

MAY 5, 1969



OFFICE OF DIRECTOR - MSFC

CODE	NAME	INIT.	<input type="checkbox"/> ACTION	<input type="checkbox"/> INFORMATION
PD-DIR	Dr. Lucas/Mr. Murphy			

REMARKS

Jim Shepherd left me an open action concerning consolidation of some or all of your weekly notes. I understand you wanted more time to think it over--but that was three months ago. If you have any suggestions, I would be glad to discuss at your convenience.

J. Foster

Suspense 9-2-69

CODE DIR	NAME J. Foster	DATE 8-25-69
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Application of the INT-20 Vehicle to the Big Gemini Study:

At the request of Mr. Humboldt Nandell, MSC, representatives from MSFC and Boeing visited MSC to brief Mr. Nandell and Mr. Dail F. Stone, McDonnell Douglas, St. Louis, on the status and capabilities of the INT-20. Their interest was in the application of this launch vehicle for delivering the "BIG GEMINI" to a 270 N.M., 50° inclination orbit.

Integral Launch and Reentry Vehicle Studies:

Contractor reviews of the Integral Launch and Reentry Vehicle Studies were held at MSFC during the past week. General Dynamics/Convair made presentations on April 29, and Lockheed reported on April 30. Attendance exceeded 100 each day. Most of the Task Team attended the North American Rockwell study review at MSC, and the McDonnell Douglas review at Langley on May 1 and 2.

Lunar Roving Vehicle Task Team

This week Mr. Jim Belew has been at NASA Headquarters supporting the Lunar Mobility Study chaired by Mr. Stoney. This group will give its report to the Management Council this week.

Bill Lucas -

There is still no appreciable meet in Hal's report - The boss has questioned the need for notes from Becker, Huber, Snel, Jolmer & Drenny & has suggested that one consolidated note would suffice -
Let's talk about this -

S. L. 5/7

- my suggestion would be (2) notes
1. Studies & other activities
 2. Task team efforts

OFFICE OF DIRECTOR - MSFC

CODE	NAME	INIT.	<input type="checkbox"/> ACTION	<input type="checkbox"/> INFORMATION
DIR	Dr. von Braun			

REMARKS

With the recent reorganization, the authors of notes had increased from 21 to 24. A comparative list of these is attached. At this time I am not personally recommending that we drop any of the notes, particularly as a number of people are submitting no notes each week. However, if you feel now or later that we need to reduce these, please let me know. Secondly, if you have any suggestions as to how the notes might be improved for your benefit, please let me know. I plan to restate the purpose of the notes and issue very general guidelines to the originators at an early date.

Shep

Do I need the ones marked " ? " ?
 One comprehensive one from Lucas may be more useful than four of his associates. Foster is now Newby's deputy. B 4/28

CODE DIR	NAME J. T. Shepherd	DATE 4-28-69
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April 8, 1969

Mr. Shepherd,

You asked about the weekly notes submissions prior to Jekyll Island trip compared to present submissions. On Oct. 21, 1968, we had 21 submissions from the following:

Balch	Kuers
Belew	Lucas
Brown	Maus
Constan	Mohlere
Geissler	Murphy
Grau	Richard
Haeussermann	Speer
Heimburg	Stuhlinger
Hoelzer	Teir
James	Williams
Johnson	

This week, 4-7-69, we had 24 submissions from:

Balch	Heller
<u>Becker</u> ? (L)	Hoelzer
Belew	<u>Huber</u> ? (L)
Brown	James
Constan	Johnson
<u>Downey</u> ? (L)	Mohlere
<u>Foster</u> ?	Moore
Geissler	Murphy
<u>Goerner</u> ? (L)	Newby
Grau	Siebel
Haeussermann	Speer
Heimburg	Stuhlinger

nancy

S-11-8 - Stage contractor operations are still on a 40-hour work week. Engine leak and functional checkout is complete, and insulation modifications are scheduled to begin this week. Removal of stage from stand is currently scheduled for 6/3/69. ✓

S-11-9 - Stage is undergoing pre-static checkout. Cryogenic proof pressure test and static firing are presently scheduled for 5/21/69 and 6/4/69, respectively. ✓

S-1C-10 - Stage was removed from the test stand on 5/1/69 and shipped to Michoud on 5/2/69 as planned. ✓

S-1C-11 - Stage is scheduled to arrive at MTF on 5/12/69. ✓

BOMEX - The ships "Rockaway", "Mt. Mitchell", and "Oceanographer" are moored on station. The ship "Rainier" is on station in a drift/station-keeping mode due to loss of deep-sea mooring device during emplanting operations on 5/1/69. The ship "Discoverer" is departing Barbados today for its station. Departure was delayed 5 days due to lack of radar spare parts. ✓

Legal Affairs - Thus far, there have been 10 complaints of damage as a result of the static firing of the S-1C-10 stage on 4/16/69, out of which has arisen one formal claim. This claim was filed by a resident of Pearl River, Louisiana. ✓

NOTES 5/5/69 BECKER

B.
5/5

Application of the INT-20 Vehicle to the Big Gemini Study:

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H-ALPHA TELESCOPE MEETING: We held a meeting April 28-29, with Perkin-Elmer, to review the proposed design changes to the H-Alpha telescope to incorporate the mechanical reticle system. The design of the mechanical reticle system was approved for incorporation into the H-Alpha telescope with several modifications to the proposed design. ✓

LATE GFE OF TV CAMERA: S&E is having problems with MSFC delivery of the low light level TV for the camera producers, as well as TV displays for the system. We are having discussions on these problems with Mr. Horton and Mr. Cagle this week. ✓

STATIC TEST ARTICLE: The Static Test Article arrived at MSFC via Pregnant Guppy on May 1. On May 2, the Test Article was transported to Building 4619 to be prepared for test with MDA and payload shroud. ✓

AIRLOCK MODULE CONTRACT NEGOTIATIONS: Cost negotiations on the Airlock and Systems Engineering and Integration were concluded on May 2, pending agreement on fee. Fee negotiations on the total contract (Workshop, Airlock and SE&I) were then initiated. After some discussion it was mutually agreed to recess until Wednesday, May 7. ✓

EXPERIMENT PRR'S: Experiment M071, Mineral Balance, Preliminary Requirements Review (PRR) was completed at MSC on April 29. M073, Bioassay of Body Fluids, PRR was started on April 30, but was postponed indefinitely. Informal discussions were continued with both the medical representatives and AAP. These discussions indicated a continued lack of confidence in the ability of the proposed dried urine sampling method to return adequate organic chemicals of interest, and a strong desire for preliminary design of an alternative specimen chiller or freezer system in parallel with the drying method on which the preliminary habitability support system waste management design is proceeding. ✓

GENERAL ELECTRIC: Procurement Plan for ESE is slowly being processed through Headquarters. The operating organizational reviews have been completed, comments provided, and the estimated Headquarters approval date is now May 9, 1969. The General Electric Contract Proposal was received April 23, for a total cost of \$14.6 million. This cost includes the transfer and installation of the ACE Station and computer programming development which will not be provided by MSC. Our remaining cost is approximately \$13.255 million plus fee. The technical evaluation is in process and negotiations are planned to begin May 26. ✓

LM-A CONTRACT NEGOTIATIONS: A major portion of last week was spent in conducting final negotiations with Grumman for definitization of the LM-A letter contract. As of May 2, agreement was reached on contract costs. Fee negotiations were also initiated on May 2, but recessed. The contract will cover procurement of the first flight article and those long lead time items necessary to initiate firm contract supplement for the backup flight article through assembly by September 1969. ✓

F-1 ENGINE - The GSE pneumatic supply for S-IC-5 was shut down for repair at KSC on 4-27-69. On board fuel was immediately admitted to the engines when the stage pre-valves returned to their normally open position. Engine hydraulic pressure was not up and turbopump purges were not on. (Both are required before fuel is admitted.) Applicable drain lines were checked and it was determined that all main fuel valves were closed and the engines remained flight worthy. However, while fuel was later being drained from the stage a kink in the LUT drain manifold caused fuel to back up through QD drain lines between the main fuel valves and the engine domes. RP-1 entered the thrust chamber jackets of four engines. A routine flushing and purging procedure was administered and the engines are again ready for flight. ✓

J-2 ENGINE - The J-2 engine alternate flight mission rules for AS-505 were accepted by General Phillips during a telecon on Friday, May 2. The only change to the rules since the FRR is the addition of a ten-second LOX dome helium purge after the eight-second LOX lead chills the LOX system. The purge assures all O₂ is purged from the chamber prior to the normal fuel lead. ✓

General Phillips requested a review of the J-2 Engine Combustion Stability Status following the above Mission Rules telecon. A letter covering this subject was promised within one week and a separate telecon will be established if he still has open questions. ✓

CONSTAN 5-5-69

B
5/5

Nothing of significance to report.

Dr. Roman Bracco
Conley

NOTES 5-2-69 Downey

B 5/5

1. SUPER EXPLORER PLANNING: Dr. Roman and Mr. Halpern of OSSA visited MSFC this week and we had several meetings connected with the Super Explorer Program Planning. This planning is reflected in the document which we hastily prepared on Wednesday as briefing information for your Lake Logan meeting. ✓

2. ASTRONOMY MISSIONS BOARD MEETING: Dr. Stuhlinger informs me that the Astronomy Missions Board will meet later this month. The AMB has requested a briefing on various astronomy activities at MSFC. Dr. Stuhlinger has asked that we brief the AMB on the Super Explorer definition effort. I believe they will endorse our planning because we are "in tune" with previous recommendations of the AMB to NASA. ✓

3. MSFC/GSFC MANAGEMENT RELATIONSHIPS ON SUPER EXPLORER: (Very sensitive item - suggest that this entry not be distributed.) Mr. Halpern, the OSSA Super Explorer Program Manager, is concerned about the joint MSFC/GSFC responsibilities being considered for the Super Explorer Program. He would like to see the full responsibility at MSFC. The joint responsibility (with MSFC in the lead) is not too awkward during definition effort. We are working quite well with our GSFC counterparts. However, if the program is approved for flight, Mr. Halpern is apprehensive over the efficiency and definition of responsibilities under the joint arrangement. I understand from Mr. Halpern that Dr. Naugle questions whether anyone at MSFC is qualified to fulfill the Program Scientist role. This may be the main reason for GSFC's present involvement. OSSA takes the Program Scientist function quite seriously. If we are to remain in the scientific payloads business, we should groom program and project scientists for our future programs. ✓ (I realize we must obtain concurrence from Dr. Mueller before we need to worry about all the potential future problems in the Super Explorer Program.) ✓

N.D.
↙ We have it now, although his views on what the Super Explorer Program should be like, does not exactly jibe with OSSA. Hope these differences between him and Naugle can be allayed.
B

B 5/5

CONGRESSIONAL INQUIRIES - We are continuing to receive requests from MSF for information to respond to Congressional inquiries. Last week, for example, Representative Teague requested charts showing the gap between major production milestones for SA-515 and SA-516 with FY-70 funding or with FY-71 follow-on funding. In addition, Senator Margaret C. Smith requested (for Congressional record) the cost of "closing down" and later "starting-up" of Saturn V production lines. ✓

SATURN COST ESTIMATES FOR PLANNING ACTIVITIES - Our discussions with PD and PM have indicated a need for Saturn follow-on estimates to be used for the PSG panels as well as many other planning activities for the next few months. Because of the budget constraints, these cost estimates could be the determining factor used in selecting the options and vehicle systems for the future.

S.F. / What can I do to get steam behind this? B

Since the Apollo Cost Study estimates are based on continuing business as usual and the Saturn Program Office's cost reduction effort will not be completed for some time, Col. James has authorized the development of an interim cost estimate. ✓ Horton Webb, Chief Saturn Control Office, will head up this effort and John Stucker of this office has been requested to assist. ✓

1. Orbital Gas Dynamics: The properties of the upper atmosphere (above 150 km) are still subject of much debate. There is a consistent difference between properties derived from satellite decay and those from satellite-borne gauges. The uncertainty reflects our lack of knowledge about the gas/surface interactions, and the less than satisfactory design of the gauges flown. We assume usually diffuse reflection of impacting molecules, though this is by no means a certainty. With this assumption we derive C_D from satellite decay, re-apply it to other satellites, and obtain good lifetime predictions by way of cancelling errors. With moments we are not so fortunate, though; they can be strongly affected by the type of reflection taking place. This affects, e.g., our complex AAP configuration. The gauges flown by all agencies were designed for laboratory use. The molecules reach the sensors only after many (20-50) collisions with the gauge walls. For molecular species this means large time constants, quite bothersome with a spinning satellite; the highly reactive atomic oxygen has by this time simply reacted with the wall, and does not reach the sensor at all. Jim Ballance of our Fluid Mechanics Research Office has analyzed density gauge measurements of the randomly spinning Explorer XXXII with respect to gas/surface interactions, after it became evident that nobody at Goddard was prepared to do such an analysis. He used previously developed Monte Carlo methods to trace how the molecules bounced through the gauge. The analysis indicates that for molecular nitrogen at satellite speeds, the first impact (high speed) is specularly reflected, while the subsequent wall impacts (lower speed) are diffusely reflected. Nothing can be said about atomic oxygen, the other main constituent at this altitude, for the reasons given previously. While we still cannot interpret the results quantitatively, at least we seem to have a reasonable explanation of the erroneous gauge behavior. ✓

2. AAP Attitude Control Propellant Reduction: The primary vehicle attitude for the AAP mission is with the longitudinal axis of the vehicle perpendicular to the orbital plane and with the solar arrays perpendicular to the solar vector. The propellant required to hold this attitude comprises about 85% of the total propellant available for the mission. A control scheme has been devised that can reduce the propellant required to hold this attitude by as much as 40%. The main ingredient of the scheme is that one takes advantage of a natural oscillation that exists about the longitudinal axis. The implementation of the scheme involves only gain changes in the control computer. ✓

3. Guest Lectures at Purdue University: Mr. Mario H. Rheinfurth of our Dynamics and Flight Mechanics Division has been invited to participate in a guest lecture series on Space Manufacturing at Purdue University on May 8, 1969. The series consists of the following three lectures: "Introduction to Space Manufacturing" by H. Wuenschel; "Low Gravity Gradient Mechanics" by M. Rheinfurth; and "Heat Sources for Space Manufacturing Processes" by J. Rasquin. The lecture series is aimed at assisting the students to find suitable thesis topics in this new and challenging area. ✓

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NOTES 5-5-69 GOERNER

Negative report.

1. RENDEZVOUS RADAR PROBLEM: George Low requested that we furnish John Berkebile to participate in an analysis of the rendezvous radar at Dalmo Victor, which experienced three recent failures. This is an extremely urgent problem; John left for Dalmo Victor on Friday to participate in the analysis over the weekend. ✓

2. BASIC ORDERING AGREEMENT (BOA) CONTRACTORS: Forty-one of the forty-two BOA contractors have been surveyed for qualifications to perform quality sensitive work. The remaining contractor is not yet ready to be examined. Of the forty-one surveyed, six have been qualified, and nine have been given interim qualification. Complete qualification of the latter depends on receipt and implementation of revised quality plans, re-survey, or qualification of welders to the appropriate specifications. The other twenty-six failed to qualify. ✓

3. RECENT RESEARCH ACHIEVEMENTS DISPLAYED FOR AMA DOCTORS' TOUR: Four research developments were displayed to visiting doctors of the American Medical Association during their tour of MSFC on April 24. These developments were (a) Prototype Direct Readout Ultrasonic Hand Scanner for Potential Industrial and Medical Applications, (b) Liquid Crystals for Dynamic Visualization of Thermal Gradients, (c) Proximity Measuring Device for Location of Metals within or behind Non-Metal Materials, and (d) Solid State Radiographic Image Amplifier. ✓

Intense interest was shown in all the exhibits but in particular to the image amplifier since it could be of tremendous value to the medical field in simplifying examination of patients. Handouts on all the exhibits were made available and detailed explanations and answers to questions provided. ✓

4. RADIOACTIVE EQUIPMENT INSPECTION: A memorandum was received from the Secretary of the Radiological and Isotopes Committee (RIC) stating that no item of non-compliance was found during the recent inspection of S&E-QUAL-AFT's radiflo test area. The memorandum commended SPACO personnel for their compliance to the AEC requirements. ✓

NOTES HAEUSSERMANN 5/5/69

B 5/5

NO SUBMISSION THIS WEEK.

1. S-IC BULKHEAD DEFORMATION: The fuel pre valves on S-IC-505 were opened inadvertently 4-27, creating a negative pressure and causing upper bulkhead of the fuel tank to collapse. The bulkhead was blown to its original shape before examination of the extent of deformation. The first dye penetrant inspection, with paint partially removed, was inconclusive. The second inspection, with surface prepared properly, showed seven indentations about 0.030" in diameter, but none in the welds or creases. The tank was purged and a visual inspection, completed at 11 p.m. 4-30, showed no abnormalities. A hydrostatic proof pressure test is to be made with RP-1 in a configuration using a standpipe to preclude any gas ullage in the tank, thus reducing the test hazard significantly. The test is planned for 5-7-69. ✓

2. S-II CENTER ENGINE ANOMALY INVESTIGATION: The POGO working group recommended on 5-1-59 the following actions be taken in search for a permanent fix on the S-II oscillation phenomenon: (a) Perform tests of a modified center engine lox line with a helium accumulator on MSFC J-2 engine bobtail test stand. The line is now being modified to a design resonant frequency below 4 Hz. Testing due to begin 5-7-69. (b) Fabricate two additional modified lox center lines, one to be used for vibration qualification tests and the other to be tested on S-II-9 when it is static fired. (c) Study the feasibility of similarly modifying the four lox outboard lines. NR/SD agreed to do this and report results to the working group on 5-8-69. ✓

3. S-II LOADS AT EARLY CENTER ENGINE CUTOFF: A transient loads analysis has been completed for the AS-505 S-II stage for early center engine cutoff. The predicted acceleration level on the center engine ranges from 2.1 g to 7.1 g depending on which thrust decay slope was used, AS-504 flight (2.1 g) or that from a static test. The center engine cross beam is structurally adequate for the 7.1 g loads. ✓

4. PX-15 PROJECT: Mr. R. Heckman, Mechanical & Crew Systems Integration Division is in training at West Palm Beach as backup crewman for Mr. Chester May. ✓

5. GENERAL: (a) Messrs. C. Lifer and R. Jewell have co-authored a paper entitled "Considerations in the Design of Orbital Telescopes for Dynamic Environments," presented at the NASA Workshop on Optical Telescope Technology on 4-30-69. The paper describes the dynamic environments (acoustic, vibration, shock) which a telescope assembly might see for a variety of launch vehicles and discusses state-of-the-art in designing for these environments, including some of the "unusual" aspects of telescope design for dynamic environments. (b) Mr. B. McKinney, Propulsion & Thermodynamics Division, has completed the requirements for his PhD at the University of Ala. His dissertation was entitled "An Experimental and Analytical Study of Water Heat Pipes for Moderate Temperatures Ranges." (c) Mr. J. Key, Analytical Mechanics Division, has completed the requirements for his MS at University of Alabama, Huntsville. His thesis was "Numerical Analysis of Finite Axisymmetric Deformation of Incompressible Plastic Solids of Revolution." ✓

1. IR PHYSICS AND ASTRONOMY: We appreciate your time for our presentation on the IR astronomy project, which is a joint enterprise between Marshall, Goddard, University of Arizona and University of New York. We are going to continue along the lines you indicated in your discussion: pursue present plans for thermal IR measurements of Apollo lunar landing sites, IR stellar astronomy, and plan for participation in IR remote sensing measurements. Our IR physics laboratory will be the basis for this participation in present and future MSFC projects. ✓

2. HYPERVELOCITY LIGHT GAS ACCELERATOR: The first phase of work on the effectiveness of honeycomb to channel debris resulting from a meteoroid impact has been completed. The energies required by an incoming projectile, with a velocity vector normal to the front surface of the target, to penetrate the two targets tested are: (1) 42.10 joules for target with honeycomb and (2) 90.57 joules for target without honeycomb. If we define the efficiency of the honeycomb to channel debris as $\frac{\text{energy to penetrate without honeycomb}}{\text{energy to penetrate with honeycomb}}$, the efficiency is 215% or, in other words, it requires a little less than half the energy to penetrate if honeycomb is present. It is obvious that different types and configurations of honeycomb will alter this efficiency. However, from these tests it is indicated that honeycomb is very effective in channeling debris which would result from a meteoroid impact. The honeycomb is not as effective a meteoroid bumper as two parallel plates. !

