

Refurbishment and
Museum Installation

for the

LUNAR EXCURSION MODULE SIMULATOR

NATIONAL HISTORIC LANDMARK

National Aeronautics and Space Administration
Langley Research Center
Hampton, Virginia

DESCRIPTION OF
THE AFFECTED LANDMARK

Attachment A
44 Pages

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(THIS IS ONE OF SIX ATTACHMENTS)

CONTENTS

<u>DOCUMENT</u>	<u>NO. OF PAGES</u>
National Register of Historic Places Inventory Nomination Form - National Park Service Draft	7
Lunar Landing Research Facility	3
Reduced Gravity Simulator for Studies of Man's Mobility in Space and on the Moon	12
LaRC Operational Announcement	1
Photographs	5
Sampling of Color Photographic Recordation Prior to Dismantling and Cleaning	14

Description

The Lunar Landing Research Facility is located in the east area of the Langley Flight Research Center. This facility was constructed in 1965 at a cost of \$3.5 million and was used by the Apollo astronauts as a training simulator to study and practice piloting problems in the final phase of the lunar landing mission. A list of the Apollo astronauts that trained on the Lunar Landing Research Facility can be found in Appendix 1 at the rear of this nomination.

The Lunar Landing Research Facility is an A-frame steel structure 400' long and 230' high. Associated with this facility is a full-scale Apollo Lunar Excursion Module or LEM. Simulation of lunar gravity is achieved by employing an overhead partial-suspension system which provides a lifting force by means of cables acting through the vehicle's center of gravity so as to effectively cancel all but one-sixth of earth's gravitational force. The lifting force and vertical alignment of the cables are controlled automatically through the action of servo-controlled hydraulic drive systems which power the overhead traveling bridge crane and dolly unit mounted on the large gantry structure. The bridge follows in the down-range motion of the vehicle, and the under-slung dolly follows in the cross-range direction.¹

The cables are attached to the vehicle by means of a gimbal system which provides freedom of motion in pitch, roll, and yaw. This system consists of a swiveled-truss assembly directly over the cab and two vertical struts attached to the vehicle on its pitch axis. Load cells are carried in the vertical struts to sense cable force for the lift servo system, and cable angle sensors are mounted on the bottom of the dolly to provide error feedback signals for the bridge and dolly servo drive systems. Automatic braking equipment built into the servo drive units provide an extra safety feature. The LEM can fly in a space of about 180 feet high, by 360 feet long, and 42 feet wide.²↑

The LEM was constructed using many pieces of off-the-shelf equipment such as the H-34 helicopter cabin and landing gear shock struts. Nitrogen gas was used to pressurize the fuel system which provided 90 percent hydrogen peroxide to the main lifting body rocket assembly and to the 20 attitude rocket motors located around the periphery of the vehicle frame. The cab of the LEM can accommodate two persons at the same time. A common instrument panel is mounted between the two pilots. Attitude controls at the right-hand seat consist of a set of standard foot pedals for yaw control and two-axis side-arm controller used for pitch and roll control. The left hand seat is provided with a three-axis side arm controller. Thrust of the main engines is controlled by either pilot with their left hand using the collective pitch levers. Weight of the vehicle is 12,000 pounds, of which 3300 pounds was hydrogen peroxide fuel, giving a flight duration of slightly less than 8 minutes.³

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The Lunar Landing Research Facility was also used as a lunar-walking simulator for the Apollo astronauts. This was done by suspending the subject on his side so that he was free to generate walking movements on a plane inclined to about 80.5° relative to the vertical direction of earth's gravity. Suspension for the test subject was supplied by a series of slings and cables attached to a lightweight trolley which traveled freely along an overhead track. By varying the angle of the inclined plane it was possible to simulate other gravitational fields. For example, to simulate the condition of weightlessness, the walkway would be moved directly under the track so that the cables were vertical and the test subject horizontal.⁴

is

The base of the Lunar Landing Facility modeled with fill dirt to resemble the actual surface of the Moon. Pock-marked holes, pits, and craters resembled the actual lunar landscape encountered by Apollo 11 when it landed on the Moon in 1969. right?

The Lunar Landing Facility is still intact and retains almost all of its original integrity. The facility is now known as the Landing Research Facility and is used by NASA Langley for aircraft crashworthy studies. The base of the facility has been modified so that the simulated lunar landscape is gone and has been replaced by an impact runway that can be modified to simulate various types of crash environments. The complex cable system that once used to carry the LEM now supports various test aircraft in crash studies. The lunar walkway has been removed. The LEM is still on the site but the main engine and some of the controls have been removed. The original electronics associated with the site are in the process of being upgraded to meet modern requirements of the crash testing program.

Significance

The Lunar Landing Research Facility ~~is significant because it~~ permitted NASA to train the Apollo astronauts to fly in a simulated lunar environment that produced ~~the~~ LEM vehicle dynamics. This training gave Neil Armstrong and others the opportunity to safely experience the dynamics of lunar flight while in a controlled research environment. Experience gained at the Lunar Landing Research Facility enable Neil Armstrong and other~~s~~ to train with a greater degree of confidence on the Lunar Excursion Module free flight training vehicle at Houston and Edwards AFB and eventually to fly to the Moon in 1969.

John F.
The decision by President Kennedy to land a man on the Moon by 1969 meant that NASA had to quickly ~~decide~~ the method of accomplishing the journey. NASA engineers evaluated three means to do this by 1962: direct ascent, Earth-orbit rendezvous (EOR) or lunar-orbit rendezvous (LOR).

determine
Direct ascent to the Moon was ruled out because of the size of the launch vehicle required to accomplish the mission. The EOR concept was ruled out because two launch vehicles were required to meet mission requirements. NASA chose the LOR concept which called for a single rocket to launch two spacecraft into lunar orbit where one would remain in orbit while the other would descend to the Moon. The vehicle on the Moon would then boost itself back into lunar orbit, rendezvous and dock with the mother ship, which would then return to the Earth.

