

March 7, 1966

NOTES 3/7/66 BALCH

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S-II-T Stage Electrical Control System Checkout (DOP-M-B010) - Pre-run rack and cable setup was officially begun at 4 p. m., Wednesday, March 3, 1966, and is presently scheduled for completion by March 9. This will permit LN<sub>2</sub> tanking to begin that date. No work was performed on Sunday, March 6, in order that overworked crews could take a break. ✓

S-II Cryogenic and Gas Facility Systems are in final preparation for LN<sub>2</sub> tanking of S-II-T. All four gas systems have been pressurized to capacity. MTF Safety Manual, prepared for MTF by General Electric, has been published and distributed on site. ✓

Test Stand S-II A-1 - GSE Installation RFG has been released for bid by NAA/ S&ID (MTF). R-TEST personnel are on site to assist the Corps in correction of welding deficiencies of the initial delivery of A-1 steel. Recent deliveries are on schedule and are of satisfactory quality. ✓

S-IC Complex - JOD inspection of ninth and tenth floors was held on March 2. Installation of Phase II Technical Systems is progressing satisfactorily in TCC, tunnels, mezzanine, cable chases, and seventh floor. ✓

Acoustic Horn is in process of relocation to its new pedestal adjacent to the Meteorology Building and should be back in operation within two weeks. ✓

Data Handling System "Workaround" is progressing satisfactorily with the help of Slidell and Huntsville personnel. An expediting team spent a few days in Covina, California, to insure the completion of the regular Data Handling System on the required dates and with the assignment of four programmers on site, the probability of meeting the dates is good. ✓

Labor Jurisdictional Disputes continue to cause much lost time and confusion. Walkout by operating engineers on March 1 and by pipefitters on March 2 had a net impact of approximately 700 man-days lost. Mr. King ( new Headquarters Labor Relations Director) will visit MTF on March 9 - 10 for a first visit. ✓

MTF fee Area will be closed to public beginning March 21. Rerouted State Highway 43 will be completed and open for traffic prior to that time. Heavy rains delayed its completion originally scheduled for March 1. ✓

3/7 JTB

RL10 ENGINE An RL10 R&D/Vehicle Integration Meeting was held at Pratt & Whitney Aircraft on March 1. Topics included (1) research and development and production programs are on schedule, with RL10A-3-3 qualification in October 1966 and engine deliveries to be completed in January 1967; (2) hardware is being procured to qualify a carbon insert for the LOX pump labyrinth seal; (3) the GD/C BPTV (Sycamore) test stand will be deactivated after the AC-8 flight, and the P&WA E-5 test stand will continue to be used for Centaur propulsion system tests. ✓

J-2 ENGINE The fourth engine for S-II 503 was delivered to S&ID this week.

During the last S-II Battleship firing, a performance shift was noted on one of the engines. The engine fuel pump was inspected and there were several pieces of the honeycomb turbine seal missing. The honeycomb seal and damaged stator have been replaced and the next test is scheduled for March 4.

The first 230K Production Engine (2060) had its initial calibration and check-out firing (100 seconds) March 2. The acceptance test was completed satisfactorily on March 5, and the engine has been removed from the test stand. ✓

Progress has been made on obtaining delinquent test cell hardware for the AEDC Test Program. A decision has been made to add a third shift to the test program. This third shift should increase our probability of obtaining desired data to support Vehicle 501. ✓

F-1 ENGINE The thrust chamber injector of engine F-3013, installed in position number one of S-IC-1, was observed to have baffle cracking after the stage acceptance firing. The crack was very similar to the one found in the injector of engine F-5030 after acceptance testing at Edwards. Acid etching of the injector revealed non-oxygen free copper. Engine F-3013 injector had been replaced at MSFC as part of the high-strength braze injector retrofit program, and the stage tests were the first engine firings. All remaining injectors at MSFC have now been inspected for oxygen-free copper and found satisfactory. When S-IC-1 is returned to ME Laboratory engine F-3013 will be removed, the injector replaced, and the engine static fired and replaced. ✓

In R&D engine system testing at RETS two solenoid failures have occurred on the four-way control valves. As a result X-ray investigation was conducted on 22 solenoids with five found to have internal braze discrepancies. Of the five discrepant solenoids, one had a totally unacceptable braze, two are questionable and two are believed adequate. To assure that solenoids on stage engines meet specifications, all spare solenoids (26 from MSFC and 8 from Michoud) and those at the contractor plant will be X-rayed. Inspected solenoids will be returned to MSFC for retrofit of stage engines within a week. We expect to have at least 10 reinspected solenoids for retrofit of the five engines of one stage. No schedule impact is anticipated. ✓

H-1 ENGINE The Configuration Control Board Directive was approved on March 1, for retrofit of the improved LOX seals on S-IB-5 at MSFC. This retrofit was completed on March 4; no problems were encountered. ✓

GENERAL This office was informed recently of an impending strike against NAA by a welding union which undoubtedly will impact engine fabrication at Canoga Park. The strike is supposed to begin March 14. The major issues, specifics, and resulting impacts are not clear at this time. ✓

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CONTRACT NAS8-5608

The Supplemental Agreement MICH-110 which is the conversion of the S-IC stage effort from CPFF to CPIF was approved by NASA Headquarters March 1, 1966. ✓

The Procurement Plan for S-IC stages 11 through 15 is expected to be approved by NASA Headquarters by March 4, 1966. ✓

S-IB PROGRAM

The 70" LOX tank failed at approximately 120% of flight loads during qualification testing during the night of March 2, 1966. The failure was a buckle in the first cylindrical section below the forward bulkhead. The loading condition was simulating the loads experienced by the tank at maximum fin loads (T-64.6 seconds). Loads consisted of 100% internal tank pressure and 120% axial, shear and bending loads. Load and strain data is being reduced and should be available today for evaluation. Continued evaluation of the reasons for failure and the impact on the program are in progress. ✓

NOTES 3-7-66 DANNENBERG

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NEGATIVE REPORT.

NOTES 3/7/66 FELLOWS

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MSFC General Support to the Apollo Program - In my 2/21/66 NOTES, I reported that in response to requirements established in Mr. Gorman's January 28 memorandum to Mr. Weidner, information was being pulled together for use in developing a plan to implement the General Apollo Support (GAS) program for submission to Mr. Gorman. A preliminary plan has been developed and is being transmitted this week. ✓

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1. Belgian Government Interest in Saturn Guidance Concepts: Belgium has, for the past four years, been in charge of development of radio guidance system for ELDO (European Launcher Development Organization) booster. The Belgian Gov't has, in turn, committed prime contractorship to a Belgian firm, Manufacture Belge de Lampes et de Materiel Electronique (MBLE). During the past several months, we have been answering a variety of questions from MBLÉ concerning Saturn guidance for possible use with ELDO booster. More recently, MBLÉ has requested permission to send two experts to visit Marshall to obtain as much information as possible concerning Saturn guidance concepts. We have referred this request to Public Affairs Office and have agreed to receive the two visitors, if proper clearance can be obtained. ✓
2. AS-201 Flight: AS-201 was launched Feb. 26 at 11:12 am EST. Launch vehicle portion of flight was highly successful. ✓ S-IB flight was completely normal with IECO occurring 0.9 sec later than predicted and OECO occurring 5.5 sec after IECO. It appears at this time that OECO was given by fuel depletion which would be first time this has occurred on a Saturn vehicle. ✓ S-IVB burn time was 9.7 sec shorter than predicted. ✓ It appears that S-IVB thrust level after mixture ratio step was lower than predicted. There is also an indication that J-2 engine had a slow start, probably due to lower temperatures of the engine than expected. This problem seems to be strongly influenced by the several re-cycles in the countdown to T - 15 minutes. Both S-IB/S-IVB and LV/CSM separations appeared to be very smooth. Excellent pictures were obtained of the S-IB/S-IVB separation from the on-board camera that was recovered. This indicated very clean separation. ✓ Guidance gave S-IVB cut off properly, but we still do not have end conditions available from tracking data. However, information we do have indicates we were close to nominal. Spacecraft impact was within about 14 n mi of predicted, however, re-entry velocity was 214 m/s less than predicted. ✓
3. Atmospheric Research Facility Activities: Our Satellite Automatic Picture Transmission Ground Station obtained the first group of weather pictures from ESSA 2 during passes within range of station on Mar. 2. NASA Hq. granted permission for Dr. Wilska, Research Engineer from Helsinki, Finland, to visit our atmospheric research facility on Mar. 4. Dr. Wilska represents Vaisala Oy, Helsinki, exclusive manufacturer of radiosonde and meteorology equipment in Finland. He expressed interest in latest research on Radiosonde Automatic Data Processing System and other atmospheric instrumentation of MSFC development. ✓
4. Key Personnel Losses: Mr. John Winch, Chief of our Applied Guidance & Flight Mechanics Branch, has resigned effective the end of March. He accepted a position with T.R.W. (Houston), performing the same function for T.R.W. (MSC) as he performed here. His stated reason for leaving is "no future at MSFC." His Branch is responsible for Guidance work, Mission planning and Flight Mechanics for mainstream Apollo and AAP. His talents will be very difficult to replace. ✓ Another extremely valuable key employee in our Unsteady Aerodynamics Branch, has indicated he will most likely leave MSFC to accept a teaching job; he has made extensive contributions in the difficult field of unsteady aerodynamics on IB and V. He is a PhD, GS-13, without hope of getting a promotion under present personnel policy. He will make more money teaching than in his present position.

E.F.  
 After our discussion today (Mr. Dahm's presentation) I'd like to have another private talk with you on this personnel morale problem. Please arrange to see Bonnie. (I'm going on a trip, so our talk should be after 3-27)  
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1. S-IC-2 CHECKOUT: Post manufacturing checkout of the S-IC-2 stage continues on schedule. At present, no problems are foreseen to jeopardize the March 22 completion date. ✓
2. INSTRUMENT UNIT 203 CHECKOUT: Hookup of IU-203 was completed February 28, and testing progress to date has been satisfactory. Outstanding E.O.'s and defects are considerably fewer than on past IBM IU's. Orbital checkout requirements still appear to be the major problem which could impact the schedule. ✓
3. S-II PROGRAM: S&ID has previously signed a memorandum of agreement with individuals from MSFC to delete all efforts associated with bringing the Automatic Checkout Equipment (ACE) on line in support of S-II-1. During a meeting at MTF, the contractor stated that the ACE system had progressed at a more rapid pace than had previously been described, and further, that the pacing effort at MTF hubbed around the problem of loss of configuration control. Present plans are to manually check out and static fire the S-II-T stage during the initial phase. However, S&ID now plans to automatically check out the Flight Control and Measurement Systems between the first and second firings. More significantly, the engines will be gimbaled during static firing using the automatic flight control equipment under computer control. ✓
4. ROCKETDYNE QUALITY SURVEY: A quality survey of the Rocketdyne, Neosho, calibration facility has recently been completed. A copy of the report has been forwarded to Rocketdyne with a request to implement a recommendation that Rocketdyne Quality Control be assigned control of the calibration facility which has been under the control of Rocketdyne Production. ✓
5. S-IC-501: During the post static inspection of S-IC-1, representatives of the Laboratory and Rocketdyne discovered several cracks in the injector plate of engine number 1. These cracks are adjacent to the welds which connect the long radial baffles to the inner circumferential baffle. The engine will have to be removed for the injector change; however, it has not been decided when nor where at this time. This is the first occurrence of cracks being discovered in the baffle to injector welds here at MSFC. The above inspection was made as the result of information received from the O&RA Laboratory representative stationed at Edwards Air Force Base pointing out that this difficulty was being experienced there. ✓

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AS-201 POSTFLIGHT EVALUATION: Analysis of the AS-201 flight data has revealed only two minor problems: (1) At about 79 and 81 seconds of flight the Z accelerometer reasonableness test failed, introducing a cross range velocity error of 2.3 m/s into the navigation system. These failures were caused by cross range wind shears which exceeded the acceleration limits of + and - 1.0 m/s<sup>2</sup> per computation cycle. (2) From S-IB Stage ignition to about 14 seconds and from about 50 to 90 seconds the control signal outputs of the Control/EDS Rate Gyro Package were noisy with maximum values of  $\pm 4$  deg/s in pitch,  $\pm 1 \frac{1}{2}$  deg/s in yaw and  $\pm 6$  deg/s in roll observed at about 62 seconds. The high noise levels on these signals are of concern because the EDS vehicle angular velocity abort limits are  $\pm 5 \frac{1}{2}$  deg/s in pitch and yaw and  $\pm 20$  deg/s in roll. Both of these conditions are currently under investigation and are expected to be corrected prior to the next flight test. The overall performance of all other Astrionics systems was satisfactory. ✓

W.H.  
→ Congratulations!  
A splendid record.  
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S-1C-1

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The replacement of the S-1C-1 Stage AirResearch LoX Prevalves with Whittaker should be completed on March 8, provided the valves are delivered on schedule. A small amount of lox will be loaded on March 10, for leak check of suction lines, prevalve cycle test, and engine cocoon GN<sub>2</sub> flow balance test. ✓

F-1

A fire occurred in the basement of the West Area F-1 Test Stand at approximately 5 p.m. on March 4. The fire apparently started in the switch boxes that control the facility roll up doors and roll out platform. The cause of the fire is being investigated. Damage is estimated to require one week to fix. ✓

S-1B-5

S-1B-5 arrived at Huntsville, Sunday, February 27, and was installed in the tower on February 28. Rocketdyne personnel removed the lox pump shaft seals on all eight engines and replaced them with pressure balanced seals which have holes drilled through the seal housing. The primary lox seal drain lines were removed and replaced by instrumented lines to accomplish temperature measurements during firings. Functional checkouts and leak tests are in progress. The propellant loading test is scheduled for March 17. ✓

S-1VB (MSFC)

Test S-1VB-017 was conducted at the S-1VB Test Stand on March 1, for a duration of 412.44 seconds. All test objectives were met except one. The "Fuel Tank Pressurization System" did not operate properly during the test and fuel tank auxiliary pressure had to be initiated to complete the test. Investigation is continuing as to the causes for problems on the fuel tank pressure system and action will be taken accordingly. ✓

S-1VB-204

Prestatic activity on Vehicle 204 is progressing at a rapid pace following the firing of Vehicle 203, which had been a constraint against 204 tape proofing. The integrated Systems Test has been completed, but may be re-run due to numerous minor discrepancies. Additional time may, therefore, be needed for verification of IST and firing automatic procedures; the static firing has been rescheduled for March 17. The new incentive contract becomes effective after post static on shipment to KSC. Consequently, DAC intends to hold as close as possible to the present schedule. ✓

S-11 BATTLESHIP (SANTA SUSANA)

A full duration (360 seconds) firing was performed on Friday, March 4, at 6:17 p.m. ✓ A fuel depletion cutoff was indicated with a 1% LH<sub>2</sub> residual and 3% lox residual. The A7-71 heat exchanger performed successfully as required using all four cooling coils. There were two unsuccessful countdown attempts voided due to inverter and solenoid failures. ✓

SATURN V SWING ARMS

Effectiveness of KSC Swing Arm Director has not completely materialized 2 weeks as it appears he has too many other responsibilities and supervisors. Mr. Buchanan B will be at MSFC tomorrow to discuss this situation and the test program as a result of late swing arm deliveries. In a meeting at Hayes on March 1, 1966, deliveries were again slipped. It does not appear that Hayes is too concerned about meeting delivery schedules. **URGENT**

K.H. Please discuss this with Debus direct since I'll be gone for 2 weeks

NOTES 3-7-66 HOELZER

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1. DEATH OF THREE COMPUTATION LABORATORY EMPLOYEES: Mr. Ray Reed, Chief, Industrial Systems Branch, Data Center Division, Mr. Paul Eddy, Industrial Systems Branch, and Mr. Wendell McKinney, Industrial Systems Branch were killed in the crash of a private plane on February 27, 1966. These were three fine young men from the same branch. Our Laboratory will sorely miss their services. They will be difficult to replace.
2. COMPUTER MEETING CALLED BY GENERAL BOGART: General Bogart and General Jones held a meeting on February 28 in Washington to discuss the Manned Spaceflight position relative to a so-called proliferation of computers within NASA. Mr. Newby, Mr. Hueter, Dr. Hoelzer, Mr. Bradshaw, Mr. Charlie Brooks, and Mr. Jerry Turner attended from MSFC. There is certain action necessary from our Center and Mr. Newby plans certain action relative to the meeting. There seems to be more concern now relative to operational computers, automatic checkout computers, and contractor use of computers rather than the so-called general purpose computer laboratories. ✓

NOTES 3/7/66 JAMES

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GROUND CAMERA COVERAGE FOR SA-201: During the first recycle of the countdown to T minus 15 minutes, during SA-201 launch, 60 fixed ground cameras exhausted their film due to the inability to stop them without destroying the film. No coverage was obtained from these cameras during the subsequent launch. This may have hindered analysis of significant launch anomalies had they occurred. The Flight Evaluation Working Group is arranging a meeting between MSFC and KSC photographic support personnel to resolve this problem for future launches. ✓

TITANIUM SPHERE: A 20 cubic foot titanium sphere has been burst tested at 7930 psi. The design requirement for this sphere is 7100 psi. This test further confirms that the sphere which failed recently at 5800 psi was of poor quality. ✓

AS-202:

SDBF: Modification of the breadboard to support 202 has been completed and the breadboard is operational in this configuration. ✓

VLF-34: The launch complex has also been modified in the 202 configuration and is ready for power-on 7 March. ✓

SA-202: Erection of S-IB Stage for SA-202 has been completed and final installation was started 7 March. ✓

AS-203:

SDBF: G.E. appears to be on schedule for delivery of mod kits to the breadboard to support SA-203 by 20 March. ✓

VLF 37-B: All mod kits necessary for GETS at VLF 37-B have been installed. The remaining mod kits are planned for shipment on or before 10 March. The DDAS was accepted by KSC last Friday. ✓

IU DESIGN: As you have been previously notified, we are still planning for a March 15 meeting with General Phillips to discuss in detail the design of the IU. Mr. Duerr has assumed the initiative in preparing for this meeting. We plan to include some discussion of IU-201's performance at this meeting. ✓

LBJ

→ What's this meeting about?  
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Control of Assembly Work in the Shop by Computer: IBM in Huntsville is presently developing a new technique of controlling assembly operations of the IU by use of a computer. This technique would be applicable to any project (hardware or software) that can be defined in a series of events, and especially advantageous to one that has multiple choices of operational sequence. The basic idea is to determine in advance all possible sequences of operations for each component and code a punch card for each component accordingly. The information for parts received in the stock room and parts installed on the IU is then fed into the computer. The computer will then (a) release daily instructions as to which work can be accomplished in the shop, (b) generate reports on missing parts which are holding up installation work, and (c) give status reports of completed installations. IBM is now processing approximately 1000 different components per IU (standard hardware is not included) by this system with good results. Now the procurement department learns daily which the real pacing items are, based on considerations of all possible "out of sequence" operations, and release of work orders and consequent shop operations are entirely geared to the availability of parts. IBM intends to expand this system to include information on workload, man-hours expended, and forecast of assembly completion. It appears that this "Multiple Operations Sequencing Technique" has great potentialities as a practical tool for control of complex assemblies which are in a development status. It might possibly replace the "PERT" concept which was more intended to serve as a reporting technique to higher management and not as an operational tool for detail operations since the new technique is not based on one logic (one sequence of events) only and provides daily for status and follow-up on all components. ✓

-Ed O'Connor

-Arthur Rudolph

FYI

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↑  
Jim Shephard

This is also a good one for Mr. Webb's management training program (U. of Ala).

