The AIMP's design, fabrication and experiment integration was conducted at Goddard. The spacecraft is set to be launched from Cape Kennedy on June 30. Goddard is responsible for the project's technical management.

OGO III Checkout Completed

The Orbiting Geophysical Observatory III spacecraft checkout program has been completed by Goddard, and OGO project officials report the 1,135-pound scientific observatory is operating well and that the 21 experiments carried on board have been turned on and are transmitting data to earth ground stations.

And again from the Vice President:

"As chairman of the National Aeronautics and Space Council, I wish to extend to you my personal congratulations for the part you played in the success of OGO III. I understand that all twenty-one of the experiments on board OGO III are now operational. Your contributions directly assisted in making OGO III a smashing success."

Hubert H. Humphrey

OGO III was launched by an Atlas-Agena rocket from Cape Kennedy, Florida, June 6, 1966, into a near perfect earth orbit. The around-the-clock checkout program conducted by Goddard's OGO Control Center involved more than 600 commands sent to and obeyed by the spacecraft.

A problem in receiving signals from the range and range-rate tracking beacon—a method for precise determination of position in orbit—is continuing to occur and its cause is under study. However, it does not seriously affect the OGO III scientific mission since an alternate system is being used.

As of last week, more than 3,000 hours of scientific experiment data have been recorded by OGO III.

GODDARD NEWS

THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

GODDARD SPACE FLIGHT CENTER / GREENBELT, MARYLAND

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FIRST ANCHORED IMP LAUNCHING SET

One of the most exciting spacecraft launchings in Goddard's history is set for Thursday, June 30, at Cape Kennedy, Florida.

At 11:10 a.m. (EDT), and during a three-minute "window," a three-stage Delta rocket is scheduled to hurl the 206-pound Goddard-designed and built Anchored Interplanetary Monitoring Platform (AIMP) into orbit around the moon.

If the three-day-plus flight to the moon succeeds, AIMP will become the first U. S. spacecraft to orbit the moon, and the Goddard-managed Delta rocket will have scored one of its most spectacular successes.

No mid-course correction will be made and, if all goes well, AIMP will be "braked" into anchored orbit around the moon by firing a small 80-pound retromotor mounted on the top of its main body.

The term "anchored" refers to the fact that the spacecraft is intended to be anchored to the moon's gravitational field. Firing the retromotor is the final step in the flight making it possible for the moon to gravitationally capture AIMP.

Because of the exceedingly precise trajectory needed, the launching is limited to a daily three-minute "window" during a four-day period. If AIMP cannot be launched between June 30 to July 3, the mission will be postponed until the next favorable period which is July 20 to July 31.

The orbit hoped for will have an apolune or high point above the moon of about 4,000 statute miles, a perilune of about 800 miles and an inclination of about 175 degrees retrograde to the lunar equator. In this ideal orbit, AIMP would circle the moon once every ten hours. These figures represent the desired orbit and considerable variation can be expected without jeopardy to the spacecraft scientific mission. Design lifetime for the AIMP is six months.

In the event the orbit around the moon cannot be achieved—chances of success have been computed to be four out of five—an alternate orbit has been planned for the spacecraft. This would be a highly elliptical earth orbit with an apogee of about 270,000 miles and a perigee of about 24,000 miles. It would take the spacecraft more than two weeks to complete one orbit.

Purpose of the AIMP is to conduct significant scientific studies of interplanetary magnetic fields, the interaction of solar wind with the moon, solar and galactic cosmic rays, ion and electron distribution in the vicinity of the moon, as well as to study the lunar gravitational field, the weak lunar ionosphere and in general to better understand the space environment of the moon.

Placing AIMP into orbit around the moon anchors it in interplanetary space and permits extended periods of study away from the influence of the earth's magnetic field. In addition, by taking advantage of the moon's orbit, AIMP will be able to study the earth's magnetic tail 13 times a year as compared with the once a year studies possible from highly elliptical earth orbits.

The AIMP scientific experiment payload consists of six prime, two passive experiments, and a solar cell damage study. These were provided by scientists from the University of California, the University of Iowa, Stanford University, the Massachusetts Institute of Technology, the NASA Ames Research Center and Goddard Space Flight Center.

Two AIMP spacecraft are presently programmed by NASA.

See Page 6

DATA TOPICS

Frank A. Keipert (left) and Richard C. Lee, both of the Information Processing Division, are the co-authors of this week's **Data Topics.** *Mr. Keipert is the Project Manager for Stars II, and Mr. Lee is the Assistant Project Manager. Both men started on the development of this project in the fall of 1963. Prior to that, they were involved in telemetry data processing: Mr. Keipert at Hollomann Air Force Base, and Mr. Lee at Edwards Air Force Base. Educated at Munich's Institute of Technology, Mr. Keipert received his Dipl. Ing. degree in 1951. Mr. Lee holds an MSEE from MIT, 1958, and an MA in Applied Math from Harvard, 1961.*

STARS II

STARS II is the newest data processing system of the Information Processing Division, and the first fully automatic, computer controlled system for production processing of telemetry data. This system is one of the principal links between the data recorded at STADAN stations, and the final experiment and spacecraft data analysis.

The STARS II system combines signal processing and quality checking of data into a single operation, thus eliminating the time delay caused by scheduling and running two independent operations. Computer control of the system reduces the number of operator errors by automatically setting up the processing for a given satellite. On-line data monitoring by the computer decreases the amount of reprocessing by immediately detecting problems in the operation. Automatic checkout through a full set of diagnostic routines is also available.

