

Nov. 7, 1966

Notes 11-7-66

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November 28, 1966

NOTE TO: Dr. von Braun

SUBJECT: Hypervelocity Facility at Space Sciences Laboratory

Your question on previous Notes, attached.

Space Sciences Laboratory has been in close contact with P&VE regarding hypervelocity impact effects. The Tullahoma gun is capable of accelerating heavier pellets, and is therefore preferable for P&VE testing. However, it is anticipated that P&VE will run at least some experiments with our gun as soon as it is ready.

Ernst.

Enc:
As stated

Ernst Stuhlinger



NOTES 11-7-66 Stuhlinger

*Dr. Dobier
Info
B 11/11*

1. HYPERVELOCITY IMPACT FACILITY: Boeing delivered a hypervelocity impact facility to RPL under terms of a contract let by this Laboratory. The hypervelocity facility shakedown firings have been successfully completed. The range has met its contract requirements. Projectiles as dense as Fe have been fired as well as Al and Ti. The Fe projectile was launched at 4 km/sec (less than half the velocity achieved with Lexan plastic projectiles, but approximately twice the energy). Glass beads were launched at approximately 8 km/sec; some appeared to impact intact, but projectile breakup caused some debris on the target. This facility will greatly enhance our capability for performing meteoroid impact investigations.

ES.
Please get in touch w/ Lucas on this. He is greatly interested in the problem of internal fires in the SIZB Workshops caused by micrometeoroid penetrations. See his NOTES 11-7-66 B

2. ATM: Ray Hembree of our Physics and Astrophysics Branch spent all of last week at MSC in connection with the optical contamination program. Two members of Ball Brothers Research Company also were there securing information on leak rates, materials, etc., for the LM and CSM to serve as input into their study being carried out under RPL technical supervision. RPL has just produced a comprehensive document covering the literature search on optical contamination. ✓

Upon request by Bill Horton of Astrionics, a meeting was held between RPL experiment scientists and Astrionics engineers working on the ATM pointing accuracies and TV displays. IO was also represented. The meeting was very fruitful in thorough discussions of the pointing and display requirements, as well as open questions affecting interfaces between ATM and experiments, between several experiments, and also the requirements to be imposed on the astronauts. One of the questions raised was whether the astronauts should be in the control loop for holding on a fuzzy target, or whether this should be fully automatic. It is expected that this and other open questions will be settled in the near future. ✓

Enc.

NOTES 11/7/66 BALCH

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S-II-1 Testing - A fix for the bottom of the LOX tank where the foil seal failed has been decided upon. The fix consists of discarding the foil seal entirely and applying 5 coats of Dynatherm. Multiple coats of Dynatherm have been successfully used in a similar situation on the S-IVB stage. Final clean up of the old foil seal and NARMCO installation is expected to be complete today, after which the first coat of Dynatherm will be applied. The first three coats are to be applied at 24-hour intervals, and the last two at 8-hour intervals. After the last coat, a 7-day cure time is required. Based on this, the earliest date for tanking would be 11 days from today, or 11/18/66. If tanking tests are satisfactory, it is planned to have the first static firing four days later → or → 23 Nov

at 11/14
Bobbie
Keep an eye on this date. I'd like to attend the firing if at all possible

LH₂ Vent Line Explosion - About noon Saturday, 11/5/66, an explosion occurred in the 24-inch LH₂ vent line from the S-II A-2 test stand to the LH₂ catch tank, rupturing about 70 feet of the line. Initial damage assessment is \$45,000. The explosion occurred at sufficient distance from the stand so that the stand and other facilities were not damaged. Cause of the explosion is being investigated by a joint S&ID and NASA Board of Investigation. Time required for replacement of the line is estimated at about 12 days. Very little impact on the S-II-1 firing is expected since it parallels the repair work on the S-II-1 aft LOX bulkhead.

J.B.

I'd like to see the report. suggest to also invite a KSC member because of the similarity of their H₂ vent setup B

Labor Relations - The work stoppages by the Operating Engineers (IUOE) ended on Friday morning, 11/4/66. On 11/3/66, the NLRB appeared before the federal judge in Gulfport to obtain a restraining order against the IUOE to end the work stoppage. The judge withheld the issuance of the order on the condition that the IUOE would have the Operating Engineers back on their jobs at the beginning of the first shift on 11/4/66. Approximately 1800 mandays were lost as a direct result of the jurisdictional dispute which caused this work stoppage. Impact on activation schedules for S-IC and S-II A-1 test stands is estimated at three to four days.

Accident on S-IC Test Stand - One person was killed and four injured when a flame deflector inspection platform fell on 10/31/66. Both the person killed and those injured were employed by Penn Erection and Rigging Company, a subcontractor to Koppers, the prime to the Corps of Engineers for the B-2 position of the S-IC Stand. The Corps of Engineers is investigating the accident.

Visitor from NASA Headquarters - Major General John D. Stevenson, USAF (Ret), Special Assistant to Dr. Mueller, was escorted on a tour of MTF facilities on 11/3/66.

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AS-209 - ORBITAL WORKSHOP:

On Thursday, November 10, representatives from John Disher's office, Ed Gray's office, MSFC, MSC, and KSC will meet here for an overall experiment compatibility coordination working session. We are to furnish the complete compatibility analysis to John Disher by November 14 for Dr. Mueller's review prior to the November 21 MSFEB. ✓

COST AND SCHEDULE ESTIMATE FOR UPPER RACK AND LOWER RACK MODIFICATIONS:

Discussions have been held with R&DO to determine the feasibility of manufacturing an upper Rack and making modifications to the lower Rack to accommodate the EO-0 experiments as requested by MSC. Cost estimates and schedule impacts are being derived for these modifications. ✓

RAK DESIGN AND MANUFACTURING:

Drawings have been released to manufacturing for the Rack configuration for the Mapping and Survey System. ✓ Manufacture of some fittings and the payload module attachment ring has started. Mockups of the payload module and the Rack have been completed and will be assembled in a S-IVB/IU/SLA section for an access review later in November. ✓

GENERAL:

John Disher has called a working meeting among key members of his staff and key people from S/AA offices at the Centers for November 9-10 at KSC. The purpose of the meeting is to discuss mission planning, program organization and program management and to come to an understanding of how specific items will be handled throughout the program. In addition to some of my people, I will attend, and have asked Ludie Richard also to attend. ✓

I think this type of working session may be of tremendous benefit to us and to the MSFC program as a whole. ✓ I will give you a report after the meeting. ✓ Some of the topics for discussion are: project and systems specifications; interface control; test, reliability and quality assurance policies and specifications; configuration management; mission directives and mission operations; experiments; organization and working relationships, etc. ✓

LB

Please keep close contact with Eberhard Kees, As you probably know, GEM wants him and George Low to keep the skids greased between MSC and MSFC in this entire "joint effort". B

NOTES 11-7-66 BROWN

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F-1 ENGINE Engine F-6047, 5th engine for S-IC-6 stage was delivered to Michoud on 11-2-66, 20 days ahead of the Boeing contractual on-dock date. ✓

During a fuel loading test at MSFC on 10-26-66, leakage was noted at the fuel pump balance cavity supply line flange of F-1 engine F-4024, position #5 on S-IC-3. This line had been replaced at Michoud. On the following day, while attempting to remove the O-ring seal for replacement, one-third of the damaged O-ring fell into the fuel turbopump balance cavity. Attempts to flush out the missing portion of the O-ring, with the engine installed in the stage, proved unsuccessful. The decision was made to replace engine F-4024 with the spare engine F-4027, prior to static test of S-IC-3. Engine F-4027 was flown to MSFC by Guppy aircraft, and arrived on 11-3-66. Engine F-4027 has thermal insulation brackets installed, but installation of stage instrumentation, and installation of the high-voltage igniter harness will require about four days work. Engine F-4027 is scheduled to be ready for stage installation by 11-9-66. ✓

H-1 ENGINE Borescope inspection of the turbopump lube seal nut has been completed on all H-1 engines in vehicles SA-204, 205, 207, 208, and 210. No discrepancies have been found. The remaining vehicles and spares are being inspected.

X-ray examination of H-1 engine thrust OK pressure switches on 11-2-66 pointed up a flaw in the X-ray procedure, and another set of X-rays was required. Final disposition of the first 15 switches to be freon flushed should be available the week of 11-6-66. ✓

J-2 ENGINE There was a successful J-2 start/restart test on 11-4-66. The first test was a 5 second Saturn IB SIVB nominal start at a simulated altitude of approximately 98,000 feet. There was no vibration count and the gas generator temperature spike was 1750°F.

After a 100 minute hold there was a 30 second Saturn V SIVB restart utilizing 4.6 seconds of fuel lead (nominal 8 seconds, last week's test indicated 8 seconds were not required for conditioning at AEDC). The simulated altitude for the restart was approximately 105,000 feet. There was no vibration count and the gas generator temperature spike was 1600°F. ✓

C-1 ENGINE Dr. Dozier, R-RP-P, has been contacted regarding the potential contamination problems in future applications. A meeting with Mr. Ray Hembree of Dr. Dozier's office will be held next week to explore what the C-1 engine program can contribute toward the solution of these contamination problems. ✓

NOTES 11/7/66 CONSTAN

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Negative report

NOTES 11/7/66 FELLOWS

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1. Shortage of Instrument Unit Environmental Control System (ECS) Coolant Pumps: The IO Saturn V Instrument Unit Manager requested that the two Astrionics Laboratory ECS Coolant Pumps be furnished to IBM as GFE. Those two pumps were planned for use by ASTR for testing rather than for installation on flight IU's. One pump was released to IBM on October 31. Mr. Duerr, IO, has been requested to reconsider the requirement for the second pump because the Saturn V Breadboard cannot be used for system development and debugging without using the other coolant pump. ✓

2. Executive Staff Study of Facilities/Plant Engineering Functions in R&DO: In support of Dave Newby's "Attrition Committee" activities, Pres Read, Operations Management Office, recently made an extensive study of the functions and workload of each individual in R&D Operations identified with facilities/plant engineering. To facilitate the current Executive Staff study of this subject, their representative has been provided with all the information we had gathered and our analysis of those data. We also arranged for an entrance interview for the Executive Staff representative with Astrionics Laboratory and a comprehensive tour of the ASTR facilities so that his first detailed laboratory review might proceed as smoothly as possible. We also briefed the Executive Staff representative on the procedures for initiating, funding, and approving Repair and Alterations and Minor Alterations Projects to tie in the technical approval and monetary aspects of facilities and plant engineering with associated personnel and functions. ✓

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1. Impact of SM Failure on 501/502 Missions: The recent blowup of a SM propellant tank, eliminated the SM assigned to the 501 flight. We have been in contact with MSC (Mission Operations Division and Flight Mechanics Panel) concerning possible approaches to perform the 501 and 502 missions. A list of 4 alternate approaches considered by MSC was received by us and evaluated, with the addition of a 5th alternative. List with our comments - as submitted to MSC - is attached as enclosure 1. The first two cases feature a profile for 502 which is referred to as "method 5" - as defined in a reentry profile study by us is 1964 (NASA TMX-53097). In this profile, the S-IVB injects into an ellipse with an apogee of some 2000 km and a low perigee of 100 km. Reentry speed is obtained by 2 burns of the S-IVB just before reentry. This profile requires payload reduction, does not resemble the LOR profile in many respects, and is restricted in reentry location and observability. It would impose a major workload on MSFC, produce a substantial schedule slip for 502, and give results of doubtful value. We favor case 3 which retains present missions and provision of another SM for 502 (MSC has directed NAA to start working on reconversion of BP30, formerly planned for 206). The delay of 502 (estimated 6 - 8 weeks) and additional funds needed would still have to be determined by MSC. The only other case acceptable to MSFC is No. 5 which leaves 501 profile as is up to injection, but eliminates the SM propulsive maneuvers, thus accepting a lower reentry speed (about 4000 ft/sec). 502 would remain as planned. Our response has been coordinated with the other laboratories and I. O. We understand that Dr. Shea favors case 3 also, but may insist on further exploration of other cases if funding difficulties develop. ✓

2. Crossed-Beam Work with E. S. S. A.: Contacts have been established with Dr. B. Bean of the Institute for Telecommunication Sciences and Aeronomy (ESSA-ITSA) and Dr. Lhermitte of National Severe Storms Laboratory (ESSA-NSSL). Tentative plans are to schedule our crossed-beam field studies next summer in such a way that the results can be compared with point measurements, which are to be provided by ESSA. Dr. J. W. Wright (ESSA-ITSA) commented in a letter to you (enclosure 2) that ESSA-ITSA may offer correlation programs which he felt are considerably in advance of our own. These ESSA programs were developed for the analysis of reflected radar beams instead of crossed-beams. They provide a curve fit over a great many space time correlation functions, whereas, we are trying to establish the numerical and statistical errors of a single correlation function and do not need elaborate curve fitting techniques. Dr. B. Bean has asked whether we could reduce a considerable amount of his data with our data reduction program, since their program does not provide equally good analog to digital conversion routines and/or statistical errors. Based on our discussions with the Comp. Lab., it has been established that their manpower is not sufficient to handle ESSA's data other than that required by the Crossed-Beam Program. ✓

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PARTS RELIABILITY INFORMATION CENTER/APOLLO PARTS INFORMATION CENTER (PRINCE APIC): At a NASA Technical Management Support Function Committee meeting in Washington, D.C., personnel from this Laboratory made brief presentations on parts standardization and the PRINCE/APIC efforts of this Laboratory. The presentations were well received. Considerable discussion and interest was generated by the PRINCE/APIC presentations, and the committee expressed a desire to discuss this, and other subjects presented to the committee, with MSFC management at a future date. Further, Mr. Cohen, the newly appointed Quality and Reliability Director of OMSF/AAP, recently toured the PRINCE/APIC facility and expressed enthusiasm regarding the potential PRINCE/APIC held as a reliability standards tool. With the increasing interest in PRINCE/APIC which could influence the future of this effort, I feel that at your earliest convenience an orientation for you on this subject would be desirable.

Step
 Please
 arrange,
 incl. possible
 use of that
 MTF components
 building B

A presentation at Brown Engineering Company which includes a tour of the operations can easily be done in one hour. To this time we should add the travel time (round trip from Building 4200 is 20 minutes) and some time for discussion. This means it should be adequate if 1-3/4 hours are reserved for such a purpose. You can save the travel time by scheduling it the first thing in the morning where you could stop at Brown Engineering Company in the Research Park on the way to your office.

