

“...one small step...”

15th Anniversary of Apollo 11

NASA
Lyndon B. Johnson Center

Space News Roundup

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National Aeronautics and Space Administration

Industry hears Space Station plans

Some 800 representatives of the aerospace industry were at JSC last week for a major milestone in the program, the first Space Station Definition Phase Industry Briefing.

It was the first opportunity industry has had to formally hear where NASA intends to go with the Space Station design and to see the products of intensive activity at NASA's "Skunk Works" in the Nova Bldg.

NASA will follow the briefing with the release of a formal Request for Proposals in several weeks, with contracts to be awarded for the definition phase by early 1985. This follows NASA's late June internal organization around four work packages (see related story).

Three basic station configurations have emerged from the Skunk Works. They are known as the Delta, the Planar and the Power Tower (see illustrations, page 3). Of the three, the Planar and the Power Tower are similar in many respects, and the Power Tower will be used as the reference configuration for industrial teams to focus on.

All three designs use different means to house the eight major elements of the Program: laboratory facilities, habitation capability, logistics and storage, utilities for a variety of science and technology applications, servicing capability for satellites, a basic assembly structure from which to grow into the 21st Century, co-orbiting and polar science platforms, and

provisions for Orbital Maneuvering Vehicles.

All three designs could also reach initial operating capability after six to eight Shuttle launches, and could be manned after the first two or three launches.

The designs — and the industry briefing — also stressed NASA's desire to achieve a commonality among different components. "Every component that we can replicate one for one is just something else that we will not have to

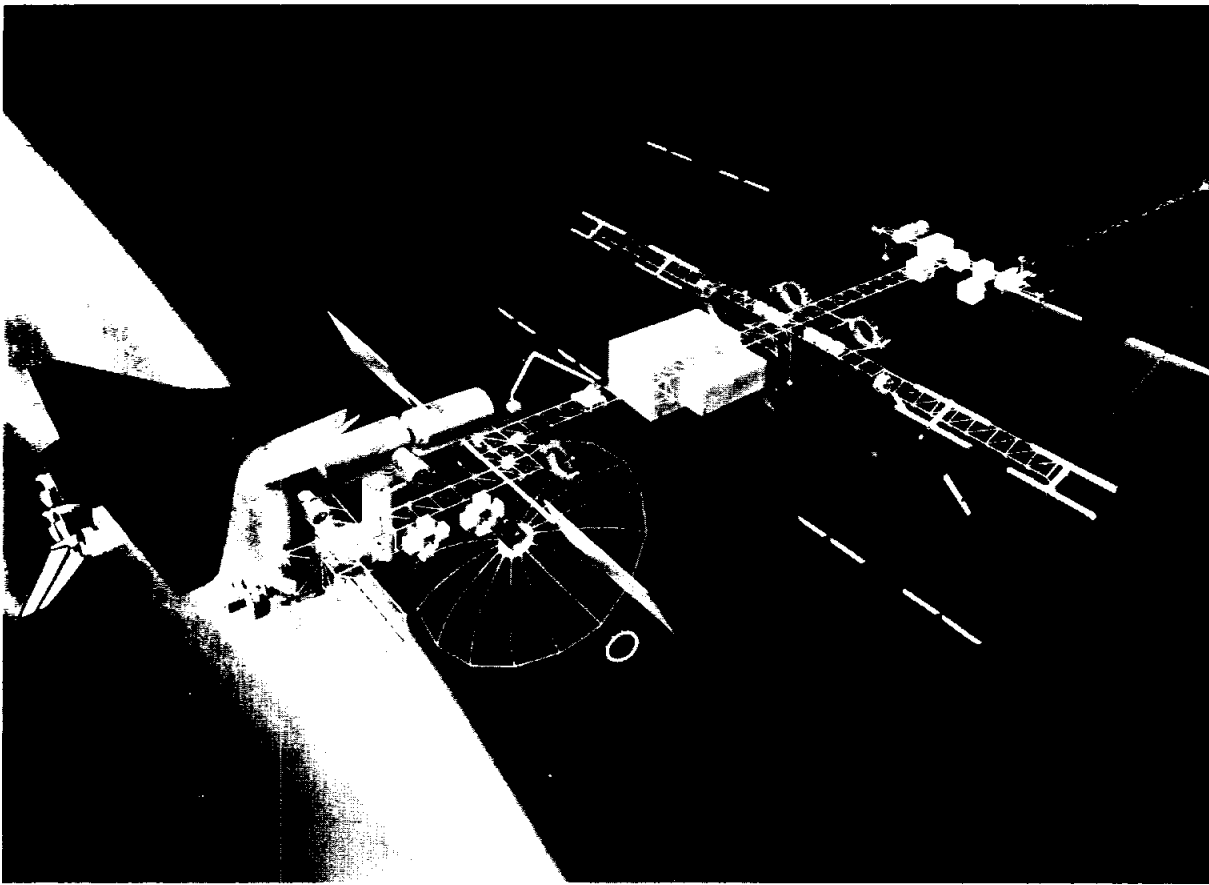
do a custom design and development job for each time," said Space Station Program Manager Neil Hutchinson.

The pressurized modules, for example, were referred to as "common modules," in the sense

that while they might function as laboratories, crew quarters or as a logistics center, they would all have basically the same internal electrical design or thermal design — the same generic plumbing. Although the reference configuration for the modules shows five connected together in a "P" shape, Hutchinson said the program hopes to build at least six such modules and perhaps as many as eight. The extra modules could then be added to the Station later or could be integrated into co-orbiting or polar platforms.