In the STARS II system, a CDC 3200 computer is combined with special signal processing equipment developed by Beckman Instruments. The CDC 3200 is a medium sized, general purpose digital computer with a 24 bit word length and average speed of 400,000 instructions per second. The computer is equipped with 16,000 words of core memory, a 1000 line per minute printer, a card reader, a card punch, and five digital tape units.

Normal data input to the system will be from analog magnetic tapes recorded at STADAN stations. Data from real time links to Goddard, or an internal stored-program simulator may also be accepted. In the case of recorded data, the analog tape can be played into the system at up to thirty-two times the recording speed, corresponding to bit rates up to 512,000 bits per second. This speed-up capability reduces the processing time proportionally. The output of the STARS II system is normally a digital tape for further processing on large scale computers, such as the UNIVAC 1108.

A STARS II system for processing PCM data consists of an input subsystem, PSM subsystem, time code subsystem, display subsystem, and the computer.

The input control unit provides automatic selection of the data source, speed and track selection, and motion control of the analog tape playback units.

The PCM subsystem consists of two signal conditioners, two group synchronizers, one stored-program controller, and one limit checking unit. By communicating with the central computer through separate input-output channels, two telemetry channels from a single satellite may be processed simultaneously.

The signal conditioners contain both point-sampling and integrate-and-dump bit detectors for high data recovery. For greater reliability in processing data from single channel satellites, the two bit synchronizers are switchable between the two PCM channels.

For group synchronization, a three-mode strategy with search, verify and lock is used. Data transfer to the computer may be started in either verify or lock mode to maximize data recovery. If the computer is started in verify mode, the information may be saved in the computer for use in case the PCM subsystem proceeds into lock mode. When in lock mode the group synchronizer automatically corrects signal conditioner bit slippage for improved data recovery.

Formats that are beyond the normal PCM subsystem capability can be handled in a bit stream mode. In this mode the reconditioned bits are transferred to the computer regardless of word, frame, and subframe synchronization. Frame synchronization and formatting are then accomplished in the computer. Although this is not an efficient mode of operation, in certain cases it is the only known method of reliably recovering the data, such as a short burst of telemetry frames.

The PCM stored-program controller contains a 4096 word core memory for the storage of up to seven different data formats. Static and dynamic instructions for the controller are loaded from the computer. A static instruction is used once each processing run for the automatic setup of such items as bit rate, data acquisition strategy and format parameters. Dynamic instructions are used at least once every telemetry word for variable word length control, data routing to displays, subframe synchronization and limit checking.

The time code subsystem utilizes signals recorded on three tracks of the station tape, reconstructs and presents a best estimate of time at which the data were received at the recording station, plus other identifying information. This subsystem provides computer setup of the speed-up factor, input signal selection, and strategy for the best estimate of time. Time readouts are provided on request from both PCM subsystems.

The interface with the CDC 3200 computer provides for communication with the PCM subsystem and PCM simulator; automatic setup of the time decoder, analog tape units, display subsystem; and data input control and feedback of status information from all subsystems to the computer, including data and time quality. The on-line computer printer displays this quality information. In addition, the display subsystem can plot raw data from the PCM subsystem, or processed data from the computer on a six channel oscillograph recorder. The remaining displays for system operation are located on a centralized telemetry console, which also contains manual over-rides for all automatic set-ups.

An executive routine for the overall STARS II system is presently under development by Computer Sciences Corporation. This routine will control the automatic set-up and verification of all subsystems, the loading of the PCM programs, the input-output of data, accounting, calculation of performance statistics, and job sequencing.

The first STARS II system for processing PCM data is already operating in Building 3 at Goddard. A second identical PCM system is scheduled for delivery next month.

GODDARD NEWS

JUNE 27, 1966

"It is difficult to say what is impossible, for the dream of yesterday is the hope of today and the reality of tomorrow."
—Dr. Robert H. Goddard

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A Compatability Problem

The Development of A Common Language

Remember the days when automobile parts were handmade, when each part was individually turned to suit only one engine—yours. Superb motor cars were built by our early automotive craftsmen, but when replacement parts were needed, you would have to have the part individually made. But as the auto industry grew, the concept of "interchangeability" developed. Parts built for one model engine would fit all of that model's engines.

In the space age, with the extensive use of computers, a modern problem along the same lines as that of the auto's developed and was overcome here at Goddard. A new computer program to standardize methods of analysis and means of communications between the various NASA centers and private industry is being developed under the leadership of Tom Butler, Head of the Test and Evaluation Division's Structural Analysis Computer Group.

Tom Butler

Prior to the development of this computer program, "efficiency of the NASA centers to analyze the static and dynamic characteristics of complicated structures was highly varied and hampered by the limitations of their present computer programs. There is no common computer program, and therefore, communication between field centers regarding structural analysis problems is severely limited," according to Mr. Butler.

In addition, says Mr. Butler, "In the design of a multi-stage launch vehicle, each stage must be structurally analyzed, and it is quite likely that each stage will be anlyzed by different methods. Therefore, the center responsible for the systems analysis of the complete vehicle must start from scratch in their analysis because of the incompatibility of the methods used for each stage."