Dave Jex presented a paper entitled "The Effect of Honeycomb on a Double Sheet Structure" at the AIAA Impact Symposium in Cincinnati last week. ✓

B
5/5

NOTES 5-5-69 HOELZER

1. Acceptance Testing of Third Generation Computer System:
Acceptance testing began on April 19, 1969, under the terms and conditions agreed upon between UNIVAC and the Government. This testing is being performed with several items of software missing from the system. This is a temporary situation whereby UNIVAC receives reduced rental credit until the missing items are furnished. As of April 29, system up-time was 84% and increasing. The reason for the low percentage was the very bad day on April 23. Since that time, it is performing well. The required up-time is 95%, achievable on a sliding 30-day basis. Component acceptance is proceeding very well with only one Fastrand drum and one tape drive reported below 95% level. Studies are being undertaken, with the results of the logs accumulated on the first ten days of acceptance, for the purpose of improving and increasing operational efficiency and control. ✓

2. GSA data Processing Center: The local GSA computing center is fully operational with IBM 7094 and IBM 1401 service available. All MSFC organizations should urge their contractors, to use this service wherever practical. At a current rate of \$160/hour maximum, and a projected reduction next fiscal year, this is a very economical service. ✓

Dave Newby
B

NOTES - HUBER - 5/2/69

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5/5

1. LUNAR BASE STUDY: MSF has initiated the Lunar Base Study that has been talked about for some time. It will be a 3-month exercise to develop technical and programmatic options for management decisions regarding the post-Apollo program. The study will be broken down into six major task areas:

- a. Objectives and Synthesis
- b. Lunar Base Concepts
- c. Space Transportation
- d. Experiments
- e. Mission Operation
- f. Management Systems - Resources

We have been asked to comment on the guidelines, define the approach MSFC will take to implement the study and to identify the resources we will apply. This data is due May 8. ✓

AS-505 Status: Wet CDDT was completed this morning at approximately 9:10 a.m. CDT with only minor problems occurring during the count. ✓
 These problems were primarily concerned with minor leakages and measurement anomalies. The most significant launch vehicle problem occurred at T-3 minutes when the azimuth laying system line-of-sight was interrupted by a LOX cloud. The count was recycled to T-22 min., and the mission rule for CDDT was changed to allow progression in CDDT even if the azimuth laying system line-of-sight was interrupted. The countdown then progressed smoothly through T-0. This was the first time on Saturn V that we have had a problem with the azimuth laying system line-of-sight being interrupted, but as you know this did occur on the Saturn IB Program. The problem is under investigation with Astrionics and others participating. Dry CDDT is scheduled to commence at 0649 EDT tomorrow, May 6, and is scheduled for completion at 1249 EDT May 6.

The schedule for the S-IC-5 hydrostat test is as follows:

Start preparations for test	1449 EDT 6 May
Complete preps and start test	0800 EDT 7 May
Complete test and start reconfiguration to flight configuration	2000 EDT 7 May
Complete reconfiguration	1200 EDT 8 May

The maximum pressure for the test will be 31 psig $\begin{matrix} +0.5 \\ -0.0 \end{matrix}$ which is 1.05 times the maximum predicted flight pressure at the level of the bulkhead. The television cameras to be trained on the standpipe and weep holes have been exercised and found to have excellent resolution. The bulkhead will be painted with a water soluble solution which reacts with RP-1 to form a highly visible stain. The final draft of the test procedures will be reviewed today.

An analysis is being made of the Flight Control Computer (FCC) failure which occurred during the Quality Assurance Sample Test (QAST) Program to determine the seriousness of the failure as related to AS-505 FCC. Subsequent to completing a portion of the QAST vibration test and repair of several failures, a small amount of water/methanol was found inside the FCC case during a leak test. Investigation revealed a crack around the internal coolant line flare where it is attached to the case cover. A check of the original qualification unit at Astrionics has revealed similar cracking. Electronics Communications, Inc. (FCC vendor) quality control and manufacturing process techniques are under scrutiny and appear rather lax in the buildup of this fitting. If the investigation reveals that the AS-505 FCC has the worst-case flare conditions, the FCC coolant loop could be bypassed with no adverse effect on the computer operation. We should have sufficient data by tonight to determine the consequences of the problem and take appropriate action. ✓

NOTES 5/5/69 JOHNSON

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5/5

Negative report.

NOTES 5/5/69 MOHLERE

B 5/5

Nothing of significance to report.

1. Contamination Test at MSC: Plans are being completed to participate in a thermal vacuum chamber contamination test at MSC in late June. The tests are to help determine the degree of cleanliness improvement necessary for Chamber A at MSC to support ATM system testing. We have optical samples from the ATM Principal Investigators in addition to MSFC samples to be exposed to the chamber environment. ✓

2. ATM Control and Display Dynamic Simulator: The last of the revised ATM Control and Display panel sections have been delivered to Computation Laboratory for incorporation into the ATM dynamic simulator. Full simulation of the current design should be operational by June 1. ✓

3. Solar Cells for Orbital Workshop: The Orbital Workshop Solar Cell bidder's conference was held at MSFC on May 1, 1969. Six firms were in attendance regarding this fixed price two step procurement. All questions previously submitted were answered, plus some of the questions raised at the conference. The remainder of the answers will be mailed out this week. This important procurement action is expected to result in a contract in August, 1969. ✓

4. Stratoscope II Project: Arrangements have been made to assist this project in three instrumentation areas: a. Emissometer - Messrs. James Zwiener and/or Don Wilkes, S&E-SSL-T, have been scheduled to go to Perkin-Elmer (PE) for several days to train personnel in the use of a late model emissometer. This will speed up the PE learning process with this instrument and convey valuable experience collected by MSFC. b. Tape Recorder - As for previous flights, MSFC is loaning an Ampex, type CP 100 tape recorder to the project for recording flight data. The recorder is being adapted for Stratoscope II requirements. Shipment will be on or about June 15. c. Photomultipliers - Information on novel photomultiplier tubes has been sent to the Principal Investigator's office for possible application in the star tracking system. These newer types may eliminate problems experienced with conventional types in the past. ✓

5. Digital Compensation of Control Systems: A digital filter has been designed and is being fabricated inhouse in connection with digital control systems studies under contract to Auburn University. Digital filters for large vehicles are a significant factor in moving toward all digital control systems which offer the advantages of standard modular compensation configurations and flexibility for new missions. To date the concept has been demonstrated using a digital compensator in a pendulous integrating gyroscopic accelerometer (PIGA) control loop and in a hybrid computer simulation of the Saturn V control system. Follow-on work will investigate limit cycles in digitally controlled systems, and sample rate versus order of digital compensation and digital word length. ✓

NOTES 5/5/69 MURPHY

B 5/5

Nothing of significance to report.

NOTES - 5/5/69 - NEWBY

Negative Report.

B 5/5

B 5/3

1. ATM Structural Test Unit: Installation of strain gages is proceeding on schedule. Training of additional personnel in strain gage bonding has been completed. This training will enable us to work the Payload Enclosure parallel with the ATM Structural Test Unit. ✓
2. KSC Support: We will machine and assemble parts necessary to manufacture two 6 million pound capacity load cells for use on mobile service structure, Launch Complex 39. ✓
3. Gravity Substitute Workbench (AAP Experiment #M507): A procurement request was prepared and submitted to amend the existing NAS8-21385 contract with the Chrysler Corporation, Michoud. The general requirements of the amendment are to provide the formal designs necessary to manufacture the aerodynamic and electrostatic workbenches. It is planned to manufacture the aerodynamic portion of the workbench in-house. A prototype of the proposed aerodynamic throat is now being fabricated in our shops. ✓
4. Neutral Buoyancy: Preparations have been completed to start testing of the MDA/Airlock fireman's pole. Hardware for this test has been installed and the test plan forwarded to Safety-Medical for approval. ✓

Astronaut Vance D. Brand participated in a SCUBA review of the Neutral Buoyancy Simulator and underwater AAP mockups in preparation for a suited run which is scheduled for the last week in May. ✓

5. Visitors: By agreement with PA we have set up arrangements to have visitors tour areas of interest in ME. During April alone 1,555 people saw the S-IVB workshop and ATM mock-ups in Building 4755; 594 people visited our Neutral Buoyancy test area. We provided guides and special showings of videotape, etc. in many instances. ✓

B
5/5

1. Apollo 10 Operations Review: This is another regular readiness review conducted at MSC. There were no major problems. Items of interest: MSC has declared the LES igniter problem an acceptable risk affecting pad abort capability only. Lunar orbit plane has been changed by 4 deg. to be more meaningful for the G mission. S/C mid-course maneuver capability following Translunar Injection is 2,400 ft/s. Dr. Berry reported on improvements on food and water and new procedures to alleviate the recognized motion sickness problem. Still open is the question of private conversations between crew and ground which would violate NASA policy but are considered highly desirable. ✓
2. LRV Mission Operations Panel: The second meeting of the Lunar Roving Vehicle Mission Operations Panel was held at JPL. The primary topics discussed were: (1) Operational aspects of navigation, guidance and control techniques; (2) Simulation requirements; and (3) JPL Mission Operations. The guidance and control techniques presently range from a very simple onboard system utilizing landmark recognition coupled with single axis dead reckoning to a very sophisticated onboard system providing an inertial reference, computed guidance and celestial fixes to update the platform. The simulation studies will consider: (1) Optimum method for traverse simulation; (2) Determine requirements for a driver simulator; and (3) Develop a preliminary simulation functional design. At present the JPL mission operations will be limited to definition of the network and control center capability requirements, including necessary modifications of the JPL Control Center (SFOF). ✓
3. Data Transfer Test: Last week an important test was conducted to expedite the return of engineering flight data from ships or remote locations back to MSFC. The Vanguard ship transmitted recorded S-IVB/IU data to an Apollo aircraft which in turn recorded these data and brought them back. Due to data noise, the test was not satisfactory; however, the principal concept is good and efforts are continuing. ✓
4. General: Mr. Rives of this office presented a paper on "ATM Operations and Data Handling" during the Workshop on Optical Telescope Technology here at MSFC. ✓

1. SYMPOSIUM ON OPTICAL TELESCOPE TECHNOLOGY: This meeting at MSFC (April 29 - May 1) was attended by more than 300 members of NASA, universities, and industry. With a total of 75 presentations, it covered a very large area of technology related to ground-based and to space-based astronomy. Many favorable comments on the substance and the organization of the meeting were received from representatives of HQ and Field Centers, and from other attendees. The proceedings of the symposium will be published in a bound volume. ✓

Emphasis at this symposium was placed on the identification of requirements, and on status reports concerning present technical capabilities. A follow-on meeting is planned for this fall; it will place emphasis on the question how the technical requirements of space astronomy can best be met with existing and with new technologies. ✓

2. ASTRONOMY MISSIONS BOARD (AMB): The AMB, chaired by Dr. Leo Goldberg, will hold its next meeting at MSFC on May 23-24. We were requested to prepare a one-hour presentation on "Astronomy-related work at MSFC". I will coordinate this effort with S&E, PD, and PM. ✓

May 12, 1969.



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NOTES 5/12/69 BALCH

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S-II-8 - Stage is still undergoing post-static checkout and modifications. Removal of stage from the test stand is still set for 6/3/69. Beginning with this stage, post-static LH₂ tank X-rays and dye-penetrant tests will be deleted. ✓

S-II-9 - Cryogenic proof pressure test has now been rescheduled from 5/21/69 to 5/23/69 for late modification installation. Static firing has been rescheduled from 6/4/69 to 6/18/69 in order to install new center engine LOX feed duct configuration. KSC delivery date will not be impacted. ✓

S-IC-II - Stage is scheduled to arrive at MTF today and to be installed in the test stand tomorrow. ✓

BOMEX - All five BOMEX ships are on station. The "Rockaway", "Oceanographer", and "Discoverer" are moored, and the "Rainier" and "Mt. Mitchell" are in a drift/station-keeping mode. The "Mt. Mitchell" became the second without a mooring device when the bouy on the device sank. ✓

Data acquisition started on 5/4/69, one day behind schedule. Air snatch of shipboard data acquired through 5/6/69 was successfully accomplished on 5/7/69, and data was delivered to MTF on 5/9/69. ✓

University Affairs - We have received and finished our review of the Mississippi State University master support plan for their NASA Headquarters/MSFC grant. We expect their personnel on site about mid-June to begin their activities. ✓

Legal Affairs - One additional complaint of damage from the 4/16/69 static of the S-IC-10 stage has been received, bringing the total number of complaints from this firing to 11. ✓

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LUNAR PROGRAM

The Lunar Rover presentation to the Management Council (Dr. Mueller) scheduled for Wednesday, May 7, 1969, in Washington was cancelled. As you know, we have been working with Bill Stoney, MA, toward obtaining a decision on a Rover Program. There appears to be good support for the Lunar Roving Vehicle in Headquarters/MSF; for example, General Phillips is quoted as ready to recommend the Lunar Roving Vehicle and, specifically, the Dual-Mode Lunar Roving Vehicle. ✓
Bill Stoney stated he will recommend only the manned LRV. The LRV presentation is now scheduled for Dr. Mueller on Friday, May 16, 1969, at Kennedy Space Center. ✓

SPACE STATION TASK TEAM

During the bidders' conference in Washington this week, we were able to discuss Borman's plan for his Field Director role on the Space Station. Nothing is yet firm beyond the fact of his appointment. He was very enthusiastic about the project and his personal involvement. He will be unavailable for the next few weeks, but will meet with us as soon after that as possible. ✓

NEGOTIATIONS WITH MDA C: Negotiations with the McDonnell Douglas Astronautics Company (WD) were completed May 8-9, for the definition of the letter contracts for the Saturn I Workshop and Airlock Module. ✓

LM-A REACTION CONTROL SYSTEM (RCS) DETANKING AND RETANKING: In answer to your question in the April 30, 1969 AAP Program Review: (1) The LM-A will require 4 to 6 days for detanking and retanking of the RCS propellant tanks in the event of a lengthy mission hold, and (2) The RCS propellant (mono-methyl hydrazine replaces the aerozene - 50 used in the Apollo LM) can be maintained in the propellant tanks for up to 60 days, making detanking unlikely. ✓

LM-2 TRANSFER AGREEMENT: The MSC/MSFC LM-2 Transfer Agreement has been signed by Dr. Gilruth, and has been received for staffing preparatory to your signature. ✓

UMBILICAL STOWAGE: As part of the LM-A stowage requirements, the LM-A is required to carry 2 EVA umbilicals. Because of space limitations, in the LM-A, management of the umbilicals has presented volume, container, and structural problems. Two locations are now being considered which require structural modifications. Grumman is now fabricating modified plexiglas spheres to evaluate these stowage concepts. ✓

ACE DELIVERY: As the result of a meeting held May 6, MSC is being requested to ship ACE and ACE-peripheral equipment, to arrive on dock at MSFC February 15, 1970, rather than October 1969, as previously scheduled. MSC is also being requested to have ACE installed and re-verified to ATM configuration by May 1, 1970. This action is the result of the ACE Control Room construction schedule presented during the meeting. ACE Control Room beneficial occupancy date is March 11, 1970. ✓

GSFC EXPERIMENT MIRROR SYSTEM TESTING: We received a letter from Jim Milligan, GSFC, requesting that performance testing in the X-ray region of the S056 mirror system be accomplished at the Martin Denver facility. The Martin facility is unique in its capability to perform this testing. We have initiated action to have this testing performed under the integration contract. ✓

F-1 ENGINE - Two igniters on S-1C-9 and four igniters on S-1C-10 indicated early link breakages, varying from 8ms to 92ms after igniter power on during static testing at MTF. The average time from power on to link breakage is 450-550 ms. Since in each case the engines ignited properly but fuses were blown in the GSE, extraneous high voltages in the stage or facility are a primary suspect. Several igniters from this single lot are being returned to Rocketdyne for failure analysis. AS-505 igniters are all from a different lot and are not in question. A test procedure is being prepared to check the power supply system on S-1C-11 at MTF. ✓

J-2 ENGINE - A bleed or "roughing" regulator diaphragm failed on the helium control package on the No. 1 engine S-II-5 during CDDT causing a massive loss of control bottle pressure. Therefore, the lower redline limit was violated and a launch abort would have resulted during an actual launch operation. The control package has been replaced at KSC and the failed unit has been subjected to extensive testing at Rocketdyne; however, the contractor has been unable to duplicate the failure. Since this type of regulator has been in use since 1963 without any prior problems, the Engine Office position is to proceed with the AS-505 launch. The test series at Rocketdyne and a review of procedural changes at KSC will continue.

On May 6 at AEDC, attempts to run the J-2S at high thrust or "powered" idle mode were unsuccessful due to freezing of the turbines. The tap-off temperature was below freezing. During subsequent testing of May 9, the powered idle mode as well as tank head restart was successfully demonstrated. ✓

*Checked by
5-13
Lee James
Request
comment
B5/13*

NOTES 5/12/69. CONSTAN

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Nothing of special significance.

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1. SUPER EXPLORER PROGRAM: Dr. Naugle has signed the letter to Dr. Mueller on the Super Explorer Program. ✓ This final letter is almost identical to the draft which you reviewed; the few changes are minor ones. The punch line in the letter states "...and with your concurrence, we want to formally establish MSFC as the Project Management Center for the High Energy Program..." (Our draft of the letter suggested different wording at this point.) We are now preparing a suggested reply to Dr. Naugle's letter for Dr. Mueller's signature. ✓

Mr. Halpern indicates that the Physics and Astronomy Program Office of OSSA is presently planning a 3.4 M funding level for Super Explorer definition in FY-70. The 3.4M figure is, of course, fluid at present, and OSSA is soliciting our requirements. Hardware development start is planned for FY-71. ✓

2. GULF STREAM DRIFT MISSION: The one week rehearsal dive has slipped to the week of May 19. Mr. May will spend May 25 and 26 at MSC baselining the sleep experiments. The NASA part of the program and associated training is proceeding on schedule. ✓

Bonnie
 Looks like our
 17 May dive
 is out. Please
 verify. B

Psh. Its
 still on
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DUBRIDGE TESTIMONY BEFORE SENATE SPACE COMMITTEE, MAY 9

Dr. DuBridge told the Senate Space Committee (Chairman Anderson, D-N.M.) that the FY-70 Nixon budget is well planned and balanced. Proposed deletions by the House SSA and ART Subcommittees, such as Mercury/Venus '73 and in Physics and Astronomy, destroy program balance and should be reinstated. He specifically supported the amounts in the Nixon budget for follow-on Saturn V's (\$46M) and scientific payloads for lunar exploration (\$90M) but stated that the additional amounts (for Saturn V improvement, Apollo Applications and Space Station) proposed by the Teague Subcommittee would destroy program balance. (House Space Committee has not yet issued its final report, but it is expected this week.) There was no specific mention of NERVA or the space station. In response to questions, Dr. DuBridge made the following key points:

- Without existing constraints, a larger budget would be desirable. Next year's budget will not be much different, but he foresees a modest, regular, and well planned growth for future years. ✓
- Manned flight does not end with Apollo, but there is need for broader application of space technology. ✓
- Saturn V is an unique and valuable resource for use at least through the mid '70's. ✓
- Soviets have made great progress in military space, but we have an excellent (classified) military program which benefits greatly from NASA technology. ✓
- DOD and NASA need separate space programs. He declined to comment on the future of manned military space flight and stated that there is a question as to whether the MOL mission should be carried out with or without man.
- Jupiter Grand Tour is a rare opportunity for which it is appropriate to plan right now.

*He couldn't have said it better,
I find myself in 100% agreement
with all this. B*

1. S-II Oscillation: In consonance with Dr. Mueller's remarks at the Apollo 10 Flight Readiness Review that early CECO should not be considered a permanent solution of the S-II oscillation problem, our computer simulation activities are continuing. Whereas we previously were able to simulate the oscillations observed on AS-503 and AS-504, later test data of the center engine LOX line changed our math model to the extent that large variations in structural characteristics of the math model had to be made in order to duplicate the AS-504 oscillation. These results are compatible with subsequent results of Boeing and NAR. We are now receiving new structural data from S&E-ASTN mini-tests. We are confident that upon incorporating this new data into our math model, we will be able, through our simulation, to duplicate the behavior of previous flights and confirm or negate potential fixes such as those mentioned in Notes 5/5/69 Heimburg (copy attached). ✓
2. AS-505/F Range Safety: KSC has informed us informally that ETR has three options they can exercise on launch day for 505 mission: Option 1: For winds from Northeast, launch azimuth will be restricted to 90 degrees if wind magnitudes are between the .25 and 1.25 sigma annual profiles; Option 2: For winds equal to or less than .25 sigma, launch window will be extended to 96 degrees; Option 3: If lift-off hasn't occurred under options 1 and 2, buses will evacuate observers (dependents, VIP's, press, etc.) and launch window will be extended to 106 degrees. As has been the case on all previous Saturn launches, a wind restriction of 1.25 sigma from Northeast will be in effect. ✓
3. Technical Feasibility Study of S-IVB Lunar Impact: Mr. William Stoney, Deputy Director (Engineering) Apollo Program, has requested MSFC to assess the feasibility of impacting the spent S-IVB into the moon in order to support and enhance the potential data return from the lunar seismic experiment. The present requirements for an optimum utilization of an S-IVB impact are: (1) The capability to hit a specified target area near the Apollo landing site zone with a circle of equal probability (CEP) of approximately 50 km; (2) Determination of the actual impact point to within 1 km (5 km acceptable); (3) Determination of impact time to within + 0.1 seconds. It was stated by Stoney that implementation of an S-IVB lunar impact would be desired for SA-507 and subsequent. This request is presently being coordinated by CSE. No in depth analysis has been performed, however, a cursory analysis has revealed several areas of concern. These areas will be identified along with a preliminary S&E assessment in a response to Mr. James. Mr. James will then respond to Mr. Stoney's request on the MSFC assessment. ✓
4. Launch Vehicle Control, Current and Future: Mr. Jerry Redus, of our Astrodynamics and Guidance Theory Division, was invited by the Faculty of Rensselaer Polytechnic Institute (RPI) to deliver a lecture on "Launch Vehicle Control, Current and Future," and to participate in a seminar on "The Use of Optical Control in Engineering Problems." While at RPI he will be briefed on contracted studies RPI is doing for JPL on a Martian Roving Vehicle, to determine the utility of their approach for the LRV. Detailed briefings about obstacle detection and long range path selection will be received. ✓
5. Astronomy for Engineers and Scientists: Mr. Bob Benson, of our Mission Analysis Division, presented a two hour lecture at the short course in Astronomy for Engineers and Scientists, sponsored by RCAA. The lecture dealt with Kepler's planetary laws, flight mechanics, tracking systems, and orbit determination. ✓

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NOTES 5-12-69 GOERNER

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Negative Report.

