

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION



68 HOURS TO THE MOON

JET PROPULSION LABORATORY • CALIFORNIA INSTITUTE OF TECHNOLOGY

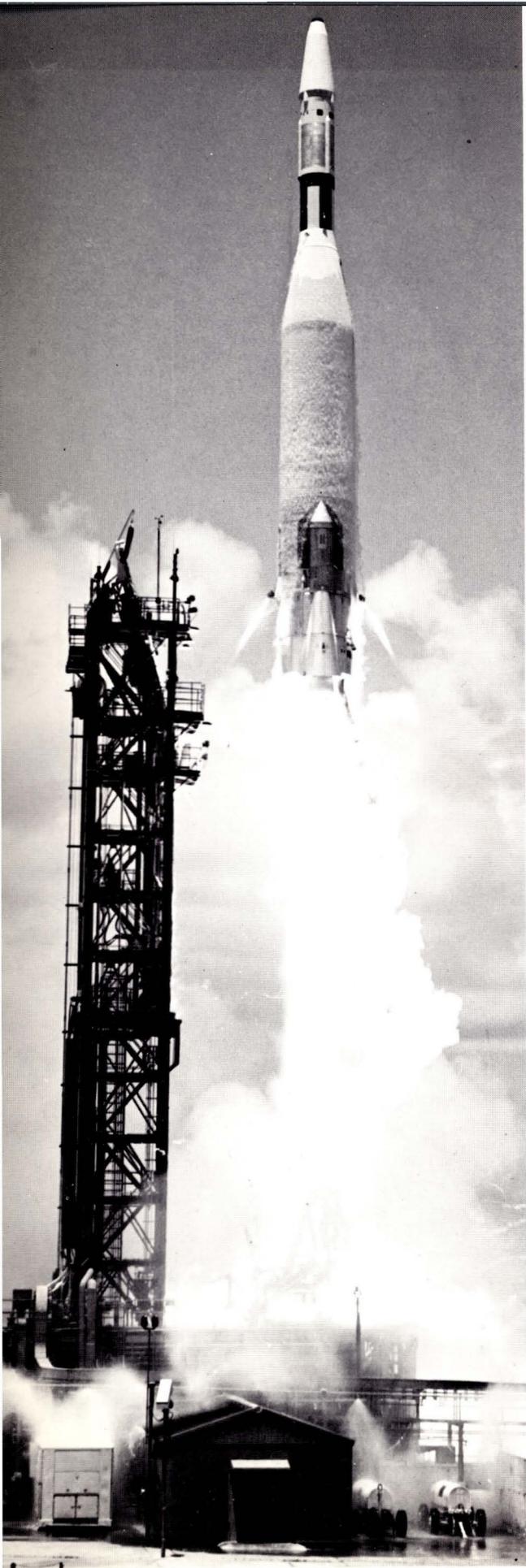


THE MOON, THE MACHINE, AND THE MISSION

"The mission of the *Ranger* Block III flights is to obtain television pictures of the lunar surface which will be of benefit to both the scientific program and the U.S. Manned Lunar Landing Program. These pictures should be at least an order of magnitude better in resolution than any available Earth-based photography."

Dr. W. H. Pickering, Director of Jet Propulsion Laboratory, points out an area chosen as the photographic objective of *Ranger* 7. The spacecraft to his left is a full-scale model of the 806-pound *Ranger* spacecraft that flew the mission.

The mission, from launch to impact, was a complete success with 4316 photographs of the lunar surface obtained during the final 17 minutes, 12 seconds, of the 68 hour and 35 minute flight. Impact occurred at 06:25.49 PDT, on July 31, 1964.

