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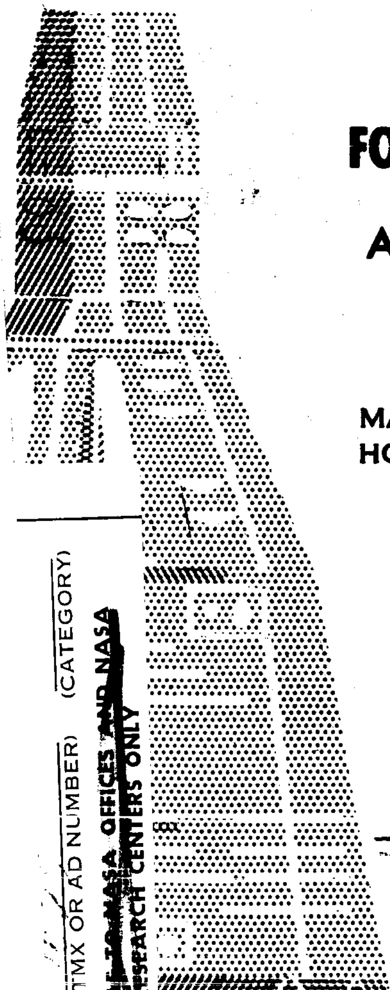
PROJECT GEMINI

QUARTERLY STATUS REPORT (U)

NO. 14

FOR PERIOD ENDING

AUGUST 31, 1965



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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
GEMINI SPACECRAFT PROGRAM
QUARTERLY STATUS REPORT NO. 14
For
PERIOD ENDING AUGUST 31, 1965
By Manned Spacecraft Center

INTRODUCTION

This status report is the fourteenth in a series of reports for the second NASA manned spaceflight program, Program Gemini. The reporting period is from June 1, 1965 to August 31, 1965.

SUMMARY

Gemini IV was launched June 3, 1965 and recovered June 7, 1965. The mission was controlled from the Mission Control Center (MCC-H) at the Manned Spacecraft Center, Houston, Texas. All subsequent Gemini missions will be controlled from the MCC-H.

Gemini V was launched August 21, 1965 and recovered August 29, 1965. Gemini V was the first mission in which a fuel cell was used to supply electrical power to the spacecraft. The operation of the fuel cell was satisfactory.

Manufacturing, testing, and delivery of equipment for the Gemini program and the training of personnel are, essentially, on schedule.

SPACECRAFT

MANUFACTURING

Spacecraft 7 - Final assembly and SST have been completed. Final inspection and cleanup in preparation for shipment to Cape Kennedy have begun.

[redacted]

Spacecraft 8 - Final assembly has been completed, and Phase I of SST has begun.

Spacecraft 9 - The RCS, R and R, and cabin sections are in final manufacturing and assembly stages.

Spacecraft 10 - Interim assembly of the cabin section has been completed, and final assembly is in progress. Structure build-up of the RCS and the R and R sections is in progress. Adapter structure build-up has been completed.

Spacecraft 11 - Cabin section structure build-up and interim assembly are in progress. Adapter structure build-up is being accomplished.

Spacecraft 12 - Cabin section structure build-up is in progress.

CONFIGURATION

Changes in spacecraft configuration made during the reporting period were minor except for the following:

1. Extravehicular activity equipment was deleted from spacecraft 6.

2. A third 400 ampere-hour battery was added to spacecraft 6.

3. Effective on spacecraft 8 and subsequent spacecraft, an auxiliary tape memory system is being incorporated into the computer.

4. Effective on spacecraft 8 and subsequent spacecraft, a tank is being provided in the adapter for storage of regular drinking water instead of using fuel cell product water for drinking.

5. Experiments MSC-4 and D-5 were integrated into spacecraft 7.

6. Experiment D-16 is being integrated into spacecraft 11 and experiment D-5 is being deleted from spacecraft 11.

7. Experiment MSC-4 is being deleted from spacecraft 10.

8. Experiment D-16 is being deleted from spacecraft 12.

[redacted]

WEIGHTS

During the reporting period, the Gemini VI spacecraft launch weight was decreased 12 pounds from 7694 to 7682 and the Gemini VII spacecraft launch weight was increased 155 pounds from 7807 to 7962. The major contributions to the weight changes were:

1. Two-day mission configuration for spacecraft 6

a. Deletion of extravehicular activity equipment, lb	-104
b. Addition of a third 400 ampere-hour battery, lb	+117
c. Weight adjustment (difference between actual and calculated), lb	-21

2. Fourteen-day mission configuration for spacecraft 7

a. Addition of experiments MSC-4 and D-5, lb	+15
b. Increase in OAMS propellant loading, lb	+126
c. Update photo equipment and tape recorder cartridges, lb	+11

STRUCTURES

During this quarter a modified spacecraft nose fairing was qualified for the launch of spacecraft 5; and major target docking adapter tests were initiated.

Trajectories of the ejected spacecraft nose fairing were unsatisfactory during its initial development because the energy supplied for ejection (45 seconds after BECO) was spent in deforming the fairing rather than in propelling its mass. Stiffening the fairing and optimizing the propellant charge resulted in satisfactory performance. The modified fairing was determined to be qualified for the Gemini V launch after 26 development, and 12 qualification ejections.

The target docking adapter (TDA) impact, latching, and functional tests were initiated the latter part of June 1965 on two static articles. Component qualification tests on the mooring drive system and the latch release actuator were also accomplished.

[redacted]

Twenty-three TDA impact tests were performed under critical load conditions. The impact tests proceeded satisfactorily and there were no structural failures. Ten additional impacts were performed to verify previous quarter-scale test results regarding latching ability for critical impact attitudes. These tests correlated well, with seven of the ten impacts resulting in engagement of at least two latches.

Functional and environmental tests of the mooring drive system and latch release system exposed a number of problems, which have since been corrected. Among these, the mooring drive system had a marginal power capability at minimum voltage. The condition was corrected by increasing the power approximately 40 percent. The brake coil of the motor (which is in series with the field winding) was rewound, providing more current through the field winding. A second problem was that the mooring drive system was susceptible to corrosion in the gear boxes. To correct this condition, the Molykote X-106 dry film on the gearing and bearings was stripped off, and the gear boxes were sealed and packed with Versilube G-300 silicone grease. A third problem was that the latch release actuator was not sealed sufficiently to pass the humidity qualification test. In addition, the mechanism exhibited a tendency in which the brake failed to release the armature. This was corrected by replacing the Teflon dynamic seal with a Buna N seal, employing RTV-20 at the static seal joints, and reconfiguring the brake disc to relieve binding tendencies and reduce the braking frictional surface area.

HEAT SHIELD

Data from Gemini flights have been incorporated into digital computer programs to more accurately calculate heat-shield temperatures which would be obtained from given orbits. These orbits are specified on a velocity versus flight-path angle plot and serve to define safe orbital reentries. The heat shield exhibited satisfactory performance on the Gemini IV and Gemini V missions.

PYROTECHNICS

An error was noted in Quarterly Status Report No. 13 for the period ending May 31, 1965. The second paragraph on page 6 indicates that both pilot and drogue mortars were equipped with aluminum breeches and CTI cartridges. The statement is erroneous and should read:

> "CTI cartridges with an aluminum breech were installed in the drogue parachute mortar on spacecraft 4, while ORDCO cartridges with a steel breech were installed in the pilot parachute mortar."

Spacecraft 5 and subsequent spacecraft also have this configuration.

The ballute and drogue aneroids failed to pass the revised 14-day humidity qualification test conducted at the end of the previous reporting period. On August 20, 1965, a new test was initiated using refurbished aneroids from spacecraft 4 and revised conditions of temperature and humidity established from the Gemini IV mission. It should be noted that all aneroids on spacecraft 4 were postflight checked prior to refurbishment, and they functioned within acceptable tolerances.

During preinstallation acceptance testing (PIA) of the mild detonating fuse (MDF) interconnects on spacecraft 5, X-ray examination indicated a manufacturing deficiency. The lines in question were returned to McDonnell Aircraft Corporation for evaluation. As a result, all MDF lines are being remanufactured by Central Technology, Inc. (CTI) under new manufacturing procedures with new part numbers, effective with spacecraft 6.

