED: _____ CW: _____ KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

$X + Y_2 = YX + Y$	F	Cl	Br	I
$Y + X_2 = YX + X$	H			
Cold (F + H ₂):	D			
Hot (H + F ₂):				

Chain (F + H₂ & H + F₂): _____
 Other (specify): _____

ENERGY TRANSFER MODES MODELED (✓): Reference
 V-T: _____
 V-R: _____
 V-V: _____
 Other: _____

Single Line Model (✓): _____
 Multiline Model (✓): _____

Assumed Rotational Population Distribution State (✓):
 Equilibrium: _____ Nonequilibrium: _____

Number of Laser Lines Modeled: _____
 Source of Rate Coefficients Used in Code: _____

LINE PROFILE MODELS (✓):
 Doppler Broadening: _____
 Collisional Broadening: _____
 Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓): None
 Cylindrical, Radially Flowing: _____
 Rectangular, Linearly Flowing: _____
 Other: _____

COORDINATE SYSTEM: _____
 FLUID GRID DIMENSION (✓): 1D: _____ 2D: _____ 3D: _____
 FLOW FIELD MODELED (✓):
 Laminar: _____ Turbulent: _____
 Other: _____

BASIC MODELING APPROACH (✓):
 Premixed: _____ Mixing: _____
 Other (specify): _____
 References for Approach Used: _____

THERMAL DRIVER MODELED (✓):
 Arc Heater: _____ Combustor: _____
 Shock Tube: _____ Resistance Heater: _____
 Other: _____

F-ATOM DISSOCIATION FROM (✓):
 F₂: _____ SF₆: _____
 Other (specify): _____

F-ATOM CONCENTRATION DETERMINED FROM MODEL?: _____
 DILUENTS MODELED: _____
 MODELS EFFECTS ON MIXING RATE DUE TO (✓):
 Nozzle Boundary Layers: _____ Shock Waves: _____
 Prereactions (thermal blockage): _____ Turbulence: _____
 Other (specify): _____

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):
 Media Index Variations: _____
 Other (specify): _____

*on optic axis

*Not presently in code. +Empirical fit to BLAZER predictions.

CODE NAME:

CROQ*

CODE TYPE: Optics, Kinetics, and Gasdynamics

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Models HSURIA and Ring Resonator with mode rotation. Is intended to be a resonator design code for maximizing focusability and power of output beam as a function of gain generator and resonator parameters.

ASSESSMENT OF CAPABILITIES: Constant or variable magnification non-everting waxicon with arbitrary offset angle. Full OPD matrix calculation. Tip flux unloading capability. Spherically diverging, converging, or collimated compact leg beam with capability to adjust ID/OD ratio (bifocal property of axicon) of output beam independent of resonator magnification. Models arbitrary tilt, decentration, misfigure, and thermal distortion of all elements. Models arbitrary number of struts.

ASSESSMENT OF LIMITATIONS: Planned additions: reflaxicon option, sparse OPD matrix calculation with interpolation, decomposition of OPD matrix into components amenable to convolution, integral annular leg treatment with introduction of FFT annular leg propagation, two or more gain sheets, polarization (vector) code.

OTHER UNIQUE FEATURES: User manuals planned; well commented listings (proprietary), available from TRW or AFWL; resonator geometrics modeled - HSURIA and ring resonator with mode rotation and axicon tip flux unloading; exp. gain, CL11, or HWN modeling.

ORIGINATOR/KEY CONTACT:

Name: Donald L. Bullock Phone: (213) 535-3484
 Organization: TRW DSSG
 Address: RI/1162, One Space Park Redondo Beach, California 90278

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T): Annular Laser Modes Studies Final Report (axicon theory, aligned and misaligned); other documentation planned.

STATUS:

Operational Currently?: Bare cavity version.
 Under Modification?: Yes
 Purpose(s): Add SLIM gain model (currently being implemented at AFWL). Thermal aberrations being coded.

Ownership?: Government
 Proprietary?: Yes for ALPHA competition.

MACHINE/OPERATING SYSTEM (on which installed): Cyber 176 (CDC)

TRANSPORTABLE?: CDC Only

Machine Dependent Restrictions: CDC only (may have to recode permanent disk file management and core size adjustment compass routines for installation other than AFWL.)

SELF-CONTAINED?: No

Other Codes Required (name, purpose): IMSLIB routines for eigenvalue calculation; DISSPLA for 2D, 3D, and/or contour plots, VIINT, KBLIMP, ALFA for nozzle exit conditions.

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec. CDC 7600)
Small Job:	70K without	10
Typical Job:	DISPLA, 140K	210
Large Job:	with DISPLA	2000
Approximate Number of FORTRAN Lines:	10500 (11213 cards)	

*Cylindrical Resonator Optical Quality

CODE NAME:

CROQ

OPTICS

BASIC TYPE (✓):

Physical Optics: Geometrical: _____

FIELD (POLARIZATION) REPRESENTATION (✓):

Scalar: Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: CY Annular Region: CY

TRANSVERSE GRID DIMENSIONALITY (✓):

Compact Region:

1D	2D
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Annular Region:

FIELD SYMMETRY RESTRICTIONS: None

MIRROR SHAPE(S) ALLOWED (✓):

Square: _____ Circular: Strip: _____

Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):

Fixed, Single Resonator Geometry: _____

Fixed, Multiple Resonator Geometries:

Modular, Multiple Resonator Geometries: _____

PROPAGATION TECHNIQUE (✓ all that apply):

Fresnel Integral Algorithms:

With Kernel Averaging

Gaussian Quadrature:

Fast Fourier Transform (FFT):

Fast Hankel Transform (FHT):

Gardner-Fresnel-Kirchhoff (GFK):

Other (specify): _____

COMPACT	ANNULAR
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

CONVERGENCE TECHNIQUE (✓):

Power Comparison: Field Comparison: _____

Other: _____

ACCELERATION ALGORITHMS USED: No

Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):

Prony:

Other: _____

RESONATOR TYPE (✓):

Standing Wave: Traveling Wave (Ring): Reverse TW: _____

BRANCH (✓):

Positive: Negative:

OPTICAL ELEMENT MODELS INCLUDED (✓):

Flat Mirrors: _____ Spherical Mirrors:

Cylindrical Mirrors: _____ Telescopes: _____

Scraper Mirrors:

Axicons

Arbitrary:

Linear:

Parabola-Parabola:

Variable Cone Offset:

Other (specify): _____

Deformable Mirrors: _____

Spatial Filters: _____

Other Elements: Bifocal axicon, coneor corner reflector back elements.

GAIN MODELS (✓):

Bare Cavity Only: _____

Simple Saturated Gain: _____ Detailed Gain:

BARE CAVITY FIELD MODIFIER MODELS (✓):

Mirror Tilt: Decantation:

Aberrations/Thermal Distortions:

Arbitrary:

Selected (specify): _____

Reflectivity Loss:

Output Coupler Edges: Rolled: _____

Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):

Medium Index Variation:

Gas Absorption: _____

Overlapped Beams: Other: Single skin at rear element.*

FAR-FIELD MODELS (✓):

Beam Steering Removal: Optimal Focal Search: Beam Quality:

Other: _____

KINETICS

GAIN REGION MODELED (✓):

Compact Region: _____ Annular Region:

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: CY Annular Region: CY

KINETICS GRID DIMENSIONALITY (✓):

1D	2D	3D
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Compact Region:

Annular Region:

GAIN REGION SYMMETRY RESTRICTIONS:

Gain Vary Along Optic Axes: Yes* Flow Direction: YesPULSED: CW KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

$X + Y_2 = YX + Y$	<input checked="" type="checkbox"/>	F	Cl	Br	I
$Y + X_2 = YX + X$	<input checked="" type="checkbox"/>	H	<input checked="" type="checkbox"/>		
Cold (F + H ₂): <input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	D	<input checked="" type="checkbox"/>		

Hot (H + F₂): _____ Chain (F + H₂ + H + F₂): _____

Other (specify): _____

ENERGY TRANSFER MODES MODELED (✓): Reference

V-T:

V-R: _____

V-V: Other: RR (ACLOS rot. noneq. to come)

Single Line Model (✓): _____

Multiline Model (✓):

Assumed Rotational Population Distribution State (✓):

Equilibrium: Nonequilibrium: PlannedNumber of Laser Lines Modeled: 24Source of Rate Coefficients Used in Code: N. Cohen

LINE PROFILE MODELS (✓):

Doppler Broadening: Collisional Broadening: Other (specify): Operation at line center

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓):

Cylindrical, Radially Flowing:

Rectangular, Linearly Flowing: _____

Other: _____

COORDINATE SYSTEM: CYFLUID GRID DIMENSION (✓): 1D: 2D: _____ 3D: _____

FLOW FIELD MODELED (✓):

Laminar: _____ Turbulent: _____

Other: Scheduled mixing.

BASIC MODELING APPROACH (✓):

Premixed: _____ Mixing:

Other (specify): _____

References for Approach Used: _____

THERMAL DRIVER MODELED (✓):

Arc Heater: _____ Combustor:

Shock Tube: _____ Resistance Heater: _____

Other: _____

F-ATOM DISSOCIATION FROM (✓):

F₂: SF₆: _____Other (specify): NF₃F-ATOM CONCENTRATION DETERMINED FROM MODEL: YesDILUENTS MODELED: He, N₂, CF₄

MODELS EFFECTS ON MIXING RATE DUE TO (✓):

Nozzle Boundary Layers: _____ Shock Waves: _____

Prereactions (thermal blockage): _____ Turbulence: _____

Other (specify): Scheduled three stream:fuel, oxidant, mixed.

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):

Media Index Variations: _____

Other (specify): Nonresonant and wake OPDindex effects planned.

*Upgrading to two skins.

*With 2 + skin upgrad.

CODE NAME:

DENTAL

CODE TYPE: Optics, Kinetics, and Gasdynamics

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Laser kinetics calculations with strip unstable resonator.

ASSESSMENT OF CAPABILITIES: Kinetics which can be selected are CO₂, HF/DF, and KRF.

ASSESSMENT OF LIMITATIONS: One transverse dimension.

OTHER UNIQUE FEATURES: _____

ORIGINATOR/KEY CONTACT: _____

Name: Capt. Ted Salvi Phone: (505) 844-0721

Organization: AFWL/ALR

Address: Kirtland AFB, New Mexico 87115

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): T, U, RP: none

STATUS: _____

Operational Currently?: Yes

Under Modification?: _____

Purpose(s): _____

Ownership?: Government (AFWL)

Proprietary?: No

MACHINE/OPERATING SYSTEM (on which installed): CDC

TRANSPORTABLE?: _____

Machine Dependent Restrictions: FFT is machine language.

SELF-CONTAINED?: _____

Other Codes Required (name, purpose): _____

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec. CDC 7600)
Small Job:	_____	_____
Typical Job:	_____	_____
Large Job:	_____	_____

Approximate Number of FORTRAN Lines: _____

CODE NAME:

DENTAL

OPTICS

BASIC TYPE (✓):
 Physical Optics: Geometrical: _____

FIELD (POLARIZATION) REPRESENTATION (✓):
 Scalar: Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):
 Compact Region: Ca Annular Region: _____

TRANSVERSE GRID DIMENSIONALITY (✓):
 Compact Region:

1D	2D
<input checked="" type="checkbox"/>	<input type="checkbox"/>

 Annular Region: _____

FIELD SYMMETRY RESTRICTIONS?: None

MIRROR SHAPE(S) ALLOWED (✓):
 Square: _____ Circular: _____ Strip:
 Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):
 Fixed, Single Resonator Geometries: _____
 Fixed, Multiple Resonator Geometries: _____
 Modular, Multiple Resonator Geometries:

PROPAGATION TECHNIQUE (✓/all that apply):

COMPACT	ANNULAR
<input checked="" type="checkbox"/>	<input type="checkbox"/>

 Fresnel Integral Algorithms:
 With Kernel Averaging:
 Gaussian Quadrature: _____
 Fast Fourier Transform (FFT):
 Fast Hankel Transform (FHT): _____
 Gardner-Fresnel-Kirchhoff (GFK): _____
 Other (specify): Trapezoidal

CONVERGENCE TECHNIQUE (✓):
 Power Comparison: Field Comparison:
 Other: _____

ACCELERATION ALGORITHMS USED?: No
 Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):
 Prony: _____
 Other: _____

RESONATOR TYPE (✓): Standing Wave:
 Traveling Wave (Ring): _____ Reverse TW: _____

BRANCH (✓): Positive: Negative: _____

OPTICAL ELEMENT MODELS INCLUDED (✓):
 Flat Mirrors: Spherical Mirrors: _____
 Cylindrical Mirrors: Telescopes: _____
 Scraper Mirrors: _____

Waxicons	Refluxicons

Axicons: _____
 Arbitrary: _____
 Linear: _____
 Parabola-Parabola: _____
 Variable Cone Offset: _____
 Other (specify): _____

Deformable Mirrors: _____
 Spatial Filters: _____ Gratings: _____
 Other Elements: _____

GAIN MODELS (✓): Bare Cavity Only: _____
 Simple Saturated Gain: _____ Detailed Gain:

BARE CAVITY FIELD MODIFIER MODELS (✓):
 Mirror Tilt: Decentration: _____
 Aberrations/Thermal Distortions: _____
 Arbitrary: _____
 Selected (specify): Intensity map
 Reflectivity Loss:
 Output Coupler Edges: Rolled: _____
 Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):
 Medium Index Variation:
 Gas Absorption:
 Overlapped Beams: _____
 Other: _____

FAR-FIELD MODELS (✓): Beam Steering Removal: _____
 Optimal Focal Search: _____ Beam Quality:
 Other: Atmospheric effects

KINETICS

GAIN REGION MODELED (✓):
 Compact Region: _____ Annular Region: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):
 Compact Region: Ca Annular Region: _____

KINETICS GRID DIMENSIONALITY (✓):

1D	2D	3D
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

 Compact Region: _____
 Annular Region: _____

GAIN REGION SYMMETRY RESTRICTIONS:
 Gain Vary Along Optic Axes?: _____ Flow Direction?: _____

PULSED: CW: KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):
 $\left\{ \begin{array}{l} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{array} \right\}$
 Cold (F + H₂):

X	F	Cl	Br	I
H	<input checked="" type="checkbox"/>			
D	<input checked="" type="checkbox"/>			

 Hot (H + F₂): _____ Chain (F + H₂ & H + F₂): _____
 Other (specify): CO₂, KrF

ENERGY TRANSFER MODES MODELED (✓): Reference
 V-T: _____
 V-R: _____
 V-V: _____
 Other: _____

Single Line Model (✓):
 Multiline Model (✓):
 Assumed Rotational Population Distribution State (✓):
 Equilibrium: Nonequilibrium: _____
 Number of Laser Lines Modeled: 1
 Source of Rate Coefficients Used in Code: _____

LINE PROFILE MODELS (✓):
 Doppler Broadening: _____
 Collisional Broadening: _____
 Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓):
 Cylindrical, Radially Flowing: _____
 Rectangular, Linearly Flowing:
 Other: _____

COORDINATE SYSTEM: Cart. strip.

FLUID GRID DIMENSION (✓): 1D: 2D: _____ 3D: _____

FLOW FIELD MODELED (✓):
 Laminar: Turbulent: _____
 Other: _____

BASIC MODELING APPROACH (✓):
 Premixed: Mixing: _____
 Other (specify): _____

References for Approach Used: _____

THERMAL DRIVER MODELED (✓):
 Arc Heater: _____ Combustor: _____
 Shock Tube: _____ Resistance Heater: _____
 Other: _____

F-ATOM DISSOCIATION FROM (✓):
 F₂: _____ SF₆: _____
 Other (specify): _____

F-ATOM CONCENTRATION DETERMINED FROM MODEL?: Yes

DILUENTS MODELED: _____

MODELS EFFECTS ON MIXING RATE DUE TO (✓):
 Nozzle Boundary Layers: _____ Shock Waves: _____
 Prereactions (thermal blockage): _____ Turbulence: _____
 Other (specify): _____

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):
 Media Index Variations:
 Other (specify): _____

CODE NAME:

DESALE-5

CODE TYPE: Optics, Kinetics, and Gasdynamics

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Calculation of CW and Pulsed Chemical Laser Performance.

ASSESSMENT OF CAPABILITIES: Calculates solutions to coupled fluid dynamic, chemical kinetic and radiation transport equations for CW and pulsed chemical lasers. Utilizes comprehensive model of chemical kinetics and includes treatment of base relief and nozzle boundary layer effects.

ASSESSMENT OF LIMITATIONS: Restricted to Fabry-Perot cavity (although ad hoc technique for first order correction for curved mirrors has been included). Uses scheduled mixing model to treat mixing phenomena (although mixing rate is determined locally at each downstream station according to local flow properties). Restricted to rotational equilibrium.

OTHER UNIQUE FEATURES: Individual vibration levels treated as separate species; models effect of blockage (base relief).

ORIGINATOR/KEY CONTACT: Name: M. Epstein Phone: (213) 648-6861
Organization: Aerophysics Laboratory, The Aerospace Corporation
Address: P.O. Box 92957, Los Angeles, California 90009

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T) "Desale-5: A Comprehensive Scheduled Mixing Model for CW Chemical Lasers." Aerospace Corporation Rpt. SAMSO-TR-79-31, May 1, 1979.
M. Epstein; (U) "The Resale Chemical Laser Computer Program." Aerospace Corporation Rpt. SAMSO-TR-75-60, W.D. Adams, E.B. Turner, J.F. Holt, D.G. Sutton, and H. Mirels, February 20, 1975.

STATUS:
Operational Currently?: Yes
Under Modification?: No
Purpose(s): _____

Ownership?: Aerospace Corporation
Proprietary?: No

MACHINE/OPERATING SYSTEM (on which installed): CDC 7600

TRANSPORTABLE?: Yes
Machine Dependent Restrictions: None

SELF-CONTAINED?: Yes
Other Codes Required (name, purpose): _____

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec, CDC 7600)
Small Job:	146K	20
Typical Job:	146K	40
Large Job:	146K	60

Approximate Number of FORTRAN Lines: Overlay

CODE NAME:

DESALE-5

OPTICS

BASIC TYPE (✓):

Physical Optics: _____ Geometrical:

FIELD (POLARIZATION) REPRESENTATION (✓):

Scalar: Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: _____ Annular Region: _____

TRANSVERSE GRID DIMENSIONALITY (✓):

Compact Region:

Annular Region:

1D	2D

FIELD SYMMETRY RESTRICTIONS?: _____

MIRROR SHAPE(S) ALLOWED (✓):

Square: _____ Circular: _____ Strip: _____

Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):

Fixed, Single Resonator Geometry:

Fixed, Multiple Resonator Geometries: _____

Modular, Multiple Resonator Geometries: _____

PROPAGATION TECHNIQUE (✓ all that apply):

COMPACT ANNULAR

Fresnel Integral Algorithms:

With Kernel Averaging

Gaussian Quadrature:

Fast Fourier Transform (FFT):

Fast Hankel Transform (FHT):

Gardner-Fresnel-Kirchhoff (GFK):

Other (specify): _____

CONVERGENCE TECHNIQUE (✓):

Power Comparison: _____ Field Comparison: _____

Other: _____

ACCELERATION ALGORITHMS USED?: _____

Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):

Prony: _____

Other: _____

None

RESONATOR TYPE (✓): Standing Wave: _____

Traveling Wave (Ring): _____ Reverse TW: _____

BRANCH (✓): Positive: _____ Negative: _____

OPTICAL ELEMENT MODELS INCLUDED (✓):

Flat Mirrors: _____ Spherical Mirrors: _____

Cylindrical Mirrors: _____ Telescopes: _____

Scraper Mirrors: _____

Asixons

Arbitrary:

Linear:

Parabola-Parabola:

Variable Cone Offset:

Other (specify): _____

Deformable Mirrors: _____

Spatial Filters: _____ Gratings: _____

Other Elements: _____

Waxicons	Reflexicons

GAIN MODELS (✓): Bare Cavity Only: _____

Simple Saturated Gain: _____ Detailed Gain: _____

BARE CAVITY FIELD MODIFIER MODELS (✓):

Mirror Tilt: _____ Decentration: _____

Aberrations/Thermal Distortions:

Arbitrary: _____

Selected (specify): _____

Reflectivity Loss: _____

Output Coupler Edges: Rolled: _____

Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):

Medium Index Variation: _____

Gas Absorption: _____

Overlapped Beams: _____

Other: _____

FAR-FIELD MODELS (✓): Beam Steering Removal: _____

Optimal Focal Search: _____ Beam Quality: _____

Other: _____

KINETICS

GAIN REGION MODELED (✓):

Compact Region: _____ Annular Region: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: Ca Annular Region: _____

KINETICS GRID DIMENSIONALITY (✓):

Compact Region:

Annular Region:

1D	2D	3D
<input checked="" type="checkbox"/>		

GAIN REGION SYMMETRY RESTRICTIONS:

Gain Vary Along Optic Axes?: _____ Flow Direction?:

PULSED: CW: KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

$\left\{ \begin{array}{l} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{array} \right\}$

Cold (F + H₂):

Hot (H + F₂): Chain (F + H₂ & H + F₂):

Other (specify): _____

X	F	Cl	Br	I
H	<input checked="" type="checkbox"/>			
D	<input checked="" type="checkbox"/>			

ENERGY TRANSFER MODES MODELED (✓): Reference

v-T: See rate coefficient reference

v-R: _____

v-V: See rate coefficient reference

Other: _____

Single Line Model (✓): *

Multiline Model (✓): _____

Assumed Rotational Population Distribution State (✓):

Equilibrium: Nonequilibrium: _____

Number of Laser Lines Modeled: 9

Source of Rate Coefficients Used in Code: _____

LINE PROFILE MODELS (✓):

Doppler Broadening: _____

Collisional Broadening: _____

Other (specify): Voigt function (includes

Doppler and collisional broadening).

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓):

Cylindrical, Radially Flowing:

Rectangular, Linearly Flowing:

Other: Rectangular + varying area due

to shrouds.

COORDINATE SYSTEM: Cartesian

FLUID GRID DIMENSION (✓): 1D: 2D: 3D: _____

FLOW FIELD MODELED (✓):

Laminar: Turbulent:

Other: _____

BASIC MODELING APPROACH (✓):

Premixed: _____ Mixing: (scheduled mass addition)

Other (specify): _____

References for Approach Used: _____

THERMAL DRIVER MODELED (✓):

Arc Heater: _____ Combustor: _____

Shock Tube: _____ Resistance Heater: _____

Other: _____

F-ATOM DISSOCIATION FROM (✓):

F₂: SF₆:

Other (specify): NF₃

F-ATOM CONCENTRATION DETERMINED FROM MODEL?: Yes

DILUENTS MODELED: He, Ar, N₂, others pos-

models effects on mixing rate due to (✓): stable.

Nozzle Boundary Layers: Shock Waves: _____

Preactions (thermal blockage): Turbulence:

Other (specify): Rate of mass addition to

mixing zone calculated as part of

solution using local values of variables.

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):

Media Index Variations: _____

Other (specify): _____

*Lasing on only one transition between prs of vibrational levels.

CODE NAME:

ELNWD2

CODE TYPE: Optics

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Compute transverse eigenmodes of bare annular resonators and later add simple gain.

ASSESSMENT OF CAPABILITIES: Mode loss, frequency, mode shape, and optical quality versus equivalent Fresnel number, magnification, and fractional length that is compacted.

ASSESSMENT OF LIMITATIONS: Linear mirrors; low azimuthal modes; geometry. Extensions are difficult $N_{EQ} \geq 1$ due to asymptotic Fresnel approximation.

OTHER UNIQUE FEATURES: Can model HSURIA and compact unstable confocal resonator.

ORIGINATOR/KEY CONTACT:

Name: John Ellinwood Phone: (213) 648-7391

Organization: Aerospace Corporation

Address: Box 92957, Los Angeles, California 90009

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T) To be submitted to JOSA; (U) none; (listings) custom available; (RP) see literature on asymptotic methods.

STATUS:
Operational Currently?: No
Under Modification?: Under development
Purpose(s): _____

Ownership?: Aerospace Corporation
Proprietary?: Distribution controlled by USAF.

MACHINE/OPERATING SYSTEM (on which installed): CDC Cyber 76/172

TRANSPORTABLE?: No guarantee
Machine Dependent Restrictions: Plot routine

SELF-CONTAINED?: No
Other Codes Required (name, purpose): Special functions, IMSL

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec, CDC 7600)
Small Job:	40K	5
Typical Job:	40K	5
Large Job:	40K	5
Approximate Number of FORTRAN Lines:	400	

CODE NAME:

ELNWD2

OPTICS

BASIC TYPE (✓):

Physical Optics: Geometrical: _____

FIELD (POLARIZATION) REPRESENTATION (✓):

Scalar: Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: CY Annular Region: CY

TRANSVERSE GRID DIMENSIONALITY (✓):

Compact Region:

Annular Region:

1D	2D
	<input checked="" type="checkbox"/>
	<input checked="" type="checkbox"/>

FIELD SYMMETRY RESTRICTIONS?: None

MIRROR SHAPE(S) ALLOWED (✓):

Square: _____ Circular: Strip: _____

Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):

Fixed, Single Resonator Geometry:

Fixed, Multiple Resonator Geometries: _____

Modular, Multiple Resonator Geometries: _____

PROPAGATION TECHNIQUE (✓ all that apply):

Fresnel Integral Algorithms:

With Kernel Averaging

Gaussian Quadrature:

Fast Fourier Transform (FFT):

Fast Hankel Transform (FHT):

Gardner-Fresnel-Kirchhoff (GFK):

Other (specify): Analytic solution of integral equation, Fresnel integrals appear explicitly

CONVERGENCE TECHNIQUE (✓):

Power Comparison: _____ Field Comparison: _____

Other: Analytic convergence as per Horwitz

ACCELERATION ALGORITHMS USED?: None

Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):

Prony: Polynomial roots

Other: _____

RESONATOR TYPE (✓): Standing Wave:

Traveling Wave (Ring): _____ Reverse TW: _____

BRANCH (✓): Positive: Negative: _____

OPTICAL ELEMENT MODELS INCLUDED (✓):

Flat Mirrors: _____ Spherical Mirrors:

Cylindrical Mirrors: _____ Telescopes: _____

Scaper Mirrors: _____

Axicons

Waxicons	Refluxicons
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Arbitrary:

Linear:

Parabola-Parabola:

Variable Cone Offset:

Other (specify): _____

Deformable Mirrors: _____

Spatial Filters: _____ Gratings: _____

Other Elements: _____

GAIN MODELS (✓): Bare Cavity Only:

Simple Saturated Gain: SOON Detailed Gain: _____

BARE CAVITY FIELD MODIFIER MODELS (✓):

Mirror Tilt: _____ Decentration: _____

Aberrations/Thermal Distortions:

Arbitrary: _____

Selected (specify): _____

Reflectivity Loss:

Output Coupler Edges: Rolled: _____

Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):

Medium Index Variation: _____

Gas Absorption: _____

Overlapped Beams: _____

Other: _____

FAR-FIELD MODELS (✓): Beam Steering Removal: _____

Optimal Focal Search: _____ Beam Quality: SOON

Other: _____

KINETICS

GAIN REGION MODELED (✓): None

Compact Region: _____ Annular Region: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: _____ Annular Region: _____

KINETICS GRID DIMENSIONALITY (✓):

1D	2D	3D

Compact Region:

Annular Region:

GAIN REGION SYMMETRY RESTRICTIONS:

Gain Vary Along Optic Axes?: _____ Flow Direction?: _____

PULSED: _____ CW: _____ KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

Other (specify): $\begin{cases} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{cases}$

Cold (F + H₂): _____

Hot (H + F₂): _____ Chain (F + H₂ & H + F₂): _____

Other (specify): _____

ENERGY TRANSFER MODES MODELED (✓): Reference

V-T: _____

V-R: _____

V-V: _____

Other: _____

Single Line Model (✓): _____

Multiline Model (✓): _____

Assumed Rotational Population Distribution State (✓):

Equilibrium: _____ Nonequilibrium: _____

Number of Laser Lines Modeled: _____

Source of Rate Coefficients Used in Code: _____

Other (specify): _____

LINE PROFILE MODELS (✓):

Doppler Broadening: _____

Collisional Broadening: _____

Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓): None

Cylindrical, Radially Flowing: _____

Rectangular, Linearly Flowing: _____

Other: _____

COORDINATE SYSTEM: _____

FLUID GRID DIMENSION (✓): 1D: _____ 2D: _____ 3D: _____

FLOW FIELD MODELED (✓):

Laminar: _____ Turbulent: _____

Other: _____

BASIC MODELING APPROACH (✓):

Premixed: _____ Mixing: _____

Other (specify): _____

References for Approach Used: _____

THERMAL DRIVER MODELED (✓):

Arc Heater: _____ Combustor: _____

Shock Tube: _____ Resistance Heater: _____

Other: _____

F-ATOM DISSOCIATION FROM (✓):

F₂: _____ SF₆: _____

Other (specify): _____

F-ATOM CONCENTRATION DETERMINED FROM MODEL?: _____

DILUENTS MODELED: _____

MODELS EFFECTS ON MIXING RATE DUE TO (✓):

Nozzle Boundary Layers: _____ Shock Waves: _____

Prereactions (thermal blockage): _____ Turbulence: _____

Other (specify): _____

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):

Media Index Variations: _____

Other (specify): _____

CODE NAME:

GASSER

CODE TYPE: Gasdynamics

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Inviscid flow code using the method of characteristics and accounts for heat release. It is used for cavity flows with heat release defining shroud contours flow conditions at end of cavity, etc.

ASSESSMENT OF CAPABILITIES: It can calculate mean flow parameters in the laser cavity and the variations normal to the optical axis, resulting in optical path difference fields.

ASSESSMENT OF LIMITATIONS: It does not do the laser mixing problem and the heat release is an input.

OTHER UNIQUE FEATURES:

ORIGINATOR/KEY CONTACT:

Name: D. Haflinger and P. Lohr Phone: (213) 536-1624

Organization: TRW DSSG

Address: R1/1038, One Space Park, Redondo Beach, California 90278

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication):

STATUS:

Operational Currently?: Yes

Under Modification?:

Purpose(s):

Ownership?: TRW

Proprietary?:

MACHINE/OPERATING SYSTEM (on which installed): CDC 6600

TRANSPORTABLE?: Yes

Machine Dependent Restrictions: None

SELF-CONTAINED?: No

Other Codes Required (name, purpose): Combustor (GLAD) generates inputs to GASSER at the cavity entrance.

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec, CDC 7600)
Small Job:		
Typical Job:	<u>50K</u>	<u>25</u>
Large Job:		

Approximate Number of FORTRAN Lines: 1000

CODE NAME:

GASSER

OPTICS

None

BASIC TYPE (✓): None

Physical Optics: _____ Geometrical: _____

FIELD (POLARIZATION) REPRESENTATION (✓):

Scalar: _____ Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: _____ Annular Region: _____

TRANSVERSE GRID DIMENSIONALITY (✓):

Compact Region:

Annular Region:

1D	2D

FIELD SYMMETRY RESTRICTIONS?: _____

MIRROR SHAPE(S) ALLOWED (✓):

Square: _____ Circular: _____ Strip: _____

Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):

Fixed, Single Resonator Geometry: _____

Fixed, Multiple Resonator Geometries: _____

Modular, Multiple Resonator Geometries: _____

PROPAGATION TECHNIQUE (✓/all that apply):

Fresnel Integral Algorithms:

With Kernel Averaging

Gaussian Quadrature:

Fast Fourier Transform (FFT):

Fast Hankel Transform (FHT):

Gardener-Fresnel-Kirchhoff (GFK):

Other (specify): _____

COMPACT	ANNULAR

CONVERGENCE TECHNIQUE (✓):

Power Comparison: _____ Field Comparison: _____

Other: _____

ACCELERATION ALGORITHMS USED?: _____

Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM: (✓):

Prony: _____

Other: _____

RESONATOR TYPE (✓): Standing Wave: _____

Traveling Wave (Ring): _____ Reverse TW: _____

BRANCH (✓): Positive: _____ Negative: _____

OPTICAL ELEMENT MODELS INCLUDED (✓):

Flat Mirrors: _____ Spherical Mirrors: _____

Cylindrical Mirrors: _____ Telescopes: _____

Scraper Mirrors: _____

Axicons

Arbitrary:

Linear:

Parabola-Parabola:

Variable Cone Offset:

Other (specify): _____

Deformable Mirrors: _____

Spatial Filters: _____ Gratings: _____

Other Elements: _____

Waxicons	Refluxicons

GAIN MODELS (✓): Bare Cavity Only: _____

Simple Saturated Gain: _____ Detailed Gain: _____

BARE CAVITY FIELD MODIFIER MODELS (✓):

Mirror Tilt: _____ Decentration: _____

Aberrations/Thermal Distortions:

Arbitrary: _____

Selected (specify): _____

Reflectivity Loss: _____

Output Coupler Edges: Rolled: _____

Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):

Medium Index Variation: _____

Gas Absorption: _____

Overlapped Beams: _____

Other: _____

FAR-FIELD MODELS (✓): Beam Steering Removal: _____

Optimal Focal Search: _____ Beam Quality: _____

Other: _____

KINETICS

GAIN REGION MODELED (✓): None

Compact Region: _____ Annular Region: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.)

Compact Region: _____ Annular Region: _____

KINETICS GRID DIMENSIONALITY (✓):

Compact Region:

Annular Region:

1D	2D	3D

GAIN REGION SYMMETRY RESTRICTIONS:

Gain Vary Along Optic Axes: _____ Flow Direction: _____

PULSED: _____ CW: _____ KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

$$\begin{cases} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{cases}$$

Cold (F + H₂): _____

Hot (H + F₂): _____ Chain (F + H₂ & H + F₂): _____

Other (specify): _____

X	F	Cl	Br	I
H				
D				

ENERGY TRANSFER MODES MODELED (✓): Reference

V-T: _____

V-R: _____

V-V: _____

Other: _____

Single Line Model (✓): _____

Multiline Model (✓): _____

Assumed Rotational Population Distribution State (✓):

Equilibrium: _____ Nonequilibrium: _____

Number of Laser Lines Modeled: _____

Source of Rate Coefficients Used in Code: _____

LINE PROFILE MODELS (✓):

Doppler Broadening: _____

Collisional Broadening: _____

Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓):

Cylindrical, Radially Flowing: _____

Rectangular, Linearly Flowing: _____ ✓

Other: _____

COORDINATE SYSTEM: Ca _____

FLUID GRID DIMENSION (✓): 1D: _____ 2D: _____ ✓ 3D: _____

FLOW FIELD MODELED (✓):

Laminar: _____ Turbulent: _____

Other: Inviscid with scheduled heat _____

BASIC MODELING APPROACH (✓): _____

Premixed: _____ ✓ Mixing: _____

Other (specify): _____

References for Approach Used: Leipman and Roshko
"Elements of Gas Dyn," Shapiro "Dyna-
ics and Thermo of Compressible Flow"

THERMAL DRIVER MODELED (✓):

Arc Heater: _____ Combustor: _____

Shock Tube: _____ Resistance Heater: _____

Other: _____

F-ATOM DISSOCIATION FROM (✓):

F₂: _____ SF₆: _____

Other (specify): _____

F-ATOM CONCENTRATION DETERMINED FROM MODEL? NO

DILUENTS MODELED: _____

MODELS EFFECTS ON MIXING RATE DUE TO (✓):

Nozzle Boundary Layers: _____ Shock Waves: _____

Prereactions (thermal blockage): _____ Turbulence: _____

Other (specify): _____

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):

Media Index Variations: _____ ✓

Other (specify): _____

CODE NAME: GCAL

CODE TYPE: Kinetics

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: To provide extremely efficient single-line gain algorithm which is anchored to available data base for nozzle being studied. Used with SAIGD.

ASSESSMENT OF CAPABILITIES: Principally designed to analyze source flow nozzles but can also be applied to conventional 2-D slit nozzles.

ASSESSMENT OF LIMITATIONS: _____

OTHER UNIQUE FEATURES: The gain algorithm is a simplification of a full gasdynamic/kinetics code. A series of gasdynamic and kinetic parameter profiles are passed from the full code to the gain algorithm in the form of a data file. The gain algorithm then solves the lasing specie equations for that gasdynamic/kinetic field with an imposed intensity profile (see SAIGD).

ORIGINATOR/KEY CONTACT: _____
 Name: Kerry E. Patterson Phone: (494) 955-2663
 Organization: Science Applications, Inc.
 Address: 6600 Powers Ferry Road, Suite 220, Atlanta, Georgia 30339

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T) HF Laser Subsystem Technology Assessment (DARPA Interim Report) Science Applications, Inc., Atlanta, Georgia, July, 1979, Section 3.

STATUS:
 Operational Currently?: Yes
 Under Modification?: Yes
 Purpose(s): Extend to multi-line capability.

Ownership?: U.S. Government
 Proprietary?: No

MACHINE/OPERATING SYSTEM (on which installed): Cyber 175

TRANSPORTABLE?: Yes
 Machine Dependent Restrictions: None

SELF-CONTAINED?: No
 Other Codes Required (name, purpose): SAIGD - SAI gasdynamics code generates gasdynamic field variables as input to this code.

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:	
	Core Size (Octal Words)
Small Job:	
Typical Job:	<u>Negligible</u>
Large Job:	

Execution Time (Sec, CDC 7600): 0.1

Approximate Number of FORTRAN Lines: 75

CODE NAME:

GCAL

OPTICS

BASIC TYPE (✓):

Physical Optics: _____ Geometrical: _____

FIELD (POLARIZATION) REPRESENTATION (✓):

Scalar: _____ Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: _____ Annular Region: _____

TRANSVERSE GRID DIMENSIONALITY (✓):

Compact Region:

Annular Region:

1D	2D

FIELD SYMMETRY RESTRICTIONS?: _____

MIRROR SHAPE(S) ALLOWED (✓):

Square: _____ Circular: _____ Strip: _____

Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):

Fixed, Single Resonator Geometry: _____

Fixed, Multiple Resonator Geometries: _____

Modular, Multiple Resonator Geometries: _____

PROPAGATION TECHNIQUE (✓/all that apply):

COMPACT ANNULAR

Fresnel Integral Algorithms:

With Kernel Averaging

Gaussian Quadrature:

Fast Fourier Transform (FFT):

Fast Hankel Transform (FHT):

Gardener-Fresnel-Kirchhoff (GFK):

Other (specify): _____

CONVERGENCE TECHNIQUE (✓):

Power Comparison: _____ Field Comparison: _____

Other: _____

ACCELERATION ALGORITHMS USED?: _____

Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):

Prony: _____

Other: _____

RESONATOR TYPE (✓): Standing Wave: _____

Traveling Wave (Ring): _____ Reverse TW: _____

BRANCH (✓): Positive: _____ Negative: _____

OPTICAL ELEMENT MODELS INCLUDED (✓):

Flat Mirrors: _____ Spherical Mirrors: _____

Cylindrical Mirrors: _____ Telescopes: _____

Scraper Mirrors: _____

Axicons

Arbitrary:

Linear:

Parabola-Parabola:

Variable Cone Offset:

Other (specify): _____

Deformable Mirrors: _____

Spatial Filters: _____ Gratings: _____

Other Elements: _____

Waxicons	Reflexicons

GAIN MODELS (✓): Bare Cavity Only: _____

Simple Saturated Gain: _____ Detailed Gain: _____

BARE CAVITY FIELD MODIFIER MODELS (✓):

Mirror Tilt: _____ Decentration: _____

Aberrations/Thermal Distortions:

Arbitrary: _____

Selected (specify): _____

Reflectivity Loss: _____

Output Coupler Edges: Rolled: _____

Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):

Medium Index Variation: _____

Gas Absorption: _____

Overlapped Beams: _____

Other: _____

FAR-FIELD MODELS (✓): Beam Steering Removal: _____

Optimal Focal Search: _____ Beam Quality: _____

Other: _____

KINETICS

GAIN REGION MODELED (✓):

Compact Region: ✓ Annular Region: ✓

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: Ca Annular Region: CY

KINETICS GRID DIMENSIONALITY (✓):

Compact Region:

Annular Region:

1D	2D	3D
	✓	
		✓

GAIN REGION SYMMETRY RESTRICTIONS:

Gain Vary Along Optic Axes?: YES Flow Direction?: YES

PULSED: _____ CW: ✓ KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

$$\begin{cases} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{cases}$$

Cold (F + H₂): ✓

Hot (H + F₂): ✓ Chain (F + H₂ + H + F₂): ✓

Other (specify): _____

X	F	Cl	Br	I
H	✓			
D	✓			

ENERGY TRANSFER MODES MODELED (✓): Reference

v.t: ✓ Cohen & Bott (1976)

V-R: _____

V-V: _____

Other: _____

Single Line Model (✓): ✓(with multi-line corrections)

Multiline Model (✓): _____

Assumed Rotational Population Distribution State (✓):

Equilibrium: _____ Nonequilibrium: _____

Number of Laser Lines Modeled: _____

Source of Rate Coefficients Used in Code: Cohen & Bott (1976)

LINE PROFILE MODELS (✓):

Doppler Broadening: ✓

Collisional Broadening: _____

Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓):

Cylindrical, Radially Flowing: _____

Rectangular, Linearly Flowing: _____

Other: _____

COORDINATE SYSTEM: _____

FLUID GRID DIMENSION (✓): 1D: _____ 2D: _____ 3D: _____

FLOW FIELD MODELED (✓):

Laminar: _____ Turbulent: _____

Other: _____

BASIC MODELING APPROACH (✓):

Premixed: _____ Mixing: _____

Other (specify): _____

References for Approach Used: _____

THERMAL DRIVER MODELED (✓):

Arc Heater: _____ Combustor: _____

Shock Tube: _____ Resistance Heater: _____

Other: _____

F-ATOM DISSOCIATION FROM (✓):

F₂: _____ SF₆: _____

Other (specify): _____

F-ATOM CONCENTRATION DETERMINED FROM MODEL?: _____

DILUENTS MODELED: _____

MODELS EFFECTS ON MIXING RATE DUE TO (✓):

Nozzle Boundary Layers: _____ Shock Waves: _____

Prereactions (thermal blockage): _____ Turbulence: _____

Other (specify): _____

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):

Media Index Variations: _____

Other (specify): _____

* with multiple gain sheets

CODE NAME:

GENRING

CODE TYPE: Optics

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: To model chemical laser ring resonators utilizing linear and non-linear reflecting axicons to produce an annular gain region; to study and trade off ring resonator candidates; to study effects of spatial filtering on mode control; to study the concept of (scraper) aperture self-imaging.

ASSESSMENT OF CAPABILITIES: Models bare and loaded unstable ring resonators of aligned circularly-shaped optics which employ a pair of similar reflecting axicons. Models positive and negative branch resonators. Models simple gain. Uses Fresnel-Kirchhoff propagation. Models far-field performance. 2-D plots.

ASSESSMENT OF LIMITATIONS: Cavity fields are assumed to be circularly symmetric; this is a 2-D code.

OTHER UNIQUE FEATURES: Models positive and negative branch P-P waxicon (reflaxicon)/P-P waxicon (reflaxicon) ring with or without offset. Bare or loaded. Also models linear waxicon (reflaxicon) combinations. Easily modified to model ring resonators without axicons.

ORIGINATOR/KEY CONTACT:

Name: Carl M. Wiggins Phone: (505) 848-5000
 Organization: The BDM Corporation
 Address: 1801 Randolph Road S.E., Albuquerque, New Mexico 87106

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T) and (U) "GENRING: A Computer Code for Modeling Cylindrical Unstable Ring Resonators With Internal Reflecting Axicons" BDM/TAC-79-152-TR, The BDM Corporation, May 1, 1979; listings available from AFWL/ALR.

STATUS:

Operational Currently?: Yes
 Under Modification?: No
 Purpose(s): _____

Ownership?: Government (AFWL/ALR)
 Proprietary?: No

MACHINE/OPERATING SYSTEM (on which installed): CDC 6600/7600

TRANSPORTABLE?: Yes, except for plot routines

Machine Dependent Restrictions: Uses AFWL plot library METALIB.

SELF-CONTAINED?: No

Other Codes Required (name, purpose): Uses AFWL plot library METALIB.

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec. CDC 7600)
Small Job:	200K	5
Typical Job:	200K	15
Large Job:	200K	30

Approximate Number of FORTRAN Lines: 1700

CODE NAME:

GENRING

OPTICS

BASIC TYPE (✓):

Physical Optics: Geometrical: _____

FIELD (POLARIZATION) REPRESENTATION (✓):

Scalar: Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: CY Annular Region: CY

TRANSVERSE GRID DIMENSIONALITY (✓):

Compact Region:

Annular Region:

1D	2D
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

FIELD SYMMETRY RESTRICTIONS: Yes

MIRROR SHAPE(S) ALLOWED (✓):

Square: _____ Circular: Strip:

Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):

Fixed, Single Resonator Geometries: _____

Fixed, Multiple Resonator Geometries:

Modular, Multiple Resonator Geometries: _____

PROPAGATION TECHNIQUE (✓/all that apply):

Fresnel Integral Algorithms:

With Kernel Averaging

Gaussian Quadrature:

Fast Fourier Transform (FFT):

Fast Hankel Transform (FHT):

Gardner-Fresnel-Kirchhoff (GFK):

Other (specify): Midpoint rule

COMPACT	ANNULAR
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

CONVERGENCE TECHNIQUE (✓):

Power Comparison: Field Comparison: _____

Other: _____

ACCELERATION ALGORITHMS USED?: None

Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):

Prony: _____

Other: _____

RESONATOR TYPE (✓): Standing Wave: _____

Traveling Wave (Ring): Reverse TW: _____

BRANCH (✓): Positive: Negative:

OPTICAL ELEMENT MODELS INCLUDED (✓):

Flat Mirrors: Spherical Mirrors:

Cylindrical Mirrors: _____ Telescopes:

Scraper Mirrors:

Axicons

Arbitrary:

Linear:

Parabola-Parabola:

Variable Cone Offset:

Other (specify): _____

Deformable Mirrors: _____

Spatial Filters: Gratings: _____

Other Elements: _____

	Waxicons	Reflexicons
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

GAIN MODELS (✓): Bare Cavity Only:

Simple Saturated Gain: Detailed Gain: _____

BARE CAVITY FIELD MODIFIER MODELS (✓):

Mirror Tilt: _____ Decentration: _____

Aberrations/Thermal Distortions:

Arbitrary: _____

Selected (specify): Can mod for circular symmetric distortions.

Reflectivity Loss: _____

Output Coupler Edges: Rolled: _____

Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):

Medium Index Variation: _____

Gas Absorption: _____

Overlapped Beams: _____

Other: _____

FAR-FIELD MODELS (✓): Beam Steering Removal: _____

Optimal Focal Search: Beam Quality:

Other: _____

KINETICS

GAIN REGION MODELED (✓): None

Compact Region: _____ Annular Region: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: _____ Annular Region: _____

KINETICS GRID DIMENSIONALITY (✓):

1D	2D	3D
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Compact Region:

Annular Region:

GAIN REGION SYMMETRY RESTRICTIONS:

Gain Vary Along Optic Axes?: _____ Flow Direction?: _____

PULSED: _____ CW: _____ KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

$X + Y_2 = YX + Y$	$Y + X_2 = YX + X$	FX	F	Cl	Br	I
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Cold (F + H ₂):						
Hot (H + F ₂):						
Chain (F + H ₂ & H + F ₂):						

Other (specify): _____

ENERGY TRANSFER MODES MODELED (✓): Reference

V-T: _____

V-R: _____

V-V: _____

Other: _____

Single Line Model (✓): _____

Multiline Model (✓): _____

Assumed Rotational Population Distribution State (✓):

Equilibrium: _____ Nonequilibrium: _____

Number of Laser Lines Modeled: _____

Source of Rate Coefficients Used in Code: _____

LINE PROFILE MODELS (✓):

Doppler Broadening: _____

Collisional Broadening: _____

Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓): None

Cylindrical, Radially Flowing: _____

Rectangular, Linearly Flowing: _____

Other: _____

COORDINATE SYSTEM: _____

FLUID GRID DIMENSION (✓): 1D: _____ 2D: _____ 3D: _____

FLOW FIELD MODELED (✓):

Laminar: _____ Turbulent: _____

Other: _____

BASIC MODELING APPROACH (✓):

Premixed: _____ Mixing: _____

Other (specify): _____

References for Approach Used: _____

THERMAL DRIVER MODELED (✓):

Arc Heater: _____ Combustor: _____

Shock Tube: _____ Resistance Heater: _____

Other: _____

F-ATOM DISSOCIATION FROM (✓):

F₂: _____ SF₆: _____

Other (specify): _____

F-ATOM CONCENTRATION DETERMINED FROM MODEL?: _____

DILUENTS MODELED: _____

MODELS EFFECTS ON MIXING RATE DUE TO (✓):

Nozzle Boundary Layers: _____ Shock Waves: _____

Prereactions (thermal blockage): _____ Turbulence: _____

Other (specify): _____

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):

Media Index Variations: _____

Other (specify): _____

CODE NAME:

GIM

CODE TYPE: Gasdynamics Code

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: General Interpolation Method (GIM) is used for laser cavity and nozzle analysis. Used for external and internal flows.

ASSESSMENT OF CAPABILITIES: Multidimensional 2-D, 3-D viscous, diffusing flows; time-dependent. Will eventually combine this capability with the chemical kinetics of ALFA and APACHE.

ASSESSMENT OF LIMITATIONS: Simplified diffusion.

OTHER UNIQUE FEATURES: _____

ORIGINATOR/KEY CONTACT:
 Name: D. W. Lankford Phone: (505) 844-9836
 Organization: Air Force Weapons Laboratory
 Address: AFWL/ARAC, Kirtland AFB, New Mexico 87117

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T) (U) To become available after modifications are completed.

STATUS:
 Operational Currently?: Yes
 Under Modification?: Yes, from December 1979 until January 1981.
 Purpose(s): Add all chemistry and laser physics capabilities of ALFA.

Ownership?: Lockheed Space and Missiles; USAF after modifications complete.
 Proprietary?: Yes, while under development by Lockheed.

MACHINE/OPERATING SYSTEM (on which installed): CDC 176, Star, Cray.

TRANSPORTABLE?: Yes
 Machine Dependent Restrictions: None

SELF-CONTAINED?: No
 Other Codes Required (name, purpose): Three modules: geometry mesh, code assembly, operational assembly.

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec. CDC 7600)
Small Job:		
Typical Job:	<u>100K CM/500K ECS</u>	<u>1-2 hours</u>
Large Job:	<u>150K CM/1000K ECS</u>	<u>2+ hours</u>

Approximate Number of FORTRAN Lines: _____

CODE NAME:

GIM

OPTICS

None

BASIC TYPE (✓): None

Physical Optics: _____ Geometrical: _____

FIELD (POLARIZATION) REPRESENTATION (✓):

Scalar: _____ Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: _____ Annular Region: _____

TRANSVERSE GRID DIMENSIONALITY (✓):

1D	2D

Compact Region: _____

Annular Region: _____

FIELD SYMMETRY RESTRICTIONS: _____

MIRROR SHAPE(S) ALLOWED (✓):

Square: _____ Circular: _____ Strip: _____

Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):

Fixed, Single Resonator Geometry: _____

Fixed, Multiple Resonator Geometries: _____

Modular, Multiple Resonator Geometries: _____

PROPAGATION TECHNIQUE (✓ all that apply):

COMPACT	ANNULAR

Fresnel Integral Algorithms: _____

With Kernel Averaging: _____

Gaussian Quadrature: _____

Fast Fourier Transform (FFT): _____

Fast Hankel Transform (FHT): _____

Gardener-Fresnel-Kirchhoff (GFK): _____

Other (specify): _____

CONVERGENCE TECHNIQUE (✓):

Power Comparison: _____ Field Comparison: _____

Other: _____

ACCELERATION ALGORITHMS USED: _____

Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):

Prony: _____

Other: _____

RESONATOR TYPE (✓): Standing Wave: _____

Traveling Wave (Ring): _____ Reverse TW: _____

BRANCH (✓): Positive: _____ Negative: _____

OPTICAL ELEMENT MODELS INCLUDED (✓):

Flat Mirrors: _____ Spherical Mirrors: _____

Cylindrical Mirrors: _____ Telescopes: _____

Scraper Mirrors: _____

Axicons

Waxicons	Reflexicons

Arbitrary: _____

Linear: _____

Parabola-Parabola: _____

Variable Cone Offset: _____

Other (specify): _____

Deformable Mirrors: _____

Spatial Filters: _____ Gratings: _____

Other Elements: _____

GAIN MODELS (✓): Bare Cavity Only: _____

Simple Saturated Gain: _____ Detailed Gain: _____

BARE CAVITY FIELD MODIFIER MODELS (✓):

Mirror Tilt: _____ Decentration: _____

Aberrations/Thermal Distortions:

Arbitrary: _____

Selected (specify): _____

Reflectivity Loss: _____

Output Coupler Edges: Rolled: _____

Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):

Medium Index Variation: _____

Gas Absorption: _____

Overlapped Beams: _____

Other: _____

FAR-FIELD MODELS (✓): Beam Steering Removal: _____

Optimal Focal Search: _____ Beam Quality: _____

Other: _____

KINETICS

GAIN REGION MODELED (✓): None

Compact Region: _____ Annular Region: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.)

