Space News ROUNDUP

VOL. 4, NO. 16 MANNED SPACECRAFT CENTER, HOUSTON, TEXAS MAY 28, 1965

Gemini IV Four-Day Flight Set For Next Week

The National Aeronautics and Space Administration will launch the United States' longest duration manned space flight to date from Cape Kennedy, Fla., no earlier than next Thursday, June 3.

The two-man Gemini IV mission is scheduled to circle the Earth 62 times in four days to evaluate the effects of extended space flight on crew performance and physical condition.

Astronaut James A. McDivitt is command pilot and Astronaut Edward H. White II is pilot for the flight. Astronauts Frank Borman and James A. Lovell Jr., the back-up crew, will replace the primary crew should either member of that team become ineligible for the flight.

The mission is designated Gemini IV—the fourth of 12 flights planned in the Gemini project. The first two missions, Gemini 1 and Gemini 2, were unmanned. Astronauts Virgil Grissom and John Young made three revolutions around the Earth March 23 in Gemini 3.

A successful full-duration Gemini IV flight will more than triple the manned space flight time accumulated by the United States. To date the U.S. has nearly 65 man-hours in space and the Gemini IV mission would bring the total to about 257 man-hours. Total U.S. manned spacecraft time in space would be about 154 hours after the 97-hour-and-50-minute Gemini IV flight.

Gemini IV will be launched by a modified two-stage Air Force Titan II, into an orbit with a high point (apogee) 185 miles and low point (perigee) of 100 miles above the Earth. Each orbit will take about 90 minutes and range between 33 degrees north and south of the Equator.

Recovery is planned in the Atlantic Ocean about 400 miles south of Bermuda.

Eleven experiments are planned for Gemini IV. Three of these are medical, four engineering, two Department of Defense and two scientific.

The medical experiments will study effects of exercise and work in space, time heart contractions with a phonocardiogram and determine whether

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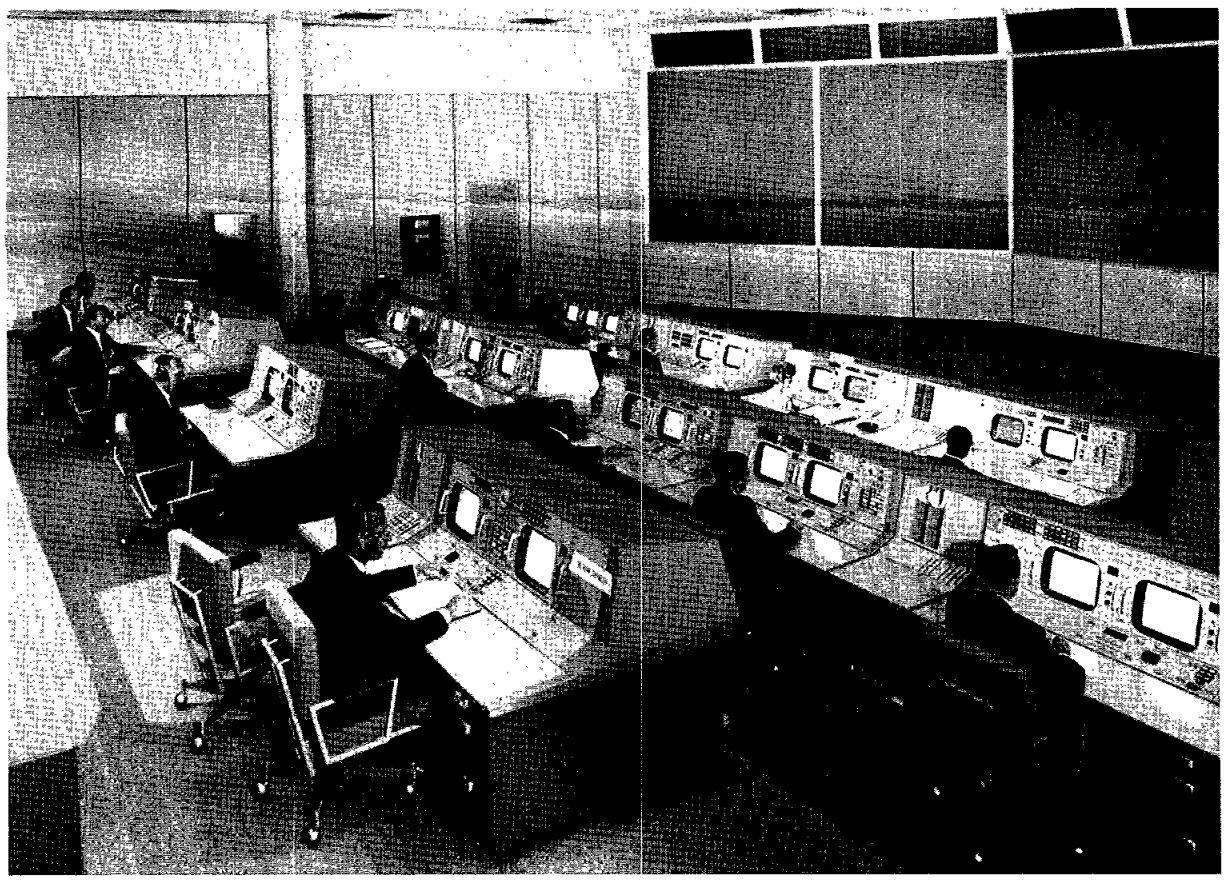


GEMINI IV CONTROL CENTER—Interior view of the Mission Control Center-Houston located in Building 30 where the Gemini IV mission will be controlled. The MCC is the center of a huge global network of tracking and communications stations providing centralized control for all manned space flights.

Extravehicular Activities Planned

During the second revolution of the Gemini IV spacecraft next week, Astronaut Edward H. White II is scheduled to egress from the cabin of the spacecraft and perform activities in space for approximately 12 minutes as he flys over the United States.

Assisting White in the extravehicular activity which will take about 19 minutes from hatch opening to closing, will be Astronaut James A. McDivitt, command pilot for the flight.

White will be attached to the spacecraft by a 25-foot umbilical cord which will supply oxygen and communications, and a 23-foot, 1000-pound test tether line. He will also carry an eight pound pack which contains an emergency oxygen supply that will be capable of sustaining him for from nine to 12 minutes, which is more than sufficient time to return to the cabin of the spacecraft in case of a failure in the oxygen supply through the umbilical.

Special meteoroid protection has been built into White's suit with seven layers of Mylar in addition to the regular suit fabric and insulation layers. Both crewmen will have special gold visors on their helmets to provide protection from the unfiltered rays of the sun.

Depressurization of the spacecraft and pressurization and checking of the astronauts' space suits will begin over Africa.

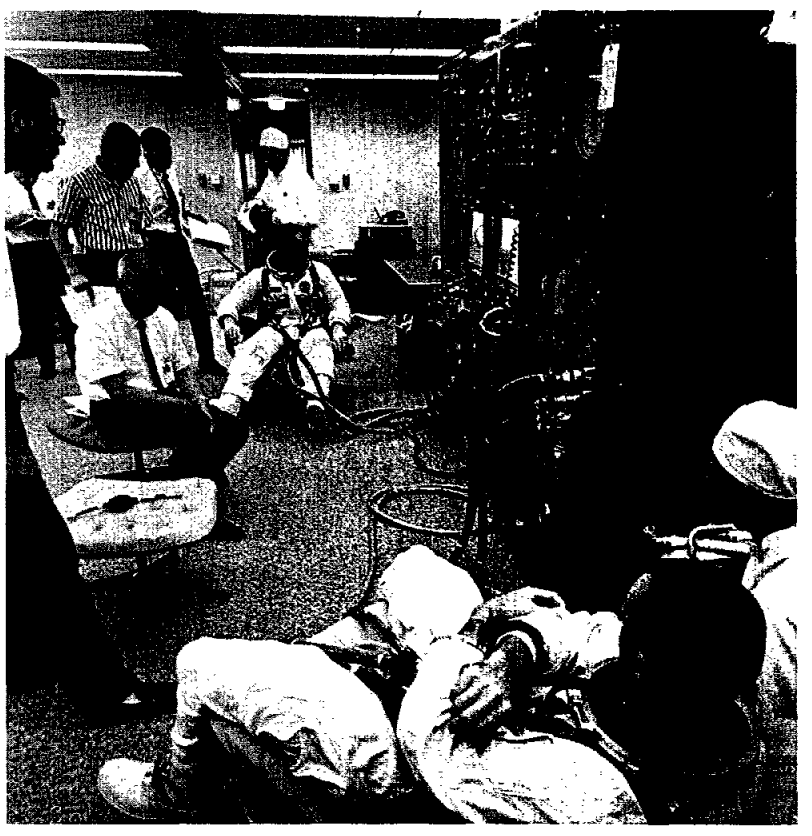
Opening of the Gemini IV hatch will begin between Hawaii and Guaymas, Mexico, and White will return to the spacecraft over Antiqua and no later than while over the Ascension Islands.

While out in space White will observe the spacecraft, earth, stars, and take photos with a 35mm camera. A movie camera inside the spacecraft operated by McDivitt will photograph White's activities. The spacecraft will maneuver to keep White in the field of view of the camera.

White has had many hours of training with the same type of extravehicular equipment in a vacuum chamber and has also performed the egress and ingress exercise from the spacecraft many times in the condition of weightlessness in an aircraft.

McDivitt also took part in these exercises which included depressurizing the spacecraft and emerging into the vacuum of the chamber.

The decision to include the extravehicular activities in the Gemini IV mission was announced at a special press conference Tuesday by Dr. Robert R. Gilruth, director of the Manned Spacecraft Center. Charles W. Mathews, manager, Gemini Program Office said the activity had been programed for possible inclusion in this flight but was dependent on Qualification of the equipment in time.



GEMINI READY ROOM—Gemini IV Astronauts James A. McDivitt and Edward H. White II have their spacesuits checked during a wet mock simulated test at Cape Kennedy. Here they are shown in the Ready Room at Launch Complex 16, with doctors and suit technicians.

Goal For 1965 Bond Campaign Set At 65 Per Cent Participation

The Star-Spangled Savings Bond Campaign of 1965 was kicked off here at the Manned Spacecraft Center May 17 with a minimum participation goal of 65 per cent set for Center employees.

May 17 through June 4 is the campaign period here at MSC for this year's Bond Campaign which has as its theme "The Star Spangled Savings Plan for All Americans."

In a letter to all employees, Dr. Robert R. Gilruth, director of MSC said, "The Manned Spacecraft Center currently has a participating rate of about 46 per cent. While our objective is always 100 per cent participation, the goal for this particular year is to obtain at least the Federal agency goal of 65 per cent participation."

Dr. Gilruth stated that in recent correspondence received from Administrator Webb, he expressed the desire that each NASA installation effect a dynamic "Star-Spangled Savings Bond Campaign" which would not only result in a measurable increase in the percentage of participation but would insure security through automatic savings for employees and a sound, strong economy for our Government.

The Payroll Savings Plan, Dr. Gilruth continued, is the heart of the Bond Program which plays a vital part in the management of

(Continued on Page 3)

Gemini IV

(Continued from Page 1)

bone demineralization takes place on long space flights.

Engineering experiments will measure electrostatic charges on the spacecraft surface, measure radiation immediately around the spacecraft, monitor direction and amplitude of the Earth's magnetic field with respect to the spacecraft and make two-color photographs of the Earth's "limb" (the outer edge of brightness).

DOD experiments concern radiation measurements inside the spacecraft and simple devices for navigation.

Scientific experiments include wide-angle terrain and weather photography.

The Gemini IV mission marks the first time that mission control will be exercised at the Manned Spacecraft Center, Houston. The Mission Control Center at Houston was used to monitor the Gemini 3 mission but control of that mission and all the Mercury manned space flights was done at Cape Kennedy.

The Gemini program, the second phase of the United States' manned space flight program, is designed to provide experience in orbiting maneuvers, rendezvous and docking, space flights lasting up to 14 days and for manned scientific investigations in space.