that
While this was a bold plan that held out the promise of achieving a lunar landing by 1969 it presented many technical difficulties. The LOR plan was based on the premise the NASA trained astronauts could master the techniques of landing the LEM on the lunar surface and returning to orbit and docking with the mother ship. The Lunar Landing Research Facility was designed to solve one part of this problem, that is, how to land men on the surface of the Moon. The need for such a facility arises from the fact that there is no direct parallel between the unique piloting problems of the LEM and normal aircraft operating in Earth's atmosphere. Conditions encountered by the LEM were different due to the Moon's lack of an atmosphere and low gravitational force. For example, a vehicle operating in the vicinity of the Moon requires the use of control rockets which are operated in an on-off manner, thereby producing abrupt changes in control torques rather than the smoothly modulated controlled torques of a helicopter. Furthermore, inasmuch as the LEM hovers with a thrust equal to its weight, the lunar vehicle hovers with only one-sixth of the thrust required to hover the same vehicle in Earth's gravity. As a result, the control system characteristics in translation are markedly different from those of an Earth vehicle, thus precluding the extrapolation of results in Earth conditions to lunar conditions. 5

Experiences gained by the Apollo astronauts on the Lunar Landing Research Facility indicated that it was possible to successfully master the complicated skills that were required to land ~~the~~ the LEM on the Moon. Both Neil Armstrong and Edwin Aldrin trained here for many hours. Only when they successfully master skills necessary to fly the LEM would NASA approve plans for their historic first landing on the Moon in July 1969.

Because of this, the Lunar Landing Research Facility was an indispensable tool that enabled NASA to land a man on the Moon by 1969.

Footnotes

1. Donald E. Hewes, Reduced Gravity Simulator For Studies of Man's Mobility In Space And On The Moon, Report Presented at the Human Factors Meeting, Dayton, Ohio, October 18-21, 1965 (Hampton, Va.: Langley Research Center, 1965), p. 3.
2. Ibid.
3. Ibid., 4.
4. Ibid., 1-2.
5. National Aeronautics and Space Administration, Lunar Landing Research Facility (Hampton, Va.: Langley Research Center, 1969), pp. 1-2.

at least the chief has spoken

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Separator?

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United States Department of the Interior
National Park Service

For NPS use only

National Register of Historic Places Inventory—Nomination Form

received

date entered

See instructions in *How to Complete National Register Forms*
Type all entries—complete applicable sections

1. Name

historic Lunar Landing Research Facility

and/or common Landing Research Facility(Also Impact Dynamics Research Facility)

2. Location

street & number Langley Research Center

not for publication

city, town Hampton

vicinity of

state Va.

code

county

code

3. Classification

Category	Ownership	Status	Present Use	
<input type="checkbox"/> district	<input checked="" type="checkbox"/> public	<input checked="" type="checkbox"/> occupied	<input type="checkbox"/> agriculture	<input type="checkbox"/> museum
<input type="checkbox"/> building(s)	<input type="checkbox"/> private	<input type="checkbox"/> unoccupied	<input type="checkbox"/> commercial	<input type="checkbox"/> park
<input checked="" type="checkbox"/> structure	<input type="checkbox"/> both	<input type="checkbox"/> work in progress	<input type="checkbox"/> educational	<input type="checkbox"/> private residence
<input type="checkbox"/> site	Public Acquisition	Accessible	<input type="checkbox"/> entertainment	<input type="checkbox"/> religious
<input type="checkbox"/> object	<input type="checkbox"/> in process	<input checked="" type="checkbox"/> yes: restricted	<input checked="" type="checkbox"/> government	<input checked="" type="checkbox"/> scientific
	<input type="checkbox"/> being considered	<input type="checkbox"/> yes: unrestricted	<input type="checkbox"/> industrial	<input type="checkbox"/> transportation
		<input type="checkbox"/> no	<input type="checkbox"/> military	<input checked="" type="checkbox"/> other: Air crash worthy site

4. Owner of Property

name National Aeronautics and Space Administration

street & number

city, town Washington, D. C.

vicinity of

state

5. Location of Legal Description

courthouse, registry of deeds, etc.

street & number

city, town

state

6. Representation in Existing Surveys

title None (2) [let's say so throughout if this is the case] has this property been determined eligible? yes no

date federal state county local

depository for survey records

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LANGLEY RESEARCH CENTER
LANGLEY STATION
HAMPTON, VIRGINIA 23365
Phone: 703 722-7961, Ext. 4866

LUNAR LANDING RESEARCH FACILITY

The Lunar Landing Research Facility is a simulator built to enable us to study the piloting problems of the final phase of the lunar mission.

The need for such a facility arises from the fact that there is no direct parallel between the unique piloting problems of the lunar vehicle and normal flying machines operating in the earth's atmosphere. The final phase of the landing maneuver is frequently compared with the landing approach of a helicopter; however, the conditions that will be encountered by the Apollo Lunar Module (LM) are appreciably different due to the moon's lack of atmosphere and low gravitational force.

For example, a vehicle operating in the vicinity of the moon requires the use of control rockets which generally will be operated in an on-off manner, thereby producing abrupt changes in control torques rather than the smoothly modulated control torques of a helicopter. Furthermore, inasmuch as a vehicle hovers with a thrust equal to its weight, the lunar vehicle hovers with only one-sixth of the thrust required to hover the same vehicle in earth's gravity. As a result, the control system characteristics in translation are markedly different from those of an earth vehicle, thus precluding the extrapolation of results in earth conditions to lunar conditions.

This facility permits us to fly a vehicle similar to the Apollo Lunar Module in a simulated lunar environment that produces true vehicle dynamics.

The equipment that provides this simulation consists of a manned rocket-powered vehicle suspended by vertical cables from a traveling crane supported on a 250-foot high gantry. A servo-controlled hoist system provides lunar gravity simulation by applying a vertical force to the support cables equal to five-sixths of the vehicle's weight to oppose the pull of earth gravity and simulate the low gravitational force at the moon's surface. Furthermore, the traveling crane is automatically controlled to follow the vehicle's linear motions in order to keep the support cables vertical. This is necessary to prevent the application of extraneous forces on the vehicle. The value of the vertical force can be varied to extend the utility of this facility by enabling us to simulate gravitational fields of planets other than the moon.

Safety features are provided in this facility to prevent the vehicle from crashing or the bridge crane from exceeding its operational limits in the event of equipment failure or pilot error.