Compact Region: _____ Annular Region: _____

KINETICS GRID DIMENSIONALITY (✓):

1D	2D	3D

Compact Region: _____

Annular Region: _____

GAIN REGION SYMMETRY RESTRICTIONS:

Gain Vary Along Optic Axes?: _____ Flow Direction?: _____

PULSED: _____ CW: _____ KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

$$\begin{cases} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{cases}$$

	F	Cl	Br	I
H				
D				

Cold (F + H₂): _____

Hot (H + F₂): _____ Chain (F + H₂ & H + F₂): _____

Other (specify): _____

ENERGY TRANSFER MODES MODELED (✓): Reference

V-T: _____

V-R: _____

V-V: _____

Other: _____

Single Line Model (✓): _____

Multiline Model (✓): _____

Assumed Rotational Population Distribution State (✓):

Equilibrium: _____ Nonequilibrium: _____

Number of Laser Lines Modeled: _____

Source of Rate Coefficients Used in Code: _____

LINE PROFILE MODELS (✓):

Doppler Broadening: _____

Collisional Broadening: _____

Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓):

Cylindrical, Radially Flowing: _____ ✓

Rectangular, Linearly Flowing: _____ ✓

Other: _____

COORDINATE SYSTEM: Ca and cy

FLUID GRID DIMENSION (✓): 1D: _____ 2D: _____ 3D: _____

FLOW FIELD MODELED (✓):

Laminar: _____ Turbulent: _____ ✓

Other: Recirculating

BASIC MODELING APPROACH (✓):

Premixed: _____ Mixing: _____ ✓

Other (specify): _____

References for Approach Used: _____

THERMAL DRIVER MODELED (✓):

Arc Heater: _____ Combustor: _____ ✓

Shock Tube: _____ Resistance Heater: _____

Other: _____

F-ATOM DISSOCIATION FROM (✓):

F₂: _____ SF₆: _____ ✓

Other (specify): NF₃

F-ATOM CONCENTRATION DETERMINED FROM MODEL: Yes

DILUENTS MODELED: He

MODELS EFFECTS ON MIXING RATE DUE TO (✓):

Nozzle Boundary Layers: _____ Shock Waves: _____ ✓

Prereactions (thermal blockage): _____ Turbulence: _____ ✓

Other (specify): _____

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):

Media Index Variations: _____

Other (specify): _____

CODE NAME:

GLADV

CODE TYPE: Gasdynamics

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: General laser analysis to calculate average flow properties in nozzles and in cavity.

ASSESSMENT OF CAPABILITIES: With general input quantities such as bulk heat loss and flow conditions, average flow conditions are calculated accurately. Two nozzle flow options are included, for high and moderate Reynold's numbers.

ASSESSMENT OF LIMITATIONS: Detailed flow conditions cannot be predicted. Cavity chemistry is also done by bulk procedures.

OTHER UNIQUE FEATURES:

ORIGINATOR/KEY CONTACT:

Name: R. Hughes/D. Haflinger/H. Behrens Phone: (213) 536-2757

Organization: TRW DSSG

Address: R1/1038, One Space Park, Redondo Beach, California 90278

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T) None; listings proprietary.

STATUS:

Operational Currently?: Yes

Under Modification?: No

Purpose(s):

Ownership?: TRW

Proprietary?: Yes

MACHINE/OPERATING SYSTEM (on which installed): CDC 174

TRANSPORTABLE?: Yes

Machine Dependent Restrictions: None

SELF-CONTAINED?: Yes

Other Codes Required (name, purpose):

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec. CDC 7600)
Small Job:	44K	15
Typical Job:	44K	15
Large Job:	44K	15

Approximate Number of FORTRAN Lines: 5000

CODE NAME:

GLADY

OPTICS

BASIC TYPE (✓): None
 Physical Optics: Geometrical: _____
 Field (POLARIZATION) REPRESENTATION (✓):
 Scalar: Vector: _____
 COORDINATE SYSTEM (Cartesian, cylindrical, etc.):
 Compact Region: Annular Region: _____
 TRANSVERSE GRID DIMENSIONALITY (✓):
 Compact Region: Annular Region: _____

1D	2D	3D

FIELD SYMMETRY RESTRICTIONS: _____
MIRROR SHAPES(S) ALLOWED (✓):
 Square: Circular: Strip: Arbitrary: _____
 Rectangular: Elliptical: _____
CONFIGURATION FLEXIBILITY (✓):
 Fixed, Single Resonator Geometries: _____
 Fixed, Multiple Resonator Geometries: _____
 Modular, Multiple Resonator Geometries: _____
PROPAGATION TECHNIQUE (✓) (all that apply): [COMPACT] [ANNULAR]
 Fresnel Integral Algorithms: _____
 With Kernel Averaging: _____
 Gaussian Quadratures: _____
 Fast Fourier Transform (FFT): _____
 Fast Hankel Transform (FHT): _____
 Gardner-Fresnel-Kirchoff (GFK): _____
 Other (specify): _____

RESONATOR TYPE (✓): Standing Wave: _____
 Traveling Wave (Ring): Reverse TW: _____
BRANCH (✓): Positive: Negative: _____
OPTICAL ELEMENT MODELS INCLUDED (✓):
 Flat Mirrors: Spherical Mirrors: Telescope: _____
 Cylindrical Mirrors: _____
 Scraper Mirrors: _____
 Anticons: Relaxations: _____
 Arbitrary: _____
 Linear: _____
 Parabola-Parabola: _____
 Variable Cone Offset: _____
 Other (specify): _____
 Deformable Mirrors: _____
 Spatial Filters: Gratings: _____
 Other Elements: _____

GAIN MODELS (✓): Bare Cavity Only: _____
 Simple Saturated Gain: Detailed Gain: _____
BARE CAVITY FIELD MODIFIER MODELS (✓):
 Mirror Tilt: Decentrations: _____
 Aberrations/Thermal Distortions: _____
 Arbitrary: _____
 Selected (specify): _____
 Reflectivity Loss: _____
 Output Coupler Edges: Relief: _____
 Serrated: Other: _____
LOADED CAVITY FIELD MODIFIER MODELS (✓):
 Medium Index Variation: _____
 Gas Absorption: _____
 Overlapped Beams: _____
 Other: _____
FAR-FIELD MODELS (✓): Beam Steering Removal: _____
 Optimal Focal Search: Beam Quality: _____
 Other: _____

KINETICS

GAIN REGION MODELED (✓): None
 Compact Region: Annular Region: _____
COORDINATE SYSTEM (Cartesian, cylindrical, etc.):
 Compact Region: Annular Region: _____
KINETICS GRID DIMENSIONALITY (✓):
 Compact Region: Annular Region: _____

1D	2D	3D

GAIN REGION SYMMETRY RESTRICTIONS:
 Gain Vary Along Optic Axes: Flow Direction: _____
PULSED: CW: KINETICS MODELED
CHEMICAL PUMPING REACTIONS MODELED (✓):

$$\begin{cases} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{cases}$$
 Cold (F + H₂): _____
 Hot (H + F₂): Chain (F + H₂ & H + F₂): _____
 Other (specify): _____

X	F	Cl	Br	I
H				
D				

ENERGY TRANSFER MODES MODELED (✓): Reference
 V-T: _____
 V-R: _____
 V-V: _____
 Other: _____
 Single Line Model (✓): _____
 Multiline Model (✓): _____
 Assumed Rotational Population Distribution State (✓):
 Equilibrium: Nonequilibrium: _____
 Number of Laser Lines Modeled: _____
 Source of Rate Coefficients Used in Code: _____

LINE PROFILE MODELS (✓):
 Doppler Broadening: _____
 Collisional Broadening: _____
 Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓):
 Cylindrical, Radially Flowing: _____
 Rectangular, Linearly Flowing: _____
 Other: _____
COORDINATE SYSTEM: Ca
FLUID GRID DIMENSION (✓): 1D: _____ 2D: _____ 3D: _____
FLOW FIELD MODELED (✓):
 Laminar: _____ Turbulent: _____
 Other: _____
BASIC MODELING APPROACH (✓):
 Premixed: _____ Mixing: _____ (butk)
 Other (specify): _____
 References for Approach Used: _____

THERMAL DRIVER MODELED (✓):
 Arc Heater: _____ Combustor: _____
 Shock Tube: _____ Resistance Heater: _____
 Other: _____
F-ATOM DISSOCIATION FROM (✓):
 F₂: _____ SF₆: _____
 Other (specify): _____

F-ATOM CONCENTRATION DETERMINED FROM MODEL: NO
DILUENTS MODELED: He, N₂
MODELS EFFECTS ON MIXING RATE DUE TO (✓):
 Nozzle Boundary Layers: Shock Waves: _____
 Preactions (thermal blockage): Turbulence: _____
 Other (specify): _____

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):
 Media Index Variations: _____
 Other (specify): _____

CODE NAME:

GOPWR

CODE TYPE: Optics, Kinetics, and Gasdynamics

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Calculational tool to study the performance of CW chemical lasers and the interaction with the gain medium.

ASSESSMENT OF CAPABILITIES: Uses geometric optics and quasi-one-dimensional aerokinetics. Useful for parameter studies to indicate the importance of design parameters on laser performance.

ASSESSMENT OF LIMITATIONS: Limited to HSURIA geometry only unless modified.

OTHER UNIQUE FEATURES: Resonator geometries modeled: HSURIA, reflexicon beam compactors.

ORIGINATOR/KEY CONTACT:

Name: J. K. Hunting/T. T. Yang Phone: (213)884-2370

Organization: Rocketdyne

Address: 6633 Canoga Avenue, Canoga Park, California

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T) Rocketdyne Internal Letter G-SL-77-509, October 5, 1977; (U) Rocketdyne Internal Letter G-0-78-937, January 24, 1978.

STATUS:

Operational Currently?: Yes

Under Modification?: _____

Purpose(s): _____

Ownership?: Rocketdyne

Proprietary?: No

MACHINE/OPERATING SYSTEM (on which installed): CDC 176 NOS BE

TRANSPORTABLE?: No

Machine Dependent Restrictions: Uses CDC Fortran extended features, uses CDC LCM.

SELF-CONTAINED?: _____

Other Codes Required (name, purpose): DISSPLA Plot library.

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec. CDC 7600)
Small Job:	16K/15K LCM	10 sec/iteration
Typical Job:	16K/15K LCM	10 sec/iteration
Large Job:	16K/15K LCM	10 sec/iteration
Approximate Number of FORTRAN Lines: <u>3200</u>		

CODE NAME:

GOPWR

OPTICS

BASIC TYPE (✓):

Physical Optics: _____ Geometrical: ✓

FIELD (POLARIZATION) REPRESENTATION (✓):

Scalar: ✓ Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: CY Annular Region: CY

TRANSVERSE GRID DIMENSIONALITY (✓):

1D	2D

Compact Region:

Annular Region:

FIELD SYMMETRY RESTRICTIONS: Axisymmetric

MIRROR SHAPE(S) ALLOWED (✓):

Square: _____ Circular: ✓ Strip: _____

Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):

Fixed, Single Resonator Geometry: ✓

Fixed, Multiple Resonator Geometries: _____

Modular, Multiple Resonator Geometries: _____

PROPAGATION TECHNIQUE (✓ all that apply): COMPACT ANNULAR

Fresnel Integral Algorithms:

With Kernel Averaging

Gaussian Quadrature:

Fast Fourier Transform (FFT):

Fast Hankel Transform (FHT):

Gardener-Fresnel-Kirchhoff (GFK):

Other (specify): Geometric optics

CONVERGENCE TECHNIQUE (✓):

Power Comparison: ✓ Field Comparison: _____

Other: _____

ACCELERATION ALGORITHMS USED?: No

Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):

Prony: _____

Other: _____

RESONATOR TYPE (✓): Standing Wave: ✓

Traveling Wave (Ring): _____ Reverse TW: _____

BRANCH (✓): Positive: ✓ Negative: _____

OPTICAL ELEMENT MODELS INCLUDED (✓):

Flat Mirrors: ✓ Spherical Mirrors: ✓

Cylindrical Mirrors: _____ Telescopes: ✓

Scrapor Mirrors: _____

Axicons

Arbitrary:

Linear:

Parabola-Parabola:

Variable Cone Offset:

Other (specify): _____

Deformable Mirrors: _____

Spatial Filters: _____ Gratings: _____

Other Elements: _____

Waxicons	Reflaxicons

GAIN MODELS (✓): Bare Cavity Only: _____

Simple Saturated Gain: _____ Detailed Gain: ✓

BARE CAVITY FIELD MODIFIER MODELS (✓):

Mirror Tilt: _____ Decentration: _____

Aberrations/Thermal Distortions:

Arbitrary: _____

Selected (specify): _____

Reflectivity Loss: ✓

Output Coupler Edges: Rolled: _____

Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):

Medium Index Variation: _____

Gas Absorption: _____

Overlapped Beams: _____

Other: _____

FAR-FIELD MODELS (✓): Beam Steering Removal: _____

Optimal Focal Search: _____ Beam Quality: _____

Other: _____

KINETICS

GAIN REGION MODELED (✓):

Compact Region: _____ Annular Region: ✓

COORDINATE SYSTEM (Cartesian, cylindrical, etc.)

Compact Region: CY Annular Region: CY

KINETICS GRID DIMENSIONALITY (✓):

1D	2D	3D
✓		

Compact Region:

Annular Region:

GAIN REGION SYMMETRY RESTRICTIONS:

Gain Vary Along Optic Axes: _____ Flow Direction?: _____

PULSED: _____ CW: _____ KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

$X + Y_2 = YX + Y$

$Y + X_2 = YX + X$

Cold (F + H₂): ✓

Hot (H + F₂): ✓

Chain (F + H₂ & H + F₂): ✓

Other (specify): _____

X	F	Cl	Br	I
H	✓			
D	✓			

ENERGY TRANSFER MODES MODELED (✓): Reference

v-T: ✓ Cohen

v-R: _____

v-V: ✓ Cohen

Other: _____

Single Line Model (✓): ✓

Multiline Model (✓): ✓

Assumed Rotational Population Distribution State (✓):

Equilibrium: ✓ Nonequilibrium: ✓

Number of Laser Lines Modeled: ≤ 12

Source of Rate Coefficients Used in Code: Aerospace -

N. Cohen

LINE PROFILE MODELS (✓):

Doppler Broadening: ✓

Collisional Broadening: ✓

Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓):

Cylindrical, Radially Flowing: ✓

Rectangular, Linearly Flowing: ✓

Other: _____

COORDINATE SYSTEM: cylindrical

FLUID GRID DIMENSION (✓): 1D: ✓ 2D: _____ 3D: _____

FLOW FIELD MODELED (✓):

Laminar: _____ Turbulent: _____

Other: Scheduled mixing.

BASIC MODELING APPROACH (✓):

Premixed: _____ Mixing: ✓

Other (specify): _____

References for Approach Used: ALOS Final Report

THERMAL DRIVER MODELED (✓):

Arc Heater: _____ Combustor: _____

Shock Tube: _____ Resistance Heater: _____

Other: Not modeled

F-ATOM DISSOCIATION FROM (✓):

F₂: ✓ SF₆: ✓

Other (specify): NF₃

F-ATOM CONCENTRATION DETERMINED FROM MODEL?: *

DILUENTS MODELED: He, N₂

MODELS EFFECTS ON MIXING RATE DUE TO (✓):

Nozzle Boundary Layers: ✓ Shock Waves: _____

Prereactions (thermal blockage): _____ Turbulence: _____

Other (specify): Trip

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):

Media Index Variations: ✓

Other (specify): _____

*Uses equilibrium thermochemistry.

CODE NAME:

GURDM

CODE TYPE: Optics

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Originally designed to model Pratt's Intracavity Adaptive Optics experiments. Models bare cavity compact beam resonators with circular end mirrors and one or two internal deformable mirrors. A far-field code includes external deformable mirror, tilt removal, optimum focus, etc.

ASSESSMENT OF CAPABILITIES: Full 3-D tilt and decentrations of all mirrors; arbitrary deformations on all mirrors; arbitrary turning angles at internal deformable mirrors. 2-D and 3-D plots.

ASSESSMENT OF LIMITATIONS: Usual paraxial requirements; restrictions on peak deformations of turning mirrors, machine and cost limitations for large problems.

OTHER UNIQUE FEATURES: Models any two-mirror stable or unstable compact beam resonator with one or two deformable turning mirrors intracavity, one deformable turning mirror extracavity.

ORIGINATOR/KEY CONTACT:

Name: Thomas R. Ferguson or Guy T. Worth Phone: (505) 848-5000
Organization: The BDM Corporation
Address: 1801 Randolph Road S.E., Albuquerque, New Mexico 87106

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T) (U) General Unstable Resonator with Deformable Mirrors (Program GURDM), T. R. Ferguson et al, The BDM Corporation, BDM/TAC-79-193-TR, March 31, 1979.

STATUS:

Operational Currently?: Yes
Under Modification?: No
Purpose(s): _____

Ownership?: Government (AFWL/ALR).
Proprietary?: No

MACHINE/OPERATING SYSTEM (on which installed): CDC 6000, 7000, 176.

TRANSPORTABLE?: Yes

Machine Dependent Restrictions: CDC I/O, size restrictions.

SELF-CONTAINED?: _____

Other Codes Required (name, purpose): None

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec, CDC 7600)
Small Job:	_____	_____
Typical Job:	_____	_____
Large Job:	_____	_____

Approximate Number of FORTRAN Lines: _____

CODE NAME:

GURDM

OPTICS

BASIC TYPE (✓):
 Physical Optics: ✓ Geometrical: _____

FIELD (POLARIZATION) REPRESENTATION (✓):
 Scalar: ✓ Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):
 Compact Region: CY Annular Region: _____

TRANSVERSE GRID DIMENSIONALITY (✓):
 Compact Region:

1D	2D
✓	✓*

 Annular Region: _____

FIELD SYMMETRY RESTRICTIONS?: None

MIRROR SHAPE(S) ALLOWED (✓):
 Square: _____ Circular: ✓ Strip: _____
 Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):
 Fixed, Single Resonator Geometry: _____
 Fixed, Multiple Resonator Geometries: _____
 Modular, Multiple Resonator Geometries: ✓

PROPAGATION TECHNIQUE (✓ all that apply):

COMPACT	ANNULAR
✓	

Fresnel Integral Algorithms: _____
 With Kernel Averaging: _____
 Gaussian Quadrature: ✓
 Fast Fourier Transform (FFT): _____
 Fast Hankel Transform (FHT): _____
 Gardner-Fresnel-Kirchhoff (GFK): _____
 Other (specify): _____

CONVERGENCE TECHNIQUE (✓):
 Power Comparison: ✓ Field Comparison: _____
 Other: _____

ACCELERATION ALGORITHMS USED?: None
 Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM: (✓):
 Prony: _____
 Other: _____

RESONATOR TYPE (✓): Standing Wave: ✓
 Traveling Wave (Ring): _____ Reverse TW: _____

BRANCH (✓): Positive: ✓ Negative: ✓

OPTICAL ELEMENT MODELS INCLUDED (✓):
 Flat Mirrors: ✓ Spherical Mirrors: ✓
 Cylindrical Mirrors: _____ Telescopes: _____
 Scaper Mirrors: _____

Axicons

Waxicons	Reflaxicons

Arbitrary: _____
 Linear: _____
 Parabola-Parabola: _____
 Variable Cone Offset: _____
 Other (specify): _____

Deformable Mirrors: ✓
 Spatial Filters: _____ Gratings: _____
 Other Elements: _____

GAIN MODELS (✓): Bare Cavity Only: ✓
 Simple Saturated Gain: ✓ Detailed Gain: _____

BARE CAVITY FIELD MODIFIER MODELS (✓):
 Mirror Tilt: ✓ Decentration: ✓
 Aberrations/Thermal Distortions:
 Arbitrary: ✓
 Selected (specify): Shape set by Zernike coefficients input.
 Reflectivity Loss: _____
 Output Coupler Edges: Rolled: _____
 Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):
 Medium Index Variation: _____
 Gas Absorption: _____
 Overlapped Beams: _____
 Other: _____

FAR-FIELD MODELS (✓): Beam Steering Removal: ✓
 Optimal Focal Search: ✓ Beam Quality: ✓
 Other: External deformable mirror.

KINETICS

GAIN REGION MODELED (✓): None
 Compact Region: _____ Annular Region: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):
 Compact Region: _____ Annular Region: _____

KINETICS GRID DIMENSIONALITY (✓):

1D	2D	3D

 Compact Region: _____
 Annular Region: _____

GAIN REGION SYMMETRY RESTRICTIONS:
 Gain Vary Along Optic Axes?: _____ Flow Direction?: _____

PULSED: _____ CW: _____ KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):
 $\left\{ \begin{array}{l} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{array} \right\}$

✓	F	Cl	Br	I
H				
D				

 Cold (F + H₂): _____
 Hot (H + F₂): _____ Chain (F + H₂ & H + F₂): _____
 Other (specify): _____

ENERGY TRANSFER MODES MODELED (✓): Reference
 V-T: _____
 V-R: _____
 V-V: _____
 Other: _____

Single Line Model (✓): _____
 Multiline Model (✓): _____
 Assumed Rotational Population Distribution State (✓):
 Equilibrium: _____ Nonequilibrium: _____
 Number of Laser Lines Modeled: _____
 Source of Rate Coefficients Used in Code: _____

LINE PROFILE MODELS (✓):
 Doppler Broadening: _____
 Collisional Broadening: _____
 Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓): None
 Cylindrical, Radially Flowing: _____
 Rectangular, Linearly Flowing: _____
 Other: _____

COORDINATE SYSTEM: _____
 FLUID GRID DIMENSION (✓): 1D: _____ 2D: _____ 3D: _____

FLOW FIELD MODELED (✓):
 Laminar: _____ Turbulent: _____
 Other: _____

BASIC MODELING APPROACH (✓):
 Premixed: _____ Mixing: _____
 Other (specify): _____
 References for Approach Used: _____

THERMAL DRIVER MODELED (✓):
 Arc Heater: _____ Combustor: _____
 Shock Tube: _____ Resistance Heater: _____
 Other: _____

F-ATOM DISSOCIATION FROM (✓):
 F₂: _____ SF₆: _____
 Other (specify): _____

F-ATOM CONCENTRATION DETERMINED FROM MODEL?: _____

DILUENTS MODELED: _____

MODELS EFFECTS ON MIXING RATE DUE TO (✓):
 Nozzle Boundary Layers: _____ Shock Waves: _____
 Pre-reactions (thermal blockage): _____ Turbulence: _____
 Other (specify): _____

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):
 Media Index Variations: _____
 Other (specify): _____

*Azimuthal Fourier expansion.

CODE NAME:

HFGOPWR

CODE TYPE: Optics, Kinetics, and GasdynamicsPRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Calculational tool to study the performance of CW chemical lasers and the interaction with the gain medium.ASSESSMENT OF CAPABILITIES: Uses geometric optics and quasi-one-dimensional aerokinetics. Useful for parameter studies to indicate the importance of design parameters on laser performance.ASSESSMENT OF LIMITATIONS: Limited to HSURIA geometry only unless modified.OTHER UNIQUE FEATURES: Resonator geometries modeled: HSURIA, reflexicon beam compactors.

ORIGINATOR/KEY CONTACT:

Name: J. K. Hunting/T. T. Yang Phone: (213)884-2370Organization: RocketdyneAddress: 6633 Canoga Ave., Canoga Park, CaliforniaAVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T) Rocketdyne Internal Letter G-SL-77-509, October 5, 1977; (U) Rocketdyne Internal Letter G-0-78-937, January 24, 1978.

STATUS:

Operational Currently?: Yes

Under Modification?: _____

Purpose(s): _____

Ownership?: RocketdyneProprietary?: NoMACHINE/OPERATING SYSTEM (on which installed): CDC 176 NOS BE.TRANSPORTABLE?: NoMachine Dependent Restrictions: Uses CDC Fortran extended features, uses CDC LCM.

SELF-CONTAINED?: _____

Other Codes Required (name, purpose): DISSPLA Plot library.

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec. CDC 7600)
Small Job:	<u>16K/15K LCM</u>	<u>10 sec/iteration</u>
Typical Job:	<u>16K/15K LCM</u>	<u>10 sec/iteration</u>
Large Job:	<u>16K/15K LCM</u>	<u>10 sec/iteration</u>

Approximate Number of FORTRAN Lines: 3200

CODE NAME:

HFGOPWR

OPTICS

BASIC TYPE (✓):

Physical Optics: _____ Geometrical: ✓

FIELD (POLARIZATION) REPRESENTATION (✓):

Scalar: ✓ Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: CY Annular Region: CY

TRANSVERSE GRID DIMENSIONALITY (✓):

Compact Region:

Annular Region:

1D	2D

FIELD SYMMETRY RESTRICTIONS?: Axisymmetric

MIRROR SHAPE(S) ALLOWED (✓):

Square: _____ Circular: _____ Strip: _____

Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):

Fixed, Single Resonator Geometry: ✓

Fixed, Multiple Resonator Geometries: _____

Modular, Multiple Resonator Geometries: _____

PROPAGATION TECHNIQUE (✓) (✓) (all that apply):

Fresnel Integral Algorithms:

With Kernel Averaging

Gaussian Quadrature:

Fast Fourier Transform (FFT):

Fast Hankel Transform (FHT):

Gardner-Fresnel-Kirchhoff (GFK):

Other (specify): Geometric optics.

CONVERGENCE TECHNIQUE (✓):

Power Comparison: ✓ Field Comparison: _____

Other: _____

ACCELERATION ALGORITHMS USED?: No

Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):

Prony: _____

Other: _____

RESONATOR TYPE (✓): Standing Wave: ✓

Traveling Wave (Ring): _____ Reverse TW: _____

BRANCH (✓): Positive: ✓ Negative: _____

OPTICAL ELEMENT MODELS INCLUDED (✓):

Flat Mirrors: ✓ Spherical Mirrors: ✓

Cylindrical Mirrors: _____ Telescopes: ✓

Scraper Mirrors: _____

Axicons

Arbitrary:

Linear:

Parabola-Parabola:

Variable Cone Offset:

Other (specify): _____

Deformable Mirrors: _____

Spatial Filters: _____ Gratings: _____

Other Elements: _____

GAIN MODELS (✓): Bare Cavity Only: _____

Simple Saturated Gain: _____ Detailed Gain: ✓

BARE CAVITY FIELD MODIFIER MODELS (✓):

Mirror Tilt: _____ Decentration: _____

Aberrations/Thermal Distortions:

Arbitrary: _____

Selected (specify): _____

Reflectivity Loss: ✓

Output Coupler Edges: Rolled: _____

Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):

Medium Index Variation: _____

Gas Absorption: _____

Overlapped Beams: _____

Other: _____

FAR-FIELD MODELS (✓): Beam Steering Removal: _____

Optimal Focal Search: _____ Beam Quality: _____

Other: _____

KINETICS

GAIN REGION MODELED (✓):

Compact Region: _____ Annular Region: ✓

COORDINATE SYSTEM (Cartesian, cylindrical, etc.)

Compact Region: CY Annular Region: CY

KINETICS GRID DIMENSIONALITY (✓):

Compact Region:

Annular Region:

1D	2D	3D
✓		

GAIN REGION SYMMETRY RESTRICTIONS:

Gain Vary Along Optic Axes?: _____ Flow Direction?: _____

PULSED: _____ CW: _____ KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

 $X + Y_2 = YX + Y$ $Y + X_2 = YX + X$ Cold ($F + H_2$): _____Hot ($H + F_2$): ✓ Chain ($F + H_2 + H + F_2$): ✓

Other (specify): _____

ENERGY TRANSFER MODES MODELED (✓): Reference

v-T: ✓ Cohen

v-R: _____

v-v: ✓ Cohen

Other: _____

Single Line Model (✓): ✓

Multiline Model (✓): ✓

Assumed Rotational Population Distribution State (✓):

Equilibrium: ✓ Nonequilibrium: ✓

Number of Laser Lines Modeled: ≤ 12Source of Rate Coefficients Used in Code: Aerospace -N. Cohen

LINE PROFILE MODELS (✓):

Doppler Broadening: ✓

Collisional Broadening: ✓

Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓):

Cylindrical, Radially Flowing: ✓

Rectangular, Linearly Flowing: ✓

Other: _____

COORDINATE SYSTEM: cylindrical

FLUID GRID DIMENSION (✓): 1D: ✓ 2D: _____ 3D: _____

FLOW FIELD MODELED (✓):

Laminar: _____ Turbulent: _____

Other: Scheduled mixing.

BASIC MODELING APPROACH (✓):

Premixed: _____ Mixing: ✓

Other (specify): _____

References for Approach Used: ALOS Final Report

THERMAL DRIVER MODELED (✓):

Arc Heater: _____ Combustor: _____

Shock Tube: _____ Resistance Heater: _____

Other: Not modeled.

F-ATOM DISSOCIATION FROM (✓):

 F_2 : ✓ SF_6 : ✓Other (specify): NF₃

F-ATOM CONCENTRATION DETERMINED FROM MODEL?: *

DILUENTS MODELED: He, N₂

MODELS EFFECTS ON MIXING RATE DUE TO (✓):

Nozzle Boundary Layers: ✓ Shock Waves: _____

Prereactions (thermal blockage): _____ Turbulence: _____

Other (specify): Trip

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):

Media Index Variations: ✓

Other (specify): _____

*Uses equilibrium thermochemistry.

CODE NAME:

HFOX

CODE TYPE: KineticsPRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Predict oscillator and amplifier performance for Sandia Lab's hydrogen fluoride fusion laser program.ASSESSMENT OF CAPABILITIES: Can do HF pulsed oscillator and amplifier cases with longitudinal nonuniformities, plus volume-averaged oscillator calculations. Rotational nonequilibrium, hot-atom enhancement of hot and cold reaction rates, chain-terminating O₂ kinetics, amplified spontaneous emission, and transverse parasitic oscillations are allowed.ASSESSMENT OF LIMITATIONS: Initiation rate must be specified. Calculations which allow longitudinal nonuniformity require increasing amounts of computer time as pulse length increases. No optics in this code. Rotational relaxation limited to R-T. Difficult to add reactions to existing scheme.OTHER UNIQUE FEATURES: Hot-atom hot and cold rate enhancement; amplified spontaneous emission along optical axis included in amplifier calculations; amplifier input pulse detailed-spectral-time-history description allowed; transverse parasitic oscillations allowed in both oscillator and amplifier calculations.

ORIGINATOR/KEY CONTACT:

Name: James B. Moreno Phone: (505) 264-4259Organization: Sandia LaboratoriesAddress: 4212, Laser Projects Division, Kirtland AFB, New Mexico 87117AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (RP) AIAA paper 75-36 presented at AIAA 13th Aerospace Sciences Meeting, Pasadena, California, January 20, 1975, J. B. Moreno.

STATUS:

Operational Currently?: YesUnder Modification?: Not at present

Purpose(s): _____

Ownership?: Sandia Laboratories/D.O.E.Proprietary?: NoMACHINE/OPERATING SYSTEM (on which installed): CDC 7600TRANSPORTABLE?: Not very, since not documented.

Machine Dependent Restrictions: _____

SELF-CONTAINED?: Yes

Other Codes Required (name, purpose): _____

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec, CDC 7600)
Small Job:		180
Typical Job:	<u>All jobs same: 150K</u>	600
Large Job:		1200

Approximate Number of FORTRAN Lines: _____

CODE NAME:

HFOX

OPTICS

None

BASIC TYPE (✓): None

Physical Optics: _____ Geometrical: _____

FIELD (POLARIZATION) REPRESENTATION (✓):

Scalar: _____ Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: _____ Annular Region: _____

TRANSVERSE GRID DIMENSIONALITY (✓):

Compact Region:

1D	2D

Annular Region:

FIELD SYMMETRY RESTRICTIONS?: _____

MIRROR SHAPE(S) ALLOWED (✓):

Square: _____ Circular: _____ Strip: _____

Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):

Fixed, Single Resonator Geometries: _____

Fixed, Multiple Resonator Geometries: _____

Modular, Multiple Resonator Geometries: _____

PROPAGATION TECHNIQUE (✓ all that apply):

COMPACT ANNULAR

Fresnel Integral Algorithms:

With Kernel Averaging

Gaussian Quadrature:

Fast Fourier Transform (FFT):

Fast Hankel Transform (FHT):

Gardener-Fresnel-Kirchhoff (GFK):

Other (specify): _____

CONVERGENCE TECHNIQUE (✓):

Power Comparison: _____ Field Comparison: _____

Other: _____

ACCELERATION ALGORITHMS USED?:

Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):

Prony: _____

Other: _____

RESONATOR TYPE (✓): Standing Wave: _____

Traveling Wave (Ring): _____ Reverse TW: _____

BRANCH (✓): Positive: _____ Negative: _____

OPTICAL ELEMENT MODELS INCLUDED (✓):

Flat Mirrors: _____ Spherical Mirrors: _____

Cylindrical Mirrors: _____ Telescopes: _____

Scraper Mirrors: _____

Axicons

Arbitrary:

Linear:

Parabola-Parabola:

Variable Cone Offset:

Other (specify): _____

Deformable Mirrors: _____

Spatial Filters: _____ Gratings: _____

Other Elements: _____

Waxicons	Reflexicons

GAIN MODELS (✓): Bare Cavity Only: _____

Simple Saturated Gain: _____ Detailed Gain: _____

BARE CAVITY FIELD MODIFIER MODELS (✓):

Mirror Tilt: _____ Decentration: _____

Abserrations/Thermal Distortions:

Arbitrary: _____

Selected (specify): _____

Reflectivity Loss: _____

Output Coupler Edges: Rolled: _____

Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):

Medium Index Variation: _____

Gas Absorption: _____

Overlapped Beams: _____

Other: _____

FAR-FIELD MODELS (✓): Beam Steering Removal: _____

Optimal Focal Search: _____ Beam Quality: _____

Other: _____

KINETICS

GAIN REGION MODELED (✓):

Compact Region: _____ Annular Region: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: _____ Annular Region: _____

KINETICS GRID DIMENSIONALITY (✓):

Compact Region:

1D	2D	3D

Annular Region:

GAIN REGION SYMMETRY RESTRICTIONS:

Gain Vary Along Optic Axes?: Flow Direction?: _____

PULSED: CW: _____ KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

$$\begin{cases} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{cases}$$

Cold (F + H₂):

Hot (H + F₂): Chain (F + H₂ & H + F₂):

Other (specify): _____

X	F	Cl	Br	I
H	<input checked="" type="checkbox"/>			
D	<input checked="" type="checkbox"/>			

ENERGY TRANSFER MODES MODELED (✓): Reference

V-T: Aerospace Corp. compilations.

V-R: _____

V-V: Aerospace Corp. compilations.

Other: _____

Single Line Model (✓): _____

Multiline Model (✓):

Assumed Rotational Population Distribution State (✓):

Equilibrium: _____ Nonequilibrium:

Number of Laser Lines Modeled: 77*

Source of Rate Coefficients Used in Code: Aerospace Corp.

LINE PROFILE MODELS (✓):

Doppler Broadening:

Collisional Broadening:

Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓): None

Cylindrical, Radially Flowing: _____

Rectangular, Linearly Flowing: _____

Other: _____

COORDINATE SYSTEM: _____

FLUID GRID DIMENSION (✓): 1D: _____ 2D: _____ 3D: _____

FLOW FIELD MODELED (✓):

Laminar: _____ Turbulent: _____

Other: _____

BASIC MODELING APPROACH (✓):

Premixed: _____ Mixing: _____

Other (specify): _____

References for Approach Used: _____

THERMAL DRIVER MODELED (✓):

Arc Heater: _____ Combustor: _____

Shock Tube: _____ Resistance Heater: _____

Other: _____

F-ATOM DISSOCIATION FROM (✓):

F₂: _____ SF₆: _____

Other (specify): _____

F-ATOM CONCENTRATION DETERMINED FROM MODEL?: _____

DILUENTS MODELED: _____

MODELS EFFECTS ON MIXING RATE DUE TO (✓):

Nozzle Boundary Layers: _____ Shock Waves: _____

Prereactions (thermal blockage): _____ Turbulence: _____

Other (specify): _____

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):

Media Index Variations: _____

Other (specify): _____

*Variable dimension code.

CODE NAME:

IPAGOS

CODE TYPE: Optics

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Interactive version of POLYPAGOS; conduct geometric ray trace analysis of general optical systems; code subroutines can design nonlinear beam compactors of reflexicon, waxicon, and noneverting waxicon designs.

ASSESSMENT OF CAPABILITIES: Code can produce OPD and spot diagrams through systems containing spheres, conics, torics, diffraction gratings, axicons, and corner cubes. Code can take Fourier transform of field at output plane and generate far-field energy distributions. Can handle up to two deformable mirrors. Will map movement of a ray via multiple passes.

ASSESSMENT OF LIMITATIONS: Has no physical optics capability internal to optical train; does not model resonators by iterative solution techniques.

OTHER UNIQUE FEATURES: Resonator geometries modeled: HSURIA, compact unstable confocal, unstable P-P waxicon/linear waxicon negative branch ring with spatial filter.

ORIGINATOR/KEY CONTACT:

Name: D. Mansell/C. Barnard/Kemp* Phone: (505) 848-5000
Organization: The BDM Corporation
Address: 1801 Randolph Road, S.E., Albuquerque, New Mexico 87106

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication); (T) "POLYPAGOS" Aerospace Report TR-0059(6311)-1; (T) "Beam Compressor Design and Fabrication Program," AFWL-TR-78-77; (T) "Geometry Ray Analyses of HSURIA Prototypes," BDM/TAC-79-151-TR; (U) POLYPAGOS Users Manual, Aerospace TR-0172(2311)-1; (U) AFWL-TR-78-77.

STATUS:

Operational Currently?: Yes
Under Modification?: No
Purpose(s): _____

Ownership?: AFWL
Proprietary?: No

MACHINE/OPERATING SYSTEM (on which installed): CDC 6600/7600

TRANSPORTABLE?: Yes

Machine Dependent Restrictions: Requires overlaying.

SELF-CONTAINED?: Yes

Other Codes Required (name, purpose): _____

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec. CDC 7600)
Small Job:		
Typical Job:	<u>120K</u>	<u>1 sec</u>
Large Job:		
Approximate Number of FORTRAN Lines: <u>8300</u>		

* TRW/DSSG, 1 Space Park, Redondo Beach, California

CODE NAME:

IPAGOS

OPTICS

BASIC TYPE (√):

Physical Optics: _____ Geometrical:

FIELD (POLARIZATION) REPRESENTATION (√):

Scalar: _____ Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: Ca Annular Region: Ca

TRANSVERSE GRID DIMENSIONALITY (√):

Compact Region: _____

Annular Region: _____

1D	2D
	<input checked="" type="checkbox"/>
	<input checked="" type="checkbox"/>

FIELD SYMMETRY RESTRICTIONS?: _____

MIRROR SHAPE(S) ALLOWED (√):

Square: Circular: Strip:

Rectangular: Elliptical: Arbitrary: No

CONFIGURATION FLEXIBILITY (√):

Fixed, Single Resonator Geometries: _____

Fixed, Multiple Resonator Geometries: _____

Modular, Multiple Resonator Geometries:

PROPAGATION TECHNIQUE (√ all that apply):

Fresnel Integral Algorithms:

With Kernel Averaging

Gaussian Quadrature:

Fast Fourier Transform (FFT):

Fast Hankel Transform (FHT):

Gardner-Fresnel-Kirchhoff (GFK):

Other (specify): _____

COMPACT	ANNULAR
<input type="checkbox"/>	<input type="checkbox"/>

CONVERGENCE TECHNIQUE (√):

Power Comparison: _____ Field Comparison: _____

Other: _____

ACCELERATION ALGORITHMS USED?: _____

Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (√):

Prony: _____

Other: _____

RESONATOR TYPE (√): Standing Wave:

Traveling Wave (Ring): Reverse TW:

BRANCH (√): Positive: Negative:

OPTICAL ELEMENT MODELS INCLUDED (√):

Flat Mirrors: Spherical Mirrors:

Cylindrical Mirrors: Telescopes:

Scraper Mirrors:

Axicons

Arbitrary: _____

Linear: _____

Parabola-Parabola: _____

Variable Cone Offset: _____

Other (specify): Noneverting

Deformable Mirrors: _____

Spatial Filters: _____ Gratings: _____

Other Elements: Torics

Corner cubes

	Waxicons	Reflexicons
Arbitrary:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Linear:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Parabola-Parabola:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Variable Cone Offset:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Other (specify):	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

GAIN MODELS (√): Bare Cavity Only:

Simple Saturated Gain: _____ Detailed Gain: _____

BARE CAVITY FIELD MODIFIER MODELS (√):

Mirror Tilt: Decentration:

Aberrations/Thermal Distortions:

Arbitrary: _____

Selected (specify): _____

Reflectivity Loss: _____

Output Coupler Edges: Rolled: _____

Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (√):

Medium Index Variation: _____

Gas Absorption: _____

Overlapped Beams: _____

Other: _____

FAR-FIELD MODELS (√): Beam Steering Removal: _____

Optimal Focal Search: _____ Beam Quality:

Other: Isometric plotting

KINETICS

GAIN REGION MODELED (√): None

Compact Region: _____ Annular Region: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: _____ Annular Region: _____

KINETICS GRID DIMENSIONALITY (√):

Compact Region: _____

Annular Region: _____

1D	2D	3D

GAIN REGION SYMMETRY RESTRICTIONS:

Gain Vary Along Optic Axes?: _____ Flow Direction?: _____

PULSED: _____ CW: _____ KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (√):

$$\begin{cases} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{cases}$$

Cold (F + H₂): _____

Hot (H + F₂): _____ Chain (F + H₂ & H + F₂): _____

Other (specify): _____

X	F	Cl	Br	I
H				
D				

ENERGY TRANSFER MODES MODELED (√): Reference

V-T: _____

V-R: _____

V-V: _____

Other: _____

Single Line Model (√): _____

Multiline Model (√): _____

Assumed Rotational Population Distribution State (√):

Equilibrium: _____ Nonequilibrium: _____

Number of Laser Lines Modeled: _____

Source of Rate Coefficients Used in Code: _____

LINE PROFILE MODELS (√):

Doppler Broadening: _____

Collisional Broadening: _____

Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (√): None

Cylindrical, Radially Flowing: _____

Rectangular, Linearly Flowing: _____

Other: _____

COORDINATE SYSTEM:

FLUID GRID DIMENSION (√): 1D: _____ 2D: _____ 3D: _____

FLOW FIELD MODELED (√):

Laminar: _____ Turbulent: _____

Other: _____

BASIC MODELING APPROACH (√):

Premixed: _____ Mixing: _____

Other (specify): _____

References for Approach Used: _____

THERMAL DRIVER MODELED (√):

Arc Heater: _____ Combustor: _____

Shock Tube: _____ Resistance Heater: _____

Other: _____

F-ATOM DISSOCIATION FROM (√):

F₂: _____ SF₆: _____

Other (specify): _____

F-ATOM CONCENTRATION DETERMINED FROM MODEL?: _____

DILUENTS MODELED: _____

MODELS EFFECTS ON MIXING RATE DUE TO (√):

Nozzle Boundary Layers: _____ Shock Waves: _____

Preactions (thermal blockage): _____ Turbulence: _____

Other (specify): _____

MODELS EFFECTS ON OPTICAL MODES DUE TO (√):

Media Index Variations: _____

Other (specify): _____

CODE NAME:

KBLIMP

CODE TYPE: GasdynamicsPRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Boundary layer analysis. Nonequilibrium Chemistry (KINETIC) Boundary Layer Integral Matrix Program (KBLIMP).ASSESSMENT OF CAPABILITIES: Treats laminar and turbulent flows. Multicomponent and chemically reacting flows (including wall recombination) are analyzed.ASSESSMENT OF LIMITATIONS: Must predetermine pressure gradient.

OTHER UNIQUE FEATURES: _____

ORIGINATOR/KEY CONTACT:

Name: H. Tong/ A.C. Buckingham/H.L. Morse Phone: (415) 964-3200Organization: Aerotherm Division of ACUREXAddress: Mountain View, CaliforniaAVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T) Nonequilibrium Chemistry Boundary Layer Integral Matrix Procedure, Aerotherm Report, UM7367. July 1973.

STATUS:

Operational Currently?: Yes

Under Modification?: _____

Purpose(s): _____

Ownership?: Industry-wide code.Proprietary?: NoMACHINE/OPERATING SYSTEM (on which installed): CDC 6600/7600TRANSPORTABLE?: Yes

Machine Dependent Restrictions: _____

SELF-CONTAINED?: NoOther Codes Required (name, purpose): Codes required to generate pressure distribution.

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec, CDC 7600)
Small Job:	<u>120K</u>	<u>300</u>
Typical Job:	<u>120K</u>	<u>1000</u>
Large Job:	<u>120K</u>	<u>2000</u>

Approximate Number of FORTRAN Lines: 14000

CODE NAME:

KBLIMP

OPTICS

None

BASIC TYPE (✓): None

Physical Optics: _____ Geometrical: _____

FIELD (POLARIZATION) REPRESENTATION (✓):

Scalar: _____ Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: _____ Annular Region: _____

TRANSVERSE GRID DIMENSIONALITY (✓):

1D	2D

Compact Region:

Annular Region:

FIELD SYMMETRY RESTRICTIONS?: _____

MIRROR SHAPE(S) ALLOWED (✓):

Square: _____ Circular: _____ Strip: _____

Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):

Fixed, Single Resonator Geometry: _____

Fixed, Multiple Resonator Geometries: _____

Modular, Multiple Resonator Geometries: _____

PROPAGATION TECHNIQUE (✓) (all that apply): COMPACT ANNULAR

Fresnel Integral Algorithms:

With Kernel Averaging

Gaussian Quadrature:

Fast Fourier Transform (FFT):

Fast Hankel Transform (FHT):

Gardner-Fresnel-Kirchoff (GFK):

Other (specify): _____

CONVERGENCE TECHNIQUE (✓):

Power Comparison: _____ Field Comparison: _____

Other: _____

ACCELERATION ALGORITHMS USED?: _____

Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):

Prony: _____

Other: _____

RESONATOR TYPE (✓): Standing Wave: _____

Traveling Wave (Ring): _____ Reverse TW: _____

BRANCH (✓): Positive: _____ Negative: _____

OPTICAL ELEMENT MODELS INCLUDED (✓):

Flat Mirrors: _____ Spherical Mirrors: _____

Cylindrical Mirrors: _____ Telescopes: _____

Scraper Mirrors: _____

Axicons

Arbitrary:

Linear:

Parabola-Parabola:

Variable Cone Offset:

Other (specify): _____

Deformable Mirrors: _____

Spatial Filters: _____ Gratings: _____

Other Elements: _____

Waxicons	Reflexicons

GAIN MODELS (✓): Bare Cavity Only: _____

Simple Saturated Gain: _____ Detailed Gain: _____

BARE CAVITY FIELD MODIFIER MODELS (✓):

Mirror Tilt: _____ Decentration: _____

Aberrations/Thermal Distortions:

Arbitrary: _____

Selected (specify): _____

Reflectivity Loss: _____

Output Coupler Edges: Rolled: _____

Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):

Medium Index Variation: _____

Gas Absorption: _____

Overlapped Beams: _____

Other: _____

FAR-FIELD MODELS (✓): Beam Steering Removal: _____

Optimal Focal Search: _____ Beam Quality: _____

Other: _____

KINETICS

GAIN REGION MODELED (✓): None

Compact Region: _____ Annular Region: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: _____ Annular Region: _____

KINETICS GRID DIMENSIONALITY (✓):

1D	2D	3D

Compact Region:

Annular Region:

GAIN REGION SYMMETRY RESTRICTIONS:

Gain Vary Along Optic Axes: _____ Flow Direction: _____

PULSED: _____ CW: _____ KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

$$\begin{cases} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{cases}$$

X	F	Cl	Br	I
H				
D				

Cold (F + H₂): _____

Hot (H + F₂): _____ Chain (F + H₂ & H + F₂): _____

Other (specify): _____

ENERGY TRANSFER MODES MODELED (✓): Reference

V-T: _____

V-R: _____

V-V: _____

Other: _____

Single Line Model (✓): _____

Multiline Model (✓): _____

Assumed Rotational Population Distribution State (✓):

Equilibrium: _____ Nonequilibrium: _____

Number of Laser Lines Modeled: _____

Source of Rate Coefficients Used in Code: _____

LINE PROFILE MODELS (✓):

Doppler Broadening: _____

Collisional Broadening: _____

Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓):

Cylindrical, Radially Flowing: ✓

Rectangular, Lineary Flowing: ✓

Other: _____

COORDINATE SYSTEM: General

FLUID GRID DIMENSION (✓): 1D: _____ 2D: ✓ 3D: _____

FLOW FIELD MODELED (✓):

Laminar: ✓ Turbulent: ✓

Other: _____

BASIC MODELING APPROACH (✓):

Premixed: _____ Mixing: ✓

Other (specify): _____

References for Approach Used: _____

THERMAL DRIVER MODELED (✓):

Arc Heater: _____ Combustor: _____

Shock Tube: _____ Resistance Heater: _____

Other: _____

F-ATOM DISSOCIATION FROM (✓):

F₂: ✓ SF₆: _____

Other (specify): _____

F-ATOM CONCENTRATION DETERMINED FROM MODEL: Yes

DILUENTS MODELED: He, N₂, etc.

MODELS EFFECTS ON MIXING RATE DUE TO (✓):

Nozzle Boundary Layers: ✓ Shock Waves: _____

Preactions (thermal blockage): _____ Turbulence: ✓

Other (specify): Laminar

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):

Media Index Variations: _____

Other (specify): _____

CODE NAME:

LAPU-2

CODE TYPE: Optics codePRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Calculation of the propagation of a short pulse down a chain of laser amplifiers and absorbers including diffraction effects; cylindrical symmetry assumed.ASSESSMENT OF CAPABILITIES: Calculates the temporal and spatial evolution of a short pulse due to nonlinear amplification and diffraction from circular apertures and lenses; includes laser kinetics appropriate for modeling of CO₂ and Nd: glass laser systems.ASSESSMENT OF LIMITATIONS: Cylindrical geometry assumed; is not designed for oscillator calculations.OTHER UNIQUE FEATURES: Models unstable and hole-coupled stable confocal resonators.

ORIGINATOR/KEY CONTACT:

Name: John C. Coldstein and D.O. Dickman Phone: (505) 667-7281
Organization: Los Alamos Scientific Laboratory, Group X-1, MS-531
Address: Los Alamos, New Mexico 87545AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T) (U) LAPU-2: A Laser Pulse Propagation Code With Diffraction, Los Alamos report LA-6955.

