Space News

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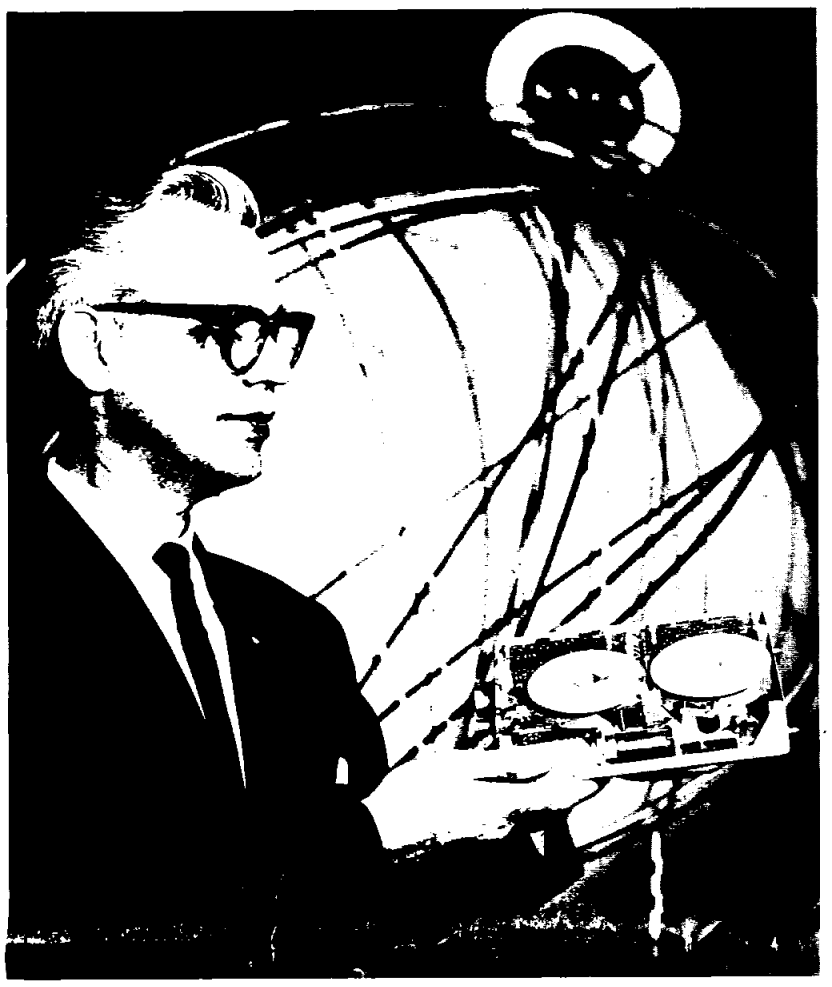

DR. ALBERT GERLACH, manager of the Cook Technological Center research section, displays one of the small magnetic tape recorders that will register the Gemini flight crew's physical and mental reactions second-by-second throughout the flight. A pair of them weighs less than six pounds.

New Magnetic Tape Recorders Register Astronauts' Reactions

The astronauts making the United States' first two-man Gemini endurance space flight next year will be wired for sound like never before—to a pair of small magnetic tape recorders that will register the spacemen's physical and mental reactions second-by-second throughout the journey.

Cook Technological Center Division of Cook Electric Company, in Chicago-suburb Morton Grove, Ill., has completed the first of the new biomedical recorders under contract from the National Aeronautics and Space Administration's Manned Spacecraft Center. The contract also includes development of playback equipment for post-flight analysis of the recorded data.

A pair of the new recorders weighs less than 6 pounds and occupies only 125 cubic inches of the Gemini spacecraft. Each recorder will receive and record continuously, for 30 hours, six kinds of simultaneous signals from sensors within the astronauts' spacesuits. Each also will have two extra reels, providing enough tape to stretch the length of five football fields and to record up to 90 hours of biomedical data on each recorder.

Manned Spacecraft Center considers the recorders as

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Cooper Picks 'Faith 7' As Name For Craft

Astronaut L. Gordon Cooper last week formally designated the spacecraft in which he will ride this month as "Faith 7."

The name, he said, was intended primarily to denote faith in the fact that no matter how long the mission goes, it will have made a contribution to man's knowledge of the universe in which we live.

The "7" refers, as have the other Mercury spacecraft names, to the original seven astronauts designated for Mercury flights. The latest nine additions to the present flight crew of 16 are being trained for Gemini and Apollo.

The Mercury flight crew therefore still numbers seven.

Spacecraft in the Mercury program to date have been named "Freedom 7," "Liberty Bell 7," "Friendship 7," "Aurora 7" and "Sigma 7."

Vice President Speaker At AIAA

Industry Asked For Study On Manned Orbital Laboratory

Requests for aerospace industry proposals for studying manned orbital research laboratory systems capable of sustaining a four-man crew in space for one year have been issued by the National Aeronautics and Space Administration's Langley Research Center, Hampton, Virginia.

The results of the comparative studies of manned orbital research laboratory concept will form another step in NASA research on the most effective ways to permit man to work usefully in space. Extensive research in progress for several years has developed technology applicable to multi-manned orbital spacecraft and has led to continuing interest in the concept.

There is no NASA approved flight project for an orbital laboratory at the present time.

A laboratory orbiting in space could provide scientists with many opportunities for scientific and engineering research which cannot be performed on earth, with wide flexibility of experimentation and operation. Controlled experiments on the effects of the space environment could be conducted and various techniques to enhance man's tolerance to the weightless or low "G" condition could be explored. The crew members themselves would be subjects of experimental studies on human effectiveness and abilities in space.

(Continued on page 2)

Saturn S-IV Starts Trip To Canaveral

The first NASA Saturn S-IV destined to fly in space left the Douglas Missile & Space Systems Division at Santa Monica, Calif. April 16 on the initial leg of its journey to Cape Canaveral.

Harnessed into a specially designed transporter, the S-IV flight vehicle was towed to Los Angeles Harbor and loaded aboard a barge for the four-day trip to the Douglas Sacramento field test installation.

There it underwent complete systems checkout and full duration firings of its cluster of six liquid hydrogen-liquid oxygen engines before delivery by ship to NASA Launch Operations Center, Cape Canaveral.

The initial flight of the block I Saturn I, consisting of an S-I booster stage, S-IV second stage, and dummy payload, is scheduled for the third quarter of this year. The launch will also be the first complete flight test of the integrated system.

Saturn I is scheduled to place both unmanned and manned payloads into earth orbit. The vehicle is the forerunner of the advanced NASA Saturn V program that will put the manned Apollo space vehicle on the moon later in this decade.

The NASA Saturn flight test program has had a spectacular beginning, with the S-1 booster vehicle having scored four successful flights in four attempts.

Most recent flight of S-1 occurred March 28, 1963, and was a complete success. These early S-1 test flights were conducted with dummy upper stages.

Currently, non-flying versions of NASA's Douglas S-IV have been undergoing extensive testing at the NASA Marshall Space Flight Center, Huntsville, Ala.; the NASA launch complex at Cape Canaveral and the Douglas installation at Sacramento.

Visitors to Exhibit Can Track Flights

Visitors to the Manned Spacecraft Center's permanent space exhibit at Houston's World Trade Center can do their own tracking of orbital manned space flights and flights of man-made satellites.

A large, revolving plastic globe, representing Earth, will display an orbit desired through an adjustable satellite arm. A lighted bulb will simulate the spacecraft or satellite orbiting the earth.

The orbit demonstrator, developed by Ames Research Center, Moffett Field, California, will be on display for approximately a month.

The National Aeronautics and Space Administration exhibit is open daily from 10 a.m. to 4 p.m. and each Saturday from 11 a.m. to 4 p.m. The World Trade Center is located at Texas and Crawford Streets, in downtown Houston.

At the American Institute of Aeronautics and Astronautics meeting in Dallas last week Vice President Lyndon B. Johnson said the United States must forge ahead in space or become a second-rate nation; Dr. Robert R. Gilruth, Director of Manned Spacecraft Center, said astronaut scientists will probably be used in lunar flights other than the first one; and Dr. Wernher von Braun said he doubted that Russia has developed any new booster capability despite rumors that the Soviets are about ready to launch another space spectacular. Paul E. Purser of MSC was co-chairman for the affair.

These developments occurred during the three-day session which featured the second manned space flight meeting of the group.

A total of 12 sessions were held during the meeting with Dr. Gilruth chairing the meeting on Manned Space Flight Programs I; Harrison A. Storms, President of Space and Information Systems Division of North American Aviation, chairing the meeting on Manned Space Flight Programs II; Dr. von Braun heading the meeting on Launch Vehicles; and George H. Stoner, vice president and manager of the Saturn Booster Branch, Aero-Space Division, Boeing Company, chairing the Spacecraft Design I meeting.

Eugene B. Konecci, director of biotechnology and human research of NASA's Office of Advanced Research and Technology, chaired the meeting on bio-technologies; the meeting on Guidance and Control was chaired by Charles S. Draper, head of the Department of Aeronautics and Astronautics and director of the Instrumentation Laboratory at Massachusetts Institute of Technology; the Spacecraft Design II meeting was chaired by C. E. Pappas, director of Scientific Research for Republic Aviation Corporation; and MSC's Walter C. Williams chaired the meeting on Operations.