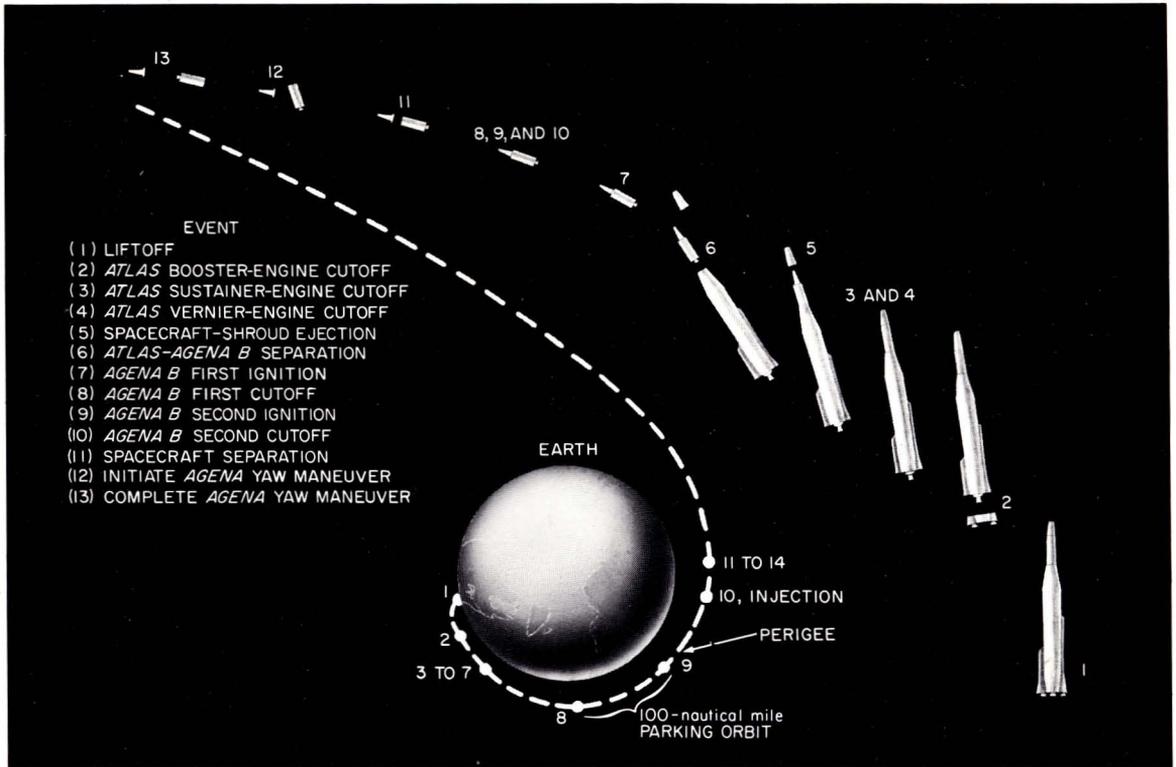


Ranger 7 was placed into its Moon intercept orbit by an Atlas-Agena launch vehicle. Liftoff occurred at 09:50.07 PDT on 28 July, 1964 from Launch Complex 12, Cape Kennedy, Florida.

The sequence of the major inflight events (illustrated on the following page) occurred as follows:

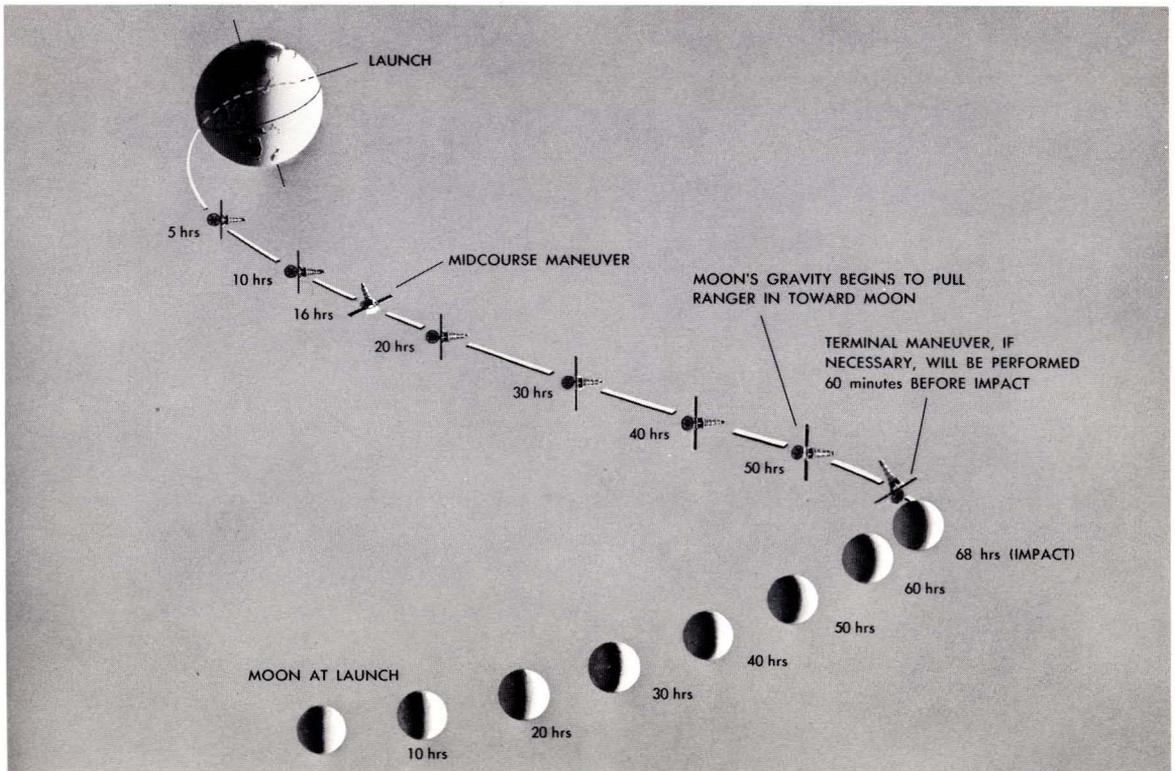
LIFTOFF	9:50 AM	28 July 1964
SHROUD EJECTION	9:55 AM	
ATLAS/AGENA SEPARATION	9:55 AM	
1st AGENA BURN	9:58 AM	
2nd AGENA BURN	10:20 AM	
RANGER/AGENA SEPARATION	10:22 AM	
AGENA RETRO FIRING	10:29 AM	
SOLAR PANELS EXTENDED	10:51 AM	
SUN ACQUISITION	11:05 AM	
EARTH ACQUISITION	1:45 PM	
OMNI-TO-DIRECTIONAL ANTENNA	2:20 PM	
DIRECTIONAL-TO-OMNI ANTENNA	2:40 AM	29 July 1964
MIDCOURSE MANEUVER COMMAND INITIATION	3:00 AM	
ROLL TURN	3:01 AM	
PITCH TURN	3:10 AM	
MOTOR ON	3:27 AM	
MOTOR OFF	3:28 AM	
SUN RE-ACQUISITION	3:36 AM	
EARTH RE-ACQUISITION	3:58 AM	
OMNI-TO-DIRECTIONAL ANTENNA	4:26 AM	
CRUISE PHASE		30 July 1964
TERMINAL SEQUENCE INITIATION	5:26 AM	31 July 1964
TV BACKUP CLOCK INITIATES WARMUP ON CHANNEL F	6:07 AM	
FULL POWER ON CHANNEL F	6:08 AM	
WARMUP ON CHANNEL P	6:10 AM	
FULL POWER ON CHANNEL P	6:11 AM	
<i>IMPACT</i>	6:25 AM	