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NOTES 3-7-66 LUCAS

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1. POGO - An informal meeting on POGO (longitudinal structural/propulsion system coupling) was held on February 14-15, 1966 at Langley Research Center, with all NASA Centers, all MSFC Prime Contractors and 12 companies and universities represented. MSFC was represented by propulsion and structures personnel from P&VE. The purpose of the meeting was to exchange ideas, discuss analysis techniques, etc. MSFC studies on Saturn IB and V show, in general, all vehicles to be stable, based on current input data. The test program on the fullscale Dynamic Test Vehicle is still mandatory for determination of damping, since the above results are based on assumed structural damping values with longitudinal modes. ✓

W.L.  
Under  
Lox →  
temperature?  
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2. QUALIFICATION TESTING OF SATURN IB - During qualification testing of the lightweight 70-inch, Lox tank planned for use on S-IB-3, failure occurred at 120% of design load, while being exposed to simulated design wind loads. Apparently, buckling occurred first at a circumferential skin-to-skin weld. P&VE is in close contact with CCSD on failure analysis. The structural test program may be in jeopardy since this tank was required for further testing. ✓

3. IU - All testing of the IU ECS for Saturn IB has been completed. The sublimator, inflight heat exchanger, is undergoing extensive study due to problems associated with starting or activating. Testing of four flight units at AEDC has yielded invaluable information towards the successful operation of the inflight ECS. ✓

4. EXPERIMENTS 3-7 - Informal discussions were held last week with OMSF personnel (Dr. Werner, Mr. Lundholm, Mr. Mason) on our experiment package 3-7 (Boiling Heat Transfer, Cryogenic Propellant Transfer, Spaceborne Propellant Storage, etc.) It appears that this package is being well received and even sought as an experiment carrier for other experimenters. We intent to have briefings to various interested experimenters in other agencies, universities and industry within the next few weeks here at MSFC. ✓

5. S-II - A configuration design review is being arranged by IO for S-II-1. We are suggesting that such a design review would include review of specific engineering drawings and documentation which would establish an accepted design for S-II-1. R-QUAL should then verify that the "as built" configuration is in compliance with these engineering requirements. ✓

P&VE is establishing a resident office at MTF now. ✓

Results of a meeting at MTF on S-II-T are summarized:

- a. Cryogenic insulation repair is nearing completion
- b. The S&ID special repair task force returned to Downey prematurely and must be recalled
- c. The membrane seal used on S-II-T must be redesigned for S-II-1. ✓

3/7/66

1. APOLLO PROGRAM OFFICE EVALUATION OF POP 66-1 - Tom Newman of the Apollo Program Office (APO) presented the APO evaluation of POP 66-1 on March 1, 1966, to key center personnel. The figures shown indicated that the APO is very optimistic about Spacecraft costs declining during the last months of FY-66. Should this reduction not occur as predicted, an MSC problem will materialize that will be impacted on MSF and potentially on MSFC. The review also indicated that there is no money set aside and that none is planned to be applied to experiments that have not yet received MSF approval. The only experiments funded are those already approved by the MSFEB. This amounts to \$2M in FY-66 and .9M in FY-67 for MSFC. ✓

SIV.B  
 Workshop not included, eh?  
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2. MSF POP 66-1 POSITION ON ENGINE DEVELOPMENT PROJECT - MSF in deciding that Engine Development funding will be prorated into the stage accounts beginning in FY-68 has provided the following guidance for preparation of MSF POP 66-1:

Major engine development contract amounts will be included under vehicle accounts. ✓

Major engine contract APA (allowance for program adjustment) will be prorated into vehicle accounts. ✓

Small residual engine development amounts covering propellants and minor service contracts will remain under engine development account. ✓

3. MODERNIZATION OF FIELD CENTERS - Bill Moore and Colonel Hamill now of MSF (Bob Freitag's office) will visit the Center March 16 and 17 to discuss modernization of field centers. Included in our talks will be logic for FY-68 Budget with emphasis on C of F.

↗ H.M.

Please alert Geissler & Dahm to this visit. Maybe Hamill will be eager and willing to put in a good fight for the High Reynolds Number Test Facility that is up and hot again. B

NOTES 3/7/66 RICHARD

B 3/7

SA-213 Specification: The Saturn IB Systems Engineering Office has requested that the Technical Systems Council prepare a vehicle specification for procurement of a block of vehicles commencing with SA-213. ✓ They desire this specification by the end of April 1966. ✓ The Systems Council has agreed to this task, and will use as a baseline the Saturn IB Standard Launch Vehicle Study and design criteria for a manned SA-208 vehicle. The next meeting to further discuss this task in detail is scheduled for Tuesday, March 8, 1966. ✓

Very important!  
B

Launch Crew Safety: In view of the number of spacecraft people who were required to ready the spacecraft after SA-201 had been fueled, I feel we may need a Launch Crew Safety Panel. I have mentioned my concern to Mr. Rees and we plan to followup on this matter. We have always planned on a crew to insert the flight crew, but I doubt that we have been formal enough. The number of people involved surprised me (particularly on an unmanned flight). The panel may need to be only "ad hoc" in nature and it could be considered KSC's prime responsibility, but we need to make sure. This will have to be handled so that we don't portray lack of confidence in our system. We need to show we have done all that we could in case the highly improbable happens. ✓

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1. Incentive Contract Conversion:

S-IC Stage - Conversion of S-IC Stage contract (NAS8-5608) from CPFF to CPIF was approved by NASA Headquarters on Tuesday, March 2, 1966, and made effective as of March 1, 1966. ✓

S-II Stage - Schedule for conversion of S-II Stage contract from CPFF to CPIF is:

- April 1, 1966 - Contractor proposal due
- April 15, 1966 - Complete MSFC review of contractor proposal
- April 22, 1966 - Pre-negotiation position established
- April 25, 1966 - Begin negotiations
- May 13, 1966 - Complete negotiations
- June 1966 - Contract approval ✓

2. S-IC-1 & S-IC-2 Stage Status:

S-IC-1 Stage - Final captive firing accomplished on Friday, February 25, 1966 and removal from Test stand is expected on Saturday, March 12, 1966, (two weeks ahead of schedule). ✓

S-IC-2 Stage - Post manufacturing checkout expected to be completed on Tuesday, March 22, 1966 and placed in MSFC test stand (five weeks ahead of schedule). ✓

3. S-IVB-501 Stage Status - Stage weighing is scheduled for Saturday, March 5, 1966 and shipment to Sacramento for Friday, March 11, 1966. Part shortages still exist and will require installation work at SACTO. However, no impact on delivery to KSC is presently predicted. ✓

NOTES 3/7/66 SPEER

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1. 201 LIEF OPERATION: Our evaluation of 201 LIEF support activities is continuing. An assessment will be presented to you today (3/7). Support requests increased significantly from 17 on SA-10 to 70 on AS-201. Although I consider the operation basically successful, major improvements are required in the following areas: (1) Direct communications to and from L/V Representative (Lee James); (2) Initial definition of problem; (3) Quick conferencing of all support engineers involved; (4) Handling of simultaneous support requests; (5) Interface between MSFC support engineers at KSC (CIF) and Huntsville. ✓
2. AS-201 FLIGHT DATA: Data are coming in from KSC at slow rate. Reasons include: (1) Power loss in the Cape area during flight destroyed much of the tracking data; (2) Some essential processing equipment was down at both Eastern Test Range and KSC in the days after launch; (3) MSF decision to eliminate 24 hr reporting may have propagated and affected nearly all early data deliveries. We are monitoring all deficiencies for data critique meetings scheduled later this month. ✓
3. NETWORK SUPPORT FOR AS-202 BULKHEAD TEST: Following LV/SC separation a SM burn occurs, rapidly increasing the separation distance between LV and SC beyond the capability of a single ground antenna at Antigua. Since this a critical time period for both S/C and bulkhead test, at least one, and possibly two ships will be required for satisfactory coverage of all mission objectives. OSRO has been informed. We are attempting to monitor the bulkhead test in real time both from ship (RKV) and Control Center - Houston. ✓
4. FLIGHT OPERATIONS PANEL: Meeting was held on 3/2 at MSC but handicapped by the fact that 7 MSFC panel members including the Co-chairman were prevented from attending due to engine trouble of NASA plane (C-47) en route to Houston. Items covered include: (1) Ship requirements for AS-202; (2) Post separation ground support for S-IVB/IU on 204 and 205; (3) Clarification of support requirements for 501 and 502 with emphasis on Ascension's role during the post separation phase; (4) Prelaunch closed loop command system test requirements for 203 (these commands relate to both LH<sub>2</sub> experiments and orbital checkout tests). I have scheduled a follow-on meeting with J. Hodge in about 3 weeks. ✓

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1. PEGASUS: No significant changes. Local reception and reduction of Pegasus tapes has been suspended during the SIB launch and subsequent data reduction at R-COMP. ✓

We have finally succeeded in accomplishing a reduction in the number of Pegasus tapes forwarded to us by GSFC. This will not affect the data analysis at all, but will reduce our workload. ✓

2. AAP: Earth Orbit - RPL is presently working on three candidate experiments for 209: Heat Pipe; Micrometeoroid; and Reaction Flywheels for Mechanical Control. It is expected that much of the necessary development work can be done inhouse.

Lunar Exploration - Dr. Costes, RPL, has been invited to attend a conference on Soil Mechanics at MSC on March 7-8, 1966. This conference was called by Dr. L. Reiffel, Apollo Program Office, and will include discussions on the role of soil mechanics prior and subsequent to first lunar manned landings. Dr. Costes was also invited to participate in the executive session to be held during the second day of the proceedings following the general discussion.

On March 16, I will participate in a Site Selection Board meeting at OMSF (Dr. Reiffel). This Board will discuss and select Apollo and AAP landing sites; I am a member of this Board. ✓

3. SPACE RADIATIONS ON LUNAR TRAJECTORIES: A radiation analysis prepared by the Nuclear & Plasma Physics Branch of RPL for six lunar trajectories was sent to Mr. Art Reetz, OART, Headquarters, on March 3. These calculations were requested about three weeks ago by Mr. Reetz. ✓

4. RADIOISOTOPE POWER SOURCES: I attended a meeting of the Advisory Committee for Radioisotopes at the AEC. Again, the recommendation of my Sub-Committee was the expedient development and fabrication of RTG's (Radioisotope Thermal Generators) in the 50 to 200 watt (electric) range for use on AAP missions. ✓

5. ELECTRICALLY PROPELLED PLANETARY PROBES: In a NASA review meeting on electrically propelled, solar powered planetary probes on March 4, Boeing, Hughes, and EOS presented results of a JPL-sponsored study of a Mars fly-by mission. OSSA is increasingly interested in such missions because of their large payload capabilities. A 10 kwe vehicle could be carried by an Atlas/Centaur; a 50 kwe vehicle by a Saturn IB/Centaur. Total development time would be 4 to 5 years. ✓

6. ASTRONAUTICA ACTA: Dr. Martin Summerfield is planning an issue of the Astronautica Acta in September devoted to ten papers on lunar base. He intends to invite a paper from this Center, and will probably write to you soon. ✓

E.S. Could you prepare one?  
B

3/9/66

1. Dr. Ruppe's Departure. As you know, Dr. Ruppe has announced that he will leave MSFC and Huntsville on or about April 1, 1966 to accept a professorship at Munich. During the intervening period, he plans to be on annual leave the majority of the time, and I have asked Mr. Jim Carter, Deputy to Dr. Ruppe, to assume the responsibilities of his office. ✓
2. S-IVB Workshop for 209. Until a tradeoff study can be made or directed otherwise, we will assume that the MAC developed airlock slice will come to Huntsville for integration of the experiments and a complete systems (excluding life support and power system) test run. ✓
3. Jones and Company Visit to MSFC. I learned from Les Fero ("Mr. Vehicles" under Davy Jones) that Jones, Disher, Taylor, Field, and himself wish to come to MSFC on March 9 or 10 to review the following:
  - a. Follow-on vehicle procurement ✓
  - b. L/V mods for SAA alternate missions ✓

The first priority is on item a. and is predominately one for IO. I have arranged for an updated presentation of the L/V mods, item b., and since I will be in MSC on Tuesday, have asked Dr. McCall to make the necessary arrangements between Jones and MSFC. I have further suggested to Dr. McCall and Jones (via Fero) that the visit be on 3/10/66 since we have an internal review on 3/9/66 of our inhouse integration effort and it will shed some light on the overall situation which will be helpful for us to have for the Jones meeting. ✓

March 14 1966

NOTES 3/14/66 BALCH

3/21/66

S-II-T Stage - Stage Electrical Control Checkout (DOP-M-B010) is complete, with minor open items to be reworked. Retest of the forward membrane seal after repair of pinhole leaks discovered during pressurization on 3/7/66 is expected to be complete today. Installation of the recirculation system covers is expected to be complete on 3/14/66. First firing of the S-II-T is now expected in April.

High Pressure Gas System - On 3/7/66, one of the hydrogen bottles in the S-II Test Complex developed a leak at 5,850 p. s. i. , necessitating the backflow of the gaseous hydrogen into another hydrogen bottle and purging the leaking bottle of the residual gaseous hydrogen. In spite of this development, it is expected that an adequate supply of gaseous hydrogen can be made available for LH<sub>2</sub> tanking and static firing of the S-II-T stage.

S-II Test Stand A-1 - As of 3/9/66, all the structural steel previously shipped with defective welds had been reinspected and repaired. A welding inspector from R-TEST will be sent to the steel supplier's plant to insure compliance with proper welding procedures.

S-IC Stage Manager's 2nd Monthly Status Review at MSFC was attended by a representative from MTF. At this meeting, it was announced that acceptance tests, beginning with S-IC-2, will include only one static firing of 120 seconds duration. The effect of this will be taken into account in our planning at MTF.

Technical Systems, Phase I - A method has now been agreed upon whereby Aetron can assure completion of the Data Handling System by the required dates.

Technical Systems, Phase II - Bid packages for S-II Test Stand A-1 Technical systems installation are being reviewed.

Labor Situation - The NLRB has made a determination on an appropriate unit of GE technicians for a collective bargaining election sought by the IAM (Machinists), and the date for the election has been set for 4/8/66. The IBEW intervened and will also be on the ballot. GE did not contest the holding of the election.

On 3/10/66, approximately 75 Operating Engineers of Koppers Construction walked off the job in protest of an NLRB decision made public on 3/9/66, which awarded the setting of light poles by use of an A-frame winch truck to Electricians. The Corps of Engineers requested the aid of the NLRB on 3/10/66, and two NLRB representatives arrived on the site before the end of the day. On the morning of 3/11/66, no Operating Engineers of Koppers were on the job, but other Operating Engineers reported for work.

### F-1 ENGINE

Engine F-5031 was accepted on February 28, 1966, (on schedule) and arrived at New Orleans via Guppy Aircraft on March 6, 1966.

Relative to the previously reported injector cracking problem, all injectors at M. A. F. have been inspected and found satisfactory (oxygen-free copper).

### RL10 ENGINE

Parts shortages for Atlas/Centaur vehicle AC-8 have been resolved, and quad-tanking is scheduled for March 17. AC-10, which is scheduled to launch the first of seven engineering Surveyor payloads in May, is ready for shipment to AMR on March 16.

The Battleship Propulsion Test Vehicle test stand at Sycamore is scheduled to stay in operation until after the flight of AC-8. Firings will be conducted to evaluate a possible short coast in the AC-9 flight program before closing down this stand. (These tests will keep the stand active until approximately April 1.)

The first production RL10A-3-3 engine is on schedule for delivery in May. It should be ready for initial test in early April.

### J-2 ENGINE

After review of Preliminary 201 Flight Data, Rocketdyne recommended that the gas generator orifice on 202 be changed to delay opening of the gas generator valve. The delay will insure that the gas generator and fuel turbine are not over-heated due to a slow opening main LOX valve. The engine installed in 203 already has the gas generator delay orifice.

Rocketdyne will participate in the flight evaluation working group meeting next week.

The S-II Battleship was fired approximately 359 seconds duration on March 4, 1966. Engine cutoff, as programmed, was initiated by the low level sensors in the LH<sub>2</sub> fuel tank. Both engine and stage systems functioned satisfactorily for the test although the PU control was erratic during the last 80 seconds. During this 80-second period the PU valve made several excursions between maximum and nominal positions. The next test is scheduled for March 15, 1966.

### H-1 ENGINE

Retrofit of the improved LOX pump seal has begun on S-IB-7. Seals are available for installation in engines on S-IB-3 at Michoud; however, the recommendation to perform the retrofit will not be made until the results of the static test of S-IB-5 have been analyzed.

### GENERAL

9:15 a. m. PST today, March 14, is the time established by the Welders Union at EAFB to strike. NAA is pessimistic on whether or not they will strike. We will keep you informed.

NOTES 3/14/66 CONSTAN

DEBRIEFING OF TSI

Telecomputing Services, Inc. (TSI), Panorama City, California, unsuccessful in its bid to continue providing computation services at Michoud's Computer Office in Slidell, requested debriefing of its proposal. Mr. M. S. Hardee, Assistant Manager, MAF, conducted the debriefing at the Michoud Assembly Facility on March 7, 1966. In attendance were Richard Farmer, President, and William Smith, Vice-President of TSI; Edward P. O'Rourke, NASA Headquarters; George Sturdivant, MSFC Huntsville; and Messrs. Robert Reeves, George Book, and M. S. Hardee, MSFC Michoud. At the conclusion, Mr. Farmer expressed appreciation for the debriefing and appeared satisfied with the results.

CONTRACT NAS8-4016, CHRYSLER CORPORATION SPACE DIVISION

Agreement has been reached with the contractor on Modification No. 292, conversion of S-IB from CPFF to CPIF. It is expected that the contract will be forwarded to MSFC Huntsville for review no later than March 16, 1966.

NOTES 3-14-66 DANNENBERG

NEGATIVE REPORT.

## NOTES 3/14/66 FELLOWS

1. Realignment of Overtime and Travel Resources: Cumulative R&D Operations FY-66 overtime percentage to the end of February was 6.3 percent. Major fluctuations in overtime requirements were due to work pressures related to stage and vehicle schedules. R&D Operations has realigned its overtime allocations to the laboratories and offices so that we can remain within our FY-66 overtime funding allotment, which will allow a 5.4 percent maximum average overtime rate for the remainder of this fiscal year. Laboratories and offices have been advised of the necessity for using overtime for essential program needs only and concentrating on the mainstream Saturn effort. Limitations on FY-66 travel fund allocations have necessitated senior laboratory management approval of all travel requests. A recent reduction of \$175 thousand in our travel funds, prorated and distributed to the laboratories March 3, has eliminated flexibility in temporary duty assignments.