It is believed that the incorporation of this program into all NASA centers will take two years to complete, but will be operational to a limited extent within a year.

The program will have two unique features; first is its universality which will make it independent of any manufacturers' digital equipment; and second is its modular design which allows for ease in updating and altering of the system.

According to the "Report of the NASA AD HOC Group on Computer Programs for Structural Analysis," of which Mr. Butler was chairman, the general purpose program will have the following features:

- Input limited to geometry, material properties definition of boundary conditions (including loads), and required control information.
- A library of elastic element representation containing general one-dimensional and two-dimensional elements. General anisotopic material properties, prismatic one-dimensional elements, and uniform thickness two-dimensional elements will be considered in the basic program. Any combination of elements must be available for a structural idealization. Thermal and mass properties will be included in all element representations.
- Modular design, so that any one module can be altered internally, or even replaced, without affecting the function of any other module. Explicit addressing of matrix operations is being provided without causing degradation of the efficiency of the basic program.

See page 7

ANALYSIS OF ANTARCTIC ALBEDO MEASUREMENTS YIELDS NEW VALUE

Dr. S. I. Rasool of the Goddard Institute for Space Studies and Wayne McGovern of New York University have completed a preliminary analysis of albedo measurements obtained during the world's first round-the-world circumpolar flight last November.

Dr. S. I. Rasool

Wayne McGovern

The measurements were made with an Eppley radiometer placed aboard a Boeing 707 aircraft which followed a 56-hour route from Hawaii, over the North Pole, to London, Rio de Janeiro, across the South Antarctic and back to Hawaii.

The most interesting result is an average reflectivity of 58 percent for the Antarctic surface and atmosphere. This value is substantially lower than the previously assumed value of 70-80 percent based on the reflectivity of surface snow and ice. Dr. Rasool's data provide evidence that the difference is caused by absorption in the atmosphere.

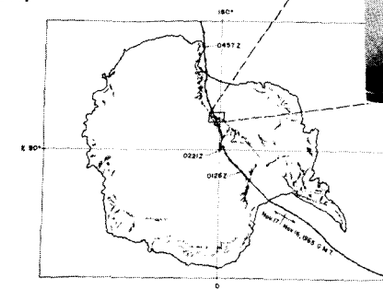
The Antarctic albedo has implications for the climatology of the region. The high value of the albedo assumed in earlier work implied that the Antarctic is a region of negative heat balance; that is, that it emits more heat into space in the form of radiation than it receives from the sun. It had been suggested that the difference was made up by an influx of heat carried into the region by atmospheric and ocean currents, and that this influx of energy in the form of currents of air and water was connected with the pattern of storminess at high latitudes which is observed in the Southern Hemisphere. The new albedo suggests a re-examination of previous studies of the heat balance in the Southern Hemisphere.

The radiometer, installed in the bottom of the plane, made its measurements across the Antarctic at an altitude of 13 kilometers. The instrument measured the reflected solar radiation at a wavelength interval of 0.3 to 1.2 microns.

Dr. Rasool and McGovern were invited to place their experiment aboard the 707 by Professor Serge Korff of NYU's Physics Department, who headed a program to obtain information on the jet stream, cosmic radiation, air samplings for spores and micrometeorites, laser determination of air density and altitude and cloud photography for correlations of meteorological satellites in orbit.

Incidental to the scientific purposes of the flight, the Boeing 707 set at least five world records, including fastest time from point to point, pole to pole, and around the world.

The path taken over the Antarctic by the airborne radiometer which obtained albedo measurements of the region is shown in the sketch at left (heavy black line.) At right is the Queen Alexandria mountain range, photographed from the plane by A. D. Goedeke of Douglas Aircraft Corp.



CADFISS constantly checks the radars at Bermuda . . . telemetry and voice systems aboard

CADFISS: *A Quick & Accurate Network Check*

Project Mercury was the first space program to create a realtime computer-centered, world-wide satellite tracking and communications network. This world-wide network is composed of remote sites or stations having a direct, on-demand access to Goddard computers via teletype, submarine cable, land lines, as well as other transmission links. With such an extensive network, a quick and accurate method to determine network capabiity to provide mission support had to be developed. Such a method had to provide for the quick identification and isolation of any malfunction anywhere in the network. In addition, a "test standard" applicable to all sites was needed regardless of their individual equipment configuration. Thus, a status of "Good" at the Canary Islands had to be identical with a status of "Good" at Woomera, Australia. Another factor to be considered was the tendency of electronic equipment to drift off calibration after being peaked for support of a mission. This tendency required that the peaking and the means of status determination of the equipment for support of a mission had to be performed reasonably close to launch time.

To fulfill these requirements, CADFIST, a computer-controlled. automated, network test was designed. It is a realtime tracking network status check which simultaneously tests the major subsystem at each of the world-wide sites for their ability and readiness to support manned missions. CADFIST is an abbreviation for Computation and Data Flow Integrated Subsystem Test. The system, made up of individual tests under control of a master program, is designed to provide a qualitative measure of how well certain logical subsets of the overall network are functioning. Without CADFISS testing, this network verification would have to be accomplished by a person or persons centrally located making visual and voice checks.

It is not sufficient to ascertain that the subsystems of a remote site are functioning properly; it must also be determined that the subsystems of all tracking sites are properly integrated to the central computer, and that the network is operational as a complete system. Since CADFISS tests are run from the central computer at Goddard the integrity of the entire system is tested.

