ROUGH DRAFT

HISTORY OF DISCOVERE

APPENDIXES C, D, E AND F

HISTORY OFFICE
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HISTORY OF DISCOVERER

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APPENDIX C

HOLD FOR RELEASE
UNTIL LAUNCH

BIOMEDICAL SPACE SPECIMENS

FACT SHEET

[Launched 6-3-1959; No recovery]

The four black mice that will be passengers aboard the DISCOVERER III satellite to be launched from California's Vandenberg Air Force Base are not ordinary mice. They are the best specimens of a special strain of hardy laboratory animals, selected and trained specifically for their round trip into space and planned return to earth. This unique biomedical experiment is being conducted by the Bioastronautics Directorate of the Air Force Ballistic Missile Division.

The mice will be borne into orbit inside a special life capsule in the DISCOVERER III payload. Plans are to return the mice to earth by means of recovery devices carried in the payload. If recovery is successful, the mice will be returned to Vandenberg and then to the Aeromedical Field Laboratory at Holloman Air Force Base where they are born.

If the satellite is successful, the mice will be the first known living beings in the world to orbit the earth in space and return safely. Their trip will furnish a mass of data for application to later programs, including man in space.

Mice were selected as the first round-trip biomedical specimens because of their stable reactions and convenient size and weight. The particular strain of mice has the genetic code name of C-57. Unlike ordinary mice, the C-57 clan of laboratory mice have a fully documented history showing unusual strength, hardiness, adaptibility and stability.

The strain was first developed at Jackson Laboratories in Bar Harbor, Michigan, in 1933. A third-generation colony was later established

(MORE)

at the University of California's Cancer and Genetics Laboratory in Los Angeles. From this colony, C-57's were supplied to Holloman, where the birth of an additional three generations brought the C-57 genealogy to the present time. Of this sixth generation colony at Holloman, 60 mice in number, most were selected for the trip to Vandenberg and the DISCOVERER III launch site. A few hours before the launch, four mice will be selected. The sex of the C-57's will not be a factor in selection. The four space mice chosen will be eight to nine weeks old and in prime physical condition.

The C-57 strain are of normal dimensions, with one exception. They average 20-22 grams in weight and 2 3/4 inches long, less tail, but they measure about an inch wide - a considerable girth for a mouse. However, the heavy-set build of the C-57's is due to their unusual muscular strength. The C-57's are considerably stronger than the average laboratory or field mice.

The only special training given the C-57's concerns use of the food and water devices aboard the life cell. When the mice arrived at Vandenberg, they were placed in the capsule for increasing periods of time, the first lasting two hours or so, to accustom the tiny animals to their space home.

In the Air Force biomedical vans at Vandenberg where the waiting mice live, temperature is controlled to within five degrees of seventy-five degress fahrenheit. Relative humidity stays between thirty-five and fifty percent, and no humans with colds or other minor ailments are allowed in the vans. Upon their arrival at Vandenberg, the C-57's switched from their usual diet, consisting

of a standard brand of dog meal, to a special menu - a preparation made of oatmeal, orange juice, ground unsalted peanuts, and gelatine, mixed and measured in exact amounts. This pre-flight diet is similar to an athlete's careful pre-game meal, although no physical feats will be required of the mice in space.

The life capsule, the recovery system, and the fully controlled environment of the life support system are made by Lockheed Missiles and Space Division, prime contractor for the DISCOVERER project. General Electric particpated as a sub-contractor. The life support system includes a mouse-sized oxygen bottle, an air conditioner, and a variety of instruments to monitor and send back complete behavior and reaction data on the C-57's. If recovered successfully, the mice will undergo an immediate medical checkup at Vandenberg before going back to Holloman for another exhaustive checkup and extended observation.

This attempt to develop a complete artifical environment to sustain life in space, and to return the mice to earth, is a joint program. The DISCOVERER III project includes the efforts of the Air Force Ballistic Missile Division; the Air Force School of Aviation Medicine at San Antonio, Texas; the Aeromedical Laboratory of Wright Air Development Center, Ohio; the Aero-Medical Field Laboratory at Holloman Air Force Base in New Mexico; Lockheed, who developed and built major portions of the life-sustaining satellite; and the General Electric Company, Philadelphia. The entire project is under the direction of the Advanced Research Projects Agency.

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Sincerest Condolences
to Thee.
OUR DEPARTED FRIENDS OF
DISCOVERER III
— from the ARMY
MONKEY.

APPENDIX D

NOTES AND EDITORIAL BACKGROUND FOR PRIMATE LAUNCH

1. Animal.

The animals to be used in the bio-astronautic experiments to be conducted as part of Project Discoverer are American-born Macaca Mullata monkeys, more commonly known as Rhesus. The colony of space monkeys is maintained for the Air Force at the University of Texas -- USAF Radio-Biology Laboratory, Balcones Research Laboratory, Austin, Texas. This activity falls under the cognizance of the Aerospace Medical Center, School of Aviation Medicine, Air Training Command, Brooks Air Force Base, Austin, Texas. This activity is being carried on as a support activity of the Air Training Command to the Air Force Ballistic Missile Division, ARDC.

The key individual associated with this undertaking is Dr. W. Lynn Brown, Professor of Psychology, University of Texas and Head of Experimental Psychology for the bio-astronautics portion of the Discoverer program. Dr. Brown is one of the U. S. pioneers in the field which encompasses the training of animals to perform psychomotor functions under various environmental conditions. He was one of the first to maintain that monkeys, a species of animal which does not lend itself to restraint, could be effectively used in this type of experiments. Dr. Brown was responsible for the training of MR. SAM, the USAF space monkey which was launched in a ballistic trajectory and was recovered in the NASA Little Joe test.

Althcugh the Radio-Biology Laboratory maintains the largest colony of Rhesus monkeys in America, we will not deal with this information in connection with the Discoverer program. The majority of these animals are being used in other classified and unclassified Air Force research programs all of which are extremely sensitive. For our purposes, we will deal with the space monkey colony which at this counting numbers 31 animals, all designated by a number followed by the letter "X", which have been born in captivity at the laboratory. There are a handful of other animals designated by the suffix "Y" following the number, which have been born elsewhere in the United States and have been purchased by the laboratory.

The three primary candidates for the first Discoverer launch are, at the time of this writing, 21X, 20X, and 3Y. In the order given, they are first, second and third choice candidates. 21X is a female, born on 26 January 1959 (present weight 4 pounds); in the University Colony; her parents were C4 and A4.

20X is a female, born 22 January 1959 (present weight 5 pounds); in the University Colony; her parents were 299+ and 893.

3Y is a male, born 14 April 1958, at Shamrock Farms, Middletown, New York; (present weight 5 pounds).

According to Dr. Brown, the criteria for selection of the space candidates are: emotional stability, performance, weight and physical condition.

All the specimens must be between four and five and a quarter pounds at launch. They must be in perfect health. In applying the other two criteria, Dr. Brown points out that they naturally would like to fly the best performer but that selection on this basis alone is not appropriate. They must combine optimum performance with optimum emotional stability. The best performer sometimes tends to react adversely under emotional pressure. Therefore, it is important to strike a happy medium. If, in the end analysis, the best performer does not appear to be entirely dependable --- that is, would not continue to perform his psychomotor tasks over an extended period, when effected by the environmental stresses of space flight --- another specimen whose excellence in performance might be slightly lower, would be selected on the basis of greater dependability.

This is the case in the selection of 21X over 20X. One's performance exceeds that of the other, but the other has proved to have greater emotional stability and can therefore be depended upon to provide more and better data over the full time span of the actual flight test.

The Rhesus monkey has been selected for these experiments over other species of primates because he is exceptionally hardy, is basically inquisitive, and to quote Dr. Brown, "is spunky."

In comparison, chimpanzees are inclined to brood and to pout. A chimpanzee, once he learns to solve a problem becomes bored with the problem and will no longer perform. The Rhesus, on the other hand,

once he learns the solution to a problem continues to react to outside stimuli and continues to perform. The Rhesus, states Dr. Brown, is in his opinion the best for testing psychological reactions. The Rhesus is also a monkey born in temperate climate and therefore is physically more adaptable to the range of temperatures which will be encountered in manned space flight. He is neither excessively sensitive to heat nor cold.

Dr. Brown relates this anecdote which underlines the intelligence and inquisitiveness of the Rhesus: "They are so smart", he says, "that when one gets out of his cage, that one will go about the room letting out all the others."

It became necessary at the laboratory to devise a special latch that the monkeys could not unfasten. Before this was devised, on several occasions, one animal would succeed in unlatching his own cage and would go around his bay, an area housing perhaps 25 individual cages and let out all the rest of them. The result, needless to say, was approaching chaotic. Additional interesting background on this particular species includes the fact that foreign-born animals are wild and inclined to be vicious. They have long, extremely sharp incisors as powerful and dangerous as the fangs of a wolf.

Full grown Rhesus monkeys weigh 40-50 pounds, stand 3 to 4 feet high and are as strong as a man. All of the foreign-born animals in the

colony must be handled by male animal caretakers who use heavily padded gauntlets to protect their hands and arms. The American-born space monkeys, however, are relatively docile. Most of them can be handled with the bare hands and although they will occasionally nip their handlers, they do so only when frightened. 21X and 20X are so docile, in fact, that even the female technicians handle them like pets. This, by the way, is frowned upon because one of the first rules of animal research is not to form emotional attachments.

Dr. Brown is assisted at the Radio-Biology Laboratory by a staff of Air Force personnel of the School of Aviation Medicine. Those who should be identified as making significant contributions to this program are: Dr. (Major) Robert Young, Head of Veterinary Services; Dr. (Captain) Donald B. Geisler, Assistant Head of Veterinary Services; and L/Col Daniel B. Williams, USAF Contract Monitor. One additional individual on the staff of the University of Texas who should be identified editorially and who is identified visually in the still and motion picture coverage, is Dr. Hugh C. Blodgett, Chairman of the Department of Psychology at the University of Texas and Research Scientist of the Bio-Astronautics program of the Discoverer project.

Pre-requisites in the selection of the animals for space flight primarily resolve around a colony of candidates raised under control conditions. The animals in the space colony are given the finest medical attention to be found anywhere. They undergo regular physical examinations including blood tests and analyses of their waste products; they are weighed on a regular schedule and their growth is carefully charted; a complete clinical history of both major and minor weaknesses is kept. They are feed a control diet, a food compounded of grains and vegetable products selected for their nutritional benefits serves as their main diet. This is supplemented with certain fresh fruits and vegetables. They are feed this standardized diet once each day. The laboratory has developed a special machine for processing the principal food. This machine adds molasses to the grain-vegetable master, giving it a malleable consistency and turns the food out formed into cakes weighing exactly one-fourth pound each. In this way their diet also is standardized.

The method by which these animals are trained to perform psychomotor experiments to the environmental stresses of space flight is relatively simple. It is based on the principal that the animal, if he reacts to a visual signal by depressing a lever, is rewarded. In the early training stages, this process is used. Because we cannot continually reward the animal for his performance the second step is to then condition the animal to perform the same actinn not for a reward but in order to avoid the unpleasant sensation of a mild electrical shock. Early in the training program the animals are introduced to the couch-like seat for protective restraint garment with which they will be associated in the actual space flight, a special training device as developed by Dr. Brown which simulates the physical layout of the biomedical capsule.

The animal, installed in his seat and restraint garment is placed in the training chamber and electrical connections are made to a timing device. The timing can be adjusted so that over a period of weeks the time period between the visual signal and the electrical shock can be adjusted as the animals profiency in reacting to the visual signal increases. The animal is then conditioned to pull the handle each time he sees the red light go on. Early in the program it was dis covered that the animals quickly learned that by holding the handle down and not releasing it at all they could avoid the shock. Therefore, the training device wqs modified so that the animal receives the mild shock either if he fails to react to the visual signal or if he fails to release the handle after he pulls it. This insures an animal so trained that in actual space flight he will perform his psychomotor test on "que", at pre-determined times throughout the space flight.

In order to record the animals physiological reactions to space flight minor surgery is performed on the flight and test specimens in which tiny, stainless steel wires, serving as electrodes are anchored to cartilage in the chest, back and groin. These tiny stainless steel wires are then covered with plastic insulation and are led under the loose skin of the animal to a central point where a single lead is brought out through a tiny incision under the arm. The seat is wired to provide connections to these leads and in this manner ground observers will receive by telemetry an EKG of the animal in flight. The seat was also designed so that a chest strap, attached to a potentiometer will provide a record of both the rapidity and the depth of the animals respiration. Ground observers also

will receive via telemetry information on the oxygen level in the bio-pack, the temperature and the humidity being maintained by the life support sustem.

In connection with the bio-pack or life support system, it is important to note that although this was designed and fabricated by the General Electric Missile and Space Vehicle Division in Philadelphia, the designing was controlled largely by criteria developed by the USAF School of Aviation Medicine at Brooks Air Force Base, Texas. In 1958 SAM was given the responsibility by the Air Force Ballistic Missile Division to establish a phychological criteria for the capsule. SAM was also given the responsibility for constant evaluation of the design which was being performed by General Electric. SAM had already, over a period of years, performed exhaustive laboratory experiments to determine, for instance, how many cubic centimeters of oxygen a mouse or monkey would require per hour; for instance, how much CO^2 lithium hydroxide would absorb per hour. SAM, throughout long laboratory experience also could provide, even that early in the program, very exact figures on what the specimen would need in the way of heat, nutrition, humidity and capsule pressure would have to be maintained by the life support system. Actually, SAM had gone so far as to develop a prototype bio-pack. SAM's experimentation with the proto-type bio-pack and Dr. Brown's techniques in training the animals to perform psychomotor tests were found to be easily adaptable to space flight experiments.

The MARK II bio-pack, or life support system provides the following environment:

1. The proper level of oxygen together with a minimum amount of humidity and CO2.

2. An average temperature which ranges between 70 and 85 degrees fahrenheit.

3. Adequate nutrition for the animal over the extended period.

Providing adequate nutrition was a considerable problem in the early stages of design. It was considered to be impracticable to attempt to give the animal water or other liquids under the condition of negative gravity which would be encountered in space. Therefore, some research went into the selection of the ideal nutritional element - one which would provide both food and water to the animal. The solution to this problem was found in the apple. High in food and energy value, fresh apples are approximately 80 percent water, therefore, in the apple both food and water requirements can be provided in an easy to handle form. Next came the problem of providing this food in small increments over an extended period of time. The nature of the monkey is such that if you provide him with the total amount of food he will immediately gorge himself and would go hungry for the rest of the flight. Therefore, a feeder which would give the animal a wedge of apple weighing from 10 to 15 grams once every four hours was developed. From the onset it was decided to make the feeder as simple as possible -- purely mechanical in operation as opposed to one which would require a complex timing mechanism.

Here a popular child's toy was found to be the answer. The silicon substance, known variously as "nutty putty, or "silly putty" which has been a child's play thing for several years was found to have the exact characteristics necessary as a timing element when combined with a simple hydraulic mechanism. The feeder is in the form of a flattened cylinder with pie-shaped compartments -- each compartment holding a wedge of apple.

The cylinder is turned by a spring-loaded ratchet so that with each turn a fresh piece of apple is made available through an opening in the feeder cylinder. Each wedge of apple, by the way, is dipped in paraffin to keep the apple fresh so that it maintains its water content. The actuating mechanism consists of a small tube closed at one end with a very small hole drilled in the closure; a piston which fits tightly into the tube which is actuated by a powerful spring. The tube is then filled with nutty putty. The so called "nutty putty" reacts as an extreme viscous liquid when gradual pressures are applied to it. The rate at which this material was forced out of the small hole was such that it gave the researchers the exact timing necessary. Now, if ordinary hydraulic liquids were used, the "G" forces of the initial acceleration, second stage acceleration, retro-rocket flying, parachute deployment and recovery impact would be such that the liquid in the tube would be prematurely exhausted on the hour when abrupt pressures are applied to the "nutty putty" which acquires the properties of a solid, thus providing just the answer that the technicians needed. The viscosity of the substance is such that it allows the piston to move at a constant rate. As the piston moves, it periodically trips the spring-loaded ratchet providing food on a regular basis for the specimen. Project authorities say that this particular design of the bio-pack is "the most dependable we have found."

There also is a waste problem to be reckoned with. Early in the program several complicated methods of waste disposal were tried. In the final analysis it was discovered that a baby diaper and plastic pants were the answer. Because of the diminutive size of the monkey, by the way, doll-

size plastic pants were used. The source of all of the above information on the design of the bio-pack is Dr. Richard W. Bancroft, Project Officer for Biomedical Support in the DISCOVERER Program, from the School of Aviation Medicine. Dr. Bancroft is considered to be the overall SAM project coordinator for support to BMD on this undertaking and he is an individual who should be identified biographically in material to be released.

The following information concerning the installation came from Mr. Robert Adams, Chief of the Bio-electronic Laboratory at SAM and the man in charge of installation for the bio-astronautic portion of the DISCOVERER Project. Mr. Adams also should be identified in the press material by a picture and biography.

The installation for this program was designed to provide the following data on the animal during the flight:

1. Psychomotor performance
2. Electro-cardiogram (EKG)
3. Respiratory rate
4. Compartment pressure
5. Compartment relative humidity
6. Compartment oxygen pressure and --
7. Photographs of the animal

During space flight all the communications, with the exception of the photography, are transmitted by analogical telemetry. All of this data, except psychomotor response, respiration and EKG are commutated. The camera

is electrically operated and it takes intermittent still films of the animal and thus provides continuous camera coverage over an extended period of time while at the same time occupying minimum space and being of minimum weight. In addition to receiving telemetry on the biomedical specimen during space flight, the recovery capsule has been instrumented to provide this same data during the re-entry phase. The multi-channel tape recorder has been installed in the capsule. On the tape recorder's seven channels during the approximately 30 minute period from re-entry vehicle separation through either air recovery or the first few minutes of emersion in the sea, data on acceleration in three axes -- temperature, respiration, EKG, compartment pressure and accoustic noise will be recorded for recovery along with the experiment.

These notes cover the editorial background acquired during my staff visit to San Antonio and Austin, Texas.

In addition, the following information is provided; the MARK II Biopack with Specimen, ready for flight will weigh approximately 60 pounds. The recovery capsule with MARK II Biopack, instrumentation, parachute, radio becon and flash light will weigh approximately 120 pounds. The re-entry vehicle with capsule, after structure, retro rocket, and associated componentry will weigh approximately 300 pounds. All other information as to DISCOVERER hardware, launch, orbit, re-entry, recovery, and tracking will be identical to that information contained in the Official USAF DISCOVERER Fact Sheet issued for DISCOVERER XVI. [launched 26 Oct 1960]

AFMD - 85988-60

Her periodic physical completed, the animal is weighed by Airman Carter. A careful record of the animal's weight is kept along with a detailed clinical chart on which is recorded all minor as well as major physical disturbances together with medical treatment given.

