

Dec 1, 1969

NOTES 12/1/69 BALCH

B 12/1

S-IC-13 Stage was installed in the test stand on 11/24/69. "Power-up" is scheduled for 12/8/69. ✓

S-II-9 Stage is in the vertical position in the S-II Stage Checkout and Storage Building. Final modification period is scheduled for completion on 12/17/69, and shipment to KSC is scheduled for 1/8/70. ✓

S-II-10 Stage is in the horizontal position in the S-II Stage Checkout and Storage Building. Insulation repair is in progress and is scheduled for completion on 12/13/69. ✓

S-II-11 Because of indication of thrust degradation on Engine No. 5 during static firing on 11/14/69, the Gas Generator LOX injector was inspected to determine if blockage of holes had occurred. Four of the 24 holes were found to be plugged. The contaminant has been identified as a LOX-safe flourocarbon resin which is applied to the threads of the injector during assembly (This same problem was encountered on one of the engines of the S-II-3 stage). Necessary components have been recleaned, and the Gas Generator has been reassembled. Static test instrumentation is being removed. Stage is scheduled to be removed from test stand on 1/13/70. ✓

9F.12.1

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MULTIPLE DOCKING ADAPTER STRUCTURAL BASELINE:

As a result of structural meetings with S&E, MMC, and MDAC-ED, the go-ahead has been given on the following mandatory structural mods to the MDA:

1. Window size 16 1/2 x 19 clear viewing area, with only the position 3 window of optical quality. (To provide for larger earth-viewing camera package) ✓
2. Intermediate ring frame added 48" from the Airlock interface and increase lower cylinder to .250" thick. (Necessary to provide more uniform loading at the Airlock/MDA interface) ✓
3. Add landed area in conical bulkhead for docking target relocation. (Due to CSM reclocking $\approx 180^\circ$) ✓
4. Modify axial tunnel for 600,000 in-pound bending moment. (To accommodate the latching loads) ✓
5. Add structure at the Airlock/MDA interface to accommodate heavy packages in the lower section of the MDA. ✓

EXPERIMENT DELIVERY REQUIREMENTS/FACTORY CHECKOUT:

The Orbital Workshop (OWS) experiment integration test (receiving inspection, bench testing, and factory checkout) meeting was held on November 24 and 25, 1969, between MSC, MSFC, and MDAC-WD. It was agreed that MDAC-WD would witness factory acceptance of experiments at the vendor's plant to assure that the experiment is acceptable for installation in the OWS. This should negate the requirement for additional bench testing at MDAC-WD. There still remains to be worked out the detailed integration of experiments into the OWS since their delivery is not compatible with OWS need dates to meet a July 1971 delivery date. ✓

ATM MONTHLY PROGRESS REVIEW: The ATM Monthly Progress Review was conducted this week. The Thermal Systems Unit continues to be the pacing item. Weekly status reporting meetings are being held. In addition, S&E Director's Office is reviewing in detail the status of in-house commitments with respect to late hardware deliveries and potential solutions. ✓

BIOMEDICAL EXPERIMENT PRELIMINARY DESIGN REVIEW (PDR):

Preliminary Design Reviews were held at MSC on November 18-21, for biomedical experiments M092, Lower Body Negative Pressure; M171, Sagometer; and the Experiment Support Systems (ESS). None of the RID's had major impact against either the schedule or the funding. The Critical Design Review (CDR) for M092 and M171 is scheduled for March 1, 1970, and for April 15, 1970, on the ESS. ✓

9/12/11

B 12/1

Fitzhugh Subcommittee Visit - Secretary of Defense Laird has established a special committee, chaired by Mr. Fitzhugh, Chairman of the Board of Metropolitan Life Insurance Company to look into the area of DOD policies and organization. A subcommittee of this committee will visit MSFC December 15-16, 1969, for the purpose of gaining an understanding of the Saturn Program management. The subcommittee will compare Saturn Program management philosophy, techniques and organization with program management within Department of Defense. A tentative agenda has been prepared for this visit and this agenda will be responsive to a list of 23 questions which we have received from the subcommittee.

*asked
committee to
get who one
1969
1973*

Status of Congressional Activities - The closeout session of the Wilson/Gould staff study on Future Manned Space Flight Effort and Launch Rate was held at MSF November 24. We expect to receive a transcript in the next few days, but there apparently were no indications as to the conclusions of the study.

*W.B.
I'd like to
see that
transcript
B*

In other Congressional actions, NASA's \$3696.6M FY-70 Appropriation was signed by the President on November 26. Also on that day, the Senate confirmed the nomination of George Low to be Deputy Administrator of NASA. (Another event of interest this past week-end was the hospitalization of Senate Space Committee Chairman Anderson for treatment of Parkinson's disease.)

Presidential Letter of Appreciation - We received a request from Dr. McConnell of the NASA Executive Secretariat for a list of candidates who performed some particularly outstanding feat in connection with the Apollo 12 launch. President Nixon wants to extend his personal appreciation by letter to candidates who fit this criteria. This particular request is on an ad hoc basis but it is likely that the practice will be continued for future launches. The emphasis for selection is on non-government people.

NOTES 12-1-69 BROWN

9/12/11

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No report.

B 12/1

JF, 12/1

1. HIGH ENERGY ASTRONOMY OBSERVATORY: The Announcement for Flight Opportunities document has not yet been released to the science community. It is apparent that Dr. Naugle will not release the AFO until the present negotiations between the BOB and NASA regarding the FY-71 budget have been completed. If HEAO survives the present BOB review as an FY-71 new hardware start, the AFO will be released. If HEAO is deferred to FY-72, I believe that OSSA will still desire to proceed with the Phase B HEAO definition study contracts planned for early next year, and it may still be possible to get a modified version of the AFO released by OSSA.

Dr. Al Schardt, who works for Mr. Jesse Mitchell in OSSA, has requested that we begin to consider and define a future version of an HEAO spacecraft to accommodate a cosmic ray experiment utilizing a large superconducting magnet, such as proposed by Dr. Alvarez. Analyses will be required to evaluate the magnet's interaction with the earth's field and associated spacecraft stabilization problems and to determine the state-of-the-art of liquid helium refrigeration systems for space applications. ✓

2. EXPERIMENT MODULE CONCEPTS STUDY: The mid-term progress review of this contracted effort with General Dynamics/Convair is scheduled for December 4 at MSFC. Mr. Max Nein in my Office is COR. This contract is being closely coordinated with the Phase B Space Station definition study. Immediately after the mid-term review, several common module concepts will be selected for further analysis during the remainder of the contract. Personnel from NASA Headquarters and other Centers will participate in this mid-term briefing. ✓

1. Flexible Baffle Program: A meeting was held on November 6, 1969, with Dave Stephens, Langley Research Center, regarding a research and development program aimed at proving the feasibility of a flexible baffle system for the Shuttle. At present, it appears that this program will consist of two parts, a contractor-conducted development program which will consider the various design problems and an experimental program to prove the concept. The funding for the development program (\$60,000) will come through Langley, but Harry Buchanan, AERO-D, will be a contract monitor, along with Dave Stephens of Langley. After a discussion with Dick Stone (S&E-ASTN-TFM), it was decided that the 40% scale S-IC LOX tank would be the most suitable facility for the experimental portion of the investigation. This S-IC LOX tank will require some modifications and ASTN is currently attempting to determine a cost. As it now stands, this test will be conducted here with technical direction from S&E-AERO-DFS and Langley. ✓
2. Space Shuttle Environmental Design Criteria: Environmental design criteria for horizontally flying vehicles presently available to the Air Force are based upon the past performance of selected aircraft but cannot be directly applied to the space shuttle design because they inherently assume - from a limit-load viewpoint - an aircraft lifetime of 60,000 hours. Space shuttle lifetime will be considerably lower. To develop proper environmental criteria for the shuttle, laboratory personnel are conferring with the System Engineering Group at Wright-Patterson AFB. Finalization of the criteria through discussions between our Dr. Fichtl and AF personnel is expected for December. ✓
3. Saturn V Workshop Trajectory: During your visit to this laboratory on November 21 you expressed concern over the status of the AAP-1 (workshop) trajectory. The inhouse effort on a preliminary nominal trajectory to a 235 nmi. 50 deg inclination orbit is well underway. A maximum payload capability trajectory for no winds is completed and the payload requirement case should be completed by Nov. 28. A trajectory biased for pitch and yaw winds should be available by Dec. 5 and will be published as soon as possible thereafter. The dispersion analysis which leads to the design trajectories will be done by Boeing. If negotiations are successful, these efforts will be initiated Dec. 1, to be completed Feb. 20. We did not feel that we could do the job inhouse because of insufficient manpower and poor computer turn-around time. ✓
4. AS-507 S-IVB Slingshot: A method has been established to simulate the S-IVB trajectory starting in earth orbit through TLI based on an IU vector and tracking vector which can be different from the former due to guidance errors. If this capability had existed here for the Apollo 12 mission we probably would have had a successful S-IVB slingshot. Two vectors have been supplied to PM-MO for use by the Smithsonian Astronomical Observatory (SAO) which will attempt to view the S-IVB when it approaches the perigee point (between 150,000 and 175,000 km). We do not expect that they will be able to see the stage, though. ✓

NOTES 12/1/69 GODFREY

B
12/1

JF 12/1

Saturn:

1. S-II-7 POGO Oscillations: Meetings were conducted Tuesday and Wednesday, November 25 and 26 with S&E and North American to review the status of plans for resolving the S-II POGO oscillations. As stated last week, two courses of action are being followed. One, justify flying AS-509 and subsequent as is. Two, add a center engine LOX accumulator system. Plans were made to align required action for a decision on December 15. This date will allow the accumulator to be installed on S-II-8 and static fired on S-II-12 prior to S-II-8 flight. Additional investigations are underway on engine to engine variations on S-II-7 and earlier stages. We are attempting to gain a better understanding of the cause of the buildup on S-II-7 prior to a final decision. ✓

LRV:

A working interface meeting with MSFC, MSC, Boeing, and Grumman on November 13 yielded an unanticipated problem. Preliminary LM drawings showing three primary LRV tie points had been treated as formal ICD's by Grumman, and completed drawings had been released to Manufacturing for LM-10, etc. Boeing, with our concurrence, considered the Grumman drawings as preliminary and for various technical reasons involving weight and ease of deployment, reflected different LRV/LM tie points in their design.

In a meeting at MSC on November 25, agreements were reached for Boeing to provide necessary redesign to conform to Grumman's lower hardpoints and Grumman will redesign the upper hardpoint attachments to withstand the LRV launch and boost loads. Agreements were also reached on the method and responsibilities for deployment attachments. Formal ICD's defining this interface (LM/LRV) will be prepared and a meeting to hopefully reach agreement on the ICD's between the centers and prime contractors is tentatively scheduled for December 10, 1969. ✓

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NOTES 12-1-69 GOERNER

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NOTHING OF SIGNIFICANCE TO REPORT

9/12/11

DLRV TEST VEHICLES - Two small "all terrain" vehicles have been received for use in performing field tests of navigation, hazard detection, and other candidate subsystem components. One vehicle has been modified with an equipment platform for mounting directional gyros, sun sensor, electronics, power supply, recording instrumentation, display equipment, etc., for performing functional tests of the navigation system. These vehicles will be used to checkout and test various components and equipments prior to the integrated systems tests with the MTF planned for first and second quarters of 1970 at remote sites such as Flagstaff. ✓

SPACE STATION MONTHLY REVIEW - The regular Monthly Review is scheduled for December 10, 1969, at 8:30 AM in the HOSC Conference Room, Building 4663. The entire 3-month period will be summarized. A series of splinter meetings is planned for December 11, 1969. ✓

SPACE SHUTTLE FIRST STAGE EXPENDABLE QUESTION - Messrs. Voss (MSC), Akridge (MSFC), and Summerfelt (NASA Hq.) wrote a summary of the history of previous reusable studies and identified "where we are today and how we got here." The purpose of this was to prepare a memo from Dr. Mueller to Dr. Paine and an answer to Dr. Gilruth to dispense with the expendable first stage question being raised in connection with the shuttle. The items considered were the Bellcomm S-IC first stage, McDonnell Douglas Corporation's ballistic first stage, and other proposals. Essentially, the summary will substantiate that we should proceed with Phase B on a fully reusable, two-lifting stage vehicle. We will furnish you the completed correspondence as soon as it is received. ✓

Please do 3

SHUTTLE ENGINE FACILITIES - Arnold Engineering Development Center (AEDC) personnel visited the Center on November 24 to present results of their studies on cell modifications for altitude testing of the Shuttle engine. Their preliminary estimate of total get-ready cost, including test-article supporting system and all other equipment, is approximately \$8 million. The cost is divided between C of F budget type items and operating-contractor overhead and in-house work. AEDC desires to continue studies which have the potential of reducing facilities modification costs by approximately \$3 million. An interesting possibility involves the use of carbon dioxide instead of nitrogen to dilute the free hydrogen in the exhaust. This dilution is necessary to facilitate pumping. ✓

12-1
NOTES ~~11-28-69~~ GRAU

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No submission this week.

NOTES HAEUSSERMANN 12/1/69

2/12/1

B 12/1

NO NOTES THIS WEEK.

NOTES 12-1-69 HEIMBURG

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12/11

9/12/11
1. S-IVB-507 O₂H₂ Burner Anomaly: The investigation is continuing into the cause of the failure of the GH₂/gox burner lox shutoff valve to close during the inflight shutdown sequence. A high-speed data plot of the switch selector output monitor has verified that the switch selector issued the proper/adequate command to the S-IVB sequencer (a 42-millisecond pulse was issued). An investigation is in process to compile the type/quantity of components/connections in the lox shutoff electrical circuit, plus all failure/problem history associated therewith. A similar investigation is being made of the pneumatic shutoff valve and actuation control module. At present, a completely random malfunction in the electrical circuit is suspected as the most likely cause of the failure (the shutoff valve actuation control module did not receive an electrical signal). As previously reported, the system responded properly to a ground control shutoff command at approximately second burn cutoff +3 minutes. There are at least 81 electrical connections now identified (previously 29) between the selector switch and the solenoids for the O₂H₂ burner. ✓

2. MDA Docking Loads Problem: After much discussion with MSC concerning MDA docking loads, we have agreed to make the design modifications necessary to the MDA axial docking port so that the MSC hardware can remain unchanged. In order to maintain the current schedules for AAP, we have arranged with ME Laboratory a different manufacturing sequence. By this arrangement, there will be no schedule impact. However, we do not plan to modify the radial docking port since we at MSFC have been unable to ascertain any mission requirement for this port. We will assess the capability of this port with respect to current MSC docking loads and then suggest changes in the docking procedure which, in an emergency, could permit use of this port.

3. Joint MSFC/MSFC Agreement on Shuttle APS Work Statement: Technical personnel from MSFC and MSC met at MSFC on November 21, 1969, to discuss and formulate a work statement that will be common to both centers for the study of APS for the Space Shuttle. Agreement was reached on the work statement. ✓

NOTES 12-1-69 Heller

B 12/1

JK 12/1

1. INTERNATIONAL INTEREST FOR APOLLO 12: I was in Germany during the Apollo 12 launching and during the lunar EVA. The interest of the whole population was tremendous. Apollo 12 was covered on the front page of all newspapers for the ten days I was in Europe. There are many things going on in America which are not understood by our European friends, but the lunar landing drew unanimous admiration and support. ✓

2. CONTAMINATION MONITORS ON DWS: OART has formally requested in a memo to ML that a Quartz Crystal Microbalance (QCMB) should be incorporated in the T027 experiment package and in the ATM canister for real time monitoring of contamination. We have been investigating QCMB's in SSL for some time, and our thinking is that the request could be implemented if so directed by OMSF. ✓

9/12/70

1. SPACE-STATION/SPACE-BASE EXPERIMENT DATA PROCESSING WORKSHOP:

The Space-Station/Space-Base Experiment Data Processing Workshop held at MSFC on November 24 and 25, 1969, considered the problems of handling and evaluating experiment data, and their implications for laboratory automation.