STATUS:

Operational Currently?: YesUnder Modification?: No

Purpose(s): _____

Ownership?: Los Alamos Scientific LaboratoryProprietary?: NoMACHINE/OPERATING SYSTEM (on which installed): CDC 7600/LTSSTRANSPORTABLE?: NoMachine Dependent Restrictions: Uses storage scheme of 7600 and relies on some aspects of LTSS operating system.SELF-CONTAINED?: Yes

Other Codes Required (name, purpose): _____

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec. CDC 7600)
Small Job:		
Typical Job:	<u>58K (decimal)</u>	<u>10 minutes</u>
Large Job:		
Approximate Number of FORTRAN Lines: <u>2000</u>		

CODE NAME:

LAPU-2

OPTICS

BASIC TYPE (✓):
 Physical Optics: ✓ Geometrical: _____

FIELD (POLARIZATION) REPRESENTATION (✓):
 Scalar: ✓ Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):
 Compact Region: _____ Annular Region: CY

TRANSVERSE GRID DIMENSIONALITY (✓):
 Compact Region:

1D	2D
✓	

 Annular Region: _____

FIELD SYMMETRY RESTRICTIONS: cylindrical

MIRROR SHAPE(S) ALLOWED (✓):
 Square: _____ Circular: ✓ Strip: _____
 Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):
 Fixed, Single Resonator Geometries: _____
 Fixed, Multiple Resonator Geometries: _____
 Modular, Multiple Resonator Geometries: ✓

PROPAGATION TECHNIQUE (✓ all that apply):

COMPACT	ANNULAR

Fresnel Integral Algorithms: _____
 With Kernel Averaging: _____
 Gaussian Quadrature: _____
 Fast Fourier Transform (FFT): _____
 Fast Hankel Transform (FHT): _____
 Gardener-Fresnel-Kirchhoff (GFK): _____
 Other (specify): Numerical scheme devised by B. R. Suydam, LASL.

CONVERGENCE TECHNIQUE (✓):
 Power Comparison: _____ Field Comparison: _____
 Other: _____

ACCELERATION ALGORITHMS USED?: _____
 Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM: (✓):
 Prony: _____
 Other: _____

RESONATOR TYPE (✓): Standing Wave: _____
 Traveling Wave (Ring): ✓ Reverse TW: _____

BRANCH (✓): Positive: _____ Negative: _____

OPTICAL ELEMENT MODELS INCLUDED (✓):
 Flat Mirrors: ✓ Spherical Mirrors: ✓
 Cylindrical Mirrors: ✓ Telescopes: ✓
 Scraper Mirrors: _____

Waxicons	Reflexicons

Axicons: _____
 Arbitrary: _____
 Linear: _____
 Parabola-Parabola: _____
 Variable Cone Offset: _____
 Other (specify): _____

Deformable Mirrors: _____
 Spatial Filters: ✓ Gratings: _____
 Other Elements: _____

GAIN MODELS (✓): Bare Cavity Only: _____
 Simple Saturated Gain: _____ Detailed Gain: ✓

BARE CAVITY FIELD MODIFIER MODELS (✓):
 Mirror Tilt: _____ Deconcentration: _____
 Aberrations/Thermal Distortions: _____
 Arbitrary: _____
 Selected (specify): _____
 Reflectivity Loss: ✓ _____
 Output Coupler Edges: Rolled: _____
 Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):
 Medium Index Variation: _____
 Gas Absorption: ✓ _____
 Overlapped Beams: _____
 Other: _____

FAR-FIELD MODELS (✓): Beam Steering Removal: _____
 Optimal Focal Search: _____ Beam Quality: ✓
 Other: _____

KINETICS

GAIN REGION MODELED (✓): None
 Compact Region: _____ Annular Region: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.)
 Compact Region: _____ Annular Region: _____

KINETICS GRID DIMENSIONALITY (✓):
 Compact Region:

1D	2D	3D

 Annular Region: _____

GAIN REGION SYMMETRY RESTRICTIONS:
 Gain Vary Along Optic Axes: _____ Flow Direction?: _____

PULSED: _____ CW: _____ KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):
 $\left\{ \begin{array}{l} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{array} \right\}$
 Cold (F + H₂): _____
 Hot (H + F₂): _____ Chain (F + H₂ & H + F₂): _____
 Other (specify): _____

X	F	Cl	Br	I
H				
D				

ENERGY TRANSFER MODES MODELED (✓): Reference
 V-T: _____
 V-R: _____
 V-V: _____
 Other: _____

Single Line Model (✓): _____
 Multiline Model (✓): _____
 Assumed Rotational Population Distribution State (✓):
 Equilibrium: _____ Nonequilibrium: _____
 Number of Laser Lines Modeled: _____
 Source of Rate Coefficients Used in Code: _____

LINE PROFILE MODELS (✓):
 Doppler Broadening: _____
 Collisional Broadening: _____
 Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓): None
 Cylindrical, Radially Flowing: _____
 Rectangular, Linearly Flowing: _____
 Other: _____

COORDINATE SYSTEM: _____

FLUID GRID DIMENSION (✓): 1D: _____ 2D: _____ 3D: _____
 FLOW FIELD MODELED (✓):
 Laminar: _____ Turbulent: _____
 Other: _____

BASIC MODELING APPROACH (✓):
 Premixed: _____ Mixing: _____
 Other (specify): _____
 References for Approach Used: _____

THERMAL DRIVER MODELED (✓):
 Arc Heater: _____ Combustor: _____
 Shock Tube: _____ Resistance Heater: _____
 Other: _____

F-ATOM DISSOCIATION FROM (✓):
 F₂: _____ SF₆: _____
 Other (specify): _____

F-ATOM CONCENTRATION DETERMINED FROM MODEL: _____
 DILUENTS MODELED: _____

MODELS EFFECTS ON MIXING RATE DUE TO (✓):
 Nozzle Boundary Layers: _____ Shock Waves: _____
 Prereactions (thermal blockage): _____ Turbulence: _____
 Other (specify): _____

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):
 Media Index Variations: _____
 Other (specify): _____

CODE NAME:

LOADPL

CODE TYPE: Optics

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: (3-D Loaded Cavity Code with Analytical Gain) The purpose is to model some of the 3-D phenomenology associated with half symmetric unstable resonator with internal axicon (HSURIA) with a radially flowing gain medium; performance predictions for power extraction and beam quality; set/verify design requirements.

ASSESSMENT OF CAPABILITIES: Capable of evaluating any general HSURIA w/reflaxicon. Analytical gain model. General field modifier, mirror misalignment, misfigure, thermal distortion, struts.

ASSESSMENT OF LIMITATIONS: Half plane symmetry, restricted to HSURIA axisymmetric or 3-dimensional calculations.

OTHER UNIQUE FEATURES: General field modifier with deformable mirrors to correct for any aberration.

ORIGINATOR/KEY CONTACT:

Name: Alexander M. Simonoff Phone: (213) 884-3346Organization: Rocketdyne, Laser OpticsAddress: 6633 Canoga Ave., Canoga Park, California

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T) (U) Simplified 3-D loaded cavity resonator code-November 1978, G-0-78-1123; see also bare cavity code.

STATUS:

Operational Currently?: YesUnder Modification?: No

Purpose(s): _____

Ownership?: AFWLProprietary?: NoMACHINE/OPERATING SYSTEM (on which installed): CDC Cyber 176TRANSPORTABLE?: Yes (with modification)Machine Dependent Restrictions: Uses CDC extended core.

SELF-CONTAINED?: No, resonator geometry systems code (for other than PP reflaxicon) 3-D fairfield code.

Other Codes Required (name, purpose): _____

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec. CDC 7600)
Small Job:	< 250K	300-600
Typical Job:	< 250K	1500 Octal sec
Large Job:	< 250K	5000 CDC 176

Approximate Number of FORTRAN Lines: _____

CODE NAME:

LOADPL

OPTICS

BASIC TYPE (✓):

Physical Optics: ✓ Geometrical: _____

FIELD (POLARIZATION) REPRESENTATION (✓):

Scalar: ✓ Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: CY Annular Region: CY

TRANSVERSE GRID DIMENSIONALITY (✓):

Compact Region:

Annular Region:

1D	2D
	✓
	✓

FIELD SYMMETRY RESTRICTIONS?: _____

MIRROR SHAPE(S) ALLOWED (✓):

Square: _____ Circular: ✓ Strip: _____

Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):

Fixed, Single Resonator Geometry: _____

Fixed, Multiple Resonator Geometries: ✓

Modular, Multiple Resonator Geometries: _____

PROPAGATION TECHNIQUE (✓/all that apply):

Fresnel Integral Algorithms:

With Kernel Averaging

Gaussian Quadrature:

Fast Fourier Transform (FFT):

Fast Hankel Transform (FHT):

Gardner-Fresnel-Kirchoff (GFK):

Other (specify): _____

COMPACT	ANNULAR
	✓
✓	✓
✓	

CONVERGENCE TECHNIQUE (✓):

Power Comparison: ✓ Field Comparison: _____

Other: _____

ACCELERATION ALGORITHMS USED?: Yes

Technique: Gain convergence algorithm.

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):

Prony: _____

Other: _____

RESONATOR TYPE (✓): Standing Wave: ✓

Traveling Wave (Ring): _____ Reverse TW: _____

BRANCH (✓): Positive: ✓ Negative: _____

OPTICAL ELEMENT MODELS INCLUDED (✓):

Flat Mirrors: ✓ Spherical Mirrors: ✓

Cylindrical Mirrors: _____ Telescopes: _____

Scraper Mirrors: ✓

Axicons

Arbitrary:

Linear:

Parabola-Parabola:

Variable Cone Offset:

Other (specify): P-P tank

Deformable Mirrors: ✓

Spatial Filters: _____ Gratings: _____

Other Elements: Corner cube (by using general field modifier to model).

Waxicons	Reflexicons
✓	✓
✓	✓
	✓
	✓

GAIN MODELS (✓): Bare Cavity Only: _____

Simple Saturated Gain: ✓ Detailed Gain: ✓

BARE CAVITY FIELD MODIFIER MODELS (✓):

Mirror Tilt: ✓ Decentration: ✓

Aberrations/Thermal Distortions:

Arbitrary: _____

Selected (specify): Irradiance mapping, bowing, HEX heating.

Reflectivity Loss: ✓

Output Coupler Edges: Rolled: _____

Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):

Medium Index Variation: _____

Gas Absorption: _____

Overlapped Beams: _____

Other: Apertures

FAR-FIELD MODELS (✓): Beam Steering Removal: ✓

Optimal Focal Search: ✓ Beam Quality: ✓

Other: _____

KINETICS

GAIN REGION MODELED (✓): None

Compact Region: _____ Annular Region: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: _____ Annular Region: _____

KINETICS GRID DIMENSIONALITY (✓):

Compact Region:

Annular Region:

1D	2D	3D

GAIN REGION SYMMETRY RESTRICTIONS:

Gain Vary Along Optic Axes?: _____ Flow Direction?: _____

PULSED: _____ CW: _____ KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

$$\begin{cases} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{cases}$$

Cold (F + H₂): _____

Hot (H + F₂): _____ Chain (F + H₂ & H + F₂): _____

Other (specify): _____

ENERGY TRANSFER MODES MODELED (✓): Reference

V-T: _____

V-R: _____

V-V: _____

Other: _____

Single Line Model (✓): _____

Multiline Model (✓): _____

Assumed Rotational Population Distribution State (✓):

Equilibrium: _____ Nonequilibrium: _____

Number of Laser Lines Modeled: _____

Source of Rate Coefficients Used in Code: _____

LINE PROFILE MODELS (✓):

Doppler Broadening: _____

Collisional Broadening: _____

Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓): None

Cylindrical, Radially Flowing: _____

Rectangular, Linearly Flowing: _____

Other: _____

COORDINATE SYSTEM: _____

FLUID GRID DIMENSIONALITY (✓): 1D: _____ 2D: _____ 3D: _____

FLOW FIELD MODELED (✓):

Laminar: _____ Turbulent: _____

Other: _____

BASIC MODELING APPROACH (✓):

Premixed: _____ Mixing: _____

Other (specify): _____

References for Approach Used: _____

THERMAL DRIVER MODELED (✓):

Arc Heater: _____ Combustor: _____

Shock Tube: _____ Resistance Heater: _____

Other: _____

F-ATOM DISSOCIATION FROM (✓):

F₂: _____ SF₆: _____

Other (specify): _____

F-ATOM CONCENTRATION DETERMINED FROM MODEL?: _____

DILUENTS MODELED: _____

MODELS EFFECTS ON MIXING RATE DUE TO (✓):

Nozzle Boundary Layers: _____ Shock Waves: _____

Preactions (thermal blockage): _____ Turbulence: _____

Other (specify): _____

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):

Media Index Variations: _____

Other (specify): _____

CODE NAME:

LS-14RGS*

CODE TYPE: Optics

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Performs an exact ray trace analysis in order to determine the geometric configuration of a HSURIA type laser optical resonator with a ray distributing reflexicon beam compactor assembly. Provides geometry data to wave optics HSURIA codes.

ASSESSMENT OF CAPABILITIES: Capable of synthesizing HSURIA resonators with: (1) parabolic-parabolic; (2) Uniform-Gaussian; (3) Uniform-Lorenzian; (4) P-P TANH redistributing reflexicon beam compactors. Computes OPDs introduced by the beam compactor. Determines optimum feedback mirror configuration.

ASSESSMENT OF LIMITATIONS: Restricted to HSURIA with nonpowered rear element and to reflexicon beam compactors.

OTHER UNIQUE FEATURES: Resonator Geometries Modeled: HSURIA, reflexicon beam compactors. Determines aberration due to beam compactor and transfers data to wave optics codes.

ORIGINATOR/KEY CONTACT:
Name: Victor L. Gamiz Phone: (213) 884-3346
Organization: Rocketdyne, Laser Optics
Address: 6633 Canoga Ave., Canoga Park, California (91304)

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T) Resonator Geometry Synthesis Code Requirements (V. L. Gamiz); Incorporate General Resonator into Ray Trace Code (W. H. Southwell); Surface Optimization Algorithms and Equations (W. H. Southwell); Equations for Wave Optics Code Parameters (V. L. Gamiz); (U) Resonator Geometry Synthesis Code Development (L. R. Stidham).

STATUS:
Operational Currently?: Yes
Under Modification?: No
Purpose(s): _____

Ownership?: AFWL
Proprietary?: No

MACHINE/OPERATING SYSTEM (on which installed): CDC Cyber 176, 6600

TRANSPORTABLE?: Yes
Machine Dependent Restrictions: None

SELF-CONTAINED?: _____
Other Codes Required (name, purpose): None

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec. CDC 7600)
Small Job:	<u>70K</u>	<u>20</u>
Typical Job:	_____	_____
Large Job:	_____	_____

Approximate Number of FORTRAN Lines: 1500

*LS-14 Resonator Geometry Synthesizer

CODE NAME:

LS-14RGS

OPTICS

BASIC TYPE (✓):

Physical Optics: _____ Geometrical:

FIELD (POLARIZATION) REPRESENTATION (✓):

Scalar: _____ Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: CY Annular Region: CY

TRANSVERSE GRID DIMENSIONALITY (✓):

Compact Region:

Annular Region:

1D	2D
	<input checked="" type="checkbox"/>
	<input checked="" type="checkbox"/>

FIELD SYMMETRY RESTRICTIONS?: Meridional

MIRROR SHAPE(S) ALLOWED (✓):

Square: _____ Circular: Strip: _____

Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):

Fixed, Single Resonator Geometry:

Fixed, Multiple Resonator Geometries: _____

Modular, Multiple Resonator Geometries: _____

PROPAGATION TECHNIQUE (✓ all that apply):

Fresnel Integral Algorithms:

With Kernel Averaging

Gaussian Quadrature:

Fast Fourier Transform (FFT):

Fast Hankel Transform (FHT):

Gardener-Fresnel-Kirchhoff (GFK):

Other (specify): Ray trace

COMPACT	ANNULAR
<input type="checkbox"/>	<input type="checkbox"/>

CONVERGENCE TECHNIQUE (✓): N/A

Power Comparison: _____ Field Comparison: _____

Other: _____

ACCELERATION ALGORITHMS USED?: _____

Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):

Prony: N/A

Other: _____

RESONATOR TYPE (✓): Standing Wave: N/A

Traveling Wave (Ring): _____ Reverse TW: _____

BRANCH (✓): Positive: Negative: _____

OPTICAL ELEMENT MODELS INCLUDED (✓):

Flat Mirrors: Spherical Mirrors:

Cylindrical Mirrors: _____ Telescopes:

Scaper Mirrors: _____

Axicons

Arbitrary:

Linear:

Parabola-Parabola:

Variable Cone Offset:

Other (specify): PPTANH

Deformable Mirrors: _____

Spatial Filters: _____ Gratings: _____

Other Elements: _____

Waxicons	Reflexicons
	<input checked="" type="checkbox"/>
	<input checked="" type="checkbox"/>
	<input checked="" type="checkbox"/>

GAIN MODELS (✓): Bare Cavity Only: N/A

Simple Saturated Gain: _____ Detailed Gain: _____

BARE CAVITY FIELD MODIFIER MODELS (✓): N/A

Mirror Tilt: _____ Decentration: _____

Aberrations/Thermal Distortions:

Arbitrary: _____

Selected (specify): _____

Reflectivity Loss: _____

Output Coupler Edges: Rolled: _____

Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓): N/A

Medium Index Variation: _____

Gas Absorption: _____

Overlapped Beams: _____

Other: _____

FAR-FIELD MODELS (✓): Beam Steering Removal: N/A

Optimal Focal Search: _____ Beam Quality: _____

Other: _____

KINETICS

GAIN REGION MODELED (✓): None

Compact Region: _____ Annular Region: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: _____ Annular Region: _____

KINETICS GRID DIMENSIONALITY (✓):

Compact Region:

Annular Region:

1D	2D	3D

GAIN REGION SYMMETRY RESTRICTIONS:

Gain Vary Along Optic Axes?: _____ Flow Direction?: _____

PULSED: _____ CW: _____ KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

$$\left\{ \begin{array}{l} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{array} \right\}$$

Cold (F + H₂): _____

Hot (H + F₂): _____ Chain (F + H₂ & H + F₂): _____

Other (specify): _____

X	F	Cl	Br	I
H				
D				

ENERGY TRANSFER MODES MODELED (✓): Reference

V-T: _____

V-R: _____

V-V: _____

Other: _____

Single Line Model (✓): _____

Multiline Model (✓): _____

Assumed Rotational Population Distribution State (✓):

Equilibrium: _____ Nonequilibrium: _____

Number of Laser Lines Modeled: _____

Source of Rate Coefficients Used in Code: _____

LINE PROFILE MODELS (✓):

Doppler Broadening: _____

Collisional Broadening: _____

Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓): None

Cylindrical, Radially Flowing: _____

Rectangular, Linearly Flowing: _____

Other: _____

COORDINATE SYSTEM: _____

FLUID GRID DIMENSION (✓): 1D: _____ 2D: _____ 3D: _____

FLOW FIELD MODELED (✓):

Laminar: _____ Turbulent: _____

Other: _____

BASIC MODELING APPROACH (✓):

Premixed: _____ Mixing: _____

Other (specify): _____

References for Approach Used: _____

THERMAL DRIVER MODELED (✓):

Arc Heater: _____ Combustor: _____

Shock Tube: _____ Resistance Heater: _____

Other: _____

F-ATOM DISSOCIATION FROM (✓):

F₂: _____ SF₆: _____

Other (specify): _____

F-ATOM CONCENTRATION DETERMINED FROM MODEL?: _____

DILUENTS MODELED: _____

MODELS EFFECTS ON MIXING RATE DUE TO (✓):

Nozzle Boundary Layers: _____ Shock Waves: _____

Prereactions (thermal blockage): _____ Turbulence: _____

Other (specify): _____

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):

Media Index Variations: _____

Other (specify): _____

CODE NAME:

MCLANC

CODE TYPE: Gasdynamics

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Modeling of a real gas flow by tracking several thousand simulated molecules. Primarily used for modeling nozzle flows with large base regions, and low pressure regions in hypersonic wedge wakes.

ASSESSMENT OF CAPABILITIES: Use of this method on a wide variety of problems has shown no sign of instability in operation.

ASSESSMENT OF LIMITATIONS: Large array sizes for flowfield cell network and molecular information imposes limits on size of flowfield which can be analyzed in one run. Cavity radiation interaction not included.

OTHER UNIQUE FEATURES: Developed cavity initial conditions for a large number of cavity injector systems. Includes nonequilibrium chemical reactions, models shock waves, recirculating flows, and transverse pressure gradient.

ORIGINATOR/KEY CONTACT:

Name: R. Hughes and H. W. Behrens Phone: (213) 536-1624
 Organization: TRW DSSG
 Address: RI/1038, One Space Park, Redondo Beach, California 90278

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (RP): "Chemical Laser Nozzle and Cavity Calculations by the Direct Simulation Monte Carlo Method," T. Sugimura, G. A. Bird, and H. W. Behrens, presented at AIAA Conference on High Power Lasers, Oct. 31-Nov. 2, 1978, Cambridge, Massachusetts.

STATUS:

Operational Currently?: Yes
 Under Modification?: No
 Purpose(s): _____

Ownership?: TRW
 Proprietary?: Yes

MACHINE/OPERATING SYSTEM (on which installed): CDC 7600

TRANSPORTABLE?: Yes

Machine Dependent Restrictions: None

SELF-CONTAINED?: Yes

Other Codes Required (name, purpose): _____

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec, CDC 7600)
Small Job:	<u>250K</u>	<u>400</u>
Typical Job:	<u>500K</u>	<u>2000</u>
Large Job:	<u>1000K</u>	<u>4000</u>

Approximate Number of FORTRAN Lines: 5000

CODE NAME:

MCLANC

OPTICS

BASIC TYPE (✓): None
 Physical Optics: _____ Geometrical: _____
 FIELD (POLARIZATION) REPRESENTATION (✓):
 Scalar: _____ Vector: _____
 COORDINATE SYSTEM (Cartesian, cylindrical, etc.):
 Compact Region: _____ Annular Region: _____
 TRANSVERSE GRID DIMENSIONALITY (✓):
 Compact Region:

1D	2D

 Annular Region: _____
 FIELD SYMMETRY RESTRICTIONS?: _____
 MIRROR SHAPE(S) ALLOWED (✓):
 Square: _____ Circular: _____ Strip: _____
 Rectangular: _____ Elliptical: _____ Arbitrary: _____
 CONFIGURATION FLEXIBILITY (✓):
 Fixed, Single Resonator Geometry: _____
 Fixed, Multiple Resonator Geometries: _____
 Modular, Multiple Resonator Geometries: _____
 PROPAGATION TECHNIQUE (✓) (all that apply):

COMPACT	ANNULAR

 Fresnel Integral Algorithms: _____
 With Kernel Averaging: _____
 Gaussian Quadrature: _____
 Fast Fourier Transform (FFT): _____
 Fast Hankel Transform (FHT): _____
 Gardener-Fresnel-Kirchhoff (GFK): _____
 Other (specify): _____
 CONVERGENCE TECHNIQUE (✓):
 Power Comparison: _____ Field Comparison: _____
 Other: _____
 ACCELERATION ALGORITHMS USED?: _____
 Technique: _____
 MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):
 Prony: _____
 Other: _____

None
 RESONATOR TYPE (✓): Standing Wave: _____
 Traveling Wave (Ring): _____ Reverse TW: _____
 BRANCH (✓): Positive: _____ Negative: _____
 OPTICAL ELEMENT MODELS INCLUDED (✓):
 Flat Mirrors: _____ Spherical Mirrors: _____
 Cylindrical Mirrors: _____ Telescopes: _____
 Scraper Mirrors: _____

Waxicons	Reflexicons

 Axicons: _____
 Arbitrary: _____
 Linear: _____
 Parabola-Parabola: _____
 Variable Cone Offset: _____
 Other (specify): _____
 Deformable Mirrors: _____
 Spatial Filters: _____ Gratings: _____
 Other Elements: _____
 GAIN MODELS (✓): Bare Cavity Only: _____
 Simple Saturated Gain: _____ Detailed Gain: _____
 BARE CAVITY FIELD MODIFIER MODELS (✓):
 Mirror Tilt: _____ Decentration: _____
 Aberrations/Thermal Distortions: _____
 Arbitrary: _____
 Selected (specify): _____
 Reflectivity Loss: _____
 Output Coupler Edges: Rolled: _____
 Serrated: _____ Other: _____
 LOADED CAVITY FIELD MODIFIER MODELS (✓):
 Medium Index Variation: _____
 Gas Absorption: _____
 Overlapped Beams: _____
 Other: _____
 FAR-FIELD MODELS (✓): Beam Steering Removal: _____
 Optimal Focal Search: _____ Beam Quality: _____
 Other: _____

KINETICS

GAIN REGION MODELED (✓): None
 Compact Region: _____ Annular Region: _____
 COORDINATE SYSTEM (Cartesian, cylindrical, etc.)
 Compact Region: _____ Annular Region: _____
 KINETICS GRID DIMENSIONALITY (✓):

1D	2D	3D

 Compact Region: _____
 Annular Region: _____
 GAIN REGION SYMMETRY RESTRICTIONS:
 Gain Vary Along Optic Axes?: _____ Flow Direction?: _____
 PULSED: _____ CW: _____ KINETICS MODELED
 CHEMICAL PUMPING REACTIONS MODELED (✓):

$$\begin{cases} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{cases}$$

X	F	Cl	Br	I
H				
D				

 Cold (F + H₂): _____
 Hot (H + F₂): _____ Chain (F + H₂ & H + F₂): _____
 Other (specify): _____
 ENERGY TRANSFER MODES MODELED (✓): Reference
 V-T: _____
 V-R: _____
 V-V: _____
 Other: _____
 Single Line Model (✓): _____
 Multiline Model (✓): _____
 Assumed Rotational Population Distribution State (✓):
 Equilibrium: _____ Nonequilibrium: _____
 Number of Laser Lines Modeled: _____
 Source of Rate Coefficients Used in Code: _____
 LINE PROFILE MODELS (✓):
 Doppler Broadening: _____
 Collisional Broadening: _____
 Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓):
 Cylindrical, Radially Flowing: _____ ✓
 Rectangular, Linearly Flowing: _____ ✓
 Other: _____
 COORDINATE SYSTEM: Cartesian
 FLUID GRID DIMENSION (✓): 1D: _____ 2D: _____ ✓ 3D: _____
 FLOW FIELD MODELED (✓):
 Laminar: _____ Turbulent: _____
 Other: Noncontinuum; direct simul.
 BASIC MODELING APPROACH (✓):
 Premixed: _____ Mixing: _____
 Other (specify): Kinetic theory, which does the mixing on the molecular scale.
 References for Approach Used: "Molecular Gas Dyn" G. A. Bird, Oxford, 1976.
 THERMAL DRIVER MODELED (✓):
 Arc Heater: _____ Combustor: _____
 Shock Tube: _____ Resistance Heater: _____
 Other: _____
 F-ATOM DISSOCIATION FROM (✓):
 F₂: _____ ✓ SF₆: _____
 Other (specify): _____
 F-ATOM CONCENTRATION DETERMINED FROM MODEL?: Yes
 DILUENTS MODELED: _____
 MODELS EFFECTS ON MIXING RATE DUE TO (✓):
 Nozzle Boundary Layers: _____ ✓ Shock Waves: _____ ✓
 Prereactions (thermal blockage): _____ Turbulence: _____
 Other (specify): Base region recirculation.
 MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):
 Media Index Variations: _____ ✓
 Other (specify): _____

CODE NAME:

MNORO

CODE TYPE: KineticsPRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Predict power and power spectral distribution of CW chemical lasers. Also see AFOPTMNORO.ASSESSMENT OF CAPABILITIES: Can predict power and power spectral distribution on 2-1 band for CW chemical lasers, typical case takes 100-200 seconds on Cyber 175. Contains Fabry-Perot resonator. With the rotational nonequilibrium kinetics, code will predict which lines lase.ASSESSMENT OF LIMITATIONS: Need to include rotational nonequilibrium on 1-0 band.OTHER UNIQUE FEATURES: The following quantities are input as polynomials: $T(x)$, $P(x)$, $U(x)$, $m_p(x)$ (flow rate remaining in primary), $m_s(x)$ (flow rate remaining in secondary), primary nozzle F atom boundary layer profile, and $L_e/L_g(x)$ (thickness of mixed flow). Coefficients of the polynomials are obtained by fits to these profiles (profiles come from BLAZE II, LAMP, etc.)

ORIGINATOR/KEY CONTACT:

Name: L. H. Sentman Phone: (217) 333-1834
Organization: Aeronautical and Astronautical Engineering Dept., University of Illinois
Address: Urbana, Illinois 61801AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication); (T) "An Efficient Rotational Nonequilibrium Model of CW Chemical Lasers," L. H. Sentman and W. Brandkamp, AAE TR 79-5. UIIU Eng 79-0505 (July 1979); (U) "Users Guide for Programs MNORO and AFOPTMNORO," L. H. Sentman, AAE TR 79-7, UIIU Eng 79-0507 (October 1979).

STATUS:

Operational Currently?: Yes

Under Modification?: _____

Purpose(s): _____

Ownership?: AFOSRProprietary?: NoMACHINE/OPERATING SYSTEM (on which installed): CDC Cyber 175TRANSPORTABLE?: Yes

Machine Dependent Restrictions: _____

SELF-CONTAINED?: Yes

Other Codes Required (name, purpose): _____

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec, CDC 7600)
Small Job:		
Typical Job:	<u>All jobs same size</u>	<u>50-100 sec</u>
Large Job:		

Approximate Number of FORTRAN Lines: _____

CODE NAME:

MPCPAGOS

CODE TYPE: Optics

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: (Derivative of IPAGOS and POLYPAGOS); calculates sensitivity coefficients for general optical train; relates output ray motions to individual optical element motions in six degrees of freedom; used in conjunction with NASTRAN to predict beam jitter through an integrated optics/structures approach.

ASSESSMENT OF CAPABILITIES: Can handle all elements of IPAGOS, but also includes an unstable resonator modeling capability.

ASSESSMENT OF LIMITATIONS: Meant to be used to generate multipoint constraint (MPC) cards for NASTRAN; output format is rough and difficult for novice to interpret.

OTHER UNIQUE FEATURES: Resonator Geometries Modeled: Unstable, Linear, with up to 4 folding flats.

ORIGINATOR/KEY CONTACT:

Name: D. Mansell/C. Barnard Phone: (505) 848-5000
Organization: The BDM Corporation
Address: 1801 Randolph Road, S.E., Albuquerque, New Mexico 87106

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T) "Final Task Report for Sensitivity Analyses of the All Optical Train," BDM/TAC-78-793-TR; (U) "MPCPAGOS Users Manual," BDM/TAC-78-727-TR.

STATUS:

Operational Currently?: Yes
Under Modification?: No
Purpose(s): _____

Ownership?: AFWL/LRO, BDM
Proprietary?: No

MACHINE/OPERATING SYSTEM (on which installed): CDC 6600/7600

TRANSPORTABLE?: Yes

Machine Dependent Restrictions: _____

SELF-CONTAINED?: Yes

Other Codes Required (name, purpose): NASTRAN uses MPCPAGOS output

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec, CDC 7600)
Small Job:		
Typical Job:	<u>120K</u>	<u>1 sec</u>
Large Job:		
Approximate Number of FORTRAN Lines: <u>6K</u>		

CODE NAME:

MPCPAGOS

OPTICS

BASIC TYPE (✓):
 Physical Optics: Geometrical:

FIELD (POLARIZATION) REPRESENTATION (✓):
 Scalar: Vector:

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):
 Compact Region: Annular Region:

TRANSVERSE GRID DIMENSIONALITY (✓):

1D	2D
	<input checked="" type="checkbox"/>
	<input checked="" type="checkbox"/>

Compact Region:
 Annular Region:

FIELD SYMMETRY RESTRICTIONS?: NO

MIRROR SHAPE(S) ALLOWED (✓):
 Square: Circular: Strip:
 Rectangular: Elliptical: Arbitrary:

CONFIGURATION FLEXIBILITY (✓):
 Fixed, Single Resonator Geometry: (± Branch, Unstable)
 Fixed, Multiple Resonator Geometries:
 Modular, Multiple Resonator Geometries:

PROPAGATION TECHNIQUE (✓all that apply):

COMPACT	ANNULAR
<input type="checkbox"/>	<input type="checkbox"/>

Fresnel Integral Algorithms:
 With Kernel Averaging
 Gaussian Quadrature:
 Fast Fourier Transform (FFT):
 Fast Hankel Transform (FHT):
 Gardener-Fresnel-Kirchhoff (GFK):
 Other (specify): _____

CONVERGENCE TECHNIQUE (✓):
 Power Comparison: _____ Field Comparison: _____
 Other: _____

ACCELERATION ALGORITHMS USED?:
 Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):
 Prony: _____
 Other: _____

RESONATOR TYPE (✓): Standing Wave:
 Traveling Wave (Ring): _____ Reverse TW: _____

BRANCH (✓): Positive: Negative:

OPTICAL ELEMENT MODELS INCLUDED (✓):
 Flat Mirrors: Spherical Mirrors:
 Cylindrical Mirrors: Telescopes:
 Scraper Mirrors:

Alicons

	Waxicons	Reflexicons
Arbitrary:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Linear:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Parabola-Parabola:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Variable Cone Offset:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Other (specify): <u>Noneverting</u>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Deformable Mirrors: _____
 Spatial Filters: _____ Gratings: _____
 Other Elements: _____

GAIN MODELS (✓): Bare Cavity Only: _____
 Simple Saturated Gain: _____ Detailed Gain: _____

BARE CAVITY FIELD MODIFIER MODELS (✓):
 Mirror Tilt: Decentration:

Aberrations/Thermal Distortions:
 Arbitrary: _____
 Selected (specify): _____
 Reflectivity Loss: _____
 Output Coupler Edges: Rolled: _____
 Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):
 Medium Index Variation: _____
 Gas Absorption: _____
 Overlapped Beams: _____
 Other: _____

FAR-FIELD MODELS (✓): Beam Steering Removal: _____
 Optimal Focal Search: _____ Beam Quality: _____
 Other: 2-dimensional Fourier transform

KINETICS

GAIN REGION MODELED (✓): None
 Compact Region: _____ Annular Region: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.)
 Compact Region: _____ Annular Region: _____

KINETICS GRID DIMENSIONALITY (✓):

1D	2D	3D

Compact Region:
 Annular Region:

GAIN REGION SYMMETRY RESTRICTIONS:
 Gain Vary Along Optic Axes?: _____ Flow Direction?: _____

PULSED: _____ CW: _____ KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

$$\begin{cases} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{cases}$$

X	F	Cl	Br	I
H				
D				

Cold (F + H₂): _____
 Hot (H + F₂): _____ Chain (F + H₂ & H + F₂): _____
 Other (specify): _____

ENERGY TRANSFER MODES MODELED (✓): Reference
 V-T: _____
 V-R: _____
 V-V: _____
 Other: _____

Single Line Model (✓): _____
 Multiline Model (✓): _____

Assumed Rotational Population Distribution State (✓):
 Equilibrium: _____ Nonequilibrium: _____
 Number of Laser Lines Modeled: _____
 Source of Rate Coefficients Used in Code: _____

LINE PROFILE MODELS (✓):
 Doppler Broadening: _____
 Collisional Broadening: _____
 Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓): None
 Cylindrical, Radially Flowing: _____
 Rectangular, Linearly Flowing: _____
 Other: _____

COORDINATE SYSTEM: _____

FLUID GRID DIMENSION (✓): 1D: _____ 2D: _____ 3D: _____

FLOW FIELD MODELED (✓):
 Laminar: _____ Turbulent: _____
 Other: _____

BASIC MODELING APPROACH (✓):
 Premixed: _____ Mixing: _____
 Other (specify): _____

References for Approach Used: _____

THERMAL DRIVER MODELED (✓):
 Arc Heater: _____ Combustor: _____
 Shock Tube: _____ Resistance Heater: _____
 Other: _____

F-ATOM DISSOCIATION FROM (✓):
 F₂: _____ SF₆: _____
 Other (specify): _____

F-ATOM CONCENTRATION DETERMINED FROM MODEL?: _____

DILUENTS MODELED: _____

MODELS EFFECTS ON MIXING RATE DUE TO (✓):
 Nozzle Boundary Layers: _____ Shock Waves: _____
 Pre-reactions (thermal blockage): _____ Turbulence: _____
 Other (specify): _____

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):
 Media Index Variations: _____
 Other (specify): _____

CODE NAME:

MRO

CODE TYPE: Optics, Kinetics, and Gasdynamics.PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Models the optical performance of linear bank CW HF and DF chemical lasers. MRO is 2D model; BLAZER is 3D model. Used as design tools for BDL, NAEL, MIRACL.ASSESSMENT OF CAPABILITIES: Resonator: Positive or negative branch confocal unstable; arbitrary optical axis position; cylindrical, toric, or spherical mirrors. Gain medium: CW flowing HF* or DF*, strut wake, mirror aberration, thermal distortion, and nonresonant index OPD'sMRO does stable Fabry Perot with geometrical optics.ASSESSMENT OF LIMITATIONS: Lacks transverse pressure gradient modeling capability, lacks FFT propagation algorithm, uses only single gain sheet, uses only rotational equilibrium description.OTHER UNIQUE FEATURES: Confocal unstable resonator modeled.

ORIGINATOR/KEY CONTACT:

Name: Donald L. Bullock Phone: (213) 535-3484Organization: TRW DSSGAddress: RI/1162, One Space Park, Redondo Beach, California 90278AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T): The BLAZER and MRO Codes, June 1978; (U): BLAZER User Manual, November 1978 (includes MRO); Listings available.

STATUS:

Operational Currently?: YesUnder Modification?: PlannedPurpose(s): Rotational nonequilibrium, FFT propagation algorithm, multiple gain skins, transverse pressure gradient description.Ownership?: GovernmentProprietary?: NoMACHINE/OPERATING SYSTEM (on which installed): Cyber 174-TRW/TSSTRANSPORTABLE?: Needs mods for exportMachine Dependent Restrictions: CDC

SELF-CONTAINED?:

Other Codes Required (name, purpose): VIINT, KBLIMP, ALFA for nozzle exit condition.

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)		Execution Time (Sec. CDC 7600)	
Small Job:	MRO: ----	BLAZER: -	---	---
Typical Job:	151K	165K	400	6500
Large Job:	---	245K	---	15000

Approximate Number of FORTRAN Lines: MRO: 4500 BLAZER: 6000

CODE NAME:

MRO

OPTICS

BASIC TYPE (✓):

Physical Optics: Geometrical:

FIELD (POLARIZATION) REPRESENTATION (✓):

Scalar: Vector:

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: Ca Annular Region:

TRANSVERSE GRID DIMENSIONALITY (✓):

Compact Region:

Annular Region:

1D	2D
<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

FIELD SYMMETRY RESTRICTIONS: None

MIRROR SHAPE(S) ALLOWED (✓):

Square: Circular: Strip:

Rectangular: Elliptical: Arbitrary:

CONFIGURATION FLEXIBILITY (✓):

Fixed, Single Resonator Geometry:

Fixed, Multiple Resonator Geometries:

Modular, Multiple Resonator Geometries:

PROPAGATION TECHNIQUE (✓) (all that apply):

Fresnel Integral Algorithms:

With Kernel Averaging

Gaussian Quadrature: (Modified)

Fast Fourier Transform (FFT):

Fast Hankel Transform (FHT):

Gardner-Fresnel-Kirchhoff (GFK):

Other (specify):

COMPACT	ANNULAR
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

CONVERGENCE TECHNIQUE (✓):

Power Comparison: Field Comparison:

Other:

ACCELERATION ALGORITHMS USED: No

Technique:

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM: (✓):

Prony:

Other:

RESONATOR TYPE (✓): Standing Wave:

Traveling Wave (Ring): Reverse TW:

BRANCH (✓): Positive: Negative:

OPTICAL ELEMENT MODELS INCLUDED (✓):

Flat Mirrors: Spherical Mirrors:

Cylindrical Mirrors: Telescopes:

Scraper Mirrors:

Axicons

Arbitrary:

Linear:

Parabola-Parabola:

Variable Cone Offset:

Other (specify):

Deformable Mirrors:

Spatial Filters: Gratings:

Other Elements:

Waxicons	Reflexicons
<input type="checkbox"/>	<input type="checkbox"/>

GAIN MODELS (✓): Bare Cavity Only:

Simple Saturated Gain: Detailed Gain:

BARE CAVITY FIELD MODIFIER MODELS (✓):

Mirror Tilt: Decentration:

Aberrations/Thermal Distortions:

Arbitrary:

Selected (specify):

Reflectivity Loss:

Output Coupler Edges: Rolled:

Serrated: Other:

LOADED CAVITY FIELD MODIFIER MODELS (✓):

Medium Index Variation:

Gas Absorption:

Overlapped Beams:

Other:

FAR-FIELD MODELS (✓): Beam Steering Removal:

Optimal Focal Search: Beam Quality:

Other: EMBLAZON

KINETICS

GAIN REGION MODELED (✓):

Compact Region: Annular Region:

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: Ca Annular Region:

KINETICS GRID DIMENSIONALITY (✓):

Compact Region:

Annular Region:

1D	2D	3D
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

GAIN REGION SYMMETRY RESTRICTIONS:

Gain Vary Along Optic Axes?: Flow Direction?:

PULSED: CW: KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

$$\begin{cases} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{cases}$$

X	F	Cl	Br	I
H	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Cold (F + H₂):

Hot (H + F₂): Chain (F + H₂ & H + F₂):

Other (specify):

ENERGY TRANSFER MODES MODELED (✓): Reference

v-T: The BLAZER and MRO Codes

v-R:

v-V: The BLAZER and MRO Codes

Other: RR with rot. nonequil.

Single Line Model (✓):

Multiline Model (✓):

Assumed Rotational Population Distribution State (✓):

Equilibrium: Nonequilibrium:

Number of Laser Lines Modeled: 24

Source of Rate Coefficients Used in Code: N. Cohen

LINE PROFILE MODELS (✓):

Doppler Broadening:

Collisional Broadening:

Other (specify): Operation at line center.

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓):

Cylindrical, Radially Flowing:

Rectangular, Linearly Flowing:

Other:

COORDINATE SYSTEM: Cartesian

FLUID GRID DIMENSION (✓): 1D: 2D: 3D:

FLOW FIELD MODELED (✓):

Laminar: Turbulent:

Other: Scheduled mixing.

BASIC MODELING APPROACH (✓):

Premixed: Mixing:

Other (specify): Scheduled mixing.

References for Approach Used: The BLAZER and

MRO Codes (TRW).

THERMAL DRIVER MODELED (✓):

Arc Heater: Combustor:

Shock Tube: Resistance Heater:

Other:

F-ATOM DISSOCIATION FROM (✓):

F₂: SF₆:

Other (specify): NF₃

F-ATOM CONCENTRATION DETERMINED FROM MODEL: Yes

DILUENTS MODELED: He, N₂, CF₄

MODELS EFFECTS ON MIXING RATE DUE TO (✓):

Nozzle Boundary Layers: Shock Waves:

Preactions (thermal blockage): Turbulence:

Other (specify): Scheduled three stream:

fuel, oxidant, mixed.

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):

Media Index Variations:

Other (specify):

CODE NAME:

NCFTDPWE*

CODE TYPE: OpticsPRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Study of wavefront distortions during propagation through amplifying self-focusing media.ASSESSMENT OF CAPABILITIES: This code propagates a two (transverse) dimensional wavefront through a medium with constant small signal gain and with a nonlinear index of refraction which induces self-focusing. The code was written by F.D. Tappert, now at the University of Miami in Miami, Florida. A description is in Los Alamos report LA-6833-MS by John C. Goldstein.ASSESSMENT OF LIMITATIONS: Although this code could be extended to be used in resonator calculations, it currently does not have any optical elements or saturable gain models included. Therefore, other than noting that the fast Fourier transform is the basic numerical method employed and that other details can be found in the report cited, no other data for this code will be given.

OTHER UNIQUE FEATURES: _____

ORIGINATOR/KEY CONTACT:

Name: F.D. Tappert/John C. Goldstein Phone: (505) 667-7281Organization: Los Alamos Scientific Laboratory, Group X-1, MS-531Address: Los Alamos, New Mexico 87545AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T) A Numerical Code for the Three Dimensional Parabolic Wave Equation, John C. Goldstein, Los Alamos report number LA-6833-MS.

STATUS:

Operational Currently?: _____

Under Modification?: _____

Purpose(s): _____

Ownership?: _____

Proprietary?: _____

MACHINE/OPERATING SYSTEM (on which installed): _____

TRANSPORTABLE?: _____

Machine Dependent Restrictions: _____

SELF-CONTAINED?: _____

Other Codes Required (name, purpose): _____

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec, CDC 7600)
Small Job:	_____	_____
Typical Job:	_____	_____
Large Job:	_____	_____

Approximate Number of FORTRAN Lines: _____

*Numerical Code for the Three Dimensional Parabolic Wave Equation

CODE NAME:

NCFTDPWE

OPTICS

None

BASIC TYPE (✓): None

Physical Optics: _____ Geometrical: _____

FIELD (POLARIZATION) REPRESENTATION (✓):

Scalar: _____ Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: _____ Annular Region: _____

TRANSVERSE GRID DIMENSIONALITY (✓):

Compact Region:

Annular Region:

1D	2D

FIELD SYMMETRY RESTRICTIONS?: _____

MIRROR SHAPE(S) ALLOWED (✓):

Square: _____ Circular: _____ Strip: _____

Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):

Fixed, Single Resonator Geometry: _____

Fixed, Multiple Resonator Geometries: _____

Modular, Multiple Resonator Geometries: _____

PROPAGATION TECHNIQUE (✓ all that apply): COMPACT ANNULAR

Fresnel Integral Algorithms:

With Kernel Averaging

Gaussian Quadrature:

Fast Fourier Transform (FFT):

Fast Hankel Transform (FHT):

Gardener-Fresnel-Kirchhoff (GFK):

Other (specify): _____

CONVERGENCE TECHNIQUE (✓):

Power Comparison: _____ Field Comparison: _____

Other: _____

ACCELERATION ALGORITHMS USED?: _____

Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM: (✓):

Prony: _____

Other: _____

RESONATOR TYPE (✓): Standing Wave: _____

Traveling Wave (Ring): _____ Reverse TW: _____

BRANCH (✓): Positive: _____ Negative: _____

OPTICAL ELEMENT MODELS INCLUDED (✓):

Flat Mirrors: _____ Spherical Mirrors: _____

Cylindrical Mirrors: _____ Telescopes: _____

Scraper Mirrors: _____

Axicons

Arbitrary:

Linear:

Parabola-Parabola:

Variable Cone Offset:

Other (specify): _____

Deformable Mirrors: _____

Spatial Filters: _____ Gratings: _____

Other Elements: _____

Waxicons	Reflexicons

GAIN MODELS (✓): Bare Cavity Only: _____

Simple Saturated Gain: _____ Detailed Gain: _____

BARE CAVITY FIELD MODIFIER MODELS (✓):

Mirror Tilt: _____ Decentration: _____

Aberrations/Thermal Distortions:

Arbitrary: _____

Selected (specify): _____

Reflectivity Loss: _____

Output Coupler Edges: Rolled: _____

Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):

Medium Index Variation: _____

Gas Absorption: _____

Overlapped Beams: _____

Other: _____

FAR-FIELD MODELS (✓): Beam Steering Removal: _____

Optimal Focal Search: _____ Beam Quality: _____

Other: _____

KINETICS

GAIN REGION MODELED (✓): None

Compact Region: _____ Annular Region: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: _____ Annular Region: _____

KINETICS GRID DIMENSIONALITY (✓):

Compact Region:

Annular Region:

1D	2D	3D

GAIN REGION SYMMETRY RESTRICTIONS:

Gain Vary Along Optic Axes?: _____ Flow Direction?: _____

PULSED: _____ CW: _____ KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

$$\begin{cases} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{cases}$$

Cold (F + H₂): _____

Hot (H + F₂): _____ Chain (F + H₂ & H + F₂): _____

Other (specify): _____

X	F	Cl	Br	I
H				
D				

ENERGY TRANSFER MODES MODELED (✓): Reference

V-T: _____

V-R: _____

V-V: _____

Other: _____

Single Line Model (✓): _____

Multiline Model (✓): _____

Assumed Rotational Population Distribution State (✓):

Equilibrium: _____ Nonequilibrium: _____

Number of Laser Lines Modeled: _____

Source of Rate Coefficients Used in Code: _____

LINE PROFILE MODELS (✓):

Doppler Broadening: _____

Collisional Broadening: _____

Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓): None

Cylindrical, Radially Flowing: _____

Rectangular, Linearly Flowing: _____

Other: _____

COORDINATE SYSTEM: _____

FLUID GRID DIMENSION (✓): 1D: _____ 2D: _____ 3D: _____

FLOW FIELD MODELED (✓):

Laminar: _____ Turbulent: _____

Other: _____

BASIC MODELING APPROACH (✓):

Premixed: _____ Mixing: _____

Other (specify): _____

References for Approach Used: _____

THERMAL DRIVER MODELED (✓):

Arc Heater: _____ Combustor: _____

Shock Tube: _____ Resistance Heater: _____

Other: _____

F-ATOM DISSOCIATION FROM (✓):

F₂: _____ SF₆: _____

Other (specify): _____

F-ATOM CONCENTRATION DETERMINED FROM MODEL?: _____

DILUENTS MODELED: _____

MODELS EFFECTS ON MIXING RATE DUE TO (✓):

Nozzle Boundary Layers: _____ Shock Waves: _____

Prereactions (thermal blockage): _____ Turbulence: _____

Other (specify): _____

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):

Media Index Variations: _____

Other (specify): _____

CODE NAME: NORO-I

CODE TYPE: Kinetics

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Models rotational nonequilibrium effects in CW chemical lasers. (Combined with other optics models, e.g., see ROPTICS).

ASSESSMENT OF CAPABILITIES: Predicts power spectral distribution, effect of rotational nonequilibrium on laser performance.

ASSESSMENT OF LIMITATIONS: Qualitative model, 2 vibrational levels, 21 P-branch and 21 R-branch lines, Fabry-Perot cavity, fluid dynamic variables p, ρ , T, u input as constants, premixed.

OTHER UNIQUE FEATURES: This model was used to demonstrate the importance of rotational nonequilibrium effects in CW chemical lasers. To ascertain the role of the resonator, it was coupled to the Bell Aerospace strip resonator code and run with a confocal unstable resonator. In this form the code is known as ROPTICS.

ORIGINATOR/KEY CONTACT:
Name: L. H. Sentman Phone: (217) 333-1834
Organization: Aeronautical and Astronautical Engineering Dept., University of Illinois
Address: Urbana, Illinois 61801

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T) J. Chemical Physics 62, 3523 (1975); (RP) Applied Optics 15, 744 (1976); (RP) J. Chemical Physics 67, 966 (1977); (RP) Applied Optics 17, 2244 (1978).