## NOTES 3/14/66 GEISSLER

1. High Reynolds Number Facility Meeting in Washington: On March 8, in Washington, we presented our justifications and plans for the High-Re-No facility to several people from OART, including Mr. Pearson, Dr. Kurzweg, representatives from Langley, Lewis, and Ames, Mr. Crobaugh from Dr. Seamans' office, and Col. J. P. Hamill from OMSF. Dr. Eggers did not attend. Mr. Pearson chaired the meeting. The comments from the research center representatives were generally indicative of a more or less concealed desire to belittle the benefits to be derived from such a facility. Especially with respect to aerodynamic noise, ground wind and base flow phenomena, it was claimed that no substantial benefit could be expected in the near future from the proposed facility. Mr. Pearson summarized his impression with an admission that genuine, important, problems had been defined by us, and that significant clarifications might be obtained by the proposed facility with respect to high angle of attack loads and shock separation phenomena. He proposed however, to establish some intermediate points in existing facilities, before going ahead with the new facility (some capability of testing in existing tunnels at higher Reynolds Numbers than previously accomplished, was claimed, but this remains to be critically explored). He agreed that continuation of advanced design studies for the facility might be a good idea. (J. P. Hamill will explore question of where funding for this would be obtained). Mr. Pearson also stated that location of facility was problematic, noting that its research character made its placement at Research Centers perhaps preferable. Mr. Crobaugh specifically requested that the location of the facility not be further discussed at this meeting. The obvious trend by most participants to attack the proposed program for parochial reasons, without offering valid technical arguments, was very discouraging. It was agreed that we will submit a proposed test program in existing facilities to check on the trend with increasing Reynolds Numbers. No firm promises as to schedules were given.

The result verifies your assessment as expected. Eliminating the screen of nice words, the outcome indicates: OART does not permit any facility with reasearch-potential at an OMSF-Center, regardless of the arguments; OART is in the position to have its cake and eat it; it can block the development centers in this respect, and simultaneously claim for itself both research-type and development-type assignments. This spells out a depressing and demoralizing trend.

2. Saturn V AS-503 Preliminary Reference Trajectory: Analysis for AS-503 preliminary reference trajectory has been halted until MSC provides desired target orbit. Four sets of orbit conditions have been given to us since Dec. 1965, each being canceled shortly after receipt. Difficulty is with radiation dosage of crew. These iterations have caused slip of approx. 4 weeks for this study, and the slippage is increasing daily.

3. Saturn V/Voyager: JPL personnel visited us on Mar. 3, for informal discussions of Saturn V/Voyager program, shroud size study, and tentative inter-center panel operations. JPL requested that Aero-Astrodynamics conduct parametric performance and mission analysis studies for 100, 200, and 300 n. mi parking orbits; 35° to 120° launch azimuths; and  $C_3 = 10, 20, \text{ and } 30 \text{ (km/sec)}^2$ . Work has started on this request. Shroud Size Phase II study results have indicated increased bending moments on the 54' cylindrical shroud length, due mainly to inclusion of non-linear aerodynamic loading effects. We are also investigating advanced control systems for application to Saturn V/Voyager, for reduction of bending moments, as compared to conventional control techniques.

NOTES 3-14-66 GRAU

1. COUNCIL OF DEFENSE AND SPACE INDUSTRIES ASSOCIATION (CODSIA): The CODSIA Group (see NOTES 5-10-65 GRAU, copy attached) visited most of the NASA Centers and some of the prime contractors last summer and is just finishing its final report. Volume I was received recently, Volume II will follow. Detailed evaluation will be performed as soon as both volumes are on hand. The spirit of Volume I is pretty well summed up in the Foreword which I would like to quote for you:

"The purpose of CODSIA Case 30-4, NASA Quality Requirements Study, was to conduct a cooperative and objective study of NASA Quality Publications NPC 200-2, NPC 200-3 and associated documents to determine their effectiveness for achieving required quality at justifiable cost. Preliminary team planning resulted in the decision to concentrate on the development of specific and objective recommendations based upon findings and conclusions, rather than a minute critique of NASA's quality publications.

"Early in the study it became apparent that quality assurance lines of communication between Industry and NASA were less effective than those between Industry and DoD. A remarkable aspect of the study was the high degree of agreement between Industry and NASA personnel on the nature of the most important quality problems and the best approaches to their solution. The development of a more favorable climate of respect and understanding between NASA and Industry quality assurance personnel was one of the most important results of the study."

2. APOLLO PARTS INFORMATION CENTER (APIC) EFFORTS: The Laboratory, with the assistance of NASA Headquarters, Code KR, has arranged that the Bureau of Naval Weapons (BUWEPS), Failure Rate Data (FARADA) Program, and the APIC Program engage in an interchange of data. FARADA data will be abstracted and placed in the APIC Master File, identified as FARADA data, and thus be available to NASA inquirers. On the other hand, our discussions with FARADA has led to their adopting some of the APIC automated techniques of data storage and retrieval.

ATTACHMENT: NOTES 5-10-65 GRAU (Dr. Von Braun's copies only)

1. S-IV PROGRAM: The S-IV 10 stage is presently being prepared for shipment from storage at Sacramento to KSC. This is considerably in advance of previously scheduled shipment and launch preparation.
2. S-IVB PROGRAM: The S-IVB Battleship stage is presently undergoing a series of static firing tests in the Beta I test stand at SACTO. During a full duration test (8 minutes, 13 seconds approximately) on May 4 the engine was successfully gimbaled. A first look indicates that no significant trouble was encountered during this test. The S-IVB 201 stage arrived at Sacramento, May 5, approximately 5 days behind schedule. It is undergoing receiving inspection and will then be installed in the Beta III test stand. The work package to be accomplished at Sacramento on the 201 stage consists of 146 Assembly Outlines and 168 shortages, approximately 3500 hours of effort.
3. DAC SUPPORT TO KSC: This Laboratory has completed review of the proposed DAC support contract to KSC. The proposal conflicts considerably with established KSC/MSFC decisions regarding low bay testing of stages at KSC. DAC proposed many system tests which KSC and MSFC had mutually agreed to eliminate. Our comments on the proposal will restate the KSC/MSFC position and recommend a significant reduction in manpower proposed by DAC.
4. COUNCIL OF DEFENSE AND SPACE INDUSTRIES ASSOCIATION (CODSIA) GROUP MEETING: A member of this Laboratory attended the first meeting of the CODSIA Group which is reviewing NASA Quality Assurance program requirements. The meeting was held at Manned Spacecraft Center, Houston, Texas, and was conducted on a constructive note. It is felt that this review can be of benefit to NASA and industry, if continued on that note. The CODSIA Group will visit MSFC on May 11-12, 1965. Concerned MSFC personnel have been notified of the meeting and requested to participate as appropriate.
5. S&ID GSE DESIGN REVIEW: A GSE Design Review was held at Downey, California, April 27, 28 and 29, using systems schematics for Station VIII. The leak-check systems portion of the review was postponed until June in that MSFC has not received most of the drawings in that area. The design review was very satisfactory to both parties, and a good information transfer between the two parties was achieved. Comments were classified as mandatory, recommended to be investigated, and drawing errors. S&ID concurred in all but three classified as mandatory; these three will be investigated further by S&ID and MSFC.

1. SUMMARY OF SA-201 INSTRUMENTATION AND COMMUNICATION SYSTEMS:

a. Measuring Systems: The following table summarizes the measurement results.

STAGE	IB	IVB	IU	TOTAL
Scheduled	483	441	303	1227
Scrubbed	0	5	2	7
On Board at L. O.	483	436	310	1220
Failed	1	10	2	13
Partial Failures	2	32	1	35
Percent Success	99.9	97.7	99.7	98.9

There are several measurements still under investigation, therefore, these figures are subject to change. As yet there is no data in house on the S-IVB failures.

b. Telemetry Systems: A total of 13 telemetry links were utilized on the Saturn Booster for retrieval of data. Three airborne tape recorders were also utilized for redundant coverage and delayed time transmission of several telemetry links to give data coverage during anticipated flame attenuation of RF Propagation. Preliminary results from evaluation activities indicate that the telemetry systems functioned satisfactory and afforded the acquisition of all necessary data. Additionally, data quality during anticipated flame attenuation periods indicated that RF attenuation due to flame effects was minimal.

c. RF Systems: Telemetry - The RF performance of the Telemetry System was satisfactory. The signal strength was degraded by main engine flame and retro-engine flame. The I.U. Telemetry System experienced a 19 second antenna breakdown, but 90% of the data was received during the breakdown. C-Band Radar - The I.U. C-Band Radar System provided good data until 466 sec and the CM C-Band system until 1141 sec. ODOP - System functioned correctly. Azusa/Glotrac - The various Ground Stations had problems in acquiring and maintaining phase-lock. There was a time between 246 and 271 seconds when no data was received. Command - The Secure Range Safety Command System performed satisfactory. Of 4979 commands transmitted, three were not received.

2. REFINEMENT IN INERTIAL PLATFORM DEVELOPMENT: The gimbal torquer drive amplifier has been one of the most outstanding problems in inertial platform development. Since it takes approximately 60 to 70 watts to drive the torquer, large components and heat sinks have been required to build reliable class B operating circuits. To overcome this problem we started investigating the use of integrated circuit techniques approximately two years ago. Prototypes were built with discrete components, and a contract was let for a completely integrated unit. The first of six integrated units was delivered on 3/3/66. The unit consists of 10 low-power transistors, 4 power transistors, 4 power diodes, and 12 resistors in 4 silicon chips which are mounted in a single power transistor case (1/2 cu. in.). To our knowledge, this unit is by far the most complex, high power integrated circuit ever developed. Evaluation is not complete, but it has far exceeded all expectations in the closed loop performance on a single axis simulator. The expected advantages of this unit are: a. extreme reliability potential, b. good efficiency (approximately 95%), c. size reduction (approximately 50/1) d. substantial cost reduction (possibly 10/1). Many other applications of the unit can be foreseen such as dc regulators, heaters or power controls, inverters, etc.

3. 4 GIMBAL PLATFORM INFORMATION: In reply to your request for a report and briefing of the 4 gimbal platform, we are preparing a memo and would like to give you the presentation the week of 4/4 as opposed to your request for 3/28. Do you agree with this delay?

S-IC

Final preparations were made for S-IC-1 stage removal from the test stand. The stage will be removed today. The S-IC-2 stage will be delivered to R-TEST on March 22, 1966.

F-1 (MSFC)

F-1 engine F-4T2 was installed on the F-1 Test Stand on March 11, 1966. The first test with this engine is scheduled for March 17.

S-II BATTLESHIP (SANTA SUSANA)

The March 4 firing data were reviewed in detail with a questionable seal performance on engine 2020. Rocketdyne has given their concurrence for one additional full duration firing on this engine, which may complete the battleship objectives.

S-IVB

S-IVB Test Stand (MSFC): Test S-IVB-018 was conducted on Wednesday, March 9, 1966, for a duration of 2.15 seconds. The test was planned for 200 seconds duration; however, it was erroneously cut off from the Gas Generator Over-Temperature (GGOT) cutoff device, which was set at approximately 1800° F rather than the required 2000° F.

S-IVB-204 (Sacramento): The checkout for static firing is progressing with a simulated static firing sequence in progress. The integrated systems test was conducted Saturday, March 12, 1966. The 204 static firing is now slated for Thursday, March 17, 1966.

NOTES 3-14-66 HOELZER

**Negative Report**

NOTES 3/14/66 JAMES

SA-202: The S-IB Stage was moved to VLF-34 on March 4. They began stacking the S-IVB Stage on March 9 and completed stacking on March 11. The IU was also stacked on March 11.

SA-203: Delivery of hardware for the 203 launch is currently tracking on schedules which adequately support the KSC need dates. S-IB-3 is being prepared for shipment at Michoud and will be shipped about April 7. The S-IVB-203 will be placed in the Vertical Checkout Laboratory at SACTO this week for final preparation prior to shipment by Super Guppy around the 4th of April. The IU-203 is in checkout at IBM and is proceeding satisfactorily toward a mid-April delivery. The IU will also be shipped via Super Guppy. The nose cone is at KSC. All ESE has been delivered to VLF-37B and GETS is in process. One of the tightest restraints on the 203 launch is the processing and delivery of software. We are working the problem with all elements to insure timely delivery of the checkout tapes.

I have scheduled a presentation at the March 25 Staff and Board meeting to review the 203 LH<sub>2</sub> experiment mission. This will be a joint presentation by my office, the Mission Operations Office, and Mr. Gordon Platt, the P&VE coordinator for 203.

IU DESIGN REVIEW FOR GENERAL PHILLIPS: (Reference my notes of March 7, 1966.) The design review for General Phillips is the one which I have previously mentioned in my notes and which had its origin in the December Management Council meeting. Dr. Mueller inquired about actions to review IU specifications to insure that our requirements were realistic. In early January, General Phillips requested an IU design review and we have been working with members of his staff and R&DO to establish the review. The review is scheduled in the 10th Floor Conference Room starting at 8:30 AM on March 15. I would like to solicit the attendance and participation in this review by our senior R&DO personnel, particularly Astrionics and P&VE.

## NOTES 3-14-66 KUERS

1. S-IC-501: This stage is being returned to ME Laboratory today. We have already, on direction by P&VE, exchanged all LOX Prevalves from Airesearch with new Whittaker valves. Since this operation could only be accomplished, without major disassembly, while the stage was in a vertical position, we completed this work at the Test Stand (Documentation will follow later). A variety of jobs have still to be accomplished prior to turn over to final checkout: one engine has to be removed for replacement of the injector (this engine has to be test fired before reinstallation), and all insulation cocoons have to be fitted on the engines and removed for separate shipment to KSC. A number of CAM's (change packages) have to be installed, the components for which have not been completely delivered yet. It is estimated that approximately 6,000 productive man-hours are still needed in the shop to complete the stage prior to final checkout. Boeing has requested to have some of their KSC support personnel here at this time for training on engine insulation since they have not done this operation on their stages at Michoud. We will comply with their request.

2. Delivery of IU-500-FS: This IU was delivered last week to DAC. Some of our personnel will be at Douglas for the next few weeks for installation of components shipped as loose equipment.

3. Tube Flaring Development: The ME Laboratory developed tube flaring technique has been accepted by most of our Prime Contractors. It is presently being used by Chrysler and Boeing in Michoud and DAC and IBM in Huntsville. IBM has reported that their rejection rate for meeting the MSFC specification for tube flaring is practically nil since early January when they started to use this machine. The equipment has been procured by IBM using our design drawings.

NOTES 3-14-66 LUCAS

1. S-IVB WORKSHOP - Indications that the S-IVB insulation might ignite if penetrated by a micrometeoroid have been confirmed. Tests at AEDC have shown that intensive burning does occur in a 5 psia oxygen environment. Coating materials designed as fire extinguishers have been unsuccessful in preventing or extinguishing fire resulting from meteoroid impact, but these coatings reduce the rate of spreading of the fire. A film of the AEDC results is available.
2. PROJECT MOONSHINE - Although 3 systems study contracts and 2 reflector study contracts are to be awarded, no funds are available for vehicle impact studies (S-IVB and IU). Present AAP modification studies are pointed toward AS-507 and subsequent. These do not include Project Moonshine requirements.
3. J-2 ENGINE UPRATING - The first 230,000 lb thrust engine is undergoing acceptance testing at Rocketdyne. This is a 5,000 lb thrust increase over the current engine.
4. SATURN IB/S-IVB - The S-IVB usable residuals at cutoff were very close to predicted on AS-201, indicating that overall vehicle performance was about as expected despite approximately 2% low thrust from the S-IVB engine.
5. SATURN IB/S-IB-203 - According to latest AERO information, the heating increases two-fold on the S-IB heatshield. This is caused by the rerouting of the turbine exhaust ducts. Our analysis shows that the heatshield design has enough safety margin to withstand this additional heating. A few minor places may need some added insulation.
6. SATURN IB/QUALIFICATION TESTING - In response to Dr. von Braun's questions, the qualification testing of the lightweight, 70-inch Lox tank planned for use on S-IB-3 (Lucas Notes 3-7-66) was not done at Lox temperature. A complete review of this situation at Michoud is planned for this week.
7. S-II-T - 130 out of 144 total propulsion system components are qualified.
8. S-II-1 - 79 components out of 131 total propulsion system components are qualified.
9. S-II-T FACILITY - One of the 3 T-1 steel high-pressure gaseous hydrogen tanks failed at MTF. This problem is believed to be similar to that encountered by LeRC on the M-1 engine program, but it is too early to verify this. Failure of a second tank will have program impact. Investigations are underway to determine if the S-II-T firing can be made at reduced gas pressure.
10. S-II - A meeting was held at MTF to review the interlocks for S-II-T static firing. Presently, S&ID has designed and installed a system of 750 interlocks which all must vote yes to proceed into firing. Most interlocks are in the GSE. These interlocks will now be reduced to 350 prior to static firing. The sequence bears little resemblance in time and events to the AS-501 launch. Further reviews by P&VE are required.

## NOTES 3-14-66 MAUS

1. APOLLO COST STUDY UPDATE - The majority of the data from the prime contractors has been received and analysis is underway. Our principle difficulty at the moment is getting the Douglas data. Their submission date has slipped from the original data of March 1 to March 16. If any problem is encountered with the Douglas data as it is received, we will not be able to meet the MSF deadline. A briefing to center management on the results of this study is now scheduled for March 28. Prior to that time IO management will review the results.

From the comments made during the AAP Launch Vehicle Compatibility meeting with Gen. Jones on March 10, we conclude that every effort will be made by the AAP Office in MSF to minimize launch vehicle program funding requirements in the Preview Memo on FY 68 funding which will go to BOB on May 1. Our most vulnerable area will be the costs outside the major prime contracts such as R&DO support and other general vehicle support costs.

2. MSF POP 66-1 - The Marshall portion of the MSF POP 66-1 has been completed. Obligations are in accordance with Headquarters guidelines and reductions are reflected in planned costs and unfilled orders. The Engine Development line for FY 68 has been reduced to \$20.5M with the balance of the requirements for engines now shown under the vehicles.

3. AAP FY 68 BUDGET EXERCISE - The NASA FY 68 preliminary budget is due at BOB May 1, 1966 and must contain the MSF proposed AAP Program upon which NASA must sell implementation of AAP in FY 68. As a result, cost estimates must be worked up and we have been alerted by Headquarters that they will possibly need Center inputs in preparing a position. They are now formulating guidelines for use in estimating cradle to grave AAP costs which they expect to get to us within a week. Because of timing, this exercise will not be treated as part of the normal POP cycle, and in view of the short deadline, MSFC must contribute immediately if we want to have any influence on the AAP that NASA submits BOB.

NOTES 3/14/66 RICHARD

SA-213 Specification: In our meeting last week with General Jones, we all agreed with the present approach we are taking in our definition of the follow-on vehicles. We are effectively defining a vehicle like SA-208 with standard launch vehicle changes where they can be implemented without requiring extensive investigation and re-engineering. In view of our apparent agreement on this approach and if you also agree, it will not be necessary to have the meeting mentioned in our notes of 2/21/66.

NOTES 3/14/66 RUDOLPH

1. S-IC Stage:

S-IC-F Stage - returned to the VAB on Wednesday, March 9, 1966 and scheduled for erection on Wednesday, March 15, 1966.

S-IC-3 Stage - moved to Post Manufacturing Checkout on Wednesday, March 9, 1966.

2. S-II Stage:

Potential Strike - Welders Union (Local #2) Contract with NAA expires today, Monday, March 14, 1966. The Union has voted to strike if new agreement cannot be reached. The strike would effect both S&ID and Rocketdyne. Issues are wages, fringe benefits, seniority and job jurisdiction. The company is identifying work-arounds and supervisory personnel are being certified as welders. Flash reports will be issued to keep MSFC Management apprised.