(The times shown are Pacific Daylight Time)



Ranger launch-to-injection events

Ranger nominal trajectory to Moon





The midnight watch during the early morning hours in the Operations Area of the Space Flight Operation Facility (SFOF) at JPL, Pasadena. The SFOF was the center from which the space flight portion of the mission was directed and controlled.

N. W. Cunningham, the NASA *Ranger 7* Program Manager, is seen at his desk (upper left center) viewing the progress of the mission.

R. J. Parks, Assistant Laboratory Director in charge of the JPL Lunar and Planetary Projects, monitors the mission from the SFOF Mission Control Room.





Space Flight Operations Manager, P. J. Rygh, directed the flight from his console in the SFOF Mission Control Room. Through this console, he kept in constant visual and vocal contact with the personnel at the various elements of the Deep Space Network and the Eastern Test Range.

From the Deep Space Instrumentation Facility at Goldstone, California, Echo Site, the commands for the midcourse maneuver and the terminal sequence were sent under the direction of the Goldstone Station Manager, Walter E. Larkin (seated at his console facing the microphone).

Here in the Control Room of the Echo Site, confirmation of the spacecraft's response to the midcourse maneuver commands is being awaited.





H. M. "Bud" Schurmeier, JPL *Ranger* Project Manager, points to the "target," chosen from mission considerations, representing the desired impact area.

Dr. Gerard Kuiper, University of Arizona, Principal Investigator for the *Ranger* Project conferring with the flight trajectory engineer as to the exact path of the spacecraft.





Trajectory experts study the data output of the SFOF Data Processing System where the telemetry and tracking data were processed. It was from these data that the performance, condition, and position of the spacecraft were determined.

Determination of the final prediction of impact time was calculated by the Flight Path Analysis Area engineers in the SFOF under the direction of W. E. Kirhofer, *Ranger* Systems Analysis Project Engineer.





From the Spacecraft Performance Analysis Area in the SFOF, the spacecraft was continuously monitored during the entire mission. The commands that were sent to the spacecraft during the midcourse maneuver and the terminal phase were generated by the engineers in the area, working in support of the Space Flight Operations Director.

Awaiting the receipt of the Channel A signals that would indicate the transmission of video pictures was a tense moment. Here at the Control Center of the Echo Site the first evidence confirming the successful accomplishment of the mission was seen on the spacecraft signal oscilloscope.





The first TV pictures of the MOON!!! In the left upper corner can be seen the first of the Polaroid pictures taken as the TV full-view cameras record the lunar scene.

Understandable congratulations are being passed among the spacecraft Television Sub-system engineers in the RCA Room, Echo Site.





Simultaneous joy is expressed by representatives of the news services, JPL, and Contractor personnel gathered in the von Karman auditorium at JPL during the final phase of the mission. We have pictures!

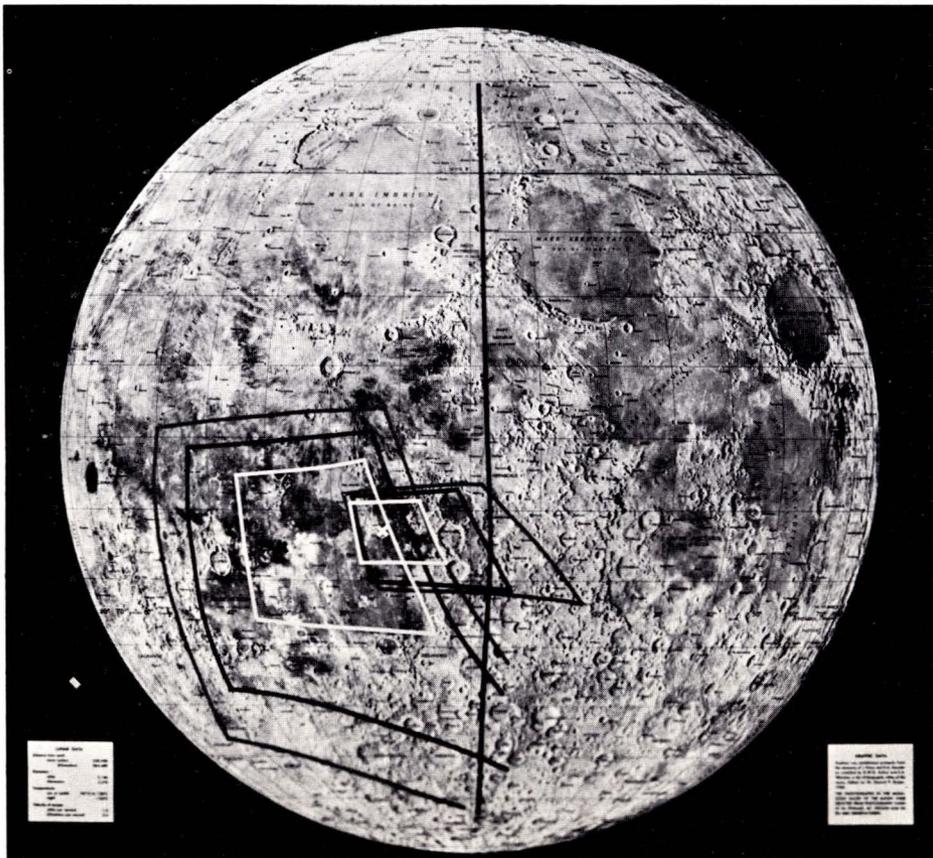
Dr. Homer Newell, NASA Director of Space Science and Applications, Dr. Pickering, H. M. Schurmeier, and A. E. Wolfe, *Ranger* Spacecraft System Manager, acknowledge the expressions of the audience and the mutual recognition of a historic accomplishment.

