



UDALL VISIT—Secretary of the Interior Stewart L. Udall is briefed on the operation of MSC's Space Environment Simulation Laboratory in the SESL chamber control room by Engineering and Development Systems Test and Evaluation Manager Aleck C. Bond during the Secretary's visit to MSC last week.

3000 PAGES LONG—

Apollo 204 Board Submits Findings

The Apollo 204 Review Board April 9 presented its final 3000-page report to NASA Administrator James E. Webb on its findings on the flash fire January 27 which took the lives of Apollo 204 crewmen Virgil I. Grissom, Edward H. White II and Roger B. Chaffee.

Findings of the Board were summarized in one section thusly:

I. FINDING

- a. There was a momentary power failure at 23:30:55 GMT.
- b. Evidence of several arcs was found in the post fire investigation.

SA-206 Stages Go Into Storage

Stages of the sixth Uprated Saturn I (SA-206) have been removed from Launch Complex 37 at Kennedy Space Center, Fla., and are being returned to various sites for storage.

The booster was scheduled to depart KSC April 1 aboard the barge *Promise* for the NASA-Michoud Assembly Facility in New Orleans for storage. The booster was assembled at Michoud.

The second stage, a type which is also used as the third stage on the larger Saturn V rockets, was scheduled to depart KSC April 12 aboard the Super Guppy aircraft for storage at the Douglas Aircraft Co. plant at Huntington Beach, Calif.

The instrument unit was flown to the International Business Machines plant in Huntsville March 30 for storage.

SA-206 was to have launched an unmanned lunar module on its first space test. Now, SA-204 will be used for that mission. SA-206 will remain in storage for use in a subsequent mission.

c. No single ignition source of the fire was conclusively identified.

DETERMINATION: The most probable initiator was an electrical arc in the sector between the -Y and +Z spacecraft axes. The exact location best fitting the total available information is near the floor in the lower forward section of the left-hand equipment bay where Environmental Control System (ECS) instrumentation power wiring leads into the area between the Environmental Control Unit (ECU) and the oxygen panel. No evidence was discovered that suggested sabotage.

2. FINDING:

a. The Command Module contained many types and classes of combustible material in areas contiguous to possible ignition sources.

b. The test was conducted with a 16.7 pounds per square inch absolute, 100 percent oxygen atmosphere.

DETERMINATION: The test conditions were extremely hazardous.

RECOMMENDATION: The amount and location of combustible materials in the Command Module must be severely restricted and controlled.

3. FINDING:

a. The rapid spread of fire caused an increase in pressure and temperature which resulted in rupture of the Command Module and creation of a toxic atmosphere. Death of the crew

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MANAGEMENT BREADTH—

Low to Head Apollo Office, Shea New Mueller Deputy

Two personnel changes in the NASA Manned Space Flight organization were announced April 5 by Dr. George E. Mueller, Associate Administrator for Manned Space Flight.

Dr. Joseph F. Shea, Manager, MSC Apollo Spacecraft Program Office, has been named Deputy Associate Administrator for Manned Space Flight in Washington. As Deputy to Dr. Mueller, Dr. Shea will be responsible for technical aspects of the manned flight program.

MSC Deputy Director George Low succeeded Dr. Shea effective April 10.

"We have spent a great deal of time and study on our total strength in the Office of Manned Flight since the end of the Gemini flight program and as we have approached the period of manned flight in Apollo," Dr. Mueller said. "These changes reflect our efforts to give us more breadth and depth in the management of the manned flight program."

Prior to his appointment in February, 1964 as MSC Deputy Director, Low was Deputy Associate Administrator for Manned Space Flight at NASA Headquarters. He has been associated with NASA and its predecessor, NACA (National Advisory Committee for Aeronautics) for 18 years.

Low was born in Vienna, Austria, in 1926. He earned a Bachelor of Science in Aeronautical Engineering in 1948, and a Master of Science in Aeronautical Engineering in 1950, both from Rensselaer Polytechnic Institute.

Low joined NACA at the Lewis Research Center in Cleveland in 1949. There he specialized in research in the fields of aerodynamic heating, boundary layer theory and transition, and internal flow in supersonic and

Hazard Premium Group Formed

A Physical Hardship and Hazard Pay Committee chaired by W. C. Stallard has been formed at MSC to develop procedures for administration of Civil Service Commission regulations. New regulations were formulated as a result of recent legislation providing for premium pay for irregular or intermittent duty involving physical hardship or hazard.

Committee members are C. P. Maxey, Dr. W. R. Hawkins, J. E. Powell and W. Grayburn. Alternates are Dr. C. D. Henderson, D. Campbell and T. L. Stanley.

hypersonic aircraft. At Lewis he was Head of the Fluid Mechanics Section, and later Chief of Special Projects Branch.

In October 1958, when NASA was established, he was assigned to the Headquarters as Assistant Director for Manned Space Flight Programs. Early in 1961, Low was Chairman of the select committee which performed the original studies leading to the manned lunar landing program.

Dr. Shea has been closely associated with the Apollo program since he joined NASA in January 1962 as Deputy Director for Systems, Office of Manned Space Flight. In October, 1963 he was appointed Manager of the Apollo Program Office at MSC.

Born in New York City on September 5, 1926, Dr. Shea earned a Bachelor of Science in mathematics and Master of Science and PhD degrees in engineering mechanics from the University of Michigan.

Shea formerly was Space Program Director at the Space Technology Laboratories in Los Angeles, California, after serving as Advanced Systems R&D Manager with General Motors AC Spark Plug Division.

Prior to his assignment as Military Development Engineer with the Bell Telephone Laboratories, Dr. Shea was an instructor in engineering mechanics at the University of Michigan.



George M. Low

Dr. Joseph F. Shea

DISTINGUISHED CONTRIBUTIONS—

MSC Director Gets Astronautical Award

The American Astronautical Society's annual Space Flight Award May 3 will be presented to MSC Director Dr. Robert R. Gilruth at the AAS Honors Night dinner in Dallas.

The award cites Gilruth "for his distinguished contributions to aeronautical and space research leading to the successful accomplishment of manned space flight, his direction of the continuing investigation of man's capabilities in space, and his active participation in the scientific community for the public good."

Gemini XI pilots Charles Conrad and Richard F. Gordon will receive the AAS Flight Achievement Award "for their new space flight altitude record and the world's first one-orbit rendezvous on Gemini XI."

The AAS Honors Night dinner will be held at 7 pm May 3 at the Statler-Hilton in Dallas.

The Society has also named two MSC officials to fellowship in the AAS. They are MSC Director of Medical Research

and Operations Dr. Charles A. Berry and MSC Director of Engineering and Development Maxime A. Faget.

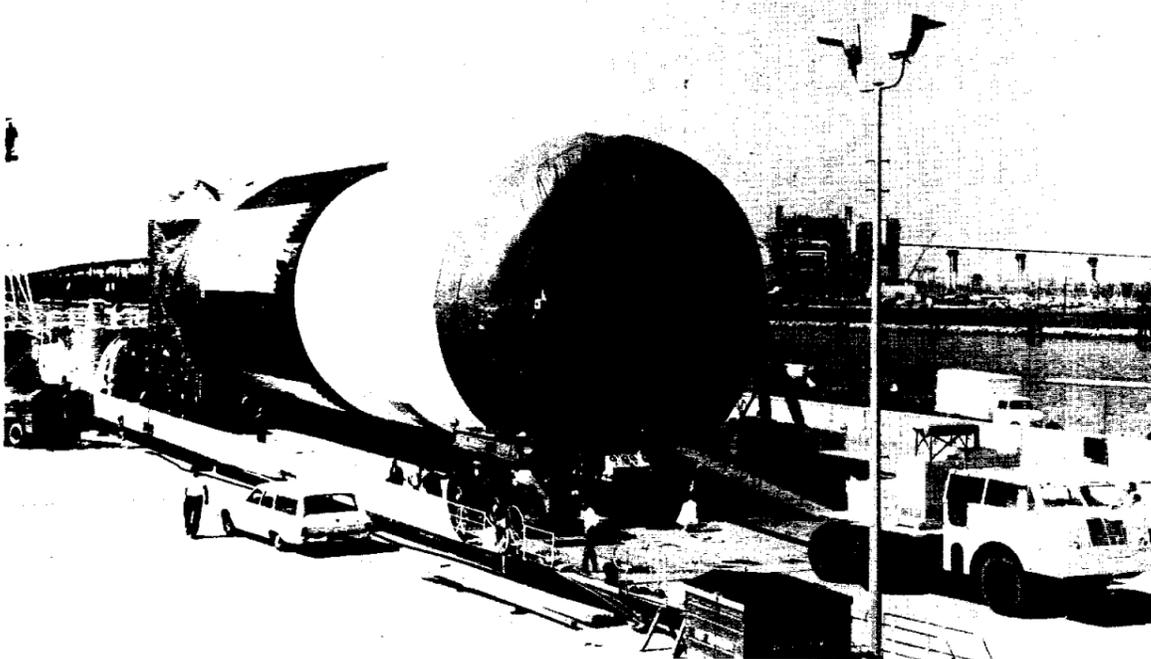
Dr. Berry's election as an AAS Fellow is "for providing exceptional medical support for the NASA manned spacecraft programs and his contributions toward expanding the organizational dimensions of the medical profession."

