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PHOTOGRAPHY FROM THE V-2 ROCKET AT ALTITUDES RANGING UP TO 160 KILOMETERS

by

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ILLUSTRATIONS

Figure		Page
1.	The V-2 rocket No. 21 on its launching platform, showing one of the cameras mounted in the midsection.	3
2.	A photograph taken 7 seconds after takeoff at an altitude of 225 meters (750 feet).	5
3.	A photograph taken 43 seconds after takeoff at an altitude of 12 kilometers (7 miles).	7
4.	A photograph taken 63 seconds after takeoff at an altitude of 34 kilometers (21 miles).	9
5.	A photograph taken 81 seconds after takeoff at an altitude of 60 kilometers (37 miles).	11
6.	A photograph taken 100 seconds after takeoff at an altitude of 85 kilometers (53 miles).	13
7.	A photograph taken 136 seconds after takeoff at an altitude of 123 kilometers (76 miles).	15
8.	A photograph taken 155 seconds after takeoff at an altitude of 137 kilometers (85 miles).	17
9.	A photograph taken 190 seconds after takeoff at an altitude of 156 kilometers (97 miles).	19
10.	A photograph taken 209 seconds after takeoff at an altitude of 161 kilometers (100 miles).	21
11.	A photograph taken 227 seconds after takeoff at an altitude of 162 kilometers (101 miles).	23
12.	A composite picture of four separate photographs taken at an altitude of 162 kilometers (101 miles).	25

CONTENTS

	Page
Illustrations	iv
Abstract	vi
Photography From The V-2 Rocket At Altitudes Ranging Up To 160 Kilometers	1

ABSTRACT

The photography conducted in the V-2 flight of 7 March 1947 is described. The objectives of the program and the results obtained are discussed. A description of the installations and of the techniques employed is given. A selection of ten of the most representative photographs taken during the flight is presented.

PHOTOGRAPHY FROM THE V-2 ROCKET AT ALTITUDES RANGING UP TO 160 KILOMETERS

On 7 March 1947 the twentieth* V-2 to be launched in America took to the air from the Army Ordnance Proving Ground at White Sands, New Mexico. As on several of the previous flights, an attempt was made to obtain photographs of the features of interest on the rocket and, of course, of the earth. In this attempt the effort met with considerable success. Included among the group of pictures obtained are the first ever to be taken from altitudes greater than 160 kilometers (100 miles). The quality of the photographs is fairly good. For the first time, in pictures taken at such high altitudes, it is possible to recognize clearly many geographical features. In addition a large number and variety of cloud formations were recorded by the cameras and other information of meteorological value.

The appearance of the earth is unquestionably the most striking feature of the photographs. The Colorado River, the Gulf of California, the peninsula of Lower California, and the Pacific Ocean beyond are all clearly discernible in Figure 11 which was taken as the rocket reached the peak of its trajectory. More than 200,000 square miles of the United States and Mexico are visible between the bottom of the picture below the rocket and the curved horizon 900 miles to the west. If the V-2 had risen in another part of North America, a similar photograph could easily have included both New York and Chicago. Many lesser lakes, rivers, dry lakes, etc. have been identified. Their locations are indicated in Figure 11.

One of the primary purposes of the photographic program was to acquire a better knowledge of various motions executed by the missile in its traverse of the upper atmosphere. Another objective was to obtain accurate information concerning existence of corona discharge at the radiating elements, the relative positions of the antennas and the jet exhaust flame of the rocket, etc. This would make it possible to assess more accurately the performance of these components. Important information was obtained from the photographs taken on 7 March concerning all of these phases of the operation of both the rocket and the experimental equipment.

When the rocket takes off, it can be controlled by the action of its carbon vanes in the jet exhaust and the stabilizing action of its air vanes on the fins. These restoring forces also can prevent rolling. However, after the end of powered flight, this source of correction is, for all practical purposes,

* Missile No. 21. Missile No. 1 was expended in a static firing test.

no longer available. There is no rocket engine flame, and the drag of the atmosphere on the air vanes is now negligible. Thus, if the rocket possesses a residual roll at this time, the mechanism orders constantly increasing amounts of correction in vain; i.e., the air vanes are turned to their extreme positions, nevertheless the rocket continues to roll. The film furnished positive evidence that this rolling actually does take place. The turning of one of the vanes and the rolling of the rocket are both clearly visible in the complete sequence of photographs. These also show the flame came between the antenna and the ground station during a portion of the flight.

The photographs were made with two K-25 aircraft cameras. These cameras employed 24 volt power and operated automatically. They were mounted symmetrically in opposite sides of the midsection of the rocket; one of which is shown in Figure 1. Each was equipped with a right angle prism and in both cases the field of view was directed toward the tail at an angle of 20° to the missile axis. Each roll of film provided for 55, 10.16 cm x 12.70 cm (4 in. x 5 in.) negatives. A 1/500th second exposure time at f/11 lens on K-25 infrared reconnaissance base film and a Wratten 25A red filter were chosen. This combination had an exposure index of 50. The recovered film was found to be slightly underexposed. Experience gained on this flight indicates that f/8 is nearer the optimum lens setting under these conditions.

The V-2 rose vertically from the launching site, tilting gradually toward the north during the burning period. At the point at which the fuel was spent, 63 seconds after take-off, it had a zenith angle of 7°. The winds from the east then caused the missile to begin turning in that direction. This motion probably continued throughout the remainder of the flight. The last six pictures given here were made while the V-2 was inclined toward the northeast at a zenith angle of approximately 10°. Explosive charges at the base of the warhead and the junction of the midsection and tail were detonated 330 seconds after take-off. The rocket broke up shortly afterward as it entered the denser portions of the atmosphere. The parts fell to earth over a wide area of the white sands which give the region its name. Both cameras were recovered on the following day. One of these was partially destroyed upon impact, allowing light to enter. As a result some of the pictures taken during the latter part of the flight were partially fogged.

The following pages contain a selection of ten photographs which are representative of those taken during the V-2 flight of 7 March. They are indicative of the results which may be obtained by means of photography at very high altitudes.

Figure 1. V-2 rocket No. 21 on its launching platform, showing one of the cameras mounted in the midsection.