LANDING AND RECOVERY SYSTEMS

Parachute Landing System

The landing system on the Gemini IV and Gemini V missions performed as designed. Additional information may be obtained from NASA MSC reports MSC-G-R-65-3 and MSC-G-R-65-4.

Postlanding Habitability Tests

Water suitability tests to determine the adequacy of the redesigned snorkel valve shroud were conducted in the Gulf of Mexico on May 12, 1965, by the MSC Landing and Recovery Division. A boilerplate Gemini vehicle was utilized. The unshrouded snorkel valve accumulated a maximum of 73cc of sea water in 100 minutes. The shrouded valve did not leak any sea water. The new shroud will be installed on spacecraft 5 and subsequent.

[redacted]

Recovery Operations

A meeting to review the MSC Recovery Operations Manual for the Gemini V mission was held on July 16, 1965, at MSC. MAC report PS186 "Corrosion Control Procedures for Recovered Spacecraft" was also reviewed and approved. The final requirements for recovery and disposition of experiments and crew station stowed equipment were discussed.

EJECTION SEAT SYSTEM

Difficulty with installation of the drogue mortar safety pins experienced during the Gemini IV mission resulted in a modification to facilitate their installation. This modification is being incorporated in all spacecraft, beginning with spacecraft 5.

The egress kit has been further modified to reduce the frontal height by approximately 2 inches. This reduction will greatly facilitate spacecraft ingress after extravehicular activity (EVA). The modification is to be incorporated in spacecraft 8, and those to follow.

A review of postlanding safety procedures revealed the potential problem of snagging the suit leg on the safing pins which were stowed on the seat/man separator device during flight. As a result, the pins were deleted.

ENVIRONMENTAL CONTROL SYSTEM

The performance of the environmental control system (ECS) during Gemini V was satisfactory with all parameters within specification throughout the flight. The system provided cooling in excess of crewman metabolic heat loads after approximately 1 day of flight thus requiring adjustment for comfort, and satisfactory adjustment was made.

Considerable analysis and testing has been accomplished relative to the lightweight pressure suit to be used during Gemini VII and possibly removed during flight. The system will adequately support the lightweight suit configuration; however, sufficient data are not available to predict the crewman comfort with the suit off. Additional tests to determine the comfort with the suit off will be conducted during the next reporting period. The cabin outflow valve is being modified to add a "stopper" so a single failure of the valve will not result in loss of cabin pressure.

[redacted]

Reliability demonstration testing at AiResearch Manufacturing Company is complete except for one 14-day simulated mission. This test is scheduled to start on September 11, 1965.

CREW INTEGRATION

Crew Station Design

The Gemini IV and V missions verified that the Gemini crew station was satisfactory for long duration flight; however, there were some problems encountered for which corrective action was initiated. These items included the following:

1. Difficulty in closing the hatch after the successful extra-vehicular operation in Gemini IV led to the redesign of the hatch lock actuating mechanism. The improved gear and linkage was incorporated in spacecraft 6 and subsequent. In addition, the hatch closing lanyard was strengthened, and a hatch holding aid was incorporated.

2. Another modification to facilitate extravehicular ingress was a further reduction in the height of the egress kit in the ejection seat. This new egress kit is being incorporated in spacecraft 8 and subsequent.

3. Inability to turn the communication system volume all the way down caused the Gemini IV crew some difficulty in sleeping. A separate switch was incorporated in the voice control center of spacecraft 5 and up in order to turn off all audio transmissions to either pilot for sleeping.

4. A separate on-off control switch for the voice tape recorder was incorporated in spacecraft 5 and subsequent. This switch permits the recorder to be operated independently of the mode selector switch on the voice control center. Also, the voice recorder out-of-tape light was relocated to the center instrument panel on spacecraft 5 and subsequent to be visible to both pilots.

5. The lack of a universal time reference display onboard the Gemini spacecraft caused unwarranted inconvenience in flight planning and recording events in real time. To eliminate the need for converting from elapsed time to Greenwich mean time in future missions, a mission elapsed time display is being incorporated in spacecraft 6 and subsequent. This elapsed time indicator will start automatically at lift-off and will display mission elapsed time up to 999 hours, 59 minutes and 59 seconds. Mission elapsed time will be used as the primary time reference on future missions.

[redacted]

6. The cryogenic oxygen pressure indicator caused some difficulty in the Gemini IV mission since the normal system pressure reading was very close to the upper limit on the display meter. Because of the difficulty in redesigning the meter scale on a short-time basis, the transducer range was increased for spacecraft 5 and subsequent. This modification eliminated the confusion resulting from critical pressure changes at or very close to the limit of the meter scale.

7. As a result of the problems encountered in light contrast between the cabin interior and the outside on Gemini IV, window sun filters were incorporated in spacecraft 5 and subsequent. The Gemini V crew found these filters effective in blocking unwanted illumination from the sun or the earth during day-side operations.

8. The Gemini IV crew found the illumination from the cabin utility lights to be inadequate for orbital use. Parabolic reflectors were added to the lights for spacecraft 5 and subsequent to increase the illumination to the proper level.

9. The dry waste stowage bags carried on the Gemini IV mission were found to be invaluable for housekeeping in orbit. Additional stowage bags of the same type were incorporated in subsequent spacecraft.

Flight Crew Equipment

The optical sight was used effectively in the Gemini IV mission for tracking ground objects; however, the intensity was inadequate against bright earth or cloud backgrounds. The sight intensity was increased, and an additional dimming resistor was provided for compatibility with dark-side operations. Evaluation during Gemini V showed the modified sight to be satisfactory for both day- and dark-side operations.

Orbital photography with the 70mm Hasselblad camera was excellent on both Gemini IV and V missions. To extend the use of this camera, a 250mm lens is being added for Gemini VI and subsequent missions.

Similarly, a high-power telescope is being added to spacecraft 7 to increase the visual capability of the crew while observing other objects in orbit and on the ground.

An alternate lightweight headset design built by Pacific Plantronics was evaluated in the Gemini V mission and found to be substantially superior in operational use to the original lightweight headset. The Plantronics headset is being provided for all future Gemini missions.

[redacted]

The design of inflight check lists and data books has become fairly well standardized after the Gemini V mission. Although the contents of these books varies with the mission, the basic format includes 8 x $10\frac{1}{2}$ flight data books for detailed systems and experiments information, 8 x $5\frac{1}{2}$ flight books for flight plan and data log activities, and 8 x $3\frac{1}{4}$ flight data cards for quick reference check lists. The latter books and data cards are carried in the pockets of the pilots' space suits for ready access at all times. This combination of books and cards has proven best for Gemini flight application.

Space Suits

The G4C space suit was used successfully during the Gemini IV and Gemini V missions for both intravehicular and extravehicular use. The principle comments were related to the bulk of the extravehicular cover layer and the cumulative discomfort with long-term wear. The results of the missions proved that the G4C suit is safe, but that further improvements in comfort and mobility should be pursued.

A thinner micrometeorite cover layer was developed by the Crew Systems Division using space suit bladder cloth instead of ballistic felt for the intermediate layers. The extravehicular cover layers for future missions will be made of this thinner combination of material layers.

For long-duration wear and comfort, the Crew Systems Division has developed a new lightweight space suit design, the G5C space suit furnished by the David Clark Company. This suit is made from G4C materials and uses techniques developed in the production of G4C suits, except that the restraint layer is eliminated. Also, the helmet is a soft helmet design with an integral visor and no neckring. When not required, the helmet is unzipped at the neck and folded up behind the head. Tests have shown this lightweight suit to be a major improvement in comfort and normal mobility without sacrifice in basic pressure integrity or crew safety. This space suit will be used in the Gemini VII long-duration mission.

Food, Water, and Waste Systems

The Gemini IV mission was the first significant operational utilization of the Gemini space food. The freeze-dried rehydratable and bite-sized food items were found to be satisfactory, and the crew found eating to be an important part of the mission. Minor problems were encountered in leakage of orange juice, but all other food packages were satisfactory.