Faget was cited "for his contributions to the basic conceptual design of the Mercury spacecraft and his subsequent engineering efforts on Project Mercury as head of the Flight Systems Division, and for his present significant role in the Gemini and Apollo programs."

Also named AAS fellows are Charles W. Mathews, former manager of the Gemini Program Office at MSC, and Walter C. Williams, former MSC Deputy Director. Mathews is now Director of Apollo Applications, NASA Office of Manned Space Flight. Williams is now vice

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Weighty Cargo



UP THE RIVER—The NASA shuttle barge *Pearl River* settles lower in the water under the weight of the second flight S-IC Saturn V stage to be built at the NASA Michoud Assembly Facility, New Orleans. The barge and its massive cargo was towed 40 miles by Intercoastal Waterway and river to the NASA Mississippi Test Facility where it will receive a 125-second static firing test. The first flight S-IC stage is in the Apollo 501 stack now in prelaunch preparation in the Kennedy Space Center Vehicle Assembly Building.

Apollo Helo Recovery Begins Phase II Tests

The second of three phases to evaluate the use of heavy-lift helicopters to support recovery of Apollo spacecraft in the launch area was begun by NASA and the Department of Defense April 10 at Eglin AFB, Fla.

Phase I tests were completed in January at Ellington AFB by MSC and the Air Force Aerospace Rescue and Recovery Service based at Orlando AFB, Fla.

The first series of tests was to define equipment and spacecraft loads and to evaluate spacecraft stability in flight beneath a Sikorsky Aircraft CH-53A cargo helicopter. As a result of these tests, certain modifications were made to some of the test equipment. The Phase II tests will take two to three weeks to complete.

Completion of the test series will demonstrate the practicality and effectiveness of using heavy-lift helicopters for Apollo crew and spacecraft recovery in the immediate area of launch pads 37 and 39 at the Kennedy Space Center. These two launch sites are surrounded by marsh, beach and surf areas not readily acces-

sible to standard recovery equipment.

Recovery in the launch site area would be required in the event of a launch escape system (LES) abort from or just off the launch pad.

Phase II testing, to be conducted at Eglin AFB, near Ft. Walton Beach, Fla., will be aimed primarily at developing operational equipment, techniques and procedures for use at the Kennedy Space Center launch area. Procedures will be developed to include recovery with a heavy-lift helicopter over dry land, marsh, calm shallow water, open sea and surf.

At the conclusion of the tests at Eglin AFB, a simulated in flight refueling of the CH-53A helicopter, with the Apollo spacecraft in tow, will be conducted with an Air Force HC-130P tanker. The two craft will be positioned in flight as if a refueling operation were taking place.

The spacecraft crew could, but normally would not, be recovered in the spacecraft. Nominal recovery plans call for two helicopters to be used, one to retrieve the crew — the primary goal of any manned mission recovery — and the other to pick up the spacecraft.

In the evaluation tests, NASA is responsible for design, fabrication and equipment-vehicle interface of Apollo-unique equipment. The DOD is responsible for the aircraft, crew, flight procedures, and deployment of the helicopters should they prove feasible for spacecraft recovery.

The MSC Landing and Recovery Division of Flight Operations Directorate is conducting the tests for NASA.

Orbiter's Film System Fails in Final Readout

After repeated efforts to reactivate Lunar Orbiter III's picture readout system, engineers have concluded that there is virtually no hope for transmission of further photographs from the spacecraft.

Readout of pictures from NASA's Orbiter III was interrupted March 2 by a series of events in the spacecraft which ultimately led to the failure to continue the readout process.

During final readout, 136 frames of the 211 taken by Orbiter were radioed to Earth. Another 46 frames had been received during earlier priority readouts so all but 29 frames taken by the spacecraft were received at Earth stations.

Engineers at NASA's Langley Research Center, Hampton, Va., have determined Orbiter III to be the origin of the failure, but the cause of the fluctuation has not been identified.

The momentary disturbance in the electrical system—similar to the dimming effect seen in a home lighting circuit when an appliance is turned on—occurred on Orbiter's 148th orbit.

Picture transmission to the Woomera, Australia, Deep Space Network tracking station was about to begin when the power fluctuation occurred, causing a shutdown of spacecraft transmission without a ground command.

The operating team did not know at the time that the momentary electrical disturbance had also upset the photo system logic (electronic memory).

After the unscheduled shutdown of picture transmission, the operating teams initiated a series of commands to begin readout. The spacecraft responded correctly, readout of picture data was begun and continued until more than one frame of photography had been transmitted. Somewhat higher than normal current load was noted in the telemetry during the readout period.

When the readout mechanism was turned off, the loopers which held film that had passed the scanning mechanism did not empty as they should have, and subsequent commands to move the film out of the looper area were not successful even though the film advance motors were energized.

Analysis of the events of March 2 now indicates that the momentary electrical fluctuation disturbed the photo system logic by turning the film advance motor memory to a forward mode. Thereafter, the motor, following incorrect logic, stalled as it attempted to move film which was being mechanically held in a fixed position while readout was in progress. During the stalled condition, the motor overheated to the failure point.

Lunar Orbiter III continues to circle the Moon, and has completed more than 400 orbits since it was launched last February 4. All spacecraft systems are normal except for the burned out film advance motor.

The spacecraft is serving as a tracking target, providing practice for stations of the NASA Manned Space Flight Network, and is continuing to record information on radiation and meteoroids in the vicinity of the Moon. Analysis of Lunar Orbiter tracking data is adding to knowledge of the Moon's field of gravity.

Lunar Orbiter is managed for NASA by the Langley Center. The Boeing Co., Seattle, is the prime spacecraft contractor.

Goddard Essay Contest Boosts Prize to \$500

The National Space Club has announced the opening of the Robert H. Goddard Historical Essay Award Competition for 1967. Offering for the first time a \$500 prize, the annual nationwide competition is open to any US citizen. Last year the prize was \$200.

The contest is named in honor of rocket pioneer Dr. Robert H. Goddard, whose scientific and technological contributions helped open the door to space, although recognition in the US of his contributions was late in coming.

Essays may treat with any significant aspects of the historical development of rocketry and astronautics and will be judged on their originality and scholarship. They may bring new information to light or may cast a new and different light upon events or individuals influencing rocketry and astronautics in the United States.

Entries should be submitted by November 1, 1967 to the Goddard Historical Essay Contest, c/o National Space Club, 1625 I Street NW, Washington,

D.C. 20006. The winner, who will be announced at the Dr. Robert H. Goddard Memorial Dinner in March 1968, will receive the Goddard Historical Essay Trophy, certificate and a \$500 prize.

Winner of the 1966 Goddard Historical Essay Trophy was Ens. Richard A. Hobbs, USN, for his essay "Development, Applications and Downfall of Congreve's War Rockets."

The National Space Club's Committee for the History of Rocketry and Astronautics, whose members serve as judges for the contest, are: Dr. Eugene M. Emme, chairman, NASA Historian; Fredrick C. Durant III, assistant director, National Air and Space Museum, Smithsonian Institute; Dr. John Patton, Hq USAF; Prof. Melvin Kranzberg of Case Institute of Technology, executive secretary Society for the History of Technology; Marvin W. McFarland, chief, Science and Technology Division, Library of Congress; and Dr. Charles S. Sheldon II, Legislative Reference, Library of Congress.

RULES OF THE CONTEST

- Essays should not exceed 5,000 words and should be fully documented.
 - Essays will be judged on originality and scholarship by the Committee for the History of Rocketry and Astronautics of the National Space Club, and their decision will be final.
 - Essays should be received by the Chairman, Committee for the History of Rocketry and Astronautics, by November 1, 1967; the winner, if one is selected, will be announced at the Dr. Robert H. Goddard Memorial Dinner in March 1967.
 - Entries may be submitted by any U. S. citizen, and evidence of citizenship should be included with essays submitted.
 - The name of the competitor shall not appear on the essay, and each essay must have a motto selected by the author in addition to the title. This motto shall appear in three places: a) on the title page of the essay, b) on the outside of a sealed envelope containing identification of the author, and c) above the name and address of the competitor inside the envelope containing this identification. The envelope identifying author will not be opened until the Committee has made the winning selection.
 - Essays and identifying envelopes must be postmarked before November 1, 1967 and mailed in a large sealed envelope marked "Goddard Historical Essay Contest."
 - Essays must be typewritten, legible, double-spaced, on paper approximately 8½ by 11, and must be submitted in duplicate, each copy complete in itself.
 - Essays remain the property of the authors, although the National Space Club retains the right to publish and distribute winning essays.
- Prize: Trophy of the Dr. Robert H. Goddard Historical Essay Award, a \$500 Honorarium, and National Space Club Certificate.