STATUS:
Operational Currently?: Yes
Under Modification?: _____
Purpose(s): _____

Ownership?: Bell Aerospace TEXTRON
Proprietary?: Yes

MACHINE/OPERATING SYSTEM (on which installed): IBM, CDC

TRANSPORTABLE?: Yes
Machine Dependent Restrictions: _____

SELF-CONTAINED?: Yes
Other Codes Required (name, purpose): _____

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:	
	Execution Time (Sec, CDC 7600)
Small Job:	
Typical Job: <u>All jobs same size</u>	<u>15 sec</u>
Large Job:	

Approximate Number of FORTRAN Lines: _____

CODE NAME:

NORO-I

OPTICS

BASIC TYPE (✓): None

Physical Optics: _____ Geometrical:

FIELD (POLARIZATION) REPRESENTATION (✓):

Scalar: _____ Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: _____ Annular Region: _____

TRANSVERSE GRID DIMENSIONALITY (✓):

1D	2D
<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

Compact Region:

Annular Region:

FIELD SYMMETRY RESTRICTIONS: _____

MIRROR SHAPE(S) ALLOWED (✓):

Square: _____ Circular: _____ Strip: _____

Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):

Fixed, Single Resonator Geometry: _____

Fixed, Multiple Resonator Geometries: _____

Modular, Multiple Resonator Geometries: _____

PROPAGATION TECHNIQUE (✓ all that apply): COMPACT ANNULAR

Fresnel Integral Algorithms:

With Kernel Averaging

Gaussian Quadrature:

Fast Fourier Transform (FFT):

Fast Hankel Transform (FHT):

Gardner-Fresnel-Kirchoff (GFK):

Other (specify): _____

CONVERGENCE TECHNIQUE (✓):

Power Comparison: _____ Field Comparison: _____

Other: _____

ACCELERATION ALGORITHMS USED?: _____

Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM: (✓):

Prony: _____

Other: _____

RESONATOR TYPE (✓): Standing Wave: _____

Traveling Wave (Ring): _____ Reverse TW: _____

BRANCH (✓): Positive: _____ Negative: _____

OPTICAL ELEMENT MODELS INCLUDED (✓):

Flat Mirrors: _____ Spherical Mirrors: _____

Cylindrical Mirrors: _____ Telescopes: _____

Scraper Mirrors: _____

Axicons

	Waxicons	Reflaxicons
Arbitrary:	<input type="checkbox"/>	<input type="checkbox"/>
Linear:	<input type="checkbox"/>	<input type="checkbox"/>
Parabola-Parabola:	<input type="checkbox"/>	<input type="checkbox"/>
Variable Cone Offset:	<input type="checkbox"/>	<input type="checkbox"/>
Other (specify):	<input type="checkbox"/>	<input type="checkbox"/>

Deformable Mirrors: _____

Spatial Filters: _____ Gratings: _____

Other Elements: _____

GAIN MODELS (✓): Bare Cavity Only: _____

Simple Saturated Gain: _____ Detailed Gain: _____

BARE CAVITY FIELD MODIFIER MODELS (✓):

Mirror Tilt: _____ Decentration: _____

Aberrations/Thermal Distortions:

Arbitrary: _____

Selected (specify): _____

Reflectivity Loss: _____

Output Coupler Edges: Rolled: _____

Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):

Medium Index Variation: _____

Gas Absorption: _____

Overlapped Beams: _____

Other: _____

FAR-FIELD MODELS (✓): Beam Steering Removal: _____

Optimal Focal Search: _____ Beam Quality: _____

Other: _____

KINETICS

GAIN REGION MODELED (✓):

Compact Region: Annular Region: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: Ca Annular Region: _____

KINETICS GRID DIMENSIONALITY (✓):

1D	2D	3D
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Compact Region:

Annular Region:

GAIN REGION SYMMETRY RESTRICTIONS:

Gain Vary Along Optic Axes: _____ Flow Direction: _____

PULSED: _____ CW: KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

$X + Y_2 = YX + Y$	X	F	Cl	Br	I
$Y + X_2 = YX + X$	H	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cold (F + H ₂): <input checked="" type="checkbox"/>	D	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Hot (H + F₂): _____ Chain (F + H₂ & H + F₂): _____

Other (specify): _____

ENERGY TRANSFER MODES MODELED (✓): Reference

V-T:

V-R:

V-V: _____

Other: _____

Single Line Model (✓): _____

Multiline Model (✓):

Assumed Rotational Population Distribution State (✓):

Equilibrium: _____ Nonequilibrium:

Number of Laser Lines Modeled: Predicts which lines lase.

Source of Rate Coefficients Used in Code: Cohen's HF rate package, Hinchin's rotational*

LINE PROFILE MODELS (✓):

Doppler Broadening:

Collisional Broadening: _____

Other (specify): Voigt profile.

*relaxation data, Polanyi's pumping distribution.

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓):

Cylindrical, Radially Flowing: _____

Rectangular, Linearly Flowing:

Other: _____

COORDINATE SYSTEM: Cartesian

FLUID GRID DIMENSION (✓): 1D: 2D: _____ 3D: _____

FLOW FIELD MODELED (✓):

Laminar: _____ Turbulent: _____

Other: _____

BASIC MODELING APPROACH (✓):

Premixed: Mixing: _____

Other (specify): _____

References for Approach Used: _____

THERMAL DRIVER MODELED (✓):

Arc Heater: _____ Combustor: _____

Shock Tube: _____ Resistance Heater: _____

Other: _____

F-ATOM DISSOCIATION FROM (✓):

F₂: _____ SF₆: _____

Other (specify): _____

F-ATOM CONCENTRATION DETERMINED FROM MODEL?: _____

DILUENTS MODELED: _____

MODELS EFFECTS ON MIXING RATE DUE TO (✓):

Nozzle Boundary Layers: _____ Shock Waves: _____

Prereactions (thermal blockage): _____ Turbulence: _____

Other (specify): _____

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):

Media Index Variations: _____

Other (specify): _____

CODE NAME:

OCELOT

CODE TYPE: OpticsPRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Tool to assist with resonator design and mode control.

ASSESSMENT OF CAPABILITIES: Very flexible code that can model almost any resonator we have been interested in - annular or compact. Both Cartesian and cylindrical coordinate systems are used, but there are more elements available in Cartesian coordinates at present. Simultaneous multiple spectral lines with coupled transitions used in simple gain model.

ASSESSMENT OF LIMITATIONS: Limited almost exclusively by lack of models for those elements we have not had time to write models for.

OTHER UNIQUE FEATURES: Modeled HSURIA, unstable P-P axicon negative branch ring; many compact, folded resonator/amplifiers, both confocal and nonconfocal. Allows amplifier beams to overlap resonator medium. User can specify any number of field stations located wherever desired. Utilizes both Cartesian and cylindrical coordinate systems.

ORIGINATOR/KEY CONTACT:

Name: David Fink 6/C 129 Phone: (213) 391-0711, Ext. 6925Organization: Hughes Aircraft CompanyAddress: Culver City, California 90230AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): Not available.

STATUS:

Operational Currently?: YesUnder Modification?: YesPurpose(s): Increase number of models in cylindrical coordinates.Ownership?: Hughes Aircraft CompanyProprietary?: YesMACHINE/OPERATING SYSTEM (on which installed): CDC 7600 CDC 176TRANSPORTABLE?: Almost, previous versions have been converted to IBM.Machine Dependent Restrictions: Control Data large core and external file usage.SELF-CONTAINED?: Yes

Other Codes Required (name, purpose): _____

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec, CDC 7600)
Small Job:	100K	50
Typical Job:	140K	500
Large Job:	200K	5,000

Approximate Number of FORTRAN Lines: _____

CODE NAME:

OCLOT

OPTICS

BASIC TYPE (✓):
 Physical Optics: Geometrical: _____

FIELD (POLARIZATION) REPRESENTATION (✓):
 Scalar: _____ Vector: with multiple spectral lines.

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):
 Compact Region: Annular Region: CY

TRANSVERSE GRID DIMENSIONALITY (✓):

1D	2D
	<input checked="" type="checkbox"/>

Compact Region: Ca, CY
 Annular Region: CY

FIELD SYMMETRY RESTRICTIONS?: left-right*

MIRROR SHAPE(S) ALLOWED (✓) for Cartesian:
 Square: Circular: Strip: _____
 Rectangular: Elliptical: Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):
 Fixed, Single Resonator Geometry: _____
 Fixed, Multiple Resonator Geometries: _____
 Modular, Multiple Resonator Geometries:

PROPAGATION TECHNIQUE (✓/all that apply):

	COMPACT	ANNULAR
Fresnel Integral Algorithms:		
With Kernel Averaging	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Gaussian Quadrature:		
Fast Fourier Transform (FFT):		
Fast Hankel Transform (FHT):		
Gardner-Fresnel-Kirchhoff (GFK):	<input checked="" type="checkbox"/>	
Other (specify): _____		

CONVERGENCE TECHNIQUE (✓):
 Power Comparison: Field Comparison: (visual)

Other: _____

ACCELERATION ALGORITHMS USED?: NO
 Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):
 Prony: _____
 Other: _____

RESONATOR TYPE (✓): Standing Wave:
 Traveling Wave (Ring): Reverse TW:

BRANCH (✓): Positive: Negative:

OPTICAL ELEMENT MODELS INCLUDED (✓):
 Flat Mirrors: Spherical Mirrors:
 Cylindrical Mirrors: Telescopes: _____
 Scaper Mirrors:

Axicons

	Waxicons	Reflexicons
Arbitrary:		
Linear:		
Parabola-Parabola:		
Variable Cone Offset:		<input checked="" type="checkbox"/>
Other (specify): _____		

Deformable Mirrors: _____
 Spatial Filters: _____ Gratings: _____
 Other Elements: _____

GAIN MODELS (✓): Bare Cavity Only:
 Simple Saturated Gain: Detailed Gain: _____

BARE CAVITY FIELD MODIFIER MODELS (✓): Cartesian*
 Mirror Tilt: Decentration:
 Aberrations/Thermal Distortions:
 Arbitrary: _____
 Selected (specify): Hughes mirror model.
 Reflectivity Loss:
 Output Coupler Edges: Rolled: _____
 Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):
 Medium Index Variation:
 Gas Absorption:
 Overlapped Beams:
 Other: Any number & loca. of gain sheets
 FAR-FIELD MODELS (✓): Beam Steering Removal:
 Optimal Focal Search: Beam Quality:
 Other: _____

KINETICS

GAIN REGION MODELED (✓): None
 Compact Region: _____ Annular Region: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.)
 Compact Region: _____ Annular Region: _____

KINETICS GRID DIMENSIONALITY (✓):

1D	2D	3D

Compact Region: _____
 Annular Region: _____

GAIN REGION SYMMETRY RESTRICTIONS:
 Gain Vary Along Optic Axes?: _____ Flow Direction?: _____

PULSED: _____ CW: _____ KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

$X + Y_2 = YX + Y$	X	F	Cl	Br	I
$Y + X_2 = YX + X$	H				
Cold (F + H ₂): _____	D				

Hot (H + F₂): _____ Chain (F + H₂ & H + F₂): _____
 Other (specify): _____

ENERGY TRANSFER MODES MODELED (✓): Reference
 V-T: _____
 V-R: _____
 V-V: _____
 Other: _____

Single Line Model (✓): _____
 Multiline Model (✓): _____

Assumed Rotational Population Distribution State (✓):
 Equilibrium: _____ Nonequilibrium: _____
 Number of Laser Lines Modeled: _____
 Source of Rate Coefficients Used in Code: _____

LINE PROFILE MODELS (✓):
 Doppler Broadening: _____
 Collisional Broadening: _____
 Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓): None
 Cylindrical, Radially Flowing: _____
 Rectangular, Linearly Flowing: _____
 Other: _____

COORDINATE SYSTEM: _____
 FLUID GRID DIMENSION (✓): 1D: _____ 2D: _____ 3D: _____
 FLOW FIELD MODELED (✓):
 Laminar: _____ Turbulent: _____
 Other: _____

BASIC MODELING APPROACH (✓):
 Premixed: _____ Mixing: _____
 Other (specify): _____
 References for Approach Used: _____

THERMAL DRIVER MODELED (✓):
 Arc Heater: _____ Combustor: _____
 Shock Tube: _____ Resistance Heater: _____
 Other: _____

F-ATOM DISSOCIATION FROM (✓):
 F₂: _____ SF₆: _____
 Other (specify): _____

F-ATOM CONCENTRATION DETERMINED FROM MODEL?: _____
 DILUENTS MODELED: _____
 MODELS EFFECTS ON MIXING RATE DUE TO (✓):
 Nozzle Boundary Layers: _____ Shock Waves: _____
 Pre-reactions (thermal blockage): _____ Turbulence: _____
 Other (specify): _____

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):
 Media Index Variations: _____
 Other (specify): _____

+also for cylindrical coordinates. *cylindrical in progress.
 *(restriction will be removed.)

CODE NAME:

POLRES/POLRESH

CODE TYPE: OpticsPRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Axisymmetric, Half-symmetric Unstable Resonator Analysis with two Fourier components for analysis of polarization effect. POLRESH-HSURIA modification.ASSESSMENT OF CAPABILITIES: Bare resonator analysis for polarization effects.ASSESSMENT OF LIMITATIONS: No-gain effects, resonator specific HSUR and HSURIA.OTHER UNIQUE FEATURES: Models HSUR, HSURIA--linear-linear, PP wax or reflax. Analysis of polarization effects.

ORIGINATOR/KEY CONTACT:

Name: William P. Latham Phone: (505) 844 -0721Organization: AFWL/ALRAddress: Kirtland Air Force Base, New Mexico 87117AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (RP) G. C. Dente, Applied Optics 18, 2911 (1979); W. P. Latham, "Polarization Effects in a Half-Symmetric Unstable Resonator with a Coated Rear Cone," Applied Optics, to be published.

STATUS:

Operational Currently?: YesUnder Modification?: H version for HSURIA, simple saturable gain, ring analysis of Chodzke andPurpose(s): Huguley's experiments.Ownership?: Government-AFWLProprietary?: NoMACHINE/OPERATING SYSTEM (on which installed): CDC 176 (AFWL)TRANSPORTABLE?: NoMachine Dependent Restrictions: Machine language FFT.

SELF-CONTAINED?:

Other Codes Required (name, purpose): IMSLLIB-LEQ2C - linear equation solution
ASPLIB-ZRPCC - polynomial root solution

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec. CDC 7600)
Small Job:		
Typical Job:	<u>175K</u>	<u>60</u>
Large Job:		

Approximate Number of FORTRAN Lines: _____

CODE NAME:

POL RES/POL RESH

OPTICS

BASIC TYPE (✓):
 Physical Optics: ✓ Geometrical: _____

FIELD (POLARIZATION) REPRESENTATION (✓):
 Scalar: _____ Vector: ✓

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):
 Compact Region: CY Annular Region: CY

TRANSVERSE GRID DIMENSIONALITY (✓):
 Compact Region: Both
 Annular Region: *

1D	2D
✓	
✓	

FIELD SYMMETRY RESTRICTIONS?: _____

MIRROR SHAPE(S) ALLOWED (✓):
 Square: _____ Circular: ✓ Strip: _____
 Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):
 Fixed, Single Resonator Geometries: ✓
 Fixed, Multiple Resonator Geometries: _____
 Modular, Multiple Resonator Geometries: _____

PROPAGATION TECHNIQUE (✓ all that apply):

COMPACT	ANNULAR
*	✓
*	✓
✓	

Other (specify): _____

CONVERGENCE TECHNIQUE (✓):
 Power Comparison: ✓ Field Comparison: _____
 Other: Krylov Matrix Method

ACCELERATION ALGORITHMS USED?:
 Technique: Krylov

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):
 Prony: _____
 Other: Krylov

RESONATOR TYPE (✓): Standing Wave: ✓
 Traveling Wave (Ring): _____ Reverse TW: _____

BRANCH (✓): Positive: ✓ Negative: _____

OPTICAL ELEMENT MODELS INCLUDED (✓):
 Flat Mirrors: ✓ Spherical Mirrors: ✓
 Cylindrical Mirrors: _____ Telescopes: _____
 Scraper Mirrors: _____

Waxicons	Reflexicons
*	✓
*	✓

Axicons: _____
 Arbitrary: _____
 Linear: _____ *
 Parabola-Parabola: _____ *
 Variable Cone Offset: _____
 Other (specify): _____

Deformable Mirrors: _____
 Spatial Filters: _____ Gratings: _____
 Other Elements: _____

GAIN MODELS (✓): Bare Cavity Only: None
 Simple Saturated Gain: _____ Detailed Gain: _____

BARE CAVITY FIELD MODIFIER MODELS (✓): None
 Mirror Tilt: _____ Decentration: _____

Aberrations/Thermal Distortions:
 Arbitrary: _____
 Selected (specify): _____
 Reflectivity Loss: _____
 Output Coupler Edges: Rolled: _____
 Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓): None
 Medium Index Variation: _____
 Gas Absorption: _____
 Overlapped Beams: _____
 Other: _____

FAR-FIELD MODELS (✓): Beam Steering Removal: None
 Optimal Focal Search: _____ Beam Quality: _____
 Other: _____

KINETICS

GAIN REGION MODELED (✓): None
 Compact Region: _____ Annular Region: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.)
 Compact Region: _____ Annular Region: _____

KINETICS GRID DIMENSIONALITY (✓):

1D	2D	3D

Compact Region: _____
 Annular Region: _____

GAIN REGION SYMMETRY RESTRICTIONS:
 Gain Vary Along Optic Axes?: _____ Flow Direction?: _____

PULSED: _____ CW: _____ KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

$$\begin{cases} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{cases}$$

X	F	Cl	Br	I
H				
D				

Cold (F + H₂): _____
 Hot (H + F₂): _____ Chain (F + H₂ & H + F₂): _____
 Other (specify): _____

ENERGY TRANSFER MODES MODELED (✓): Reference
 V-T: _____
 V-R: _____
 V-V: _____
 Other: _____

Single Line Model (✓): _____
 Multiline Model (✓): _____
 Assumed Rotational Population Distribution State (✓):
 Equilibrium: _____ Nonequilibrium: _____
 Number of Laser Lines Modeled: _____
 Source of Rate Coefficients Used in Code: _____

LINE PROFILE MODELS (✓):
 Doppler Broadening: _____
 Collisional Broadening: _____
 Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓): None
 Cylindrical, Radially Flowing: _____
 Rectangular, Linearly Flowing: _____
 Other: _____

COORDINATE SYSTEM: _____
 FLUID GRID DIMENSION (✓): 1D: _____ 2D: _____ 3D: _____

FLOW FIELD MODELED (✓):
 Laminar: _____ Turbulent: _____
 Other: _____

BASIC MODELING APPROACH (✓):
 Premixed: _____ Mixing: _____
 Other (specify): _____
 References for Approach Used: _____

THERMAL DRIVER MODELED (✓):
 Arc Heater: _____ Combustor: _____
 Shock Tube: _____ Resistance Heater: _____
 Other: _____

F-ATOM DISSOCIATION FROM (✓):
 F₂: _____ SF₆: _____
 Other (specify): _____

F-ATOM CONCENTRATION DETERMINED FROM MODEL?: _____
 DILUENTS MODELED: _____
 MODELS EFFECTS ON MIXING RATE DUE TO (✓):
 Nozzle Boundary Layers: _____ Shock Waves: _____
 Prereactions (thermal blockage): _____ Turbulence: _____
 Other (specify): _____

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):
 Media Index Variations: _____
 Other (specify): _____

* H version only

CODE NAME:

POP

CODE TYPE: Optics

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: POP (Physical Optics Propagation) Code; Physical optics analysis of general HEL optical system and atmospheric propagation. Not limited to HEL resonators. Can model CW or pulsed CO₂ EDL, GDL and iodine lasers.

ASSESSMENT OF CAPABILITIES: General purpose, versatile code which is easily applied to HEL problems including resonators, beam transfer optics, atmospheric, and adaptive optics.

ASSESSMENT OF LIMITATIONS: Normal limits due to sampling and aliasing requirements. Transverse grid dimensionality: (1) Compact Region: (a) 2-D Cartesian, $2^N \times 2^M$, $N+M = 16$; (b) 2-D cylindrical 2048 radial points x 1 azimuthal modes ($1 \leq 300$); (2) Annular region: 1-D cylindrical, 2048 radial points x 1 azimuthal modes ($1 \leq 300$).

OTHER UNIQUE FEATURES: Principle Resonator Geometries Modeled: HSURIA, Compact Unstable Confocal or Non-Confocal, Compact Unstable Astigmatic (or Toric, Toric Unstable Resonators (Annular), Oscillator/Amplifier. A versatile interface routine allows use of a variety of kinetic models with the POP. Other features include ZERNIKE polynomial decomposition and modification, pulsed or CW thermal blooming, kinetic cooling.

ORIGINATOR/KEY CONTACT:

Name: Dr. Peter B. Mumola Phone: (203) 762-4415
 Organization: Perkin-Elmer Corporation
 Address: 50 Danbury Rd./Ms 241, Wilton, Connecticut 06897

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T) Available; (U) Available

STATUS:

Operational Currently?: Yes
 Under Modification?: As required
 Purpose(s): _____

Ownership: Perkin-Elmer
 Proprietary: Yes

MACHINE/OPERATING SYSTEM (on which installed): CDC 7600, CYBER 176, IBM 3032, CRAY, CRAY-I (In progress).

TRANSPORTABLE: Yes

Machine Dependent Restrictions: _____

SELF-CONTAINED?: No

Other Codes Required (name, purpose): _____

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec. CDC 7600)
Small Job:		
Typical Job:	<u>200K (SCM), 240K (LCM)</u>	<u>56 sec. (CYBER 176) 1 iteration (loaded cavity Pulsed EDL (CO₂))</u>
Large Job:		

Approximate Number of FORTRAN Lines: ≈10,000

CODE NAME:

POP

OPTICS

BASIC TYPE (✓):
 Physical Optics: ✓ Geometrical: ✓

FIELD (POLARIZATION) REPRESENTATION (✓):
 Scalar: ✓ Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):
 Compact Region: Bot Annular Region: Strip

TRANSVERSE GRID DIMENSIONALITY (✓):

1D	2D
✓	✓

Compact Region: cy Ca
 Annular Region: _____

FIELD SYMMETRY RESTRICTIONS: None

MIRROR SHAPE(S) ALLOWED (✓):
 Square: ✓ Circular: ✓ Strip: ✓
 Rectangular: ✓ Elliptical: ✓ Arbitrary: ✓*

CONFIGURATION FLEXIBILITY (✓):
 Fixed, Single Resonator Geometries: _____
 Fixed, Multiple Resonator Geometries: _____
 Modular, Multiple Resonator Geometries: ✓

PROPAGATION TECHNIQUE (✓/all that apply):

	COMPACT	ANNULAR
Fresnel Integral Algorithms:		
With Kernel Averaging		✓
Gaussian Quadrature:		
Fast Fourier Transform (FFT):	✓	✓
Fast Hankel Transform (FHT):		
Gardner-Fresnel-Kirchhoff (GFK):	✓	
Other (specify):		

CONVERGENCE TECHNIQUE (✓):
 Power Comparison: ✓ Field Comparison: ✓
 Other: Phase, RMS Intensity, Coupling.

ACCELERATION ALGORITHMS USED: ✓
 Technique: Field/Gain averaging, Dynamic averaging.

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):
 Prony: _____
 Other: _____

RESONATOR TYPE (✓): Standing Wave: ✓
 Traveling Wave (Ring): ✓ Reverse TW: _____

BRANCH (✓): Positive: _____ Negative: ✓

OPTICAL ELEMENT MODELS INCLUDED (✓):
 Flat Mirrors: ✓ Spherical Mirrors: ✓
 Cylindrical Mirrors: ✓ Telescopes: ✓
 Scraper Mirrors: ✓

Axicons

Arbitrary:	Waxicons	Reflexicons
Linear:		
Parabola-Parabola:		
Variable Cone Offset:		
Other (specify):		

Deformable Mirrors: ✓

Spatial Filters: ✓ Gratings: ✓

Other Elements: Generalized conics, windows, struts.

GAIN MODELS (✓): Bare Cavity Only: ✓
 Simple Saturated Gain: ✓ Detailed Gain: ✓

BARE CAVITY FIELD MODIFIER MODELS (✓):
 Mirror Tilt: ✓ Decentration: ✓

Aberrations/Thermal Distortions:
 Arbitrary: ✓
 Selected (specify): As per HAC mirror model.

Reflectivity Loss: ✓
 Output Coupler Edges: Rolled: ✓
 Serrated: ✓ Other: Different rad. of curv.

LOADED CAVITY FIELD MODIFIER MODELS (✓):
 Medium Index Variation: ✓
 Gas Absorption: ✓
 Overlapped Beams: ✓

Other: _____

FAR-FIELD MODELS (✓): Beam Steering Removal: ✓
 Optimal Focal Search: ✓ Beam Quality: ✓
 Other: Adaptive optics evaluation, Atmospheric propagation effects

KINETICS

GAIN REGION MODELED (✓): None
 Compact Region: _____ Annular Region: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.)
 Compact Region: _____ Annular Region: _____

KINETICS GRID DIMENSIONALITY (✓):

1D	2D	3D

Compact Region: _____
 Annular Region: _____

GAIN REGION SYMMETRY RESTRICTIONS:
 Gain Vary Along Optic Axes?: _____ Flow Direction?: _____

PULSED: _____ CW: _____ KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

$X + Y_2 = YX + Y$	F	Cl	Br	I
$Y + X_2 = YX + X$	H			
Cold (F + H ₂):	D			

Hot (H + F₂): _____ Chain (F + H₂ & H + F₂): _____
 Other (specify): _____

ENERGY TRANSFER MODES MODELED (✓): Reference

V-T: _____
 V-R: _____
 V-V: _____
 Other: _____

Single Line Model (✓): _____
 Multiline Model (✓): _____

Assumed Rotational Population Distribution State (✓):
 Equilibrium: _____ Nonequilibrium: _____

Number of Laser Lines Modeled: _____
 Source of Rate Coefficients Used in Code: _____

LINE PROFILE MODELS (✓):
 Doppler Broadening: _____
 Collisional Broadening: _____
 Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓): None
 Cylindrical, Radially Flowing: _____
 Rectangular, Linearly Flowing: _____
 Other: _____

COORDINATE SYSTEM: _____

FLUID GRID DIMENSION (✓): 1D: _____ 2D: _____ 3D: _____

FLOW FIELD MODELED (✓):
 Laminar: _____ Turbulent: _____
 Other: _____

BASIC MODELING APPROACH (✓):
 Premixed: _____ Mixing: _____
 Other (specify): _____

References for Approach Used: _____

THERMAL DRIVER MODELED (✓):
 Arc Heater: _____ Combustor: _____
 Shock Tube: _____ Resistance Heater: _____
 Other: _____

F-ATOM DISSOCIATION FROM (✓):
 F₂: _____ SF₆: _____
 Other (specify): _____

F-ATOM CONCENTRATION DETERMINED FROM MODEL: _____

DILUENTS MODELED: _____

MODELS EFFECTS ON MIXING RATE DUE TO (✓):
 Nozzle Boundary Layers: _____ Shock Waves: _____
 Prereactions (thermal blockage): _____ Turbulence: _____
 Other (specify): _____

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):
 Media Index Variations: _____
 Other (specify): _____

*Generalized conics

CODE NAME: PRE-WATSON

CODE TYPE: Optics

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Evaluate impact on resonator solution of conical element polarization.

ASSESSMENT OF CAPABILITIES: Models polarization of conical mirror. Allows arbitrary selection of reflectivity and phase delay.

ASSESSMENT OF LIMITATIONS: Low resolution, only models polarization.

OTHER UNIQUE FEATURES: Resonator Geometries Modeled: half symmetric unstable resonator with rear cone. Rear cone polarization.

ORIGINATOR/KEY CONTACT:
 Name: Phillip D. Briggs Phone: (213) 884-3851
 Organization: Rockwell International, Rocketdyne Division
 Address: 6633 Canoga Ave., Canoga Park, California (91304)

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (RP) Various papers in open literature.

STATUS:
 Operational Currently?: Yes
 Under Modification?: _____
 Purpose(s): _____

Ownership?: Developed under contract to AFWL.
 Proprietary?: No

MACHINE/OPERATING SYSTEM (on which installed): CDC Cyber 176

TRANSPORTABLE: Yes, with mod.
 Machine Dependent Restrictions: Uses CDC-extended core.

SELF-CONTAINED: Yes
 Other Codes Required (name, purpose): _____

	Core Size (Octal Words)	Execution Time (Sec, CDC 7600)
Small Job:		
Typical Job:	<u>70K 5 cm, 200K 6 cm</u>	<u>< 1 min</u>
Large Job:		

Approximate Number of FORTRAN Lines: 600

CODE NAME:

PRE-WATSON

OPTICS

BASIC TYPE (✓):
 Physical Optics: ✓ Geometrical: _____
 FIELD (POLARIZATION) REPRESENTATION (✓):
 Scalar: _____ Vector: ✓
 COORDINATE SYSTEM (Cartesian, cylindrical, etc.):
 Compact Region: CY Annular Region: _____
 TRANSVERSE GRID DIMENSIONALITY (✓):
 Compact Region:

1D	2D
	✓

 Annular Region: _____
 FIELD SYMMETRY RESTRICTIONS?: None
 MIRROR SHAPE(S) ALLOWED (✓):
 Square: _____ Circular: ✓ Strip: _____
 Rectangular: _____ Elliptical: _____ Arbitrary: _____
 CONFIGURATION FLEXIBILITY (✓):
 Fixed, Single Resonator Geometry: _____ ✓
 Fixed, Multiple Resonator Geometries: _____
 Modular, Multiple Resonator Geometries: _____
 PROPAGATION TECHNIQUE (✓) (all that apply):
 Fresnel Integral Algorithms:

COMPACT	ANNULAR

 With Kernel Averaging: _____
 Gaussian Quadrature: _____
 Fast Fourier Transform (FFT): _____ ✓
 Fast Hankel Transform (FHT): _____
 Gardener-Fresnel-Kirchhoff (GFK): _____ ✓
 Other (specify): _____
 CONVERGENCE TECHNIQUE (✓):
 Power Comparison: _____ Field Comparison: _____
 Other: Eigenvalue
 ACCELERATION ALGORITHMS USED?: _____
 Technique: _____
 MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):
 Prony: ✓
 Other: _____

RESONATOR TYPE (✓): Standing Wave: ✓
 Traveling Wave (Ring): _____ Reverse TW: _____
 BRANCH (✓): Positive: ✓ Negative: _____
 OPTICAL ELEMENT MODELS INCLUDED (✓):
 Flat Mirrors: _____ Spherical Mirrors: ✓
 Cylindrical Mirrors: _____ Telescopes: _____
 Scraper Mirrors: _____

Waxicons	Reflexicons

 Axicons: _____
 Arbitrary: _____
 Linear: _____
 Parabola-Parabola: _____
 Variable Cone Offset: _____
 Other (specify): _____
 Deformable Mirrors: _____
 Spatial Filters: _____ Gratings: _____
 Other Elements: Cone
 GAIN MODELS (✓): Bare Cavity Only: ✓
 Simple Saturated Gain: _____ Detailed Gain: _____
 BARE CAVITY FIELD MODIFIER MODELS (✓):
 Mirror Tilt: _____ Decentration: _____
 Aberrations/Thermal Distortions: _____
 Arbitrary: _____
 Selected (specify): _____
 Reflectivity Loss: _____
 Output Coupler Edges: Rolled: _____
 Serrated: _____ Other: _____
 LOADED CAVITY FIELD MODIFIER MODELS (✓):
 Medium Index Variation: _____
 Gas Absorption: _____
 Overlapped Beams: _____
 Other: _____
 FAR-FIELD MODELS (✓): Beam Steering Removal: _____
 Optimal Focal Search: _____ Beam Quality: ✓
 Other: _____

KINETICS

GAIN REGION MODELED (✓): None
 Compact Region: _____ Annular Region: _____
 COORDINATE SYSTEM (Cartesian, cylindrical, etc.):
 Compact Region: _____ Annular Region: _____
 KINETICS GRID DIMENSIONALITY (✓):
 Compact Region:

1D	2D	3D

 Annular Region: _____
 GAIN REGION SYMMETRY RESTRICTIONS:
 Gain Vary Along Optic Axes?: _____ Flow Direction?: _____
 PULSED: _____ CW: _____ KINETICS MODELED
 CHEMICAL PUMPING REACTIONS MODELED (✓):

$$\begin{cases} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{cases}$$

X	F	Cl	Br	I
H				
D				

 Cold (F + H₂): _____
 Hot (H + F₂): _____ Chain (F + H₂ & H + F₂): _____
 Other (specify): _____
 ENERGY TRANSFER MODES MODELED (✓): Reference
 V-T: _____
 V-R: _____
 V-V: _____
 Other: _____
 Single Line Model (✓): _____
 Multiline Model (✓): _____
 Assumed Rotational Population Distribution State (✓):
 Equilibrium: _____ Nonequilibrium: _____
 Number of Laser Lines Modeled: _____
 Source of Rate Coefficients Used in Code: _____
 LINE PROFILE MODELS (✓):
 Doppler Broadening: _____
 Collisional Broadening: _____
 Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓): None
 Cylindrical, Radially Flowing: _____
 Rectangular, Linearly Flowing: _____
 Other: _____
 COORDINATE SYSTEM: _____
 FLUID GRID DIMENSION (✓): 1D: _____ 2D: _____ 3D: _____
 FLOW FIELD MODELED (✓):
 Laminar: _____ Turbulent: _____
 Other: _____
 BASIC MODELING APPROACH (✓):
 Premixed: _____ Mixing: _____
 Other (specify): _____
 References for Approach Used: _____
 THERMAL DRIVER MODELED (✓):
 Arc Heater: _____ Combustor: _____
 Shock Tube: _____ Resistance Heater: _____
 Other: _____
 F-ATOM DISSOCIATION FROM (✓):
 F₂: _____ SF₆: _____
 Other (specify): _____
 F-ATOM CONCENTRATION DETERMINED FROM MODEL?: _____
 DILUENTS MODELED: _____
 MODELS EFFECTS ON MIXING RATE DUE TO (✓):
 Nozzle Boundary Layers: _____ Shock Waves: _____
 Prereactions (thermal blockage): _____ Turbulence: _____
 Other (specify): _____
 MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):
 Media Index Variations: _____
 Other (specify): _____

CODE NAME:

QFHT

CODE TYPE: Optics

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: The QFHT (quasi fast Hankel transform) code was developed as a tool for modeling high Fresnel number annular resonators.

ASSESSMENT OF CAPABILITIES: The QFHT code will model azimuthally symmetric resonators with collimated Fresnel numbers in excess of 200. Code will model large variety of unstable resonators, positive or negative branch, annular or ring. Modular code construction is used with resonator geometry determined by input.

ASSESSMENT OF LIMITATIONS: Because of storage requirements, resonators with severe azimuthal variations (i.e. 16 modes) and large (~25) Fresnel numbers cannot be adequately sampled.

OTHER UNIQUE FEATURES: Models positive and negative compact unstable confocal resonators, rings, rings with IFPA (inter focal point aperture), misaligned and offset axicon cones, and extra cavity phase correction.

ORIGINATOR/KEY CONTACT:

Name: Paul E. Fileger Phone: (305) 840-6643
Organization: United Technologies Research Center, OATL
Address: P.O. Box 2691, MS-R-48 West Palm Beach, Florida 33402

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): None

STATUS:

Operational Currently?: Yes
Under Modification?: Yes
Purpose(s): To incorporate multiline loaded capabilities by coupling to CLQ3D kinetics package.

Ownership?: UTRC
Proprietary?: Yes

MACHINE/OPERATING SYSTEM (on which installed): CDC-176, IBM-370

TRANSPORTABLE?: Yes

Machine Dependent Restrictions: None

SELF-CONTAINED?: Yes

Other Codes Required (name, purpose): None

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec, CDC 7600)
Small Job:		
Typical Job:		
Large Job:		

Approximate Number of FORTRAN Lines: _____

CODE NAME:

QFHT

OPTICS

BASIC TYPE (✓):
 Physical Optics: Geometrical: _____

FIELD (POLARIZATION) REPRESENTATION (✓):
 Scalar: _____ Vector: In process

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):
 Compact Region: CV Annular Region: CV

TRANSVERSE GRID DIMENSIONALITY (✓):

1D	2D
	✓
	✓

Compact Region: _____
 Annular Region: _____

FIELD SYMMETRY RESTRICTIONS: None

MIRROR SHAPE(S) ALLOWED (✓):
 Square: Circular: _____ Strip:
 Rectangular: Elliptical: Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):
 Fixed, Single Resonator Geometry: _____
 Fixed, Multiple Resonator Geometries: _____
 Modular, Multiple Resonator Geometries:

PROPAGATION TECHNIQUE (✓ all that apply):

	COMPACT	ANNULAR
Fresnel Integral Algorithms:		
With Kernel Averaging		
Gaussian Quadrature:	✓	✓
Fast Fourier Transform (FFT):	✓	✓
Fast Hankel Transform (FHT):		
Gardner-Fresnel-Kirchhoff (GFK):		
Other (specify): <u>Radial asymptotic propa-</u>		
<u>gator.</u>		

CONVERGENCE TECHNIQUE (✓):
 Power Comparison: _____ Field Comparison:
 Other: Will also use power when loaded.

ACCELERATION ALGORITHMS USED: Yes
 Technique: Field averaging.

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):
 Prony:
 Other: _____

RESONATOR TYPE (✓): Standing Wave:
 Traveling Wave (Ring): Reverse TW: _____

BRANCH (✓): Positive: Negative: _____

OPTICAL ELEMENT MODELS INCLUDED (✓):
 Flat Mirrors: Spherical Mirrors:
 Cylindrical Mirrors: Telescopes: (geometric)
 Scraper Mirrors:

Asixons

Waxicons	Reflixicons
In progress	
✓	

Arbitrary: _____
 Linear: _____
 Parabola-Parabola: _____
 Variable Cone Offset: _____
 Other (specify): _____

Deformable Mirrors:
 Spatial Filters: Gratings: _____
 Other Elements: Misaligned and offset cones

GAIN MODELS (✓): Bare Cavity Only:
 Simple Saturated Gain: _____ Detailed Gain: (in work)

BARE CAVITY FIELD MODIFIER MODELS (✓):
 Mirror Tilt: Decentration:
 Aberrations/Thermal Distortions:
 Arbitrary:
 Selected (specify): _____

Reflectivity Loss:
 Output Coupler Edges: Rolled:
 Serrated: Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):
 Medium Index Variation: _____
 Gas Absorption: _____
 Overlapped Beams: _____
 Other: _____

FAR-FIELD MODELS (✓): Beam Steering Removal:
 Optimal Focal Search: Beam Quality:
 Other: _____

KINETICS

GAIN REGION MODELED (✓): None
 Compact Region: _____ Annular Region: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):
 Compact Region: _____ Annular Region: _____

KINETICS GRID DIMENSIONALITY (✓):

1D	2D	3D

Compact Region: _____
 Annular Region: _____

GAIN REGION SYMMETRY RESTRICTIONS:
 Gain Vary Along Optic Axes?: _____ Flow Direction?: _____

PULSED: _____ CW: _____ KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

$$\begin{cases} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{cases}$$

	F	Cl	Br	I
H				
D				

Cold (F + H₂): _____
 Hot (H + F₂): _____ Chain (F + H₂ & H + F₂): _____
 Other (specify): _____

ENERGY TRANSFER MODES MODELED (✓): Reference
 V-T: _____
 V-R: _____
 V-V: _____
 Other: _____

Single Line Model (✓): _____
 Multiline Model (✓): _____
 Assumed Rotational Population Distribution State (✓):
 Equilibrium: _____ Nonequilibrium: _____
 Number of Laser Lines Modeled: _____
 Source of Rate Coefficients Used in Code: _____

LINE PROFILE MODELS (✓):
 Doppler Broadening: _____
 Collisional Broadening: _____
 Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓): None
 Cylindrical, Radially Flowing: _____
 Rectangular, Linearly Flowing: _____
 Other: _____

COORDINATE SYSTEM: _____
 FLUID GRID DIMENSION (✓): 1D: _____ 2D: _____ 3D: _____
 FLOW FIELD MODELED (✓):
 Laminar: _____ Turbulent: _____
 Other: _____

BASIC MODELING APPROACH (✓):
 Premixed: _____ Mixing: _____
 Other (specify): _____
 References for Approach Used: _____

THERMAL DRIVER MODELED (✓):
 Arc Heater: _____ Combustor: _____
 Shock Tube: _____ Resistance Heater: _____
 Other: _____

F-ATOM DISSOCIATION FROM (✓):
 F₂: _____ SF₆: _____
 Other (specify): _____

F-ATOM CONCENTRATION DETERMINED FROM MODEL: _____
 DILUENTS MODELED: _____
 MODELS EFFECTS ON MIXING RATE DUE TO (✓):
 Nozzle Boundary Layers: _____ Shock Waves: _____
 Prereactions (thermal blockage): _____ Turbulence: _____
 Other (specify): _____

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):
 Media Index Variations: _____
 Other (specify): _____

CODE NAME:

RASCAL

CODE TYPE: Optics, Kinetics, and GasdynamicsPRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Resonator parameter selection, assess mode control, performance predictions for power and beam quality, resonator perturbation analysis, beam quality budgeting, set/verify design requirements.ASSESSMENT OF CAPABILITIES: 3-D optics calculation with general field modifier models coupled to AEROKNS code for kinetics and gasdynamics calculations. Code uses modular construction (see AEROKNS for more details).ASSESSMENT OF LIMITATIONS: Kinetics model does not include rotational nonequilibrium. Code is presently being developed.OTHER UNIQUE FEATURES: Resonator geometries modeled: HSURIA w/waxicon or reflaxicon (general surface), ring w/waxicon or reflaxicon (general surface). Beam rotators, axisymmetric mode competition, 3D basis set competition.

ORIGINATOR/KEY CONTACT:

Name: Phil Briggs Phone: (213) 884-3851Organization: Rockwell International-Rocketdyne DivisionAddress: 6633 Canoga Ave., Canoga Park, California 91304AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T) Annular Laser Optics Study Final Report (AFWL-TR-77-117) (U) Annular Laser Optics Study User's Manual: Loaded Cavity Codes.

STATUS:

Operational Currently?: NoUnder Modification?: Under development

Purpose(s):

Ownership: Rockwell InternationalProprietary?: YesMACHINE/OPERATING SYSTEM (on which installed): CDC Cyber 176TRANSPORTABLE?: With modification.Machine Dependent Restrictions: Uses CDC extended core.

SELF-CONTAINED?:

Other Codes Required (name, purpose): None

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec, CDC 7600)
Small Job:	<u>200K SCM - 200K LCM</u>	<u>?</u>
Typical Job:	<u>200K SCM - 500K LCM</u>	<u>?</u>
Large Job:	<u>200K SCM - 1000K LCM</u>	<u>?</u>

Approximate Number of FORTRAN Lines: ?

CODE NAME:

RASCAL

OPTICS

BASIC TYPE (✓):

Physical Optics: Geometrical: _____

FIELD (POLARIZATION) REPRESENTATION (✓):

Scalar: Vector:

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: CY Annular Region: CY

TRANSVERSE GRID DIMENSIONALITY (✓):

Compact Region:

1D	2D
	<input checked="" type="checkbox"/>
	<input checked="" type="checkbox"/>

Annular Region:

FIELD SYMMETRY RESTRICTIONS?: None

MIRROR SHAPE(S) ALLOWED (✓):

Square: _____ Circular: Strip: _____

Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):

Fixed, Single Resonator Geometry: _____

Fixed, Multiple Resonator Geometries: _____

Modular, Multiple Resonator Geometries:

PROPAGATION TECHNIQUE (✓ all that apply):

Fresnel Integral Algorithms:

With Kernel Averaging

Gaussian Quadrature:

Fast Fourier Transform (FFT):

Fast Hankel Transform (FHT):

Gardner-Fresnel-Kirchhoff (GFK):

Other (specify): Midpoint Rule: Com/Ann

	COMPACT	ANNULAR
Fresnel Integral Algorithms:		
With Kernel Averaging		<input checked="" type="checkbox"/>
Gaussian Quadrature:		
Fast Fourier Transform (FFT):	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Fast Hankel Transform (FHT):		
Gardner-Fresnel-Kirchhoff (GFK):	<input checked="" type="checkbox"/>	

CONVERGENCE TECHNIQUE (✓):

Power Comparison: Field Comparison: _____

Other: _____

ACCELERATION ALGORITHMS USED?:

Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):

Prony:

Other: _____

RESONATOR TYPE (✓):

Standing Wave:

Traveling Wave (Ring): Reverse TW: _____

BRANCH (✓): Positive: Negative:

OPTICAL ELEMENT MODELS INCLUDED (✓):

Flat Mirrors: Spherical Mirrors:

Cylindrical Mirrors: _____ Telescopes:

Scaper Mirrors:

Axicons

	Waxicons	Reflexicons
Arbitrary:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Lineal:		
Parabola-Parabola:		
Variable Cone Offset:		
Other (specify):		

Other (specify): _____

Parabola-Parabola:

Variable Cone Offset:

Other (specify): _____

Deformable Mirrors:

Spatial Filters: Gratings: _____

Other Elements: _____

GAIN MODELS (✓): Bare Cavity Only: _____

Simple Saturated Gain: Detailed Gain:

BARE CAVITY FIELD MODIFIER MODELS (✓):

Mirror Tilt: Decentration:

Aberrations/Thermal Distortions:

Arbitrary:

Selected (specify): _____

Reflectivity Loss: _____

Output Coupler Edges: Rolled: _____

Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):

Medium Index Variation:

Gas Absorption:

Overlapped Beams: _____

Other: General medium in homogeneities

FAR-FIELD MODELS (✓): Beam Steering Removal:

Optimal Focal Search: Beam Quality:

Other: Beam phase cleanup system

model.

KINETICS

AEROKNS

GAIN REGION MODELED (✓):

Compact Region: _____ Annular Region:

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: _____ Annular Region: CY

KINETICS GRID DIMENSIONALITY (✓):

Compact Region:

1D	2D	3D
<input checked="" type="checkbox"/>		

Annular Region:

GAIN REGION SYMMETRY RESTRICTIONS:

Gain Vary Along Optic Axes?: _____ Flow Direction?:

PULSED: _____ CW: KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

$X + Y_2 = YX + Y$	<input checked="" type="checkbox"/>	F	Cl	Br	I
$Y + X_2 = YX + X$	<input checked="" type="checkbox"/>	H	<input checked="" type="checkbox"/>		
Cold (F + H ₂):	<input checked="" type="checkbox"/>	D	<input checked="" type="checkbox"/>		

Hot (H + F₂): Chain (F + H₂ + H + F₂):

Other (specify): _____

ENERGY TRANSFER MODES MODELED (✓): Reference

V-T: Cohen

V-R: _____

V-V: Cohen

Other: _____

Single Line Model (✓): _____

Multiline Model (✓):

Assumed Rotational Population Distribution State (✓):

Equilibrium: Nonequilibrium: _____

Number of Laser Lines Modeled: ≤12

Source of Rate Coefficients Used in Code: Handbook of Chemical Lasers.

LINE PROFILE MODELS (✓):

Doppler Broadening:

Collisional Broadening:

Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓):

Cylindrical, Radially Flowing:

Rectangular, Linearly Flowing: _____

Other: _____

COORDINATE SYSTEM: CY

FLUID GRID DIMENSION (✓): 1D: 2D: _____ 3D: _____

FLOW FIELD MODELED (✓):

Laminar: _____ Turbulent: _____

Other: Scheduled mixing

BASIC MODELING APPROACH (✓):

Premixed: _____ Mixing:

Other (specify): _____

References for Approach Used: ALOS Final Report.

THERMAL DRIVER MODELED (✓):

Arc Heater: _____ Combustor: _____

Shock Tube: _____ Resistance Heater: _____

Other: Not modeled.

F-ATOM DISSOCIATION FROM (✓):

F₂: SF₆:

Other (specify): NF₃

F-ATOM CONCENTRATION DETERMINED FROM MODEL?: *

DILUENTS MODELED: He, N₂

MODELS EFFECTS ON MIXING RATE DUE TO (✓):

Nozzle Boundary Layers: Shock Waves: _____

Preactions (thermal blockage): _____ Turbulence: _____

Other (specify): Trip

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):

Media Index Variations:

Other (specify): _____

* By equilibrium thermochemistry

CODE NAME:

ROPTICS

CODE TYPE: Optical and KineticsPRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Study interaction between rotational nonequilibrium kinetics and optical resonator geometry. Also see NORO-I.ASSESSMENT OF CAPABILITIES: Since kinetic-fluid dynamic model is qualitative, code provides qualitative understanding of nonlinear interactions between kinetics, fluid dynamics, and optical resonator.ASSESSMENT OF LIMITATIONS: Qualitative kinetics and fluid dynamics; strip minor resonator model (developed by Bell Aerospace Textron) models two mirror stable and unstable resonators.OTHER UNIQUE FEATURES: Can take up to 30 lines; because of rotational nonequilibrium kinetics, predicts which lines will lase.

ORIGINATOR/KEY CONTACT:

Name: L.H. SentmanPhone: (217) 333-1834Organization: Department of Aeronautical and Astronautical Engineering, University of IllinoisAddress: 101 Transportation Building, Urbana, Illinois 61801AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (RP) Applied Optics 17, 2244 (1978).

STATUS:

Operational Currently?: Yes

Under Modification?: _____

Purpose(s): _____

Ownership?: Bell Aerospace TEXTRONProprietary?: Yes

MACHINE/OPERATING SYSTEM (on which installed): _____

TRANSPORTABLE?: Yes

Machine Dependent Restrictions: _____

SELF-CONTAINED?: Yes

Other Codes Required (name, purpose): _____

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec, CDC 7600)
Small Job:		
Typical Job:		150 sec/iteration*
Large Job:		

Approximate Number of FORTRAN Lines: _____ * typically takes 15 iterations to converge.

CODE NAME: _____

ROPTICS

OPTICS

BASIC TYPE (✓): Geometrical; _____
 Physical Optics: _____
 FIELD (POLARIZATION) REPRESENTATION (✓):
 Scalar: Vector: _____
 COORDINATE SYSTEM (Cartesian, cylindrical, etc.):
 Compact Region: Annular Region: _____
 TRANSVERSE GRID DIMENSIONALITY (✓):
 Compact Region:

1D	2D
✓	

 Annular Region: _____

FIELD SYMMETRY RESTRICTIONS:
 MIRROR SHAPE(S) ALLOWED (✓):
 Square: _____ Circular: Strip:
 Rectangular: _____ Elliptical: _____ Arbitrary: _____
 CONFIGURATION FLEXIBILITY (✓):
 Fixed, Single Resonator Geometry: _____
 Fixed, Multiple Resonator Geometries:
 Modular, Multiple Resonator Geometries: _____

PROPAGATION TECHNIQUE (✓) (Mark that apply):
 Fresnel Integral Algorithms: _____
 With Kernel Averaging: _____
 Gaussian Quadrature: _____
 Fast Fourier Transform (FFT): _____
 Fast Hankel Transform (FHT): _____
 Gardner-Fresnel-Kirchoff (GFK): _____
 Other (specify): _____

CONVERGENCE TECHNIQUE (✓):
 Power Comparison: Field Comparison:
 Other: p chem/p loss total optics.
 ACCELERATION ALGORITHMS USED:
 Technique: _____
 MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):
 Priority: _____
 Other: _____

RESONATOR TYPE (✓): Standing Wave:
 Traveling Wave (Ring): _____ Reverse TW: _____
 BRANCH (✓): Positive: Negative: _____
 OPTICAL ELEMENT MODELS INCLUDED (✓):
 Flat Mirrors: _____ Spherical Mirrors: _____
 Cylindrical Mirrors: Telescopes: _____
 Scaper Mirrors: _____
 Achroms: _____
 Arbitrary: _____
 Linear: _____
 Parabola-Parabola: _____
 Variable Cone Offset: _____
 Other (specify): _____
 Deformable Mirrors: _____
 Spatial Filters: _____ Gratings: _____
 Other Elements: _____

Waxicons Refractions

 GAIN MODELS (✓): Bare Cavity Only:
 Simple Saturated Gain: _____ Detailed Gain:
 BARE CAVITY FIELD MODIFIER MODELS (✓):
 Mirror Tilt: _____ Decantation: _____
 Aberrations/Thermal Distortions: _____
 Arbitrary: _____
 Selected (specify): _____
 Reflectivity Loss: _____
 Output Coupler Edges: Rolled: _____
 Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):
 Medium Index Variation: _____
 Gas Absorption: _____
 Overlapped Beams: _____
 Other: _____
 FAR-FIELD MODELS (✓): Beam Steering Removal: _____
 Optimal Focal Search: _____ Beam Quality: _____
 Other: _____

KINETICS

GAIN REGION MODELED (✓):
 Compact Region: _____ Annular Region: _____
 COORDINATE SYSTEM (Cartesian, cylindrical, etc.)
 Compact Region: _____ Annular Region: _____
 KINETICS GRID DIMENSIONALITY (✓):
 Compact Region:

1D	2D	3D

 Annular Region: _____

GAIN REGION SYMMETRY RESTRICTIONS:
 Gain Vary Along Optic Axes: _____ Flow Direction: _____
 PULSED: _____ CW: KINETICS MODELED
 CHEMICAL PUMPING REACTIONS MODELED (✓):

$$\begin{cases} x + y_2 = yx + y \\ y + x_2 = yx + x \end{cases}$$

 Cold (F + H₂): _____
 Hot (H + F₂): _____ Chain (F + H₂ & H + F₂): _____
 Other (specify): _____

ENERGY TRANSFER MODES MODELED (✓): Reference
 V-T:
 V-R:
 V-V: _____
 Other: _____
 Single Line Model (✓): _____
 Multiline Model (✓):
 Assumed Rotational Population Distribution State (✓):
 Equilibrium: _____ Nonequilibrium:
 Number of Laser Lines Modelled: 1355
 Source of Rate Coefficients Used in Code: Cohen HF rate package, Hinch's rotational relaxation data, Polanyi's pumping distribution profile models
 Doppler Broadening:
 Collisional Broadening: _____
 Other (specify): Voigt profile.