Joseph Shea, deputy director for systems in NASA's Office of Manned Space Flight, chaired the meeting on Future Space Systems; Raymond L. Bisplinghoff, director of NASA's Office of Advanced Research and Technology,

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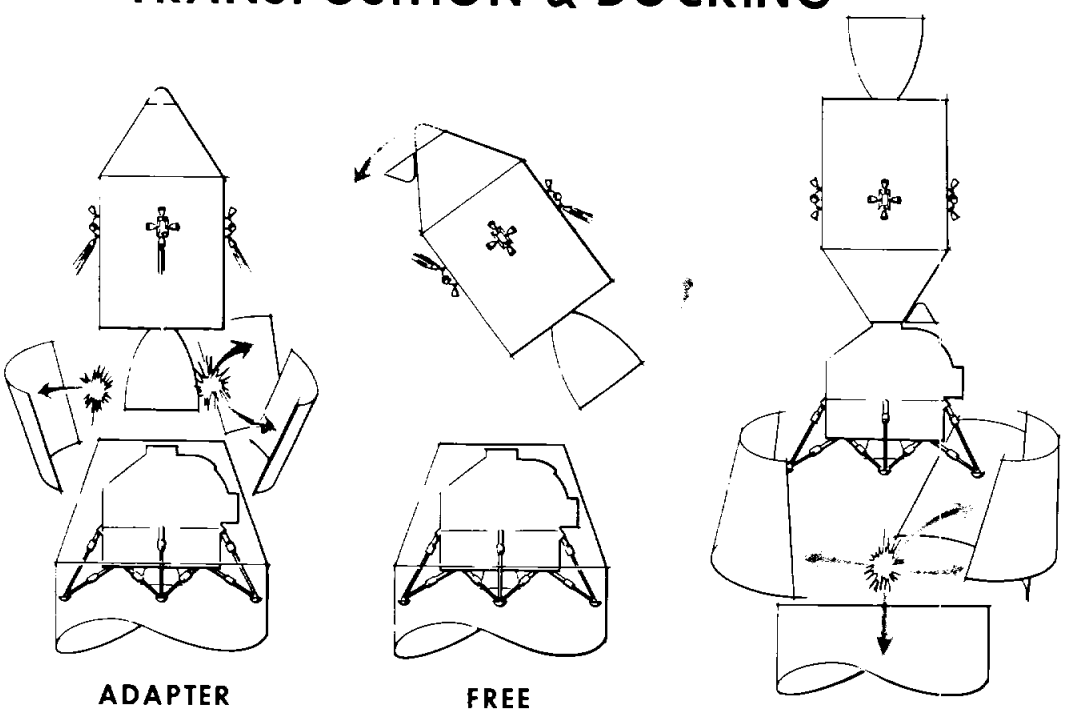
TRANSPOSITION & DOCKING



TRANSPOSITION — Prior to lunar appraoch, the Apollo spacecraft, using the Service Module reaction control system engines, free-flies around to mate with the LEM, which is stabilized by the S-IVB stage. After mating, the S-IVB is separated and the spacecraft with the LEM proceeds toward the moon, where two astronauts board the LEM through a hatch in the joined portion.

No Technical Reasons to Stop Moon Trip by 1970 — Feltz

There is no known technical reason why the United States cannot make a lunar landing and return the astronauts safely to earth by 1970, Charles H. Feltz, of North American Aviation's Space and Information Systems Division, Downey, Calif., said at Dallas last week.

Feltz, who served as project engineer on the X-15 rocket plane, is Apollo chief engineer and assistant program manager at Space and Information Systems Division, which is designing and building the lunar spacecraft for NASA's Manned Spacecraft Center.

Special design features associated with lunar landing and earth return were described by Feltz in a paper presented at the American Institute of Aeronautics and Astronautics' Second Manned Space Flight Meeting, April 22-24.

Feltz said the main factor affecting design of the conical shaped command module were booster limitations, crew safety and natural mission requirements. Astronaut safety through system redundancy and exhaustive testing has been emphasized throughout, he said.

As an example of a specific safety consideration, Feltz described the flight trajectory which is designed to permit abort anytime prior to lunar touchdown.

To insure stability of the an abort at low level two strakes, or fins, have been added vertically to the command module.

Feltz said the command module can be lowered to earth either on land or water through use of three main parachutes, any two of which will permit a safe landing.

The Apollo spacecraft must provide a "shirt sleeve" environment with reasonable comfort for the three astronauts for at least ten consecutive days.

AIAA Meet

(Continued from page 1)

chaired the meeting on Research Requirements; J. R. Clark, vice president and general manager of Chance Vought Corporation's Astronautics Division, chaired the meeting on Advanced Engineering Development; and William B. Bergen, president of Martin Company served as moderator in the panel discussion on Challenges in Planning and Management.

Col. James H. Fox presented a briefing on Russian Manned Space Flight Programs.

Shea was also a luncheon speaker during the three-day meeting and spoke about Systems Engineering for Space Flight. Other luncheon speakers were W. H. Pickering. president of AIAA and director of Jet Propulsion Laboratory, whose subject was "AIAA Looks into the Future," and General Thomas S. Power, commander of the Strategic Air Command who spoke on the "Military Aspects of Manned Space Flight."

The Vice President spoke at the banquet Tuesday night on "The New Frontier of Space." He said "What we are doing—and we hope to do—would still be required of us in our own self interest if we were the only nation on earth to possess space capabilities."

The Vice President reminded the group that much of the nation still ponders the worth of spending billions to go to the moon, but pointed out that "if we are to make science the servant of man, we must go into space to put science to work for us on earth."

Gemini Launch Escape Modes Are Discussed

Warren J. North, Chief of the Manned Spacecraft Center's Flight Crew Operation Division, presented a paper last week to the conferees of the AIAA meeting in Dallas on the Gemini launch escape modes and explained that mission reliability and crew safety have been enhanced by incorporating a redundant guidance and control system and a manual launch vehicle monitoring system.

The paper prepared in collaboration with William B. Cassidy, Life Sciences Section, Astronautics Division, Chance Vought Corporation, explained the work that has been done to verify the feasibility and desirability of using manual escape in the Gemini system. Using the moving base aerospace flight simulator at Ling-Temco-Vought, Inc. the program involved 51 malfunction runs ranging through 9 major types including those from partial loss of thrust in one engine through total loss of thrust in both engines, staging failures, pressure losses of fuel and oxidizer.

NASA astronauts participating in the simulation were given one day of indoctrination and scheduled for 75 runs of which ten were normal and 65 having malfunctions. The pilot's control response to each run was recorded with his verbal assessment of each run.

"With only one day of familiarization and with partial developed displays, the pilots were able to analyze and react correctly to the critical malfunctions," North said. "It became clear during this simulation that the pilot's presence in the abort control loop provides the potential to save missions which would probably be aborted by an automatic system."

Rasmussen Says Interpersonal Space Stresses Will Be Great

Commander J. E. Rasmussen, director of the Behavioral Science Department of the Naval Medical Research Institute, was one of the speakers in the Bio-Technologies session at the Dallas AIAA meeting. His subject was "Selection and Effectiveness Considerations Arising from Enforced Confinement of Small Crews."

Following is a summary of his presentation.

The closed ecological systems of manned space vheicles and future weapon systems still engender specific individual and interpersonal stresses which exceed anything heretofore encountered. The significance of these problems has been recognized, but very little systematic effort has been focused on evaluating their magnitude and devising techniques for coping with them. The problem area of concern is one which extends beyond the province of man-machine research as it is presently envisioned.

On the basis of the Navy's operational research experience with small isolated groups in the Antarctic, as well as Air Force research on bomber crews, it is clearly evident that mission success is dependent upon more than adequate human engineering and the selection of technically qualified and trained personnel.

Two additional variables are introduced by the use of small crews in the closed ecology of space and future weapon systems vehicles. Effectiveness of interpersonel interaction among personnel operating the system is a critical variable in mission success. Secondly, factors inherent in prolonged isolation and physical confinement assume a significant magnitude in both individual and group effectiveness.

Industry

(Continued from page 1)

Before interplanetary exploring missions can be undertaken, it is necessary to learn much more than we now know about the long term effects of weightlessness or reduced gravity on human crews. Because extended periods of weightlessness cannot adequately be simulated on the surface of the earth, a manned orbital laboratory concept offers a useful way to make such studies.

The laboratory concept as outlined provides an orbital workshop for four men with provision for changing crew members and periodically resupplying the vehicle. At least one crewman could complete a full year's mission to provide a long-term check on weightlessness and its effects.

The NASA concept described in the request for proposals would make maximum use of current programs.

According to NASA's concept, the laboratory would be launched by a Saturn I or I-B into a circular orbit from Cape Canaveral, after a checkout period. Two crew members using the Gemini spacecraft currently being developed would ascend to the laboratory's orbit and complete a rendezvous and docking maneuver. Later, two more crewmen would join the laboratory by the same method to complete the four-man crew. At intervals of 90 days or less, an unmanned resupply spacecraft launched by an Atlas-Agena combination would be orbited and brought by radio control to a rendezvous with the laboratory. One man could enter the laboratory at each crew change, thus providing a check on the cumulative effects of weightlessness on man's total capability.

Two contracts are expected to evolve from the requested proposals.

Phase I will provide a comarative study of several alternative ways to obtain the orbital laboratory which is envisioned. Phase I will also consider the feasibility of providing artificial gravity for the laboratory. Following completion and evaluation of the Phase I comparative studies, NASA may follow with a Phase II preliminary design study. However, Phase II has not been approved by NASA at this time.

Should Phase II be undertaken, a single contractor would be required to synthesize into a mature concept the design study found most feasible in Phase I and to furnish a preliminary design for a complete orbital laboratory system. Mockups of the laboratory and resupply spacecraft would be provided, including mockup systems and equipment.

It would be expected that the preliminary design could be prepared from the information supplied by the preliminary designer. The contractor would be required to furnish cost estimates in detail, evidence of reliability of all systems in the laboratory and resupply vehicles, and a detailed operating plan for the entire laboratory, space ferry, and resupply system. In acordance with the recent NASA-Department of Defense agreement on Gemini, no hardware procurement would be conducted without the prior agreemend of DoDo.

Langley Research Center will monitor work under the study contracts. Interested firms are to have their response to the request filed with the Langley Research Center by May 14. Evaluation and contractor selection will follow.

Carpenter Says Mercury Gave Skill, Confidence, Knowledge

Astronaut M. Scott Carpenter, speaking at the AIAA Conference in Dallas, Texas on April 22, told the members that the Mercury Program was nearly "wrapped up" now but that it had given the skill, confidence, and knowledge of space flight which was initially sought four years ago.

Reviewing the flight experiences in the Mercury Program, Carpenter stated, "In April of 1959, when the astronauts joined NASA, we were told that in our flights we would be subjected to a frightening combination of stresses resulting from vibration, heat, cold, humidity, noise, acceleration, weightlessness, high concentration of carbon dioxide, immobility, disorientation, radiation, and – hopefully – land shock. Our eyes, inner ears, cardiovascular and respiratory systems, and even our very intellect were considered suspect by many."

Recognizing that some unknowns would be encountered, a training program was put together to familiarize the astronauts with them; it proved to of great value in providing accurate and representative experience. The most valuable proved to be the procedures trainer, a full-sized replica of the Mercury spacecraft with controls and displays animated by a computer. Other training included repeated periods on the centrifuge, desert and water survival, zero-G flight in various types of airplanes, star recognition, SCUBA diving, egress training, and systems study.

"In retrospect," Carpenter said, "the only unknowns that existed in my mind after this very thorough training program was completed were: what would be the effect of prolonged weightlessness, and what reactions might be caused by various untried combinations of these stresses?"

Of the astronauts' experiences in the Mercury Program, Carpenter recalled that the first suborbital space flight was made by Alan Shepard in "Freedom 7" on May 5, 1961 and progressed almost exactly as planned with only a minor problem in vibration during powered flight. During the period of maximum dynamic pressure, Shepard's vision blurred slightly. This condition was avoided in subsequent flights by the addition of a sponge rubber pad between the couch and helmet.