Because of the stowage limitations in the Gemini V mission, there was a preliminary effort to provide a diet made up exclusively of bite-sized items and beverages. Although this menu was satisfactory for stowage and for calorie content, actual food trials with the crew showed that they were unable to eat this type of concentrated diet continuously. By adjusting the calorie content slightly and providing increased food stowage volume, a food menu similar to Gemini IV was used for Gemini V. The flight results showed that the varied diet of rehydratable foods and beverages was received better by the crew than the highly concentrated bite-sized items.

Further progress was made in food packaging such that it will be possible to stow all the food required for Gemini VII, using a menu similar to Gemini IV and V, in the prescribed stowage containers.

The drinking water dispenser worked satisfactorily for most of the Gemini IV mission. Prior to the end of the mission the shut-off valve in the dispenser was difficult to operate and tended to hang up. This difficulty was traced to a bent barrel in the dispenser, and a higher strength aluminum was used in the dispenser for Gemini V to prevent this type of failure.

The water dispenser functioned satisfactorily in Gemini V; however, the lack of a system for measuring the crew's water consumption caused difficulty in analyzing fuel cell water production and in determining the available water storage volume remaining. The Crew Systems Division initiated a priority design effort to obtain a water dispenser which would measure the amount of water used. This design was completed, and a water dispenser which meters one-half-ounce increments of water is being procured for spacecraft 6 and subsequent.

The substantial urine spillage encountered in Gemini IV led to a complete redesign of the urine system for spacecraft 5 and subsequent. This new system, which consists of a portable receiver and collection bag, worked very well on Gemini V. The system design is now considered to be satisfactory, and similar systems have been incorporated in spacecraft 6 and subsequent.

The defecation equipment was satisfactory for Gemini IV and Gemini V missions.

Extravehicular Operation

The extravehicular operation of Gemini IV successfully demonstrated the operation and use of the extravehicular space suit, the life support system umbilical hose, and spacecraft ECS oxygen supply, and the hand-held maneuvering unit (HHMU). Because of the favorable results of the HHMU evaluation, planning and design efforts for subsequent extravehicular missions were oriented toward further evaluation of the HHMU with an increased propellant supply.

An extravehicular support package (ESP) was designed to provide an increased propellant supply for the HHMU as well as a source of primary breathing oxygen independent of the spacecraft ECS oxygen system. The ESP is an extravehicular back pack containing two 5000 psi tanks, a battery, and a UHF transceiver. One of the tanks contains primary breathing oxygen to supply the extravehicular life support system chest pack in lieu of the oxygen supplied by the umbilical hose assembly.

The other tank in the ESP contains Freon 14 for use as a cold gas propellant in the HHMU. With this Freon 14 propellant, the HHMU will provide an impulse of 750 pound-seconds, nearly twenty times the impulse available in Gemini IV. Use of the ESP will also permit the extravehicular astronaut to operate on a lightweight tether which is longer and less restrictive than the 25-foot oxygen umbilical hose assembly. The ESP is being incorporated in spacecraft 8, 10, and 11.

Extravehicular activity was initially planned for the Gemini VI mission. After reviewing the crew training and operational preparation activities for the first rendezvous mission, it was decided that EVA would be deleted from the Gemini VI mission. This deletion precluded any interference between extravehicular activity and the primary rendezvous objective of this mission. All removable extravehicular equipment has been omitted from spacecraft 6.

COMMUNICATIONS SYSTEM

The spacecraft communications systems operated satisfactorily during the Gemini IV and V missions.

The use of high-frequency (HF) voice communications was extensive during the Gemini V mission in comparison to previous missions. The objective of the HF tests was to evaluate the system as an emergency long-range link. The Gemini IV HF test results were inconclusive, and

[redacted]

Gemini V test data are still being evaluated. High frequency for voice or direction finding was not used during the postlanding phase of Gemini V because the HF antenna was not extended. The interphone circuit to the rescue personnel was used successfully during the Gemini V postlanding phase.

Minor changes incorporated in the communications system are as follows:

1. Effective with spacecraft 4, the voice tape recorder start function was removed from the communications mode switch (a new switch was added to the voice control center for this function), and a sleep switch was added to the voice control center to mute the earphones of one crew member at a time.

2. On spacecraft 5, the HF antenna switch was modified to include an "extend" position for the adapter antenna, a "postlanding" position for the reentry module antenna, and an "off" position (the "postlanding" position has a mechanical guard which must be removed prior to switching to this position).

3. Effective with spacecraft 6, a modification was incorporated in which the landing bus arm switch must be closed to extend the reentry HF antenna, and the HF antenna switch has "extend", "retract", and "off" positions.

Plantronics microphones were used successfully during the Gemini V mission in the command pilot's helmet, and in both of the lightweight headsets. Plantronics molded earpieces were used in the headsets.

TIME REFERENCE SYSTEM

During the Gemini IV and V missions, all elements of the time reference system performed normally and within the specified accuracy. The event timer was changed, effective with spacecraft 5, from a capacity of 99 minutes 59 seconds to a capacity of 59 minutes 59 seconds. An elapsed time clock is being developed, effective with spacecraft 6. There are no equipment delivery problems at this time.

[redacted]

INSTRUMENTATION SYSTEM

As a result of mylar drive belt breakages in the PCM tape recorders for spacecraft 5, 6, and 7 during spacecraft systems tests, an investigation was conducted by Radio Corporation of America (RCA). Two factors were found to adversely affect drive-belt life. The first and major factor was the method of trimming the drive belts to the proper width during belt fabrication. The RCA belt vendor trimmed the belts to the proper width by using an emery wheel. When these were tested along with drive belts made by slicing to final width, the emery-wheel-ground belts broke when 30 to 40 percent elongation was reached, while those made by slicing did not break until 90 percent elongation occurred. RCA also found that the drive-belt tension was the second factor affecting belt life. Using the emery-wheel-ground belts, it was found that with belt tensions larger than 1 pound, belt life was severely curtailed. With 3 to 3.5 pounds belt tension, the belts would fail in approximately 60 hours. The new belts have been tested by RCA, and did not fail until over 700 hours life had been reached. Drive belts for all PCM recorders are being replaced with the edge-sliced belts, and belt tension is now controlled to a maximum of 1 pound.

The PCM tape recorder in spacecraft 4 ceased recording during reentry when the spacecraft was at 2000 to 3000 feet on the main parachute, as if caused by a power failure. Spacecraft testing of the wiring, switches, and circuit breakers; tape recorder testing under vibration, and high and low temperature extremes; and endurance (over 700 hours run time) testing have not revealed any mode of tape recorder failure. It is concluded that the flight crew inadvertently turned the tape recorder power control switch off, and turned it back on after being on the water, with the dc-to-dc converter off.

ELECTRICAL SYSTEM

Performance on Gemini IV and Gemini V

On Gemini IV, a chemical (silver-zinc) battery system supplied nominal electrical power to all systems on the main busses for all phases of the mission. There were two malfunctions related to the isolated bus system. The manual retrofire did not function, and RCS thruster no. 5 failed to operate. Testing following the flight did not reveal any anomalies in the manual retrofire circuitry, which remained with the reentry vehicle. The investigation of the RCS thruster circuitry uncovered an open wire with evidence to show that it had received abusive handling.

Attention given the fuel cell power system during the Gemini V mission was due to the heater failure in the reactant oxygen supply early in the flight, and hydrogen usage rates and water production rates calculated during the mission. None of these factors became a major problem. The oxygen cryogenic system operated successfully at the reduced pressures. From accurate computer determinations of ampere-hours following the mission, it appears that the hydrogen usage rate and water production rates calculated during the mission were high.

From examination of the Gemini data, there is evidence to show that a fault and resultant open in a wire to the cryogenic oxygen system did occur. Examination of remaining spacecraft wire and components after the flight revealed no anomalies. The failed area, therefore, stayed with the adapter module as expected.

Fuel Cell

As reported in the previous report, sections 1528(521) and 1531(522), allocated to spacecraft 5, were replaced by sections 1532(523) and 1533(524). Prior to beginning the horizontal spacecraft powered-up test in the vacuum chamber (Tenney), these sections were leak-checked. They were found to have gross leakage through the individual cell frames. Subsequent failure analysis showed evidence of extensive membrane drying, which could have caused the cell leaks. It should be noted that short screen cells with improved edge sealing have already been placed in production with effectivity of section 1537 and up. In addition, a procedure for biweekly leak-checking fuel cell sections in storage and maintenance of the cell water content was initiated.