AFMD - 85975-60

The Air Force space monkey colony has a new member. The mother is not entirely sure that all of this is necessary. However, it is most important that shortly after birth each American-born animal is tatooed with an identification number in order that permanent records may be kept. Dr. Gisler and Airman Carter are assisted by A/1C George W. Bigley also a veterinary technician.

AFMD - 85956-60

Little 31X, the 31st potential space member to be born in the Air Force primate colony at the Radio-Biology Laboratory, seems to be expressing his approval to Dr. Gisler over the recording of his birth. Dr. Gisler holds one of the standard birth certificates which indicates the animal's identification number, the time and place of birth, the mother and father, and a statement certifying to the birth together with a certificate notarized by a notary public of the State of Texas.

APPENDIX I

OFFICE OF INFORMATION
Hqs, Air Force Ballistic Missile Division
Air Research and Development Command
Los Angeles 45, California

HOLD FOR RELEASE UNTIL LAUNCH

(Note to Radio Editors) -- The [redacted] of United States born monkey into orbit aboard a United States Air Force [redacted] satellite marks the first U. S. attempt to orbit a primate capable of collecting data on the animal's ability to perform useful functions during space flight; acquire information on the effect the space environment has on physiological functions; and bring the animal safely back to earth.

The selection, conditioning and training of a group of American-born rhesus monkeys has been the responsibility of the University of Texas, United States Air Force Aero-Medical Laboratory, Holloman Air Force Base, New Mexico, and the Air Force Missile Development Center, Holloman Air Force Base, New Mexico. Each monkey has been carried on an activity of the Air Training Command's School of Aviation Medicine in support of the Air Research and Development Command's Ballistic Missile Division, operating manager for project [redacted]. The biosatellite portion of PROJECT [redacted] is managed on an [redacted] basis by the program's primary test objective which includes the development of launching techniques, propulsion, communications, orbital performance and recovery techniques necessary to bring it to operational maturity a series of military satellite systems. The following photographs attached comprise a photo story of the activity conducted at the Aero-Biology

Laboratory. This material is Part I of a two-part photo feature covering the exhaustive preparations conducted by the Air Force to pave the way for today's history making launch.

AFMD - 85961-60

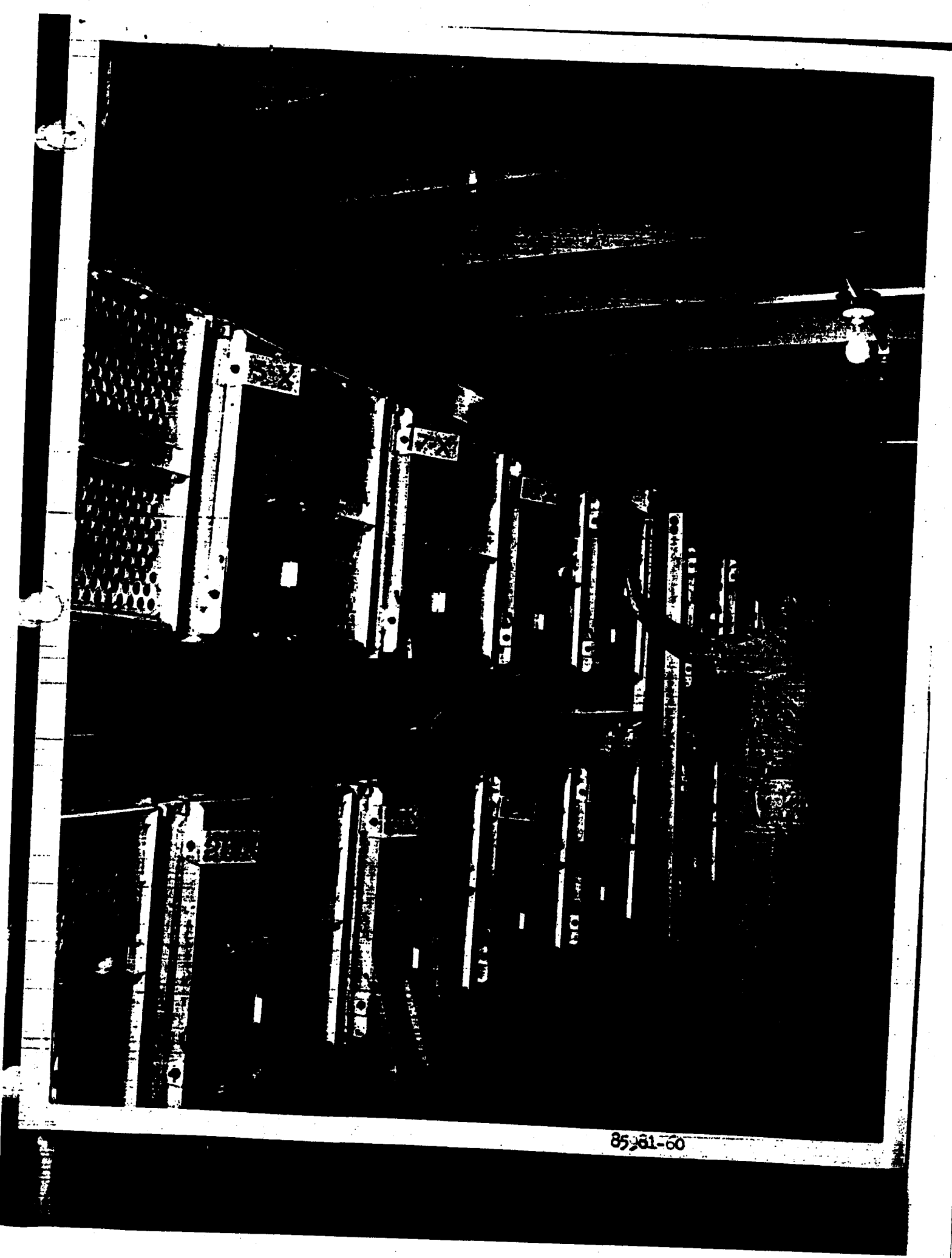
This is part of a space monkey colony at the University of Texas - USAF Radio-biology Laboratory at Austin, Texas. The animals live in individual cages under a stringent program of sterilization. Trained veterinary personnel of the School of Aviation Medicine are responsible for all aspects of animals' physical and clinical well being. Potential flight animals are known simply by a number and a letter; I indicating that an animal was born in the Radio-biology laboratory, P indicating he was born elsewhere in the United States.

AFMD - 85973-60

Virtually hand-reared from birth, the space monkeys are docile and friendly. Dr. (Captain) Pamela K. Wiley, assistant chief of Veterinary Services at the laboratory, prepares to give one of the animals its periodic physical examination.

AFMD - 85973-60

Dr. Wiley and veterinary technician, A/2C Billy Carter, perform one of the frequent periodic physical examinations which are necessary to maintain the animals in top condition.



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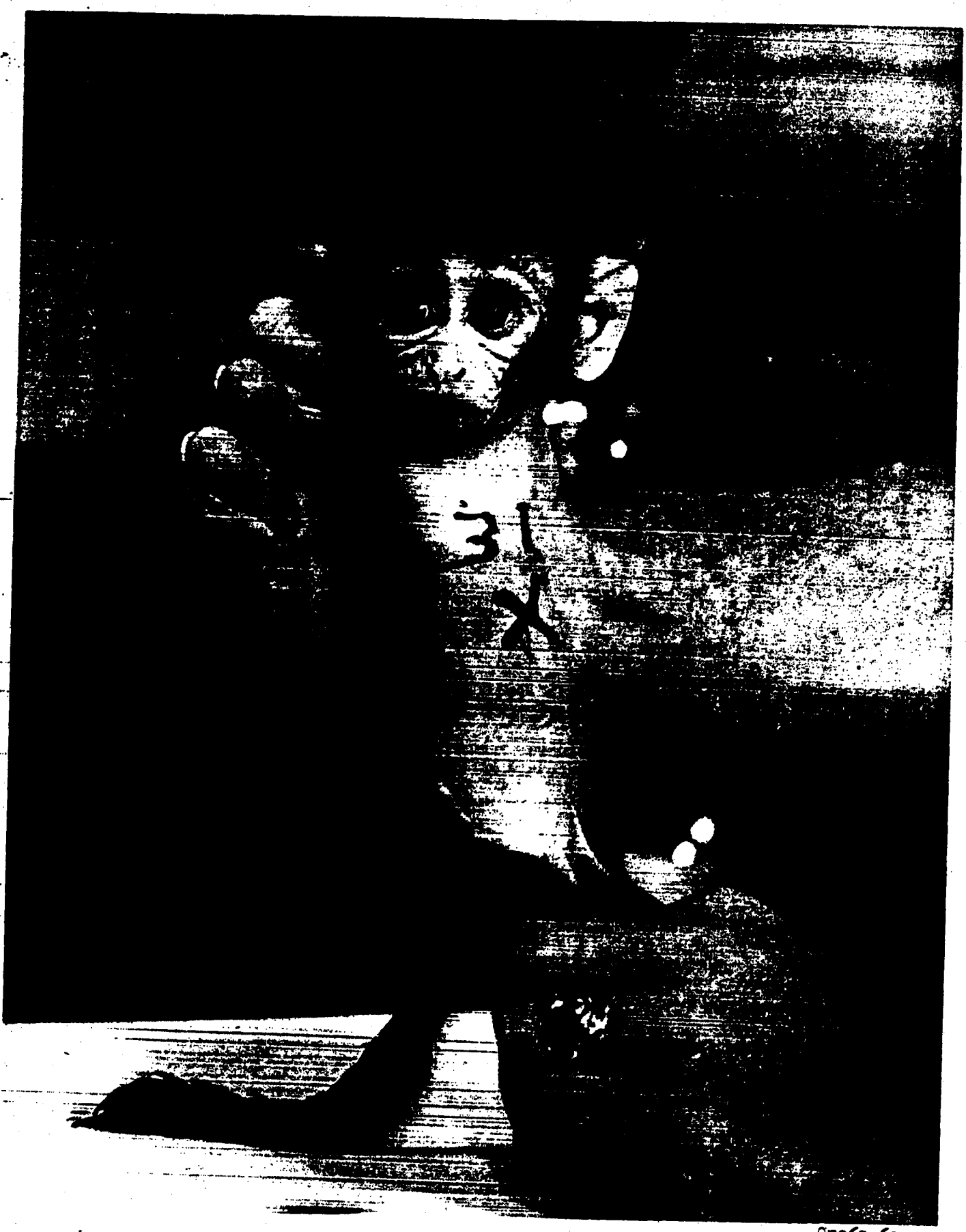

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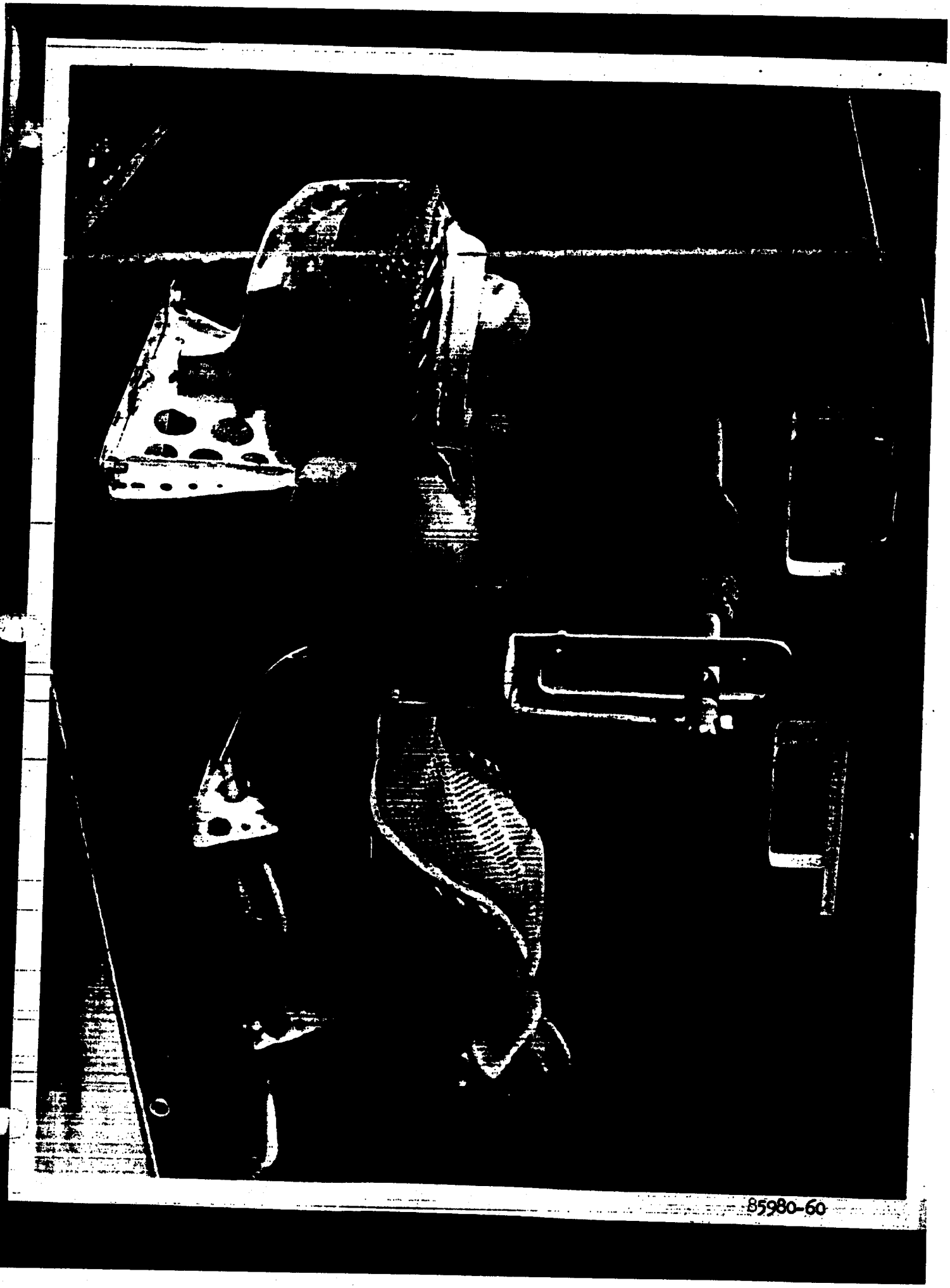

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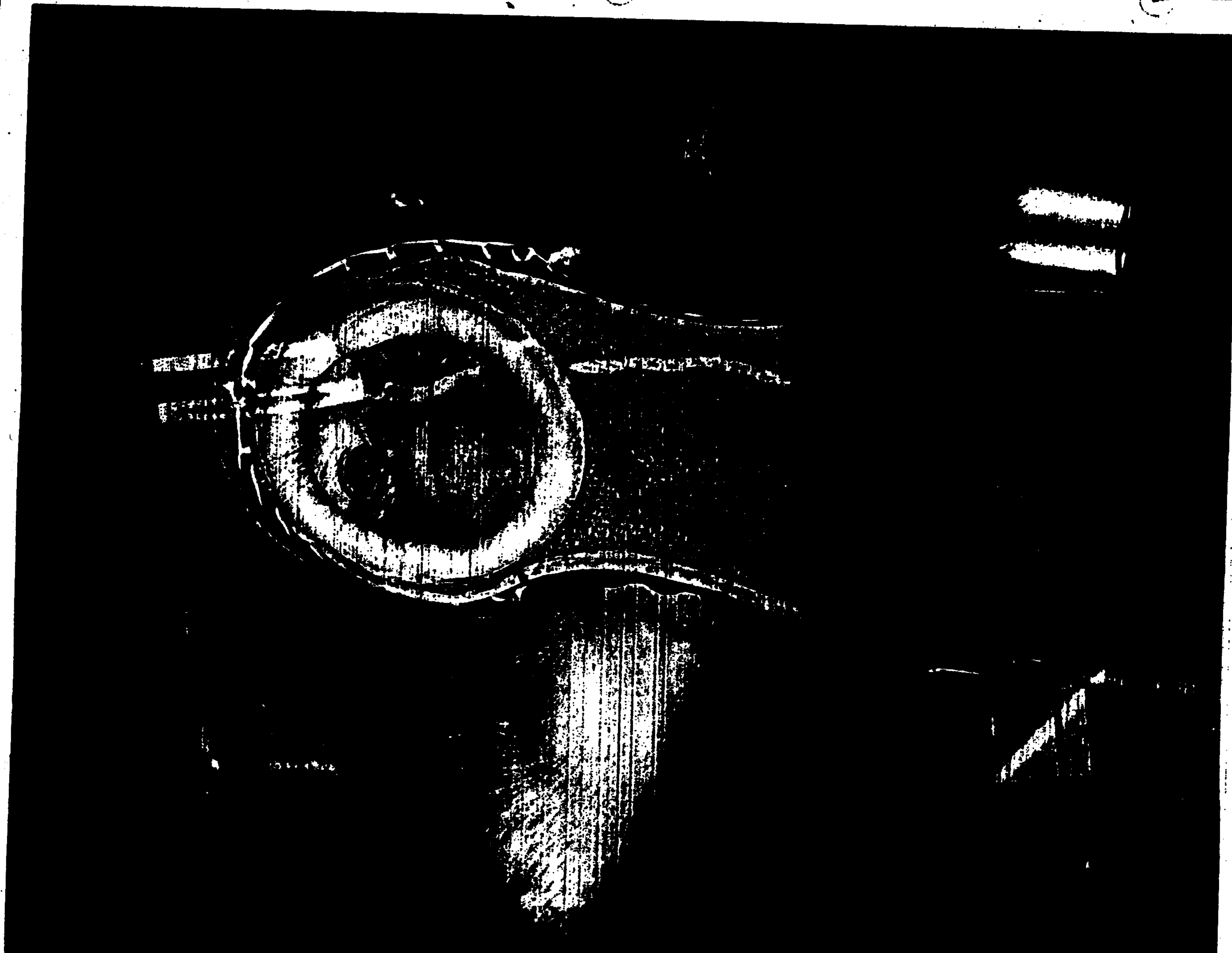

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SAFOI-3B 12 January 1961

Biomedical Release

AFBMD (Lt.Col McGinty) AF Unit PO, Los Angeles,Calif.

1. Forwarded herewith is the completed and approved (with amendments) DOD release of your Biomed photo package minus the photos. Please note the redlined photos and captions DOD desires to eliminate. Date of DOD approval is 10 January 1961. The "Life Cell" group has been resubmitted to DOD with new captions for consideration. No problem is expected and the approval is anticipated in a matter of a week.