NOTES 11/7/66 HAEUSSERMANN

958 11/7

Bull

1. As a result of Headquarter's decision regarding the 209/210/211/212 mission configuration, all detailed design effort for ATM has been reoriented accordingly. ✓ The major design change involved is the requirement for a fine gimbaling of the ATM Experiment Package within the ATM rack. ✓ System technical definition in depth is proceeding with the objective of having a definition sufficient for revised Project Development Plan draft by 12/12. ✓

B
11/11F-1

Test FW-055 scheduled for November 1, 1966, was cancelled due to an improper configuration (installation interference) of the Anaconda flight supply to gimbal filter manifold duct assembly. The test has been rescheduled for November 10, 1966. ✓

S-1C

The tentative date for the S-1C stage acceptance static firing is November 15, 1966. The changeout of the center engine is the primary cause of this schedule slippage. ✓

S-1B-8

Hookup of all stage mechanical systems has been completed. A sequence test is planned for November 7, 1966, and a propellant test on November 8, 1966. ✓

S-1VB-(SACTO)

Pre-static checkout is progressing satisfactorily on S-1VB-502. However, pre-static modifications to the stage are being placed by parts shortages. The acceptance firing remains scheduled for December 14, 1966. ✓

SATURN V GSE - SWING ARMS

Another meeting was held with KSC personnel on Thursday, November 3, including LVO, to try to make them aware of what they need to do and not do on the 501 Swing Arms. Nothing was accomplished and it was very evident that the operations people (Petroni's organization) do not feel that they have a responsibility in controlling the activity on the swing arms or assuring that they work. ✓

↑
Arturo Rudolph

Please comment.

B

NOTES 11-7-66 HOELZER

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WORKLOAD CONTROL PRESENTATION TO MR. NEWBY:

A presentation was given to Mr. Newby on November 3, 1966, regarding the workload control procedure for scientific problems submitted to Computation Laboratory. The presentation included a typical digital problem from Aero-Astro dynamics, and the methods by which such a problem would be approved and accepted by Computation Laboratory; how it would be processed, using the support contractor; and what review and monitoring procedures are used during the development, operation, and completion of the problem. Also included, was a discussion of reports submitted back to the sponsors regarding the monthly workload and costs. Mr. Newby had several suggestions concerning improvements to the approval procedures which are now under consideration. ✓

Baj

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EDS SINGLE POINT FAILURES: Since the discussions at the Design Certification Review, the stage contracts have reviewed in depth the changes required to eliminate EDS single failure points. We have agreed, with R&DO personnel, that adoption of the ECPs submitted for the S-IB stage and the I. U. would have considerable cost and schedule impact. The primary change is still the addition of the redundant connectors and reworking hardware to accept the redundant connectors and wiring. Our discussions of this subject have also made it quite evident that there is still considerable disagreement between knowledgeable individuals in R&DO laboratories whether a connector should or should not be considered a single failure point. In view of the impact of adding redundant connectors, I now feel that the most logical solution is to accept a locking fix that has been proposed. A lock wire can be inserted through a hole presently in the connector after it has been completely connected and locked. This locks the connector without drilling any extra holes. I expect to implement the change unless discussion at the next Level II CCB indicates otherwise. ✓

Ludie
Richard
That's
your view
on this
general
subject
B

SATURN IB AAP ALTERNATE MISSIONS DECISION POINT: Reference is made to my notes dated September 12, 1966 (copy attached). We, in conjunction with R-TO, held a meeting on November 2, 1966, to continue the analysis of the significant items that constrain the decision point for selecting AAP missions. Orbital sequencing, orbital maneuvers, propulsion predictions, guidance systems, and mission operations were evaluated. Based on the assumptions that the mainstream 207/208, 209/210, and 211/212 missions are the same; only one alternate AAP mission will be carried per vehicle (209-212); and dual software will be carried until the decision point; then the alternate AAP mission decision can be made as late as 13 weeks prior to launch. This is the same as the time point required for selection of the flight filter to be used in the control computer. Therefore, the decision point for alternate AAP missions based on the above items and the control computer is 13 weeks or 3 months prior to launch. We still have one more meeting planned to investigate the AAP oriented hardware interfaces involved to ensure that there is no conflict with the 3 months decision point. ✓

STRESS CORROSION SURVEY: We have recently intensified our efforts to complete a more thorough survey on stress corrosion for all stages of the Saturn IB vehicle. We feel our past survey gave us good coverage of the primary vehicle structure but did not cover many of the vehicle components obtained from vendors. We expect that the re-emphasized prime contractor surveys will cover all of the critical vendor items in depth. They will investigate the materials, heat treatments, machining, etc. and, where necessary, visit the vendor plants. The latest of these surveys should be completed by July 1, 1967. ✓

Arthur
Rudolph
Suggest you
do the
same for
Saturn IV
B

(1 attachment as described above)

NOTES 11/7/66 JOHNSON

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1. Project SUPER - Re your comments on NOTES 9-19-66 and 10-17-66 (Attachment 1 & 2). As you suggested, MSFC has accepted a small support task of machining test instrumentation parts for the Arnold Engineering Development Center ✓ R-TEST shops will perform the work on a non-scheduled basis as capacity is available. AEDC has agreed that this type low priority will meet their requirements. ✓

The attached table (Attachment 3) summarizes all "Project SUPER" activities undertaken since you initiated it in May, 1963. The "Estimated Value" shown is that which the Technical sponsor estimates would have been required to accomplish the task on a direct contract. You will observe that we have started no new work since May, 1965. ✓

B.J. Any suggestions for new work? B

2. Exhibit Room - A temporary location for the Exhibit Room for Research Achievement Items is being provided in the Space Orientation Center (Building 4471). Arrangements are being made to relocate as much as possible of the Exhibit Room equipment to this new area. It is expected that the move will take place 11-9-66. ✓

Bonnie
I'd like
to see it
when
ready
B

The possibility of locating one display case in the lobby of Building 4200 is being explored. ✓

3. FY-66 Program Funded Supporting Development Type Work - A review has been made of our contract files to determine the extent of Saturn IB and Saturn V funding in FY-66 of Supporting Development type work. Fifty-one contracts, representing \$3,526,919, were identified as being of a Supporting Development nature. Also, based on this review, it was concluded that there are at least an equal number of these Saturn contracts which are in the OART category. We have established a review procedure with IO (Dr. Mrazek) participating to guard against duplication of effort. We do not expect to attempt to establish a procedure to get strictly SRT type, now funded directly by the Saturn programs, coded to an SRT or Supporting Development program. Budgets in the SRT programs are too small to cover already established requirements in them. ✓

4. Pegasus III Coupon Measurement and Retrieval - Per discussion with Dr. J. Lundholm, MLA, this experiment will be referred to MSC for the initiation of an Experiment Implementation Plan. This action has not yet been taken because of the uncertainty of mission assignments which involves the Workshop revisit, the ATM, and the multiple docking concept. As soon as the mission assignment situation is cleared up, the experiment will be referred to MSC. In the meantime, the MSFC input, in the form of an EDP is being finalized and should be available next week. ✓

B.J. I think in view of the Aemou-
does potential of SUPER we shouldn't
allow it to die on the vine. What are
your plans? B

NOTES 11-7-66 KUERS

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Saturn V Damping Retract and Reconnect System: The fabrication of the damper arms (structures and systems) is proceeding satisfactorily. The completion date is ahead of our original estimate by about ten days--we now expect to ship the first unit to R-TEST by December 5. This, however, is 10 days later than the original IO demand date. The console, hoist and kick-off system will be completed by December 15.

All the above schedules have been coordinated with R-TEST. The early delivery of the arms, in fact, will permit more extensive testing of the system than would otherwise have been possible.

The auxiliary system, a late requirement from KSC, is in less good shape because all the design documentation has not yet been released. Consequently, vendors have not yet been able to supply delivery dates on parts and components. For this reason, we are not able to estimate delivery dates for the complete system.

The excellent progress made on this project is due to the fine cooperation by P&C in the procurement of parts, the helpful attitude of all the laboratories, and also to the extensive use of overtime in our planning and manufacturing divisions.

Twenty to thirty percent of the vendor parts were rejected in receiving inspection and most were then reworked in-house, some defects were waived and some unqualified hardware was accepted. The level of work effort therefore has been erratic and heavy overtime was necessary to keep to a tight schedule; overtime will be continued unless the shipping date from MSFC can be slipped now that other items seem to pace the program. ✓

B 411

1. J-2 TESTING AT AEDC, TULLAHOMA, TENNESSEE: Several major objectives were achieved during testing of the J-2 Engine on October 27, 1966. The first objective was a hot duct test where the propellants were loaded with prevalues shut and the recirculation pumps run for 300 seconds. LOX inlet conditions were met when the prevalues were opened at the end of the 300 seconds. Fuel inlet temperature rose out of the start box when the prevalue opened; however, an 8-second fuel lead is sufficient to drop the temperature back into the box. The second objective was a 20-second hot firing simulating S-IVB/204 flight conditions. The conditions at engine start were worst case for a gas generator temperature and vibration counts. Approximately 2 milliseconds of count were picked up by the vibration safety cutoff device (150 milliseconds allowable), and a gas generator temperature of 1760° F was recorded (which is not considered excessive). Cell pressure during the firing was 1.0 psia. This test will be repeated and if no problems occur will verify safe operation of S-IVB/204. The third objective was to evaluate an 8-second fuel lead at altitude. Steam was used in order to attain a cell pressure of 0.24 psia. The data indicate that satisfactory thrust chamber conditions for engine start were achieved after about 4 seconds of fuel lead. Further analysis is being conducted to see if the first restart at AEDC should be attempted with less than an 8-second fuel lead. The fourth objective was facility oriented to see if a satisfactory thrust chamber warm-up rate could be obtained while using facility steam to obtain 100,000 ft. altitude. Results were encouraging, and the next test will be conducted with steam. ✓

B.L.
Please
get in touch w/
Stallings, RPL
was a new
hypervelocity
impact facility
See his NOTES
of 11-7-66
B

2. SATURN/APOLLO APS TITANIUM TANKS: The failure analysis of the SM titanium tanks is not complete, but the current indications have prompted S&ID to assess the failure as "an environmentally induced failure complicated by stress". We are attempting to induce similar failures of titanium in methanol in order to study the failure characteristics. We are in close contact with MSC and S&ID on their findings. ✓

B.L.
If the
fires are
only
smoldering,
a shirt-sleeve
crew in the
SIVB tank
would, of
course,
have time
enough to
put a
mask on
and get
back into
the CSM via
airlock. Subsequent depressurization of the
SIVB tank would

3. ORBITAL WORKSHOP MICROMETEOROID IMPACT TESTS: In our continuing experimental program, to evaluate coatings for application to the interior insulation in the Orbital Workshop, we have been unsuccessful in finding any coating which will extinguish an insulation fire if a micrometeoroid penetration occurs in a 5 psi gaseous oxygen environment. Included in coatings tested were aluminum foil recommended by DAC and Kapton film suggested by MSC. Neither was successful in extinguishing fires initiated by penetrations at the AEDC hypervelocity impact facility. ✓

4. SATURN/APOLLO APS EXPULSION BLADDERS: To assure the validity of the LM and S-IVB APS expulsion bladders, full vibration qualification tests were initiated using actual propellants. Former qualification of these bladders was done using "referee" propellants. The initial test on an LM fuel bladder resulted in failure. A duplicate test will be made. A major concern has been the lack of uniformity of bladders. ✓

5. S-IC SYSTEM FLIGHT SUPPLY LINE: The Anaconda flight supply lines that Boeing purchased for the static firing of S-IC-3 could not be used because of interference with the ground supply line. The MSFC developed line has been installed on S-IC-3 for static firing. Boeing has indicated that the MSFC back-up lines will also be used for flight. This will be the third line in the MSFC back-up program that has been required for use on flight stages. ✓

Questions:
1) Is time sufficient for a safe escape of 2 or 3 men?
2) Could SIVB tank be repaired in space after such a puncture w/ subseq. fire? B

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MSFC APOLLO COST POSITION - Reference is made to my note of October 17, 1966, copy attached, regarding the MSFC Apollo Cost Position and your subsequent request for suggestions.

Based on informal information received from Bill Lilly's office, Dr. Mueller will request a "shirtsleeve" presentation by each Center (1/2 hour each) during the next Executive Session of the Management Council Meeting (November 23) to review the AO and MSF R&D Programs. It is expected that this review will result in the establishment of funding levels for the remainder of the fiscal year with possible realignment of funds between Centers. ✓

Current plans are to review in a Staff Luncheon the AO and R&D Program status and discuss the position to be taken by the Center during the Management Council Executive Session. ✓

DOD/NASA - STOIC (Systematic Technique of Incentive Contracting) WORKSHOP - George Vecchietti's office has announced a "NASA-DOD STOIC Workshop" at MSFC on November 15 and 16. Attendance will be from the three services, Office of Secretary of Defense, NASA Headquarters, and several NASA centers. The workshop mushroomed out of an informal agreement to acquaint 6-7 people from the Army Material Command with STOIC. ✓

VISIT OF REP. EVINS (D-TENN) - Rep. Joe Evins, Chairman of the important House Appropriations Subcommittee on Independent Offices, and Mr. Homer Skarin, Chief Staff Member, visited MSFC from 10:15 a.m. to 12:15 p.m. on November 3. Mr. Evins was especially interested in our current problems and our thoughts about the future. Although Mr. Evins was very sorry to have missed seeing you, he was well satisfied with his discussions with Dr. Rees and Mr. Gorman. ✓

NOTES 11/7/66 RICHARD

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Alternate Mission Decision Point: We have been working with Colonel James (see his note) and the laboratories to gear up to handle decision points on AAP flights as late as three months prior to launch. This time point seems compatible with any corresponding hardware schedule. The approach is based on parallel development of control system filters and gains in the control area. The control computer would be modified at the decision time. There will still be time for simulation testing at MSFC and six weeks in the vehicle for all critical KSC testing prior to launch. The flight software approach will be based on a completely verified basic flight program available at the decision time. This basic program is planned to have software components and scaling to handle any normal mission requirements. Changes to a verified program can be made with a considerable amount of confidence. Obviously, there will be parallel work necessary throughout R&D Operations on mission constants required at the decision time. ✓

9/11/67

B 11/11

1. SA-501 Status:

- S-IC-1 Stage - erection in VAB at KSC completed on Wednesday, 28 October 66. ✓
- S-II Spacer - stacked on Monday, 31 October 66. ✓
- S-IVB-501 Stage - stacked on Tuesday, 1 November 66.
- IU-501 - Stacked on Wednesday, 2 November 66.
- S-II-1 Stage - decision was made to discard the aluminum foil seal approach for repair of the aft LOX Bulkhead dollar weld doubler and to implement an approach (successfully utilized on the S-IVB Stage for a similiar problem) consisting of a 15-coat application (18 mil total thickness) of a LOX compatible dynatherm sealant. 1st firing now anticipated for Monday, 21 November 66. ✓

2. S-II-F/D Stage - shipped from KSC on Saturday, 29 October 66 and is forecast to arrive "on dock" MSFC on Thursday, 10 November 66. ✓

3. S-IC-3 Stage - Center F-1 Engine (024) must be replaced because of loss of a portion of a small (approx 1/8" dia) "O-ring" in turbopump. Efforts to remove "O-ring" by fuel flushing and mechanical means failed.