Initially, CADFISS tests were used to systematically test the newly installed tracking sites and integrate them into the tracking network one at a time. The CADFISS tests, under the automatic control of a centrally located computer, are designed to test, evaluate and determine the degree to which the computer related portions of the Manned Space Flight Tracking Network have fulfilled their system design requirements, to determine those portions of the network which are not functioning properly, and to determine the operational capability of the network to support a mission. Techniques, developed for the CADFISS system, are employed to achieve various depths of testing and evaluation. Complete system testing is accomplished by: 1) logical choice and arrangement of individual CADFISS tests; 2) use of computer generated analysis; and 3) human evaluation of the results.

Subsystems, such as radar, digital command or telemetry, may be independently tested by the proper selection and logical grouping of unit tests associated with each subsystem. By arranging groups of subsystems tests, a remote site may be tested as a complete site system. Combining the tests of all remote sites, a complete tracking network may be tested and verified in the same amount of time as that required to test a single site.

CADFISS tests with individual sites are arranged in a building block sequence. If a confidence check is all that is required, the test performed would be an end-to-end test; that is, data flow from the radar to the computer. A step-by-step procedure, the CADFISS is employed as a diagnostic tool; testing can begin with a communication continuity test between the site data transmitter and the computer, then penetrate further into the site to the data collection point and then further still until the overall end-to-end test has been accomplished.

Basically the CADFISS Testing System operates in the following

ean stations

manner. The computer is loaded with a set of tests and corresponding standards against which the test results are to be compared. Under program control, the computer simultaneously transmits cues (signals to a site identifying the particular test in progress) to each of the sites being tested. The site then has a specific number of minutes within which it must respond. There is a separate cue, standard and time limit for each test. A test may exercise and devaluate the operating capability and efficiency of individual pieces of equipment, or groups of equipment forming systems or subsystems at the site. In all of these tests, a criteria of successes vs. failures has been established. If a system, for example, exceeds the allowable number of failures, the system is considered to have failed the test and adjustments are made.

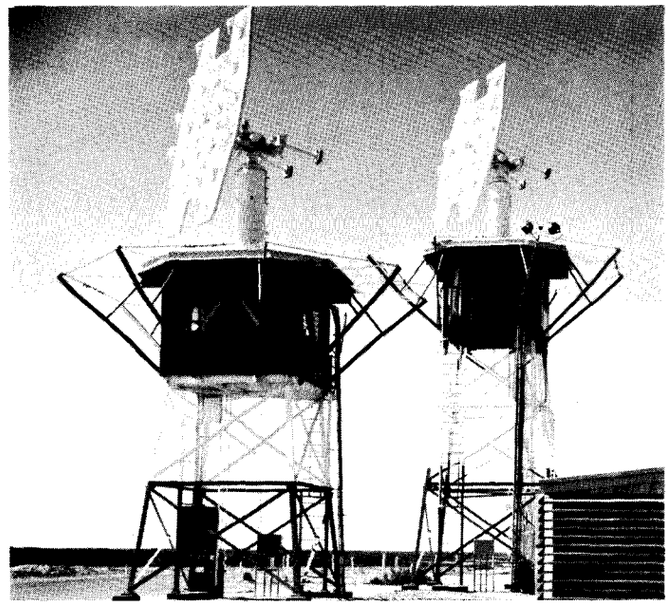
The CADFISS System is divided into three major computer programs; the Input Generator Program, the CADFIST Monitor Analysis Program, and the Log Tape Dump Program. Test selection, sequence of tests and other test parameters are specified by the CADFISS Test Director, Walter Adams. These specifications are prepared for insertion into the Input Generator Program in the form of punched cards. The Input Generator converts, expands, and organizes these test requirements into the form of commands required by the Monitor and Analysis Program and prepares the test module magnetic tape. The program also prepares an on-line listing of the tests with all pertinent information and provides a validity check in the event of an erroneous request. If an erroneous request is made, or if a card is mispunched, the program provides an on-line printed indication of the error and the corrective action required. The realtime operation is contained in the CADFISS Monitor and Analysis Program. When loaded into the computer, this program reads the test module magnetic tape prepared by the Input Generator and causes the computer to cycle until a sense switch is set to initiate the start of the test. The program is time synchronized to a WWV time standard signal. At the first WWV one minute pulse after the sense switch is set, the monitor program automatically generates and transmits cues to the remote sites. Once the test has started, the monitor program conducts and controls the test automatically without need for human intervention. As data is received from each site in response to the various types of test cues, the computer compares the data to predetermined standards, scores the test, presents the data to the analysis program, and logs all incoming and outgoing data and cues on a magnetic tape for further post test analysis. As each test is completed, the test score is printed in the Goddard Realtime Computing Center.

The CADFIST Director has three major controls over the CADFIST Monitor and Analysis Program while test test is in progress. He may rerun individual tests which have not met his requirements, he may delete individual tests which were originally scheduled, or he may prematurely end the complete operation. In this manner the CADFISS program utilizes the speed of automatic computer control and at the same time permits the flexibility of test control by human intervention.