DILUENTS MODELED: _____
 MODELS EFFECTS ON MIXING RATE DUE TO (✓):
 Nozzle Boundary Layers: _____ Shock Waves: _____
 Preactions (thermal blockage): _____ Turbulence: _____
 Other (specify): _____
 MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):
 Media Index Variations: _____
 Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓): None
 Cylindrical, Radially Flowing: _____
 Rectangular, Linearly Flowing: _____
 Other: _____
 COORDINATE SYSTEM: _____
 FLUID GRID DIMENSION (✓): 1D: _____ 2D: _____ 3D: _____
 FLOW FIELD MODELED (✓):
 Laminar: _____ Turbulent: _____
 Other: _____

BASIC MODELING APPROACH (✓):
 Premixed: _____ Mixing: _____
 Other (specify): _____
 References for Approach Used: _____
 THERMAL DRIVER MODELED (✓):
 Arc Heater: _____ Combustor: _____
 Shock Tube: _____ Resistance Heater: _____
 Other: _____
 F-ATOM DISSOCIATION FROM (✓):
 F₂: _____ SF₆: _____
 Other (specify): _____

F-ATOM CONCENTRATION DETERMINED FROM MODEL: _____
 DILUENTS MODELED: _____
 MODELS EFFECTS ON MIXING RATE DUE TO (✓):
 Nozzle Boundary Layers: _____ Shock Waves: _____
 Preactions (thermal blockage): _____ Turbulence: _____
 Other (specify): _____
 MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):
 Media Index Variations: _____
 Other (specify): _____

DILUENTS MODELED: _____
 MODELS EFFECTS ON MIXING RATE DUE TO (✓):
 Nozzle Boundary Layers: _____ Shock Waves: _____
 Preactions (thermal blockage): _____ Turbulence: _____
 Other (specify): _____
 MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):
 Media Index Variations: _____
 Other (specify): _____

CODE NAME:

ROTKIN

CODE TYPE: Optics, Kinetics, and GasdynamicsPRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Prediction of HR/DF chemical laser performance based on coupled rate equation analysis of chemical, vibrational, rotational, and radiative transfer.ASSESSMENT OF CAPABILITIES: Accurate prediction of laser spectra results from rotational nonequilibrium feature of kinetic analysis. Can vary mixing rate and schedules of flow variables to approximate certain physical effects (e.g. boundary layers, shock, etc.) Geometrical optics is used.ASSESSMENT OF LIMITATIONS: Fabry-Perot resonator analysis is one-dimensional; fluid dynamic analysis is of one-dimensional, scheduled mixing variety.OTHER UNIQUE FEATURES: Scheduled mixing model with different mixing lengths for primary and secondary mixing zones. Allows use of linear, exponential, or tabular rates.

ORIGINATOR/KEY CONTACT:

Name: R. J. Hall Phone: (203) 727-7349
Organization: United Technologies Research CenterAddress: Silver Lane, E. Hartford, Connecticut 06108AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (RP) R. J. Hall, "Rotational Nonequilibrium and Line-Selected Operation in CW DF Chemical Lasers", IEEE JQE, QE-12, 453 (1976).

STATUS:

Operational Currently?: YesUnder Modification?: No

Purpose(s): _____

Ownership?: UTRCProprietary?: YesMACHINE/OPERATING SYSTEM (on which installed): Univac 1110TRANSPORTABLE?: YesMachine Dependent Restrictions: NoneSELF-CONTAINED?: YesOther Codes Required (name, purpose): None

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec, CDC 7600)
Small Job:		
Typical Job:	<u>Same for all: 110K</u>	<u>~ 60-90</u>
Large Job:		
Approximate Number of FORTRAN Lines:	<u>2000</u>	

CODE NAME:

ROTKIN

OPTICS

BASIC TYPE (✓):

Physical Optics: _____ Geometrical:

FIELD (POLARIZATION) REPRESENTATION (✓):

Scalar: Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: _____ Annular Region: _____

TRANSVERSE GRID DIMENSIONALITY (✓):

Compact Region:

Annular Region:

1D	2D
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>

FIELD SYMMETRY RESTRICTIONS?: _____

MIRROR SHAPE(S) ALLOWED (✓):

Square: _____ Circular: _____ Strip:

Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):

Fixed, Single Resonator Geometry: (Fabry-Perot)

Fixed, Multiple Resonator Geometries: _____

Modular, Multiple Resonator Geometries: _____

PROPAGATION TECHNIQUE (✓all that apply):

COMPACT ANNULAR

Fresnel Integral Algorithms:

With Kernel Averaging

Gaussian Quadrature:

Fast Fourier Transform (FFT):

Fast Hankel Transform (FHT):

Gardner-Fresnel-Kirchhoff (GFK):

Other (specify): _____

CONVERGENCE TECHNIQUE (✓):

Power Comparison: _____ Field Comparison: _____

Other: _____

ACCELERATION ALGORITHMS USED?: _____

Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):

Prony: _____

Other: _____

RESONATOR TYPE (✓): Standing Wave:

Traveling Wave (Ring): _____ Reverse TW: _____

BRANCH (✓): Positive: _____ Negative: _____

OPTICAL ELEMENT MODELS INCLUDED (✓):

Flat Mirrors: Spherical Mirrors: _____

Cylindrical Mirrors: _____ Telescopes: _____

Scraper Mirrors: _____

Axicons

Arbitrary:

Linear:

Parabola-Parabola:

Variable Cone Offset:

Other (specify): _____

Deformable Mirrors: _____

Spatial Filters: _____ Gratings: _____

Other Elements: _____

Waxicons	Reflexicons

GAIN MODELS (✓): Bare Cavity Only: _____

Simple Saturated Gain: _____ Detailed Gain:

BARE CAVITY FIELD MODIFIER MODELS (✓):

Mirror Tilt: _____ Decentration: _____

Aberrations/Thermal Distortions:

Arbitrary: _____

Selected (specify): _____

Reflectivity Loss: _____

Output Coupler Edges: Rolled: _____

Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):

Medium Index Variation: _____

Gas Absorption: _____

Overlapped Beams: _____

Other: _____

FAR-FIELD MODELS (✓): Beam Steering Removal: _____

Optimal Focal Search: _____ Beam Quality: _____

Other: _____

KINETICS

GAIN REGION MODELED (✓):

Compact Region: _____ Annular Region: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.)

Compact Region: _____ Annular Region: _____

KINETICS GRID DIMENSIONALITY (✓):

Compact Region:

Annular Region:

1D	2D	3D

GAIN REGION SYMMETRY RESTRICTIONS:

Gain Vary Along Optic Axes?: _____ Flow Direction?:

PULSED: _____ CW: KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

$$\begin{cases} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{cases}$$

Cold (F + H₂):

Hot (H + F₂): _____ Chain (F + H₂ & H + F₂): _____

Other (specify): _____

X	F	Cl	Br	I
H	<input checked="" type="checkbox"/>			
D	<input checked="" type="checkbox"/>			

ENERGY TRANSFER MODES MODELED (✓): Reference

V-T:

V-R:

V-V:

Other: _____

Single Line Model (✓): _____

Multiline Model (✓):

Assumed Rotational Population Distribution State (✓):

Equilibrium: _____ Nonequilibrium:

Number of Laser Lines Modeled: Up to 68.

Source of Rate Coefficients Used in Code: ALFA

kinetics.

LINE PROFILE MODELS (✓):

Doppler Broadening: _____

Collisional Broadening:

Other (specify): (Voigt)

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓):

Cylindrical, Radially Flowing:

Rectangular, Linearly Flowing:

Other: _____

COORDINATE SYSTEM: Cartesian or cylindrical

FLUID GRID DIMENSION (✓): 1D: 2D: _____ 3D: _____

FLOW FIELD MODELED (✓):

Laminar: Turbulent:

Other: Scheduled mixing model.

BASIC MODELING APPROACH (✓):

Premixed: _____ Mixing:

Other (specify): Scheduled mixing model with different mixing lengths for different zones.

References for Approach Used: _____

THERMAL DRIVER MODELED (✓):

Arc Heater: _____ Combustor: _____

Shock Tube: _____ Resistance Heater: _____

Other: _____

F-ATOM DISSOCIATION FROM (✓):

F₂: _____ SF₆: _____

Other (specify): _____

F-ATOM CONCENTRATION DETERMINED FROM MODEL?: _____

DILUENTS MODELED: He, N₂

MODELS EFFECTS ON MIXING RATE DUE TO (✓):

Nozzle Boundary Layers: _____ Shock Waves: _____

Pre-reactions (thermal blockage): _____ Turbulence: _____

Other (specify): Can vary mixing rate, schedules of flow variables to approximate above effects.

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):

Media Index Variations: _____

Other (specify): _____

CODE NAME:

SAIC2D

CODE TYPE: OpticsPRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Provide capability of modeling high-order modes in cylindrical/annular optical resonators.ASSESSMENT OF CAPABILITIES: Provides beam intensity and phase distribution throughout any cylindrical/annular resonator system. Determine effects of system perturbations of these distributions.ASSESSMENT OF LIMITATIONS: Limited to analysis of beams with azimuthal modes and compact region Fresnel numbers < 10.OTHER UNIQUE FEATURES: Models HSURIA and traveling wave annular ring resonator

ORIGINATOR/KEY CONTACT:

Name: Jerry Long Phone: (404) 955-2663Organization: Science Applications, Inc.Address: 6600 Powers Ferry Road, Suite 220, Atlanta, Georgia 30339AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (RP) E. A. Sziklas and A. E. Siegman, Applied Optics 14, 1874 (1975).

STATUS:

Operational Currently?: YesUnder Modification?: YesPurpose(s): Incorporate generalized axicon/reflexicon model.Ownership?: U.S. GovernmentProprietary?: NoMACHINE/OPERATING SYSTEM (on which installed): Cyber 175/176TRANSPORTABLE?: YesMachine Dependent Restrictions: Requires 370K or virtual memory computer. Some CDC FORTRAN dependent code.SELF-CONTAINED?: Yes, except as noted below.Other Codes Required (name, purpose): Requires input from kinetics calculations on a subroutine to do gain calculations for power extraction option. (See GCAL.)

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec. CDC 7600)
Small Job:	370K	250-300
Typical Job:	370K	300-500
Large Job:	370K	500-2000

Approximate Number of FORTRAN Lines: 3000

CODE NAME:

SAIC2D

OPTICS

BASIC TYPE (√):

Physical Optics: Geometrical: _____

FIELD (POLARIZATION) REPRESENTATION (√):

Scalar: Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: Ca Annular Region: CY

TRANSVERSE GRID DIMENSIONALITY (√):

Compact Region:

Annular Region:

1D	2D
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

FIELD SYMMETRY RESTRICTIONS: 1-16 Azimuthal
MIRROR SHAPE(S) ALLOWED (√): modes in annular
regions

Square: Circular: Strip: _____

Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (√):

Fixed, Single Resonator Geometry: _____

Fixed, Multiple Resonator Geometries: _____

Modular, Multiple Resonator Geometries:

PROPAGATION TECHNIQUE (√ all that apply):

Fresnel Integral Algorithms:

With Kernel Averaging

Gaussian Quadrature:

Fast Fourier Transform (FFT):

Fast Hankel Transform (FHT):

Gardener-Fresnel-Kirchhoff (GFK):

Other (specify): Radial asymptotic

expansion in annular region

CONVERGENCE TECHNIQUE (√):

Power Comparison: Field Comparison:

Other: _____

ACCELERATION ALGORITHMS USED?: Yes

Technique: Field and gain averaging

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (√):

Prony: _____

Other: _____

COMPACT	ANNULAR
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

RESONATOR TYPE (√): Standing Wave:
Traveling Wave (Ring): Reverse TW:

BRANCH (√): Positive: Negative:

OPTICAL ELEMENT MODELS INCLUDED (√):

Flat Mirrors: Spherical Mirrors:

Cylindrical Mirrors: _____ Telescopes:

Scraper Mirrors:

Axicons

Arbitrary: _____

Linear:

Parabola-Parabola:

Variable Cone Offset: _____

Other (specify): _____

Deformable Mirrors:

Spatial Filters: _____ Gratings: _____

Other Elements: _____

	Waxicons	Reflexicons
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

GAIN MODELS (√): Bare Cavity Only: _____

Simple Saturated Gain: Detailed Gain:

BARE CAVITY FIELD MODIFIER MODELS (√):

Mirror Tilt: Decentration:

Aberrations/Thermal Distortions:

Arbitrary:

Selected (specify): Intensity mapping & bowing

Reflectivity Loss:

Output Coupler Edges: Rolled: _____

Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (√):

Medium Index Variation:

Gas Absorption:

Overlapped Beams:

Other: _____

FAR-FIELD MODELS (√): Beam Steering Removal:

Optimal Focal Search: Beam Quality:

Other: _____

KINETICS

GAIN REGION MODELED (√):

Compact Region: _____ Annular Region: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: _____ Annular Region: _____

KINETICS GRID DIMENSIONALITY (√):

1D	2D	3D
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Compact Region:

Annular Region:

GAIN REGION SYMMETRY RESTRICTIONS:

Gain Vary Along Optic Axes?: _____ Flow Direction?: _____

PULSED: _____ CW: _____ KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (√):

$X + Y_2 = YX + Y$	F	Cl	Br	I
$Y + X_2 = YX + X$	H			
Cold (F + H ₂):	D			

Hot (H + F₂): _____ Chain (F + H₂ & H + F₂): _____

Other (specify): _____

ENERGY TRANSFER MODES MODELED (√): Reference

V-T: _____

V-R: _____

V-V: _____

Other: _____

Single Line Model (√): _____

Multiline Model (√): _____

Assumed Rotational Population Distribution State (√):

Equilibrium: _____ Nonequilibrium: _____

Number of Laser Lines Modeled: _____

Source of Rate Coefficients Used in Code: _____

Other: _____

LINE PROFILE MODELS (√):

Doppler Broadening: _____

Collisional Broadening: _____

Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (√):

Cylindrical, Radially Flowing: _____

Rectangular, Linearly Flowing: _____

Other: _____

COORDINATE SYSTEM:

FLUID GRID DIMENSION (√): 1D: _____ 2D: _____ 3D: _____

FLOW FIELD MODELED (√):

Laminar: _____ Turbulent: _____

Other: _____

BASIC MODELING APPROACH (√):

Premixed: _____ Mixing: _____

Other (specify): _____

References for Approach Used: _____

THERMAL DRIVER MODELED (√):

Arc Heater: _____ Combustor: _____

Shock Tube: _____ Resistance Heater: _____

Other: _____

F-ATOM DISSOCIATION FROM (√):

F₂: _____ SF₆: _____

Other (specify): _____

F-ATOM CONCENTRATION DETERMINED FROM MODEL?: _____

DILUENTS MODELED: _____

MODELS EFFECTS ON MIXING RATE DUE TO (√):

Nozzle Boundary Layers: _____ Shock Waves: _____

Prereactions (thermal blockage): _____ Turbulence: _____

Other (specify): _____

MODELS EFFECTS ON OPTICAL MODES DUE TO (√):

Media Index Variations: _____

Other (specify): _____

CODE NAME:

SAIC2DV

CODE TYPE: Optics

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Provide accurate, cost-effective method of cylindrical/annular optical resonator mode and power extraction analysis and determine the effect of various design perturbations on these parameters. (This code is a vectorized version of SAIC2D.)

ASSESSMENT OF CAPABILITIES: Provides beam intensity and phase distributions throughout any cylindrical/annular resonator system. Determine effects of system perturbations on these distributions.

ASSESSMENT OF LIMITATIONS: Limited to analysis of beams with 1-32 azimuthal modes and compact region Fresnel numbers < 30.

OTHER UNIQUE FEATURES: Models HSURIA and traveling wave annular resonator.

ORIGINATOR/KEY CONTACT:

Name: Jerry Long Phone: (404) 955-2663
 Organization: Science Applications, Inc.
 Address: 6600 Powers Ferry Road, Suite 220, Atlanta, Georgia 30339

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (RP) E. A. Sziklas and A. E. Siegman, Applied Optics 14, 1874 (1975)

STATUS:

Operational Currently?: Yes
 Under Modification?: Yes
 Purpose(s): To complete optimization of vectorized routines

Ownership?: U.S. Government
 Proprietary?: No

MACHINE/OPERATING SYSTEM (on which installed): CYBER 203

TRANSPORTABLE?: No

Machine Dependent Restrictions: Usus CYBER 203 vector algorithms

SELF-CONTAINED?: Yes, except as noted below.

Other Codes Required (name, purpose): Requires input from kinetics calculations or a subroutine to do gain calculations for power extraction option (See GCAL).

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec, CDC 7600)
Small Job:	1000K	20 CYBER 203
Typical Job:	1000K	100 CYBER 203
Large Job:	1000K	500-1000 CYBER 203

Approximate Number of FORTRAN Lines: 3000

CODE NAME:

SAIC2DV

OPTICS

BASIC TYPE (✓):
 Physical Optics: Geometrical: _____

FIELD (POLARIZATION) REPRESENTATION (✓):
 Scalar: Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):
 Compact Region: Ca Annular Region: CY

TRANSVERSE GRID DIMENSIONALITY (✓):

1D	2D
	✓(1)
✓(2)	✓(3)

Compact Region: _____
 Annular Region: _____

FIELD SYMMETRY RESTRICTIONS: 1-64 azimuthal
 MIRROR SHAPE(S) ALLOWED (✓): modes in annular
 Square: Circular: Strip: _____
 Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):
 Fixed, Single Resonator Geometries: _____
 Fixed, Multiple Resonator Geometries: _____
 Modular, Multiple Resonator Geometries:

PROPAGATION TECHNIQUE (✓ all that apply):

	COMPACT	ANNULAR
Fresnel Integral Algorithms:		
With Kernel Averaging		
Gaussian Quadrature:		
Fast Fourier Transform (FFT):	✓	
Fast Hankel Transform (FHT):		
Gardener-Fresnel-Kirchhoff (GFK):		

Other (specify): Radial asymptotic expansion in annular region

CONVERGENCE TECHNIQUE (✓):
 Power Comparison: Field Comparison:

Other: _____

ACCELERATION ALGORITHMS USED?:
 Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):
 Prony: _____
 Other: _____

RESONATOR TYPE (✓): Standing Wave:
 Traveling Wave (Ring): Reverse TW:

BRANCH (✓): Positive: Negative:

OPTICAL ELEMENT MODELS INCLUDED (✓):
 Flat Mirrors: Spherical Mirrors:
 Cylindrical Mirrors: _____ Telescopes:
 Scraper Mirrors:

Axicons

	Waxicons	Reflaxicons
Arbitrary:		
Linear:	✓	✓
Parabola-Parabola:	✓	✓
Variable Cone Offset:		
Other (specify):		

Deformable Mirrors:
 Spatial Filters: _____ Gratings: _____
 Other Elements: _____

GAIN MODELS (✓): Bare Cavity Only: _____
 Simple Saturated Gain: Detailed Gain:

BARE CAVITY FIELD MODIFIER MODELS (✓):
 Mirror Tilt: Decentration:
 Aberrations/Thermal Distortions:
 Arbitrary:
 Selected (specify): Intensity mapping & bowing
 Reflectivity Loss:
 Output Coupler Edges: Rolled: _____
 Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):
 Medium Index Variation:
 Gas Absorption:
 Overlapped Beams:
 Other: _____

FAR-FIELD MODELS (✓): Beam Steering Removal:
 Optimal Focal Search: Beam Quality:
 Other: _____

KINETICS

GAIN REGION MODELED (✓):
 Compact Region: _____ Annular Region: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):
 Compact Region: _____ Annular Region: _____

KINETICS GRID DIMENSIONALITY (✓):

1D	2D	3D

Compact Region: _____
 Annular Region: _____

GAIN REGION SYMMETRY RESTRICTIONS:
 Gain Vary Along Optic Axes?: _____ Flow Direction?: _____

PULSED: _____ CW: _____ KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

$$\begin{cases} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{cases}$$

	F	Cl	Br	I
H				
D				

Cold (F + H₂): _____
 Hot (H + F₂): _____ Chain (F + H₂ + H + F₂): _____
 Other (specify): _____

ENERGY TRANSFER MODES MODELED (✓): Reference

V-T:	
V-R:	
V-V:	

Other: _____

Single Line Model (✓): _____
 Multiline Model (✓): _____

Assumed Rotational Population Distribution State (✓):
 Equilibrium: _____ Nonequilibrium: _____

Number of Laser Lines Modeled: _____
 Source of Rate Coefficients Used in Code: _____

LINE PROFILE MODELS (✓):
 Doppler Broadening: _____
 Collisional Broadening: _____
 Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓):
 Cylindrical, Radially Flowing: _____
 Rectangular, Linearly Flowing: _____
 Other: _____

COORDINATE SYSTEM: _____

FLUID GRID DIMENSION (✓): 1D: _____ 2D: _____ 3D: _____

FLOW FIELD MODELED (✓):
 Laminar: _____ Turbulent: _____
 Other: _____

BASIC MODELING APPROACH (✓):
 Premixed: _____ Mixing: _____
 Other (specify): _____

References for Approach Used: _____

THERMAL DRIVER MODELED (✓):
 Arc Heater: _____ Combustor: _____
 Shock Tube: _____ Resistance Heater: _____
 Other: _____

F-ATOM DISSOCIATION FROM (✓):
 F₂: _____ SF₆: _____
 Other (specify): _____

F-ATOM CONCENTRATION DETERMINED FROM MODEL?: _____

DILUENTS MODELED: _____

MODELS EFFECTS ON MIXING RATE DUE TO (✓):
 Nozzle Boundary Layers: _____ Shock Waves: _____
 Prereactions (thermal blockage): _____ Turbulence: _____
 Other (specify): _____

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):
 Media Index Variations: _____
 Other (specify): _____

CODE NAME:

SAIFHT

CODE TYPE: Optics

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Provide accurate, cost-effective method of cylindrical/annular optical resonator parameter analysis including power extraction for use in overall system optimization.

ASSESSMENT OF CAPABILITIES: Provides beam intensity and phase distributions throughout any cylindrical/annular resonator system.

ASSESSMENT OF LIMITATIONS: Models only circular beams which can be described with 1 - 8 azimuthal modes.

OTHER UNIQUE FEATURES: Models standing wave and annular ring resonators, compact unstable confocal resonators, confocal and non-confocal HSURIA.

ORIGINATOR/KEY CONTACT:

Name: Jerry Long Phone: (404) 955-2663Organization: Science Applications, Inc.Address: 6600 Powers Ferry Road, Suite 220, Atlanta, Georgia 30339

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T) HF Laser Subsystem Technology Assessment (DARPA Interim Report), SAI, Atlanta, Georgia, July, 1979 (CONFIDENTIAL).

(RP) E. A. Sziklas and A. E. Siegman, Applied Optics 14, 1874 (1975).

STATUS:

Operational Currently?: YesUnder Modification?: YesPurpose(s): To provide generalized axicon/reflexicon model.Ownership?: U.S. GovernmentProprietary?: NoMACHINE/OPERATING SYSTEM (on which installed): Cyber 175, 176TRANSPORTABLE?: Yes

Machine Dependent Restrictions: Requires machine with minimum of 370K or virtual memory; some lines in code are CDC FORTRAN dependent.

SELF-CONTAINED?: Yes, except as noted below.

Other Codes Required (name, purpose): Requires input from kinetics calculations or a subroutine to do gain calculations for power extraction (See GCAL).

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec. CDC 7600)
Small Job:	370K	10 - 50
Typical Job:	370K	50 - 100
Large Job:	370K	100 - 300

Approximate Number of FORTRAN Lines: 2500

CODE NAME:

SAIFHT

OPTICS

BASIC TYPE (✓):
 Physical Optics: ✓ Geometrical: _____
 FIELD (POLARIZATION) REPRESENTATION (✓):
 Scalar: ✓ Vector: _____
 COORDINATE SYSTEM (Cartesian, cylindrical, etc.):
 Compact Region: CY Annular Region: CY
 TRANSVERSE GRID DIMENSIONALITY (✓):
 Compact Region:

1D	2D
81924096*	
81924096*	

 Annular Region: _____
 FIELD SYMMETRY RESTRICTIONS: 1-8 azimuthal
 MIRROR SHAPE(S) ALLOWED (✓): modes
 Square: _____ Circular: ✓ Strip: _____
 Rectangular: _____ Elliptical: _____ Arbitrary: _____
 CONFIGURATION FLEXIBILITY (✓):
 Fixed, Single Resonator Geometry: _____
 Fixed, Multiple Resonator Geometries: _____
 Modular, Multiple Resonator Geometries: ✓
 PROPAGATION TECHNIQUE (✓/all that apply):
 Fresnel Integral Algorithms:

COMPACT	ANNULAR

 With Kernel Averaging _____
 Gaussian Quadrature: _____
 Fast Fourier Transform (FFT): _____
 Fast Hankel Transform (FHT): ✓
 Gardener-Fresnel-Kirchhoff (GFK): _____
 Other (specify): Radial asymptotic expansion
in annular region
 CONVERGENCE TECHNIQUE (✓):
 Power Comparison: ✓ Field Comparison: ✓
 Other: _____
 ACCELERATION ALGORITHMS USED: Yes
 Technique: Field and gain averaging
 MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):
 Prony: _____
 Other: _____

RESONATOR TYPE (✓): Standing Wave: ✓
 Traveling Wave (Ring): ✓ Reverse TW: ✓
 BRANCH (✓): Positive: ✓ Negative: ✓
 OPTICAL ELEMENT MODELS INCLUDED (✓):
 Flat Mirrors: ✓ Spherical Mirrors: ✓
 Cylindrical Mirrors: _____ Telescopes: ✓
 Scraper Mirrors: ✓

Axicons	Waxicons	Reflexicons
Arbitrary:		
Linear:	✓	✓
Parabola-Parabola:	✓	✓
Variable Cone Offset:		
Other (specify):		

 Deformable Mirrors: _____
 Spatial Filters: _____ Gratings: _____
 Other Elements: _____
 GAIN MODELS (✓): Bare Cavity Only: _____
 Simple Saturated Gain: ✓ Detailed Gain: ✓
 BARE CAVITY FIELD MODIFIER MODELS (✓):
 Mirror Tilt: ✓ Decentration: ✓
 Aberrations/Thermal Distortions:
 Arbitrary: ✓
 Selected (specify): intensity mapping &
bowing
 Reflectivity Loss: ✓
 Output Coupler Edges: Rolled: _____
 Serrated: _____ Other: _____
 LOADED CAVITY FIELD MODIFIER MODELS (✓):
 Medium Index Variation: ✓
 Gas Absorption: ✓
 Overlapped Beams: ✓
 Other: _____
 FAR-FIELD MODELS (✓): Beam Steering Removal: ✓
 Optimal Focal Search: ✓ Beam Quality: ✓
 Other: _____

KINETICS

GAIN REGION MODELED (✓):
 Compact Region: _____ Annular Region: _____
 COORDINATE SYSTEM (Cartesian, cylindrical, etc.):
 Compact Region: _____ Annular Region: _____
 KINETICS GRID DIMENSIONALITY (✓):

1D	2D	3D

 Compact Region: _____
 Annular Region: _____
 GAIN REGION SYMMETRY RESTRICTIONS:
 Gain Vary Along Optic Axes?: _____ Flow Direction?: _____
 PULSED: _____ CW: _____ KINETICS MODELED
 CHEMICAL PUMPING REACTIONS MODELED (✓):

$$\begin{cases} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{cases}$$

X	F	Cl	Br	I
H				
D				

 Cold (F + H₂): _____
 Hot (H + F₂): _____ Chain (F + H₂ & H + F₂): _____
 Other (specify): _____
 ENERGY TRANSFER MODES MODELED (✓): Reference
 V-T: _____
 V-R: _____
 V-V: _____
 Other: _____
 Single Line Model (✓): _____
 Multiline Model (✓): _____
 Assumed Rotational Population Distribution State (✓):
 Equilibrium: _____ Nonequilibrium: _____
 Number of Laser Lines Modeled: _____
 Source of Rate Coefficients Used in Code: _____
 LINE PROFILE MODELS (✓):
 Doppler Broadening: _____
 Collisional Broadening: _____
 Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓):
 Cylindrical, Radially Flowing: _____
 Rectangular, Linearly Flowing: _____
 Other: _____
 COORDINATE SYSTEM: _____
 FLUID GRID DIMENSION (✓): 1D: _____ 2D: _____ 3D: _____
 FLOW FIELD MODELED (✓):
 Laminar: _____ Turbulent: _____
 Other: _____
 BASIC MODELING APPROACH (✓):
 Premixed: _____ Mixing: _____
 Other (specify): _____
 References for Approach Used: _____
 THERMAL DRIVER MODELED (✓):
 Arc Heater: _____ Combustor: _____
 Shock Tube: _____ Resistance Heater: _____
 Other: _____
 F-ATOM DISSOCIATION FROM (✓):
 F₂: _____ SF₆: _____
 Other (specify): _____
 F-ATOM CONCENTRATION DETERMINED FROM MODEL?: _____
 DILUENTS MODELED: _____
 MODELS EFFECTS ON MIXING RATE DUE TO (✓):
 Nozzle Boundary Layers: _____ Shock Waves: _____
 Prereactions (thermal blockage): _____ Turbulence: _____
 Other (specify): _____
 MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):
 Media Index Variations: _____
 Other (specify): _____

* per NL

SAIGD

CODE NAME:

CODE TYPE: Gasdynamics and Kinetics

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: (1) To correlate and analyze closed cavity data. (2) To optimize operating conditions and geometric configurations. (3) To generate gain algorithms for wave optics analysis. Lasing and chemical kinetics modeling are included. Generates gasdynamic/kinetic profiles for gain algorithm (GCAL).

ASSESSMENT OF CAPABILITIES: Model has been applied to a wide variety of source flow nozzles and has correlated the available closed cavity data base well. Utilizes 1-D gasdynamics to model the 3-D flowfield of source flow nozzles. Includes effects of base pressure, mixing rate and source flow geometry. Treats expansion plane of source flow as two distinct regions, a base pressure region and a pure source flow region.

ASSESSMENT OF LIMITATIONS:

OTHER UNIQUE FEATURES: Models HF or DF lasing. Single line lasing is modeled, but multi-line corrections are made to account for photon production at all levels. Utilizes either constant gain approximation or laser rate equation.

ORIGINATOR/KEY CONTACT: Name: Kerry E. Patterson Phone: (404) 955-2663 Organization: Science Applications, Inc. Address: 6600 Powers Ferry Road, Suite 220, Atlanta, Georgia 30339

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T) HF Laser Subsystem Technology Assessment (DARPA Interim Report), Science Applications, Inc., Atlanta, Georgia, July, 1979, Section 3.

STATUS: Operational Currently?: Yes Under Modification?: Yes Purpose(s): To extend kinetics model to full multi-line capability.

Ownership?: U.S. Government Proprietary?: No

MACHINE/OPERATING SYSTEM (on which installed): Cyber 175

TRANSPORTABLE?: Yes Machine Dependent Restrictions: None

SELF-CONTAINED?: Yes Other Codes Required (name, purpose):

ESTIMATE OF RESOURCES REQUIRED FOR RUNS: Table with columns for Core Size (Octal Words) and Execution Time (Sec. CDC 7600). Rows for Small Job, Typical Job, Large Job, and Approximate Number of FORTRAN Lines.

CODE NAME:

SAIGD

OPTICS

BASIC TYPE (✓):

Physical Optics: _____ Geometrical: _____

FIELD (POLARIZATION) REPRESENTATION (✓):

Scalar: _____ Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: _____ Annular Region: _____

TRANSVERSE GRID DIMENSIONALITY (✓):

1D	2D

Compact Region:

Annular Region:

FIELD SYMMETRY RESTRICTIONS: _____

MIRROR SHAPE(S) ALLOWED (✓):

Square: _____ Circular: _____ Strip: _____

Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):

Fixed, Single Resonator Geometry: _____

Fixed, Multiple Resonator Geometries: _____

Modular, Multiple Resonator Geometries: _____

PROPAGATION TECHNIQUE (✓ all that apply):

	COMPACT	ANNULAR
Fresnel Integral Algorithms:		
With Kernel Averaging		
Gaussian Quadrature:		
Fast Fourier Transform (FFT):		
Fast Hankel Transform (FHT):		
Gardner-Fresnel-Kirchhoff (GFK):		
Other (specify): _____		

CONVERGENCE TECHNIQUE (✓):

Power Comparison: _____ Field Comparison: _____

Other: _____

ACCELERATION ALGORITHMS USED: _____

Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):

Prony: _____

Other: _____

RESONATOR TYPE (✓): Standing Wave: _____

Traveling Wave (Ring): _____ Reverse TW: _____

BRANCH (✓): Positive: _____ Negative: _____

OPTICAL ELEMENT MODELS INCLUDED (✓):

Flat Mirrors: _____ Spherical Mirrors: _____

Cylindrical Mirrors: _____ Telescopes: _____

Scraper Mirrors: _____

Axicons

Arbitrary:

Linear:

Parabola-Parabola:

Variable Cone Offset:

Other (specify): _____

Deformable Mirrors: _____

Spatial Filters: _____ Gratings: _____

Other Elements: _____

Waxicons	Reflexicons

GAIN MODELS (✓): Bare Cavity Only: _____

Simple Saturated Gain: _____ Detailed Gain: _____

BARE CAVITY FIELD MODIFIER MODELS (✓):

Mirror Tilt: _____ Decentration: _____

Aberrations/Thermal Distortions:

Arbitrary: _____

Selected (specify): _____

Reflectivity Loss: _____

Output Coupler Edges: Rolled: _____

Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):

Medium Index Variation: _____

Gas Absorption: _____

Overlapped Beams: _____

Other: _____

FAR-FIELD MODELS (✓): Beam Steering Removal: _____

Optimal Focal Search: _____ Beam Quality: _____

Other: _____

KINETICS

GAIN REGION MODELED (✓):

Compact Region: ✓ Annular Region: ✓

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: Ca Annular Region: CV

KINETICS GRID DIMENSIONALITY (✓):

1D	2D	3D
	✓	
	✓	

Compact Region:

Annular Region:

GAIN REGION SYMMETRY RESTRICTIONS:

Gain Vary Along Optic Axes: No Flow Direction: Yes

PULSED: _____ CW: ✓ KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

X	F	Cl	Br	I
X + Y ₂ = YX + Y				
Y + X ₂ = YX + X	✓			
Cold (F + H ₂): ✓		✓		
Hot (H + F ₂): ✓			✓	

Chain (F + H₂ & H + F₂): ✓

Other (specify): _____

ENERGY TRANSFER MODES MODELED (✓): Reference

v-T: ✓ Cohen & Bott (1976)

v-R: _____

v-V: _____

Other: _____

Single Line Model (✓): ✓*

Multiline Model (✓): _____

Assumed Rotational Population Distribution State (✓):

Equilibrium: _____ Nonequilibrium: _____

Number of Laser Lines Modeled: _____

Source of Rate Coefficients Used in Code: _____

Cohen & Bott (1976)

LINE PROFILE MODELS (✓):

Doppler Broadening: ✓

Collisional Broadening: _____

Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓):

Cylindrical, Radially Flowing: ✓

Rectangular, Linearly Flowing: ✓

Other: Source flow nozzles

COORDINATE SYSTEM: Cartesian or cylindrical

FLUID GRID DIMENSION (✓): 1D: _____ 2D: _____ 3D: ✓*

FLOW FIELD MODELED (✓):

Laminar: ✓ Turbulent: ✓

Other: _____

BASIC MODELING APPROACH (✓):

Premixed: _____ Mixing: _____

Other (specify): Flame sheet approach

References for Approach Used: _____

THERMAL DRIVER MODELED (✓):

Arc Heater: _____ Combustor: ✓

Shock Tube: _____ Resistance Heater: _____

Other: _____

F-ATOM DISSOCIATION FROM (✓):

F₂: ✓ SF₆: _____

Other (specify): NF₃

F-ATOM CONCENTRATION DETERMINED FROM MODEL: Yes

DILUENTS MODELED: N₂ He

MODELS EFFECTS ON MIXING RATE DUE TO (✓):

Nozzle Boundary Layers: ✓ Shock Waves: _____

Preactions (thermal blockage): _____ Turbulence: ✓

Other (specify): _____

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):

Media Index Variations: In flow direction

Other (specify): _____

* with multi-line corrections

* Pseudo

CODE NAME:

SAI1D

CODE TYPE: Optics

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Provide accurate, cost-effective method of linear optical resonator mode and power extraction analysis and the affect of various design perturbations on these parameters.

ASSESSMENT OF CAPABILITIES: Provides beam intensity and phase distribution throughout one transverse dimension in a linear resonator.

ASSESSMENT OF LIMITATIONS: Models only one transverse dimension and does not provide for any cross-coupling affects that may occur.

OTHER UNIQUE FEATURES: Models linear confocal and non-confocal positive and negative branch resonators.

ORIGINATOR/KEY CONTACT:

Name: Jerry Long Phone: (404) 955-2663
 Organization: Science Applications, Inc.
 Address: 6600 Powers Ferry Road, Suite 220, Atlanta, Georgia 30339

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (RP) E. A. Sziklas and A. E. Siegman, Applied Optics 14, 1874 (1975).

STATUS:

Operational Currently?: Yes
 Under Modification?: No
 Purpose(s): _____

Ownership?: U.S. Government
 Proprietary?: No

MACHINE/OPERATING SYSTEM (on which installed): Cyber 175/176

TRANSPORTABLE?: Yes

Machine Dependent Restrictions: Has some lines that are CDC FORTRAN dependent.

SELF-CONTAINED?: Yes, except as noted below.

Other Codes Required (name, purpose): Requires input from a kinetic calculation or a subroutine to do gain calculations for power extraction (See GCAL).

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec. CDC 7600)
Small Job:	200K	5 - 10
Typical Job:	200K	25 - 75
Large Job:	200K	100 - 200

Approximate Number of FORTRAN Lines: 2000

CODE NAME:

SAITD

OPTICS

BASIC TYPE (✓):

Physical Optics: ✓ Geometrical: _____

FIELD (POLARIZATION) REPRESENTATION (✓):

Scalar: ✓ Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: Ca Annular Region: _____

TRANSVERSE GRID DIMENSIONALITY (✓):

Compact Region: * 8192

1D	2D
✓*	

Annular Region: _____

FIELD SYMMETRY RESTRICTIONS?: +

MIRROR SHAPE(S) ALLOWED (✓):

Square: _____ Circular: _____ Strip: ✓

Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):

Fixed, Single Resonator Geometry: _____

Fixed, Multiple Resonator Geometries: _____

Modular, Multiple Resonator Geometries: ✓

PROPAGATION TECHNIQUE (✓ all that apply):

	COMPACT	ANNULAR
Fresnel Integral Algorithms:		
With Kernel Averaging		
Gaussian Quadrature:		
Fast Fourier Transform (FFT):	✓	
Fast Hankel Transform (FHT):		
Gardner-Fresnel-Kirchhoff (GFK):		
Other (specify):		

CONVERGENCE TECHNIQUE (✓):

Power Comparison: ✓ Field Comparison: ✓

Other: _____

ACCELERATION ALGORITHMS USED?: Yes

Technique: Field and gain averaging

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):

Prony: _____

Other: _____

RESONATOR TYPE (✓): Standing Wave: ✓

Traveling Wave (Ring): ✓ Reverse TW: ✓

BRANCH (✓): Positive: ✓ Negative: ✓

OPTICAL ELEMENT MODELS INCLUDED (✓):

Flat Mirrors: ✓ Spherical Mirrors: ✓

Cylindrical Mirrors: ✓ Telescopes: ✓

Scraper Mirrors: ✓

Axicons

Arbitrary: _____

Linear: _____

Parabola-Parabola: _____

Variable Cone Offset: _____

Other (specify): _____

Deformable Mirrors: _____

Spatial Filters: ✓ Gratings: _____

Other Elements: _____

Waxicons	Reflexicons

GAIN MODELS (✓): Bare Cavity Only: _____

Simple Saturated Gain: ✓ Detailed Gain: ✓ *

BARE CAVITY FIELD MODIFIER MODELS (✓):

Mirror Tilt: ✓ Decentration: ✓

Aberrations/Thermal Distortions:

Arbitrary: ✓

Selected (specify): intensity mapping & power bowing

Reflectivity Loss: ✓

Output Coupler Edges: Rolled: _____

Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):

Medium Index Variation: ✓

Gas Absorption: ✓

Overlapped Beams: ✓

Other: _____

FAR-FIELD MODELS (✓): Beam Steering Removal: ✓

Optimal Focal Search: ✓ Beam Quality: ✓

Other: _____

KINETICS

GAIN REGION MODELED (✓):

Compact Region: _____ Annular Region: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: _____ Annular Region: _____

KINETICS GRID DIMENSIONALITY (✓):

1D	2D	3D

Compact Region: _____

Annular Region: _____

GAIN REGION SYMMETRY RESTRICTIONS:

Gain Vary Along Optic Axes?: _____ Flow Direction?: _____

PULSED: _____ CW: _____ KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

$$\begin{cases} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{cases}$$

X	F	Cl	Br	I
H				
D				

Cold (F + H₂): _____

Hot (H + F₂): _____ Chain (F + H₂ & H + F₂): _____

Other (specify): _____

ENERGY TRANSFER MODES MODELED (✓): Reference

V-T: _____

V-R: _____

V-V: _____

Other: _____

Single Line Model (✓): _____

Multiline Model: (✓): _____

Assumed Rotational Population Distribution State (✓):

Equilibrium: _____ Nonequilibrium: _____

Number of Laser Lines Modeled: _____

Source of Rate Coefficients Used in Code: _____

LINE PROFILE MODELS (✓):

Doppler Broadening: _____

Collisional Broadening: _____

Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓):

Cylindrical, Radially Flowing: _____

Rectangular, Linearly Flowing: _____

Other: _____

COORDINATE SYSTEM: _____

FLUID GRID DIMENSION (✓): 1D: _____ 2D: _____ 3D: _____

FLOW FIELD MODELED (✓):

Laminar: _____ Turbulent: _____

Other: _____

BASIC MODELING APPROACH (✓):

Premixed: _____ Mixing: _____

Other (specify): _____

References for Approach Used: _____

THERMAL DRIVER MODELED (✓):

Arc Heater: _____ Combustor: _____

Shock Tube: _____ Resistance Heater: _____

Other: _____

F-ATOM DISSOCIATION FROM (✓):

F₂: _____ SF₆: _____

Other (specify): _____

F-ATOM CONCENTRATION DETERMINED FROM MODEL?: _____

DILUENTS MODELED: _____

MODEL EFFECTS ON MIXING RATE DUE TO (✓):

Nozzle Boundary Layers: _____ Shock Waves: _____

Prereactions (thermal blockage): _____ Turbulence: _____

Other (specify): _____

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):

Media Index Variations: _____

Other (specify): _____

+ Not accurate for large cross-coupling effects

* with GCAL

CODE NAME:

SAI2D

CODE TYPE: Optics

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Modeling of rectangular linear resonators and optical trains.

ASSESSMENT OF CAPABILITIES: Provides beam intensity and phase distributions throughout a linear rectangular resonator system.

ASSESSMENT OF LIMITATIONS: Limited to a combined 2-dimensional sampling resolution of 8192 points (64 x 128).

OTHER UNIQUE FEATURES: Models compact unstable confocal (ABLE, MIRACL, MADS, HELWS) resonators.

ORIGINATOR/KEY CONTACT:

Name: Jerry Long Phone: (404) 955-2663
 Organization: Science Applications, Inc.
 Address: 6600 Powers Ferry Road, Suite 220, Atlanta, Georgia 30339

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (RP) E. A. Sziklas and A. E. Siegman, Applied Optics 14, 1874 (1975)

STATUS:

Operational Currently?: Yes
 Under Modification?: No
 Purpose(s): _____

Ownership?: U.S. Government
 Proprietary?: No

MACHINE/OPERATING SYSTEM (on which installed): Cyber 175/176

TRANSPORTABLE?: Yes

Machine Dependent Restrictions: Contains some CDC FORTRAN dependent Code.

SELF-CONTAINED?: Yes, except as noted below.

Other Codes Required (name, purpose): Requires input from kinetics calculation or a subroutine to do gain calculations for power extraction options (See GCAL).

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec, CDC 7600)
Small Job:	370K	100 - 200
Typical Job:	370K	200 - 500
Large Job:	370K	500 - 1000

Approximate Number of FORTRAN Lines: 2500

CODE NAME:

SAI2D

OPTICS

BASIC TYPE (✓):

Physical Optics: Geometrical:

FIELD (POLARIZATION) REPRESENTATION (✓):

Scalar: Vector:

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: Ca Annular Region:

TRANSVERSE GRID DIMENSIONALITY (✓):

Compact Region: $NX \cdot NY = 8192$

1D	2D
	<input checked="" type="checkbox"/>

Annular Region:

FIELD SYMMETRY RESTRICTIONS: NONE

MIRROR SHAPE(S) ALLOWED (✓):

Square: Circular: Strip:

Rectangular: Elliptical: Arbitrary:

CONFIGURATION FLEXIBILITY (✓):

Fixed, Single Resonator Geometries:

Fixed, Multiple Resonator Geometries:

Modular, Multiple Resonator Geometries:

PROPAGATION TECHNIQUE (✓) (all that apply): COMPACT ANNULAR

Fresnel Integral Algorithms:

With Kernel Averaging:

Gaussian Quadrature:

Fast Fourier Transform (FFT):

Fast Hankel Transform (FHT):

Gardener-Fresnel-Kirchhoff (GFK):

Other (specify):

CONVERGENCE TECHNIQUE (✓):

Power Comparison: Field Comparison:

Other:

ACCELERATION ALGORITHMS USED: Yes

Technique: Field and gain averaging

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):

Prony:

Other:

RESONATOR TYPE (✓): Standing Wave:

Traveling Wave (Ring): Reverse TW:

BRANCH (✓): Positive: Negative:

OPTICAL ELEMENT MODELS INCLUDED (✓):

Flat Mirrors: Spherical Mirrors:

Cylindrical Mirrors: Telescopes:

Scraper Mirrors:

Axicons

Arbitrary:

Linear:

Parabola-Parabola:

Variable Cone Offset:

Other (specify):

Deformable Mirrors:

Spatial Filters: Gratings:

Other Elements:

Waxicons	Reflexicons

GAIN MODELS (✓): Bare Cavity Only:

Simple Saturated Gain: Detailed Gain: *

BARE CAVITY FIELD MODIFIER MODELS (✓):

Mirror Tilt: Decentration:

Aberrations/Thermal Distortions:

Arbitrary:

Selected (specify): Intensity mapping,

Reflectivity Loss: bowing

Output Coupler Edges: Rolled:

Serrated: Other:

LOADED CAVITY FIELD MODIFIER MODELS (✓):

Medium Index Variation:

Gas Absorption:

Overlapped Beams:

Other:

FAR-FIELD MODELS (✓): Beam Steering Removal:

Optimal Focal Search: Beam Quality:

Other:

KINETICS

GAIN REGION MODELED (✓):

Compact Region: Annular Region:

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: Annular Region:

KINETICS GRID DIMENSIONALITY (✓):

1D	2D	3D

Compact Region:

Annular Region:

GAIN REGION SYMMETRY RESTRICTIONS:

Gain Vary Along Optic Axes?: Flow Direction?:

PULSED: CW: KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

$$\begin{cases} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{cases}$$

X	F	Cl	Br	I
H				
D				

Cold ($F + H_2$):

Hot ($H + F_2$): Chain ($F + H_2$ & $H + F_2$):

Other (specify):

ENERGY TRANSFER MODES MODELED (✓): Reference

V-T:

V-R:

V-V:

Other:

Single Line Model (✓):

Multiline Model (✓):

Assumed Rotational Population Distribution State (✓):

Equilibrium: Nonequilibrium:

Number of Laser Lines Modeled:

Source of Rate Coefficients Used in Code:

LINE PROFILE MODELS (✓):

Doppler Broadening:

Collisional Broadening:

Other (specify):

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓):

Cylindrical, Radially Flowing:

Rectangular, Linearly Flowing:

Other:

COORDINATE SYSTEM:

FLUID GRID DIMENSION (✓): 1D: 2D: 3D:

FLOW FIELD MODELED (✓):

Laminar: Turbulent:

Other:

BASIC MODELING APPROACH (✓):

Premixed: Mixing:

Other (specify):

References for Approach Used:

THERMAL DRIVER MODELED (✓):

Arc Heater: Combustor:

Shock Tube: Resistance Heater:

Other:

F-ATOM DISSOCIATION FROM (✓):

F_2 : SF_6 :

Other (specify):

F-ATOM CONCENTRATION DETERMINED FROM MODEL?:

DILUENTS MODELED:

Nozzle Boundary Layers: Shock Waves:

Preactions (thermal blockage): Turbulence:

Other (specify):

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):

Media Index Variations:

Other (specify):

* with GCAL

CODE NAME:

SOS

CODE TYPE: Optics and KineticsPRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: (Son-of-Spike): calculation of pulsed HF and DF chemical laser performance.ASSESSMENT OF CAPABILITIES: Calculates solutions to coupled thermodynamic, chemical kinetic, and radiation transport equations for pulsed HF and DF lasers. Utilizes comprehensive model of chemical kinetics and includes rotational nonequilibrium. Treatment of rotational nonequilibrium allows very short computing time.ASSESSMENT OF LIMITATIONS: Restricted to Fabry-Perot cavity.OTHER UNIQUE FEATURES: The existing code is strictly a pulse code. Hence there are no flow-field features that are pertinent. However, a modification to be known as GSOS (Grandson-of-Spike) is now being debugged which will incorporate the DESALE-5 mixing model into SOS. The result will be an efficient CW code with rotation nonequilibrium.

ORIGINATOR/KEY CONTACT:

Name: Orig: J. Hough; Contact: M. Epstein Phone: (213) 648-6861Organization: Aerophysics Laboratory, The Aerospace CorporationAddress: P. O. Box 92957, Los Angeles, California 90009AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T) "Efficient Model for HF Lasers with Rotational Nonequilibrium," J.J.T. Hough, Aerospace Corporation, Rpt. SAMSO-TR-78-79, August 15, 1978; (U) "SPIKE: A Computer Model for the H₂(D₂) + F₂ Pulsed Chemical Laser", J.J.T. Hough, Aerospace Corporation, Rpt. SAMSO-TR-78-84, April 14, 1978. (T) "A Reveiw of Rate Coefficients in the H₂ - F₂ Chemical Laser System Supplement (1977)", Aerospace Corporation Rpt. SAMSO-TR-78-41, N. Cohen² June 8, 1978.