- Spare Engine (027) transported from Michoud to MSFC by Guppy on Thursday, 3 November 66. S-IC-3 Stage center engine 024 removed on Friday, 4 November 66. Engine instrumentation removed from engine 024 and installed on engine 027 over the weekend (5 & 6 Nov 66). Engine (027) to be installed today, Monday, 7 November 66. ✓
- Acceptance firing anticipated during the week of 14 November 66. ✓

988 11/7

1. CHRISTENSEN VISIT: Mr. Christensen, Director of Mission Operations, OMSF, visited MSFC on November 3 for an exchange of views on various Mission Operations functions. Major subjects included: Operations support requirements; SAA and Voyager Mission Operations; coordination of L/V ground commands; and scope of Mission Rule Guidelines. Important agreements were reached to make the Program Support Requirements Document (PSRD) more efficient. Mr. Christensen invited our comments to a letter being prepared from Dr. Mueller to Dr. Newell proposing to adopt existing MSF (OSRO) ground support requirement procedures for the Voyager program. However, the letter does not consider the latest developments in this program and will have to be revised. Mr. Christensen saw with great interest our SAA mockups and the swing arm test area.

2. AS-204A LAUNCH MISSION RULES: The draft AS-204A Launch Mission Rules has been received from KSC and is being reviewed within MSFC. MSFC concurrence is expected to be completed today. Official publication by KSC is anticipated in mid-November. This is the first time KSC has implemented the new format and internal KSC procedure. The space vehicle redlines are now an integral part of the Launch Rules. All MSFC inputs are satisfactorily considered. ✓

3. AS-501 LAUNCH MISSION RULES: A presentation on Launch Mission Rules was made to Saturn V stage contractors on November 2, 1966. The presentation resulted in considerable discussion on the rules, indicating a high degree of interest and a desire to participate in formulating the mission rules. The contractor representation was of a relatively high management level and it is felt that we have now achieved a common baseline which will greatly improve the further development of the rules for AS-501 and subs. ✓

F.S.
 Again:
 Don't rock the boat with OSSA and JPL before we are firmly on board! I think the proposed approach is basically sound, but OSSA is awfully sensitive to anything that looks like MSF "muscling its way into Voyager".

B

9/13/11/11

B 11/11

1. HYPERVELOCITY IMPACT FACILITY: Boeing delivered a hypervelocity impact facility to RPL under terms of a contract let by this Laboratory. The hypervelocity facility shakedown firings have been successfully completed. The range has met its contract requirements. Projectiles as dense as Fe have been fired as well as Al and Ti. The Fe projectile was launched at 4 km/sec (less than half the velocity achieved with Lexan plastic projectiles, but approximately twice the energy). Glass beads were launched at approximately 8 km/sec; some appeared to impact intact, but projectile breakup caused some debris on the target. This facility will greatly enhance our capability for performing meteoroid impact investigations.

2. ATM: Ray Hembree of our Physics and Astrophysics Branch spent all of last week at MSC in connection with the optical contamination program. Two members of Ball Brothers Research Company also were there securing information on leak rates, materials, etc., for the LM and CSM to serve as input into their study being carried out under RPL technical supervision. RPL has just produced a comprehensive document covering the literature search on optical contamination. ✓

Upon request by Bill Horton of Astrionics, a meeting was held between RPL experiment scientists and Astrionics engineers working on the ATM pointing accuracies and TV displays. IO was also represented. The meeting was very fruitful in thorough discussions of the pointing and display requirements, as well as open questions affecting interfaces between ATM and experiments, between several experiments, and also the requirements to be imposed on the astronauts. One of the questions raised was whether the astronauts should be in the control loop for holding on a fuzzy target, or whether this should be fully automatic. It is expected that this and other open questions will be settled in the near future. ✓

E.S.

Please get in touch w/ Lucas on this. He is greatly interested in the problem of internal fires in the

SVB Workshop caused by micrometeoroid penetrations. See his NOTES 11-7-66 B

NOTES 11-7-66 WILLIAMS

B 11/11

9/18 11/4
1. Voyager: Although a firm decision on the management approach may not be made for several weeks, we will increase our activities now as we discussed in our meeting here last week and as you presented in Washington. ✓

(1) Initiate with the laboratories in-house studies and analysis of the completed contractor studies, starting from the brief exercise that was reported to you in late August. ✓

(2) Request a discussion session with the proper people at JPL for information purposes. ✓

(3) Prepare a plan for initial staffing covering our total Voyager involvement. ✓

Nov. 14, 1966

B 11/15

NOTES 11/14/66 BALCH

S-II-1 Testing - Repairs to the aft LOX bulkhead are continuing. The fourth of five coats of Dynatherm buckled after application and a sample of this coat has been sent to the lab for analysis. This analysis has not been completed at this time. When Dynatherm application is completed, a test will be made at the end of five days to determine whether the cure is complete. On 11/7/66, it was determined that the LOX tank diffuser should be changed out because of failures of similar configuration test articles on the west coast. This work is scheduled for accomplishment after the Dynatherm cure period. The LH₂ tank was entered late Saturday, 11/12/66, to search for a protective cover that might have entered the tank as a result of the LH₂ facility dump line explosion on 11/5/66. The protective cover was found, along with bits of insulation, foam and other debris. Time required for cleanup and closeout of LH₂ tank has not been determined. ✓

LH₂ Facility Dump Line Explosion - Repairs to the 24-inch LH₂ dump line that ruptured on 11/5/66 were completed and accepted on Sunday, 11/13/66. There will be an end-to-end check of the LH₂ system 11/16/66. The board convened to investigate the accident has not completed its findings. ✓

B 11/15

ORBITAL WORKSHOP EXPERIMENT COMPATIBILITY ANALYSIS: The experiment compatibility work sessions held at MSC Nov. 7 and MSFC Nov. 10 uncovered two questionable areas and one problem area in the 209/210 mission. Data management and power requirements are not fully resolved and RCS propellants are insufficient to complete the mission. We will present the compatibility analysis on Nov. 21 to the MSFEB. ✓

MDA AND RM: Discussions were held with MSC to describe our preliminary layouts and to determine design criteria for the Multiple Docking Adapter and Resupply Module. MSC pointed out two general problem areas: (1) the arrangement for sequential docking, removal, stowage, and replacement of docking probes and drogues; and (2) the installation of adequate sighting devices for docking of the Resupply Module to the MDA. ✓

MEETING WITH MSC ON LM/ATM: The MSC people were not here Nov. 9-10 for the purpose we anticipated (i. e., to establish functional interface counterparts to start the overdue task of working the LM/ATM operational and hardware interface). The group was chartered for one week by George Low as a "fact finding" committee to see what our work to date has been on LM/ATM and what our plans are for the future. They are to "prepare" George Low for his meeting with Mr. Rees. I feel, however, that we did have a useful meeting. We discussed some of the details of the operational and functional interfaces of the LM/ATM and did impress upon them the need for identification of a method of getting on with day-to-day activities between the two Centers. ✓

MODELS AND MOCKUPS: Hayes is working maximum overtime and some 1/20 scale models will be delivered in about two weeks. Within about four weeks, we will have 1/20 scale models of the cluster. ✓ A meeting with R&DO on mockups and display area will be held on Nov. 14. ✓

ATM: The weekly ATM review revealed a consequence of the clustered configuration - that an active liquid cooling system will probably be required for the experiment package due to back radiation from the Orbital Workshop. In my opinion this adds substantial complexity to the ATM. P&VE is scheduled to define this system by mid December. ✓

! B

GENERAL: A program level meeting was held by OMSF with MSC, MSFC, and KSC (host) on Nov. 9-10. The major purpose was an exchange of views on plans and methods for running the overall Apollo Applications Program and Center implementation. The degree of Apollo documentation applicability to AAP was a major consideration. ✓

J-2 ENGINE Reference J-2 notes of 9-26-66, Rocketdyne's latest engine purge requirements have been under review by R&DO for six weeks. These requirements include the "heated" purge to evaporate moisture from the injector and consequently, preclude engine cutoff and possible hardware damage from combustion instability due to "icing." Fortunately, no hardware damage has occurred to date; however, review, approval and distribution of the "heated" purge requirements will be expedited. ✓

The next test at AEDC is scheduled for Wednesday, 11-16-66. The test, a restart couple, will be comprised of short duration Saturn IB S-IVB nominal start, a 90 minute simulated orbital hold, and a Saturn V S-IVB restart. After the restart test there are plans to start the engine with a hot turbine exhaust duct (duct did not cool as predicted on Saturn IB flight 201, 202, and 203). This test will be terminated prior to mainstage. ✓

F-1 ENGINE F-1 Engine F-4027 has been installed in the S-IC-3 stage, position #5, using the skirt extension from the replaced engine F-4024. Use of the engine F-4024 skirt extension reduced the effort required to change the already installed Boeing instrumentation. The spare engine arrived at MSFC from Michoud by Guppy aircraft on 11-3-66, after being delayed by weather for one day, and was installed in the S-IC-3 stage on 11-8-66. The Boeing Company's close cooperation with Rocketdyne and NASA personnel was a major factor in the streamlined changeout of the engine. ✓

The missing O-ring segment has not been retrieved from the balance cavity of Engine F-4024. One more attempt to dislodge the segment will be made by attempting to float the O-ring with "freon," and pumping it out. ✓

H-1 ENGINE During pre-launch checkout of Engine H-7080 on S-IB-7, a small sliver of plastic was found in the LOX dome which protruded through a LOX injector spray nozzle. The engine is being removed and returned to Neosho for rework. The plastic piece will be removed from the engine at Michoud for laboratory analysis to determine its origin.

Fifteen H-1 Engine TOPS switches have been subjected to the new freon flush cleaning at Southwestern Industries. Radiographic analysis has been completed on these switches. Eleven were acceptable and four were classified as rejects due to loose solder particles. The four reject switches have been returned for recleaning. ✓

COMPUTER OPERATIONS

B 11/15

The UNIVAC 1108-1 Interim System began acceptance testing November 9, 1966. Present plans call for approximately 150 hours of equivalent IBM-7094 work and 200 hours of equivalent H-800 work to be fully converted and ready for use on the Interim System by December 1, 1966. ✓

S-IB

The prevalves on S-IB-4 have been replaced with new valves. One of the new fuel prevalves leaked after in stallation through the casting on the upper part of the valve (dog house). An analysis of this part shows porosity above the acceptable limit and leakage occurred in this area. ✓

S-IC

S-IC-3 - The center engine was successfully changed out on the test stand at MSFC during the week. ✓

S-IC-4 - Programming and equipment problems were encountered during the engineering evaluation run of Simulated Static Firing (SSF). Final Simulated Stand Firing has now been rescheduled to November 24, 1966. However, the contractor is ahead of his schedule and should have no problem meeting all contract milestone dates provided the Test Stand at MTF is available. ✓

S-IC-5 - The second engine has been installed on the stage and all work is progressing on schedule. ✓

S-IC-6 - The thrust structure is in the Vertical Assembly Position in the VAB. All prevalves have been installed. Fuel tank, forward skirt, and inter-tank are completed and are awaiting build-up operations. Cracks in the ring baffles, which were stop drilled prior to installation in the hydrostatic test position, have continued to propagate. Engineering is making a study to ascertain the reasons for these cracks. Final cleaning will be delayed until an engineering disposition has been made. ✓

S-IC-7 - The thrust structure is in its pick-up position and is being used to fit check S-IC-3 fins and fairings. The intertank and forward skirt are complete and are in pick-up positions. The fuel tank is complete and is awaiting cleaning and hydrostatic test. ✓

S-IC-8 - The thrust structure is approximately 15% complete. Upper and lower fuel and lower LOX bulkheads have been fabricated. The upper LOX is in the process of being fabricated. All skin rings for the build-up of the fuel and LOX tanks have been fabricated. ✓

S-IC-9 - Component fabrication is progressing on schedule. ✓

B 11/15

1. S-IVB Workshop Research and Development Plan (RDP): A preliminary RDP for the S-IVB Workshop was furnished to IO on November 8 so that IO and the laboratories could proceed with a common plan, although Dr. Mueller's decision to cluster the S-IVB 209 Orbital Workshop and the Apollo Telescope Mount on AS-212 will require an RDP revision. The areas affected by the cluster decision are being studied; guidelines will be modified as soon as problems (such as one-gas versus two-gas atmosphere, penetration probabilities based on 1-year versus the 28-day mission, mock-up requirements, etc.) are resolved. The RDP will then be up-dated and furnished to IO based on a mutually acceptable approach to the cluster concept. ✓

2. Selection of the AAP Payload Integration Facility: Recommendations for the Payload Integration Facility location have been submitted to MSFC by Martin Company and Lockheed Missiles and Space Company as parts of their October (first quarterly) reports. Those portions of the reports pertaining to facility selection were furnished for evaluation to the AAP Integration Ad Hoc Facilities Committee, of which I am chairman. This committee will recommend to the IO AAP office, by November 24, the Payload Integration Facility Plan which optimizes benefits to NASA and facilitates the implementation of tasks assigned to MSFC. The recommended plan will be developed from the contractor plans submitted; however, those plans may be modified or combined as required to obtain the best overall Facility Plan.

S.F.