The primary objectives of Gemini IV are:

1. Demonstrate and evaluate performance of the spacecraft systems for a period exceeding four days.

2. Evaluate effects of prolonged exposure to the space environment of the two-man flight crew in preparation for flights of longer duration.

The spacecraft will be launched from Pad 19 on a true azimuth of 72 degrees east of north. Slightly more than six minutes after liftoff, it will be inserted into a 100-185-statute-mile orbit inclined approximately 32.5 degrees to the Equator. (All miles are statute).

Orbital insertion will occur about 680 miles from Cape Kennedy at a velocity of 25,766 feet per second (17,567 miles per hour), including up to 10 feet per second provided by the spacecraft's aft-firing thrusters during the separation maneuver.

While in orbit, maneuvers totaling 55 feet per second will be used to adjust the orbital lifetime and to demonstrate the maneuvering ability of the spacecraft. Additional maneuvers totaling 25 feet per second will be performed separately, but in conjunction with orbit adjustment maneuvers, to check out operational procedures.

Retrofire is planned at 97 hours, 31 minutes and 43 seconds after liftoff as Gemini IV is passing over the west coast of the United States before the end of the 62nd revolution. Landing is expected approximately 17 minutes after retrofire n the Atlantic Ocean about 400 miles south of Bermuda.

Each of the maneuvers will be calculated in realtime and adjusted to meet requirements as determined by the mission director.

Recovery capability is based primarily on reports from recovery force commanders to the recovery task force command at Mission Control Center.

Weather and status of contingency recovery forces will be continually monitored. Recommendations will be made to the Mission Director who will make the go-no-go decision based upon conditions at the time.

The decision to use para-rescue personnel depends upon

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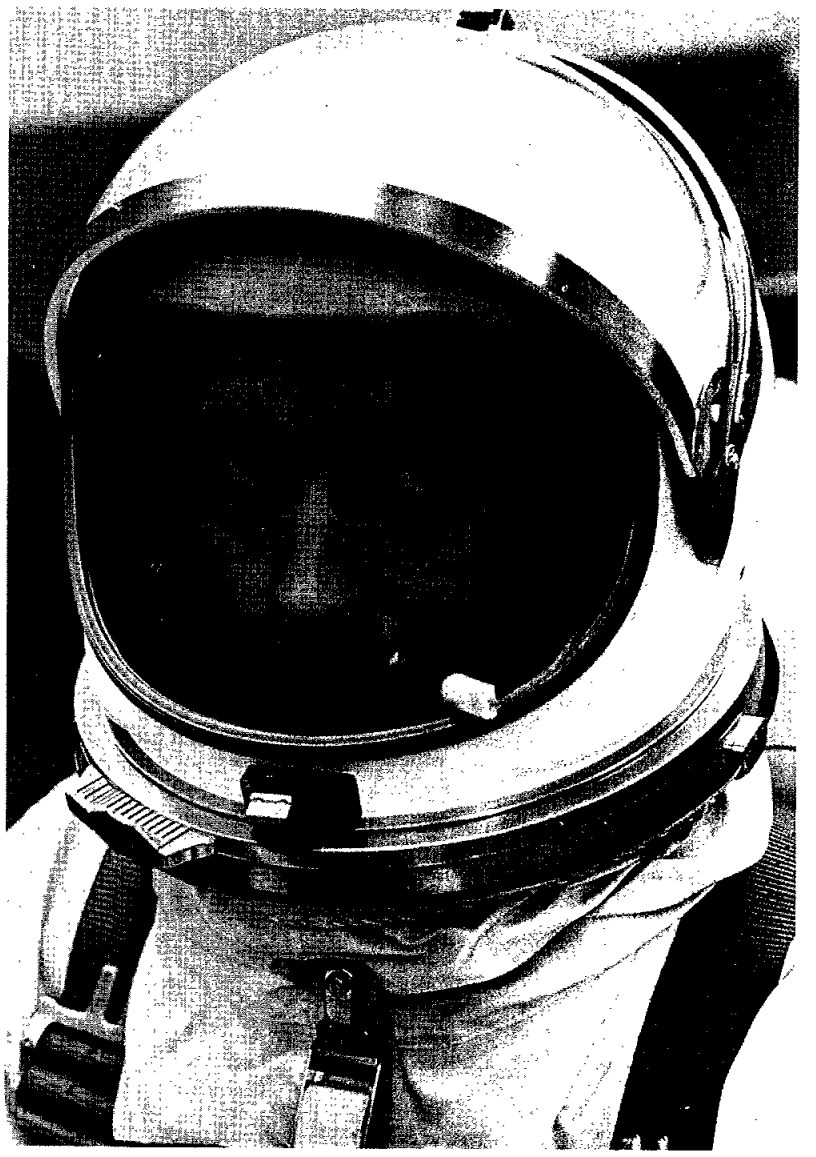
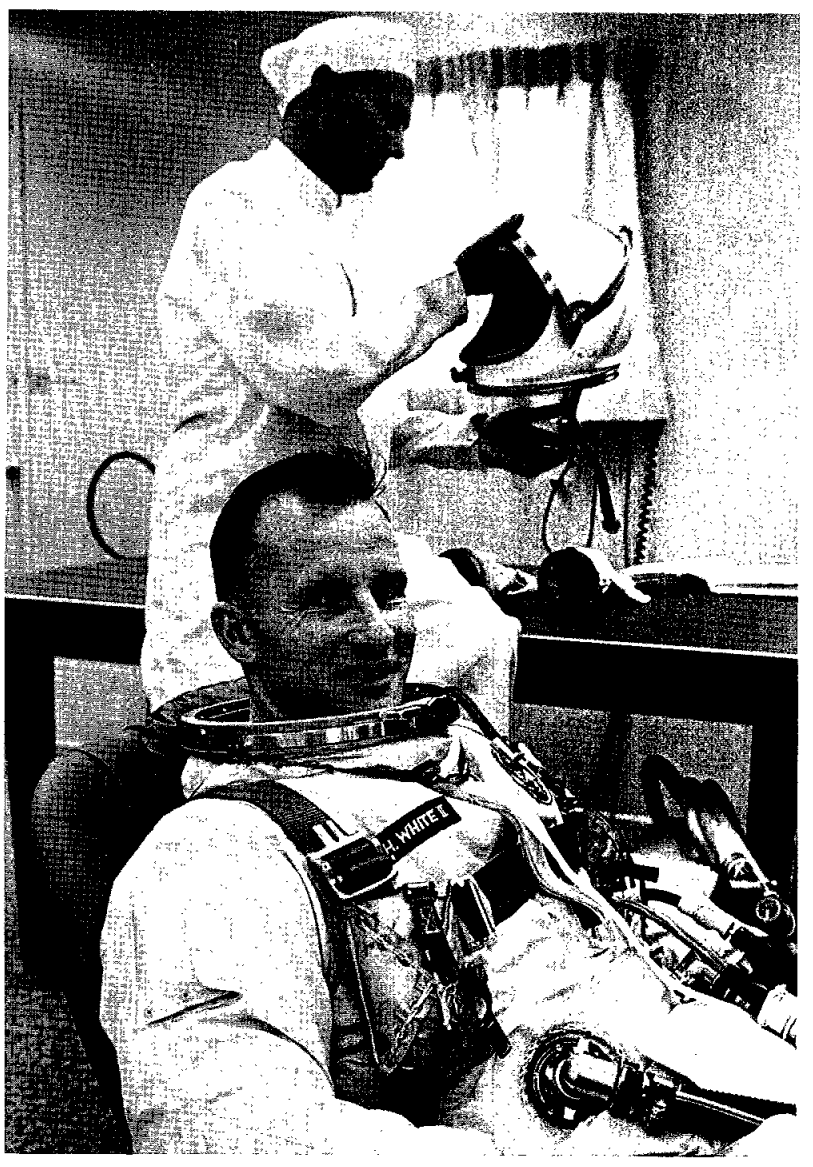
GEMINI IV TESTS—Astronaut Edward H. White II goes through a wet mock simulated test as part of the checkout procedure for the Gemini IV mission at Cape Kennedy.



TEMPERATURE RECORDING—Astronaut James A. McDivitt is having his temperature recorded during wet mock simulations at Cape Kennedy, in the flight crew ready room.

GEMINI IV CREWS—The four astronauts selected for the Gemini IV mission are shown in Washington, D.C., April 29, the day they visited Capitol Hill to see members of Congress. They are (l. to r.) Frank Borman, James A. McDivitt, Edward H. White II, and James A. Lovell, Jr.



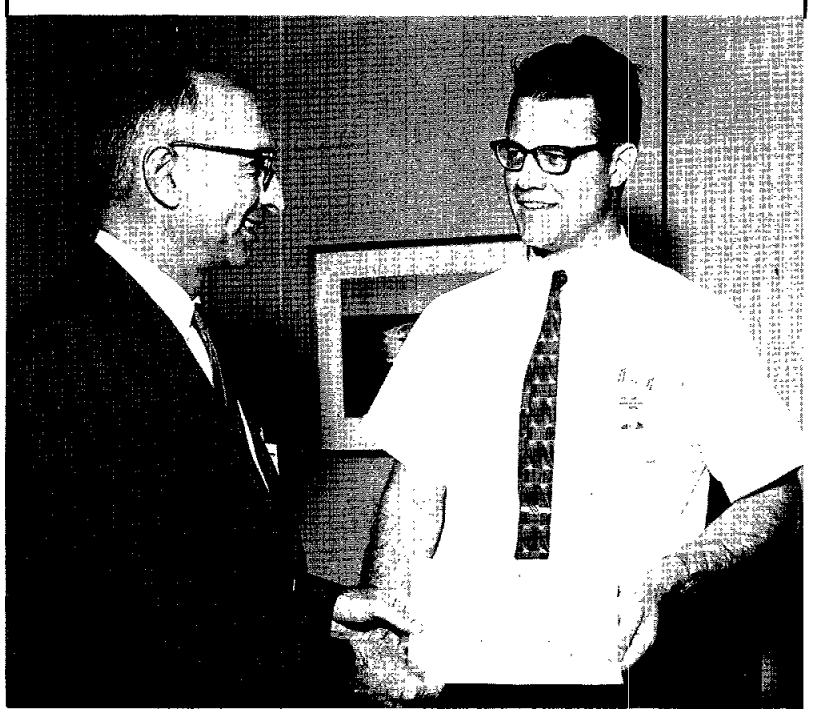
HELMET FITTING—Astronaut Edward H. White II has his spacesuit helmet fitted by Joe Schmitt during a wet mock simulated test at Cape Kennedy, in the flight crew ready room at Complex 16.

Space News ROUNDUP!

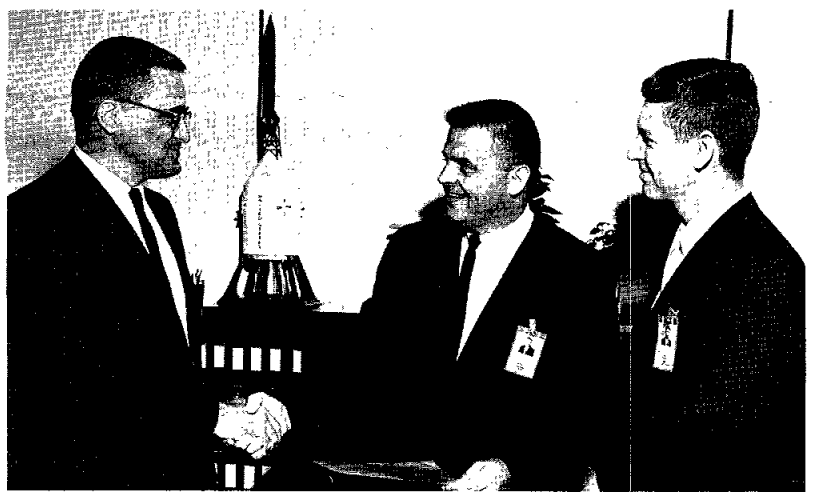
MANNED SPACECRAFT CENTER, HOUSTON, TEXAS

EMPLOYEE NEWS

Performance Awards Given Here



SSP AWARD—William E. Simon (r.), an aerospace technologist with the Thermodynamic Power Section, Power Generation Branch, Propulsion and Power Division, receives the Sustained Superior Performance Award. The presentation was made by Aleck C. Bond, manager of Systems Tests and Evaluation, Office of the Assistant Director for Engineering and Development.