STATUS:

Operational Currently?: YesUnder Modification?: YesPurpose(s): Extension to CW case.Ownership?: Aerospace CorporationProprietary?: NoMACHINE/OPERATING SYSTEM (on which installed): CDC 7600TRANSPORTABLE?: Yes

Machine Dependent Restrictions: _____

SELF-CONTAINED?: Yes

Other Codes Required (name, purpose): _____

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec. CDC 7600)
Small Job:		30
Typical Job:	6K	60
Large Job:		300
Approximate Number of FORTRAN Lines:	3200	

CODE NAME:

SOS

OPTICS

BASIC TYPE (✓):

Physical Optics: _____ Geometrical:

FIELD (POLARIZATION) REPRESENTATION (✓):

Scalar: Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: Annular Region: _____

TRANSVERSE GRID DIMENSIONALITY (✓):

1D	2D
<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

Compact Region:

Annular Region:

FIELD SYMMETRY RESTRICTIONS?: _____

MIRROR SHAPE(S) ALLOWED (✓):

Square: _____ Circular: _____ Strip: _____

Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):

Fixed, Single Resonator Geometry:

Fixed, Multiple Resonator Geometries: _____

Modular, Multiple Resonator Geometries: _____

PROPAGATION TECHNIQUE (✓ all that apply):

Fresnel Integral Algorithms:

With Kernel Averaging

Gaussian Quadrature:

Fast Fourier Transform (FFT):

Fast Hankel Transform (FHT):

Gardner-Fresnel-Kirchoff (GFK):

Other (specify): _____

CONVERGENCE TECHNIQUE (✓):

Power Comparison: _____ Field Comparison: _____

Other: _____

ACCELERATION ALGORITHMS USED?: _____

Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):

Prony: _____

Other: _____

RESONATOR TYPE (✓): Standing Wave: _____

Traveling Wave (Ring): _____ Reverse TW: _____

BRANCH (✓): Positive: _____ Negative: _____

OPTICAL ELEMENT MODELS INCLUDED (✓):

Flat Mirrors: Spherical Mirrors: _____

Cylindrical Mirrors: _____ Telescopes: _____

Scraper Mirrors: _____

Axicons

Arbitrary:

Linear:

Parabola-Parabola:

Variable Cone Offset:

Other (specify): _____

Deformable Mirrors: _____

Spatial Filters: _____ Gratings: _____

Other Elements: _____

Waxicons	Reflexicons
<input type="checkbox"/>	<input type="checkbox"/>

GAIN MODELS (✓): Bare Cavity Only: _____

Simple Saturated Gain: _____ Detailed Gain: _____

BARE CAVITY FIELD MODIFIER MODELS (✓):

Mirror Tilt: _____ Decentration: _____

Aberrations/Thermal Distortions:

Arbitrary: _____

Selected (specify): _____

Reflectivity Loss: _____

Output Coupler Edges: Rolled: _____

Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):

Medium Index Variation: _____

Gas Absorption: _____

Overlapped Beams: _____

Other: _____

FAR-FIELD MODELS (✓): Beam Steering Removal: _____

Optimal Focal Search: _____ Beam Quality: _____

Other: _____

KINETICS

GAIN REGION MODELED (✓):

Compact Region: Annular Region: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: Annular Region: _____

KINETICS GRID DIMENSIONALITY (✓):

1D	2D	3D
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Compact Region:

Annular Region:

GAIN REGION SYMMETRY RESTRICTIONS:

Gain Vary Along Optic Axes: No Flow Direction: No

PULSED: CW: _____ KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

$$\begin{cases} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{cases}$$

X	F	Cl	Br	I
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
H	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Cold (F + H₂):

Hot (H + F₂): Chain (F + H₂ & H + F₂):

Other (specify): _____

ENERGY TRANSFER MODES MODELED (✓): Reference

V-T:

V-R:

V-V:

Other: _____

Single Line Model (✓): _____

Multiline Model: (✓)

Assumed Rotational Population Distribution State (✓):

Equilibrium: _____ Nonequilibrium:

Number of Laser Lines Modeled: 150

Source of Rate Coefficients Used in Code: N. Cohen, SAMS0-TR-78-41, June 8, 1978.

LINE PROFILE MODELS (✓):

Doppler Broadening: _____

Collisional Broadening: _____

Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓): None

Cylindrical, Radially Flowing: _____

Rectangular, Linearly Flowing: _____

Other: _____

COORDINATE SYSTEM: _____

FLUID GRID DIMENSION (✓): 1D: _____ 2D: _____ 3D: _____

FLOW FIELD MODELED (✓):

Laminar: _____ Turbulent: _____

Other: _____

BASIC MODELING APPROACH (✓):

Premixed: _____ Mixing: _____

Other (specify): _____

References for Approach Used: _____

THERMAL DRIVER MODELED (✓):

Arc Heater: _____ Combustor: _____

Shock Tube: _____ Resistance Heater: _____

Other: _____

F-ATOM DISSOCIATION FROM (✓):

F₂: _____ SF₆: _____

Other (specify): _____

F-ATOM CONCENTRATION DETERMINED FROM MODEL?: _____

DILUENTS MODELED: _____

MODELS EFFECTS ON MIXING RATE DUE TO (✓):

Nozzle Boundary Layers: _____ Shock Waves: _____

Preactions (thermal blockage): _____ Turbulence: _____

Other (specify): _____

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):

Media Index Variations: _____

Other (specify): _____

CODE NAME: TDLCLRC*

CODE TYPE: Optics, Kinetics, and Gasdynamics

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Performs 3-D wave optics resonator analysis of a positive branch confocal unstable resonator with rectangular spherical mirrors.

ASSESSMENT OF CAPABILITIES: Power extraction from an active DF medium. Off-axis geometry configuration. Apertures at all stations. 3-D plot capability. Kinetics and mixing calculations are performed with AEAOKNS. (See AEROKNS for additional details).

ASSESSMENT OF LIMITATIONS: No misalignment model. No Farfield model.

OTHER UNIQUE FEATURES: Resonator geometries modeled: positive branch unstable confocal linear resonator with rectangular spherical mirrors. Off-axis geometry capability.

ORIGINATOR/KEY CONTACT:
Name: Victor L. Gamiz Phone: (213) 884-3346
Organization: Rocketdyne, Laser Optics
Address: 6633 Canoga Ave., Canoga Park, California (91304)

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T) High Power Testing of Optical Components (HIPTOC) Technical Proposal, Part III, Appendix B (V. L. Gamiz).

STATUS:
Operational Currently?: Yes
Under Modification?: No
Purpose(s): _____

Ownership?: Rocketdyne
Proprietary?: Yes

MACHINE/OPERATING SYSTEM (on which installed): CDC Cyber 176

TRANSPORTABLE?: Yes
Machine Dependent Restrictions: _____

SELF-CONTAINED?: _____
Other Codes Required (name, purpose): None

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec, CDC 7600)
Small Job:	<u><250K</u>	<u>100</u>
Typical Job:	<u><250K</u>	<u>500-1000</u>
Large Job:	<u><250K</u>	<u>2000</u>

Approximate Number of FORTRAN Lines: 8000

* 3-D Loaded Cavity Linear Resonator Code

CODE NAME:

TDLCLRC

OPTICS

BASIC TYPE (√):

Physical Optics: Geometrical: _____

FIELD (POLARIZATION) REPRESENTATION (√):

Scalar: Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: Ca Annular Region: N/A

TRANSVERSE GRID DIMENSIONALITY (√):

Compact Region: _____

Annular Region: _____

1D	2D
	<input checked="" type="checkbox"/>

FIELD SYMMETRY RESTRICTIONS?: None

MIRROR SHAPE(S) ALLOWED (√):

Square: Circular: _____ Strip: _____

RECTANGULAR: Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (√):

Fixed, Single Resonator Geometry:

Fixed, Multiple Resonator Geometries: _____

Modular, Multiple Resonator Geometries: _____

PROPAGATION TECHNIQUE (√all that apply):

Fresnel Integral Algorithms: _____

With Kernel Averaging: _____

Gaussian Quadrature: _____

Fast Fourier Transform (FFT): _____

Fast Hankel Transform (FHT): _____

Gardener-Fresnel-Kirchhoff (GFK): _____

Other (specify): _____

COMPACT	ANNULAR
<input checked="" type="checkbox"/>	<input type="checkbox"/>

CONVERGENCE TECHNIQUE (√):

Power Comparison: _____ Field Comparison:

Other: _____

ACCELERATION ALGORITHMS USED?: Yes

Technique: Mirror Edge Tapering

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (√):

Prony: N/A

Other: _____

RESONATOR TYPE (√): Standing Wave: _____

Traveling Wave (Ring): Reverse TW: _____

BRANCH (√): Positive: Negative: _____

OPTICAL ELEMENT MODELS INCLUDED (√):

Flat Mirrors: _____ Spherical Mirrors:

Cylindrical Mirrors: _____ Telescopes: _____

Scraper Mirrors: _____

Axicons

Arbitrary: _____

Linear: _____

Parabola-Parabola: _____

Variable Cone Offset: _____

Other (specify): _____

Deformable Mirrors: _____

Spatial Filters: _____ Gratings: _____

Other Elements: _____

Waxicons	Reflexicons

GAIN MODELS (√): Bare Cavity Only: _____

Simple Saturated Gain: _____ Detailed Gain:

BARE CAVITY FIELD MODIFIER MODELS (√):

Mirror Tilt: _____ Decentration: _____

Aberrations/Thermal Distortions: _____

Arbitrary: _____

Selected (specify): _____

Reflectivity Loss:

Output Coupler Edges: Rolled:

Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (√):

Medium Index Variation: _____

Gas Absorption: _____

Overlapped Beams: _____

Other: _____

FAR-FIELD MODELS (√): Beam Steering Removal: _____

Optimal Focal Search: _____ Beam Quality: _____

Other: _____

KINETICS AEROKNS

GAIN REGION MODELED (√):

Compact Region: _____ Annular Region:

COORDINATE SYSTEM (Cartesian, cylindrical, etc.)

Compact Region: _____ Annular Region: CY

KINETICS GRID DIMENSIONALITY (√):

1D	2D	3D
<input checked="" type="checkbox"/>		

Compact Region: _____

Annular Region: _____

GAIN REGION SYMMETRY RESTRICTIONS:

Gain Vary Along Optic Axes?: _____ Flow Direction?:

PULSED: _____ CW: KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (√):

$$\begin{cases} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{cases}$$

Cold (F + H₂):

Hot (H + F₂): Chain (F + H₂ & H + F₂):

Other (specify): _____

ENERGY TRANSFER MODES MODELED (√): Reference

V-T: Cohen

V-R: _____

V-V: Cohen

Other: _____

Single Line Model (√): _____

Multiline Model (√):

Assumed Rotational Population Distribution State (√):

Equilibrium: Nonequilibrium: _____

Number of Laser Lines Modeled: ≤ 12

Source of Rate Coefficients Used in Code: Handbook of Chemical Lasers

LINE PROFILE MODELS (√):

Doppler Broadening:

Collisional Broadening:

Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (√):

Cylindrical, Radially Flowing:

Rectangular, Linearly Flowing: _____

Other: _____

COORDINATE SYSTEM: CY

FLUID GRID DIMENSION (√): 1D: 2D: _____ 3D: _____

FLOW FIELD MODELED (√):

Laminar: _____ Turbulent: _____

Other: Scheduled mixing

BASIC MODELING APPROACH (√):

Premixed: _____ Mixing:

Other (specify): _____

References for Approach Used: ALOS Final Report

THERMAL DRIVER MODELED (√):

Arc Heater: _____ Combustor: _____

Shock Tube: _____ Resistance Heater: _____

Other: Not modeled

F-ATOM DISSOCIATION FROM (√):

F₂: SF₆:

Other (specify): NF₃

F-ATOM CONCENTRATION DETERMINED FROM MODEL?: *

DILUENTS MODELED: He, N₂

MODELS EFFECTS ON MIXING RATE DUE TO (√):

Nozzle Boundary Layers: Shock Waves: _____

Prereactions (thermal blockage): _____ Turbulence: _____

Other (specify): _____

MODELS EFFECTS ON OPTICAL MODES DUE TO (√):

Media Index Variations:

Other (specify): _____

* Uses equilibrium thermochemistry

CODE NAME:

TDWORRC*

CODE TYPE: OpticsPRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Performs 3-D wave optics resonator analysis of a cylindrical annular ring laser resonator in either two reflexicon or two waxicon beam compactor assembly.ASSESSMENT OF CAPABILITIES: General geometry specification; i.e., positive or negative branch, arbitrary scraper location, analytical gain model. Mirror misalignment, mirror misfigure, mirror thermal distortion models, struts. Ray distribution beam compactors.ASSESSMENT OF LIMITATIONS: Half-plane symmetry. No cross-slit filter model. One V-T transition operation.OTHER UNIQUE FEATURES: Resonator geometries modeled: unstable ring resonator with: PPTANH reflexicon - or waxicon beam compactor, negative (spatial filter) or positive branch, self-imaging scraper geometry. 180° beam rotation at scraper.

ORIGINATOR/KEY CONTACT:

Name: Victor L. Gamiz Phone: (213) 884-3346
Organization: Rocketdyne, Laser Optics
Address: 6633 Canoga Ave., Canoga Park, CaliforniaAVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T) Simplified 3-D loaded cavity resonator code - Nov 1978, G-0-78-1123; (T)(U) 3-D bare cavity resonator code.

STATUS:

Operational Currently?: Yes
Under Modification?: Yes
Purpose(s): Detailed checkout.Ownership?: Rocketdyne
Proprietary?: YesMACHINE/OPERATING SYSTEM (on which installed): CDC Cyber 176TRANSPORTABLE?: NoMachine Dependent Restrictions: Uses extended core.

SELF-CONTAINED:

Other Codes Required (name, purpose): None

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec. CDC 7600)	
Small Job:	<250K	100	} CDC 176
Typical Job:	<250K	1000	
Large Job:	<250K	2000	

Approximate Number of FORTRAN Lines: 8000

*3-D Wave Optics Ring Resonator Code

CODE NAME:

TDWORRC

OPTICS

BASIC TYPE (✓):

Physical Optics: Geometrical: _____

FIELD (POLARIZATION) REPRESENTATION (✓):

Scalar: Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: CY Annular Region: CY

TRANSVERSE GRID DIMENSIONALITY (✓):

Compact Region:

Annular Region:

1D	2D
	<input checked="" type="checkbox"/>
	<input checked="" type="checkbox"/>

FIELD SYMMETRY RESTRICTIONS: Half-plane symmetry

MIRROR SHAPE(S) ALLOWED (✓):

Square: _____ Circular: Strip: _____

Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):

Fixed, Single Resonator Geometry: _____

Fixed, Multiple Resonator Geometries:

Modular, Multiple Resonator Geometries: _____

PROPAGATION TECHNIQUE (✓) (all that apply):

Fresnel Integral Algorithms:

With Kernel Averaging

Gaussian Quadrature:

Fast Fourier Transform (FFT):

Fast Hankel Transform (FHT):

Gardner-Fresnel-Kirchhoff (GFK):

Other (specify): _____

	COMPACT	ANNULAR
		<input checked="" type="checkbox"/>

CONVERGENCE TECHNIQUE (✓):

Power Comparison: Field Comparison: _____

Other: _____

ACCELERATION ALGORITHMS USED?: NO

Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):

Prony:

Other: _____

RESONATOR TYPE (✓): Standing Wave: _____

Traveling Wave (Ring): Reverse TW: _____

BRANCH (✓): Positive: Negative:

OPTICAL ELEMENT MODELS INCLUDED (✓):

Flat Mirrors: Spherical Mirrors:

Cylindrical Mirrors: _____ Telescopes:

Scraper Mirrors:

Axicons

Arbitrary:

Linear:

Parabola-Parabola:

Variable Cone Offset:

Other (specify): PPTANH

Deformable Mirrors:

Spatial Filters: Gratings: _____

Other Elements: 180° Beam Rotator.

Waxicons	Reflexicons
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

GAIN MODELS (✓): Bare Cavity Only: _____

Simple Saturated Gain: Detailed Gain: _____

BARE CAVITY FIELD MODIFIER MODELS (✓):

Mirror Tilt: Decentration:

Aberrations/Thermal Distortions:

Arbitrary: _____

Selected (specify): _____

Reflectivity Loss:

Output Coupler Edges: Rolled: _____

Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):

Medium Index Variation: _____

Gas Absorption: _____

Overlapped Beams: _____

Other: _____

FAR-FIELD MODELS (✓): Beam Steering Removal:

Optimal Focal Search: Beam Quality:

Other: _____

KINETICS

GAIN REGION MODELED (✓): None

Compact Region: _____ Annular Region: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.)

Compact Region: _____ Annular Region: _____

KINETICS GRID DIMENSIONALITY (✓):

Compact Region:

Annular Region:

1D	2D	3D

GAIN REGION SYMMETRY RESTRICTIONS:

Gain Vary Along Optic Axes: _____ Flow Direction: _____

PULSED: _____ CW: _____ KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

$$\begin{cases} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{cases}$$

X	F	Cl	Br	I
H				
D				

Cold (F + H₂): _____

Hot (H + F₂): _____ Chain (F + H₂ & H + F₂): _____

Other (specify): _____

ENERGY TRANSFER MODES MODELED (✓): Reference

V-T: _____

V-R: _____

V-V: _____

Other: _____

Single Line Model (✓): _____

Multiline Model (✓): _____

Assumed Rotational Population Distribution State (✓):

Equilibrium: _____ Nonequilibrium: _____

Number of Laser Lines Modeled: _____

Source of Rate Coefficients Used in Code: _____

LINE PROFILE MODELS (✓):

Doppler Broadening: _____

Collisional Broadening: _____

Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓): None

Cylindrical, Radially Flowing: _____

Rectangular, Linearly Flowing: _____

Other: _____

COORDINATE SYSTEM: _____

FLUID GRID DIMENSION (✓): 1D: _____ 2D: _____ 3D: _____

FLOW FIELD MODELED (✓):

Laminar: _____ Turbulent: _____

Other: _____

BASIC MODELING APPROACH (✓):

Premixed: _____ Mixing: _____

Other (specify): _____

References for Approach Used: _____

THERMAL DRIVER MODELED (✓):

Arc Heater: _____ Combustor: _____

Shock Tube: _____ Resistance Heater: _____

Other: _____

F-ATOM DISSOCIATION FROM (✓):

F₂: _____ SF₆: _____

Other (specify): _____

F-ATOM CONCENTRATION DETERMINED FROM MODEL?: _____

DILUENTS MODELED: _____

MODELS EFFECTS ON MIXING RATE DUE TO (✓):

Nozzle Boundary Layers: _____ Shock Waves: _____

Prereactions (thermal blockage): _____ Turbulence: _____

Other (specify): _____

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):

Media Index Variations: _____

Other (specify): _____

CODE NAME:

TMRO

CODE TYPE: Optics, Kinetics, and Gasdynamics

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Version of MRO for toric resonators (TMRO):

ASSESSMENT OF CAPABILITIES: Models L=0 mode for half symmetric or confocal toric ring or standing wave resonators. Provides economical screen code for CROQ.

ASSESSMENT OF LIMITATIONS: No azimuthal variations modeled. No axicon. Provides only a mode which has the same geometric optics properties in the gain region as CROQ.

OTHER UNIQUE FEATURES: Toric resonator modeled.

ORIGINATOR/KEY CONTACT:

Name: Donald L. Bullock Phone: (213) 535-3484

Organization: TRW DSSG

Address: RI/1162, One Space Park, Redondo Beach, California 90278

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T): none; however, the BLAZER and MRO codes, June 78 (TRW), contain much information; (U): none, but nearly same as MRO (use BLAZER user manual, November 78). Listings available.

STATUS:

Operational Currently?: Yes

Under Modification?: Yes

Purpose(s): For ACLOS Program, TMRO being modified for rotational nonequilibrium and anomalous dispersion description.

Ownership?: Government

Proprietary?: No

MACHINE/OPERATING SYSTEM (on which installed): CYBER 174 TRW/TSS
AFWL CYBER 176, NOS/BE

TRANSPORTABLE?: Yes

Machine Dependent Restrictions: CDC

SELF-CONTAINED?: No

Other Codes Required (name, purpose): VIINT, KBLIMP, Monte Carlo, ALFA

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec, CDC 7600)
Small Job:		
Typical Job:	<u>151K</u>	<u>400</u>
Large Job:		
Approximate Number of FORTRAN Lines: <u>4500</u>		

CODE NAME:

TMRO

OPTICS

BASIC TYPE (✓):
 Physical Optics: Geometrical: _____

FIELD (POLARIZATION) REPRESENTATION (✓):
 Scalar: Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):
 Compact Region: _____ Annular Region: CY

TRANSVERSE GRID DIMENSIONALITY (✓):
 Compact Region:

1D	2D
<input checked="" type="checkbox"/>	<input type="checkbox"/>

 Annular Region: _____

FIELD SYMMETRY RESTRICTIONS: L=0

MIRROR SHAPE(S) ALLOWED (✓):
 Square: _____ Circular: Strip: _____
 Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):
 Fixed, Single Resonator Geometry: _____
 Fixed, Multiple Resonator Geometries:
 Modular, Multiple Resonator Geometries: _____

PROPAGATION TECHNIQUE (✓) (✓all that apply):

COMPACT	ANNULAR
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

Fresnel Integral Algorithms:
 With Kernel Averaging
 Gaussian Quadrature: (Modified)
 Fast Fourier Transform (FFT):
 Fast Hankel Transform (FHT):
 Gardener-Fresnel-Kirchhoff (GFK):
 Other (specify): _____

CONVERGENCE TECHNIQUE (✓):
 Power Comparison: Field Comparison: _____
 Other: _____

ACCELERATION ALGORITHMS USED?: No
 Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):
 Prony: _____
 Other: _____

RESONATOR TYPE (✓): Standing Wave:
 Traveling Wave (Ring): Reverse TW: _____

BRANCH (✓): Positive: Negative:

OPTICAL ELEMENT MODELS INCLUDED (✓):
 Flat Mirrors: _____ Spherical Mirrors: _____
 Cylindrical Mirrors: _____ Telescopes: _____
 Scraper Mirrors: _____

Waxicons	Reflexicons
<input type="checkbox"/>	<input type="checkbox"/>

Axicons
 Arbitrary: _____
 Linear: _____
 Parabola-Parabola: _____
 Variable Cone Offset: _____
 Other (specify): _____
 Deformable Mirrors: _____
 Spatial Filters: _____ Gratings: _____
 Other Elements: Toric mirrors.

GAIN MODELS (✓): Bare Cavity Only: _____
 Simple Saturated Gain: _____ Detailed Gain:

BARE CAVITY FIELD MODIFIER MODELS (✓):
 Mirror Tilt: _____ Decentration: _____
 Aberrations/Thermal Distortions:
 Arbitrary: _____
 Selected (specify): _____
 Reflectivity Loss:
 Output Coupler Edges: Rolled: _____
 Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):
 Medium Index Variation:
 Gas Absorption:
 Overlapped Beams:
 Other: _____

FAR-FIELD MODELS (✓): Beam Steering Removal: _____
 Optimal Focal Search: _____ Beam Quality: _____
 Other: _____

KINETICS

GAIN REGION MODELED (✓):
 Compact Region: _____ Annular Region:

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):
 Compact Region: _____ Annular Region: CY

KINETICS GRID DIMENSIONALITY (✓):
 Compact Region:

1D	2D	3D
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

 Annular Region: _____

GAIN REGION SYMMETRY RESTRICTIONS:
 Gain Vary Along Optic Axes: No Flow Direction: Yes

PULSED: _____ CW: KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):
 $\left\{ \begin{array}{l} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{array} \right\}$
 Cold (F + H₂):
 Hot (H + F₂): _____ Chain (F + H₂ & H + F₂): _____
 Other (specify): NF₃

X	F	Cl	Br	I
H	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

ENERGY TRANSFER MODES MODELED (✓): Reference
 V-T: BLAZER and MRO
 V-R: _____
 V-V:
 Other: RR with ACLOS rot. non-equilib.

Single Line Model (✓): _____ model.
 Multiline Model (✓):
 Assumed Rotational Population Distribution State (✓):
 Equilibrium: _____ Nonequilibrium: _____
 Number of Laser Lines Modeled: 24
 Source of Rate Coefficients Used in Code: N. Cohen

LINE PROFILE MODELS (✓):
 Doppler Broadening:
 Collisional Broadening:
 Other (specify): operation at line center.

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓):
 Cylindrical, Radially Flowing:
 Rectangular, Linearly Flowing: _____
 Other: _____

COORDINATE SYSTEM: CY

FLUID GRID DIMENSION (✓): 1D: 2D: _____ 3D: _____

FLOW FIELD MODELED (✓):
 Laminar: _____ Turbulent: _____
 Other: Scheduled mixing.

BASIC MODELING APPROACH (✓):
 Premixed: _____ Mixing: _____
 Other (specify): Scheduled mixing.

References for Approach Used: BLAZER and MRO.

THERMAL DRIVER MODELED (✓):
 Arc Heater: _____ Combustor:
 Shock Tube: _____ Resistance Heater: _____
 Other: _____

F-ATOM DISSOCIATION FROM (✓):
 F₂: SF₆: _____
 Other (specify): NF₃

F-ATOM CONCENTRATION DETERMINED FROM MODEL? Yes*

DILUENTS MODELED: He, N₂, CF₄

MODELS EFFECTS ON MIXING RATE DUE TO (✓):
 Nozzle Boundary Layers: _____ Shock Waves: _____
 Prereactions (thermal blockage): _____ Turbulence: _____
 Other (specify): Scheduled three stream: fuel, oxidant, mixed.

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):
 Media Index Variations:
 Other (specify): _____

* in the mixed stream

CODE NAME:

TWODNOZ

CODE TYPE: Gasdynamics

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Calculate nozzle flow including boundary layer and inviscid core analysis.

ASSESSMENT OF CAPABILITIES: Can calculate two dimensional or axisymmetric nozzle flow. Uses local similarity boundary layer solution coupled with inviscid core solution.

ASSESSMENT OF LIMITATIONS: Does not calculate boundary layer profiles as presently formulated.

OTHER UNIQUE FEATURES: _____

ORIGINATOR/KEY CONTACT:
Name: D. Haflinger/P. Lohn Phone: (213) 536-1624
Organization: TRW DSSG
Address: RI/1038, One Space Park, Redondo Beach, California 90278

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T): None.

STATUS:
Operational Currently?: Yes
Under Modification?: _____
Purpose(s): _____

Ownership?: TRW
Proprietary?: _____
MACHINE/OPERATING SYSTEM (on which installed): CDC 6600

TRANSPORTABLE?: Yes
Machine Dependent Restrictions: _____

SELF-CONTAINED?: Yes
Other Codes Required (name, purpose): _____

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec, CDC 7600)
Small Job:		
Typical Job:	<u>40K</u>	<u>10</u>
Large Job:		
Approximate Number of FORTRAN Lines:	<u>1000</u>	

CODE NAME:

TWODNOZ

OPTICS

BASIC TYPE (✓): None
 Physical Optics: _____ Geometrical: _____
 FIELD (POLARIZATION) REPRESENTATION (✓):
 Scalar: _____ Vector: _____
 COORDINATE SYSTEM (Cartesian, cylindrical, etc.):
 Compact Region: _____ Annular Region: _____
 TRANSVERSE GRID DIMENSIONALITY (✓):
 Compact Region:

1D	2D

 Annular Region: _____
 FIELD SYMMETRY RESTRICTIONS?: _____
 MIRROR SHAPE(S) ALLOWED (✓):
 Square: _____ Circular: _____ Strip: _____
 Rectangular: _____ Elliptical: _____ Arbitrary: _____
 CONFIGURATION FLEXIBILITY (✓):
 Fixed, Single Resonator Geometry: _____
 Fixed, Multiple Resonator Geometries: _____
 Modular, Multiple Resonator Geometries: _____
 PROPAGATION TECHNIQUE (✓ all that apply):

COMPACT	ANNULAR

 Fresnel Integral Algorithms: _____
 With Kernel Averaging: _____
 Gaussian Quadrature: _____
 Fast Fourier Transform (FFT): _____
 Fast Hankel Transform (FHT): _____
 Gardner-Fresnel-Kirchhoff (GFK): _____
 Other (specify): _____
 CONVERGENCE TECHNIQUE (✓):
 Power Comparison: _____ Field Comparison: _____
 Other: _____
 ACCELERATION ALGORITHMS USED?: _____
 Technique: _____
 MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):
 Prony: _____
 Other: _____

None

RESONATOR TYPE (✓): Standing Wave: _____
 Traveling Wave (Ring): _____ Reverse TW: _____
 BRANCH (✓): Positive: _____ Negative: _____
 OPTICAL ELEMENT MODELS INCLUDED (✓):
 Flat Mirrors: _____ Spherical Mirrors: _____
 Cylindrical Mirrors: _____ Telescopes: _____
 Scraper Mirrors: _____
 Axicons:

Waxicons	Reflexicons

 Arbitrary: _____
 Linear: _____
 Parabola-Parabola: _____
 Variable Cone Offset: _____
 Other (specify): _____
 Deformable Mirrors: _____
 Spatial Filters: _____ Gratings: _____
 Other Elements: _____

GAIN MODELS (✓): Bare Cavity Only: _____
 Simple Saturated Gain: _____ Detailed Gain: _____
 BARE CAVITY FIELD MODIFIER MODELS (✓):
 Mirror Tilt: _____ Decentration: _____
 Aberrations/Thermal Distortions: _____
 Arbitrary: _____
 Selected (specify): _____
 Reflectivity Loss: _____
 Output Coupler Edges: Rolled: _____
 Serrated: _____ Other: _____
 LOADED CAVITY FIELD MODIFIER MODELS (✓):
 Medium Index Variation: _____
 Gas Absorption: _____
 Overlapped Beams: _____
 Other: _____
 FAR-FIELD MODELS (✓): Beam Steering Removal: _____
 Optimal Focal Search: _____ Beam Quality: _____
 Other: _____

KINETICS

GAIN REGION MODELED (✓): None
 Compact Region: _____ Annular Region: _____
 COORDINATE SYSTEM (Cartesian, cylindrical, etc.):
 Compact Region: _____ Annular Region: _____
 KINETICS GRID DIMENSIONALITY (✓):
 Compact Region:

1D	2D	3D

 Annular Region: _____
 GAIN REGION SYMMETRY RESTRICTIONS:
 Gain Vary Along Optic Axes?: _____ Flow Direction?: _____
 PULSED: _____ CW: _____ KINETICS MODELED
 CHEMICAL PUMPING REACTIONS MODELED (✓):
 $\begin{cases} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{cases}$

X	F	Cl	Br	I
H				
D				

 Cold (F + H₂): _____
 Hot (H + F₂): _____ Chain (F + H₂ & H + F₂): _____
 Other (specify): _____
 ENERGY TRANSFER MODES MODELED (✓): Reference
 V-T: _____
 V-R: _____
 V-V: _____
 Other: _____
 Single Line Model (✓): _____
 Multiline Model (✓): _____
 Assumed Rotational Population Distribution State (✓):
 Equilibrium: _____ Nonequilibrium: _____
 Number of Laser Lines Modeled: _____
 Source of Rate Coefficients Used in Code: _____
 LINE PROFILE MODELS (✓):
 Doppler Broadening: _____
 Collisional Broadening: _____
 Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓):
 Cylindrical, Radially Flowing: _____ ✓
 Rectangular, Linearly Flowing: _____ ✓
 Other: _____
 COORDINATE SYSTEM: Cart/axisymmetric
 FLUID GRID DIMENSION (✓): 1D: _____ 2D: _____ ✓ 3D: _____
 FLOW FIELD MODELED (✓):
 Laminar: _____ ✓ Turbulent: _____
 Other: _____
 BASIC MODELING APPROACH (✓):
 Premixed: _____ ✓ Mixing: _____
 Other (specify): _____
 References for Approach Used: _____
 THERMAL DRIVER MODELED (✓):
 Arc Heater: _____ Combustor: _____
 Shock Tube: _____ Resistance Heater: _____
 Other: _____
 F-ATOM DISSOCIATION FROM (✓):
 F₂: _____ SF₆: _____
 Other (specify): _____
 F-ATOM CONCENTRATION DETERMINED FROM MODEL?: _____
 DILUENTS MODELED: _____
 MODELS EFFECTS ON MIXING RATE DUE TO (✓):
 Nozzle Boundary Layers: _____ Shock Waves: _____
 Prereactions (thermal blockage): _____ Turbulence: _____
 Other (specify): _____
 MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):
 Media Index Variations: _____
 Other (specify): _____

CODE NAME:

URINLA2

CODE TYPE: Optics

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Models cylindrical lasers with arbitrary axicon (except noneverting waxicon). Bare resonator code which determines mode control and beam quality.

Unstable Resonator with Internal Non-Linear Axicon (URINLA2).

ASSESSMENT OF CAPABILITIES: Computationally accurate, uses full OPD matrix treatment of axicon, very flexible for design.

ASSESSMENT OF LIMITATIONS: Computationally slow, number of Gaussian points and Fourier components limited by large core storage capability on CYBER 176. Half plane symmetry required for misalignments, i.e., all decentrations colinear, all tilt axes parallel, and at 90° from decentration direction.

OTHER UNIQUE FEATURES: Resonators modeled: HSURIA, "HSURIA" with toric back mirror, or TURIA. Models H-H and H-P reflexicons and waxicons, P-P reflexicons, tip unloaded axicons, and variable magnification axicons.

ORIGINATOR/KEY CONTACT:
 Name: Donald L. Bullock Phone: (213) 535-4384
 Organization: TRW DSSG
 Address: R1/1162, One Space Park, Redondo Beach, California 90278

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T): Annular Laser Mode Studies Final Report; (U): Program URINLA2 User Manual, June 1978; Listings available.

STATUS:
 Operational Currently?: Yes
 Under Modification?: No
 Purpose(s): _____

Ownership?: Government
 Proprietary?: No

MACHINE/OPERATING SYSTEM (on which installed): AFWL CYBER 176, NOS/BE

TRANSPORTABLE?: With modification
 Machine Dependent Restrictions: CDC only

SELF-CONTAINED?: _____
 Other Codes Required (name, purpose): Yes

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec. CDC 7600)
Small Job:		
Typical Job:	<u>136K (SCM), 100K (LCM)</u>	<u>1800</u>
Large Job:		
Approximate Number of FORTRAN Lines:	<u>2000</u>	

CODE NAME:

URINLA2

OPTICS

BASIC TYPE (✓):

Physical Optics: ✓ Geometrical: _____

FIELD (POLARIZATION) REPRESENTATION (✓):

Scalar: ✓ Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: CY Annular Region: CY

TRANSVERSE GRID DIMENSIONALITY (✓):

Compact Region:

Annular Region:

1D	2D
✓	✓
✓	✓

FIELD SYMMETRY RESTRICTIONS: Half-plane.

MIRROR SHAPE(S) ALLOWED (✓):

Square: _____ Circular: ✓ Strip: _____

Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):

Fixed, Single Resonator Geometry: _____

Fixed, Multiple Resonator Geometries: ✓

Modular, Multiple Resonator Geometries: _____

PROPAGATION TECHNIQUE (✓ all that apply):

Fresnel Integral Algorithms:

With Kernel Averaging

Gaussian Quadrature:

Fast Fourier Transform (FFT):

Fast Hankel Transform (FHT):

Gardner-Fresnel-Kirchhoff (GFK):

Other (specify): _____

COMPACT	ANNULAR
✓	✓
✓	✓
✓	✓
✓	✓
✓	✓

CONVERGENCE TECHNIQUE (✓):

Power Comparison: _____ Field Comparison: ✓

Other: _____

ACCELERATION ALGORITHMS USED: YesTechnique: Aitken*

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM: (✓):

Prony: _____

Other: Aitken

*(Cf. The Algebraic Eigenvalue

Problem, J. H. Wilkinson, Oxford

(1965), p. 578).

RESONATOR TYPE (✓): Standing Wave: ✓

Traveling Wave (Ring): _____ Reverse TW: _____

BRANCH (✓): Positive: ✓ Negative: _____

OPTICAL ELEMENT MODELS INCLUDED (✓):

Flat Mirrors: _____ Spherical Mirrors: _____

Cylindrical Mirrors: _____ Telescopes: ✓

Scraper Mirrors: ✓

Axicons

Arbitrary:

Linear:

Parabola-Parabola:

Variable Cone Offset:

Other (specify): _____

Deformable Mirrors: _____

Spatial Filters: _____ Gratings: _____

Other Elements: H-H & H-P reflexiconsand waxicons; P-P reflexicons, rearcone or flat

GAIN MODELS (✓): Bare Cavity Only: ✓

Simple Saturated Gain: _____ Detailed Gain: _____

BARE CAVITY FIELD MODIFIER MODELS (✓):

Mirror Tilt: ✓ Decentration: ✓

Aberrations/Thermal Distortions:

Arbitrary: _____

Selected (specify): Aberrations only.

Reflectivity Loss: _____

Output Coupler Edges: Rolled: _____

Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):

Medium Index Variation: _____

Gas Absorption: _____

Overlapped Beams: _____

Other: _____

FAR-FIELD MODELS (✓): Beam Steering Removal: ✓

Optimal Focal Search: ✓ Beam Quality: ✓

Other: _____

KINETICS

GAIN REGION MODELED (✓): None

Compact Region: _____ Annular Region: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):

Compact Region: _____ Annular Region: _____

KINETICS GRID DIMENSIONALITY (✓):

Compact Region:

Annular Region:

1D	2D	3D
✓	✓	✓
✓	✓	✓

GAIN REGION SYMMETRY RESTRICTIONS:

Gain Vary Along Optic Axes?: _____ Flow Direction?: _____

PULSED: _____ CW: _____ KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

$$\left\{ \begin{array}{l} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{array} \right\}$$

Cold (F + H₂): _____Hot (H + F₂): _____ Chain (F + H₂ & H + F₂): _____

Other (specify): _____

ENERGY TRANSFER MODES MODELED (✓): Reference

V-T: _____

V-R: _____

V-V: _____

Other: _____

Single Line Model (✓): _____

Multiline Model (✓): _____

Assumed Rotational Population Distribution State (✓):

Equilibrium: _____ Nonequilibrium: _____

Number of Laser Lines Modeled: _____

Source of Rate Coefficients Used in Code: _____

Other: _____

LINE PROFILE MODELS (✓):

Doppler Broadening: _____

Collisional Broadening: _____

Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓): None

Cylindrical, Radially Flowing: _____

Rectangular, Linearly Flowing: _____

Other: _____

COORDINATE SYSTEM: _____

FLUID GRID DIMENSION (✓): 1D: _____ 2D: _____ 3D: _____

FLOW FIELD MODELED (✓):

Laminar: _____ Turbulent: _____

Other: _____

BASIC MODELING APPROACH (✓):

Premixed: _____ Mixing: _____

Other (specify): _____

References for Approach Used: _____

THERMAL DRIVER MODELED (✓):

Arc Heater: _____ Combustor: _____

Shock Tube: _____ Resistance Heater: _____

Other: _____

F-ATOM DISSOCIATION FROM (✓):

F₂: _____ SF₆: _____

Other (specify): _____

F-ATOM CONCENTRATION DETERMINED FROM MODEL: _____

DILUENTS MODELED: _____

MODELS EFFECTS ON MIXING RATE DUE TO (✓):

Nozzle Boundary Layers: _____ Shock Waves: _____

Pre-reactions (thermal blockage): _____ Turbulence: _____

Other (specify): _____

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):

Media Index Variations: _____

Other (specify): _____

CODE NAME:

VIINT

CODE TYPE: GasdynamicsPRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: Calculates flow between wedges for hypersonic wedge modeling.(Viscid Inviscid Interaction Program (VIINT))ASSESSMENT OF CAPABILITIES: Calculates full viscous-inviscid flow field with shocks, reflected shocks, and shock-body interactions. Considers transverse pressure gradients in the supersonic flow.

ASSESSMENT OF LIMITATIONS: _____

OTHER UNIQUE FEATURES: _____

ORIGINATOR/KEY CONTACT:

Name: J. Ohrenberger Phone: (213) 536-4024
Organization: TRW DSSG
Address: 88/1012, One Space Park, Redondo Beach, California 90278AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T): "Turbulent Near Wake Modeling Analysis for Reentry Application", J.T. Ohrenberger, Prepared for Ballistic Missile Defense Adv. Tech. Center, DASG60-76-C-0043, April 1977; (U): "Computer Program Description and Users Manual of a Near and Far Wake Modeling Analysis for Reentry under Laminar or Turbulent Boundary Layer Conditions," J.T. Ohrenberger, Prep. for Ballistic Missile Defense Systems Command, DASG60-76-C-0043, March 1979. Ohrenberger, J.T. and Baum, E., "A Theoretical Model of the Near Wake of a Slender Body in Supersonic Flow," AIAA Journal Vol. 10, No. 9, September 1972, pp. 1165-1172. AIAA Paper No., 70-792 (June 1970). AIAA Paper No., 72-116 (Jan., 1972)

STATUS:

Operational Currently?: Yes

Under Modification?: _____

Purpose(s): _____

Ownership?: TRW
Proprietary?: On file at ARC Facility, BMDATC, HuntsvilleMACHINE/OPERATING SYSTEM (on which installed): CDC 6600/7600TRANSPORTABLE?: Yes

Machine Dependent Restrictions: _____

SELF-CONTAINED?: Yes

Other Codes Required (name, purpose): _____

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec, CDC 7600)
Small Job:		
Typical Job:	<u>65K</u>	<u>60</u>
Large Job:		
Approximate Number of FORTRAN Lines:	<u>3500</u>	

CODE NAME:

VIINT

OPTICS

None

BASIC TYPE (✓): None
 Physical Optics: _____ Geometrical: _____
 FIELD (POLARIZATION) REPRESENTATION (✓):
 Scalar: _____ Vector: _____
 COORDINATE SYSTEM (Cartesian, cylindrical, etc.):
 Compact Region: _____ Annular Region: _____
 TRANSVERSE GRID DIMENSIONALITY (✓):

1D	2D

 Compact Region: _____
 Annular Region: _____
 FIELD SYMMETRY RESTRICTIONS?: _____
 MIRROR SHAPE(S) ALLOWED (✓):
 Square: _____ Circular: _____ Strip: _____
 Rectangular: _____ Elliptical: _____ Arbitrary: _____
 CONFIGURATION FLEXIBILITY (✓):
 Fixed, Single Resonator Geometry: _____
 Fixed, Multiple Resonator Geometries: _____
 Modular, Multiple Resonator Geometries: _____
 PROPAGATION TECHNIQUE (✓ all that apply):

COMPACT	ANNULAR

 Fresnel Integral Algorithms: _____
 With Kernel Averaging _____
 Gaussian Quadrature: _____
 Fast Fourier Transform (FFT): _____
 Fast Hankel Transform (FHT): _____
 Gardener-Fresnel-Kirchoff (GFK): _____
 Other (specify): _____
 CONVERGENCE TECHNIQUE (✓):
 Power Comparison: _____ Field Comparison: _____
 Other: _____
 ACCELERATION ALGORITHMS USED?: _____
 Technique: _____
 MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM: (✓):
 Prony: _____
 Other: _____

RESONATOR TYPE (✓): Standing Wave: _____
 Traveling Wave (Ring): _____ Reverse TW: _____
 BRANCH (✓): Positive: _____ Negative: _____
 OPTICAL ELEMENT MODELS INCLUDED (✓):
 Flat Mirrors: _____ Spherical Mirrors: _____
 Cylindrical Mirrors: _____ Telescopes: _____
 Scraper Mirrors: _____
 Axicons

Waxicons	Reflexicons

 Arbitrary: _____
 Linear: _____
 Parabola-Parabola: _____
 Variable Cone Offset: _____
 Other (specify): _____
 Deformable Mirrors: _____
 Spatial Filters: _____ Gratings: _____
 Other Elements: _____
 GAIN MODELS (✓): Bare Cavity Only: _____
 Simple Saturated Gain: _____ Detailed Gain: _____
 BARE CAVITY FIELD MODIFIER MODELS (✓):
 Mirror Tilt: _____ Decentration: _____
 Aberrations/Thermal Distortions:
 Arbitrary: _____
 Selected (specify): _____
 Reflectivity Loss: _____
 Output Coupler Edges: Rolled: _____
 Serrated: _____ Other: _____
 LOADED CAVITY FIELD MODIFIER MODELS (✓):
 Medium Index Variation: _____
 Gas Absorption: _____
 Overlapped Beams: _____
 Other: _____
 FAR-FIELD MODELS (✓): Beam Steering Removal: _____
 Optimal Focal Search: _____ Beam Quality: _____
 Other: _____

KINETICS

GAIN REGION MODELED (✓): None
 Compact Region: _____ Annular Region: _____
 COORDINATE SYSTEM (Cartesian, cylindrical, etc.)
 Compact Region: _____ Annular Region: _____
 KINETICS GRID DIMENSIONALITY (✓):

1D	2D	3D

 Compact Region: _____
 Annular Region: _____
 GAIN REGION SYMMETRY RESTRICTIONS:
 Gain Vary Along Optic Axes?: _____ Flow Direction?: _____
 PULSED: _____ CW: _____ KINETICS MODELED
 CHEMICAL PUMPING REACTIONS MODELED (✓):

$$\begin{cases} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{cases}$$

X	F	Cl	Br	I
H				
D				

 Cold (F + H₂): _____
 Hot (H + F₂): _____ Chain (F + H₂ & H + F₂): _____
 Other (specify): _____
 ENERGY TRANSFER MODES MODELED (✓): Reference
 V-T: _____
 V-R: _____
 V-V: _____
 Other: _____
 Single Line Model (✓): _____
 Multiline Model (✓): _____
 Assumed Rotational Population Distribution State (✓):
 Equilibrium: _____ Nonequilibrium: _____
 Number of Laser Lines Modeled: _____
 Source of Rate Coefficients Used in Code: _____
 LINE PROFILE MODELS (✓):
 Doppler Broadening: _____
 Collisional Broadening: _____
 Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓):
 Cylindrical, Radially Flowing: _____
 Rectangular, Linearly Flowing: _____
 Other: _____
 COORDINATE SYSTEM: Cart. and cylind.
 FLUID GRID DIMENSION (✓): 1D: _____ 2D: _____ 3D: _____
 FLOW FIELD MODELED (✓):
 Laminar: _____ Turbulent: _____
 Other: Turb capability available.
 BASIC MODELING APPROACH (✓):
 Premixed: _____ Mixing: _____
 Other (specify): _____
 References for Approach Used: _____
 THERMAL DRIVER MODELED (✓):
 Arc Heater: _____ Combustor: _____
 Shock Tube: _____ Resistance Heater: _____
 Other: _____
 F-ATOM DISSOCIATION FROM (✓):
 F₂: _____ SF₆: _____
 Other (specify): _____
 F-ATOM CONCENTRATION DETERMINED FROM MODEL: NO
 DILUENTS MODELED: _____
 MODELS EFFECTS ON MIXING RATE DUE TO (✓):
 Nozzle Boundary Layers: _____ Shock Waves: _____
 Prereactions (thermal blockage): _____ Turbulence: _____
 Other (specify): _____
 MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):
 Media Index Variations: _____
 Other (specify): _____

CODE NAME:

WAP*

CODE TYPE: Gasdynamics

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: To determine base flow between laser nozzle. Detailed analysis of base flows, recirculation and embedded subsonic zone, boundary remnant lip and wake shock formation are included.

ASSESSMENT OF CAPABILITIES: Analysis extendable through saddle to the intermediate near wake. Heat release capability to simulate exothermic reactions. Parabolized Navier-Stokes (finite difference) calculation. Base pressure determined uniquely by saddle point technique.

ASSESSMENT OF LIMITATIONS: Does not handle chemistry directly. Two dimensional (but can handle source flows).

OTHER UNIQUE FEATURES: Can handle base injection.

ORIGINATOR/KEY CONTACT:

Name: J. Ohrenberger Phone: (213) 536-4024
 Organization: TRW DSSG
 Address: 88/1012, One Space Park, Redondo Beach, California 90278

AVAILABLE DOCUMENTATION: (T = Theory, U = User, RP = Relevant Publication): (T): "Turbulent Near Wake Modeling Analysis for Reentry Application," J.T. Ohrenberger, Prep for Ballistic Missile Defense Adv. Tech. Center. DASG60-76-C-0043, April 1977; (U): "Computer Program Description and Users Manual of a Near and Far Wake Modeling Analysis for Reentry under Laminar or Turbulent Boundary Layer Conditions." J.T. Ohrenberger, Prep for Ballistic Missile Defense Systems Command, DASG60-76-C-0043, March 1979. Ohrenberger, J.T. and Baum, E., "A Theoretical Model of the Near-Wake of a Slender Body in Supersonic Flow," AIAA Journal, Vol. 10, No. 9, September 1972, pp. 1165-1172. AIAA paper No. 70-792 (June 1970). AIAA paper 72-116 (Jan 1972)

STATUS:

Operational Currently?: Yes

Under Modification?: _____

Purpose(s): _____

Ownership?: TRW
 Proprietary?: On file at ARC Facility, BMDATC, Huntsville

MACHINE/OPERATING SYSTEM (on which installed): CDC 7600TRANSPORTABLE?: Yes

Machine Dependent Restrictions: _____

SELF-CONTAINED?: Yes

Other Codes Required (name, purpose): _____

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec. CDC 7600)
Small Job:		
Typical Job:	<u>107K</u>	<u>300</u>
Large Job:		
Approximate Number of FORTRAN Lines:	<u>7000</u>	

* Wake Analysis Program

CODE NAME:

WAP

OPTICS

BASIC TYPE (✓): NONE
 Physical Optics: _____ Geometrical: _____

FIELD (POLARIZATION) REPRESENTATION (✓):
 Scalar: _____ Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.):
 Compact Region: _____ Annular Region: _____

TRANSVERSE GRID DIMENSIONALITY (✓):

1D	2D

Compact Region: _____
 Annular Region: _____

FIELD SYMMETRY RESTRICTIONS: _____
 MIRROR SHAPE(S) ALLOWED (✓):
 Square: _____ Circular: _____ Strip: _____
 Rectangular: _____ Elliptical: _____ Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):
 Fixed, Single Resonator Geometries: _____
 Fixed, Multiple Resonator Geometries: _____
 Modular, Multiple Resonator Geometries: _____

PROPAGATION TECHNIQUE (✓) (all that apply):

COMPACT	ANNULAR

Fresnel Integral Algorithms: _____
 With Kernel Averaging: _____
 Gaussian Quadrature: _____
 Fast Fourier Transform (FFT): _____
 Fast Hankel Transform (FHT): _____
 Gardener-Fresnel-Kirchoff (GFK): _____
 Other (specify): _____

CONVERGENCE TECHNIQUE (✓):
 Power Comparison: _____ Field Comparison: _____
 Other: _____

ACCELERATION ALGORITHMS USED: _____
 Technique: _____

MULTIPLE EIGENVALUE/VECTOR EXTRACTION ALGORITHM (✓):
 Prony: _____
 Other: _____

None

RESONATOR TYPE (✓): Standing Wave: _____
 Traveling Wave (Ring): _____ Reverse TW: _____

BRANCH (✓): Positive: _____ Negative: _____

OPTICAL ELEMENT MODELS INCLUDED (✓):
 Flat Mirrors: _____ Spherical Mirrors: _____
 Cylindrical Mirrors: _____ Telescopes: _____
 Scraper Mirrors: _____

Waxicons	Reflexicons

Axicons: _____
 Arbitrary: _____
 Linear: _____
 Parabola-Parabola: _____
 Variable Cone Offset: _____
 Other (specify): _____
 Deformable Mirrors: _____
 Spatial Filters: _____ Gratings: _____
 Other Elements: _____

GAIN MODELS (✓): Bare Cavity Only: _____
 Simple Saturated Gain: _____ Detailed Gain: _____

BARE CAVITY FIELD MODIFIER MODELS (✓):
 Mirror Tilt: _____ Decentration: _____
 Aberrations/Thermal Distortions: _____
 Arbitrary: _____
 Selected (specify): _____
 Reflectivity Loss: _____
 Output Coupler Edges: Rolled: _____
 Serrated: _____ Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):
 Medium Index Variation: _____
 Gas Absorption: _____
 Overlapped Beams: _____
 Other: _____

FAR-FIELD MODELS (✓): Beam Steering Removal: _____
 Optimal Focal Search: _____ Beam Quality: _____
 Other: _____

KINETICS

GAIN REGION MODELED (✓): None
 Compact Region: _____ Annular Region: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.)
 Compact Region: _____ Annular Region: _____

KINETICS GRID DIMENSIONALITY (✓):

1D	2D	3D

Compact Region: _____
 Annular Region: _____

GAIN REGION SYMMETRY RESTRICTIONS:
 Gain Vary Along Optic Axes: _____ Flow Direction: _____

PULSED: _____ CW: _____ KINETICS MODELED

CHEMICAL PUMPING REACTIONS MODELED (✓):

$$\begin{cases} X + Y_2 = YX + Y \\ Y + X_2 = YX + X \end{cases}$$

X	F	Cl	Br	I
H				
D				

Cold (F + H₂): _____
 Hot (H + F₂): _____ Chain (F + H₂ & H + F₂): _____
 Other (specify): _____

ENERGY TRANSFER MODES MODELED (✓): Reference

V-T: _____
 V-R: _____
 V-V: _____
 Other: _____

Single Line Model (✓): _____
 Multiline Model (✓): _____

Assumed Rotational Population Distribution State (✓):
 Equilibrium: _____ Nonequilibrium: _____

Number of Laser Lines Modeled: _____
 Source of Rate Coefficients Used in Code: _____

LINE PROFILE MODELS (✓):
 Doppler Broadening: _____
 Collisional Broadening: _____
 Other (specify): _____

GAS DYNAMICS

NOZZLE GEOMETRY MODELED (and type) (✓):
 Cylindrical, Radially Flowing: _____ ✓
 Rectangular, Linearly Flowing: _____ ✓
 Other: _____

COORDINATE SYSTEM: Cartesian _____

FLUID GRID DIMENSION (✓): 1D: _____ 2D: _____ ✓ 3D: _____

FLOW FIELD MODELED (✓):
 Laminar: _____ ✓ Turbulent: _____ ✓
 Other: _____

BASIC MODELING APPROACH (✓):
 Premixed: _____ ✓ Mixing: _____
 Other (specify): _____

References for Approach Used: _____

THERMAL DRIVER MODELED (✓):
 Arc Heater: _____ Combustor: _____
 Shock Tube: _____ Resistance Heater: _____
 Other: _____

F-ATOM DISSOCIATION FROM (✓):
 F₂: _____ SF₆: _____
 Other (specify): _____

F-ATOM CONCENTRATION DETERMINED FROM MODEL: _____

DILUENTS MODELED: _____

MODELS EFFECTS ON MIXING RATE DUE TO (✓):
 Nozzle Boundary Layers: _____ ✓ Shock Waves: _____ ✓
 Prereactions (thermal blockage): _____ Turbulence: _____ ✓
 Other (specify): _____

MODELS EFFECTS ON OPTICAL MODES DUE TO (✓):
 Media Index Variations: _____ ✓
 Other (specify): _____

Section IV

SUPPLEMENTARY INFORMATION FOR LONG SURVEY FORM

INTRODUCTION

The first two columns in the long survey form relate to the capability of the code to perform optical modeling of the electromagnetic fields in the laser cavity. The third column summarizes the key features of the gain region chemical kinetic processes available in the code. The last column deals with the gasdynamic properties treated by the code.