Spanish Club Meets April 18

The newly-formed MSC Spanish Club has elected a slate of officers and will hold its first formal meeting April 18 at 5:15 pm in Room 108, Bldg 13.

The program will be a topic discussion in Spanish. For additional information, call John Williams at 2408.

No olvidas traer su diccionario de español-inglés.

Seek Astronomers

Stargazers and planetpeepers interested in amateur astronomy and telescope making at any level of experience are asked to call Clark Neily at 5348 or John Erickson at 3485 to discuss joint activity or affiliation.

Apollo 204 Board Submits Findings

(Continued from Page 1)

was from asphyxia due to inhalation of toxic gases due to fire. A contributory cause of death was thermal burns.

b. Non-uniform distribution of carboxyhemoglobin was found by autopsy.

DETERMINATION: Autopsy data leads to the medical opinion that unconsciousness occurred rapidly and that death followed soon thereafter.

4. FINDING:

Due to internal pressure, the Command Module inner hatch could not be opened prior to rupture of the Command Module.

DETERMINATION: The crew was never capable of effecting emergency egress because of the pressurization before rupture and their loss of consciousness soon after rupture.

RECOMMENDATION: The time required for egress of the crew be reduced and the operations necessary for egress be simplified.

5. FINDING:

Those organizations responsible for the planning, conduct and safety of this test failed to identify it as being hazardous. Contingency preparations to permit escape or rescue of the crew from an internal Command Module fire were not made.

a. No procedures for this type of emergency had been established either for the crew or for the spacecraft pad work team.

b. The emergency equipment located in the White Room and on the spacecraft work levels was not designed for the smoke condition resulting from a fire of this nature.

c. Emergency fire, rescue and

medical teams were not in attendance.

d. Both the spacecraft work levels and the umbilical tower access arm contain features such as steps, sliding doors and sharp turns in the egress paths which hinder emergency operations.

DETERMINATION: Adequate safety precautions were neither established nor observed for this test.

RECOMMENDATIONS: a. Management continually monitor the safety of all test operations and assure the adequacy of emergency procedures.

b. All emergency equipment (breathing apparatus, protective clothing, deluge systems, access arm, etc.) be reviewed for adequacy.

c. Personnel training and practice for emergency procedures be given on a regular basis and reviewed prior to the conduct of a hazardous operation.

d. Service structures and umbilical towers be modified to facilitate emergency operations.

6. FINDING:

Frequent interruptions and failures had been experienced in the overall communication system during the operations preceding the accident.

DETERMINATION: The overall communication system was unsatisfactory.

RECOMMENDATIONS: a. The Ground Communication System be improved to assure reliable communications between all test elements as soon as possible and before the next manned flight.

b. A detailed design review be conducted on the entire spacecraft communication system.

7. FINDING:

a. Revisions to the Operational Checkout Procedure for the test were issued at 5:30 pm EST January 26, 1967 (209 pages) and 10:00 am EST January 27, 1967 (4 pages).

b. Differences existed between the Ground Test Procedures and the In-Flight Check Lists.

DETERMINATION: Neither the revision nor the differences contributed to the accident. The late issuance of the revision, however, prevented test personnel from becoming adequately familiar with the test procedure prior to its use.

RECOMMENDATIONS: a. Test Procedures and Pilot's Checklists that represent the actual Command Module configuration be published in final form and reviewed early enough to permit adequate preparation and participation of all test organization.

b. Timely distribution of test procedures and major changes be made a constraint to the beginning of any test.

8. FINDING:

The fire in Command Module 012 was subsequently simulated closely by a test fire in a full-scale mock-up.

DETERMINATION: Full-scale mock-up fire tests can be

used to give a realistic appraisal of fire risks in flight-configured spacecraft.

RECOMMENDATION: Full-scale mock-ups in flight configuration be tested to determine the risk of fire.

9. FINDING:

The Command Module Environmental Control System design provides a pure oxygen atmosphere.

DETERMINATION: This atmosphere presents severe fire hazards if the amount and location of combustibles in the Command Module are not restricted and controlled.

RECOMMENDATIONS: a. The fire safety of the reconfigured Command Module be established by full-scale mock-up tests.

b. Studies of the use of a diluent gas be continued with particular reference to assessing the problems of gas detection and control and the risk of additional operations that would be required in the use of a two gas atmosphere.

10. FINDING:

Deficiencies existed in Command Module design, workmanship and quality control, such as:

a. Components of the Environmental Control System installed in Command Module 012 had a history of many removals and of technical difficulties including regulator failures, line failures and Environmental Control Unit failures. The design and installation features of the Environmental Control Unit makes removal or repair difficult.

b. Coolant leakage at solder joints has been a chronic problem.

c. The coolant is both corrosive and combustible.

d. Deficiencies in design, manufacture, installation, rework and quality control existed in the electrical wiring.

e. No vibration test was made of a complete flight-configured spacecraft.

f. Spacecraft design and operating procedures currently require the disconnecting of electrical connections while powered.

g. No design features for fire protection were incorporated.

DETERMINATION: These deficiencies created an unnecessarily hazardous condition and their continuation would imperil any future Apollo operations.

RECOMMENDATIONS: a. An in-depth review of all elements, components and assemblies of the Environmental Control System be conducted to assure its functional and structural integrity and to minimize its contribution to fire risk.

b. Present design of soldered joints in plumbing be modified to increase integrity or the joints be replaced with a more structurally reliable configuration.

c. Deleterious effects of coolant leakage and spillage be eliminated.

d. Review of specifications be conducted, 3-dimensional jigs be used in manufacture of wire bundles and rigid inspection at

all stages of wiring design, manufacture and installation be enforced.

e. Vibration tests be conducted of a flight-configured spacecraft.

f. The necessity for electrical connections or disconnections with power on within the crew compartment be eliminated.

g. Investigation be made of the most effective means of controlling and extinguishing a spacecraft fire. Auxiliary breathing oxygen and crew protection from smoke and toxic fumes be provided.

11. FINDING:

An examination of operating practices showed the following examples of problem areas:

a. The number of the open items at the time of shipment of the Command Module 012 was not known. There were 113 significant Engineering Orders not accomplished at the time Command Module 012 was delivered to NASA: 623 Engineering Orders were released subsequent to delivery. Of these, 22 were recent releases which were not recorded in configuration records at the time of the accident.

b. Established requirements were not followed with regard to

the pre-test constraints list. The list was not completed and signed by designated contractor and NASA personnel prior to the test, even though oral agreement to proceed was reached.

c. Formulation of and changes to pre-launch test requirements for the Apollo spacecraft program were unresponsive to changing conditions.

d. Non-certified equipment items were installed in the Command Module at time of test.

e. Discrepancies existed between NAA and NASA MSC specifications regarding inclusion and positioning of flammable materials.

f. The test specification was released in August 1966 and was not updated to include accumulated changes from release date to date of the test.

DETERMINATION: Problems of program management and relationships between Centers and with the contractor have led in some cases to insufficient response to changing program requirements.

RECOMMENDATION: Every effort must be made to insure the maximum clarification and understanding of the responsibilities of all the organizations involved, the objective being a fully coordinated and efficient program.

Credit Union Adopts New Handling Policies

Merrill A. Lowe won the first free tickets in the monthly MSC Federal Credit Union drawing. He chose tickets to one of the Astro baseball games.

To get in on the drawings for local entertainment tickets, an employee must invest in at least one \$5 Credit Union share each month.

Effective May 1, the MSC Federal Credit Union has adopted the following policies:

Awards

(Continued from Page 1)

president and general manager of Aerospace Corporation's Manned Systems Division.

The 1965 AAS Space Flight Award went posthumously to Dr. Hugh L. Dryden, who at the time of his death in December, 1965 was Deputy Administrator of NASA.

Frank Borman, James A. Lovell, Walter M. Schirra and Thomas P. Stafford received last year's Flight Achievement Award for accomplishing the work's first space rendezvous in the Gemini VI/VII mission. Winners in previous years have included Charles A. Lindbergh, L. Gordon Cooper, Jr., John H. Glenn, Alan B. Shepard and Virgil I. Grissom.

Others at MSC previously elected Fellows of the Society are Gilruth, Cooper, Schirra, M. Scott Carpenter, Christopher C. Kraft, George M. Low, and Dr. Joseph F. Shea.

- Personal checks will be cashed for members only making loan payments or with a minimum deposit of \$1. Government checks and contractor payroll checks will be cashed for members only. No transaction necessary.

- Share withdrawals in excess of one per month will be charged a \$.50 fee for each additional share withdrawn in the same month.

- When personal checks are returned from the member's bank marked "insufficient funds" the first time, the Credit Union sends it back and there is no charge. If the same check is returned for the second time marked "insufficient funds," the member will be charged a \$2 fee unless there is sufficient proof of bank error.

Among the advantages of Credit Union membership are:

- Low interest rate—one percent of the unpaid balance per month. If a borrower pays back a loan faster than the terms, he reduces the cost of the loan. Interest is charged only for the time the money is actually used.

- Loan protection insurance pays off the loan balance on insurable risks up to \$10,000 in event of death of member prior to age 70, or member's total disability of a member prior to age 60.