The standup pilot's compartment you see on the vehicle has been recently installed to enable us to simulate the pilot orientation of the LM. A flight test program will be initiated to study the piloting problems imposed by this configuration.

Our previous research programs, performed with the pilot oriented in a sitting position, have contributed to an understanding of piloting problems and verification of the concept of the LM. The results have indicated, for example, that the pilots do not prefer to make gross maneuvers at altitudes below 30 to 50 feet. They prefer to fly an inclined flightpath until hover conditions are reached close to the ground. The flight test programs have been

conducted using Langley research pilots and astronauts. The astronaut participation has given them an opportunity to safely experience the dynamics of a lunar landing vehicle prior to their operation of the free flight training vehicle at the Manned Spacecraft Center, Houston, Texas. The overall experience we have gained to date indicates that the landing approach to the moon can be successfully performed despite the unusual control problems imposed by the lunar environment.

#

Appendix 1

ASTRONAUTS TRAINED AT
LUNAR LANDING RESEARCH FACILITY

Armstrong, Neil A.
Aldrin, Edwin E., Jr.
Anders, William A.
Bean, Alan L.
Borman, Frank
Carr, Gerald P.
Cernan, Eugene A.
Chaffee, Roger
Cooper, L. Gordon, Jr.
Conrad, Charles
Duke, Charles M.
Engle, Joe N.
Haise, Fred W., Jr.
Irwin, James R.
Lovell, James A., Jr.
McDivitt, James A.
Mitchell, Edgar D.
Schmitt, Harrison H.
Schweickart, Russell L.
Scott, David R.
Shepard, Allen B., Jr.
Stafford, Thomas P.
Williams, C. C.
Young, John W.

REDUCED GRAVITY SIMULATOR FOR STUDIES OF MAN'S MOBILITY

IN SPACE AND ON THE MOON

By Donald E. Hewes

NASA Langley Research Center
Langley Station, Hampton, Va.

Presented at the Human Factors Meeting

Dayton, Ohio
October 18-21, 1965

REDUCED GRAVITY SIMULATOR FOR STUDIES OF MAN'S MOBILITY

IN SPACE AND ON THE MOON

By Donald E. Hewes

NASA Langley Research Center

INTRODUCTION

Due to the urgent nature of our national space program and the many unknown facets of man operating in space, there have been many parallel efforts carried out in recent years to develop methods for duplicating the environmental characteristics of space here on earth under controlled laboratory conditions. Many of these efforts have been fruitful and provided a spectrum of simulation facilities, each with unique performance characteristics and limitations. The purpose of this paper is to describe briefly the different facilities developed by the Spacecraft Research Branch of the Langley Research Center to study specifically the problems of man's mobility in space. We speak here of space as pertaining to any place outside the atmospheric veil of our planet; thus, we are concerned with situations ranging from man walking inside an orbiting space laboratory, to man landing a vehicle on the moon, or to man carrying heavy loads across the Martian terrain. I will attempt to discuss briefly the principal features of the three current specialized reduced-gravity simulators, to outline current research objectives, and to illustrate some typical test results performed in two of the facilities.

DISCUSSION OF FACILITIES AND RESEARCH OBJECTIVES

The simplest of the three simulators is the one commonly referred to as the lunar-walking simulator because it was developed specifically to study the problem of studying man's self-locomotive ability on the moon. There are, however, other applications of this facility which will be mentioned momentarily.

This simulator produces the gravitational equivalent of the moon, or any other place where the gravitational field is less than that of earth, by suspending the subject, as shown in figure 1, on his side so that he is free to generate body locomotive movements in a plane inclined with respect to earth's gravity vector. In the case of simulated lunar gravity, the body members move at about 80.5° relative to the vertical direction, so as to encounter a component equal to one-sixth of the gravity vector. As shown in figure 2, suspension is provided by a series of slings and cables attached to a lightweight trolley which travels freely along an overhead track. This track runs parallel with a walkway that is inclined 9.5° from the vertical and serves as the ground plane over which the subject travels. Other gravitational fields less than earth gravity are simulated merely by displacing the walkway parallel to the track so as to change the inclination of the subject and support cables to the appropriate angle. Of course, the inclination of the walkway would also be adjusted to match. To simulate the condition of weightlessness, the walkway

would be moved directly under the track so that the cables are vertical and the subject horizontal.

Long cables of about 150 feet permit the subject to jump to maximum heights, up to about 12 feet, with only a slight distortion of the simulated gravity. This distortion is caused by the changing inclination angle of the cables as the subject swings out from the walkway. Corrections can be applied easily to the test results, when necessary, to compensate for the small gravity distortion present. The lightweight trolley is unpowered and employs low friction bearings, and, consequently, imposes a negligible restraint on the subject as he moves along the walkway.

Operation of the facility is simple and is best demonstrated by the following motion-picture scenes which illustrate a test subject walking, loping, and sprinting in the simulator adjusted to produce lunar gravity. The pictures are taken with a telephoto-camera mounted on the overhead gantry structure which supports the trolley track. The camera is pointed downward and operated by a cameraman so as to keep the subject within the field of view of the camera as he first walks, lopes, and then runs.

Objectives of the current research program for this facility are to evaluate performance of the lunar explorers both with and without their space suits while carrying various sizes of equipment loads. An additional program is being initiated to explore the use of back-pack type of rocket propulsion units to assist travelers over lunar terrain obstacles and to extend the traveler's range of operation.

Figure 3 summarizes some typical test results where the average variations of stride and stepping rate of three test subjects with speed of locomotion are shown for the simulated lunar gravity and are compared with those for the same three subjects performing in earth gravity. These tests were performed while wearing lightweight coveralls, rubber soled shoes, and a helmet. The comparison shows some significant differences between lunar and earth locomotion. For instance, both maximum lunar walking and running speeds were about 60 percent of the corresponding earth rates; also, for a given speed, the lunar stride was generally greater and the stepping rate was less than their earth counterparts. These data, along with the test subjects' comments, indicate that the effort involved in lunar activity is significantly less than that required for corresponding activity on earth.