Sections 1534(525) and 1536(526) were then installed in spacecraft 5 and powered-up in the vertical vacuum chamber (CBI) test on June 11, 1965. It had its initial activation on June 6, 1965. Third activation occurred on July 21, 1965, as part of the wet mock simulated launch test. A decay in performance of the sections observed at this time indicated that their performance at the times of scheduled launch and subsequent flight would be marginal. The spacecraft was demated and the sections were then removed from the spacecraft and returned to St. Louis for further testing. During wet mock, fuel cell product water was observed to be leaking from the module plumbing. The leaking lines and product water "B" tank were replaced and sections 1537(527) and 1538(528) were installed on the module. On August 4, 1965, the new sections received their initial activation from the fuel cell reactant supply system module in the demated condition. The product water valves were replaced, and the module was installed on the spacecraft. These sections were subsequently activated on August 18, 1965, for the scheduled launch of spacecraft 5 on August 19, 1965. During the hold, the fuel cells were kept on low loads (1 ampere per stack) until initiation of the count for the launch on August 21, 1965. Inflight performances of sections 527 and 528 were entirely satisfactory and consistent with previous ground tests. Details of their performance will be given in the Gemini Program Mission Report - Gemini V (MSC-G-R-65-4).

Prior to the wet mock, simulated launch with sections 525 and 526, checkouts of launch facility AGE and procedures were performed utilizing sections 1522(518) and 1531(522). The tests with 518 were a continuation of the simulation of spacecraft 5 procedures initiated in St. Louis. Section 522 joined 518 after the coolant contamination introduced by failure of 521 was cleaned up at the vendor (GE) facilities. During the flight of Gemini V, problems occurring in the reactant supply system led to off-nominal operation of its fuel cells. Sections 525 and 526 were tested, while the flight progressed, to determine the effect of these conditions. These sections were deliberately flooded by shutting the product water valves. A period of 39 hours was required to reduce their performance below acceptable levels. In addition, these sections were subjected to extensive periods of oxygen purging, open circuit operation and low reactant supply pressure. This series of tests indicated that sections 525 and 526 were capable of supplying Gemini V requirements.

Due to the corrosion problems associated with the water valves, a program was initiated to develop valves resistant to the product water. The initial approach taken was replacement of the affected materials by a more corrosion resistant alloy. The new alloy will require modified solenoids due to the changed magnetic properties.

Water samples resisting purification by the ion exchange column were analyzed. Identification of the impurities led to selection of new resins, which when used in series with the previous ion-exchange materials, clarified the water. A program with human volunteers drinking raw fuel cell water resulted in no apparent ill effects. The results of the program are still under analysis. Due to possible induced water system problems and the lack of any urgent requirement, all plans for utilizing the column and product water in the Gemini program have been terminated.

POSTFLIGHT INSPECTIONS

Spacecraft 4

The postflight evaluation of the spacecraft 4 reentry module was conducted at the Kennedy Space Center (KSC) from June 11 to June 25,

1965. The reentry module was received at the Cape in good condition. A detailed summary of the inspection is contained in NASA MSC Report MSC-G-R-65-3 "Gemini Program Mission Report-Gemini IV".

Spacecraft 5

A meeting was held at KSC on July 13, 1965, to incorporate final revisions to Cape SEDR F598-5 "Gemini Postflight Inspection and Cleanup-Spacecraft 5" and to discuss revisions to the spacecraft test request (STR) procedures for spacecraft 5.

The spacecraft 5 reentry module was recovered by the U.S.S. Lake Champlain on August 29, 1965. Certain items of equipment in the inertial guidance and instrumentation systems were removed, cleaned, and packaged to prevent further deterioration due to salt water immersion. The reentry module was returned to Mayport Naval Station, Florida, where the RCS was deactivated and the reentry assembly then flown to Cape Kennedy for the postflight evaluation.

GEMINI LAUNCH AND TARGET VEHICLES AND ASSOCIATED EQUIPMENT

GEMINI LAUNCH VEHICLE

General

Gemini IV was launched from Cape Kennedy on June 3, 1965. Launch vehicle performance was satisfactory. The only anomaly was a higher than predicted first-stage trajectory. This anomaly was caused primarily by higher than predicted thrust, even though the engine model was revised after GT-3 and the trajectory was reshaped.

Gemini V was successfully launched on August 21, 1965. Launch vehicle performance was satisfactory.

GLV-6 status.- The vehicle completed vertical test fixture (VTF) testing, and rollout inspection was accomplished on July 10, 1965. The vehicle was removed from the VTF on July 19, 1965, and weight-balance measurements were made on July 21, 1965. Delivery to Cape Kennedy was completed, and the vehicle was held in storage until the Gemini V launch.

[redacted]

GLV-7 status.- Erection of GLV-7 in the VTF was completed on June 28, 1965. Subsystems functional verification test (SSFVT) was started July 22, 1965, and completed August 20, 1965.

GLV-8 status.- Horizontal splicing was completed on July 9, 1965. Horizontal testing is in progress.

GLV-9 status.- Tank rollout inspection was held at Denver on July 28 and 29, 1965. Shipment to Baltimore was by rail between August 9 and August 16, 1965.

GLV-10 status.- Tank rollout inspection was held at Denver on August 24 and 25, 1965.

Flight Controls

A three-axis reference system (TARS) design review was conducted with SSD/Aerospace, Martin, and Gemini Program Office representatives at Minneapolis-Honeywell to review several manufacturing improvements for five new TARS packages. The improvements include X-ray of all mylar-type capacitors and all diodes and transistors, except the semiconductors used in the TARS timers. A similar review was conducted for the TARS timer at Texas Instruments to review quality and reliability for the new TARS.

The Reliability and Extended-Life Test Program for the malfunction detection system (MDS) rate switch package and the malfunction detection package are progressing satisfactory. The test program is expected to demonstrate that the rate switch package life can be extended from the present 500-hour limit to possibly 1000 hours.

Gemini Program Office representatives met with Aerospace and General Electric at Syracuse, New York, to review the postflight data analysis program in an attempt to determine the discrepancies between NASA's and General Electric's insertion parameters. Preliminary investigation indicates a possible lateral rate measurement bias problem or possibly a refraction problem that somehow affects the elevation and lateral rate measurements. Additional meetings are being conducted to determine these biases.

Propulsion

Engine status.- Two first-stage engines (serial nos. 1009 and 1010) and one second stage engine (serial no. 2009) were delivered during the reporting period. There were no significant engine problems during this reporting period.

[redacted]

Gemini stability improvement program (GEMSIP).- All engine testing planned under the GEMSIP program has been successfully completed. The first Gemini engine equipped with the GEMSIP injector (2009) was delivered during this reporting period. The two GEMSIP injector equipped engines for Titan IIIC flight test have been delivered with the first flight test scheduled for early December of 1965.

Qualification Status

All flight components of the Gemini launch vehicle have completed qualification testing.

ATLAS/AGENA VEHICLE

General

During this quarter, Gemini Agena target vehicles (GATV) 5001 and 5002 were delivered to the Eastern Test Range (ETR) on May 30, 1965, and July 26, 1965, respectively. Vehicle 5001 was ferried by a C-124, and vehicle 5002 by the Guppy. Vehicle 5001 was checked out at ETR as a flight unit, and on July 22, 1965, a simultaneous countdown and launch simulation demonstration (SLD) was held. This test covered almost all factors of a normal launch and performance of the Gemini Atlas Agena target vehicle (GAATV) systems was satisfactory. The test also included, for training purposes, postlaunch simulation of the GATV injection and the first orbit pass during the GLV countdown.

A failure in the MCC-Houston computer system caused a transmission to the GATV of several spurious commands. Some of these commands were valid and were accepted by the GATV. Fortunately, most of these were stored program command loads and there were no serious results. The count was held and later concluded successfully. This problem has been under investigation by all parties concerned.

Computer groups at ETR reported that no problems were encountered in switching the guidance equation trays from those for the GAATV to those for the GLV during the 90-minute period. After SLD, the Atlas vehicle and GATV were removed from the stand and returned to hangars. Atlas vehicle 5301 was returned to the stand on August 16, 1965.