Among the points that became clear during discussion, the following items are noted:

1. Those disciplines using the Laboratory for its Zero-G, and high vacuum environment, notably material processing and human performance studies will not make heavy computer demands. Production processing of materials cannot be expected for the early phase of the Space Station Program, and thus automation will not be required. The Biomedical/Behavioral area will require extensive data storage.

2. The Earth Surveys, Solar Astronomy and Space Physics, areas will demand extensive computer support, beyond the current capacity of ground-based machines, if the goal of autonomy and a high degree of automation are to be achieved. It was conceded that the equivalent of an IBM 7094, if available, onboard would still be of immense value to these fields.

3. The main bottleneck in implementing effective Earth Survey techniques is the present lack of ability to handle large volumes of parallel data. If techniques for spatial coherence detection could be developed to complement current spectral analysis, it may be possible to eliminate blocks of data and still accelerate the rate of signature identification.

A detailed report on the work of the panel will be published by February 1, 1970.

2. DATA REDUCTION EFFORT ON AS-507 FLIGHT: The Data Reduction Branch processed a record amount of data on the Astronaut reported AS-507 SII low frequency vibrations prior to the FEWG Meeting on November 17, 1969. Computation Laboratory personnel anticipated the needs of the FEWG and initiated a reduction of all telemetry measurements related to the SII structure. The data were reduced and processed in record time, thus enabling responsible personnel, both NASA and stage contractors, to report to the FEWG Meeting with "hard" numbers. A total of 10,500 data plots were distributed to MSFC laboratories, NAR, Boeing-Huntsville, and Rocketdyne. This total represented 525 slice time analyses and related oscillograms. This effort was in addition to the routine post flight data reduction.

B 12/1

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1. OART ADVANCED MISSIONS: OART reviewed their FY-70 Advanced Mission Study program with the PSG in response to Dr. Newell's request; OSSA and OMSF have already completed their reviews. The only proposed advanced study in this category is MSFC's follow-ons to our Nuclear Stage Definition Studies.

Mission Analysis Division (MAD) will conduct in-house studies on a broadfront but will have no advanced mission study contracts.

B.H.
I understand
what Keith
Glennon is now
Chairman of
the Board
of Aerospace.
My relation
to him is
very cordial.
Shall I grease
the skids?
B

During this review, Chuck Matthews expressed interest in the relationship between the MSFC nuclear stage studies and the Aerospace study, and expressed the opinion that the Aerospace results should be fed into the MSFC studies. This could be a problem since we do not have a direct input to Aerospace - only an informal arrangement. ✓

2. S-IVB/CENTAUR STUDY: This OSSA funded study is now under contract and the orientation meeting is scheduled for December 4. Contractor participation will include McDonnell-Douglas, GD-Convair, IBM and Honeywell. ✓

3. SATURN WORKSHOP # 2 ACTIVITIES: Mr. Schneider (ML/Director) has formally requested definition studies for a second workshop (SWS II). ✓ These studies are to be conducted in preparation for a Phase B effort starting in FY-71. Alternate mission options emphasizing Earth Surveys, Astronomy, and Extended Manned Space Flight Capability will be studied as well as mission characteristics such as continuous manned operation for one year and artificial gravity operations (spinning workshop). If you desire, we are prepared to elaborate on this activity at your convenience. ✓

→ Yes, please do. B
(After I'm back
from A.L.)

NOTES 12/1/69 HUETER

JK_{12/1}

B 12/1

No submission this week.

NOTES 12/1/69 JOHNSON

9/12/11

B_{12/1}

Nothing of significance to report.

B 12/1

JK 12/1

SMALL COLLEGE COMPUTER NET: In the Notes of 4/14/69 there was mentioned the possibility of improving the use factor (currently about 25%) of the third generation computer at A&M by employing it as the main frame center for a remote station network. As you will recall, our idea was to tie small colleges into the network in order to give them a computer capability for instructional and administrative purposes at an acceptable cost. Subsequently, a meeting was held with Dr. Stone, State Superintendent of Education. At this meeting the benefits of such a proposal, not only operational but innovational as well, were pointed out to Dr. Stone who readily appreciated the potential of such a scheme particularly the meaningful significance in having a Negro college serve as the lead institution in such an endeavor. Last Tuesday, November 25th, representatives of small colleges located in Northern Alabama were invited to Alabama A&M for a presentation of the proposed scheme. The following colleges were represented: Athens, Snead, St. Bernard, and Northwestern Junior College. The presentation was given by Clyde Foster whom you may recall is the MSFC employee currently assisting A&M in the managing of their computer center. As a direct outgrowth of this meeting, Clyde and I will travel to Northwestern Junior College at Phil Campbell there to make a feasibility study. Upon completion of this, a representative study, I intend to communicate once again with Dr. Stone to complete arrangements for presentation of the overall concept to members of the State Board of Education. The Junior College study will be used as a vehicle. Concurrently, studies will be conducted at other interested colleges.

E&M.
 Sounds like a splendid idea. However, I view our own troubles with 3rd generation computers. I suggest we doubt what the appetite of all these colleges before we are absolutely sure that the software

Throughout these endeavors, a proper perspective will be maintained in our participation to assure that no untoward commitments result. The path leading toward completion of these undertakings is fraught with a whole host of difficulties, some economic, some operational, and, of course, some human. I still consider it well worth the effort.

problems of such a 3rd generation computer sharing program can be successfully solved.

Jim Shepard is thoroughly familiar with our own problems in this area. Suggest you ask him for a thorough briefing before you sell this scheme too hard to the colleges.

B

NOTES 12/1/69 MOORE

B 12/1

JK.2/1

1. NEW PRINTED CIRCUIT BOARD MATERIAL: An evaluation program has been established by Astrionics, Astronautics, Quality & Reliability Assurance, and Manufacturing Engineering Laboratories to test new polyimide/fiber glass printed circuit boards. The new polyimide printed circuit board, developed by Thiokol under MSFC contract, has a thermal coefficient of expansion of 16.5×10^{-6} cm per $^{\circ}\text{C}$ in the thickness plane versus 55×10^{-6} cm per $^{\circ}\text{C}$ for standard G10 epoxy/fiber glass boards. The low expansion polyimide/fiber glass board matches the expansion of a copper lead. This match of expansion should eliminate cracked solder joints caused from board expansion. ✓

2. AS-507 FLIGHT: Although the accelerometers experienced acoustically induced vibration around liftoff, it now appears that no velocity bias was accumulated as in AS-506. The area around 36 seconds after liftoff has been thoroughly investigated, and data shows that no error resulted. The A and B counters on the Z accelerometer disagreed and, although both readings passed the reasonableness test, the Launch Vehicle Digital Computer (LVDC) properly chose the B reading as it was closer to the expected value. At this same time, the pitch gimbal angle failed the reasonableness test for one minor loop. The LVDC responded properly by rejecting the reading. Both of these discrepancies appear to be electrical in nature and were probably the result of lightning striking the vehicle. ✓

NOTES 12-1-69 SIEBEL

B 12/1

9/12/11
"Composites Casting"- M512 Space Manufacturing Experiment #4:

The feasibility has been demonstrated of using exothermic chemicals for heating a metal sample to obtain a temperature gradient and subsequently cooling it at a controlled rate. The Whittaker Corporation has test fired their first exothermic heated micro-furnace for this task. A temperature gradient of several hundred degrees was achieved from one end of the 6" long metal sample to the other end. Also lowering of temperature at the approximately desired rate of 8°C per minute was achieved. Refinements are now being made by Whittaker to achieve the temperatures needed for unidirectional solidification of aligned structures. ✓

B 12/11

NOTES 12/1/69 SPEER

9F12/11

1. AAP Data Flow Management: MSFC has been studying several techniques to handle the large quantities of "post flight" engineering and scientific data flow for AAP. We have been evaluating these from the viewpoints of cost effectiveness and maximum utilization of NASA available hardware/software resources, while still insuring no loss of information to the engineer or scientist user. We have now reached agreement on the most effective techniques from an MSFC standpoint. These are essentially: (1) implement more efficient ground station recording techniques; (2) increase utilization of "real time" operations data for mission evaluation; (3) limit amount of data processing based on (2); and (4) implement a data redundancy removal scheme at the data processing Centers. We are aware of one discrepancy with MSC desires, in that they have proposed data redundancy removal at the remote sites rather than at the data processing Centers. We are working with MSC to iron out this difference in our proposals. ✓

2. Implementation of MSFN Facility at Santiago, Chile: MSC (Kraft) has recently submitted to Gen. Stevenson a firm requirement for a Manned Space Flight Network (MSFN) facility at Santiago, Chile. As you know, the implementation of significant changes in the MSFN configuration has been underway since April 1969. These changes have been principally those of reductions to realize operations cost savings. However, AAP analysis indicated the requirement for a new facility in the vicinity of Chile. Significant disadvantages in the use of an Apollo Instrumentation Ship led us to recommend, in a July 1969 letter to Gen. Stevenson, the upgrading of the existing STADAN station at Santiago, Chile, to MSFN capability and the deletion of the ship from the MSFN. The ship deletion has been accomplished and the upgrading of Santiago is under final assessment by Headquarters. ✓

3. Gulf Stream Drift Mission: We attended the November 25 presentation on this mission with great interest. While noting the similarities of this underwater mission to a long duration space flight mission, the absence of any imposed requirements for similarity to space flight was also apparent; e. g., in the food management area. Future tests could potentially include specific requirements which would directly benefit the Space Station Program. The high degree of maintenance experienced (approximately 1 man of 6 man crew for duration of mission) indicates a need for careful consideration of the maintenance concept in design of Space Stations. ✓

NOTES 12/1/69 STAMY

12/1

B 12/1

Nothing of special significance to report.

NOTES 12-1-69 Stuhlinger

No submission this week.

9/12/1

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12/1

Dec 8, 1969

R 12/10

NOTES 12/8/69 BALCH

9/12/8

S-IC-13: All work is on schedule for power-up, scheduled for today December 8, 1969.

S-II-9: Stage is in the vertical position in the S-II Stage Checkout and Storage Building. Final modifications are on schedule for completion on December 17, 1969. As a result of a determination that a start tank discharge valve (STDV) which was removed from the S-II-10 stage, because of bellows leakage, had been reworked to an inadequate drawing, an investigation was conducted to determine what other valves had been reworked to the same drawing. As a result three S-II-9 STDV's were found to have been improperly reworked and are being replaced at MTF. Retest requirements will be deferred to KSC. ← Shipment of S-II-9 to KSC is scheduled for January 8, 1970.

CAN THIS BE DONE PROPERLY AT KSC?
R

S-II-10: Stage is in the horizontal position in the S-II Stage Checkout and Storage Building. Insulation repair is on schedule for completion on December 13, 1969. LH₂ tank entry is scheduled to start on December 15, 1969, for the purpose of replacing the fast-fill shutoff sensor.

S-II-11: Removal of static test instrumentation is underway. Stage is scheduled to be removed from the test stand on January 13, 1969.

do they have these reworked valves too?

S-II-12: Stage departed Seal Beach on Saturday, December 6, 1969, and is scheduled to arrive at MTF December 22, 1969.

Roy Godfrey, what can be done to avoid such mishaps? How can "inadequate" drawings sneak into the system? What would have happened if this would not have been detected? It would be interesting ^{to know} how many of the successful launched S-II's had these wrongly reworked valves.

R 12/10

9/12/8

B 12/10

ROLL POSITIONING MECHANISM & EXPERIMENT POINTING

CONTROL: The flight unit of the RPM and EPC from Perkin-Elmer was received November 24, 1969. This completes the delivery of all major items of this contract. Pin pullers and miscellaneous spare parts will be delivered later. This hardware is configured to the wet Workshop requirements. Those minor changes necessary to reconfigure to the dry Workshop requirements will be accomplished by modification kits.

MSC THERMAL SYSTEMS UNIT (TSU) OPERATIONS AND THERMAL

VACUUM FACILITY: ATM Management Plan for MSC TSU operations has been signed by MSC and will be distributed by MSFC the week of December 8. The Test Readiness Review Board will meet December 8 at MSC to determine readiness of MSC facilities and equipment to support the chamber contamination test scheduled for December 15 thru 23. Dr. Dozier and John Belcher will represent MSFC as members of the board.

MANNED ORBITAL LABORATORY (MOL) HARDWARE TRANSFER TO ORBITAL WORKSHOP (OWS):

As of November 25, 1969, McDonnell Douglas Astronautics Company-Western Division (MDA C-WD) has reviewed 7,999 line items of the MOL termination inventory for OWS usage. Of this number, requests to NASA for transfer to the OWS Program were submitted for 305 items, which includes four re-requests. NASA has approved, and the Air Force has concurred in, the transfer of 173 items; 57 have been disapproved and 74 are in the review process. Resident NASA personnel have been meeting with MDA C-WD personnel relative to giving proper consideration to the price of the OWS effort as a result of these transfers.

ORBITAL WORKSHOP-1: Internal MDA C-WD work release orders have been released to begin structural modifications to the OWS-1 tank. The OWS-1 tankage is located in the insulation chamber #1, at Huntington Beach, and preliminary installation effort is in progress.

FILAMENT WOUND O₂ BOTTLES: A meeting among Astronautics, MDA C-ED and Airlock Project personnel was held on December 4, to clarify groundrules concerning the development of the filament wound O₂ bottles. General agreement was reached on MDA C-ED proceeding with the Brunswick Company as the subcontractor. Structural and pressure-cycling tests were agreed upon and action items were assigned to both MDA C-ED and MSFC. Status of the bottle development will be reviewed during the scheduled design review in January.

9/1/8

B 12/10

CENTER REVIEW OF POP 69-2 SUBMITTAL - The Center review of the MSF R&D POP 69-2 was held on December 1, 1969. The following decisions were made during this review:

1. Marshall's submission would be over the MSF mark for FY 71 for Saturn V Follow-on by \$19.6M. (MSF mark - \$100M; MSFC submission - \$119.6M)
2. Keep MTF contractor manpower at a 450 man level for EOY FY 71 & subsequent rather than at the 50 - 100 man guideline level.
3. Marshall's Apollo Cost Plan would be above the MSF target in FY 70 and 71.

	<u>MSF Target</u>	<u>MSFC Plan</u>	<u>Δ</u>
FY 70	487M	493.6M	6.6M
FY 71	330M	334.4M	4.4M

4. Include Saturn Workshop #2 requirements in the manual addendum, although not requested by MSF.
5. Keep the R&D funded in-house support contractors at a level of 2171 for FY 70 & subsequent because of fund limitations. In the Center requirements POP 69-2C our submission supported the 2356 level.

A letter has been forwarded to MSF stating Center position on the POP 69-2 submittal.

PRESIDENTIAL LETTERS OF APPRECIATION - In response to a request from Dr. McDonnell of the Executive Secretariat, the names of three candidates for Presidential letters of appreciation were submitted. Draft letters and appropriate justification related to contributions to Apollo 12 were furnished. The candidates included one employee from Mission Operations, one from Astrionics Laboratory, and one from North American Rockwell. Mr. Gorman has advised us that there is a continuing requirement for NASA to submit five candidates each week. This program reflects the President's attempt to provide recognition for selected individuals that typify the "silent majority" of Americans who are making significant contributions to the American way of life. Mr. Gorman emphasized that the criteria for selection could include any commendable type of activity covering any aspect of American life. We expect to receive further guidelines for future submissions.

Woody, please, let me know when you have those guidelines. B

9/2/8

B. Brown

B. Brown
Before this
during these
please, please
make sure
that we do
not run into

F-1 Engine - Changes for the low cost F-1 engine have been proposed in five major areas: (1) Turbopump, (2) Interface, (3) Hardware Elimination, (4) Problem Elimination, and (5) Changes in processes or materials. The Center accepted most of the changes except those relating to turbopump rotating machinery items. Of the approved items, the simplified thermal insulation system change represents more than one-third of the total savings which can be realized per engine.

problems
Which stage
would have
the first
engines
with changes?