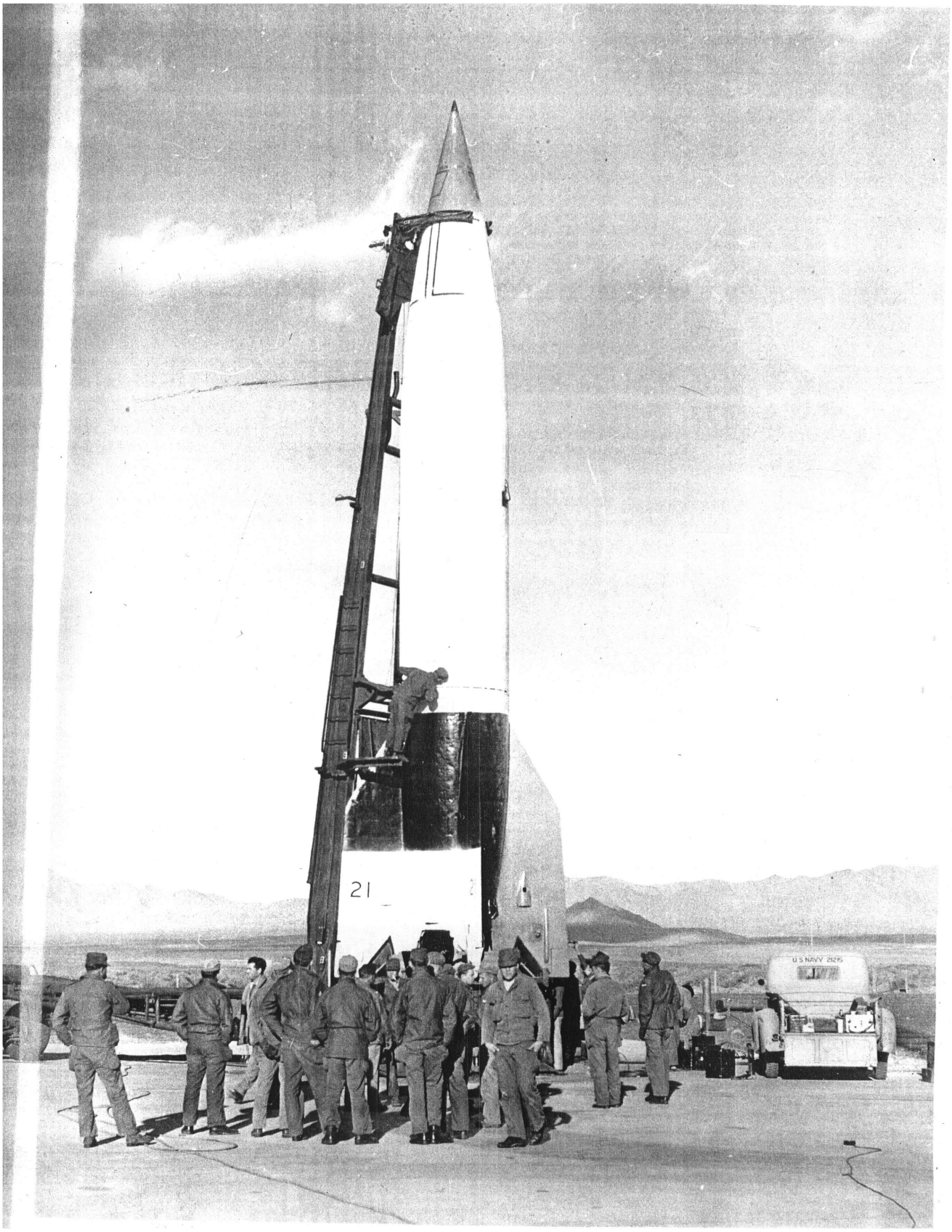
21
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Figure 2. A photograph taken 7 seconds after takeoff at an altitude of 225 meters (750 feet). The camera was pointed southeast. Desert scrub bushes can be seen.

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Figure 3. A photograph taken 43 seconds after takeoff at an altitude of 12 kilometers (7 miles). The camera was pointed southeast.

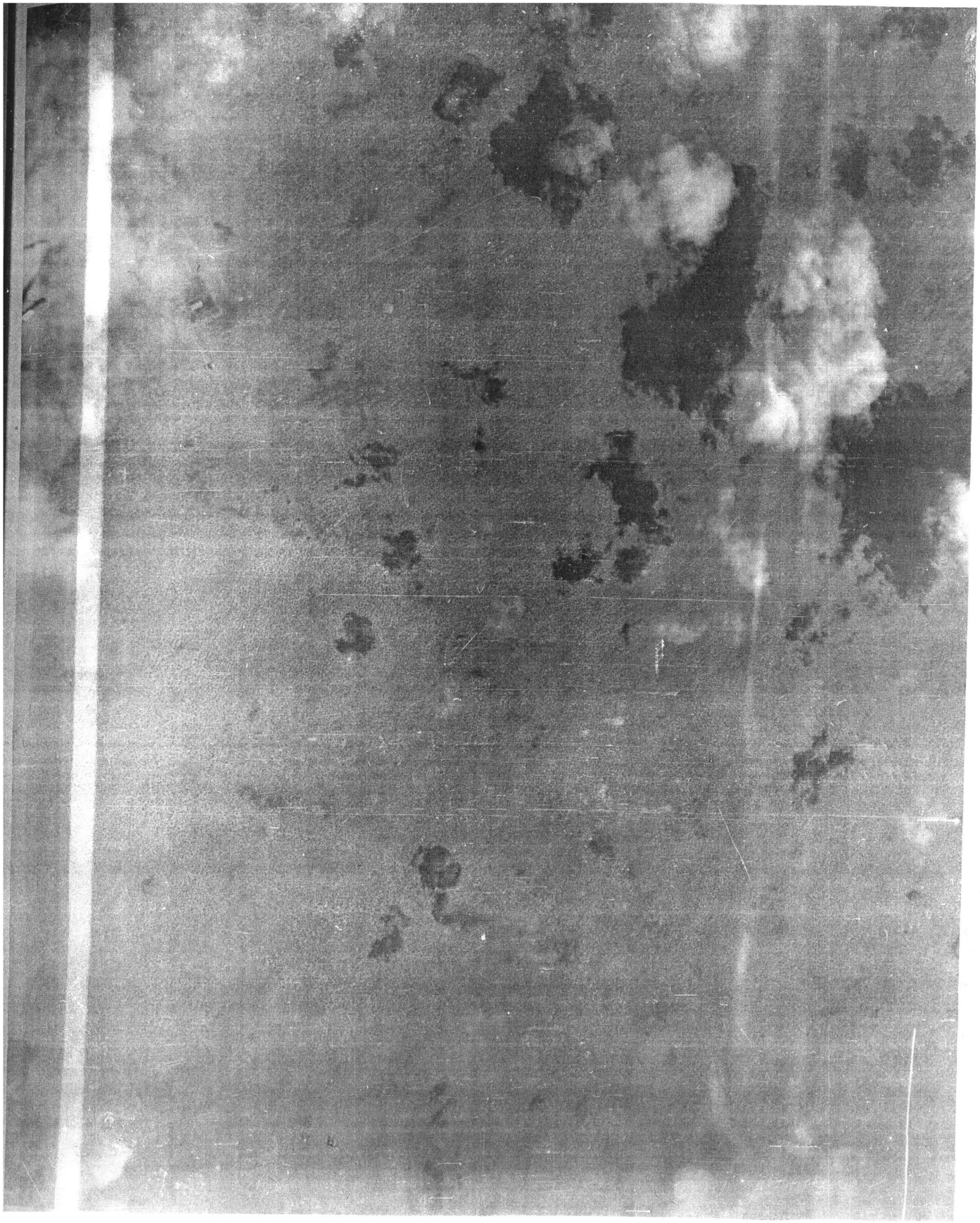

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Figure 4. A photograph taken 63 seconds after takeoff at an altitude of 34 kilometers (21 miles). The camera was pointed southeast.