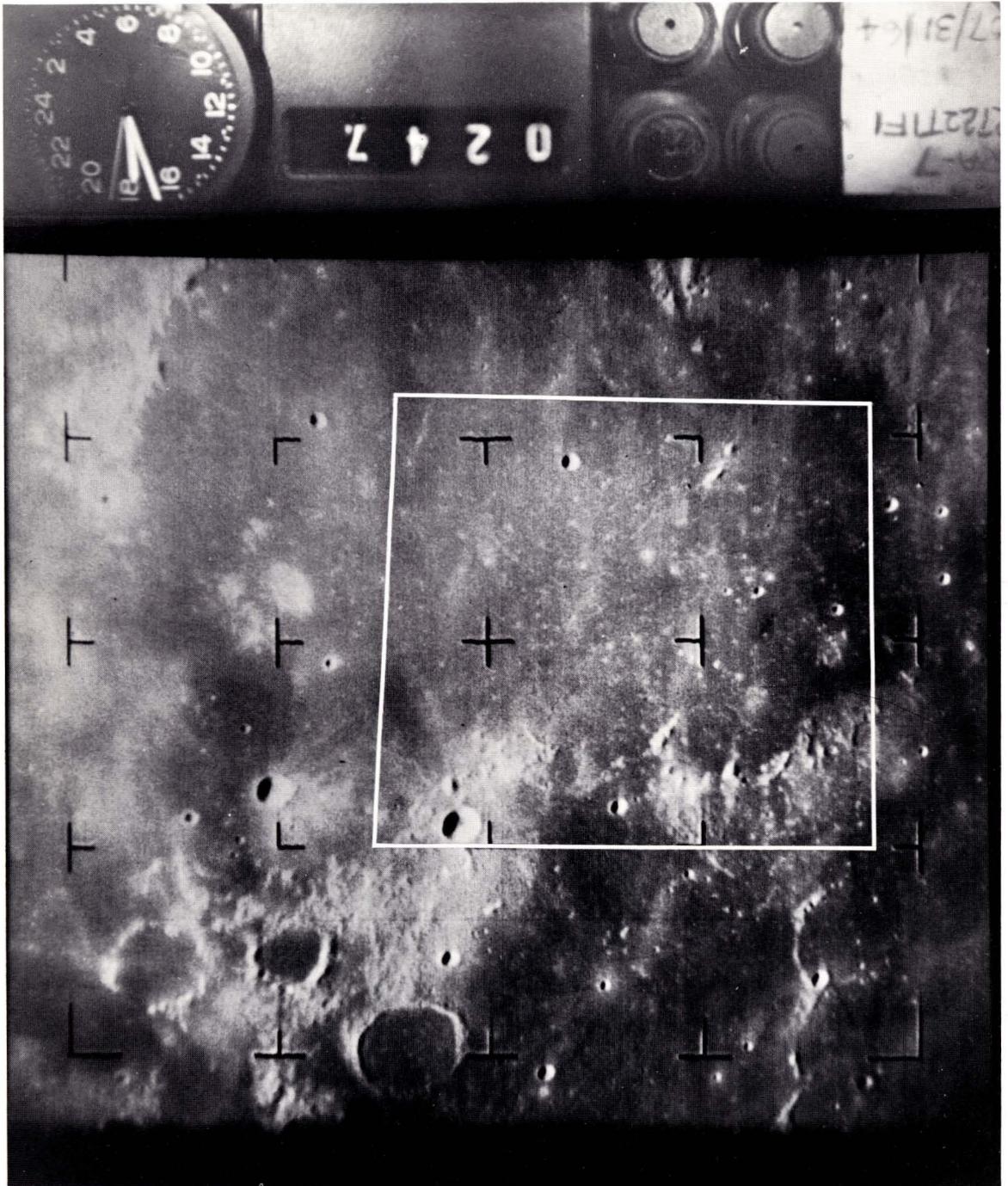




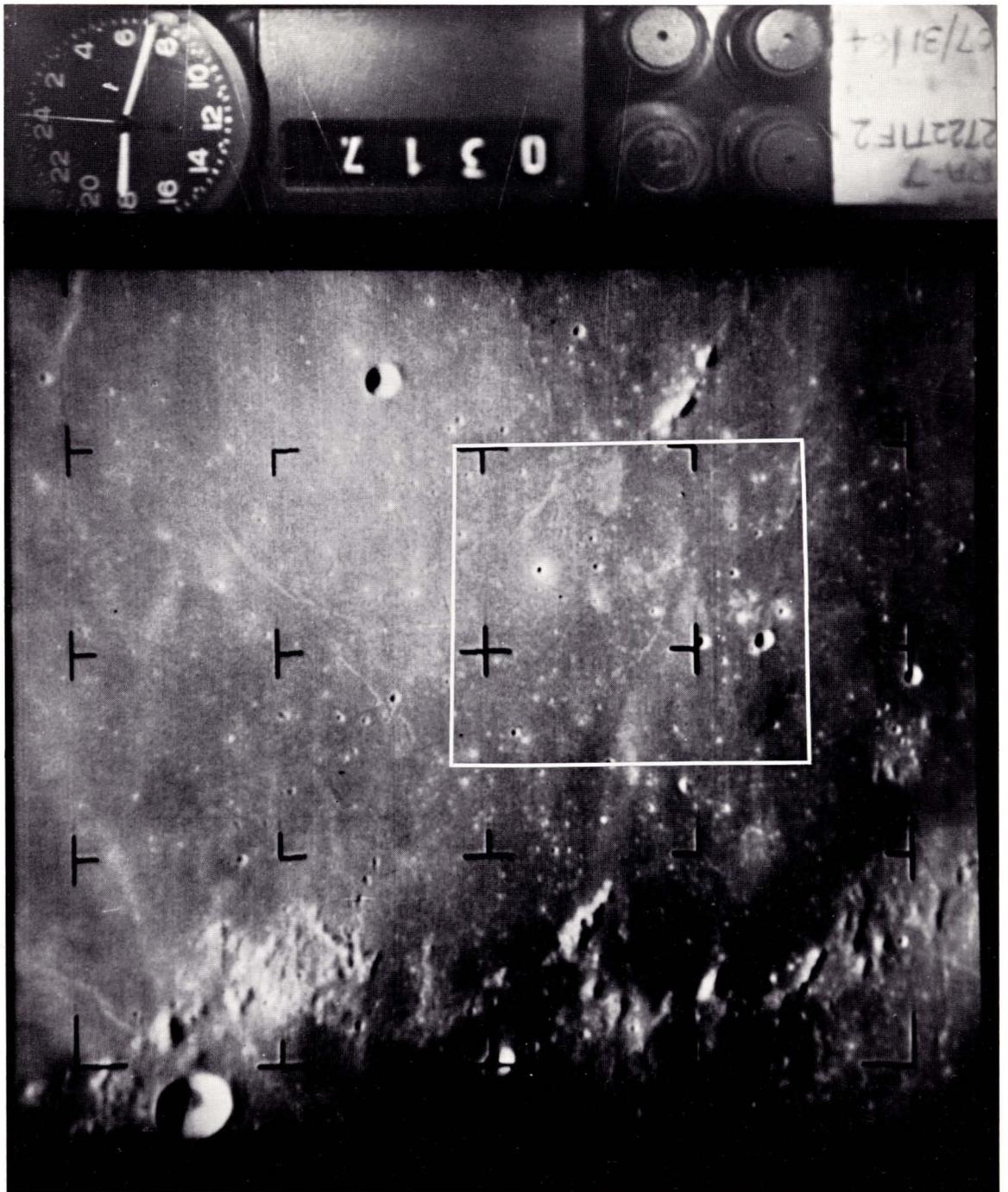
The experimenter team study the Polaroid pictures rushed by airplane from the Echo Site. The Scientific Experimenters Room in the SFOF was the place where the first scientific evaluation of the TV lunar data was made preparatory to the study of the 4316 video pictures.

The Moon map marked to show the progressive areas of the lunar surface photographed by *Ranger 7*.