NOTES 5-12-69 GRAU

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H-1 ENGINE STORAGE EVALUATION: Three H-1 Engines (4081, 7080, and 7083) have been received at Canoga from MAF for a modified second E&M checkout. Results from this checkout will serve as a base line for determining the acceptability of H-1 engines after an extended storage period. It is planned to return these engines to MAF after checkout for storage in the same cocoon with S-IB stages having engines of the same vintage. At the time the stages are removed from storage for launch preparations, the separately stored engines will be returned to Rocketdyne for hot firing and subsequent checkout. Information from this test program may be used in establishing additional checkout requirements or component replacement for engines mated to the S-IB stages. ✓

B 5/15

NOTES 5-12-69 HAEUSSERMANN

1. Preliminary Technical Feasibility Study of S-IVB Lunar Impact: Dr. Lucas received a request from Mr. Stoney, Deputy Director (Engineering) Apollo Program, to assess the feasibility of impacting a spent S-IVB into the moon in order to support and enhance the potential data return from a lunar seismic experiment. Since AS-506 is expected to carry the first seismometer to the moon, implementation of an S-IVB lunar impact is desired for AS-507 and subsequent. S&E has conducted a cursory analysis of the problem, and it appears that the requirements set forth by Mr. Stoney can be met; however, a much more detailed study is required. The results of the study have been transmitted to Col. James. ✓

2. Launch Azimuth Restriction on AS-505: The Guidance and Performance Subpanel, held at MSC on May 6, reviewed the LV and SC mission planning activities for the AS-505F Mission to insure LV/SC program compatibility and flight readiness. It became necessary to restrict the launch azimuth of AS-505. The possibility of a failure of engine No. 3 immediately after liftoff from Pad B has required a redefinition of the acceptable flight azimuths from the viewpoint of range safety. New limit lines have been established; however, two spectator stands and the VAB lie within the limits. In order to safeguard personnel who might be endangered during the launch, the following limits have been established:

- a. For a headwind, launch azimuths from 72° to 90° are acceptable.
- b. For a tailwind, launch azimuths from 72° to 96° are acceptable.
- c. In the event that the launch has not occurred until a launch azimuth in excess of 96° is required, buses will be provided to evacuate all personnel from the areas of concern, and the flight azimuth limit will be readjusted to 106° . ✓

3. Reassignment of Flight Evaluation Working Group (FEWG): The functions and responsibilities of the FEWG (formerly Aero-Astroynamics) are being transferred to Central Systems Engineering! ✓

1. SATURN V/FLIGHT CONTROL COMPUTER (FCC): Recently, a leak developed in the internal methanol/water (M/W) coolant line of an Instrument Unit (IU) FCC during vibration, quality and reliability program testing. This failure is not unique and can happen on the current flight vehicles. Concern over the AS-505 computer resulted in a recommendation to disconnect the FCC from the M/W system and use passive cooling. A thermal vacuum test was conducted at IBM to determine if passive cooling can maintain the FCC within allowable temperatures. Flight and test data indicate that passive thermal control is possible within the qualification limits of the computer components, but will result in a 60 to 100°F higher temperature. As a result, IBM and Astrionics Laboratory have recommended that passive thermal control be utilized on AS-505. Modification kits to disconnect and plug the M/W coolant lines have been sent to KSC. ✓

2. S-IVB STAGE GSE: During AS-505 countdown demonstration test (CDDT) the conoseal located between the LH₂ and LO₂ debris valves and the fill and drain couplings on the S-IVB aft umbilical leaked. A similar leak occurred during AS-502 CDDT on the LOX umbilical coupling. As a result of the malfunction, tests were conducted at MSFC to determine if the problem was hardware design deficiency or a poor installation. The tests proved that by properly installing the hardware, no leakage would occur. ✓

3. ZERO G PROCESSING OF MATERIALS: Personnel of our Materials Division met this week with Dr. Shaw and Dr. Gouse of Carnegie-Mellon University regarding a cooperative venture with them in beneficial uses of the space environment. This meeting was in response to a letter to you regarding a survey by Carnegie-Mellon on uses of the space environment for science and manufacturing. ✓

4. S-IC-5 FUEL TANK TEST: As was reported in many places, the S-IC-5 fuel tank was successfully tested 5-8-69. A significant aspect of this test, which has received no publicity, was that it took one week to develop the 61 page procedure book for making the test. Especially noteworthy was the fact that the procedures were developed without the participation of the actual operating personnel. The operating people, both NASA and TBC, were first shown the operation procedure book the morning of the day the test was scheduled. Since we required a familiarity run before actually implementing the test, the test was delayed one day when the operations personnel obviously were sufficiently unfamiliar to make the test without considerable procedure review and evaluation. The development of these procedures and the actual operation can be likened to a surgeon performing from procedures written by others. It appears that our method of doing business exposes us to mistakes which may cause extensive loss of time. ✓

1. SOLAR OBSERVATORY: The build-up phase of our Solar Observatory, which is a joint SSL-ASTR task, is essentially complete; and we have started regular daily operation. Mr. A. Rule, a co-op student, will operate the observatory for H-alpha viewing and photography daily from 8 to 11 a.m., when the sun is out. In the afternoon the observatory will be open by appointment. We are continuously working together with ASTR to improve the heliostat mirrors, evaluate H-alpha filters obtained from ASTR, and provide other services for ATM. ✓

2. MANUFACTURING IN SPACE: In line with SSL's increased role to provide scientific support for S&E and MSFC activities, SSL is supporting the manufacturing-in-space program (space processing). Some of the basic approaches to utilizing the orbital environment for space processing include: (a) utilization of the infinite vacuum of space, (b) utilization of zero-gravity for combining materials of great differences in density, (c) zero-gravity for levitation melting of non-magnetic materials, and (d) crystal growth under zero gravity conditions. SSL has a three-and-one-half-year background in crystal growing and its study under space conditions. This includes two flight experiments, T-005 and T-038, which are sponsored by OART. SSL has been requested to support the S&E effort in space processing. Because of our established capability, we have agreed to furnish support in the area of crystal growing. SSL is supporting ME Lab by consultation on scientific aspects of the ME program and by furnishing alternate COR's for ME contracts. SSL will also continue to work closely with the Materials Division of ASTN. The previously approved funding for space processing has been handled by Dr. Johnson's office. Selection of basic tasks of an SRT nature has been made by OART (George Deutsch in Hermann Kurzweg's office). OART is well aware of and seemed to be quite impressed with our capability. ✓

B 5/15

NOTES 5-12-69 HOELZER

PROGRESS OF MARSYAS DEVELOPMENT:

A meeting between the design team of the Marshall System of Aerospace System Simulation (MARSYAS) (Computer Applications, Inc.), the implementation team (Computer Sciences Corporation), and Dr. Trauboth (S&E-COMP-CS) was held to discuss the interface of the software system MARSYAS with the UNIVAC 1108 operating system EXEC VIII. Agreement was reached on how to utilize EXEC VIII capabilities for the MARSYAS system. Rigid control of design changes and schedules, similar to those for hardware systems, will be employed for this complex software system to assure that the final operational system will meet the original design goals for the engineer-oriented language, the applied mathematics, and the modular software structure. ✓

B 5/15

NOTES 5/12/69 HUBER

1. SENATE COMMITTEE ON AERONAUTICS AND SPACE: Dr. DuBridge testified before this committee on May 9. Mr. Tockley (A&TS) and I (PD) attended. In his prepared statement Dr. DuBridge described the Space Task Group and its activities. They plan to have a series of meetings with Congressional leaders to obtain their views. These will be chaired by the Vice President and the first meeting is scheduled for May 16.

Dr. DuBridge recommended that we not set another major goal (like Apollo) for the next decade but rather have a balanced program. He emphasized the need for additional lunar science and follow-on Saturn V production. In the unmanned area, he recommended three new starts: The Applications Technology Satellite; Earth Resources Technology Satellite; and, the 1973 Venus/Mercury Mission.

There was a great deal of discussion on the need to utilize space for national defense and that we need stronger military programs. In general, Dr. DuBridge supported the budget request as a balanced program and proposed that any cuts or additions would tend to unbalance the program. ✓

2. SPACE STATION/SPACE BASE: As a consequence of a recent presentation by Georg von Tiesenhausen, to the School of Architects and others at Auburn University, the American Institute of Architects with NASA-Headquarters (Stan Deutsch) are having a meeting on May 19, at MSC to discuss a possible symposium on the subject of large space station habitability problems. Mr. von Tiesenhausen has been invited to discuss the subject further at that time. ✓

3. SPACE SHUTTLE: The OMSF Space Shuttle Task Team efforts currently in progress in Washington were significantly influenced by inputs received from Dr. Mueller Monday evening, May 6. Dr. Mueller has requested the four (Integral Launch and Reentry Vehicle) contractors and the task team to provide a preferred shuttle design on or before May 19 that would be responsive to the following requirements: 50,000 # payload, 10,000 ft.³ vol. or more, and Payload Diameters - up to 22' dia.

Representatives of the Program Planning Office (Sneed) have made significant contributions on projected cost for the space shuttle. The task has been complicated by the sudden change in groundrules to a 50,000 pound cargo capability rather than 25,000 pounds. This increased vehicle size negates most of the data now available. Additionally, this week Dr. Mueller increased the non-recurring cost he will allow by another billion dollars (from \$4 billion to \$5 billion). In our judgement, this is beginning to approach the true cost of an ILRV system, but is still shy by perhaps \$1-\$2 billion. ✓

1. AS-505 Status: The hydrostatic test conducted May 8 verified the structural integrity of the S-IC-5 fuel tank bulkhead. Reconfiguration to flight status and revalidation tests were completed last Friday night (May 9).

General Phillips signed the Level I CCBD approving the operation of the Flight Control Computer (FCC) in a dry mode for prelaunch checkout and launch. This will eliminate the possibility of a water methanol leak from a failure of the internal coolant line flare attachment to the FCC case.

A mission rule is in the approval cycle to permit progression of the count if the azimuth laying line-of-sight is interrupted by a LOX cloud. If an interruption occurs and the mission rule is used there will be a slight degradation in the guidance accuracy, but we can stay well within the allocated midcourse error budget. Also, KSC has indicated the L/V venting test will be run ahead of the critical ST-124M alignment period.

A resistor failure in an S-II P. U. computer has been isolated to cracks in the ceramic core of the resistor which opened due to the elevated temperatures achieved during bench testing. Some of the failure modes of the resistors could leak to a P. U. valve hard over, and resulting mission loss from low performance or failure to start an engine. Several resistors of the same lot have subsequently failed in temperature cycling, but all of them failed well above the temperature expected in flight. No action is planned for AS-505 since the risk of a failure appears small, and acceptable. Testing is continuing to determine if the problem is restricted to one lot of resistors or to all of the over two hundred resistors used in the P. U. computer.

Thus far, analysis of the failed diaphragm of the S-II engine pneumatic package regulator has not disclosed reasons for failure. This failure occurred during CDDT. The regulator has been replaced at KSC and retest has been completed. NR/SD, Rocketdyne, and MSFC have agreed that the failure appears to be an isolated case, and no further action is anticipated for AS-505. ✓

2. S-II Oscillations: Testing of an experimental accumulator for helium damping in the center engine LOX line for the oscillation problem started May 8 on the bobtailed test engine at MSFC Test Lab. ✓

3. Seventeen (17) cps Oscillations on S-IC-10 during Static Firing: Rocketdyne's review of S-IC-10 static firing data showed that 17 cps oscillations existed on the center engine throughout the firing. As you know, this frequency is associated with POGO. This frequency (17 cps) has been noted in static firing S-IC-6 and subsequent; however, the duration and amplitude have been insignificant. On S-IC-10, the 17 cps is present in the fuel pump inlet for the entire firing and for the first 90 seconds in the chamber pressure. The amplitude in the fuel inlet is 38-45 psig and in the chamber pressure 3-9 psig. Boeing, Rocketdyne, and the POGO Working Group are reviewing the data along with stage and engine changes in an effort to determine probable causes. A more detailed report is expected from both Boeing and Rocketdyne today (May-12). ✓

NOTES 5/12/69 JOHNSON

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Review of Space Power Program with OART: A meeting with Mr. Woodward and members of his staff to review the work in space power now being conducted by the Center is scheduled for May 21. In addition to reviewing the FY-69 program some time is to be devoted to discussions of the planned FY-70 program. Presently, OART is planning support to the Center only for investigations of solar cell-battery systems for Lunar use. We will attempt to gain support for a modest program involving power systems (both solar cell and nuclear) for space stations. ✓

Galactic X-Ray Mapping Experiment: Several months ago Dr. Kraushaar decided to propose an experiment package and set of measurements which would extend the capabilities planned for his originally proposed X-ray mapping experiment. His position is that flight of the originally planned experiment as a passenger on an AAP flight after 1970 is essentially scientifically meaningless since much of the measurement he planned would already have been accomplished by others using smaller systems now being flown as probes. The updated experiment was presented to the MSFEB on May 5. It was not approved for development due to lack of funds (\$400k). We are looking for other means to fly the original experiment prior to AAP. None so far investigated appears attractive. ✓

University Visits: Over the period of the past six months, I have visited a respectable percentage of the universities and colleges in the area. The thrust of these visits has been aimed at establishing close relationships, educating and being educated, fulfilling speaking engagements, and inquiring into the degree that objectives have been met. Revelations stemming from these visits have been quite interesting and instructive. Some of the institutions have accepted Marshall's largesse as a matter of course, others have complained that it is insufficient, some have conveyed the impression that it is their just due and, in a few cases, a positive, appreciative reaction has been noted. No one has, however, yet approached Auburn in acknowledgement. A Friday, 9 May visit revealed the following for the Electrical Engineering Department under one contract-- "Study in Digitalized Servo-Electronics for Use in Gyro-Stabilized Loops of a Stabilized Platform System."

- a. Major Technical Reports - 9
- b. National Publications - 10
- c. Patents - 2
- d. PhD's Gained - 3
- e. MSEE Degrees - 6

As an additional gratifying observation, Auburn, in all publications, clearly acknowledges the Marshall contribution and is by no means reticent in indicating such to visitors.

Ordinarily, I would not bother you with visits reports but this visit was so singular as to merit special notice. The letter and the spirit of the Auburn participation in meeting the NASA objectives has nowhere been better shown. ✓

1. SNAP-19 Testing: Sustained life testing in support of AEC and NASA Headquarters of a SNAP-19 30 watt Radioisotope Thermoelectric Generator is continuing in a vacuum chamber on a unit which has accumulated 16,000 hours total usage. Electrical heating is utilized in lieu of a nuclear source. A very low internal pressure is currently being experienced in SNAP-19's and testing is to determine the effect of this pressure on the thermoelectric elements. Subsequent to vacuum testing the unit will be disassembled for analysis. ✓

2. AAP Hardware: Detailed design and fabrication of inhouse AAP hardware continues as a most active work area with its attendant detailed coordination/expediting problems. Items of accomplishment this week include:
 - a. The design of AAP-2 OWS 800 Hertz inverter is complete, documentation is released, and fabrication will start next week.
 - b. The design of GFE power supplies for Naval Research Laboratory (NRL) and High Altitude Observatory (HAO) ATM experiments is complete and documentation has been released to fabrication.
 - c. A prototype motor for the ATM Environmental Control System has been received. The inhouse breadboard inverter has been tested for compatibility with the motor with no apparent problems.
 - d. Problems continue to arise regarding the design and fabrication of the 80 ATM Charger-Battery-Regulator Modules. A delay in release of the off-site procurement for two prototype housings will delay their delivery until early June. This in turn will slip completion of prototype testing, thus completion of detailed design. Documentation release cannot occur until we mount and wire components in the prototype, estimated as August 1. The Critical Design Review for this hardware has been slipped to June 25.
 - e. In close cooperation with ME, schedules have been improved for delivery of GFE TV camera units to NRL and HAO experiments. As previously noted to you by PM, these units are critical items to the schedules of NRL and HAO Principal Investigators. Overtime inhouse and with our support contractor is being used liberally to meet these commitments at the expense, in some instances, of other schedules. ✓

3. 24-Inch Cervit Mirror: In connection with large optics technology, we are in the process of grinding and polishing a 24-inch diameter parabolic mirror from cervit, an extremely low thermal expansion optical material. This mirror will be used in our laser communication ground station telescope on Matkin Mountain. The figure of the mirror will be measured using a scatter fringe interferometer to an accuracy of $\lambda/50$ to enable the opticians to polish the surface to comparable accuracy. One of the principal reasons for using cervit is to study the effects of material creep on the optical quality of large mirrors. ✓

4. Electron Microscope: The Stereoscan Scanning Electron Microscope has been placed in full operation. Resolutions of less than 200\AA are currently being obtained. Work is progressing using the microscope on failure analysis of integrated circuits and observations of the surface quality of bearings and bearing races for accelerometers. ✓

NOTES 5/12/69 MURPHY

B 5/16

Nothing of significance to report.

1. S-II Pogo: The hydraulic unit has been installed on foundation at the S-II Structural, and the installation of the shaker bases has been started. Due to some delay in decision on hardware required for the test, we have decided to move out immediately with the installation of the thrust structure and skirt to prevent a slippage in schedule. ✓
2. AAP Spacecraft: ME Resident Engineers are involved in an assessment of the manufacturing status of the four AAP spacecrafts. This review encompasses existing hardware status, planning, tooling, and other aspects of the total manufacturing effort. ✓
3. Space Manufacturing - Glass Experiment: A small high temperature (up to 1500°C) furnace capable of operating on available MDA power is required to carry out the glass melting experiment proposed by the American Optical Company. Owing to the limited power available and the requirement for controlled cooling, it will be necessary to insulate the furnace with a high performance, high temperature insulation. ASTN Materials Division have agreed to support us in the selection of materials and the preliminary design and thermal analysis of a furnace capable of operating in the chamber designed for the AAP-2 "manufacturing in space" experiments. One possible type of insulation which might be used is, curiously enough, an outgrowth of the superinsulation studies where multilayer insulation is used for LH₂ tanks. The multilayers for high temperature insulation could be made from materials such as zirconia fibers and molybdenum foil. ASTN have also offered their assistance for the fabrication of a small furnace for initial in-house feasibility studies. ✓
4. Flammability Experiment: The principal investigator of flight experiment M-479, Mr. J. H. Kimzey of MSC, has proposed that his zero g flammability experiment be added to M-512 (Space Manufacturing). The experiment would consist of 37 flammability tests on six different materials. The impact on the M-512 chamber would amount to addition of an electrical socket, a 12 oz. water tank, and water nozzles. The combined experiments would increase the total weight by approximately 20 lb., and would require an as yet undetermined increase in funding and manpower, particularly for documentation. ✓

1. AS-505 Mission Rules: A number of significant changes to AS-505 Mission Rules have occurred since the FRR. The Flight Rule changes necessary due to S-II Center Engine Cutoff, S/C guidance takeover, and the restart rules for J-2 chilldown failures were finalized last week. Launch rule changes are being made to reflect CDDT experience (including provision for use of the backup L/V alignment scheme for a late interruption of the primary theodolite system) and to permit a recycle and launch attempt rather than an automatic scrub after S-IC forward umbilical arm disconnect at T - 16.8 seconds. The required Launch Rule changes will be finalized early this week. KSC is aware of all changes. ✓

2. AS-505 Flight Control Simulation: At the request of the crew (Stafford) an AS-505 Translunar Injection (TLI) simulation of a launch vehicle platform reference failure during the boost burn was conducted on May 7. The simulation involved the Mission Control Center (MCC), the crew simulator at KSC and MSFC support from the HOSC. The crew took over guidance of the vehicle and successfully flew to orbital insertion and through TLI second burn. The crew initiated cutoff of the second burn resulted in an overspeed of 350 ft/sec (the overspeed was caused by an error in the spacecraft simulator math model and would not have occurred in actual flight) which is outside the normal midcourse correction budget but still would have allowed completion of a meaningful contingency lunar orbit mission. Personnel from S&E participated in the simulation from the HOSC and their successful support was praised by both the crew and the Flight Director. ✓

3. AAP Flight Control Measurement Requirements: With the significant weight and performance problem on AAP, one of the prime areas that is being closely scrutinized is instrumentation requirements. In our earlier work with the system designers, Principal Investigators, and MSC we have identified approximately 1600 flight control parameters. We have initiated a concerted effort to cut these requirements down in a rational way and are now working with CSE, the Program Office and MSC in establishing a more restrictive measurement criteria. ✓

NOTES 5-12-69 Stuhlinger

B 5/16

1. PSG ACTIVITIES: As a member of the PSG Astronomy Panel, I will spend May 16 at a meeting in Washington. During the last meeting of this group, about one-half of the total time was devoted to the Heavy Explorer Program alone; I expect that the same will happen during the forthcoming meeting. Interest in this program on the part of OSSA, GSFC, and outside astronomers is very high; in fact, this seems to be the only project now which does not meet with criticism from members of the "community". (This is only true as long as it is an unmanned project!) ✓

2. HEAVY EXPLORER LETTER: Dr. Naugle has signed and mailed a letter to Dr. Mueller with the request that Dr. Mueller permit MSFC to perform studies for a Heavy Explorer Program. PD and AD-S had helped to draft this letter. ✓

In response to Dr. Mueller's suggestion to you, we are now working on the draft for a reply from Dr. Mueller to Dr. Naugle. ✓

3. NEW LOCATION OF AD-S: On May 8, AD-S (Dr. Bucher, Frances Davidson, and I) moved to Building 4200. We are occupying two rooms in the south-west corner of the ninth floor. ✓

MAY 19, 1969



SCIENCE & ENGINEERING

2522

CODE	NAME	INIT.	<input type="checkbox"/> A C T I O N	<input type="checkbox"/> I N F O R M A T I O N
DIR	Mr. Shepherd			
<i>Haney - Hold this for possible slowing to VIB -</i>				

REMARKS

Subject: Haeussermann 5/19/69 NOTES

The status of on-board strength for CSE vs authorized strength was indicated in the subject NOTES, as well as difficulty in obtaining release of personnel to adequately staff the line divisions. It was noted by Dr. von Braun to Mr. Weidner who, in turn, asked me to advise you of the steps being taken within S&E to staff CSE.