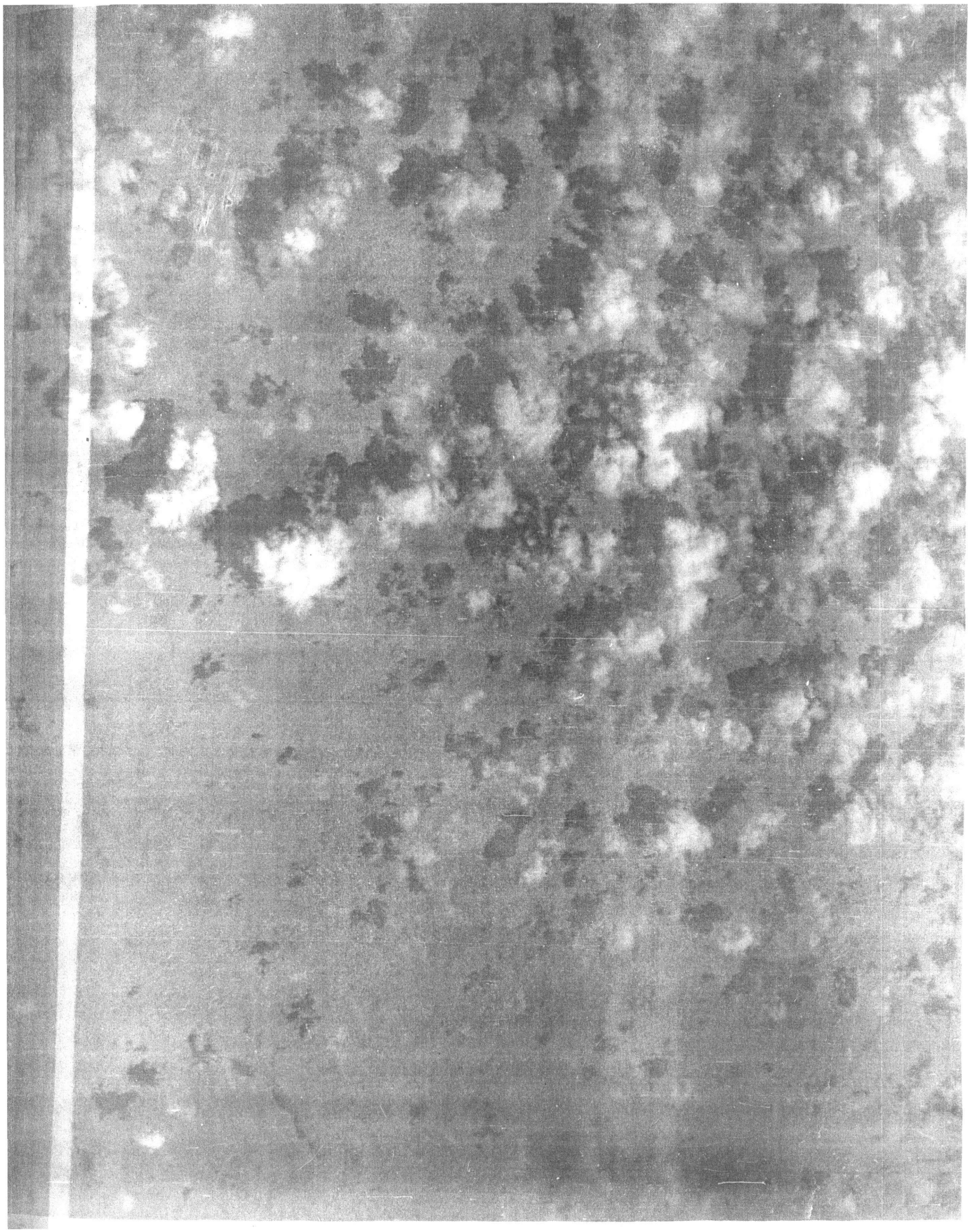

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Figure 5. A photograph taken 81 seconds after takeoff at an altitude of 60 kilometers (37 miles). The camera was pointed west. Part of White Sands area shown in lower left. (See Fig. 8 for same area at a higher altitude).