In a subsequent paper, Dr. Walter Kuehnegger of the Northrop Space Laboratories will discuss further work under a NASA study contract utilizing a similar facility directed toward obtaining accurate metabolic, biomechanical, and other physiological data pertaining to lunar locomotion. Preliminary information from this work tends to substantiate the present test results.

The second type facility in use at Langley is a rotating space station simulator which employs a modification of the lunar-walking technique. Studies of man's ability to walk and work effectively in the environmental conditions of a space station rotating to produce artificial gravity are currently under way.

The setup of the simulator is illustrated in the photograph of figure 4. First, to produce the condition of weightlessness in space, the subject is supported in the same manner as previously discussed except that he is inclined on his side at 90° from the vertical so that all body members move at right angles to earth's gravity vector. The overhead trolley is mounted on a boom that follows the subject, so that he is free to walk around on the inner periphery of the circular walkway. Secondly, the condition of rotation is produced by an adjustable speed drive motor which rotates the platform on which the walkway and support boom are mounted.

Use of this facility is directed toward studying two aspects of space station operations. First is the evaluation of problems of vestibular disturbances which arise from the combination of angular motions about different axes resulting from work activity. These combined motions cause the vestibular sensors of the ears to generate distorting and nauseating reactions under some conditions. The objective of the research effort is to determine the effects of station diameter and rotational rate on threshold limits of the combined motions which generate the difficulties. Secondly, studies are being carried out to evaluate the effects of station diameter, rotational rates, and various station design features on the ability of the inhabitants to move from one portion of the station to another. The various design features include the use of stairs, ramps, ladders, poles, and hand grips.

The third simulator operated by the Spacecraft Research Branch is the lunar landing research facility, shown in figure 5, used to study the problems of flying a vehicle in lunar gravity and landing on the surface of the moon. For these studies a full-scale operational vehicle, similar to the Apollo Lunar Excursion Module or LEM, is flown by experienced research test pilots and astronauts under conditions of simulated lunar gravity. Simulation of lunar gravity is achieved by employing an overhead partial-suspension system which provides a lifting force by means of cables acting through the vehicle's center of gravity so as to effectively cancel all but one-sixth of earth's gravitational force. The lifting force and vertical alignment of the cables are controlled automatically through the action of servo-controlled hydraulic drive systems which power the overhead traveling bridge crane and dolly unit mounted on the large gantry structure. The bridge follows down-range motion of the vehicle, and the under-slung dolly follows in the cross-range direction.

The cables are attached to the vehicle by means of a gimbal system which provides freedom of motion in pitch, roll, and yaw, as shown in the photograph of figure 6. This system consists of a swiveled-truss assembly directly over the cab and two vertical struts attached to the vehicle on its pitch axis. Load cells are carried in the vertical struts to sense cable force for the lift servo system, and cable angle sensors are mounted on the bottom of the dolly to provide error feedback signals for the bridge and dolly servo drive systems. Automatic braking equipment built into the servo drive units provides an extra safety feature unique to the particular facility. An aerial photograph of the facility is shown in figure 7 to illustrate the large size of the structure which can be compared with automobiles parked beside the operations building near the structure. The flight vehicle is on the ground beneath the bridge-crane unit at the left. The structure is 240 feet high and the vehicle can fly in a space of about 180 feet high, by 360 feet long, and 42 feet wide. This

space is adequate for evaluating the vehicle handling characteristics for flight near the lunar surface and for touchdown.

The vehicle, shown next in figure 8, was constructed with many pieces of off-the-shelf equipment, such as the H-13 helicopter cabin and the H-34 landing-gear shock struts, so as to facilitate design, construction, and maintenance of the vehicle. Nitrogen gas is used for pressurizing the fuel system which supplies 90 percent hydrogen peroxide to the main lifting rocket motor assembly and the 20 attitude rocket motors located around the periphery of the vehicle frame. The cab has provisions for two test pilots, each with a complete set of controls. A common instrument panel is mounted between the two pilots, as shown in figure 9. Attitude controls at the right-hand seat consist of a set of standard foot pedals for yaw control and two-axis side-arm controller, of the pencil type, used for pitch and roll control. The left-hand seat is provided with a three-axis side-arm controller similar to the one intended for actual LEM use. Thrust of the main engines is controlled by either pilot with their left hand using the collective pitch levers. Weight of the vehicle is 12,000 pounds, of which about 3500 pounds is hydrogen peroxide fuel, giving a flight duration of slightly less than 3 minutes.

The objective of current research program employing this simulator is to evaluate the pilot handling-qualities criteria for manned lunar flight vehicles and determine the effects of various vehicle design and operational factors, such as out-of-the-window visibility and sharing of piloting tasks and responsibilities. This effort is being applied directly to the Apollo Lunar Excursion Module and is also aimed at providing basic information for second generation projects likely to follow the Apollo mission. The present vehicle, which was designed and built at least 1 year before the LEM concept became an approved program, bears a close family resemblance to the LEM arrangement, as illustrated in the sketch of figure 10, and duplicates many of the pertinent LEM system characteristics. However, so as to provide an even closer simulation, steps are currently under way to revise the vehicle to include an exact replica of the interior arrangement of the LEM cab. Subsequently, major modifications to the vehicle will be made so as to evaluate various other possible configurations for a second generation type vehicle. By making only minor adjustments in the servo system electronics, this facility can be adapted to study similar type problems for the conditions of spaceflight and landing on other planets such as Mars.

Preliminary results from the current flight-test program, which has provided over 37 flights with a total time in simulated lunar gravity of about 2 hours, show that the vehicle can be controlled and landed safely with characteristics matching those of the LEM vehicle. These initial flights have been performed using Langley research test pilots and the current program includes the use of the astronauts to provide a direct input of their experience and background for this program, as well as to provide them with some realistic-type lunar flight experience prior to their actual lunar mission.

SUMMARY

In summary, we have reviewed three unique reduced-gravity simulators currently in use at the Langley Research Center and discussed briefly their application. It must be remembered that these facilities were built to study particular problems but as these problems are resolved the features and modes of operation of the facilities most likely will be altered so as to make them useful tools for studying new and as yet unforeseen problems we will be encountering as we continue in our quest of space.