SSP AWARD—W. H. Taylor (c.), project engineer for Service Module 001, Ground Test Branch, Checkout and Test Division, Apollo Spacecraft Program Office, receives congratulations after receiving the Sustained Superior Performance Award. Congratulating Taylor are W. M. Bland Jr. (l.), chief, Checkout and Test Division; and H. P. Davis (r.), chief, Ground Test Branch. The presentation of the SSP Award was made earlier by Dr. Joseph F. Shea, manager, Apollo Spacecraft Program Office.

PERFORMANCE AWARD—Robert H. Voight (l.), manager, NASA Regional Audit Office, presents a Sustained Superior Performance Award to Jerald L. Greif, Audit Office.

Proposed per annum rates and steps for Classification Act employees.

Grade	1	2	3	4	5	6	7	8	9	10
GS-1	$ 3,495	$ 3,610	$ 3,725	$ 3,840	$ 3,955	$ 4,070	$ 4,185	$ 4,300	$ 4,415	$ 4,530
GS-2	3,800	3,925	4,050	4,175	4,300	4,425	4,550	4,675	4,800	4,925
GS-3	4,120	4,260	4,400	4,540	4,680	4,820	4,960	5,100	5,240	5,380
GS-4	4,615	4,770	4,925	5,080	5,235	5,390	5,545	5,700	5,855	6,010
GS-5	5,150	5,320	5,490	5,660	5,830	6,000	6,170	6,340	6,510	6,680
GS-6	5,670	5,860	6,050	6,240	6,430	6,620	6,810	7,000	7,190	7,380
GS-7	6,220	6,430	6,640	6,850	7,060	7,270	7,480	7,690	7,900	8,110
GS-8	6,820	7,050	7,280	7,510	7,740	7,970	8,200	8,430	8,660	8,890
GS-9	7,445	7,695	7,945	8,195	8,445	8,695	8,945	9,195	9,445	9,695
GS-10	8,160	8,430	8,700	8,970	9,240	9,510	9,780	10,050	10,320	10,590
GS-11	8,920	9,220	9,520	9,820	10,120	10,420	10,720	11,020	11,320	11,620
GS-12	10,590	10,945	11,300	11,655	12,010	12,365	12,720	13,075	13,430	13,785
GS-13	12,490	12,905	13,320	13,735	14,150	14,565	14,980	15,395	15,810	16,225
GS-14	14,640	15,130	15,620	16,110	16,600	17,090	17,580	18,070	18,560	19,050
GS-15	17,020	17,585	18,150	18,715	19,280	19,845	20,410	20,975	21,540	22,105
GS-16	19,575	20,225	20,875	21,525	22,175	22,825	23,475	24,125	24,775	
GS-17	22,185	22,925	23,665	24,405	25,145					
GS-18	25,235									

Pay Raise For Civil Service Employees Asked Of Congress By President Johnson

President Johnson asked Congress May 12 to give a pay raise to 4.5-million Federal civilian and military employees effective next January 1.

He said the increases would put the Government in a far better position to attract and retain the best talent in America, and prevent loss of ground already attained, to bring Federal pay rates in line with those in industry.

The increases proposed by the President would average three per cent for the 1.8-million classified, postal, foreign service, VA medical and related civilian employees. Wage board employees, whose salaries are under the prevailing rate law, would not be included in the pay raise.

Pay raises would vary from $110 per year in the lowest grade to $740 per year in the higher grades.

The chart on this page shows the proposed pay schedule for Classified Act employees.

EAA Now Selling Tickets For Ringling Circus In Dome

The Employees Activities Association is now selling tickets in the Cafeteria for the Ringling Brothers' Barnum & Bailey Circus that will be held in the Harris County Domed Stadium June 10-13, and buyers are urged to get their tickets before June 1.

Tickets may be purchased for the Saturday night, June 12 performance or the Sunday Matinee, June 13. All unsold tickets must be returned to the Domed Stadium the afternoon of June 1.

Reserved tickets are $3 each and may be purchased in the Cafeteria from 11:30 a.m. through 1:30 p.m. For those people located at Ellington AFB or Building 419, 420, etc., please contact your EAA district representative for tickets.

Because the Domed Stadium Ticket Office is handling the sale of these tickets as an "agent" for the Circus, the EAA was not able to get a discount on these tickets.

However, the EAA will provide transportation (four school buses) to and from the Domed Stadium for those who wish to attend the Sunday Matinee performance. These buses will depart from the SAGE parking lot, 8555 Gulf Freeway, Exit 13, promptly at 1:00 p.m. and return to SAGE parking lot immediately following the conclusion of the circus performance.

Chairman for this event is Myrtle Richard, Building 4, Ext. 5151.

Back Issues Of Roundup Needed For Files

Anyone got old copies of the first volume of the Roundup that they would like to part with?

To complete our files of back issues of the Roundup, we are in need for the following issues of Volume I: 1, 2, 6, 13, 15, 17. If spare copies are around we would be happy to receive them. Just send them to: Editor, Roundup, AP3.

EAA CALENDAR OF EVENTS

Specific times and places that are not indicated for these proposed events will be announced later.

Center-wide Social Activities

Mary Sylvia, chairman, Ext. 3958.

June 26: Summer Dance, Sylvan Beach, Rex Bauerlein, chairman, Ext. 4895.

July 16, 17, 18: Vaudeville Revisited '65, MSC Auditorium, Juanita Bower, chairman, Ext. 4951.

Due to scheduling problems, it was necessary to change the date of the Vaudeville Revisited '65 production. Mark your calendar. Price of tickets will be $1 per person. Show time 8:00 p.m.

August: Style Show Dinner Dance.

September: Annual Picnic, Tony Yeater, chairman, Ext. 2108.

October: Halloween Costume Ball, Rex Bauerlein, chairman, Ext. 4895.

December 10: Annual Christmas Dance, Sylvan Beach, Rex Bauerlein, chairman, Ext. 4895.

Children's Activities

Joyce Lowe, chairman, Ext. 5258.

June: Circus.

July: Movie Party.

August: Roller Skating Party.

September: Annual Picnic.

October: Halloween Costume Party.

November: Theatre Party or Symphony Concert.

December: Annual Christmas Party.

Model Auto Slot-Racing Club Being Formed

MSC employees interested in joining a model auto slot-racing club are asked to call Don Lewis at Ext. 5361.

Lewis said a 125-foot lap track is available for use by club members at no charge.

Couples Bowlers To Begin Season, Teams Needed

The MSC Couples Summer Bowling League which is scheduled to begin at 6:30 p.m., June 8 at Mimosa Lanes, has openings for teams, couples, or individuals.

Persons interested in joining the league are asked to contact Jim McBride, Ext. 3376 as soon as possible. The teams are composed of two men and two women.

MSC Co-op Earns Award At Georgia Tech

David E. Evans, a student in the NASA co-op program and assigned to the Structures and Mechanics Division's Mechanical Systems Branch, was recently awarded the Scott Paper Company Foundation Award for Leadership.

Evans, a sophomore in the School of Mechanical Engineering, at Georgia Tech, is the first Tech student to receive the award. It is given annually to students displaying leadership potential with a definite interest for a career in commerce or industry. The award includes $1000 a year for two years.

MSC-EAFB SOFTBALL LEAGUE

Standings as of May 14

Fast Pitch

TEAM	WON	LOST
ID	2	0
2578th AB SQ	2	0
Colt 38's	2	0
Rag Mops	1	1
Lone Stars	1	1
FCD	1	1
Hustlers	1	1
IBM	1	1
Lockheed	1	1
Weather	1	1
CG-Choppers	1	1
Rams	1	1
Comm-SQDN	1	1
Firemen	0	2
LoBos	0	2
Wolfs	0	2

Slow Pitch

TEAM	WON	LOST
RMD-Plus	2	0
Hustlers	2	0
Mets	2	0
8-Balls	2	0
MPAD-RAB	2	0
Animals	2	0
Mis-Fits	1	1
CSD	1	1
Odds-Ends	1	1
Machinists	1	1
Virginians	0	2
LRD	0	2
Moonrakers	0	2
USCG(H)	0	2
Fabricators	0	2
Lunartechs	0	2

Game Scores

Rag Mops – 8, Lone Stars – 7
ID – 12, Wolfs – 2
FCD – 26, LoBox – 3
Colt 38's – 24, Firemen – 5
Hustlers – 9, Comm-SQDN – 7
Rams – 8, IBM – 0
CG-Choppers – 12, Lockheed – 1
2578th AB SQ – 5, Weather – 4
Colt 38's – 19, LoBos – 3
IBM – 10, Rag Mops – 7
Lockheed – 3, Hustlers – 1
2578th AB SQ – 14, Firemen – 1
Weather – 10, FCD – 9
ID – 13, CG-Choppers – 6
Lone Stars – 10, Rams – 3
Comm-SQDN – 13, Wolfs – 3

Game Scores

RMD-Plus – 16, Virginians – 6
Hustlers – 12, Lunartechs – 9
Mets – 5, Machinists – 3
Mis-Fits – 7, Fabricators – 0
CSD – 11, Odds-Ends – 3
8-Balls – 26, USCG(H) – 2
MPAD-RAB – 22, Moonrakers – 0
Animals – 5, LRD – 3
Machinists – 14, Fabricators – 5
MPAD-RAB – 10, CSD – 6
Animals – 13, Mis-Fits – 1
Mets – 11, LRD – 6
Hustlers – 22, Moonrakers – 9
RMD-Plus – 22, USCG(H) – 6
Odds-Ends-9, Lunartechs – 6
8-Balls – 24, Virginians – 5

MSC BOWLING ROUNDUP

NASA 5 O'CLOCK MON.

Final Standings as of May 17

TEAM	WON	LOST
Suppliers	77	51
Foul Five	76	52
Computers	70	58
Sombreros	60	68
Hot Shots	54	74
Alley Gators	49	79

High Game: W. Kutalik 244, T. Hutchens 232, J. McDowell 230.

High Series: H. Erickson 595, E. R. Walker 591, T. Hutchens 590.

High Team Game: Computers 880, Suppliers 865, Foul Five 862.

High Team Series: Suppliers 2473, Foul Five 2464, Computers 2321.

MSC COUPLES LEAGUE

Final Standings as of May 18

TEAM	WON	LOST
Wha' Hoppen?	47	21
EZ-GO	46	22
Bowlernauts	40	28
Schplitz	39½	28½
Bltzf	35½	32½
Alley Cats	35½	32½
The Crickets	34	34
Pin Splitters	32	36
Goof Balls	28	40
Sandbaggers	26	42
Hi-Ho's	25½	42½
The Thinkers	19	49

High Game Women: J. Foster 228, K. Gentile 224.

High Game Men: D. Behne 250, J. Garino 246.

High Series Women: J. Foster 564, J. Sands 538.

High Series Men: J. Garino 642, B. Jones 628.

MIMOSA MEN'S LEAGUE

Standings as of May 13

TEAM	WON	LOST
Whirlwinds	41	23
Roadrunners	40	24
Green Giants	38	26
Fabricators	33½	30½
Technics	33	31
Spastics	32	32
Alley Oops	29½	34½
Sizzlers	27	37
Fireballs	26	38
Pseudonauts	20	44

High Game: Blair 254, Grimwood 244, Amason 233.

High Series: Morgan 629, Gordon 623, Gaffney 613.

High Team Game: Fabricators 990, Alley Oops 975, Pseudonauts 973.

High Team Series: Alley Oops 2730, Roadrunners 2681, Fabricators 2641.

Government Service Award

FIFTEEN-YEAR AWARD—Raymond Hassett (l.), conference coordinator and education liaison officer, Educational Programs and Services, Public Affairs Office, is presented a 15-Year Service Award by Eugene Horton, chief, Educational Programs and Services Branch.