In discussing the four work packages, Hutchinson said various elements will be worked on at the same time by the different centers and their contractors. Thermal design for the overall station architecture, for example, will be a JSC responsibility, while Marshall Space Flight Center will also be exploring thermal design for the modules in particular. "This means that contractor-to-contractor interface will be required," Hutchinson said. "If we're going to get this thing done, we're going to have to talk to each other."

Two configuration control boards will be established to help integrate the work, much like the way the Shuttle program is managed, he said. A Systems Integration Board (SIB) will meet to work various elements into the overall design. A Program Requirements Board (PRB), chaired by Hutchinson, will meet to consider each of the major elements.



The above artist's concept shows the Power Tower Space Station design being visited by a Space Shuttle in low Earth orbit. The Power Tower has been chosen as a reference configuration by NASA, a design from which to work as definition and design continue over the next few months. (Art by Jerry Elmore)

NASA assigns additional Station tasks

NASA has added to and formalized the duties of four centers for definition and preliminary design studies on the Space Station.

The Agency currently is considering a number of design concepts for the Space Station. The definition and preliminary design activity, or Phase A, is intended to narrow these ideas to a single concept by the first part of 1985.

JSC, in addition to its lead center role in the project, was named in the June 28 Headquarters announcement to be responsible for the structural framework definition and integration of systems onto the structure. The structural framework will be the base to which modules, solar arrays and experiment platforms will be attached. JSC also will be responsible for

the interfaces between the Station and the Space Shuttle, and for mechanisms such as the Remote Manipulator Systems required for assembly of the Station in orbit.

The Marshall Space Flight Center was given the responsibility for definition of pressurized modules on the Space Station. Marshall also will manage environmental and propulsion control systems and will define the configuration of orbital maneuvering vehicles to be based at the Station.

Development of a single common module design will be a central task for Marshall, with provisions to be made for data distribution, power, environmental control, thermal control and communications systems to be used in all pressur-

ized areas of the low Earth orbit facility.

The Lewis Research Center will be responsible for the definition of the electrical power generation, conditioning and storage systems. Although most of the current studies have focused on large solar arrays as the probable power generation system, Lewis will be examining a number of alternative systems, the Headquarters announcement said.

The Goddard Space Flight Center will be responsible for the definition of the automated free-flying platforms which are part of the overall Space Station concept. Goddard will study how these platforms will be serviced, and also will define the provisions for instruments and payloads to be attached externally to the Space Station.

Other NASA centers will support the definition and design activities in particular technology areas. The Kennedy Space Center, for example, will be responsible for pre-flight and launch operations, as well as logistical support activities.

Headquarters said that while a definitive breakdown of where the money will be spent is somewhat sketchy because the program is still in its early stages, it is likely that JSC and Marshall would each manage approximately 40 percent of the resources to be spent on contractor studies and hardware definition. Goddard will be responsible for from 10 to 15 percent, and Lewis will spend from 7 to 10 percent.

Headquarters also said it is reasonable to expect that JSC civil service manpower requirements

could rise, given the number of people already assigned to the Shuttle program here.

NASA will release a Request for Proposal to industry later this summer which will lead to the award of competing contracts with the four centers for the definition/design activities listed above. The contracts are expected to be awarded early in 1985.

During the definition phase, NASA will continue negotiations with several other nations to determine means of international cooperation in the development and use of the Space Station, Headquarters said. At the completion of the definition period, agreements will be concluded with international partners on the roles they will play in the Space Station.

Space News Briefs

Leak suspect in Centaur failure

A leak in the liquid oxygen system of the Centaur upper stage could have been the reason why Intelsat F9 failed to reach its proper orbit June 9, according to an investigative board. NASA Chief Engineer Dr. Milton Silveira said a review of telemetry indicates a higher than normal use of liquid oxygen in the Centaur upper stage after separation from the Atlas first stage, which indicates a leak in the Centaur's liquid oxygen system. The first stage Atlas performance, the first of a new uprated version, appeared nominal. The Intelsat satellite, launched from Cape Canaveral, is presently in an unusable low Earth orbit. The Board plans to issue a formal report in the near future.

Ames consolidates aircraft ops

The Ames Research Center has shifted aircraft operations at the Dryden Flight Research Facility to management by the Ames Flight Operations Directorate. All aircraft operations at Ames' Moffett Field and at Dryden will now come under the one organization, Ames Director William F. Ballhaus announced June 19. Ames and the former Dryden Flight Research Center, now Ames Dryden, were consolidated in 1981. Ames officials said the change is a continuing part of the overall Ames-Dryden consolidation and will centralize all flight operations in terms of procedures, safety and management philosophy. At present, there are no plans to move any aircraft or personnel from either location.

OTV study contracts awarded

Martin Marietta Aerospace and Boeing Aerospace each have been awarded \$1 million parallel study contracts to examine concepts for Orbital Transfer Vehicles. The companies will conduct conceptual studies on both space-based and ground-based transfer vehicles. The space-based version would operate out of the Space Station, whereas a ground-based vehicle would be carried into orbit by the Shuttle.

Bulletin Board

NMA's next meeting is July 25

The JSC Chapter of the National Management Association (NMA), with a total membership of almost 100 since its formation in April, will hold its next meeting at 5 p.m. July 25 at the Gilruth Recreation Center. The gathering begins with a social hour at 5 p.m., followed by a business meeting at 6 p.m. The NMA offers training by instructors from JSC and the surrounding area, and seeks to provide its members with insight into management practices in general and at the Center in particular. Dues cover the cost of training courses as well as the four to five dinner meetings each year. Membership is open to all JSC employees interested in management practices. For more information, call Estella Gillette at x3895 or Cecil Dorsey at x2891.