S-II-F Stage - Arrived at Port Canaveral on Friday, March 4, 1966 and on dock at VAB on Sunday, March 6, 1966. Stage stacked with the aft-interstage in the checkout cell of the Low Bay area on Wednesday, March 9, 1966.

3. S-IVB Stage:

S-IVB-F Stage - In VAB Low Bay and work on conversion to Saturn V configuration continues. No problem anticipated in meeting the erection schedule.

S-IVB-501 Stage - will arrive at Sacramento by barge, today, Monday, March 14, 1966 and will be off-loaded tomorrow, Tuesday, March 15, 1966. Approximately 2,000 manufacturing hours remain to be completed at Sacramento prior to pre-static firing checkout. This represents only about 2/3 of 1% of the total stage manufacturing hours.

4. Instrument Unit:

S-IU-500ST, Systems Test Unit (Breadboard) - Updating to Saturn V configuration is expected to be completed tomorrow, Tuesday, March 15, 1966.

S-IU-F (Facilities) Unit - Arrived at KSC on Thursday, March 10, 1966 and was off-loaded on Friday, March 11, 1966.

Computer Programming - integrated GETS operating systems program will be debugged and delivered by Wednesday, March 16, 1966 for SA-500F use at KSC.

5. Saturn V Breadboard Activities:

- o Integrated GETS completed Tuesday, March 8, 1966, one week ahead of schedule.
- o Vehicle/ESE Integration to begin on Tuesday, March 15, 1966.

1. AS-202/203 SUPPORT REQUIREMENTS REVIEW: This review was held March 10, at MSC. The meeting was co-chaired by Gen. Bolender and Capt. Middleton. Its purpose was to identify potential problem areas in ground support for missions AS-202 and 203. In attendance were representatives from GSFC, KSC, MSC, MSFC, OTDA, MSF and DOD (representatives from Eastern and Western Test Ranges). Although many areas will require special attention, no real problem was uncovered with regard to MSFC requirements. Some areas still of concern to MSFC are: the requirement for continuous coverage from cutoff to re-entry on AS-202, launch vehicle data delivery dates, and the need for better communication between the requestors and implementors in regard to last minute changes in support implementation. A more detailed support requirement meeting has been scheduled for April 26 at KSC. At this meeting, a detail data critique of AS-201 will be held with special emphasis on data delivery, quantity, quality and timeliness. The second portion of this meeting will review AS-202/203 requirements in an attempt to reduce support requirements in line with general cost reductions.

2. AS-203 OPERATIONS: A review of the operational aspects of the AS-203 mission was held on March 11, 1966. The review covered: (a) Experiment Status and Sequencing; (b) Orbital Checkout Tests; (c) Ground Support; and (d) Flight Control Personnel and Training. To minimize potential interference it was agreed to start orbital checkout tests not earlier than the third orbit. Ground instrumentation support is satisfactory including scheduling for recorder playback. All operations personnel functions are identified. Most of the nominations have been received. Extensive training programs start 3/15 in Huntsville with emphasis on LH<sub>2</sub> experiment. The following programs and simulations will be conducted at Houston; LV systems training is to start on 3/21. Operations documentation schedule is beginning to get tight and I have asked P&VE (Platt) to support our Houston Flight Control Office.

NOTES 3-14-66 Stuhlinger .

NEGATIVE REPORT

NOTES 3/14/66 WILLIAMS

1. During my absence the week of March 14 - 18, Mr. Bill Huber will assume the responsibilities of the office.

2. S-IVB Workshop. Bill Ferguson and I discussed the current Workshop situation with Mr. Raffensperger on Friday, 3/11/66. According to him, Ed Gray and Dr. Mueller want and expect a Preliminary PDP on the Workshop Experiment by next week. I told him the current situation and suggested that Headquarters send a TWX from Ed Gray or Dr. Mueller to you and Dr. Gilruth stating that (1) MSFC would be the "lead center", (2) MSFC would be responsible for the Experiment and overall systems integration for the 209 flight, (3) etc., and that a Preliminary PDP must be received prior to "go-ahead" being issued to MAC. We can have the document ready (it is already written - our way) and delivered to Washington on schedule if we wish to do so.

March 21, 1966

NOTES 3/21/66 BALCH

3/21 9/18  
S-II-T Stage - Retest of the repaired forward membrane seal was successfully completed on 3/15/66. Recirculation system covers were installed and are being foamed in. All insulation work was expected to be complete on 3/19/66, with final integrated checkout to start on 3/21/66. Target date for start of dry countdown for LN<sub>2</sub> tanking is 3/22/66.

High Pressure Gas Systems - The hydrogen bottle in the S-II Test Complex which developed a leak and a cracked inner shell on 3/7/66 will be replaced by an identical bottle from the S-IC Test Complex. Efforts are still underway to obtain additional hydrogen bottles by loan, lease, or purchase to provide additional storage capacity in the S-II Test Complex, needed because of the reduction in allowable working pressure made as a result of failure of the hydrogen bottle last week.

S-II Test Stand A-1 - Expect partial joint occupancy of first through sixth floors by 3/31/66 for technical systems installation. Remaining access required is expected to be available by 4/15/66. Work delayed by strike of Operating Engineers. /

S-IC Stand - Took beneficial occupancy of first through tenth floors of center pier on 3/17/66. Late delivery of T-1 steel piping for high pressure gas system is seriously impacting critical completion dates. Additional delays have been caused by weather and strike by Operating Engineers.

Technical Systems, Phase I - The Data Handling System off-line equipment was operational as of 3/15/66 and is expected to be ready to support the S-II-T firing. Aetron has presented their time sequence for completion of the Data Handling System by 5/28/66.

Technical Systems, Phase II - General Electric has completed negotiations with three bidders for the balance of S-II Test Stand A-1 technical systems installation. Construction delays on S-IC Test Stand threaten to delay occupancy for technical systems installation with consequent slippage of Boeing need dates.

Labor Situation - Strike of Operating Engineers reported last week continued to 3/16/66, with approximately 2,000 man days of scheduled work lost. On 3/16/66, a Federal District Court hearing was held in Biloxi, Mississippi. After examination of evidence submitted, the judge found the union guilty as charged and issued a non-expiring injunction against further secondary work stoppages by the Operating Engineers. On March 16, 1966, the union's international office, and Koppers' Washington officials came to an agreement that the job would be manned at once and that there would be an end to such striking activity by the union at MTF. The International further said that it would put the local union under a trusteeship should its instructions to the local be disregarded.

3/21 9/28

RL10 ENGINE Two experimental engines with a carbon insert in the oxidizer pump housing have been successfully tested without evidence of blade rubbing. This configuration will be incorporated on the initial production engines if no problems are encountered during substantiation testing.

Dr. Seaman's letter with copies to you and Dr. Silverstein was received. We will proceed as appropriate with an orderly transfer of the RL10 to LeRC. If you have any special desires relative to the transfer, please let us know.

J-2 ENGINE A 230K/5.5MR R&D engine (J020) has accumulated 5707 seconds in 53 tests without any major hardware changes. Ten successful restart tests have been conducted on this engine.

An S-II Battleship test was conducted on March 15, 1966, for 349 seconds. The vehicle gimbal program produced a gimbal rate of 6.4 cycles per second with an amplitude of .25 degrees instead of the planned .64 cycles per second at two degrees amplitude. Some line and clamp damage was sustained on the engines; however, it has not been determined if these failures were attributed to the gimbal program. Engine J-2020 (center position) has accumulated 3672 seconds on the S-IVB and S-II Battleship programs and must be replaced prior to the next test.

Rocketdyne has officially recommended five changes to SA-202 and 203 prior to flight. The recommended changes are: a. Install the gas generator delay orifice on SA-202; b. Change the main LOX valve orifice on 202 and 203 to yield a mid-temperature range valve opening time; c. Install insulation over the T/C Bell exit skin temperature patches, to preclude retro fire compromising the actual skin temperature measurement; d. Transfer two of the existing temperature measurements to the main LOX valve housing the closing control line; e. Douglas determine the heat energy of the retro motors on the J-2 Bell.

Engine 2038, an outboard engine on the S-II-1 stage, was found to have LOX pump turbine damage when hydraulic pump installation was initiated, requiring replacement of the LOX turbopump. It has been decided to replace the engine, which will require about three shifts of operation.

The S-IVB stage for SA-204 was acceptance tested on Friday, March 18, 1966, at DAC/SACTO. The J-2 engine operated satisfactorily for 451 seconds, including 295 seconds at maximum mixture ratio and a 48 second gimbal program.

F-1 ENGINE The LOX system of engine F-4017 became contaminated with fuel during a simulated launch checkout of S-IC-2 at R-QUAL on Thursday, March 10, 1966. The contamination resulted from a procedural oversight and intensive investigation indicates that only the one engine has LOX system contamination; however, further investigation is underway. Engine 017 will be removed, selected components cleaned, and reinstalled by ME Laboratory before the stage is transferred to the static test stand. In addition, the lower LOX valve of each of the remaining four engines will be removed to assure that fuel has not contaminated the LOX feed system.

H-1 ENGINE During acceptance of engine H-7081 one of the three TOPS switches was found to have solder contamination. As a result of this discovery, all switches on SA-202 and subsequent will be inspected and replaced if necessary.

GENERAL Labor situation at Canoga Park - Federal Mediation Service requested the United Welders of America to return to work on March 16, 1966. The union and NAA are to meet with Washington Mediation Service Representation at the Department of Labor on March 18, 1966. Labor situation at EAFB - UAW and NAA representatives are meeting March 17, 1966, with the Presidential Missile Sites Labor Commission to attempt to settle the issues of the labor situation at EAFB/Rocket Engine Test Site. Representatives of the UAW and the Air Force were meeting in Los Angeles on March 16, 1966, with the NLRB to provide "ground rules for picketing at EAFB." Only one gate will be picketed in event of another strike at EAFB.

9/3/21

1. BOEING WORK TRANSFER

Boeing is proceeding with a plan to transfer as much of the S-IC work from Seattle and Wichita to the Michoud facility as is practicable. They plan to transfer practically all fabrication work with the exception of that requiring the numerically controlled mills used for tank skins and gore assemblies and the large thrust posts forgings. We agree in principal with the plan and will work with them to develop the necessary details to implement.

2. STATUS OF CURRENT BOEING - IAM UNION AGREEMENT

Under the current agreement between The Boeing Company and the International Association of Machinists and Aerospace Workers, which was effective October 2, 1965, it was agreed that the company and union would continue to bargain on the subject of a manpower control system (performance analysis and seniority). It was further agreed that if the parties had not reached a mutual agreement by midnight March 31, 1966, the union can, without reversing the "no-strike" clause, call a strike within the following thirty days. Negotiations have continued since October and to date no mutual agreement has been reached. A representative of the Federal Mediation and Conciliation Service has been called in by the union. Meetings are being held daily; however, as of this date, no agreement has been reached. We will keep you informed as developments occur. The Stage Manager has been informed and The Boeing Company has been requested to provide a plan of action in the event of a strike.

3. CONTRACT NAS8-4016, CHRYSLER CORPORATION SPACE DIVISION

Modification No. 292 converting the S-IB contract from CPFF to CPIF should be forwarded to Marshall for review during the week of March 28. The delay was occasioned by the necessity to make some last minute changes to Government Furnished Property and support services as well as a requirement that the provision dealing with interface control documents be revised. Although the forecasted date for review was not met, it is expected that the improved modification will result in less time for review and approval.

NOTES 3-21-66 DANNENBERG

9/3/21

Interface Control Documentation (ICD's) - The identification phase of the ICD effort can now be considered as essentially complete. Methods and procedures have also been established for ICD control and accounting of ICD changes; however, the actual implementation requires additional effort in IO as well as in R&DO before complete compliance with NPC 500-1 can be claimed.

Here is a brief status report on the ICD identification:

a. Required SAT-IB ICD's have been identified with support from the system engineering contractor (CCSD), by means of a "matrix" for all launch vehicle oriented ICD's, while for all electrical ground support equipment, a list furnished by R-ASTR with GE support has been accepted as being correct and complete. These two documents identify all ICD's applicable to vehicles 202-204; this information has been checked and verified by the affected R&DO labs. Additional information covering the remainder of the vehicles is well under way, and can also be considered complete pending final verification.

b. A similar effort was conducted with the SAT-V systems engineering support contractor (Boeing), and was improved by integrating matrix data into the equivalent ESE-ICD list. The result is an "ICD Chart," which also indicates applicability by stage, IU, LVGSE, Center, etc. To make this "ICD Chart" even more useful, it was split for "visibility" reasons into three "sections":

Section #1: New documents per launch vehicle are required only for relatively few ICD's (between 11 and 33, depending on vehicle).

Section #2: Unless major changes (AAP?) are being introduced, 123 ICD's remain unchanged.

Section #3: Fifteen (15) ICD's do not affect any MSFC contract, but Level II Change Board will implement these to assure KSC recognition.

c. After Chart and Matrix information has been included in stage and equipment contracts, changes can only be made through official Configuration Control Board action.

In order to get prepared for this phase of complete control, R&DO is updating previously issued R&DO Management Directives 4-1 (Handling of ECP's), 4-11 (Handling of ECR's), and 4-14 (ICD Procedures).

An R&DO proposal in regard to accounting procedures was presented to you early this month (IO presentation on Configuration Management). The SAT IB Manager has directed its implementation already and steps are under way to implement it also completely for the SAT V program.

On March 8, stage contractors were briefed on the intent of the MSFC-IO program and on the status of implementation. They were invited to actively participate and to forward any improvement suggestions.

NOTES 3/21/66 FELLOWS

3/21

1. FY-66 Initiations: Continued management attention at all levels in R&D Operations has resulted in the following status of initiations:

(Dollars in thousands)

	Program Authority	Initiations to Date (a)	Obligations to Date (b)
Office Manned Space Flight			
Saturn I	53	53	53
Saturn IB	28,560	25,850	18,336
Saturn V	106,247	97,305	59,717
Engine Development	842	817	545
All other MSF	12,250	10,775	4,865
Total OMSF	147,952	134,800	83,516
Office of Tracking and Data Acquisition			
	1,500	1,483	207
Office Advanced Research and Technology			
	16,249	11,985	2,870
Office Space Sciences and Application			
	608	487	200
Total R&D Operations	166,309	148,755	86,793

(a) Saturn Programs as of March 15. All other programs as of February 28.

(b) Saturn Programs as of March 11. All other programs as of February 28.

This fine performance by the laboratories in getting FY-66 initiations in good shape at this early date also increases the practicability of a substantial start of FY-67 initiations next month.

2. Unsteady Aerodynamics - Panel Flutter Test Program: A meeting has been called this week between P&VE, AERO, and members of my office to resolve problems in the Panel Flutter Test Program. Previously, it was decided that June was the latest date test results could be provided for a fix on 204. However, it now appears that test results cannot be secured within the desired time by using either the AMES or the AEDC tunnel. At the meeting scheduled this week, a revised schedule will be developed, a decision will be made as to which tunnel will be used, and target dates established for each step in the test program. The revised schedule will also provide time for design modification if the tests reveal such a requirement.

NOTES 3/21/66 GEISSLER

3/21/66

1. Current Contract Work in the Areas of Astrodynamics and Guidance Theory:

J. Lovingood made a trip to ERC on March 15 and 16 to discuss current contract work in the areas of astrodynamics and guidance theory. It was found that there are several common contractors which means there is a possible duplication of effort. Both ERC and Aero Lab are going to make an effort to prevent this through personal contacts and contractor meetings.

2. MSFC Presentation to the OSSA Space Applications Office: On Wednesday March

16th, a presentation was given by MSFC personnel to the OSSA Space Applications Office (Dr. M. Tepper) on the Manned Meteorology Study Program, Earth Orbital Mission #2 (Manned Meteorology), certain natural resource experiments, and the Natural Resource Program. The first two presentations were organized by Aero Lab with cooperation of P&VE, RPL, and Astr; the last two were organized by Astronics Lab. Dr. J. McCall led the MSFC team. OSSA apparently has previously had many discussions with other NASA centers, including MSC, on these subjects. It appears that the MSFC presentations were well received, as were the earlier presentation on the Navigation and Communications Study Projects given Mr. Jaffe and Dr. Tepper at MSFC. Earth Orbital Mission #2 is of main interest to Dr. Tepper due to the time of expected launch, late 1968. Typical elements of Earth Orbital Mission #2 are the following experiments: (A) Image Orthicon Camera System (AAP): To image cloud cover scenes during day and night portions of orbit; (B) Dielectric Tape Camera System (AAP): To demonstrate the value of high resolution cloud cover television for meteorological analysis and prediction; (C) Oxygen and Water Vapor Microwave Radiometer (AAP): To measure temperature and water vapor profile in the lower atmosphere by means of a multichannel microwave radiometer; and (D) Infrared Temperature Sounding (AAP): To determine vertical temperature profile of the atmosphere from the surface to one millibar, and to determine reflected solar radiation from the surface and clouds. The participation mechanisms relative to MSFC & OSSA actions and commitments on the six presentations were discussed in closed session by Dr. McCall and Dr. Tepper with Mr. Horton in attendance.

3/21

1. S-IC-2 CONTAMINATION PROBLEMS: During recent S-IC-2 checkout activities of this Laboratory, a procedural error, aggravated by the absence of preventive interlock, was committed which caused hydraulic fluid to inadvertently be pumped into the engines. The design of the engines plus the fact that the stage was in a horizontal position provided a flow passage through the fuel lines to the injector and back through the lox dome to the main lox valves, or a direct passage to the fuel tank and to the gas generator. Engine No. 1 lox dome and No. 1 and 2 main lox valves are contaminated. Engines No. 2, 3, 4, and 5 had R-J1 introduced into the fuel system; however, there are ~~no~~<sup>no</sup> indications that the fuel went into these engine lox systems. An estimated 200 gallons of fluid was pumped into the fuel tank. An R&DO meeting conducted 3-17-66 determined the following corrective action to be required. Engine No. 1 will be removed to clean all contaminated areas and to further inspect for possible contamination not currently known. Main lox valves on engines No. 2, 3, 4, and 5 will be removed and cleaned. The gas generator will be removed, inspected and cleaned on engine No. 4. (All investigations determined that gas generators were not contaminated on engines No. 2, 3, and 5.) Fuel will be pumped from propellant tank, and all systems which have been disconnected will be retested after reinstallation on the stage. An interlock system is being developed for the GSE which will prevent recurrence of this incident. The above activities are scheduled for completion April 13, 1966, based on a nonovertime schedule. The stage office has been notified of the delay and has proposed that we wait until April 18, 1966, to deliver the vehicle and thus avoid stage storage problems inherent in the present schedule.
2. RL-10 ENGINES: As a result of the transfer of the quality and reliability functions at Pratt and Whitney Aircraft Company, all Laboratory personnel except one have accepted a transfer with the functions to the Navy. Planned effective date of the transfer is April 24, 1966.