Apollo Guidance, Navigation Courses Offered Here

A series of courses for Center employees on the Apollo guidance and navigation system is scheduled to begin here at the Manned Spacecraft Center June 8.

The courses will begin with a 16-hour Guidance and Navigation Familiarization course on the Block I System. This is to be followed by a 100-hour detailed system course which will begin August 2.

A special 24-hour briefing on the Block II and Lunar Excursion Module systems will be presented beginning June 21, for those participating in Block II critical design review exercises.

These courses, conducted by instructors from AC Spark Plug, will be held in the Systems Training Rooms, second floor, Building 4.

Detailed course descriptions and schedules have already been distributed to the division offices. Interested persons who have not seen this information should contact their branch or division office.

For additional information contact Tim Brown, subsystem manager for training, Flight Crew Support Division, Ext. 4371.

Bridge Club Members Play In Tournament

Duplicate Bridge Club members participated in the sectional tournament held in Baytown over the May 14-16 weekend.

Paul and Mary Swanzy placed 6th overall in the Mixed Pairs, Lee Pearson and Bob Hodgson captured a section first in the Open Pairs, Bob and Dolores Sheridan came in second in the Novice event, and Edith and Richard Reid had a section third in the Mixed Pairs.

The Club schedule for June includes the Club Master Point June 1, a special Charity Master Point June 15, plus the regular rating point games on June 8, 22 and 29.

Winners at the May 11 rating point game were: North-South, W. B. Hamby and Floyd Bennett, first; J. N. LaMarche and J. R. Arnett, second. East-West: Ray Lynch and Charles Shoemake, first; Charlie Brown and Richard Reid, second. At the May 18 game, also a rating point session, winners were: North-South, Max Cone and Leona Kempainen, first; Dolores and Bob Sheridan, second; East-West, Sara and Bill Stewart, first; Terry and Bob Hodgson, second.

MSC at work...

ROBERT A. NANZ, Microbiology and Nutrition Section, Environmental Physiology Branch, Crew Systems Division, inspects foods which will be used for Gemini flights.

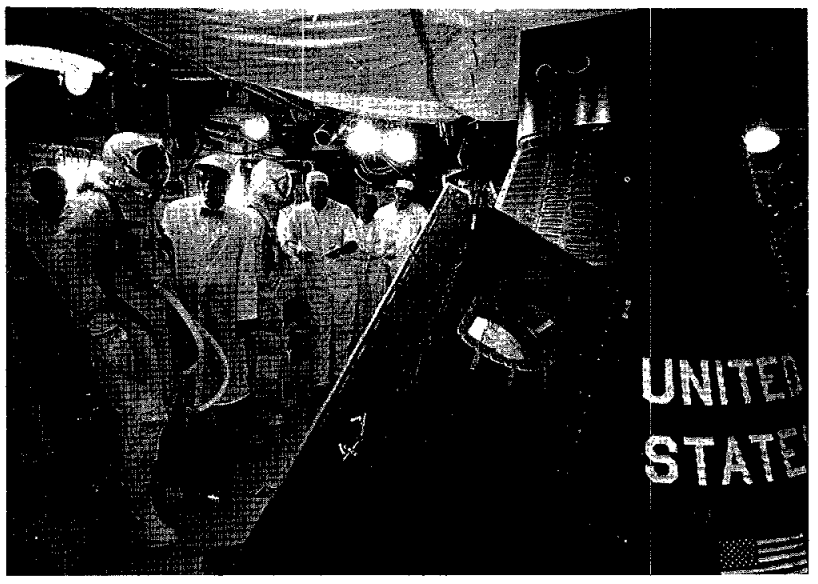
CLARE MARTIN, industry assistance officer, Procurement and Contracts Division, processes applications for the Center's bidders and commodity source list.

NICKIE VELASQUEZ, Industry Assistance Office, Procurement and Contracts Division, posts new bids and proposals on the Bid Board in Bldg. 1.

(Continued from Page 2)

weather conditions, surface vessel locations and the ability to provide air dropped supplies until the arrival of a surface vessel. The final decision to jump will be made by the jumpmaster.

Gemini is under the direction of the Office of Manned Space Flight, NASA Headquarters, Washington, D.C., and is managed by NASA's Manned Spacecraft Center, Houston. Gemini is a national space effort and is supported by the Department of Defense in such areas as launch vehicle development, launch operations, tracking and recovery.



PREPARING TO ENTER GEMINI—Astronaut Edward H. White II, left, (assisted by Complex Leader Gunther Wendt, center) and Astronaut James A. McDivitt, right, prepare to enter the Gemini IV spacecraft for the wet mock simulated test at Cape Kennedy, May 14.

WEIGHT AND BALANCE TEST—Astronaut James A. McDivitt, Gemini IV command pilot, goes through a weight and balance test during a wet mock simulation at Cape Kennedy, Fla.

Aerospace Medical Group Installs Dr. Charles A. Berry As Head

The installation of Dr. Charles A. Berry as president of the Space Medicine Branch of the Aerospace Medical Association and the closed circuit TV demonstration of the extravehicular Gemini suit and Gemini medical experiments highlighted Manned Spacecraft Center participation in the annual Aerospace Medical Association meeting in New York City April 26-28.

Approximately 2500 of the over 4000 members of the association attended the meeting to hear and view the latest advances in this rapidly growing area of medicine.

Dr. Berry, who is also serving a three year membership on the Aerospace Medical Association Executive Council, was named president of the Branch at a noon luncheon April 28. At the installation Dr. George Mueller, associate administrator for Manned Space Flight, said "The election of Dr. Berry to this post honors the whole manned spaceflight program for he is the chief of Center Medical Programs at MSC." He will represent for the coming year more than 412 members of the Branch, which includes doctors and engineers working in the aerospace field for government, industry, and the universities. He has also been appointed to the post of

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Bond Campaign

(Continued from Page 1)

our country's public debt and contributes substantially to the Nation's economic strength. It is also the method by which millions of Americans have experienced, for the first time, the benefits of systematic thrift

Application forms for U. S. Savings Bonds can be obtained from division secretaries or from the Payroll Office of the Resources management Division.

SAVINGS BOND KICKOFF—Harry Dedeaux (left) a representative from the Savings Bond Division, U. S. Treasury Department, Houston Office, was here at the Center May 17 to help kickoff the 1965 Savings Bond Campaign. Wesley L. Hjornevik (center), assistant director for Administration, and MSC's 1965 Bond Campaign Chairman, Abner Askew, administrative officer of Resources Management Division, hold a poster that features this year's campaign slogan, "Join the Star-Spangled Savings Plan."

Pegasus Meteoroid Detection Satellite To Gather Knowledge Of Space Hazards

Launching of the second Pegasus meteoroid detection satellite by NASA took place at 2:35 a.m., EST, Tuesday of this week from Cape Kennedy Launch Complex 37, and was the first nighttime launching by a Saturn I vehicle.

The one and one-half ton spacecraft is an improved version of Pegasus I which has been circling the Earth since February 16 of this year. While a significant number of meteoroid penetrations were recorded in the first three months of Pegasus' I orbital life, one of its main objectives was to provide NASA with experience on a new meteoroid penetration detection system.

The SA-8 launch will also further verify the launch vehicle and the Apollo spacecraft configuration. The meteoroid detection satellite is encased in the service module portion of the boilerplate Apollo spacecraft during liftoff.

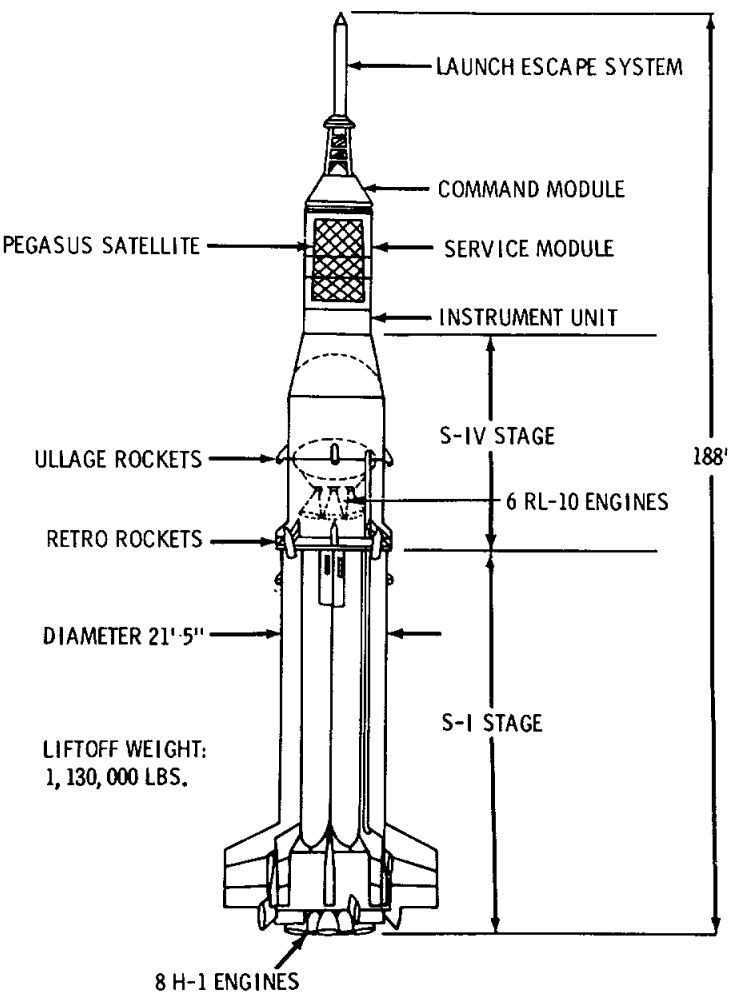
If placed in the proper orbit, Pegasus B is expected to send back meteoroid data to ground stations for at least one year. It may remain in orbit around the Earth for three years or more.

The large panels which the satellite will expose to the meteoroid environment are 96 by 14 feet, offering 2,300 square feet of instrumented surface.

Meteoroid hit data gathered by Pegasus B will add to the knowledge gained by Pegasus I as to the hazard to spacecraft from meteoroids in near-Earth space. This information is becoming increasingly more important to designers as the emphasis on larger, long-life spacecraft increases.

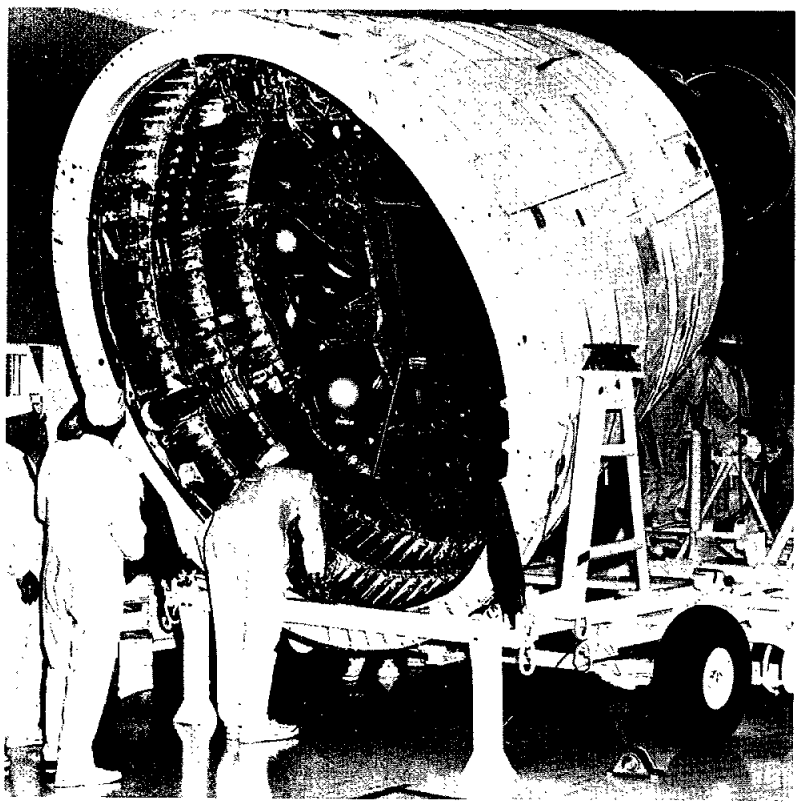
Pegasus B is to be followed later this year by Pegasus C, the last of three such satellites planned for launch by Saturn I vehicles.