I'd like to
hear that
recommendation,400
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NOTES 11/14/66 GEISSLER

B 11/15

1. (c) Project Able: In response to question concerning stable orbits, asked in Nov. 9 Able Executive Summary presentations, Westinghouse systems contractor has found stable orbits for case of one-sided reflectors. For 24-hr orbit and area to mass ratio of $10 \text{ m}^2/\text{kg}$, stable orbit eccentricity is 0.15 compared to 0.10 for two-sided reflector. This result is entirely reasonable and to be expected. Unfortunately, the Goodyear people departed on Nov. 9 before their problem in this area could be discussed. We were unaware of orbital mechanics problem experienced by Goodyear. Arrangements have been made for them to contact us to discuss the matter. ✓

2. Saturn V EDS: Recent Saturn V EDS analysis revealed serious problems in setting limits using present sensors (angle-of-attack meter and angular overrates). Structural limit data recently furnished by P&VE for EDS design indicates that for single engine out a 50% chance for structural failure with virtually no warning time will occur. In addition, other failures such as engine hardover, loss of hydraulic pressure, etc., indicates need for sensor abort settings at or within normal operating levels. This implies a possible crew loss for failures occurring in maximum dynamic pressure region (50 to 90 sec of flight). Results of this analysis are very preliminary and input data is presently being reexamined for its validity. In addition, control capability with present control system does not exist during period from 60 to 85 sec. of flight for an engine out. This is contrary to recent MSFC commitment to Headquarters for engine out capability during S-IC flight.

3. Guidance and Performance Sub-Panel: This sub-panel of Flight Mechanics, Dynamics and Control Coordination Panel met here Nov. 8. Among topics discussed were mission planning activities for each Apollo mission, status of orbital attitude timelines, planned action of S/C in event of early staging of S-IVB from S-II stage, and AS-205 orbital lifetime. During AS-205 orbital lifetime discussion, MSC expressed an interest in Atmospheric model which we use in obtaining this information. MSC representatives stated that when they used our method of modifying the 1962 U.S. Standard, excellent results had been obtained when applied to Gemini missions. They were very interested in using our deck as their standard and wanted to investigate possibility of using it at Cape for real-time analysis. Meeting will be arranged to discuss subject with MSC. We plan to make presentation on "Orbital Life-time Prediction Techniques" in Dec. 2 Staff and Board Meeting. ✓

4. Mission Planning and Recycle Capability: Aero-Astroynamics representatives participated in meeting on this subject at MSC, Nov. 3 with MSC, KSC, and Bellcomm, to prepare for presentation on Saturn V mission planning and recycle capability to be given at Nov. 22 Management Council. We shall keep you informed of any problems in our areas of work. A dry-run of Management Council presentation will be given here 11/16/66. ✓

E.F.
I thought
all this had
been
satisfactorily
resolved
by Dr.
Kueltnet's
famous
EDS group
Are these
new insights
or did the
EDS
group just
do a lousy
job?
B

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GROUP 4
Downgraded at 3 year intervals;
declassified after 10 years

NOTES 11-14-66 GRAU

B 11/6

S-IC-2 CHECKOUT: All distributors have been removed from the S-IC-2 stage and inspected by personnel of this Laboratory and KSC. The inspection revealed some workmanship defects and some noncompliance to drawings. The discrepancies have been discussed with Manufacturing Engineering Laboratory and the distributors are currently being reworked. Schedule for completion of the rework conflicts with current checkout schedules, and we are now examining possible solutions to the schedule problem. It is planned that KSC quality will return to participate in the final inspection of the distributors in the next few weeks. ✓

NOTES 11/14/66 HAEUSSERMANN

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11/66

1. ATM MEETING WITH MSC PERSONNEL: MSC personnel from Max Faget's organization held discussions with our R&DO Laboratory personnel on 11/9 and 11/10. Representatives from their Project Office made it clear that all official transactions would be through that office. Most of the discussions concerned the technical definition of ATM. MSFC provided a copy of the preliminary PDP and the new design ground rules for the clustered concept to MSC for comment. The general attitude of the meeting was open and cooperative. ✓

2. STATUS REPORT: The AS-204 flight program is in the final stages of verification. The AS-501 programing and verification effort is proceeding without major problems. ✓

NOTES 11/14/66 HEIMBURG

B11/66

S-1C

The S-1C-3 stage acceptance firing is scheduled for tomorrow, November 15, 1966. The test, duration of 125 seconds, is planned for 3 p.m. ✓

F-1

Test FW-055 was conducted on the West Area F-1 Test Stand. Primary purpose of this test was to evaluate modifications to the static firing instrumentation system that will be utilized on static firings of S-1C flight stages. ✓

S-1B-8

A propellant load test was successfully performed on November 8, 1966. Test SA-40, duration of 40 seconds, is scheduled for November 16, 1966 at 4:40 p.m. ✓

Barge ORION

Plans and specifications for modifications to the ORION were completed and submitted to IO on November 4, 1966. The Contracts Office will advertise for bids on November 14, 1966. The ORION will be used primarily for transporting the S-1C stage and other cargo in the Gulf Coast area and to and from KSC. Also, it will serve as a backup for the USNS Pt. Barrow (West Coast). ✓

1. THIRD GENERATION COMPUTER PREPARATION: Preparation has continued for installation of the third generation computer (UNIVAC 1108) on July 1, 1967. A major area of activity at present concerns preparation of program conversion. Program conversion will be principally into the languages of FORTRAN and COBOL. Some classes have been taught in both of these languages and related manuals have been distributed to programmers. Some program conversion activity has begun. There continues to be coordination with Slidell on third generation activity. In the past month plans for acceptance test development were coordinated and responsibilities for development were divided between the two locations. Comprehensive acceptance tests are planned for both hardware and software. ✓

2. STUDIES FOR GRAPHIC DISPLAY CONSOLES: For more effective man-machine communication, third generation computers will be connected to remote graphic display consoles located in the various laboratories. These consoles will use time-sharing to allow man-machine interaction. With 18 advanced display consoles scheduled for April 1968 delivery, a detailed study was initiated:

a. To review existing graphic systems in industry and government for determining the state-of-the-art of software development and application adaptation, ✓

b. To survey the market of available and proposed hardware design, and ✓

c. To define the specific requirements of MSFC for advanced computer graphics. ✓

In support of the first two projects, plans are being proposed for an early 1967 symposium of graphic display users and manufacturers. Under the co-sponsorship of MSFC and the Army Missile Command, this symposium would help to solidify the results of the hardware, software and applications survey. ✓

To accomplish the third task of itemizing the needs at MSFC, a committee was appointed to search each laboratory for applications requiring man-machine interaction. The reports of this committee have revealed requirements in several areas from design to management systems. ✓

As a result of the projects described, several courses of action have been charted. By mid-December, the software specifications for the third generation advanced graphic systems will be defined. Preliminary work should begin in early 1967 to define and implement supporting computations needed for the analysis of various applications. If present studies reveal the need for further software development prior to the proposed 1968 delivery date, we plan to release requests for proposals in early January for a system to be delivered in the near future. ✓

NOTES 11/14/66 JAMES

B 11/16

REPAIR AND REPLACEMENT OF SA-204 COMPONENTS AT KSC: The delay in the scheduled launch of SA-204 has caused us to become concerned about unrequired changeout of components at KSC, just because the time is available, in cases where the components meet specifications but may not meet the close tolerance desired by some engineers. To check this we have made arrangements to obtain a complete listing of all component removal/replacements on SA-204 between the dates of October 20 and November 14. This listing will indicate the item removed/replaced, the reason for the removal/replacement, the UCR number and the person authorizing the work. This listing will be compared to the KSC Daily Status Report for the same time period and the results of the comparison will be reviewed by the stage and staff offices in order to ascertain if they were cognizant of the change, if it was completely justified, and if it had been properly approved. ✓

S-IVB-210 COMMON BULKHEAD STATUS: Adrain O'Neal, Chief Engineer at DAC, visited MSFC on November 10 and met with Dr. Lucas, some of his people and the S-IVB stage managers to discuss the problem of water in the insulation of the S-IVB-210 common bulkhead. In general, the data now indicate the tankage will be acceptable. The major point of concern now is the path by which the water entered the cells. Two personnel from P&VE will visit DAC Monday to examine x-ray data. ✓

70" LOX TANK QUALIFICATION TEST: In the initial qualification tests of the S-IB 70" LOX tank it passed the 125% safety factor test but had a tank buckling failure at about 134% of the prelaunch standing load requirements. A modification that included cutting holes (skin cutouts) in the upper skirt about 18" below the load points to better distribute the loads was subsequently approved. On November 7 the modified test tank was being qualified to 140% of the design limit flight loads with maximum internal pressure. As the loads were being increased from 120% to 125%, a failure occurred in the upper skirt near the skin cutouts. This failure consisted primarily of shearing several rivets and slight skin deflections on both sides of the cutout. Testing is expected to resume the latter part of the week of November 21, 1966. This does not effect SA-204 since we do not have this fix in SA-204. ✓

REMOVAL OF ENGINE #3 ON S-IB STAGE OF SA-207: A piece of foreign material, possibly teflon, was found lodged in one of the nozzles of the LOX injector of H-1 engine #3 on SA-207. The engine is being removed from the stage for disassembly in order to determine the origin of the material. Should analysis show that the material originated from the stage and not the engine, we may have other engines to be investigated. ✓

NOTES 11-14-66 JOHNSON

B 11/16

University Sustaining Program Grants - At the request of the Office of Grants and Research Contracts, OSSA, we have recently conducted a detailed review of the Sustaining Program Grants made to universities in this region. The purpose was to identify particular research items in which MSFC might have more than a "scientific curiosity" level of interest and for which we might take on a non-directing, non-managing type of sponsorship by requesting potential MSFC user personnel to monitor the university effort on the item. This, in principle, has been the mode of operation since initiation of the Grant Program. In practice, it has not worked well, because the in-house user has had no means, other than moral persuasion, to influence the direction of research taken by the university researcher. This, coupled with what appears to be the doctrine of OGRC that "immediately useful research results, constitute something akin to prostitution of science and is therefore detrimental to the best interest of the university," has resulted in a very low level of participation by our specialist groups. The current interest in OSSA in a heavier participation by MSFC (and the other Centers) in this type effort seems to have been generated by a desire for aid from the grass roots levels in justifying the budget rather than a recognition that Center personnel could contribute to the programs undertaken if given means for more responsible roles in their development and execution. Because I do not detect any lessening of the belief that the mature wisdom and intellect prerequisite to dealing effectively with universities is solely resident in Washington, I do not foresee any major changes in our relations to the programs or any great increase in the support provided institutions in this region. However, we will continue to co-operate as fully as possible and will attempt to take advantage of the opening offered by this exercise to increase our influence in the selection of grantees and level of support. We will keep you advised on progress in this effort. ✓

Cryogenic Stretch Forming of High Pressure Storage Bottles for Saturn V Vehicle:

A research study has been conducted by ME Lab. with the Arde-Portland Company of Paramus, N. J. to determine the applicability of using a cryogenic temperature forming process for manufacturing high pressure storage bottles of the type required for the Saturn V stages. If type 301 stainless steel is yielded 12 to 15% at cryogenic temperatures, the parent material and joining welds increase in strength and develop properties of approximately 200,000 psi and elongation characteristics of four to five percent at cryogenic temperatures. Metallurgically adequate stretch is imposed in the material to cause the normal austenitic structure to partially transform to a martensite structure. A remaining problem not fully resolved is undesirable brittleness of cryogenically formed 301 alloy at cryogenic working temperatures. A variation of 301 stainless steel using a lowered Silicon content is being investigated which will hopefully reduce the brittleness problem. This cryogenic forming process has been developed by the Arde-Portland Company, who has manufactured pressure vessels for a guided missile project and other applications by use of this method. The technique consists basically of fabrication of a welded undersized bottle which is then hydraulically expanded at liquid N₂ temperature against a female die. Possible applications of this manufacturing process would be for helium bottles on the S-IC Stage, which are presently made from 2014 Aluminum, or for S-IVB Titanium spheres in the liquid hydrogen tank. In case of the S-IC, a weight saving of approximately 1800 pounds and a cost saving could be achieved, while the replacement of Titanium spheres in the S-IVB, at a nearly equal weight, would eliminate the stress corrosion problem of Titanium and would make these He spheres compatible with the Oxygen atmosphere in the orbital workshop. Negotiations are presently in progress on an additional effort to fabricate and qualify 301 stainless steel spheres of the S-IVB configuration. Four prototype S-IC bottles have been delivered to MSFC and will be tested and evaluated in-house. ✓

B 11/16

1. ORBITAL WORKSHOP: P&VE participated in the first Orbital Workshop (SAA-209) Mission Subpanel Meeting. This meeting was very fruitful. MSC agreed with our approach; however, their idea of the scope of the subpanel did not include the human factors engineering effort and this part is being coordinated.

Conceptual layouts have been completed on: (1) a pre-installed thermal control sleeve, (2) a device to facilitate initial entry into the S-IVB tank, (3) a scheme of padding internal tank protrusions for astronaut protection, and (4) shielding for the titanium helium bottles to prevent micrometeoroid penetration. Layouts and preliminary designs for pre-installed crew quarters and a television camera system for monitoring astronaut activities are in progress. ✓

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11-14-66
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2. PROJECT THERMO: Tank rack configuration was presented at the Project THERMO third contract interface meeting with MSC, GAEC, DAC, and the Garrett Corporation. Final agreement was not reached on the design ground rules established for the remainder of phase "B" effort. The most important of these are (a) size of tanks, (b) structural support system, (c) attitude control concept, (d) TV recording system. Items (a), (b), and (c) will be resolved in approximately 2 weeks. Astrionics Laboratory will define a TV system by the end of November 1966 to show development time and cost. ✓

3. S-II SERVICING REQUIREMENTS: The two major problems in this area which became apparent during SA-500F testing were the S-II LOX tank baffle damage and the LH₂ vent system back pressure. The LOX baffle problem has been resolved by eliminating the "40 percent leak check" and conducting it at 100%. We were informed that a back pressure of 7 psi was observed in the hydrogen vent on LC-39 during recent tests. We have reiterated to KSC that the 1.5 psi is the maximum back pressure for SA-501, and that higher pressures will have a significant impact on the S-II stages (as well as S-IVB). We are meeting with KSC to resolve this problem. ✓

4. USE OF SILANE COUPLING AGENTS WITH POLYURETHANE ADHESIVE SYSTEMS: A very significant increase in polyurethane adhesive bond strengths has been obtained through use of silane coupling agents. An average 100% strength increase for lapshear specimens tested at room temperature and -300°F was observed when aluminum adherends were primed with Dow Z-6020 or Dow Z-6040. An average bond strength increase of 400 to 500% was obtained with specimens tested at +200°F. ✓

5. SATURN V DAMPING SYSTEM: The progress on the primary "Damping, Retract, and Reconnect System" and "Auxiliary Damping Systems" is satisfactory. Analysis, design, and software are on or ahead of schedule. ✓

NOTES 11/14/66 MAUS

B 11/16

Negative Report

B 11/16

NOTES 11/14/66 RICHARD

"Soft Spot" Followup: We are following up our soft spot presentation with task assignments in each area. We will update our soft spot status in December. This update will be in writing and cover specific problems still needing attention in the stages and at KSC. As in the past, we will not hold any "make work" items for this report, but rather we will move out on these problems when they are identified. ✓

NOTES 11/14/66 RUDOLPH

B 11/16

1. S-IC-3 Stage Acceptance Firing - scheduled for Tuesday, 15 November 66. ✓
2. S-IC Quarterly Review - scheduled for Tuesday, 15 November 66, at Michoud. ✓
3. S-II-F/D Stage - arrived "On Dock" MSFC from KSC on Thursday, 10 November 66. ✓
4. S-II-1 Stage Schedule:
 - o Friday, 18 November 66 - completion of dynatherm sealant application and cure. ✓
 - o Sunday, 20 November 66 - LN₂ tanking. ✓
 - o Thursday, 24 November 66 - 1st acceptance firing. ✓
 - o Monday, 2 January 67 - "On Dock" KSC. ✓
5. S-II Quarterly Review - scheduled for Thursday and Friday, 17 & 18 November 66 at NAA/S&ID, Downey, California. ✓

NOTES 11/14/66 SPEER

B 11/16

1. MONITORING OF THE S-IVB SECOND BURN ON AS-504: At the request of our Flight Control Office at MSC, monitoring of the second S-IVB burn was discussed at the AS-504 Flight Operations Planning meeting on November 4. Three possible methods of monitoring the pre-ignition sequence and second burn were considered: (1) Ship coverage; (2) Aircraft coverage (with proper equipment to display critical measurements); (3) Onboard monitoring by the Crew. Of the three, the onboard monitoring appears to be the most attractive since either of the remaining two could limit the launch window. To properly monitor this flight phase onboard the spacecraft, additional displays will be required since presently only LH₂ and LOX tank pressures and engine thrust O.K. switch are displayed. We are continuing to investigate all aspects of this coverage and expect to discuss the status at the MSFC Mission Operations Review on November 29. ✓

B 11/16

E.S.