- Fair return on savings.
- Life savings insurance up to \$2,000.

Oceanographers Hear Dr. Gilruth At Symposium

MSC Director Dr. Robert R. Gilruth outlined the role of NASA in manned observation from orbit to attendees of the three-day symposium "The Ocean From Space" sponsored by the American Society for Oceanography. The symposium was held at the Rice Hotel April 5-7.

Among the 26 symposium speakers were Interior Secretary Stewart Udall who spoke on "Earth Resources Orbiting Satellite" and Navy oceanographer Rear Adm. Odale E. Waters Jr. whose keynote talk was titled "Surveillance of the World Ocean."

Also taking part in the symposium, co-sponsored by the Gulf Universities Research Corporation, were Gemini XII pilot Edwin E. Aldrin Jr.; Dr. Peter Badgley, chief of the Natural Resources Program, NASA Headquarters Office of Space Science and Applications; MSC Earth Resources Office chief Leo Childs, and Mrs. Marjorie Townsend, Goddard Space Flight Center X-Ray Explorer Satellite project manager.



CELESTIAL HUDDLE—Positions of navigation stars during a future manned mission are discussed in a Mission Planning and Analysis Division conference room huddle. Left to right are Division Operations Office Chief Jim Dalby, Mathematical Physics Branch Chief Jim McPherson and Division Chief John P. Mayer.

MPAD Planners

Design Manned Flights

From Launch to Splashdown

By Milton Reim

In early 1959, during the infancy of America's space program, about ten engineers were brought together at Langley, Va., for the purpose of forming a group to develop, design, and optimize operational trajectories for space flight missions within spacecraft, booster, operational, and environmental constraints.

This group, then called Mission Analysis Branch, was part of the Flight Operations Division of the Space Task Group. From this small beginning, the group has grown to include 245 Civil Service employees plus about 300 contractor employees. The name has been changed to Mission Planning and Analysis Division, and, of the original group of engineers, many are still with the division, including the Chief of MPAD, John P. Mayer.

The responsibilities of the division are basically the same now as they were in 1959, with a few additional assigned duties, such as spacecraft consumables analysis, and a greatly expanded scope of operations. Work now goes on simultaneously for several types of missions.

With the Mercury and Gemini programs almost of the distant past, work in the division is now concentrated on Apollo, AAP, and interplanetary missions. The changeover from Gemini to Apollo was not a rapid or abrupt change, as the MPAD had begun concentrating on Apollo for many months prior to the end of Gemini. Actually, work on the first space task group lunar trajectory program was started by the group in 1959 — this was before the Gemini Program was officially started, and nearly all NASA efforts were then being concentrated on the Mercury Program.

Six branches and four staff offices are coordinated into one organization under the division office to form the group responsible for development of opera-

tional trajectories for all MSC space flight missions.

Mission Redesign

The people in MPAD consider themselves to be realists. They consider not only the nominals for a given mission, but place more stress on the variables of when and where things could go wrong in a space flight, and then provide the capabilities for redesigning the mission to fit new mission objectives even during the mission period itself.

During the Mercury and Gemini Programs, over 60 percent of all MPAD work was concerned with mission abort studies or "What If" studies, and a large proportion of the work done on the Apollo Program is of the same nature.

As in Gemini, alternate mission design is also developed for Apollo. Essentially the concern in alternate mission design is how to recover from an off-nominal situation during a mission and go on to gain the most data. This capability must be worked out in advance of the mission, however. Program logic and mathematics are developed so that, during a mission, changes can be made in real time. This program logic, figured out in advance, is in the computers in the Real Time Computer Complex, ready for use when a new set of objectives is decided on. This provides flexibility to readjust maneuver times, thrust magnitudes and directions, etc., in order to attain the new mission objectives when necessary.

Four Major Jobs

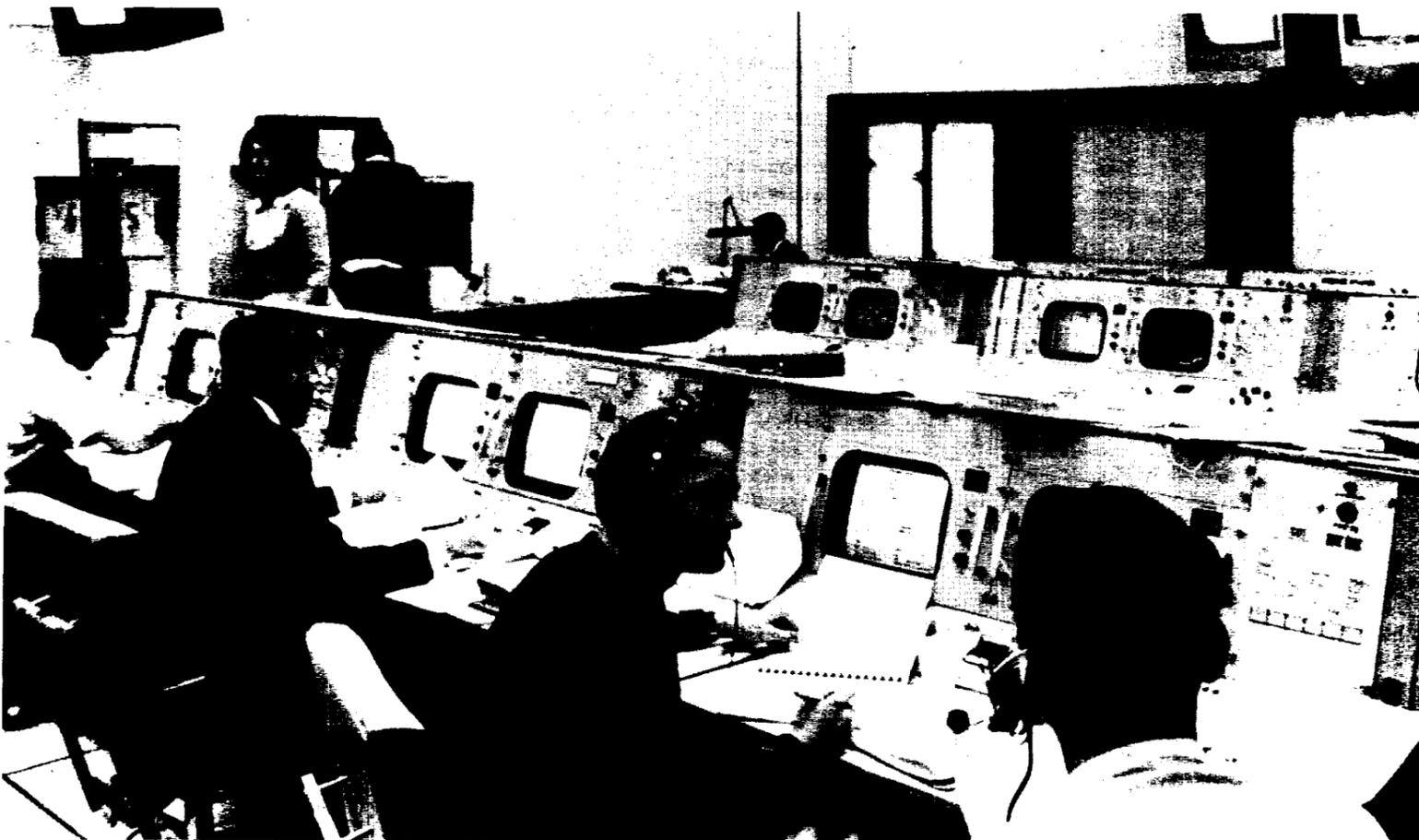
Responsibilities of MPAD include four major functions, and these are supported by the branches within the division. Some functions are of larger scope than others, and therefore more than one branch assumes the duty of fulfilling requirements in this case.

The four functions are: (1) analytical tool development for mission design; (2) mission definition and design; (3) mathematical formulation and mission logic development for the MCC Real Time Computers and the spacecraft computers; and (4) flight support activities.

Branches of MPAD work closely with several contractors in attaining the desired trajectories for the space flights. The contractors and areas of work are: TRW Systems for detailed technical support of all MPAD branches; Analytical Mechanics Associates, Inc., for trajectory determination and mission optimization; the Bissett-Berman Corporation for navigational analysis and data reduction; North American Aviation and Grumman supply basic data for trajectory analysis; ITT Federal Electric Corporation supplies graphics, math aide, and document preparation support. Also, IBM helps develop and implements the mathematical formulation and mission logic supplied by MPAD for the Mission Control Center computers, and MIT develops and implements on-board computer programs under MPAD direction.

Future Studies

The function of analytical tool development for mission design



REAL-TIME SUPPORT—MPAD flight dynamics, trajectory and rendezvous specialists assist in manning the Flight Dynamics Staff Support Rooms (FIDO-SSR) during simulations and actual missions. The FIDO-SSR is an extension of the Flight Dynamics flight controller on duty in the Mission Operations Control Room, and feeds to him detailed information on maneuvers, event times and mission historical data.

is concerned with tasks such as trajectory program development, optimization techniques, analysis of the Manned Space Flight Network, and the spacecraft navigational procedures and accuracies. Also included in this function of MPAD are interplanetary studies. Advanced studies, for example, have been made on ways of using present Apollo hardware for manned flybys of the planet Venus in the early 1970's.