Informal sailboat races offered

The Clear Lake Sailing Club and the Lido-14 fleet are holding free, informal sailboat races at 6 p.m. every Wednesday at the Clear Lake Park public launch ramp. The events are designed to improve sailing skills through informal racing, to have fun and to publicize the two non-profit organizations. The races are free and open to anyone with a sailboat. For more information, call Richard Hoover at 334-2392.

Safety Learning Center opens

More than 140 safety representatives from across JSC are inaugurating the new Safety Learning Center in Bldg. 226N this week as they participate in safety certification classes. These are the first training sessions to be held in the new facility, which is intended to become a central safety resource for JSC. Webb-Murray, JSC's safety contractor, plans to stock films, video tapes and training materials. The goal is to be able to respond to specific safety training needs, and also to provide a meeting place for safety functions and other activities when the Gilruth Center meeting rooms are filled. For more information on the present and future offerings of the new facility, call Wesley Ott at x2719.

Security has car theft reminders

The JSC Security Branch, concerned over recent vehicle thefts and the theft of personal property from vehicles in the Clear Lake area — and to a limited extent at JSC — is reminding drivers to exercise caution when leaving their cars. The best security measures are the simplest, said Security Branch Chief David H. Troupe. "Make sure your steering wheel is in a locked position and that you have the ignition and door keys. Remove valuables from your car, close the windows, lock the doors and try to park in a lighted area if you are on-site after dark." Troupe said uniformed security officers regularly patrol JSC parking areas. During normal work hours, employees can call the Security Branch at x4441 for assistance. During other times of day, those needing assistance can call the Security Dispatcher at x3333 or x4658, he said.

Gilruth Center News

Call x3594 for more information

Beginning ballroom dance — Learn the basics of the rumba, the waltz, the cha-cha and the foxtrot in this four-week class which begins July 18. The class meets from 7:30 to 9:30 p.m. at a cost of \$20 per person or \$40 per couple.

Macrame — Learn basic knots and how to combine them in this class which meets for four weeks beginning July 23. The sessions meet from 7 to 9 p.m. at a cost of \$25 per person.

Home buying — Find out how much home you can afford in today's market in this class on what to look for and what to watch out for when buying a home. The class meets from 7:30 to 9:30 p.m. beginning July 23 and runs for two weeks. The cost is \$10 per person.

Men's weight training — This four-week session begins August 7 and meets on Tuesdays and Thursdays from 8 to 9 p.m. The cost is \$20 per person.

Home maintenance — Learn residential carpentry, drywall and plaster patch, tilework, cabinet installation and all the odds and ends in this class which begins August 1 and runs for 8 weeks. The class meets from 7 to 9 p.m. at a cost of \$40 per person, all materials included.

Volleyball registration — Openings still exist in the Rec Center's volleyball leagues, and registration will be underway until July 25. Play begins the first week of August.

Basketball registration — The Tuesday night basketball league still has openings, and registration will continue until July 25. Play begins the first week of August.



Members of the new class of astronaut candidates were in T-38 ground school last week at the Lunar and Planetary Institute learning the ins and outs of that venerable aircraft. Briefing them is Charlie Justiz of Aircraft Operations. (Photo by Otis Imboden)

41-D, 41-F combined

Payloads from flights 41-D and 41-F will be combined, and NASA is now aiming for a first launch of the new Orbiter *Discovery* no earlier than August 24, the Agency announced last week.

The crew for the mission will be the six-member 41-D flight team, and the mission will retain the designation 41-D.

The combined mission cargo will consist of three communications satellites—the Hughes Leasat, Satellite Business Systems' SBS-D, the AT&T Telstar 3-C and the OAST-1 collapsible solar array. Also on board will be the McDonnell Douglas Block III electrophoresis system.

The Large Format Camera from 41-D and the SPARTAN-1 payload from 41-F, both NASA experiments, will be manifested for later flights.

"A decision to schedule the next launch in August is based on an intensive review of the 41-D abort as well as the requirements of our commercial customers," said Acting Associate Administrator for Space Flight, Jesse W. Moore.

"The Shuttle program is adaptable enough to meet the needs of our paying customers without risking lives, equipment or payloads," Moore said. "The abort we experi-

enced demonstrated clearly that we are able to control the launch process down to the last split second; to launch when everything is right and to stop without danger to the crew, ship or cargo when something is wrong. The ability to integrate payloads demonstrates a flexibility to recover from unexpected delays that is essential to an operational transportation system. We are determined to honor launch commitments to our commercial customers."

The second Hughes Leasat satellite originally manifested on flight 41-F, will be flown on 51-A in November, 1984.

Hughes selects two specialists

Two civilian engineers from Hughes Communications, Inc., Los Angeles, Calif., will fly aboard the Space Shuttle next year as part of NASA's commercial payload specialist program. The two individuals will be on flights that will deploy the firm's Leasat communications satellites.

Hughes has nominated two payload specialists and two alternates for Shuttle flight 51-D in March and flight 51-I in August 1985. A total of four of the Leasat (Syncom IV) satellites will be flown.

Selected as payload specialist candidates are Gregory Jarvis of Hermosa Beach, Calif., and Dr. John Harrison Konrad of El Segun-

do, Calif., both employees of Hughes Aircraft Co. Space and Communications Group.

Jarvis was a member of the Leasat design and engineering team and managed the integration and test team for the Leasat program. He has been with Hughes for 11 years.

Konrad has been a Hughes employee for eight years. He has been involved with the Intelsat 6 and Telstar 3 programs. Konrad was also a member of the system engineering team for the Shuttle launched Anik and SBS satellite programs.