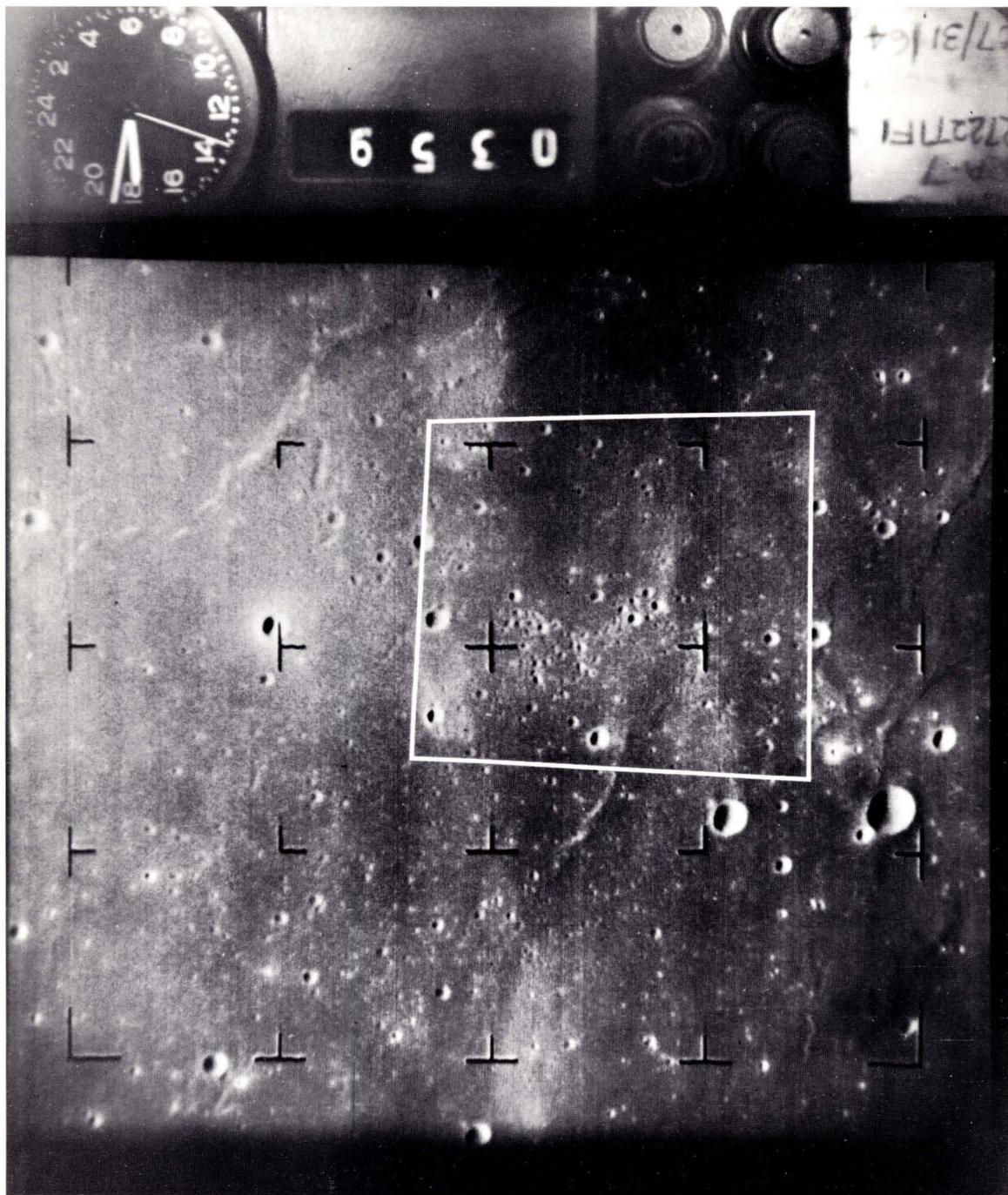




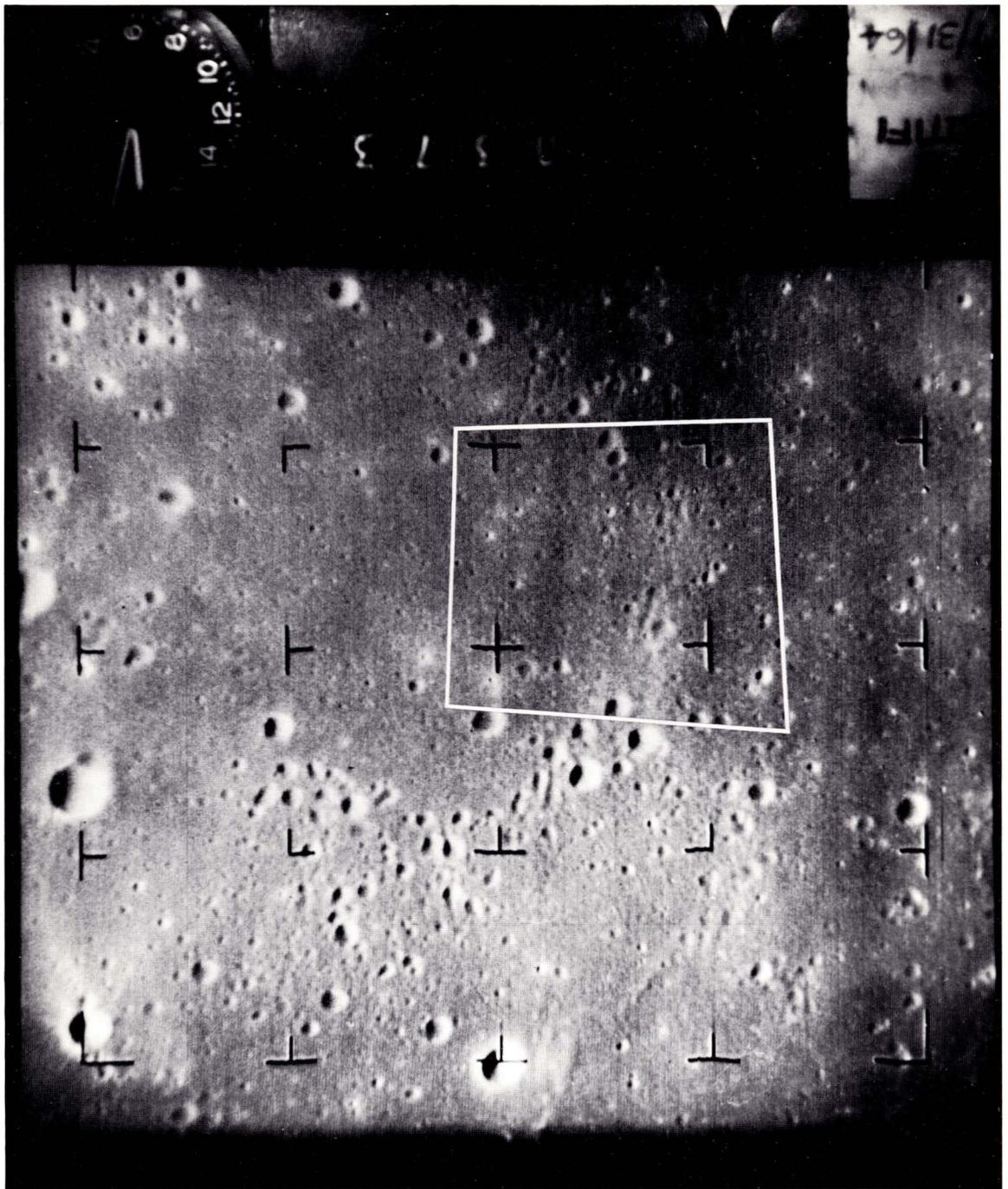
Photograph taken by the *Ranger 7* spacecraft before it impacted on the Moon. Viewed with the three large shallow craters in the lower left-hand corner, North is at the top of the picture. It was taken by the F-a camera with a 25mm, f/1 lens from an altitude of 480 miles. It duplicates closely resolution obtained in Earth-based photography. The large open dark crater in lower margin is Lubiniezky.