2. The State Department expressed a desire to be advised of any forthcoming release dates on this subject.

FOR THE CHIEF OF STAFF

SHERWOOD A. MARK
Major, USAF
Pictorial Branch
Public Information Division
Office of Information

1 atch
a/s

REL 2-7

OFFICE OF INFORMATION
Hqs, Air Force Ballistic Missile Division
Air Research and Development Command
Los Angeles 45, California

HOLD FOR RELEASE UNTIL LAUNCH

(Note to Photo Editors) The photographs attached are Part II of a two-part photo series documenting the selection, conditioning and training of the USAF space monkeys and the exhaustive test program which the Air Force has carried on to insure the maximum chance for success in today's history-making space experiment. Part II deals exclusively with the test program. Insofar as it is technologically possible, all conditions of the actual space flight have been artifically induced during the test program. The schedule of each of the tests which have been run using a small primate of the same size, weight and training as the actual flight animals follows exactly the schedule of an actual countdown, launch, orbit and recovery during a flight test. In the Air Force Ballistic Missile Division's medical vans at Vandenberg Air Force Base the test animal undergoes all of the steps of actual launch countdown. After the biopack is sealed and the life support system is activated the pack is placed in an actual DISCOVERER recovery capsule. The capsule is then placed aboard a USAF transport plane and is flown to the Lockheed Missile and Space Division at Sunnyvale, California. The period of time covered by the flight and handling of the capsule coincides with the period of time during which the AGENA satellite vehicle and its THOR IRBM booster would be undergoing final countdown prior to launch.

At Sunnyvale the capsule is introduced into an environmental chamber which will simulate all of the phenomena of space flight except acceleration and weightlessness. The capsule remains in the chamber during the 27 hours it would normally be in orbit. During this time, the scientists and technicians are receiving, through electronic instrumentation, complete data on the reaction of the specimen and on the operation of the life support system. At the conclusion of the 27 hour period, the capsule is removed and is immersed for a period of several hours in a vat of salt water simulating sea immersion. On one of the last tests conducted prior to today's launch the animal emerged healthy and active after more than 65 hours in the biopack.

AFBMD - 07393-60

In the medical vans at Vandenberg Air Force Base, a test animal is examined prior to a ground test in which a complete DISCOVERER flight is simulated. Dr. (Major) Robert Young, chief, Veterinary Services at the University of Texas, United States Air Force Radio-biology Laboratory, examines the animal. He is assisted by Airman 2c Billy Carter (center) and Dr. W. Lynn Brown, in charge of experimental psychology for the Discoverer Biomastronautics program.

AFBMD - 07392-60

The test subject has been buttoned up in the form-fitting foam rubber-covered flight couch and protective nylon restraint garment. The flight couch is identical to that used in today's Discoverer launch.

AFBMD - 07405-60

The test subject has been installed in the General Electric Mark II biopack. Note that the subject has its hand on the psychomotor performance lever. Directly above the subject's face can be seen the red signal light which will trigger his performance of the psychomotor tasks for which he has been trained. To the right of his face can be seen a white light which will be turned on to provide illumination whenever the electrically-operated single frame still camera is activated. The camera, in flight, will record the animal's facial expressions at certain designated times.

AFBMD - 07402-60

Captain Bruce Pine (right), chief, Biomedicine, AFBMD Directorate of Bioastronautics, and Mr. Art Rachild, General Electric technician, install the cover to the Mark II Biopack. Once the cover is installed, the life support system goes into operation. This system maintains a constant compartment pressure, provides a supply of fresh oxygen, absorbs carbon dioxide, maintains relative humidity and temperature within acceptable limits and also provides for the animal's nutrition -- a wedge of fresh apple every 4 hours.

AFBMD - 16432-60

The biopack, installed in an actual General Electric DISCOVERER recovery capsule, is shown here immediately after arrival at the Lockheed Missile and Space Division laboratory, Sunnyvale, California. Captain Pine and Lockheed project personnel make final adjustments to the capsule before it is installed in a DISCOVERER re-entry vehicle for the simulated space flight.

AFBMD - 16428-60

The recovery capsule containing the biopack and specimen has now been mounted in the General Electric re-entry vehicle. The re-entry vehicle is positioned on a hydraulically operated pallet. This pallet will be raised into the environmental chamber in the roof of the laboratory where, for 27 hours, the temperature, vacuum and other phenomena of space flight will be artifically induced.

AFBMD - 16431-60

This is the long wait. Captain Pinsand and project personnel "sweat it out" watching the banks of complex electronic instruments which are telling a minute-by-minute story of the animal's space flight. The instruments record the animal's performance, his respiration and electrocardiogram, as well as the operation of the life support system.

AFBMD - 11004-60

The period of space flight is concluded. The recovery capsule is being lowered into a vat of salt water where, for the next few hours, emersion of the capsule in the sea will be simulated. During this period, the life support system continues to function. It is designed to function for more than 50 hours.

AFBMD - 1642960

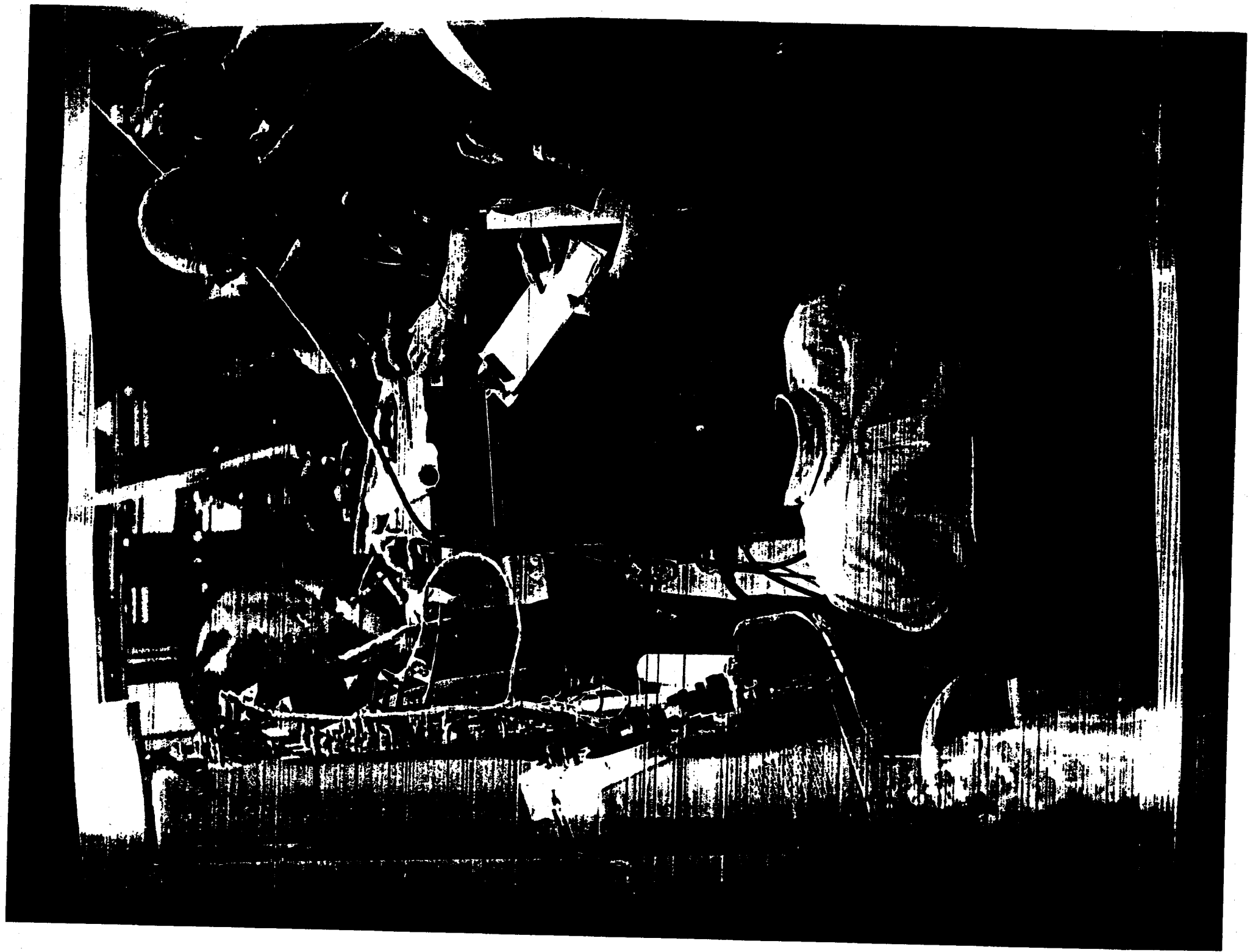
Project personnel are almost at the end of the road on another test. The biopack has been unbuttoned. Captain Pinsand and Mr. Art Rachild are removing the animal.

AFBMD - 16430-60

The animal is alive and well after 70 hours in the biopack. The success of the test is mirrored in Captain Pinsand's face. Although the smile is tired after the long vigil, nevertheless it is a smile of success.

07393-60

07392-60



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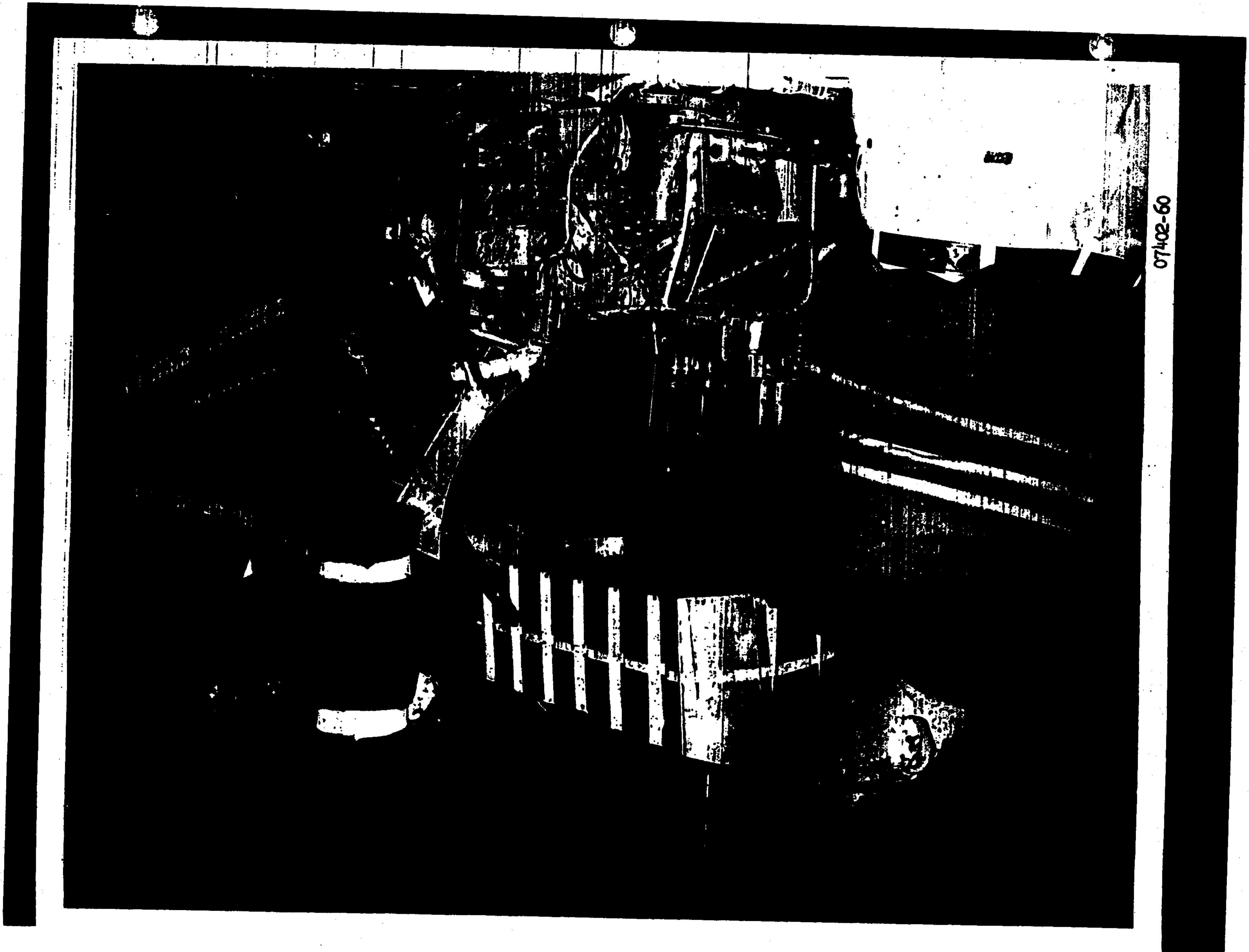
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With the launching of this THOR-AGENA combination from Vandenberg Air Force Base, California, 28 February 1959, the free world's most ambitious space development program, and the most successful, got underway. This marked the launching of DISCOVERER I.

Initially directed by the Advanced Research Projects Agency of the Department of Defense (ARPA), Project DISCOVERER is an open ended research and development program designed to perfect a reliable military satellite vehicle which will become the basis for a whole family of versatile military space systems. In late 1959 executive management of Project DISCOVERER was turned over by ARPA to the Air Force. The Air Force Ballistic Missile Division continued as the executive manager. The booster used in Project DISCOVERER is a standard Air Force THOR intermediate range ballistic missile modified to accommodate the AGENA satellite vehicle. The THOR is the product of an Air Force-industry team headed by AFBMD and including Douglas Aircraft and Rocketdyne. The AGENA satellite was developed by Lockheed Aircraft Company.

UNITED STATES AIR FORCE PHOTO (AFBMD 00962-59)
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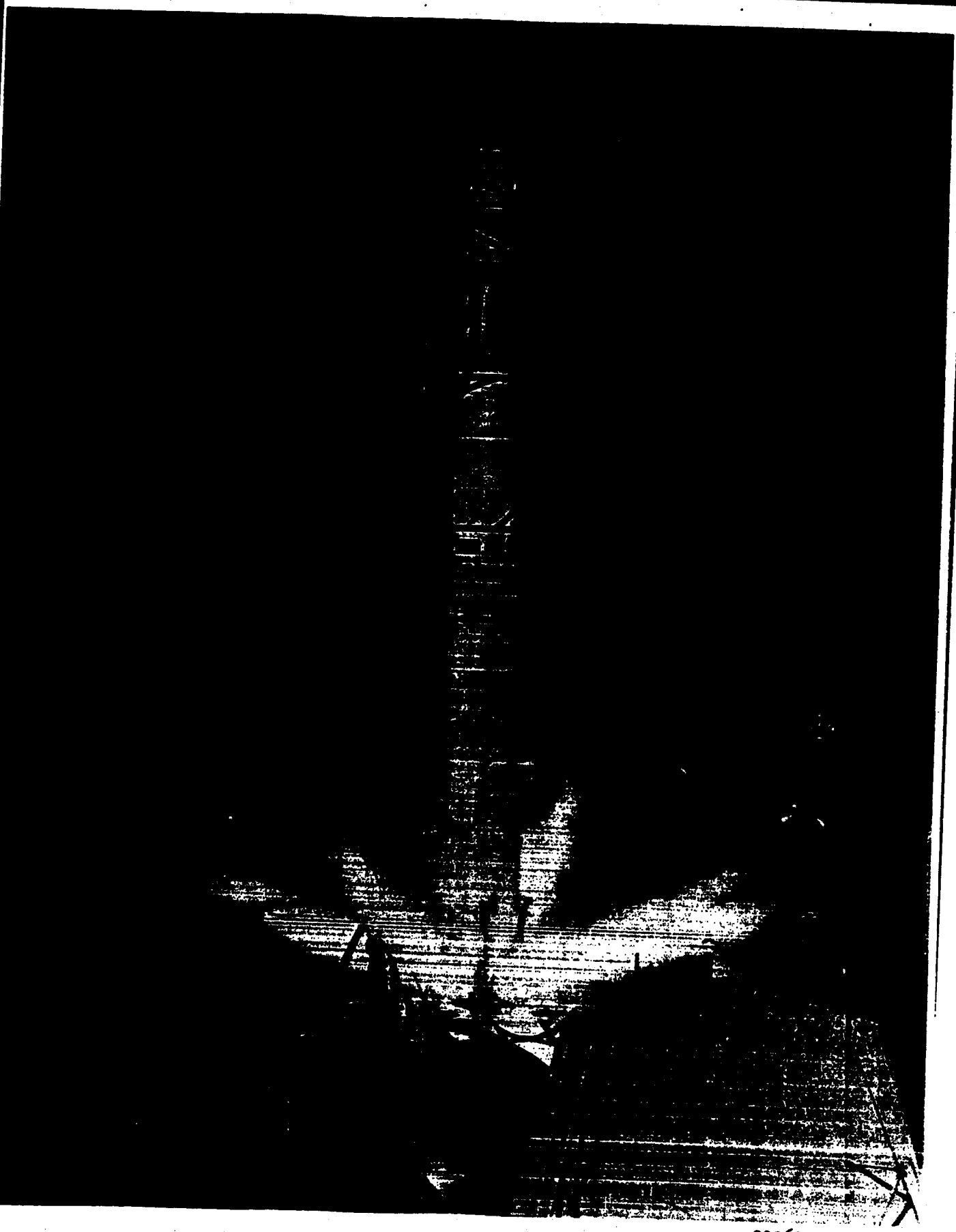

00962 59

Competition is keen among the crews of the 6593rd Test Squadron, aerial recovery unit assigned to Project DISCOVERER. Each rigger assigned to a C-119 recovery aircraft makes his own individual modifications to the standard recovery harness which he feels will give his crew a definite edge on the others. Each rigger keeps his harness stored under lock and key to be used only by himself on his own aircraft.