After receipt of Gemini Agena target vehicle 5002, a complete check-out and composite interface test was run with the target docking adapter (TDA) in preparation for Plan X (radio frequency and functional compatibility tests). Plan X, including use of both the old and the new

GATV communications and control (C and C) equipment, were conducted from August 25 to September 1, 1965.

No significant radio frequency interference (RFI) or electromagnetic interference (EMI) problems were found to exist between the target vehicle and the spacecraft. A few internal anomalies were noted in both vehicles and corrective actions were taken. Most significant of these was a repetitive clockout (time remaining goes to zero) of the GATV's emergency reset timer, and a 1- to 2-second loss of telemetry when commands for the TDA cone to unrigidize were sent.

Complex C-10 and the Hangar E AGE were given a first article configuration inspection (FACI) during July and August. Some paperwork discrepancies were found but none which would compromise vehicle testing.

Gemini Agena Target Vehicle

Structures.- A series of four shroud separation tests were successfully completed during this period. A Gemini Agena target vehicle (GATV) shroud, modified with the tension band and stronger pivot brackets, was subjected to two separations each at the nominal and worst case conditions. No problems were found and the amount of debris from explosive bolts was small. Although data evaluation is still in progress, the test results indicate that the shroud system is fully qualified for flight.

During this period, discussions of possible damage to the horizon sensors led to a decision to change the timing for blowoff of the TDA transponder cover door. This operation now takes place at SECO instead of VECO and the timing circuitry has been changed on vehicles 5001 and 5002.

Some corrosion of the SLV-to-GATV mating flange has been noted at the ETR. This area was cleaned, thoroughly inspected, and sealed to prevent further damage. No flight problem presently exists.

Propulsion.- As of August 26, 1965, the last tests on the final configuration primary propulsion system (PPS) gas generator valves were completed satisfactorily. This concluded qualification of all propulsion system components. A review was made during August of Bell Aerospace Corporation (BAC) and Lockheed Missiles and Space Co. (LMSC) replacements of critical turbopump parts and a directive was issued by SSD that no further replacements of such parts were to be made without SSD approval. This decision was based on the fact that there was no established criteria for, nor control of, such repairs. Formal procedures will be provided for future work of this type.

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A high-pressure leak in the helium pressurization system prior to simultaneous launch demonstration led to replacement of most of the system plumbing and valves, and the pressure bottle. Analysis of the contaminants found revealed that improper cleaning and parts replacement had been performed on the vehicle helium system after use of the system during hot fire at the Santa Cruz test base.

Electrical.- As a result of earlier tests and studies, a series of running lights have now been designed and installed on the GATV. The set consists of three lights fore and aft on the GATV, with each group having a red, green, and amber light. The lights are 12 volt, 2 watts each, and like colors are alined. A timer circuit and two batteries were installed on GATV 5002 to allow reactivation of the lights after a preselected time in orbit.

Final design and installation of circuitry changes to the engine safing (arm/stop system) were also completed. With this new design, the engine can be armed or safed by ground command. In addition, with the proper mode of operation, a loss of spacecraft power through the arm/stop circuit will cut off or prevent engine secondary propulsion system (SPS) or PPS firings. Regardless of previous ground commands, the flight crew can fire or stop the propulsion systems by hardline command, once docked.

The forward power distribution J-box completed qualification tests and the aft power distribution J-box, aft signal conditioning J-box, forward signal conditioning J-box, and flight command logic package completed life testing during early August of 1965. Elevated stress and life tests on the forward power distribution J-box will not now be completed before the date set for the Gemini VI launch.

Communications and control.- A programer and command controller of the new-type C and C system were delivered to Cape Kennedy on August 14 and 16, 1965, respectively. These units were used successfully in Plan X efforts. During Plan X testing, it was noted that the old-type programer would not accept a binary one in the fourth bit of the time word. This was later traced, by tests at LMSC, to a shorted sense amplifier transformer and to a shorted resistor in the A-11 module of the memory load logic circuit. This programer will be repaired and returned to Cape Kennedy as a spare for vehicle 5002.

During this period, approval was given for circuit changes to the program to increase the triggering level of the logic and logic counter flip-flop circuits in the memory assembly.

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Guidance.- Final Massachusetts Institute of Technology (MIT) studies on docked stability, using the latest McDonnell Aircraft Corporation (MAC) damping data, have shown the GATV's flight control system to be marginal or unstable for main engine firings. Therefore, direction was given on August 2, 1965, to proceed with the design changes necessary to install a "lead-lag" circuit change into the flight control electronics package for all vehicles to be flown after 5002.

Atlas Launch Vehicle

The Atlas SLV-3 (vehicle 5302) arrived at the Cape on August 11, 1965 via truck and is undergoing checkout in Hangar J.

LAUNCH COMPLEX MODIFICATIONS

Complex 19

As a result of the difficulties encountered in lowering and raising the erector during the Gemini IV and V operations, the following steps have been taken:

1. The electrical drawings for the erector have been brought up to date.

2. All erector wiring and relays have been inspected and reidentified, and a large number of relays have been replaced.

3. Engineering and maintenance personnel have been trained for and assigned the responsibility for the operation of the erector. Preventive maintenance procedures have been updated and will be adhered to.

4. All relays required only for the operation of the second stage erector, which is no longer used, have been bypassed.

5. A thorough checkout of the erector systems will be included as an F-1 day procedure for each launch operation.

The installation of the dual propellant storage and conditioning system is now complete and operational. The equipment will be used for the Gemini VI and VII launch operations.

Two flowmeters, in a series arrangement in each fuel and oxidizer transfer line to the launch vehicle, will be used for the Gemini VI and VII launch operations. The use of these tandem flowmeters will provide a check on the calibrations of the meters while they are in use. The shed which houses the flowmeters on the complex was extended to cover the new installation.

The backup launch vehicle air conditioning equipment is operational. No further major modifications of Complex 19 are planned.

Complex 14

The complex became operational for the simultaneous launch demonstration (SLD) held in conjunction with the Gemini V wet mock simulated launch (WMSL). There were no significant complex problems during this exercise. No major modifications to the complex are planned.

FLIGHT EVALUATION

GEMINI IV

The Gemini IV Launch Summary Report, written at Cape Kennedy 2 hours after lift-off on June 3, 1965, reflected information obtained by voice monitoring the Gemini launch vehicle and spacecraft launch operations, and by coordination with mission control and launch operations personnel. Preparation of daily progress reports was accomplished at Houston from the same data sources plus limited quick-look data.

Systems personnel, monitoring mission progress in facilities adjacent to the mission operations control room (MOCR), had excellent access to mission information concerning individual areas of responsibility. This information was useful for orientation and direction of mission evaluation activities. Evaluation commenced on end-of-mission (EOM) plus 2 days and the Gemini IV Mission Report was distributed on EOM plus 33 days.

Due to the magnitude of data collected by the PCM telemetry system on a long duration flight, and the necessity for reducing this data with an interim reduction system at MSC-Houston, the GPO decided to utilize oscillograph data as a prime information source, and reduce by computer means only that data which related to selected time segments of spacecraft systems activity, experiment performance, and problem periods. Data was reduced principally at MSC-Houston; however, significant data reduction was accomplished by the Kennedy Space Center and the McDonnell Aircraft Corporation. The Goddard Space Flight Center and the Air Force Eastern Test Range provided essential support of oscillograph data reduction and magnetic tape formating and copying.

Seventy-one Spacecraft Test Requests (STR's) were generated as a result of the Gemini IV evaluation. The first STR was written on launch minus 1 day; but the majority were initiated during the first 2 weeks of evaluation. STR's were initiated immediately to resolve problems uncovered or defined during the evaluation, and to provide corrective action. Some results of STR action were partially available for consideration prior to completion of the Mission Report. The majority of test results were available subsequent to the completion of mission evaluation.

GEMINI V

Inflight reporting of Gemini V was conducted in the same manner as that of Gemini IV, except that additional monitoring facilities were established for mission evaluation team members in Building 12, and two special support teams were formed to provide systems support on the fuel cell and guidance and control systems to flight control personnel.