On December 4, 1969, Rocketdyne presented the design status and the proposed verification plans for the simplified F-1 thermal insulation to MSFC. The new insulation consists of multiple layers of aluminized, inconel wire inserted, asbestos cloth mounted on a tubular frame assembly above the engine throat or strapped directly to the engine on areas below the throat. Testing will include thermal and structural design analysis, small scale lab tests, engine tests, flight simulation load tests, and lab hot gas dynamics tests. The hot gas dynamics test facility at Los Angeles Division of North American Rockwell utilizes a hydrogen, oxygen-air burner and nozzle to provide simulation of the expected flight temperatures and dynamic pressures to test sections of the insulation. The present nozzle capability of about 4 ft² exit area is sufficient to conduct the proposed tests. Additional demonstration tests desired by MSFC are being considered which would require enlarging the hot gas facility to either a 14 ft² or 30 ft² exit area.

R₂

What would this cost? R₂

J-2 Engine - Following the failure of the fuel turbopump on J-2S engine J-114 on October 24, Rocketdyne has been conducting failure investigation. The fuel pump inducer experienced high-cycle fatigue failure with the broken blades being ingested causing the pump to stop suddenly. Component pit testing of the fuel turbopump utilizing fatigue meters glued to the inducer blades has revealed some indications of fatigue. Rocketdyne believes localized cavitation at low NPSH causes cyclic loading of the blades. An improved design will be ready in February 1970, but in the meantime engine testing will be conducted in a manner minimizing risk of another failure. An engine test is scheduled for December 11, 1969, on Engine J-113. This engine has been modified with an acoustic absorber for stability aid.

Lee Thomas
Bill Brown
Before we
take final
action let's
see the
outcome of
budget FY 71

General - Follow-on Production - The authorization from Headquarters to release RFQ's for the follow-on production engines was received on November 13, 1969, and the RFQ's were released immediately. The proposals are expected by January 16, 1970. The contractor is preparing B&P estimates for the identified long-lead effort to submit by December 15, 1969. Letter or other pre-contract authority may be required as early as January 5, 1970, to accomplish the long-lead effort.

7/12/8

B 12/10

1. EXPERIMENT MODULE CONCEPTS STUDY: The mid-term briefing was held on December 4. This briefing covered all of the work leading up to and including the selection of common module concepts for further analysis in the remainder of the study. The result of the commonality analysis was that a set of four modules will provide the least cost approach to satisfying the requirements of the 21 experiment payloads under consideration. The contractor (GD/C) is not to proceed, however, with further definition of these modules until they have our approval. A final decision will be made after comments have been received from the key individuals who attended the presentation. This approval is anticipated to require approximately one week. The briefing benefited from very good attendance from NASA Headquarters and other Centers. Representatives from the MSFC and MSC Phase B Space Station contractors also attended and expressed an interest in further discussions with GD/C.

Mr. Doug Lord and Dr. Rod Johnson of MSF praised the contractor on the work accomplished to date. Both were very complimentary of the effort.

I was somewhat apprehensive when I learned on short notice that Professor Bondi and his associates planned to participate in this mid-term review meeting. However, I now believe their visit was very profitable; they seemed to be genuinely impressed by our planning activities. Professor Bondi is a most perceptive person. I appreciated the opportunity to participate in his visit to MSFC.

2. LUNAR SCIENCE PAYLOADS: It is unfortunate that time ran out during the SSL/PD presentation to you on December 1 on lunar science experiments. We did not have the opportunity to discuss in any detail the mission opportunities. We look forward to completing this presentation. I realize that several of the programmatic questions which you raised were not answered because the PD presentation was not completed.

I recently discussed the lunar science program with Dr. Allenby in Captain Scherer's Office. Dr. Allenby believes that because of schedule and funding considerations the first opportunities for incorporating not yet approved lunar scientific experiments (requiring new instrumentation) will be about Apollo 18 (February 1972). The experiments through Apollo 15 are firm. Experiments which require only a storage interface (completely self-contained) can of course be accommodated on earlier missions than experiments which require integration into some other system. NASA Headquarters (with scientific community involvement) is currently in the process of evaluating over 200 experiment proposals, including those submitted by MSFC, for Apollo missions 16 to 20 and future missions.

B12/10

9/12/8

1. AS-507 LIGHTNING STRIKE: A meeting was held 12/4 with lightning experts from the New Mexico Institute of Mining and Technology, State University of New York at Albany, and the National Center for Atmospheric Research at Boulder, Colorado. Instrumentation specialists from Boeing and Martin-Marietta and representatives from MSC and KSC attended also. There is still no absolute certainty, but a high probability that the vehicle - in passing through an electrified cloud - initiated a lightning discharge at 36.5 seconds with a subsequent flow of current in the vehicle structure. From engineering data, a second discharge affected the vehicle at about 52 seconds, with different effects on the vehicle than those produced by the first discharge. The consensus of the atmospheric physicists was that lightning discharges involving the vehicle can be expected in flight through electrified clouds. The intensity of the discharge to be expected will depend on the size of the cloud. However, it is difficult to establish quantitatively the magnitude of cloud electrification from ground measurements. Certain guidelines can be established, though, which can be used in assessing the existence of electrification, and we are working with the FEWG, MSC and KSC on this presently.

2. POLAR ORBIT ASCENT TRAJECTORIES: Initial results from efforts aimed at generating polar orbit ascent trajectories for the INT-20 (S-IC/S-IVB) and INT-21 (S-IC/S-II) vehicles are becoming available; they show that for an INT-21 vehicle the trace of instantaneous impact points (IIP) for early shutdown on an otherwise normal flight comes within a few miles of the south-east coast of Florida. Also, the nominal impact point of the S-IC stage (computed without aerodynamics) occurs within 30 n. mi. of Cuba. It appears that neither of these conditions could be alleviated without extreme degradation of performance. For INT-20 flights, the IIP trace near southern Florida is within about 20 miles of the coast, but nominal S-IC impact is near the center of the Caribbean Sea.

3. NASA MONOGRAPH ON MAGNETIC FIELDS: The Nasa Environment Design Criteria Monograph entitled "Magnetic Fields - Earth and Extra-terrestrial" (NASA SP-8017) has been published by Headquarters/OART as a Special Publication. Mr. Harold Euler of our Aerospace Environment Division served on the advisory panel and made several contributions to the document's contents.

*E. Geissler,
would it be
feasible from
a technical and
operational point
of view to hire
some of our
weather pilots
who don't get
clouds to find
out their electrical
condition prior
to an Apollo
launch?*
Rs.

etc

B 12/10

9K.2/8

Saturn:

R. Godfrey
How can
you make
firm decision
on Dec. 17 if
S-II-12
status is
only in Feb.
Ps

1. POGO, AS-507 Flight: (Reference Notes 12/1/69 Godfrey, Item 1). We are still pursuing two approaches to the POGO oscillation problem encountered on AS-507 flight. One, justify flying AS-508 and subsequent as is. Two, add a center engine LOX accumulator system. The hardware design and engineering for the accumulator system is underway with a decision date of December 17 still firm. Data evaluation of static firing, flight and engine tests is still underway. Hardware installation schedules at KSC for S-II-8 are being scrubbed. KSC indicates that schedules can be met if we are able to meet some very tight need dates; optimistically we can. The static firing date of S-II-12, with the flight accumulator system, can be rescheduled from February 12 to February 4 based on a 6-day week; this date has been concurred in by NR/SD and MTF. The meeting on December 17 will be held at MSFC.

Lee James,
Rory Godfrey
How about
if follow-on
work be
approved for
FY 71? Ps

2. Saturn V Follow-On Procurement: Approval of the SA-516 thru 521 Procurement Plan and Project Approval Document (PAD) is anticipated since the President has approved the FY70 Appropriation Bill. The follow-on RFP's have been released or are scheduled for release as follows:

	<u>Release to</u> <u>Contractor</u>	<u>Scheduled receipt</u> <u>of Proposal</u>
S-IC Stage	Nov 7, 69	Jan 1, 70
S-II Stage	Dec 10, 69	Feb 10, 70
S-IVB Stage	Dec 2, 69	Feb 5, 70
Instrument Unit	Oct 30, 69	Feb 1, 70

3. Early Delivery of S-IC-9: KSC has requested and Headquarters approved an early delivery of S-IC-9 (11 January 1970 instead of 31 January 1970) to assist KSC in their revised checkout flow for AS-509.

4. Saturn IB Briefing to Astronauts: MSC has requested MSFC to brief the astronauts on the Saturn IB vehicle. This briefing will be held at Houston on December 9, 1969.

5. Apollo 13 Flight Readiness Review (FRR): Headquarters has tentatively scheduled the Apollo 13 FRR for February 11, 1970.

LRV:

R. Godfrey
See my
annotation
on the
"Lunar Module
notes" to

Preliminary subsystem reviews involving all major components of the LRV have been held at TBC, Huntsville over the past two weeks. The meetings, attended by MSFC (PM and S&E), MSC, and Headquarters personnel have resulted in the firming up of some parts of the LRV design, indicating weaknesses in certain areas, and uncovering additional proposed requirements from other centers.

Lee James
Ps

B
12/10

9/12/8

1. AIR FORCE (DOD) SPACE TRANSPORTATION SYSTEM (STS) STUDIES:

Mr. Scott from our Performance and Flight Mechanics Division attended the final briefings of the Air Force (DOD) STS studies at Aerospace Corporation on November 27-28, 1969. You may recall, the Air Force had contracts with General Dynamics Convair (GD/C), North American Rockwell (NAR), McDonnell Douglas Astronautics Company (MDAC), and Lockheed, running parallel with the NASA Integral Launch and Reentry Vehicle (ILRV) studies. All contractors gave their final briefings except Lockheed which has been scheduled for mid-December.

The Air Force retained relatively firm guidelines throughout the contract period: i.e.,

cross range: \approx 1500 nautical miles
 cargo size & weight: \approx 15' x 60' and 50,000 lbs.
 s.l. thrust/engine: $<$ 1.0 M lbs

Each contractor was left the freedom of determining and designing the vehicle configuration that best satisfied the stated requirements. The presentations were of excellent quality. Each contractor gave a 45-minute Executive Summary and approximately 3 hours of detailed design information. GD/C presented the triamese configuration with and without cross-feed and therefore paralleled very closely the results of the NASA study. Both NAR and MDAC deviated considerably from the configurations studied under the NASA contracts.

The NAR concept for the orbiter was a delta planform type lifting body exhibiting good hypersonic characteristics $L/D = 1.8$ and subsonic characteristics of $L/D = 5.5$. The payload was mated through the base of the orbiter between the two engines. The configuration was a drastic departure from the fixed wings version studied for MSC.

MDAC departed from the HL-10 shape and configured a lifting body with a hypersonic $L/D = 2$, and swing-wings to achieve good subsonic performance.

2. CONFIGURATIONS DESIGN LAYOUTS FOR ARTIFICIAL "G" PROVISIONS:

We have investigated several rotating hub configurations for the artificial "g" portion of the Space Base. Two basic configurations which allow transfer of crew and materials between rotating and nonrotating volumes have been established. First, an axle configuration which mechanically indexes the opposite sides of the zero gravity Space Base together, and secondly, a restrained floating center section between the zero gravity sections, which requires that the two be electrically indexed. Additionally, the design of the transfer mechanism for crew and materials (elevator or conveyor) have been evaluated for active and passive participation of man. Time needed to evacuate an artificial "g" module, safety requirements, balancing systems to maintain acceptable center of spin axes, and other subsystem impacts were studied. Structural and traffic conditions at the artificial gravity end of the spokes were evaluated. Space Station impacts have been assessed, and some modifications to our inhouse design have been established. Also, impacts to MDAC Space Station Design, if used as module for the Space Base, are apparent. A number of areas have been found which need further study before a preferred configuration can be defined.

NOTES 12-8-69 GOODRUM

2/12/8
MAINTAINABILITY PRESENTATION BY MDAC AND PAA - MDAC and Pan Am will give a maintainability presentation on 12-11-69. It will cover MDAC's approach to maintainability on the DC-10, its impact on support cost savings and the application of these principles to the Space Shuttle. John Yardley, MDAC Vice President, will head the team. *B 12/10*

OMSF SPACE SHUTTLE SAFETY ADVISORY PANEL - An OMSF Space Shuttle Safety Advisory Panel has been established to prepare meaningful and timely guidelines for safety systems analysis in the Phase B Shuttle effort and to review safety considerations for current shuttle configuration. Arnold Stein, PD-PS, is the MSFC representative.

DLRV SCIENCE PANEL ACTIVITIES - A DLRV Science Panel comprised of individuals from MSFC, JPL, USGS, and NASA Headquarters met for four days last week to review a draft of the Announcement for Flight Opportunity (AFO) for the DLRV Science. General agreement has been reached on the intent and content of this AFO and we expect that it will be issued by Headquarters in early January.

DLRV RESOURCES - The initial \$2M of the \$5M project definition funds required for DLRV for FY70 was received last week. Funding of the additional \$3M is expected upon approval of the follow-on Apollo Program; a decision expected in mid-December.

Headquarters has established a tentative DLRV Program schedule which includes requirements to start a Phase C in July 1970, and a Phase D in January 1971. First flight article deliveries are scheduled for 33 months after program start or the fourth quarter of 1973. The first DLRV mission is now scheduled for the first quarter of 1974.

SPACE SHUTTLE - A follow-on meeting to the 10-18-69 Design Criteria Review will be held in Washington on 12-10-69. We will make presentations on three action items: a) Payload Sensitivity to Mixture Ratio, b) Use of Aerospike as Reaction Control System, c) Effect of Increased Landing Gear Footprint loading assuming infrequent operation from commercial and military airfields.

SPACE STATION - The first Quarterly Review of our Space Station Study (MDAC) will be held in the HOSC conference room on 12-10-69, beginning at 8:30. A series of splinter meetings is planned for 12-11-69.

NOTES 12-8-69 GRAU

R 12/10

9K12/3

1. NONDESTRUCTIVE TESTING PRESENTATION: Mr. J. B. Beal recently presented a paper, authored by himself and Mr. R. W. Neuschaefer of our Laboratory, entitled "Nondestructive Testing - Potential Space Applications" to a meeting in Montreal, Quebec, Canada, of the American Society for Nondestructive Testing. Movie excerpts from Apollo 8 and Apollo 11 were also shown. The presentation was well received by the 41 persons present, and numerous questions were asked about the solid-state radiographic image amplifier (which was shown and operated) and ultrasonic probe coupling-to-structure method. Additional data and backup information were requested by 21 of those present. Representatives were there from Atomic Energy of Canada, Canadair Ltd., Department of Highways, Ontario Electric, Canadian Steel, United Aircraft, and various other engineering and aircraft industries.

D. von Braun

NOTES HAEUSSERMANN 12/8/69

2/12/8

B 12/10

1. Triggered Lightning Hazard to Apollo-Saturn: On December 4 AERO and CSE conducted a meeting with recognized outside experts on atmospheric lightning phenomena and airborne electronics design. The primary objectives of this meeting were to obtain estimates of the relative probability of occurrence of triggered lightning for various weather conditions and the resultant vehicle effects for future flights. The discussions and presentations were highly instructive and informative. The indications are that the determination of the hazard requires a weighted judgment factor on several indicators, including thickness of clouds, proximity of approaching cold front, presence of precipitation, electrostatic gradient at ground monitoring stations, rate of rise for cloud tops, etc. Furthermore, the greatest hazard to the launch vehicle is "set bits" which may change instructions or information in digital computers and associated equipment. Any hardware changes to our present design to further minimize the effects of lightning on or in the near proximity of the launch vehicle were not readily apparent. We will continue to pursue this problem and keep you informed of our progress.

2. Vibro-Acoustic Testing: On November 25 the AAP contractors made a series of presentations on their vibration and acoustic testing programs and the rationale for these. Subsequent to this, at the request of PM, further discussions were held with S&E personnel to clarify and define the program for an MSFC position. This was presented to Mr. Schneider on December 2. He indicated that he would reach a decision by December 4. The MSFC plan provides for vibration and acoustic testing of the entire AAP cluster. The decision on this part of the program, together with the expected upcoming decision on the Integrated Cluster Test in the VAB will complete the baselining of the test program and make possible early publication of the finalized Master Verification Plan.