UNITED STATES AIR FORCE PHOTO (AFBMD 01629-59)
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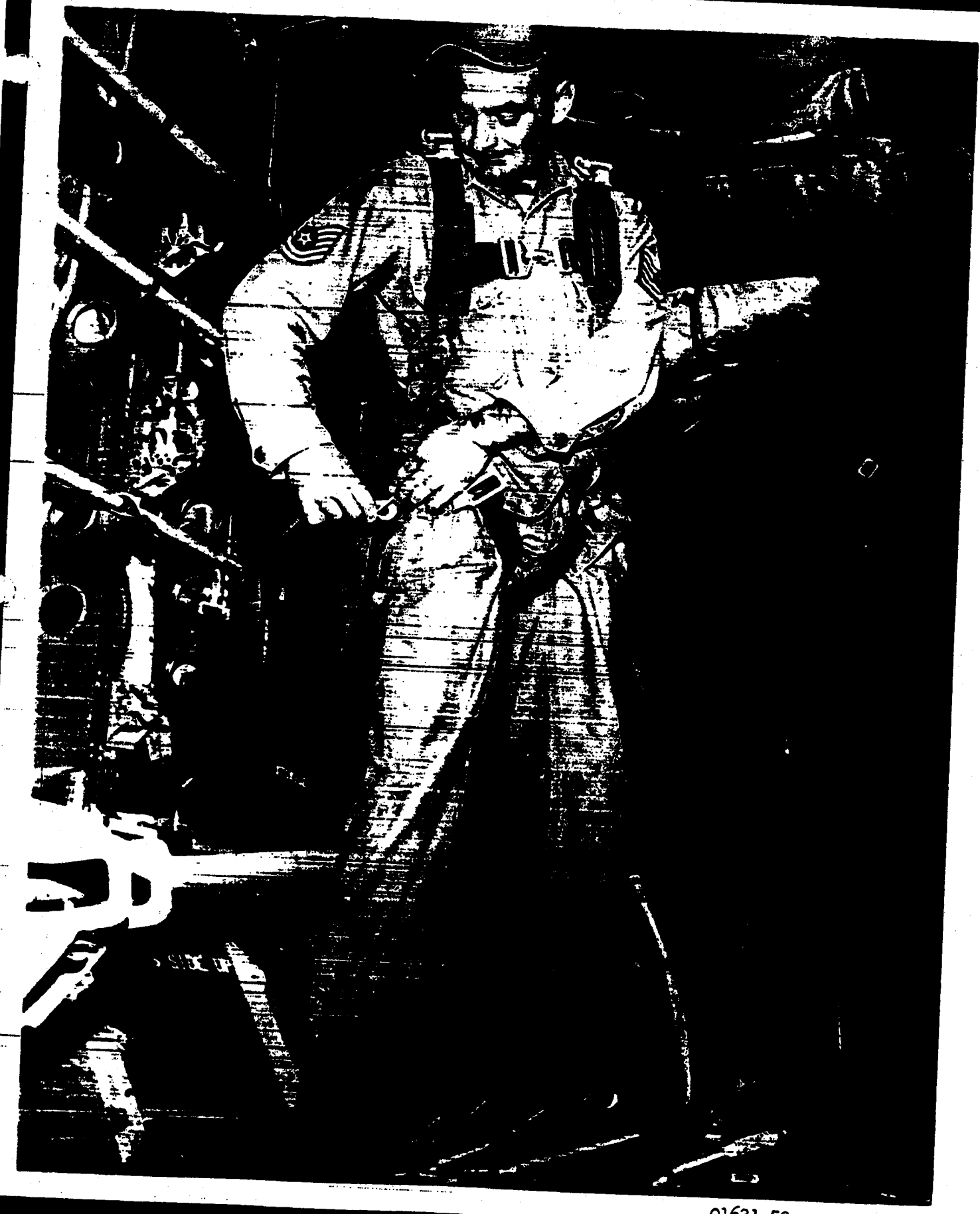
Hq., Air Force Ballistic Missile Division
Los Angeles 45, California.

T/Sgt Stanley Sojda, Whitesboro, New York, fastens a safety strap to his parachute harness before extending the recovery equipment through rear cargo doors of the C-119 aircraft. During recovery operations the plain will fly as high as 15,000 feet.

Official U. S. Air Force Photo Released by AFBMD, Hq ARDC, Inglewood, California (01631-59 BMD)



01631-59

An especially modified C-119 its recovery gear extended is about to score a "hit" on a simulated recovery capsule and parachute. This is the technique developed to retrieve the recovery capsule in Project DISCOVERER. Recovery crews of the 6593rd Test Squadron, the 6594th Recovery Control Group (AFBMD), Hickham Air Force Base, Hawaii, have been successful in more than 90 percent of their recovery training missions. A high flying jet aircraft drops a simulated recovery capsule somewhere in a broad, predetermined area of the Pacific south of Hawaii. C-119 aircraft stationed in the area must home on the radio beacon in the simulated capsule, visually acquire the descending package and successfully execute an air-snatch.

UNITED STATES AIR FORCE PHOTO (AFBMD 01632-59)
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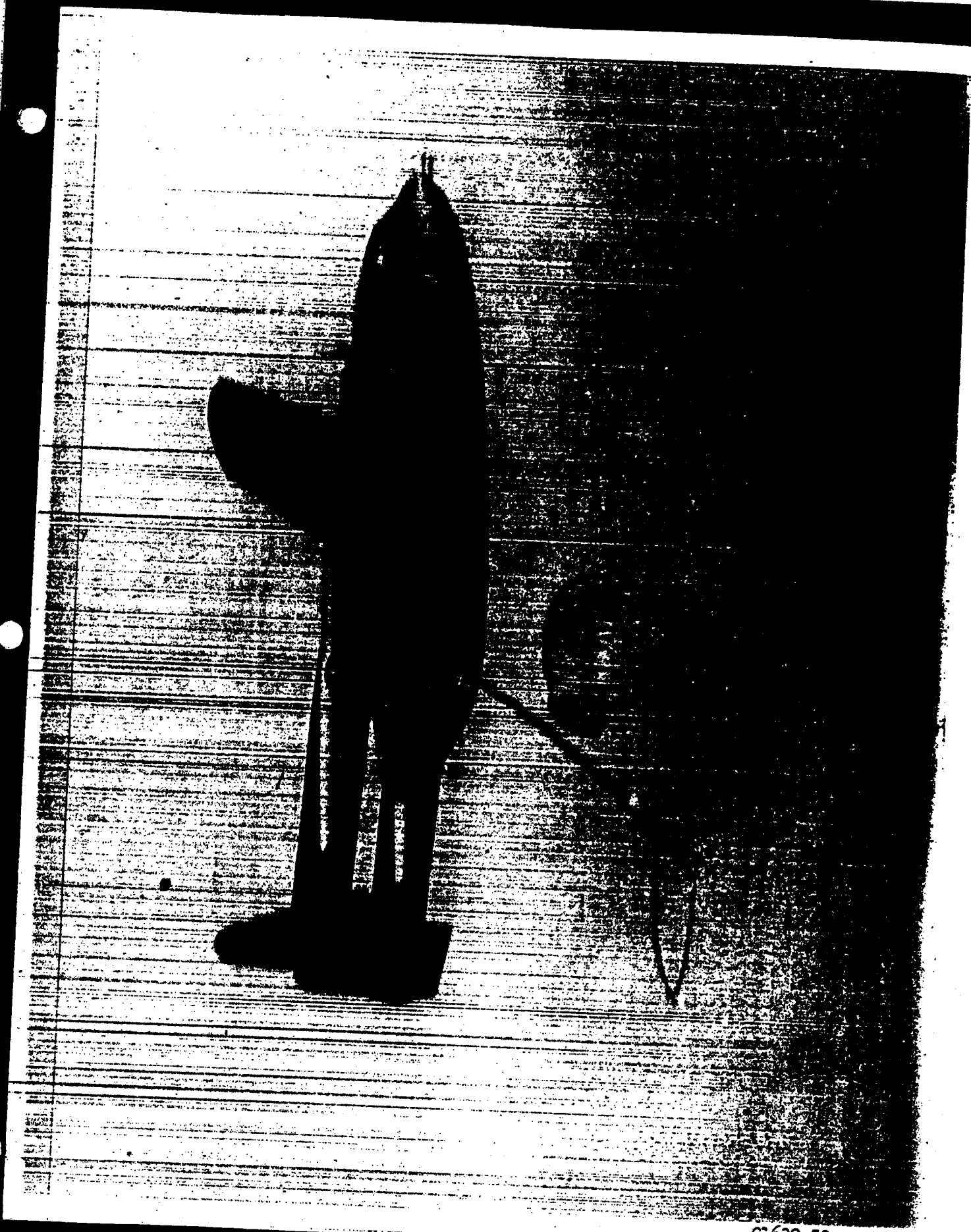

01632-59

S/Sgt Lynwood Pickett makes adjustments on the special radio receiver antenna on the nose of the C-119 aircraft used in the recovery. The short range set homes on the beacon in the parachuting capsule.

OFFICIAL U. S. AIR FORCE PHOTO (01635-59)
RELEASED BY AFBMD, HQ ARDC, INGLEWOOD, CALIFORNIA

01635-59

Captain Charles Clawson sits in the co-pilot's seat of the converted C-119 as the capsule recovery aircraft patrols a wide sector of the Pacific.

OFFICIAL U. S. AIR FORCE PHOTO RELEASED BY AFBMD, HQ ARDC, INGLEWOOD, CALIFORNIA (01640-59 BMD)

01649 65934

01640-59

This is an artist's concept of the air-snatch recovery technique developed by the Air Force Ballistic Missile Division as part of Project DISCOVERER. One of the overall test objectives of Project DISCOVERER is the development of a capability to recover a capsule which has been returned from a satellite orbiting in space. It was determined that maximum mobility was a prime requisite in choosing a recovery technique. An aerial technique obviously permitted maximum mobility of the recovery force. Depicted from left to right (top), an Air Force C-119 recovery aircraft approaches the descending capsule which is supported by a parachute. The C-119 aircraft commander orients his aircraft so that the "trapeeze-like" recovery gear will contact the parachute just below the point where the shroud lines are attached to the canopy. (bottom) The recovery gear anchors on to the descending parachute and capsule; and finally, the capsule is drawn aboard by a power winch.

UNITED STATES AIR FORCE PHOTO (AFBMD 01642-59)
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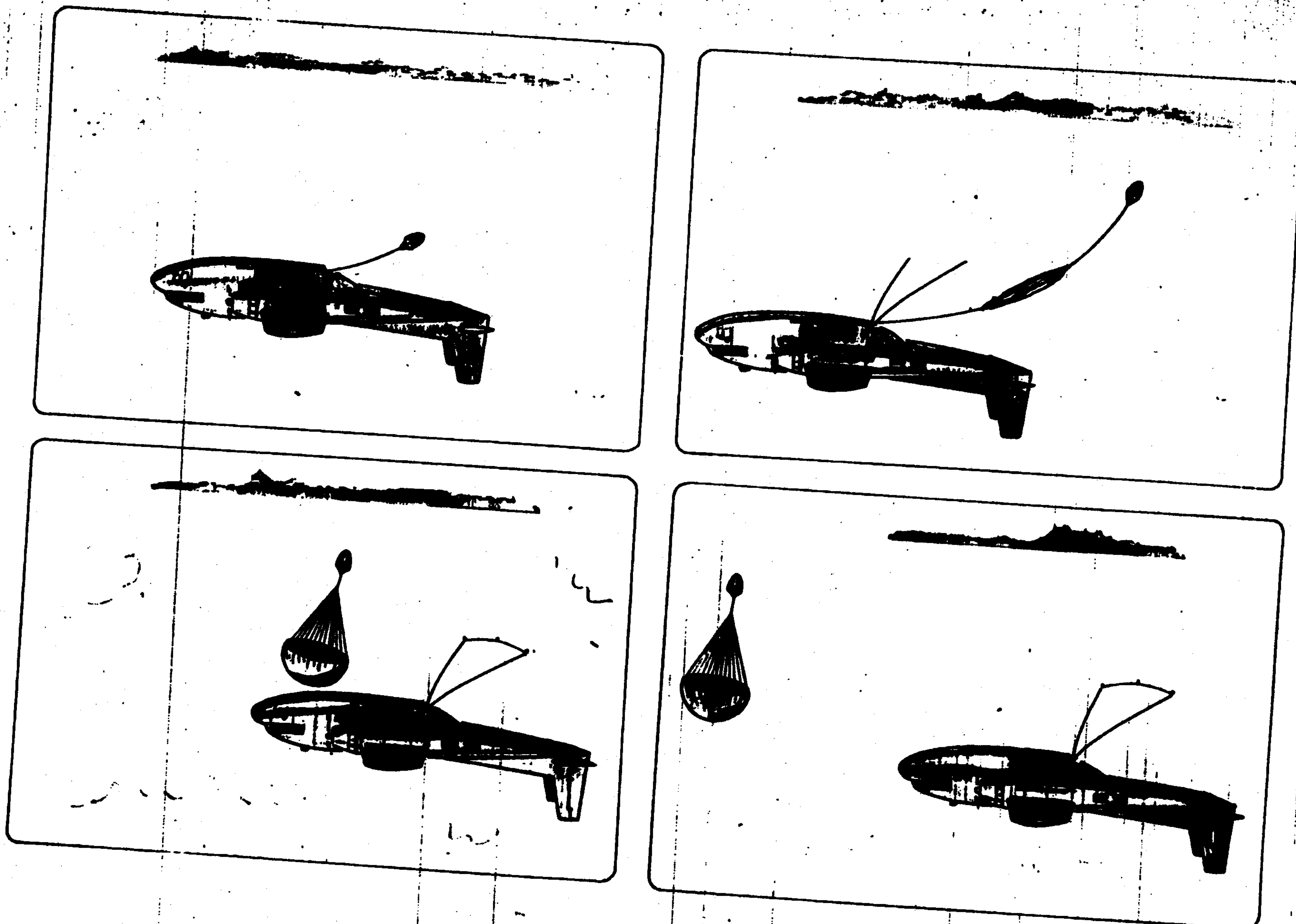

01642 59

This is the DISCOVERER Tracking Station at Vandenberg Air Force Base, California. The huge 65-foot parabolic antenna receives telemetry signals from the vehicle during its launch phase and later as it orbits the earth.

UNITED STATES AIR FORCE PHOTO (AFBMD 02031-59).
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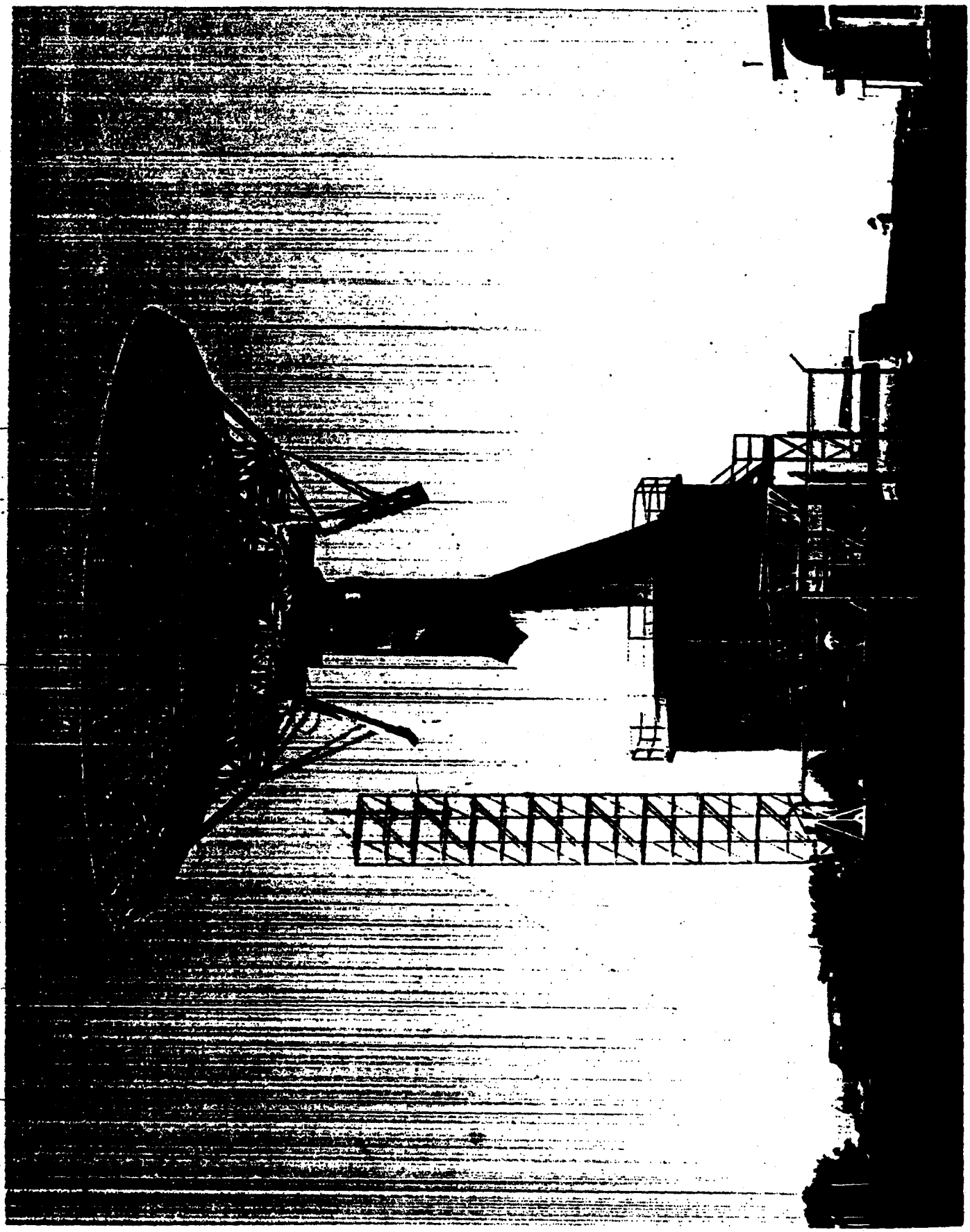

02031-59

The recovery package and recovery capsule is installed in the AGENA re-entry vehicle. Separated from the AGENA satellite on orbit, by a timing device, the re-entry vehicle is slowed by a retro-rocket. Once it is expended, the rocket, together with the after structure is jettisoned. The ablative shield which protects the re-entry vehicle from burning-up as it enters the atmosphere also is jettisoned after its job is done. The parachute then lowers the recovery capsule.