The MPAD function of mission definition and design requires iterative loops to be set up with NASA Headquarters, MSC program offices, other MSC divisions and certain contractors, in order to come up with preliminary, reference, and operational trajectories for each mission.

All requirements, objectives, and constraints are brought together that have a relation to the trajectory to be flown on a particular mission. These include requirements and constraints from the program offices, the flight crew, spacecraft systems representatives, and the launch vehicle people. Then a cut-and-try, iterative procedure is followed that leads to the trajectory that best satisfies the mission objectives without bending any of the constraints.

To come up with an operational trajectory, all guidance equations must be checked out for operational assurance that these are adequate for each powered phase of flight.

Another function is to determine launch windows, injection areas, and the selection of logic for lunar landing sites.

Back to Drawing Board

This all must be done within the specified constraints; then a reference trajectory can be turned out by the people in this area of work. If a mission con-



NUMBER MILL—The Real-Time Auxiliary Computing Facility in the office wing of the Mission Control Center serves as an off-line computing center for programs not included in the Real-Time Computer Complex mission

straint is violated, it sometimes requires "going back to the drawing boards." Environmental constraints such as winds, G forces, and radiation, along with others, have to be considered when determining the trajectory. Spacecraft constraints include such items as electrical power, structural, heating, and propulsion limitations. The accuracy of the guidance, and performance of the booster provide other constraints. Operational considerations such as tracking, lighting, and recovery must also be taken into consideration.

In addition, the division does dispersion analyses so that, for example, the proper propellant will be taken that will allow for off-nominal conditions. This requires making an analysis of spacecraft consumables and the variation in requirements for them in a mission.

In Flight Testing

Also, people in MPAD have participated in flight test programs at the White Sands Proving Grounds in New Mexico and at Cape Kennedy.

Real-time program development is a highly specialized function. This includes developing the mathematical formulation and mission logic to be incorporated into real time computer programs for all trajectory control functions. For example, programs had to be developed to handle incoming flight data in order that the position and velocity of the spacecraft may be pinpointed at any time in the flight. This is basic information needed to make corrections to the trajectory. Various mathematical techniques were examined for doing this job, equations and the flow of data through computers were documented, and then all was turned over to IBM for real-time program implementation and check out for use in missions.

Calculate Rendezvous

Mathematics and maneuver logic of great complexity are being used by MPAD in areas such as those dealing with rendezvous of spacecraft. Rendezvous processors and logic had to be developed to accomplish rendezvous. This includes selecting the proper time of launch and the series of maneuvers subsequent to insertion into orbit of the second vehicle. Also included are maneuver orientation requirements, time for the maneuver, and answers to questions such as: is adequate tracking available, what length burns, what orbit should the maneuvers be performed in, and where in the orbit should they be performed. Again, this information is turned over to IBM for real-time program implementation and check out prior to the mission.

Mission Support

The fourth major function of MPAD is in the area of flight support activities. Part of this function is to have trajectory and flight dynamics experts from MPAD stationed in the Flight Dynamics Staff Support Room in the Mission Control Center during a mission to assist flight controllers as required.

programs and for flight controller computations which are not time-critical. The Real-Time Auxiliary Computing Facility was featured in the August 5, 1966 Roundup.

Another aid to mission control requirements during a mission is supplied by MPAD's Real Time Auxiliary Computing Facility in the office wing of Building 30. This is an off-line computing facility, and is used in addition to the RTCC. MPAD people are responsible for all the program development for these computers, and man the room during the mission. This computer is used for mission control functions which can not be incorporated into the MCC real-time computer because of checkout schedule limitations or for functions which are not time-critical. These programs furnish answers in minutes following requests of the flight controllers in the Mission Control Center. This computing facility is also on call during mission simulations.

Postflight Analysis

Postflight analysis is another portion of the flight support activities function. This responsibility entails specifying, prior to the mission, data necessary for postflight analysis and then collecting and analyzing these data from all areas involved in the mission. These data are then used for performance evaluation

of certain of the booster and spacecraft systems, and to check the validity of math models, the adequacy of the trajectory plan, tracking, and other mission-related items.

A nominal operational trajectory has probably never been flown, and chances are that one will never be flown that will not require some real-time changes somewhere in the mission. This is why MPAD has to make certain that the capabilities exist so that missions can be redesigned during the missions by means of flexible mission control computer programs in the RTCC and RTACF.

Produce Documents

The professional makeup of MPAD is primarily engineers with aeronautical or mechanical engineering degrees, and applied mathematicians and physicists. Because the main product of the division is flight documentation, there is a large report preparation office consisting of math aides, editing, and report control people.

MPAD is one of the largest users of computer time in the Center (not even counting the RTCC).



MISSION PLANNERS—Mission Analysis Branch Chief Pete Frank and Rocky Duncan use an earth-moon planar model to help visualize trajectories, orbital planes and entry corridors of a lunar mission.



AFTER IT'S ALL OVER—Sheaf upon sheaf of computer printouts generated by tracking and telemetry during missions are gone over in detail by MPAD people in evaluating mission results. Here, Bill Reini and Jerry Kahane of Rendezvous Analysis Branch check a postflight printout.

"... so I can better myself."

JOY Trainees Gain Experience Through MSC Work Assignment

By Stanley Goldstein

"I'd like to learn a trade so I can better myself", is a common answer from the prospective JOY applicant when asked why he wants to become a trainee in the project.

The JOY program, supervised at MSC by Stanley Goldstein, Chief of the Employee Development Section, and Rosa Broussard, counselor from the Houston JOY office, strives to give suitable work experience and academic training to youth from low-income backgrounds.

Most dropped out of school for economic or social reasons and some because of disinterest. A few, 12 out of the 60 at MSC, finished high school, but because of lack of skills or academic performance, were able to qualify for training. These trainees, ages 16 through 21, receive a gross salary of \$40.00 per week paid by the JOY office.

They are not paid for attending school or for days absent and receive neither vacation nor fringe benefits. At the end of the training period (usually 6 months or longer, depending on the individual), trainees are given assistance by the JOY office in finding permanent employment or they are moved into formal training like Nursing School or Business School.

The first two hours of the workday (except for Friday when they work all day) are spent in remedial math, typing,

and English classes at Ellington AFB. All are taken directly to their work site except those scheduled for one hour of group counseling.

During the four months since the inception of the JOY school, some excellent progress has been made in improving English and mathematical skills. In the typing classes, some trainees have learned to type while others improved the little skills they had already learned in high school.

Though most of the trainees from Houston (16 live in Dickinson) must arise at 5 am to get their one or two infants or younger sisters and brothers to a baby-sitter, then ride one or two busses to the JOY office near downtown Houston, they seem to take pride in being trained at MSC.

The greatest challenge is learning a skill that will help them get a job. The 45 females desiring to be clerical workers receive only 40 minutes in typing class two days weekly, and are dependent upon their training job for the remainder of their experience. The male trainee, however, depends almost totally on his training job for experience.

Accomplishments for trainees at MSC seem to be directly proportionate to the amount of interest and effort expended by the work supervisor, former training the trainee brought to

the program, and the amount of effort the youth exerts.

The supervisor has the major responsibility since he is providing the actual training. It becomes his responsibility to evaluate the trainee's progress; to tackle with the trainee any problems which may develop on the job and make recommendations for further training or regular job employment. This is time consuming and requires energy, but the reward is evident when the trainee succeeds.

Supervising a trainee can only be an accomplishment when the supervisor recognizes that he must not allow his trainee special privileges that he would not allow his regular employees. Most want to be treated like regular employees, but may take advantage of being idle when there is no work to do.

Because of good supervision, interest, and effort, MSC can take pride in the following trainees who are now working on jobs at nearly triple their JOY salary:

Netherland Morris, who was trained by Armenta Yanez of the Regional Audit Office, is employed at over \$300 a month in a Houston firm; Joyce Jackson, trained by Bobbie Ebner in the Training Office, received a similar secretarial job at Texas Southern University; Carol Alexander, also trained by Miss Ebner, was recently hired as a secretary by a social work organization; and Leon Fitch, trained in Medical Operations, is now working as an orderly at Memorial Baptist Hospital in Houston . . . and there are more.

Unlike the previously named trainees, others realize that they must have additional education to reach their potential, and must return to full-time or night school. Some, because of experience at MSC and encouragement, pursue other career aspirations (one trainee obtained a nursing scholarship and will start training this month).

For more there is an intermediate step between JOY and a career. This is MDTA (Manpower Development Training Act) classes which are intensive courses and training to equip students to obtain employment in a fairly short time. Trainees are not sent to MDTA until they have proven themselves in attitude, interest, attendance, and ability.