1. LUNAR PROGRAM: Dr. Gilruth, in his reply to your letter, agreed with the continuation of the LSSM and Lunar Drill projects under MSFC's responsibility, but requested transfer of the Surveying System (Jacob's Staff) project to MSC. He qualified his endorsement of the first two projects, though, by making the following statement: "If, however, the increased payload capability is delayed, or if present concepts and approaches to lunar surface mobility are found to be inappropriate, we would propose a reassessment of responsibility for hardware implementation."

There will be a new MSC/MSFC detail agreement. Went based on GEM's letter of Nov. 14.

Under the existing circumstances, we at SSL are willing to accept this outcome.

cyat...
ng

Jim Shepard can show it to you or send you a terox.
B

2. ATM: Last Wednesday members of SSL presented six talks on the background and the scientific objectives of the ATM experiments to a large audience consisting primarily of engineering people from IO and R&DO (above 200). The material will be published as an internal report.

3. CONTAMINATION STUDIES: Ray Hembree, along with two members from Ball Brothers Research Corp., spent three days at MSC last week in an attempt to set up lines of communication for the ATM contamination study by Ball Brothers. For the most part, everyone was cooperative; however, much of the required information just isn't available at MSC. We are somewhat in a box since MSFC doesn't have access to MSC contractors and sub-contractors where the detailed info on the CSM and LM has to be obtained. It may become necessary that we ask you to request approval from Dr. Gilruth for this access.

Shep
Please discuss this with Ernst

4. MISSION PLANNING FOR 510: Mr. Clingman (ASO), Dr. Shelton, and Mr. Downey met with Dr. Henry Smith and other members of OSSA to discuss potential science experiments on the 510 manned synchronous orbit mission. Several promising experiments were considered, mostly dealing with radiation physics and relativity.

and if it's considered desirable, put a briefing note into my

5. ELECTRIC PROPULSION TESTING: A long-time test run of an ion engine was terminated recently (depletion of propellant) at Electro-Optical Systems after 8200 hours of uninterrupted operation. The entire system was still in excellent shape at the end of the test.

my MCM travel folder
B

NOTES 11-14-66 WILLIAMS

Negative.

B 11/16

Nov. 21, 1966



NOTES 11/21/66 BALCH

B 11/27

11/22 90s

S-II-1 Testing - In the repair of the aft LOX bulkhead, all Dynatherm applications have been completed and the five-to-seven day cure period began on 11/17/66. Today, test samples will be removed from the LOX tank and closeout of the tank initiated. Tonight, tests will be made on a portion of these samples. If these tests are satisfactory, final preparations will be initiated for LH₂ tanking on Wednesday, 11/23/66. If the tests are not satisfactory, subsequent tests will be made on the remaining samples at 24-hour intervals. If LH₂ tanking is not accomplished on Wednesday, 11/23/66, it is not expected that it will be accomplished before Sunday, 11/27/66. ✓

LH₂ Vent/Dump Line - Repair and major portion of checkout required for cause investigation have been completed. Additional preventive measures have been incorporated and procedures are under revision to insure non-recurrence of explosion. Board of Investigation Technical Panel Preliminary Report is to be issued today. With reference to your comments on my NOTES dated 11/7/66, KSC was invited on 11/6/66, to participate in investigation and has had Mr. Russell Rhodes at MTF for this purpose. ✓

Labor Relations - Last Thursday, 11/17/66, there was a dispute between a member of the Operating Engineers (IUOE) and a member of the Pipefitters Union (UA) concerning the operation of a gasoline engine driven pump. An altercation between the two ensued, and as a result, the employer, the Koppers Company, construction contractor on the B-2 position of S-IC test stand, fired the IUOE member but not the UA member. The other IUOE members working for Koppers stopped work but did not leave the job. Because they were not working, Koppers fired all IUOE members on the job and asked the local for replacements. Early the next day, 11/18/66, the IUOE had pickets at entrances to the site, and substantially all craftsman refused to come on site to work, with the result that approximately 800 to 900 workmen were off the job. IUOE is still picketing the site at separate gates set aside for Koppers and although some craftsmen have come to work today, an estimated 700 are still off the job. The Koppers Company has initiated legal action in an effort to terminate this work stoppage. S-IC and S-II A-1 activation schedules are definitely impacted, but the extent cannot be determined at this time.

J.B.

→ Did they consult with your labor relations man before they took such drastic action? If not, I think you should convince management of how construction contractors again how sensitive the overall labor situation is, and how easily some hot-headed action can precipitate a major crisis with intolerable delays. B

B 11/27

ATM PROJECT REVIEW: An ATM project review is scheduled for MSFC management on Dec 8. It is planned to show progress achieved against the definition which now includes the clustered configuration. Critical problem areas will be highlighted. ✓

OAD-C EXPERIMENT: Representatives from Perkin-Elmer visited here Nov 17 for purpose of discussing OAD-C experiment (Princeton) as possible addition to ATM. The OAD program is presently under review at OSSA with the indication that a two year delay is probable. Apparently the idea of joining the OAD-C and ATM was one that came from this and our recent visit to Perkin-Elmer. Discussions included the ATM and cluster concepts and some details on OAD-C. As discussed, the OAD-C had several basic differences in requirements from the ATM to indicate that flight of both on the same spacecraft would mean changes to either the ATM or OAD-C. Perkin-Elmer was requested to provide more specific engineering and interface data on OAD-C in case this idea gathers more momentum in OSSA. R-AERO, R-RP and R-ASTR participated in the meeting. ✓

LM&SS PROGRAM REVIEW: At MSC on Nov 17, aircraft film showing the astronaut's retrieval of film from M&SS in zero "g" condition were reported on by astronaut J. Lousma. Considerable difficulty in retrieving film while in a pressurized suit led to recommendation that payload module be pressurized to allow use of unpressurized suit (face plate down and gloves on for backup). Astronauts J. Armstrong and W. Pogue confirmed these findings in identical 20 minute zero "g" flights on aircraft. Pressurization of payload module forward section, however, is a fairly major design change and alternate methods of film retrieval will be investigated as a primary approach. Major Pogue conducted a film removal exercise in a darkened simulated spacecraft with a flashlight but was unable to effectively remove film (poor lighting conditions). The film of these activities was very revealing in that difficulty of IVA (Intra Vehicular Activity) is very different in a pressurized suit. It is suggested MSFC review these tests as they seem to be applicable to the ATM and Workshop projects. ✓

ORBITAL WORKSHOP: We are moving out on a MSFC docking adapter design/concept. MSC and MSFC will jointly present the adapter proposals to Headquarters within the next two weeks (tentative). ✓

SELECTION OF AAP PAYLOAD INTEGRATION FACILITY: We are planning a briefing to you Dec. 15 on Payload Integration Contractors' Phase "D" proposed guidelines. The IO/R&DO payload integration facility recommendation will be covered in this briefing. ✓

L.B.
LM 22/1
B

Good idea
B

11/22 948

B 11/27

Lac/laues
So we
still
discover
surprises
during
static
testing
of SIB
stages !!!
B

H-1 ENGINE During the first static test of S-IB-208 on 11-16-66, Engine H-4078 (position #6) ran significantly lower in thrust than expected (19,000 lbs. less than the other seven). A quick look at the data pointed to the turbine as the suspect component. Disassembly of the turbine showed that approximately 20% of the first stage blades were missing, second stage blades were dented and scored, and there were dents in the heat exchanger coils. The cause of the failure cannot be determined until the engine is disassembled for further investigation. An apparently unrelated problem was discovered on this same engine during the regular examination of the filter between the FABU and the gear box. A quantity of metal filings were found on this filter. They are being analyzed by the P&VE Materials Division.

J-2 ENGINE There was a J-2 start/restart test at AEDC on 11-16-66. The first test was a 40 second Saturn IB S-IVB nominal start at a simulated altitude of approximately 109,000 feet. After a 93 minute simulated orbital hold there was programmed a 10 second restart utilizing an 8 second fuel lead. This test was terminated 1.4 seconds after the start command by a gas generator over-temperature condition. The gas generator over-temperature resulted from a subcooled thrust chamber due to the 8 second fuel lead. This test further verified that eight seconds of fuel lead will not be required for a Saturn V restart. Prior to the test, under simulated altitude, the heat bank for simulating orbital heating was checked out. The results of this checkout indicate that the heat bank would not produce the heat rates required to simulate retro and ullage motor impingement on the engine. All engines for S-II-506 have now been delivered. (No's. 89 & 90). ✓

see
also
Heimburg
NOTES
11-21-66

F-1 ENGINE The F-1 engines performed satisfactorily during the static firing of S-IC-3 on 11-15-66. Preliminary hand reduced data indicates engine thrusts ranging from 1506K (position #2) to 1546K (position #3) with an average thrust of 1525K. If reorificing is required on position #3 (engine 4025), a paper calibration should be adequate. One gas generator drain plug was not reinstalled on engine 4026 (position #4), but no damage resulted. F-1 engine contract NAS8-18734 (CPIF) which provides for the last thirty Apollo engines and continued production support thru CY June 1970 was approved by NASA Headquarters on 11-18-66. ✓

C-1 ENGINE. A meeting was held with Dr. Dozier, Mr. Ray Hembree of R-RP-P, and Ball Brothers' representatives to explore what the C-1 engine program can contribute toward identification and solution of the contamination problem associated with altitude control engines used in ATM missions. C-1 program will assist Research Projects, wherever possible, to plan and implement necessary experiments to evaluate effects of engine exhaust products on various ATM experimental hardware. ✓

NOTES - 11/21/66 - CONSTAN

11/22/68

B 11/27

Nothing of special significance.

11/29/68

1. Rotation of Project Managers by Assignment to Promising Advance Study Projects: IO and R&DO management are in general agreement that the assignment of project management personnel to promising projects in Frank Williams' office would be important to the future of Marshall. Basically, the four purposes of such an arrangement would be to provide: (a) project continuity from R&DO to IO; (b) improved project management from inception through a project; (c) technical retraining of project managers; and (d) project management thinking injected into project planning phase. To add definition to the general approach and to identify all aspects of an IO/R&DO agreement for this type assignment, Bob Pace and I met on October 25 and agreed on the items we should independently consider. We plan to get together again on November 29 with Frank Williams to begin preparation of an agreement which will accomplish the purposes mentioned above and which will be attractive to experienced project managers.

2. Conversion of the Saturn V Systems Engineering and Integration Support (SE&IS) Contract to Incentive Fee Basis: Final negotiations covering conversion of the Saturn V SE&IS contract to incentive fee basis were held November 16, 1966. Approximately one year of combined IO and R&DO effort was required to convert the contract to CPIF basis. Essential features of the contract incorporated to meet the flexibility required by R&DO are:

a. Government furnished data (GFD) can be furnished up to 15 days later than contractually required.

b. Format and content of study reports can be revised by the laboratory technical managers.

c. A GFD work-around can be agreed to and initiated by the Boeing and MSFC technical managers prior to determination of cost impact.

d. Technical approval of reports will be an R&DO responsibility. Final appeal of contractor disagreement is to be determined by DIR or his appointed representative. Heretofore, disagreements about their reports could be carried on to NASA Headquarters by the contractor.

e. Special studies for the Apollo Program may be initiated jointly by laboratory technical managers and The Boeing Company without contractual change order.

f. Performance and schedule incentives are incorporated as furnished to IO by R&DO.