UNITED STATES AIR FORCE PHOTO (AFBMD 02152-59)
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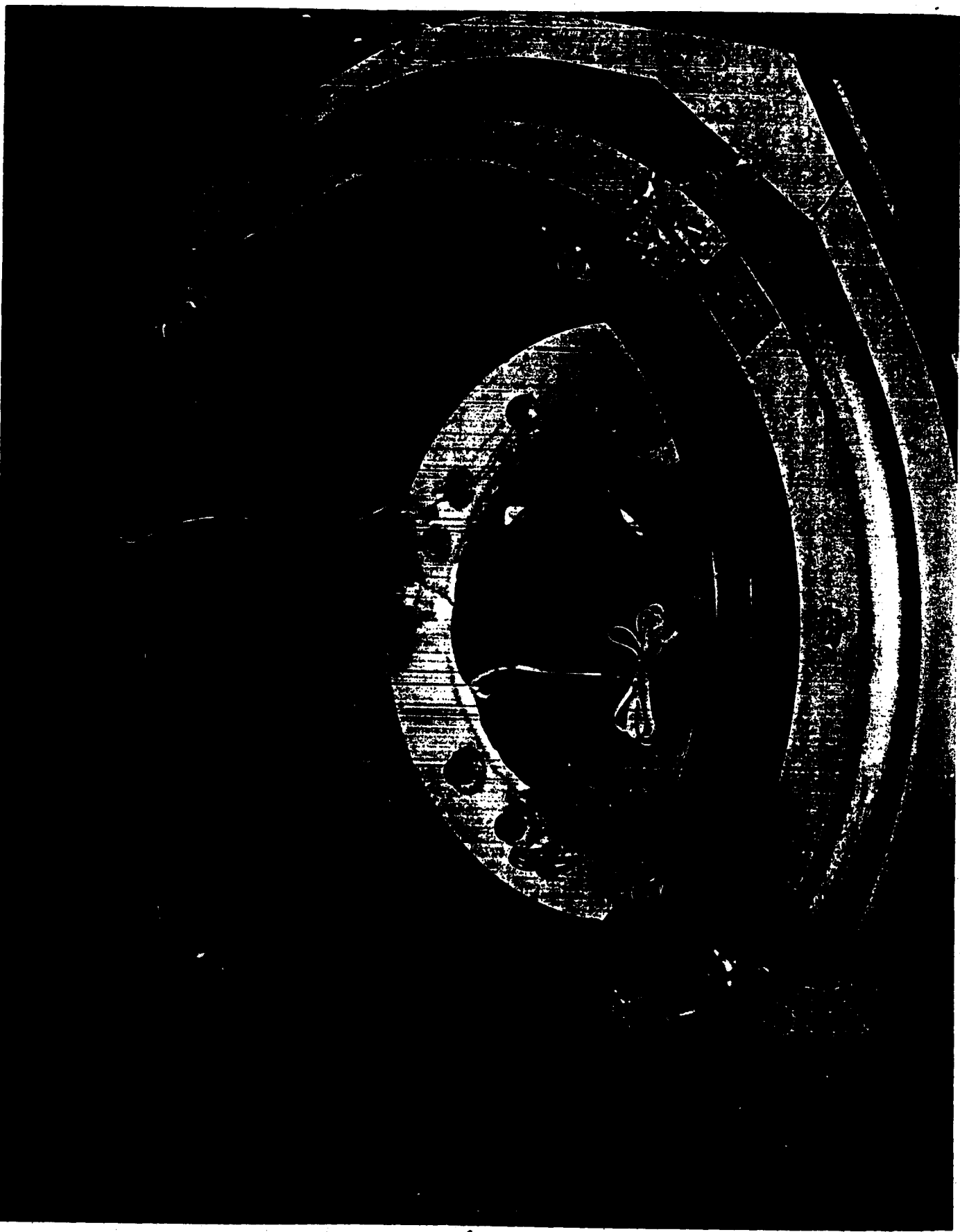

Technicians at Lockheed Aircraft Corporation make the final adjustments to a recovery package, part of the re-entry vehicle for an AGENA Satellite. AGENA is the satellite vehicle used in Project DISCOVERER, a research and development program to perfect a versatile satellite to be used in several military space systems. This recovery package contains a parachute which is deployed when a "G" switch is activated by decelleration forces; radio homing beacon, and a high intensity flashing light.

UNITED STATES AIR FORCE PHOTO (AFBMD 02153-59)
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02153 59

Lockheed technicians install the fairing on an AGENA re-entry vehicle. In Project DISCOVERER, these re-entry vehicles may carry bio-medical specimens and scientific instruments.

UNITED STATES AIR FORCE PHOTO(AFBMD 02156-59)
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02156 59

This is a completed AGENA re-entry vehicle. The re-entry vehicle is separated from the AGENA satellite by series of springs and explosive bolts actuated by a timing device. Ground controllers can adjust the timing device by radio command while the satellite is on orbit. A retro-rocket fires after separation, the rocket and its after structure, together with the protective ablative shield are jettisoned at the appropriate time. The recovery capsule then descends to earth by parachute. Although the capsule is designed for recovery by an air-snatch technique, it is built to float in the event aerial recovery is not possible.

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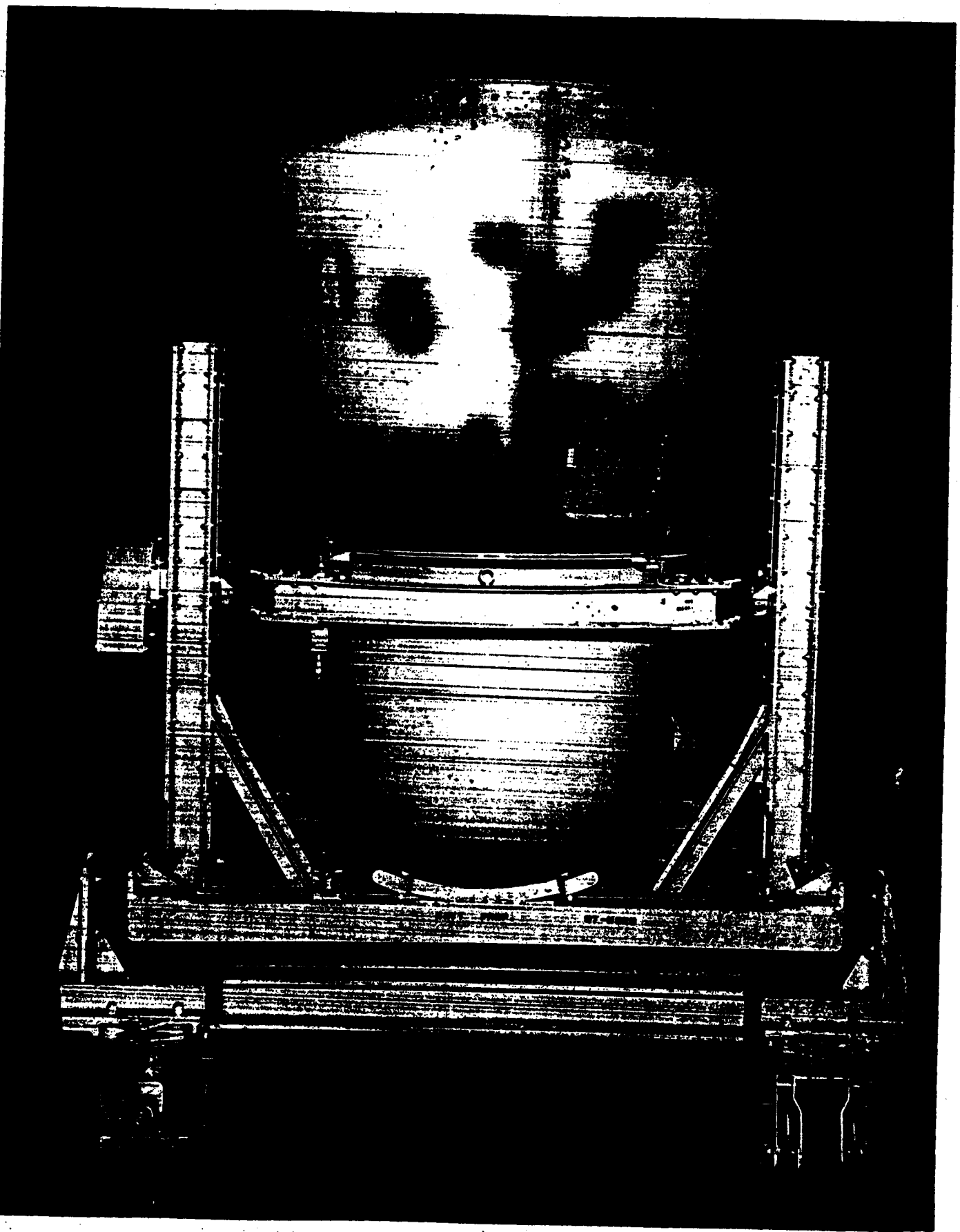

3210 59 - DET #1

Lockheed technicians attach the retro-rocket to an AGENA re-entry vehicle. After the vehicle is separated from the AGENA satellite on orbit the retro-rocket fires. This rocket provides a velocity vector which, when applied to the velocity vector of the satellite results in the re-entry trajectory. The after structure and retro-rocket is jettisoned after its work is done.

UNITED STATES AIR FORCE PHOTO (AFBMD 02157-59)
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02157 59

Here the re-entry vehicle is mated with an AGENA satellite vehicle at the launch site. The recovery capsule in the re-entry vehicle could carry a wide variety of scientific payloads including bio-medical specimens.

UNITED STATES AIR FORCE PHOTO (AFBMD 02160-59)
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02160 59

Lockheed technicians mount the after structure to the recovery capsule to be used in a Project DISCOVERER flight test. The after structure will support the retro-rocket which will slow the re-entry vehicle to a safe re-entry speed.

UNITED STATES AIR FORCE PHOTO (AFBMD 02162-59)
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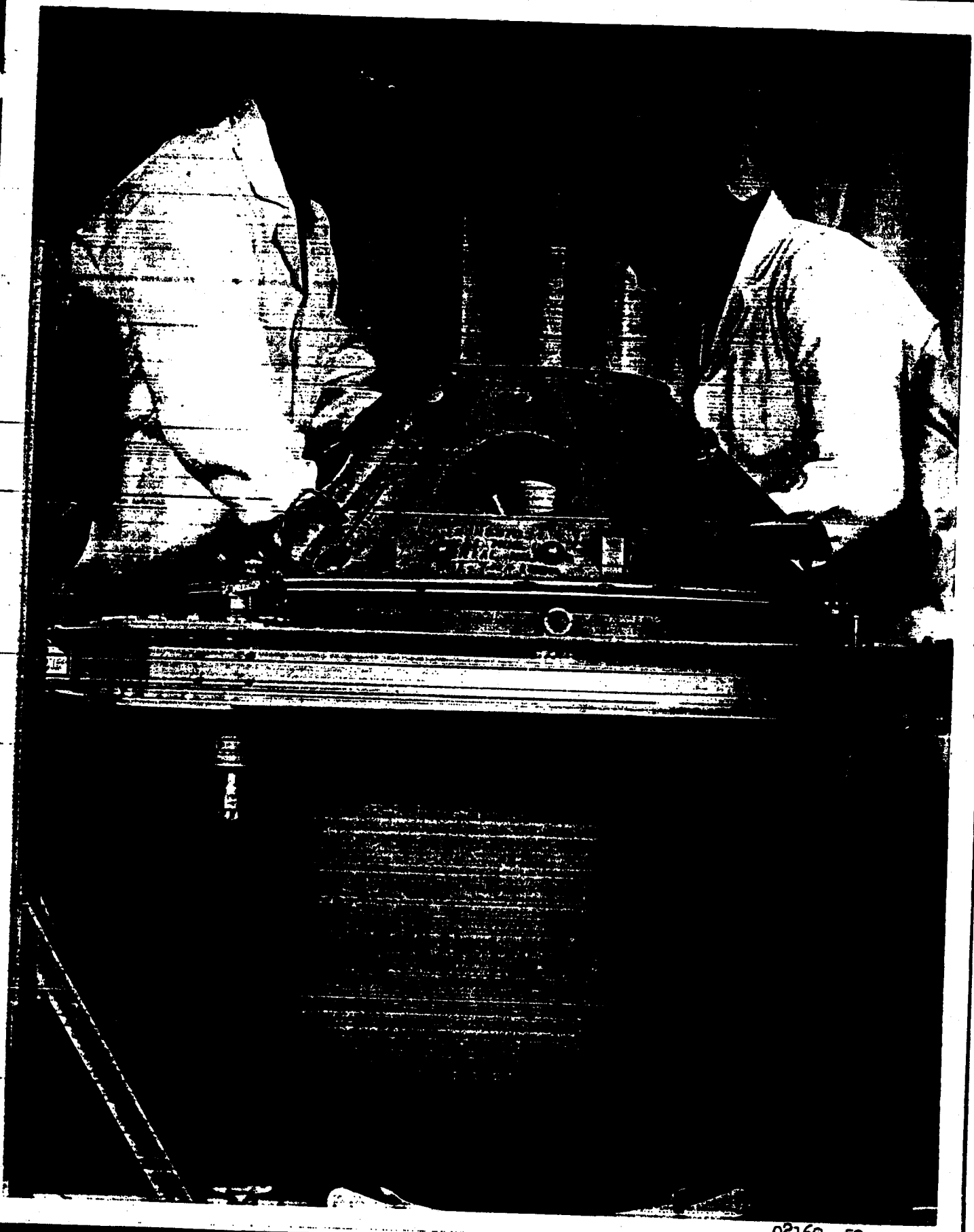

02162 59

The THOR-AGENA combination is poised for launching. "Men from Mars" (left foreground) are really missile technicians who are supervising the loading of rocket fuel into the AGENA satellite vehicle. The most ambitious space program ever undertaken, Project DISCOVERER is designed to develop a reliable military satellite having certain specific capabilities. The military satellite systems which will use the AGENA vehicle call for precisely defined orbits - near circular, polar orbits; the capability to stabilize and control the vehicle on orbit, the capability to communicate with the vehicle and to command it on orbit; the capability to separate the portion of the vehicle and bring it safely back to earth with its payload of instruments or bio-medical specimens; and the capability to recover the re-entry vehicle and its cargo.

UNITED STATES AIR FORCE PHOTO (AFBMD 05333-59)
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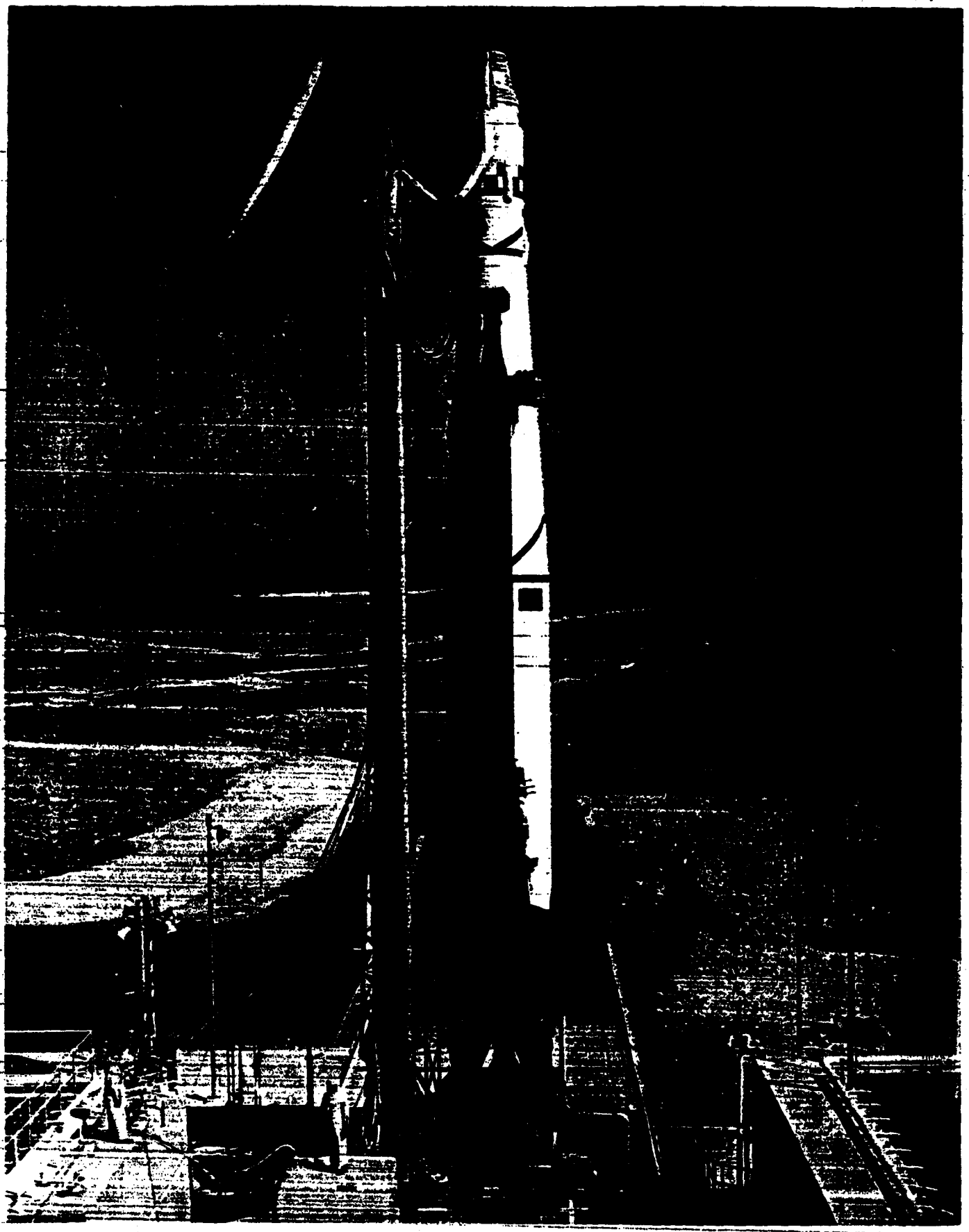

The AGENA satellite vehicle uses a powerful new propellant combination, unsymmetrical dimethylhydrazine (UDMH) and inhibited red fuming nitric acid (IRFNA). The THOR booster uses the standard liquid oxygen oxidizer and a kerosene base rocket fuel known as RJ1 - similar to ram jet fuel.