The MSC training program is only a part of the larger JOY program which serves 350 youths in agencies like Veterans Administration Hospital; Day Care Association; YWCA; American Red Cross; Rice University; and many other agencies in Houston. The JOY program is a Neighborhood Youth Corps Program sponsored by the Houston Vocational Guidance Service on a grant from the Department of Labor.

Space News Of Five Years Ago

April 14, 1962—Dr. Homer E. Newell, NASA's Director of Space Sciences, said that in addition to NASA's international program for space science and the European organizations for cooperative space research, "some South American groups are considering the possibility of cooperative sounding rocket endeavors."

April 19, 1962—NASA announced that Friendship 7, the Mercury spacecraft in which John Glenn orbited the earth three times, would be lent to USIA for a world tour, with some 20 stops on the itinerary and touching all continents. This tour was known as the "fourth orbit of Friendship 7." William Bland of the Mercury Project Office served as tour officer. In mid-August the spacecraft would be displayed at the Century 21 Exhibition in Seattle, Washington, before being presented to the Smithsonian Institution in Washington, D.C. for permanent exhibition.

April 25, 1962—Saturn SA-2 was successfully launched from AMR in the second test of the Saturn family of launch vehicles. Like the first Saturn vehicle launched on October 27, 1961 the Saturn fired only the first-stage engines, generating 1.3 million pounds of thrust. Dummy second and third stages filled with water were detonated at 65 miles altitude (Project High Water) and the water ballast formed an artificial cloud. Maxi-

mum velocity was slightly more than 3700 mph. Modifications to decrease the slight fuel sloshing encountered near the end of the previous flight test were apparently successful.

D. Brainerd Holmes, NASA's Director of Manned Space Flight, speaking before the American Management Association in New York, said: "We believe that the soundness of our present engineering program can be illustrated by the correlation between predicted events and the time of occurrence in John Glenn's recent flight. Indeed, the time of liftoff to impact in this mission was within one second of the preflight calculations."

April 26, 1962—NASA graduated first group of Project Mercury tracking personnel completing new course at Wallops Station, the seven graduates representing personnel from NASA and DOD contractors. Directed by GSFC the Mercury Network Training Program consists of specialized courses to support the man in space mission, requiring that the subsystems at all 18 sites in a global network are constantly monitored and provide data concerning the spacecraft's location, altitude, and operational status as well as the pilot's condition. Real-time data must flow between the sites, the Computer Center at GSFC, and the Mercury Control Center at Cape Canaveral.

JA Company President In Sweetheart Finals

Cathy Chance, president of the MSC-sponsored Junior Achievement Company "Spacecrafters," April 8 was third runner-up in the 1967 Junior Achievement Miss Houston competition.

Each of 114 Houston-area JA companies selected a sweetheart to represent them in the preliminaries held April 2, and Cathy was one of ten going to the finals. She is the daughter of Atlas Chance of the Supply Branch, Administrative Services Division.

The girls were judged on attractiveness, poise, speech, and knowledge of JA activities and the free-enterprise system.

Approximately 1500 persons attended the JA Sweetheart Ball at the Trade Mart East.

Spacecrafters is one a dozen JA companies meeting at Clear Creek high school, and Cathy was elected company president both semesters. The company

capitalized by selling 100 shares and produces souvenirs with a space motif.

Spacecrafters' sales have been brisk and the company has shown a profit. The company will liquidate the first week in May, pay a 10 percent dividend to stockholders, salaries to officers, wages to production employees and commissions to salesmen.

Co-op of Month



EQUIPMENT DESIGNER—SMU mechanical engineering major Steve Musselman works in the Equipment Section of Landing and Recovery Division where takes part in the design of equipment for use in recovery training and operations. Musselman is in his junior year at SMU.

Club Holds Beach Party

The Twixt 20 and 30 Club for single men and women in the Bay area tomorrow will hold a beach party at Galveston.

For information on the party or about the Club, call Susie Smith at 534-4170 or Marlene Sneed at 534-5369.

The SPACE NEWS ROUNDUP, an official publication of the Manned Spacecraft Center, National Aeronautics and Space Administration, Houston, Texas, is published for MSC personnel by the Public Affairs Office.

Director Dr. Robert R. Gilruth
Public Affairs Officer Paul Haney
Editor Terry White
Staff Photographer A. "Pat" Patnesky



CONSERVATION • EMPLOYEE SUGGESTIONS
PROCUREMENT SAVINGS • WORK MEASUREMENT
VALUE CONTROL • OPERATIONS IMPROVEMENT

(add lots of enthusiasm, stir well and serve)

**COST
REDUCTION**

Roundup Swap-Shop

(Deadline for classified ads is the Friday preceding Roundup publication date. Ads received after the deadline will be run in the next following issue. Send ads in writing to Roundup Editor, AP3. Ads will not be repeated unless requested. Use name and home telephone number.)

FOR SALE/RENT—REAL ESTATE

1 and 1½ acre sandy, high-ground country lots within sight of MSC, good drainage, reasonable. Mac Owen, 877-1689.

3-bdr 1½-bath brick, 2-car garage, central air/heat, large paneled den, living room, kitchen with dining area, large walk-in closets, 80x120-ft lot, backyard fenced, schoolbus available. Take \$1500 for \$3000 equity; \$110/mo payments include everything. James Weaver, 1506 Webster St., League City, 932-2371.

4-2-2 in Friendswood, air conditioned, drapes, carpets, refrigerator/freezer combination, landscaped, 5½% mortgage. Jim Harris, HU 2-7569 or 591-3300 Ext 3155.

3-bdr 2-bath in Friendswood, central heat/air, fireplace, 1-car garage, built-in oven, range and disposal; carpets, drapes, fireplace set, workbench, garden tools, one year old. Total \$15,580—\$1450 down includes all costs. Assume 5¾% loan, \$111/month. Richard G. Ayers, HU 2-1043.

3-bdr 2½-bath brick in Pearland, carpet, large den, 2-car garage, two acres. Carolyn Dewey, HU 9-8403.

3-bdr 2-bath unfurnished for rent in El Lago, study, available June 67-June 68. \$217 plus utilities. C. H. Perrine, 877-2718.

4-bdr 3-bath for rent in El Lago, study, patio, 2-car garage, family room, central air, all appliances, furnished. Available for one year from June 10. R. B. Erb, 877-1435.

3-bdr 2½ baths in Clear Creek Woods subdiv of Friendswood, living room, dining room, paneled den w/fireplace, all-electric kitchen w/breakfast area, all-brick exterior, 1980 sq ft living space, heavily-wooded area. \$20,800; \$1800 down. Charles Shoemaker, 1206 Timber Lane, HU 2-7874 or 591-3300 Ext 3182.

4-bdr 2-bath in Clear Lake City, air conditioned, landscaped, fenced, available June 30. Equity, \$164/mo. Jack Skinner, 1919 Huntress Lane, HU 8-0519 or HU 8-3530 Ext 2636.

3-2-2 in Friendswood school district in Alvin, Spanish brick on half-acre, den, central air/heat, drapes. \$1800 down, \$146/mo. CA 8-3172 or OL 8-9673.

4-bdr 3-bath in Bayou Brae across from Clear Creek high, 2-car carport with covered patio, large paneled den, near water. George Carlisle, 2219 Bayou Drive, League City, 932-2836.

FOR SALE-AUTOS

1962 Rambler Classic station wagon 4-door deluxe 400 series, factory air, reclining bucket seats, headrests, vinyl interior, radio, autotrans. Original owner who ordered it from factory. \$875. Financing can be arranged; consider trade. Floyd Turner, RE 3-7667.

1964 9-passenger Pontiac station wagon, power steering/brakes, air, clean, swap or trade equity for late-model VW. Luther Palmer, 877-1269.

1961 Volkswagen, xcint mechanical condition, 49,000 miles, one owner. \$600. Jim Peacock, 932-4458.

1959 Chevy 6-passenger V-8 wagon, powerglide, 70,000 miles, one owner, good work/fishing car. \$195. R. B. Erb, 877-1435.

1966 Bonneville, loaded, burgundy, 12,000 miles. \$2995. Eugene Horton, 877-4102.

1964 Ford 4-door custom 500, air, radio, heater, power steering/brakes, tinted glass. Make offer. J. W. Moore, JA 3-9932.

1963 Corvair convertible, maroon w/black top and black vinyl interior, custom tonneau, radio, heater, 4-speed floor shift, 110-hp, top condition. Bob Kemp, Dickinson 534-4242 after 5:30 weekdays.

1963 Volkswagen sedan with radio and sunroof. \$725. Ray C. Longmire, GR 1-4322.

1961 Chevy, top condition, economical and reliable, a bargain at \$495. Chuck Heald, Dickinson 534-5233.

1965 Pontiac 3-seat Safari wagon, V-8, full power, factory air, clean, original owner, 30,000 miles. \$2,550. Don St. Clair, HU 2-7320.

1958 Cadillac Coupe de Ville, extra clean, new double-duty battery, new tires, (no air). Best offer. Chris Critzos, Kemah 877-3218.

1963 Chevy Impala 2-door hardtop, V-8, air, radio, whitewalls, white with blue interior, clean, one owner. \$1095. W. Teasdale, HU 2-7801.