NOTES 3/21/66 HAEUSSERMANN

3/21

1. SATURN V DISPLAY SYSTEM: The first (15) operator console Saturn V Display System is presently being installed at the Kennedy Space Center's Launch Complex No. 39. Installation and final acceptance by the Government is scheduled to be complete by the end of March 1966. Two other systems have been previously accepted and are presently supporting test and checkout operations in the Astrionics Laboratory. We would like to take this opportunity to invite you, at any time which is convenient for you, to come to the Astrionics Laboratory and view a demonstration of this advanced and versatile display system.
2. PRESENTATIONS TO OSSA: Presentations concerning potential MSFC support in Manned Meteorology and in Natural Resources were completed on 3/16 in Washington by R-AERO, R-ASTR and R-RP representatives. Dr. McCall represented R-DIR and Mr. Palaoro represented R-P&VE. Messrs. Horton, Digesu, Barr and Paludan represented R-ASTR. Messrs. Vaughan and Smith represented R-AERO. Mr. Ruth represented R-RP. The presentations were received by Dr. Tepper of Ossa Space Applications Program Office, with Mr. Jaffe and Dr. Badgley attending part-time. Dr. Tepper stated that he was pleased, impressed, and appreciative of MSFC's response in these areas. He plans to write OMSF in early April to request MSFC support. In this connection, we are preparing, at Dr. McCall's request, a letter for your signature to advise Dr. Mueller of our Ossa discussions and interests.

gfb 3/21

S-IC

The S-IC-1 stage was removed from the test stand on March 14, 1966, and transported to R-ME for refurbishment.

F-1

Tests FW-017 and FW-018 were conducted at the West Area F-1 Test Stand on March 18, with F-1 engine F-4T2 for approximate mainstage durations of 41 seconds each. Tests were conducted to obtain performance data for the high lox NPSH studies in connection with S-IC flight cutoff conditions.

S-IVB

S-IVB (Sacramento): The S-IVB-501, which arrived at the VCL on March 15, with approximately 2,005 manufacturing hours, transferred from Huntington Beach. This includes 65 line items short to the stage. Manufacturing and checkout will be done in the VCL.

S-IVB-204: A 451 seconds mainstage firing was successfully conducted on Friday, March 18, on the first firing attempt. The auxiliary hydraulic pump failed to start at T-10 minutes as programmed, but the firing was continued and the engine gimbaled using the engine-driven hydraulic pump. The problem was indicated to be in the switching unit. A data session will be conducted Monday, March 21, 1966.

S-II BATTLESHIP

Test No. 033 was conducted at the S-II Battleship Facility at 11:18 a.m. PST, on Tuesday, March 15. The duration of the test was 349 seconds of mainstage operation, with cutoff being initiated from LH<sub>2</sub> low level cutoff (ECO) sensors. The residuals remaining after cutoff were 1% and 2% in the LH<sub>2</sub> and LO<sub>2</sub> tanks, respectively. The SLAM pitch restrainer on Engine No. 1 did not release at T+18 seconds as programmed. Post-test examination revealed no malfunction, although a weak signal to the explosive bolt mechanism was suspected. Post-test examination of the engine tubing revealed four broken lines on Engine No. 2 and one on Engine No. 1.

NOTES 3-21-66 HOELZER

9/21

FOLLOW-UP ON MEETING CALLED BY GENERAL BOGART: In line with a request by General Bogart made on February 28, 1966, at a meeting in Washington, a group of some twenty people met in New Orleans to analyze overall problems in the computer field and to develop a scope of effort for a study in this area. MSFC was represented by Dr. Hoelzer, C. L. Bradshaw, Robert L. Reeves (Slidell), Tom Smith (Executive Staff), C. O. Brooks (Quality Lab), Jerry Turner (Technical Systems Office), and Chalmers Riley (Quality Lab). A scope of effort was evolved which should provide top management in OMSF with all the information needed in the computer field.

NOTES 3/21/66 JAMES

3/21/66

SA-202: Pre-launch checkout is in progress. Power has been applied to the vehicle and installation and modifications are being accomplished. KSC plans to proceed with a single-shift operation until SA-203 arrives. They will then transfer the launch crews to Pad 37B for a two-shift operation on SA-203.

AS-207/208 DUAL LAUNCH: We recently received a TWX from MSF advising that we should plan for the 207/208 dual launch. I am planning to forward a letter to MSF requesting that two primary objectives be added to the flight mission assignments document (FMAD) for 207 and 208. The two objectives are: (1) demonstrate Saturn IB dual launch capability, and (2) demonstrate launch vehicle variable azimuth capability.

S-IVB-202 INFLIGHT BULKHEAD TEST: The test is being planned as a secondary mission objective for AS-202. R&DO (Structures) personnel have stated that since there are temperature and pressure measurements and no strain measurements on the bulkhead the pressure and temperature data that will be received will not provide data from which a complete evaluation can be made. The test will provide an indication of the bulkhead design adequacy. The maximum  $\Delta P$  expected during the test will be 37 to 40 psid depending on the operation of the LH<sub>2</sub> vent valve. If the bulkhead fails at a pressure lower than the ground test pressure (34.7 psid), the test will provide a second data point but how or where it failed probably will not be known. For the bulkhead to fail during normal flight would require a double failure, i. e. , LOX vent valve fail open and hydrogen vent valve fail closed.

We are continuing the planning of this experiment and the possibility that continuous tracking coverage may require two ships is being investigated.

GENERAL PHILLIPS' REVIEW OF THE I. U.: It has been reported to me that the review for General Phillips on the I. U. design went very well. I would like to thank R&DO for their fine support.

3/21<sup>952</sup>1. Structural Adhesive Bonding Conference:

Last week the MSFC-sponsored Structural Bonding Conference was held here in the Morris Auditorium. This was a joint conference of P&VE, QUAL, and ME Laboratories with our Prime Contractors and other aerospace companies in order to present the results of some special R&D contracts to the audience with a following question and answer period. Also, other companies presented papers on specific topics and aspects in bonding technology of general interest for the Saturn/Apollo program. The conference was conducted in four major sessions covering design, materials, manufacturing processes, and evaluation (quality control). The great interest of industry in the topic of this meeting was reflected by high level representatives from industry and the high number of participants with 196 in attendance representing 43 industrial organizations. Some of the major companies represented at the conference were NAA, Boeing, DAC, Rohr Aviation, Goodyear Aerospace, Lockheed, General Dynamics, IBM, Avco, etc. A major benefit of such a conference is the informal establishment of contacts between the experts and experienced people between companies and between NASA and industry.

2. Technical Support to Sub-Contractors:

Here is one example of numerous cases of technical support furnished by our personnel to industry: Welding problems related to the water-methanol heat exchanger for the IU were reviewed at Solar Aircraft Company. Detailed welding procedures were recommended and demonstrated, and extensive instructions were given on two shifts to all welders working on this hardware. Two design changes were recommended and concurred with by Solar and IBM. Approval will be requested through proper channels by IBM.

3/21 943

1. T-38 JET TRAINER CRASH INVESTIGATION - In response to a request from Lt. Commander Allen Bean, we are investigating the combined air speed-mach number indicators taken from the T-38 trainer which claimed the lives of Astronauts See and Basset. The request was made because the Sheppard committee wanted to keep the instruments of concern within NASA.
2. S-IVB-503 REPAIR - The LOX tank bulkhead ruptured during hydrostatic proof pressure testing. Present plans for the fix of the ruptured area call for installing mechanical fastened doublers inside and outside of the bulkhead. Structural verification tests will be required. For schedule reasons, this stage will then be used for flight. The S-IVB-504 stage will then be pulled from flight status and used for a structural test vehicle.
3. S-IVB-203 HYDROGEN TANK PRESSURIZATION PROBLEMS - Two potentially serious problems in the hydrogen tank pressurization area exist. S-IVB-201 experienced a significant pressure decay due to sloshing, having a 2000 cu. ft. ullage volume. Vehicle 203 has only 200 cu. ft. volume, thus the problem may be worse. Acceptance firing of 203 revealed a significant pressure decay, attributed to ullage volume-pressurant distributor incompatibility. These problems are under accelerated study at DAC and MSFC in addition to investigations to be conducted here on the S-IVB Battleship.
4. CRYOGENIC INSULATION - A liquid hydrogen test of over 200 hours duration on the combined cryogenic insulation-micrometeoroid shield under development for P&VE has yielded a thermal conductivity of about  $.0003 \text{ BTU-in}/^{\circ}\text{F-ft}^2\text{-hr}$ . This represents the lowest thermal conductivity that anyone, to our knowledge, has ever achieved with a cryogenic insulation under simulated space conditions. The contract is with GAC (NAS8-11747).
5. S-IVB WORKSHOP - Use of residual propellant oxygen for breathing purposes. The small amounts of contaminants contained in the propellant grade oxygen are insignificant. The problem is the mixing of the pressurant helium with the oxygen, which apparently is acceptable as long as it can be properly regulated within acceptable limits. An oxygen blood saturation level of 95 percent is maintained at sea level. To support the same degree of oxygen in the blood at lower pressure, the percentage of oxygen in the atmosphere must be increased to prevent hypoxia and eventually asphyxiation. At 5.0 psia, the volume percent of oxygen must be 70 to provide sea level oxygen blood saturation. At 3.5 psia, the volume percent of oxygen should be 90. Unimpaired human performance is possible at slightly lower oxygen concentrations for periods of 1 - 2 weeks. Thus, some helium or other diluent is tolerable depending upon total pressure; however, a system (not presently available) for controlling and monitoring the mixture must be provided.

NOTES 3/21/66 MAUS

qB 3/21

FY-68 AAP BUDGET EXERCISE - MSF will accumulate AAP cradle-to-grave funding requirements for inclusion in the NASA preliminary FY-68 submission to BOB via three separate exercises.

For FY-66-67, MSF has spelled out firm funding availability totals by task which will be included as part of the POP 66-2 submission. No internal estimates are required for FY-66-67 unless we elect to submit unfunded requirements.

Phase I of the preparation of the FY-68 thru runout estimates will terminate on May 1, 1966 with the submission of the FY-68 preliminary to BOB. This exercise will be related but separate from POP 66-2. Estimates for this Phase will be staff developed by MSF with the Centers inputing on specific items as requested, except for launch vehicle costs. The current cost study results will be used by headquarters for this purpose.

The third exercise will be Phase II of the preparation of the FY-68 cradle-to-grave estimates which will terminate in September 1966 with submission of the NASA final FY-68 budget to BOB. This Phase will be developed by the Centers based on guidelines to be issued by MSF on April 1, with submission due in July.

A meeting was held at MSF on March 17, 1966, with Center representatives to discuss the guidelines and assumptions for these exercises. These guidelines will have to be approved by Dr. Seamans before release to the Centers.

NOTES 3-21-66 RICHARD

3/21 958

No submission.

NOTES 3/21/66 RUDOLPH

3/21

1. S-IC Stage Procurement Plan - for Stages S-IC-11 thru 15 was approved by NASA Headquarters on Friday, March 11, 1966. Request for firm cost proposal on long lead time hardware has been sent to Boeing.

2. S-II Stage:

S-II Battleship Stage - A successful full duration (350 seconds) test was conducted on Tuesday, March 15, 1966. This is the third consecutive successful full duration firing. Test results to date are currently being evaluated to establish a position as to the need for any further testing.

Welders Strike at NAA/S&ID - Welders Union (Local #2) went on strike Monday, March 14, 1966 at 10:00 am, PST. The welders returned to work on Thursday, March 17, 1966, under the terms of an interim agreement between the Union and NAA to:

- Remove pickets
- Resume work under the old contract temporarily
- Meet in Washington, D.C., with the Mediation Service on Friday, March 18.

The strike can be resumed with ten days notice by the Union if satisfactory contract terms cannot be reached. Impact on the S-II Stage Project is negligible thus far.

3. S-IVB-503 Flight Stage LOX Tank Failure:

- Decision has been reached to repair the tank failure by means of doublers huck bolted and bonded in place.
- The fix will be verified by hydrostatic test of an identical built-up fix on the LOX tank remaining from the old hydrostatic test tank item.
- The propellant tanks now in buildup for flight stage S-IVB-504 are planned to be diverted and used for more extensive structural testing.
- A general structural review meeting to analyse and review in detail the above and other structural problem areas in the S-IVB Program has been tentatively established for Friday, March 25, 1966.

4. Instrument Unit Design Specification Review with General Phillips - on Tuesday, March 15, 1966, adequately covered the "Action Item" from the December 1965, Management Council Meeting. The R&DO presentations were excellently prepared and well received. No additional action items were established.

A brief visit by General Phillips was made to (1) IBM (Huntsville), (2) GE (Huntsville), and (3) Saturn V Breadboard.

5. Saturn V Breadboard Activity:

- Familiarization Tape (500 GETS) delivered to KSC on Wednesday, March 16, 1966, on schedule.
- Completion of Vehicle/ESE Integration Test is expected by Tomorrow, Tuesday, March 22, 1966, on schedule.

90 3/21

1. AS-201 PHOTO COVERAGE: MSFC and KSC are actively pursuing corrective actions to avoid a repeat of the close-in ground camera failure that occurred on AS-201. These close-in cameras are sequenced by the Ground Sequencer to start at various times between T-10 second and T-3 seconds. Since count recycle occurred on AS-201 after the cameras had been started, 63 cameras ran to film depletion. At the actual liftoff of the vehicle only ten cameras were operating. The lack of a means for stopping the camera in case of cutoff had been recognized by KSC prior to the AS-201 launch, but for reasons unknown they were unable to make the necessary changes. To insure improved support for future missions, 50 of the continuous record cameras can be connected with a start-stop sequencer in the blockhouse. MSFC and KSC photographic personnel were to have met today and tomorrow to discuss the technical details of this, but KSC notified us last Friday that they were not yet prepared for the meeting. The meeting will be held (at MSFC) as soon as possible.
2. AS-201 MISSION DIRECTOR VISIT: Gen. Bolender the AS-201 Mission Director visited MSFC on March 16 for general discussions on the 201 operations. The discussions concerned: (a) LIEF operations; (b) Mission Rules; (c) Readiness Reviews; (d) Ground Support Implementation; and (e) Mission Director's Experience. It is felt that the visit and the exchange of views was worthwhile.
3. MSFC PARTICIPATION IN GT-8: Three MSFC personnel observed the GT-8 operation at the Mission Control Center - Houston. Those participating were Mr. Rowan (Saturn V), Mr. Ferguson (AAP), and Mr. Justice (ASTR).

NOTES 3-21-66 Stuhlinger

3/21

1. PEGASUS: No significant changes in meteoroid measurements.

With the help of our support contractor (Brown Engineering), we are presently computerizing bookkeeping procedures for Pegasus data analysis.

On the basis of Pegasus and other meteoroid data, an effort has been initiated recently by LaRC (B. Kinard) to update the NASA definition of the meteoroid distribution in space. It appears that enough experimental data are now on hand to permit a realistic estimate of this distribution function. RPL is working very closely with LaRC and MSC in this effort.

2. AAP: Earth Orbit - The Astronomical Telescope Mount (ATM) Project was assigned to GSFC by Dr. Newell, Messrs. Mitchell, Smith, and Forsythe from OSSA expressed their appreciation and recognition for the work MSFC had done in connection with the ATM proposal. I believe that our effort was still worthwhile because it demonstrated capabilities, competence, and interest existing at MSFC.

RPL was requested by OSSA to assist in the preparation of inputs to a work statement for a manned voice broadcast study to be let out of Headquarters (OSSA). Marshall will probably be asked to participate in monitoring the resultant contract.

As a result of the Headquarters (OSSA) presentation this week, MSFC apparently will be lead Center for some of the application experiments (manned meteorology and selected remote sensors). Details are not yet known. RPL will apparently be assigned technical supervision of the absorption spectroscopy area (Shelton and Hale) and the gravity gradient area (Dozier and Bob Jones).

Lunar Surface - Bendix was selected as the ALSEP contractor by MSC.

Funds (FY 1966) for our present lunar surface exploration program are still not available from OSSA. There is a chance, however, that Ed Gray may be able to obtain MSF funds for at least part of the program.

3. APPLICATIONS FOR S-IB WITH ZERO STAGE: Members of OART and JPL, during a review meeting on electric propulsion contract studies at MSFC, expressed great interest in the S-IB Zero Stage vehicle in combination with solar-powered electric propulsion stages. If combined with a 40 to 50 kw solar powered ion engine stage, this vehicle could serve as carrier for a complete Voyager. Basic technologies for an electric propulsion stage of this kind are presently available. ASO will provide S-IB Zero Stage data to OART and JPL for further studies.

4. APOLLO LANDING SITE SELECTION BOARD: This Board, chaired by General S. Phillips, held its first meeting last week. Members are from MSF, OSSA (Ed Cortright), MSC, KSC, and Bellcomm. Criteria for Site Selection are (in priority order): operational considerations; spacecraft considerations; lunar soil mechanics; scientific objectives. Numerous possible sites have been identified so far. It is expected that lunar orbiter flights and Surveyors will contribute substantially to this effort. I was asked to give a short presentation at the next board meeting on the appraisal of various potential landing sites from the standpoint of scientific exploration. If several sites should be equally suitable from the operational and the vehicle standpoints, the scientific value of each site may be a useful criterion for the final decision.

NOTES 3-21-66 WILLIAMS

9/3/21

Negative.

RL10 ENGINE Two experimental engines with a carbon insert in the oxidizer pump housing have been successfully tested without evidence of blade rubbing. This configuration will be incorporated on the initial production engines if no problems are encountered during substantiation testing.

Dr. Seaman's letter with copies to you and Dr. Silverstein was received. We will proceed as appropriate with an orderly transfer of the RL10 to LeRC. If you have any special desires relative to the transfer, please let us know.

J-2 ENGINE A 230K/5.5MR R&D engine (J020) has accumulated 5707 seconds in 53 tests without any major hardware changes. Ten successful restart tests have been conducted on this engine.

An S-II Battleship test was conducted on March 15, 1966, for 349 seconds. The vehicle gimbal program produced a gimbal rate of 6.4 cycles per second with an amplitude of .25 degrees instead of the planned .64 cycles per second at two degrees amplitude. Some line and clamp damage was sustained on the engines; however, it has not been determined if these failures were attributed to the gimbal program. Engine J-2020 (center position) has accumulated 3672 seconds on the S-IVB and S-II Battleship programs and must be replaced prior to the next test.

Rocketdyne has officially recommended five changes to SA-202 and 203 prior to flight. The recommended changes are: a. Install the gas generator delay orifice on SA-202; b. Change the main LOX valve orifice on 202 and 203 to yield a mid-temperature range valve opening time; c. Install insulation over the T/C Bell exit skin temperature patches, to preclude retro fire compromising the actual skin temperature measurement; d. Transfer two of the existing temperature measurements to the main LOX valve housing the closing control line; e. Douglas determine the heat energy of the retro motors on the J-2 Bell.

Engine 2038, an outboard engine on the S-II-1 stage, was found to have LOX pump turbine damage when hydraulic pump installation was initiated, requiring replacement of the LOX turbopump. It has been decided to replace the engine, which will require about three shifts of operation.

The S-IVB stage for SA-204 was acceptance tested on Friday, March 18, 1966, at DAC/SACTO. The J-2 engine operated satisfactorily for 451 seconds, including 295 seconds at maximum mixture ratio and a 48 second gimbal program.

F-1 ENGINE The LOX system of engine F-4017 became contaminated with fuel during a simulated launch checkout of S-IC-2 at R-QUAL on Thursday, March 10, 1966. The contamination resulted from a procedural oversight and intensive investigation indicates that only the one engine has LOX system contamination; however, further investigation is underway. Engine 017 will be removed, selected components cleaned, and reinstalled by ME Laboratory before the stage is transferred to the static test stand. In addition, the lower LOX valve of each of the remaining four engines will be removed to assure that fuel has not contaminated the LOX feed system.