Mission evaluation, scheduled for 33 days, began on August 26, 1965, the fifth day of flight, and was to continue through the remainder of the reporting period. By the fifth day of evaluation, 31 STR's had been submitted, of which two were disapproved and one withdrawn.

Evaluation proceeded normally and completion was anticipated to be on schedule. A total of 36 known or suspected problem areas had been identified for resolution.

NETWORK COORDINATION

PROGRAM REQUIREMENTS DOCUMENT

Revision 15 to the Gemini Program Requirements Document (PRD) 3600 was published and distributed during the quarter.

A new document, the Program Support Requirements Document (PSRD) has been approved by the Operations Support Requirements Office (OSRO) at NASA Headquarters and the National Range Division (NRD) of DOD for levying mission requirements for Gemini VI. This document replaces the Mission Support Requirements Document that was required by OSRO for levying MSC support requirements for Gemini Missions IV and V. The majority of the PRD information is duplicated in the new PSRD.

GROUND NETWORK

The radar skin-tracking procedures which were being developed to support Gemini missions proved to be extremely successful. On Gemini Missions IV and V, the Manned Space Flight Network (MSFN) C-band radars were able to track the spacecraft in both the beacon and skin-track mode. As a result, it was possible to obtain tracking data when the spacecraft was powered-down and had no tracking beacons operating. The MSFN C-band radars and the North American Air Defense Command (NORAD) Space Acquisition Detection and Tracking System (SPADATS) radars provided track of the launch vehicle second stage from spacecraft separation until reentry. On the Gemini V mission, the NORAD radars also tracked the rendezvous evaluation pod and provided NASA with ephemeris and reentry data. These skin-tracking procedures have now been integrated into the network support plan for all remaining Gemini missions.

MISSION COMPLETED AND MISSION PLANNING

GEMINI IV MISSION SUMMARY

The second manned mission of the Gemini Program, Gemini IV, was launched from Complex 19 at Cape Kennedy, Florida, at 10:16 a.m. e.s.t. on June 3, 1965. The mission was successfully concluded on June 7, 1965, with the recovery of the spacecraft at 2:28 p.m. e.s.t. The spacecraft was manned by Astronaut James A. McDivitt, command pilot, and Astronaut Edward H. White II, pilot. The flight crew completed a 4-day mission in excellent physical condition, and demonstrated full control of the spacecraft and competent management of all aspects of the mission.

The major objectives of the Gemini IV mission were to demonstrate and evaluate the performance of the Gemini spacecraft systems for a period of approximately 4 days in space, and to evaluate the effects of prolonged exposure of the flight crew to the space environment in preparation for missions of longer duration. In addition, it was desired to demonstrate extravehicular activity, to conduct station-keeping and rendezvous maneuvers with the expended Gemini launch vehicle (GLV) second stage, to demonstrate the capability to make significant inplane and out-of-plane maneuvers, to deomonstrate orbital attitude and maneuver system (OAMS) capability to operate as a backup to the retrograde rocket system, and to execute eleven experiments.

All primary and secondary mission objectives were met with two exceptions. A decision was made late in the first revolution not to attempt the rendezvous with the expended Gemini launch vehicle second stage because the allotted propellants for the orbital attitude and maneuver system had been consumed during the station-keeping exercise with the second stage. A computer-controlled reentry was not flown because of an inadvertent alteration of the computer memory during revolution 48. This alteration occurred during an attempt to remove power from the computer following an apparent malfunction of the computer power-down circuitry.

The Gemini launch vehicle performed satisfactorily in all respects. A wiring error in the erector system caused a 75-minute hold at T-35 minutes. The launch vehicle had a slightly lofted first stage trajectory; however, the changes to the guidance program after the GT-3 mission did decrease this condition from that experienced on previous flights.

For the first time, mission control was accomplished from the Mission Control Center, Houston. Some minor problems occurred; however, they did not deter from accomplishing the control in a satisfactory manner.

GEMINI V MISSION SUMMARY

The third manned mission of the Gemini Program, Gemini V, was launched from Complex 19 at Cape Kennedy, Florida at 9:00 a.m. e.s.t. on August 21, 1965. Astronauts L. Gordon Cooper, command pilot, and Charles Conrad, Jr., pilot, completed their 8-day mission on August 29, 1965. The Gemini V mission was highly successful and provided significant information for future space programs. The mission marked the first time that fuel cells provided the electric power for a spacecraft in orbit. The problems associated with an 8-day flight were met and solved in an orderly fashion. This flight provided a wealth of experience in the field of extended manned space flight.

The first-order mission objectives of the Gemini V mission were to evaluate the performance of the rendezvous guidance and navigation system using the rendezvous evaluation pod (REP), to demonstrate manned orbital flight in the Gemini spacecraft for approximately 8 days, and

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to evaluate the effects of exposing the two-man crew to a long period of weightlessness in preparation for missions of even longer duration. The second-order mission objectives were to demonstrate a controlled reentry guided to a predetermined landing point, to conduct further evaluation of the spacecraft electrical power system (fuel cells), and the guidance and control system (rendezvous mission support, spacecraft maneuver, and rendezvous radar performance), and to execute 15 inflight experiments.

Nearly all of the primary and secondary objectives of the flight were met; however, one first-order objective was not totally met in that evaluation of the rendezvous guidance and navigation system was only partially attained using the rendezvous evaluation pod. This was due to a decision to decrease the power load when the fuel cell oxygen supply pressure decreased rapidly while the radar test was being conducted.

One second-order objective was not attained in that the attempted controlled reentry resulted in a landing approximately 10 miles off track and 90 miles short of the planned landing point.

Although a rapid decay of the fuel cell oxygen supply resulted in loss of planned performance evaluation data on the rendezvous radar, radar tests using a ground-based transponder from a Gemini target docking adapter did permit representative data to be obtained. In addition, fuel cell operation under the conditions which prevailed subsequent to the oxygen supply pressure decay provided excellent information on fuel cell capabilities and purging operations.

Results obtained to date on astronaut and spacecraft performance have provided no indication of insurmountable difficulties for a 14-day mission in a Gemini spacecraft.

Data were obtained on all experiments except D-2, which depended on a successful REP operation. Also, the M-1 experiment was terminated early after 93 hours because of insufficient supply pressure to operate the pneumatic cuffs.

FLIGHT MISSION PLANNING

A new Program Directive, M-D MGS 1352.1.1, "Gemini Flight Mission Assignments", dated August 6, 1965, was received from NASA Office of Manned Space Flight.

All Gemini mission planning has been reviewed and mission objectives and descriptions will be published in the Gemini Program Mission Directive under review for early publication.

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Following are the major Gemini mission objectives planned during this reporting period.

Gemini VI* - Rendezvous and docking, radar-computer closed loop rendezvous, experiments, docked vehicle attitude maneuvers, multiple docking exercise, postdocking (after spacecraft separation) maneuvers, GATV visability observations, and placement of the GATV into a high orbit so that it may serve as an alternate, passive back-up target for Gemini VIII.

Gemini VII* - Up to 14-day long duration flight, evaluation of effects of long duration flight, station keeping with GLV second stage, experiments, lightweight suits, and controlled reentry.

Gemini VIII* - Rendezvous development, docked vehicle maneuvers, phantom rendezvous, re-rendezvous exercise, extravehicular activity (EVA), experiments, and placement of the GATV into a high orbit for use as a dual rendezvous target on Gemini X.

Gemini IX - Rendezvous development, EVA including evaluation of the modular maneuvering unit (MMU), experiments, early rendezvous (M = 3), controlled reentry, and placement of the GATV into a high orbit for use as an alternate dual rendezvous target on Gemini X.

Gemini X - Rendezvous advancement, dual rendezvous with the Gemini VIII or Gemini IX GATV as the passive dual target, EVA including retrieval of an experimental package from the Gemini VIII or Gemini IX GATV, and experiments,

Gemini XI (preliminary) - Rendezvous advancement, rendezvous with the Pegasus "C" satellite through dual rendezvous, EVA including retrieval of micrometeoroid panels from Pegasus, and experiments.

Gemini XII (preliminary) - Rendezvous advancement including early or direct rendezvous, simulation of Apollo rendezvous, EVA using the MMU, and experiments.