This section provides supplementary background information keyed to the survey form format and ordering of topics. This brief narrative provides introductory material to the user of this survey who may not be conversant with some portions of this broad, complex physical, chemical, and computational problem. Some or all of the material will be well known to the reader. Where it is not, we do not claim to provide an in-depth, self-contained description of phenomena but, rather, a brief highlighting of the topics so that the reader can get an immediate impression of the nature of the material and the degree of completeness of its treatment by the codes.

We must, furthermore, warn the reader that the individual codes treat a number of these phenomena very differently, so the general description given here may vary from the approach in a particular code.

In short, those readers who require special, in-depth knowledge of any particular topic treated here should seek that level of information from the key contact person denoted on the first page of the long form or from the references given.

OPTICS (COLUMN 1)

Basic Type

Codes generally fall into two categories: (a) those that use *geometrical ray tracing* techniques either to get usually quick, *zerth* order analyses or evaluations of optical resonator performance or to evaluate optical component specifications in systems such as telescopes beam transfer, etc. An example would be a misalignment sensitivity study or the generation of OPD (optical path differences) for input to a physical optics code; (b) *physical optics* codes that calculate propagation by nearly exact algorithms can predict resonator modes and can account for physical optics phenomena such as diffraction and dispersion.

Field (Polarization) Representation

The electromagnetic field is fundamentally a vector field.* In the general case, any valid resonator analysis must accommodate to the vector character of the electromagnetic field. Nevertheless, to simplify the treatment of these complex problems, we are highly motivated to find special cases where a scalar or single vector component treatment is valid.

In the case of an empty resonator, the scalar treatment is valid when a single component of the electromagnetic vector field can propagate through the entire resonator and back to the starting point without any coupling to other components of the field.

As an example, consider the reflection of light incident along the axis of a conical reflector. The field configurations that do not mix are those whose transverse polarization is everywhere either parallel with or perpendicular to the plane of incidence locally. If some other field configuration is incident, such as plane-polarized light, mixing will occur and an orthogonal polarization will result.

Thus, the inclusion of conical elements inside the resonator that scramble the field-polarization vector has led to the development of more detailed codes that keep track of the polarization vector at each field point. These vector codes divide the polarization into two components and combine or resolve the components as necessary at the end of each propagation leg.

The case of a loaded resonator introduces additional complications. In an empty resonator where a scalar treatment is valid, the scalar treatment of modes with orthogonal polarizations may proceed independently. In a loaded resonator, the polarization may couple through such effects as saturation differences of the gain medium and mirror distortion, since only one polarization component may be absorbing. Thus for a scalar treatment to be valid in the loaded resonator, we must suppress all but the desired polarization mode.

Finally, Maxwell's equations predict a depolarization term given by

$$\mathbf{E} \cdot \nabla \ln n^2$$

where \mathbf{E} is the electric field and n is the complex index of refraction. For media in which gradients in index are negligible in a wavelength, the latter term can be neglected compared with terms retained in the Helmholtz equation, i.e., the term

$$n^2 k^2 \mathbf{E},$$

where k is the wave number.

For most media of interest in the high-energy chemical laser problem, this condition is well satisfied.

*One might even argue that because of the peculiar properties of the cross product, the electromagnetic field is actually a second-rank tensor field.

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Coordinate System

The numerical algorithms for beam propagation are simpler, usually more efficient, and possibly more accurate when the coordinate system (or system of grid points where the field is specified) matches the resonator geometry. In chemical laser resonators two types of beams are typically encountered, compact beams and annular beams (Fig. IV-1). Circular compact beams and annular beams are best described by use of a cylindrical coordinate system, and beams of square and rectangular cross section typically should use Cartesian coordinates. The particular curvature of a wavefront (spherical, cylindrical, planar, etc.) usually does not influence the choice of coordinate system. One reason for this is because most numerical propagation algorithms are simplified by propagating planar wavefront beams. In this case the appropriate curvature corresponding to a given optical element is formulated as a phase sheet* which then multiplies the field. The more general codes offer the user a choice of coordinate systems for describing compact region fields that are selected according to the geometry of the elements to be modeled. Cartesian coordinates are usually not considered appropriate for representing annular beams because of the large number of grid points that would be typically involved in modeling cases of interest. In fact, usually a restriction is even forced on the general use of cylindrical coordinates, which leads to the use of so-called strip algorithms for propagating annular beams. (The strip propagator is elaborated upon in later discussions on specific propagators.)

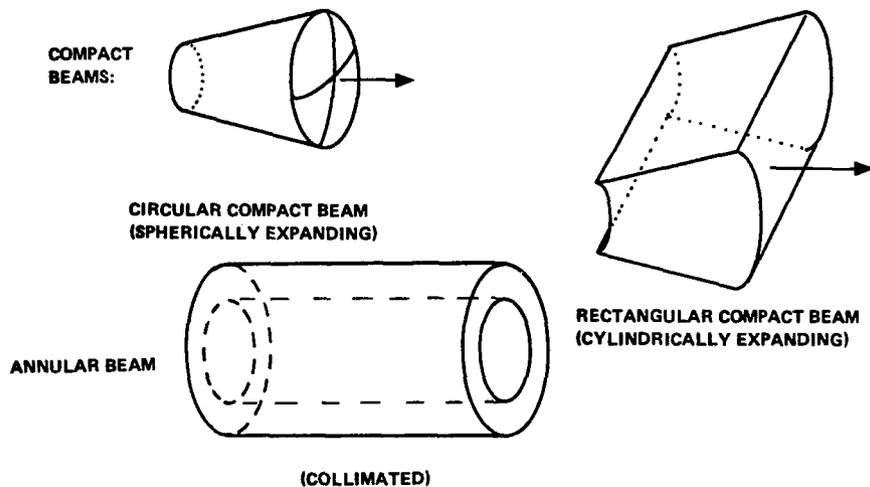


Fig. IV-1 — Types of beams

Transverse Grid Dimensionality

Many times, codes are developed based on tradeoffs between numerical accuracy, code capability, and computer run time. The simplest codes are one-dimensional (1-D) and are relatively fast, running at the expense of the ability of model asymmetric phenomena such

* Assuming, as is usually the case, that the curvature is sufficiently small that amplitude differences over the range of OPDs can be ignored.

as misalignments.* One-dimensional codes can be used to provide reasonable approximations for laser power, spectral content, mode shapes and separation, mirror flux loads, axisymmetric thermal distortions (such as thermal bowing), and misalignments in the flow direction for short gain lengths. Two-dimensional (2-D) codes more accurately model more complex phenomena such as misalignments, two-dimensional asymmetry of the media, arbitrary mirror distortions, and strut obscurations; thus, 2-D codes offer the capability of performing a number of important sensitivity studies encountered in practical resonators that cannot be handled with the 1-D codes.

The dimensionality selected is related to the highest expected spatial frequency structure developed in the electromagnetic field due to diffraction, gain medium inhomogeneities, flow properties, etc. Typical upper limits dictated by computer machine capabilities for current (1980) state-of-the-art machines are listed below.

	<u>Dimensionality</u>	<u>Fresnel Number</u>
1-D problem	$2^{10} - 2^{11}$	100 - 500
2-D problem	$2^8 \times 2^8$	20 - 40

The implications of machine restrictions on array sizes can be appreciated by a simple example. Suppose the required sampling leads to a grid of 128×128 points. This leads to a basic array of over 16,000 points, and at each point we have both the real part and the imaginary part of the complex field amplitude. If we wish to store only the field amplitude and phase in a source plane and an observation plane, we require a total of $64 K_{10}$ storage locations even before we have loaded the computer program.

We can easily get a rough estimate of the number of grid points required in an observation plane from the following considerations. Let us imagine an infinite-slit aperture with transverse dimension $2a$ and an observation plane located a distance R downstream.

The single-slit diffraction pattern has half-cycle nulls a distance d apart in the observation plane, where d is given by

$$d = \frac{\lambda R}{2a}.$$

This distance can also be written in terms of the Fresnel number of the source as seen from the observation plane; we obtain

$$d = \frac{a}{2N_F}.$$

*This does not necessarily imply that they are more efficient.

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For good sampling, we require about four points per half-cycle at the highest spatial frequency so that the spacing of points required is just $d/4$. If the characteristic transverse dimension on the observation plane is also of order $2a$, we find that the total number of points required in one transverse dimension is given by

$$m = \frac{2a}{d/4} = 16N_F .$$

Thus for a Fresnel number of 50, we may require as many as 800 points in the transverse dimension. Of course this requirement may be eased if the amplitude at the source aperture falls to zero as one approaches the edge of the source grid.

In addition, when doing a detailed kinetics and gasdynamic calculation as well (see below) these arrays of field quantities must be retained at sequential times or transverse points for use in the calculation of gain as the molecules flow away from the nozzle exit plane.

When a machine core is exhausted, techniques are devised to extend the effective storage by overlay and mass storage (disk) usage. With the advent of vector, parallel processing machines of effectively unlimited core, many of these restrictions will be removed and only cost will dictate the limits of the size of problems to be attempted.

Field Symmetry Restrictions

In some instances, quasi-two-dimensional codes are assembled that assume field symmetry about a line or point. Codes also can be tailored to model systems that are circularly symmetric. These codes have definite field symmetry restrictions. Often, code users take advantage of field symmetry by specifying only the nonrepeating portion of the field. Thus one can reduce the total number of required grid points by a factor of n where there is n -fold symmetry, without affecting the field resolution.

Mirror Shapes Allowed

Codes that have been assembled with one type of coordinate system are usually restricted in their ability to model mirror shapes fitting another coordinate system. Two-dimensional Cartesian codes do an excellent job in modeling square or rectangular mirrors, and an inefficient job in modeling elliptical or circular shapes. One-dimensional Cartesian codes can model strip mirrors (mirrors that are considered infinitely long in one dimension). Elliptical mirrors that are circular or of moderate eccentricity can be handled by cylindrical coordinate codes.

The field modification by a mirror usually takes the form of an amplitude and phase change imposed on the field at the mirror plane. This introduces the effects of mirror curvature and absorption. Actual measured data on mirror shape, curvature, and reflectivity can be used as well, if available, provided that the code has been designed to accept such data.

Flexibility of Configuration

There appear to be only three approaches or philosophies taken in building detailed resonator codes. These are: (a) codes developed to model only one specific resonator type (e.g., the HSURIA*), (b) codes that allow the user to select one of several different pre-programmed resonator models usually by simply setting certain flags in the input files, and (c) codes that attempt to provide the user complete freedom to model any resonator he chooses (the modular codes). In the latter approach, the code builder attempts to provide, in a useful format, all necessary submodels that could be of interest in modeling resonators over as wide a range as possible and leaves to the code user the task of representing his own resonator by utilizing modules in the proper sequence. Essentially, the user writes his own executive program, which amounts to a particular sequence of calls to the various modules (subroutines models) representing a complete set of operations on the field in transversing one round trip through the resonator.

There are obvious advantages and disadvantages to a given approach. The fixed, single resonator code is of little use unless it models the resonator of interest. On the other hand, its limited scope offers the possibility of making it highly efficient and cost effective to run. Also, compared to the other code configurations, it *should* be the easiest to use given that all these code types are performing the same level of analysis. The fixed, multiple resonator code configuration offers the capability of modeling several different resonators with relative ease. Using one basic code to model several different resonators for performance comparisons is advantageous since the numerical precisions will be nearly the same. Such code configurations require a more complex logical structure; they can become unwieldy if too many resonator models are included. Finally, the multiple, modular code construction approach offers very great modeling flexibility in return for a great amount of foresight in the selection and interfacing of a large number of physical models on the part of the code builder, as well as the time required to construct the iteration loop to represent a particular resonator on the part of the user. The advantage is that a user will (in principle) have to learn how to use only one code. Disadvantages are that it is extremely difficult to predict all the necessary code features and build a code that is both simple and efficient to use.

Often, cost and/or schedule constraints have dictated the approach to code construction. Single-purpose codes can be built in several months by those already familiar with the physical models and the numerical algorithms. Modular codes, on the other hand, require many man-years of planning and construction before they can be used.

Propagation Technique

We turn now to the question of calculating the electromagnetic field at a downstream location when its amplitude and phase are specified on some surface upstream. The surface need not be planar, but it is often so chosen to simplify the calculations.

There are two basic propagator types, the integral type using the Huygens-Fresnel principle and the differential equation type derived from the paraxial wave equation. Each type can deal with a complete vector field, but to simplify our discussion we assume that the problem has been structured so that a scalar treatment is valid. Our discussion here is oriented toward numerical calculations. Later we will touch briefly on analytical treatments.

*Half-symmetric unstable resonator with internal axicon.

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Paraxial Wave Equation

In the scalar version of paraxial wave treatment we assume that a single transverse component propagating in the z -direction can be written as the real part of the expression

$$E_x(x, y, z, t) = \Psi(x, y, z) \exp(ikz - i\omega t),$$

where Ψ satisfies the paraxial wave equation

$$\nabla_T^2 \Psi + 2ik \frac{d\Psi}{dz} + k^2 \left[\frac{n^2(x, y, z, t)}{n_o^2} - 1 \right] \Psi = 0. \quad (1)$$

The refractive index may be complex if it is to include gain. If the gain is to be introduced as one or several isolated gain sheets, we set $n = n_o$ and the last term in Eq. (1) drops out.

Huygens-Fresnel or Integral Equation [1]

In the paraxial approximation, the field at any observation point downstream is given by

$$\Psi(P) = -\frac{ik}{2\pi} \int_{s_1} \frac{\Psi(s_1) \exp(ikR)}{R} ds_1, \quad (2)$$

where the integral extends over the area of the source aperture s_1 , R is the distance from each element in s_1 to the observation point P , and $\Psi(s_1)$ is the complex field as a function of position in the source plane.

Comparison of the Two Approaches

Since the integral equation and the paraxial wave equation are alternative approaches to the same problem, we expect that both approaches will yield the same correct answer. The question for discussion, then, is which approach can be more readily implemented in a given case.

In comparing the two approaches, we find that the integral propagator seems to be the natural choice for a long propagation distance. The integral is evaluated in a single step from the source plane to the observation plane. The numerical integration of the differential equation, on the other hand, is expected to require many steps for a long propagation distance.

As the propagation distance decreases, the quantity $\exp(ikR)$ in Eq. (2) will begin to oscillate more rapidly as we move across the aperture carrying out the numerical integration. The number of one-half cycles of oscillations is given by the Fresnel number N_F , defined by

$$N_F = a^2/(R\lambda), \quad (3)$$

where a is the radius of the source aperture, λ is the wavelength, and R is as before. For good accuracy in our numerical integration, we may require somewhere between four and eight points per Fresnel number; thus, as the distance to an observation point R decreases, the Fresnel number increases to a value of, say $N_F = 100$; we require between 400 and 800 radial grid points. If, in addition we introduce tilt or otherwise destroy the axial symmetry, the total number of grid points can climb rapidly into the range of 10^3 to 10^4 . This discussion assumes, of course, that the phase and amplitude of $\Psi(s_1)$ vary at a slower rate than $\exp(ikR)$, a condition not always met in practice. For relatively short distances and corresponding large values of N_F , the paraxial wave equation seems the natural choice. In the limit of short distances we have the geometric optics solution in which the electric field can be expressed in terms of the second derivatives (or equivalently, the radius of curvature of the phase fronts) of $\Psi(s_1)$ in the source plane.

In numerical calculations, the values for the electromagnetic field are always presented on a grid of finely spaced points. The configurations of the grids and the total number of points are important issues. One is always faced with the tradeoff between computer storage requirements and calculation speed on the one hand and accuracy requirements on the other.

The early calculations were often carried out with Cartesian coordinate and square or rectangular grid systems. The early fast Fourier transform (FFT) (to be discussed later) algorithms were easily applied to these systems. For circularly symmetric systems, however, this is not an efficient grid system. Accordingly, radial systems were introduced and suitable integral propagators were developed for azimuthally decomposed fields. For an axisymmetric system, the number of grid points for a given level of sampling can be reduced substantially. Even when the axial symmetry is disturbed by such factors as tilts, mirror distortions, and struts, one often samples relatively heavily in r and relatively thinly in θ , with an overall increase in sampling efficiency compared to a Cartesian system.

Before we leave our discussion of basic considerations, we mention briefly some of the analytic techniques and contrast them with the numerical techniques.

Since the early work of Horowitz [2] on the empty cavity modes of the perfectly aligned infinite strip resonator, slow and steady progress has been made with the analytic techniques. Butts and Avizonis [3] have studied the cylindrically symmetric bare resonator. Ellenwood and Meyer [4] have obtained preliminary results on the empty perfect HSURIA resonator. The analytic studies are significantly limited by the fact that they cannot deal with the general cases of major interest. Nevertheless, to the degree that they can handle important ideal cases, they serve a useful role for baseline comparison purposes. Some workers also feel that they retain closer contact with the basic physics of the problem.

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Although the large numerical codes are held in mixed regard within the community, they do appear to hold promise for accurate numerical results for all cases of interest. The full set of cases of interest spans a much wider range of phenomena than those that can be handled by the analytic approaches.

The large codes may be plagued with long run times, considerable expense, and uncertain results, particularly for those cases where there is no convergence. We do not yet seem to have achieved the happy circumstance of efficient and economic computer codes producing results of high confidence for all the realistic cases of interest.

Some Specific Propagators

We present now a brief discussion of some of the features of several propagators used in practice. We will discuss only Huygens-Fresnel algorithms, since these are the most often used. The ordering here follows that of the survey form.

Kernel Averaging

This technique takes account of the fact that a relatively fine grid is required to sample rapid variations in the quantity $\exp(ikR)$ in Eq. (2), whereas a coarser grid is generally adequate for the field distribution in the source aperture. The $\exp(ikR)$ grid can be computed once and the values for the field amplitude obtained by interpolation.

Gaussian Quadrature

This is a well-known technique for carrying out numerical integration with a given accuracy and fewer grid points than those used in the evenly spaced grids. The grid points must be spaced unevenly to effect this improvement. A nonuniform weighting function is used. One possible penalty is the requirement for interpolation to obtain the field values at the proper locations in the source plane. In addition, for large Fresnel numbers, sampling restrictions lead to prohibitive run times.

Fast Fourier Transform

The FFT is a well-known technique [5] by which the number of steps required to carry out an integration of an $N \times N$ -point 2-D function expanded in an $N \times N$ series of basis functions may be reduced from $\approx N^2$ to $\approx N \log_2 N$, which is a substantial saving when N is ≥ 100 . In its original version the FFT is suited to the case of a rectangular grid system. To carry out the procedure, one takes the (fast) Fourier transform of the field distribution in the source plane, propagates this transform to the observation plane with a simple multiplication, and finally, if desired, calculates the inverse (fast) finite Fourier transform.

Fast Hankel Transform

The FHT transform has been described by Siegman [6]. The Hankel transform and the Fourier transform are very closely related. In fact, the result of a zeroth order Hankel transform is numerically equal to that of a double Fourier transform in x and y when the function being transformed is cylindrically symmetric. Higher order Hankel transforms accommodate cases where, for example, $\cos m\theta$ symmetries are present.

Gardner-Fresnel-Kirchhoff

The Gardner transform [7] is applied to Eq. (2), resulting in a Gardner-Fresnel-Kirchhoff (GFK) algorithm. If the Fresnel integral is written in terms of the cylindrical coordinate variables r and θ , the θ integrations can be carried out analytically for circularly symmetric fields. As it stands, the form of the remaining integral over γ does not lend itself to any of the fast transform techniques. However, if we apply the Gardner transform to the radial coordinate, the new variables u and u' appear in the form $(u - u')$, which is a form of a convolution to which the fast transform techniques can be applied. Both FHT and GFK methods use the Gardner transform. The FHT requires an additional Fourier transform, since a convolution is not used.

Strip Propagators

The strip propagator [8] is the appropriate one for the one-dimensional strip resonator problem in which the fields are independent of the coordinate along the strip. These propagators are applied in the annular region of circularly symmetric HSURIA resonators. Strip propagators are of interest because we anticipate great difficulty in handling the number of grid points required for a fully general treatment. We can understand these requirements from the following considerations. Let us imagine an annulus 60 cm in diameter with a 4-cm shell which is 400 cm long. From Eq. (3) we take the Fresnel number

$$N_F = \frac{2^2}{(3 \times 10^{-4}) 400} \approx 33 .$$

If we assume that the annulus can be considered as an infinite strip closed on itself, then about 500 points are required to properly model the field through the thickness. If now we add the possibility of an angular dependence around the annulus, we may require one to several orders of magnitude more points to model the fields properly, depending on the magnitude of the angular variations. A Fourier decomposition is made in the azimuthal components. These fields are then carried along separately.

Convergence

Convergence in laser resonators is an iterative process that amounts to reflecting the field around the resonator until the field distribution is repeated to within a multiplicative constant from one iteration to the next. This constant is related to the mode eigenvalue. The iterative procedure is terminated when the field stabilizes to within a convergence criterion. In some codes the measure of convergence is taken to be the (normalized) power in the field fed back into the resonator immediately after outcoupling. Convergence is reached when either (a) a certain number of the last computed values of the feedback power are all within some prescribed amount, or (b) the most recently computed minimum and maximum values of the feedback power agree to some preset number of decimal places. Convergence can also be established by requiring the point-to-point variation in the field distribution to be less than a prescribed amount for consecutive iterations.

When the two largest eigenvalues have nearly the same value, e.g., for resonators of nearly integer equivalent Fresnel number, convergence to the dominant eigenvalue can be quite slow if obtainable at all. In such situations convergence acceleration algorithms are sometimes used to predict the eigenvalue in hopes of reducing the number of iterations to convergence.* Since the results obtained with some algorithms can be misleading or erroneous, they should be utilized with caution.

Eigenvalue/Eigenvector Extraction [9]

In modern unstable resonator calculations, it is very important to determine a resonator's transverse mode behavior to ensure adequate transverse mode discrimination and insensitivity to small mirror misalignments (tilts, translations, decentrations, etc.). This means that, typically, several high-order transverse modes of the resonator, in addition to its lowest, need to be calculated. Ordinarily, however, numerical unstable resonator solutions yield only one eigenvalue, i.e., the one associated with the dominant, or lowest loss, mode represented by the stable (self-replicating) field distribution at convergence. Thus, to obtain information about some other (higher order) mode, one must somehow extract the known modes from the initial field distribution and reiterate the resonator to convergence. There are two basic problems with this approach. First, finding many eigenvalues (and transverse modes) one at a time for a complex resonator can be very expensive, since convergence must be reached every time. It would not be unusual for higher order modes to converge more slowly. Second, due to numerical inaccuracies, it could be very difficult to completely extract a known (lower order) eigenvalue from the starting field distribution, to prevent its dominating again after many iterations.

The Prony method, which provides an effective algorithm for extracting all of the significant lowest order modes in a resonator eigenvalue calculation, is one means of alleviating the problems just discussed [10]. Furthermore, with this method several different transverse modes of a resonator can be found without iterating the field to convergence! This is obviously a very powerful technique and provides an important measure of both power and efficiency to be considered in trading off resonator optics codes for use in higher order mode calculations.

Resonator Type

Standing-wave resonators have mirrors at either end of a cavity that reverse the beam direction, causing it to alternately retrace its path in the opposite direction. Field points inside standing-wave resonators have a bidirectional flux traveling through them. Traveling-wave resonators, commonly called ring resonators, circulate the mode unidirectionally (if properly designed). Sometimes, poorly designed traveling wave resonators can support reverse running modes, which are generally undesirable.

*For example, see Aitken's method as discussed in J. H. Wilkinson, *The Algebraic Eigenvalue Problem*, Oxford University Press, Cambridge, 1965, p. 578.

Branch

The branch of a resonator relates to the stability diagram [11] for two-element resonators, made up of spherical mirrors at unequal curvature (see Fig. IV-2), which is equivalent to a sequence of lenses of alternating focal length $f_1 = R_1/2$, $f_2 = R_2/2$ equally spaced a distance d apart.

One identical subelement of this sequence of lenses is a space d followed by a lens of focal length f_1 , followed by another space d , and finally the second lens of focal length f_2 . By applying the appropriate paraxial ray transfer matrix to this subelement and requiring that one-half the trace of this matrix be between -1 and 1 , we arrive at the condition for stability. That is, for the optical system representing the complete round trip in the resonator mirror system, we have the equivalent lens sequence shown in Fig. IV-3.

The matrix operations are, for this sequence,

$$\begin{bmatrix} 1 & d \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ -\frac{1}{f_1} & 1 \end{bmatrix} \begin{bmatrix} 1 & d \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ -\frac{1}{f_2} & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 1 - d/f_2 & 2d - d^2/f_1 \\ -\frac{1}{f_1} - \frac{1}{f_2} + \frac{d}{f_1 f_2} & 1 - \frac{d}{f_1} - \frac{2d}{f_2} + \frac{d^2}{f_1 f_2} \end{bmatrix}$$

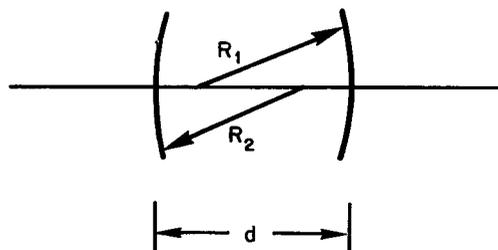


Fig. IV-2 -- General open optical resonator

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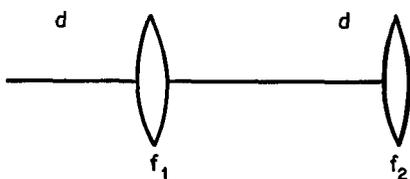


Fig. IV-3 — Equivalent lens sequence
for open optical resonator

Stability requires that $-1 < 1/2(\text{trace}) < 1$, or,

$$-1 < 1/2 \left[2 - \frac{2d}{f_1} - \frac{2d}{f_2} + \frac{d^2}{f_1 f_2} \right] < 1.$$

Thus,

$$0 < \left(1 - \frac{d}{R_1} \right) \left(1 - \frac{d}{R_2} \right) < 1 \quad \text{for stable resonators}$$

where we have substituted $f_1 = R_1/2$ and $f_2 = R_2/2$. Let $g_1 = 1 - d/R_1$ and $g_2 = 1 - d/R_2$. Then the unstable resonators split into two categories

$$\text{positive branch} \quad g_1 g_2 \geq 1$$

and

$$\text{negative branch} \quad g_1 g_2 \leq 0.$$

The stability diagram is a plane representing all combinations of $g_1 g_2$, as in Fig. IV-4. A special case of great interest is the confocal resonator for which the focal points of the mirrors coincide. The condition of confocality is given by

$$f_1 + f_2 = d$$

which leads to contours of confocality

$$g_1 = g_2 / (2g_2 - 1)$$

on the stability diagram.

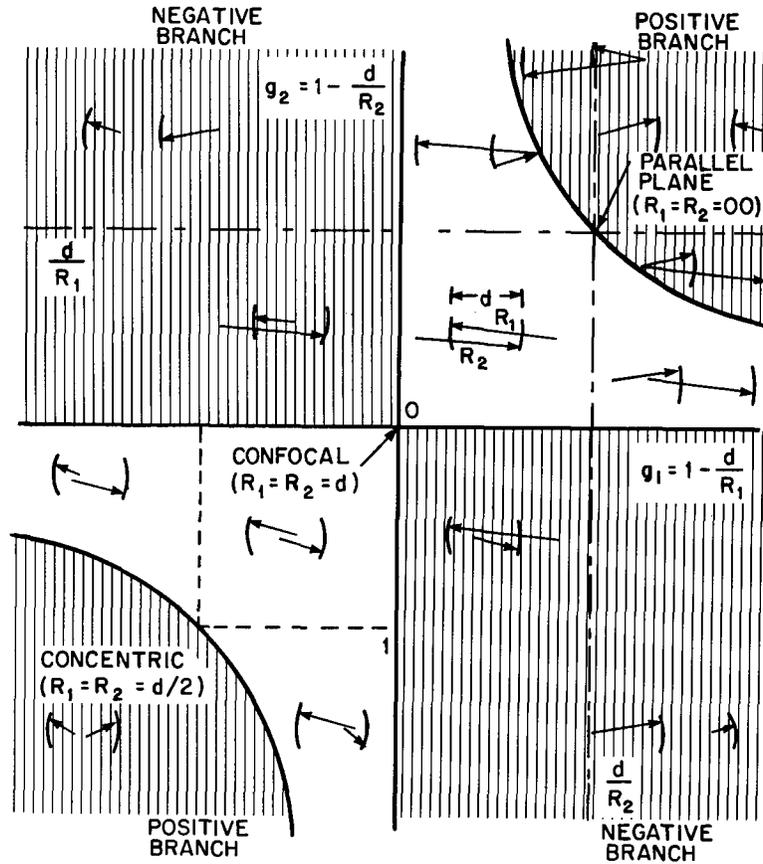


Fig. IV-4 — Stability diagram. Unstable resonator systems lie in shaded regions.

The *positive-branch confocal resonator* has g_1 and g_2 positive, but the curvatures of the mirrors are of opposite sign. The *negative-branch confocal resonator* has both curvatures positive, but g_1 and g_2 are of different sign. Thus, the negative-branch resonator has a real internal focus. These examples are shown in Fig. IV-5. Both have fundamental mode *collimated outputs*.

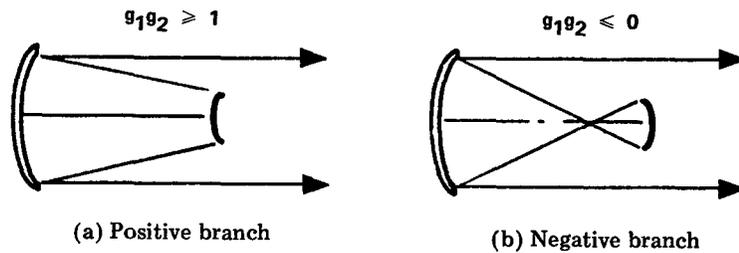
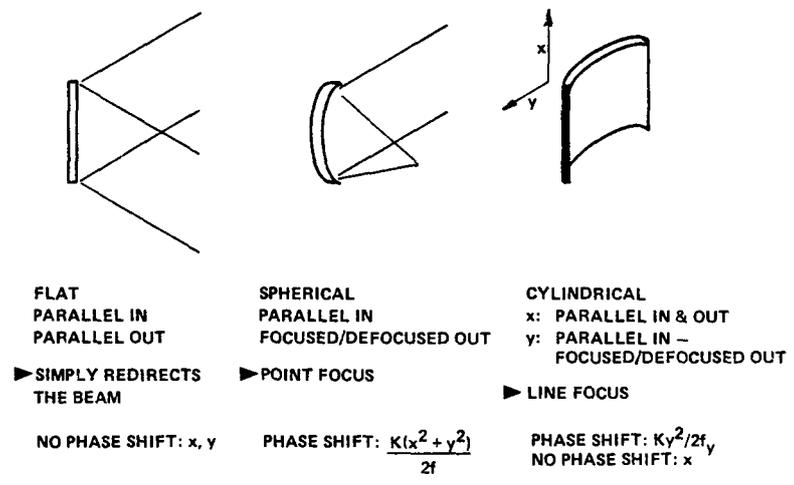


Fig. IV-5 — Two classes of confocal resonator

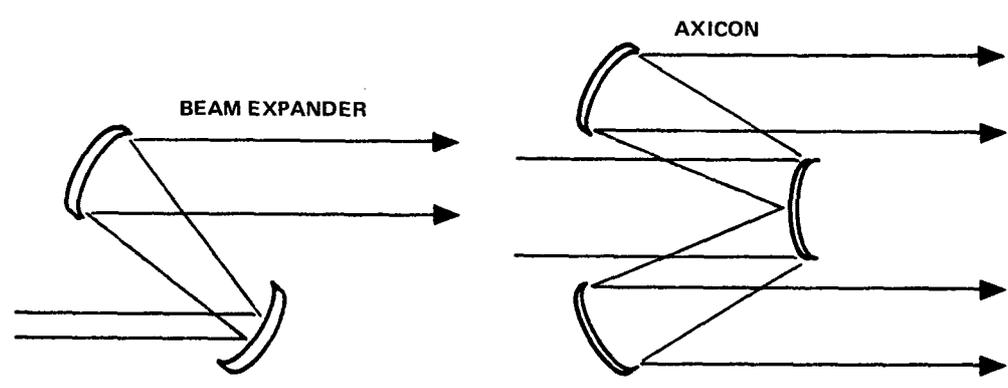
Optical Element Models Included

Most optics codes are capable of modeling standard components such as those discussed in this section.

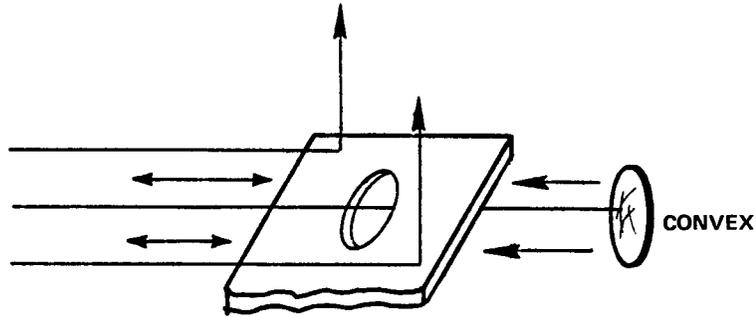
Flat, spherical, and cylindrical mirrors are standard optical components.



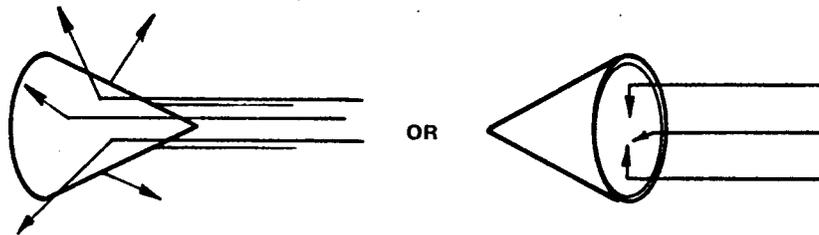
Telescopes, intra- or extracavity, are used to enlarge or reduce beam sizes:



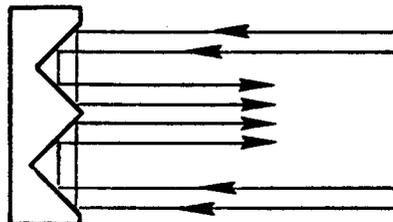
Scraper mirrors are placed between the end mirrors of unstable resonators to outcouple the beam. A scraper mirror is usually a flat with a hole in it, placed near the convex cavity mirror. (Note: Usually not modeled.)



Axicon is the generic term for an axisymmetric, cone-shaped optical element.

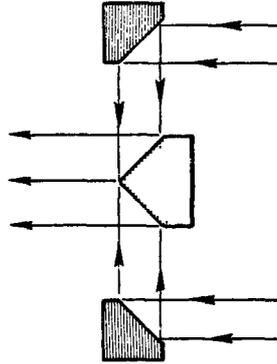


Waxicon is the term for a compound axicon (two cones) whose cross section is W-shaped. An annular input beam is transformed into a compacted beam traveling in the opposite direction.



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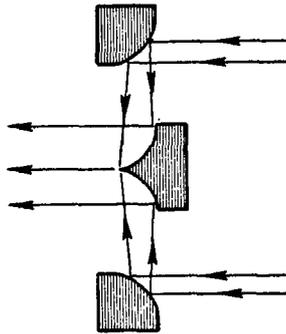
Refluxicon refers to a compound axicon that compacts an annular beam without reversing the beam direction.



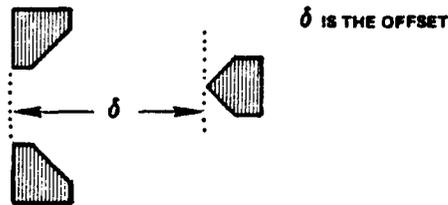
Arbitrary refers to the surface contour of the axicon. Arbitrary axicons can be designed to change the beam phase or intensity profiles.

Linear model: surface contour is a line of revolution, resulting in a true cone section.

Parabola-parabola model: the inner and outer cone of surfaces are parabolas of revolution. These configurations spread the compact beam to reduce flux loading on optical elements.



Variable cone offset is the axial separation between the inner and outer cones and is a code variable.



Deformable mirrors refers to a mirror whose surface contour is adjustable by use of a series of actuators. When a deformable mirror is coupled to a feedback system of sufficient bandwidth, an adaptive optic system results. This can be used to offset aberrations induced in the intracavity beam by gain media inhomogeneities and fluctuations, mirror deformations, or jitter.

Spatial filters refers to an aperture stop placed near a focal point to restrict passage of a beam to those elements that can be focused through the aperture. Since unwanted modes have energy in the wings of the focal pattern, the filter acts as a suppressant by removing this energy from the feedback loop. If the passage to a "point" focus is impossible due to high flux, then a cylindrical lens can be used to form a line focus, thereby spreading out the beam power over a greater area. In this case the filter is a line aperture.

Gratings are linear, circular, or holographic contours of wavelength dimensions etched or ruled into a mirror to disperse the beam.

Gain Models

Bare cavity models do not contain gain models but mathematically normalize the circulating flux to unity after each round trip. Simple saturated gain models use a simple gain algorithm for homogeneous and inhomogeneous broadening to boost the intracavity flux on each round trip. Detailed gain models calculate the gain by taking into account the actual number densities of active media at each field point and consider effects such as cascading, mixing, and deactivation. These models are summarized in the sections of the survey form dealing with kinetics (column 3) and gasdynamics (column 4).

Bare Cavity Field Modifier Models

Field modifiers are mathematical operations applied to the intracavity field at selected points to model various resonator elements such as mirrors or errors. For instance, errors due to thermal distortion of a laser mirror can be calculated once the field is predicted at

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the plane of the mirror. An algorithm is then used to determine the mirror distortion, which in turn is converted to a phase error and added point by point to the field phase.

Recent work by Felsen, Dente, and others on the effect of the mirror edges on resonator mode stability and control have resulted in the comments on output coupler edges: rolled, serrated, etc.

Loaded Cavity Field Modifier Models

In loaded cavity models (gain included), field modifiers to simulate gain sheets as well as errors in the gain medium index of refraction, gaseous resonant or nonresonant absorption of the intracavity flux, or the effects of overlapped beams in detailed three-dimensional gain packages are sometimes modeled. The gain is a function of the laser intensity; hence, matrix methods are not usable, since the problem is nonlinear.

Far-Field Models

Far-field models are used to project a beam with a certain intensity and phase profile taken at the resonator output into the far field for purposes of evaluating beam quality. Errors in the output beam phase such as tilt and focus need to be removed in some instances in order to properly evaluate the residual beam quality. Beam quality is usually calculated by measuring the fraction of the total power that passes through an aperture of fixed size and comparing the ratio of the theoretically perfect beam to the predicted beam by one of a number of simple algorithms.

KINETICS

Introduction

The objective of the chemical kinetics subroutines in these computer codes is to calculate the gain coefficient by taking account of the detailed rates of pumping, deactivation, and stimulated emission of the vibrational states of the excited product molecules in the chemical reaction of the laser medium. These instantaneous point solutions are then coupled with fluid flow models (cf. discussion of column 4 of survey form) of various degrees of sophistication to describe the gain as a function of position transverse to the laser light beam propagating between the mirrors. Since the pumping and stimulated emission rates are dependent in part on the local intensity of laser light at the site of each molecule in the stream, one sees immediately that the most comprehensive solutions require that self-consistency be established (the laser light appears both as a cause and an effect of the molecular kinetics).

The *gain coefficient* α is calculated at a discrete plane along the propagation direction (z) and is used in the radiative transfer equation to calculate the local intensity I ;

$$\frac{dI}{dz} = I\alpha .$$

The gain coefficient is derived from the details of the complex behavior of the molecules, which derives from functions of the following factors:

1. Their combustion formation processes (rate coefficients)
2. Collisions with other molecules (foreign and self-broadening and energy transfer)
3. Their motion at the temperature of the flowing, expanding gas (Doppler broadening)
4. Rotational and vibrational populations (Boltzmann or non-Boltzmann distribution plus partition function)
5. Einstein coefficients for stimulated emission and competing deactivation modes.

Gain Region Modeled

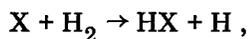
If the gain generator is in the compact region of an annular device, as it is in laboratory test beds in many cases, the model is appropriate for that configuration—that is, for example, linear banks of nozzle and parallel flow. If the gain generator is in the annular region, then cylindrical symmetry dictates a (r, θ) coordinate system to model the radial diverging gain medium.

Kinetics Grid Dimensionality and Symmetry

The molecular effects summarized above are calculated for each transverse point in the region intercepted by the laser beam modes in the most sophisticated models. For some geometries and flow patterns, an approximation of *one-dimensional kinetics* is assumed and implemented by averaging over the transverse coordinate perpendicular to the flow direction. The *variation of gain along the optic axis* is achieved by use of more than one transverse plane for the kinetics/gasdynamics calculation. One does so only with care, however, since this gain calculation can be very time consuming. Typically, one to three gain “sheets” are used, although some lasers have been studied with as many as six sheets. A rule of thumb is about one per meter of HF. One tries to keep the gain \times length product between sheets such that the intensity rises linearly.

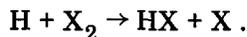
Chemical Reactions Modeled

The reactions modeled for use in high-energy lasers have generally fallen into three categories: (a) cold, (b) hot, and (c) chain. *Cold* and *hot* are terms referring to the relative exothermicity of the one reaction compared with the other. The cold reactions are given by the class of halogen-hydrogen reactions

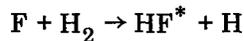


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where X is any of the halogen atoms F, Cl, Br, or I, and H can be replaced by D. The hot reactions are given by the class of atom transfer reactions,



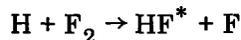
The energy to be distributed among the reaction products is $-\Delta H + E_\alpha$ where ΔH is the change in enthalpy of the reaction and E_α is the activation energy needed to overcome the potential barrier between the two initially stable reactants. The reference to cold and hot reactions can be understood by reference to energy values for a specific reaction. For example,



has

$$-\Delta H + E_\alpha = 34 \text{ kcal} ,$$

whereas



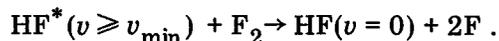
has

$$-\Delta H + E_\alpha = 102 \text{ kcal} .$$

Since this excess energy appears as excited state HF^* , one sees that much higher vibrational levels are possible in the hot reaction.

The higher exothermicity of the hot reaction can be attributed to the difference between the very weak bonding of F_2 and strong dissociation energy at 0 kelvins from $v = 0$ of HF. The difference of about 100 kcal is sufficient to excite HF vibrationally to $v = 11$.

The *chain reaction* occurs with a mixture of H_2 and F_2 so that both the hot and cold reactions are present in the gain medium, supplying the necessary H and F atoms to activate the excited HF molecules. In addition, the hot reaction allows energetic interaction of F_2 with the excited HF above a minimum vibrational level to create a surplus of F atoms via the branch



The difference in exothermicity and hence in available vibrational energy for population inversion is clearly seen in the following coordinate energy level diagrams for F/H₂ and H/F₂ reactions. In Fig. IV-6 the energies shown are for one mole of reactants. The k'_i and k_i are the rate constants for activation and recombination, respectively.

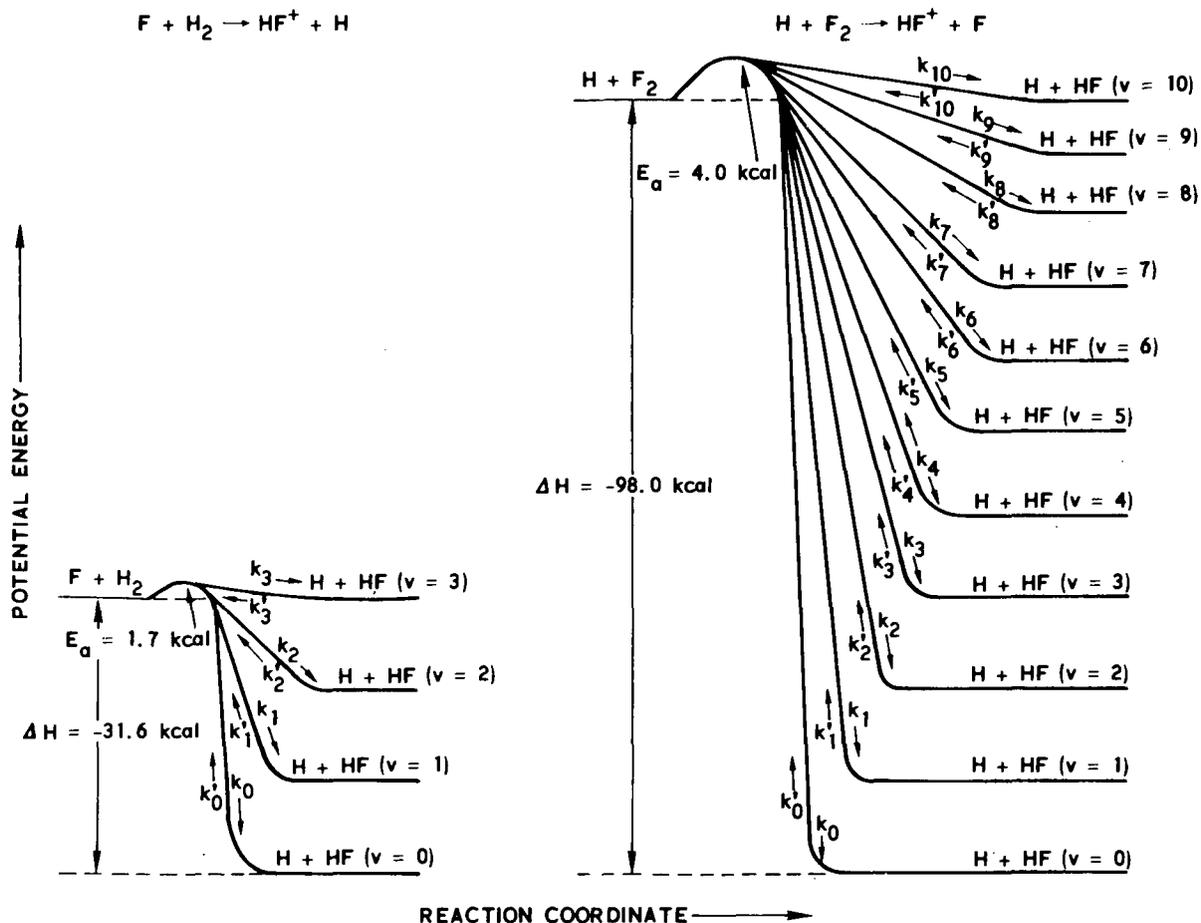
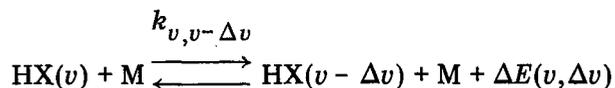


Fig. IV-6 — Reaction coordinate diagrams for F/H₂ and H/F₂ reactions [12a]

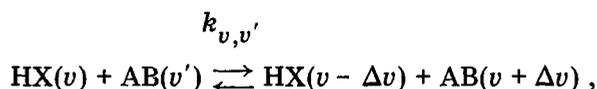
Modeling of Energy Transfer Modes

Deactivation of the inverted population occurs via stimulated emission together with competing radiative and collisional processes. Relaxation rate coefficients are used in the computer calculations to account for the self-deactivation of the hydrogen halides and for their deactivation by other species of atoms, molecules, and radicals present in the flowing medium.

The energy transfer occurs through either vibrational-translational reactions or vibrational-vibrational reactions. The vibrational-vibrational (rotational, V-T(R)) reactions are exemplified by



where $k_{v,v-\Delta v}$ is the rate coefficient, v is the initial vibrational level of HX, and Δv is the number of vibrational quanta transferred to the chaperone specie molecule M as translational and/or rotational energy. This type of transfer leads, clearly, to a real loss of available quanta for stimulated emission at vibrational level v . In the vibrational-vibrational (v, v') reaction



energy remains in vibrational states. In the case of self-deactivation, lasing species are preserved in $v, -v'$ transfer.

Single vs Multiline

Since the vibrational-rotational levels are populated and deactivated at different rates, the inversion condition necessary for lasing depends on the instantaneous relative population between all $V-R$ levels and therefore changes with time. Thus the spectral output of the chemical laser is generally *multiline*. The line profile as a function of the transverse flow coordinate is in general different for each line because of differences in gain distribution.

Rotational Population Distribution

To avoid excessive computational time, the assumption of rotational state population equilibrium is usually made. The partition function describes a Boltzmann distribution in this case. At the low pressures encountered in some HF laser designs, this assumption is not necessarily a good one. If, for example, collisional rates are greatly exceeded by stimulated emission rates, then the equilibrium assumption is suspect. Brute-force inclusion of rate equations for each J level would lead to inordinate run time and expense. Thus various simplifying assumptions are made, including empirical distributions fit to small-signal gain and chemiluminescence data. Care must be exercised, however, since in the absence of lasing, the Boltzmann distribution is very well fitted to available data.