The Marshall Space Flight Center has project management responsibility for Pegasus.

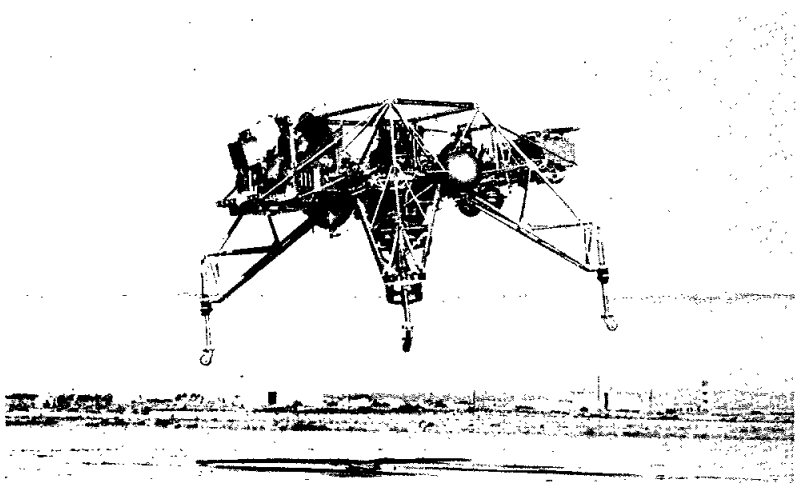


SA-8 VEHICLE—The Saturn vehicle with the Pegasus B meteoriod measurement satellite in the specially adapted Apollo boilerplate service module is shown in the above drawing. The launch escape system, boilerplate Apollo command and service modules, will be jettisoned to free the satellite's "wings" once the vehicle enters Earth orbit. The satellite, instrument unit and S-IV stage will continue to orbit as an entity. In a separate orbit will be the Apollo spacecraft elements.

General Electric Providing Operational And Tech



FUEL CELL BATTERIES—Two General Electric fuel cell batteries and their associated cryogenic fuel supply are shown, center of capsule, in the adapter section of the Gemini spacecraft during preparation at McDonnell Aircraft for final checkout and testing installations. The G-E fuel cell batteries—to be used in GT-5—will be the first such power system to operate during spacecraft missions.



LLRV IN FLIGHT—A General Electric CF700 turbofan jet engine equalizes the forces of gravity and rockets for pilot control movements in this Bell Lunar Landing Research Vehicle. It is designed to simulate moon landings in the Apollo Program. The CF700 is derived from the J85 turbojet and uses a scaled down fan version of G.E.'s CJ805-23 commercial transport aft-fan engine.

Three divisions of General Electric's Aerospace and Defense Group—Missile & Space, Flight Propulsion and Defense Electronics—as well as many smaller components are making significant contributions to the nation's overall manned space flight effort. These G-E components, in turn, draw on the resources of the company's more than 80 laboratories.

GERALD L. PHILLIPE
chairman of the board, General Electric Company.

FRED J. BORCH
president and chief executive officer of General Electric Company.

G.E. provides NASA with operational and technical support for the Apollo and Gemini programs. It helps test the giant Saturn boosters, assists in checkout and reliability tests, designs equipment for astronaut training, guides launch vehicles and will provide on-board electrical power during space flights.

A complex electronics system is maintained by the Apollo Support Department as part of the company's reliability and assessment activities for the moon shot. G.E. has completed four of ten Acceptance Checkout Equipment (ACE) systems, which will provide high speed, accurate and reliable tests for sophisticated spaceflight vehicles.

G-E Apollo support personnel are located at Houston, Huntsville, Ala., and Cape Kennedy.

Located at historic Valley Forge, Pa., is the G-E Space Technology Center. The 800,000 square-foot center – headquarters for the G-E Missile and Space Division's Spacecraft Department and Space Sciences Laboratory—has the primary responsibility for research, development and test of long-life satellites and space probes.

Work at Valley Forge includes proposed design for the Air Force's manned orbital laboratory. In efforts leading up to this program, the effects of artificial environment on man have been tested at the Center.

Work at the Missile & Space Division's Re-Entry System Department at nearby Philadelphia includes the development and fabrication of six Biosatellite reentry recovery vehicles. The program is the first one designed to learn the effects of prolonged space travel on terrestrial life. Primates, plants and other biological specimens will be among the experiments.

In Mississippi, 40 miles northeast of New Orleans, General Electric is assisting NASA in establishment and operation of the world's largest static test center for space boosters.

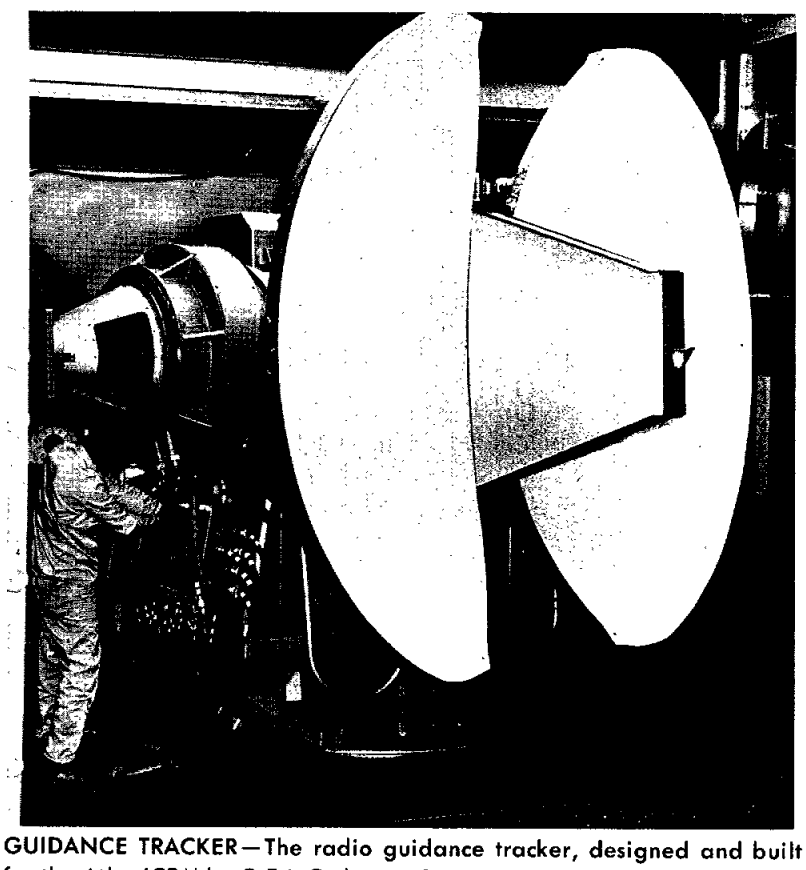
G. E.'s Mississippi Test Support Operation will direct preflight testing of the first and second stages of the giant Saturn V boosters.

Power in flight is vital to the success of the Gemini two-man missions. The company's Direct Energy Conversion Operation at Lynn, Mass., produces fuel cell batteries that will provide up to

JACK S. PARKER
vice president, General Electric's Aerospace and Defense Group.

EDITOR'S NOTE: This is the forty-fourth in a series of articles designed to acquaint MSC personnel with the Center's industrial family, the contractors who make MSC spacecraft, their launch vehicles and associated equipment. The material on these two pages was furnished by the General Electric Company.

GUIDANCE CONTROL ROOM—Control room for the General Electric radio guidance system at Cape Kennedy, Fla., receives position and velocity information from external ground equipment and aerospace equipment aboard the launch vehicle. The information is sent to a Burroughs computer which, in turn, computes any necessary corrections in course and sends them to the guidance system. With extreme precision, and at just the right moment, the system signals the launch vehicle to cut off its engines. G-E guidance systems have successfully guided more than 380 missions.



GUIDANCE TRACKER—The radio guidance tracker, designed and built for the Atlas ICBM by G.E.'s Ordnance Department at Pittsfield, Mass., has also been used in other major U. S. space shots. The tracker monitors the vehicle's flight and transmits guidance commands throughout the powered flight. Extreme tracking smoothness and accuracy are made possible by use of specially designed gearless power drives.

nical Support For Apollo And Gemini Programs

two kilowatts of on-board electrical power and water.

The fuel cell batteries, which are silent, reliable and fumeless, use hydrogen gas as fuel. They achieve a practical thermal efficiency upwards of 50 per cent.

Last year a test battery ran continuously for more than 46 days — completing more than three successive 14-day simulated Gemini missions.

The current production model, an improved version of the original fuel cell batteries for the Gemini program, is scheduled to provide power for the longer Gemini manned flights.

The second major space application of G.E. fuel cells will come in the Biosatellite Program which calls for 21 and 30-day missions. A one-third kilowatt battery, weighing about 35 pounds, will provide on-board electrical power. Conventional storage batteries, delivering equal power for 30 days, would weigh approximately 800 pounds.

Ground support test equipment for the G-E fuel cell batteries was developed by the company's Ordnance Department at Pittsfield, Mass.

Contributing to the success of Mercury, Mariner, Ranger and Gemini were highly accurate guidance systems developed by the G-E Radio Guidance Operation at Syracuse, N.Y.

The Titan II launch vehicle for Gemini will be guided by a G-E radio guidance system, such as the one that placed Astronaut Gordon Cooper's Faith 7 spacecraft into almost the exact center of a "keyhole in the sky." The shot was described as the nation's most accurate space launching.

The company's radio command system also will be used in Gemini booster guidance for rendezvous missions prior to the Apollo mission. The system not only will guide the astronauts' launch vehicle but will place into a precisely related orbit, the Agena stage of the Atlas/Agena rocket—target for the rendezvous.

The tracking antenna for the radio guidance system, which transmits guidance signals, was developed by the G-E Ordnance Department. The tracker's unique gearless power drives permit exceptionally smooth and accurate operation at the extremely low rates of rotation required to track missiles.

MISTRAM, a missile trajectory measuring system developed by RGO, is currently used to monitor performance of launch vehicles.

The efforts of the Electronics Laboratory, headquartered in Syracuse, produced a visual spaceflight simulator now in use at Houston.

The simulator is expected to play a significant role in the design programs of manned lunar exploration vehicles by simulating on a television screen the scene an astronaut will see during approach and touchdown phases of lunar missions.

The results of the flight simulations will contribute to the evaluation, analysis and confirmation of operating characteristics of the vehicle before it is built.

A major part of the simulator is a computer display detailing electronically programmed landscapes.

G-E motors will power two 12-million pound crawler-transporters designed to carry the 360-foot Apollo launch vehicles from an assembly area to the launching pad. The crawler-transporter—larger than a baseball diamond—will have more than 7,500 horsepower to move its gigantic load at a rate of one mile per hour. The vehicle will carry the entire package—Saturn V launch vehicle, launcher and umbilical tower.

Providing flight and lunar landing training equipment for the NASA programs is another G-E contribution. Northrop T-38A aircraft, powered by two General Electric J85-5 turbojet engines, are used by astronauts to maintain flight proficiency.

At Edwards Air Force Base, a strange-looking machine called a Lunar Landing Research Vehicle (LLRV) has been making 10-foot high flights—a prelude to simulated Apollo lunar missions.