The third phase of the CADFISS program, Realtime Cadout process and outputs all data that was transmitted or received by the computer during the progress of the test. The data received and the cues transmitted are listed in raw form and are time tagged as to the time of receipt or transmission for the purpose of documentation and given the site information concerning a test problem. The documentation furnished by the three programs is not only used during the test, but also in the post test analysis and evaluation of all sites and equipments. When these test results are accumulated over a period of time and are analyzed as related data, they offer an excellent basis for trend determination, evaluation of maintenance techniques, modification evaluation studies, and comparison of like equipments at different locations.

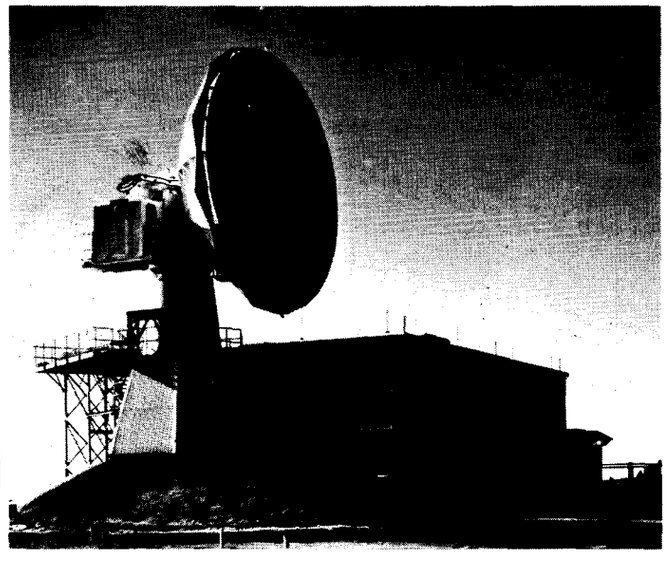
. . . and this information is presented to the watchful eyes of the CADFISS team throughout the mission.

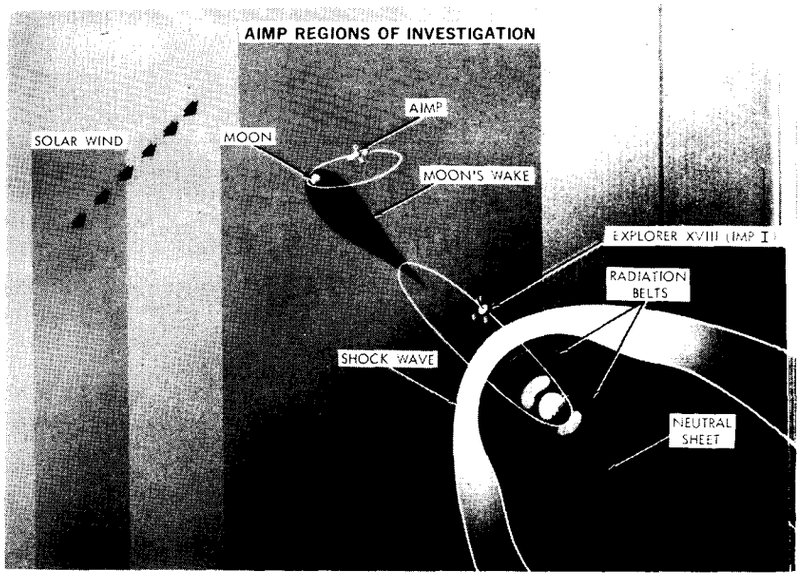
. . . telemetry antenna in Australia



. . . mountain top long range radar, telemetry, and voice systems at Hawaii

. . . and the extra long FPQ-6 radars





AIMP LAUNCHING . . . *from page 1*

They will be launched about one-year apart.

AIMP is a phase of the overall Interplanetary Monitoring Platform (IMP) program now constituted as a series of seven spacecraft. The primary objective of this program is to extend man's knowledge of solar-terrestrial relationships through continuous monitoring of the near-earth and interplanetary space environment over a major portion of the 11-year solar cycle. Three regular IMPs have been successfully launched. Each of them has contributed valuable scientific information.

Data obtained by AIMP and regular IMP spacecraft are also useful in determining the radiation levels to be expected during Apollo flights to the moon, as well as aiding in the eventual development of a solar flare prediction capability for that program. Moreover, results from the AIMP program can be expected to contribute to future space exploration efforts by uncovering new phenomena to be investigated.

AIMP and IMP spacecraft are part of the scientific space exploration program conducted by NASA's Office of Space Science and Applications. Project technical management for both programs is directed by Goddard. The design, fabrication and experiment integration of these spacecraft is conducted at Goddard. The experiments are provided by the individual scientific investigators.

Whenever possible, handling of all spacecraft components—as well as the fully assembled AIMP—has been under the strict clean-room conditions. Moreover, every effort has been made to make it the most magnetically "clean" spacecraft ever launched by the United States.

SCIENTIFIC OBJECTIVES

The basic scientific objectives of the AIMP program are to investigate from a moon "anchored" orbit the interplanetary magnetic field, fluxuations of the solar wind and the interaction of the solar wind with the moon, distribution of low energy ions and electrons, the intensity of solar and galactic cosmic rays, and to conduct detailed studies of gross and temporal changes in the boundaries of the tail of the earth's magnetosphere—the so-called magnetohydrodynamic wake—every 29.5 days.

Secondary objectives of the first AIMP mission include an analysis of the dynamics of the spacecraft orbit to provide much needed data on the moon's gravitational field. The study of variations in the spacecraft telemetry signal should help scientists better understand the lunar ionosphere. In addition, a solar cell damage experiment is being flown to obtain data on radiation damage to various types of solar cells at lunar distances.