Since subject NOTES were written, agreement has been reached on additional ASTN personnel to go to CSE.

We have also had discussions on what is the best way to fill the remaining requirements and believe that, now the nucleus has been established, the remaining requirements should be obtained through the normal procedure of advertising within the Center. We are proceeding on this basis for the balance.

We also reached agreement with PD to use this route in so far as our unfilled portion of the last 54 allocation out of S&E for PD.

SCIENCE & ENGINEERING

CODE	NAME	INIT.	<input type="checkbox"/> ACTION	<input type="checkbox"/> INFORMATION

REMARKS

I think this approach will give us wider coverage within S&E and will place the Center in a better position with respect to possible criticism from the Union and the Civil Service Commission on the route we took to give both organizations a strong nucleus to undertake the responsibilities assigned to them.

Sometimes people are inclined to forget that S&E is trying to fulfill three Center objectives: (a) to build and support PD, (b) to establish, build and place into operation a strong systems engineering organization which covers not only CSE but the Systems Divisions within the design laboratories, and (c) to enhance the Center's scientific image which means reinforcing SSL and replacing the losses to PD in the functional transfer of Jim Downey and his group. I believe you realize "it ain't easy" to satisfy all three of them, as well as continuing to carry out our responsibilities to Lee James and Lee Bel ew and trying to cover the ART/SRT area.

SCIENCE & ENGINEERING

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REMARKS

As you know, S&E has come down in strength since June 1964 in excess of 1000 civil service personnel. In addition, since that time, the reduction in support contractor personnel has been approximately 3000. Also, for the greater part of the last three years, we have been in an almost total freeze in hiring civil service personnel. So, I think it is remarkable that we have been able to cover about 85% of our requirements for PD, CSE and SSL, particularly when all three organizations are seeking the best Marshall has.

We are not seeking help or sympathy, just understanding of our problem.

1 Enc:

Cy subject NOTES

cc:

Mr. Weidner, S&E-DIR

CODE S&E-DIR	NAME R. W. Cook	DATE 6/12/69
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NOTES - 5/19/69 - BALCH

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5/19/69

S-11-8 - Removal of stage from the test stand has been rescheduled from 6/3/69 to 6/11/69 due to the planned accomplishment at MTF of four MCR's originally scheduled to be accomplished at MSC. ✓

S-11-9 - Cryogenic proof pressure test is still set for 5/23/69. Static firing has been rescheduled from 6/18/69 to 6/6/69 because of unavailability of the new LOX feed duct for the center engine. It is now planned to commence incorporating the center engine LOX feed duct modification with the S-11-10 stage. ✓

S-11-10 - Stage arrived at MTF on 5/12/69 and was installed in the test stand on 5/13/69. "Power-up" was accomplished on 5/16/69. Static firing is scheduled for 6/25/69. ✓

BOEX - All five fixed ships have left their ocean stations and arrived at Bridgetown, Barbados, after completing the first observational phase. The next observational phase is scheduled to start on 5/24/69. Data recorded during the past nine days is due to arrive at MTF on 5/21/69. A four-hour sampling of each ship's data recorded from 5/4/69 through 5/6/69 has been processed at MTF, and "quick-look" data has been returned to Barbados. ✓

Edgewood Arsenal Project - This project has been progressing satisfactorily as planned. Indications are that planning is underway for expansion of the project, for which it is expected that additional funds amounting to almost \$300,000 will be made available to MTF by Edgewood Arsenal. ✓

Proposed Photographic Support to MSC by MTF - In response to inquiries from MSC, we are studying the feasibility of supporting the photographic needs of that center. ✓

Labor Relations - About 25 members of the various building and construction trades unions employed by subcontractors to the General Electric Company and Slocum Iron Works, a Corps of Engineers contractor, left their jobs at MTF on 5/12/69. This work stoppage was led by the United Association (plumbers and pipefitters) in protest of a government decision that certain work at MTF is not covered by the Davis-Bacon Act. The work stoppage has had no significant effect on MTF operations. It is anticipated that the trades personnel will return to their jobs this week. ✓

NOTES 5-19-69 BECKER

5/19/69

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1. AIAA CONTRIBUTION TO SPACE TASK GROUP: Chuck Ellsworth was informed last week that Dr. DuBridge has requested an input from the AIAA (through the AIAA President, R. Smelt) for the President's Space Task Group. This will be a document of about 20 pages on space programs for the '70's. Members and former members of the Spacecraft Technical Activities Committee are primarily responsible for generating this document. ✓

2. HEAT PIPE TECHNOLOGY AND MANNED SPACE STATION APPLICATIONS: Arrangements are complete for an informal technical interchange, Heat Pipe Technology and Manned Space Station Applications, on May 27, 1969, at MSFC. Purposes are: (1) to survey the technology, (2) to identify prospective applications of merit for the Space Station and Space Base, and (3) to identify engineering data required but not available. The program is jointly sponsored by Program Development and Los Alamos Scientific Laboratory. Speakers are contributors among their peers and attendance is generally limited to persons technically involved in the subject matter. Strong participation from MSFC and other organizations is indicated. ✓

5/19/69

ATM "BLACK BOX" CRITICAL DESIGN REVIEW (CDR): The following review was held this past week: Solar Array Wing Assembly - A good in-depth presentation was given on the design of the solar array wing on May 12. The design and supporting analysis is essentially complete, with all drawings planned for release in July. There appears to be no significant problems in this area. As a means of reducing ATM weight, the scissor mechanisms and cross beams are being considered for re-design to use aluminum in lieu of steel. The weight savings is expected to be in the order of 250 pounds, with a potential delay in design of three to four weeks. ✓

BIOMEDICAL EXPERIMENTS SCHEDULE: Current potential problems include delays in completion of PRR's for M071/M073, Mineral Balance/Bioassay of Body Fluids, which could impact the M487, Habitability Support System, and progress of the Preliminary Requirements Review for the Experiment Support System. Efforts are continuing to expedite these reviews through MSC's Program Office. ✓

LM-2 DELIVERY TO AAP: The LM-2 Lunar Landing Simulations (drop tests) have been completed and post test verification is in progress.

Shipment to Grumman for transfer to AAP is planned for May 28, 1969. ✓

AAP-2 AND AAP-4 ACOUSTIC TEST PROGRAM: A visit was made to both the MSC and Lockheed/Sunnyvale Acoustic Test facilities (together with a representative of the Astronautics Lab) for the purpose of finalizing a facility choice for AAP-2 and AAP-4 front end payload tests. Unofficial information was obtained from MSC to the effect that the MSC facility can be modified to perform the tests in a reverberant mode as specified at no cost to MSFC. Official confirmation has been requested. ✓

STAGE S-IVB 212: Stage S-IVB 212 component removals have been completed. The stage is in the No. 2 Insulation Chamber, and preparations are beginning for the LH₂ tank internal modifications. Approximately 85 percent of the Scar's drawings have been released to date. ✓

40

80

240 x .82

 1920
 480

 2401280
 197

 437 knots x 1.19
 437
 3933

 52063

 520 mph

NOTES 5-19-69 BROWN

5/19/69

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F-1 ENGINE - As previously reported, the four outboard engines on S-1C-10 exhibited thrust levels approximately 15K below the levels measured during acceptance tests at Edwards Air Force Base. The center engine showed a 1K increase. Thrust levels, lower than predicted for flight, have been common on previous vehicles and have been attributed to site differences, instrumentation, turbine coking and run-to-run variations. A detailed investigation has been underway since the S-1C-10 static test. The quality of the propellants (both oxidizer and fuel) is a prime suspect. Samples from all sites are being analyzed. A detailed report will be made by Rocketdyne in the F-1 Program Review at Canoga Park on June 3, 1969. Early flight data from S-1C-5 indicates close agreement with the predicted thrust which had an empirical 9K negative bias. ✓

CONSTAN 5-16-69 NOTES

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VISITORS:

On Tuesday, May 13, 1969, Mr. Ismail H. Tekinal, Member of the Grand National Assembly, Istanbul, Turkey, visited Michoud Assembly Facility. After a briefing which was presented with the assistance of Mr. Akbay, S-IC Project Office at MSFC, Mr. Tekinal was conducted on a tour of the facility. ✓

On May 15, 1969, Dr. Robert C. Seamans, Jr. Secretary of the Air Force, spoke at the Greater New Orleans Chamber of Commerce, Armed Forces Luncheon. The chief topics of Dr. Seaman's address were the establishment of the ABM system and ROTC in colleges. ✓

5/19/69

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1. GULF STREAM DRIFT MISSION: The rehearsal dive which had slipped is scheduled for this week. All training requirements remain on schedule. The actual mission is planned for the period of June 2 to July 2. Dr. Ed McLaughlin of the Office of Space Medicine, MSF, has sent Bellcomm personnel to West Palm to consult on experimental data to be taken for the life sciences part of the NASA program. ✓
2. SPACE BIOLOGY SUMMER STUDY: A summer study on "Space Biology Future Program Plans" will be sponsored by the Space Sciences Board of the National Academy of Sciences - National Research Council. The study will be at the University of California at Santa Cruz and will be about three weeks in duration. Dr. John Hilchey and Mr. Jerry Johnson of my Office have been requested by OSSA to participate and to support the study in the program planning area during the week of July 13. OSSA seems to be encouraging more active participation of MSFC in the space biology area. This is probably a result of the recent meetings between Dr. Reynolds and you, Dr. Reynolds and Dr. Lucas and follow-up activity and vigorous PSG support by Dr. Hilchey and Mr. Ray Page, the MSFC representative and alternate on the Space Biology Panel. ✓
3. ATM-B (SOLAR MISSION): Dr. Harold Glaser, Chief, Solar Astronomy Program, OSSA, has been encouraging MSFC to assume responsibility for the photoheliograph experiment. This experiment, which is being developed by Dr. Harold Zirin of CIT, is the principal experiment for the proposed ATM-B mission. Dr. Glaser has taken the position that, if ATM-A is successful, the backup experiment hardware will not be reflowed. However, the photoheliograph experiment could be incorporated in the backup ATM canister for the ATM-B mission. We hope to provide a satisfactory cooperation and support for Dr. Zirin with a minimum involvement of manpower. Dr. Zirin is a very well respected young scientist. I have been told that he is a close friend of Dr. Lee Dubridge. Also, Dr. Zirin was a college roommate and fellow graduate with Dr. Henry Smith, Chief Scientist, OSSA. ✓
4. SUPER EXPLORER PROGRAM: Mr. Halpern of OSSA has requested that we prepare a presentation on the Super Explorer concept for the High Energy Panel of the Astronomy Missions Board. This presentation will take place in about one month. Dr. Kraushaar, Chairman of the High Energy Panel, will then present the Super Explorer concept to the AMB. Mr. Halpern's strategy is that the High Energy Panel will eagerly accept the concept, and the AMB will better accept the proposed program when it is presented by one of their members rather than by NASA. Mr. Halpern does not desire any detailed discussions of Super Explorer during the AMB meeting here on May 23 and 24. ✓

NOTES 5/19/69 FOSTER

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NASA LONG RANGE PLAN - The long range goals and objectives of NASA as formulated by the PSG activity were distributed to government agencies and offices outside of NASA for comment last month. Copies of their comments were received from MSF this week. ✓

Of particular interest was "Decision Criteria for Space Planning" which was included in the comments received from the Executive Office of the President (Office of Science and Technology, Mr. Drew). The compelling reasons stated for support of a large space program were: contributions to national security, international posture, and attitudes and morale within the United States. While important contributions to engineering and scientific development were recognized, they are considered secondary to the above social and political reasons. In the coming decade the total scale of space activities is expected to be still largely determined by non-scientific conditions. ✓

Other interesting comments were: Department of Defense - The space transportation issue should be treated separately from the space station. President's Office (Office of Science and Technology) - Temporary lunar shelters are preferred over permanent lunar bases; -- the lunar program should not be an indefinite open ended program; -- It might be advisable for the space station to follow, not precede, low cost transportation development; -- There is no reason that a gravity free laboratory in space is worth the increased cost over ground based facilities; -- The austere medicine section "is unrealistic, devoid of any method of approach and constitutes a random list of happy solutions for any foreseen problems"; -- The astronomy section "probably underestimates the potential contribution of space astronomy to basic physics"; -- "Experience has largely eliminated the uncertainty about what was possible in space - and the military significance of space capability; in the second decade greater emphasis can be placed applying our capability to specific worthwhile opportunities."

SATURN COST ESTIMATES FOR PLANNING - Reference your comments on our notes of 5/5/69, copy attached. The plan for making this interim estimate has two phases: First, we are making a rapid preliminary estimate. This estimate is ready for review by PM management this week (May 19). This estimate will be given to Dr. Lucas' organization for their planning activities. The second phase will be a more detailed analysis and documentation of the rationale. We feel this documentation is necessary to bridge the "credibility gap" between the past Saturn estimates and this "production" estimate. We will keep you advised of the progress and review this interim estimate with you as soon as it has been endorsed by PM. ✓

5/19/69

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1. POGO: At the POGO Working Group Meeting on the west coast on May 13, 1969, Douglas/McDonnell Co. (MDC) gave a presentation which indicated a slight POGO-type instability at 8 seconds prior to termination of the S-IVB second burn. Updated MDC data also shows that AS-503 would have been only slightly stable at this flight time. The message is that the S-IVB is marginally stable, and there is a possibility of an instability occurring. However, only 1/2 % damping of the unstable structural mode was used in the MDC study, whereas the actual damping is felt to be higher. A damping ratio of .007 is sufficient to eliminate the instability according to the Douglas study. Since the oscillation occurs so late in flight, we do not feel that sufficient time will be available for the oscillations to increase to dangerous levels before shutdown of the engines. ✓

2. Space Shuttle Program: In the area of aerospace environment for the space shuttle, this laboratory has identified the following potential study areas: (1) Atmospheric launch and landing constraints; (2) Orbital atmospheric criteria for operations beyond 1975; (3) A flight profile dependent atmospheric model for the region below 90 km, with emphasis on reentry heating problems; (4) Ground, inflight, and deorbit wind conditions, and (5) World-wide meteorological conditions for abort. A space shuttle aerospace environment design criteria document is being prepared. Contact with the Air Force Dynamics Laboratory, WPAFB, has been made to discuss aircraft related environmental problems which might influence the design and mission planning for the space shuttle. ✓

3. Fourth National Conference on Aerospace Meteorology: This conference, which is sponsored by AIAA and the American Meteorological Society, will be held May 4-7, 1970, in Las Vegas, Nevada. The last similar conference was held in New Orleans in April 1968. Mr. William W. Vaughan of our Aerospace Environment Division, and Mr. Norman Sissenwine, Air Force Cambridge Research Laboratories, will co-chair the conference. Principal agenda topics will be related to meteorological and space vehicle/aircraft engineering application studies. We expect that MSFC efforts will be well represented as for previous conferences, since this is the major national meeting on the subject. Plans are being made to have copies of all presentations available prior to the conference date, so that the sessions will consist of author-panel discussions with attendee participation, rather than individual paper presentations. ✓

4. Educational Accomplishment: George H. Fichtl, of our Laboratory, has completed all the requirements for, and will receive his Ph. D. in Atmospheric Turbulence in June 1969. The subject of his dissertation is "Shear Layer and Jet Instability in Stratified Media." Pending final NASA approval, he is planning to present a paper entitled "Longitudinal and Horizontal Lateral Spectra of Turbulence in the Atmospheric Boundary Layer" at the AGARD Specialists' Meeting on "The Aerodynamics of Atmospheric Shear Flows," Munich, Germany, September 15-17, 1969. ✓

NOTES 5-19-69 GOERNER

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Negative report.

NOTES 5-19-69 GRAU

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No submission this week.

NOTES HAEUSSERMANN 5/19/69

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5/19/69

Present onboard strength for Central Systems Engineering is 107 personnel out of the 154 presently authorized. Due to the requirements of other Center elements which are presently being staffed, we have had much difficulty in obtaining the release of personnel to adequately staff our line divisions. This minimizes the operational effectiveness of several of these organizations and causes concern as to the capability of this organization to fulfill its intended mission.

Here, (written)
Please note

Lifetime and Reliability Problems of Gyro Spin Axis Ball Bearings: From Dr. Ralph Ragan, a close associate of Dr. Draper, I learned recently about their difficulties in obtaining high qualification ball bearings for the spin axis of their gyros; their problems are identical to those outlined in a weekly NOTE to you on January 16, 1967. For our own program, the situation has not improved, since it was not possible to obtain the necessary IO funding support for a special high precision ball bearing manufacturing contract (about \$350,000). In the meantime, one of Bendix' vendors, New Departure, does not deliver anymore because this business has not been profitable to them. For future orders (516 and following), we should increase the reliability and the lifetime of our gyros, which depends mainly on the quality of the ball bearings. It is of interest that Kearfott manufactures now precision ball bearings for their own gyro products with excellent success -- just as we had proposed it for Bendix; we will contact Kearfott whether they can manufacture for our gyros. Yesterday I learned in Houston that MSC/MIT will reduce the preload on the spin axis bearings and lubricate them with heavier oil to increase the bearing reliability; this will result in higher acceleration dependent drift rates. This fact is not, however, too important if the launch vehicle propulsion phases can be disregarded.

EOC
Maybe we should support this after all. Please look into it B



5/19/69
1. S-11 CENTER ENGINE ANOMALY INVESTIGATION: An S-11 inboard LOX line modal characteristics study was made to determine from a stability standpoint, the best location for an accumulator. Two locations were considered. The requirement of the accumulator is to give a first line frequency of 5 hertz or less and a second line frequency separated a safe distance above the high gain engine and tank modes. Results of the analyses show a location 11.25 inches above the pump flange to be superior. For this location a somewhat larger accumulator is required to obtain the 5 hertz first mode. However, it will result in a 66 hertz second mode, which is 10 hertz higher than that for an accumulator located 8.25 inches lower. North American Rockwell has been directed to provide four lines with the upper accumulator. One line will be used for J-2 bobtail engine tests, one for qualification, one for S-11-9 static firing, and the fourth for installation on S-11-8 flight stage. A battleship version is now being tested on the J-2 bobtail stand. A test on 5-8-69 under nominal conditions indicated that the resonant natural frequency was reduced from 21 cps to 4.5 cps. Two tests were conducted this week with suction line pulsing on the first test and discharge line pulsing on the second test. Preliminary data indicate that the accumulator functioned satisfactorily as planned. ✓

2. HUMAN FORCE EXERTION INVESTIGATION: Auburn University has submitted an unsolicited proposal for developing a general model describing human dynamic force exertion and resultant motion in zero gravity. Since a long standing problem has been the specification of strength requirements for astronaut aids and other structures with which a crewman may come into contact, the proposal has been favorably reviewed. The problem is to find the money. ✓

3. S-11 STRESS CORROSION REVIEW: Personnel of the Materials Division participated in a review meeting at North American Rockwell last week to discuss S-11 follow-on procurements for S-11-516 and subs. NR agreed in almost every case to change out materials to eliminate those now considered to be susceptible to stress corrosion cracking. Little or no requalification of components will be required, and a significant cost reduction can be realized through the elimination of periodic inspections that now have to be made on these parts. We consider this an important milestone in our attempts to combat stress corrosion failures in Saturn hardware. ✓

4. PERSONNEL ACHIEVEMENTS: Mr. Fred Uptagrafft of Materials Division has been recognized for submitting the best cost reduction item for April. His suggestion was to use a less costly material (Krytox) for lox compatibility in the S-1C stage, and results in a cost reduction of \$603,000. He receives a \$50.00 award and scale model of Saturn V. ✓

5. BEN FRANKLIN DRIFT MISSION: We have successfully concluded negotiations with the Medical Directorate at MSC, and our Bioastronautics Office is implementing the electroencephalogram sleep experiment with Chet May on board the Ben Franklin. The Aerospace Medicine Office in Headquarters will provide MSFC with Bellcomm help in preparations and data reduction on the Ben Franklin mission. We have agreed to provide Headquarters a brief weekly report on this experiment and on the general mission status. ✓

NOTES 5-19-69 Heller

5/19/69

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5/23

1. MOUNT YARBROUGH: Mr. Leonard S. Yarbrough of our Scientific Engineering Division received notice that the U.S. Board on Geographic Names has designated, in his honor, Mount Yarbrough in the Pensacola Mountains, Antarctica. This is a result of his participation in the United States Antarctic Research Program during the austral summers of 1965-66 and 1967-68, first at the then new Plateau Station, and later at the new facility (Palmer II) on Anvers Island. It is also noted that Mr. Yarbrough has received the Antarctic Service Medal from the Department of Defense for his participation in the USARP activities. ✓

Congrats!
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2. GAMMA-RAY SHIELDING: Last week the Gamma-ray Shielding Experiment on board a 10.6×10^6 cubic foot balloon was successfully launched from Palestine, Texas. Weather conditions which had held up the launch effort for several days cleared on the 12th, and the balloon remained in close proximity to the launch site for the entire duration of the flight. The data from the balloon flight for gamma-ray shielding studies looks very good, but a close analysis will be necessary to determine the true effectiveness of the shield. ✓

Two technical summaries, (1) ST-100 Platform and Far UV Experiments and (2) Proton Spectrometer, have been forwarded separately to Mr. Hammick of Executive Staff for possible inclusion in the MSFC Weekly Report to Dr. Paine. ✓

5/19/69

B5/23

1. ACCEPTANCE TESTING OF THIRD GENERATION COMPUTER SYSTEM:

Acceptance testing continues. The system is performing steadily, with a current uptime of 91% and rising more slowly, as of May 8, 1969.