NOTES 11/21/66 GEISSLER

B 11/27

11/22 953

1. AS-501 and 502 Mission Changes: Mr. Aller (MSF) contacted us and requested that 501 and 502 missions be reshaped for S/C splash and recovery in the Atlantic. This change is caused by DOD budget problems associated with providing recovery ships in both Atlantic and Pacific. Therefore, Dr. Mueller requested this feasibility analysis. We are considering three possibilities for trajectory reshaping, namely having S-IV B second burn over Cape area, Australia, or South Africa. First concept would employ a long waiting orbit (\approx 22 hrs), to impact back in the Atlantic. A more southerly launch azimuth would also probably be required. The only constraint this seems to violate is 12 hour maximum mission duration imposed by S/C IMU drift. A problem may also exist with instantaneous impact point locus for S-IVB second burn malfunctions occurring over populated areas. Igniting over Australia or South Africa would result in ground tracking crossing South America prior to impact which is probably unsatisfactory. Preliminary study results will be available soon. A meeting was planned for Tuesday, Nov. 22 at Headquarters to give MSFC's and MSC's inputs, but was cancelled Friday, Nov. 18 by Mr. Aller, at the request of MSC. Analysis will continue here, and further discussions will be held with MSC.
2. Guidance Switchover and Manual Booster Control Task Team: This team, consisting of members from R-AERO, R-ASTR, I.O., and MSC, met Nov. 15, at Houston. Apollo Systems Specification requires Saturn V guidance switchover capability in orbit. In this area, we are comparing S/C Trans-Lunar Injection guidance equations with IGM equations for performance and accuracy in case of switchover. In the area of manual booster control, MSC proposed a scheme, which monitors altitude, altitude rate, and velocity, for manually controlling booster during Saturn V upper stage flight, if required. MSFC expressed concern that at switchover, discontinuity would exist and large transients could result, since the IGM could actually be functioning properly, even though the actual profile might not compare closely with the pre-programmed artificial profile in the S/C. The scheme logic was then modified at the meeting to compare the pre-programmed profile to the actual profile, and to bias the pre-programmed to match the actual prior to switching to manual control. This would alleviate the potential problem. We and R-ASTR will conduct dynamic simulations to verify performance, stability, etc, with man-in-the-loop. MSC plans to implement this scheme and guidance switchover during orbit on 503 and subs. No spacecraft/LV hardware interface problems were identified.
3. Graduate Co-op Program: This new program, which was discussed in a recent meeting with the Personnel Office, promises to furnish us some valuable scientific support. Colorado State University and the University of Oklahoma have already agreed to conduct thesis work related to programs in our Laboratory, and are considering locating their candidates here. The University of California, Illinois Institute of Technology, and Georgia Tech. have also expressed interest. Crossed-beam technology is typical of the subjects we are considering for thesis work. We agreed to assist Personnel in contacting key officials of universities and to notify them of candidates who are recommended to us. Approximately twenty spaces are available to MSFC for these assignments.

NOTES 11-21-66 GRAU

11/229FS

B 11/27

Nothing of significance to report this week.

NOTES 11/21/66 HAEUSSERMANN

953 1/22

B 11/27

1. ATM STATUS INFORMATION

A display type mockup will be built which is planned to be completed by 1/15/67. ✓

Approximately \$17 million for FY-67 are available for use on ATM within R&DO. To date, there has been approximately \$4 million initiated by R-ASTR which includes the CMG procurement and the 3-axis simulator procurement. ✓

2. STRATOSCOPE II - REVIEW

A verbal preliminary report on the findings and recommendations resulting from the review of Stratoscope II was presented to the sponsors (National Aeronautics and Space Administration, National Science Foundation and Office of Naval Research) of this project by Mr. J. Boehm, chairman of the review committee, on 11/14/66. It appears that the continuation of the project can be recommended in spite of numerous and essential findings in various areas. This will be justifiable because the applied optical systems are of considerable excellency and are reflecting the state-of-the-art. The bulk of the review activity is accomplished. Lists for mandatory and desirable changes and/or modifications are being prepared. The review activity will be documented by an encompassing and comprehensive final report.

W.H.

→ I'd like to see it show ready

B

NOTES 11/21/66 HEIMBURG

B 11/27

F-1 F-1 Engine S/N F-4T2 was removed from the West Area F-1 Test Stand on November 16, 1966. Engine S/N 5038 will be installed the first of this week. ✓

S-1C The static firing acceptance test of the Saturn S-1C-3 stage, Test S-1C-19, was successfully conducted at 3:38 p.m. on November 15, 1966. ✓ The mainstage duration was 121.7 seconds with test termination initiated as planned by the firing panel operator. All major test objectives were achieved. ✓ Post-static firing activities have been completed and the stage is scheduled for removal from the test stand November 21, 1966, and for loading on the barge the following day. ✓

S-1VB (MSFC) Test S-1VB-039 was run Monday, November 14, 1966, for a duration of 288 seconds. Cutoff was by fuel level chart observer when the level reached 360 pounds. ✓

S-1B-8 Test SA-40 was conducted November 16, 1966, for 35 seconds. Results were satisfactory except performance of engine position No. 6. This engine operated at 184,000 pounds compared to the nominal thrust of 205,000 pounds. Post-test inspection revealed the first stage wheel of the turbine had lost 42 blades and the second stage turbine wheel was severely damaged. The engine had a "frozen" turbopump on the first torque check before the loading test on November 8, 1966, and could not be turned with an applied torque of 800 In/Lb. The exhaust duct was removed and torque of 60 In/Lb (allowable) was applied from the turbine side with no success. After rocking the turbine shaft back and forth, something dropped and the turbopump was free. During the first few revolutions a clanking noise was heard which later disappeared. Local operating personnel (R-TEST, Chrysler, Rocketdyne) felt that the turbine should be disassembled and checked before firing. Rocketdyne's Canoga Park people decided that this action was not necessary and I.O. agreed. (See TWX attached to Dr. von Braun and Mr. Weidner only).

Lee James
Bill
Strown
FRI
B

SATURN V DAMPING ARM On November 16, 1966, ME Laboratory informed us that their delivery date of the Saturn V Damping Arm to us has slipped from November 25, 1966, to December 12, 1966. Assuming absolute success, we require 31 working days to complete the minimum test program. Based on the new date from ME Laboratory, January 24, 1967, is the earliest test completion date. Approximately a week in addition will be required by ME to refurbish and prepare for shipment to KSC. These times are inconsistent with the demand date of I.O. to ship the Arm to KSC on December 26, 1966. With the announced slip in the Saturn V schedule, it is hoped that a realistic KSC need date can be established.

↑
Fritzsche-Rudolph
B

B 11/27

NOTES 11-21-66 HOELZER

11/22 JKS

Negative Report.

NOTES 11/21/66 JAMES

B 11/27

11/22/66

SATURN IB MISSION CHANGES: The Apollo Program Director last week sent all Centers a draft of the new Apollo Program Directive 4F with the new launch schedule delaying AS-205 for the rendezvous mission with AS-208, and asked for comments. Our Saturn IB answer was short and direct stating that we can support the schedule dates. The mission changes, of course, require many detailed changes in our planning and software development and some hardware changes, primarily in the I. U. It now looks like these changes may require that the I. U. for AS-205 go back through checkout for about a week to be sure we are sending checked-out hardware to KSC. I will have a memorandum prepared in a few days covering in a little more detail the overall changes required by this mission change. ✓

S-IVB WORKSHOP STATUS: The S-IVB Stage for SA-209 has now completed the assembly phase and will start through factory checkout this week at Huntington Beach prior to shipment to SACTO about March 10, 1967. S-IVB Stage for SA-210, which we understand the new AAP mission changes designate as the new S-IVB workshop, will include the same internal tank fittings as SA-209. SA-210 will be starting into the insulation chamber this week and could still accept in-sequence modifications for a couple more weeks. SA-210 will go into checkout in about six to seven weeks and be shipped to SACTO about April 28, 1967. ✓

AS-204 PFR: Based on the present schedule of AS-204, the Flight Readiness Review at KSC is scheduled for mid-January. Based on this, we have tentatively scheduled our AS-204 Preflight Review during the first week in January. ✓

↓
I will not be here, but I guess I'm not needed, since I attended entire DCR

B

NOTES 11-21-66 JOHNSON

11/22/66

B 11/27

No significant items to report.

NOTES 11-21-66 KUERS

11/22/68

B 11/27

Negative report.

NOTES 11/21/66 MAUS

B 11/27

11/22 JS

1. VISIT OF CONGRESSMAN RHODES - Representative John J. Rhodes (R-Arizona), member of the Appropriations Sub-Committee on Independent Offices, visited MSFC on November 19. Mr. Rhodes displayed a great interest in the Apollo Program, AAP and Post Apollo activities. He displayed no interest in Administrative Operations, which is the particular forte of his Committee. Mr. George Urian, Staff Member of the Public Works Committee, accompanied him. Congressman Robinson did not come along. ✓

2. MATTHEWS - GEMINI PROGRAM - We are arranging for Mr. Chuck Matthews, Gemini Program Manager, to give the same presentation to MSFC top management that he gave to Mr. Webb in the Administrators' Review. This presentation is an excellent summary treatment of the entire Gemini Program from start to finish. The presentation will be scheduled in mid-December at a time agreeable with our key people. ✓

3. ADMINISTRATIVE OPERATIONS - MSF has advised us that we will be cut an additional \$2.2M in the Administrative Operations Plan for FY-67. MSF directed this cut in order to stay within the \$315M MSF allocated for AO, and effected the MSFC reduction in personnel services and overtime. This cut will be reclaimed during the AO Status Review at the November 22 Management Council Executive Session. Provided the reclama is unsuccessful, MSFC will propose that the cut fall against the Operations of Installations since we are still planning to continue our present recruiting and overtime policies. The present AO funding picture is as follows:

HM
has
postponed
B

FUNDING LEVELS (\$ in thousands)

<u>Fund Source</u>	<u>Current Plan</u>	<u>Hqts Guidelines 11/16/66</u>
(1) Personnel Compensation (including overtime) and Benefits	89,624	87,386
(2) Travel	3,193	3,193
(3) Operation of Installations	37,152	37,166
TOTAL	129,969	127,745

✓

B 11/27

NOTES 11/21/66 RICHARD

11/22/68

ATM/LEM/Workshop: To keep a consistent approach to R&D Operations design efforts until official program documentation is available, we are preparing a draft of a mission defining document for the four-vehicle clustered mission for Orbital Workshop - Apollo Telescope Mount. This document is intended to be a base point which keeps the pieces a part of the total and still allows each package to be developed as a single item, as before. We will keep it a "living" document, updating it as necessary, until it is replaced by something better. ✓

NOTES 11/21/66 RUDOLPH

B 11/27

11/22 X's

1. S-IC-3 Stage - was successfully acceptance fired for 121.5 seconds on Tuesday, 15 November 66. ✓
2. S-II-1 Stage - first firing is now scheduled for Thursday, 1 December 66, (Thursday, 24 November 66 firing date reported in Notes 11/14/66 Rudolph) the delay is due to problems encountered in application of the dynatherm sealant to the aft LOX bulkhead dollar weld doubler and the decision not to work on Thanksgiving holiday. ✓
3. Stress Corrosion Survey - (Reference your comment to Notes 11/7/66 James, copy attached). A re-emphasis by Saturn V on the stress corrosion problem has been initiated. Since the early surveys dealt principally with the primary vehicle structure, present efforts will cover (in depth) components, the piece parts within the components, including all processing such as heat treat, surface treat, etc. Detail plan of actions and interim status from each major contractor is expected to be available by the end of November for review with appropriate R&DO personnel. Survey completion dates are not yet established in all areas but will require an estimated three months. Components and problems that are common items to the Saturn IB/V vehicle systems will be treated in a single investigation so that no duplication will be encountered. ✓
4. A Saturn V Astronaut Familiarization Presentation - has been requested by MSC. The presentation will be similar in approach to the Saturn IB presentation held 19 - 21 April 66. MSC initially requested the presentation for Tuesday and Wednesday, 13 & 14 December 66, however, we now have mutual agreement to wait until sometime in April or May 1967. ✓

A S-IC Stage Familiarization Briefing to a small group of astronauts is planned for Tuesday, 13 December 66 at Michoud. ✓

Mr. Howard P. Lloyd, of my Systems Engineering Office is coordinating all activity re Saturn V Astronaut Familiarization Presentations. ✓

5. Human Errors During Operational Testing - A one day seminar on the human error aspect of major test operations will be held on Wednesday, 30 November 66, at the Douglas Test Center, Sacramento, California. The purpose of this seminar is to have an exchange of information on above subject by the responsible Saturn test managers from contractors plant sites, captive test sites, and the launch site. The Seminar is being coordinated by Mr. Jewel Moody, Chief, Saturn V Reliability and Quality Office. ✓

1 Attachment: a/s (DIR, I-DIR & R-DIR's copy only)

NOTES 11/21/66 SPEER

B
11/27

11/22 K/S

1. USE OF ODOF FOR IMPACT PREDICTION: I have received a request from Dr. Debus to continue carrying the ODOF transponder on all Saturn IB and Saturn V flights for the purpose of providing adequate data for a new near pad impact prediction system. This request is based on a joint KSC - Eastern Test Range study which proved ODOF to be far superior to any other system. I feel we should support this request, however, it should be identified and justified as KSC requirement since our own requirement for precision tracking data during first stage flight will fall off starting with AS-504 and AS-205. Transponders seem to be in sufficient supply for quite some time. Approval for this requirement will have to come from OMSF. Mr. Christensen is aware of this development and has promised to take necessary action. ✓
2. AS-204 LAUNCH VEHICLE - CONTROL CENTER INTERFACE TEST: The L/V to MCC-H interface test of the Digital Command System for AS-204 was attempted on 11/18 but was scrubbed due to transmitter modulation problems. Detail analysis of the nature of the problems encountered has not been completed but it appears that a distortion in the modulation of the commands generated by the ground system was so large that the on-board system would not accept them as valid commands. The test will be rescheduled after analysis is completed. ✓
3. AS-204 PREPLANNED GROUND COMMAND: MSC recently requested MSFC to agree to a preplanned ground command to change the AS-204 attitude maneuver sequence in orbit. The change was desired to permit the first astronaut landmark sighting to occur at a more optimum time and location. The Saturn IB Level II CCB determined on November 18 that, due to the 204 schedule slip, the desired sequence change can be accomplished by software modification without schedule impact, and therefore will be done by this method instead of by ground command. ✓
4. AS-501 C-BAND RADAR SUPPORT: There has been some concern at MSFC regarding the assurance of C-band radar support during the AS-501 second burn. A portion of our requirement was initially rejected by the Operations Support Requirements Office (OSRO) at Headquarters. Justification of the requirement was prepared and we have now been assured that the MSFC C-band support will be fully satisfied. ✓
5. S-IVB SYSTEMS FAMILIARIZATION COURSE: An S-IVB Systems course was held at MSFC last week. The course was established primarily for our LIEF operations support engineers and was oriented toward AS-501; it was presented by DAC and Rocketdyne personnel. The average attendance was about 32. ✓

NOTES 11/21/66 Stuhlinger

11/22 953

B 11/27

No submission this week.