The two alternates selected are L. William Butterworth of Rolling

Hills Estates, Calif., and Dr. Steven Lee Cunningham of Altadena, Calif. Butterworth is presently assistant program manager of the Galileo Probe Program. Cunningham is manager of the Space and Communications Group's Systems Analysis Department.

The two engineers selected for the flights will undergo NASA training for about nine months, but remain employees of Hughes.

The Leasat program provides dedicated data and voice communications to U.S. Armed Forces mobile units. The system, owned by Hughes Communications, Inc., is operated on a long-term lease basis with the U.S. Navy.

Cookin' in the Cafeteria

Week of July 23 - 27, 1984

Monday: Cream of Chicken Soup; Beef Burgundy over Noodles, Fried Chicken, BBQ Sausage Link, Hamburger Steak (Special); Buttered Corn, Carrots, Green Beans, Standard Daily Items: Roast Beef, Baked Ham, Fried Chicken, Fried Fish, Chopped Sirloin. Selection of Salads, Sandwiches and Pies.

Tuesday: Beef Noodle Soup; Baked Meatloaf, Liver & Onions, BBQ Spare Ribs, Turkey & Dressing (Special); Spanish Rice, Broccoli, Buttered Squash.

Wednesday: Seafood Gumbo; Broiled Fish, Tamales w/Chili, Spanish Macaroni (Special); Ranch Beans, Beets, Parsley Potatoes.

Thursday: Navy Bean Soup; Beef Pot Roast, Shrimp Chop Suey, Pork Chops, Chicken Fried Steak (Special); Carrots, Cabbage, Green Beans.

Friday: Seafood Gumbo; Broiled Cod, Fried Shrimp, Baked Ham, Tuna & Noodle Casserole (Special); Corn, Turnip Greens, Stewed Tomatoes.

Week of July 30 - Aug. 3, 1984

Monday: Chicken Noodle Soup; Wieners & Beans, Round Steak w/Hash

Browns, Meatballs & Spaghetti (Special); Okra & Tomatoes, Carrots, Whipped Potatoes, Standard Daily Items: Roast Beef, Baked Ham, Fried Chicken, Fried Fish, Chopped Sirloin. Selection of Salads, Sandwiches and Pies.

Tuesday: Beef and Barley Soup; Beef Stew, Shrimp Creole, Fried Chicken (Special); Stewed Tomatoes, Mixed Vegetables, Broccoli.

Wednesday: Seafood Gumbo; Fried

Perch, New England Dinner, Swiss Steak (Special); Italian Green Beans, Cabbage, Carrots.

Thursday: Cream of Chicken Soup; Turkey & Dressing, Enchiladas w/Chili, Wieners & Macaroni, Stuffed Bell Pepper (Special); Zucchini Squash, English Peas, Rice.

Friday: Seafood Gumbo; Baked Cod, 1/4 Broiled Chicken w/Peach Half, Salisbury Steak (Special), Cauliflower au Gratin, Mixed Vegetables, Buttered Cabbage, Whipped Potatoes.

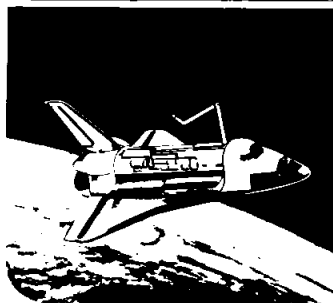
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Space News Roundup

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Editor

Brian Welch



In Memoriam

George M. Low

1926-1984

Fifteen years to the week after the first manned landing on the Moon, George Michael Low, a central figure in the U.S. space program and a man who made that event possible, passed away in Troy, New York.

Low, 58, had been ill for some time, suffering from recurrent melanoma. His technical career spanned an era from the X-1 to the advent of routine operations in space, and he lived to see one of his sons, George David Low, become a member of the U.S. Astronaut Corps.

The list of his contributions to the space program is a long one, from his presence on the earliest councils of NASA up to his role as Acting Administrator in the early 1970s. But the role for which he is best remembered began on an April day in 1967, in the dark aftermath of the tragic Apollo 204 fire which claimed the lives of astronauts Grissom, White and Chaffee and almost wrecked the program.

Low was a passenger aboard NASA 2 that April day as it taxied for a takeoff from Washington National Airport. He was Deputy Director of the Manned Spacecraft Center (MSC) at the time, and he and his boss, MSC Director Robert Gilruth, were about to return to Houston after a series of meetings. A terse message from the tower instructed the pilot to turn back, and Gilruth and Low were taken to the pilot's lounge.

They were shortly joined there by NASA Administrator James Webb, Deputy Administrator Robert Seamons, George Mueller, the head of Manned Space Flight, and Gen. Sam Phillips, the head of the Apollo Program. "Counting Bob Gilruth," Low later wrote, "everybody in the NASA hierarchy between me and the President was there."

It was an extraordinary gathering, and the group was there to ask Low to take on an extraordinary and awesome task: rebuild Apollo, and make the program fly. To his enduring credit, that is exactly what George Low did.

Low inherited a tough job in the toughest of programs at the lowest ebb in NASA's history, then or since. A "crisis of confidence" gripped the Apollo program. Many people were in a state of shock. Crew training had been suspended. Congressional hearings surrounding the accident had been brutal at times, and NASA's own report, a 3,000-page document issued by the Apollo 204 Review Board, also minced no words: "The Board's investigation revealed many deficiencies in design and engineering, manufacture and quality control."

George Low was seen as the man to turn the situation around. "He had the talent of being able to take advantage of the wealth of ability we had and use it to solve those problems," former JSC Director Dr. Christopher C. Kraft, Jr. said. "He had a rapport with the people involved, and Gilruth had great confidence in him."