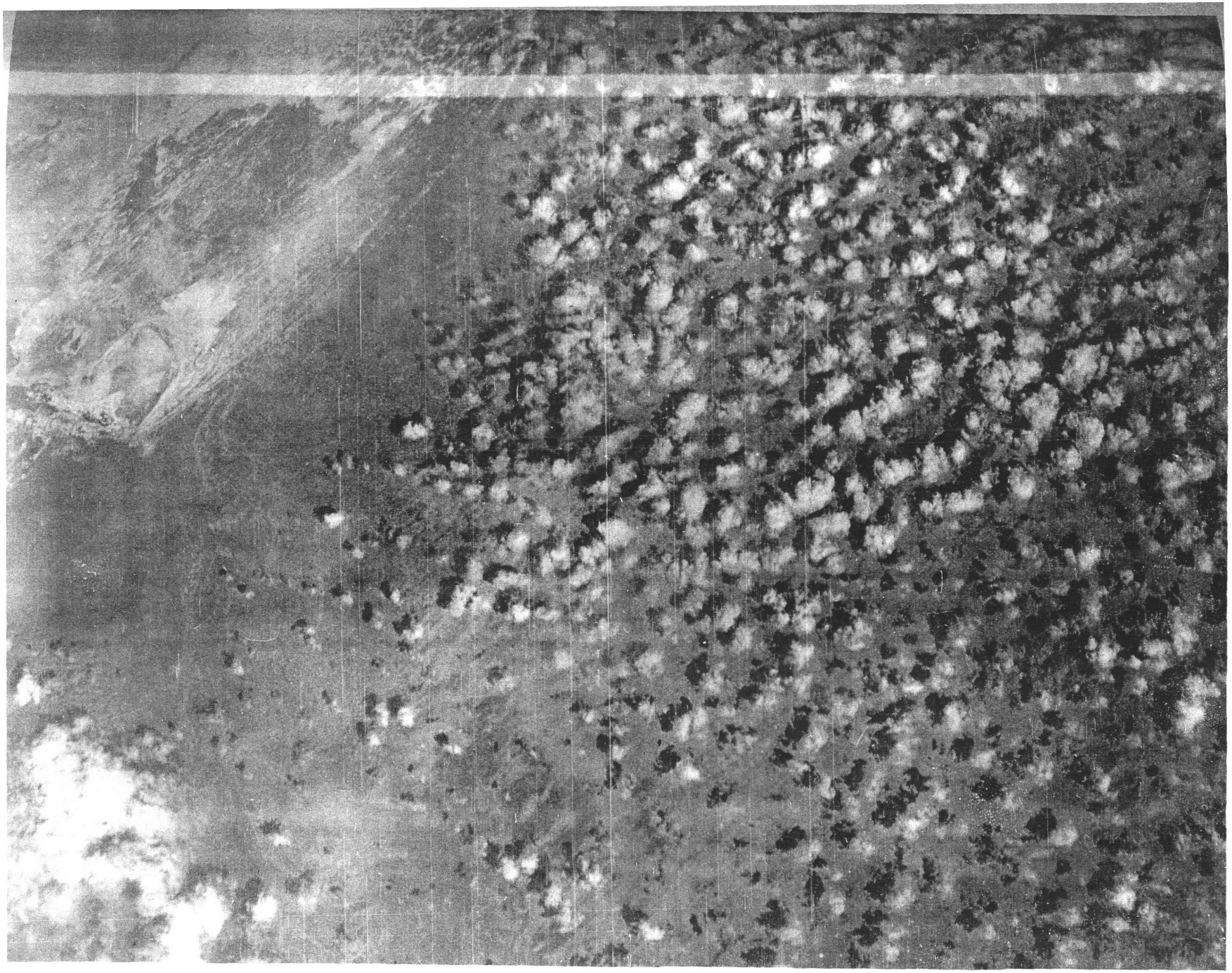

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Figure 6. A photograph was taken 100 seconds after takeoff at an altitude of 85 kilometers (53 miles). The camera was pointed northeast.

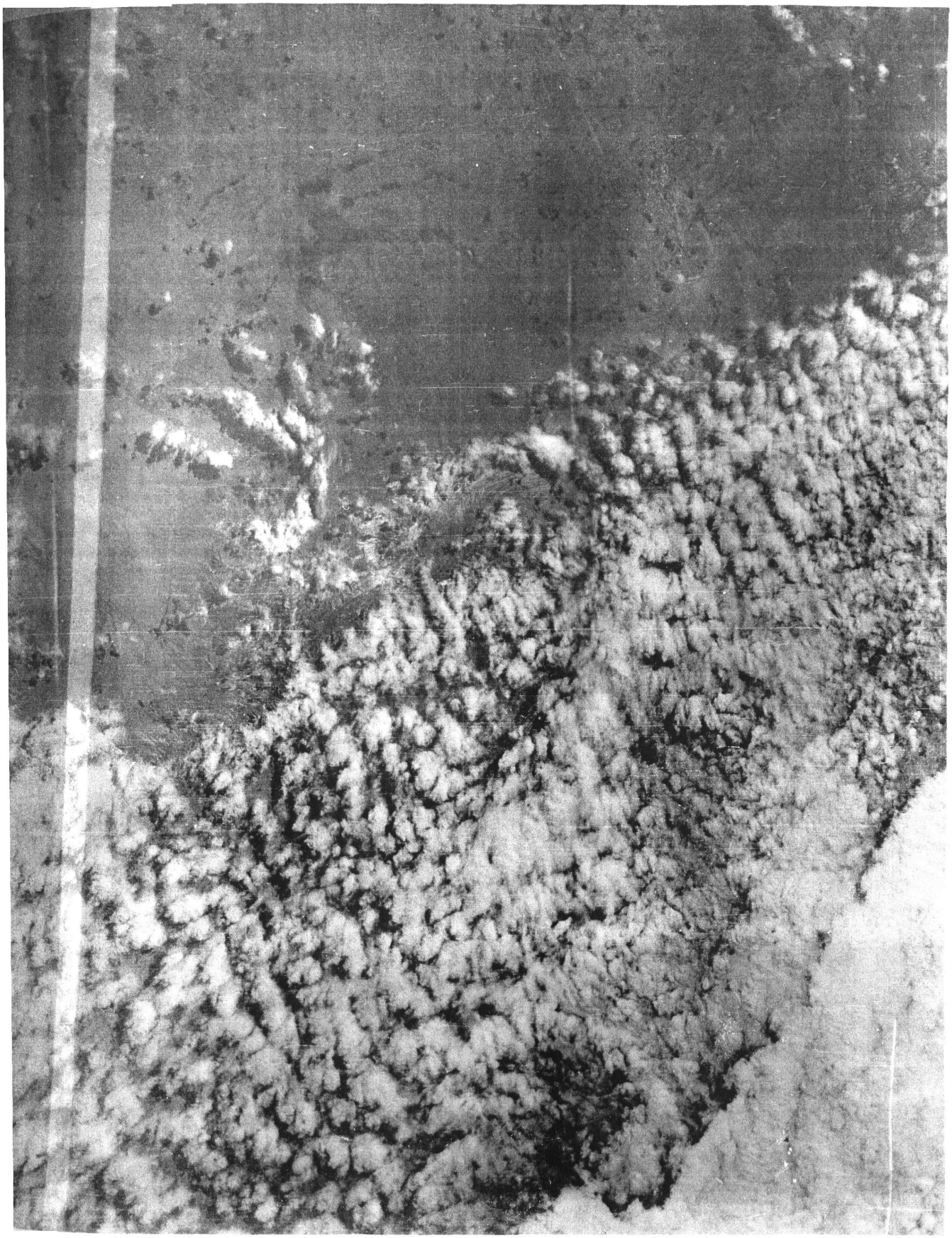

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Figure 7. A photograph taken 136 seconds after takeoff at an altitude of 123 kilometers (76 miles). The camera was pointed north northeast. A portion of the lake formed by Caballo Dam on the Rio Grande River is visible in the lower left hand corner.