In brief, AIMP should be able to give scientists much new information on interplanetary space and the space environment in the vicinity of the moon. Among some of the things being looked forward to are:

* Extended measurements of the interplanetary magnetic field unaffected by the magnetic field of the earth.

* Measurements of the interplanetary and perhaps the lunar magnetic field in the immediate vicinity of the moon. To date such measurements have been made only on a gross, imprecise basis.

• Measurements to show the direction of motion and general characteristics of cosmic rays of galactic and solar origin. In this respect, the moon will actually be used as a shield against solar particle fluxes and thus making possible precise measurements of galactic cosmic rays.

• Measurements of the interaction of the solar wind with any weak magnetic field of the moon may reveal whether or not the surface of the moon is bombarded with high energy; particles normally deflected by a strong magnetic field. The importance of such information in planning missions in the Apollo program should be obvious.

• By analysis of the tracking signal from the spacecraft it may be possible to obtain information on the mass distribution of the moon, get an insight into its interior structure, and achieve a better understanding of variations in its gravitational field.

Scientific data will be sent to Goddard from tracking stations where it will be processed in rough form before it is forwarded to individual experimenters.

THE FLIGHT PLAN

The flight path for the AIMP mission will be the first trajectory in the history of rocketry which does not require a mid-course maneuver to achieve lunar orbit.

The flight parameters are so stringent that Delta Number 39 must attain a flight velocity to within one third of one percent. To achieve the proper orbit, Delta will be shooting at a target well ahead of the moon. If all goes well, orbital insertion should occur 72 hours after liftoff, about 3,000 miles ahead of the moon, at which time the retromotor will be fired.

This launching will also mark one of the shortest launch windows, three-minutes, in American space launchings. The window is four days in early July and only three days the latter part of July.

The launch window is as follows:

Date	*Opens*	*Closes*	*Launch Azimuth*
June 30	10:10 am EST	10:13 am EST	80 degrees true
July 1	11:04 am EST	11:07 am EST	84 degrees true
July 2	11:58 am EST	12:01 pm EST	89 degrees true
July 3	12:52 pm EST	12:55 pm EST	97 degrees true

The launching will be from Launch Complex 17, Pad A, and will be the 39th flight for the reliable space booster. To date, Delta has achieved orbit 35 times out of 38 attempts.

It will be the fourth flight for NASA's Thrust Augmented Improved Delta which has the capability of hurling almost three times more weight into orbit than the earlier Deltas.

The 80-pound retromotor to be used in the AIMP Mission is a Thiokol Chemical Company TE–M–458 solid-fuel rocket. Its purpose is to decelerate the spacecraft as it approaches the moon to a velocity slow enough to allow it to be captured by the moon's gravitational field.

Time of firing the 916-pound thrust motor will be determined at the Goddard AIMP Control Center about five or six hours after launching. Nominal burn time of the motor is 20 to 22 seconds. About two hours after burnout the retromotor will be separated from the spacecraft either by ground command or by an automatic jettison system.

Goddard AIMP Project Officials

Paul G. Marcotte, Project Manager
Jeremiah J. Madden, Assistant Project Manager
Dr. Norman F. Ness, Project Scientist
John J. Brahm, Project Coordinator
Merrick E. Shawe, Tracking and Data Scientist
Robert G. Martin, Chief Integration Engineer
Elmer W. Travis, Chief Merchanical Engineer
Francis N. LeDoux, Decontamination Consultant
Dr. Freidrich O. Vonbun, T&DS Orbital Consultant
Donald P. Wrublik, T&DS Manager
Leonard C. Ripley, T&E Support Manager
Robert J. Goss, Delta Spacecraft Coordinator
William R. Schindler, Delta Rocket Systems Manager

GEMINI 10 LAUNCH SET FOR JULY 18

NASA has scheduled the launch of the Gemini 10 mission for no earlier than July 18 at Cape Kennedy.

The three-day mission will begin with the launch of the Agena target vehicle by an Atlas booster about 3:40 p.m. EST. The Gemini 10 spacecraft will be launched by a Titan II rocket about 5:20 p.m. EST. The Agena will be inserted into a 185-mile circular orbit and the Gemini into a 100 by 168-mile elliptical orbit.

Command Pilot John W. Young

Pilot Michael Collins

Primary crew for the mission is John W. Young, command pilot; and Michael Collins, pilot. Backup crew is Alan L. Bean, command pilot; and Clifton C. Williams, pilot.

Young, a Navy commander, was pilot on the first manned Gemini flight, Gemini 3, March 23, 1965. Collins, an Air Force major; Bean, a Navy lieutenant commander; and Williams, a Marine Corps major, have not made space flights.

Plans for the Gemini 10 mission include rendezvous, docking, and extravehicular activity. The Gemini 10 spacecraft is scheduled to rendezvous and dock with its target vehicle and if possible to achieve a dual rendezvous with the Agena launched in the Gemini 8 mission March 16.

The first rendezvous is scheduled in the fourth revolution over South Africa with docking following a period of station keeping.

The crew will maneuver the docked vehicles, using the Agena target vehicle propulsion system, into a position to accomplish a dual rendezvous with the Gemini 8 Agena at an altitude of approximately 247 miles. The crew will undock from the Gemini 10 Agena and use the spacecraft control and propulsion systems to initiate the final phase of the dual rendezvous with the Gemini 8 Agena.