H-1 ENGINE During acceptance of engine H-7081 one of the three TOPS switches was found to have solder contamination. As a result of this discovery, all switches on SA-202 and subsequent will be inspected and replaced if necessary.

GENERAL Labor situation at Canoga Park - Federal Mediation Service requested the United Welders of America to return to work on March 16, 1966. The union and NAA are to meet with Washington Mediation Service Representation at the Department of Labor on March 18, 1966. Labor situation at EAFB - UAW and NAA representatives are meeting March 17, 1966, with the Presidential Missile Sites Labor Commission to attempt to settle the issues of the labor situation at EAFB/Rocket Engine Test Site. Representatives of the UAW and the Air Force were meeting in Los Angeles on March 16, 1966, with the NLRB to provide "ground rules for picketing at EAFB." Only one gate will be picketed in event of another strike at EAFB.

## NOTES 3/21/66 CONSTAN

### 1. BOEING WORK TRANSFER

Boeing is proceeding with a plan to transfer as much of the S-IC work from Seattle and Wichita to the Michoud facility as is practicable. They plan to transfer practically all fabrication work with the exception of that requiring the numerically controlled mills used for tank skins and gore assemblies and the large thrust posts forgings. We agree in principal with the plan and will work with them to develop the necessary details to implement.

### 2. STATUS OF CURRENT BOEING - IAM UNION AGREEMENT

Under the current agreement between The Boeing Company and the International Association of Machinists and Aerospace Workers, which was effective October 2, 1965, it was agreed that the company and union would continue to bargain on the subject of a manpower control system (performance analysis and seniority). It was further agreed that if the parties had not reached a mutual agreement by midnight March 31, 1966, the union can, without reversing the "no-strike" clause, call a strike within the following thirty days. Negotiations have continued since October and to date no mutual agreement has been reached. A representative of the Federal Mediation and Conciliation Service has been called in by the union. Meetings are being held daily; however, as of this date, no agreement has been reached. We will keep you informed as developments occur. The Stage Manager has been informed and The Boeing Company has been requested to provide a plan of action in the event of a strike.

### 3. CONTRACT NAS8-4016, CHRYSLER CORPORATION SPACE DIVISION

Modification No. 292 converting the S-IB contract from CPFF to CPIF should be forwarded to Marshall for review during the week of March 28. The delay was occasioned by the necessity to make some last minute changes to Government Furnished Property and support services as well as a requirement that the provision dealing with interface control documents be revised. Although the forecasted date for review was not met, it is expected that the improved modification will result in less time for review and approval.

Interface Control Documentation (ICD's) - The identification phase of the ICD effort can now be considered as essentially complete. Methods and procedures have also been established for ICD control and accounting of ICD changes; however, the actual implementation requires additional effort in IO as well as in R&DO before complete compliance with NPC 500-1 can be claimed.

Here is a brief status report on the ICD identification:

a. Required SAT-IB ICD's have been identified with support from the system engineering contractor (CCSD), by means of a "matrix" for all launch vehicle oriented ICD's, while for all electrical ground support equipment, a list furnished by R-ASTR with GE support has been accepted as being correct and complete. These two documents identify all ICD's applicable to vehicles 202-204; this information has been checked and verified by the affected R&DO labs. Additional information covering the remainder of the vehicles is well under way, and can also be considered complete pending final verification.

b. A similar effort was conducted with the SAT-V systems engineering support contractor (Boeing), and was improved by integrating matrix data into the equivalent ESE-ICD list. The result is an "ICD Chart," which also indicates applicability by stage, IU, LVGSE, Center, etc. To make this "ICD Chart" even more useful, it was split for "visibility" reasons into three "sections":

Section #1: New documents per launch vehicle are required only for relatively few ICD's (between 11 and 33, depending on vehicle).

Section #2: Unless major changes (AAP?) are being introduced, 123 ICD's remain unchanged.

Section #3: Fifteen (15) ICD's do not affect any MSFC contract, but Level II Change Board will implement these to assure KSC recognition.

c. After Chart and Matrix information has been included in stage and equipment contracts, changes can only be made through official Configuration Control Board action.

In order to get prepared for this phase of complete control, R&DO is updating previously issued R&DO Management Directives 4-1 (Handling of ECP's), 4-11 (Handling of ECR's), and 4-14 (ICD Procedures).

An R&DO proposal in regard to accounting procedures was presented to you early this month (IO presentation on Configuration Management). The SAT IB Manager has directed its implementation already and steps are under way to implement it also completely for the SAT V program.

On March 8, stage contractors were briefed on the intent of the MSFC-IO program and on the status of implementation. They were invited to actively participate and to forward any improvement suggestions.

NOTES 3/21/66 FELLOWS

1. FY-66 Initiations: Continued management attention at all levels in R&D Operations has resulted in the following status of initiations:

(Dollars in thousands)

	Program Authority	Initiations to Date (a)	Obligations to Date (b)
	_____	_____	_____
Office Manned Space Flight			
Saturn I	53	53	53
Saturn IB	28,560	25,850	18,336
Saturn V	106,247	97,305	59,717
Engine Development	842	817	545
All other MSF	12,250	10,775	4,865
Total OMSF	147,952	134,800	83,516
Office of Tracking and Data Acquisition	1,500	1,483	207
Office Advanced Research and Technology	16,249	11,985	2,870
Office Space Sciences and Application	608	487	200
Total R&D Operations	166,309	148,755	86,793

(a) Saturn Programs as of March 15. All other programs as of February 28.

(b) Saturn Programs as of March 11. All other programs as of February 28.

This fine performance by the laboratories in getting FY-66 initiations in good shape at this early date also increases the practicability of a substantial start of FY-67 initiations next month.

2. Unsteady Aerodynamics - Panel Flutter Test Program: A meeting has been called this week between P&VE, AERO, and members of my office to resolve problems in the Panel Flutter Test Program. Previously, it was decided that June was the latest date test results could be provided for a fix on 204. However, it now appears that test results cannot be secured within the desired time by using either the AMES or the AEDC tunnel. At the meeting scheduled this week, a revised schedule will be developed, a decision will be made as to which tunnel will be used, and target dates established for each step in the test program. The revised schedule will also provide time for design modification if the tests reveal such a requirement.

1. Current Contract Work in the Areas of Astrodynamics and Guidance Theory:  
J. Lovingood made a trip to ERC on March 15 and 16 to discuss current contract work in the areas of astrodynamics and guidance theory. It was found that there are several common contractors which means there is a possible duplication of effort. Both ERC and Aero Lab are going to make an effort to prevent this through personal contacts and contractor meetings.

2. MSFC Presentation to the OSSA Space Applications Office: On Wednesday March 16th, a presentation was given by MSFC personnel to the OSSA Space Applications Office (Dr. M. Tepper) on the Manned Meteorology Study Program, Earth Orbital Mission #2 (Manned Meteorology), certain natural resource experiments, and the Natural Resource Program. The first two presentations were organized by Aero Lab with cooperation of P&VE, RPL, and Astr; the last two were organized by Astronics Lab. Dr. J. McCall led the MSFC team. OSSA apparently has previously had many discussions with other NASA centers, including MSC, on these subjects. It appears that the MSFC presentations were well received, as were the earlier presentation on the Navigation and Communications Study Projects given Mr. Jaffe and Dr. Tepper at MSFC. Earth Orbital Mission #2 is of main interest to Dr. Tepper due to the time of expected launch, late 1968. Typical elements of Earth Orbital Mission #2 are the following experiments: (A) Image Orthicon Camera System (AAP): To image cloud cover scenes during day and night portions of orbit; (B) Dielectric Tape Camera System (AAP): To demonstrate the value of high resolution cloud cover television for meteorological analysis and prediction; (C) Oxygen and Water Vapor Microwave Radiometer (AAP): To measure temperature and water vapor profile in the lower atmosphere by means of a multichannel microwave radiometer; and (D) Infrared Temperature Sounding (AAP): To determine vertical temperature profile of the atmosphere from the surface to one millibar, and to determine reflected solar radiation from the surface and clouds. The participation mechanisms relative to MSFC & OSSA actions and commitments on the six presentations were discussed in closed session by Dr. McCall and Dr. Tepper with Mr. Horton in attendance.

1. S-IC-2 CONTAMINATION PROBLEMS: During recent S-IC-2 checkout activities of this Laboratory, a procedural error, aggravated by the absence of preventive interlock, was committed which caused hydraulic fluid to inadvertently be pumped into the engines. The design of the engines plus the fact that the stage was in a horizontal position provided a flow passage through the fuel lines to the injector and back through the lox dome to the main lox valves, or a direct passage to the fuel tank and to the gas generator. Engine No. 1 lox dome and No. 1 and 2 main lox valves are contaminated. Engines No. 2, 3, 4, and 5 had R-J1 introduced into the fuel system; however, there are now indications that the fuel went into these engine lox systems. An estimated 200 gallons of fluid was pumped into the fuel tank. An R&DO meeting conducted 3-17-66 determined the following corrective action to be required. Engine No. 1 will be removed to clean all contaminated areas and to further inspect for possible contamination not currently known. Main lox valves on engines No. 2, 3, 4, and 5 will be removed and cleaned. The gas generator will be removed, inspected and cleaned on engine No. 4. (All investigations determined that gas generators were not contaminated on engines No. 2, 3, and 5.) Fuel will be pumped from propellant tank, and all systems which have been disconnected will be retested after reinstallation on the stage. An interlock system is being developed for the GSE which will prevent recurrence of this incident. The above activities are scheduled for completion April 13, 1966, based on a nonovertime schedule. The stage office has been notified of the delay and has proposed that we wait until April 18, 1966, to deliver the vehicle and thus avoid stage storage problems inherent in the present schedule.
2. RL-10 ENGINES: As a result of the transfer of the quality and reliability functions at Pratt and Whitney Aircraft Company, all Laboratory personnel except one have accepted a transfer with the functions to the Navy. Planned effective date of the transfer is April 24, 1966.

1. SATURN V DISPLAY SYSTEM: The first (15) operator console Saturn V Display System is presently being installed at the Kennedy Space Center's Launch Complex No. 39. Installation and final acceptance by the Government is scheduled to be complete by the end of March 1966. Two other systems have been previously accepted and are presently supporting test and checkout operations in the Astrionics Laboratory. We would like to take this opportunity to invite you, at any time which is convenient for you, to come to the Astrionics Laboratory and view a demonstration of this advanced and versatile display system.
  
2. PRESENTATIONS TO OSSA: Presentations concerning potential MSFC support in Manned Meteorology and in Natural Resources were completed on 3/16 in Washington by R-AERO, R-ASTR and R-RP representatives. Dr. McCall represented R-DIR and Mr. Palaoro represented R-P&VE. Messrs. Horton, Digesu, Barr and Paludan represented R-ASTR. Messrs. Vaughan and Smith represented R-AERO. Mr. Ruth represented R-RP. The presentations were received by Dr. Tepper of OSSA Space Applications Program Office, with Mr. Jaffe and Dr. Badgley attending part-time. Dr. Tepper stated that he was pleased, impressed, and appreciative of MSFC's response in these areas. He plans to write OMSF in early April to request MSFC support. In this connection, we are preparing, at Dr. McCall's request, a letter for your signature to advise Dr. Mueller of our OSSA discussions and interests.

S-1C

The S-1C-1 stage was removed from the test stand on March 14, 1966, and transported to R-ME for refurbishment.

F-1

Tests FW-017 and FW-018 were conducted at the West Area F-1 Test Stand on March 18, with F-1 engine F-4T2 for approximate mainstage durations of 41 seconds each. Tests were conducted to obtain performance data for the high lox NPSH studies in connection with S-1C flight cutoff conditions.

S-1VB

S-1VB (Sacramento): The S-1VB-501, which arrived at the VCL on March 15, with approximately 2,005 manufacturing hours, transferred from Huntington Beach. This includes 65 line items short to the stage. Manufacturing and checkout will be done in the VCL.

S-1VB-204: A 451 seconds mainstage firing was successfully conducted on Friday, March 18, on the first firing attempt. The auxiliary hydraulic pump failed to start at T-10 minutes as programmed, but the firing was continued and the engine gimbaled using the engine-driven hydraulic pump. The problem was indicated to be in the switching unit. A data session will be conducted Monday, March 21, 1966.

S-11 BATTLESHIP

Test No. 033 was conducted at the S-11 Battleship Facility at 11:18 a.m. PST, on Tuesday, March 15. The duration of the test was 349 seconds of mainstage operation, with cutoff being initiated from LH<sub>2</sub> low level cutoff (ECO) sensors. The residuals remaining after cutoff were 1% and 2% in the LH<sub>2</sub> and LO<sub>2</sub> tanks, respectively. The SLAM pitch restrainer on Engine No. 1 did not release at T+18 seconds as programmed. Post-test examination revealed no malfunction, although a weak signal to the explosive bolt mechanism was suspected. Post-test examination of the engine tubing revealed four broken lines on Engine No. 2 and one on Engine No. 1.

NOTES 3-21-66 HOELZER

FOLLOW-UP ON MEETING CALLED BY GENERAL BOGART: In line with a request by General Bogart made on February 28, 1966, at a meeting in Washington, a group of some twenty people met in New Orleans to analyze overall problems in the computer field and to develop a scope of effort for a study in this area. MSFC was represented by Dr. Hoelzer, C. L. Bradshaw, Robert L. Reeves (Slidell), Tom Smith (Executive Staff), C. O. Brooks (Quality Lab), Jerry Turner (Technical Systems Office), and Chalmers Riley (Quality Lab). A scope of effort was evolved which should provide top management in OMSF with all the information needed in the computer field.

NOTES 3/21/66 JAMES

SA-202: Pre-launch checkout is in progress. Power has been applied to the vehicle and installation and modifications are being accomplished. KSC plans to proceed with a single-shift operation until SA-203 arrives. They will then transfer the launch crews to Pad 37B for a two-shift operation on SA-203.

AS-207/208 DUAL LAUNCH: We recently received a TWX from MSF advising that we should plan for the 207/208 dual launch. I am planning to forward a letter to MSF requesting that two primary objectives be added to the flight mission assignments document (FMAD) for 207 and 208. The two objectives are: (1) demonstrate Saturn IB dual launch capability, and (2) demonstrate launch vehicle variable azimuth capability.

S-IVB-202 INFLIGHT BULKHEAD TEST: The test is being planned as a secondary mission objective for AS-202. R&DO (Structures) personnel have stated that since there are temperature and pressure measurements and no strain measurements on the bulkhead the pressure and temperature data that will be received will not provide data from which a complete evaluation can be made. The test will provide an indication of the bulkhead design adequacy. The maximum  $\Delta P$  expected during the test will be 37 to 40 psid depending on the operation of the LH<sub>2</sub> vent valve. If the bulkhead fails at a pressure lower than the ground test pressure (34.7 psid), the test will provide a second data point but how or where it failed probably will not be known. For the bulkhead to fail during normal flight would require a double failure, i. e. , LOX vent valve fail open and hydrogen vent valve fail closed.

We are continuing the planning of this experiment and the possibility that continuous tracking coverage may require two ships is being investigated.

GENERAL PHILLIPS' REVIEW OF THE I. U.: It has been reported to me that the review for General Phillips on the I. U. design went very well. I would like to thank R&DO for their fine support.

1. Structural Adhesive Bonding Conference:

Last week the MSFC-sponsored Structural Bonding Conference was held here in the Morris Auditorium. This was a joint conference of P&VE, QUAL, and ME Laboratories with our Prime Contractors and other aerospace companies in order to present the results of some special R&D contracts to the audience with a following question and answer period. Also, other companies presented papers on specific topics and aspects in bonding technology of general interest for the Saturn/Apollo program. The conference was conducted in four major sessions covering design, materials, manufacturing processes, and evaluation (quality control). The great interest of industry in the topic of this meeting was reflected by high level representatives from industry and the high number of participants with 196 in attendance representing 43 industrial organizations. Some of the major companies represented at the conference were NAA, Boeing, DAC, Rohr Aviation, Goodyear Aerospace, Lockheed, General Dynamics, IBM, Avco, etc. A major benefit of such a conference is the informal establishment of contacts between the experts and experienced people between companies and between NASA and industry.

2. Technical Support to Sub-Contractors:

Here is one example of numerous cases of technical support furnished by our personnel to industry: Welding problems related to the water-methanol heat exchanger for the IU were reviewed at Solar Aircraft Company. Detailed welding procedures were recommended and demonstrated, and extensive instructions were given on two shifts to all welders working on this hardware. Two design changes were recommended and concurred with by Solar and IBM. Approval will be requested through proper channels by IBM.

NOTES 3-21-66 LUCAS

1. T-38 JET TRAINER CRASH INVESTIGATION - In response to a request from Lt. Commander Allen Bean, we are investigating the combined air speed-mach number indicators taken from the T-38 trainer which claimed the lives of Astronauts See and Basset. The request was made because the Sheppard committee wanted to keep the instruments of concern within NASA.
2. S-IVB-503 REPAIR - The LOX tank bulkhead ruptured during hydrostatic proof pressure testing. Present plans for the fix of the ruptured area call for installing mechanical fastened doublers inside and outside of the bulkhead. Structural verification tests will be required. For schedule reasons, this stage will then be used for flight. The S-IVB-504 stage will then be pulled from flight status and used for a structural test vehicle.
3. S-IVB-203 HYDROGEN TANK PRESSURIZATION PROBLEMS - Two potentially serious problems in the hydrogen tank pressurization area exist. S-IVB-201 experienced a significant pressure decay due to sloshing, having a 2000 cu. ft. ullage volume. Vehicle 203 has only 200 cu. ft. volume, thus the problem may be worse. Acceptance firing of 203 revealed a significant pressure decay, attributed to ullage volume-pressurant distributor incompatibility. These problems are under accelerated study at DAC and MSFC in addition to investigations to be conducted here on the S-IVB Battleship.
4. CRYOGENIC INSULATION - A liquid hydrogen test of over 200 hours duration on the combined cryogenic insulation-micrometeoroid shield under development for P&VE has yielded a thermal conductivity of about  $.0003 \text{ BTU-in/}^{\circ}\text{F-ft}^2\text{-hr}$ . This represents the lowest thermal conductivity that anyone, to our knowledge, has ever achieved with a cryogenic insulation under simulated space conditions. The contract is with GAC (NAS8-11747).
5. S-IVB WORKSHOP - Use of residual propellant oxygen for breathing purposes. The small amounts of contaminants contained in the propellant grade oxygen are insignificant. The problem is the mixing of the pressurant helium with the oxygen, which apparently is acceptable as long as it can be properly regulated within acceptable limits. An oxygen blood saturation level of 95 percent is maintained at sea level. To support the same degree of oxygen in the blood at lower pressure, the percentage of oxygen in the atmosphere must be increased to prevent hypoxia and eventually asphyxiation. At 5.0 psia, the volume percent of oxygen must be 70 to provide sea level oxygen blood saturation. At 3.5 psia, the volume percent of oxygen should be 90. Unimpaired human performance is possible at slightly lower oxygen concentrations for periods of 1 - 2 weeks. Thus, some helium or other diluent is tolerable depending upon total pressure; however, a system (not presently available) for controlling and monitoring the mixture must be provided.