Nov. 28, 1966

B 11/30

NOTES 11/28/66 BALCH

11/28

S-II-1 Testing - LN₂ tanking test was completed late Wednesday, 11/23/66, and all test objectives were met. The area of the aft LOX bulkhead which has just been repaired was inspected while LN₂ was in the tank, and no leaks were detected. Detailed Test Plan for static firing has been reviewed and approved, and present S&ID schedules call for first firing not earlier than Wednesday, 11/30/66. ✓

S-IC and S-II A-1 Test Stands - Due to picketing by Operating Engineers (IUOE), both Corps of Engineers' contractors on these jobs were shut down from Friday, 11/18/66, through Monday, 11/21/66, and a large number of crafts' workers were off their jobs throughout the remainder of last week. Preliminary estimates indicate a slippage of two to three weeks in S-IC B-2 and S-II A-1 activation schedules because of recent labor troubles. We are working to see if any recovery is possible. ✓

S-IC-T Activities - Configuration verification is still in progress. Electrical system checkout with the Brooks Analyzer is completed. Boeing Quality, aided by two R-QUAL personnel, have isolated approximately 500 discrepancies in the mechanical systems of the stage. Present plans are that these discrepancies will be dispositioned by designated NASA personnel of the Activation Task Group in association with MSFC. ✓

Labor Situation - On Friday, 11/25/66, the Federal District Court at Gulfport, Mississippi, issued a temporary restraining order directing the local of the operating engineers' union (IUOE) to remove pickets from the site, and by the end of the day, the picketing was discontinued. Today all crafts' workers are back on the job except about 30 operating engineers on the Koppers Company job (S-IC B-2 and S-II A-1 test stands). A total of approximately 2,000 man days were lost as a result of the work stoppage caused by the IUOE picketing. On Wednesday afternoon, 11/23/66, all electricians on the site left their jobs as a result of a jurisdictional dispute involving work being performed in the A-1 portion of the S-II TCC by S&ID technicians and technicians of the Martin Company, activation subcontractor to S&ID. Electricians of Aetron, the GSE subcontractor to S&ID, contended that they should have been assigned the work being performed by the technicians. The international office of the electricians' union (IBEW) did not approve of the work stoppage and on the same day directed the business agent of the local to take the necessary action to get the electricians back on the job. Today most of the electricians are back on the job. ✓

NOTES 11/28/66 BELEW

11/28/66

B 11/30

ATM: The CMG Procurement Plan is now on Dr. Seamans' desk but as of this date has not been signed. Approval of this procurement is now one week in delay past the projected date of Nov. 21 and is affecting project schedules. Impact of the delay will not be known until completion of negotiations with Bendix. ✓

RACK/M&SS REVIEW: A Mockup Access Review will be at MSFC this week with representatives of MSC, AF, the Payload Module contractor, and North American present. An agenda has been agreed upon between MSFC, MSC and the -8 (Payload Module) contractor. The -8 contractor will provide a battery/black box insertion cart, with the interface being at the MSFC supplied instrument unit rails. MSC will provide MSFC with mockup requirements beyond the Nov. 30 Access Review. MSFC will estimate cost and manpower required to perform any extended use of the mockup. ✓

RACK MODELS: Scale models of the Rack, 1/4" = 1', incorporating various experiments (ATM, EMR, Thermo, M&SS) are available for demonstration of Rack capabilities and three-dimensional visual location of potential experiments and subsystems. ✓

ORBITAL WORKSHOP STATUS REVIEW: The Dec. 1 Status Review has been postponed at the request of R&DO until Dec. 13 to allow better assessment and redirection due to the cluster decision. KSC and MSC have been notified. ✓

GENERAL: Mr. Webb recently announced that Mr. Charles Matthews was being transferred to Washington for a Post Apollo assignment. AAP director ✓

MSFC/MSC MEETING ON MULTIPLE DOCKING ADAPTER AND RE-SUPPLY MODULE: Meeting was held with MSC personnel on the MDA and RM to develop a common set of design groundrules. The MSC people reviewed for us a rather sophisticated, "unsellable" MAC approach (approx. 1,200 cu. ft. can) with a 9 million dollar cost. We advised MSC of our approach to "square out" the volume of our original docking cross to provide space for storage and staging the OWS experiments but retaining the same basic dimensions and low cost. A set of common design groundrules was established. MSC will redirect MAC to "propose" a MDA according to the groundrules discussed. We will brief you in 7-10 days. ✓

LM/ATM MSC/MSFC Task Team: MSC has agreed to the draft charter for this team. MSFC membership is being finalized, and a meeting of the team will be called this week. ✓

MISSION REQUIREMENTS DOCUMENT: Discussions are being held with R&DO considering this document as a joint MSC/MSFC plan. Discussions with MSC will follow shortly. ✓

11/28

F-1 ENGINE During the first acceptance test on deliverable F-1 engine 5053 on 11-21-66, an erosion occurred on the tip of the inner circumferential baffle. The test duration was 42 seconds with no effect on performance which could be attributed to the eroded area. The injector has been removed from the engine and returned to Canoga Park for investigation and analysis. The cause of the erosion is not known at this time, but baffle coolant orifice plugging is suspected. ✓

H-1 ENGINE Engine H-4078 which had a turbine malfunction during the first static test of S-IB-8 has been shipped to Neosho for failure analysis and rework. Spare engine H-4071 has been utilized to replace the discrepant engine. No delay in the static firing schedule is forecast. All other engines on S-IB-8 performed satisfactorily. Analysis of engine H-4078 should be complete by December 15.

A meeting is scheduled in the I. O. Conference Room at 9 a. m. on December 1, 1966 to discuss what action is required to assure that no further contamination exists in the engines on S-IB-7. Engine H-7080 from this vehicle was originally found contaminated with Teflon and has been replaced by engine H-7074. ✓

J-2 ENGINE The next test at AEDC is scheduled for this week. The test will consist of two Saturn V/S-IVB first burn starts. Subsequent to the two firings, the heat bank for simulating orbital temperatures will be checked out. In the original modification to the test cell, a heat bank was added on the start bottle side of the engine to simulate orbital heating and a cryopanel was installed on the opposite side to simulate the orbital cold side. Since installation of these environmental systems, the data from SA-203 has indicated that there will possibly be a hot side and a hotter side in orbit. In the test this week, the initial heat bank will be checked out to determine its capability to simulate the condition that existed on SA-203 and also to simulate retro and ullage impingement on the thrust chamber. (In the event this initial heat bank cannot produce the latest predicted orbital temperatures, a second heat bank is currently being fabricated for installation early 1967.) The test this week will turn the lower half of the heat bank on maximum heating rate in order to determine the maximum temperatures that can be obtained without exceeding the redline temperatures of critical engine components. This will be followed by turning the upper half of the bank on (above the fuel manifold), to determine: (1) if the temperature limits of the critical components can be reached, (2) if component protection will be required when testing with the thrust chamber bell at simulated retro and ullage motor impingement temperatures. ✓

NOTES - 11/28/66 - CONSTAN

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Nothing of special significance.

NOTES 11/28/66 FELLOWS

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1. Saturn V Damper Systems Research and Development Plan (RDP): A reissue is being furnished to IO of the Saturn V Damper Systems Research and Development Plan (RDP), which updates the September 15, 1966, AS-501 Damper System RDP. This new RDP includes requirements for the auxiliary damper system, in addition to the primary damper system described on September 15, and also maintains the original IO demand schedule for the damper system: a January 3, 1967 roll-out date, with a shipping date from MSFC of December 26, 1966. Although the new RDP is being published with the January 3 date in the interest of time, errata sheets will be published, as soon as available, to indicate a new KSC on-dock date of February 1, 1967, for the primary and auxiliary damper systems with a shipping date from MSFC of January 29, 1967. That new schedule will provide Test Laboratory the 31 days needed to accomplish the minimum qualification test program specified in the damper system plan. This schedule relief, if approved by IO, will enhance R&DO confidence that the system will perform as intended. ✓

2. Selection of the AAP Payload Integration Facility: (Reference your November 5 note attached.) Mr. Belew has planned a briefing to you on December 15 which will include recommendations of the AAP Integration Ad Hoc Facilities Committee on the Payload Integration Facility Plan (reference NOTES 11/14/66 BELEW). Therefore, we will not plan a separate briefing unless you so desire. ✓

NOTES 11/28/66 GEISSLER

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1. AS-501/502 Trajectory Reshaping Study: Preliminary results of the feasibility study of providing an Atlantic Ocean recovery for 501 and 502 spacecrafts to minimize recovery operations cost are as follows (reference Notes 11/21/66 Geissler). On AS-501, an Atlantic recovery can be obtained from waiting orbit injections over the U.S., Eastern Test Range (ETR), or Australia. However, all profiles exceed the 12 hour mission duration limit imposed by the S/C inertial measuring unit (IMU) drift rates with the exception of the Australia injection. Generally, injections over the U.S. or ETR provide satisfactory tracking of both launch vehicle powered flight periods but results in S/C dispersion footprints which partially overlay land masses. Furthermore, premature termination of S-IVB thrust can result in stage impact upon land masses. For these profiles the S/C trajectory tracking and communications would have to be augmented by ships and/or aircraft. Injection over Australia provides significantly less satisfactory tracking coverage for the S-IVB stage second burn. The S/C burn and re-entry will be away from any existing land tracking capability, thus again requiring ship support. The S/C footprint will extend across S. Africa; however, any premature S-IVB shutdown will not result in a land impact. The AS-502 profiles have not yet been investigated, but it is anticipated that the S/C could make the primary adjustments after separating from the S-IVB stage. The 12 hour IMU constraint would probably again require second ignition over Australia. MSC representatives will be briefed here on our input to the study Nov. 28-29, 1966. Gen. Phillips has requested recommended OMSF course of action by Dec. 1, 1966. MSC is to take lead in this study. ✓

2. Saturn V and IB Systems Engineering Incentive Contracts: Negotiations with Boeing on the Systems Engineering Documentation (Task 8.0) portion of the incentive contract have been completed. Our Projects Office represented R&DO in this task. The negotiated plan includes motivating incentives in the areas of: (1) flight verification (a measure of Boeing's system integration support and computation accuracy); (2) schedule (an award or penalty for delivering documents on time or late); and (3) performance (a measure of Boeing's ability to produce adequate software in support of the Saturn V Program). The incentive features will impose an added burden on MSFC personnel associated with Task 8.0, in the form of additional paperwork, schedule monitoring, and a decrease in program operating flexibility. However, we have made every attempt to minimize the added burden inherent with incentive contracts by providing special clauses for program flexibility. The incentivizing of the CCSD systems engineering contract has been perturbed by recent Saturn IB mission changes which require that all delivery schedules be reworked.

Negotiations will be continued and delivery changes will be integrated into the contract. The real problem is in finalizing the incentive plan, since it is contingent on firm document delivery schedules. This exemplifies our belief that incentivizing does not allow proper flexibility in conducting systems engineering efforts. In view of (1) the above and other unforeseen perturbations, (2) the fact that AS-209-212 AAP missions are quite fluid, and (3) the fact that CCSD has worked for a year under a contract that is yet to be negotiated, it is being proposed within R&DO that the CCSD Systems Engineering Contract be based only on cost incentive. ✓

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1. IU-204: Modification work continues on this unit even though it has been at KSC for three months (since August 15, 1966). Five ECP's had not been installed as of November 18, 1966. IBM will supply kits to KSC to make these modifications. All kits are expected to be available to KSC by November 27, 1966. ✓
2. S-IC-1: On November 17, 1966, a malfunction occurred during testing of the S-IC-1 stage at KSC. In applying power to the measuring rack selector, this assembly and six cables were damaged. Four cables and the measuring rack selector were damaged to the extent that replacement is necessary. Two cables were repairable. The cause of the malfunction was attributed to two factors: (1) Wiring in the ESE allowed the 28-volt DC source polarity to be reversed, and (2) an ESE 50-ampere circuit breaker failed to open when the short existed. The ESE was wired according to documentation, which is a design error. The circuit breaker had a manual locking device which would allow the breaker to be locked in the closed position. It is suspected that the breaker was in the locked-in position and was an operational error. No discrepancies were found in the S-IC-1 stage that contributed to the malfunction. The replacement items are now available at KSC and the two cables are being repaired. ✓
3. APOLLO TELESCOPE MOUNT: Last week, accompanied by representatives of Astrionics Laboratory, Contracting Office, and IO Project Office, a Q&RA Laboratory team composed of Laboratory and Division Project Engineers visited the Ball Brothers Research Corporation (BBRC), Boulder, Colorado. The trip was primarily to work out the Quality and Reliability Plans for the ATM and this mission was accomplished. BBRC will be the prime subcontractor for three of the principal investigators contributing experiments on the ATM. ✓

NOTES 11/28/66 HAEUSSERMANN

11/28 9:45

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1. ATM (Apollo Telescope Mount):

After careful consideration, regarding the future application of flat conductor cable, I have decided in favor of selective and limited use of it in the ATM. I consider representative experience can be gained through use of flat conductor interconnection of the ATM measuring racks and associated equipment and of the ATM pointing control subsystem. The ATM measuring rack design will be the same as one rack flown on AS-201 which utilized flat conductor cabling. The new black boxes of the pointing control subsystem (CMG's, sun seeker, and associated electronics) will be designed with flat connectors. ✓

The principal objective is to gain hardware development experience from design through flight application in order to determine the practical advantages/disadvantages of flat cable. This experience will then determine whether to select flat cable in future weight-critical payloads, such as Voyager. ✓

The impact of this course of action in ATM is being coordinated with other laboratories involved and with the Apollo Applications Office. ✓

2. Saturn V Launch Vehicle Digital Computer:

The launch vehicle digital computer for Saturn V will need 8 memory modules. This is to accommodate capacity necessitated by increased mission requirements, such as providing for real-time contingencies; an example of this is the alternate sequence which provides early staging capability for the S-IVB stage in the event of a malfunctioned S-II stage. The AS-501 LVDC will be retro-fitted for 8 memory modules at the Cape. The software for 501 is already oriented for the 8 modules. ✓

NOTES 11/28/66 HEIMBURG
11/28/66

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F-1

F-1 Engine S/N F-5038 was installed in the West Area F-1 Test Stand on November 22, 1966. The next test is scheduled for December 1, 1966. ✓

S-1C

The S-1C-3 stage was removed from the test stand on November 21, 1966, and loaded on the barge November 22, 1966. The stage will go to Michoud for refurbishment and post-static checkout prior to shipment to KSC. ✓

S-1B-8

A spare engine has been installed in Position No. 6 on S-1B-8. The engine which was removed because of a damaged turbine has been sent to Neosho. The duration test, SA-41, is scheduled for November 29, 1966. ✓

LOX BARGE

The MTF lox barge which was damaged in the bridge collision on September 16, 1966, arrived in Huntsville on October 15, for repair. Because of the problems encountered at the time a chlorine loaded barge sank near Natchez about a year ago, the Coast Guard has tightened their procedures and codes. As a result they required approximately 850 X-rays of the newly fabricated pipe of our damaged lox barge. The barge will be ready for shipment to MTF on December 7, 1966, when the S-1B stage is scheduled to depart for Michoud. ✓