UNITED STATES AIR FORCE PHOTO (AFBMD 05336-59)
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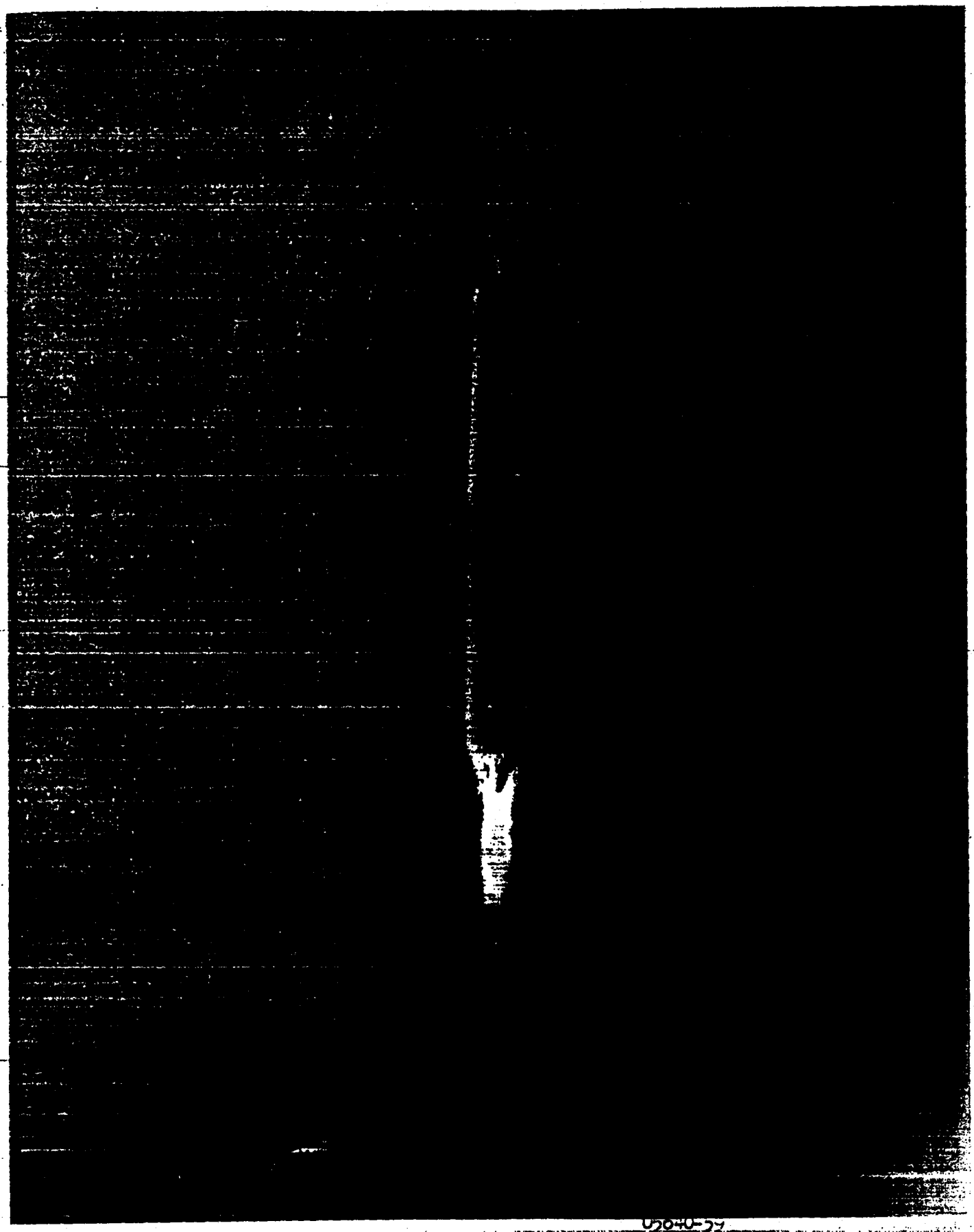

One of the primary test objectives of Project DISCOVERER is the development of control, tracking and communications equipment and techniques necessary in the operation of several military space systems. All Project DISCOVERER flight tests are controlled from this room at the Air Force Satellite Test Center, Sunnyvale, California. The Satellite Test Center is operated by the 6594th Test Wing (Satellite), Air Force Ballistic Missile Division. Here Air Force and Lockheed technicians work side by side. The STC is in direct voice and teletype contact with the launch site at VAFB, California, tracking stations in Alaska and Hawaii and with AFBMD Headquarters in Los Angeles.

UNITED STATES AIR FORCE PHOTO (AFBMD 05879-59)
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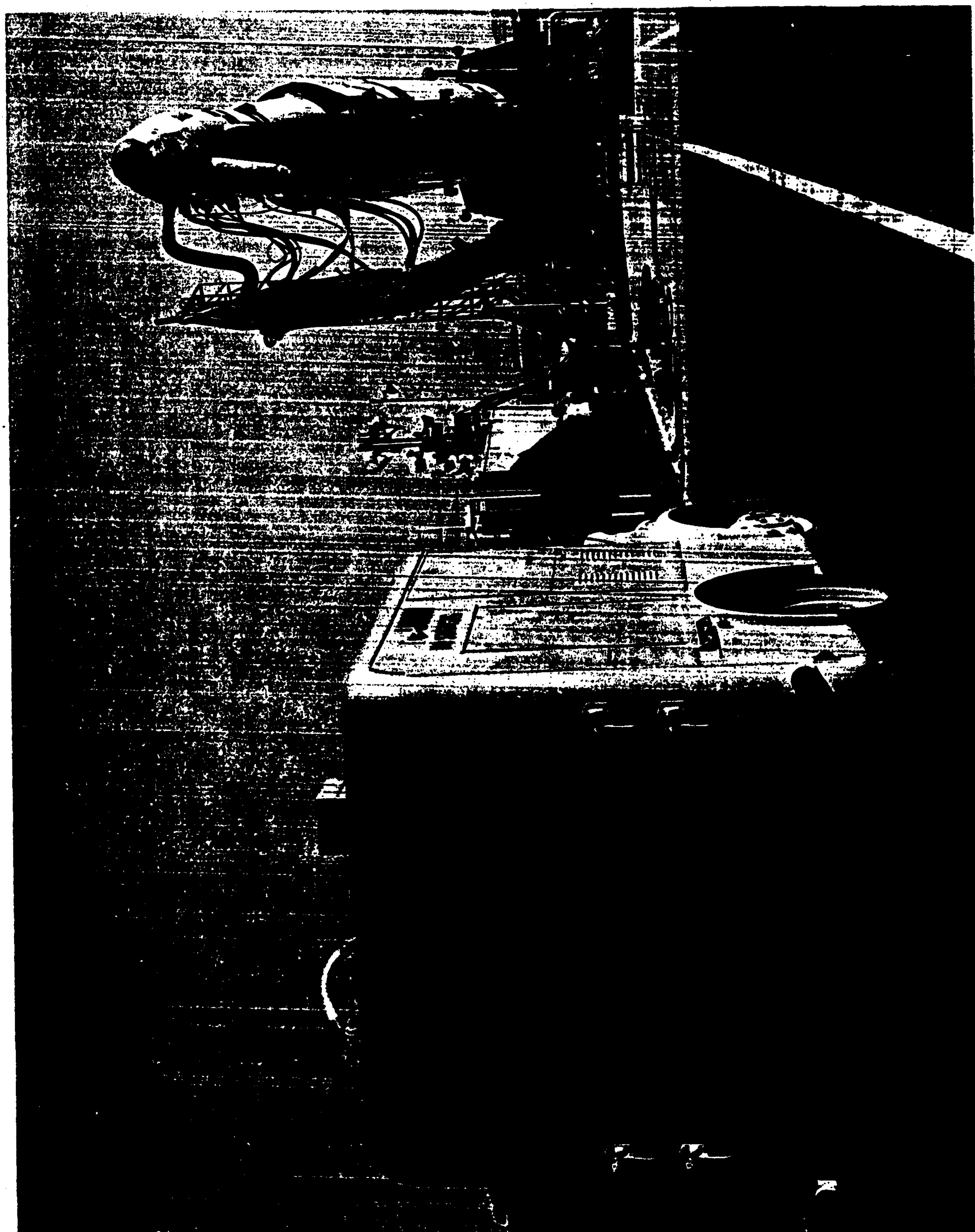
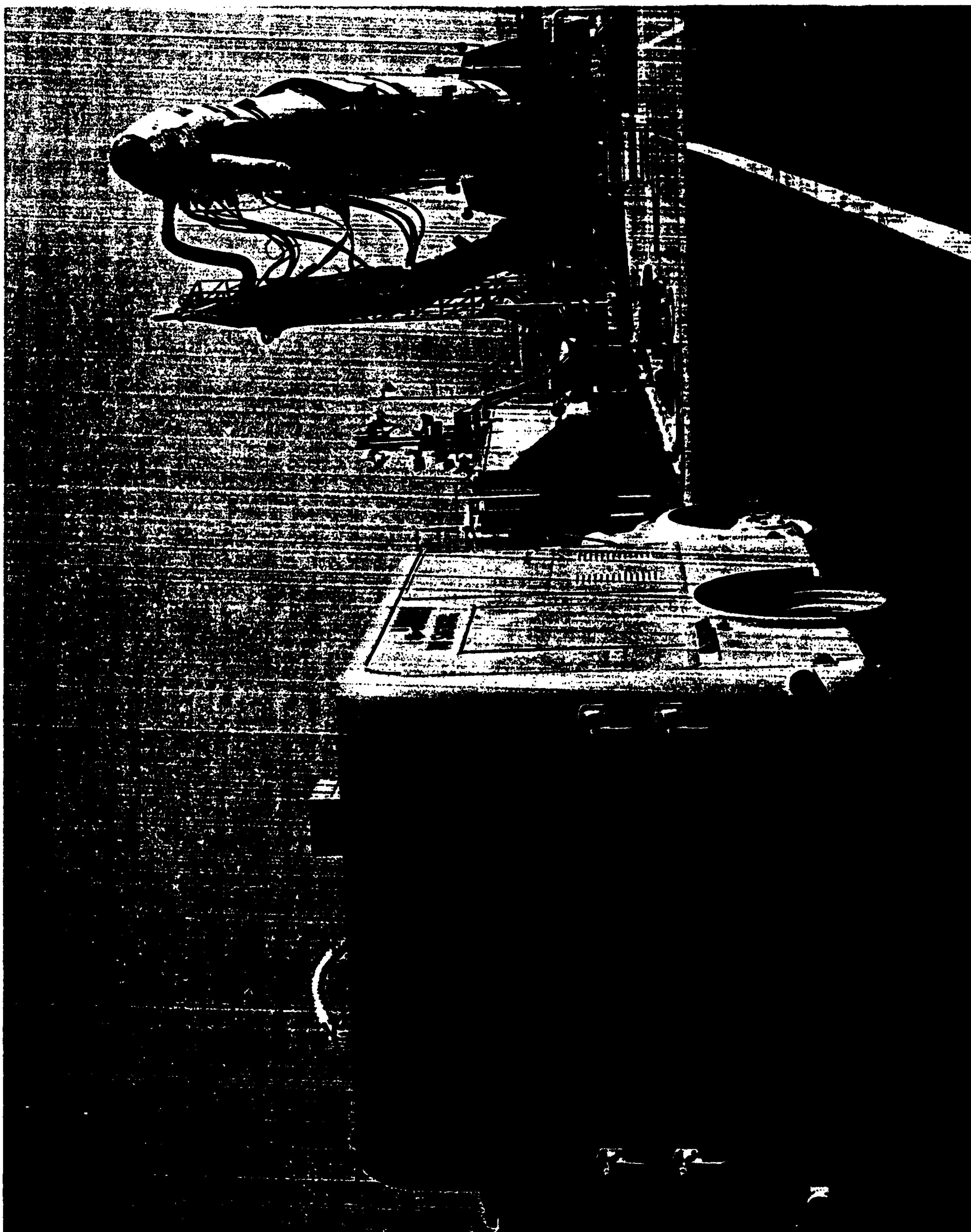


05336 59



05336 59

DISCOVERER VII launched 7 November 1959

U. S. AIR FORCE PHOTO RELEASED BY OFFICE OF INFORMATION, HQ AFBMD, LOS ANGELES 45 CALIFORNIA

05640-59

This is the computer room at Lockheed Missile and Space Division, Sunnyvale, California. Tracking data is received by teletype from Project DISCOVERER stations in California, Hawaii, Alaska and from instrumentation ships at sea and is reduced by a UNIVAC electronic computer. The computer compares actual orbital characteristics with the nominal established for a particular flight test and tells the test controllers what adjustments must be made to the satellites timing devices to trigger certain activities at specific points in space and time.

UNITED STATES AIR FORCE PHOTO (AFBMD 05880-59)
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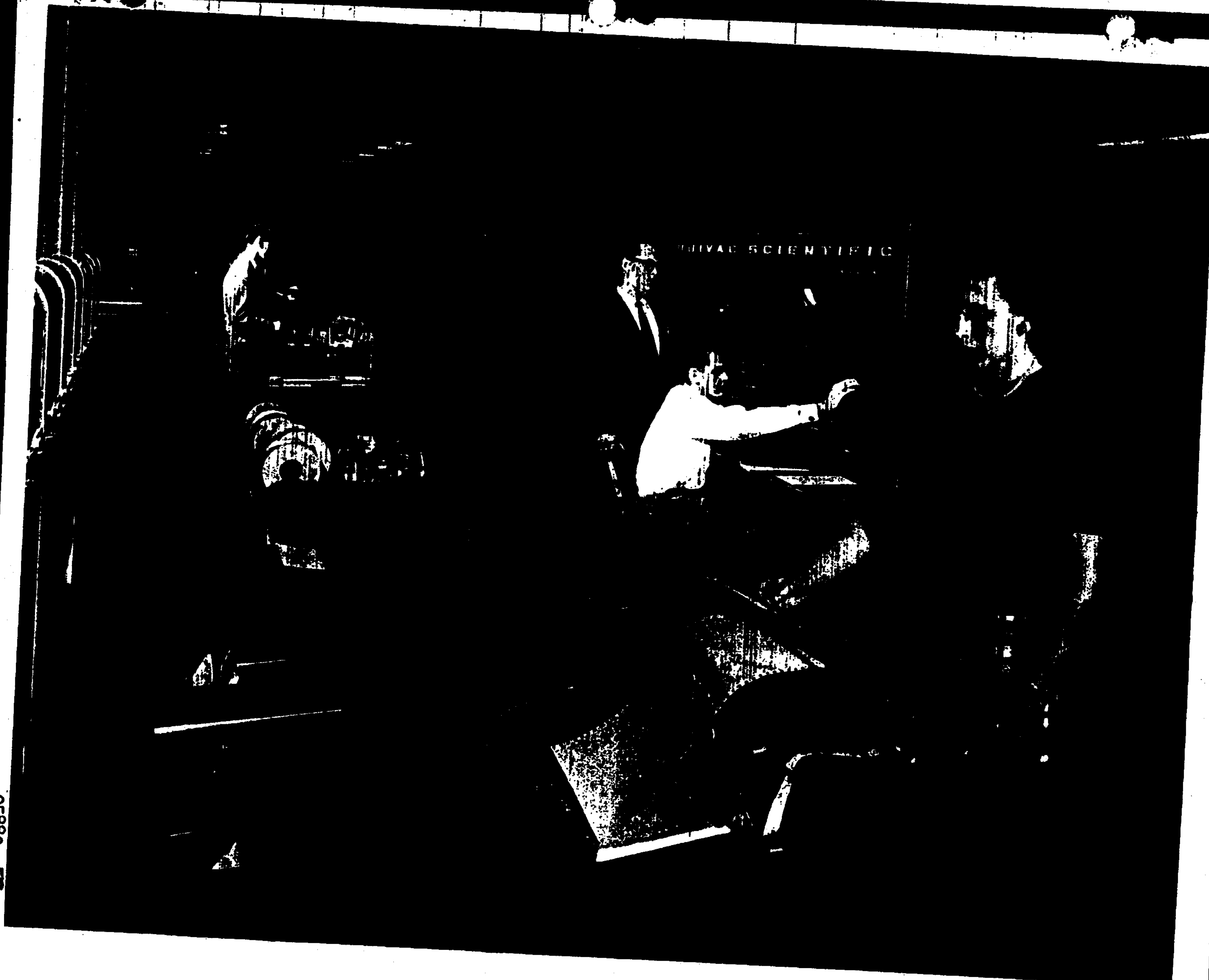

05880 59

05882 59

When an AGENA satellite is launched in Project DISCOVERER on its orbital path from Vandenberg Air Force Base, California over the poles, the first station which will track it is located on Kodiak Island, Alaska. Even when launch and injection data indicate a successful orbit has been obtained, project scientists wait anxiously during the first 90 minutes for "Kody" to report the satellite as it appears over the North Pole. When "Kody" confirms the orbit another DISCOVERER flight test is well underway.

UNITED STATES AIR FORCE PHOTO (AFBMD 05888-59)
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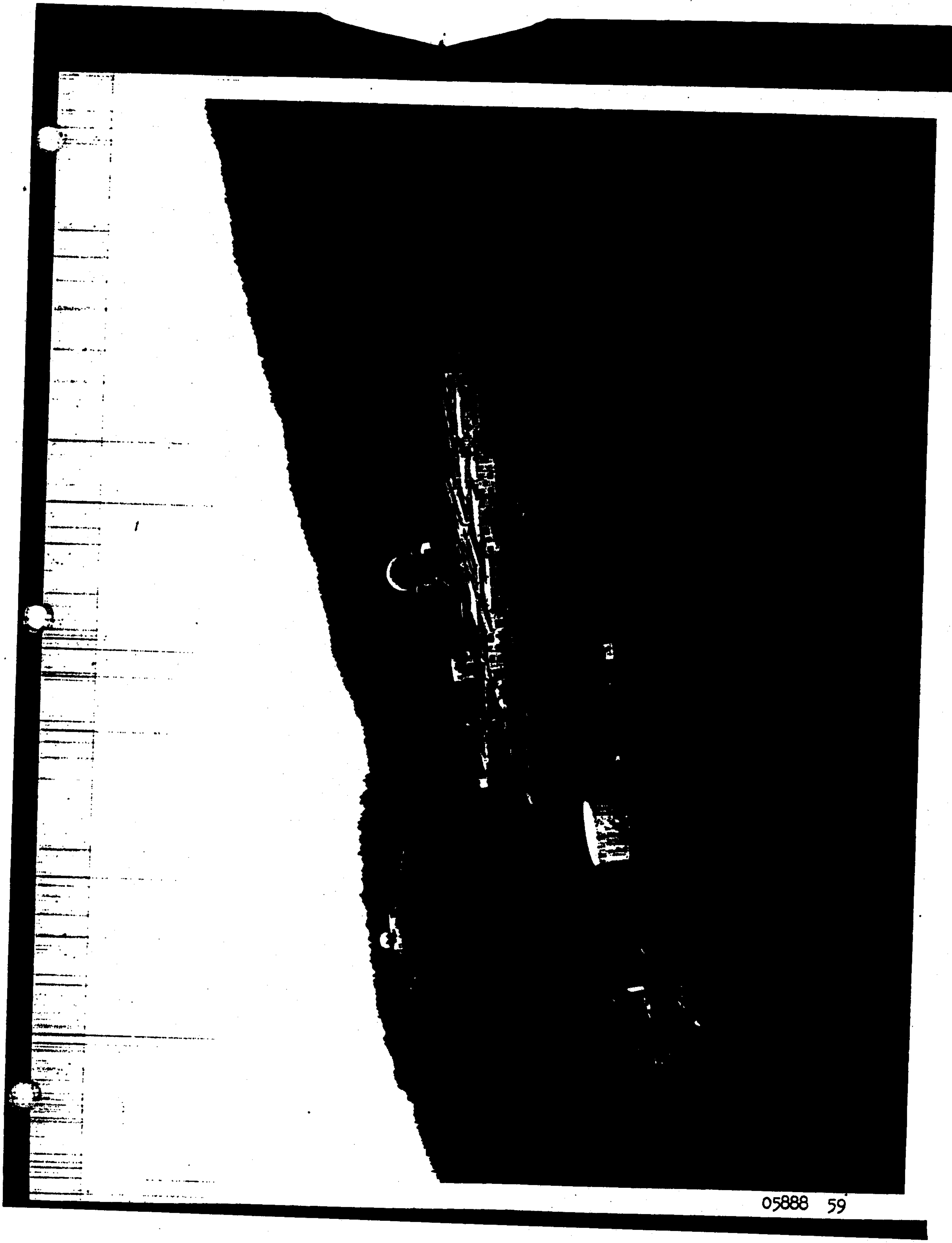
05888 59

This is the interior of the station at Kodiak. A project technician signals his associates to activate the tracking and command equipment as an AGENA satellite approaches within range of the station's radar and telemetry antennas.