3. Integrated Systems Test at KSC: We met this week with KSC, MSC and Martin to close out action items pertaining to the Integrated Systems Test (IST) of AAP modules at KSC. The report on action items completed a 60-day study to determine the limitations and impacts resulting from conduct of the IST in a stacked configuration at the VAB. The study data collected is being compiled this week into a final study report. A review of the report is planned for next week within S&E and will be presented to MSFC management at a later date.

4. Upgrading Launch Complex 34 to a Saturn V-type operating system: In reply to your question on my 11-10 NOTES: At this time the MSFC cost for upgrading LC-34 to a Saturn-V type operating system has been a determination of how much more, or less, it will cost than if we keep the Saturn IB operating system. It has been established by our Launch Vehicle Systems Engineering Office (May) and by PM-SAT-G that the net increase by going to a Saturn-V type operating system is approximately \$114K. Of interest, however, are the periods of time in which these delta expenditures will be required and the delta cost avoidances effective. The attached sheet illustrates this. The basis for this proposal is that hardware is available from one of the Saturn V firing rooms being closed down. The hardware cost would be too great if we had to make a procurement. (Haeussermann 11-10 NOTES attached to Dr. von Braun's and Mr. Weidner's copies only.)

Dear let me know about the extra

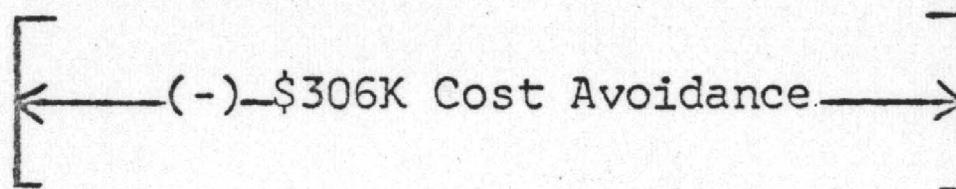
*See
Samm
also
points
really
bad
points
to me
like*

5. MLRV: The contract negotiations of Boeing's subcontractor for the traction drive subsystem, General Motors, for the back-up motor are dragging on. Uncontrollable delivery promises seem to be more decisive than technical capabilities in the subsystems contractor selection. Similar difficulties exist in the selection of the navigation subsystem (directional gyro vs. the very complex strapdown system). In general, our control of the technologies applied and in systems engineering is almost nullified by administrative limitations, the complex contractor setup (the sub-subcontractor is supposed to do the actual work) and the lack of contractor personnel in the responsibility channel that has the proper engineering understanding for the subsystems.

The old woman R&D is I.C. Please, talk it over with L. Richard and see what

MSFC EXPENDITURE/COST AVOIDANCE BY GOING TO A SATURN V-TYPE OPERATING SYSTEM @ LC-34.

FY-70	FY-71	FY-72	FY-73
(+) \$350K Expenditure	(+) \$120K Expenditure		
	(-) \$50K Cost Avoidance		



Summary

Expenditure (FY-70)		\$350K
Expenditure (FY-71)		120K
Cost Avoidance (FY-71)	\$50K	
Cost Avoidance (FY's 71-72-73)	306K	
	<u>(-) \$356K</u>	<u>(+) \$470K</u>
		356K

\$114K NET EXPENDITURE

NOTES 12-8-69 HEIMBURG

B12/10

9/12/8

1. Air-Breather Technology Meeting: Contrary to the surprise registered by Mr. Pratt of Pratt and Whitney on the cost of developing an LH₂ air-breathing turbojet, Pratt and Whitney has proposed two techniques to develop such an engine. The first approach would involve modification of an existing turbofan and vacuum proofing the oil system for a cost of approximately \$50 million and three years. The second proposal was to develop an entirely new system costing six years and several hundred million dollars. Apparently, Mr. Pratt is not aware of his company's proposals.
2. TBC LRV Management Orientation Tour: On December 5, Mr. Kudish, the TBC LRV Manager, toured our Materials Division in order to acquaint him with our capability to support the LRV program. Mr. Kudish expressed considerable interest in several areas of our work and asked that we investigate certain potential seal problems. Our efforts would be considerably enhanced if we could obtain a small sample of lunar dust; however, we have been unsuccessful in doing so. Mr. Kudish and his party, escorted by Sonny Morea, also toured other elements of S&E.
3. AAP Photography: Laboratory personnel participated in the AAP Photographic Requirements Review at MSC on November 25, 1969. One of the significant items from the meeting is: The AAP photographic requirements which were to have been baselined have still not been completely identified and assembled. Incompletion of this task is delaying release of the procurement actions of AAP photographic hardware in addition to impacting the sizing of the corollary experiment film vaults.
4. Bioastronautics: In support of our study with the University of Alabama Medical Center, Mr. Brandner of our Materials Division was invited and observed an open heart operation on a child at the Center this week. The operation was successful and Mr. Brandner was able to observe firsthand the use of the blood oxygenator system that we have been requested to assist in improving. Our work on this project is continuing satisfactorily.

B
20/10

9/12/8

1. VISIT OF DR. HARDIE: Dr. Hardie, who heads the Dyer Observatory of Vanderbilt University, and three of his co-workers visited SSL. This is the follow-up of a suggestion made by Dr. Nancy Roman for a closer cooperation between the Vanderbilt astronomers and SSL. Two weeks ago about twelve members of SSL visited Dr. Hardie in Nashville. During his visit to MSFC, we showed Dr. Hardie the solar magnetograph and the hydrogen-alpha telescopes, the astronomy site at the south end of Redstone, the ATM hardware, and our astronomy-oriented laboratories. Areas of special interest where possible cooperation could develop are our UBVRI (Ultraviolet, Blue, "Visible," Red, Infrared) photometry of eclipsing binaries and our lunar IR astronomy with the 1.5 m instrument at Dr. Kuiper's Lunar and Planetary Laboratory, and possibly joint seminars which could be alternated between SSL and Vanderbilt. As soon as our plans become more firm, I am going to discuss them with Nancy Roman.

2. VISIT OF THE MSFC SCIENCE CONSULTANTS: Bob O'Dell and Peter Meyer visited SSL for about one hour to see our telescope tower and the solar magnetograph, plus hydrogen-alpha telescopes. Although we do not yet have the electronics from EMR (due in two weeks) nor the specialized optics from NRL (expected early 1970), our visitors seemed to be well impressed that we are doing something significant from a scientific viewpoint. The discussions in the afternoon were very interesting. They brought out very clearly the grave concern of the scientific community for a serious reduction of flight opportunities in the next few years. They endorsed the concept of space facilities erected by NASA and operated on a scheduled basis, like Kitt Peak or like a synchrotron particle accelerator. The scientists are alarmed about the rumored delay or even cancellation of the HEAO. They are pleased about MSFC initiative on this project. One subject that came up several times in the discussion was the necessity of project scientists in the implementation of scientific projects right from the beginning.

3. PROTON SPECTROMETER: George Detko, who is in charge of the Proton Spectrometer for SSL, held an orientation meeting on December 3 for the participating Labs and Offices. Documentation (RDP, End Item Spec. Document and Quality & Reliability Document) was distributed to all present. Critical problem areas, especially in connection with the experiment-MDA interfaces, were defined and action items taken by the Lab representatives involved. The PR for the flight hardware will be released by PM after solutions have been identified for these areas.

NOTES 12-8-69 HOELZER

2/12/8

B_{20/10}

GUEST LECTURER AT UNIVERSITY OF TENNESSEE SPACE INSTITUTE:

Mr. Jack A. Jones has been invited to participate as guest lecturer in a short course on "Mathematical and Statistical Analysis of Laboratory Data" at the University of Tennessee Space Institute. This course is to be presented during the week of January 26, 1970. Mr. Jones was invited to lecture in a similar short course at the Institute last year. Two lectures will be presented as follows:

1. Random Data Reduction and Analysis Systems.
2. Engineering Applications of the Reduction and Analysis of Random Data.

B
20/10

9/12/8

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9K12/3

B 20/10

1. OSSA PROGRAM MANAGEMENT MEETING: OSSA held a 2-day symposium on December 5 and 6 in Gaithersburg, Maryland to discuss their program management procedures and problems. The meeting was organized by Oran Nicks and was attended by almost all OSSA program directors and field center project managers. Total attendance was about 90 with heavy participation by Headquarters, Goddard and JPL.

The following subjects were discussed:

- a. Establishing Objectives and Mission Success Criteria.
- b. How to do Phased Project Planning.
- c. Management Information Control Systems.
- d. Cost Estimating.
- e. Budgets and POP's.
- f. Review of Proposed NASA Management Instruction for OSSA Programs.

I was asked to serve on a panel in the area of Phased Project Planning and how we use it.

OSSA is attempting to issue a new management instruction on Approval and implementation of new programs. They would like to get this established as soon as possible.

2. SPACE TUG: As was reported to you earlier, MSF has to date provided for only one Phase A type study of the Space Tug (\$250K FY-70 funds); this study is presently assigned to MSC. We have emphasized to Headquarters that studies by both Centers are needed at this early point in planning toward a major new system, as has been the practice in other areas such as Space Station and Shuttle.

We met with Headquarters and MSC on 12-3-69, to review plans for Space Tug studies with the Centers, and to discuss the Space Tug part of the current Air Force-NASA study contract with Aerospace Corporation. Both Centers recommended parallel MSFC and MSC studies; several of the Headquarters elements also support this view. The MSF people are looking into possible sources of additional funds to allow the additional study; we should know within a couple of weeks whether this is successful.

3. MANNED PLANETARY MISSION REQUIREMENTS: An inter-Center study team has been initiated by MSF people working under Mr. C. Donlan, to compile information on manned planetary missions, and requirements that should be imposed upon predecessor manned and unmanned missions. Participants include OSSA, MSFC, MSC, and Langley. Ron Harris and Gene Austin from my office attended the first meeting of this group at Headquarters, called for the purpose of organizing the study efforts, and to discuss study approaches and assignments. The first action request was for the Center representatives to compile data on typical mission profiles; We are presently working on this within PD.

It is planned that system and operational requirements could then be derived for these profiles, and to work toward the primary aim of identifying requirements for precursor manned and unmanned missions. The next meeting of the Group is to be held on 12-18-69 at Headquarters.

NOTES 12/8/69 HUETER

9F_{12/8}

B 12/10

No submission this week.

NOTES 12-8-69 JOHNSON

2K_{12/8}

B_{12/10}

Nothing of significance to report.

9/12/8

R
12/10

LUNAR MATERIAL DISPLAY: On Tuesday, December 2nd, I visited Montgomery to participate in ceremonies involving lunar material display. These ceremonies conducted at the Gayle Planetarium were presided over by Mayor James of Montgomery and Mr. Frank Plummer who is Chairman of the Board and President of the First National Bank of Montgomery as well as President of the Chamber of Commerce. They appeared to be impressed by Marshall's display of interest. In addition to my presence, John Bensko of SSL was on hand to deliver remarks pertaining to the geologic aspects of the 42 gram specimen. In addition he suggested that a card containing such information be placed by the specimen. This specimen, about the size of a large walnut, will be available for display in Montgomery until December 6. It had been flown in to Montgomery the evening before from a similar type display at San Antonio, Texas, where it drew 36,000 spectators.

Regarding the possibility of a display sample for the opening of the Space Museum in the late Spring, John Bensko anticipates no difficulty. He will place the matter before Dr. Anderson of the LRL.

PRESIDENT SEARCH UAH: Dr. Dowdle of UAH and Mr. Rufus Beal, Board of Trustees, University of Alabama, informed me that a press conference will be held on December 15 at which time there will be announced the election of Dr. Benjamin Graves to President of the University of Alabama, Huntsville. You may recall that Dr. Graves is currently President of Millsaps College in Jackson, Mississippi. As is customary in such cases, the effective date will be determined after discussions with the Board at Millsaps. However, somewhat optimistically, the Alabama Board of Trustees is hoping that Dr. Graves can assume his duties on February 1.

NOTES 12/8/69 MOORE

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B 12/10

1. ATM CHARGER-BATTERY-REGULATOR MODULE (CBRM): Thermal vacuum testing of a prototype CBRM is nearing completion in our environmental test area. Preliminary analysis of test results indicates that we will be able to utilize more power from each of the 18 CBRM's that we had originally anticipated. The units run cooler than expected, thus allowing a greater power output before reaching maximum temperatures permissible from a battery-life point of view. It appears that 250 watts vice 200 watts can be established as the allowable load on each CBRM.

2. ATM TV CAMERAS: The two TV vidicon cameras for the ATM H-alpha flight prototype telescopes have been delivered by MSFC as GFE to Perkin-Elmer for integration. In addition, another TV camera has been delivered to Perkin-Elmer for incorporation into an H-alpha telescope to be used at the Lockheed Rye Canyon Facility for solar observations using flight type equipment.

3. ATM SIMULATION LABORATORY: System test of three Control Moment Gyros mounted in the Vehicle Simulator in the ATM Simulation Laboratory are in progress. Acceptance tests of the Experiment Pointing Control dynamic test fixture have been completed and this portion of the system is being tied into the hybrid computer which supports the simulation facility. A "Dry Workshop/ATM" control console is being laid out to replace the Wet Workshop version.

NOTES 12-8-69 SIEBEL

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1. Portable Space Light: This laboratory, as you will recall, has been developing for some time a portable fluorescent "space light". The initial purpose, in the days when the Orbital Workshop was simple, was to provide a light for EVA in the IU area. Since then the light has evolved to provide supplementary illumination for motion picture photography. The light is powered by OWS power and consumes 0 to 150W depending on the intensity chosen. The light is accepted for flight as an operational item. The Engineering Review was held November 25 as scheduled. Nothing was mentioned which would cause a major change in the approach. Dr. Elrod and Mr. Rusnic from MSC, the M151 "Time and Motion Study" experiment Principal Investigators, were very pleased with the concept, and there were no major adverse comments from the Workshop, Human Factors, or Integration Offices. The Program Office (PM-AA) has promised us \$30K to keep the contract (NAS8-24527) going. The additional money is needed in order to incorporate new human factors requirements and tighter specifications on the performance for photography needs.

2. Neutral Buoyancy: Testing operations at the Neutral Buoyancy Simulator are resuming today. The first test is a one-week body restraint study conducted in conjunction with MDAC. Installation of hardware for the AAP cluster configuration will be accomplished simultaneously with these testing operations.

NOTES 12/8/69 SPEER

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B-20/10

1. Cluster Systems Review: The Cluster Systems Review held last week was extremely valuable from the Mission Operations viewpoint in consolidating data needed for operations planning and identifying items requiring further work; e.g., the ATM tape recorder system, which presently requires use of the primary and backup recorders for the nominal mission timeline, does not permit in-flight replacement and does not, in our opinion, provide adequate reliability for the Dry Workshop mission; or the current loose definition of orbital checkout criteria which cluster systems must meet before committing each manned launch, docking and cluster entry. The absence of firm criteria may result in a deficiency in onboard system capabilities. We are working these and other items with the Program Office.

2. NASA Advanced Computer Study: A consolidated report from this study is due January 1, and the several task teams performing the study will meet this week to consolidate their results. Our input to the Mission Assessment Team, which we have reviewed with other MSFC elements, covers the requirements associated with systems assessment for the space station/base, shuttle, lunar orbiting station and a Mars mission. We have concluded that the desired goals of onboard autonomy can be met with a common type of onboard computer which is within the state-of-the-art. The ground support required for systems operation can be provided with existing computer hardware. However, the scientific data processing requirements present a problem challenging the capabilities of many ground computers and must be studied further. The Experiment Data Management Team, in which we also participated, has concluded that management controls can be implemented to reduce the data volumes to be handled while increasing the useful information acquired from any experiment.

3. Apollo Launch Azimuths: A teletype from the Mission Director (Chet Lee) has confirmed that there is no Apollo requirement for future launches on azimuths greater than 96 degrees. This had been in question since the Apollo 12 spacecraft LOX tank replacement resulted in a contingency plan to exceed 96 degrees.

NOTES 12/8/69 STAMY

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UNIVAC 3G COMPUTER NEGOTIATIONS: MAF representatives participated in MSFC's formal negotiations of the UNIVAC 3G computer system contract. Objectives of the negotiations, which are expected to be completed this week, include the ability of MAF to better utilize the 3G system in a production environment.