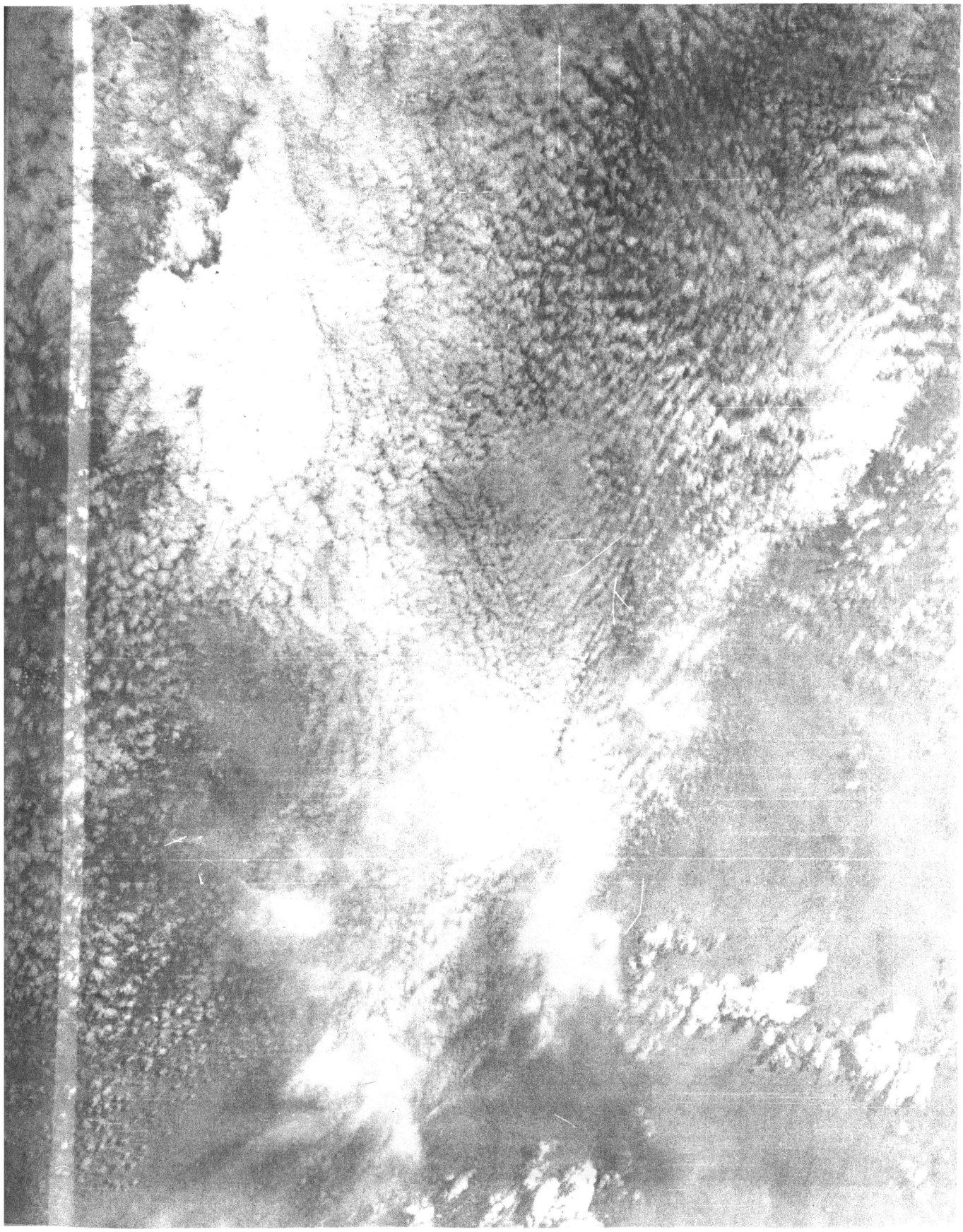

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Figure 8. A photograph taken 155 seconds after takeoff at an altitude of 137 kilometers (85 miles). The camera was pointed southwest. The White Sands region appears between the clouds in the right center. The rocket came to earth in this area.

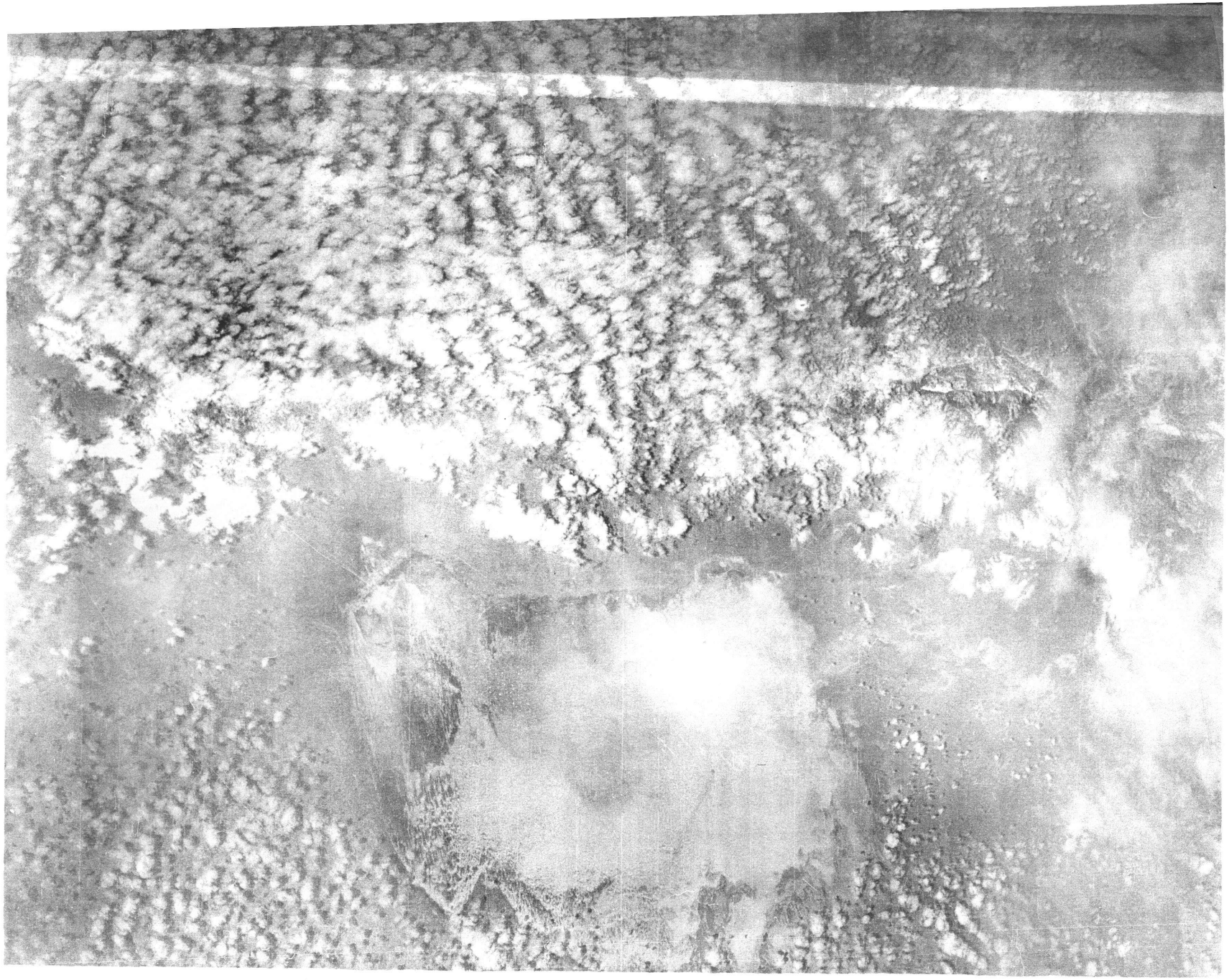

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Figure 9. A photograph taken 190 seconds after takeoff at an altitude of 156 kilometers (97 miles). The camera was pointed southwest. Caballo Dam Lake, the lower end of Elephant Butte Dam Lake and the Rio Grand River between are all discernible in the upper left hand corner.