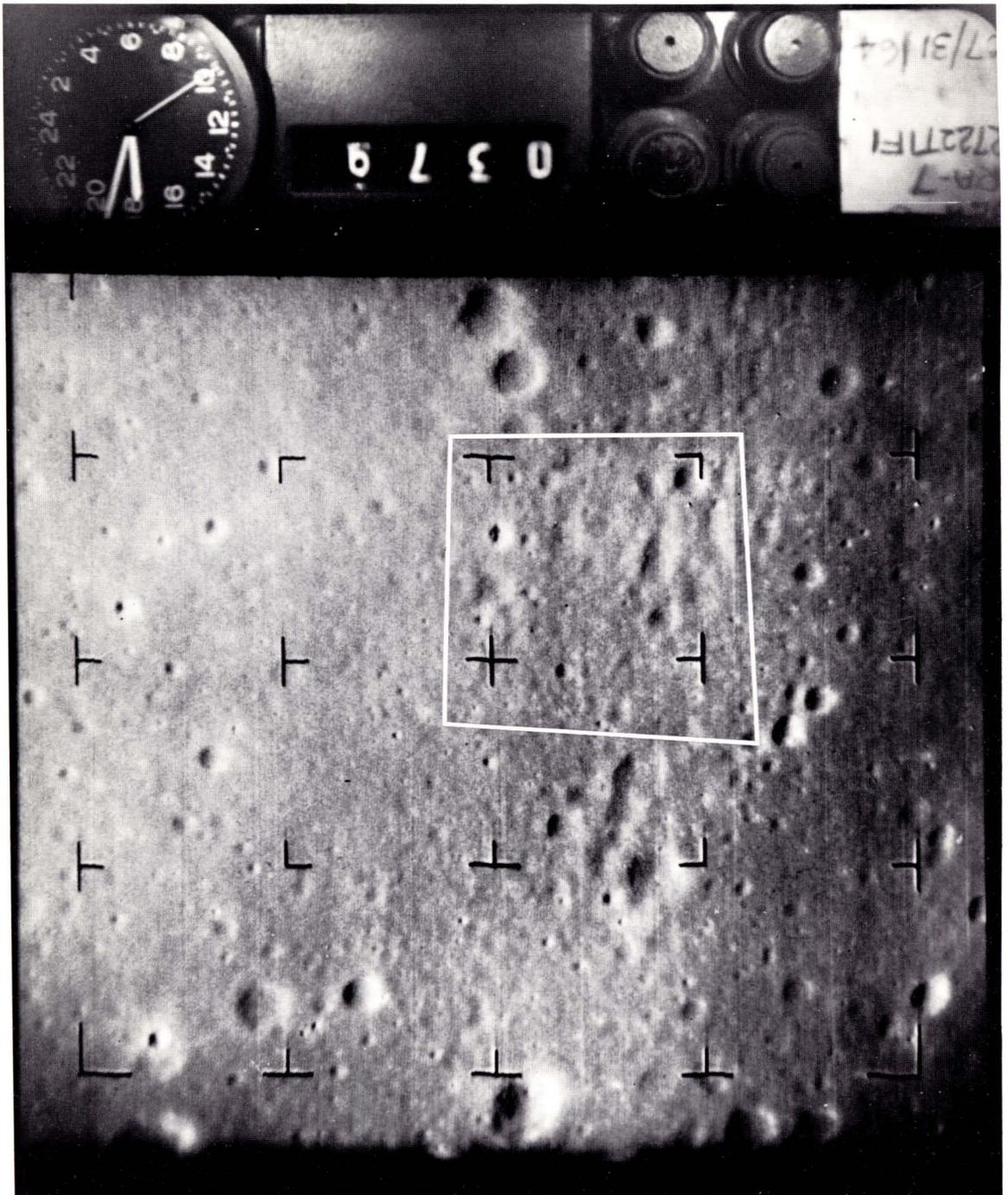
Viewed with the clock at the upper left-hand corner, North is at the top of the photograph. This picture was taken by the F-a camera with a 25-mm, f/1 lens at an altitude of about 235 miles some two-minutes-46-seconds before impact. The photo shows an area about 113 miles on a side. The eventual impact point of *Ranger 7* is approximately on the border between the two squares in the upper right hand corner as defined by the reseau marks. The smallest craters are about 1,000 feet in diameter and are shown with a resolution about four times Earth-based photography.