Component acceptance has improved to the point that only two Fastrand drums are below 90% uptime.

At the present rate, the earliest date acceptance can be predicted is between 40 to 45 days from April 19, 1969. This is subject to change, since the rules of acceptance allow for dynamic event occurrences, such as downtime, etc. ✓

2. EXEC II CONVERSION:

Conversion of EXEC II work, run at University of Alabama, Huntsville is progressing. About 75 out of 115 jobs have been converted to EXEC VIII for third generation production. Production level on some of the jobs remaining has been very high and machine time utilization has still been high. Further conversion, now being completed, should reduce University of Alabama, Huntsville machine time utilization significantly. ✓

3. PRESENTATION TO S&E-ASTN ON COMPUTER SYSTEM OF STRUCTURAL TEST FACILITY:

The Systems Analysis Branch of Computer Systems Division gave a presentation to the Test Division of S&E-ASTN on May 5, 1969, to inform (1) Test management personnel of the computer hardware and software systems utilized in support of structural testing, and (2) make recommendations for planning and coordinating activities for optimum utilization of existing systems for future test. The capabilities, limitations, and problems encountered in the past with each system were also presented and discussed. It was agreed that Test Division personnel would accept responsibility for computer operations including climate control, and make plans for coordinating training for MDA test. The Systems Analysis Branch is responsible for the software system of the Structural Test Facility, and its personnel will be made available throughout test runs to assist in troubleshooting of a systems failure. The initial training would also be provided by the Systems Analysis Branch. A similar presentation and discussion was held on May 9, 1969, at the request of Test Division personnel to inform test conductors and test engineers about utilization of the system. ✓

NOTES 5/19/59 HUBER

B5/23

5/19 JHS

1. PLANETARY/NUCLEAR: The Planetary Exploration Planning Panel met May 13-14, 1969, in NASA Headquarters. A great deal of time was spent discussing the mission, spacecraft and resource requirements for each mission in the base and optional programs. Two new optional plans were added in the outer planet area of the overall plan. These two new plans place heavy emphasis on Saturn V and Saturn V/NERVA utilization. This is the first time during the course of the panel's planning that realistic Saturn V class options have been made visible. The outer planet grand tour type missions (three planet flybys) have been identified as desirable major new start in the FY-71 budget and a five month work plan to prepare for this potential request has been formulated. ✓

Don Hearth has sent letters to MSFC, GSFC, ARC and JPL requesting a "well-thought out program plan" by mid-July, covering both technical and management aspects, if the respective Center is interested in being assigned the Project Management responsibility. It is Mr. Hearth's option that the responsible Center must be selected this fall. Action has been assigned to the Advanced Systems Analysis Office (Huber). We will prepare a progress report to you in a few weeks. ✓

2. LUNAR SHELTER STUDIES: Langley Research Center is planning two parallel studies (8-month) of \$250,000 each on a 2-man, 14-day lunar shelter. It is to weigh less than 3,000 pounds and will probably use an expendable or inflatable concept. We are participating on the management group which met last week to finalize the work statement. ✓

5/19/69

1. Apollo 10 (AS-505) Report: The launch vehicle prelaunch operations were nominal with no problems occurring which impacted the countdown. Actual launch vehicle event times during powered flight were very close to predicted times with earth orbit insertion occurring approximately 3.4 seconds later than predicted. Based on the initial data received at HOSC and inputs from KSC and MSC, the following status was derived: S-IC systems performed at or near nominal. Initial analysis indicates that the oscillations reported by the flight controllers during the S-IC powered phase were the normal structural "ring out" associated with S-IC center engine shutdown. The S-IC/S-II separation sequence was comparable with AS-504. All S-II engine start box conditions were met at ignition and all systems were nominal throughout the burn. The center engine cutoff occurred as planned and the data available at this time shows no indication of the oscillations previously experienced. All S-IVB stage and engine systems were within the expected limits throughout the first burn flight. I.U. performed as expected with desired orbital conditions being achieved. During orbital flight and TLI burn all major systems performed as required. The astronauts reported high frequency vibrations in the vehicle from about 3 minutes after ignition through TLI cutoff. The HOSC data appeared smooth with no evidence of rough combustion or other vibration source. The CSM accelerometer data was noisy, but did not show evidence of significant amplitudes in the S-IVB second burn. TLI activities, consisting of the LOX and LH₂ propellant lead experiments and the propellant dump, were conducted without any significant problems. However, during preparations for the propellant dump, the S-IVB auxiliary hydraulic pump appeared to draw only about 1/3 the normal current load when it was energized at TB7 + 53:20. No system pressure rise was observed; however, sufficient system pressure was available to center the engine for the LOX dump maneuver. The preplanned experiment and propellant dump provided sufficient impulse for a successful slingshot to escape velocity. Therefore, the APS ullage engine burn was terminated by ground command immediately after ignition. We are expediting the return of down range data on restart and post TLI activities. ✓

2. S-II Oscillation Testing: Two tests have been run using the experimental accumulator for helium damping on the bobtailed engine at MSFC. In both tests, a 4.5 engine mixture ratio (EMR) was used with the system being pulsed at pump inlet and pump discharge in the respective tests. Both tests yielded same results with the natural frequency being reduced to 4-1/2 Hertz. Tests will continue using different flow rates and EMR. ✓

NOTES 5/19/69 JOHNSON

5/19/69

B 5/23

Nothing of significance to report.

NOTES 5/19/69 MOHLERE

5/19 908

B 5/23

Nothing of significance to report.

NOTES 5/19/69 MOORE

B 5/23

5/15 9/63

1. CMG Desaturation for the ATM Backup Mode: The initial ground rule for automatic gravity gradient CMG desaturation maneuvers for AAP orbital configurations was that the maneuvers be accomplished during the night portion of the orbit. The reason for this ground rule was to avoid any potential thermal impact and to maximize the time for solar observation. Preliminary indications are that under certain orbital conditions for the backup mode (CSM docked to the LM/ATM) maneuvers subsequent to sunrise and prior to sunset will have to be made in order to provide sufficient time for CMG desaturation by use of gravity gradient. The additional time amounts to approximately 5 minutes at each end of the daylight portion of the orbit. We have informally advised the ASTN thermal personnel and indications are that the thermal design will not be adversely impacted. With respect to solar observation time, the loss will average about 5% or less and is dependent upon the time of year of launch. The computer runs of the desaturation scheme for the backup mode have been made by Bendix under the Martin contract. We expect more data fairly soon from which we can more fully assess the problem and perhaps improve the situation. ✓
2. Bio-Med Experiments: The first working model ergometer, built by ASTN Lab, was delivered to ASTR to help in the development of the heart rate control system which is progressing. Fabrication of a breadboard model has been started. This breadboard will be delivered to MSC mid-June. ✓
3. Miniature TV Camera: The miniature TV camera was used by Ronald Phillips, Chief, Technology Utilization Division, in his opening remarks at the President's Committee on Aid to the Handicapped. He cited it as a key example of how microminiaturization had made possible useful devices outside the space program. He then used the camera to show, on a large TV projection screen, the size comparison of a scale Saturn V to a scale man. Response was good. ✓
4. Personnel Transfer Status: To date personnel actions for 181 persons transferring out of Astrionics Lab have been cleared by us. Of this number 29 go to Central Systems Engineering, 124 to Manufacturing Engineering, 27 to Program Development, and one to Space Sciences Laboratory. Yet to be cleared are three to Astronautics, one to Program Development, and one to Products Office. In addition, we have four or five yet to be determined for Dr. Lucas and transferred by June 30, making a total of 191. To date 36 have come to Astrionics, primarily from Test Lab. Five are yet to move to Astrionics, primarily from Astronautics. Those additions to our strength bring their functions with them in most cases. ✓
5. Trimming Techniques for Microcircuit Thin-Film Techniques: Vapor deposited nichrome thin-film resistors have been fabricated in-house for development of precision trimming techniques for thin-film microcircuits. One group of resistors was laser trimmed using a TRG Corporation biolaser; one group was ultrasonically trimmed using a Sonobond Corp. ultrasonic bonder; the third group was used as control samples. The trimming techniques are being evaluated against temperature aging, temperature cycling, and load-life tests. Preliminary results are encouraging in that the trimming processes have had no detrimental effect on the characteristics of nichrome resistors. ✓

NOTES 5/19/69 MURPHY

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5/23

NASA OMSF Safety Survey: We have received the official announcement from Dr. Mueller that the annual safety survey will be held at MSFC on June 23 - 26, 1969, headed by Mr. Jerry Lederer. Members of this team will also be from Mr. Bob Helgeson's organization. The primary purpose of the survey will be to evaluate the implementation of the MSFC Safety Program as required by the Manned Space Flight Safety Program (NMI 1700.2).

The survey teams will be divided into two groups: Systems Safety and Industrial Safety. We notified the different organizations about the survey earlier and identified certain actions that are to be completed in preparation for this visit. These actions include a review and closeout of items that the team was critical of during their last annual survey in May 1968. The Saturn, AAP, Program Offices and Program Development have been asked to present to the survey team the status of system safety implementation in their respective areas.

1. Neutral Buoyancy: The MDA mockup was removed from the tank this report period for structural updating. All neutral buoyancy diving personnel are being re-examined for proficiency. Written examinations have been given and are being graded. Water proficiency will be determined next week. ✓
2. S-II Pogo: The installation of skirt and thrust structure to the mini-stage has been completed and air bag connectors are now being attached to the skirt. Astronautics has requested that we make every possible effort to place this facility in a checkout status as of May 24 (originally scheduled for June 1). We feel that if no more significant changes are requested we can meet this deadline. ✓
3. Electronic Manufacturing Development: An off-site fabrication order, estimated cost \$40,000, had been initiated by ASTR to develop a process specification and inspection criteria for machine soldering of flat packs to printed circuit boards because the capability to perform this operation to flight standards does not exist at MSFC. Owing to the immediate need for performing modifications to Saturn telemetry hardware, it was agreed between Astrionics and Manufacturing Engineering Laboratories to do the development in-house. This action will save money and time, and provide in-house capabilities for future fabrication and for the technical assessment of this process. ✓
4. Telescope (3 Meter Class): During the recent three-day workshop on Optical Telescope Technology, Mr. Angele presented a proposal to build a lightweight, symmetrical reflector from a low expansion material (fused silica, silicon, cervet, etc.) The reflector would consist of a shell made of a thin preformed sheet, the rear surface would be made of a similarly formed concave sheet. Sandwiched between these two sheets and joining them would be a foam core of sintered-in-place micro (glass) balloons. This design will eliminate the ill effects due to the characteristics of the more conventional core drilled or honeycomb structure, and will minimize the distortion due to thermal effects and to delayed residual stress relaxation. Grinding and finishing would be done while the blank is floating, 50 percent submerged, in a liquid (preferably water) to compensate for the distortion effects caused by 1g gravity. ✓
5. Project Super in Support of Tullahoma: Two of our people made a trip to AEDC, Tullahoma, Tenn., for the purpose of discussing AEDC plating workload to ME Lab for Project Super. Their anticipated work would be the plating of large nozzles (48" O.D. x 50" Lg) weighing between 1200 and 2200 lbs. on a frequency of two to four times per year. Other requirements would be special plating jobs such as nickel plating on lightweight foam plastic models. Ours is the only plating facility in this area capable of handling jobs of this size and/or complexity. ✓

NOTES 5/19/69 SPEER

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5/19/69

1. S-IVB Restart GO-NO GO Criteria: The GO-NO GO Flight Mission Rules for failures related to the S-IVB TLI burn have all been based in the past on criteria agreed to with MSC which required the S-IVB/IU to achieve translunar injection with an error requiring no more than 25 m/s of midcourse maneuver delta velocity. During the evolution of the AS-505 rules, it became apparent that the spacecraft had available significantly more performance capability than this for contingency lunar missions in the event of S-IVB/IU injection errors. As a result of this and some very late pre-mission coordination, several failure cases requiring TLI inhibit according to the formal rules on AS-505 would probably have been accepted as GO conditions in real time (e.g., IU accelerometer failures). We are conducting action with MSC to insure that we have more realistic criteria in the future on which to base our launch vehicle analyses and mission rules.

2. Reductions in Program Support: As reported previously, the need to reduce expenditures for program support has necessitated a reassessment of ground operations in support of NASA programs. GSFC has made the decision to reduce the mobile support for the post-lunar landing period to two ships (Vanguard and Redstone) and three Apollo Range Instrumentation Aircraft. This is basically compatible with MSFC's requirements.

NOTES 5-19-69 Stuhlinger

5/19/69

B 5/23

No submission this week.

May 26, 1969

NOTES - 5/26/69 - BALCH

B 5/28

S-11-8 - Stage is undergoing post-static checkout and modifications. Removal from the test stand is set for 6/11/69, and shipment is planned to meet the on-dock KSC date of 6/30/69. ✓

S-11-9 - Cryogenic proof pressure test was successfully completed on 5/23/69, and all work is on schedule for static firing on 6/6/69. ✓

S-1C-11 - Stage is undergoing pre-static checkout. Static firing remains scheduled for 6/25/69. ✓

BOYEX - Project scientific observers were pleased with the initial "quick-look" data we sent them at Barbados and are using it to plan Phase II operations, which began on 5/24/69 as previously scheduled. Data recorded through the end of Phase I operations arrived at MTF on 5/22/69, one day later than scheduled. Processing of this data will be started this week, after the data from the cryogenic proof pressure test of the S-11-9 stage on 5/23/69 has been processed. ✓

GE Service Contract - NASA Headquarters requested that a Procurement Plan for MTF, Contract NASw-410, MSFC-1, covering the nine-month period 10/1/69 through 6/30/70, be forwarded for inclusion as a part of the NASA Headquarters procurement package for the basic NASw-410 contract. The Procurement Plan was furnished to MSFC for transmittal to NASA Headquarters, and it is understood it was forwarded from MSFC to NASA Headquarters on 5/20/69. ✓

NOTES 5-26-69 BECKER

5/26

B 5/28

Negative report.

5/26/69

B 5/28

ATM CLEAN ROOMS: The 7 month construction contract for the 4755 ME clean room has been signed. The ACE control room design should be complete by July 29. Authority to advertise and award a contract for the 4708 Quality clean room has not been received from Headquarters. We understand it is awaiting Dr. Mueller's signature. Advertising and award takes six weeks and construction seven months (complete by February 1970). This is rapidly becoming the pacing ATM milestone. If we do not hear something positive from NASA Headquarters by this week, we plan to prepare a TWX for your signature to Dr. Mueller. ✓

HABITABILITY SUPPORT SYSTEM (HSS): Habitability Support System design and review item discrepancy (RID) status review is scheduled at MDA C-Western Division on May 26, 27, and 28. We have invited MSC participation and expect personnel from the Medical Directorate and Crew Systems Division, as well as from the Program Office. MDA C-WD has given Fairchild Hiller preliminary coverage for study items on the waste management system. ✓

WACS ELECTRONICS INTEGRATION: During last week, we received MDA C-ED contract change proposal for integration of the WACS electronic equipment with the Airlock Module. The proposed cost is \$5.4M. We anticipate having this effort under contract on or before mid-June. ✓

MEASUREMENTS: Mission Operations, AAP hardware designers and the AAP Operations Branch met last week to review measurements on the ATM Thermal Control System, PCS System and Electrical System, and to reduce the measurements to minimum requirements. This week the same procedure will be used with the Orbital Workshop designers. We intend to review the measurements with all designers and to cover the flight control requirements with MSC by the end of June. ✓

PAYLOAD SHROUD PDR: The Preliminary Design Review (PDR) on the Payload Shroud was conducted at MSFC on May 20. Representatives from Headquarters, MSC, KSC, MDA C, Martin, Bellcomm, and MSFC elements were in attendance. Approximately 52 RID's were submitted. The PDR Board will meet on June 4, 1969, to disposition the RID's.

APOLLO LM PROGRAM STRETCH-OUT: Scheduling exercises are being coordinated between MSC, MSFC, Headquarters and Grumman concerning a possible stretch-out of Apollo LM deliveries and launches, depending on the success of the Apollo 10 and 11 missions. The Apollo Program has agreed to retain the LM-15 (and other hardware scheduled to be turned over to AAP), on the current Apollo schedule. The stretch-out will involve additional effort by Grumman under the Apollo LM contract and will extend the Apollo LM deliveries past the AAP deliveries. This rescheduling should allow Apollo LM activities to provide a substantial base for the AAP LM-A activities. ✓

LM-A CONTRACT: Cost and scope discussions were completed on May 2, 1969, but agreement has not been reached on fee to date. A letter contract extension will be required prior to definitization. ✓

NOTES 5-26-69 BROWN

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5/26/69

F-1 ENGINE - The F-1 Program Review will be held at Canoga Park, California on June 3, 1969.

The package authorizing negotiation of the F-1 Engine Flight and Operational Support Program (Determination and Findings) is now in the Administrator's Office. It was submitted to Headquarters in January 1969. Concurrences obtained from Mr. Lilly and Mr. Moritz (in absence of Mr. Finger) contained discussion pertaining to rate of expenditure in comparison with other engine programs (Aerojet and Pratt and Whitney) and proposes that further discussions be held with MSFC prior to entering into any contract for the extended effort. ✓

J-2 ENGINE - Three successful J-2S engine tests of program duration were conducted at AEDC on May 22. Turbine icing (reference my notes of 5-12-69) was not evident. The tests were all high level idle mode tests with transition to mainstage. Typical duration was 20 seconds low level idle mode, 15 seconds high level idle mode, and 5 seconds mainstage. The third test also had 5 seconds of post mainstage idle mode operation. ✓

NOTES 5-12-69 BROWN

F-1 ENGINE - Two igniters on S-1C-9 and four igniters on S-1C-10 indicated early link breakages, varying from 8ms to 92ms after igniter power on during static testing at MTF. The average time from power on to link breakage is 450-550 ms. Since in each case the engines ignited properly but fuses were blown in the GSE, extraneous high voltages in the stage or facility are a primary suspect. Several igniters from this single lot are being returned to Rocketdyne for failure analysis. AS-505 igniters are all from a different lot and are not in question. A test procedure is being prepared to check the power supply system on S-1C-11 at MTF.

J-2 ENGINE - A bleed or "roughing" regulator diaphragm failed on the helium control package on the No. 1 engine S-II-5 during CDDT causing a massive loss of control bottle pressure. Therefore, the lower redline limit was violated and a launch abort would have resulted during an actual launch operation. The control package has been replaced at KSC and the failed unit has been subjected to extensive testing at Rocketdyne; however, the contractor has been unable to duplicate the failure. Since this type of regulator has been in use since 1963 without any prior problems, the Engine Office position is to proceed with the AS-505 launch. The test series at Rocketdyne and a review of procedural changes at KSC will continue.

On May 6 at AEDC, attempts to run the J-2S at high thrust or "powered" idle mode were unsuccessful due to freezing of the turbines. The tap-off temperature was below freezing. During subsequent testing of May 9, the powered idle mode as well as tank head restart was successfully demonstrated. ✓

CONSTAN 5-26-69 NOTES

5/26/69

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AEROSPACE SAFETY ADVISORY PANEL MEETING AT MAF

The Aerospace Safety Advisory Panel met at the Michoud Assembly Facility on Friday, May 23, 1969, to discuss with Boeing their test philosophy and its implications for reliability and safety. The Panel included:

Mr. Frank C. DiLuzio, President, Reynolds Electrical & Engineering Co., Inc., Las Vegas, Nevada.

Maj. Gen. Carroll H. Dunn, USA
Director of Military Construction, Office of Chief of Engineers
Washington, D. C.

Dr. Charles D. Harrington, President, Douglas United Nuclear Inc.,
Richland, Washington.

Mr. S. T. Harris, Texas Instruments Inc., Dallas, Texas.

Mr. Bruce T. Lundin, Associate Director for Development
Lewis Research Center, Cleveland, Ohio.

Mr. Henry Reining, Jr., Dean Von Klein Smid Center
International and Public Affairs, Univ. of Southern California
Los Angeles, Calif.