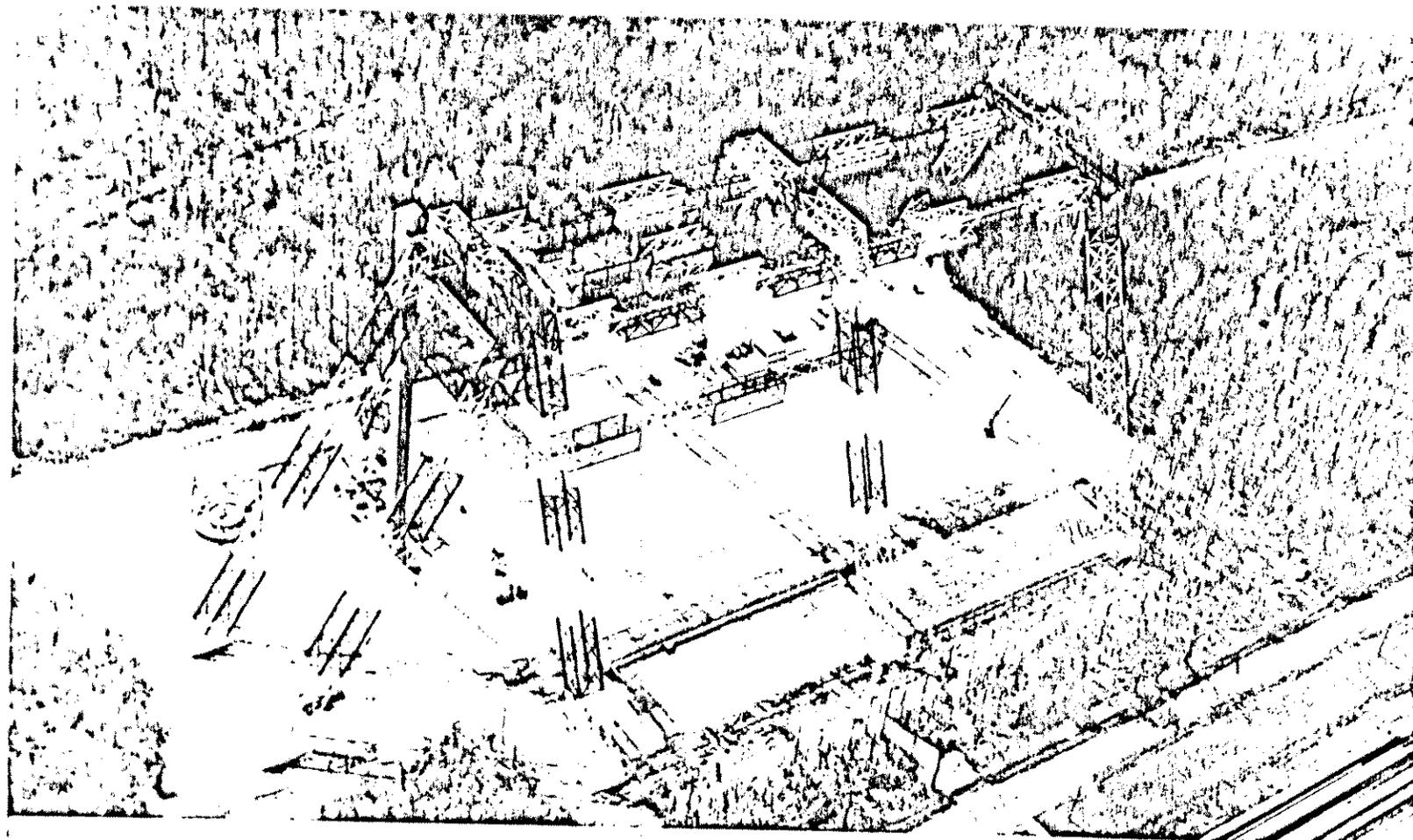


Figure 7.- Aerial photograph of the lunar landing research facility.