Astronaut Grissom's second ballistic flight on July 21, 1961 in "Liberty Bell 7" was similar to the first suborbital flight except that it investigated spacecraft systems not used on the first flight. Maneuvers were made by using alternate control systems; and a window that replaced the smaller portholes was used as a reference rather than the periscope and instruments used before. After impact a premature detonation of the explosive side hatch caused the spacecraft to ship water and eventually sink. Despite the loss of the spacecraft, the postflight analysis of telemetered information and the pilot's report found the flight a success and resulted in a decision to attempt an orbital flight.

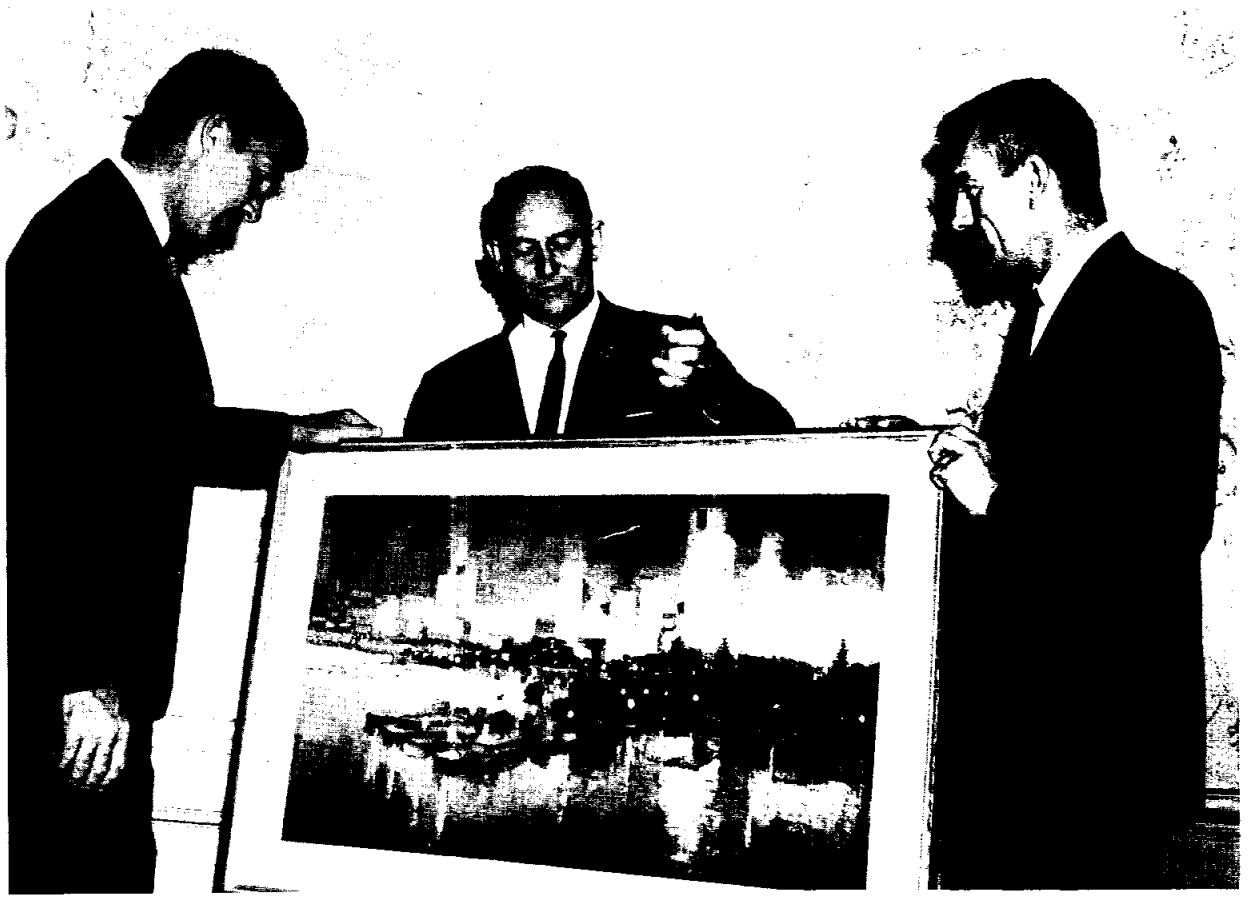
Carpenter called the three-orbit flight by Astronaut John Glenn in "Friendship 7" on Feb. 20, 1962 an epic event for the nation and a tremendous technical and personal triumph. The flight went substantially as planned but some minor malfunctions did occur. The failure of the one-pound thrusters caused Glenn to control manually for most of the flight and the failure of a limit switch gave erroneous information indicating that the heat shield was being held by the restraining straps of the retropack only. For this reason the decision was made to make the reentry with the retropack in place.

Speaking of his own orbital flight on May 24, 1962 in "Aurora 7" Carpenter recalled that the spacecraft systems operated perfectly except for the horizon scanners which caused intermittent error in pitch attitude and necessitated manual attitude control at the time of retrofire. Yaw error was attributed as the major factor in the 250 mile overshoot of the landing area.

Commenting on the Nation's third orbital flight on October 3, 1962, Carpenter said that Astronaut Walter Schirra in his "Sigma 7" flew a near perfect six-pass flight, almost putting the spacecraft down on the deck of the recovery carrier. Using drifting flight to conserve fuel Schirra showed that the Mercury Spacecraft had the capability to fly a day-long mission.

"Next month," Carpenter said, "the Mercury program will culminate in the one-day mission of Gordon Cooper." He will continue the modest program of scientific research that has begun and which may aid in the future programs of Gemini and Apollo.

"The Gemini missions are going to require a great deal of astronaut control from launch to recovery," Carpenter stated, and "pilot decision is going to play a larger part in the space mission of the future. It is the increasing importance of man in the system that is going to characterize our space flights. We will need skilled pilots to fly these missions, and we are in the process of developing those skills now. We are convinced that succeeding programs will continue to expand our knowledge of the universe, hopefully for the benefit of all mankind."



PREMIER BRAND of Western Australia presented a painting, "Perth At Night," to Astronauts Walter M. Schirra, Jr. and Donald K. Slayton during his visit to Houston April 21, as a gift to the Mercury team. Perth was the city in Australia which turned on all its lights during Astronaut John Glenn's first orbital flight February 20, 1962, making it clearly visible from his spacecraft.

Chamberlin Lists Gemini Objectives For AIAA Group

James A. Chamberlin of MSC told the members of the AIAA meeting in Dallas that the design and test philosphies of Gemini will provide a spacecraft system with mission flexibility that will evolve techniques and basic technology necessary for future space exploration.

Co-authored by James T. Rose, of MSC Gemini Project Offiice, the paper presented by Chamberlin discussed in detail the techniques and objectives of the program.

Chamberlin stated that although many other objectives may receive attention ultimately, specific objectives of the Gemini Program at this time are:

1. Long duration spaceflights of up to 14 days.
2. Rendezvous
3. Maneuvering in space (before and after docking)
4. Extravehicular activity
5. Landing at a preselected site
6. Provision of a platform for scientific experiments.

Following the first phase of the program of unmanned flights to qualify the spacecraft and launch vehicle systems, Chamberlin said that preliminary experience in terminal maneuvering would be accomplished with a small target carried in the adapter section of the spacecraft which would be ejected in orbit. The final missions of the program will be devoted to the development of rendezvous techniques with the maneuverable Agena target vehicle and postrendezvous maneuvers after docking when the pilots will control the Agena's attitude, ignite its engine, and monitor its systems.

Kraft Tells AIAA Meeting Mission Control Flight Needs

The members of the AIAA attending the 2nd Manned Space Flight Meeting in Dallas last week were told by Christopher C. Kraft, Jr., chief Flight Operations Division, MSC that it was essential to the development of a new, complex space vehicle that parallel development of a test and control organization be made to accomplish the test objectives when qualifying it for operational use rather than research and development.

The paper entitled, "Mission Control for Manned Space Flight," was prepared by Kraft, John D. Hodge, and Eugene F. Kranz all of MSC's Flight Operations Division, and traced in detail the development of the real time control from concept, through a Mercury mission to those of Gemini and Apollo.

Kraft stressed than in manned space flight the vehicle traveled almost to the extremes of its limit design envelope on every flight and that the need for flight control, the work of a ground based crew, to monitor, evaluate, recommend and – if necessary – command, was evident.

"The fundamental aims of the flight-control crew," Kraft said, "are the safety of the astronaut and the successful completion of the mission."

Recorder

(Continued from page 1)

being vital to one of Gemini's prime objectives – detailed continuous analysis of astronauts' physical and mental endurance in long periods of space flight, pointing toward the Apollo moon project. Up to now Mercury flights have utilized spot-check telemetry to ground stations for biomedical data on astronauts in orbit.

Center officials say the recorders are adaptable to Mercury flights.

Smallest ever developed for such long operation, each seven-channel recorder will register simultaneously electrocardiograph (EKG) heart readings, blood pressure, and respiration. Other parameter recordings may be established by MSC at a later date. One channel of each recorder will register time.

Dr. Albert A. Gerlach, manager of Cook's Research Section responsible for biomedical recorder development, said the machines are designed with sufficient amplifier senstitivity to pick up 1/1,000th-volt signals from signal conditioners and sensors within the astronauts' spacesuits. The recorders utilize two types of electronic processing – direct, for heart, brain, muscle, and time recordings; sampled on-off or chopped, for blood pressure, respiration, and body temperature data. The choice of electronic processing for the tape channels will be pre-set before each flight, depending upon the type of recording and measurements desired for each astronaut.

Dr. Gerlach said the recorders can be set for intermittent operation through a programmer. There would be a recorder for each astronaut initially. It would be possible for the two Gemini recorders to be used consecutively instead of simultaneously, however, to check one man continuously or two or more men alternately.

Grumman Aircraft Engineering Corp. Builds LEM Whi

ASTRONAUTS Eliot See and Frank Lovell operate the lunar landing simulator at Grumman Aircraft. The Grumman-built lunar excursion module is the only part of the Apollo configuration which will actually touch down on the moon during the nation's first manned moon mission, sometime before 1970.

AERIAL VIEW of Grumman's plant at Bethpage, on Long Islang, N. Y., which had produced more than 25,000 military and commercial aircraft by the end of last year. Still headed by five of the six original founders, Grumman has already assigned 1,000 personnel to the LEM program and current expectations are that the figure will double by the end of this year.

ROCK FROTH, made by melting pumice in a hard vacuum, is part of a company funded work in lunar soil mechanics and associated lunar surface locomotion problems.

FLEXIBLE METALASTIC WHEELS, developed under a company-funded study, are being investigated as possibly suitable for lunar surface vehicles. Highly flexible, they are being tested over loose, sandy soils.