Two separate extravehicular activities are planned for Gemini 10. The first is a stand-up EVA in which the pilot will be standing on his seat with his upper body extending through the open hatch of the spacecraft.

During the 55 minutes of this stand-up EVA the pilot will perform the ultra-violet astronomical experiment, color patch photography experiment, synoptic terrain and synoptic weather photography.

During the umbilical EVA the pilot will evaluate the operation of the Extravehicular Life Support System (ELSS, chestpack), the Hand-Held Maneuvering Unit (HHMU), evaluate maneuvering in space and perform two micrometeoroid collection experiments. He will be using a 50-foot umbilical tether throughout this 55-minute EVA.

Sixteen experiments are to be performed during the Gemini 10 mission: Star Occultation Navigation, Ion Sensing Attitude Control, Tri-Axis Magnetometer, Lunar Ultraviolet Spectral Reflectance, Beta Spectrometer, Bremsstrahlung Spectrometer, Color Patch Photography, Landmark Contrast, Zodiacal Light Photography, Synoptic Weather Photography, Synoptic Weather Photography, Micrometeorite Crater Collection, Micrometerite Collection, Ultraviolet Astronomical Camera, Ion Wake Measurement, and Bioassays of Body Fluids.

Landing of Gemini 10 is planned at the beginning of the 44th revolution in the Western Atlantic recovery zone.

CONTRACTOR SELECTED FOR APOLLO GROUND SYSTEMS MONITOR SYSTEM

Goddard has selected the Brush Instruments Company, Cleveland, Ohio, to provide an electronic monitor for the worldwide land stations and instrumented tracking ships in NASA's Manned Space Flight Tracking Network. The award approximates $900,000 and provides for the delivery of twenty-two such systems.

Called Unified S-Band Systems Monitor, the complex is composed of high speed, very finite sensing and recording devices that provide continuous realtime monitoring of the Appollo spacecraft's prime tracking and communications ground system known as Unified S-Band. S-Band is that super-high portion of the radio frequency spectrum where voice and coded messages are transmitted or received at billions of cycles per second. "Unified" stems from NASA's need to combine all information going to or coming from Apollo spacecraft onto one frequency for greater clarity and ease of handling.

USB's new monitoring systems will perform much in the manner of a giant patient surveillance system common to many of today's modern hospitals. Unlike an alarm flashing a central medical status board, the S-Band Monitor System compares favorably to having a Registered Nurse at each bedside and a Doctor at every door. It will provide network personnel an immediate reading of critical subsystems performance while simultaneously recording operating events as they occur. In the event of trouble or a failure, the monitor pinpoints the trouble spot, records it and then serves as a diagnostic tool for remedial action.

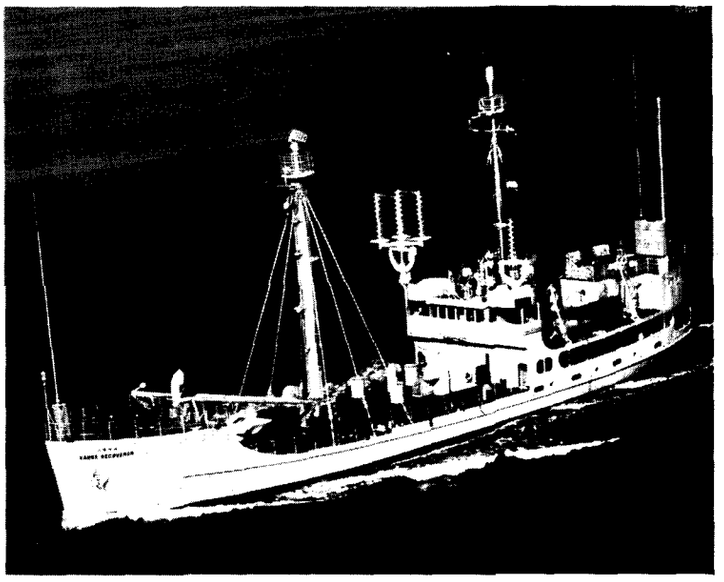
COMMON LANGUAGE ... *from page 3*

- Fortran IV source language in order that the program can be readily adapted at present, and in the foreseeable future, to the computers of the various Centers. Certain arithmetic operations may be in an assembly program language where a significant increase in efficiency is obtained.
- Entry and exit at many points to allow modification of prior analyses, and to permit restarts after machine errors with minimum repetition of computations.
- Structural partitioning so that major components of complex structures may be analyzed separately, and then combined to provide a complete overall analysis of the entire structure.
- Provision for matrix partitioning is required to reduce unduly large matrix operations to a series of smaller operations.
- Force and a displacement option. In general, both methods are applicable to the solution of complex structural problems; however, each method has advantages over the other in particular instances.
- Automatic selection of redundants for the force method.
- Complete documentation for both the programmer and the user. Sufficient detail will be included so that modifications may easily be made by NASA personnel, and so that input to the program may be prepared by persons trained in structural analysis, but unfamiliar with computer operations.
- Automatic checks on compatability of input data and conditioning of the Problem.

NASA has selected the Computer Sciences Corporation in El Segundo, California, for contract negotiations to provide a NASA General Purposes Computer Program for Structural Analysis. The negotiations for this program are expected to result in a cost-plus-award-fee contract amounting to about $1 million. Program direction will be under Goddard.