This group was accompanied by Messrs. Carl Praktish, Sam Darden, and E. Harris of NASA Headquarters and Col. Jim Murphy and other MSFC representatives. ✓

NOTES 5-26-69 Downey

5/26/69

B 5/28

1. GULF STREAM DRIFT MISSION: Navy certification has not been completed. It now appears that the mission will slip about two weeks. The activities for which NASA is responsible continue on schedule. ✓

2. ASTRONOMY MISSIONS BOARD MEETING: A very interesting discussion on man's role in space astronomy developed in the afternoon session. The AMB is preparing an overall position paper, and a chapter concerning man's role is to be prepared by Dr. Martin Schwarzschild. He indicates that he does not want to imply that space astronomy requires man. The AMB as a whole was reluctant to see astronomy cited as a justification for the manned program. Dr. Schwarzschild suggested prefacing his remarks on man's role by the comment, "If manned space stations are available, man can possibly be used to support space astronomy in the following ways:" In my opinion, the astronomers wish to keep their options open. If the manned program prospers, they will want a place in it. If it does not, much good space astronomy can be done with completely automated systems. ✓

3. AMB MEETING - INTEGRATED MANNED SPACE FLIGHT PLAN: Dr. Goldberg, a member of STAC, heard a presentation by Dr. Mueller last week on the Integrated Plan. Dr. Goldberg made a few brief comments during the AMB meeting concerning Dr. Mueller's plan. I gathered that Dr. Goldberg was not enthusiastic about the Integrated Plan and considered it unrealistic. Mr. Dave Woods of Bellcomm was responsible for fitting astronomy missions to the Integrated Plan. He was in attendance at the AMB meeting and made an interesting suggestion to me during a break; namely, integrate the 120" diffraction limited telescope (NASO) in a shuttle and bring it back to earth every thirty days for servicing, repair and updating. This is certainly a novel idea, which may have some merit, particularly since the Integrated Plan does not provide for a large Space Base in earth orbit. ✓

4. AMB MEETING - SUPER EXPLORER: The Super Explorer Program was discussed by Mr. Aucremanne early Friday morning before you arrived at the meeting. The PSG planning which Mr. Aucremanne described included eight Super Explorer missions before 1980. The last four missions are not defined. ✓

5/26/69

B 5/26

CENTAUR CONTRACTING EXPERIENCE - We are arranging at the request of Col. Teir, for a discussion with Mr. T. B. Norris, Medium Launch Vehicle Program Manager, OSSA, and appropriate Lewis representatives concerning their contracting experience for the Centaur. Indications are that the Centaur contracting arrangements have certain aspects that may be helpful in achieving follow-on Saturn low-cost production. The Centaur procurement has four basic contracts e.g.,

- a) Production of a base-line vehicle (Firm Fixed Price)
- b) Modifications for specific mission (Cost Plus Fixed Fee)
- c) Launch Services at KSC (Cost Plus Award Fee) and,
- d) Management and Engineering (Cost Plus Award Fee).

The Centaur experience could provide insight into problems we may face. ✓

MSF R&D PROGRAM OPERATING PLAN - Dr. Mueller has informed us that a Center submission based on the MSF POP 69-1 "Mark" is not required. Instead, he asks that the foundation for our internal planning be the following:

1. Maintain a \$15M FY 1970 Apollo obligation and cost reserve requiring the Apollo Program Director's approval prior to use. The use and specific line-item location will be clarified as the Apollo/Lunar Exploration planning interface develops. ✓
2. Additional FY 1970 funds required for qualifying the J-2S Engine by June 30, 1971 will be absorbed within POP 69-1C Apollo (Rocketdyne) estimates. ✓
3. Apollo to fund approximately \$8M in FY 1970 for MDC (S-IVB), IBM/Bendix (IU), and GE (GSE) production support and maintenance of minimum required capabilities which are common to Saturn IB and Saturn V. ✓
4. Continued suspension of procurement plans for production of S-IVB and IU stages for AS-213 and 214 vehicles. ✓
5. Delay deliveries of AAP backup mission hardware sufficiently to avoid any requirements for additional equipment or crew. ✓
6. AAP Experiment Development effort will be limited to flight assigned experiments. The Habitability Support System's total runout effort will be limited to \$11.2M. ✓

We are requesting Center comments to these guidelines in order to prepare a reply to Dr. Mueller. ✓

5/26/69

B 5/28

1. Space Shuttle Aerothermodynamics: We have been concerned about the apparent lack of interest or misconceptions in some quarters about the necessity for a strong aerothermodynamics research program for the space shuttle. Task descriptions and proposed test programs have been furnished Dr. Mrazek. Further, our concerns have been expressed through memoranda (Geissler to Johnson "Comments Concerning Preliminary FY-70 OMSF Advanced System Development Planning Information," dated April 10, 1969). We also briefed Dr. Johnson and his key people. Dr. Johnson carried our story to Dr. Eldon Hall and Mr. Norman Peil of MTP, NASA Hq. This prompted Mr. Peil to request a briefing on our requirements for the space shuttle. This briefing was made at MSFC on May 20, 1969. Mr. Peil was accompanied by Mr. Chuck Bendersky, Bellcom; others attending were representatives of the Research Planning Office, S&E, and of course, members of Aero-Astrodynamic Laboratory. During the meeting, we learned that the Flight Dynamics Laboratory, WPAFB is vigorously planning a large aerothermodynamics research program for the space shuttle. The details of the program are not available; however, we learned that their FY-70 fund requirements for their test program alone amount to 6 times what we have tentatively proposed. After having the benefit of both the AF and our briefings, Messrs Peil and Bendersky stated that they were very impressed with our indepth consideration of the aerothermodynamics problems which must be solved for a successful development of the space shuttle.

2. AS-505 Real Time Trajectory Support: Real time trajectory support for AS-505 flight was very successful. Data provided to MSC proved to be very accurate; predicted time base six and S-IVB second burn time were within about one second of actual values according to real time data. Accumulated longitudinal velocity was within 0.6 fps of actually achieved value. The 1108 was used with 7094 as a backup. Results for both first and second S-IVB re-start opportunities were available within about 1 hour 10 minutes after launch. Our schedule called for first opportunity data by 1 hour 30 minutes. The AS-505 real time slingshot efforts also proved to be very successful. The actual lox residuals were greater than pre-flight analysis had predicted and this would have resulted in more impulse than desired, with a consequent earth capture. A real time decision was made to eliminate the implemented on-board APS ullage burn by ground command. If the APS ullage burn had not been commanded off we would have had a total slingshot velocity increment of 52.4 m/sec; earth capture would occur for a velocity of 51-52 m/sec. All personnel supporting this real time trajectory support activity did an outstanding job.

3. NASA Research Advisory Committee Meeting on Aircraft Structures: This committee met at Edwards Research Center, Edwards, California, May 14-15, 1969. Bob Ryan, of our Dynamics and Control Division, attended this meeting as our center representative. This committee, composed of leading individuals from aircraft companies, universities, and NASA centers, has responsibility of recommending research areas in aircraft structures (structural dynamics, materials, aerodynamics) to NASA Hq. Meeting consisted of a survey report from each individual on research programs carried out by his group. Additional special reports were given on (a) procedures for calculating aerodynamics for aircraft, (b) application of Boron epoxies and other composites to military aircraft components, (c) load relief effectivity on X-15. Major emphasis of the meeting centered on use of composites, gains in using them, problems in fabrication, and present and proposed implementations.

E.G.

Have you ever briefed on MSC's new concept for the shuttle?
If not, please ask Sue to arrange it. (Classified)

B 5/28

B 5/28

NOTES 5-26-69 GOERNER
5/26/69

MOBILITY TEST ARTICLE (MTA): The MTA Human Factors Test has been completed. The purpose of the test was twofold: first, to compare driver proficiency of many subjects, and, second, to compare the actual driving performance of the two MTAs on earth with the performance of the MOLABs in the visual simulator in Computation Laboratory. Since the MTAs were originally designed in 1965 for about a 400-hour lifetime and were to simulate MOLAB's lunar weight by limiting MTA mass to one-sixth MOLAB's, low safety factors were used and the vehicles were nearly worn out before the Human Factors tests began. Unfortunately, inclement weather and mechanical/electronic problems with the vehicles have prevented accomplishment of the scope of the original program as planned. The winter rains made the course unuseable for weeks at a time and frequent vehicle breakdowns caused more time loss. Initial plans were to use about 12 hard-suited test subjects driving a prescribed route on our simulated lunar surface. The ambitious program was to include simulation of various emergencies, such as a wheel locked, scuff steering only, etc. Metabolic rate, response rate, pulse rate, etc., were to be measured as an index of driver performance. Unfortunately, the selected route included several severe craters requiring maximum torque from the vehicle's wheels. This in turn caused electronic problems from current overload, and mechanical failures on the wheels and chassis as well. The test was then modified to use fewer subjects and runs in order to complete the test in the limited time remaining. This program began immediately after the MTA Dynamics Test Program here at MSFC. Although much less data were derived from the test program than originally expected, due to the equipment breakdowns, etc., it is felt that some useful Human Factors data have been obtained, and the weak points of the GM/MTA have been revealed and will be corrected during refurbishment. ✓

The planned MTA Refurbishment and Test Program was discussed with Mr. Benjamin Milwitzky last week and he reiterated NASA Headquarters' firm backing for the program. ✓

Since the MTA Human Factors Test has been completed, S&E-ASTR and S&E-ASTN have been checking out and testing the GM/MTA to assure that the electronics system improvements have been accomplished. To verify the torque capability of the improved system, an attempt was made to scale an eight-foot step obstacle. Although the electronics worked satisfactorily, almost immediately the harmonic drive of the left rear wheel failed mechanically and the vehicle was not quite able to negotiate the obstacle. The incident was filmed and motion pictures will be available soon. We believe that a refurbished MTA would have negotiated the obstacle. If more information on the MTA programs is desired, a short presentation can be arranged at your convenience. ✓

5/26/69

1. OVS MATERIALS CONTROL: The following is submitted in reply to your comment to me on NOTES 3-3-69 HEIMBURG pertaining to McDonnell Douglas Astronautics Company (MDAC) OVS documentation which continues to specify flammable and stress corrosive susceptible materials. A stress corrosion review meeting was held with MDAC on March 10 to resolve material application problems identified in the Final Design Review of February 18, 1969. In summary, MDAC agreed to change materials or provide additional justification for the specific design applications. The changes agreed to in the meeting have been forwarded to MDAC through PM for implementation. During a workshop materials review meeting with MDAC on May 1, 1969, all but two items of concern (cover material for the OVS lights and wiring insulation) pertaining to flammability problems appeared to have been resolved. We are working with MDAC to resolve these two items.
2. PARTS PROGRAM: Mr. Leon Hamiter's paper, entitled "Large Scale Integrated Circuits for Space Electronics," has been selected for presentation at the Eighth International Symposium on Space Technology and Science, Tokyo, Japan, during the week of August 25, 1969. Throughout NASA, only four papers were selected for this symposium.
3. TELEDYNE QUALITY SURVEY: Lewis Research Center recently requested that we participate with Dr. Holladay from Astrionics Laboratory in a survey of the microcircuit facilities of Teledyne Systems in Culver City, California. Teledyne has a contract for the Upgraded Centaur Computer. The procedures developed under the NASA Microcircuit Line Certification program were employed in making a detailed review of the key process steps. The survey has been completed, and a report is ready to be sent to Lewis Research Center. Deficiencies, too numerous to mention here, were found in the process and documentation.

5/26/69

1. Acceleration Design Limit (g level) for Saturn V Launch Vehicle and Spacecraft Modifications: In connection with the Saturn V Dry Workshop, CSE requested ASTN to determine what g level the launch vehicle could take and still maintain manned rating safety factor of 1.4 and a payload of 105K pounds. ASTN has indicated that the launch vehicle is presently good for a g level of 4.35. In checking with MSC it was learned that the present spacecraft is good for 4.35 g's; however, MSC has a contract to NAR for building new and larger tanks for the Spacecraft Propulsion System (SPS) and their spec only calls for a 4.0 g design value. We asked MSC to change their design spec and they indicated this would require a letter from MSFC. We are now getting the g level documented and preparing the letter to Col. James. This should be accomplished by May 29. ✓
2. Cluster Test for AAP: We met on May 21 with QUAL, ASTN and Products Office to discuss checkout flow for the AAP hardware involved in the Cluster test. This includes the OWS, AM, MDA, WACS, SAS, experiments, and to some extent, the payload shroud and IU. Agreement was reached on flow, what has to be done with each module for each test location and for the Cluster test, and to a limited extent how the hardware flows at KSC. Thus, an S&E position is established. Minutes are being prepared for distribution. A particular benefit from achieving agreement on overall flow is a net reduction of previously planned test effort and equipment and thus reduced costs in verifying the flight hardware. ✓
3. S-II POGO Instrumentation: S-II 506 is virtually void of instrumentation to support a POGO analysis should a problem occur or to assist in modeling. We have discussed the problem with Lee James, who does not want to add instrumentation at this time due to the severity of the impact. The whole chain of events in the flight control measurements flow through the MSFN would be impacted. We will now only depend on additional S-IVB vibration measurements which have been approved for 506. PM has approved the S-II vibration measurement request for 507 through 510. ✓
4. S-IVB Second Burn Vibration/Oscillation Reported by Astronauts: Astronauts reported (in real time) a high frequency vibration after four minutes of second S-IVB burn. Recapping later, they reported lateral and longitudinal oscillations of low frequency throughout first and second burns with a definite higher frequency (estimated approximately 20 Hz) superimposed on the low frequency late in the S-IVB second burn. Review of flight records to date indicates a correlation between the astronaut report and measurements on the launch vehicle. S-IVB gimbal block longitudinal acceleration of ± 0.1 g 12-13 Hz is fairly persistent for the last 100 seconds of burn. Accelerometers located in the S-IVB forward skirt, pitch and yaw, indicate a definite increase in amplitude of a 45 Hz oscillation about 70 seconds before cutoff, remaining to cutoff (pitch amplitude approx. ± 2.0 g, yaw amplitude approx. ± 1.0 g). Preliminary review of accelerations measured in the spacecraft does not indicate low frequency longitudinal oscillation or a high frequency pitch or yaw vibration, but there are low amplitudes ± 0.05 g, 15-16 Hz oscillations fairly persistent over the latter part of the second burn. The discrepancy between the low vibrations amplitudes measured in the spacecraft and the high values reported by the astronaut might be resolved by the attenuation of the accelerometers. Efforts will continue to resolve the unexplained vibration late in the second S-IVB burn and the contradicting information on spacecraft vibration. ✓

5/26/69

B 5/28

1. EXPERIMENT ON APOLLO 10 FOR FILM DEGRADATION BY HIGH ENERGY PARTICLES:

The film canister which I mentioned in my Notes of April 21 (attached) is being flown on Apollo 10. It got on board with the help of Dieter Grau, Ernst Stuhlinger, Lee James, Dixon Forsythe, and many others. The canister was loaded at KSC with fresh film at 3:30 p. m. on May 16 and installed in the CM. The canister will be picked up from MSC by Ray Hembree. The exact time will be obtained from Houston.

2. G-1 SOIL MECHANICS INVESTIGATION: As you already know from your correspondence with Dr. J. Naugle, Dr. N. Costes' appointment as the team leader of the G-1 Soil Mechanics Investigation Science Team has been confirmed. This team of "Cognizant Scientists" will participate in the scientific evaluation of Apollo 11 with respect to the lunar soil properties. Other members of the team are:

Professor R. F. Scott of the California Institute of Technology, Professor J. K. Mitchell of the University of California-Berkeley, and Dr. W. D. Carrier of MSC. Dr. Costes has also been formally invited by Dr. E. M. Shoemaker, Principal Investigator on the Apollo Lunar Geology Experiment (ALGE), to serve as a Co-Investigator on Dr. Shoemaker's team during the Apollo 12 through 14 lunar landing missions. Results of these studies will be published in the form of NASA reports, papers presented at societies, and open literature publications. The information obtained will have a bearing on the LRV, Early Apollo Scientific Experiment Package (EASEP), and Apollo Lunar Surface Experiment Package (ALSEP).

3. MSFC-UAH RELATIONS: I spent considerable time last week formulating a program of SSL tasks which are suitable for contracting to the UAH Research Institute. In addition to in-house discussions, I had a meeting with Drs. Porter and Thompson. I have the impression that we can expect from both a desire to respond to MSFC's needs. I intend to select for the first set of tasks those which have a direct connection to our MSFC scientific projects and are suitable to build up a space sciences oriented capability at the University. I would like to present this to you in a week. (It will take me about a week to complete my homework on this.)

1. Package of Film to be Flown on Apollo 10:

Drs. Dozier and deLoach recently initiated (as part of SSL's radiation analysis for the ATM and OWS) an experiment to measure effects of proton irradiation on 12 different kinds of film for the CM (command module) of the 505 flight. Design was begun on April 1 and the completed package was handcarried to KSC on April 7. Help was received from many people at MSFC, otherwise it would not have been possible to meet this nearly impossible deadline.

2. Proton Spectrometer:

I am glad we could present to you, in connection with Dr. Guenther's NAS termination discussion, the status and background of the Proton Spectrometer experiment which is planned as a housekeeping or Saturn engineering measurement. We hope that it does not mean farewell to Dr. Guenther, but that he can continue with us on the experiment as a member of the University of Alabama. Your help with PM (Program Management) to obtain the funding for a possible University contract is greatly appreciated. As Dr. Guenther explained in our meeting, the experiment will measure the hard tail end of the proton spectrum. The results are urgently needed for solution of the film fogging problem for ATM and for longtime occupancy of the OWS (Orbital Workshop).

3. T-031 Flight Experiment Status:

T-031 is an OART approved SSL flight experiment to fly retrievable coupons on the S-IV/B Workshop. These coupons contain several thermal control coupons which are exposed to the space environment. At the end of the mission, in-space measurements of a few of these samples will be made and one of the coupons will be retrieved for ground evaluation. Other coupons with the same samples will be left on the workshop for retrieval on subsequent revisits.

The in-space measuring instrument is an integrating sphere reflectometer, the prototypes of which are in the final checkout stages at Block Engineering, Boston, Mass. These instruments will be brought to MSFC and evaluated both electronically and optically.

The experiment has not been approved by the MSFEB; however, a similar experiment proposed by Carl Boebel of the Air Force has been approved. The Air Force experiment is essentially the same as T-031 except they are not planning any in-space measurements. Mr. Boebel indicated he would be in favor of a joint AF/NASA experiment using our reflectometer. We are going to follow this up with OART and the OMSF/AAP Office. Dr. Sieber and his Scientific Engineering Division will work on this jointly with members of our Space Thermophysics Division.

5/26/69

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AS-505 POGO SUMMARY

- S-1C Stage - No problem. Flight data similar to AS-504.
- S-1I Stage - Early center engine cutoff solved the problem experienced on previous flights.
- S-1VB Stage - Data from first burn indicates only one measurement where oscillations significantly outside of the noise level. The measurement of concern is on the J-2 gimbal block. The oscillation starts at $T_4 + 35$ seconds (593 seconds GET) at $+0.05$ g at $17\frac{1}{2}$ Hz, peaks at $T_4 + 6.6$ seconds (624 seconds GET) at $+0.25$ g at 19 Hz, and becomes indiscernible at $T_4 + 83$ seconds (681 seconds GET). The command module recorded a peak of 0.04 g during this time.
- Data from the second burn indicates no discernible oscillations to support either longitudinal or lateral dynamics of the vehicle. This evaluation is preliminary and efforts are continuing to explain the astronaut reports of oscillations during second burn. ✓

S-1I-508 INSULATION PROBLEMS Continued investigation of the spray foam insulation on S-1I-508 after cryoproof and static testing have turned up several significant deficiencies in adhesion between foam and tank. The problems all appear to stem from poor workmanship; that is incorrect adhesive application, failure to remove metal primer prior to applying insulation, and improper cleaning of the aluminum substrate. Considerable repair may be required, depending on the results of a test program being made at NR/SD. Unfortunately, the test results will be delayed since NR/SD improperly prepared the test specimens. TEST SPECIMENS.

BEN FRANKLIN DRIFT MISSION It appears that the drift mission will have to be slipped by about 2 weeks because of Grumman negotiations with the Navy regarding qualification requirements. This will necessitate at least 2 weeks longer participation by MSFC personnel. A test dive was made this week; but a minor cable leak developed, and no further dives have been attempted. ✓

PAYLOAD SHROUD The Payload Shroud Preliminary Design Review (PDR) was held as scheduled 5/20. Fifty-two RID's resulted from review of data package and the PDR. Two of the RID's, if accepted for implementation, will impact not only the Payload Shroud by possibly 6 months or more, but will impact the AAP-2 and -4 by equal amounts. Reference is made to KSC request for additional access doors; in the lower frustum and in the lower cylinder. Impact of adding a lower cylinder door will include re-design of the structure with some weight penalty, whereas a door in the lower frustum may require only a modification. However, a door in the lower frustum will require a complete qualification test program for the nose cone which constitutes a major added item to the program in both time and money. Since handling fixtures are already available for use with the current design, we believe these requirements are in the "nice to have" category. The RID way of doing business exposes us to significant impacts imposed by any level of management in MSF. ✓

NOTES 5/26/69 HOELZER

5/26/69

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THIRD GENERATION COMPUTER SYSTEM:

On Friday, May 23, 1969, UNIVAC successfully satisfied the contractual terms and conditions of acceptance by passing acceptance testing with an average effectiveness level of 95%. ✓

The efforts of system analysts and support personnel will be directed toward implementation and checkout of those features determined as operationally expedient and deficient. ✓

NOTES 5/26/69 HUBER

5/26/69

B 5/28

NUCLEAR ENGINE: The nuclear XE engine unsuccessfully attempted a full power test (1100 thermal megawatts and 50,000 pounds thrust) at the Nuclear Rocket Development Station (NRDS) in Nevada on May 15 and 16. Both days the engine failed to achieve bootstrap startup (i.e., using the pressure on the propellant in the propellant tank and the stored heat energy in the engine system to provide the energy needed to accelerate the turbopump during startup to pump the hydrogen propellant through the engine). The bootstrap startup had performed very successfully during the intermediate power tests on this engine. Initial examination of the turbopump on May 17, revealed that the turbopump shaft could not be turned even with a torque greater than eight times the normal required turning torque. Options under consideration for corrective action in order to continue the tests are: (1) To replace the turbopump assembly with the XE-Backup engine turbopump; (2) replace the upper module assembly (UMS) (including turbopump) with the XE-Backup UMS; and, (3) replace the XE engine with the XE-Backup engine. No estimate is currently available of the time before resumption of tests.