STUDY OF POGO PROBLEM IN AS-507: An analysis of data from the AS-507 flight revealed an oscillation problem during the burn of the S-II stage. To preclude a similar problem from occurring in AS-508 and future launches, Messrs. Robert Hunt and James Odum of MSFC and the POGO Working Group, with the assistances of the Slidell computer staff, made an intensive study of previous S-II, static and flight tests to identify the cause of oscillation. This involved processing test data from S-II statics 4, 5, 6, and 8, and S-II flights 504, 505, 506, and 507, utilizing 358 manhours and 105 hours on each of the SDS-930 computer and the Gulton Vibration Analysis System between Friday, November 28, and Tuesday, December 2, 1969. All processed data was forwarded to North American Rockwell through the S-II Branch of MTF.

CHANGE IN MAF AUDIT RESPONSIBILITY: Mr. George Noel, M-DU, confirmed NASA Headquarters plans to change audit responsibility at MAF from NASA Audit to DCAA. Searcy Smith, NASA Audit Manager, is to be transferred to Langley. Mr. Smith and his staff have been of great help to procurement personnel at NASA Headquarters, MSFC, and MAF in the negotiation and administration of contracts and are considered a part of the MAF staff. The projected future combinations of NASA vs. other agencies workload at MAF will require greater rather than a dilution of audit coverage and it is believed that a continuation of NASA audit coverage at MAF should be considered.

Lick Cook please look into this, I do not have any opinion about this. NASA seems to want to save personnel which is certainly commendable, but the change of audit responsibility to another Agency might also have repercussions.

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NOTES 12-8-69 Stuhlinger

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P.S.

1. VISIT BY SCIENCE CONSULTANTS: Drs. O'Dell and Meyer spent a profitable full day at this Center on 12/2. Meetings were held with representatives of Staff and Center Management, and of the various offices and labs. The Consultants are now broadly familiar with this Center and its activities. From now on, their visits will concern specific questions and problems. In January, the Consultants will meet with Mr. Downey and his associates to discuss aspects of astronomy and physics projects planning. Other visits are planned with Mr. Taylor and Dr. Randall (optical technology), Mr. Heller (solar, microwave and X-ray astronomy), Dr. Parnell (cosmic ray physics), and others. The Consultants said they hoped to meet with you in the near future and discuss the basic question of a better contact between NASA planning activities and the scientific community.

The Consultants do not feel that a real problem exists with respect to engineers vs scientists. Both have been getting along fairly well in previous projects, and they are continuously learning to get along even better in present projects. The real problem, in their opinion, is the continuation of a strong and progressive space program in view of the "severe unbalance" reflected by the proposed STG Option II Program with its overwhelming emphasis on transportation capability, and its neglect of scientific programs. A detailed report will be distributed this week.

2. APOLLO 12 PHOTO AND SCIENTIFIC DEBRIEFINGS AT MSC: Nick Costes, Otha Vaughn and I attended a full day debriefing on these subjects at MSC on 12/5. Although detailed scientific results are not yet available, several important points were made, among them the following:

There was a great amount of dust everywhere. It covered surfaces and lenses, and it penetrated even through closed zippers. Sometimes, settings on cameras were hard to read because of dust. A dust cloud came out of the stereo camera whenever it was set on the ground for picture taking. Thomas Gold said (followed by roaring laughter), "I told you there is dust on the moon!"

There was not enough time, and not enough film, to do and to photograph all the astronauts wanted to.

Logging of pictures, and of the photographed objects, was a problem. Automated procedures should be developed.

Lack of body flexibility, due to the stiffness of the suit, hampered observations.

The astronauts stated that with better training in scientific matters, particularly geophysics, and with more indoctrination before flight about what they should observe, they would have been able to make more profitable use of their short time on the moon. Activities during traverses should be worked out in great detail before the flight. Traversing, ditch digging, sample selection, photographing, and keeping a log of activities should be practiced more before flight.

The dust problem, as observed during EVA and on the surface of Surveyor, will be a tough problem for a lunar astronomical observatory. Also, the design of roving vehicles should be checked carefully under this aspect. A more detailed verbal report on the debriefing will be given soon.

Dec 15, 1969

NOTES 12/15/69 BALCH

P₂ 12/16

S-IC-13 - "Power-up" was completed on 12/8/69 as scheduled. Static firing is scheduled for 1/13/70.

S-II-9 - Stage is in the vertical position in the S-II Stage Checkout and Storage Building. Final modifications are on schedule for completion on 12/17/69. Shipment to KSC remains scheduled for 1/8/70.

S-II-10 - Stage is in the horizontal position in the S-II Stage Checkout and Storage Building. Insulation repair was completed on 12/12/69. LH₂ tank entry for replacement of the fast-fill shut-off sensor is scheduled to start today, 12/15/69, and complete on 12/19/69.

S-II-11 - Removal of static test instrumentation was completed on 12/8/69. Stage modification and disconnect, in preparation for removal from the A-1 Test Stand, is scheduled to start today. Removal from the test stand remains scheduled for 1/13/70.

S-II-12 - Stage is expected to arrive at MTF from Seal Beach on 12/20/69, two days earlier than previously scheduled.

Start Discharge Valves on S-II Stages - Replacement of the three improperly reworked Start Tank Discharge Valves on the S-II-9 stage (Discussed in last week's NOTES) has been completed. Investigation also revealed that two STDV's on the S-II-11 stage and three on the S-II-12 stage were improperly reworked and will have to be replaced. These replacements will be made at MTF, with no impact to major milestone schedules.

GE/TEMPO Contract on MTF Utilization Options - Final report will be delivered tomorrow (12/16/69) with discussion of its recommendations scheduled in Huntsville this week.

BOMEX - Several leading environmental scientists from Gulf of Mexico Universities, representatives from Coast Guard, ESSA, Bureau of Commercial Fisheries, and Industry will convene at MTF on December 18 and 19, 1969, to review BOMEX data and data system planning. Group will be addressed by Dr. Shykind of the President's Marine Council.

NOTES 12/15/69 BELEW

Ps 12/16

PAYLOAD SHROUD (PS) CONFIGURATION: A firm PS configuration is being defined at a meeting this week between MDA/C and MSFC. Results of this meeting will be signed off by both parties and officially baselined in immediate future.

TRAINER REQUIREMENTS: MMC to meet with MSFC on 12-16-69, to establish MDA Trainer Requirements. MMC and MSFC to meet with MSC on 12-18-69, to finalize the requirements. The objective of these meetings is to lead to pricing the hardware.

ATM FILM VAULT PROPOSAL: On Monday, 12-8-69, representatives from MMC visited the Center to present technical and cost proposals on the design and development of the ATM film vaults for installation in the MDA.

AIRLOCK MODULE MANAGEMENT MEETING: An Airlock Module Management Meeting was held at MDA/C/St. Louis on December 10 and 11. Design, test and procurement schedules were stasured. Also, significant items from the Cluster Systems Design Review were discussed and MDA/C-ED provided gross impacts for some of these. The significant result of the meeting was the extremely tight schedule on all aspects of the project.

THERMAL SYSTEMS UNIT: All Thermal Mechanical Units except rate gyros have been installed on ATM spar and minor wiring problems are being cleared up. Rack structural fabrication will be completed next week and component installation is expected to begin. The present fabrication schedule still needs improving if the ATM canister thermal vacuum test to be performed at Astronautics Lab is not to be cut short since we are constrained by a completion date at MSC. This area is under continuous and joint S&E/AAP review.

DYNAMIC TEST ARTICLE: Now that the decision to keep the Dynamic Test Article in the OWS test program has been made, it is imperative that the most expeditious mode of transporting the S-IVB-500F to Huntington Beach be selected (present Dynamics Test Article schedules are based upon delivery of 500F to MDA/C-WD on 11/15/69). Without a Super Guppy contract, water transportation from MSFC to Huntington Beach could take as long as 53 days from go-ahead. Failure or delay in renewing the Super Guppy contract could result in cost and/or schedule impact to the program. Effort is underway to determine the schedule impact of late delivery of the Dynamic Test Article to MDA/C-WD.

LEE JAMES
SHEPHERD
WHAT IS
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OF THIS
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R-12/16

OSSA R&D PROGRAM OPERATING PLAN - Preliminary guidelines and flight schedules have been received from OSSA for preparation of R&D POP 70-1. OSSA has requested MSFC's submission no later than February 16, 1970. Since the Agency's FY 1971 budget levels have not been determined, funding guidelines consist of the latest approved Operating Plan that assumes the Center's level of effort projects are to continue at the FY 1970 level. MSFC's FY 1970 guideline of \$1,727K is \$705K less than requirements submitted in our previous POP 69-2.

New OSSA effort for FY 1971 includes \$4.0M for HEAO A-D (designated for MSFC), \$7.0M for Navigation/Traffic Control Satellite A & B, and \$12.0M for Earth Observations. These guidelines have been distributed requesting that particular attention be given to the programs indicating new effort and undistributed funds.

HOUSE HEARINGS ON AERONAUTICAL RESEARCH - The House Subcommittee on Advanced Research and Technology (Hechler) held hearings on Aeronautical Research, December 2-4 and December 8-11.

Testimony was by Dr. Paine, Harper, Lundin and Elms for NASA; Seamans and Foster for DOD, Bislinghoff for the National Academy of Engineering; and by a number of representatives of the air transport industry.

There was general agreement that much more aeronautical research must be done. Chairman Hechler felt that NASA's research effort should be increased, but the consensus seemed to be that NASA's current role was a proper one, particularly in the absence of a national policy. House Space Chairman Miller questioned whether the air transport industry was itself doing all that it should, and Hechler asked that the President give national direction to the program.

NOTES 12-15-69 BROWN

B 12/116

F-1 ENGINE - We are proceeding to implement a Saturn Program Office request to reorifice each engine for a flight tag value of 1,522,000 pounds for those engines installed on stages S-1C-11 and subs. Rocketdyne thrust predictions for the engines on S-1C-13 for static test and flight are as follows:

<u>Position</u>	<u>Engine</u>	<u>Stage Test Prediction (Kips)</u>	<u>Flight Prediction (Kips)</u>	
1	F-6079	1521	1512	<i>Rede Brown</i> <i>Why is flight prediction (lift-off) always lower than Stage Test?</i> <i>MTC is practically sealed as in PAD 59.</i>
2	F-6080	1508	1499	
3	F-6082	1521	1512	
4	F-6077	1513	1504	
5	F-6081	1514	1505	

All S-1C-13 engines will be reorificed prior to static firing.

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The engines installed on stage S-1C-12 will require reorificing; it will carry the first LRV and maximum payload might be required. Although S-1C-12 has already been static fired, we cannot see any significant reliability loss. The range of thrust uncertainty is increased since the "paper calibration" will not be confirmed before flight.

J-2S ENGINE - We reviewed with Rocketdyne last week the restructuring of the J-2S project in the light of a reduced budget and no firm implementation plans. Rocketdyne will submit a program plan late this week or early next week. It is my intent to work up the several alternatives available to us with respect to the J-2S and discuss these alternatives in a meeting with the appropriate Center personnel.

B 12/16

1. ARTIFICIAL G REQUIREMENT: Dr. Rees raised a question during the Space Station Quarterly Review concerning the requirement for an artificial g Space Station environment and asked who is looking into this matter. Dr. Hilchey and others in my Office had expressed a concern several months ago that the requirements for the artificial g experiment had not been defined. This situation prompted Dr. Lucas to write a letter to Chuck Mathews suggesting that a committee or working group of appropriate experts be convened to define a meaningful artificial g experiment. The committee should involve both scientific experts representing the biomedical community and engineers familiar with SWS II and Space Station designs. Action to establish such a committee has been taken by Headquarters. Mr. Ellsworth, in Mr. Huber's Office, is the focal point of this activity at MSFC and can supply additional information if required.

2. DUAL MODE ROVING VEHICLE PAYLOADS - PRESENTATION TO THE LUNAR AND PLANETARY MISSIONS BOARD: In my Notes of 11-24-69, I indicated that we had been asked to make a presentation on the DLRV and its science payload to the Lunar and Planetary Missions Board. This requirement was canceled. I understand that Captain Scherer did make a presentation to the Board last week, but we are not aware of the material which he presented and have received no feedback as yet.

3. IONOSPHERIC SUBCOMMITTEE MEETING: I reported previously (Notes of 11-3-69) that we are hosting the next meeting of OSSA's Ionospheric Subcommittee of the Space Science and Applications Steering Committee. The dates for the meeting are now firm - January 6, 7, and 8. Dr. Ed Schmerling of OSSA (works for Jesse Mitchell) chairs this Subcommittee. Mr. Roberts of my Space Physics Group will make necessary administrative arrangements, including a tour. Dr. Bucher will welcome the Subcommittee to MSFC, since Dr. Stuhlinger will be out of town on January 6. As usual, this Subcommittee meeting will be a closed meeting. MSFC does not have a member on this Subcommittee, but Mr. Roberts will serve as an observer.

4. SPACE STATION QUARTERLY REVIEW: I am of the opinion that MDAC has developed the appropriate philosophy concerning the payloads and experiments, i. e. design to accommodate laboratory facilities instead of individual experiments; design for flexibility since the actual payload requirements cannot be specified at the present time; provide facilities to satisfy "user requirements"; and recognize that the experiment equipment within the laboratories (user facilities) will require updating during the course of long term investigations. I believe that MMC, the subcontractor for experiments and payloads, has in general an excellent understanding of the scientific program requirements.

B 12/17

1. AIR FORCE CRITERIA FOR LOADS, DYNAMICS & CONTROL: A recent meeting with Air Force design personnel (in contradistinction to theoretical research personnel) at Wright-Patterson (see Notes 12/1/69 Geissler, attached) resulted in the following more general observations pertaining to Space Shuttle design: The current wind gust criteria of the Air Force (AF), written for long-lifetime aircraft, should and could be toned down to reflect the much shorter Shuttle lifetime. AF is using PSD (power spectral density) vertical wind gust loads, maneuver loads and landing loads criteria; with the Shuttle, this approach would be too simple since horizontal wind magnitude, wind shear and gust loads will be of concern also, certainly for ascent and probably for descent. Aeroelastic problems, of little concern in our Saturn structural models, will be very important in design, and both static and dynamic effects must be included. Aircraft of Space Shuttle dimensions must have a rigid body automatic stability augmentation system (SAS) including some gust load alleviation (i.e., the first fuselage mode). All AF people we talked to are against fly-by-wire, their reason being the many exposures to lightning and possible knock-out of power. They still have very little confidence in zero/zero automatic landing possibilities and feel pilot takeover is still necessary. One reason they give is vulnerability to erroneous signals from parked planes, etc., using present ILS systems. We have obtained their specifications for handling qualities, control, stability and runways for study with respect to Space Shuttle applicability.
2. SPACE SHUTTLE ENGINE MIXTURE RATIO: Aero personnel attended the Space Shuttle Action Item Review Meeting at Hq, 12/10/69, and recommended that the engine should be designed for an operating range of mixture ratios from 5.5 to 6.5, with a nominal value of 6.0. A representative from MSC agreed with our recommendations and noted that the wider the range of mixture ratios at nominal power, the higher the available emergency power level at midpoint.
3. PARTICIPATION IN AF CLEAR AIR TURBULENCE PROGRAM: We have received a request from the Air Force to participate with our Jimsphere system in their January/February/March 1970 winter studies of aircraft turbulence, centered near Wallops Island, Va., during which Air Force personnel will make extensive studies of their remote sensing equipment under development. The efforts requested of us involve taking Jimsphere measurements from Wallops Island. Airplane flights and measurements will be conducted by the Air Force. Since participation will provide us with the acquired data and will cost only our contribution of the Jimspheres (a measurement program arrangement with Wallops is already in existence) we will endeavor to take part. The results may well be of value in our Shuttle related efforts.
4. BASE HEATING ON THOR/TIROS VEHICLE: At request of Goddard SFC, we have presented our base-heating technology to MFDC and GSFC at the Tiros-M Flight Readiness Review, Dec. 3/4. The base thermal environment of the Thor-Delta launch vehicle with six solid strap-ons was discussed, with particular interest on the influence of the solid motors on the recirculation of the turbine exhaust gases in the base region. One or two Thor vehicles have failed because of base heating problems. Discussions, which may lead to vehicle modifications, are continuing.