GRUMMAN'S LEADERS include five of the six original founders, include LeRoy R. Grumman (left), chairman of the board. At center is E. Clinton Towl, president, and at right William T. Schwendler, chairman of the executive committee. Grumman's employee turnover rate is about one quarter that of the aerospace industry average.

When Grumman Aircraft Engineering Corporation was founded in 1929, its first business was repairing Loening amphibians. Today the Long Island company is developing the vehicle, under a NASA contract administered by the Manned Spacecraft Center, which will land the first American astronauts on the moon.

Technologically, the progression has been from nuts and bolts to investigations of lunar soil properties and orbital rendezvous mechanics. Financially speaking, its growth has been from a first year's gross of a few thousand dollars to a record 1962 gross of $357,099,282. Perhaps even more dramatic is the comparision between the company's first repaired amphibian and the 25,106 military and commercial aircraft that had been produced by the end of 1962.

Characterizing its corporate history is a reputation for highly reliable aircraft and space systems, an employee turnover rate one quarter that of the aerospace industry average, and the most experienced corporate officer team in the aerospace industry—five of the six original founders, including LeRoy Grumman.

Grumman brings these characteristics to its only hardware program with the Manned Spacecraft Center, the lunar excursion module.

Since the company was selected as the prime contractor for the LEM program, it has completed preliminary analysis of equipment that might be considered for common usage for the command and service modules and LEM in a joint investigation with MSC; presented to MSC a preliminary configuration aimed an an early freeze of the LEM design; established permanent representation at MSC and Atlantic Missile range, as well as technical liaison in Los Angeles for California sub contractors; begun development of plans for propulsion system testing at the White Sands missile range; and selected four major sub contractors for negotiations.

As of the month of April, approximately 1,000 personnel had been assigned to the LEM program. It is currently anticipated that the staff complement on the LEM program would more than double by the end of 1963.

But although the lunar excursion module is the only Grumman hardware development program administered by MSC, it is only one of the many Grumman programs employing advanced concepts applicable to manned space flight.

Grumman is now completing a funded study for NASA designed to investigate the supplies necessary for support of the astronauts during an extended stay on the moon. Begun in September, the $75,095 study was completed in February.

As an addendum to this lunar logistic study, Grumman's preliminary design department analyzed the basic LEM vehicle for its suitability to carry several payloads. Recently presented to NASA, the study indicates that the descent stage of the lunar excursion module could be stocked with the necessary provisions to extend a lunar mission another 70 days.

In addition to carrying staples (food, water, oxygen, spare space suits and back packs, a power supply, and other life support items), the LEM descent stage, or "truck," as Grumman calls it, could also accommodate a 10-foot diameter, pre-assembled shelter which would protect the astronauts from the lunar hazards of micrometeorite showers, and solar flares. The shelter could also contain enough life support, power supply, and communications equipment to sustain the astronauts for as long as three months.

Another possibility, according to the study, would be the inclusion of a lunar roving vehicle which could be used by the astronauts for cargo carrying purposes.

The LEM-truck would be capable of carrying a total payload of about 7,500 pounds. The concept, should NASA decide to employ it, could be accomplished with minimum modification to the basic LEM design and maximum development efficiency.

Another related facet of the logistic problem — the locomotion and control of lunar vehicles — was first investigated by Grumman under a company funded study in preparation for the prospector program.

Recognizing that continuity in research and advanced development programs are essential in the development of significant data, Grumman continued company funded work in lunar soil mechanics and associated locomotion problems.

The company concentrated on hard vacuum testing of clean soils to study cohesive effects, and generated a hard rock froth substance by heating a sample of pumice to its melting temperature of 2,700 degrees. The froth could be analagous to a lunar substance created from the heat generated by micrometeorite impact, or larger meteorite impact.

The company's advanced development department continues to correlate optical, thermal, and radiometric measurements of these samples for

Secretaries' Salute

These four friendly faces are well known to many an employee of MSC. They are all secretaries to MSC executives, and at right and left they kick off a new feature for the Space News Roundup, a salute to the Center's secretaries.

At top left is Mrs. Iva L. Scott, secretary to Director Robert R. Gilruth. Born in Indian Springs, Tenn., Mrs. Scott attended high school, business college and university night school in Akron, Ohio. She has been in Government service for five and a half years, the last two with Manned Spacecraft Center. She is the wife of Maj. Reid K. Scott, U. S. Army, and says that her hobbies are reading, music and gardening.

At top right is Miss Voula Tsitsera, secretary to Deputy Director for Mission Requirements and Flight Operations Walter C. Williams. A native of New Rochelle, N. Y., she graduated from Newport News High School in Virginia and holds a business diploma from Madison College, Harrisburg, Va. Voula has a long career with the Government, having transferred to MSC from Langley Research Center when Williams was named associate director. Voula's hobbies are reading and dancing.

At bottom left is a newcomer to MSC, Miss Marilyn Bockting, who joined the Center in March as secretary to James C. Elms, Deputy Director for Development and Programs. Born in DuLuth, Minn., she nevertheless considers herself a native of California, where she graduated from high school and has lived since 1941. Prior to joining the Center she was Elms' secretary at the Aeronutronic Division of Ford Motor Co. She has had nine years of Government service, with Army Counter-Intelligence Corps and the Naval Intelligence Office. Her hobbies are playing cards, swimming and reading.

At bottom right is Phoncille De Vore, secretary to Special Assistant Paul E. Purser. Phoncille is a native of Texas, born in Sweetwater. She is a graduate of Draughons Business Colleges in Oklahoma City and Abilene, Texas, and of the College of Hampton Roads in Virginia. Phoncille has nine years of Government service, having transferred from Ft. Monroe, Va. to Space Task Group in July of 1960. She was the first secretary in Apollo Project Office when it was established. Wife of Major John P. DeVore, USAF, she is the mother of two, Melody Evans, 23, now living in Tampa, Fla., and Danielle, 15. Her hobbies are oil painting and sketching, flower arranging, and bowling.

MSC Bowling Roundup

Editors Note; Team standings, and high averages, series and games for the four MSC bowling leagues will be listed in each issue of the Roundup provided they are turned in by Wednesday afternoon one week before publication. Space requirements prohibit publishing individual averages. Winners of end-of-season trophies and awards will be listed. Those groups establishing summer leagues after the end of the regular season are urged to turn in standings.

NASA FIVE O'CLOCK LEAGUE
(Male personnel from Financial Management, Logistics and Procurement Divisions. Bowls Monday nights at Ellington Lanes.)

Team	Won	Lost
SUPPLIERS	80	32
BANKERS	70	42
ALLEYGATORS	57½	54½
ALLEYCATS	57	55
PROCURERS	38½	73½
PRICING	33	79

Hi Series: George Elder, 599
Hi Team Scratch Game: Alleycats, 909.

MSC MEN'S LEAGUE
(Personnel from all divisions. Bowls Monday nights at Meadowbrook.)

Team	Won	Lost
TIGERS	34½	13½
COSMONUTS	33	15
CEE GEES	29	19
STRIKES AND SPARES	27	21
PLUMWOOD HOMES	25½	22½
BLIVITS	24½	23½
WHIRLWINDS	19	29
SHERLOCK HOMES	16½	31½
FIZZLERS	16	32
STATION MASTERS	15	33

Hi Team Series: Plumwood Homes, 2574; Tigers, 2496.
Hi Team Handicap Series: Plumwood Homes, 2895; Tigers, 2829.
Hi Team Scratch Game: Strikes and Spares, 899; Station Masters, 854.
Hi Team Handicap Game: Strikes and Spares, 1010; Station Masters, 1007.
Hi Individual Scratch Series: Garino, 627.
Hi Individual Handicap Series: Cairl, 661.
Hi Inidvidual Scratch Game: Cairl, 245.
Hi Individual Handicap Game: Cairl, 265.
Last Week's Highs: Gorecki, 204 (535); Bryant, 520; Bazhaw, 214; T. Lewis, 203 (549); Shumilak, 506; Pavlosky, 203 (563); Dornbaca, 529, Yusken, 527; Bell, 206 (523); Geier, 202 (548); Devine, 521; Guinn, 527; Sandars, 501; Chevers, 519; Marak, 200 (568).

Obituary

Texie Belle Miller, former Langley Research Center employee and wife of Jules M. Miller, Research Staff Office, died March 24 in Dixie Hospital after an illness of 3 weeks.

Born February 21, 1921 in Boykin, she received a A.B. degree in Mathematics from Longwood College in 1942 and joined the Center staff on July 1, 1942 as an assistant computer in the Full Scale Tunnel. She transferred to East Computers on May 21, 1945 and resigned October 1, 1946.

In addition to her husband she is survived by three sons, John Malcolm, Jerald Felts and Warren Scott.

The United States' space program has cast into discard two ancient maxims—"The sky is the limit," and "What must go up must come down."

Classified

FOR SALE

1 ACRE WOODED LOT IN SHOREACRES — Beautifully wooded (pines, oaks, sweet gum). Cleared. Water, gas, electricity. Sewers this year. Restricted. Shell roads, pavement planned. Schools 3 miles (La Porte District). Houston Yacht Club, Galveston Bay—1-1/2 miles. NASA Clear Lake site—6 miles. $3900 cash. Call Houston—PA 3-1311.

* * *

WINDOW AIR CONDITIONING UNIT—Hotpoint, 3/4 ton, 9,000 b.t.u., 115 v. a.c., used one season. $95.00. Call HU 6-6967.

* * *

HOUSE FOR SALE OR LEASE—Brick, 3 bedroom, family room, 1-1/2 baths, two-car garage in Fairmont Park. Three blocks from beautiful sub-division swimming pool and park; convenient to schools and shopping. For information call John McLeaish, GA 1-3210, LaPorte in p.m. During day, call Ext. 3571.

MSC Staff Includes Magician Turned Engineer

Almost everyone has a hobby of some kind or another. In some people it amounts to an avocation. But for one member of the MSC staff, it was a vocation, and still is, although it has taken a back seat to his job as deputy chief of the Facilities Division.

He is Edward Campagna, an engineering graduate of Iowa State College who is also a master magician—and good enough at it to have been a professional for some time.

Campagna got interested in his art at the age of nine, watching his uncle perform some skilled sleight of hand. In college, he met Trix Cooney, a student of T. Nelson Downs, the "king of coins" in magic circles. By this time, he was practised enough to earn his education by performing at fraternity, sorority and school functions for about $7 a night, supplemented by his football scholarship.