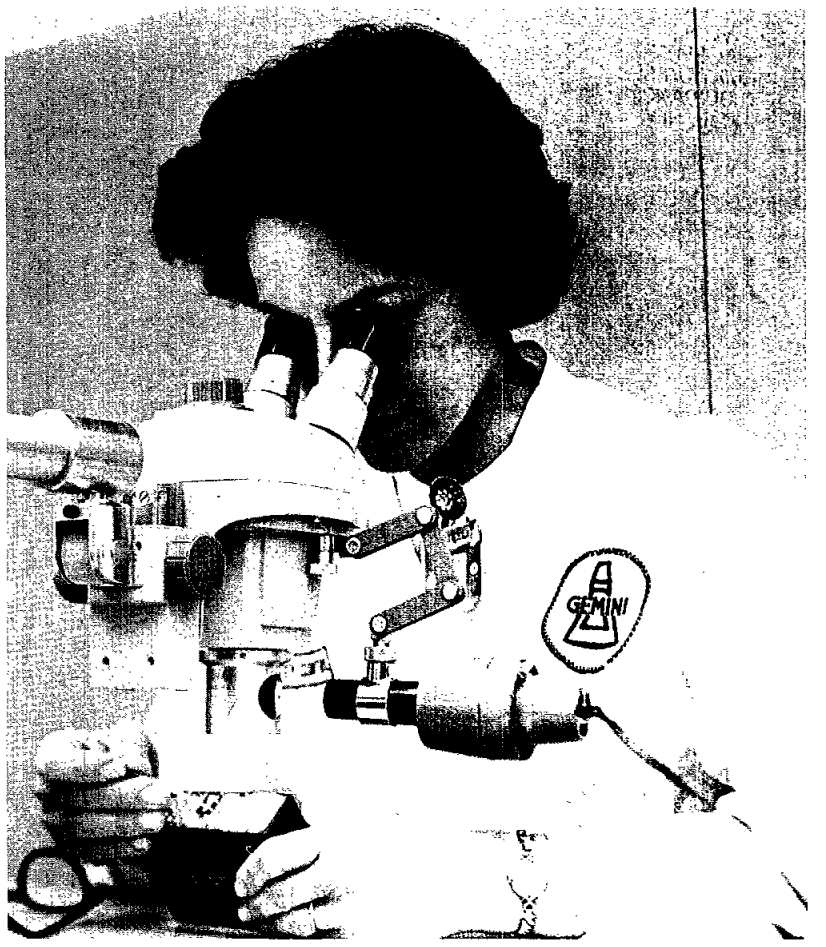
The LLRV, built by Bell Aerosystems, is equipped with a General Electric CF700 turbofan jet engine. The engine is used to cancel most of the earth's gravitational pull, simulating the gravitational pull of the moon which is about one fifth of the earth's.

The CF700 and J85 are built at G.E.'s Small Aircraft Engine Department in Lynn, Mass.

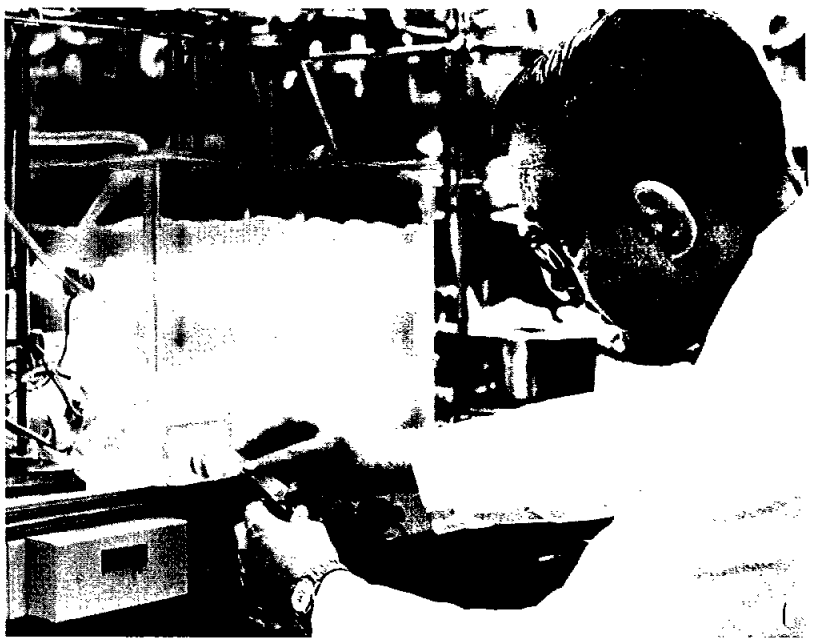
The company's Research Laboratory and Advanced Technology Laboratories are currently engaged in scientific and technological programs—such as the development of superstrong materials and a cryogenic motor designed to operate near absolute zero—to aid future space efforts.

General Electric is also deeply involved in basic research. Among such projects are a probing of space mysteries, including an asteroid search to learn their orbits and origin and studies of aurora australis, the Southern Hemisphere equivalent of the aurora borealis, or Northern Lights.

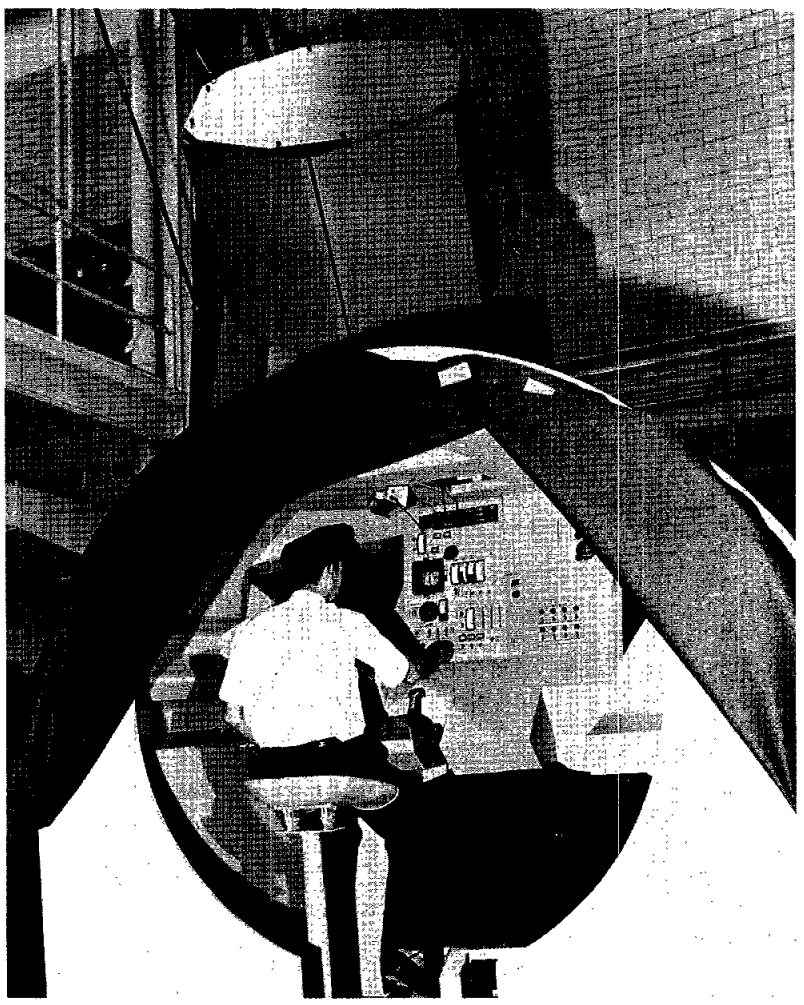
Potentialities of such research obscure at the present, may play an important part in space technology in the years to come.



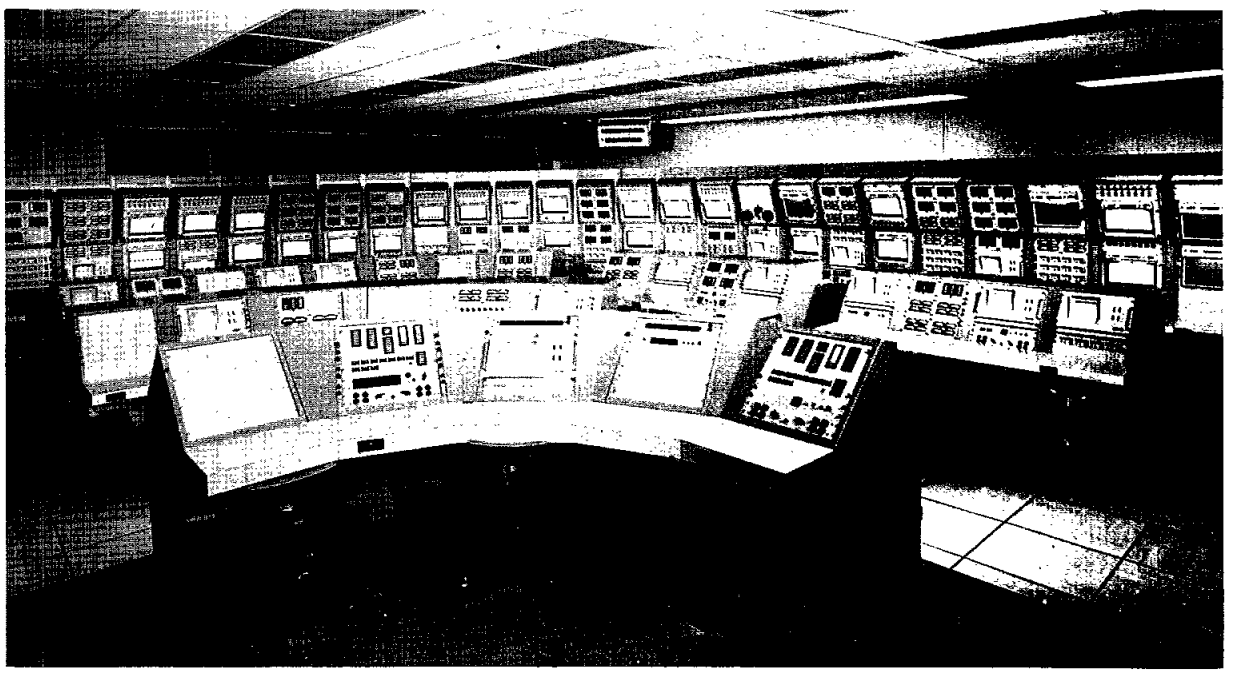
GUIDANCE SYSTEM CHECK—A General Electric test laboratory employee makes a microscopic check on components for the radio guidance system which will guide the Gemini launch vehicle. Extensive tests are made at the Radio Guidance Operation facility at Utica, N. Y. and again at Syracuse, N. Y. before equipment is sent to NASA.



"ALGAE FARM"—Space researcher taps an "algae farm" at General Electric's Space Sciences Laboratory, Valley Forge, Pa. The microscopic plants are a source of protein—and, in addition, produce oxygen and absorb carbon dioxide. They are under study for use in spaceships.



LEM SIMULATOR—A NASA engineer flies a simulated lunar landing from the mockup of the lunar excursion module cockpit. The spaceflight simulator at the Manned Spacecraft Center was designed by General Electric's Electronics Laboratory to help evaluate spacecraft landing equipment. The simulator produces a television image similar to the scene an astronaut would see looking from a series of windows in his craft.



ACE SYSTEM—Row on row of high speed, electronic equipment is provided by the Apollo Support Department to maintain an accurate and reliable system to test sophisticated spaceflight vehicles such as Apollo. G.E. has shipped four of ten Acceptance Checkout Equipment (ACE) systems. The control room of an ACE station is shown above.

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 . . . . . Paul Haney
Editor . . . . . Milton E. Reim
Staff Photographer . . . . . A. "Pat" Patnesky

On The Lighter Side

". . . and then, comrade, we finish by saying 'Our Lunar Soft Landing Was A SMASHING SUCCESS!!'"

Space News Of Five Years Ago

During May, 1960—Production of the manned space flight configuration of the Mercury pressure suit was started. The astronauts and medical personnel who had tested the developmental suits received in November 1959, recommended a number of changes to increase the physical mobility of the astronaut before the production effort began. Evaluation of the test suits with the suggested modifications indicated that the mobility and suit-spacecraft compatibility had been greatly enhanced. The stretching which had been a problem area had been significantly decreased.

—McDonnell delivered the flight-pressurized couches to be used in the animal phase of the Mercury flight test program. According to test results, the couches appeared to be satisfactory, with the exception of a slight sealing problem. McDonnell was attempting to resolve this problem.

May 31, 1960 – NASA selected Rocketdyne Division of North American Aviation to develop a 200,000-pound-thrust engine utilizing hydrogen and oxygen propellants. This engine is second only to the F-1 in single-thrust chamber level.