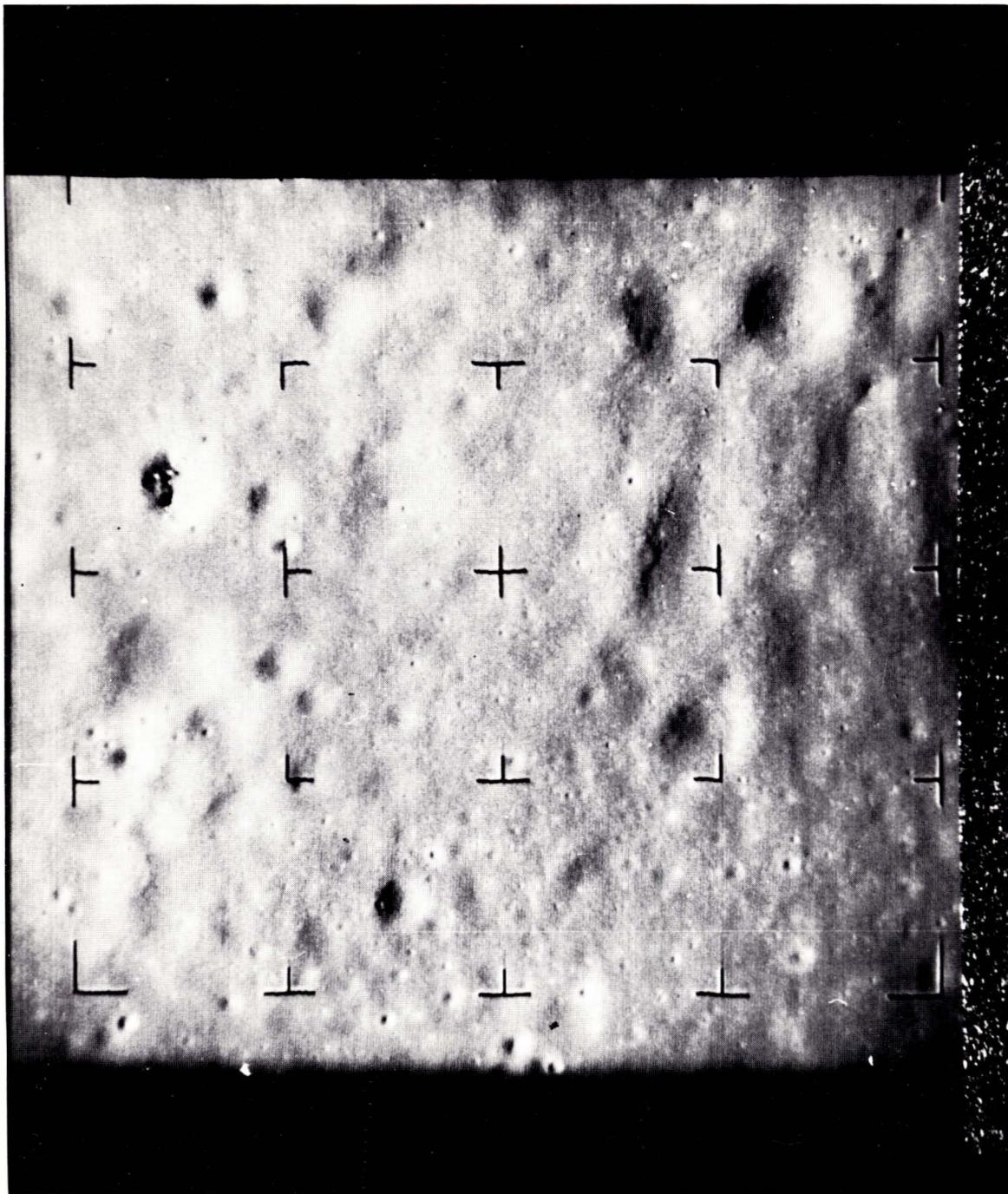
Viewed with the clock in the upper left-hand corner, North is at the top. The photograph was taken by the F-a camera with a 25mm, f/1 lens from an altitude of 85 miles. The picture covers an area 48 miles on a side and shows craters as small as 500 feet in diameter. The central area shows a cluster of secondary craters in part of an outlying ray of the crater Copernicus. This cluster is shown with greater resolution in the picture marked 0373. The largest craters shown, with prominent shadows, are primary craters of approximately conical shape.



Viewed with the clock in the upper left-hand corner, North is at the top. The picture was taken by the F-a camera with a 25mm, f/1 lens from an altitude of 34 miles. The picture shows an area 16 miles on a side with craters as small as 15 feet in diameter. Central area is occupied by an outlying ray of the crater Copernicus containing numerous secondary craters.



Viewed with the clock in the upper left-hand corner, North is at the top. The picture was taken by the F-a camera with a 25mm, f/1 lens from an altitude of 12 miles. It shows an area four miles on a side with craters as small as 45 feet in diameter. Note numerous secondary craters with rounded walls as well as several sharp pits down to the smallest size recognizable. Area shown is a close-up of region just below and left of center of picture marked 0373. Crater with central rock mass seen in close-up on picture marked 0381 is seen just below center.



Photograph taken just prior to impact. Viewed with the largest crater in the upper right-hand corner, North is at the top of the photograph. The picture was taken by the F-a camera with a 25mm, f/1 lens from an altitude of about three miles some 2.3 seconds before impact. The picture shows an area about one-and-two-thirds miles on a side. The smallest craters shown are approximately 30 feet in diameter and ten feet deep. There are many craters with rounded shoulders. One rounded crater, at left toward the top of the photograph, is about 300 feet in diameter and has an angular rock mass in its center which might possibly be responsible for its origin.

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Pasadena, California