It was also at Iowa College that he met a psychology professor who traded lessons in Ed's magic for lessons in hypnosis—after first insisting that Ed take every human behavior and most of the psychology courses on campus. Since then, Campagna has worked with doctors in France and England in the use of hypnosis in reducing pain, and has also worked with dentists along the same lines. He has even had some success with helping people reduce their weight by post-hypnotic suggestion. One man in Washington dropped from 272 to 171 pounds and has not gained it back in five years.

Campagna started his Government service at Aberdeen Proving Grounds, Md., and at the same time, started making money in Baltimore night clubs and at banquets, and at a long series of Special Service shows for the Army.

About this time he met his wife Terry, a dancer also in show business. After the war, and a stint in France where he broke his leg, he returned to show business full time, now in partnership with his wife. She did tap, toe and ballet dancing. He had a comedy act coupled with magic. From 1945 to '48, they played most of the major clubs and theatres in the country.

But the road was no place to raise a family, so the couple eventually decided to settle in Washington D. C. where Ed went to work for the Army Corps of Engineers Research and Development lab at Ft. Belvoir. Ed went back to school at George Washington University, earning part of his tuition by doing banquets and a little night club work.

"I did about three shows a week before 1961, when I joined NASA," he says. I haven't done much since, but I'd like to get back into it." By way of keeping his hand in, he belongs to the Houston Magic Association, a combined chapter of the International Brotherhood of Magicians and the Society of American Magicians. (He is a past president of the Washington chapter of the latter organization.)

"I'd like to get back into home and banquet work when the load slows down a bit," he says.

Campagna has a fund of stories from his years in show business, including the time the orchestra gimmicked everything on his equipment table and the tale of how his once-all-magic act changed gradually to a combination of comedy and magic, as he acquired what every successful performer must have, a sense of showmanship.

The Campagnas now have two children, a boy, 8, and a girl, 10. The boy is already taking after his father's talent with magic tricks.

Asked for a demonstration, Ed last week walked into the Roundup office for an interview and did 30 minutes of amazing magic with nothing more than what he could carry in his pockets. His audience was never more than two or three feet away.

"This is what we call close work," he explained. "It's a different kind of magic from the act you would do from a stage, before a big audience."

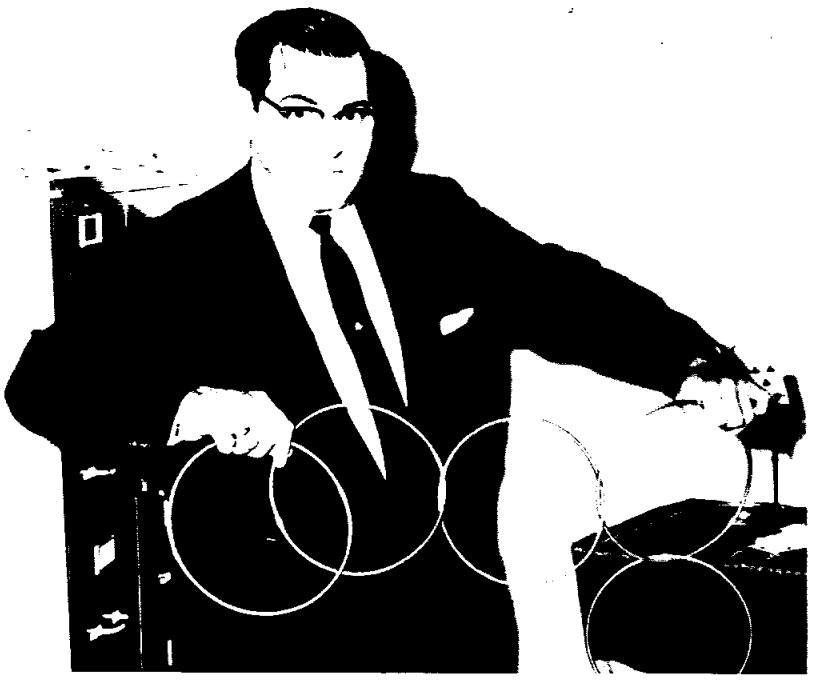
As he talked, rings appeared magically on pencils, cards materialised out of thin air, a 50-cent piece somehow showed up in a soft drink bottle with a neck you couldn't put a dime through, sealed envelopes revealed their contents, and ordinary objects like a pocketknife changed finish and color right before our eyes.

Campagna was working at incredibly close quarters, with his sleeves pulled back.

Later on, by way of enlarging his subject, he produced a small overnight bag out of which he said he could do an hour-and-a-half show. No one in his fascinated audience doubted it.

EILEEN BALISKY of Graphic Services proves she has a head for money as Ed Campagna seems to discover a quarter in her left ear. Campagna can also get a half-dollar in and out of a soft drink bottle, a trick which puzzles his audience no end, since none of the spectators can do it.

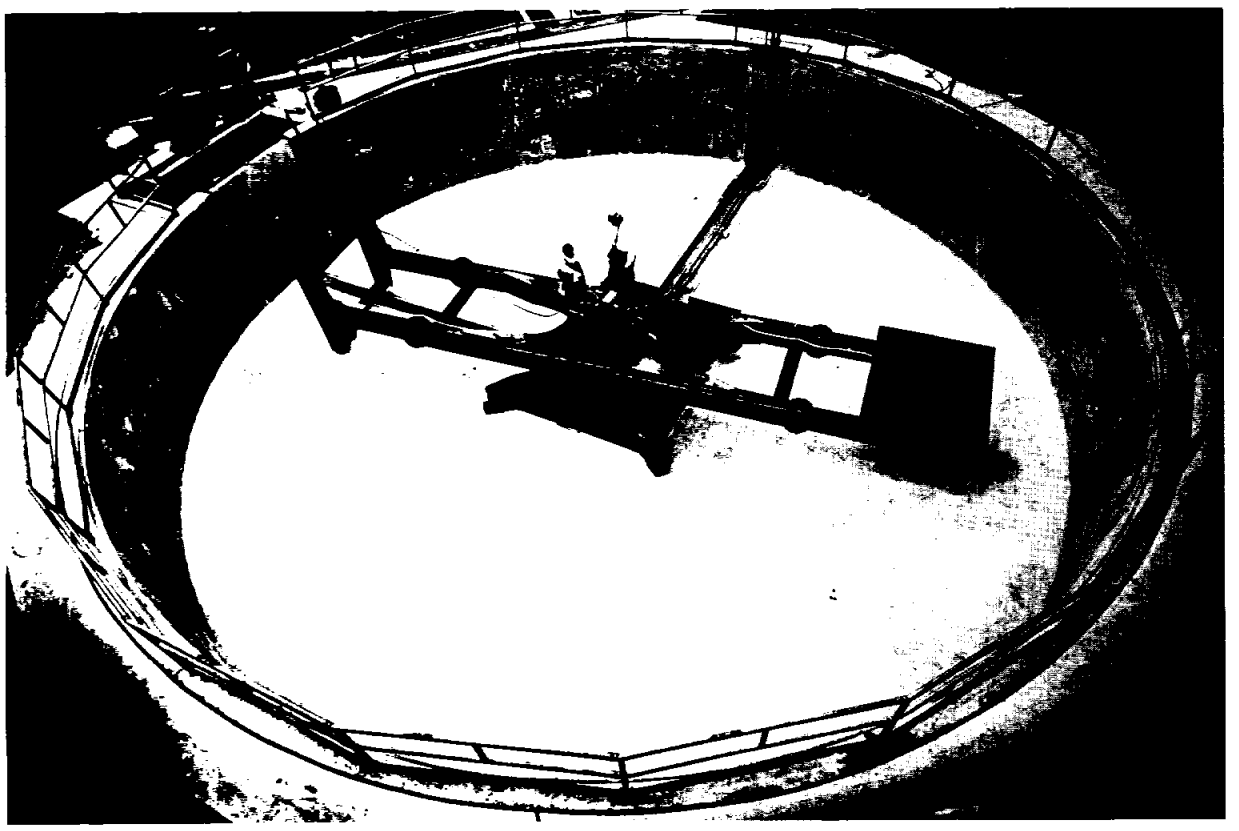
TURNING GIRL into gorilla isn't part of the act, but it makes a good gag shot. Campagna says he has given up sawing women in half, since, he says "I always get the half that eats."



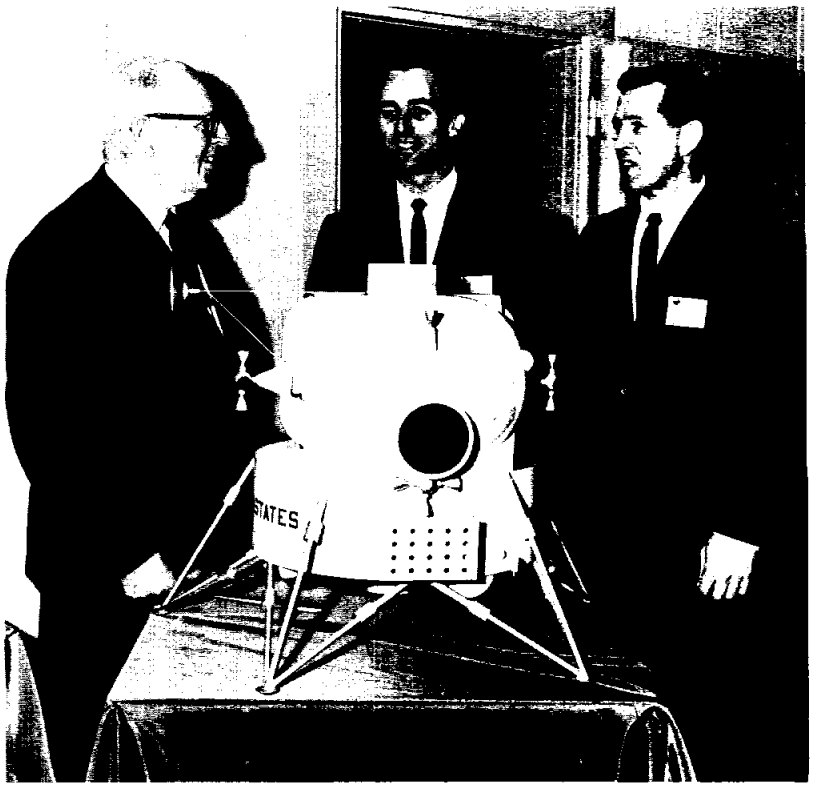
THE SERIOUS MAGICIAN at work. Although Campagna has the usual magic equipment, he specializes in using ordinary objects and a deck of cards borrowed from his hostess for the close-range magic required at parties and private gatherings.