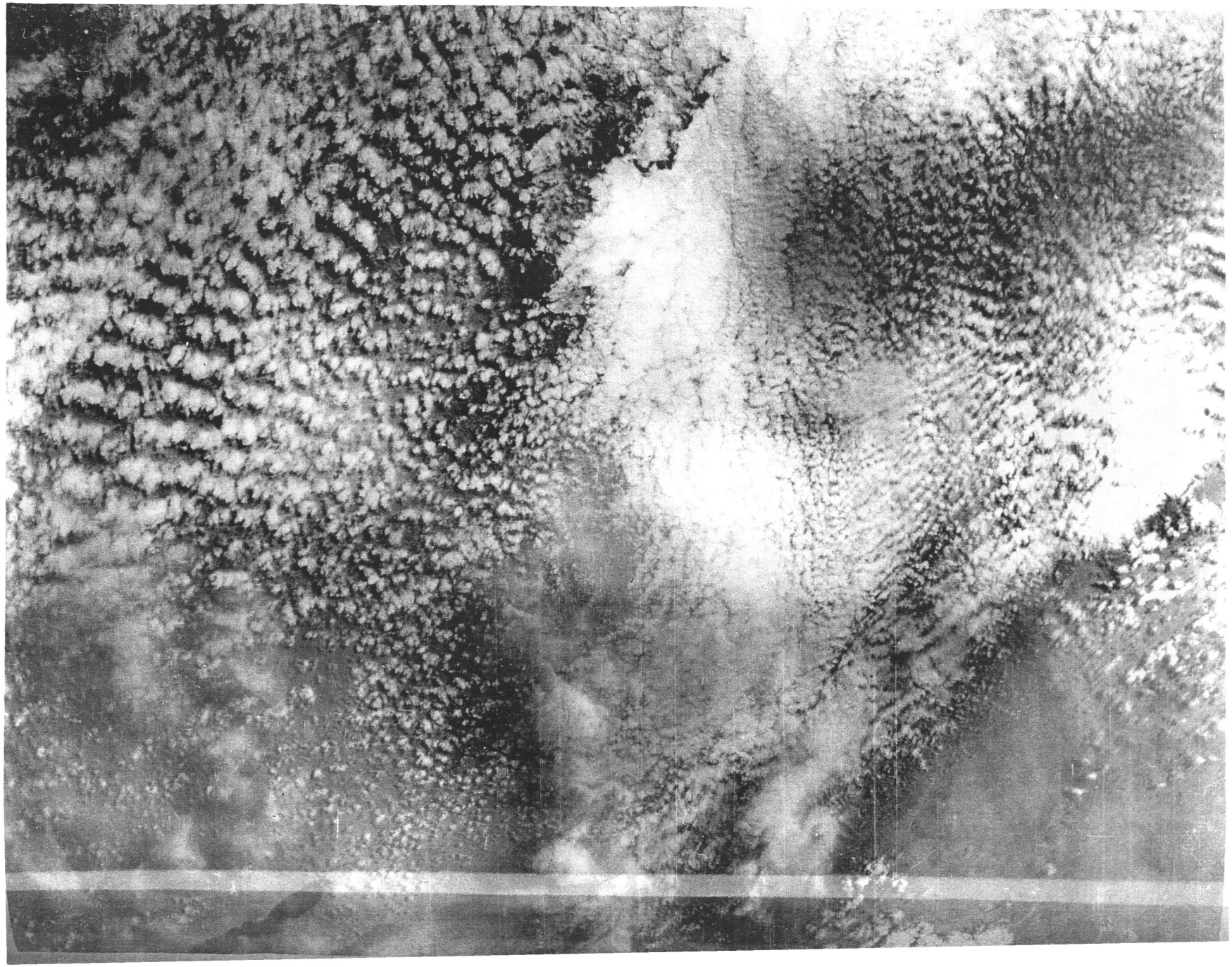

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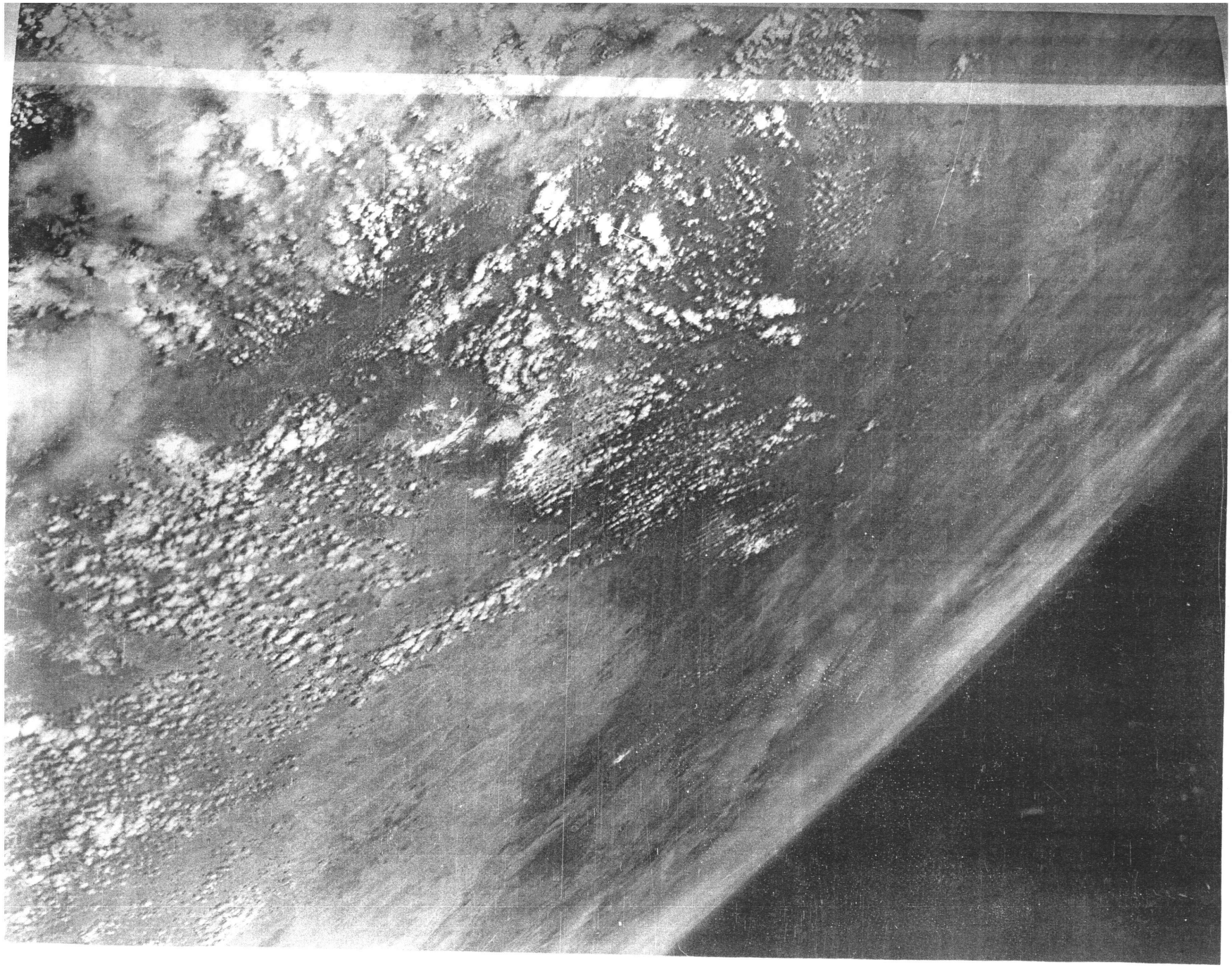
Figure 10. A photograph taken 209 seconds after take-off at an altitude of 161 kilometers (100 miles). The curvature of the earth may be clearly seen. The camera was pointed toward the northwest.