The completion of this negotiation will close out the second phase of a two-phased effort to develop the computer program. The first phase, completed earlier this year, was a task to develop the detailed plan of the program.

Solar Eclipse Studies Held In Greece



THE USNS RANGE RECOVERER was the site of the successful launch of 5 sounding rockets during the solar eclipse studies conducted near Greece.

Studies of last month's solar eclipse were carried out near Koroni Beach, Greece, under a cooperative project between the Greek National Committee for Space Research and NASA, during and after the total solar eclipse of May 20.

During the eclipse, five successful sounding rocket launchings were conducted from the deck of the USNS Range Recoverer ship. The rocket launchings were planned to investigate ionization of the upper atmosphere during an eclipse of the sun.

The ship from which the Boosted Arcas rockets were launched was stationed several miles off shore from Koroni in the southern Peloponnesus. An antenna and an instrumentation van were located on shore to record signals from the rockets.

The project is a cooperative agreement to investigate variations in ionization up to 56 miles altitude caused by passage of the moon between the earth and the sun. The experiments are designed to obtain information on the electron and ion density distribution in the D-region of the ionosphere, and to measure the changes caused by the solar eclipse, as the moon temporarily blocks out radiation from the sun.

The ionosphere is a region of charged particles above the earth, beginning at about 45 miles altitude and extending a few hundred miles out into space. It is divided into several layers or regions and its composition is almost constantly changing. It serves as a reflector of radio waves and makes long distance radio communications possible. The D-region is the lowest layer of the ionosphere.

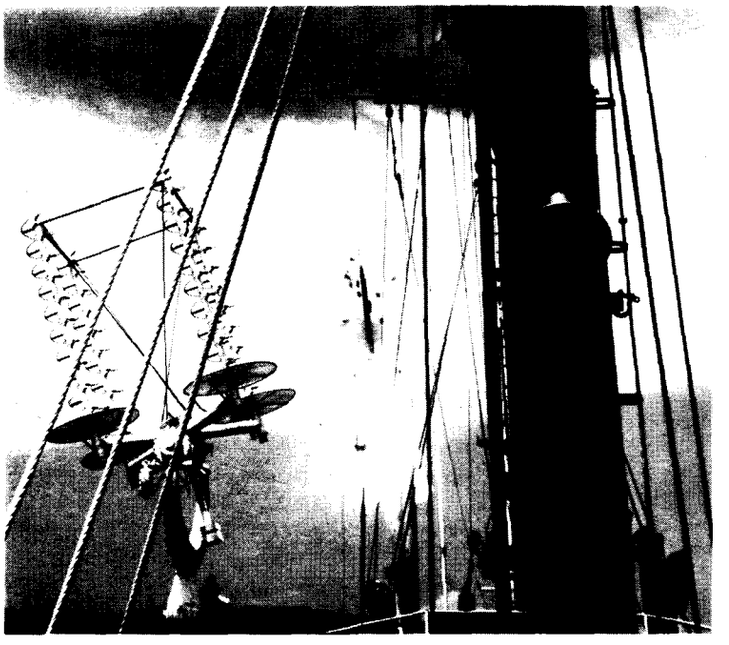
The experiments employ the radio propagation method to measure electron density, utilizing the Faraday rotation technique.

The payload weight for these experiments was 10 pounds. The Boosted Arcas rocket, including the payload, was about 11 feet long, 4½ inches in diameter, and weighed 114 pounds. The rocket used solid propellant fuel. The standard Arcas, without the booster, is used primarily as a meteorological rocket to carry payloads for measuring winds, temperature, density, and pressure up to 225,000 feet. With the booster added, it can achieve altitudes up to 300,000 feet.

Under terms of the agreement, NASA, under Goddard management, provided the rockets, payloads, telemetry receiver, and launch facilities on board the ship. The Greek Space Committee was responsible for logistics, range safety, providing a land site for receiver antenna and van, and furnishing meteorological information at time of launching.

Results of the experiments will be made available to the world scientific community within six months after the solar eclipse.

A BOOSTED ARCAS SOUNDING ROCKET is launched during the eclipse studies from the USNS Range Recoverer.



SR SCOREBOARD

GODDARD LAUNCHED SOUNDING ROCKETS

Rocket Type	Experiment	Proj. Scientist	Site	No. Launched
Arcas	Eclipse Ionospheres Test Shot	Dr. Joseph Kane	Greece	1
Aerobee 150A	Ultraviolet Star Brightness Measurement	Dr. A. D. Code	Wallops Island	1
Arcas	Eclipse Ionospheres	Dr. Joseph Kane	Greece	6
Javelin	Radio Astronomy	Joseph Alexander, Jr.	Wallops Island	1
Aerobee 150	Solar Studies	William Muney	White Sands	2
Aerobee 150	Stellar Spectra with ACS	Dr. Donald Morton	White Sands	1
Nike Apache	De-region Electron Density	Dr. L. G. Smith and Dr. S. A. Bowhill	Wallops Island	1
Nike Cajun	Synoptic Rocket Grenade	Wendell Smith	Ft. Churchill	1
Nike Cajun	Synoptic Rocket Grenade	Wendell Smith	Pt. Barrow	1

Goddard launchings this year. (Jan. 1-June 20): 72; Launched May 10-June 20; total 15.