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NOTES 12/15/69 GODFREY

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12/14

1. Reference Godfrey Notes 12/8/69: In regard to your question on my notes of 12/8/69, the schedule for AS-508 launch will not permit waiting for static firing results to make a decision. We will have to move out on hardware modification kits in January in order to meet the 508 launch date. Even then, the schedule is tight. If the static firing reveals an unexpected problem, we are maintaining a "back out" capability with the hardware and software.
2. DCR on Elimination of Static Firing: Rocco Petrone has requested that we make a presentation to the Design Certification Review (DCR) Board on the decision to eliminate static firing on Saturn stages. The presentation will be made on January 13, 1970, as a part of the Management Council meeting.
3. Saturn IB Program Cost and Manpower Review: Bill Schneider requested a detailed review of Saturn IB Program technical requirements, tasks, manpower, skills and costs. The purpose of the review was to provide AAP personnel with first-hand knowledge and understanding of detail requirements which back up our POP cost submissions. The review consisted of contractor presentations and tours of plant facilities and storage areas at IBM, MDAC, and Chrysler, with a summary review at MSFC on Tuesday, December 9. The Headquarters team was satisfied with our portion of the review and plan to proceed to KSC to survey launch site plans.
4. Human and Procedural Error Control: Because of our concern on human and procedural errors, we are implementing a uniform system for reporting and correction of potential errors as well as actual errors throughout the Saturn Program. This system was operated on a pilot basis for six weeks at KSC. The system will be operated by our Resident Management Office and DCAS inspection personnel. The system is presently in operation at IBM and will be implemented at other locations after completion of RMO and DCAS personnel training in January.
5. Saturn V Follow-On Procurement: In regard to your question on my notes (item 2) of 12/8/69, if the follow-on procurement is not approved for FY-71, the contractors' proposals will be used for planning only and we will not negotiate or sign any contracts. We need the proposals to firm up our understanding of the impact of the lower two-per-year production rate, regardless of the start date of the follow-on procurement.

1 Enc (cy 12/8/69 Notes)
(- for Dr. Rees only)

B 12/17

SPACE SHUTTLE AERODYNAMICS: The MDAC has developed, under Air Force contract, the "Hypersonic Arbitrary Body Aerodynamic Computer Program," which is now being used by us to calculate the aerodynamic and stability characteristics of space shuttle vehicles.

The author of this program, Mr. Arvel E. Gentry, MDAC, has made this computer program available to us and was most helpful to facilitate the operational status of the program deck here at the Center.

The MDAC computer program is capable of performing a complete aerodynamic analysis of an arbitrary shape, has program flexibility and a wide variety of options, including vehicle geometry generation and description, visual graphics necessary in handling geometry data and in preparing plots of the final aerodynamic data, aerodynamic calculations of surface pressures and skin friction forces, and the integration of these forces to give all aerodynamic coefficients and stability derivatives.

The program can be used to study a wide variety of hypersonic vehicle shapes including hypersonic cruise aircraft, air-breathing booster vehicles, blunt lifting reentry bodies, high L/D reentry vehicles, blunt reentry capsules, and satellite shapes.

The preparation of input data for this program is a tedious job and may take several days to generate, depending on the configuration. At the present time input decks have been prepared for the proposed General Dynamics and Lockheed Shuttle configurations. Aerodynamic data are now being generated for the Martin booster concept and the MSFC - S&E in-house design, assisting the Aero-Astroynamics Laboratory in their effort.

EFFECTS OF IONIZATION ON BEHAVIOR OF HUMAN BEINGS: In considering the biological experiments being studied by this Office for Dr. Hilchey, it was suggested that environments other than the standard atmosphere, temperature, radiation, g-level, etc. be considered. Magnetism and atmospheric ionization have been shown to influence human behavior and well-being. Therefore, we welcomed the opportunity to discuss this topic with Dr. Christofv of the ESCOA Corporation of Arizona on his recent visit here. Dr. Christofv has a thorough background and considerable experience regarding the effects of positive and negative ionization on human behavior and well-being. Dr. Christofv stated that "It has been conclusively established that an electro-power field between atmosphere and earth exists in nature." However, astronauts, while in space, must function in environments which are completely shielded from the earth's natural electric field. He further stated that previous experiments clearly indicate that a person's performance and efficiency will be significantly upgraded if they are exposed to the influence of an artificially-produced and properly-controlled electric field which duplicates the missing natural field. At the conclusion of the meeting, Dr. Christofv offered to submit an unsolicited proposal to investigate the ionization effects of man in space and plans to do so within a month.

NOTES 12-15-69 GOODRUM

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SPACE SHUTTLE TECHNOLOGY STEERING GROUP MEETING: Dr. Mrazek will attend this meeting in Washington Dec. 16 & 17 as a member of the steering group. He will discuss program deficiencies. Jerry Thomson will report on propulsion panel activities and Charles Wood will review cryogenics.

NASA HDQRS REVIEW OF SHUTTLE DCR ACTION ITEMS (Dec. 10): MSFC personnel reported on assigned action items at this review, chaired by Mr. Day. Mr. Mathews and Gen. Hedrick attended. There were only a few questions and no extensive discussion on any item. No new action items were identified. DOD gave a good report on air-breathing propulsion for STS application--high thrust-to-weight, hydrogen system. It appears that a high-thrust-to-weight hydrogen fuel air-breathing engine is a long way from being ready to go, and it was reported that R&D would require a \$400-500M program over a 7-8 year period.

SPACE STATION REVIEW TO HDQRS: Messrs. Brooksbank and T. Smith (MDAC) presented our part of the Space Station effort to date in a quarterly review to Dr. Paine on December 12.

MDAC SPACE STATION QUARTERLY REVIEW: MDAC gave their quarterly review on 12-10-69, with about 200 persons attending, about 150 from MSFC. It is gratifying to see this much interest in the program, especially since most of the people remained through the complete presentation. We probably will have to hold at least our next quarterly review in the auditorium, which is what MSC has been doing. Considerable technical data was presented. On 12-11-69 an all-day special session was held with appropriate PD and S&E personnel on the Space Base and Planetary Mission. Mr. Don Charhut (MDAC) did an exemplary job of walking through 8 hours of analyses, rationale, conclusions, and recommendations. This was probably the most comprehensive detailed review that any Phase B contractor has been subjected to. About 20 key MDAC people were in the meeting to answer specific questions. There are two or three areas where some of our organizations are still not satisfied with MDAC selection criteria and rationale, and we will arrange for a special review in those areas. There were 12 other splinter meetings held 12-11 and 12-12-69 on: Test Philosophy, Long Life Subsystems Assurance, Rendezvous Radar, Crew Integration/Habitability, Environmental Control/Life Support System, Structures, Weights, Mockup Layouts, Experiments Integration/Modules, Nuclear Power, Mission Operations, Launch Vehicles and Logistics.

JPL SUPPORT -DLRV: JPL has been funded approximately \$1M to provide science, mission operations, and systems engineering support for our DLRV studies. JPL will be directly responsive to MSFC in these areas although they are being funded from Hdqrs. Representatives from JPL will be at MSFC on 1-20-70 to describe the tasks they will perform in the next six months.

FIRST QUARTERLY PROJECT DEFINITION REVIEW: This review of Lunar Exploration Hardware Definition activities will be held 2-5-70 at MSFC, with individuals from Hdqrs and other Centers invited. A two-hour dry-run summary is tentatively scheduled for 2-3-70. Each Systems Manager (Science, Mobility, Mission Operations and Astrionics) will present a summary of progress in his area and we will describe overall progress towards defining the DLRV.

R-12/14

1. AAP FAILURE MODE EFFECTS ANALYSIS (FMEA): One of the tasks of Martin Marietta Corporation (MMC) under the AAP Integration contract is the development of an overall AAP mission FMEA. This effort, when completed, should provide a tabulation of all failure modes to which the AAP missions are subject, and the effect of any given failure on the mission. It should identify all critical failure modes, i.e., those failures which could result in loss of life or loss of mission. This information will be extremely valuable to the program manager in making decisions forced by hardware problems or decisions involving the allocation of additional resources. In support of the MMC AAP Integration effort, the Quality and Reliability Assurance Laboratory has furnished approximately 16 FMEA's on major items of AAP hardware such as the H-Alpha Telescopes, the Star Tracker, and the ATM, and 25 lower tier FMEA's. FMEA's on other AAP hardware will be forwarded to MMC as they are received from the hardware contractors. It is anticipated that we may furnish on-site guidance to MMC in developing the overall AAP Failure Mode and Effects Analysis.

*Director's Group
I would like
to see the
FMEA on
the ATM.*

Rs

2. COMPONENT LIFE EXPECTANCY ACTIVITY: A meeting was held recently with PM-SAT and Component Life Expectancy Committee representatives to discuss the proposed S-IB Component Life Program. The program consists of inspection, functional testing, and mission simulation testing of components which will be 4 to 11 years old. The resulting data will be excellent for verifying the life of similar components and for predicting additional calendar life (using aging analysis techniques) of the components being tested. It was unanimously agreed that CCSD should do this work. PM-SAT agreed to take immediate contract action.

3. LRV PROGRAM: We are proceeding with plans to staff two LRV resident offices with Quality and Reliability Assurance Laboratory personnel. One at TBC, Huntsville, and one at GM, Santa Barbara. Dates for staffing are December 15 for Huntsville and January 5, 1970, for Santa Barbara with itinerate coverage by our West Coast personnel as required until that date. Operational guidelines for the offices have been prepared and are being coordinated with the LRV manager.

R-12/17

1. Shuttle: To prepare for a visit of CSE and other laboratory representatives in January to obtain basic test program information on high speed aircraft, two members of CSE visited MDAC-East and Aerospace Corporation last week. The MDAC visit was to obtain comparative information on military vs. civilian programs. Of particular interest was a comparison of Navy, Air Force, and FAA specifications and their effect on test programs. MDAC expects to combine experienced people from aircraft, missile, and space vehicle fields into a single development organization to propose on the Shuttle.

Aerospace Corporation is conducting a Shuttle study for NASA Headquarters which is about completed. They noted that test programs must have a significant impact on systems requirements if operational parameters are to be met. They have also commented in regard to the work statement for the Shuttle that the verification area and certain others should be expanded significantly before the RFQ can be expected to elicit a reasonable contractor response.

2. MLRV: After quite some insistence to get GE as sub-subcontractor for the MLRV backup drive motor and controller development, I hope that we will be successful too that Boeing will select the simpler directional gyro navigation system instead of the strapdown inertial system proposed by their newly established G&C group in Seattle. Our specifications had been written that the simpler system is capable of fulfilling them.

B 12/17

1. S-11-8 POGO Corrective Action: A POGO Working Group Meeting is scheduled for December 16, 1969. The primary purpose of this meeting will be to review the evaluation results of the S-11 flight data from Apollo 12 and assess whether a fix is required for S-11-8 (Apollo 13). If required subsequent to this decision meeting, a design review will be held with North American Rockwell on December 17 for the center LOX feedline accumulator system. If the helium accumulator is adapted for the S-11 stage POGO problem, helium at the rate of 0.003 lb/sec nominal and 0.0085 lb/sec maximum failure will flow into the engine. Rocketdyne has expressed the concern that this amount of helium will significantly increase the critical NPSH of the J-2 LOX pump. Our Propulsion & Thermodynamics Division has evaluated nine MSFC cavitation tests with the accumulator, six with He ingestion and three without He ingestion and have found the increase in NPSH to be 6-8 feet regardless of the He flowrate. Flowrates up to double the maximum North American Rockwell/Space Division (NR/SD) predicted were tested. This degradation would be acceptable to the S-11 stage.
2. Orbital Workshop (OWS): Stacking of the OWS mockup in Building 4619 has been completed. Pending the decision to be made by PM, we will either update the mockup to the current baseline configuration or prepare it for shipment to MDAC-West.
3. Aerospike Thrustor for Shuttle Reaction Control System: A presentation was given to NASA Headquarters in response to an action item from the Management Council meeting to investigate the possibility of using the aerospike concept as a thrustor for the Shuttle RCS. No requirement could be established by the study and a recommendation not to pursue any technology for Shuttle RCS aerospike was made. MSFC's presentation was essentially in consonance with a report by MSC on the same action.
4. Personnel Technical Accomplishments: Mr. Ralph Higgins of the Materials Division has received an award for his Technical Brief on "Renewal of Corrosion Protection of Coated Aluminum After Welding". Information from Illinois Institute of Technology Research Institute indicated that this repair process was needed in private industry and is being used.
Mr. O. Y. Reece has received Patent # 3,469,437 for his Horizontal Cryostat for Fatigue Testing of Metals and Sandwich Structures.
5. Saturn V Workshop: In response to a request from NASA Headquarters, a summary of premature failures during static structural testing of the Saturn vehicles was compiled to illustrate the need for testing on the SWS. In the short time available, 27 premature failures were identified. Data from the summary indicated that testing in addition to analysis is required to assure reliable flight hardware. Similar dynamics test data were developed and transmitted with the static testing data to PM-AA. These data were requested as justification of our SWS test program.

NOTES 12-15-69 Heller

B
12/19

1. VISIT BY ALSEP P.I.: Dr. Langseth of the Lamont Geological Observatory visited SSL on December 11. He is the P.I. of the thermal probe to be flown on Apollo 13 and planned also for Apollo 16. We are conducting thermal measurements of simulated lunar soil for him in our laboratories. Mr. B. P. Jones of SSL has been invited to become co-investigator because of his well known studies of the lunar thermophysical environment.

2. S-183 FLIGHT EXPERIMENT BY DR. COURTES (FRANCE): A delegation of four people from France and from the French embassy in Washington was here Wednesday through Friday for detailed discussions of S-183. This is an experiment for ultraviolet stellar astronomy which has been approved by the SSASC (Space Science and Application Steering Committee) and by the MSFEB for AAP. The most likely location for the SWS interface is the anti-solar SAL (scientific airlock). Dr. Johnson's office is in charge of the experiment, and Mr. H. Atkins of SSL has been assigned as the experiment scientist. Mr. Atkins is attending a meeting with the same group this week at Northwestern University.

3. PROTOTYPE OF PROTON-SPECTROMETER: The Proton-Spectrometer, which is scheduled for SWS 1, has the purpose to measure the proton spectrum of the hard tail end of the South Atlantic Anomaly in the Van Allen Belt up to 400 MeV. The prototype electronics produced under contract by Space Tac was checked out last week, together with the Measuring Head which is being made in-house in SSL together with the University of Alabama, Huntsville. A team of scientists and engineers of SSL and the UAH went to the Harvard University Proton Cyclotron to test the complete prototype. After correcting some electronic timing problems, the final test runs proved that the experiment is working and performs within expectations. This is an essential milestone in the implementation of the Proton-Spectrometer assigned to SSL.

P2 12/19

1. MSFC TERMINAL CONNECTED TO HEADQUARTERS SCIENTIFIC AND TECHNICAL INFORMATION FACILITY AT COLLEGE PARK, MARYLAND:

The Bunker Ramo terminal with cathode ray capabilities has been installed in Building 4484. The telephone line between Marshall and NASA's Scientific and Technical Information Facility at College Park, Maryland, was put in last week and the hardware hooked up the next day. Only minor software difficulties at College Park are preventing the first tests on retrieving data from the Central Data Bank pertaining to library publications maintained on the IBM 360 at College Park.

These tests should begin by the end of this week and continue for approximately a week and a half at which time a representative from NASA Headquarters will hold detailed training sessions at Marshall for prospective users of the library information retrieval system. After conclusion of the training the terminal will be placed in production status.