Line Profile Models

The natural line width of the lasing transition is broadened by collision and the Doppler effect. In high-pressure devices (> 75 torr), collisional broadening dominates. In low-pressure devices (< 5 torr), Doppler broadening dominates. A convenient method for inclusion of both effects is to use the Voigt function defined by

$$K(x,y) = \frac{y}{\pi} \int_{-\infty}^{\infty} \frac{e^{-t^2} dt}{y^2 + (x-t)^2}$$

The line profile at wavenumber ω is then

$$\Phi(\omega; v, J, m) = \left(\frac{\ln 2}{\pi} \right)^{1/2} \frac{1}{\alpha_{DP}(v, J, m)} K(x, y)$$

where

$$\int_{\omega_c - \infty}^{\omega_c + \infty} \Phi(\omega) d\omega = 1$$

$$x = (\ln 2)^{1/2} \frac{|\omega - \omega_c(v, J, m)|}{\alpha_{DP}(v, J, m)}$$

$$y = (\ln 2)^{1/2} \frac{\alpha_{LR}(v, J)}{\alpha_{DP}(v, J, m)}$$

Also, α_{DP} and α_{LR} are the Doppler and Lorentz HWHM (half widths at half maximum), respectively. For laser operation at line center ($\omega = \omega_c$), $x = 0$ and the Voigt function [12b] reduces to the exact formula

$$K(0, y) = [1 - \text{erf}(y)] \exp(y^2)$$

Then in the limit of pure Doppler broadening ($y = 0$ and $K(0, 0) = 1$), the line profile becomes

$$\Phi_{DP}(\omega_c) = \frac{(\ln 2/\pi)^{1/2}}{\alpha_{DP}}$$

whereas in the (Lorentz) limit of pure collisional broadening ($y \rightarrow \infty$ and $K(0, y) \approx 1/y\sqrt{\pi}$) it becomes

$$\Phi_{LR}(\omega_c) = \frac{1}{\pi\alpha_{LR}}$$

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For operation at other than line center ($\omega \neq \omega_c$), approximate algebraic expressions for the Voigt function exist [13].

GASDYNAMICS

Background

Gasdynamics, the fourth column on the detailed code survey form, describes the capability of the code to account for the fluid mechanical properties of the gases as they are mixed and transported through the laser and, in particular, to account for the effects of gas mixing on the production rate and spatial distribution of HF^* (or DF^*), which determine power production.

Nozzle Type and Geometry Modeled

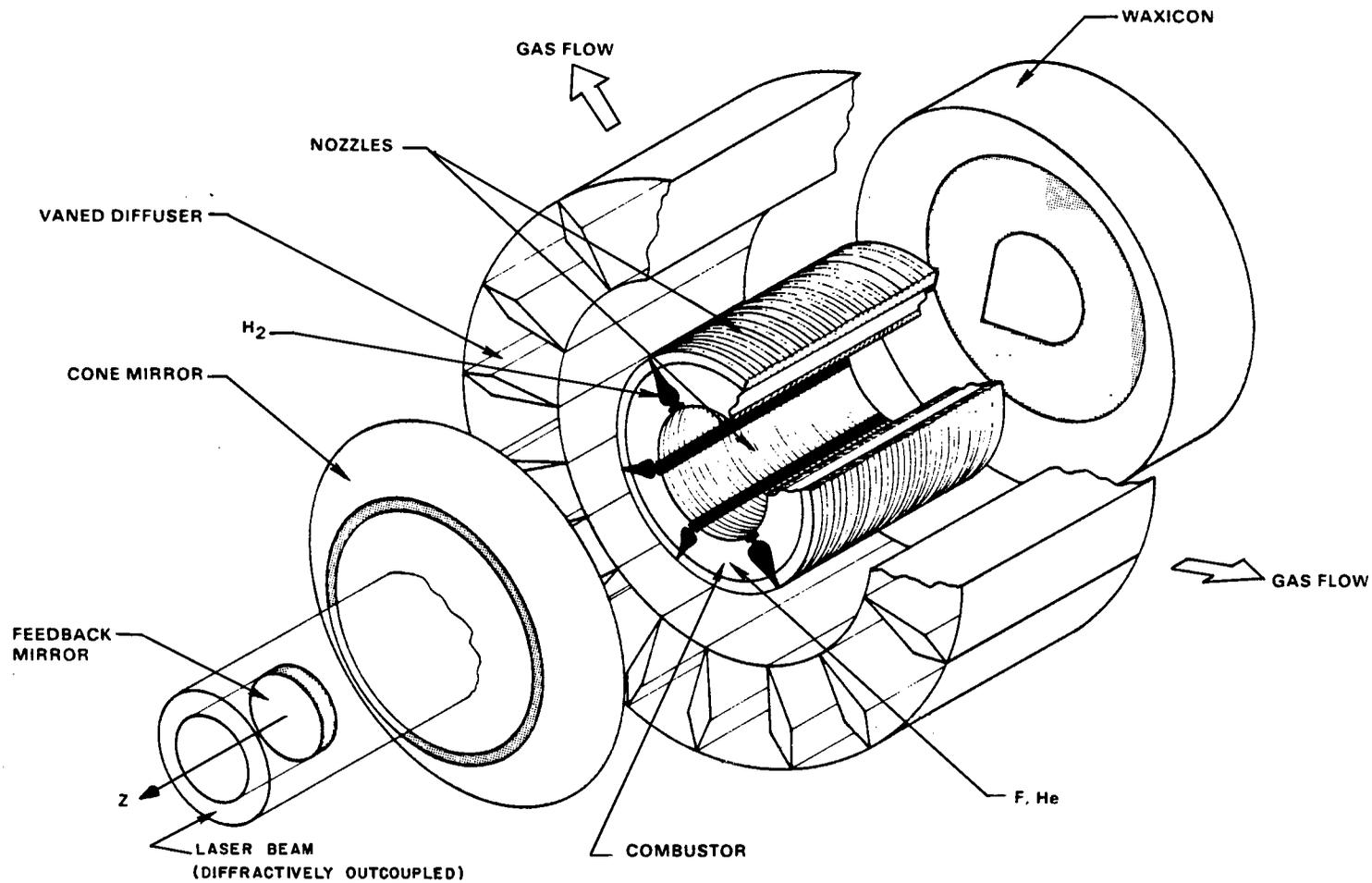
There are basically two distinct overall nozzle bank geometries that define the shape of the gain region: cylindrical and rectangular. The specific nozzle elements themselves usually reflect geometries characteristic of subsonic or supersonic flows. There are many different types of chemical laser nozzles. The cylindrical, radially flowing nozzle banks produce a gain region of annular cross section as seen in Fig. IV-7. The gases flow radially outward and hence the streamlines diverge. Rectangular, linearly flowing nozzle banks (shown in Fig. IV-8) produce a gain region of rectangular cross section with parallel streamlines. In either geometry the flow is transverse to the optical beam path.

Coordinate System

The representation and calculation of fluid flow phenomena are usually simplified when the chosen coordinate system reflects the flow field geometry. It is often important to be aware of which coordinate system is used in a given code, especially when that code is to be combined with another for extended calculations or when a code is being considered as a candidate for analyzing a problem of given geometry where the run time, cost, and/or accuracy should be compromised if the coordinate system and problem geometry were not the same.

Fluid Flow Grid Dimension

This section requests specification of the spatial dimensionality of the numerical fluid dynamics grid. The ability to accurately represent actual physical phenomena increases (as do the run time and cost) as fluid grid dimensionality is increased from one to say, three dimensions. Certain phenomena may actually require four dimensions, three spatial dimensions and time, in order to be modeled satisfactorily. Other phenomena may be adequately modeled by only a single spatial variable in a time-independent calculation. There may be no advantage at all in using a code with higher dimension capability than is required for a given analysis, although there are usually significant cost, run time, and job turnaround penalties.



WIGGINS, MANSELL, ULRICH, AND WALSH

Fig. IV-7 — Hypothetical combustion-driven CW HF chemical laser employing a cylindrical, radially flowing nozzle bank and a HSURIA resonator producing an annular gain region

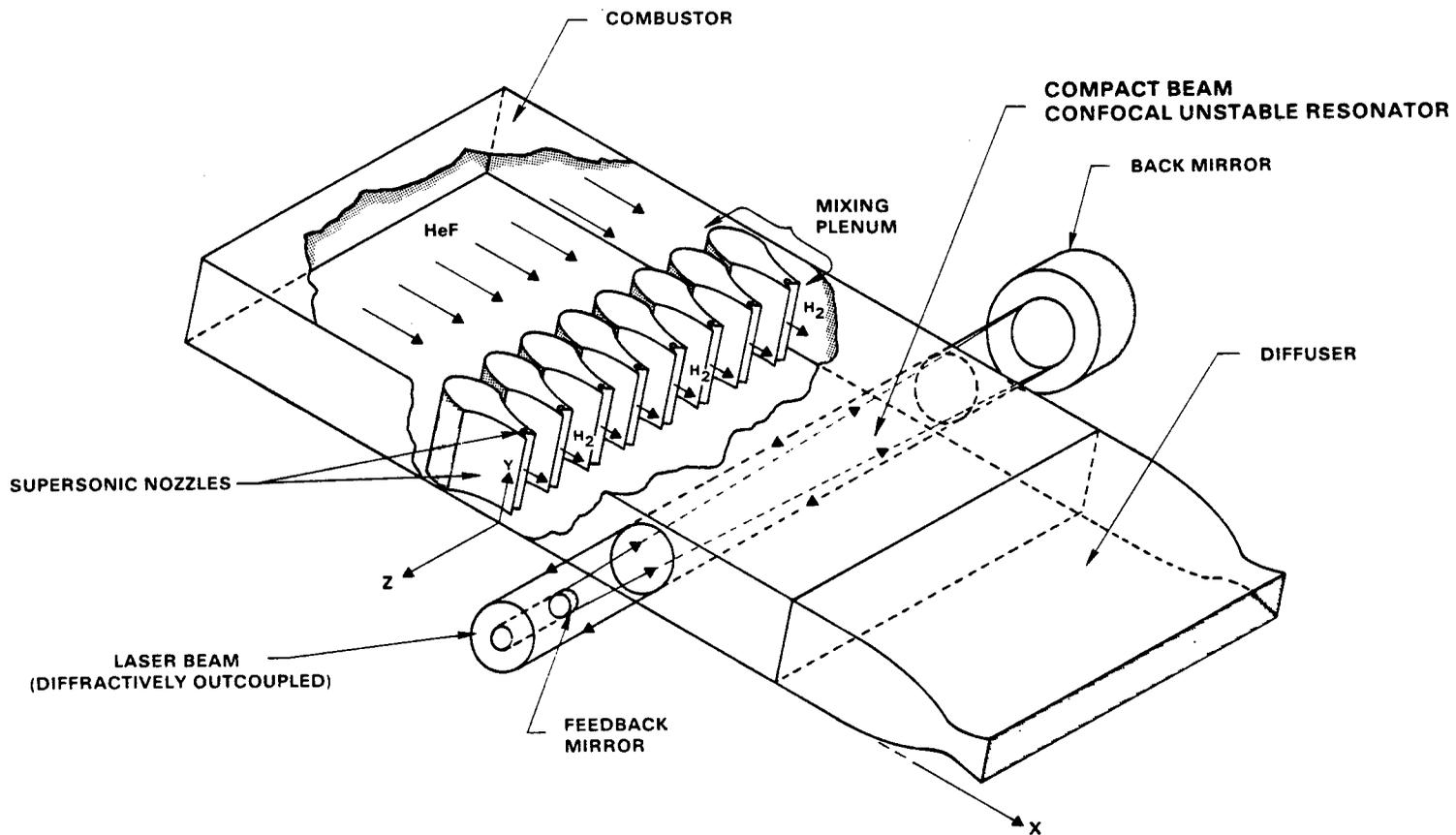


Fig. IV-8 — Hypothetical combustion-driven CW HF chemical laser employing a rectangular, linearly flowing nozzle bank and a positive-branch, compact-beam, confocal unstable resonator

Equally important (but ignored in the survey) in assessing the suitability of a code for a given problem is the actual number of grid points per grid dimension allowed, which determines the maximum sizes of the arrays that can be handled by the computer, and which for a given set of geometrical dimensions determines the maximum achievable resolution.

Flow Field Modeled

Typically the supersonic HF/DF mixing laser must solve a number of gasdynamical problems because the type of mixing influences the mixing rate that affects the lasing process. The mixing rate depends on whether the mixing in the laser cavity is laminar, transitional, or turbulent. Since this is a question that has not been fully resolved, the capability of a code for modeling a variety of flow field conditions is an important measure of its usefulness in certain types of performance analyses.

Basic Modeling Approach

When F and (H_2 or D_2) are mixed in a flowing system, the chemical reaction producing HF^* (or DF^*) begins as soon as the reactants come into contact. As a result the overall rate and spatial distribution of HF^* (or DF^*) produced by such a reaction is governed by both the chemical reaction rate and by the rate of mixing. Attempts to model the influence of both rates on power production and distribution in the cavity lead first to an investigation of two limiting cases, the so-called premixed and mixing- or diffusion-rate dominated cases.

In the premixed approach the rate of mixing or diffusion of F and H_2 is considered to be very fast compared to the reaction rate, and therefore the production of HF^* is limited by the chemical reaction rate. In this case gases are allowed to mix before the chemical reaction starts, hence the production of HF^* (and laser gain) occurs downstream from the mixing. Thus, in this limiting case the diffusion equations that describe the mixing process are ignored. This approach also leads to a considerable simplification in modeling.

In the mixing-rate-dominated approach, the rate of mixing (or diffusion) is considered to be slow in comparison to the chemical reaction rate, and therefore power production is governed by the mixing process.

As might be expected, neither limiting case is considered sufficiently accurate for modeling the coupling of finite diffusion and chemical reaction rates necessary for adequately describing HF production in CW HF lasers. As a result, other approaches have been developed that attempt a more realistic modeling approach, i.e., one that is intermediate between the limiting cases. For example, there is the so-called flame sheet solution approach. In this approach the mixing process is incorporated into the premixed solution through the use of a flame sheet diffusion profile [12]. Such approaches are referred to as scheduled mixing.

There are many approaches to modeling chemical lasers [12,14]. Generally they can be divided into two overall categories—those that are basically numerical and those that are analytical. Some of these are loosely grouped by category below in terms of (generally speaking) decreasing rigor, scope, and complexity:

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Detailed Numerical Approaches

There are three main detailed numerical approaches, which are given here, with appropriate references.

- Rigorous attempts at mixing solutions (possibly with kinetic and radiative processes) included work by the following researchers:

A. W. Ratliff, J. Thoenes, and S. D. Smith, "Method of Characteristics Laser and Mixing Program Theory and User's Guide," vol. IV, Technical Report RK-CR-73-2, Lockheed Missiles and Space Co., Huntsville, Ala., 1973.

B. R. Bronfin, et al., "Development of Comprehensive Laser Computer Models," United Aircraft Research Laboratories Report K911252, Nov. 1971.

B. R. Bronfin, et al., "Development of Chemical Laser Computer Models," Air Force Weapons Laboratory Technical Report AFWL-TR-73-48, Kirtland AFB, July 1973.

"ALFA Code," Air Force Weapons Laboratory Technical Report AFWL-TR-78-19, Kirtland AFB, Feb. 1979. An upgrade of the LAMP code incorporating turbulent nozzle flows, cylindrical laser configurations, pressure-unbalanced cavity flows, effects of rotational nonequilibrium, and multiline lasing for analysis of CW chemical lasers.

"APACHE Code," Los Alamos Scientific Laboratory Report LA-7427, Jan. 1979. Time-dependent finite difference code for modeling a multicomponent chemically reactive fluid flow interacting with an intense radiation field.

D. B. Rensch and A. N. Chester, "Chemical Laser Mode Control Program," Final Technical Report, Contract DAAH01-70-C-1082, Hughes Research Laboratories, Malibu, Calif., 1971.

W. S. King and H. Mirels, "Numerical Study of a Diffusion Type Chemical Laser," *Amer. Inst. Aeronaut. Astronaut. J.* 10, 1647 (Dec. 1972).

- Flame-sheet solutions incorporating mixing processes into premixed solutions through use of flame-sheet diffusion profile include those reported in "A Simplified Model of CW Diffusion-Type Chemical Laser," by H. Mirels, R. Hofland, and W. S. King, *Amer. Inst. Aeronaut. Astronaut. J.* 11, 156 (1973).

- Premixed solutions (which ignore the diffusion equations which describe the mixing process) include the works of Emanuel, et al., and Meinzer, et al.:

G. Emanuel, W. D. Adams, and E. B. Turner, "RESALE-1: A Chemical Laser Computer Program," Aerospace Corporation Report TR-0172(2776)-1, El Segundo, Calif., 1972.

R. A. Meinzer, et al., "CW Combustion Mixing Chemical Laser: HF, DF," *Proceedings of the 6th International Quantum Electronics Conference*, Tokyo, Japan, Sept. 1970.

Approximate Analytical Approaches

- Variable gain-length mixing model:

J. E. Broadwell, "Effect of Mixing Rate on HF Chemical Laser Performance," *Appl. Opt.* 13, 962 (1974).

- Flame-sheet mixing scheme utilizing premixed solutions;

R. Hofland and H. Mirels, "Flame-Sheet Analysis of CW Diffusion-Type Chemical Lasers, I. Uncoupled Radiation," *Amer. Inst. Aeronaut. Astronaut. J.* 10, 420 (Apr. 1972).

H. Mirels and R. Hofland, "Flame-Sheet Analysis of CW Diffusion-Type Chemical Lasers, II. Coupled Radiation," *Amer. Inst. Aeronaut. Astronaut. J.* 10, 1271 (Oct. 1972).

H. Mirels, "Interaction Between Unstable Optical Resonator and CW Chemical Laser," *Amer. Inst. Aeronaut. Astronaut. J.* 13, 785 (June 1975).

J. M. Herbelin, "Continuous-Wave (F + H₂) Chemical Lasers: A Temperature-Dependent Analytical Diffusion Model," *Appl. Opt.* 15, 223 (Jan. 1976).

- Premixed solutions (which ignore diffusion):

G. Emanuel, "Analytical Model for a Continuous Chemical Laser," *J. Quant. Spectrosc. Radiat. Transfer* 11, 1481 (1971).

G. Emanuel and J. S. Whittier, "Closed-Form Solution to Rate Equations for an F + H₂ Laser Oscillator," *Appl. Opt.* 11, 2047 (1972).

Thermal Driver Modeled

The thermal driver refers to the process of generating the oxidizer, atomic fluorine, usually from F₂, SF₆, or NF₃. There are a number of different types of thermal drivers including arc heaters, shock tubes, resistance heaters, combustors, and chemical reactions. Whatever the method, it is necessary to produce a known, large concentration of F atoms with the thermal driver and then mix F with H₂ or D₂ in a fast expansion through a supersonic mixing nozzle. Figure IV-9 shows the role of the thermal driver in relation to mixing, population inversion, and pressure recovery. In the figure a combustor illustrates the production of atomic fluorine by burning nitrogen trifluoride in ethylene. It is important to accurately control the desired degree of fluorine dissociation, mass flow, and temperature of the F atoms since these quantities directly affect the laser operating point (defined by the combustor and nozzle diluent ratios β_c/β_n and mass flux \dot{m}/A), and hence the power production.

F-Atom Dissociation From:

Specifies the compound (F₂, SF₆, NF₃, etc.) from which atomic fluorine is obtained as modeled by the code. (See *Thermal Driver Modeled*.)

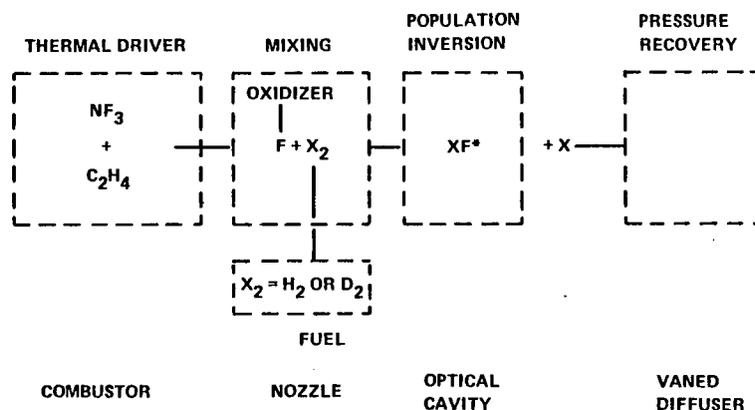


Fig. IV-9 — A CW mixing Hf/DF chemical laser illustrating use of a combustor as thermal driver

F-Atom Concentration Determined From Model?:

This question is posed to help determine the extent of computer model capability.

Diluents Modeled

Diluents (He, N₂, etc.) added to the mixing plenum play a very important role in establishing the laser operating point and hence the amount of power produced under a given set of conditions. It is of interest in measuring the capability of a computer model to determine the types of diluents and the extent to which their effect on laser performance is modeled. Often one may want to conduct tradeoff studies with several different diluents and/or diluent ratios as functions of other device parameters to optimize power output.

Models Effects on Mixing Rate Due To:

In the supersonic HF mixing laser there are many gasdynamical phenomena that will affect the mixing rate (and hence the detailed gain profile and power production). Thick laminar boundary layers of F and He can form along a nozzle wall and have a tendency to separate, giving rise to shock waves that can intersect in the flow outside of the nozzle. In assessing code capabilities it is important to determine whether such models are included.

Models' Effects on Optical Modes Due To:

Effects producing gain medium inhomogeneity arising from pressure, density, or refractive index variations can couple to and alter optical modes. Sonic or ultrasonic waves traveling in the active medium may cause these mode/media interactions.

REFERENCES

1. J. W. Goodman, *Introduction to Fourier Optics*, McGraw-Hill, New York, 1968, p. 40.
2. P. Horowitz, "Asymptotic Theory of Unstable Resonator Modes," *J. Opt. Soc. Amer.* **63**, 1528-1542 (1973).
3. R. R. Butts and P. V. Avizonis, "Asymptotic Analysis of Unstable Resonators With Circular Mirrors," *J. Opt. Soc. Amer.* **68**, 1071-1076 (1978).
4. J. Ellinwood and F. Meyer, Aerospace Corporation, private communication, 1980.
5. For example, see E. A. Sziklas and A. E. Siegman, *Appl. Optic.* **14**, 1874 (Aug. 1975).
6. A. E. Siegman, "Quasi-Fast Hankel Transform," *Optics Lett.* **1**, 13 (July 1977).
7. W. D. Murphy and M. L. Bernabe, "Numerical Procedures for Solving Nonsymmetric Eigenvalue Problems Associated with Optical Resonators," *Appl. Opt.* **17**, 2359 (Aug. 1978).
8. A. G. Fox and T. Li, "Resonant Modes in a Maser Interferometer," *Bell Syst. Tech. J.* **40**, 453 (1961).
9. W. P. Latham, Jr., and G. C. Dente, "Matrix Methods for Bare Resonator Eigenvalue Analysis," *Appl. Opt.* **19**, 1618 (1980).
10. A. E. Siegman and H. Y. Miller, "Unstable Optical Resonator Loss Calculations Using the Prony Method," *Appl. Opt.* **9**, 2729 (Dec. 1970). Also, W. D. Murphy and M. L. Bernabe, "Numerical Procedures for Solving Nonsymmetric Eigenvalue Problems Associated with Optical Resonators," *Appl. Opt.* **17**, 2359 (1978).
11. A. E. Siegman, *An Introduction to Lasers and Masers*, McGraw-Hill, New York, 1971, Chapter 8. See also, A. E. Siegman, "A Canonical Formulation for Analyzing Multi-element Unstable Resonators," *IEEE Trans. QE-12*, 35 (1976).
12. R. W. F. Gross and J. F. Bott, eds., *Handbook of Chemical Lasers*, John Wiley & Sons, New York, 1976.
 - a. p. 398
 - b. p. 488
13. E. E. Whiting, *J. Quantum Spectrosc. Radiat. Transfer* **8**, 1379 (1968).
14. J. M. Herbelin, *Appl. Opt.* **15**, 223 (Jan. 1976).

BIBLIOGRAPHY

The following references are intended for users of this document who may not be familiar with one or more areas addressed by the survey or who may want a more detailed introduction to the subject. This list is not intended to be exhaustive; it does not contain references to numerous important papers.

R. W. F. Gross and J. F. Bott, eds., *Handbook of Chemical Lasers*, Wiley, New York, 1976. This represents probably the best comprehensive review of chemical lasers. Individual chapters have been written by leaders of their respective areas of technology.

K. Smith and R. M. Thomson, *Computer Modeling of Gas Lasers*, Plenum Press, New York, 1978.

Although this text addresses primarily CO₂ laser chemistry, it is a good example of the breadth and level of detail achievable in modeling gas lasers.

A. E. Siegman, *An Introduction to Lasers and Masers*, McGraw-Hill, New York, 1971.

This introductory text covers the fundamental physics of lasers. Chapter 8 gives a good introduction to the theory of stable resonators.

J. W. Goodman, *Introduction to Fourier Optics*, McGraw-Hill, New York, 1968.

Material presented here is fundamental to modern diffraction and propagation algorithms.

J. D. Anderson, *Gasdynamic Lasers: An Introduction*, Academic Press, New York, 1976.

Comprehensive discussion of CO₂ gasdynamic lasers technology, developed from first principles.

S. Jacobs, M. Sargent III, and M. O. Scully, eds., *High Energy Lasers and Their Applications*, Addison-Wesley, Reading, Mass., 1974.

Chapter 5 by P. V. Avizonis reviews CO₂ electrical, CO₂ gasdynamic, and HF chemical lasers.

Appendix A
CHEMICAL LASER CODE CAPABILITY SURVEY FORM

1.0 OPTICAL CAVITY CODE

1.1 GENERAL (Please complete if different from 2.1 and 3.1)

CODE NAME: _____

PROGRAM NAME (if applicable): _____

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: _____

ASSESSMENT OF CAPABILITIES: _____

ASSESSMENT OF LIMITATIONS: _____

ORIGINATOR/KEY CONTACT:

Name: _____

Organization: _____

Address: _____

Phone: _____

AVAILABLE DOCUMENTATION:

Theory Manuals: _____

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User Manuals: _____

Listings: _____

Other Relevant Publications: _____

STATUS:

Operational Currently?: _____

Under Modification?: _____

Purpose(s): _____

Ownership?: _____

Proprietary?: _____

MACHINE/OPERATING SYSTEM (on which installed): _____

TRANSPORTABLE?: _____

Machine Dependent Restrictions: _____

SELF-CONTAINED?:

Other Codes Required (name, purpose): _____

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec, CDC 7600)
Small Job:	_____	_____
Typical Job:	_____	_____
Large Job:	_____	_____
Approximate Number of FORTRAN Lines: _____		

1.2 CODE STRUCTURE

BASIC TYPE (✓):

Physical Optics: _____

Geometrical: _____

FIELD (POLARIZATION) REPRESENTATION (✓):

Scalar: _____

Vector: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.)

Compact Region: _____

Annular Region: _____

TRANSVERSE GRID DIMENSIONALITY (✓):

	1-D	2-D
Compact Region:		
Annular Region:		

FIELD SYMMETRY RESTRICTIONS?: _____

MIRROR SHAPE(S) ALLOWED (✓):

Square: _____

Rectangular: _____

Circular: _____

Elliptical: _____

Strip: _____

Arbitrary: _____

CONFIGURATION FLEXIBILITY (✓):

Fixed, Single Resonator Geometry: _____

Fixed, Multiple Resonator Geometries: _____

Modular, Multiple Resonator Geometries: _____

Other (describe): _____

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PROPAGATION TECHNIQUE (✓ all that apply):

	COMPACT	ANNULAR
Fresnel Integral Algorithms:		
With Kernel Averaging:		
Gaussian Quadrature:		
Midpoint Rule:		
Romberg:		
Simpson:		
Trapezoidal:		
Fast Fourier Transform (FFT):		
Fast Hankel Transform (FHT):		
Gardener-Fresnel-Kirchhoff (GFK):		
Other (specify): _____		
Finite Difference Algorithms		
Method (specify): _____		

CONVERGENCE (✓):

Technique:

 Power Comparison: _____

 Field Comparison: _____

 Other (specify): _____

Acceleration Algorithms Used?: _____

 Technique: _____

MULTIPLE EIGENVALUE/EIGENVECTOR EXTRACTOR ALGORITHMS (✓):

 Prony: _____

 Other (specify): _____

1.3 RESONATOR MODELING FEATURES

GENERAL CAPABILITIES:

Stability (✓):

 Stable Resonators: _____

 Unstable Resonators: _____

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Type (✓)

Standing Wave: _____

Traveling Wave (Ring): _____

Reverse Traveling Wave: _____

Branch (✓):

Positive: _____

Negative: _____

Optical Element Models Included (✓):

Flat Mirrors: _____

Spherical Mirrors: _____

Cylindrical Mirrors: _____

Telescopes: _____

Scraper Mirrors: _____

Axicons	Waxicons	Reflaxicons
Arbitrary:	_____	_____
Linear:	_____	_____
Parabola-Parabola:	_____	_____
With Offset Cones:	_____	_____
Other (specify):	_____	_____

Deformable Mirrors: _____

Spatial Filters: _____

Gratings (specify type): _____

Other Elements (specify): _____

PRINCIPAL RESONATOR GEOMETRIES MODELED(e.g. HSURIA, Compact Unstable Confocal, Unstable P-P Waxicon/Linear Waxicon Negative Branch Ring With Spatial Filter, etc; Please List): _____

GAIN MODELS (✓):

- Bare Cavity Only: _____
- Simple Saturated Gain: _____
- Detailed Model (see 2.0 below): _____

BARE CAVITY FIELD MODIFIER MODELS (✓):

- Mirror Tilt: _____
- Mirror Decentration: _____
- Aberrations/Thermal Distortion
 - Arbitrary: _____
 - Selected (specify): _____
- Reflectivity Loss: _____
- Output Coupler Edges
 - Rolled: _____
 - Serrated: _____
 - Other: _____

LOADED CAVITY FIELD MODIFIER MODELS (✓):

- Refractive Index Variation: _____
- Gas Absorption: _____
- Overlapped Beams (for flux updating): _____
 - Number of overlaps Allowed: _____
- Other (see 2.0, 3.0): _____
- _____
- _____

FAR FIELD MODELS (✓):

- Beam Steering Removal: _____
- Optimal Focal Search: _____
- Beam Quality: _____
- Atmospheric Propagation Effects: _____
- Other: _____
- _____
- _____

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OTHER UNIQUE FEATUES (e.g. Beam/Mode Rotation, Extra-Cavity
Adaptive Optics, Multipath/Parasitic Effect, etc.) _____

2.0 KINETICS

2.1 GENERAL (Please complete if different from 1.1 and 3.1)

CODE NAME: _____

PROGRAM NAME (if applicable): _____

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: _____

ASSESSMENT OF CAPABILITIES: _____

ASSESSMENT OF LIMITATIONS: _____

ORIGINATOR/KEY CONTACT:

Name: _____

Organization: _____

Address: _____

Phone: _____

AVAILABLE DOCUMENTATION:

Theory Manuals: _____

User Manuals: _____

Listings: _____

Other Relevant Publications: _____

STATUS:

Operational Currently?: _____

Under Modification?: _____

Purpose(s): _____

Ownership?: _____

Proprietary?: _____

MACHINE/OPERATING SYSTEM (on which installed): _____

TRANSPORTABLE?: _____

Machine Dependent Restrictions: _____

SELF-CONTAINED?: _____

Other Codes Required (name, purpose): _____

WIGGINS, MANSELL, ULRICH, AND WALSH

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec, CDC 7600)
Small Job:	_____	_____
Typical Job:	_____	_____
Large Job:	_____	_____

Approximate Number of FORTRAN Lines: _____

2.2 CODE STRUCTURE/FEATURES

GAIN REGION (✓):

Compact Region: _____

Annular Region: _____

COORDINATE SYSTEM (Cartesian, cylindrical, etc.)

Compact Region: _____

Annular Region: _____

KINETICS GRID DIMENSIONALITY (✓)

	1-D	2-D	3-D
Compact Region:	_____	_____	_____
Annular Region:	_____	_____	_____

GAIN REGION SYMMETRY RESTRICTIONS:

Gain Vary Along

Optic Axis?: _____

Flow Direction?: _____

KINETICS TYPE MODELED (✓):

Pulsed: _____

CW: _____

CHEMICAL PUMPING REACTIONS MODELED (✓):

	X=F	X=D
Cold Reaction (X+H ₂):	_____	_____
Hot Reaction (H+X ₂):	_____	_____
Chain Reaction (X+H ₂ and H+X ₂):	_____	_____
Other (including non-chemical, specify):	_____	

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ENERGY TRANSFER MODES MODELED (✓): Follows (reference)

V-T:	_____
V-R:	_____
V-V:	_____

Other (Specify): _____

Single Line Model (✓): _____

Multi-Line Model (✓): _____

Assumed Rotational Population Distribution State (✓):

Equilibrium: _____

Non-Equilibrium: _____

Number of Laser Lines Modeled: _____

Source of Rate Coefficients Used in Code: _____

LINE PROFILE MODELS (✓):

Doppler Broadening: _____

Collisional Broadening: _____

Other (specify): _____

2.3 OTHER UNIQUE FEATURES: _____

3.0 GAS DYNAMICS

3.1 GENERAL (Please complete if different from 1.1 and 2.1)

CODE NAME: _____

PROGRAM NAME (if applicable): _____

PRINCIPAL PURPOSE(S)/APPLICATION(S) OF CODE: _____

ASSESSMENT OF CAPABILITIES: _____

ASSESSMENT OF LIMITATIONS: _____

ORIGINATOR/KEY CONTACT:

Name: _____

Organization: _____

Address: _____

Phone: _____

AVAILABLE DOCUMENTATION:

Theory Manuals: _____

User Manuals: _____

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Listings: _____

Other Relevant Publications: _____

STATUS:

Operational Currently?: _____

Under Modification?: _____

Purpose(s): _____

Ownership?: _____

Proprietary?: _____

MACHINE/OPERATING SYSTEM (on which installed): _____

TRANSPORTABLE?: _____

Machine Dependent Restrictions: _____

SELF-CONTAINED?: _____

Other Codes Required (name, purpose): _____

ESTIMATE OF RESOURCES REQUIRED FOR RUNS:

	Core Size (Octal Words)	Execution Time (Sec, CDC 7600)
Small Job:	_____	_____
Typical Job:	_____	_____
Large Job:	_____	_____

Approximate Number of FORTRAN Lines: _____

3.2 CODE STRUCTURE/FEATURES

COORDINATE SYSTEM (Cartesian, cylindrical, etc.): _____

NOZZLE GEOMETRY MODELED (✓) (and nozzle type(s) if known):

Cylindrical-radially flowing: _____

Rectangular-linearly flowing: _____

Other (specify): _____

FLUID GRID DIMENSIONALITY (✓):

1-D: _____

2-D: _____

3-D: _____

FLOW FIELD MODELED (✓):

Laminar: _____

Turbulent: _____

Other: _____

BASIC MODELING APPROACH (✓):

Premixed: _____

Mixing: _____

Other (specify): _____

References for Approach used: _____

THERMAL DRIVER MODELED (✓):

Arc Heater: _____

Combustor: _____

Shock Tube: _____

Resistance Heater: _____

Other (specify): _____

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F-ATOM DISSOCIATION FROM

F₂: _____

SF₆: _____

Other (specify): _____

IS F-ATOM CONCENTRATION DETERMINED BY MODEL?: _____

DILUENT(S) MODELED (list): _____

MODEL EFFECTS ON MIXING RATE DUE TO (✓):

Nozzle Boundary Layers?: _____

Shock Waves?: _____

Pre-Reaction (thermal blockage, etc.)?: _____

Turbulence?: _____

Other (specify): _____

MODEL EFFECTS ON OPTICAL MODES DUE TO (✓):

Index of refraction variation?: _____

Other (specify)?: _____

3.3 OTHER UNIQUE FEATURES: _____

Appendix B
RESEARCHERS AND SURVEY MAILING LIST

POTENTIAL MAILING LIST FOR CODE SURVEY

Novel Resonator Program Contractors

TRW

- | | | | |
|------------------------------|------------------------------|---|---|
| *D. L. Bullock (1), (2), (4) | { ALL HEL codes and models } | { Gain model, ring resonator, optical rotator } | { IMOPA, BLAZER, MRO, CROQ, BRIA, URINLA2 } |
| K. T. Yano (1), (2), (4) | | | IMOPA, ring resonator, optical rotator, BRIA |
| J. B. Kaelberer (2) | | | IMOPA |
| D. Dee (2) | | | BLAZER, MRO |
| *H. W. Behrens (2) | | | BLAZER, MRO |
| C. L. Merkle (2) | } | | Monte Carlo laser flow, ALFA, LAMBDA nozzle, HYWND. Modeled chemical laser (CL) flow-thru nozzles; modeled recirculating flow regions and fuel/oxidizer stream merging. |
| T. Sugimura (2) | | | |
| R. D. Hughes (2) | | | |
| R. S. Lipkis (2) | | | Gain modeling, saturation effects, hole burning, mode pulling. |
| H. M. Bobitch (2) | } | | Ring resonator with optical rotator (BRIA). Used double waxicon setup and evaluated mode control by measuring beam quality (BQ). |
| J. Munch (2) | | | |
| A. Murthy (2) | | | |
| R. K. DeLong (2) | | | MIRACL performance |
| P. M. Livingston (2), (4) | | | Doppler shift produced by HYWND |
| S. Jarvis (3) | | | |
| J. Miller (4) | | | |
| O. Minnick (4) | | | |
| K. Vogelsang (5) | | | |

- (1) Attendees, Novel Resonator Mid-Term Review, December 5 and 6, 1978, NRL.
- (2) Attendees/Presenters, 6th Tri-Service Chemical Laser Symposium, August 28-30, 1979, AFWL.

*Survey recipient

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- (3) Attendees, ICAO/IFLA Review, April 10, 1979, AFWL.
 (4) Distribution List for Novel Resonators for High Power Chemical Lasers Program.
 (5) ADABECS Technical Interchange Meeting, September 12-14, 1979.

Rocketdyne

- | | | |
|---|------------------------|---|
| *R. Brandewie (1), (2), (4), (5) | (All codes and models) | Physical optics codes; geometrical optics code (GOPWA) |
| J. B. Shellan (1), (4), (5) | | HSURIA performance analysis |
| G. A. Tyler (1), (5) | | Ring resonators with spatial filters |
| T. Waite (1), (2), (3), (4) }
*D. Holmes (2), (3) }
P. Briggs (2) } | | Mode-media interactions in HSURIA with flowing gain model |
| G. E. Mevers (5) | (All codes and models) | Resonator configurations, alignment |
| F. D. Feiock (3), (5) | (All codes and models) | Resonator configurations, alignment |
| T. Marks (4) | | |
| V. L. Gamiz (5) | | Compensatory misalignment in ring resonators |

*Pratt & Whitney/United Technologies Research Center***Pratt & Whitney**

- | | | |
|--|--|---|
| P. E. Fileger (2) }
W. B. Watkins (2) } | | Anchored CLOQ3D kinetics model to CL-XI nozzle data as part of IFLA annular ring study. |
| *R. Quinnell (2), (3) | | Used ALFA tilt sensitivity, IFLA rings, injection-locked annular resonator |
| R. Schmidtke (4) | | |
| R. Freeman (4) | | |
| *J. Campbell (3), (4) | | |
| J. M. Bruckler (3) | | |
| G. MacClafferty (4) | | |

*Survey recipient

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UTRC

R. L. Hall (2)
H. R. Garcia (2), (3), (4)

P. Slaymaker (2)
R. Tansey (2)
K. E. Oughstun (2), (3)

A. W. Angelbeck (2)
G. E. Palma

J. J. Hinchey (2)
R. H. Hobbs (2)

J. M. Spinhirne (3)

R. Freiberg (3)

Perkin-Elmer

*P. B. Mumola (1), (2), (4)
D. Stoler (1), (2)

P. W. Milonni (2)

F. Way (4)

Non-NOVEL Resonator Program Contractors

Bell Aerospace

W. Brandkamp (1), (4)

T. F. Buddenhagen (1), (3)

*S. W. Zelazny (2)
W. A. Chambers (2), (3)
M. Subbiah (2)
L. Lang (2)

CLOQ3D studies using ALFA code of mixing regions; rotational nonequilibrium; wave optics. Garcia only: Injection-locked annular resonator.

Tilt misalignment sensitivity studies on unstable negative-branch ring resonators (IFLA). Forward/reverse mode sensitivity studies.

Analysis and computer modeling of injection-locked annular resonator. Also compact rings. Geometries and wave optics.

Rotational relaxation and linewidths for DF compared to HF. Pressure broadening measurement.

Mode selectivity in annular resonators, radial strut effects on mode control. HSURIA comparison.

Anomalous dispersion in HF/DF. Broadening.

Extended BLAZE to STARE, a rotational equilibrium code modeling upstream-downstream coupling across optical axis. Compares with CL-XI nozzle data.

*Survey recipient

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W. Solomon (4)

W. L. Rushmore (2)

Efficient nonrotational equilibrium model

Aerospace Corporation

*R. A. Chodzko (1), (2), (4) }

H. Mirels (1), (4)

E. B. Turner (2)

S. B. Mason (2)

Experimental HSURIA with linear waxicon and rear flat. Tip and outer cone obscuration studies, strut obscuration studies, polarization studies. HSURIA w/rear cone comparisons.

R. L. Varwig (2) }

P. L. Smith (2)

C. P. Wang (2), (4)

Phase detectors based on optical heterodyning with acousto-optic modulator for control of adaptive optics. Anomalous dispersion studies.

C. G. Coffey (2) }

R. W. F. Gross (2)

Multiline HF tuning and phase control. Anomalous dispersion in HF.

J. F. Bott (2) }

R. F. Heidner (2)

Upper vibrational level deactivation in HF/DF. Absolute rate coefficient for $F + H_2$ and $F + D_2$. Oxygen-iodine laser; upper vibrational level deactivation in a HF/DF.

R. L. Wilkins (2) }

M. A. Kwok

G. I. Segal (2)

E. F. Cross (2)

R. H. Ueunten (2)

Temperature dependence of vibrational relaxation from upper vibrational levels of HF and DF. V-R and V-V studies.

Experimental study of significance of R-T equilibrium in presence of V-R collisional transfer.

*N. Cohen

Temperature dependence and rate coefficients for $F + H_2$, $F + D_2$, $H + F_2$, and $D + F_2$ pumping reactions.

*W. Warren (4)

W. J. Schafer Associates

*W. Evers (1), (2), (4)

G. W. Zeiders (1), (2), (4)

E. Gerry (4)

R. Schaefer (2)

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Science Applications, Inc.

*F. Horrigan (Boston) (1), (4)

J. Long (Atlanta) (1)

*R. Wade (Atlanta) (1), (3), (4)

S. S. Howie (Atlanta) (2)
K. E. Patterson (Atlanta) (2)

}

Modeled gasdynamics of high area relief nozzles.

H. Ford (Atlanta) (4)

*R. Hodder (Stuart) (4)

MIT Lincoln Laboratory

*A. J. Morency (1), (2)
R. Osgood (1), (2)
*C. A. Primmerman (1), (2)
R. Rediker (4)
L. Marquet (4)

}

Modeled propagation of arbitrarily polarized electric fields via physical optics code.

*J. Herrman

Air Force Weapons Laboratory

A. Paxton (1), (2), (3), (4)

HSURIA, rings, three-level cascading HF/DF media.

*W. Plummer (1), (3), (5)

All resonators and codes.

G. C. Dente (2)

Polarization effects in HSURIA with real cone.

R. Butts (3), (4), (5)

Atmospheric effects; thermal blooming.

T. Salvi (2), (4)

Physical optics codes, kinetics, and fluid dynamics.

L. D. Buelow (3)

*B. Deuto (3)

P. Latham (3)

Modular physical optics codes (MOC3).

R. F. Shea (2), (3)

Oxygen-iodine kinetics.

R. Bower (4)

*Survey recipient

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- | | | |
|--|---|---|
| <p>W. H. Lowrey (2)
H. D. McIntire (2)
W. H. Swantner (2)</p> | } | <p>Interferometric testing of waxicons and re-flaxicons and aberration balancing using two geometric ray-tracing codes.</p> |
| <p>*N. L. Rapagnani</p> <p><i>The BDM Corporation</i></p> | | |
| <p>*T. R. Ferguson (2), (3)</p> <p>G. T. Worth (2)</p> | | <p>Physical optics codes URINLA2, GURDM, MOC3, PROPAGATORS.</p> <p>Physical optics codes GURDM, MOC3, intra/extra cavity adaptive optics.</p> |
| <p>*D. N. Mansell (2), (3), (4)</p> <p>C. M. Wiggins (2), (5)</p> <p><i>Hughes Aircraft Company</i></p> | | <p>Geometric codes POLYPAGOS, IPAGOS, MCPAGOS, IMOPA.</p> <p>Physical optics codes HSURIA with rear flat, positive- and negative-branch ring resonator, spatial filtering, self-imaging (GENRING, SARAD).</p> |
| <p>M. Greenfeld (3)</p> <p>*D. Fink (3), (4)</p> <p>*B. J. Skehan (4)</p> <p>J. Fitts (4)</p> <p>W. B. King</p> <p>R. Cubalchini</p> | | <p>Optics.</p> <p>LPTS code.</p> <p>Beam Control Systems (LPTS code).</p> <p>Beam Control Systems (BREUX code).</p> |
| <p>*I. Abrahmowitz</p> <p><i>Ford Aerospace</i></p> | | |
| <p>*V. F. Pizzurro (3), (5)</p> <p>P. Valliones (4)</p> <p>*R. Buchheim (5)</p> <p><i>GE Company/RES D</i></p> | | |
| <p>*J. B. Gilstein (4)</p> | | |
| <p>*Survey recipient</p> | | |

WIGGINS, MANSELL, ULRICH, AND WALSH

C. S. Draper Lab

J. Valge (4)

*C. Whitney (4)

AVCO Everett Research Labs

*J. Daugherty (4)

Johns Hopkins Applied Physics Laboratories

*R. Gorozdos (4)

Pacific Sierra Research

*A. Shapiro (4)

ITEK Corp.

*J. R. Vyce (4)

Lawrence Livermore Lab

*J. Emmett (4)

Lockheed Missile and Space Company

*R. Stewart (4)

Los Alamos Scientific Laboratory

*C. Fenstermacher (4)

J. Ramshaw (4)

McDonnell Douglas Astronautics

W. Gaubatz (4)

Director, Naval Research Laboratory

P. Ulrich (1), (4)

W. Watt (4)

S. C. Lin (1), (4)

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Polytechnic Institute of New York

S. H. Cho (2) }
L. B. Felsen (2) } Circular mirror resonators with axicons modeled using ray optics; cone tip and edge diffraction studied.

University of Illinois

*L. H. Sentman (2) }
P. Bradbury (2) } Efficient rotational nonequilibrium model. V-R and V-V relaxation in HF and DF.

Sandia Laboratories

*J. B. Moreno (2) HF chemical laser models for laser fusion.

Michigan State University

*R. L. Kerber (2) }
R. C. Brown (2) } Evaluation of rotational nonequilibrium models for R-R, and V-R transitions. Computer simulation.
K. Emery (2) }
D. H. Stone (2) Developed statistical model to correlate relative rate coefficients in HF/DF pumping.

R&D Associates

J. M. Green (2) }
*R. D. Melville } Gas breakdown in CL resonators (HSURIA) with rear cone. Gas breakdown on line focus of axicons in presence of dirty helium.
T. K. Tio (2) }

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Appendix C
BELL AEROSPACE CODES RESPONSE

This appendix contains two tables summarizing the analysis capability related to the Bell Aerospace Textron laser and reports detailed information on 28 codes. This information is provided as submitted by Bell Aerospace Corp.

WIGGINS, MANSELL, ULRICH, AND WALSH

Table C-1 — Laser Design Related Computer Analysis Capabilities at Bell

KEY FEATURES, METHODOLOGY, STATUS	CODE																	
	1. BLAZE I (BELL)	2. BLAZE II (BELL)	3. BLAZE III (BELL)	4. BLAZE IV (BELL)	5. COMOC - 2DNS (BELL)	6. COMOC - 3DPNS (BELL)	7. COMOC - TA (BELL)	8. COMOC SA (BELL)	9. CNCDE (BELL)	10. DIFF-2 (BELL)	11. DIFF-3 (BELL)	12. NORO-I (BELL)	13. NORO-II (BELL)	14. ACCOS (SCI)	15. MRO-2 (TRW)	16. BLAZE V (BELL)	17. BLAZE VI (BELL)	18. R/E OPTIC (BELL)
1. ANALYZE COMBUSTOR	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
2. ANALYZE NOZZLE	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
3. ANALYZE OPTICAL CAVITY	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
4. ANALYZE OPTICS	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
5. ANALYZE DIFFUSER/ELECTORS	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
6. OPERATIONAL	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
7. IN DEVELOPMENT																		
8. MODIFYING FOR IBM 360																		
9. THREE DIMENSIONAL																		
10. TWO DIMENSIONAL																		
11. ONE DIMENSIONAL	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
12. FLUID ANALYSIS	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
13. STRUCTURAL ANALYSIS																		
14. THERMAL ANALYSIS																		
15. COMPUTES LASER POWER																		
16. GENERAL CHEMISTRY	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
17. PREMIXED	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
18. SCHEDULED MIXING	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
19. LAMINAR MIXING	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
20. TURBULENT MIXING	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
21. TURB. CHEM. INTERACTION	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
22. 20 N. EOS.																		
23. BOUNDARY LAYER EOS.																		
24. PARABOLIC N.S. EOS.																		
25. FREE SHEAR LAYER ANALYSIS																		
26. METHOD OF CHARACTERISTICS																		
27. CONTROL VOLUME ANALYSIS																		
28. FINITE ELEMENT																		
29. FINITE DIFFERENCE																		
30. EXPLICIT INTEGRATION																		
31. IMPLICIT INTEGRATION	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
32. EXPLICIT/IMPLICIT																		
33. FFT																		
34. ROTATIONAL NON EQUIL.																		
35. SIMPLIFIED CHEMISTRY																		
36. SIMPLIFIED FLUID MECH.																		
37. FAB-PEROT CAVITY																		
38. UNSTABLE RESONATOR																		
39. COMPUTES ZERO POWER GAIN	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
40. COMPUTES MEDIA QUALITY																		
41. COMPUTES SPECTRAL DIST																		

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Table C-2 — Bell Aerospace Codes

RESONATOR ANALYSIS CAPABILITY

FEATURES	CODES	GOAD (1)	ARM-D (2)	ARM-G (3)
(1) OPERATIONAL ON IBM 370		X		X
(2) OPERATIONAL ON CYBER 176			□	
(3) GEOMETRIC ANALYSIS		X		X
(4) DIFFRACTIVE ANALYSIS			X	
(5) r-X MODELED			X	
(6) r- θ -Z MODELED		X		X
(7) LOADED CAVITY			X	
(8) DIFFRACTIVELY COMPUTES FFBO			□	X
(9) MODELS HSURIA RESONATOR			X	X
(a) INTERNAL FOCUS WAXICON		X	X	X
(b) CONFOCAL REAR CONE			X	□
(c) VTT ABERRATIONS		X		
(d) REFLAXICON			X	X
(10) MODELS RING RESONATOR			X	X
(11) MODELS STRUT EFFECTS				
(12) MODELS MISALIGNMENT AND TILT EFFECTS				X
(13) MODELS MIRROR THERMAL DIST.				
(14) MODELS MEDIA EFFECTS				

- NOTES: (1) THE ARM-D CODE MODELS r- θ -Z IN COMPACTED LEG ONLY, SRM-D IS USED IN ANNULAR LEG.
(2) *DENOTES HAC SUPPLIED CODE CAPABILITY.
(3) CODE (3) PROVIDES SAME CAPABILITY, HOWEVER, ARM-G ALLOWS FOR INTERACTIVE MODE OPERATION DUE TO REDUCED CORE SIZE REQUIREMENT.
(4) □ DENOTES FEATURE CURRENTLY BEING INCORPORATED,
* DENOTES FEATURE NOT YET EXERCISED BUT WITH THE CAPABILITY FOR ANALYSIS CURRENTLY EXISTING.