The job called for a total examination of the entire spacecraft from the ground up, and a great deal of redesign. Aside from the technical considerations, which were legion, Low had to inspire a new sense of confidence in the more than 100,000 people directly involved in the project. In this task, his previous experience served him well.

Born in Vienna in 1926, Low came to the U.S. in 1940 and became a naturalized citizen in 1945. He earned a bachelor's in aeronautical engineering from Rensselaer Polytechnic Institute in 1948 and a master's in aeronautical engineering from RPI in 1950, a year after he



George Low, with Chris Kraft and Robert Gilruth, at the Apollo 11 splashdown celebration in Mission Control.

joined the staff at the Lewis Flight Propulsion Laboratory in Cleveland, now the Lewis Research Center. There he specialized in experimental and theoretical research in the fields of heat transfer, boundary layer flows and internal aerodynamics. He was named head of the Fluids Mechanics Section and later, Chief of the Special Projects Branch.

In the meantime, the nation was entering the Space Age. Six months before NASA was officially formed, two teams, one from Lewis and one from the Langley Memorial Aeronautical Laboratory (now Langley Research Center), were sent to Washington to head the transition from the National Advisory Committee for Aeronautics to NASA.

Low became the first Chief of Manned Space Flight at NASA. Today, some 300 people report to the head of manned space flight. In those days, Low ran the office with the help of one other person. "But he was up to it," recalls Max Faget, former Director of Engineering and Development at JSC.

While most of NASA's efforts were directed toward Project

Mercury, another side of the house was studying missions to the Moon. George Low headed that effort, and the Low Committee began to concentrate on the Moon as the next logical step after Mercury. "When President Kennedy called up Jim Webb and said, 'Now what about this Moon mission?' NASA already had the answers," Faget said, "primarily through the work of the Low Committee."

At the time the decision was announced in May 1961 to go to the Moon, Low was Deputy Associate Administrator for Manned Space Flight. In February 1964 he transferred to MSC to become Gilruth's Deputy. As the Center's general manager, he had overall responsibility for the Gemini and Apollo spacecraft efforts, as well as a hand in program development, flight control and flight crew operations.

Then came the terrible fire on January 27, 1967. When Low became Apollo Spacecraft Program Manager three months later, Kraft said, "he used his experience from the NACA and from NASA to bring the damn thing up out of the mire."

Low himself recalled the demands of his new job: "These were the Apollo spacecraft: two machines, 17 tons of aluminum, steel, copper, titanium, and synthetic materials; 33 tons of propellant; 4 million parts, 40 miles of wire, 100,000 drawings, 26 subsystems, 678 switches, 410 circuit breakers. To look after them there was a brand-new program manager who would have to leap upon this fast-moving train, learn all about it, decide what was good enough and what wasn't, what to accept, and what to change. In the meanwhile, the clock ticked away, bringing the end of the decade ever closer."

Low worked six and seven days a week during the next two years in what Kraft called "a tenacious effort" to find solutions and turn the program around. He called on the talents within NASA and the aerospace community. He invented a Configuration Control Board with "exceedingly tough" standards which met every Friday. Every month, the board would fly to Grumman's Bethpage, New York plant and then to North American's Downey, California plant. In this way he brought the prime contractors, North American Aviation (now Rockwell) and Grumman Aerospace, more directly into the decision making process. He visited the plants, and is remembered as the relentless top NASA official who was often seen at the facilities on weekends. "He was at work long before most people came in the morning and long after they left at night," recalled George W. S. Abbey, Director of Flight Crew Operations and Low's technical assistant at the time. "Even if he wasn't there his mind was still on the program." Officials in the Public Affairs Office still remember scheduling an interview with Low for a Los Angeles Times reporter at 6 a.m. one day, not because it was convenient but because that is when Low had time to see him.

During this period, a new quick release hatch was brought into the program, new fire resistant space-suits made of Beta cloth were designed, many flammable materials were removed from the Command Module and mockups went through severe fire tests. The entire program took on a sense of dedicated urgency. "Some people are literally killing themselves," said Rocco A. Petrone, then the Director of Launch Operations at the Cape.

Still, the program had its hardware problems and delays, and the

(Continued on page 4)

George M. Low

(Continued from page 3)

time left in the decade seemed to be running out much too quickly. "The probability of landing on the Moon before 1970 is not high," Gilruth wrote in a September 1967 memo.

Then came Apollo 4, the first unmanned test of the full-up Saturn V vehicle, in November 1967. There were problems, but NASA was satisfied with the rocket, and pressed on to Apollo 5, an unmanned Saturn IB test of the Lunar Module in January 1968, and Apollo 6, another test of the Saturn V itself in April 1968. After that came Apollo 7, the first manned test of the system with a Saturn IB in October 1968. It was a 10-day and 20-hour test of the Command and Service Module with men aboard, and after the flight George Low was ecstatic. "He had worked hard," wrote John Wilford of the New York Times in his book, *We Reach the Moon*. "Apollo had passed out of the shadow of its darkest hour."

What reporters and most people in the program did not know at the time was that George Low had suggested, two months before the launch of Apollo 7, that the first manned flight of the Saturn V should carry a crew of three around the Moon and back to Earth. "When he saw that the Lunar Module would

not be ready in time for the first Saturn V flight, Low knew there would be a delay, and he wanted to see if there was some way to push ahead in the program while we solved the problem with the LM," Kraft said. Abbey remembers that Low came up with the idea for sending Apollo 8 around the Moon while he was on vacation in August 1968. "He said the mission would give us important experience in things you had to do whether you had an LM or not. He sold it, and we were off."