NOTES 11-28-66 HOELZER

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Negative Report

NOTES 11/28/66 JAMES

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AS-205 MISSION CHANGE REQUIREMENTS: Our initial analysis of hardware changes caused by the AS-205 mission change indicated that there would be significant hardware change in only the IU with very little change in other stages. These changes included primarily: (1) modification to EDS distributor to interface with S-IVB and spacecraft relative to S-IVB tank pressure display in the spacecraft, and (2) modification to EDS distributor and addition of wires between EDS distributor and the LVDA and between EDS distributor and flight control computer to provide spacecraft backup attitude control capability. Because of the time required to run the IU back through the manufacturing checkout stand and at Gen. Phillips' suggestion, we were considering changing and flying the SA-207 IU for the AS-205 mission. However, it now appears that the hardware change will not be as great as first expected. MSC has agreed that there is no requirement to tie the spacecraft orbital control to the launch vehicle which would reduce considerably the changes and cable rework required. It is anticipated that Gen. Phillips will agree to delete this requirement this week. We have also determined that there is approximately two weeks of IU checkout stand time available starting January 17 without interference. Because of the above, we plan to give no further consideration to switching the IU's between SA-205 and SA-207. ✓

INTERFACE COORDINATION WITH SATURN IB PROGRAM/SAA PROGRAM:

The SAA Program is now getting to the point where we are noticing that the interface requirements with the Saturn IB Program are increasing considerably and there are indications of increased longer range mission planning interface requirements. We plan to meet with Mr. Belew and some of his people today to discuss some of these upcoming interface requirements as well as coordination required on the S-IVB workshop mission. ✓

REMOVAL AND REPLACEMENT OF FLIGHT HARDWARE AT KSC: Both Dr. Rees and we recently became concerned about the volume of flight hardware changeout at KSC because of the extended period of time that the SA-204 is remaining on the launch pad. We have just completed a brief study and report of this hardware changeout that is being forwarded to Dr. Rees in answer to his question. In general, although the changeout rate appears quite high the findings are that most of the changeout appears to be required, most changes are known to our Saturn IB office at KSC, and all configuration changes are approved by MSFC prior to change. KSC is operating within the MSFC/KSC agreements and is trying to launch a reliable functional vehicle that operates within the limits required by MSFC. I don't feel this review indicates any requirement for change in this area. ✓

NOTES 11-28-66 JOHNSON

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Experiments Office Visit to Headquarters - During the period 11-28 through 11-30-66, Messrs. Chase, Miles, and I will be in Washington, D. C. to discuss with the major Headquarters Program Offices their budgets in the areas of research tasks and experimental activities and to solicit their advice on how MSFC can best work with them in these areas. We plan to contact Messrs. Lord, Beckwith, and Gray from OMSF, Mr. Foster from OSSA, and Dr. Adams, Dr. Kurzweg, Messrs. Jones, Ames, Novik, Buckley, Tischler, and Sullivan from OART. ✓

After our return, we will prepare a presentation to you on research tasks and experimental activities based on the information gathered in these meetings and an in-house assessment. Tentatively, we plan to have this presentation ready, at your convenience, by the end of December. ✓

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NOTES 11-28-66 KUERS

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LEM Rack Components Procurement:

As of this date, 13 out of 14 RFQ's have returned a no bid on the very complicated corner attach fittings and the SLA attach fittings. R-ME anticipated the probability of such an occurrence and has been making a parallel approach by machining separate simple parts of each fitting and then joining these parts by electron beam welding to make a complete fitting. This approach does require additional processing but is necessary in order to use in-house capability to best advantage. Test welds have been completed and indicate that this is a feasible approach. Configuration weld samples will be delivered to R-P&VE as soon as possible for concurrence. ✓

Raw material procurement has become a problem. The tubing as specified by design has a normal delivery time of 11 months, but may be procured by March 10, 1967, at a premium cost. This date is still seven weeks late according to the production schedule and may not allow time for tool tryout and development. ✓

Material procurement is also a problem with the extruded angles. In this instance the problem will be relieved by welding angles from plate stock for the first few racks. Program stock left over from the Saturn V effort and other material diverted from less critical programs are being utilized for the remaining requirements. The Payload Module docking collar, for instance, is being fabricated from two rings in lieu of one in order to meet schedule and use existing material. ✓

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1. IN-HOUSE VOYAGER SHROUD DESIGN STUDY: The following items of progress are noted: (a) voyager Planetary Vehicle dynamic envelopes have been defined by MSFC and JPL and published, (b) the Voyager/Saturn V launch vehicle configuration and weight summary have been defined and published, (c) launch vehicle flight trajectory has been calculated and vehicle aerodynamics largely determined, (d) shroud separation study, shroud venting analysis, and structural design study have been initiated, (e) KSC contacts have been established (Messrs. Hock and Stahley). The midterm review for MSFC management has been rescheduled for 12-20-66. ✓
2. S-II LOX RECIRCULATION SYSTEM: System testing of the liquid oxygen recirculation system required for thermally conditioning the J-2 engine revealed performance inadequacies. Further testing explored the sensitivity of the local environment and evaluated several potential "fixes". With this data as a basic, vehicle change recommendations for problem solution have been made; S&ID and IO concur. The fix will involve helium injection for augmenting the existing thermal pumping system during flight. Changes to the compartment purge system will be minor. All system design details are to be available by November 29, 1966. Solution of this problem is mandatory. ✓
3. NUCLEAR GROUND TEST MODULE (NGTM): Analysis of preliminary fluid requirements and other available data is continuing in order to complete preliminary piping criteria and physical ICD block diagrams by December 1, 1966. Flow calculations indicate many current lines described on Kaiser (NGTM facilities contractor) drawings are undersized to handle the flow specified in the preliminary fluid requirements. These discrepancies are being investigated. ✓
4. REFERENCE NOTES 11-7-66: In the event of a micrometeoroid penetration of a gaseous oxygen pressurized Orbital Workshop, current data indicate approximately ten minutes after the penetration would be available for astronaut escape. However, the inner tank aids planned for temperature control could preclude astronaut observation of the impact when it occurred. Because of this situation, we are designing a two-gas system, (Oxygen-Helium) which will eliminate the fire hazard associated with micrometeoroid penetration by dilution of oxygen to less than 45% by volume. In the event of a penetration with either a one or two-gas system, the Workshop could be repaired to maintain pressure in space with state-of-the-art techniques. However, repair to the passive temperature control system, in the event of a fire with the one gas system, is still under study and could be a major problem. Primary effort, therefore, is placed on the design of the two-gas system. We will discuss this during the Workshop Quarterly Review on December 13. ✓

B. L.

How does that interface
with MSC and the airlock? B

NOTES 11/28/66 MAUS

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AMERICAN ASTRONAUTICAL SOCIETY NATIONAL MEETING -

During the National Conference on the Management of Aerospace Programs held recently at the University of Missouri, Mr. Peter Hatt of OSSA presented the proposed management systems which are contemplated for use on Voyager. There is a striking similarity between the approach being considered by OSSA and that now applied by MSF in Apollo. At this same conference General Phillips presented the overall view of the Management Scheme for Apollo.

We were also gratified to find at this conference that the NASA and MSFC work in the analytical approach to program estimation and in the field of incentive contracting is more advanced than that presented by speakers representing other agencies at the conference. ✓

ORGANIZATION CHANGE AT MSC - The proposal to establish a visible and strong space science capability at the Manned Spacecraft Center, as previously reported by Dr. Stuhlinger, is now being firmed up by Houston. We have received word from Paul Cotton's office of a formal proposal to establish a "Directorate of Science" at MSC. This directorate would pick up the Experiments Program Office and Space Science Division, now assigned to Max Faget, and would include the recently established Lunar Receiving Laboratory. Bob Piland would get the job of deputy director for the new directorate. This change has not yet been approved by Dr. Mueller. ✓

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Crew Safety Redundant Shutdown: Several weeks ago it was pointed out that the explosion that occurred on the F-1 engine during the pre-valve shutdown was causing a re-evaluation of the use of pre-valves as a redundant means for thrust termination for crew safety purposes. Upon re-examination of all engines the following are the methods by which the engines will be shut down for crew safety purposes:

- a. H-1 Engine - The redundant Conax valve existing in the engine will be used as the two means.
- b. J-2 Engine - The existing cutoff circuit in the J-2 electronic control assembly will be used, backed up in an abort by removal of total power to the engine.
- c. F-1 Engine - The present four-way valve will be used as one method, backed up in an abort situation by the use of an additional valve which will apply fuel delivery pressure directly to the shuttle in the four-way valve, causing cutoff. (An auxiliary valve is presently used in all test stand applications. A valve is being qualified for flight by NAA.)

In all engines the pre-valves will still be closed, providing two conditions are met: (1) a cutoff command has been issued, and (2) the thrust has begun to decay, as sensed by the thrust OK pressure switches. Closing the pre-valves under these conditions will help in one possible situation--engine failure and ruptured lines upstream of the main valves. In this case, closing the pre-valves will stop propellant flow, reducing the possibility of a catastrophic explosion. ✓

All changes that are required to accomplish the above redundant means are being implemented through the existing change procedures. ✓

NOTES 11/28/66 RUDOLPH

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1. S-IC-1 Stage - experienced an electrical short with application of power to stage on Wednesday, 16 November 66. Several electrical cable harness assemblies and a measurement rack were damaged.

Problem has been isolated to incorrect wiring. Fault has been corrected and damaged components replaced. ✓

2. S-IC-3 Stage - shipped to Michoud for refurbishment via barge Poseidon on Tuesday, 22 November 66. Arrived on dock Michoud, Sunday, 27 November 66, (four weeks ahead of schedule). ✓

3. S-II-1 Stage:

- Partial LN₂ retanking (LOX tank only to 40% level) to certify doubler seal was successfully completed on Wednesday, 23 November 66.

No leaks were found.

- 1st acceptance firing still anticipated for Thursday, 1 December 66.

4. S-II-F/D Stage - cracks repaired and stage turned over to Boeing on Monday, 21 November 66. Stage mated to S-IC-D in Dynamic Test Tower on Tuesday, 22 November 66. ✓

5. S-IVB-501 Stage - checkout at KSC progressing on schedule with no major problems. ✓

NOTES 11/28/66 SPEER

11/29/66

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1. SATURN HIGH PRECISION TRACKING: Dr. Mueller (in a letter to you) has decided to give no further consideration to any future use of the Unified S-Band transponder in conjunction with existing ground stations as high precision tracking system. We have also been notified that NASA (MSF) will become sole user of the existing Azusa/Glotrac tracking system (operated by DOD) after June 67. This means an estimated additional price tag of 1.5 Million \$ / year. We (MSFC) are therefore requested to consider discontinuation of these DOD facilities after AS-204 and AS-503. An actual removal of the on-board hardware would not necessarily be required at that point in time. Although high precision tracking is desirable for operational flights, I do not believe that our requirements are sufficiently hard to justify the additional cost which were carried by DOD in the past. We are also requested to eliminate ODOP tracking of the first stages after the above mentioned missions. However, in the meantime we have received a strong request for ODOP from KSC for their impact prediction system. This office will coordinate a reply to Dr. Mueller for your signature. ✓

11/28/68

1. TRANSFER OF LUNAR SCIENCE TASKS TO MSC: Copies of the technical reports generated under our lunar science contracts have been transmitted to MSC. Mr. Vale (Mr. Piland's Deputy) has indicated that he will contact us if any further information is required on these completed efforts. The approved work statement on the Lunar Surveying System, which we prepared, has been made available to MSC by Headquarters. Thus, the transfer of the Space Sciences Lab contracts has been completed. No physical transfer of the official MSFC contract files was required because all of the contracts had been or are in the process of being closed out. What remains to be established with MSC is a mechanism of coordinating MSFC's continuing work in the lunar program on the LSSM, the Moderate Depth Drill, and the Lunar Flying Vehicle. ASO is taking the initiative to establish this coordination. The tasks which we are working on for Mr. Wilmarth (OSSA) are in the SR&T category and have general and broad planetological applications. It is not necessary to coordinate these tasks with MSC, particularly at the present early stages of these efforts. MSC is aware of our work in these areas. The only SSL efforts in the mainstream post-Apollo lunar program will be Mr. Bensko's role as Project Scientist, and hopefully Principal Investigator, on the Moderate Depth Drill; and Dr. Costes' support of the LSSM development in the Soil Mechanics (Mobility) area. ✓

A memorandum, replying in detail to your question on my previous Notes of 10-24-66, (attached) is being sent to you this week. ✓

This transfer of lunar surface exploration work to MSC marks the end of a nine-year period during which we established and maintained a small, but very active and competent group for lunar exploration studies (lunar science, experiments, instrumentation, observation programs, geophysical traverses). This group was supported by each of Space Sciences Laboratory's branches, and by our Support Contractor (Brown Engineering). We enjoyed excellent cooperation with our counterparts in Headquarters, at the USGS, at universities, and in industry, and we found this work program most interesting and rewarding. It is our hope that at least some of the momentum of the post-Apollo lunar exploration program, which is in danger of being lost now because of the transfer and lack of funds, can be retained so that NASA has a meaningful lunar program. ✓

Those members of Space Sciences Laboratory who were engaged in lunar work during past years are now working on ATM, Voyager, EMR, Synchronous Satellite Payloads, and other projects involving scientific objectives planning. ✓

NOTES 11/28/66 WILLIAMS

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11/28/66

1. Voyager: The R&DO Labs are beginning to get on board in the Voyager Spacecraft area with first priority being to educate ourselves concerning the program and technology studies already completed and underway. The immediate in-house work needed prior to studies leading to a Phase "C" procurement package has been assigned to the labs. ✓

2. Saturn Improvement Studies: A summary presentation of the recently completed Saturn Improvement Studies was presented in Washington to a joint meeting of OSSA, OART and OMSF. There appeared to be more than passing interest in these studies. Approximately 35 Headquarters people attended the 2 1/2-hour presentation. ✓

3. Space Station Committee Presentation to Dr. Seamans: Dr. Seamans had a last minute schedule conflict which necessitated an extremely short discussion (about 20 minutes) with him rather than the planned 2-1/2 hour presentation. He asked that we reschedule the presentation in about two weeks. I would like to review the total presentation with you prior to the Seamans meeting if you can find time. ✓

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Bonnie
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12/1/66
Please arrange
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