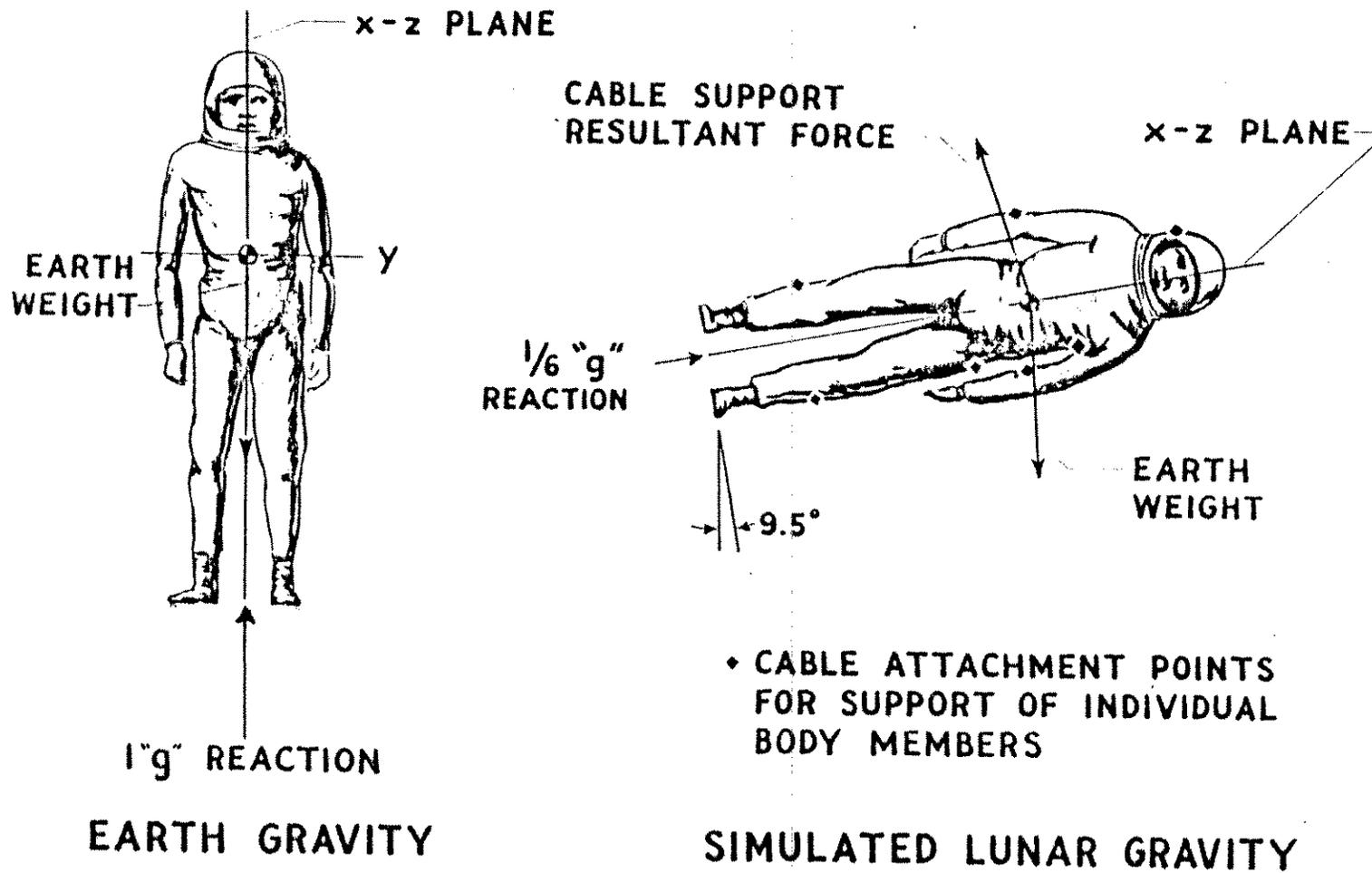


Figure 1.- Illustration of lunar gravity simulation technique for self-locomotive studies.

MAN SELF-LOCOMOTION STUDIES

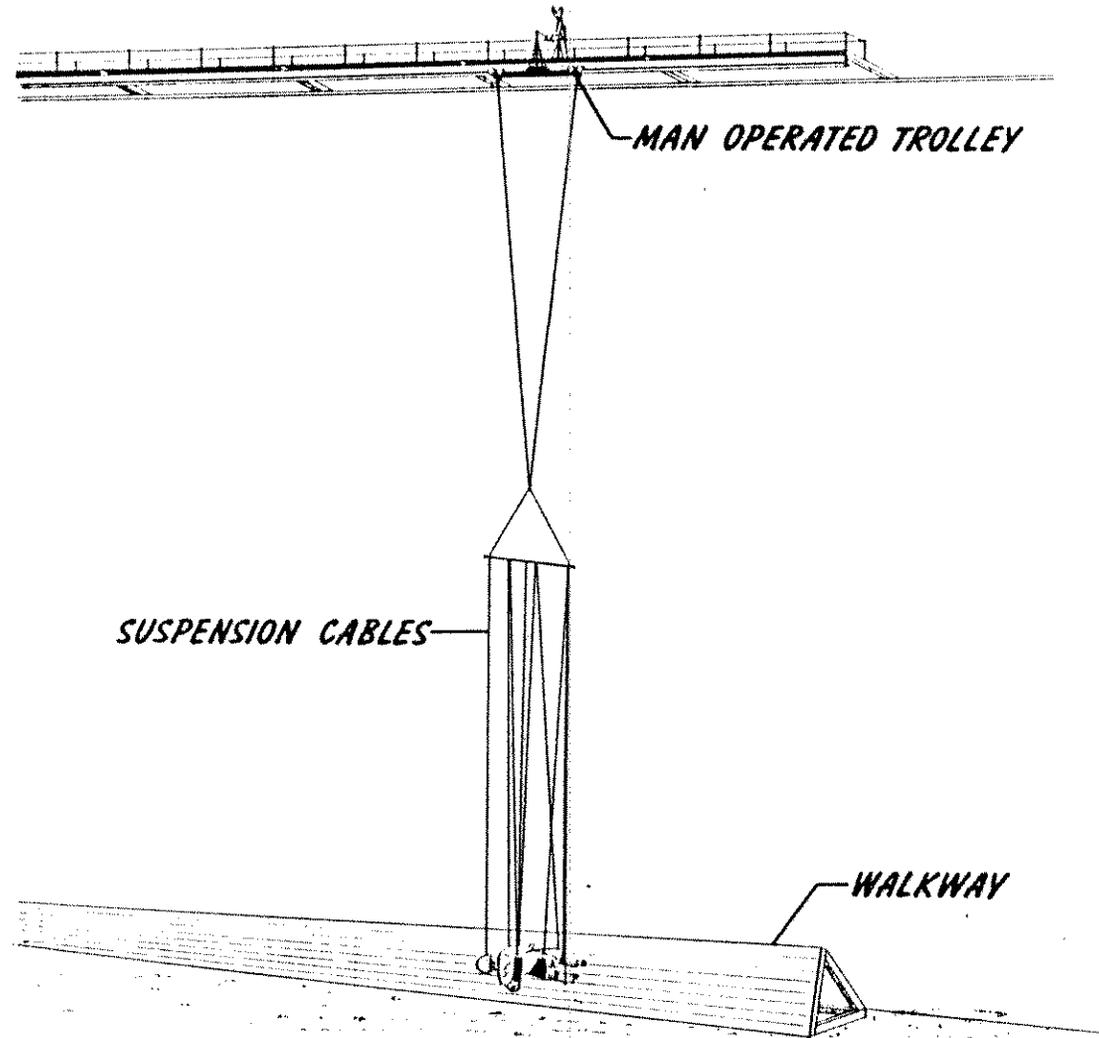


Figure 2.- Sketch illustrating the lunar walking simulator.