The final decision on the new mission of Apollo 8 was made in November 1968 and announced publicly shortly thereafter. Elaborate invitations were sent out for the launch which read, "You are cordially invited to attend the departure of the United States Spaceship *Apollo VIII* on its voyage around the moon departing from Launch Complex 39A, Kennedy Space Center, with the launch window commencing at 7 a.m. on December 21, 1968."

Sending Apollo 8 on to the Moon was, said Kraft, "the boldest decision of the space program." Low had said in a meeting two months before, "Assuming Apollo 7 is a success, there is no other choice."

Other managers agreed, and at 6:51 CST on December 21, Apollo

8 lifted off and 11.5 minutes later was in a parking orbit around the Earth. On the second orbit, the S-IVB stage reignited and sent the spacecraft into a translunar trajectory. Commander Frank Borman, Command Module Pilot James A. Lovell, Jr. and Lunar Module Pilot William A. Anders became the first humans to leave the gravity influence of the Earth when they crossed over into the realm of the Moon at 2:29 p.m. CST on December 23. On the 24th, they went behind the Moon for the first time, and later that day, on the ninth orbit of another planetary body, they read from *Genesis*. On Christmas Day, the main engine of the CSM fired for three minutes and the spacecraft headed back to Earth for a landing in the Pacific Ocean on December 27.

The mission had been an enormous success, as well as an enormous calculated risk. "It was a key milestone in enabling us to land on the Moon by 1969," Abbey said.

"The gains were worth the risk," Kraft said, and he ticked off the risks: "It was the first manned launch of a Saturn V. It was the first burn of an S-IVB into a lunar trajectory. It was the first time men had left the gravitational influence of the Earth. It was the first time we had tried to navigate with onboard systems to the Moon. It was the first time we went into orbit around another planet. It was the first time men



had looked down on the Moon from a distance of 60 miles. And it was the first time we had attempted a manned reentry on such a trajectory and at such speeds."

Apollo was back on track. Low stayed on as Apollo Spacecraft Program Manager until December 1969, when he was appointed Deputy Administrator of NASA. From September 1970 to May 1971 he served as Acting Administrator, and negotiated the space agreements with the Soviet Union which led to the Apollo-Soyuz Test Project. In 1976, he assumed the Presidency of his alma mater, Rensselaer, and turned his talents to education. During his tenure, a 300-acre technology park was built near the university in Troy, and the school's research volume rose from \$20 million a year to \$600 million.

"George Low was a brilliant engineer," Kraft said. "He was

always a factor in everything NASA did in the field of manned space flight. He was involved and he believed."

Abbey said of him, "It is hard to put into words what kind of individual George Low was. He was totally dedicated to the program and to the nation. You'll not find very many people who knew him whose lives he did not influence. I don't think there is any way we would have gotten to the Moon when we did without him."

George Low was quiet about his successes, Faget said. He believed in the space program and in the ability of each person to rise to the example that he and others set. He refused to accept anything short of success, and he put everything he had into the effort.

There was, Abbey said, "nothing halfway about George Low."

— Brian Welch

Roundup Swap Shop

Ads must be under 20 words total per person, double spaced, and typed or printed. Deadline for submitting or cancelling ads is 5 p.m. the first Wednesday after publication. Send ads to AP 3 Roundup, or deliver them to the Newsroom, Building 2 annex. No phone-in ads will be taken. Swap Shop is open to JSC federal and on-site contractor employees for non-commercial personal ads.

Property and Rentals

For Sale: 2BR condo in Austin on the UT shuttle bus route. Pool, private balcony, fans, \$48,900. (\$49,200 with frost-free refrigerator). Call 482-7910.

For Lease: CLC Meadowgreen, very clean, 4-2-2, newly painted, fenced, FPL, \$735/mo. Call x4364 or 643-8944.

For Sale: 3/4 acre waterfront lot with access to excellent bass fishing in Brazoria county. Call Don before 4 p.m. at 280-4257.

For Sale: Walden on Lake Conroe timeshare condo, sleeps 4. Call Don before 4 p.m. at 280-4257.

For Sale: 8 plus acres, state highway frontage, Alvin area, \$8,000/acre, \$10,000 down, 10 years at 10%. Call Barr at x4871 or 485-6074.

For Sale: 3-2-2 house in Friendswood, 1810 sq. ft. w/FPL and many extras. Easy assumable FHA loan. Sacrifice at \$80,900. Call Cindy at x4321 or 488-1048.

For Lease: 2BR house for responsible couple, fenced, central air, Seabrook. Call Horton at x6130.

For Lease: Piper's Meadow/CLC, 2-2, professional landscape, fenced, refrigerator, W/D, office garage, \$585/mo. Call 482-6609.

For Lease: Forest Bend/Friendswood, 3-2-2, newly painted, fans, patio, fenced, \$495/mo. Call 482-6609.

For Rent: Galveston Gulf Front Condo, treat yourself to a relaxing two day to one month vacation in this completely furnished condo. Low rates. Call Nussmen at 488-7762.

For Lease: Waterview condo at The Landing, 2BR, newly decorated, \$500/mo., bills paid, first month free with 12 month lease. Call Corcoran at 483-3821.

For Sale or Lease with option to buy: Country Side Estates, brick home in League City 3-2-2, FPL, fans, \$69,000 non-escalating 9-5% assumable or rent \$625/mo. Call 332-4492.

For Lease: Egret Bay condo w/water view, split 2-2, W/D, FPL, covered parking, \$495/mo. plus deposit. Call Jim at x3486 or 333-2877.

For Sale: Must Sell by Mid-August, House in League City, 3-1 1/2-2, fans, fenced, central air and heat. Call Keith at 483-3643 or 332-8251.

For Lease: Egret Bay 1-1-2 condo, FPL, W/D, all appliances, two pools, boat ramp, view of water. Call Actkinson at x6451 or 482-7061.