1963 Mercury Comet, custom interior, radio/heater, low mileage, new Firestone 500 whitewalls, 6-cyl standard shift. Make offer. George Eby, 591-4021 or see car after 5 at 303 Clear Lake Road, Clear Lake Shores (1 mile west of Kemah).

1967 Mustang 2+2 GTA, 390 V-8, sport-deck seat, sportshift, wide ovals, discs, console, warning lights, exterior appearance

group, floormats, courtesy lites, clock, tinted glass, air, 8,000 miles. Will consider trade and/or part cash. Assume remaining note or refinance. Asking \$100 less than Bluebook whlsle. J. W. Colburn, MI 9-6361 after 5.

1965 Buick Wildcat, full power, air, new tires, still in warranty, xcint condition. Robert W. Becker, HU 4-5118.

FOR SALE—MISCELLANEOUS

1966 Ducati Motorcycle, 160cc, 70.75 mph, 90 mpg, 1500 actual miles, xcint condition. Also helmet, tinted bubble, cable lock w/keys tarpaulin \$300 for all. J. M. Walker, RI 8-5910.

Baby crib \$10; Auto-Wind baby swing, \$4; baby gates, \$1; baby dressing table, \$8.50; twin mattress, \$10. baby car playpen, \$2. Colonial rug, \$10; air conditioner, \$95. John Fitzgerald, 932-4155.

500-lb capacity small-wheel boat trailer with winch, frontwheel caster, spare and tire, 67 license. \$55. J. K. Finlayson, 591-3446.

1963 Harley Davidson 74, full dress, xcint condition. Bob Becker, HU 4-5118.

Honda Super 90, black and silver, 3300 miles, xcint condition, \$250. Mrs. Bogue, RI 8-4796 after 5.

Gentle 6-year old red and white Shetland pony mare, bridle and harness included. \$100. Cal Mitchell, GR 9-2020.

Wheeled cannister Ward's vacuum cleaner, all attachments. \$25. Ear: Rubenstein, 877-3288.

Mamiya C-22 twin-lens reflex camera, 105mm Sekor f/3.5 lens, 65mm Sekor f/3.5 wideangle lens and case, Porroflex eye-level finder and case, handgrip and flashholder. Retail value \$435; sacrifice for \$250. Pentax Spotomatic 35mm reflex with BTL exposure metering, complete with case. Retail at \$317.50—sell for \$250. All equipment in new condition, original packing, with instruction manuals. Murray Getz, 877-1088 or GR 4-2718.

9½-hp Johnson 1966 model, 4x8-ft hydro-plane, beginner's clarinet. D. H. Johnson, 591-3541.

Squall class 9-ft fiberglass sailboat with hand trailer. \$350. Bill Petynia, 877-4605.

Snare drum set including stand. \$25. Ben Reina, HU 8-1326.

Sears 20-in window fan, 2 speeds each direction, thermostat control, xcint condition. \$15. Bob Handley, HU 2-7041.

1-ton 220-volt Westinghouse window air conditioner, 2-speed fan, xcint condition. \$75. C. D. Thompson, HU 6-7768.

1965 Honda 150, windshield, crash bars, new clutch, good condition, priced to sell. Jessie False, 502 Honeysuckle Drive, La-Marque, WE 5-6546 after 4.

Membership in Edgewood Swim Club, 5815 Van Fleet St., (across from K-Mart), family lifetime corporate share \$200, no-interest time payment available, shares may be resold, summer membership \$60 until June 1, No. 2 Olympic pool (82-5x42) with kiddie wading pool, lifeguard and manager, clubhouse facilities. Will Brugger, MI 5-5287 after 6.

Thoroughbred broodmare due half-Arab foal in July. \$200. Yearling half-Arab filly, \$300. Beautiful snow-white German Shepherd puppies, AKC registered, 8-weeks old, wormed, shots. Will lease female puppies. Phancille DeVore, Alvin OL 8-6227 after 5.

Fly a Cessna 150 for \$9/hour, aircraft based at Clover Field, no gimmicks. Neel Tilton, GR 9-1176.

14½-ft Whirlwind sailboat, all fiberglass, 95-sq ft dacron sail, galvanized tilt trailer, 6-mos old. \$500. Marvin Williams, HU 8-2187.

Rummage at garage sale tomorrow (April 15) at north end of Dallas street in League City. P. Pakeltis, 932-4709 or John Fitzgerald, 932-4155.

One pair drapes 12 ft wide by 90 in long, light blue-green; Frigidaire dishwasher, can be built in. P. Pakeltis, 932-4709.

17-ft boat, 40-hp Mercury, big-wheel trailer. \$375. R. Courtney, 2014 Shasta, Kemah 877-2083.

16-ft Rebel sailboat, fiberglass, 20-ft aluminum mast, nylon sails, stainless rigging, fully equipped, factory trailer, used little, good price. Esther Davis, GR 2-1034.

Halton cornet in good condition, \$75. Maj. C. W. Leaverton, GR 9-3759.

5-hp Johnson outboard motor, \$40. Ray Longmire, GR 1-4322.

Beginning guitar lessons. J. W. Moore, JA 3-9932.

WANTED

Bachelor wants to share 2-bdr furnished lakefront home on Clear Lake, 10 minutes to MSC, large recreation room w/svc bar and

EAA Sponsors Teen Hootnanny

The MSC Employee Activities Association May 6 will sponsor a hootnanny for teenage offspring of MSC employees at the Kemah Elks Club from 8 to 11 pm.

Refreshments will be served, but each person must bring his own cushion to sit on. The 100 hootnanny tickets at \$.50 each will be sold first-come, first served.

Tickets are available from the following EAA representatives: Bob Merrifield, Room 354 Bldg 4, Ext 3621; Kitty Cornish, Room 2036 Bldg 30, Ext 3128; Peggy Chambers, Room 248 Bldg 16, Ext 2403; Tim White, Room 248, Bldg 31, Ext 2005; Sue Richardson, Room 533 Bldg 45, Ext 4616; Ted Lapko, Room 326 Bldg 2, Ext 3901, and Jerry Haptonstall, EAFB Bldg 317, Ext 7361.

Lady Aerobatic Pilot To Perform at Airshow

The Aero Club and the airshow committee of the Clear Lake Chamber of Commerce have received confirmation that past women's national aerobatic champion Mary Aiken will perform at the June 10-11 airshow at Spaceland Airpark.

The airshow, sponsored jointly by the Aero Club and the Chamber, is a part of this year's Clear Lake Rendezvous.

Aerial displays will be held from 1 to 4 pm both days, and the Airpark in League City will be closed to all other air traffic at these times. In addition to Mary Aiken's aerobatics, the Galveston County Skydiving Club will open the show with eight to 10 jumpers, two of whom will carry smoke streamers. Flybys by NASA T-38 and Texas Air National Guard aircraft and demonstrations of parading and STOL/VTOL aircraft round out the program.

Static displays by the Experimental Aircraft Association, the Antique Aircraft Association, the Ninety-Nines and Petticoat Pilots will be open both days from 8 am until dark. The airshow committee is attempting to obtain displays from major aircraft manufacturers, MSC and MSC contractors.

fireplace, fenced ½-acre, 4-car carport, outside barbecue, two patios, new private pier w/three boat docks and sundeck on top, ideal for boatowner. \$100 deposit; \$115/mo rent plus half of utilities. Bill Munro, 877-2219.

Carpool from Baytown to Bldg 4, 7:30-4. LeAnne Bible, Ext 3606 (no home phone).

Carpool from 1119 Second Street, La-Margue to Bldg 2, 8:30-5. Mary Lee Boudreaux, WE 5-2912.

4-wheel tandem trailer capable of carrying 2500 lbs at sustained high speed, must carry medium-size car approx 7x14, with runners at least one foot wide. Jon Farberman, WA 6-7192.

Want 12-15 ft travel trailer. Darrel Greenwell, HU 8-1034.

Want ride from vicinity of Woodridge and Gulf Freeway to Lockheed Bldg on El Camino Real, 8-4:45 shift. Jan Wells, MI 4-5728 after 6.

Want ride from 8541 Winkler Drive to Bldg 30 8-4:30, can alternate on driving. Al Crowder, HU 6-5640.

ROUNDUP EMPLOYEE NEWS

QUARTERLY COLLECTION—

Bloodmobile to Visit MSC April 24-May 2

Prior to the time the MSC Blood Deposit Program was established seven months ago, the need for such a program was vividly pointed up by a special drive at MSC to raise 70 pints of blood for a critical case.

Since the MSC Blood Deposit Program began operating, 17 families have been aided from the Program's "bank balance" collected in quarterly visits by the Bloodmobile.

The Bloodmobile's next visit to MSC and contractor facilities begins April 24 and runs through May 2.

Persons who have required blood have averaged 5.53 pints each—a rather large amount to be replaced by a single family. The MSC Blood Deposit Program offers to its participating members a sort of insurance policy that covers them when the need for blood arises.

Any employee who cannot give blood may have a friend or relative give blood in the employee's name, thereby qualifying the employee for all the benefits of a participating member.