CREW TRAINING

Gemini mission simulator.- The Cape Kennedy mission simulator was used to complete final mission simulation for the Gemini IV crew members. Each Gemini IV crew member received approximately 125 hours in the mission simulator.

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*Objectives revised subsequent to reporting period.

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The Gemini V crew members began training in the Cape Kennedy mission simulator approximately 1 month after the Gemini IV flight. Each Gemini V crew member received approximately 110 hours training prior to flight, of which approximately 55 hours were accomplished on the Houston-Gemini mission simulator. The training accomplished in the Houston-Gemini mission simulator prepared the crew in spacecraft operation failure detection and application of alternate procedures or systems modes, while that training received at Cape Kennedy was related to specific mission training, which included network operations.

The GTA-6 and Gemini VII flight crew members began training on the Houston simulator approximately 6 weeks after the departure of the Gemini V crew to Cape Kennedy. At the end of the reporting period, each GTA-6 crew member has approximately 10 hours training and each Gemini VII crew member has approximately 5 hours.

Spacecraft tests.- Pad spacecraft tests were completed during this period on spacecraft 4 and 5 with respective crew participation.

The Gemini IV crew members participated in spacecraft 4 pad tests with a total of approximately 20 hours for each crew member.

The Gemini V crew participated in final pad tests of spacecraft 5 with a total of approximately 20 hours per crew member.

Extensive spacecraft 6 testing, with extensive crew participation, was conducted at McDonnell Aircraft Corporation, St. Louis, Missouri, during this period. Approximately 23 hours has been accomplished per crew member for the prime crew and approximately 9 hours per backup crew member.

The Gemini VII crew members participated in spacecraft 7 tests at McDonnell Aircraft Corporation, St. Louis, Missouri.

Translation and docking trainer.- Translation and docking training was received during this report period subsequent to moving and updating of the trainer. The GTA-6 crew has accomplished approximately three sessions each, practicing the docking maneuver in conjunction with various lighting conditions and systems failures. The Gemini V crew took up residence at Cape Kennedy at approximately the same date that the translation and docking trainer was back in operation after being transferred to building 5. The Gemini VII crew completed three training sessions during this period. They practiced generally under the same conditions as described above for the GTA-6 crew.

Water egress training- The Gemini V crew members and the GTA-6 prime crew completed the Gulf of Mexico water egress training utilizing spacesuits, survival equipment, helicopter pickup, and necessary related equipment.

Launch complex egress training.- The Gemini V crews completed launch complex egress training including familiarization with egress elevator, canister masks, and slide wire familiarization and practice.

Parachute training.- Gemini V crew parachute training was attempted but terminated due to weather and equipment problems. Because of severe scheduling problems, the parachute training for Gemini V was not rescheduled. The Gemini VII crew completed parachute training on August 25, 1965. Due to a scheduling conflict, the GTA-6 crew parachute training was postponed to September 11, 1965.

Planetarium.- The Gemini V crew made two trips to Morehead Planetarium for a final review of the celestial sphere, briefings, and demonstration on S-1 experiment. The GTA-6 crew completed their planetarium training at the Morehead Planetarium August 3, 1965. The Gemini VII crew spent 2 days at this planetarium for a general celestial review on July 22 and 23, 1965.

Centrifuge.- The centrifuge refresher training scheduled for the Gemini V flight crew during this period was cancelled because of a conflict in crew training activities.

Weightless flying.- In mid-June, the GTA-6 pilots accomplished several zero g flights in the KC-135. Further zero g flights for the GTA-6 crew were terminated because of a decision not to do EVA during this mission.

Launch abort training.- The Gemini V crew members received launch abort training on the Houston DCPS during this period. The command pilots received an average of 66 runs of 4 hours each while the pilots received an average of 26 runs of 2 hours each.

Systems and operations briefings.- The Gemini V crew received 7 days (42 hours) of formal systems briefings at Cape Kennedy which was conducted by McDonnell Aircraft Systems Engineers.

The GTA-6 crew received a series of GATV systems briefings (16 hours) on July 29 and 30, 1965, given by the contractor. They received approximately 12 hours of Gemini systems briefings at McDonnell Aircraft Corporation on June 8 and 9, 1965, in conjunction with the systems assurance test. The GTA-6 crew has spent approximately 12 hours each in reviewing the flight plan as a result of two reviews on July 29 and August 18, 1965.

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The Gemini VII crew has received systems briefings at Houston by MSC engineers on July 6 and 7, 1965 and a prestowage review briefing by McDonnell Aircraft Corporation engineers on July 13, 1965. Additional systems briefings were received in conjunction with the Systems Assurance Tests during the first 2 weeks of August.

Rendezvous training.- The Gemini V crew received training on the McDonnell Aircraft Corporation rendezvous simulator at St. Louis, Missouri, from July 11 through July 17, 1965. The prime crew received an average of 36 hours each while the backup crew received 30 hours per crew member. Normal closed loop rendezvous and rendezvous with various platform, computer and radar malfunctions were practiced. In addition, each crew member completed math flow six reentries on this simulator.

The GTA-6 crew conducted rendezvous training on the rendezvous simulator at the McDonnell Aircraft Corporation in St. Louis, Missouri from August 5 through 15, 1965. The prime crew accomplished approximately 34 hours each and the backup crew 25 hours. Various radar, computer, and platform systems failures were simulated in conjunction with both nominal trajections and trajectories with dispersions. The prime crew command pilot also made a dozen reentry runs utilizing this simulator.

Experiments.- The Gemini V crew completed over 200 hours of experiments training consisting of briefings, demonstration and practice. Experiments briefings were conducted on June 28 and 29, and August 9, 1965, in addition to 3 days of experiment briefings conducted prior to this report period. The Gemini V crew spent approximately 25 hours in the experiments van practicing, primarily, D-13/S-8.

The GTA-6 crew is beyond the halfway point in their experiments training. A 2-day experiments briefing for the GTA-6 crew was conducted on July 6 and 7, 1965.

The Gemini VII crew is well along in their extensive experiments training program, having accumulated approximately 60 hours in this area during this period. Formal Gemini VII experiments briefings were held on July 19 and 20, 1965.

OPERATIONS, CHECKOUT, AND AEROSPACE GROUND EQUIPMENT

SPACECRAFT 4, 5, 6, 7 and 8 CHECKOUT

Spacecraft 4 successfully completed countdown and was launched on June 3, 1965, and was recovered on June 7, 1965. The countdown was

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marred by a 1-hour 16-minute hold caused by a wiring mistake which delayed the initiation of erector lowering. For details of the flight, see Gemini IV Mission Report No. MSC G-R-65-3.

A spacecraft telemetry component failure and a weather problem caused the scrub of the Gemini V launch at T-10 minutes on August 19, 1965. The launch was successfully completed on August 21, 1965, after a very smooth countdown. The spacecraft was recovered on August 29, 1965. For details of flight see Gemini V Mission Report No. MSC G-R-65-4.

Spacecraft 6 completed Phase II of St. Louis SST and was shipped to Cape Kennedy on August 4, 1965. During this reporting period, testing progressed through the satisfactory completion on August 31, 1965, of Plan X testing with the GATV at the RF Test Facility.

Spacecraft 7 started into Phase I of St. Louis SST on June 16, 1965, and successfully completed this phase of testing on July 20, 1965. System assurance testing was completed on August 11, 1965, and simulated flight testing was completed on August 30, 1965.

Spacecraft 8 started into Phase I of St. Louis SST on August 6, 1965, and has progressed through this test phase on schedule.

AEROSPACE GROUND EQUIPMENT (AGE)

The East SST station at McDonnell Aircraft Corporation (MAC) was updated for Phase II testing on spacecraft 7. The West SST station was updated for Phase II testing of spacecraft 8 beginning August 30, 1965.

Complex 19 AGE was refurbished and updated for prelaunch checkout of spacecraft 5 in 21 days following the successful launch of spacecraft 4. Pad damage as a result of the Gemini V launch was minimal, and the refurbishment and update for the Gemini VI space vehicle progressed satisfactorily for spacecraft erection on September 3, as scheduled.

LOGISTICS

As of August 15, 1965, 87.5 percent of the total spacecraft spare part line items on order have been delivered to the designated support site. As of the same date, 98 percent of the total AGE spare parts have been delivered.