For Sale or Lease: CLC/Camino South, 3-2-2, paneling, oak floors, excellent location, \$620/mo. or \$74,000. Call Jerry at x5171 or 486-8918.

For Rent: Egret Bay 1-2 condo, microwave, FPL, \$350/mo. Call 333-3871.

For Lease: CLC Baywind II condo, 1 BR, microwave, FPL, W/D connections, tennis, exercise room. Call Jim Briley, 280-3675 or 488-7901 after 5 p.m. and weekends.

For Sale: Champion 82 mobile home, 14 x 64, located in Northeast Park, \$750

down, assume \$286/mo. Call Anselmo, 453-1870.

For Rent: Webster 2-1 apartment, off Hwy. 3, W/D connections, new, \$350/mo. Call Walt, x5557 or 334-4395 after 5 p.m.

For Sale: Barringer Knoll fourplex, 2-1 each unit, excellent tax shelter and rented, assumable mortgage. Call Walt, x5557 or 334-4395 after 5 p.m.

For Lease: 10 acres, Alvin area, fenced, on paved road, horses, cattle. Call Damewood, 482-5572.

Cars and Trucks

1983 Oldsmobile Toronado, 2 DR, navy blue, velour interior, AM/FM cassette. Call 780-1121.

1982 Renault Le Car, 6,500 miles, 4DR, AM/FM, AC, excellent condition, \$4,950. Call x5956 or 474-7020 after 5 p.m.

1976 Olds Delta 88, good mechanical condition, PS, PB, AC, AM radio, \$1200. Call Hansen at x4418 or 488-8977 after 5 p.m.

1973 BMW 2002, AC, AM/FM cassette, newly painted, \$4900/best offer. Call 333-3871.

1979 Ford LTD, loaded, very good condition, \$3,500. Call Sharon at x5094 or 729-5102 after 3:30 p.m.

1977 Chevy Chevette \$700. Call Sharon at x5094.

1977 Mercury Cougar XR-7 one owner, low mileage, all power, AC, excellent condition, \$2395. Call 280-0454 after 7 p.m., and all day on weekends.

1968 VW Bug, automatic, blue, 120,000 miles, fair condition, running okay, \$550. Call Fred at x3404.

1982 Chevy S-10 PU, red, 4 speed, AC, tilt wheel, 22,000 miles, excellent condition, \$5,700. Call Ray at x5672.

1978 Chevy PU, custom deluxe, V-8, auto, PS, PB, AM/FM/cassette, \$2275. Call 585-6698 after 6 p.m.

1980 Firebird Formula, turbo, AC, PS, PB, clean, new tires, \$6,200/best offer. Call Ken at x5047 or 482-1717.

1977 Honda Accord, AC, rebuilt engine, \$2,700. Call Ken at x5047 or 482-1717.

Toyota pickup aluminum cover, \$195. Call 480-2367.

1981 Honda Prelude, immaculate, red plush interior, 5-speed, electric sunroof, AM/FM/cassette, \$6,699. Call 538-1889.

1980 Toyota Tercel, 32,000 miles, very clean, one owner, air, automatic, AM/FM, \$4,500. Call 488-5564.

1964 Pontiac Tempest, 6 cyl., still runs, \$300 as is. Call Marland, x4819 or 488-8880.

Restorable dune buggy, engine runs, needs some light mechanical work, \$400. Call Pat Loftus, 482-5432.

RVs and Mobile Homes

Champion 82, 14'x64', 2-1, all appliances, W/D connections, located in

Northeast Park, assume \$286/mo. with \$750 down. Call Anselmo 453-1877.

Champion 14'x54', 2-1, gas heat, skirted, quiet, clean, League City location, \$1,750 equity payments. Call 554-6485 after 3 p.m.

Beaver Classic, 35', rear bedroom, 8,000 miles, loaded. Under list price. Call 538-1816.

1972 Nova, 4-door, 307, \$850; 1978 Subaru Brat, 4WD, 1600cc, AM/FM radio, \$1,950. Call 482-5309 or 482-8316.

1975 Toyota Corona station wagon, AC, auto, runs well, \$975. Call 482-6291.

Boats and Planes

1974 15 ft. Skeeter Bass boat with 50 h.p. Johnson motor, trolling motor, depth sounder, \$2,100; brand new Minn Kota trolling motor, \$125; new Hummingbird Super Sixty depth sounder, \$115. Call Don, 280-4257 before 4 p.m.

1978 16 ft. Hobie Cat, new sails, DBL trap, trailer, extras, \$3,000. Call Gerry at x3686 or 333-2661.

Lido-14 sailboat, 4 sails, galvanized tilt trailer, \$2,695. Call Hoover at 334-2392.

Three blade SST propeller for large OMC outboard motor, \$155. Call Charles at x4688 or 661-4789.

Starcraft aluminum Deep V, 16', with small wheel trailer, \$800. Call Bob Scarlett, x4331 or 332-1396.

Aircraft for rent: Cherokee Lance, 6-place, \$75/hr. wet; Cherokee 140, 4-place, \$30/hr. wet. Both hangared in Friendswood. Call L. Damewood, 482-5572.

Grumman 9 ft. aluminum dinghy, \$150. Call Alter, 480-0202.

Cycles

1978 Honda CB 400 Hawk, 8,000 miles, excellent condition. Two helmets included, \$700. Call Scott at x4895 or 480-0724.

1982 Honda Cr 250, low miles, excellent condition, \$850. Call Brad at 488-7899.

1983 Honda 650 Nighthawk (under warranty until Jan 1985), \$2400. Call 481-2854 after 6 p.m.

1974 Suzuki 180, electric start, low miles, \$450. Call Jack, x2285 or 482-2956.

Musical Instruments

1974 Les Paul custom with peavey-30 amp \$400, 4-channel peavey pa w/stack \$150, SRO-50 cartiod \$80. Call Rick at x2691 or 280-0539.