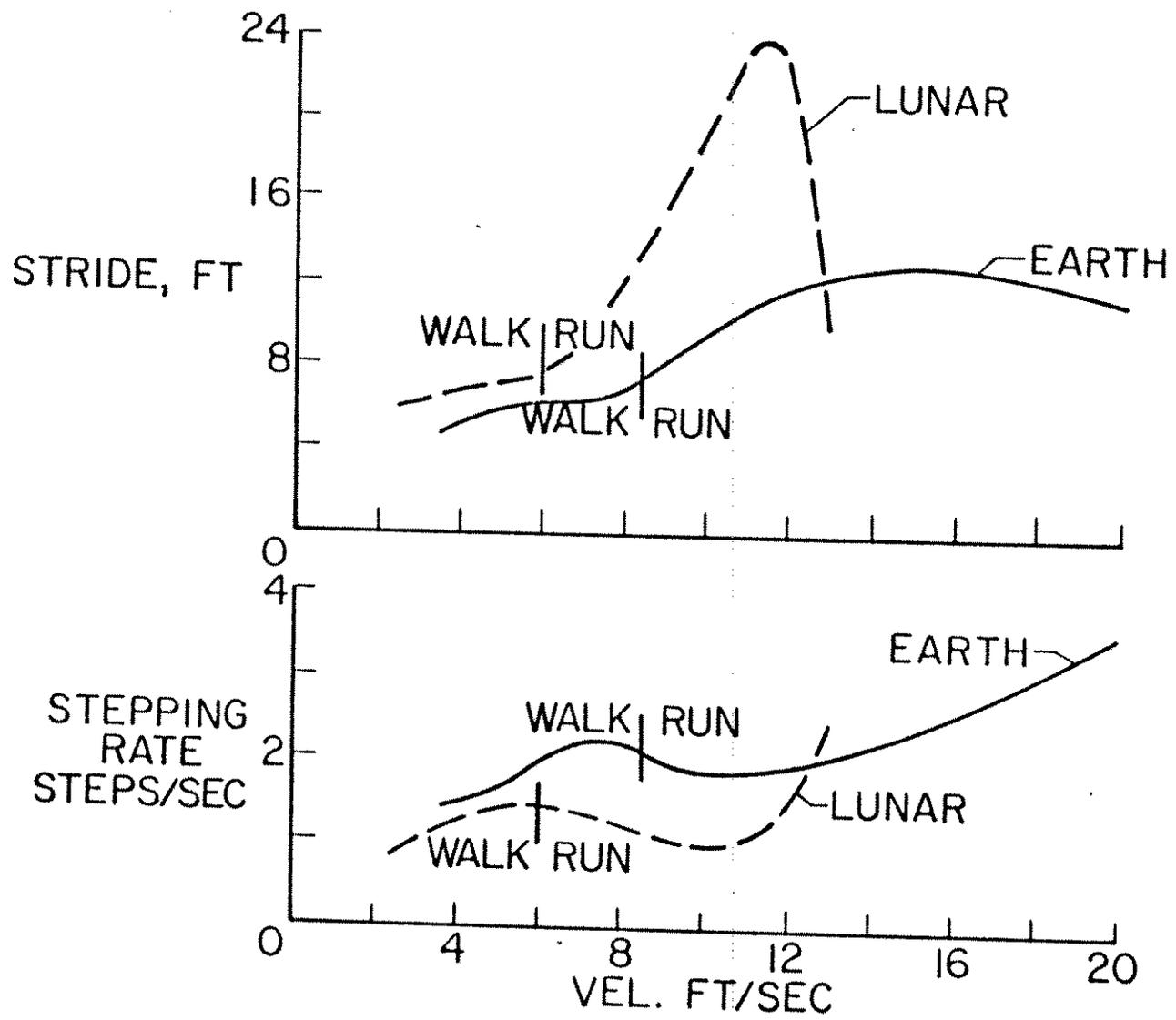


Figure 3.- Some test results obtained using the lunar walking simulator.