Continuing program logistics support is being accomplished through planned repair and refurbishment of failed components. It is planned to augment this support through refurbishment and reuse of flown spacecraft hardware and equipment wherever feasible and economical.

Reliability and Quality Assurance

The following paragraphs summarize the significant Reliability and Quality Assurance Office activities of Test Operations Office, Gemini Program Office.

The IGS packages directly concerned with the Gemini IV failure were flown to the IGS integrating subcontractor's plant for failure analysis. During approximately 400 cycles of operation, nothing was found that could have caused the anomaly in which the flight crew were unable to sequence the computer to OFF; however, seven known failure modes which could have caused the IGS malfunction on spacecraft 4 were identified, and a method was incorporated into the Gemini V spacecraft which permitted the bypassing of these modes.

As a result of the detailed investigation of the potential odor and toxicity problem associated with the spacecraft 4 water absorbent material, a new processing method was developed to correct this condition. All data relative to this modification indicated that it was acceptable for spacecraft 5 use.

During Phase II of the spacecraft acceptance review (SAR) for spacecraft 5, it was discovered that certain Central Technology, Inc. (CTI) cartridges used in the drogue and pilot parachute mortars were not providing minimum required exit velocities. As a result of this, the cartridges and breech were replaced on the spacecraft 4 pilot parachute mortar, and a detailed evaluation was performed leading to the conclusion that the CTI cartridges would be used in the spacecraft 5 drogue mortar assembly, and that the same type of cartridges and breech used on spacecraft 4 would be used in the spacecraft 5 parachute pilot mortar assembly.

The fungus testing of the polyvinyl chloride (PVC) materials, used in the fabrication of water bags, bioinstrumentation wire coating, and the passive dosimeter packages has demonstrated that all of these materials are fungus nutrient; however, there was no significant degradation of tensile strength because of fungus growth. The Environmental Physiology Branch is at present evaluating the biological impact of these results.

A design review of the auxiliary tape memory (ATM) was held at Raymond Engineering Laboratories on August 25, 1965. It was determined that the ATM failure mode and effects analysis, and qualification tests would be performed by IBM. One interface problem which was pointed out was that the line capacity of the wire which supplied the computer clock pulse to the ATM appeared high. An engineering evaluation is in process.

First activation of the spacecraft 5 fuel cell was completed on August 3, 1965, and performance appeared to be quite satisfactory. The product water plumbing was replaced wherever possible to minimize the deleterious effects of corrosion, and the product water system was flushed several times to reduce the acidity of the residue in the water system. Based on the latest test results and on the quality of the activation procedures, the fuel cell has achieved a posture of acceptability for space flight.

A disposition and control system for postlaunch hardware has been established and implemented for Gemini V postlaunch operation which includes the following:

1. A quality bond room has been established and is in operation for receipt of postlaunch hardware at MSC.

2. A plan for accepting previously flown contractor-furnished equipment for subsequent flights is being prepared for coordination and approval.

GEMINI CONTROL ROOMS

The MSC Control Room has increased its scope of activity to include four additional Sched-u-graph boards for coverage of the Heat Shield Qualification (HSQ) portion of the Manned Orbiting Laboratory (MOL) Program. Areas covered by these boards include procurement, engineering, manufacturing, and delivery of aerospace ground equipment and aerospace vehicular equipment, and any other that may be considered problems or potential schedule constraints. A similar control room operation has been implemented at MAC in St. Louis, Missouri. The GPO Control Room HSQ boards are updated weekly by change reports and photographs from the MAC Control Room. Additionally, inserts for these boards are to be provided on an "as required" basis as requested by the GPO Control Room.

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HEAT SHIELD QUALIFICATION PROGRAM

Refurbishment of spacecraft 2 continues with buildup progressing in areas of insulation and retaining channel installations. Spacecraft 2 inspection is 100 percent complete.

All purchase orders for spacecraft hardware have been issued.

Some structures testing is in progress by the contractor, including plasma jet testing of protrusions.

The preliminary launch support plan has been issued by the contractor, and instrumentation requirements have been defined.

Engineering work is progressing on schedule and is expected to be complete by November 15, 1965.

AGE requirements have been identified and all NASA actions to transfer AGE to the Heat Shield Qualification Program have been completed.

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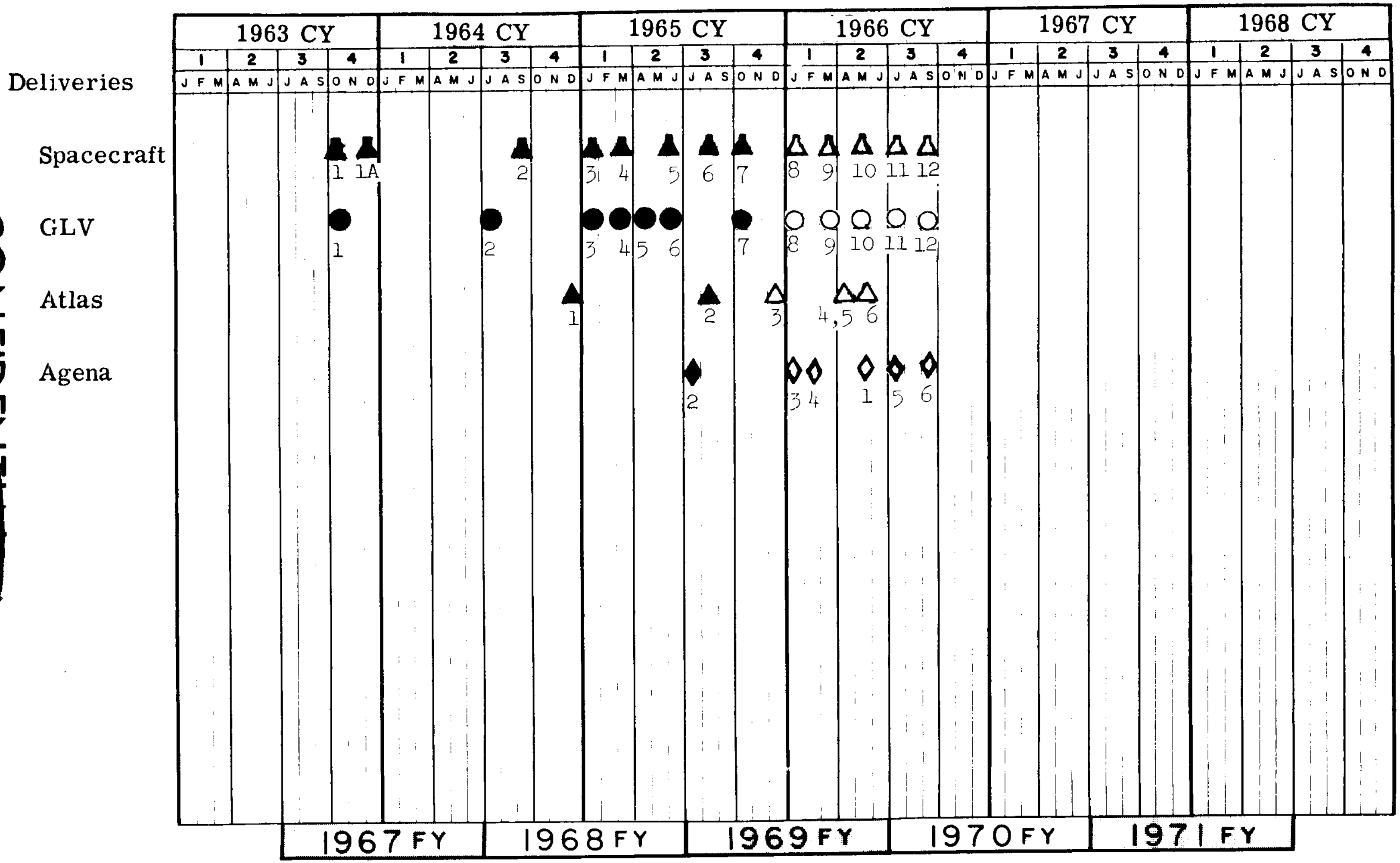
Gemini Delivery Schedule - October 16, 1965



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