June 2, 1960—In considering the possible meteoroid damage to the Mercury spacecraft in orbital flight, it was concluded by the Space Task Group that damage likelihood was small even during periods of meteor showers. However, it was recommended that Mercury missions not be scheduled during forecasted shower periods.

June 3, 1960—As of this date, the funding status of Contract NAS5-59, for Mercury spacecraft, was $75,565,196.

June 8, 1960—A complete eight-engine static firing of Saturn was successfully conducted for 110 seconds at Marshall Space Flight Center, Huntsville, Ala.

SPACE QUOTES

SPACE ACCOMPLISHMENTS ARE PRODUCT OF A TEAM. Dr. Hugh L. Dryden, deputy administrator, Statement before Committee on Science and Astronautics, House of Representatives.

"In 1903, Orville and Wilbur Wright conceived, designed and built the first airplane to accomplish controlled, powered flight . . . For a number of years following that flight it was possible for any individual to learn and know all there was to know about aeronautics and airplane design . . .

". . . Today it is difficult, if not impossible, to identify the designer of one of our airplanes, or boosters, or spacecraft. It is the product of an organization of many specialists of many types; it is the product of a team. No member of the team has complete knowledge of the final product in all its detail. It has been estimated that over 45,000 scientists and engineers are directly engaged in our greatest space undertakings—the Gemini and Apollo programs."

MSC PERSONALITY

Homer Dotts A Contributor To Early Gemini Design

HOMER W. DOTTS

With a background of 24-years experience in aircraft design and operations research work, Homer W. Dotts, deputy manager, Office of Spacecraft Management, joined NASA in January 1962 as a design specialist during the early phases of the Gemini program.

Dotts began his designing career with the Curtiss-Wright Aircraft Corporation in Buffalo, N.Y., as design engineer on the P-36 aircraft for the Army Air Corps in 1938. This was to be the first major military contract for aircraft prior to World War II, with the order calling for 213 planes at a cost of $3-million. This was an unprecedented order for any type aircraft in those days, Dotts recalled.

From there he went on to work as a design engineer on the Army P-40 and the Navy SB2-C and then in 1940 he was named senior engineer in charge of all production structural design at Curtiss-Wright.

During the period from 1942 through the early part of 1945, Dotts also worked as an assistant project engineer on various aircraft which included the P-60, and the C-46 cargo plane.

In 1945 when Curtiss-Wright consolidated it's operations in Columbus, Ohio, he was named production engineer-in-charge of the Design Section. During 1948, Dotts was project engineer for the F-87 aircraft, and was later appointed as chief of design and developmental engineering at Curtiss-Wright.

Dotts aided in the organization of the Columbia Research and Development Corporation in Columbus in 1950 and left Curtiss-Wright to serve as vice-president and chief engineer of that organization until he joined NASA.

The company did research and developmental work that was primarily military in nature, utilizing various mathematical techniques in solving operational problems. The effectiveness, as well as the vulnerability of airborne weapons for the Navy and Air Force was the subject of studies by the company. Also, studies were made by the group of the logistical supply problems of the military.

Non-military projects of the company were concerned with designing automatic machines for parts assembly of electrical and hydraulic units by industry.

When he joined the NASA Space Task Group in 1962, Dotts worked first in the early phases of designing the Gemini spacecraft and later headed the Mechanical and Structural Design group in Gemini.

In his current assignment, which he assumed in November 1963, as deputy manager of the Office of Spacecraft Management, Dotts, in company with the manager, is responsible for all technical aspects of the development and qualification for flight of the Gemini spacecraft.

Under their direction is a group of highly trained and experienced design specialists who are each responsible for the development of the many systems and component assemblies of the spacecraft. This group is also responsible for postflight analysis of the performance of the Gemini spacecraft during each mission.

Dotts also serves as senior editor of mission evaluation of spacecraft for all Gemini missions. He also provides close attention to the needs of the Gemini spacecraft by taking an active part in the continuous review of the spacecraft's status, beginning at McDonnell in St. Louis and continuing until the actual flight.

He is an associate fellow in the American Institute of Aeronautics and Astronautics and served on the advisory board of the local chapter in 1964. He is also a registered engineer in the state of Ohio.

Dotts was born in Chicago, Ill., and attended Main Township High School in that city. He received a BS degree in aeronautical engineering from the University of Michigan in 1933.

Dotts is married to the former Erma McLane of Chicago, and the couple has two sons and a daughter. The two sons are married and their daughter Marilyn who is a junior studying education at the University of Houston, resides with the couple at their home in Nassau Bay.

His oldest son Wilfred is an engineering physisist specializing in infrared technology and is working with the Navy. He and his wife have two sons.

Robert, Dotts' youngest son is employed here at MSC as a mechanical engineer in the Structures and Mechanics Division and is presently a graduate student at the University of Houston on a NASA scholarship. He and his wife have a daughter.

Fishing is Dotts' favorite sport and hooking a king fish from his 21-foot boat in the Gulf is quite a thrill he said.

His position at MSC requires considerable traveling and to help absorb his free time on flights and while on TDY, he enjoys playing duplicate bridge with his fellow travelers.

Welcome Aboard

During the last reporting period, 21 new employees joined the Manned Spacecraft Center.

Center Medical Office: Dora L. Booth, Josephine F. Causey, and Charles J. Howard.

Office of Administrative Services: Beverly C. Hildebrand.

Office Services Division: Tony Gomez and Marion H. Wickware.

Procurement and Contracts Division: Eileen W. Bigham and Nancy L. Rimmer.

Personnel Division: Karen M. Hall, Janice G. Hunter, and Patricia L. Wightman.

Photographic Division: Shirley J. Roberts.

Crew Systems Division: Juanie Jo Smith.

Computation and Analysis Division: Judy E. Immel, and James L. Talbert.

Flight Control Division: Charlotte A. Thomas.

Landing and Recovery Division: Susan L. Collins.

Mission Planning and Analysis Division: Cecilia C. Ramirez.

Flight Support Division: Joseph W. Griffin.

Apollo Spacecraft Program Office: Helen S. McMillian (Downey, Calif.), and Mary E. DeLoach.

Dr. Berry

(Continued on Page 3)

Program Chairman for next year's meeting in Las Vegas.

At the meeting, Dr. Berry described the GT-3 medical results and moderated a panel discussion and briefing as a progress report on Project Gemini. This featured Jim Correale, Crew Systems Division, on the Gemini extravehicular suit, and Dr. Lawrence Dietlein on medical experiments.

Carter Alexander, Crew Systems Division, wore the suit and was assisted by Paul Kiehl in a demonstration of its features. An audience of 750 watched the performance over closed circuit color television.

Gemini medical experiments equipment such as the exercisor, the waste management system, and the phonocardiogram or heart sound monitor were shown and described by Russell Hair of Crew Systems and Dr. Kenneth Beers, aerospace medical resident.

Dr. W. W. Kemmerer, Crew Systems Division, delivered a paper on "Drinking Water Supplies for Project Gemini Space Flights," Margaret Jackson, Crew Systems Division, presented a paper on her work with the Air Force on the effects of weightlessness, and Dr. John Zieglschmid, aerospace medical resident, gave a paper on the effects of the use of drugs on pilot performance in aircraft.

LJII/BP22

(Continued from Page 8)

phere. The other was to demonstrate orientation of the launch escape vehicle to a relatively stable position with the main heat shield forward, using the canards, for proper deployment of the dual drogue parachutes.

During the flight May 19, the abort system automatically fired and carried the command module from 14,000 to an apogee of 19,000 feet, where the launch escape motor burned out and the spacecraft was lowered gently to the desert floor three miles down range by the parachute recovery system.

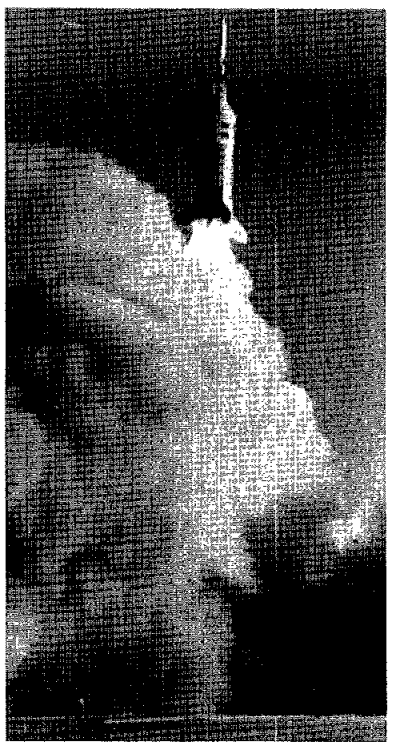
With the firing of the 155,000 pound-thrust launch escape motor, the command module was separated from the service module and whisked a safe distance away from the Little Joe II launch vehicle. The small pitch control motor mounted in the forward section of the escape system fired simultaneously to place the spacecraft in the correct flight trajectory.

Several seconds after firing, two wing-like canards mounted near the nose of the launch escape system deployed. After the spacecraft passed through its apogee of 19,000 feet, the canards reduced vehicle tumbling and stabilized the vehicle in a blunt-end-forward condition.

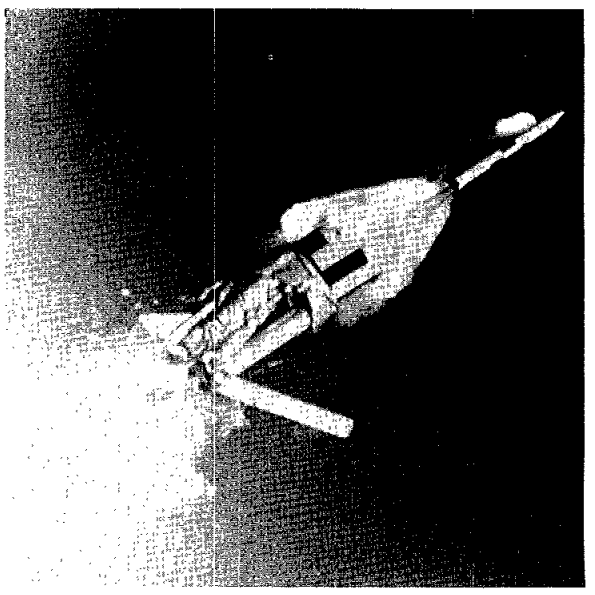
After launch escape motor burnout, explosive bolts separated the launch escape tower, with the command module's boost protective cover (designed to protect the Apollo from the blast effects of the escape motor), from the spacecraft. Then the tower jettison motor fired, pulling the tower and spent escape motors clear of the spacecraft's trajectory.

Drogue chutes were then unreefed to slow and stabilize the command module for main parachute deployment. The drogue chutes were released and pilot chutes were deployed. These, in turn, extracted the three main parachutes which lowered the command module gently to the ground approximately three miles north of the launching site.

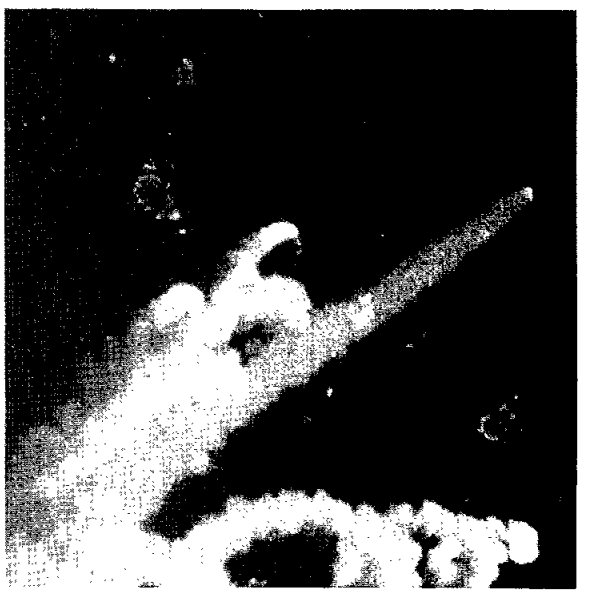
According to Dr. Joseph Shea, manager, Apollo Spacecraft Program Office, "this test gave us a free demonstration of the effectiveness of the launch escape and recovery systems under actual, unscheduled emergency conditions."