*He. He.
I was of the
opinion that
the KSC
system was
built up
to fit ours
and that
there was a
close co-
operation
with KSC and
MSFC.
P2*

2. USE OF COMPUTER TIME AT KSC: The practicality of utilizing idle computer time at KSC has been investigated. There are vast differences in the KSC and MSFC systems. Three or four months of work by three Computation Laboratory systems people in residence at KSC would be required before conversion of MSFC programs could be started. Only a selected workload could ever be run at KSC unless a major systems job were done. The use of the KSC computers does not look at all attractive.

3. CONFIGURATION MANAGEMENT ORIENTATION SEMINAR: Personnel from MSFC, KSC, and Seal Beach recently attended a two-day configuration management orientation seminar held at MSFC. The purpose of this seminar was to instruct personnel from these locations in the techniques of remote terminal on-line update and retrieval of information from the MSFC UNIVAC 1108 Configuration Management Data Base. IBM 1050 remote terminals are located at both Centers and tied into the MSFC UNIVAC 1108 Configuration Management Data Base via communications lines. During a pilot program scheduled to occur during the final quarter of 1970, these remote terminals will be utilized to update and retrieve information from the Data Base. Results of this pilot remote terminal effort will be presented to appropriate MSFC Management personnel for a decision on utilizing the remote terminal concept of operation to update and retrieve information from the MSFC Configuration Management Data Base.

Pa 14/19

1. VISIT TO GODDARD SPACE FLIGHT CENTER: We have set up a meeting at Goddard on December 18, 1969, to present our activities in the area of future programs. This meeting resulted from Goddard's request to Dr. Stuhlinger and the November 11 letter from Dr. von Braun to Dr. Clark. The agenda is as follows:

- | | |
|-----------------------------------|----------------|
| Introduction | Bill Huber |
| Space Shuttle | O. C. Jean |
| Space Station | K. Dannenberg |
| Space Tug | A. Orillion |
| Experiment Modules
(Astronomy) | Jean Olivier |
| Summary | Dr. Stuhlinger |

The detailed agenda and arrangements have been finalized with Dr. Meredith of GSFC. He stated that Dr. Clark has reserved the whole day, so we should get a good attendance from Goddard management.

2. SATURN WORKSHOP #2, ARTIFICIAL GRAVITY ASSESSMENT: On December 9, 1969, the McDonnell Douglas Corporation gave a comprehensive review of their work to date to determine the systems impacts of performing an artificial gravity experiment on the SWS II. This experiment appears to be feasible and may be accomplished without the addition of any major new components. The location of the ATM/RACK after deployment is not compatible with the desired spin axis, and would require a two-degree-of-freedom yoke assembly, as opposed to the current single axis rotation. Use of the Service Module RCS system for spin up/spin down thrust is favored, pending further assessment with MSC. The CMG control system can be used for rotation damping during spinning. The ATM solar arrays would not be deployed for this experiment, requiring up to 50% increase in size of the workshop arrays, to provide CMG power.

This assessment was made on the Workshop only spinning (no S-II stage) and assumes an ATM (A or B) mounted forward and deployed similar to the method used in Workshop #1. The resultant radius arm is 33 feet, and a 4 RPM spin rate yields about 0.2 g's at the Workshop floor. These parameters are all within the range of requirements recently established by MSC.

3. LAUNCH OPERATIONS FOR HIGH ENERGY ASTRONOMY OBSERVATORY (HEAO): MSFC personnel visited KSC Unmanned Launch Operations (ULO) on 12-5-69 for the purpose of briefing the ULO staff on HEAO missions and to obtain information on facilities, procedures, and interfaces at KSC for HEAO launch vehicle and spacecraft. As you know, the ULO mode of operation is often quite different from the Saturn/Apollo part of KSC. For example, it is expected that MSFC and its contractors will have complete responsibility for HEAO spacecraft assembly and checkout at KSC, prior to stacking the spacecraft on the launch vehicle. The meeting seemed timely and profitable. We will try to arrange (thru. Col. Montgomery) a briefing to MSFC management by Bob Gray, head of KSC-ULO, in early February to discuss unmanned launch operations at the Cape.

NOTES 12/15/69 HUETER

R 12/19

No submission this week.

B 12/19

Liquid Chemical Propulsion Semi-Annual Review - OART - The MSFC Liquid Chemical Propulsion Program Review was held at the Center on December 10-11, 1969. OART personnel attending expressed positive satisfaction with the progress reporting and asked for presentation material on several pay-off items for use in congressional hearings in the future. Mr. A. O. Tischler, Director of the Chemical Propulsion Division, indicated that we must focus on future goals in order to develop the long lead time technology which will be required in the next 15-20 years. He pointed out that these goals should give us the incentive to focus programs to enable MSFC to do its job in implementing the program laid by the President's Space Task Group. Obviously, because of his dual capacity position as Technology Manager for Space Shuttle, he has begun to work in terms of project oriented (focused) technology. This is appropriate, of course, as the Agency sets out to establish a new major program, i.e., Space Shuttle, so long as a reasonable balance is maintained between the focused (project) and the nonfocused (discipline) oriented work within the Research and Technology Program. The risk of upsetting the critical balance by overstressing focused technology is generally understood. However, such heavy emphasis and "nut and bolt" control and management is now being imposed by MSFC and Headquarters project oriented groups that the balance has in fact been upset. Because of this, coupled with declining funding, an unpublicized dangerous trend is developing causing a number of critical technology areas to be left unattended by MSFC or superficially treated. Impellers, pumps, fluid management, ducting, and data management systems are examples of such areas.

Forthcoming Research Achievements Reviews - Because the Research Achievements Review scheduled for November conflicted with Thanksgiving Day, it was re-scheduled to this week. This will result in two reviews occurring in the immediate future. The first, dealing with Materials Research for Shuttle and Space Station, will be held this Thursday, December 18, beginning at 8:30 a.m. Sponsored by the Materials Division of Astronautics Laboratory, it will consider such topics as Bearing and Lubricant Research for Extended Life Orbital and Lunar Systems, Space Station Processing of Materials, and Promising Metal Matrix composites for Shuttle. The second review, covering Microelectronics Research is scheduled for January 29, 1970. This review will permit a local audience to hear the five papers which MSFC participants will present at the Fourth NASA Microelectronics Symposium to be held at Langley Research Center on February 10-11, 1970. These papers are only representative of MSFC microelectronics activities and are aimed at indicating the spectrum of our research and technology work needed to support present and future mainstream Center programs.

U.V. Panorama Flight Experiment (S-183). At OSSA's request, we have worked with the French P.I. for this experiment to better define it and locate it in Saturn Workshop (SWS) I. On December 8, 1969, the MSFEB approved the experiment for flight. On December 10-12, five Frenchmen who are responsible for building S-183 visited MSFC to brief SWS people on their experiment and, in turn, be briefed on SWS. On December 15, two of the Frenchmen, accompanied by Miss Mary Jo Smith of my office, are visiting Northwestern University to be briefed on the S-019 (U.V. Stellar Astronomy) mirror system which S-183 will use for pointing control.

NOTES 12/15/69 MOHLERE

No submission this week.

B 12/19

Rs 12/19

1. COMMAND COMMUNICATION SYSTEM (CCS) PROBLEMS ON AS-507:

At 5 hours and 18 minutes the CCS downlink failed on the omni-antenna. A commanded antenna switching procedure verified that only the omni-antenna was inoperative. A similar failure had occurred on AS-504, 505, and 506. At 7 hours and 21 minutes the uplink was lost. The downlink on high and/or low gain antenna was tracked until end of IU battery life at 12 hours and 48 minutes. Analysis has revealed a large temperature rise on cold plates 17 through 24 in the IU probably due to direct sunlight. Sunlight in this area has been correlated with vehicle attitude information. The coaxial cables of the CCS system are above these cold plates. Tests on cables at the temperatures calculated due to direct sunlight have shown that failure could occur under exposure of relative short duration. The uplink problem may also be explained by this analysis. IBM is submitting an ECP to further study the problem, but the expected action is a shield for the coaxial cables to keep the sunlight out.

2. MANNED LUNAR ROVING VEHICLE DESIGN (LRV): After extensive discussions with Boeing personnel, an agreement has been reached to use a 36-volt power system rather than a 28-volt system on the Manned LRV. The higher voltage will permit a more optimum motor and motor controller design. The resolution of the power system question still leaves the following two major unresolved differences of opinion on technical approaches: (a) Boeing plans to use a brush-type motor, whereas we prefer the brushless motor (Boeing has now agreed to consider the brushless motor as a back-up solution); (b) Boeing plans to use a "strapdown" inertial system for navigation, whereas we consider the much simpler "directional gyro" system with occasional reference checks by a sun compass to be a far preferable approach.

We are continuing to work both of these problems with Boeing and Mr. Morea.

3. NATIONAL AIR POLLUTION CONTROL ADMINISTRATION: A representative of the Research Triangle Institute (RTI), a non-profit research organization, visited Astrionics to observe a demonstration of a thin film technique which provides a resistance change when exposed to hydrocarbon gas. RTI has a contract with NASA concerning technology transfer to the National Air Pollution Control Administration. The demonstration observed was an outgrowth of our work in detecting hydrogen gas using a thin film of tungsten tri-oxide. During the research, it was determined that other thin films were sensitive to various gases. A thin film of indium oxide was found to exhibit a drastic resistance change when exposed to hydrocarbon gas. This provides an easy and reliable method of implementation into a measuring system since only a resistance bridge arrangement is required for an analog output voltage. Our contractor, in this instance General Electric, will provide a working instrument to RTI for evaluation at their facility in Durham, N.C., and we will follow through as necessary.

B 12/19

1. ATM Thermal Systems Unit: In order to expedite the manufacture of this test article (to be tested at MSC), Mr. Weidner and the laboratories agreed to accord first priority to it. Also a TSU team has been set up within ME to tackle manufacturing difficulties or holdups as they arise. Team members are drawn from S&E-P, S&E-ASTR, S&E-ASTN, S&E-QUAL, and S&E-ME. As a result of this emphasis on the TSU, some work of lesser importance may be delayed and the quick response fabrication services will be more heavily used for the procurement of parts.

2. ATM Transporter Base: To ensure quality and timely delivery of this item which is crucial to the ATM schedules, a vendor survey team composed of representatives from S&E-ASTN, S&E-QUAL, S&E-ME, and A&TS-PR reviewed the manufacturing facilities of three potential contractors. The low bidder was found to be unqualified to perform this fabrication within the required time frame. Their fabrication facility consisted of an airplane hangar. They had no machining capability installed and no handling equipment in evidence. There was a noticeable lack of planning for this job. It was the consensus of the Survey Team that this bidder could not perform the contract within the required delivery date. After discussing the above with the contractor, he decided formally to withdraw his bid. The results of the survey at both other contractors find that both are technically capable and competent to do the task. One has total capability within his facilities to perform the task, while the other will have to subcontract the honeycomb work. Final cost information will be available today so that a contractor may be selected. We have a very short lead time for delivery by May 1, 1970, and a major item of concern is that this Transporter requires FAA certification.

3. Neutral Buoyancy Simulator: The OWS Body-Restraint Study was conducted last week in conjunction with McDonnell Douglas, Western Division. Both shirt-sleeve and pressure suit evaluations were made. A report is currently being written for distribution.

B 12/19

1. Wind Constraints Meeting: We met with KSC in a well attended meeting to discuss further improvements in launch wind constraints analysis and implementation. KSC and MSC accepted the MSFC proposal to use the 445 ft. (top of LUT) level instead of 60 ft. as reference level for Saturn V wind limits effective on AS-509. AERO and ASTN analyses were presented and showed that this change will result in a significant reduction of launch constraints without increased risk to the vehicle structure. KSC accepted the action to evaluate various possible means to improve the measuring reliability from the new level. MSFC will recommend the best reference level for future Saturn IB launchings. Also presented were the results of the theodolite deflection measuring program. This program confirmed MSFC predicted wind deflections for certain cases but was quite impaired by strong thermal effects during day times. It was agreed to continue this program only on days with really high wind forecasts.

2. AS-508 Lunar Impact: The MSFC team which will perform the S-IVB/IU lunar impact operations for AS-508 presented a status review of their planning. The team is led by S&E-AERO-M and includes both S&E and PM members. Their preparations are proceeding well but on a tight schedule, and much work remains to be done. Most open trajectory analysis questions are to be answered and the operational timeline and procedures firmed between now and mid-January. Simulations with the Mission Control Center will begin at that time. A good working interface exists between the Huntsville team and both the MCC Guidance Officer and our launch vehicle flight controllers. PM-SAT is working to solve the problem related to the IU CCS failure experienced on AS-507.

3. OMSF Advanced Computer Study: The OMSF Advanced Computer Study Team met with the Steering Committee, chaired by Mr. Gorman, to present preliminary results. The goal of the team is to define the ground operations to be performed in the period 1975-1985, establish computer requirements, and consider options for consolidation of facilities. Major considerations reported were: (1) Present predictions of experiment data handling and processing requirements will far exceed engineering requirements for the development and operational phases of the space station/base and shuttle; (2) KSC is considering the development of an institutionalized GSE for both the Saturn V and autonomous vehicles of the future; (3) Centralized data switching and processing computer facilities are being studied, which could be a consolidation point for flight operations; (4) Criticism was raised that the study was duplicating other Phase B Information Management Studies in existence. The team will furnish a definition of operational concepts by mid-January at which time the Steering Group can determine if the activity will be continued.

NOTES 12/15/69 STAMY

B 12/19

George Constan Tribute Luncheon: In recognition of Dr. Constan's contribution to the New Orleans area during his tenure as Manager of the Michoud Assembly Facility, the NASA-New Orleans Coordinating Committee sponsored the "George Constan Tribute Luncheon" which was held on Wednesday, December 10, 1969, at the Royal Sonesta Hotel. Special presentations were made by Mayor Schiro, Rep. LeBreton representing Gov. McKeithen, and George Healy, Editor of the Times Picayune, for the NASA-New Orleans Coordinating Committee. The program included comments by the contractor management at Michoud and the principal speaker, Col. Lee James, was introduced by Jim Stamy. The luncheon was attended by approximately 200 persons.

NOTES 12-15-69 Stuhlinger

B 12/19

VISIT WITH DR. CHRISTIAAN BARNARD: On 12/11, I had the opportunity of meeting Dr. Barnard, heart transplant specialist from South Africa, at the General Electric plant in Philadelphia where Dr. Barnard serves as a consultant on bio-medical projects. Dr. Barnard showed an unexpectedly deep interest in the rocket and space flight program; although he is primarily involved in bio-medical studies, he asked many questions concerning technical and physical details of rocket propulsion and control. He pointed out that a certain similarity exists between transplanting organs and flying through space: in both cases, we must do it before we understand every minute detail of biological reactions. He is fully in favor of the 28-day and 56-day missions on DWSI on the basis of our present bio-medical knowledge. However, he emphasized that in parallel to the bold approach of these new projects, we should engage in a carefully planned study program that will enable us to understand more and more of the basic functions in living organisms; this program should include studies of virus cultures; of healing and regeneration; and of transplanted organs under weightless conditions. Dr. Barnard will probably visit our Center and give a lecture late in January or early in February.

During my visit with General Electric (Re-entry and Environmental Systems Division which designed and built the Biosatellite payload), I expressed the conviction that the biological program in OSSA and the medical program in OMSF should be brought together more closely and that a joint bio-medical program should be established that serves the interests and the functions of both organizations.

Dec 22, 1969

Rs 12/23

NOTES 12/22/69 BALCH

S-IC-13 - Stage processing is approximately three days behind schedule, but no impact is expected to static firing, which remains scheduled for 1/13/70.

S-II-9 - Stage is in the vertical position in the S-II Stage Checkout and Storage Building. Final modifications were completed on 12/17/69 as scheduled. Although stage will be ready to ship to KSC on 1/8/70, as previously scheduled, decision has been made to postpone shipment until 1/14/70.

S-II-10 - Stage is in the horizontal position in the S-II Stage Checkout and Storage Building. LH2 tank entry for replacement of the fast-fill shut-off sensor commenced on 12/15/69, and tank closure was completed on 12/18/69, one day ahead of schedule.

S-II-11 - Stage modification and disconnect started on 12/15/69 as scheduled. Removal from the test stand, originally scheduled for 1/13/70, has been rescheduled to 1/14/70 in order to avoid conflict with the S-IC-13 static firing.