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5/26 JS

1. S-IVB Second Burn Oscillations Reported by Astronauts: A very preliminary review of the downrange ship data and CSM data does not show excessive oscillations or vibrations during S-IVB second burn timeframe. The data does show 12-13 cps oscillations with a .25 G peak-to-peak amplitude during most of the S-IVB second burn and 40-50 cps vibrations with a .2 G peak-to-peak amplitude (pitch) and .08 G peak-to-peak amplitude (yaw) starting approximately four minutes into the second burn. The review of the data is continuing to try and correlate the data with the oscillations reported by the astronauts.

Action has been initiated to install two accelerometers to measure low frequency vibration and three pressure measurements (LOX pump inlet and outlet and engine chamber pressure) on S-IVB-506 through 508 utilizing the FM/FM telemetry link in the IU for transmission. These measurements will be high-speed monitoring type and will be in addition to the present pressure measurements on the LOX pump inlet and outlet and chamber pressure that are transmitted through the PCM link.

2. S-IVB Auxiliary Hydraulic Pump Failure: The failure which occurred during the Apollo 10 flight has been duplicated during ground testing by simulating the breakage of the compensator spring guide which allowed the pressure to drop from 3650 psi to 500 psi. Approximately two years ago, a weakness was noted in this spring guide and Vickers, the vendor, was directed to install a stronger spring guide on all manufactured pumps and subsequent production. The vendor data reflects that the change was made; however, it was discovered during the inspection of another pump that Vickers had failed to make the change. Action has been initiated to inspect the compensators to assure that all pumps have the new spring guide. Inspection of the S-IVB-506 pump is scheduled for May 27.

3. S-II Center Engine LOX Line Accumulator: The last test of the experimental accumulator for helium damping is scheduled for May 29. Good data has been obtained thus far from the accumulator charge sequence and rate. The bobtail engine testing of the "flight configuration" accumulator will start approximately June 10, 1969. The earliest possible flight effectivity of the accumulator is now planned for S-II-8 with the earliest static firing by S-II-10; however, as a result of performance of S-II-5 with early center engine cutoff, stronger consideration is being given to accepting center engine cutoff as the permanent fix.

4. S-IVB-212/OWS Static Firing at MSFC: We are working with CSE (S&E) and the AAP Office to prepare for a June 5 CSE/AAP review of the plans for static firing the S-IVB-212/OWS at MSFC. We have provided draft copies of our charts to MDAC for their comment and reaction. Although we expect MDAC to work with us in arriving at a workable plan for S-IVB static firing and checkout at MSFC, we should not be surprised if their initial reaction is one of opposition to the decision and they may make inquiries to your office. After the June 5 review, we will schedule a presentation to you on this subject.

NOTES 5/26/69 JOHNSON

5/26/69

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OSSA FY-70 Program Submission - Copies of the task descriptions making up the program proposed by the Center for OSSA support are now being reproduced. The major technical areas being stressed are Astronomy and Optical Technology, Communication Applications, Meteorology, and Biology (Sterilization and Biological load control). The only fiscal guidelines provided by OSSA represent about 10 - 15% of the proposed program value. However, at the time of issuance of guidelines, no work in the Center on the Heavy Explorer was contemplated. FY-70 requirements for this effort are estimated at \$4+M and represent about 45% of the total program dollar value. ✓

Current SRT submission does not include plans for BOMEX follow-on. ✓

NOTES 5/26/69 MOHLERE

5/26/69

B 5/28

Nothing special to report.

NOTES 5/26/69 MOORE

B 5/26

5/26/69

1. New Generation of Telemetry Equipment: A major problem in acquiring data from space vehicles has always been the shortage of transmission capacity for wideband data signals such as vibration and acoustic measurements. The single sideband/frequency division (SS/FM) telemetry technique was developed to alleviate this problem for the R&D Saturn vehicles and over a thousand vibration measurements have been monitored via SS/FM on Saturn vehicles since its initial use on SA-2. In addition the Titan program took advantage of MSFC developmental work on SS/FM by using SS/FM on Titan 3-C developmental vehicles. The SS/FM equipment used on Saturn and Titan had limitations in low data frequency response and channel phase characteristics which degraded usefulness for defining certain data characteristics. Using S&RT funding a new generation of telemetry equipment using frequency division multiplexing (FDM) techniques has been developed which overcomes these limitations of earlier telemetry equipment. The Inter-Range Instrumentation Group (IRIG), associated with DOD, decided several months ago to modify the IRIG telemetry standards to include this new technique. ASTR personnel through their participation in national standards groups (IRIG/Telemetry Working Group and Telemetry Standards Coordination Committee) are now contributing to the formation of this new telemetry standard.

2. Solar Sensors for Orbital Workshop: The contract document for the design, development, fabrication, and delivery of eleven flight qualified solar sensors for the Orbital Workshop Project was forwarded to the contractor, Adcole Corporation, for signature on May 16, 1969. This requirement had been delayed previously by an MSFC legal opinion that the contract document was insufficient because the quantity of end items being procured varied from the quantities called out in the OWS Class Determination and Finding as approved by the NASA Administrator.

3. ATM Digital Computer (ATMDC): The Critical Design Review for the IBM ATMDC was conducted May 15, 1969, on schedule. Action items resulting therefrom are scheduled for closeout by May 30. Four IBM Deviation Approval Requests were approved by MSFC relative to manufacturing techniques. There are no known problems outstanding on the ATMDC at this time.

4. University of Tennessee Remote Sensing Aircraft: Several Astrionics technical personnel participated in a demonstration flight on the University of Tennessee Remote Sensing aircraft last week. University of Tennessee has 5 Hasselblad 500 EL cameras on board with filters and a single channel radiometer (3-5 microns). Readings were taken over the Widow Creek portion of the Tennessee River. Observers could clearly distinguish the river and the banks, and even a barge that happened by at the time.

5. Green Mountain: Shipment or transfer of 210 line items of equipment dismantled from the Antenna Pattern Test Range (Green Mountain) has been completed. Items were shipped to KSC, MTF, SSL, MICOM, and Alabama Space Museum. Project is considered complete and files are closed as of May 19, 1969. 'Tis like losing an ole friend.

NOTES 5/26/69 MURPHY

5/26 JTA

B 5/25

Nothing of significance to report.

B 5/28

5/26/69

1. S-II Mini-stage: The J-2 engine has been installed on the S-II Mini-stage and the stage lowered into test position. The air bag system is being connected to the stage and shaker hardware. The desired accelerated schedule has now been met.
2. Payload Shrouds: MDA Test Cylinders: The lower cylinder was completed on May 22 and moved to ASTN. The forward cylinder is being equipped with strain gages. Completion and transfer to ASTN is planned for May 29. ATM Test Cylinders: Assembly of the rings for the lower cylinder has been started. The last missing ring for the forward cylinder will be shipped on May 24 from McDonnell/Douglas.
3. Progress in Space Manufacturing Activities: A number of research organizations in industry and in the universities are working at their own expense on zero gravity processes. This is a direct result of the meeting last November on Manufacturing Technology Unique to Zero Gravity Environment. We think that more organizations will want to take part in this program as soon as the letter of agreement on industry participation in NASA programs between NASA and American Optical Corporation is prepared and sent out. This will establish a precedent which can be used with others. Zero-g manufacturing experiments suitable for near-term orbital flight application are being defined by: American Optical, Dr. Deeg, Glass Manufacturing Experiment; Revere Copper & Brass, Dr. Mondolfo, Aluminum Matrix Abrasive Material; Martin Metals, Dr. Thielemann, High Temperature Alloys for Turbine Blades. Other experiments are being defined by: North American Rockwell, Mr. Olsen, Optical Glass; North American Rockwell, Dr. Hung, Specialized Electron Tube Manufacture and Fiber Reinforced Castings; Grumman, Mr. Foggerty, Polymerization of New Types of Plastics; Grumman, Mr. Whitt, Solid Boron Filaments; Martin-Denver, Dr. Kober, Processing of Vaccine and Isotope Separation by Thermal Gradient; Sandia Laboratories, Dr. Nelson, High Temperature Chemistry of Refractories. In the universities the following activities are in progress: Advanced degree theses for doctoral program are being prepared at Purdue University concerning Zero-g Processing Systems for Positioning and Heating of Materials; Dr. Shaw of Carnegie-Mellon University is preparing a group study program for 30 - 40 undergraduate seniors to study and propose ways of using our earth orbital capability; Dr. Ruppe of the Technical University in Munich is defining a space manufacturing experiment. Studies will soon be underway and working groups exist to help in the assessment of the feasibility and value of any proposed experiment. No publication of experiment ideas is made without such an assessment and the approval of the investigator. A meeting is planned for September 23-24 here at MSFC for engineers and scientists to present their ideas on the Utilization of our Earth Orbital Capability for Manufacturing. This will be a follow-up to last year's meeting giving those who have been working in the subject an opportunity to report their progress and future plans. We invite you to lead a panel discussion in the afternoon session on September 24.

NOTES 5/26/69 SPEER

B 5/28

5/26/69

1. Apollo 10 Data: We were reasonably successful in expediting the key second burn data on this mission. L/V data recorded by the Mercury and Redstone ships were played back to ARIA aircraft, picked up by special courier and arrived at MSFC and McDonnell Douglas within $2\frac{1}{2}$ days. Although we had some processing problems, these data were quite useful for the early assessment of the vibrations reported by the crew. The actual ship tapes were received at MSFC $4\frac{1}{2}$ days after launch. CSM vibration data were finally received from MSC on Saturday (5/24). Earlier copies were unusable. Thanks to GSFC, this schedule is much better than any in the past. However, in the event of critical anomalies and if we need an immediate assessment during an on-going mission, still better delivery schedules are required. We shall discuss this with GSFC. ✓

2. Apollo 11 Range Safety: In a personal message to you, Dr. Debus has requested a crash effort to generate additional trajectory data to alleviate the range safety problem for the engine #3-out case and to avoid limiting the launch azimuth for that reason. In past calculations of velocity vector turning rates it was assumed for simplicity that at engine-out and simultaneous loss of control all four control engines go hardover. The requested refinement is expected to result in reduced turning rates since the loss of a control engine (in an assumed hard-over position) would reduce the effective moment by 25%). S&E-AERO supported by Boeing will have to run approximately 400 trajectories and the established deadline (June 3) is extremely short, but every effort is being made to accomplish this goal. Your answer to Dr. Debus is being prepared.

NOTES 5-26-69 Stuhlinger

5/26/69

3 5/25

ASTRONOMY MISSIONS BOARD (AMB) MEETING AT MSFC: The AMB, chaired by Dr. Leo Goldberg, held a one-day meeting here on May 23. Besides the regular Board members, about six NASA observers from HQ and GSFC, and 12 from MSFC, attended the presentations which were given by Marc Aucremanne (NASA Astronomy Program), Urner Lidell (Lunar and Planetary Missions Board report), and me (Astronomy-related work at MSFC). The Board then discussed the AMB Position Paper to be submitted to PSG shortly. By and large, the Board is in agreement with the NASA astronomy program as proposed by OSSA. The role of man in space astronomy is still not clearly defined. There was agreement, without objections, that man will eventually be useful in the operation of astronomical systems in space, but there was much hesitation to define his role in connection with an early space station. Board members expressed again the hope that NASA would make a study in which two systems with the same scientific objectives are compared, the first for remote control from ground, redundancy design, and, if necessary, complete substitution by another spacecraft, and the second for man-maintenance including repair and replacement of components by astronauts. ✓

Dr. Goldberg expressed his and the Board's appreciation for MSFC's hospitality, including the tour through the mock-up area and Astrionics Laboratory. Obviously, the Board was surprised and impressed by the large and diversified program of astronomy-related work at our Center. ✓

OFFICE OF DIRECTOR - MSFC

CODE	NAME	INIT.	<input type="checkbox"/> A C T I O N	<input type="checkbox"/> I N F O R M A T I O N

REMARKS

THIS IS THE REMAINDER OF THE 5-26-69
ANNOTATED NOTES.

CODE	NAME	DATE
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NOTES 5-26-69 Downey

5/26/69

B 5/26

1. GULF STREAM DRIFT MISSION: Navy certification has not been completed. It now appears that the mission will slip about two weeks. The activities for which NASA is responsible continue on schedule. ✓
2. ASTRONOMY MISSIONS BOARD MEETING: A very interesting discussion on man's role in space astronomy developed in the afternoon session. The AMB is preparing an overall position paper, and a chapter concerning man's role is to be prepared by Dr. Martin Schwarzschild. He indicates that he does not want to imply that space astronomy requires man. The AMB as a whole was reluctant to see astronomy cited as a justification for the manned program. Dr. Schwarzschild suggested prefacing his remarks on man's role by the comment, "If manned space stations are available, man can possibly be used to support space astronomy in the following ways:" In my opinion, the astronomers wish to keep their options open. If the manned program prospers, they will want a place in it. If it does not, much good space astronomy can be done with completely automated systems. ✓
3. AMB MEETING - INTEGRATED MANNED SPACE FLIGHT PLAN: Dr. Goldberg, a member of STAC, heard a presentation by Dr. Mueller last week on the Integrated Plan. Dr. Goldberg made a few brief comments during the AMB meeting concerning Dr. Mueller's plan. I gathered that Dr. Goldberg was not enthusiastic about the Integrated Plan and considered it unrealistic. Mr. Dave Woods of Bellcomm was responsible for fitting astronomy missions to the Integrated Plan. He was in attendance at the AMB meeting and made an interesting suggestion to me during a break; namely, integrate the 120" diffraction limited telescope (NASO) in a shuttle and bring it back to earth every thirty days for servicing, repair and updating. This is certainly a novel idea, which may have some merit, particularly since the Integrated Plan does not provide for a large Space Base in earth orbit. ✓
4. AMB MEETING - SUPER EXPLORER: The Super Explorer Program was discussed by Mr. Aucremanne early Friday morning before you arrived at the meeting. The PSG planning which Mr. Aucremanne described included eight Super Explorer missions before 1980. The last four missions are not defined. ✓

NOTES 5/26/69 FOSTER

5/26/69

B 5/26

CENTAUR CONTRACTING EXPERIENCE - We are arranging at the request of Col. Teir, for a discussion with Mr. T. B. Norris, Medium Launch Vehicle Program Manager, OSSA, and appropriate Lewis representatives concerning their contracting experience for the Centaur. Indications are that the Centaur contracting arrangements have certain aspects that may be helpful in achieving follow-on Saturn low-cost production. The Centaur procurement has four basic contracts e.g.,

- a) Production of a base-line vehicle (Firm Fixed Price)
- b) Modifications for specific mission (Cost Plus Fixed Fee)
- c) Launch Services at KSC (Cost Plus Award Fee) and,
- d) Management and Engineering (Cost Plus Award Fee).

The Centaur experience could provide insight into problems we may face. ✓

MSF R&D PROGRAM OPERATING PLAN - Dr. Mueller has informed us that a Center submission based on the MSF POP 69-1 "Mark" is not required. Instead, he asks that the foundation for our internal planning be the following:

1. Maintain a \$15M FY 1970 Apollo obligation and cost reserve requiring the Apollo Program Director's approval prior to use. The use and specific line-item location will be clarified as the Apollo/Lunar Exploration planning interface develops. ✓

2. Additional FY 1970 funds required for qualifying the J-2S Engine by June 30, 1971 will be absorbed within POP 69-1C Apollo (Rocketdyne) estimates. ✓

3. Apollo to fund approximately \$8M in FY 1970 for MDC (S-IVB), IBM/Bendix (IU), and GE (GSE) production support and maintenance of minimum required capabilities which are common to Saturn IB and Saturn V. ✓

4. Continued suspension of procurement plans for production of S-IVB and IU stages for AS-213 and 214 vehicles. ✓

5. Delay deliveries of AAP backup mission hardware sufficiently to avoid any requirements for additional equipment or crew. ✓

6. AAP Experiment Development effort will be limited to flight assigned experiments. The Habitability Support System's total runout effort will be limited to \$11.2M. ✓

We are requesting Center comments to these guidelines in order to prepare a reply to Dr. Mueller. ✓

B 5/28

NOTES 5-26-69 GOERNER
5/26/69

MOBILITY TEST ARTICLE (MTA): The MTA Human Factors Test has been completed. The purpose of the test was twofold: first, to compare driver proficiency of many subjects, and, second, to compare the actual driving performance of the two MTAs on earth with the performance of the MOLABs in the visual simulator in Computation Laboratory. Since the MTAs were originally designed in 1965 for about a 400-hour lifetime and were to simulate MOLAB's lunar weight by limiting MTA mass to one-sixth MOLAB's, low safety factors were used and the vehicles were nearly worn out before the Human Factors tests began. Unfortunately, inclement weather and mechanical/electronic problems with the vehicles have prevented accomplishment of the scope of the original program as planned. The winter rains made the course unuseable for weeks at a time and frequent vehicle breakdowns caused more time loss. Initial plans were to use about 12 hard-suited test subjects driving a prescribed route on our simulated lunar surface. The ambitious program was to include simulation of various emergencies, such as a wheel locked, scuff steering only, etc. Metabolic rate, response rate, pulse rate, etc., were to be measured as an index of driver performance. Unfortunately, the selected route included several severe craters requiring maximum torque from the vehicle's wheels. This in turn caused electronic problems from current overload, and mechanical failures on the wheels and chassis as well. The test was then modified to use fewer subjects and runs in order to complete the test in the limited time remaining. This program began immediately after the MTA Dynamics Test Program here at MSFC. Although much less data were derived from the test program than originally expected, due to the equipment breakdowns, etc., it is felt that some useful Human Factors data have been obtained, and the weak points of the GM/MTA have been revealed and will be corrected during refurbishment. ✓

The planned MTA Refurbishment and Test Program was discussed with Mr. Benjamin Milwitzky last week and he reiterated NASA Headquarters' firm backing for the program. ✓

Since the MTA Human Factors Test has been completed, S&E-ASTR and S&E-ASTN have been checking out and testing the GM/MTA to assure that the electronics system improvements have been accomplished. To verify the torque capability of the improved system, an attempt was made to scale an eight-foot step obstacle. Although the electronics worked satisfactorily, almost immediately the harmonic drive of the left rear wheel failed mechanically and the vehicle was not quite able to negotiate the obstacle. The incident was filmed and motion pictures will be available soon. We believe that a refurbished MTA would have negotiated the obstacle. If more information on the MTA programs is desired, a short presentation can be arranged at your convenience. ✓

NOTES 5-26-69 GRAU

5/26/69

B 5/28

1. OWS MATERIALS CONTROL: The following is submitted in reply to your comment to me on NOTES 3-3-69 HEIMBURG pertaining to McDonnell Douglas Astronautics Company (MDAC) OWS documentation which continues to specify flammable and stress corrosive susceptible materials. A stress corrosion review meeting was held with MDAC on March 10 to resolve material application problems identified in the Final Design Review of February 18, 1969. In summary, MDAC agreed to change materials or provide additional justification for the specific design applications. The changes agreed to in the meeting have been forwarded to MDAC through PM for implementation. During a workshop materials review meeting with MDAC on May 1, 1969, all but two items of concern (cover material for the OWS lights and wiring insulation) pertaining to flammability problems appeared to have been resolved. We are working with MDAC to resolve these two items.
2. PARTS PROGRAM: Mr. Leon Hamiter's paper, entitled "Large Scale Integrated Circuits for Space Electronics," has been selected for presentation at the Eighth International Symposium on Space Technology and Science, Tokyo, Japan, during the week of August 25, 1969. Throughout NASA, only four papers were selected for this symposium.
3. TELEDYNE QUALITY SURVEY: Lewis Research Center recently requested that we participate with Dr. Holladay from Astrionics Laboratory in a survey of the microcircuit facilities of Teledyne Systems in Culver City, California. Teledyne has a contract for the Upgraded Centaur Computer. The procedures developed under the NASA Microcircuit Line Certification program were employed in making a detailed review of the key process steps. The survey has been completed, and a report is ready to be sent to Lewis Research Center. Deficiencies, too numerous to mention here, were found in the process and documentation.