LITTLE JOE II/BP 22 LIFTOFF



UNEXPECTED LES TEST—As the Little Joe II launch vehicle begins to break up, the Apollo launch escape system automatically takes over and pulls the Apollo away from danger. The three first stage algol rockets had already exited through the skin of the Little Joe and the second stage algols are shown falling away.



ALGOL ROCKETS—The three first stage algol rockets can be seen as they spiral away from the launch vehicle after breakup of the Little Joe. The launch escape motor with its payload makes its exit toward the upper right. The breakup occured after an abnormal roll rate began some 25 seconds after liftoff.

SEPARATION—The launch escape tower, command module boost protective cover and command module are shown just after separation.

Apollo Suit Being Developed Here By Crew Systems

The space suit for the lunar landing mission is the only operational equipment which must be designed to go all the way to the surface of the moon and return to earth.

LATEST APOLLO SUIT—The latest design of the Apollo suit for the lunar mission is worn by a Hamilton Standard engineer. The portable life support system backpack, which is to provide life support for the astronaut on the lunar surface, can be seen over the engineer's right shoulder.

The Apollo suit, being developed by Crew Systems Division here at the Manned Spacecraft Center, for use on the lunar surface is not a single garment, but an integrated series of garments. It is designed to provide the astronaut the best possible protection against the environment he will encounter on the lunar surface.

The entire suit is called the Extravehicular Mobility Unit and it must shield its occupant against extremes of temperature from minus 250 degrees Fahrenheit to plus 250 degrees Fahrenheit. Micrometeoroids and the complete vacuum of space are two other hazards it must withstand.

The well-dressed astronaut would wear the following assembly when he steps onto the lunar surface.

The first layer is a liquid cooled undergarment. Through earthbound tests, scientists have determined the heat load an astronaut would generate while working on the lunar surface. The best method of cooling the astronaut under these conditions is by circulating cool water through small tubes which are in direct contact with the skin.

The second layer of the astronaut's attire is the pressure garment or the actual suit assembly. It must be pressurized while the astronaut is on the lunar surface to protect him against vacuum. The soft pressure garment tends to take a spherical shape when pressurized, so joints must be built into the suit to provide mobility.

Covering the pressure suit is micrometeoroid protection garment. It is composed of lightweight materials arranged to provide as much protection from meteoroids as a thin sheet of aluminum.

The astronaut's attire is completed with a thermal overgarment composed of many thin layers of superinsulation with a white synthetic fabric as an outer layer. Thermal mittens protect the hands and are provided with slit openings in the palms to permit egress of specially insulated gloves when tasks requiring finger dexterity must be performed.

The suit, including the thermal and micrometeoroid garment, weighs less than 50 pounds. The backpack which supplies oxygen and ventilation to the astronaut on the lunar surface weighs 60 pounds, and emergency oxygen and commmunications weigh ten pounds.

While wearing all this equipment, the astronaut must be able to walk over the surface and perform many tasks.

The suit unit was taken to Bend, Ore. recently to be tested in terrain similar to conditions expected to be found on the moon. The tests indicated that some joint areas, particularly in the thigh and ankle, need improvement to allow the man to move and perform assigned tasks more easily.

MSC engineers are pursuing a development program to cut down weight and bulk of the outer layers to provide more mobility and several alternate approaches have been suggested.

In one concept, micrometeoroid and thermal protection would be integrated as additional layers to the basic Apollo suit, as the Gemini extravehicular suit is constructed. A second approach combines the two types of protection into the basic suit below the waist, and the astronaut wears a separate covering on the upper part of the body.

Protection for the astronaut's eyes must also be considered as part of the pressure garment assembly. Without any atmosphere to scatter and cut down the power of the sun's rays on the lunar surface, the astronaut is exposed to visible, infrared, and ultra-violet rays. Solar reflection from the space suit, the lunar excursion module, or scientific equipment can produce a blinding glare. Dark adaption problems will be created by the transition from light to shadow in sunlit areas.

As a solution to these visual problems, an adjustable visor has been designed on the helmet. It operates similar to a sun visor in an automobile, and can reflect 80 to 90 per cent of visible light, 60 to 80 per cent of infrared rays, and nearly all of the ultraviolet rays. An inner and outer visor arrangement prevents fogging due to temperature extremes.

While the Apollo suit is undergoing its development period, the Gemini suit is being qualified for early earth orbital flights.

With small modifications, Gemini suits will also be used for early Apollo earth orbital missions to allow design engineers to concentrate on development of the Apollo suit for lunar trips.

The major development effort remaining for the Gemini program is the extravehicular suit. In later Gemini missions, the astronaut will step outside his spacecraft for the first time, protected only by his pressure suit.

For micrometeoroid protection, a cloth material which will stop penetrating particles has been developed for Gemini. The Gemini suit will be qualified for vacuum and extreme temperature operation in the 35-foot diameter vacuum chamber at the Manned Spacecraft Center.

Since the beginning of manned spaceflight programs by the U.S., the development work in suits has had two goals—first, to protect the man inside the spacecraft cabin in case of a loss of pressure; second, to provide protection for the man venturing outside into space. An investment of $12 million in developing pressure suits for Gemini and Apollo has already been made by the U.S.

Without the space suit to protect man, the national goal of walking on the surface of the moon and gathering the scientific information cannot be met.

Ever since the late President Kennedy expressed our national purpose in reaching the moon, MSC has been working on suits which can support man in true space as found on the lunar surface.

Space News ROUNDUP!

SECOND FRONT PAGE

Apollo Boilerplate 22

Launch Escape System Test Provides Unexpected Realism

An unexpected test of the Apollo launch escape motor was demonstrated more realistically than planned during a launch of the Little Joe II vehicle that was to carry an Apollo boilerplate 112,000 feet above the ground at White Sands Missile Range in New Mexico, May 19.

Because of a failure aboard the Little Joe II booster, an abnormal roll rate began, causing centrifugal force to build up and destroy the booster at 14,000 feet, some 25 seconds after launch.

The abort system was automatically fired carrying the command module to safety. Two solid propellant rocket motors, saved the day, as they would should a launch vehicle malfunction occur in a manned launch.

These motors are the first major subsystem components to be fully "man-rated," that is, qualified to be used in an actual manned launch.

In the scheduled test, the launch escape system was to have carried the Apollo Boilerplate 22 spacecraft from 112,000 feet to an altitude of about 175,000 feet. The spacecraft was expected to land about 110 miles uprange.

The flight had two main objectives. One was to determine performance of the launch escape vehicle at an altitude approximating the upper limit of the canard subsystem (used to orient the Apollo command module aerodynamically in an escape situation in the atmos-

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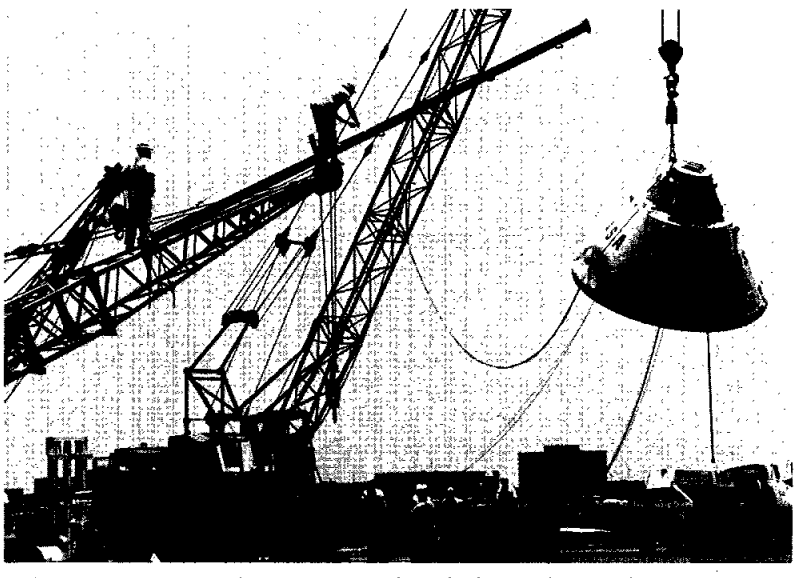
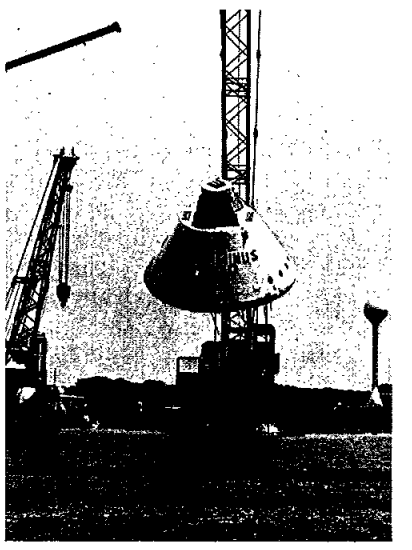
LANDING AREA—The Apollo Boilerplate 22 command module is shown a short while after making its landing about three miles from the launch pad. The main parachutes and lines are spread out in the foreground.

SAFE LANDING—After making a landing that was described as well within the limits for survival had astronauts been on board, the Apollo Boilerplate 22 command module is examined by John M. Trebes (right), Landing Technology Branch, Structures and Mechanics Division, and Astronaut Alan L. Bean.





DROP PREPARATIONS—Riggers (above) from the Technical Services Division make preparations for the May 12 drop of the Apollo command module in a test of a landing rocket system. The sequence of photos at the right was taken of the drop.

Landing Rocket System Tests Performed Here With Apollo

The first development test of a possible landing rocket system for the Apollo spacecraft was successfully performed here May 12 with the drop of boilerplate spacecraft from a crane into a 700,000 gallon water tank.

The 15-foot deep tank, located on the northwestern edge of the Manned Spacecraft Center, was built by the Facilities Division for the tests. It is 130 feet on a side, with 3-foot high retaining walls, and is lined with a plastic material.

The boilerplate was fitted with two pair of rockets and an 8-foot long altitude sensor. The rockets were mounted outside the pressure vessel in the outer rim of the heat shield and the thrust vector of the rockets was alined with the gravity vector of the spacecraft.

The rockets are identical to those used with the parasail boilerplate, each one producing 6,000 pounds of thrust. They are being tested as a possible method of attenuating landing loads for Apollo.

Structural reinforcement of the heat shield area of Apollo is the present solution for preventing damage to the spacecraft in a rough water landing. If the landing rocket system proves desirable, it would cut several hundred pounds from the weight of the Apollo command module, in addition to providing an improved emergency and landing capability.

A second test was conducted last Friday. Only three of the four motors were to be fired in the second test to determine the amount of attenuation with a partial failure of the rocket system.

In both tests, the boilerplate was to be instrumented with 14 pressure transducers on the bottom of the heat shield and accelerometers and rate gyros inside the spacecraft. Lead weight was used to ballast the boilerplate to 10,000 pounds to give the vehicle a drop rate of 30 feet a second.

The Apollo boilerplate was dropped from 22 feet at a 27 degree angle which is the same angle at which the Apollo command module is suspended from its parachutes.

Project engineers for the testing were Jack Lands and Jerry McCullough from Structures and Mechanics Division's Landing Dynamics Section headed by Harold Benson.

Rockets for the tests were developed by the Propulsion and Power Division and installation and instrumentation wiring for the firings was by the Hazardous Materials Branch of Technical Services Division. Roger Messier was in charge of the installation by his group which included Gene Waldron, Ken Easley, Jim Bailey, Larry Magers and Bill Hodge.

Buildup of the Apollo boilerplate spacecraft for the tests was performed by Fred Furey and Harold Siegfried of the Field Test Branch of Technical Services, and rigging for the drops was handled by Charlie Vernon, Sonnie Porter and James Martin.

Marvin Perry, assisted by Gene Zetka and Gerald Flanagan of Instrumentation and Electronic Systems Division provided the recording instrumentation for G load, pressures on the heat shield, angular rates, and impact of the spacecraft.