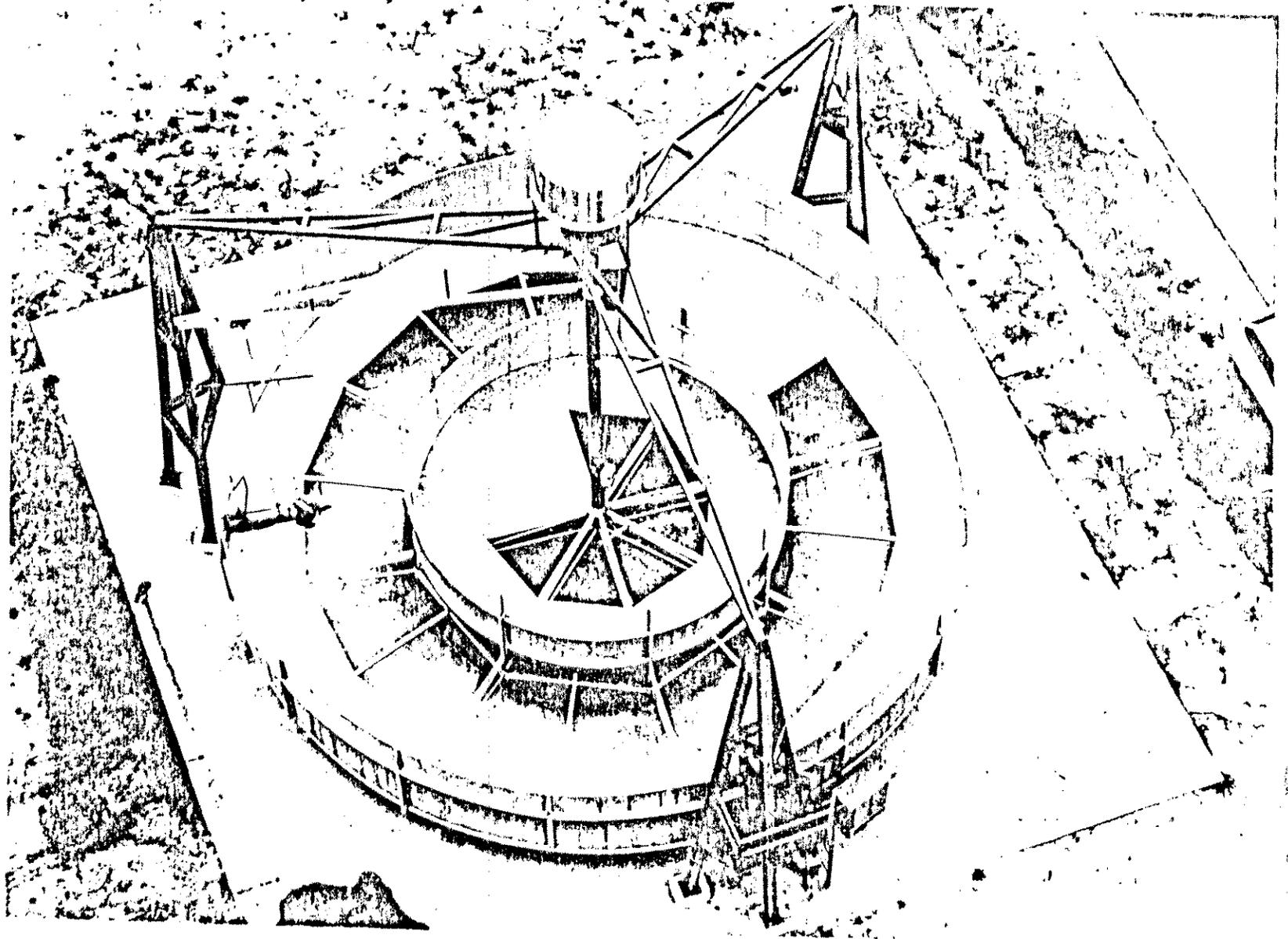


Figure 4.- Photograph of the rotating space station simulator.

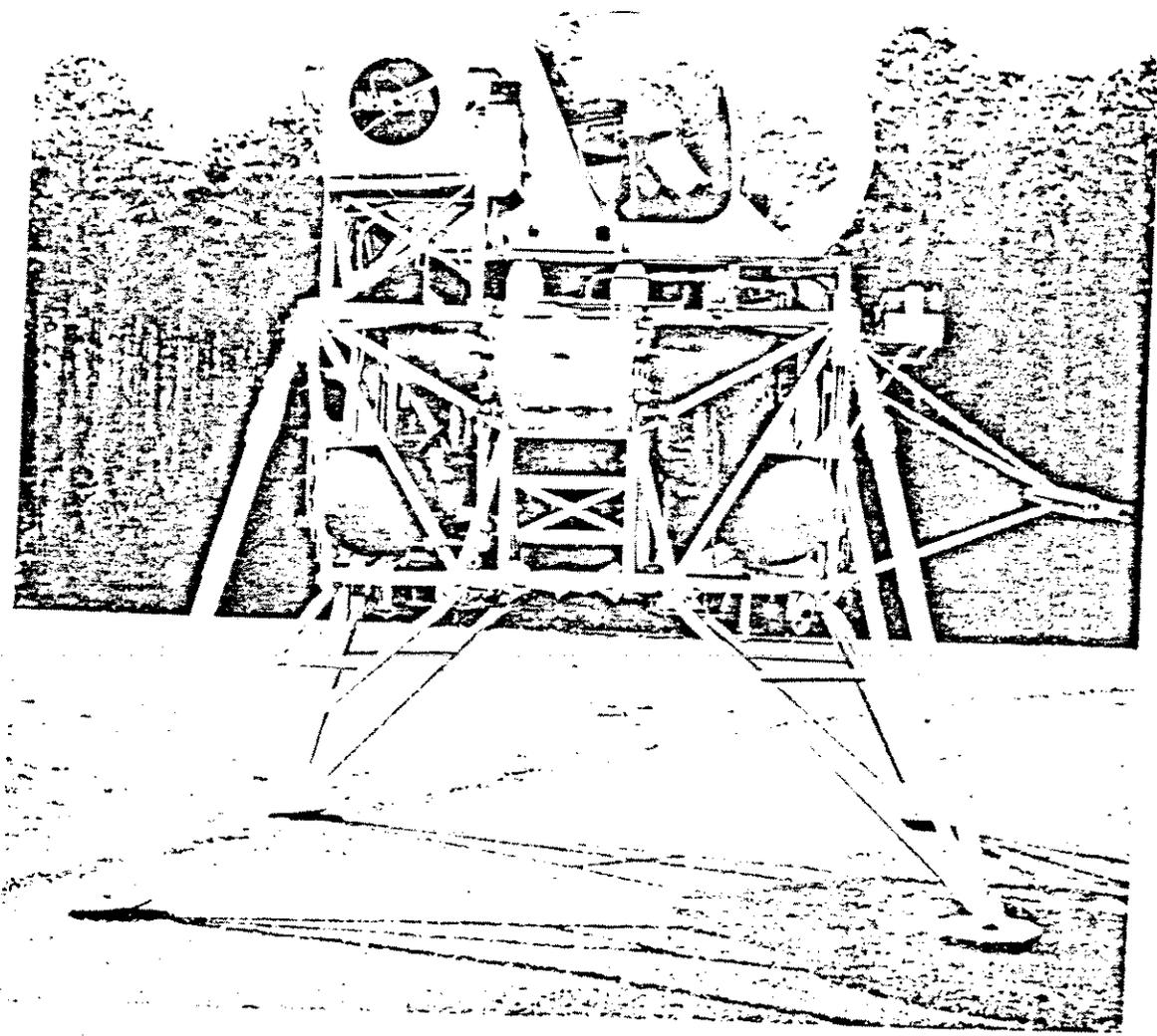
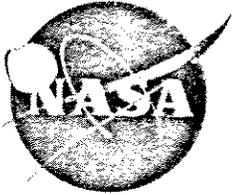


Figure 8.- Photograph of the research vehicle.



LANGLEY RESEARCH CENTER
ANNOUNCEMENT

No.

39-69

DATE

June 24, 1969

SUBJECT: Restriction of Access to the Lunar Landing Facility
Test Site

The Lunar Landing Facility at the Center is being employed for the training of astronauts in preparation for the actual lunar landings. Extensive effort has been given to simulate actual conditions in as much detail as possible. These research tests are conducted during the evening darkness in order to permit the generation of artificial light which simulates conditions anticipated on the lunar surface.

The presence of light sources, groups of people or automobiles severely reduce the value of these tests, and exposes observers to hazards which cannot be controlled. The possibility of objects falling from the gantry supporting the test vehicle or the discharge of hydrogen peroxide from the vehicle are readily identifiable as possible hazards.

Therefore, it is necessary that we limit access during these tests at the Lunar Landing Facility to those who are officially assigned duties associated with the tests.

The cooperation of the staff will be appreciated.

T. Melvin Butler
Assistant Director for
Administration

cc:
Each Employee