5/26/69

1. Acceleration Design Limit (g level) for Saturn V Launch Vehicle and Spacecraft Modifications: In connection with the Saturn V Dry Workshop, CSE requested ASTN to determine what g level the launch vehicle could take and still maintain manned rating safety factor of 1.4 and a payload of 105K pounds. ASTN has indicated that the launch vehicle is presently good for a g level of 4.35. In checking with MSC it was learned that the present spacecraft is good for 4.35 g's; however, MSC has a contract to NAR for building new and larger tanks for the Spacecraft Propulsion System (SPS) and their spec only calls for a 4.0 g design value. We asked MSC to change their design spec and they indicated this would require a letter from MSFC. We are now getting the g level documented and preparing the letter to Col. James. This should be accomplished by May 29. ✓

2. Cluster Test for AAP: We met on May 21 with QUAL, ASTN and Products Office to discuss checkout flow for the AAP hardware involved in the Cluster test. This includes the OWS, AM, MDA, WACS, SAS, experiments, and to some extent, the payload shroud and IU. Agreement was reached on flow, what has to be done with each module for each test location and for the Cluster test, and to a limited extent how the hardware flows at KSC. Thus, an S&E position is established. Minutes are being prepared for distribution. A particular benefit from achieving agreement on overall flow is a net reduction of previously planned test effort and equipment and thus reduced costs in verifying the flight hardware. ✓

3. S-II POGO Instrumentation: S-II 506 is virtually void of instrumentation to support a POGO analysis should a problem occur or to assist in modeling. We have discussed the problem with Lee James, who does not want to add instrumentation at this time due to the severity of the impact. The whole chain of events in the flight control-measurements flow through the MSFN would be impacted. We will now only depend on additional S-IVB vibration measurements which have been approved for 506. PM has approved the S-II vibration measurement request for 507 through 510. ✓

4. S-IVB Second Burn Vibration/Oscillation Reported by Astronauts: Astronauts reported (in real time) a high frequency vibration after four minutes of second S-IVB burn. Recapping later, they reported lateral and longitudinal oscillations of low frequency throughout first and second burns with a definite higher frequency (estimated approximately 20 Hz) superimposed on the low frequency late in the S-IVB second burn. Review of flight records to date indicates a correlation between the astronaut report and measurements on the launch vehicle. S-IVB gimbal block longitudinal acceleration of ± 0.1 g 12-13 Hz is fairly persistent for the last 100 seconds of burn. Accelerometers located in the S-IVB forward-skirt, pitch and yaw, indicate a definite increase in amplitude of a 45 Hz oscillation about 70 seconds before cutoff, remaining to cutoff (pitch amplitude approx. ± 2.0 g, yaw amplitude approx. ± 1.0 g). Preliminary review of accelerations measured in the spacecraft does not indicate low frequency longitudinal oscillation or a high frequency pitch or yaw vibration, but there are low amplitudes ± 0.05 g, 15-16 Hz oscillations fairly persistent over the latter part of the second burn. The discrepancy between the low vibrations amplitudes measured in the spacecraft and the high values reported by the astronaut might be resolved by the attenuation of the accelerometers. Efforts will continue to resolve the unexplained vibration late in the second S-IVB burn and the contradicting information on spacecraft vibration. ✓

5/26/69

B 5/28

1. EXPERIMENT ON APOLLO 10 FOR FILM DEGRADATION BY HIGH ENERGY PARTICLES:

The film canister which I mentioned in my Notes of April 21 (attached) is being flown on Apollo 10. It got on board with the help of Dieter Grau, Ernst Stuhlinger, Lee James, Dixon Forsythe, and many others. The canister was loaded at KSC with fresh film at 3:30 p. m. on May 16 and installed in the CM. The canister will be picked up from MSC by Ray Hembree. The exact time will be obtained from Houston.

2. G-1 SOIL MECHANICS INVESTIGATION:

As you already know from your correspondence with Dr. J. Naugle, Dr. N. Costes' appointment as the team leader of the G-1 Soil Mechanics Investigation Science Team has been confirmed. This team of "Cognizant Scientists" will participate in the scientific evaluation of Apollo 11 with respect to the lunar soil properties. Other members of the team are: Professor R. F. Scott of the California Institute of Technology, Professor J. K. Mitchell of the University of California-Berkeley, and Dr. W. D. Carrier of MSC. Dr. Costes has also been formally invited by Dr. E. M. Shoemaker, Principal Investigator on the Apollo Lunar Geology Experiment (ALGE), to serve as a Co-Investigator on Dr. Shoemaker's team during the Apollo 12 through 14 lunar landing missions. Results of these studies will be published in the form of NASA reports, papers presented at societies, and open literature publications. The information obtained will have a bearing on the LRV, Early Apollo Scientific Experiment Package (EASEP), and Apollo Lunar Surface Experiment Package (ALSEP).

3. MSFC-UAH RELATIONS:

I spent considerable time last week formulating a program of SSL tasks which are suitable for contracting to the UAH Research Institute. In addition to in-house discussions, I had a meeting with Drs. Porter and Thompson. I have the impression that we can expect from both a desire to respond to MSFC's needs. I intend to select for the first set of tasks those which have a direct connection to our MSFC scientific projects and are suitable to build up a space sciences oriented capability at the University. I would like to present this to you in a week. (It will take me about a week to complete my homework on this.)

1. Package of Film to be Flown on Apollo 10:

Drs. Dozier and deLoach recently initiated (as part of SSL's radiation analysis for the ATM and OWS) an experiment to measure effects of proton irradiation on 12 different kinds of film for the CM (command module) of the 505 flight. Design was begun on April 1 and the completed package was handcarried to KSC on April 7. Help was received from many people at MSFC, otherwise it would not have been possible to meet this nearly impossible deadline.

2. Proton Spectrometer:

I am glad we could present to you, in connection with Dr. Guenther's NAS termination discussion, the status and background of the Proton Spectrometer experiment which is planned as a housekeeping or Saturn engineering measurement. We hope that it does not mean farewell to Dr. Guenther, but that he can continue with us on the experiment as a member of the University of Alabama. Your help with PM (Program Management) to obtain the funding for a possible University contract is greatly appreciated. As Dr. Guenther explained in our meeting, the experiment will measure the hard tail end of the proton spectrum. The results are urgently needed for solution of the film fogging problem for ATM and for longtime occupancy of the OWS (Orbital Workshop).

3. T-031 Flight Experiment Status:

T-031 is an OART approved SSL flight experiment to fly retrievable coupons on the S-IV/B Workshop. These coupons contain several thermal control coupons which are exposed to the space environment. At the end of the mission, in-space measurements of a few of these samples will be made and one of the coupons will be retrieved for ground evaluation. Other coupons with the same samples will be left on the workshop for retrieval on subsequent revisits.

The in-space measuring instrument is an integrating sphere reflectometer, the prototypes of which are in the final checkout stages at Block Engineering, Boston, Mass. These instruments will be brought to MSFC and evaluated both electronically and optically.

The experiment has not been approved by the MSFEB; however, a similar experiment proposed by Carl Boebel of the Air Force has been approved. The Air Force experiment is essentially the same as T-031 except they are not planning any in-space measurements. Mr. Boebel indicated he would be in favor of a joint AF/NASA experiment using our reflectometer. We are going to follow this up with OART and the OMSE/AAP Office. Dr. Sieber and his Scientific Engineering Division will work on this jointly with members of our Space Thermophysics Division.

5/26/69

35/20

AS-505 POGO SUMMARYS-IC Stage - No problem. Flight data similar to AS-504.S-II Stage - Early center engine cutoff solved the problem experienced on previous flights.S-IVB Stage- Data from first burn indicates only one measurement where oscillations significantly outside of the noise level. The measurement of concern is on the J-2 gimbal block. The oscillation starts at $T_4 + 35$ seconds (593 seconds GET) at $+0.05$ g at $17\frac{1}{2}$ Hz, peaks at $T_4 + 6.6$ seconds (624 seconds GET) at $+0.25$ g at 19 Hz, and becomes indiscernible at $T_4 + 83$ seconds (681 seconds GET). The command module recorded a peak of 0.04 g during this time.

Data from the second burn indicates no discernible oscillations to support either longitudinal or lateral dynamics of the vehicle. This evaluation is preliminary and efforts are continuing to explain the astronaut reports of oscillations during second burn. ✓

S-11-508 INSULATION PROBLEMS Continued investigation of the spray foam insulation on S-11-508 after cryoproof and static testing have turned up several significant deficiencies in adhesion between foam and tank. The problems all appear to stem from poor workmanship; that is incorrect adhesive application, failure to remove metal primer prior to applying insulation, and improper cleaning of the aluminum substrate. Considerable repair may be required, depending on the results of a test program being made at NR/SD. Unfortunately, the test results will be delayed since NR/SD improperly prepared the test specimens.

BEN FRANKLIN DRIFT MISSION It appears that the drift mission will have to be slipped by about 2 weeks because of Grumman negotiations with the Navy regarding qualification requirements. This will necessitate at least 2 weeks longer participation by MSFC personnel. A test dive was made this week; but a minor cable leak developed, and no further dives have been attempted. ✓

PAYLOAD SHROUD The Payload Shroud Preliminary Design Review (PDR) was held as scheduled 5/20. Fifty-two RID's resulted from review of data package and the PDR. Two of the RID's, if accepted for implementation, will impact not only the Payload Shroud by possibly 6 months or more, but will impact the AAP-2 and -4 by equal amounts. Reference is made to KSC request for additional access doors; in the lower frustum and in the lower cylinder. Impact of adding a lower cylinder door will include re-design of the structure with some weight penalty, whereas a door in the lower frustum may require only a modification. However, a door in the lower frustum will require a complete qualification test program for the nose cone which constitutes a major added item to the program in both time and money. Since handling fixtures are already available for use with the current design, we believe these requirements are in the "nice to have" category. The RID way of doing business exposes us to significant impacts imposed by any level of management in MSF.

NOTES 5/26/69 HOELZER

5/24/69

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5/28

THIRD GENERATION COMPUTER SYSTEM:

On Friday, May 23, 1969, UNIVAC successfully satisfied the contractual terms and conditions of acceptance by passing acceptance testing with an average effectiveness level of 95%. ✓

The efforts of system analysts and support personnel will be directed toward implementation and checkout of those features determined as operationally expedient and deficient. ✓

NOTES 5/26/69 HUBER

5/26/69

B 5/28

NUCLEAR ENGINE: The nuclear XE engine unsuccessfully attempted a full power test (1100 thermal megawatts and 50,000 pounds thrust) at the Nuclear Rocket Development Station (NRDS) in Nevada on May 15 and 16. Both days the engine failed to achieve bootstrap startup (i.e., using the pressure on the propellant in the propellant tank and the stored heat energy in the engine system to provide the energy needed to accelerate the turbopump during startup to pump the hydrogen propellant through the engine). The bootstrap startup had performed very successfully during the intermediate power tests on this engine. Initial examination of the turbopump on May 17, revealed that the turbopump shaft could not be turned even with a torque greater than eight times the normal required turning torque. Options under consideration for corrective action in order to continue the tests are: (1) To replace the turbopump assembly with the XE-Backup engine turbopump; (2) replace the upper module assembly (UMS) (including turbopump) with the XE-Backup UMS; and, (3) replace the XE engine with the XE-Backup engine. No estimate is currently available of the time before resumption of tests. ✓

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5/26/69

1. S-IVB Second Burn Oscillations Reported by Astronauts: A very preliminary review of the downrange ship data and CSM data does not show excessive oscillations or vibrations during S-IVB second burn timeframe. The data does show 12-13 cps oscillations with a .25 G peak-to-peak amplitude during most of the S-IVB second burn and 40-50 cps vibrations with a .2 G peak-to-peak amplitude (pitch) and .08 G peak-to-peak amplitude (yaw) starting approximately four minutes into the second burn. The review of the data is continuing to try and correlate the data with the oscillations reported by the astronauts.

Action has been initiated to install two accelerometers to measure low frequency vibration and three pressure measurements (LOX pump inlet and outlet and engine chamber pressure) on S-IVB-506 through 508 utilizing the FM/FM telemetry link in the IU for transmission. These measurements will be high-speed monitoring type and will be in addition to the present pressure measurements on the LOX pump inlet and outlet and chamber pressure that are transmitted through the PCM link.

2. S-IVB Auxiliary Hydraulic Pump Failure: The failure which occurred during the Apollo 10 flight has been duplicated during ground testing by simulating the breakage of the compensator spring guide which allowed the pressure to drop from 3650 psi to 500 psi. Approximately two years ago, a weakness was noted in this spring guide and Vickers, the vendor, was directed to install a stronger spring guide on all manufactured pumps and subsequent production. The vendor data reflects that the change was made; however, it was discovered during the inspection of another pump that Vickers had failed to make the change. Action has been initiated to inspect the compensators to assure that all pumps have the new spring guide. Inspection of the S-IVB-506 pump is scheduled for May 27.

3. S-II Center Engine LOX Line Accumulator: The last test of the experimental accumulator for helium damping is scheduled for May 29. Good data has been obtained thus far from the accumulator charge sequence and rate. The bobtail engine testing of the "flight configuration" accumulator will start approximately June 10, 1969. The earliest possible flight effectivity of the accumulator is now planned for S-II-8 with the earliest static firing by S-II-10; however, as a result of performance of S-II-5 with early center engine cutoff, stronger consideration is being given to accepting center engine cutoff as the permanent fix.

4. S-IVB-212/OWS Static Firing at MSFC: We are working with CSE (S&E) and the AAP Office to prepare for a June 5 CSE/AAP review of the plans for static firing the S-IVB-212/OWS at MSFC. We have provided draft copies of our charts to MDAC for their comment and reaction. Although we expect MDAC to work with us in arriving at a workable plan for S-IVB static firing and checkout at MSFC, we should not be surprised if their initial reaction is one of opposition to the decision and they may make inquiries to your office. After the June 5 review, we will schedule a presentation to you on this subject.

NOTES 5/26/69 JOHNSON

5/26/69

B 5/26

OSSA FY-70 Program Submission - Copies of the task descriptions making up the program proposed by the Center for OSSA support are now being reproduced. The major technical areas being stressed are Astronomy and Optical Technology, Communication Applications, Meteorology, and Biology (Sterilization and Biological load control). The only fiscal guidelines provided by OSSA represent about 10 - 15% of the proposed program value. However, at the time of issuance of guidelines, no work in the Center on the Heavy Explorer was contemplated. FY-70 requirements for this effort are estimated at \$4+M and represent about 45% of the total program dollar value. ✓

Current SRT submission does not include plans for BOMEX follow-on. ✓

NOTES 5/26/69 MOHLERE

5/26/69

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Nothing special to report.

NOTES 5/26/69 MOORE

5/26/69

3/5/69

1. New Generation of Telemetry Equipment: A major problem in acquiring data from space vehicles has always been the shortage of transmission capacity for wideband data signals such as vibration and acoustic measurements. The single sideband/frequency division (SS/FM) telemetry technique was developed to alleviate this problem for the R&D Saturn vehicles and over a thousand vibration measurements have been monitored via SS/FM on Saturn vehicles since its initial use on SA-2. In addition the Titan program took advantage of MSFC developmental work on SS/FM by using SS/FM on Titan 3-C developmental vehicles. The SS/FM equipment used on Saturn and Titan had limitations in low data frequency response and channel phase characteristics which degraded usefulness for defining certain data characteristics. Using S&RT funding a new generation of telemetry equipment using frequency division multiplexing (FDM) techniques has been developed which overcomes these limitations of earlier telemetry equipment. The Inter-Range Instrumentation Group (IRIG), associated with DOD, decided several months ago to modify the IRIG telemetry standards to include this new technique. ASTR personnel through their participation in national standards groups (IRIG/Telemetry Working Group and Telemetry Standards Coordination Committee) are now contributing to the formation of this new telemetry standard.

2. Solar Sensors for Orbital Workshop: The contract document for the design, development, fabrication, and delivery of eleven flight qualified solar sensors for the Orbital Workshop Project was forwarded to the contractor, Adcole Corporation, for signature on May 16, 1969. This requirement had been delayed previously by an MSFC legal opinion that the contract document was insufficient because the quantity of end items being procured varied from the quantities called out in the OWS Class Determination and Finding as approved by the NASA Administrator.

3. ATM Digital Computer (ATMDC): The Critical Design Review for the IBM ATMDC was conducted May 15, 1969, on schedule. Action items resulting therefrom are scheduled for closeout by May 30. Four IBM Deviation Approval Requests were approved by MSFC relative to manufacturing techniques. There are no known problems outstanding on the ATMDC at this time.

4. University of Tennessee Remote Sensing Aircraft: Several Astrionics technical personnel participated in a demonstration flight on the University of Tennessee Remote Sensing aircraft last week. University of Tennessee has 5 Hasselblad 500 EL cameras on board with filters and a single channel radiometer (3-5 microns). Readings were taken over the Widow Creek portion of the Tennessee River. Observers could clearly distinguish the river and the banks, and even a barge that happened by at the time.

5. Green Mountain: Shipment or transfer of 210 line items of equipment dismantled from the Antenna Pattern Test Range (Green Mountain) has been completed. Items were shipped to KSC, MTF, SSL, MICOM, and Alabama Space Museum. Project is considered complete and files are closed as of May 19, 1969. 'Tis like losing an ole friend.

NOTES 5/26/69 MURPHY

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B 5/28

Nothing of significance to report.

5/26/69

1. S-II Mini-stage: The J-2 engine has been installed on the S-II Mini-stage and the stage lowered into test position. The air bag system is being connected to the stage and shaker hardware. The desired accelerated schedule has now been met. ✓
2. Payload Shrouds: MDA Test Cylinders: The lower cylinder was completed on May 22 and moved to ASTN. The forward cylinder is being equipped with strain gages. Completion and transfer to ASTN is planned for May 29. ATM Test Cylinders: Assembly of the rings for the lower cylinder has been started. The last missing ring for the forward cylinder will be shipped on May 24 from McDonnell/Douglas. ✓
3. Progress in Space Manufacturing Activities: A number of research organizations in industry and in the universities are working at their own expense on zero gravity processes. This is a direct result of the meeting last November on Manufacturing Technology Unique to Zero Gravity Environment. We think that more organizations will want to take part in this program as soon as the letter of agreement on industry participation in NASA programs between NASA and American Optical Corporation is prepared and sent out. This will establish a precedent which can be used with others. Zero-g manufacturing experiments suitable for near-term orbital flight application are being defined by: American Optical, Dr. Deeg, Glass Manufacturing Experiment; Revere Copper & Brass, Dr. Mondolfo, Aluminum Matrix Abrasive Material; Martin Metals, Dr. Thielemann, High Temperature Alloys for Turbine Blades. Other experiments are being defined by: North American Rockwell, Mr. Olsen, Optical Glass; North American Rockwell, Dr. Hung, Specialized Electron Tube Manufacture and Fiber Reinforced Castings; Grumman, Mr. Foggerty, Polymerization of New Types of Plastics; Grumman, Mr. Whitt, Solid Boron Filaments; Martin-Denver, Dr. Kober, Processing of Vaccine and Isotope Separation by Thermal Gradient; Sandia Laboratories, Dr. Nelson, High Temperature Chemistry of Refractories. In the universities the following activities are in progress: Advanced degree theses for doctoral program are being prepared at Purdue University concerning Zero-g Processing Systems for Positioning and Heating of Materials; Dr. Shaw of Carnegie-Mellon University is preparing a group study program for 30 - 40 undergraduate seniors to study and propose ways of using our earth orbital capability; Dr. Ruppe of the Technical University in Munich is defining a space manufacturing experiment. Studies will soon be underway and working groups exist to help in the assessment of the feasibility and value of any proposed experiment. No publication of experiment ideas is made without such an assessment and the approval of the investigator. A meeting is planned for September 23-24 here at MSFC for engineers and scientists to present their ideas on the Utilization of our Earth Orbital Capability for Manufacturing. This will be a follow-up to last year's meeting giving those who have been working in the subject an opportunity to report their progress and future plans. We invite you to lead a panel discussion in the afternoon session on September 24. ✓

NOTES 5/26/69 SPEER

B 5/28

5/26/69

1. Apollo 10 Data: We were reasonably successful in expediting the key second burn data on this mission. L/V data recorded by the Mercury and Redstone ships were played back to ARIA aircraft, picked up by special courier and arrived at MSFC and McDonnell Douglas within $2\frac{1}{2}$ days. Although we had some processing problems, these data were quite useful for the early assessment of the vibrations reported by the crew. The actual ship tapes were received at MSFC $4\frac{1}{2}$ days after launch. CSM vibration data were finally received from MSC on Saturday (5/24). Earlier copies were unusable. Thanks to GSFC, this schedule is much better than any in the past. However, in the event of critical anomalies and if we need an immediate assessment during an on-going mission, still better delivery schedules are required. We shall discuss this with GSFC. ✓

2. Apollo 11 Range Safety: In a personal message to you, Dr. Debus has requested a crash effort to generate additional trajectory data to alleviate the range safety problem for the engine #3-out case and to avoid limiting the launch azimuth for that reason. In past calculations of velocity vector turning rates it was assumed for simplicity that at engine-out and simultaneous loss of control all four control engines go hardover. The requested refinement is expected to result in reduced turning rates since the loss of a control engine (in an assumed hard-over position) would reduce the effective moment by 25%. S&E-AERO supported by Boeing will have to run approximately 400 trajectories and the established deadline (June 3) is extremely short, but every effort is being made to accomplish this goal. Your answer to Dr. Debus is being prepared.

NOTES 5-26-69 Stuhlinger

5/26/69

3 5/28

ASTRONOMY MISSIONS BOARD (AMB) MEETING AT MSFC: The AMB, chaired by Dr. Leo Goldberg, held a one-day meeting here on May 23. Besides the regular Board members, about six NASA observers from HQ and GSFC, and 12 from MSFC, attended the presentations which were given by Marc Aucremanne (NASA Astronomy Program), Urner Lidell (Lunar and Planetary Missions Board report), and me (Astronomy-related work at MSFC). The Board then discussed the AMB Position Paper to be submitted to PSG shortly. By and large, the Board is in agreement with the NASA astronomy program as proposed by OSSA. The role of man in space astronomy is still not clearly defined. There was agreement, without objections, that man will eventually be useful in the operation of astronomical systems in space, but there was much hesitation to define his role in connection with an early space station. Board members expressed again the hope that NASA would make a study in which two systems with the same scientific objectives are compared, the first for remote control from ground, redundancy design, and, if necessary, complete substitution by another spacecraft, and the second for man-maintenance including repair and replacement of components by astronauts.

Dr. Goldberg expressed his and the Board's appreciation for MSFC's hospitality, including the tour through the mock-up area and Astrionics Laboratory. Obviously, the Board was surprised and impressed by the large and diversified program of astronomy-related work at our Center.