Kimball Piano, upright, oak veneer, needs refinishing, asking \$250. Call D.J. Ochadink at x3205 or 996-9717.

Bounty trumpet with new case, \$100. Call Booth at x5231 or 538-4260.

Fender Rhodes 73 key stage piano. Call James at x3406 or 332-8837.

Wurlitzer Omni 6000 keyboard computer, state-of-the-art organ, 3 keyboards, digital synthesis, 8 speaker stereo separation. Call Bob, x5961 or 488-7340 after 5 p.m.

Fender acoustic guitar, never used, lists for \$215, will sell for \$150. Call Patrick, x4027 or 480-8296.

Pets

Belgian Sheepdog puppies, AKC, two females, whelped Dec. 21, 1983. They have long black hair and make excellent watch dogs/companions. Call Sharon at x4941 or 489-1701.

Boxer puppies, AKC, all shots, 1 male, 2 female, \$150; one white male, no papers, \$75. Call 482-6291.

Free kittens, adorable, tabby. Call Bill, x3921 or Faye, x4676.

Audiovisual

Pioneer laser disk player, lists for \$600, sell for \$300. Call Patrick, x4027 or 480-8296.

Panasonic stereo, full-sized, with cassette, phonograph and speakers, \$250. Call 480-4063.

Sears 14" color TV, nice, \$125. Call 488-5564.

Household

Hoover upright, has taken a lickin' but keeps on tickin', still runs well, with tools, \$15. Call Brian, x5111 or 480-5194.

Large Craftsman mower, 5 h.p., 110 vac electric start self-propelled, excellent condition, \$325. Call x3833 or 921-7212.

Beautiful 10'x13' braided rug, Indian browns, reversible, used 8 months. \$200 or best offer. Call Smith at x4571 or 471-2419 after 5 p.m.

15.1 cu. ft. Sears freezer, upright, white, \$125. Call Sid at x3212 or 485-8648.

GE 16" upright frostless freezer, \$275. Call D. Long, 538-1816.

Electric range, combined lower oven and eye level oven, \$495. Call 480-2367.

Large sectional L-shaped sofa, 2 ottomans, brown velvet, great condition, \$350; 4-drawer chest, end table and coffee table, \$40. Call Alzena, x2576.

Coffee table, \$40; end table, \$40. Call Brent, x4981.

Water bed mattress, as new, motionless king-size, \$75. Call Dave, 486-0808.

Sears 10 h.p. riding mower, 36-inch deck, with electric starter, like new, \$700. Call Sharon at x4763 or 482-3078 after 6 p.m.

Seven foot sofa and love seat, beige, very good condition, \$300. Call 333-3866 after 5 p.m.

Montgomery Ward freezer, 18.5 cu. ft., white, \$275. Call 554-6027.

Queen-size mattress and box springs, \$75. Call Faye, x4676.

French coffee table, \$35. Call 488-5564.

Wanted

A house, assumable loan preferred, cash available. Call Tom at 480-2776.

Used man's bike. Single speed coaster, for exercise. Call Chuck at x5528 or 538-3273 after 5 p.m.

Want to buy tube-type stereo equipment. Call Jeff at x6154 or 480-2439 after 5 p.m.

Foreign exchange student from Oslo, Norway arriving for one year, would like to contact windsurfers. Call Phyllis at x3537 or 946-4752.

Want used dining room set, at least six chairs and china cabinet. Call Kathy at 534-3738 or 534-4734.

Will trade electric dryer for 20 cu. ft. frostless upright freezer. Call Dale, x3851 or 941-2495.

Want to buy electric trains. Call Don, x2449.

Want good working 4000 DR 7500 BTU window unit air conditioner, price negotiable. Call Crissy, 486-1299.

Miscellaneous

Exercycle, good condition, \$20. Call Sharon at x4763 or 482-3078 after 6 p.m.

Tennis racquets, Prince Graphite \$160, Wilson Sting Graphite \$70, both with 4 1/2 grip and strings. Call Ken at x5047 or 482-1717.

24 ft. Rowing shell, top aerobic. Call Mr. Horton at x6130.

Garage sale-several items for sale, including tools and minibike carrier. Call Joe at x4905 or 944-6513.

Aquarium, 55 gallon, \$50. Call 488-4089.

3000 Watt 110 volt portable generator, 7 h.p., techumseh engine hardly used, \$550. Call Don at x4606 or 488-8105 after 5 p.m.

Spring Honey Crop is here! Get your quarts or gallons of fresh honey from Welby Ward at x4278.

15 inch wheels w/78 R15 B.F. Goodrich tires, 4,000 miles on both. Make offer. Call 944-3184.

Large collection of habitrail equipment for gerbils, etc. Call 538-2082.

Carnivorous plants, last offering this summer. Pitchers, sundews, bladderworts (24 varieties) plus growing instructions. Call Jeff x3967 or 996-0755 after 5 p.m.

Four brand new Uniroyal Steeler tires, size P235/75 R15 \$250. Call Rogers at x3576.

Antique claw-footed bathtub, 5 feet long, good condition, \$75. Call 482-6291.

Pet-Porter dog carrier, for medium dog, \$25. Call 480-4063.

Smith Corona Galaxie XII manual typewriter, \$50; Texas Instruments 58C calculator, \$50. Call Dwight, 480-9349 after 5 p.m.

Large car top carrier with attachment hardware, \$20. Call 538-2082.