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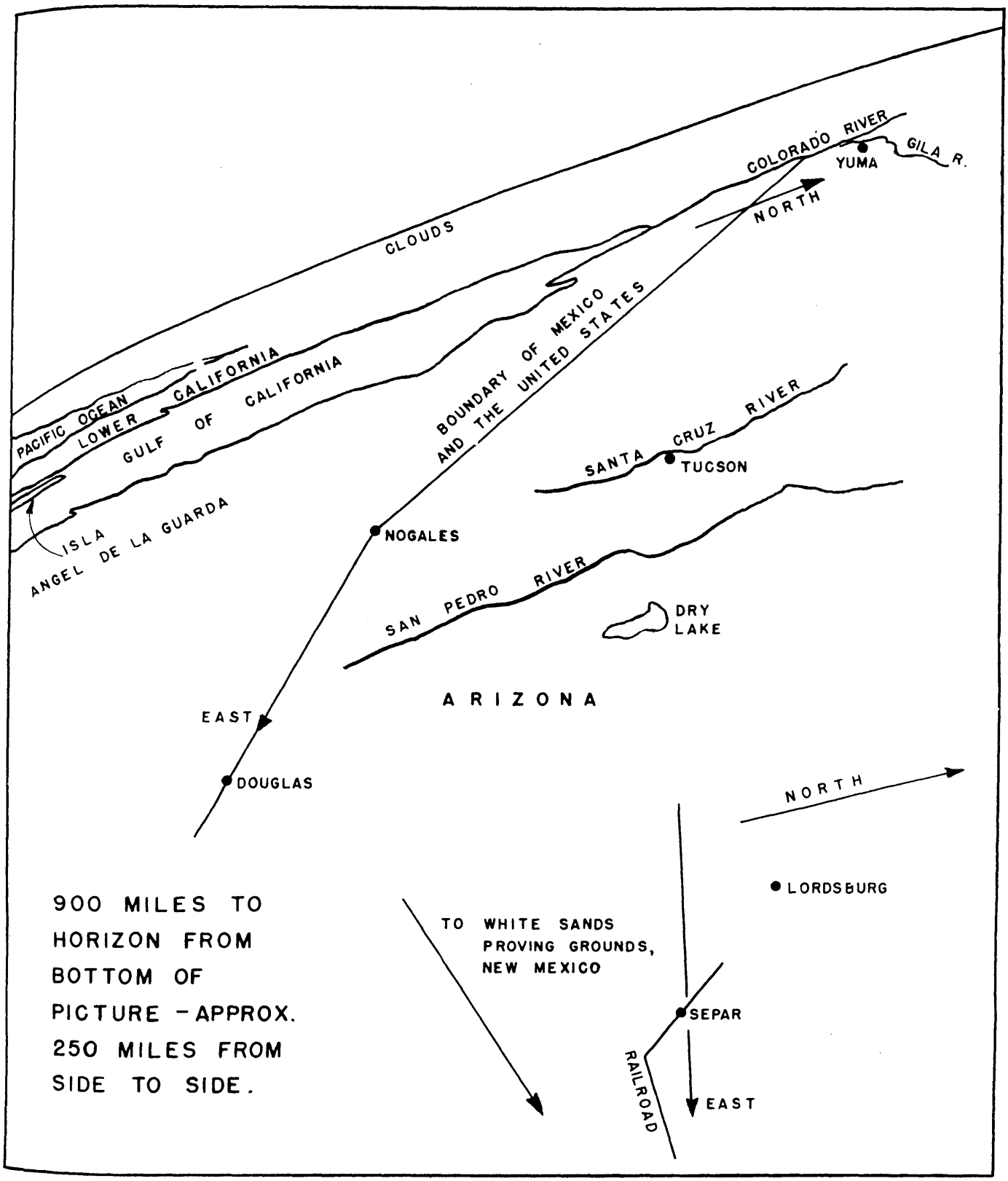
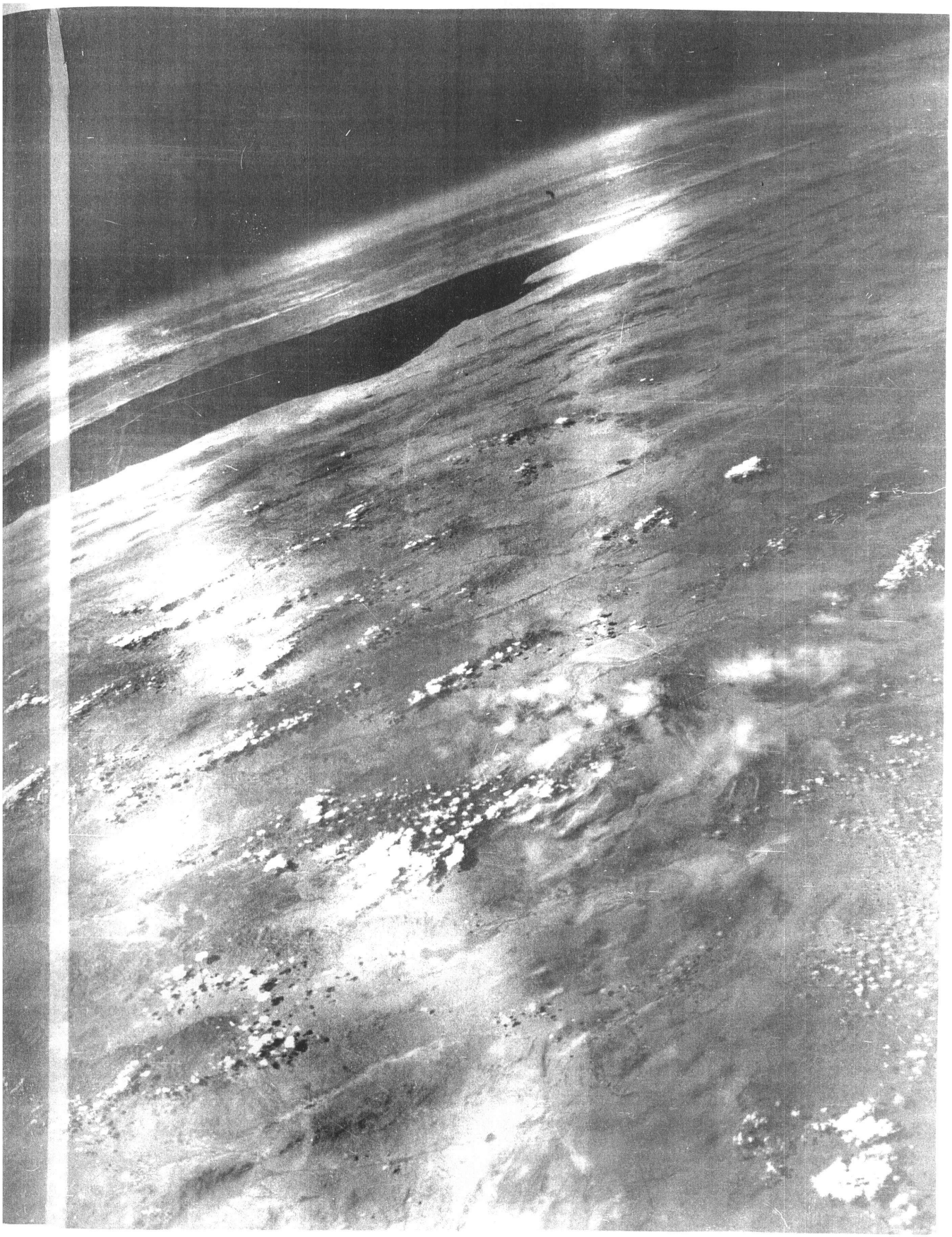