EVERY MAGIC ACT should have a rabbit. Since there weren't any available in the office, Campagna improvised one from his handkerchief and got a grin from Eileen Balisky of Graphics and Sally Gates of the Public Affairs Office. True to form, the rabbit later disappeared.

h Will One Day Touch Down On The Moon's Surface



GRUMMAN'S 46-FOOT CENTRIFUGE has been modified to conduct research on rotating environments, directed at finding out whether it is possible for astronauts to live comfortably in space stations rotating as high as eight revolutions per minute. A ten-by-eight-by-eight foot tilting room can be mounted on this centrifuge for the testing of human subjects within the room.



EXAMING a one-eighth scale model of the lunar excursion module are (left to right) Rep. George Miller, chairman of the House Science and Astronautics Committee; Joseph Gavin, Grumman vice president, and Joseph Mullaney, program director at Grumman for the lunar landing vehicle.

further comparision to "signatures" provided by the actual lunar surface.

Concurrently, engineers at Grumman have developed a type of wheel which is thought to be suitable to locomote a lunar vehicle because of its highly flexible characteristics. Called a "metalastic" (metal-elastic) wheel, tests conducted in unconsolidated sandy type substances indicate the wheel has the properties of large footprints for weak soil, low unsprung weight to accommodate the dynamics of reduced lunar gravity, and invulnerability to micrometeorites and low temperatures.

The company has already prepared several alternative preliminary designs of lunar roving vehicles, including the employment of a two wheel module "land train" system utilizing metalastic wheels.

A great deal of effort is expended in Grumman's research and advanced development departments on study programs which are associated with manned space flight but not necessarily with the lunar program. Among these studies is one designed to investigate whether it is possible for astronauts to live comfortably in space stations rotating faster than four revolutions per minute, possible as high as eight revolutions per minute.

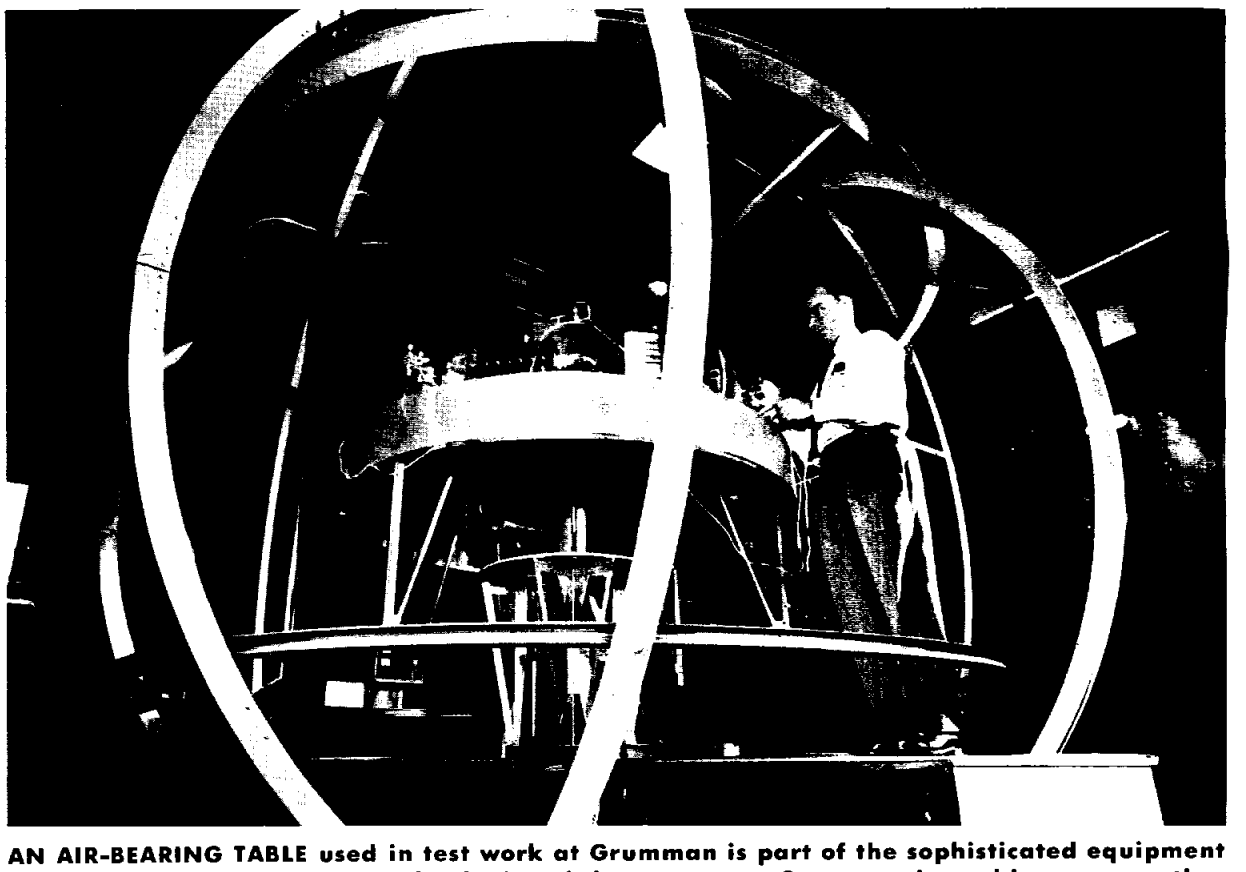
Only the first half of this program has been completed, but trends detected in the study of test subjects indicate that it may be possible for humans to perform space station functions at approximately eight rpm for extended periods, if the radius from the hub is about 50 feet. The increased rotation, however, is not without its penalty of limiting the normal head motions a man might make.

Experiments are being conducted in an enclosed environment, a 10-foot by eight-foot by eight-foot tilting room located on the company's 46-feet in diameter centrifuge. Further experiments with the tilting room and the centrifuge will be performed to confirm results already indicated about the effects of a rotating environment in the regions about 8 rpm upon man.

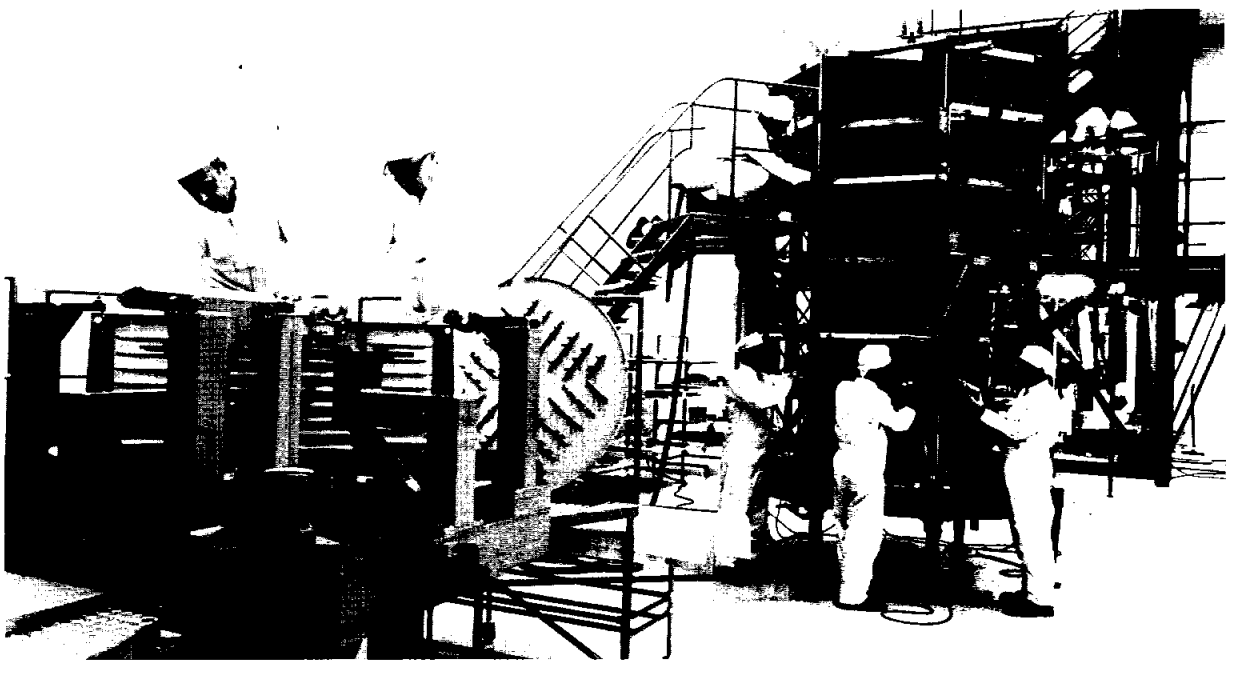
Some other study work Grumman is performing in the research and advanced development departments include a simplified guidance scheme for re-entering spacecraft; magnet control of ionized airflow to provide maneuverability at extremely high re-entry altitudes; effects of nuclear radiation on solid state electronic components; the basic mechanism of friction as applied to space materials; the basic equations for interplanetary flight; the direct use of human balance and reflexes for vehicle control; remote control of an unmanned lunar vehicle from earth; thermal control and dynamic control of a rotating space station; and manned simulator studies of earth entry and orbital rendezvous.

In addition to these studies, the company has just begun advanced design work on a vehicle which could be used to carry astronauts to Mars.

Editor's Note: This is the fourth in a series of articles designed to acquaint MSC personnel with the Center's industrial family, the contractors and subcontractors who make MSC spacecraft and their launch vehicles. The material and pictures on these two pages was furnished by Grumman Aircraft Engineering Corporation public relations personnel, Bethpage, N. Y.



AN AIR-BEARING TABLE used in test work at Grumman is part of the sophisticated equipment necessary for the advanced technologies of the space age. Grumman is working on one other NASA-funded program in addition to the LEM program for MSC, plus their own studies.



ONE OF THE LARGEST clean rooms in the country is located at the Grumman plant, where white garbed workers are shown assembling an Orbiting Astronomical Observatory under dust-free, regulated temperature conditions, a necessity for equipment under zero-g.

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 . . . . . Robert R. Gilruth
Public Affairs Officer . . . . . John A. Powers
Chief, Internal Communications . Ivan D. Ertel
Editor . . . . . Anne T. Corey

On The Lighter Side

Moon-Age Cocktail: Rocks on the Rocks

"Throw a couple of rocks in the pot and let's have a drink!"

That could very well be the way a couple of spacemen might greet each other in a chance meeting on the moon—and they'd mean it literally, not figuratively.

Dr. Roy G. Brereton, one of the space age thinkers at Aerojet-General, is convinced that while you may not be able to get blood from a stone, you can get water from it.

His studies convince him that certain kinds of rocks, known to contain as high as five per cent water, can be found on the moon.

To get the water out of the rock, for vital drinking needs, Dr. Brereton says the men on the moon will need a source of great heat to "cook" the stones.