UNITED STATES AIR FORCE PHOTO (AFBMD 05890-59)
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As a practice mission reaches its conclusion, crewmen of the 6593rd Test Squadron signal the winch operator during the final steps in bringing aboard a simulated recovery capsule. The 6593rd Test Squadron trains constantly against the day when they will have an opportunity to air-snatch a recovery capsule which has re-entered from a military satellite orbiting in space. This activity is part of Project DISCOVERER, an open ended research and development program to perfect a basic satellite vehicle for a whole family of versatile military space systems.

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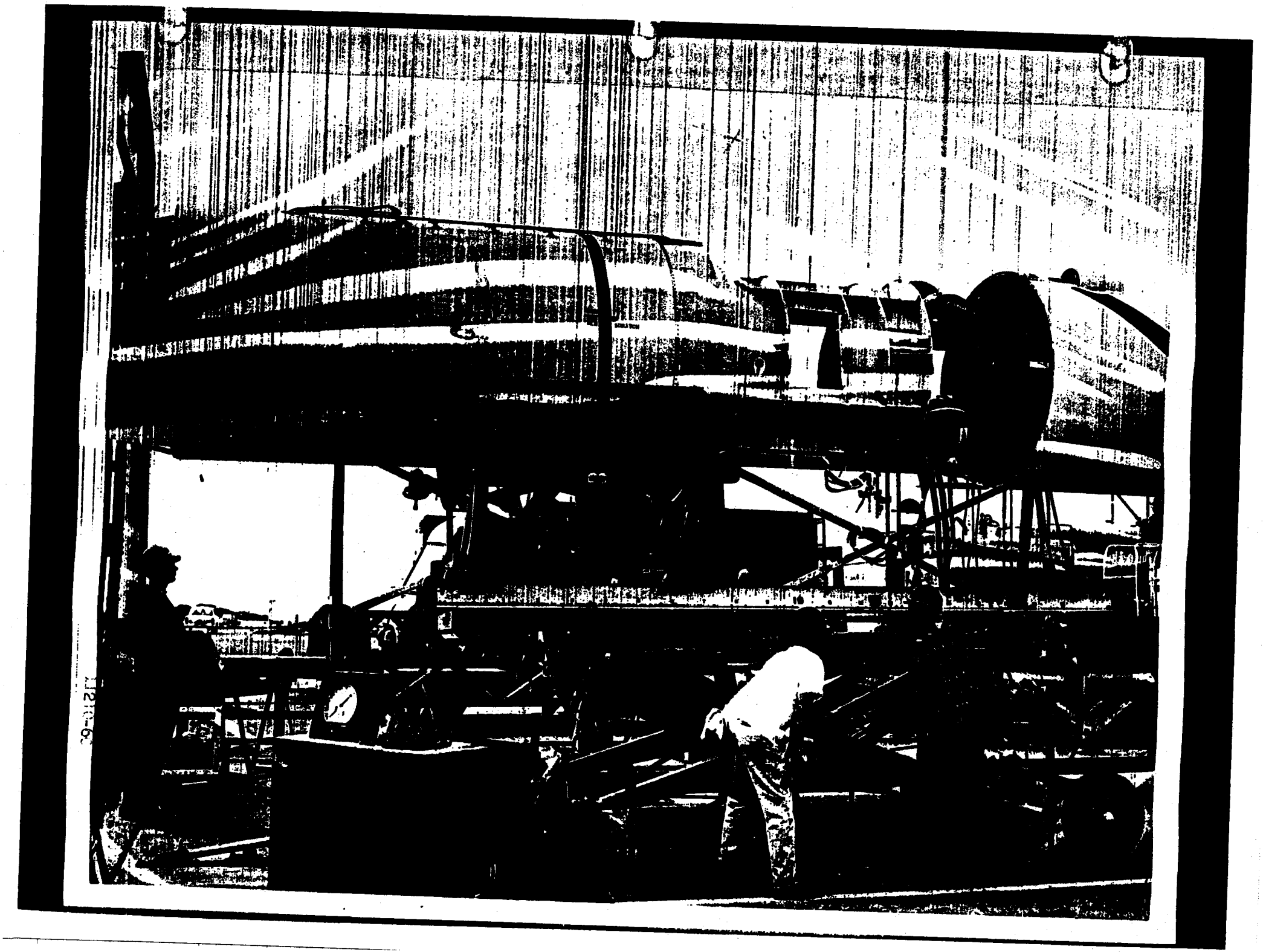

At Vandenberg Air Force Base, compatibility tests are performed on the Air Force THOR IRBM booster and the AGENA B -- the newest version of the versatile AGENA satellite vehicle under development as part of PROJECT DISCOVERER. The launch today of DISCOVERER XVI marks the first launch of an AGENA B vehicle. Versions of the AGENA B will continue to be launched in PROJECT DISCOVERER. Other AGENA B vehicles will be launched as part of PROJECT MIDAS and in the SAMOS research and development program. The vehicle shown mated here to the THOR is a dummy vehicle used for checkout purposes. It also will be noted that it does not have a nosecone. The B version is twenty-five long, five and a half feet longer than the A, and weighs almost twice as much, 15,000 pounds, at launch. Orbital weight after fuel exhaustion is approximately 2,100 pounds. To accommodate the AGENA B the guidance compartment of the THOR has been eliminated, shortening the booster by some 10 feet. In PROJECT DISCOVERER the THOR booster is controleed by tape-fed autopilot. The inertial guidance system is not used. Although the AGENA B launched today does not have a restart capability, such a capability is planned for future vehicles. PROJECT DISCOVERER is a research and development program to perfect a versatile satellite vehicle for use in a series of military space programs. The Air Force Ballistic Missile Division (ARDC) is executive manager of the program. Launch, tracking, communications and recovery is the responsibility of the 6594th Satellite Test Wing. Lockheed Missile and Space Division is the prime contractor for the AGENA satellite vehicle.

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06015 59

An Air Force C-119 recovery aircraft maneuvers in close to a training capsule which has been successfully air-snatched by its sister ship. The pilot will radio the snatch aircraft and report on the condition of the parachute, shroud lines, and the recovery gear, indicating whether or not the capsule can successfully be brought aboard the recovery aircraft.

UNITED STATES AIR FORCE PHOTO (AFBMD 06017-59)
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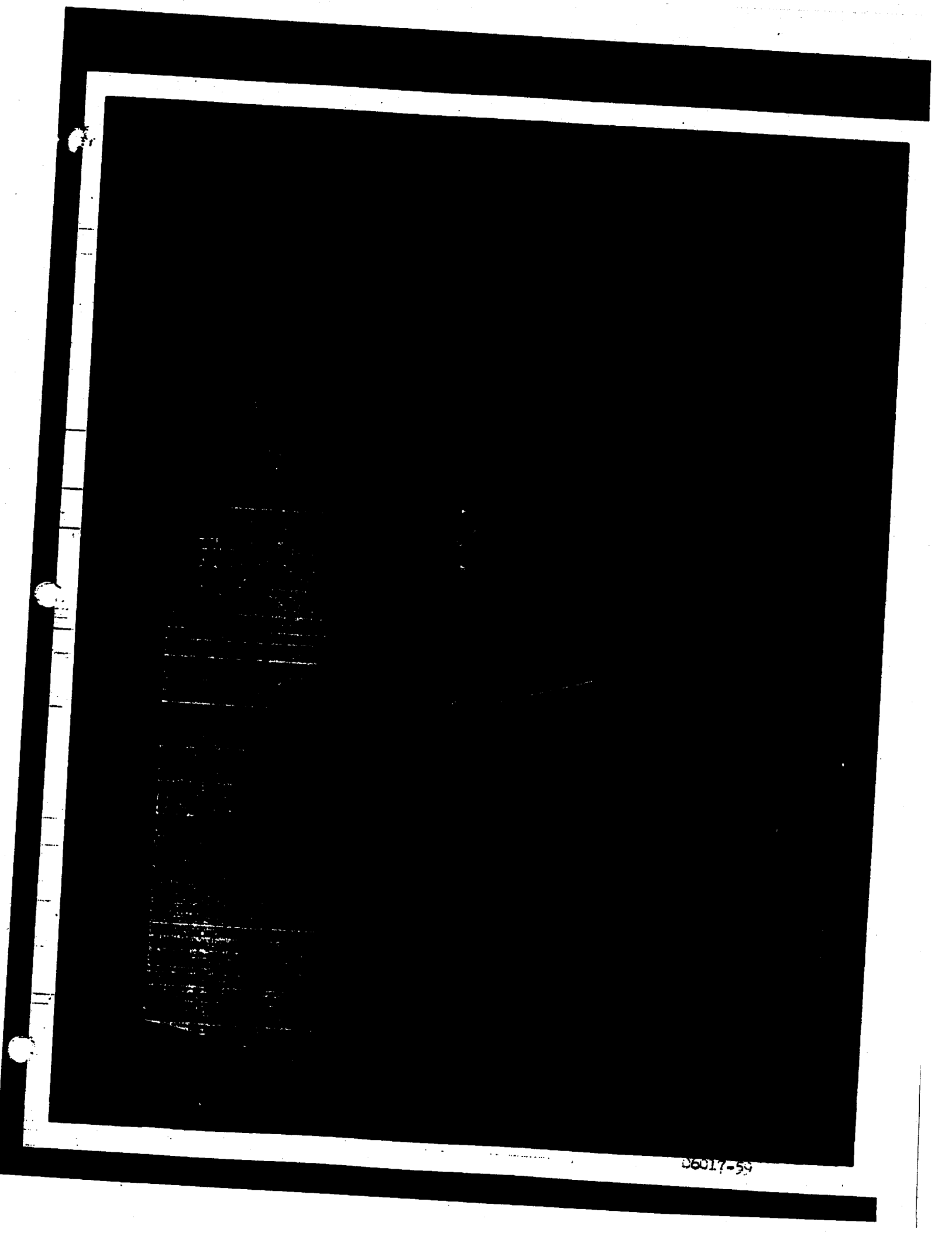

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A successful air-snatch accomplished, crewmen of the C-119 relax during the 30-minute period necessary for the winch operator to bring the capsule aboard.

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06018 59

A thousand feet above the Pacific Ocean at Kaena Point, Oahu, Hawaii is another Project DISCOVERER tracking station. These stations track, communicate with and command the AGENA satellite vehicle as it passes overhead on orbit. Timing devices in the satellite turn on its transmitters only when it is in range of a DISCOVERER tracking station.

UNITED STATES AIR FORCE PHOTO (AFBMD 0[illegible]-59)
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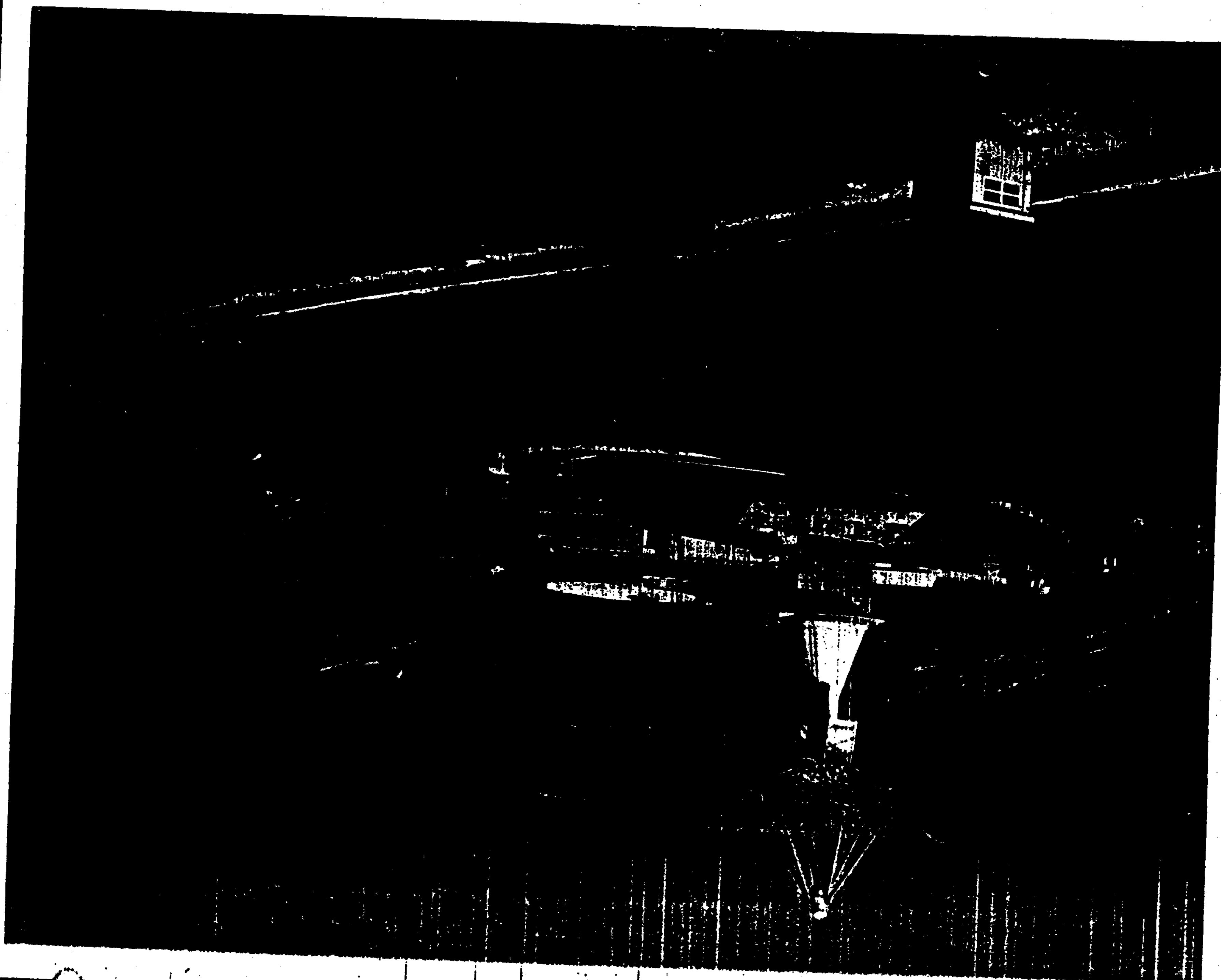

06482-59

Here an AGENA satellite, minus its re-entry vehicle is mated to the THOR IRBM booster. The AGENA satellite vehicle has its own orbit injection engine, a 15,000-pound thrust liquid rocket engine developed by Bell Aircraft Corporation.

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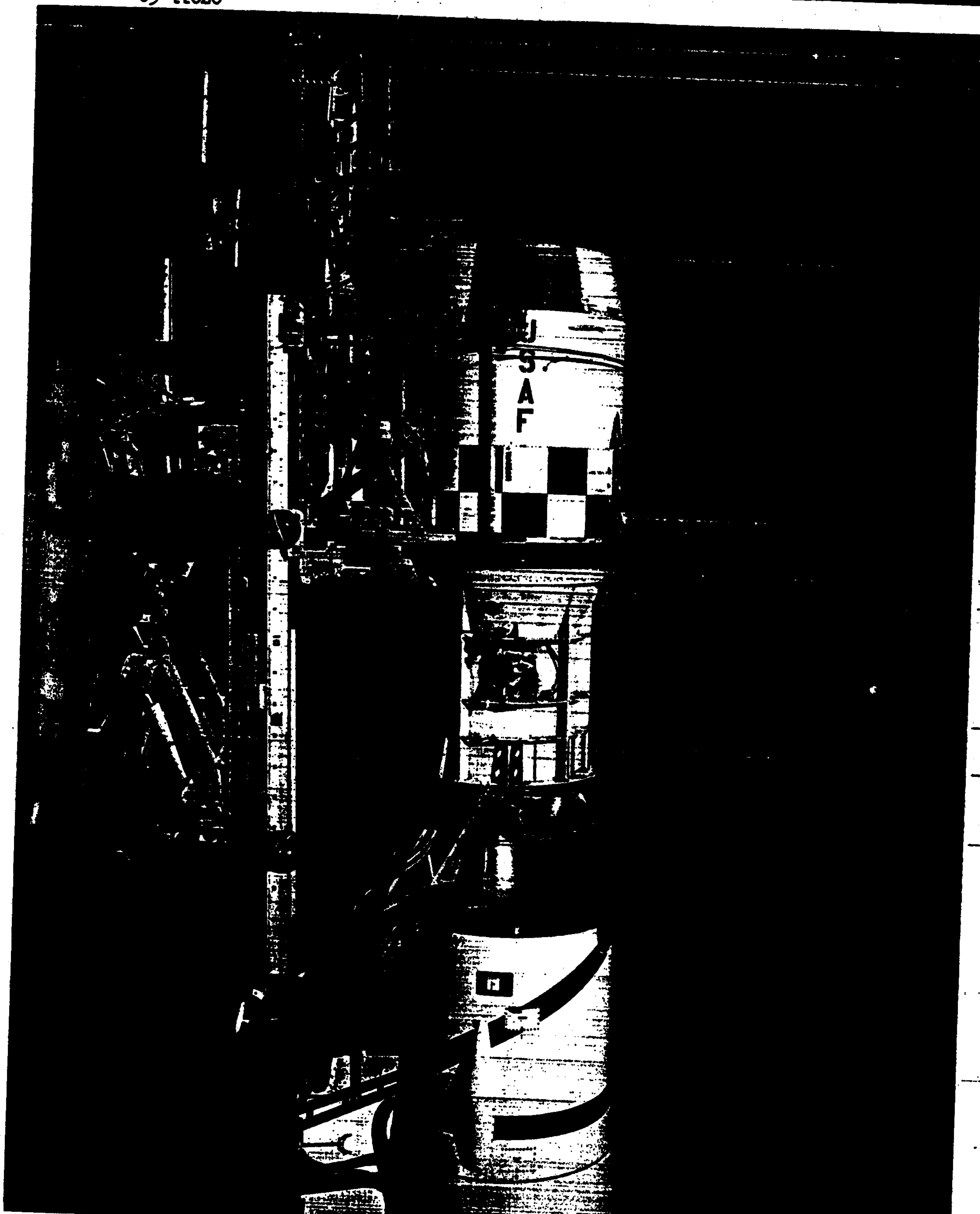
07011-60



Launches in the Project DISCOVERER series are conducted from one of two modified THOR IRBM training sites at Vandenberg Air Force Base, California. Here the AGENA satellite vehicle and its THOR booster are being erected into launch position.