NOTES 3/21/66 MAUS

FY-68 AAP BUDGET EXERCISE - MSF will accumulate AAP cradle-to-grave funding requirements for inclusion in the NASA preliminary FY-68 submission to BOB via three separate exercises.

For FY-66-67, MSF has spelled out firm funding availability totals by task which will be included as part of the POP 66-2 submission. No internal estimates are required for FY-66-67 unless we elect to submit unfunded requirements.

Phase I of the preparation of the FY-68 thru runout estimates will terminate on May 1, 1966 with the submission of the FY-68 preliminary to BOB. This exercise will be related but separate from POP 66-2. Estimates for this Phase will be staff developed by MSF with the Centers inputting on specific items as requested, except for launch vehicle costs. The current cost study results will be used by headquarters for this purpose.

The third exercise will be Phase II of the preparation of the FY-68 cradle-to-grave estimates which will terminate in September 1966 with submission of the NASA final FY-68 budget to BOB. This Phase will be developed by the Centers based on guidelines to be issued by MSF on April 1, with submission due in July.

A meeting was held at MSF on March 17, 1966, with Center representatives to discuss the guidelines and assumptions for these exercises. These guidelines will have to be approved by Dr. Seamans before release to the Centers.

NOTES 3-21-66 RICHARD

No submission.

NOTES 3/21/66 RUDOLPH

1. S-IC Stage Procurement Plan - for Stages S-IC-11 thru 15 was approved by NASA Headquarters on Friday, March 11, 1966. Request for firm cost proposal on long lead time hardware has been sent to Boeing.

2. S-II Stage:

S-II Battleship Stage - A successful full duration (350 seconds) test was conducted on Tuesday, March 15, 1966. This is the third consecutive successful full duration firing. Test results to date are currently being evaluated to establish a position as to the need for any further testing.

Welders Strike at NAA/S&ID - Welders Union (Local #2) went on strike Monday, March 14, 1966 at 10:00 am, PST. The welders returned to work on Thursday, March 17, 1966, under the terms of an interim agreement between the Union and NAA to:

- Remove pickets
- Resume work under the old contract temporarily
- Meet in Washington, D.C., with the Mediation Service on Friday, March 18.

The strike can be resumed with ten days notice by the Union if satisfactory contract terms cannot be reached. Impact on the S-II Stage Project is negligible thus far.

3. S-IVB-503 Flight Stage LOX Tank Failure:

- Decision has been reached to repair the tank failure by means of doublers huck bolted and bonded in place.
- The fix will be verified by hydrostatic test of an identical built-up fix on the LOX tank remaining from the old hydrostatic test tank item.
- The propellant tanks now in buildup for flight stage S-IVB-504 are planned to be diverted and used for more extensive structural testing.
- A general structural review meeting to analyse and review in detail the above and other structural problem areas in the S-IVB Program has been tentatively established for Friday, March 25, 1966.

4. Instrument Unit Design Specification Review with General Phillips - on Tuesday, March 15, 1966, adequately covered the "Action Item" from the December 1965, Management Council Meeting. The R&DO presentations were excellently prepared and well received. No additional action items were established.

A brief visit by General Phillips was made to (1) IBM (Huntsville), (2) GE (Huntsville), and (3) Saturn V Breadboard.

5. Saturn V Breadboard Activity:

- Familiarization Tape (500 GETS) delivered to KSC on Wednesday, March 16, 1966, on schedule.
- Completion of Vehicle/ESE Integration Test is expected by Tomorrow, Tuesday, March 22, 1966, on schedule.

NOTES 3/21/66 SPEER

1. AS-201 PHOTO COVERAGE: MSFC and KSC are actively pursuing corrective actions to avoid a repeat of the close-in ground camera failure that occurred on AS-201. These close-in cameras are sequenced by the Ground Sequencer to start at various times between T-10 second and T-3 seconds. Since count recycle occurred on AS-201 after the cameras had been started, 63 cameras ran to film depletion. At the actual liftoff of the vehicle only ten cameras were operating. The lack of a means for stopping the camera in case of cutoff had been recognized by KSC prior to the AS-201 launch, but for reasons unknown they were unable to make the necessary changes. To insure improved support for future missions, 50 of the continuous record cameras can be connected with a start-stop sequencer in the blockhouse. MSFC and KSC photographic personnel were to have met today and tomorrow to discuss the technical details of this, but KSC notified us last Friday that they were not yet prepared for the meeting. The meeting will be held (at MSFC) as soon as possible.
  
2. AS-201 MISSION DIRECTOR VISIT: Gen. Bolender the AS-201 Mission Director visited MSFC on March 16 for general discussions on the 201 operations. The discussions concerned: (a) LIEF operations; (b) Mission Rules; (c) Readiness Reviews; (d) Ground Support Implementation; and (e) Mission Director's Experience. It is felt that the visit and the exchange of views was worthwhile.
  
3. MSFC PARTICIPATION IN GT-8: Three MSFC personnel observed the GT-8 operation at the Mission Control Center - Houston. Those participating were Mr. Rowan (Saturn V), Mr. Ferguson (AAP), and Mr. Justice (ASTR).

NOTES 3-21-66 Stuhlinger

1. PEGASUS: No significant changes in meteoroid measurements.

With the help of our support contractor (Brown Engineering), we are presently computerizing bookkeeping procedures for Pegasus data analysis.

On the basis of Pegasus and other meteoroid data, an effort has been initiated recently by LaRC (B. Kinard) to update the NASA definition of the meteoroid distribution in space. It appears that enough experimental data are now on hand to permit a realistic estimate of this distribution function. RPL is working very closely with LaRC and MSC in this effort.

2. AAP: Earth Orbit - The Astronomical Telescope Mount (ATM) Project was assigned to GSFC by Dr. Newell, Messrs. Mitchell, Smith, and Forsythe from OSSA expressed their appreciation and recognition for the work MSFC had done in connection with the ATM proposal. I believe that our effort was still worthwhile because it demonstrated capabilities, competence, and interest existing at MSFC.

RPL was requested by OSSA to assist in the preparation of inputs to a work statement for a manned voice broadcast study to be let out of Headquarters (OSSA). Marshall will probably be asked to participate in monitoring the resultant contract.

As a result of the Headquarters (OSSA) presentation this week, MSFC apparently will be lead Center for some of the application experiments (manned meteorology and selected remote sensors). Details are not yet known. RPL will apparently be assigned technical supervision of the absorption spectroscopy area (Shelton and Hale) and the gravity gradient area (Dozier and Bob Jones).

Lunar Surface - Bendix was selected as the ALSEP contractor by MSC.

Funds (FY 1966) for our present lunar surface exploration program are still not available from OSSA. There is a chance, however, that Ed Gray may be able to obtain MSF funds for at least part of the program.

3. APPLICATIONS FOR S-IB WITH ZERO STAGE: Members of OART and JPL, during a review meeting on electric propulsion contract studies at MSFC, expressed great interest in the S-IB Zero Stage vehicle in combination with solar-powered electric propulsion stages. If combined with a 40 to 50 kw solar powered ion engine stage, this vehicle could serve as carrier for a complete Voyager. Basic technologies for an electric propulsion stage of this kind are presently available. ASO will provide S-IB Zero Stage data to OART and JPL for further studies.

4. APOLLO LANDING SITE SELECTION BOARD: This Board, chaired by General S. Phillips, held its first meeting last week. Members are from MSF, OSSA (Ed Cortright), MSC, KSC, and Bellcomm. Criteria for Site Selection are (in priority order): operational considerations; spacecraft considerations; lunar soil mechanics; scientific objectives. Numerous possible sites have been identified so far. It is expected that lunar orbiter flights and Surveyors will contribute substantially to this effort. I was asked to give a short presentation at the next board meeting on the appraisal of various potential landing sites from the standpoint of scientific exploration. If several sites should be equally suitable from the operational and the vehicle standpoints, the scientific value of each site may be a useful criterion for the final decision.

NOTES 3-21-66 WILLIAMS

Negative.

March 28, 1966

NOTES 3-28-66  
WITH COMMENTS

MR. GORMAN'S COPY

*No comment for DEP-A  
attention*

# OFFICE OF DIRECTOR - MSFC

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

**REMARKS**

Mike Kalange, the COR on the Moog Servo-controls contract, says that they are selecting a second source for a suitable potentiometer. The Markite Corporation has been totally unresponsive, and he and the Moog people feel that further pressure from Marshall or Moog would have no bearing on their ability to deliver the potentiometers. The owner of the company, Mr. Cohler, is a New York school teacher and apparently very eccentric. In addition to that, the plant is located in Greenwich Village. Kalange is to call me back in a day or two if he feels your interjection into the situation could be of any help.

✓ B

CODE DIR	NAME J. T. Shepherd	DATE 4-6-66
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3/28 JES

1. SERVOACTUATOR POTENTIOMETER PROBLEM: Production problems at the Markite Products Corp., New York, N.Y., have resulted in a severe shortage of potentiometers for the Saturn Servoactuators. Moog Servocontrols, Inc., supplier of the S-IB, S-IC, S-II, and S-IVB actuators, and Hydraulic Research and Manufacturing Co., supplier of the S-IC actuator, use potentiometers built by Markite. This sole source situation has developed because Markite was the only vendor who had an "infinite-resolution" potentiometer of a suitable configuration on the market at the time the servoactuators were designed. The company apparently cannot now supply potentiometers in the quantity needed to support the Saturn production at Moog and Hydraulic Research. The seriousness of the situation has been emphasized to Markite management, but no meaningful commitment can be obtained. Immediate action is being initiated to develop a second source for a potentiometer of the "infinite-resolution" type. In addition, sources for wire-wound potentiometers are also being investigated. ✓

Jim Shepherd

In reference to my  
travel schedule 12/13 April,

B

B 4/1

NOTES 3/28/66 BALCH

3/28 958

S-II-T Stage - Engineering run of dry countdown for LN<sub>2</sub> tanking was complete on 3/23/66. Sell run was started on 3/25/66. Final integrated checkout of insulation repair was being run concurrently. Installation of LOX pre-pressurization line was in process late Friday, 3/25/66. Both these activities and pressurization of the LH<sub>2</sub> and LOX tanks were expected to be completed in time to permit start of LN<sub>2</sub> tanking on Sunday, 3/27/66. ✓

High Pressure Gas Storage Bottles - Removal of faulty hydrogen bottle from S-II Complex was begun on 3/21/66. Replacement with identical bottle from S-IC Test Complex will be accomplished as planned. Also, a storage bottle is to be shipped from MSFC to provide more storage capacity for gaseous hydrogen, and action is being taken to obtain additional bottles from the west coast as back-up for existing hydrogen, helium, and nitrogen bottles from the same supplier that furnished the hydrogen bottle that failed. ✓

S-IC Test Stand - Late delivery and subsequent installation of T-1 steel piping from Dravo Corporation for high pressure gas systems continue to be the most critical restraint on timely completion of B-2 position. Action is being taken to effect establishment of firm construction schedules, close coordination of Boeing requirements and Phase II Technical Systems activities, and maximum utilization of all available access to test stand areas for critical technical systems installation. ✓

S-II Test Stand A-1 - Means are being explored for expediting behind-schedule activities. Potential delay in delivery of T-1 steel piping for high pressure gas systems is the most serious problem. Dravo Corporation is also the supplier for this piping and cannot deliver it until completion of deliveries for S-IC Test Stand. ✓

Technical Systems, Phase II - Wismer and Becker was selected for the installation of the balance of S-II Test Stand A-1 technical systems, and work is scheduled to start on 3/31/66. Final on-site acceptance tests of the One-Third Octave Analyzer System in the DHC have been completed satisfactorily. ✓

An Equal Employment Opportunity seminar scheduled by Mississippi Gulf Coast postmasters to establish better communications with Negro citizens of the various communities on equal employment opportunities within the Postal Department was attended by a representative from MTF. ✓

3/28 JS

B 4/1

RL10 ENGINE

Atlas/Centaur vehicle AC-8 is scheduled to be launched tomorrow. Prime objective is to determine if the RL10 engines can be restarted after a 25-minute programmed coast. A 1,730-pound mass model of the Surveyor spacecraft will target a simulated moon (a point in space 236,000 miles from earth) and thereafter follow a highly elliptical orbit (apogee = 576,000 miles, perigee = 110 miles). This is the first vehicle to fly the uprated RL10 engines. The hydrogen tank is heavily instrumented to determine the effect of liquid hydrogen in space. After mass model separation, the Centaur will be rotated, the RL10 engine valves will be opened, and residual propellants will be "blown down" through the engines to assist in the retromaneuver. ✓

J-2 ENGINE

The first stage LOX pump turbine wheel was found to be cracked on engine J-2038 installed in S-II 501. The engine has been replaced without stage impact. An identical wheel from engine J-2027 was found to contain cracks after accumulating the full engine life of 3,750 seconds at the MSFC Test Lab. The first stage wheel on J-2027 was inspected as a normal procedure after accumulating 2,750 seconds and found in good condition. As a result of the two occurrences, a precautionary inspection will be made on all engines of this configuration. (Thicker wheels are incorporated with engine J-2060, 504 and subsequent, 208 and subsequent.) Rocketdyne teams are already in the field to perform LOX pump turbine wheel inspections. ✓

H-1 ENGINE

As a result of the successful performance of engines on the short duration test of Stage S-IB-5 which was retrofitted with improved LOX pump seals, the recommendation to retrofit engines on Stages S-IB-2, S-IB-3, and S-IB-4 has been made and adopted. Retrofit of seals in the engines assigned to S-IB-3 is in progress at Michoud and will require approximately four days to complete. Retrofit of S-IB-2 will be performed at KSC after April 16, 1966. Retrofit of S-IB-4 will be performed at Michoud. ✓

F-1 ENGINE

Three F-1 engines have been removed from S-IC-2. The engines in positions one and four (F-4017 and F-4021) were removed for inspection and decontamination following the previously reported fuel contamination of the LOX systems, and the third engine (F-4018) was removed for contamination inspection and to simplify replacement of a faulty heat exchanger. ✓

GENERAL

Negotiations between the United Welders of America and NAA, Inc., which are being held in the Washington offices of the Federal Mediation Service broke down on Tuesday, March 22, 1966, and both parties returned to the West Coast.

Labor situation at EAFB - The United Auto Workers and Rocketdyne presented their positions independently to the full Presidential Missile Sites Labor Commission. Both parties emphasized that they reserved the right to accept or reject the recommendation of the commission. ✓

3/28 *JD*

*B4/1*

1. STATUS OF CURRENT BOEING - IAM NEGOTIATIONS

No further news is available concerning settlement of the potential disagreement which could possibly result in a strike (see last week's notes). Negotiations are still in progress. ✓

2. S-IC

The S-IC-3 has entered checkout and passed the "power on" function and everything is proceeding satisfactorily. ✓

NOTES 3-28-66 DANNENBERG

3/28/68

B4/1

NEGATIVE REPORT.

3/28/66

1. Panel Flutter Wind Tunnel Test Program: It has been decided to perform the panel flutter wind tunnel test program at AEDC, rather than Ames. The Ames test could not be accomplished until approximately January 1967. The AEDC tunnel will be available for tests in July of this year. Preliminary test information should be available in August 1966 to make a decision whether or not to apply beef-up kits to SA-204 and SA-501. The magnitude of flutter could not be assessed at either Ames or AEDC. The flutter boundaries can be assessed at both tunnels; however, at AEDC testing can be performed at the Mach number which occurs at Saturn IB Max Q, while this information would have to be extrapolated from the Ames test data. The cost of the test at AEDC will be \$440,000 but schedule dictates that the test be done there. ✓

2. S-IVB Panel Flutter: The S-IVB Project Office required by 3/24/66 an R&DO position on the beef-up of the S-IVB stage forward and aft skirts in order for them to direct the contractor to take action. R&DO recommended:

a. No beef-up for SA-202 and SA-203.

b. Have the stage contractor design, manufacture, and be prepared to install a structural fix at KSC on SA-204 (both skirts) and SA-501 (forward skirt only).

c. Preliminary test information should be available in August 1966. The final decision for installation of the structural fix for SA-204 and SA-501 will be made on or before September 1, 1966, providing this date does not cause a flight schedule slip. If a schedule slippage is apparent by delaying this decision until September 1, 1966, then action should be taken prior to this date to insure installation of the fix prior to flight. ✓

d. Install the same structural fix (or a refined design) on subsequent S-IVB stages if the test program indicates a fix is required. ✓

3. Computation Laboratory Support Requirement Proposals: Five proposals were received March 21 on the Computation Laboratory Support Requirement. Firms responding were General Electric, Ling Temco Vought, Computer Science Corp., Wolfe Research and Development Corp., and C-E-I-R, Inc. The latter proposal is non-responsive to the RFP and cannot be evaluated due to the absence of a technical, business, and cost proposal. It is expected that the Technical and Business Committees will complete evaluation of the other four proposals by April 5, with final evaluation by the Board being completed on or before April 20. ✓

B4/1

NOTES 3/28/66 GEISSLER

3/28 JTS

Panel Flutter Wind Tunnel Tests and Beef-up for S-IVB Panel Flutter: As a result of several meetings held this week to resolve the panel flutter problem for the S-IVB stage, the following approach to resolving the problem was agreed upon by R&DO elements and will be recommended to IO:

(1) No structural modifications will be made on 202 and 203.

(2) The stage contractor should design, manufacture, and be prepared to install a structural fix at KSC on SA-204 (both skirts) and SA-501 (forward skirt only).

(3) Preliminary panel flutter test information should be available in August 1966. The final decision for installation of the structural fix for AS-204 and AS-501 will be made on or before September 1, 1966, providing this date does not cause a flight schedule slip. If a schedule slippage is apparent by delaying this decision until September 1966, then action should be taken prior to this date to insure installation of the fix prior to flight.

(4) The same structural fix (or a refined design) should be installed on subsequent S-IVB stages if the panel flutter test program indicates a fix is required.