The doctor says a mirror would focus the sun's heat to the needed temperature—1500 degrees centigrade or, roughly, about 5 or 6 times the temperature needed to make a cake.

This heat would then be directed on a vat, or huge pan, in which the rocks were placed. When the water in the rocks got hot enough it would rise in the form of steam. A dome would catch the steam and let it condense and drip off as usable water.

Can there be much doubt that men on the moon will call the product of their do-it-yourself distillery—"Moonshine?"

—Cartoon by Pete Bentovoja, Los Angeles Examiner. Copy by Don Bailer. Reprinted courtesy of Aerojet-General.

WELCOME ABOARD

Some 62 new personnel joined MSC between April 7 and 29. Nine will be stationed at Cape Canaveral, three at White Sands, N. M., two in St. Louis, Mo. and one in Downey, Calif.

Gemini Project Office: Preston H. Allen, and James L. Gibson.

Liaison Office, Sunnyvale, Calif: Jack D. Garrett, Row W. Collins.

Apollo Project Office: Philip L. Suttler, Jr., Leon H. Ballinger, John W. Harris, and Richard D. Nelson.

Business Liaison Rep. Office, Downey, Calif: Florence L. Simmons.

Resident Office, White Sands: Clarence A. Chauvin, Jr., Peggy J. Johnson, Frederick W. Warner.

Spacecraft Technology Division: Leonard S. Nicholson, Weldon H. Waln, Walter J. Klinar, and Philip E. Cota, Jr.

Space Environment Division: Uel S. Clanton, Jr.

Crew Systems Division: Joe L. Saunders, William H. Stout, and Kenneth D. Cashion.

Systems Evaluation and Development Division: Max D. Dougherty.

Preflight Operations Division, Cape Canaveral: Frank Glen Crow, James L. Lindemann, Ellis L. Begnaud, Law Fleming, James L. Cain, John P. Hoffman, and Donald L. Nichols.

MSC-AMR Operations, Cape Canaveral: Blanche Helen Mills.

Operations Support, Cape Canaveral: James S. Moore.

Flight Operations Division: Phyllis A. Geisler, Mary H. Brewer, Lawrence Davis, Carline M. Bruemmer, Kenneth R. Haugen, Thomas E. O'Brient.

Computation and Data Reduction Division: Emmit E. Fisher, Mary F. Lopez, Frieda L. Haney, Doris S. Sheffield, Cara E. King, Ethel M. Marques, Jo Anne Patten, Myrtle P. Everett, Robert N. Lea, William R. Burdett, Paul J. Iglinski, and Edgar B. Walters.

Instrumentation and Electronics System Division: Tommy F. Fleming and Richard F. Broderick.

Management Analysis Division: Sidney S. Kendall.

Personnel—Steno Services: Diane F. Spellman, Carolyn S. Teal, and Lou C. Barrett.

Financial Management Division: Evalie B. Green.

Procurement and Contracts Division: Joseph D. Wellman, and Rodney P. Clyatt.

Technical Services Division: Curtis H. White.

Logistics Division: Evelyn M. Villeneuve.

Audit Office: Ralph E. Tippit.

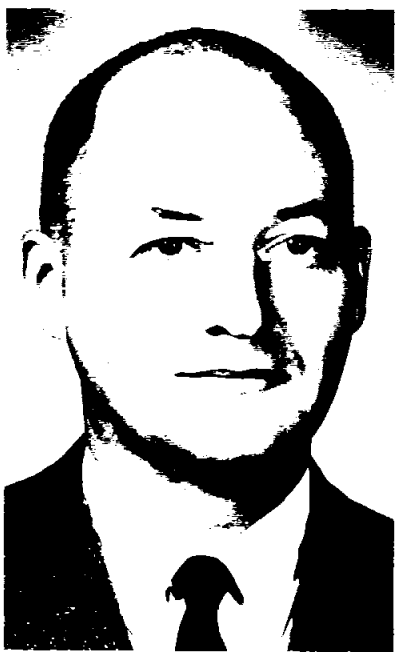
Public Affairs Office: Robert T. White.

The average Texas credit union has 636 members who have saved $275,824.

MSC PERSONALITY

Mercury's James E. Bost Is Native Of Tar Heel State

A North Carolinian by birth and education, James E. Bost has had a long career in Government service preceding his present position as chief, Engineering Operations Office, Mercury Project Office. He has been with Manned Spacecraft Center since March of 1960, when it was Space Task Group.



James E. Bost

Bost was born July 2, 1924 in Eagle Springs, N. C., and grew up in Eagle Springs and West End, both in Moore County.

He put in a year as a machinist's helper at the Naval Air Station in Norfolk, Va. following high school, then entered the service during World War II.

The next two and a half years were spent as a navigator on B-17 bombers with the Eighth Air Force in Europe, and later the Fifth Air-Sea Rescue Squadron.

After the war, Bost went back to school at the N. C. State College, graduating in March of 1949 with a BS in general engineering.

After college, Bost went to work at the Newport News Shipbuilding and Drydock Co. as a design engineer in the Piping Design Division. He worked on the USS United States, and did preliminary design of piping aboard the Navy carrier U. S. Forestall.

In April of 1952, Bost joined the Norfolk Naval Shipyard as a marine engineer in the Power Piping Section of the Design Division, doing design and modification on power piping systems in all types of Navy ships, from PT boats to carriers.

In August of 1958, Bost transferred to the U. S. Transportation Research and Engineering Command, working in the Materiel Standards Division, at Ft. Eustis, Va. He was concerned with the preparation of specifications for small landing craft, particularly the LARC 5 and 15.

In March of 1960, Bost transferred to the Space Task Group in the contract section of the Engineering Division, involved in technical monitoring of contracts, the issuing of technical directives on the Mercury program and support procurement in negotiations of contracts and contract changes.

In January of 1962, Bost became assistant chief of the Engineering Operations Office of Project Mercury and three months later was made chief of the office.

His office includes four groups—project control, documentation, schedule analysis and resources. Project control is concerned with the technical monitoring of contracts; documentation with the preparation of pre- and post-launch memos and mission directives and technical information sheets. Schedule analysis includes the preparation of detailed schedules for each launch, updating of these and keeping up with the progress and current status of Project Mercury within the PERT system. Resources has to do with cost control and manpower requirements to support the project.

Bost and his wife, the former Fannie McKay Chapin of Lillington, N. C., have four children: Janet, who will soon be 14, Rebecca, almost 11, Ed, 6 and Elizabeth, 19 months.

They have bought a house in Pearland, Rt. 1, and are members of the First Presbyterian Church in Alvin.

Bost's chief recreational activities, when he has time for them, include working in the yard, softball, baseball, and basketball.

Satellite System

(Continued from page 8)

ture and other characteristics favorable to marine life of commercial value.

A similar application would allow the sattellite to track iceberg or pack ice and relay the information to the International Ice Patrol and other services. This could be accomplished by planting transponders on the ice formations.

Meterorologists are interested in data from the ocean and from various heights above the surface. A network of small balloons floating at a constant pressure altitude might carry sensors and transponders to provide simultaneous weather data over wide areas. Automatic weather stations in remote areas and aboard ships at sea would provide additional coverage.

Results of the NASA-sponsored study to determine interest in the system will influence a decision whether to proceed with development. It is probable that the users of the data would be expected to provide the buoy, ground station or balloon to gather the information.

Procurement Handles $9 Million-Plus Work Load

A grand total of $967,848,316 in contracts was being administered by MSC's Procurement and Contracts Division as of the end of March, and purchase requests from all over the center were pouring in at from 1,000 to 1,400 a month.

That statement, when you consider that the division came to Houston with no mechanized record keeping and no source list, "no nothing," and with only a few hundred PR's a month to take care of, is amazing in itself.

"Right now I think we are as well equipped to handle our work load as any division in the Center," says deputy division chief Bill Parker. "We have to be.

"If a Congressman inquires, we can tell immediately by state and city the number and amount of contracts we have there, with whom, and for what. If one of our own people inquires, we know exactly at what stage a purchase request is, and the date it got there."

Source List

"Our first job was a source list—to get one started and keep it up to date," he said. "It was and is a big job, but an essential one. Without it, our buyers would have to resort to the Yellow Pages."

A source list, in essence, tells an MSC buyer where to go to get what—who handles that type of equipment and where to get in touch with them.

At present, there are 5,000 firms, manufacturing everything from spacecraft to nuts and bolts, in the source book, two two-inch-thick volumes which are still growing. Some 40 requests a day come in for addition to the list. They are processed in the office of H. T. Christman.

Firms are listed by each type of equipment which the firm would like to be considered a source for. This type of listing meant setting up definite catagories and the resulting key punch system mechanized and speeded up the operation considerably.

"Front Door"

"Christman is the 'front door' to our organization," Parker says. "He interviews contractors for our source list and screens out the pencil salesman."

Unsolicited proposals are also logged in through Christman, and referred to various sections or divisions where the equipment in question might possibly find a need. If there is no need for it, Christman's office must write the "Dear John" letter saying no thanks.

"About 30 to 35 unsolicited proposals a month come in, of which 12 to 15 per cent are acceptable," Christman says. But since industry assistance is also Christman's job, he sees as many as 60 people a day.

"Unsolicited proposals are the product of original thinking by the organization or individual presenting them; they are offered in the hope that NASA will wish to contract with the offeror for further development or exploitation of the ideas they contain. If NASA does contract with the offeror, it will do so on a sole-source basis; that is, without soliciting other sources that may be fully competent to perform the desired work.

"This procedure departs from the normal procurement process, whereby NASA formulates its own requirements, competitively solicits offers to fill them, and then contracts with the source that offers the best value to the government. But the departure is necessary and justified; any other practice would discourage people from disclosing to the government ideas which they have conceived and developed and which may have substantial value."

Christman is also the small business administrator, representing their interests. Every purchase request over $2500 is called to his attention for a decision on whether it should be given to small business or not. Those under that amount are automatically small business. "Small businesses" are defined by the management manual, but a general rule-of-the-thumb are that they have less than 500 employees.

In Christman's shop is found the library—two rooms stocked to the ceiling with 40,000 vendors' catalogues.

He must make all presentations between industry and management, as well, sometimes three a day.

Bidders' Board

Hanging on an oversized board in Christman's office are listings and specifications sheets on the latest batch of gadgets that the Center is looking for. All are stamped "Do not remove from this room." At almost any hour of the day, a half-dozen contractors' representatives can be found avidly perusing the material. Once a contract is awarded, notification of that fact goes up on another board across the room. From this, a firm which makes something which the prime contractor might be able to use can find out who the prime contractor is.

Purchase Request

To show what happens to a purchase request, let's start at the beginning, as explained by A. E. Garrison, head of Procurement Operations, and Plans and Systems section chief J. P. Harris.