Figure 11. A photograph taken 227 seconds after takeoff at an altitude of 162 kilometers (101 miles). The rocket was then within a quarter of a kilometer of the peak of its trajectory. The camera was pointed southwest.



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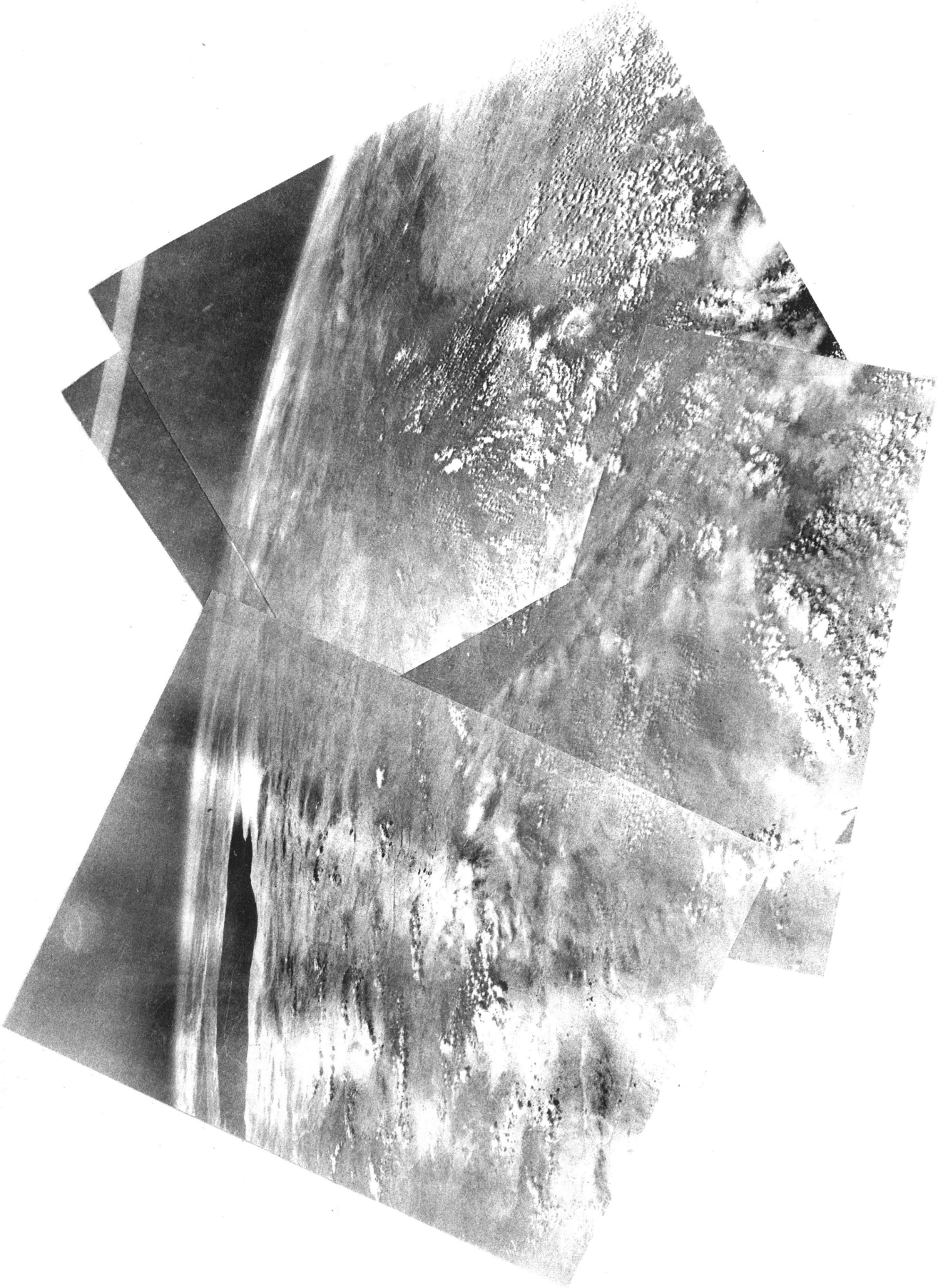
Figure 12. A composite picture made up of four separate photographs taken at an altitude of 162 kilometers (101 miles). This picture covers approximately 500,000 square miles of southwestern United States and northern Mexico.
The photographs do not match exactly due to the varying camera angles.