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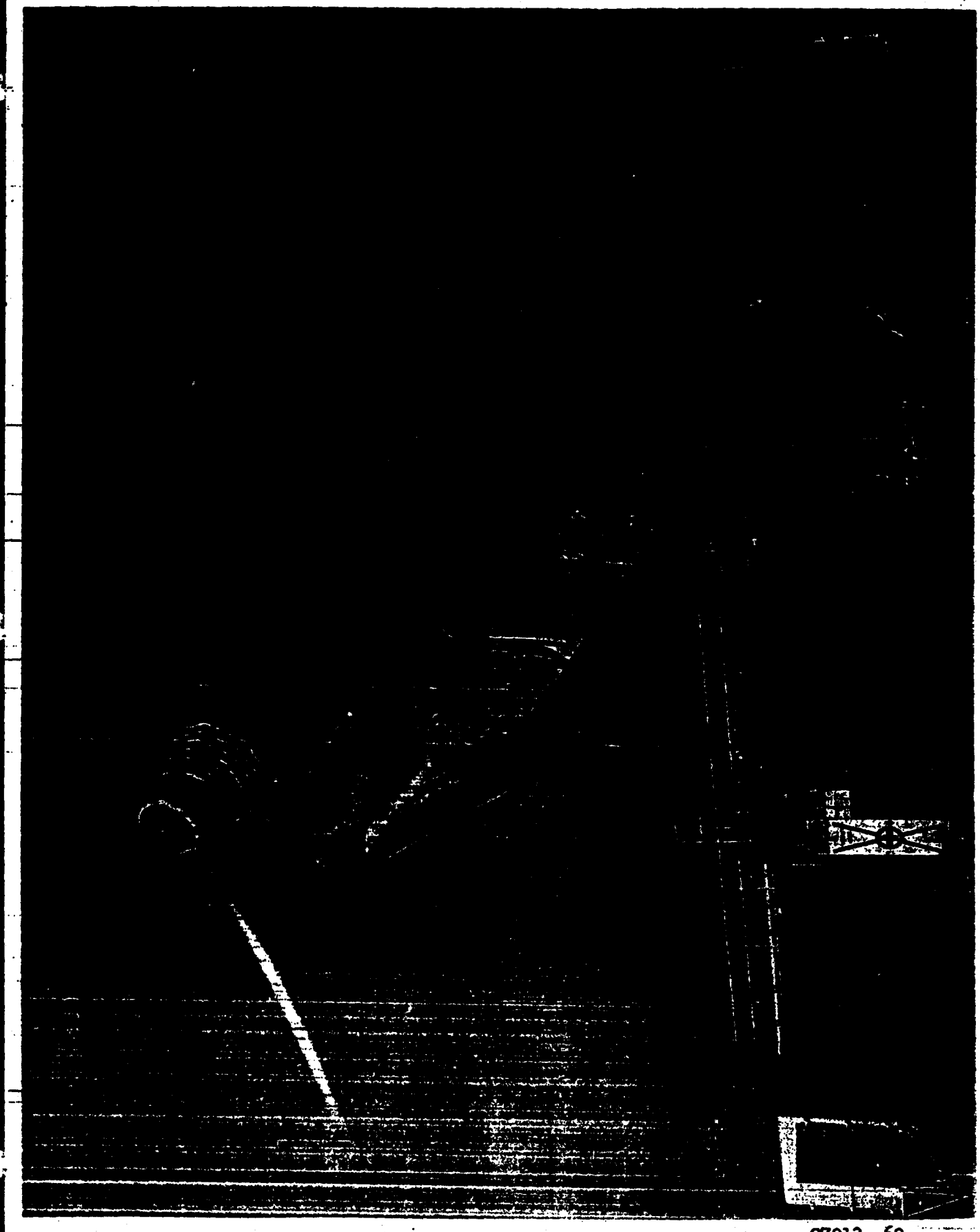

07013 60

To augment tracking facilities during the launch and orbital injection phase of Project DISCOVERER flight tests, the Pacific Missile Range provides this instrumentation ship, the USS Kings County. Telemetry and tracking equipment on the ship is operated by Air Force contractor personnel assigned to Project DISCOVERER. The ship is assigned a station down-range from VAFB off the coast of Baja, California.

UNITED STATES AIR FORCE PHOTO (AFBMD 08306-60)
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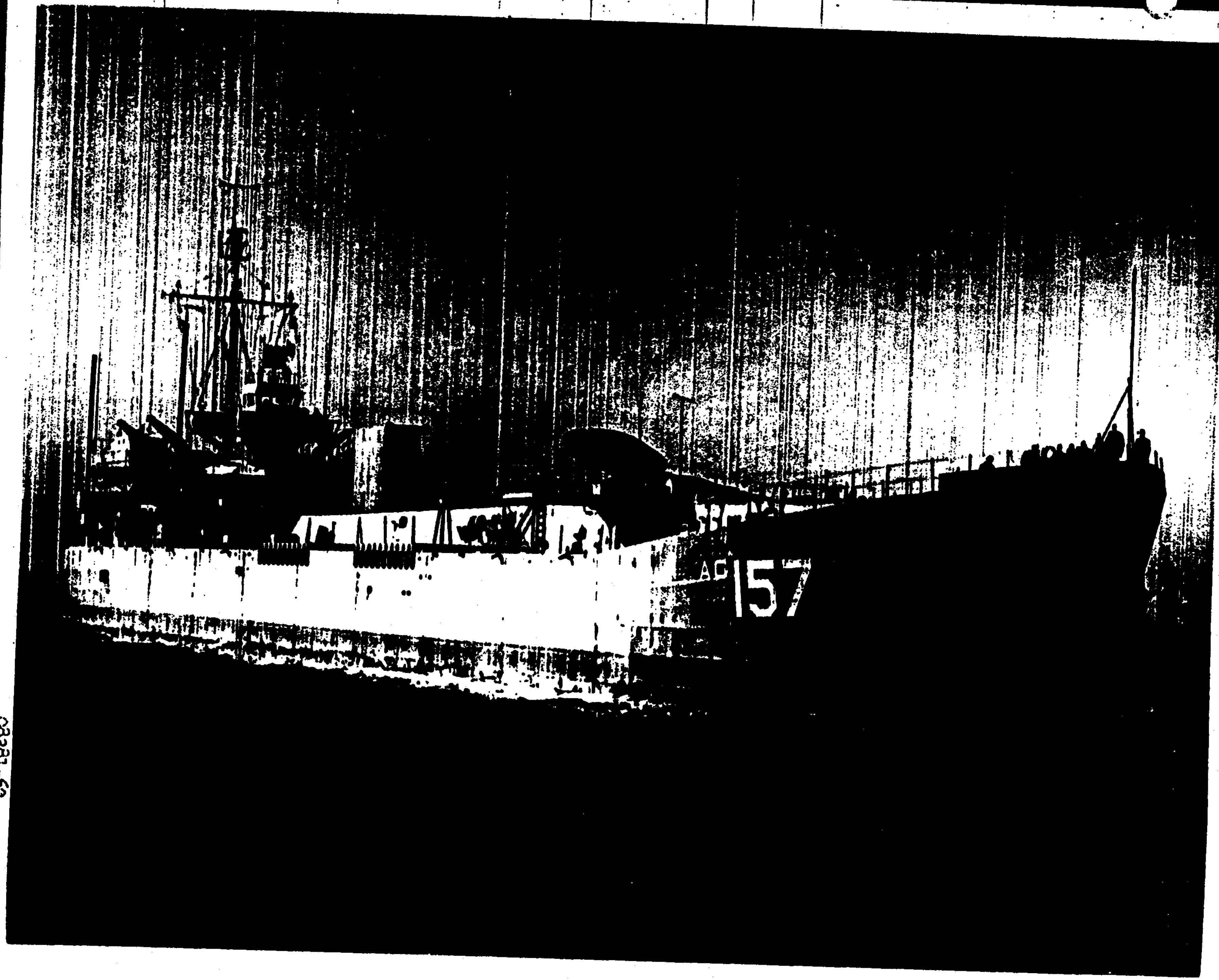

08381-60

The USNS Private Joe E. Mann, another instrumentation ship provided by the Pacific Missile Range in support of Project DISCOVERER. This ship is positioned about half-way between the tracking stations at Kodiak, Alaska and Kaena Point Hawaii. This ship provides facilities for receiving telemetry from the re-entry vehicle as it follows its trajectory from a point over the far north, where it is separated from the satellite, to the recovery area south of the Hawaiian Islands.

UNITED STATES AIR FORCE PHOTO (AFBMD 08382-59)
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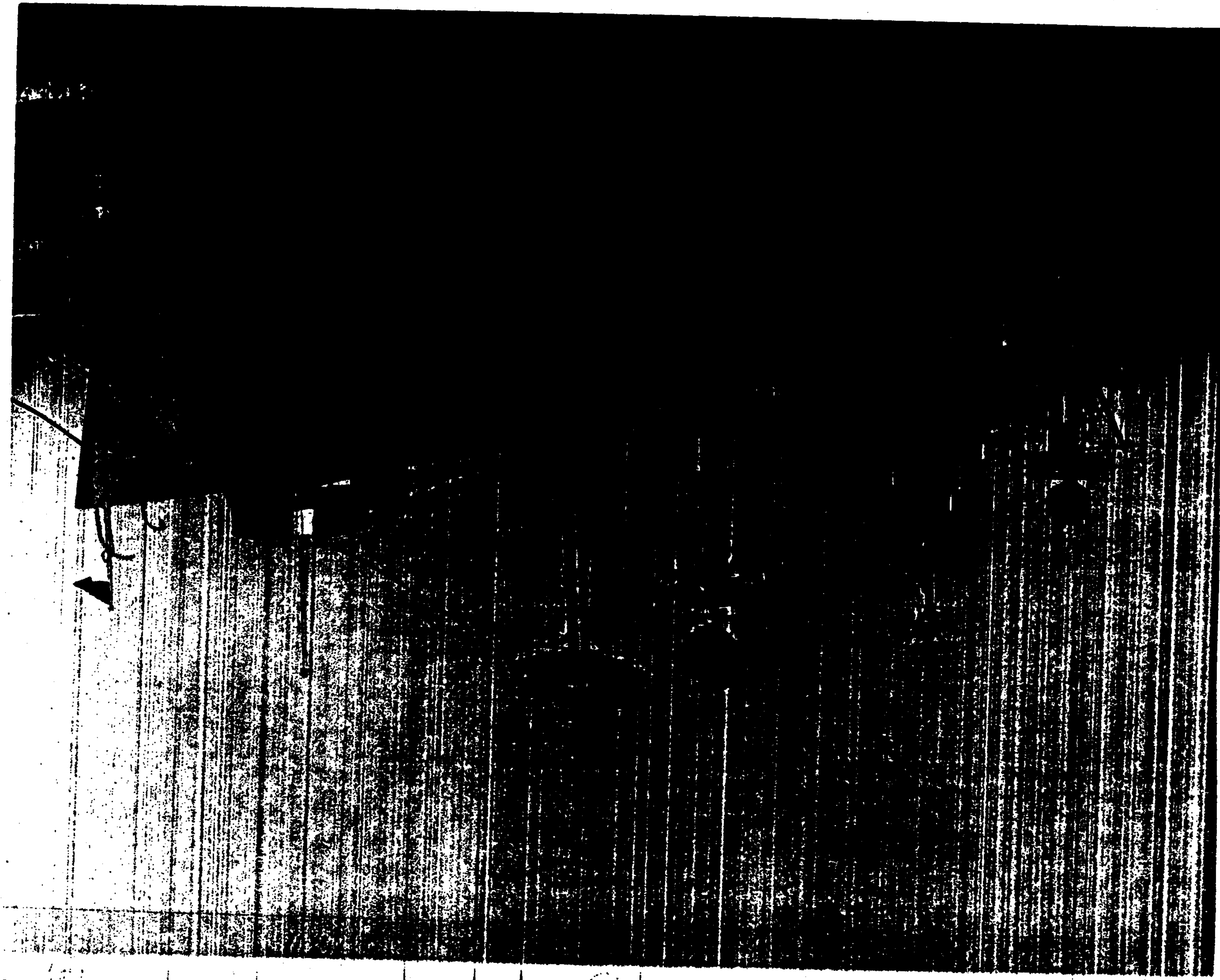

08382-60

At Vandenberg Air Force Base compatibility tests are performed on the Air Force THOR IRBM booster and the AGENA B -- the newest version of the versatile AGENA satellite vehicle under development as part of PROJECT DISCOVERER. The launch today of DISCOVERER XVI marks the first launch of an AGENA B vehicle. Versions of the AGENA B will continue to be launched as part of PROJECT DISCOVERER. Other AGENA B vehicles will be launched as part of PROJECT MIDAS and in the SAMOS research and development program. The vehicle shown mated here to the THOR is a dummy vehicle used for checkout purposes. It also will be noted that it does not have a nosecone. The B version is twenty-five feet long, five and a half feet longer than the A, and weighs almost twice as much, 15,500 pounds, at launch. Orbital weight after fuel exhaustion is approximately 2,100 pounds. To accommodate the AGENA B the guidance compartment of the THOR has been eliminated, shortening the booster by some 10 feet. In PROJECT DISCOVERER the THOR booster is controlled by tape-fed autopilot. The inertial guidance system is not used. Although the AGENA B launched today does not have a restart capability, such a capability is planned for future vehicles. PROJECT DISCOVERER is a research and development program to perfect a versatile satellite for use in a series of military space programs. The Air Force Ballistic Missile Division (ARDC) is executive manager of the program. Launch, tracking communications and recovery is the responsibility of the 6594th Satellite Test Wing. Lockheed Missile and Space Division is the prime contractor for the AGENA satellite vehicle.

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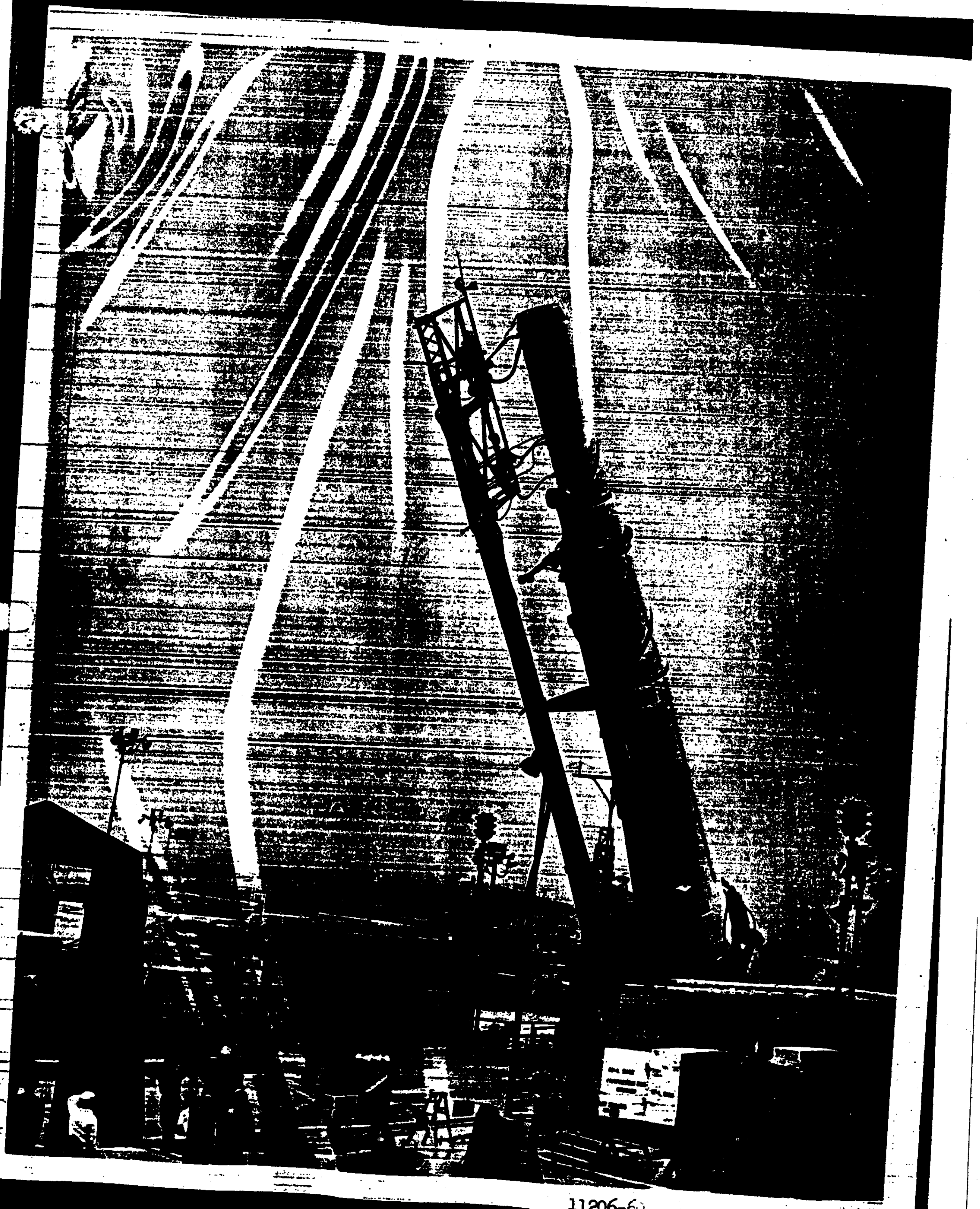

11206-60

At Vandenberg Air Force Base compatibility tests are performed on the Air Force THOR IRBM booster and the AGENA B -- the newest version of the versatile AGENA satellite vehicle under development as part of PROJECT DISCOVERER. The launch today of DISCOVERER XVI marks the first launch of an AGENA B vehicle. Versions of the AGENA B will continue to be launched as part of PROJECT DISCOVERER. Other AGENA B vehicles will be launched as part of PROJECT MIDAS and in the SAMOS research and development program. The vehicle mounted here to the THOR is a dummy vehicle used for checkout purposes. It also will be noted that it does not have a nosecone. The B version is twenty-five feet long, five and a half feet longer than the A, and weighs about twice as much, 15,500 pounds, at launch. Orbital weight after [illegible] is approximately 2,100 pounds. To accommodate the AGENA the guidance compartment of the THOR has been eliminated, shortening the booster by some 30 feet. In PROJECT DISCOVERER the THOR booster is controlled by tape-fed autopilot. The inertial guidance system is not used. Although the AGENA B launched today does not have a restart capability, such a capability is planned for future vehicles. PROJECT DISCOVERER is a research and development program to perfect a versatile satellite for use in a series of military space programs. The Air Force Ballistic Missile Division (ARDC) is executive manager of the program. Launch, tracking communications and recovery is the responsibility of the 6594th Satellite Test Wing. Lockheed Missile and Space Division is the prime contractor for the AGENA satellite vehicle.

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Released by the Office of Information
Hq. Air Force Ballistic Missile Division
Los Angeles 45, California