A new project is studied first on an "in-house" basis. It may then be developed in greater detail by private concerns. During the period of early study, some private organizations will make their own studies on the project even if they have not been chosen to do the pilot-study. "What we are looking for is a way to solve a given problem, whether we develop the criteria or others do it," Christman explained.

The man or group who needs the goods begins by making up a purchase request, or in the case of contractual services, a work statement. It includes a general description of research and development services and can run to several pages. It may be only an order for study of the problem at hand, in other words, a purchase request for a study contract.

This must be processed and approved through supervisory channels, and signed by the person who controls the funds from which the money will be drawn. Sometimes, the PR must be coordinated through another office as well, depending on the equipment involved.

Accounting Branch

It then goes to the Accounting Branch for a dollar commitment. Since the contract has not yet been awarded, this of course will be an estimated amount specified by the requiring office. The branch checks it for complete and accurate information and verifies that the number on it is not the same as any other PR.

At this point, it is set aside for small business, and/or checked to see if it is a sole-source contract. Sole-source contracts must have a justification attached giving the reason for using a specific source firm; for instance, the fact that this particular firm is the only one equipped to do the job in the allowable time. A special Contract and Review Branch reviews it to see that the sole source is justified.

The PR is then assigned to a buying branch, project or function-oriented such as Apollo, Center Facilities and Construction, Control Systems, Mercury-Gemini, or the like. The head of the buying branch assigns it to a certain section or buyer. The buyer must then send a notification slip back to the point at which the PR orginated to let the requiring office know who is handling the transaction.

Card System

During the entire process, a McBee punch card system is at work keeping up with the number of PRs received, the number on hand, the number processed, the number canceled, the number completed etc., and whether each PR is in the planning stage, solicitation preparation, out to an individual, or in the contract preparation and signature phase.

The division is presently in the process of going from this system into an IBM machine system which is considered faster and more efficient.

Procurement must determine if the item needed is to be advertised, negotiated competively or negotiated from a sole source.

A contract of over $100,000 must have a procurement plan attached. This can be signed by the procurement division chief up to a million dollars. Between one and five million, it must be signed by the Center's director. Over five million, it must go to Washington for approval by NASA Headquarters.

The type of contract must also be decided upon.

A letter contract shows no specific amount, only a money "ceiling." It is brief, general in scope, and without detail. It is used largely for jobs with an urgency factor, where it will take the contractor time to tool up for the job. A definitive contract, on the other hand, involves agreement on terms and conditions, a work statement, a definite amount, and detailed specification of the equipment or work involved.

There are fixed price contracts, used for off-the-shelf equipment; cost type contracts, which agree to reimbursement of the cost where the price is difficult to determine; cost plus fixed fee contracts, which include the cost reimbursement plus a fixed profit; and cost plus incentive fee contracts, a new type which includes cost reimbursement, and a profit fee which increases if the cost is less than the original estimate or if the item is ready ahead of time. (If it is late, or costs run higher than the original estimate, the firm's profit decreases.)

Best Qualified

Price is not the only consideration in contract awards. Procurement, working with the requiring office, must find the best qualified firm to do the job within the money limitations. After selecting the firm, contract negotiating are carried out to definitize the contract. Before the signatures go on it, it gets a legal review and approval by the appropriate party—the requireing office or division up to $1 million, the Center director from there to $5 million, and NASA Headquarters over that amount.

When a purchase order is put out for competitive bidding, it will be sent either to all the firms listed for that type of material on the source list, or to a partial list of bidders on a rotating basis. But a copy will always be available on the bidder's board in Christman's office.

Texas credit unions will pay about $13 million in dividends to members this year.

THE BIDDERS' BOARD at W. T. Christman's office in Procurement and Contracts Division attracts the attention of a couple of contractors' representatives. The latest prospective assignments of all types are kept available on this board for interested aerospace manufacturing firms.

Space News NASA ROUNDUP!

SECOND FRONT PAGE

General Precision Inc. Gets Spacecraft Simulator Contract

Apollo mission trainers to put space-bound astronauts through simulated two-week trips to the moon and back have been ordered for NASA's Manned Spacecraft Center.

The Link Division of General Precision, Inc., Binghampton, N.Y. was selected by North American Aviation's Space Systems Division, Downey, Calif., to develop and install the two spacecraft simulators. Amount of the contract is expected to total approximately nine and one half million dollars.

One of the simulators will be placed at NASA's Houston facility and the other is to be at the Atlantic Missile Range, Cape Canaveral.

The Apollo mission simulators will train astronauts from launch through lunar orbit and return to earth.

Unique in design, the trainer provides a new concept in simulation which will project the training into deep space. The trainers will duplicate prelaunch conditions, first and second stage boost and separation, parking and earth orbits, injection into translunar trajectory, initial and mid-course coast, circumluner pass, preretro coast and retro to circular lunar orbit, separation with lunar excursion module, rendezvous with lunar excursion module, injection to transearth trajectory, initial mid-course coast, reentry and landing.

The trainers will not simulate space conditions such as zero gravity or G forces.

The simulator will provide sound effects of booster separation and space lighting effects so that astronauts will be able to see the moon and earth in proper relation to the spacecraft during all mission phases.

The computer will respond to crew and instructors' actions by solving mathematical and logical problems, providing data exhange, storing information, making decisions and simulating equipment failure diagnoses.

A total of twenty-seven major subcontracts amounting to more than two hundred million dollars for Apollo spacecraft systems have been awarded to various companies. More than two thousand firms throughout the Unites States are expected to participate in the program.

MSC personnel are cautioned and advised of the possible security and intelligence ramifications involved in answering questionnaires from unknown organizations.

Space Vehicular Maintenance Is AIAA Subject

In a paper presented at the AIAA meeting in Dallas last week, Carl R. Cording, manager of General Electric's Manned Systems Simulation Laboratory, discussed "Extra-Vehicular Maintenance and Techniques." A summary of his paper follows.

Performance of inspection, replacement, repair, assembly, and construction of spacecraft in orbit is one of the most significant roles anticipated for the astronaut in the near future.

In recognition of this problem a device which simulates the dynamics of weightlessness and which permits evaluation of man's performance within this environment has been developed and used at General Electric for the past several months.

The work performed to date on this simulator has included investigation of a pressure suited man's ability to apply forces in push/pull and torque versus time, his oxygen consumption and task time to accomplish while fractionless as compared to the one "g" case.

Results at this time are both qualitative and quantitative in nature and indicate that adaptation quickly occurs to the frictionless environment and that with practice a subject can perform remarkably well by proper application of his mass in reaction to the force vector. His ability to apply forces and torques increases rapidly as a function of time in the simulater. This is also true of the "time to accomplish" measurements which have been made of relatively complex tasks.

Tentatively, the conclusions suggest that with simple restraint a man can perform representative extra-vehicular tasks satisfactorily with a minimum of special support equipment. The time to accomplish any given task, however, although rapidly improving with adaptation, still remains well below that of terrestrial environment. Increased oxygen consumption is also apparent and coupled with early fatigue has obvious implications on crew size and work schedules.

AWARD WINNERS of the recent Houston Seminar of High School Science toured the Lane Wells Building recently as part of a tour of MSC. The tour was a portion of the winning award for writers of sceintific papers and editorial essays on exploration of space and related sciences.

Relay I Achievements Listed; All Experiments Successful

Relay I has successfully performed all of its experiments and missions.

The 172-pound National Aeronautics and Space Administration communications satellite was launched Dec. 13, 1962. Its list of missions—drawn up before launch in a four-inch thick book—included testing intercontinental microwave communications, measuring energy levels of space radiation in orbit, and determining radiation damage to solar cells and electronic components.

Relay I, as did Telstar before it, has experimentally demonstrated the feasibility of low-altitude active repeater satellites. Only when improvements in reliability and longevity are achieved through additional flight testing will such satellites be ready for use in an operational communications satellite system.

In view of the success of Relay I, it is not expected that radical changes will be made in the design of the second Relay which is scheduled for launch by NASA in the third quarter of this year.

Some redesign will be made in the satellite's electronic circuitry and voltage regulating components to eliminate the chance of power drain which hampered its operations shortly after launch in December and again last week. Other components may be improved or replaced to take advantage of state-of-the-art advances. These include solar cells, betteries, traveling-wave tubes and connectors.

In performance of its communications experiments, Relay has demonstrated its capabilities in permitting television transmission between the United States and Europe and voice, facsmile and teletype transmission between the U.S. and Europe, the U.S. and Brazil and between Brazil and Europe.

Other communications experiments demonstrated Relay's performance in handling wideband (such as TV) and narrowband (voice, facsmile and teletype) tests, noise measurement, non-linearity distortion, linear waveform, and steady state characteristics.

F. J. Bailey Speaks On Safety Aspects Of Manned Flight

A paper entitled, "Flight Safety Aspects of Manned Space Flight," by F. J. Bailey, Jr., chief, Reliability and Flight Safety Office, MSC, given at the Dallas AIAA meeting last week outlined the many practical operational procedures that have reduced the hazards of space flights.

Among the preflight procedures proven of value in the augmentation of flight safety which were discussed in detail were development engineering inspections, factory roll-out inspections, interface control between major systems of the space vehicle, flight safety reviews, and mission simulation on environmental spacecraft and during prelaunch preparation.

Other problem areas of flight safety discussed by Bailey included the possible effect of zero g on spacecraft equipment which was not completely free of even minute particles of debris, structural deformations and distortions under load.

Bailey concluded that the Mercury experience has shown that special operational procedures and special attention to design detail can produce increased safety in space flights.

NASA Considers Data Collection Satellite System

The National Aeronautics and Space Administration is considering a new family of "practical" satellites that will collect data from remote areas of the earth.

NASA will sponsor a study to determine the interest in such a system, the number of satellites necessary and their orbits. This will be followed by a feasibility and design study if warranted.

Since the first successful launch of an artificial earth satellite in 1957, the number and variety of spacecraft have increased steadily. Increasingly, attention is being given to practical uses of satellites.

One of the promising new uses is in data collection from floating buoys distributed over the ocean surface. Sensors in the buoys could measure both sea and air temperatures at the surface, wave height and a variety of readings at various depths. As the satellite passed anywhere above the horizon, it would interrogate each buoy by means of a code and store the information on magnetic tape. Upon command from a ground retrieval station, the satellite would transmit the information for distribution to oceanographers and other users.

Buoys could be located by the satellite to give data on ocean currents and to measure the depth of water if suitable sounding equipment were installed in the buoys.

Analysis of the data collected on a world-wide basis would result in a better knowledge of the sea. More effective weather routing of ships to reduce weather damage and improve the economics of ship operations are possible benefits. It might even be possible to locate water having tempera-

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