The Program's balance above 100 pints following the next Bloodmobile visit will be donated to the Harris County Leukemia Society—a recommendation made by a Deposit Program member. Members may recommend to the Blood Bank Committee organizations or individual cases considered worthy of receiving aid in the form of excess blood.

The schedule for the April 24-May 2 Bloodmobile visit is as follows:

- April 24—MSC Bldg 8—8:30 am to 1 pm
- April 25—GE Bldg 1—8:30 am to 1 pm
- April 26—MSC Bldg 8—8:30 am to 1 pm
- April 27—EAFB Bldg 276—8:30 am to 3 pm
- April 28—MSC Bldg 8—8:30 am to 1 pm
- May 1—Lockheed Bldg—8:30 am to 11 am
- Gemini Bldg—12 noon to 3 pm
- May 2—MSC Bldg 8—8:30 am to 1 pm

For appointments and further information call the following: Ed Stelly 3378 and Rita Sommer 2397 at MSC; Bill Averyt, BR-N, HU 8-2500; Jim Hallmark, NAA, HU 8-2720; Roger Hobart, GE, 932-4511; Gerald Holder, Lockheed, HU 8-0080; and Albert Schneider, Dynalotron, HU 3-7630.

MSC BOWLING

MIMOSA MEN'S LEAGUE TEAM	WON	LOST
Chizzlers	71½	48½
Technics	69½	50½
Real Timers	68	52
Fabricators	67½	52½
Whirlwinds	67	53
Foul Five	66½	53½
Alley Oops	64½	55½
Road Runners	60	60
Strikers	57	63
Weightless Wonders	56	64
Agitators	42	78
Hustlers	30½	89½

High Games Bill Whipkey and Jim Grimwood 275, Bob Lacy 269.

High Team Game: Fabricators 1096, Chizzlers 1086.

High Series: Bill Holton 728, Bob Lacy 700.

High Team Series: Chizzlers 3132, Real Timers 3105.

Lunarfins Hold Advanced Swim, 1st Aid Courses

Members of the MSC Lunarfins skin and Scuba diving club will conduct certified Red Cross courses in first aid and swimming during April and May.

The standard first aid course will be held at Ellington AFB Bldg 336 beginning April 25 at 7 pm. The course runs a total of 12 hours and covers the fundamentals of first aid.

A six-weeks advanced swimming course begins May 1 at the Tropicana Swimming Club on Telephone Road. The course is aimed toward persons who wish to improve their swimming ability and may also be helpful to anyone planning to take the summer Scuba course.

Approximately 25 persons will complete the Lunarfins spring Scuba course April 17. A lake dive April 22 has been scheduled to further familiarize these new members with practical applications of classroom and pool instruction.

Want male roommate to share large 2-bdr studio apartment in Nassau Bay, approx \$80. Chuck Nelson, 932-4511 Ext 3580 or Dennis Dotter, 591-3133.

Want push-type lawnmower, walnut desk and 2-drawer filing cabinet. J. M. Huff, HU 2-1473.

Want to rent apartment, townhouse or house with 3 or more bedrooms, suitable for family with 4 children, near MSC, in Clear Lake school area, want to occupy May 1 or thereafter, transferring from Goddard. Herbert A. Tiedemann, 3188 Teal Lane, Bowie, Maryland 20715.

Retirement Ain't What It's Cracked Up to Be



OUT TO PASTURE — Space pioneer Ham pensively strokes his chin in his cage in the Washington National Zoo as he recalls his moment of glory six years ago when he made a suborbital Mercury-Redstone flight to qualify the Mercury Spacecraft environmental control system. At right the chimpanzee grabs his post-recovery meal aboard the USS Donner after the 420-mile trip January 21, 1961.

ROUNDUP
SECOND FRONT PAGE

45 YEARS SERVICE—

Langley's Chief Gets Civil Service Award

Dr. Floyd L. Thompson, Director of the NASA Langley Research Center, Hampton, Virginia, has been honored for his outstanding contributions to excellence in government during a 45-year federal career.

The National Civil Service League announced it has selected Dr. Thompson as one of ten public servants to receive the organization's Career Service Award for his pioneering efforts as an engineer, scientist, and administrator in advancing the science of aeronautical and space flight in the United States.

The award will be presented to Dr. Thompson at the League's 13th annual Career Service Awards banquet at the Sheraton-Park Hotel in Washington, D.C., on April 21. Two thousand top federal officials, business, and community leaders will be invited to attend the ceremony.

The League cited Dr. Thompson for his dedicated public service in building and directing an outstanding team of engineers, scientists, and support personnel whose wind tunnel, laboratory, and flight research have advanced the science of aeronautics and increased man's knowledge of the universe.

Dr. Thompson was recognized for his vision in anticipating research requirements and his expert guidance in the establishment of advanced aerospace research facilities which have made it possible for Langley to contribute significantly to the success of a number of flight programs of world importance.

The Center's wind tunnels, specialized laboratories, and other facilities represent an in-

vestment of \$250,000,000. Many of them were the first of their type anywhere and were designed and developed by members of Dr. Thompson's engineering and science staff at Langley.

Langley was established in 1917 and is celebrating its 50th year of service to the Nation throughout 1967. Dr. Thompson has been at Langley 41 of the Center's 50 years, and served four years as an Aviation Mechanic in the U.S. Navy during World War I—for a combined total of 45 years of federal service.

Radar Telescope Topic of Talk At ISA Meeting

Dr. William E. Gordon, Rice University dean of engineering and science, April 26 will speak to the Apollo Section of the Instrument Society of America on the powerful Arecibo Radar Telescope in Puerto Rico. The meeting will be at the Holiday Inn on NASA Road 1 at 6:15 pm.

The world's largest antenna is the 1000 ft. diameter reflector at the Arecibo Ionospheric Observatory which is formed by a natural depression in the hills of Puerto Rico. Dr. Gordon will describe the construction highlights and the early results of observations made with this telescope.

He will discuss the three major areas of investigation pursued at Arecibo—studies of the earth's upper atmosphere—the probes for specific information of our nearby planets—and some of the radio astronomy work accomplished.

Dr. Gordon will describe the use of Arecibo as a radar telescope (as opposed to a radio telescope) for the study of planetary details such as surface features, rotation rates, and atmospheric qualities as well as distances and sizes.

He will also touch upon the use of this huge radio telescope in astronomical studies including preliminary investigations into the newest and most mysterious heavenly discovery—the Quasars.

Non-members are welcome. For more information and reservations, call Pat Todsén, HU 8-0900.



Erb, Perrine Receive MIT Sloan Fellowships

Two MSC employees are among 45 persons to receive 1967-1968 Alfred P. Sloan Fellowships at the Massachusetts Institute of Technology. They are Richard B. Erb, Structures and Mechanics Division, and Calvin H. Perrine, Jr., Apollo Spacecraft Program Office.

These Fellowships, for a full year for education in management at MIT, leading to a master of science degree, were granted to outstanding young business and government executives both in the United States and abroad.

This year's group includes ten from abroad including two from England and one each from Canada, Ireland, Norway, Japan, Yugoslavia, the Netherlands, Peru and Cyprus.

The Fellows will begin their intensive year of study in management in June.

Sloan Fellowships for participation in this program are considered among the highest honors which can come to young men during their management careers. The Fellows, in their mid-30's, were carefully selected by MIT from a group of exceptionally able executives whose organizations nominated them for admission to the program to accelerate their development into positions of major executive responsibilities for the future.

The Sloan Fellows will move with their families to the Cambridge area in June, to spend twelve months at MIT, studying in depth the fundamentals that underlie sound management decisions and the changes in management and technology. Many will complete MIT's requirements for the degree of Master of Science in Management.

"Men who are selected as Sloan Fellows have already distinguished themselves within some specialized area to the

Illustrator Speaks To Tech Writers

Industrial-Mechanical design illustrator Fred Fukal will address the April 19 meeting of the Houston Chapter Society of Technical Writers and Publishers. His topic will be "Don't Just Write — Communicate, Draw!"

Held at the Ramada Inn on NASA Road 1, the meeting starts with a social hour at 5:30 pm, dinner (\$2.50/person) at 6:30 and program at 7:15.

Required dinner reservations can be made with Dave Holman, Ext. 2611.

"The way I look at Apollo— it's MORE than just a job"
Neil Armstrong

KEEP THE SYMBOL OF EXCELLENCE MANNED FLIGHT AWARENESS

Reserved Parking Set at Cafeterias

Parking in the vicinity of the two center cafeterias during lunch periods has become critical. Employees working beyond a reasonable walking distance from the cafeterias frequently use up the greater part of their half-hour lunch periods trying to find a parking place.

In an effort to ease the situation, restricted parking areas have been set up adjacent to each cafeteria. Parking is limited to one-half hour from 7 am to 5 pm. During lunch periods (11 am to 1:30 pm) these areas are reserved for cafeteria patrons only.

The spaces may be used for other purposes outside the specified lunch periods, but are still subject to the half-hour limit.