Shep

Fellows and Geissler's notes are repetitive. Please ask Fellows to make arrangements to avoid this kind of thing in the future JB

(Note: Some overlaps between NOTES don't hurt! But not verbatim repetitions)

3/28 JS

B 4/1

1. S-IC-2 CHECKOUT: My "Notes" of last week indicated that it would be necessary to remove engine No. 1 from the stage to perform cleanup of the contamination, and that the lox valves on the other engines would be removed without engine removal. Information from Manufacturing Engineering Laboratory now indicates that it may be necessary to remove the engines to permit removal of the lox valves. If it becomes necessary to remove all engines, the delivery date of the stage to Test Laboratory will change from April 18, 1966, to May 2, 1966. (Test Laboratory has agreed to this date.) To date, engines No. 1 and 2 are removed and engine No. 4 is scheduled for removal. During this downtime, ten of the stage distributors have been removed for incorporation of flight-qualified relays and printed circuit boards. ✓
2. S-IB INSTRUMENT UNIT PROGRAM: A major modification in IU-202 and IU-203 is required as a result of the distributors' failure in qualification testing. These modifications will have to be accomplished at KSC due to schedule considerations. The modifications will disrupt the electrical/electronic networks system, due to removal of distributors and relocation and rerouting of cables, to the extent that three systems tests should be performed after the modification is complete. We are presently considering requirements for support of this effort by this Laboratory. ✓
3. F-1 ENGINES: Evidence of improvement in quality at Rocketdyne is beginning to appear. During final inspection of F-1 Engine 5030, Rocketdyne inspectors wrote 381 squawks. When submitted to the Government for acceptance, only five squawks were found. F-1 Engine reliability demonstrations have been successfully completed per the applicable contract procedure. ✓
4. CHECKOUT WORKING GROUP MEETING: A Checkout Working Group meeting was convened at MSFC on March 22 to discuss with DAC the following topics: (a) GSE computers, logs and records, (b) Single test requirement/procedure concept, (c) Test results reports, (d) End Item Test Plan, and (e) Guideline for conduct of business between DAC and customer during checkout under CPIF program. The last item was the main subject of this meeting. This Laboratory presented a detailed guideline, covering procedural operations, allowable substitutes, shortages, response time on procedure approval, and other elements relating to checkout. No official response was given by DAC at the meeting, but all items were discussed for definition and understanding. The guideline presented had been coordinated with Mr. Godfrey and is in accordance with the CPIF contract. ✓

3/28 JS

1. SERVOACTUATOR POTENTIOMETER PROBLEM: Production problems at the Markite Products Corp., New York, N.Y., have resulted in a severe shortage of potentiometers for the Saturn Servoactuators. Moog Servocontrols, Inc., supplier of the S-IB, S-IC, S-II, and S-IVB actuators, and Hydraulic Research and Manufacturing Co., supplier of the S-IC actuator, use potentiometers built by Markite. This sole source situation has developed because Markite was the only vendor who had an "infinite-resolution" potentiometer of a suitable configuration on the market at the time the servoactuators were designed. The company apparently cannot now supply potentiometers in the quantity needed to support the Saturn production at Moog and Hydraulic Research. The seriousness of the situation has been emphasized to Markite management, but no meaningful commitment can be obtained. Immediate action is being initiated to develop a second source for a potentiometer of the "infinite-resolution" type. In addition, sources for wire-wound potentiometers are also being investigated. ✓

Jim Shepherd

In reference to my  
level schedule 12/13 April!

B

3/28 JTB

B41

S-1B-5

A simulated flight test was performed on March 16, 1966, and the propellant loading test was performed on March 17, 1966. No discrepancies were noted. Since loose particles were detected in thrust OK pressure switches on Vehicle S-1B-3 and S-1B-7, all TOP switches were removed from S-1B-5 and X-rayed. Only one switch was found with a loose particle in it. This switch was replaced and all switches reinstalled. The short duration test was successfully performed on March 23. Full duration test is scheduled for Thursday, March 31. ✓

S-1C

The S-1C-2 stage is scheduled for delivery to R-TEST on May 2, 1966. The engine's lox system is presently being cleaned of fuel contamination. R-ME will incorporate all E.O.'s, CAM's and ECP's during the extended schedule as hardware delivery and time permits. ✓

F-1 Engine

Tests FW-019 and FW-020 were conducted at the West Area F-1 Test Stand on March 21, 1966, with F-1 engine F-4T2, for mainstage durations of 41 seconds each. The lox pump inlet pressure was increased during Test FW-019 to approximately 90 p.s.i.g. ✓

S-11 Battleship

The S-11 Stage Office decided March 24, 1966, to maintain the S-11 battleship in a standby condition for an additional 30 days until a final decision can be made on the extension of the battleship program. ✓

S-1VB-2004

Post-test investigation of the hydraulic auxiliary pump failure during Vehicle 2004 acceptance firing has revealed an anomaly in the HPU switch, which electrically turns on the pump. Data evaluation is essentially complete and no other major discrepancies were evidenced. Post-test sampling of a port to the common bulkhead "T" cavity has disclosed a possible leak past the fillet weld in the LH<sub>2</sub> tank. An investigation is still pending by DAC at this time. ✓

NOTES 3-28-66 HOELZER

3/28/66

B-41

Negative Report

B 4/1

NOTES 3/28/66 JAMES  
3/28/66

S-IB SDBF: All mandatory SA-202 software programs were shipped to KSC on March 24 and the breadboard was shut down for installation of mod kits and program distributors to convert the breadboard to the 203 configuration. Delivery of all necessary mod kits should be completed this week. The modification is scheduled for completion by April 7. ✓

VLF-34: Refurbishment of VLF-34 and checkout of SA-202 are proceeding on schedule. ✓

VLF-37B: All known mandatory mod kits have been delivered and GETS is proceeding on or slightly ahead of schedule. ✓

RCA 110 COMPUTER: A new technical problem has developed in the solder joints of the PC boards that were being reworked at Van Nuys. The joints are cracking, apparently due to tension as the conformal coating cures. A new procedure has been developed by MSFC engineers and a two-week test period started using the new procedure last Friday. We hope that this procedure will work and will prove to be the final solution for the rework problem. ✓

S-IVB QUARTERLY REVIEW: Although our S-IVB Quarterly Review went satisfactorily I noted that no Directors or Deputy Directors for either R&DO or any of the labs were present. I am concerned that this may indicate that we are becoming overly confident because of our successes or we are becoming enamored with our future projects. ✓

→ Hermann Weidner  
Please take appropriate action  
B

NOTES 3-28-66 KUERS

3/28 JS

B  
4/1

S-IC Short Lox Test Tank: The configuration of the Y-rings for S-IC containers was changed last year by milling the Y-ring leg, which connects to the container skin, to a T-stiffener configuration. This configuration change brings a weight savings of approximately 6,000 pounds per stage and is effective for -504.

Y-rings of this new configuration are (for some time) in production at Michoud. The program provided for assembly of a short lox test container to this configuration, to be built here in-house and to be load tested at P&VE structural load test facility. We have now completed the assembly of this container in our Tower Building and are ready for turn-over to hydrostatic test next week. This milestone has been accomplished on schedule. ✓

3/28/66

Ludy  
Richard  
Please  
straighten  
this out  
under our  
new  
under-  
standing  
with  
KSC  
B

1. MECHANICAL DAMPING OF SA-500F - The damping tests on the 500F at KSC are mandatory. The total ground winds program, including wind tunnel test, 500F ground tests, and vehicle fixes is an integrated test program where one part depends upon another. A damping test program was submitted to KSC and was rejected by KSC. A substitute test was suggested that we believe is not adequate. Negotiations for incorporation of these tests are continuing with KSC.

2. INSTRUMENT UNIT - Spurious outputs from the EDS rate control gyro caused by vibration during AS-201 flight exceeded allowable levels planned for closed loop operation on AS-202. This problem is being evaluated and recommendations will be made. ✓

3. MOON MOTORS - We have run our 1/6 horsepower moon motors at loads in excess of 1/2 horsepower. Motor operation has been successful for short times at temperatures up to 500°F. To date, we have not reached the upper operational limit of these motors. ✓

4. NUCLEAR ENGINE - A verbal request was received by telephone from personnel of SNPO, Cleveland, for support by the Vibration and Acoustics Branch of the Structures Division in preparation of NERVA II engine components. A letter from SNPO will be forwarded to MSFC documenting this request. ✓ *Let's help them!*  
B

5. FILM RETURN CAPSULE - A study was initiated to define a small capsule and associated subsystems that can be carried in the Apollo Command Module and be dispatched, as desired, to return photographic film, small scientific instruments, or other data from either lunar or earth orbit. Preliminary designs are scheduled for completion in mid-July; a report should be issued by 8-1-66. *Request briefing. Who's behind this study?*  
B

6. CRYOGENIC EXPERIMENTS - Eight noted professors and visitors attended an introductory seminar on potential experiments in the area of reduced gravity fluid mechanics and instrumentation which was held at MSFC on 3-22-66. The purpose was to obtain additional experiment proposals for a potential payload under study within MSFC. (Experiments 3 - 7) ✓

7. J-2 LOX TURBINE WHEEL CRACKS - LOX pump turbine wheels have been found to be cracked in Engine 2038 (Vehicle 501) and Engine 2027 (at MSFC). These are the first known LOX pump turbine wheel failures to occur in production engines. The wheels are the original thin wheel design, and the new thick wheel designed to eliminate cracking is not scheduled until Vehicles 504 and 208. Rocketdyne and MSFC are making an inspection of all engines and a complete investigation of the problem. ✓

8. S-II - The S-II All-systems test stage was to be tanked with LN<sub>2</sub> on 3-26-66. Due to erroneous operation of the GSE heater at zero-gas flow, teflon material deteriorated and contaminated the system. Evaluation of problem is under way. ✓

B 4/1

NOTES 3/28/66 MAUS

3/28/66

1. INDEPENDENT OFFICES SUBCOMMITTEE - HEARING: We are preparing appropriate backup data to support you in your appearance before the Evins Subcommittee on April 5. Data will cover specific subjects stressed during the hearings of the Teague Subcommittee, as well as the general AO area which is always of particular interest to the Evins Subcommittee. We discussed areas of emphasis with Bob Freitag during his visit to MSFC on March 25. Ray Kline has action and will brief you on ~~April 1~~. *March 31*. ✓

2. BOB VISIT - Mr. Don Crabill, who visited MSFC last fall for the routine BOB review has been promoted to Special Deputy to Mr. Veatch who heads the BOB division concerned with NASA and DOD. Mr. Franz Kretzman, Mr. Crabill's replacement, and Mr. Ted Heintz, will make a special orientation visit to MSFC on March 31 and April 1. ✓

The principle interests of Messrs. Kretzman and Heintz are (1) sustaining engineering, (2) incentive contract conversion status and (3) communications and data acquisition. ✓

Only FY's 66 and 67 will be discussed. AAP is excluded from primary discussions. ✓

A dry run of material for this visit is scheduled for Wednesday, March 30. ✓

3. AAP Vs. MOL - Mr. Crabill in his new assignment has been asked to compare AAP and MOL. Mr. Crabill is planning to meet with General Jones this week to discuss this effort. ✓

4. CONTRACTORS INDEPENDENT TECHNICAL EFFORT (CITE) - We have concluded that this funding source could be tapped beneficially to provide urgently required momentum to the AAP payload and experiment effort if MSFC was able to provide "guidance" to its contractors.

Contractors may be expected to respond quite eagerly if we make this a joint (MSFC - Contractor) effort.

It has been estimated (in a study conducted by MSFC in late FY 65) that approximately 4% of the total Apollo funding will go into this fund category which is approximately 100M at MSFC contractors during the FY 66-67 time frame.

The Legal Office has stated "there would not be an impropriety, " if MSFC should hint to our contractors that we would like to see them use independent research funds for AAP tasks, "if we made it clear that we were not making an advanced commitment to accept any proposals resulting therefrom. "

Hans Maus

Let's discuss this thoroughly. Make appointment through Bonnie (1 1/2 hours) and bring along whoever you want to participate. I have a few inputs myself. Don't delay past 20 April. B

B 4/1

NOTES 3/28/66 RICHARD

3/28/66

Operational Aspects of the Saturn V-Umbilical Tower Damping Device:  
The exact solution has not been worked out for the flight vehicle; it will be needed only when the vehicle is empty. Should sufficient damping be provided by the umbilicals, no fix will be needed. If it is needed, the damping device can be released before the final launch sequence. This should make the operational problems with the device simpler, but we will still need a remote connect/disconnect capability. A meeting will be held between KSC and MSFC during the week of April 4 to discuss specific design details and the general approach to this problem on 500F and SA-501. We will continue to work with the laboratories and I-V-E to make sure all of the operational requirements are covered. ✓

→ 11  
re-  
connect  
B

.3/28 RB

1. Saturn V/Voyager - The final oral presentation by Boeing on the study of Saturn V Vehicle Capability Using Voyager Payloads (shroud size study) is scheduled for Thursday, March 31, 1966. ✓
2. Super Guppy Flight Test Program:
  - o Super Guppy with the S-IVB Dynamics Stage aboard departed MSFC for the West Coast at 9:00 am, Sunday, March 20, 1966. ✓
  - o Arrived Los Alamitos Naval Air Station at 8:00 pm, Sunday, March 20, 1966. ✓
  - o Returned to MSFC 8:00 am, Thursday, March 24, 1966. ✓
  - o No significant problems encountered. ✓
3. S-IC Stage Quarterly Review - will be held at Michoud on Wednesday, April 27, 1966. ✓
4. S-II Stage:
  - o S-II-F Stage - Stacking at KSC was completed on Friday, March 25, 1966, on schedule with no problems. The S-IVB-F stage is scheduled for stacking today, Monday, March 28, 1966 and the Instrument Unit is scheduled for tomorrow, Tuesday, March 29, 1966. ✓
  - o S-II-T Stage:
    - o The first LN<sub>2</sub> dry countdown was performed successfully on Wednesday, March 23, 1966. ✓
    - o The final LN<sub>2</sub> dry countdown started on Friday, March 25, 1966. ✓
    - o A J-2 engine purge unit overheated, damaging helium facility lines and some stage lines.
    - o Repairs made and dry countdown sell-off to be picked up today, Monday, March 28, 1966. ✓
5. Saturn V Breadboard - Schedule completions and Boeing Manpower:
  - o As I have indicated to you in previous NOTES concerning the Saturn V Breadboard our objectives are: First, meet our "almost impossible" schedule commitments and, then, reduce Boeing manpower.
  - o We completed another major milestone in the Saturn V Breadboard activation, i.e., vehicle/ESE integration on Tuesday, March 22, 1966 - one day ahead of schedule. Boeing will now maintain the Breadboard on a six-day, two-shift operation (except that the computers will be in operation 7 days - 24 hours).
  - o Boeing will reduce approximately 125 people and their high overtime rate (double time on Sunday). As a result, the net dollar reduction will be approximately \$1.4 million per quarter. Although we have drastically reduced Boeing manpower and overtime, we will continue to meet all Saturn V Breadboard schedules. ✓✓

NOTES 3/28/66 SPEER

B 4/1

3/28 JS

1. AAP POLAR ORBITS: A joint NASA-DOD Range Safety meeting was held at PAFB on 3/24 to review progress made on the Saturn IB polar orbit study. The meeting was attended by MSF, KSC, MSFC and Eastern Test Range (ETR). Mr. Stone (AERO) gave a summary of the data submitted so far. ETR will now conduct an independent study based on MSFC data evaluating risk factors for Florida for selected flight azimuths. They will develop specific destruct criteria and intend to include land impact of both CSM and launch vehicle (destruct failed). It is now evident that ETR will not attempt, in this first phase, to develop a rationale which would eventually permit to overfly land on a routine basis. These results will be presented to you and the Operations Executive Group by ETR on April 22 through 24 at Antigua. As a guideline of general interest the following possible flight azimuth sectors were quoted by ETR: (1) 93-110° most desirable; (2) 55-82° no special problems; (3) 82-93° undesirable; (4) 45-55° very undesirable. ✓
  
2. LIEF: Changes to LIEF, based on the AS-201 experience, are now under investigation. Numerous and valuable comments to the 201 operation have been received from 18 sources and are being considered in the improvement studies. A LIEF Review with KSC (Petroni, Gruene and Preston) has been scheduled for April 11, 1966 at MSFC. Gen. Bolender will chair the review. Also scheduled is a review for Gen. O'Connor on proposed changes and disposition of recommendations. ✓
  
3. HUNTSVILLE OPERATIONS SUPPORT CENTER (HOSC): A meeting was held with Dr. Hoelzer and other R-COMP personnel to review current HOSC status and problems. Primary subjects of discussion were HOSC management problems as we leave the primary development phase for the facility and display system and enter the operational phase, and additional facility and system requirements based on shortcomings recognized on AS-201. Most additional hardware items currently required are already in work. A major software reprogramming effort is required and already begun to correct display system deficiencies and implement the added requirements for orbital support. Major problems foreseen are physical space limitations of the present facility and allocation of adequate manpower to support launch schedules. A trailer adjacent to Building 4663 may be required to satisfy mandatory space needs. A follow up meeting with R-COMP is planned within the next two weeks, and a full review of problems will be given at the Mission Operations Quarterly Review on April 15. ✓
  
4. FLIGHT CONTROL TRAINING: The AS-203/204 Flight Control Qualification Training was begun on March 21, 1966. The initial phase consisted of 6 hours of Saturn launch vehicle orientation and was followed by daily sessions covering prime S-IVB systems. ✓

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1. PEGASUS: No changes. <sup>3/28/66</sup> Cloud charts obtained by the Aero-Astro dynamics Lab ground station from ESSA II are being used to correlate with RPL's albedo measurements from Pegasus. This will allow separation of the albedo effects of clouds from the strong limb and terminator brightening effects predicted from the Rayleigh scattering theory. ✓

2. AAP: Earth Orbit - In addition to the manned voice broadcast study, OSSA has requested MSFC's assistance in preparing a work statement for a manned TV broadcast study. Parker (RPL), Clingman (AS), and Hamilton (ASTR) are cooperating in these efforts. The suggested work statements are being forwarded in draft and will be transmitted formally with an official cover letter offering the appropriate MSFC participation. ✓

Lunar Surface - Mr. Beattie advised us that OSSA has 1M of FY-66 funds presently earmarked for RPL's AAP lunar surface scientific experiments program. This is in addition to the 450K now available from OMSF. Mr. Beattie feels that these are just first installments on the FY-66 money, and that other moneys will become available toward the end of FY-66. ✓

Dr. Costes of RPL attended a two-day special working conference at MSC entitled, "Soil Mechanics from the Apollo Viewpoint". The conference was chaired by Dr. R. Reiffel, Apollo Program Office and Professor T. W. Lambe of MIT who also serves as a STAC\* member under Dr. Townes. The group included six soil mechanics specialists, NASA representatives, and various NASA contractors or affiliated organizations who gave presentations on their soil mechanics work relative to the Surveyor and Apollo programs. The main questions were: (1) What additional lunar measurements are needed if Surveyor succeeds? and (2) What pre-Apollo measurements are feasible if Surveyor shall fail? The answers were rather involved; they are documented in a RPL trip report (available upon request). ✓

3. WEBB REVIEW: Gerhard Heller attended the Management Program Review of Mr. Webb on the Electronics Systems Program presented by OART on March 22. The presentation by the program directors was well received. MSFC was mentioned quite often, at least as frequently as ERC, and advanced research and technology areas of MSFC were used as examples. Notable among these were the Cryogenic Superconduction Gyro, Optical Technology, AMTRAN Computer Research (Dr. Seitz, RPL), Microelectronics, Optical Radar Using a Laser Beam, Solid State TV. ✓

Mr. Webb seemed to like the presentation, and asked many technical questions during the program. At the end, he discussed how the electronics program could contribute to important national issues. He expects OART and especially ERC to address themselves to the advanced electronics requirements of the SST. He asked specifically that ERC take this on immediately and not wait to have all planned people on board. ✓

NOTES 3-28-66 WILLIAMS

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1. S-IVB WORKSHOP: With regard to Dr. Mueller's decision to have three study contracts (60 days in duration for \$50K each) with McDonnell, Douglas, and Grumman on the airlock slice, Bill Ferguson (ASO) and Wilbur Thompson (P&VE) were in Washington Friday, March 25, 1966, to help establish criteria for the studies and work on the statement of work. ✓

2. AAP EXPERIMENTS CONTROL SYSTEM: Due to the lack of time at the March 21, 1966 MSFEB Meeting, a presentation on the AAP Experiments Control System was not made. This is a system which we have developed for Jones' office at their request. New input data have been received on all available experiments (regardless of their degree of approval or their status), and we hope to have the first complete reports out by late April. In addition to the support of the MSF activity, we are now turning much of our attention to developing a system for internal use. This will be done in support of Mr. Reinartz and Dr. Johnson. ✓