S-II-12 - Stage arrived at MTF on 12/20/69 and will be installed in the A-2 Test Stand today, 12/22/69, one day ahead of schedule.

Start Tank Discharge Valves on S-II Stages - With reference to my NOTES of 12/8/69, and question raised by Dr. Rees as to whether Start Tank Discharge Valve replacements on S-II stages can be properly retested at KSC, it is my understanding that this will be done in the course of regular leak check procedures. The question as to whether the S-II-11 and S-II-12 had reworked Start Tank Discharge Valves was answered in my NOTES of 12/15/69. The two on S-II-11 have been removed, found to be satisfactory, and replaced.

BOMEX - This program will be continued and endorsed by the National Academy of Sciences under the acronym BOMAP (Bomex Analysis Project). Scientific review of preliminary results conducted at MTF on 12/18/69 and 12/19/69, resulted in several useful recommendations. GARP (Global Atmospheric Research Program) planners (Draus, Byers, et al) were participants.

B 12/23

NOTES 12/22/69 BELEW

OWS PROPOSAL REVIEW: Review of the OWS Proposal is continuing and adequacy of the principal technical and program documentation is to be determined by December 23, 1969. Our plan is to complete the cost evaluation phase and deliver the report to Contract's Office by January 9, 1970.

ENGINEERING MOCKUP: A review of the mockup requirements with MDA C-WD was held on December 15, 1969. A followup meeting will be held after Christmas week, to define the cost and schedule impact to provide adequate fidelity to meet test requirements of MSFC and MSC One-G trainer requirements. A decision will be made at that time as to the fidelity to be attained in support of this testing and the Crew Station Review scheduled for mid-March.

IMPACT OF MDA REDESIGN ON AM: The extensive MDA redesign presently in work will have a significant impact on the AM Test Program schedule, since the AM/MDA are presently linked together for the static test, vibro-acoustics test and flight article checkout. One or more of these AM tests may have to be performed without the MDA. We will be assessing the merits and demerits of running separate tests in the next month, prior to receiving a firm MDA schedule impact due to the redesign for earth resources experiment incorporation.

AM LOGISTICS PLAN: Discussions between MSFC and MDA C-ED were held December 17 to review a first draft of the MDA C-ED proposed Logistics Plan. This effort should lead to a final submittal of an AM Logistics Plan before February 1, 1970.

L. B. PAYLOAD SHROUD (PS) PLUM BROOK SEPARATION TEST:

A meeting was held here Tuesday (12/16/69) with Plum Brook and MDA C personnel to review the plan for transporting the PS to Plum Brook and preliminary requirements for the separation test. The working relations are excellent thus far.

Why do we have to go to

Plum Brook

for this test? Do they have a particular facility? I was never there and thought it is mainly a facility of LBRL for nuclear testing.

E. P.

R2 12/23

Woody,
I would
appreciate
if you would
let Freitag
know that
v. Bureau
will be
back on
Feb. 2
and 3
on Jan. 22.

PREPARATION FOR FY-71 AUTHORIZATION HEARINGS - According to sources in Capt. Freitag's Office, tentative schedule for visits by the Subcommittee on Manned Space Flight (Rep. Teague) is between mid-January and the first of February. Due to the time constraint, they expect to make only two trips. One would include MSFC and MSC. The other to some central location in the Los Angeles area with the contractors coming to the Subcommittee. There is the possibility that on the return from Los Angeles they may stop at Denver. Capt. Freitag's Office is working on guidance for these visits. However, an MSF "party line" cannot be established until the President's FY-71 budget request becomes firm.

We will keep in close contact with Freitag's Office for further developments.

E. R.

BLUE RIBBON DEFENSE PANEL VISIT - A task group of this panel, recently established by Secretary of Defense Laird, visited MSFC December 15-16, 1969, to study MSFC management techniques used in the Saturn program. Perhaps the most significant aspect of interest by the task group was the way the Apollo team was established in NASA and within participating aerospace companies. The impact of visibility within the program was felt to be a pertinent lesson for managing DOD programs and projects. Also the importance of in-house technical strength was recognized as key to the success of Saturn. Of primary interest was Marshall's approach to maintaining a viable and responsive organization, particularly under the constraints of limited flexibility in personnel hiring and replacement and of uncertainties in budgets and future missions.

FY-71 BUDGET STATUS - The current NASA FY-71 budget level being considered by BOB is at the \$3.7B level. Dr. Paine sent a reclama to the President on December 17, 1969 with three budget levels: \$4.250B, \$4.075B and \$3.935B. Concerning the \$4.250B level it was stated that NASA could basically do the same program for \$4.075B by reducing some program content. The basic difference between the \$4.075B plan and the \$3.935B plan is Saturn V follow-on production. This is being left up to the President to make the decision. However, it is inferred in the reclama that if NASA has to make a choice, it would prefer to drop Saturn V follow-on production in favor of new starts.

Ps 12/23

NOTES 12-22-69 BROWN

F-1 ENGINE - The "GOX out" to GOX wrap around" line seal leakage experienced on the F-1 engines during the initial leak checks on S-1C-12, reference Weekly Notes 9-19-69, are recurring on S-1C-13. New leak check criteria, allowing fuzz leakage at 1000 psig pressure rather than no leakage, has failed to totally correct the seal replacement problem. Leak checks of this particular seal are part of the post manufacturing checkout function transferred from MAF to MTF in May 1969. All five F-1 engines installed in the S-1C-13 stage had "growing bubble" leakage when first exposed to the 1000 psig pressure at MTF. The sealing flange torque was increased to the maximum on all engines, but three engines still had excessive leakage. The three discrepant seals were replaced twice and excessive leakage prevailed with normal bolt torque. The flanges will be polished, retorqued to the high limit, and leak checked again.

A new seal with a larger sealing tip, originally scheduled for the follow-on engines, is being procured and will be available prior to static firing for stages S-1C-11, S-1C-14, and S-1C-15.

J-2S ENGINE - A 30-second test and a 100-second test were accomplished on engine J-113. This engine is equipped with an acoustical absorber in the thrust chamber as a possible solution to high amplitude 4400 Hz buzzing. Preliminary results indicate a significant reduction in the level of the 4400 Hz vibration.

B 12/23

1. FUTURE PROGRAM PRESENTATION AT GSFC: In response to an invitation from GSFC, a series of presentations was made which covered the major elements of the NASA Integrated Plan. One of these presentations was made by Mr. Olivier on MSFC's in-house and contracted study efforts in astronomy and other experiment areas related to the Space Station time period.

As a result of the questions and comments from the audience there are still differences between the GSFC and MSFC approaches to conducting these missions. The most significant of these differences are: (a) GSFC desires a 400-500 nautical mile operating orbit for astronomy, whereas MSFC studies indicate that a 270 nautical mile orbit would be equally suitable. The GSFC philosophy seems to be driven by a fear that the decay rate at 270 nautical miles would limit this operational lifetime. (b) GSFC is still opposed to pressurized IVA maintenance techniques. Our philosophy is that the increase in operational flexibility and the ability to better cope with unique operational problems make IVA shirtsleeve crew access essential.

I believe that this visit was worthwhile. We were treated most courteously by Dr. Clark and his associates. In my opinion all the presentations (Shuttle, Space Station, Tug, and Experiment Modules) were well received. I had a discussion with Mr. Joe Purcell, the OAO Project Manager, after our presentations had been completed. As a result I now see an excellent opportunity for cooperation with Goddard in planning future space telescopes and methods of transporting and servicing these systems.

2. HIGH ENERGY ASTRONOMY OBSERVATORY (HEAO): Dick Halpern, the OSSA Program Manager for HEAO, has been asked to begin preparation of material for briefings to Congress on this subject. This is a positive indication of the possibility of a new start; however, he emphasized that he has received no specific word that HEAO is or is not in the most recent BOB markup. We will begin supplying visual aids and supporting documentation for his use.

3. GULF STREAM DRIFT MISSION: Mr. Chet May and Dr. Piccard presented to NASA Headquarters representatives the results of the Gulf Stream Drift Mission. Approximately 50 persons were in attendance with all major elements represented. Considerable interest was shown as evidenced by an excellent question and answer session. Questions were received concerning the proper utilization of the crew's experiences and subsequent data analyses in the Space Station definition effort. Subsequent to these discussions, MSC representatives requested that the same review be given to Dr. Gilruth.

Rees 12/23

1. USE OF ROCKET PROBES TO MEASURE CLOUD ELECTRIFICATION:

With regard to your question on NOTES 12/8/69 GEISSLER (copy attached, Dr. Rees only): Use of a rocket probe to obtain information on cloud electrification as a pre-launch operational system for Saturn/Apollo launch operations has been discussed for two different purposes: 1. (with trailing wire) for triggering possible lightning and discharging ("safing") a cloud prior to Saturn launch; 2. (without trailing wire, but instrumented) for measuring atmospheric electrification as a monitoring system. For both uses, the rocket probe system does not appear attractive to us: If used as a lightning rod, according to expert opinion voiced during the 12/4 meeting here, cloud re-charging occurs too soon after discharge to offer safety assurance for Saturn launch; if used as a measuring instrument, ambiguities remain. A properly instrumented aircraft would have more flexibility; also, more important, cloud formations should be inspected from topside visually, stipulating aircraft use. We are examining these alternatives at present. One of the lightning experts attending the 12/4 meeting at MSFC/AERO, Dr. Winn of NCAR, has developed a specially instrumented rocket to measure cloud electrification with respect to altitude (to approx. 20,000 ft). He and his colleagues are most anxious to fire this rocket from the Cape for research and for any benefit we may derive from their measurements at no direct cost to NASA. I will keep you posted on further developments. - By request of a group of West Coast scientists of the American Geophysical Union (AGU), a special meeting on the 507 lightning event was convened last week on the occasion of the AGU/AIAA meeting on "Exploration of the Planets Mars and Venus" in San Francisco, attended by representatives of MSC (Don Arabian), Stanford Research Institute, MSFC (Glenn Daniels of AERO), and others. Results will be forthcoming.

2. CORRECTIVE NOTE: As a parting shot for the old year, we would like to correct an erroneous statement made inadvertently in a recent note on the Direct Ascent profile (NOTES 11/10/69 GEISSLER, copy attached, Dr. Rees only). Due to a misinterpretation, it was overlooked that the direct ascent trajectory resulting in the quoted 5000-6000 lbs delta-payload was properly constrained to standard heating and dynamic pressure limits. However, the two major spacecraft abort limit lines (16 g's entry deceleration, and 100 seconds free-fall time to 100,000 ft) are not considered in this case. Aside from this, our main argument against the Direct Ascent profile would still be our inability to support such a change with present manpower.

3. MERRY CHRISTMAS AND A HAPPY NEW YEAR from Aero-Astro-dynamics Laboratory!

G

B 12/23

NOTES 12/22/69 GODFREY

SATURN:

1. S-IVB Static Firing: The S-IVB-511 stage was successfully fired for a full duration test of 442 seconds on December 18, 1969. Preliminary information indicates no problem with stage systems. This is the final S-IVB firing now planned for Sacramento. MDAC will proceed to mothball the stage test facilities and will attempt to relocate as many of the skilled test crew as possible at the Huntington Beach checkout area in order to minimize the time required to re-establish a stage static firing capability.

R. Godfrey
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some
experience
with it.

2. IU Environmental Control System Change: After many months of analysis and testing, a change to Oronite fluid in the ECS System was submitted to and approved by Rocco Petrone. This should inhibit or eliminate the chronic gas evolution and pressure buildup problems experienced at KSC, while using the present water-methanol coolant. In addition, the Oronite may eliminate the need for the complex and expensive passivation system required for the Saturn Workshop missions. If any unforeseen problems are encountered in actual use with the new fluid, we are maintaining a backout plan to purge and recharge the IU ECS Systems with water-methanol.

LRV:

Source
sample test
we don't
make
matter
none.
Z. B.

The first LRV Project Review was conducted on December 16 and 17. A crew station interface review was held on December 18 with Astronaut trials of the latest suit configuration in an LRV crew station mockup. The three-day session was well attended by MSFC, MSC, MSF and KSC, and provided a progress review and a working session on requirements between Headquarters and the three Centers. It is clear from the review that Rover dry weight and the extremely tight development schedule are the major problems. Satisfactory progress is being made in resolving technical and program issues. In reference to Dr. Haeussermann's notes of 12/8/69, we do not agree that administrative limitations or the subcontractor setup will be a deciding factor in meeting LRV commitments. In our view, the major problem will be in training our entire system to react to a development cycle of approximately one-third the duration to which we are accustomed. So far we are encouraged that the MSFC Rover task team, Boeing and the major contacts at MSC and Headquarters recognize the problems and are ready to make the necessary adjustments in thinking. In any event, the process can't take too long since the design will be essentially complete by April 15 (Critical Design Review), the wheel and motor-drive system selected by April 1, and the qual test vehicle delivered to qual test by July 24, 1970.

Walter
Haeussermann

NOTES 12-22-69 GOERNER

B312/23

NUCLEAR POWER FOR SPACE STATION/BASE: Some time earlier this year we presented the status of the combined efforts of PD-DO and S&E-ASTR in the area of Reactor Power/Thermo Electric Conversion Systems to you and MSFC management. You suggested at that occasion that this subject matter should for orientation purposes be discussed with the Frank Borman Space Station Field Director Office at their convenience.

The discussion took place on 12-11-69 after the MDAC Space Station/Base review here at MSFC. The meeting was attended by Mr. Frank Williams, Messrs. Kitterman and Johnson, AEC, Mr. Ginter, OART and appropriate personnel of MSFC. The items discussed covered:

- a. Mission requirements, constraints and trades.
- b. Candidate reactor power systems (i.e., thermoelectric, organic and mercury Rankine, Brayton, and Thermionic).
- c. Integration requirements, constraints and trades.
- d. Power system build up options.

Mr. Williams expressed at the conclusion of the discussions that he appreciated this opportunity of receiving an orientation on the efforts here and elsewhere with respect to Nuclear Power and Conversion Systems and their suitability to satisfy Space Station/Base electrical power requirements. I think the purpose of the meeting has been achieved.

HIGH ENERGY ASTRONOMY OBSERVATORY (HEAO) MEETING AT GODDARD SPACE FLIGHT CENTER (GSFC): A meeting was held at GSFC with Drs. Finchels and Rochel on 12-12-69, to discuss data storage, retrieval and analysis requirements and the communication networks that would be available for the HEAO missions. Bendix personnel also attended this meeting since they have been assigned the tasks of studying and making recommendations on the onboard systems to accomplish the data management and communication requirements for this mission under our stabilization and control contract with them. As a followup to this meeting, Bendix personnel visited MSFC and a work plan was formulated and agreed upon as to the work that would be accomplished under these tasks.

Rs 12/23

SHUTTLE ENGINE - Verbal information from the Headquarters' Space Shuttle Task Team indicates a further schedule stretchout: Phase B start - April 15, 1970; Engine PFRT - Jan. 1, 1975; and IOC - Nov. 15, 1976. We have been informed that Mr. Gorman has authorized funding to support the Engine Study PER effort. Authority should be at MSFC within a few days.

H₂/O₂ ATTITUDE CONTROL PROPULSION SYSTEM FOR SPACE SHUTTLE - As a result of a Dec. 12 meeting between Shuttle Task Team personnel, Dick Cook, Dave Newby, Bill Davis and Garland Buckner, to discuss the planned procurement approach for the Space Shuttle Auxiliary Propulsion System Technology Studies, it was decided that: A formal letter of concurrence between MSFC and MSC will be released from MSFC; a formal SEB will be required for the proposal evaluation as opposed to a joint MSC/MSFC committee; and a D&F will have to be sent to NASA Headquarters for approval, since the proposed four contracts (\$300,000 each) total more than \$1M.

KSC COMMENTS TO MDAC PRESENTATION - Reference the question raised during the Space Station Quarterly Review about KSC comments to launch operations portion of the MDAC presentation: (a) The statement made that the material had been previously presented to KSC was incorrect. Similar material was presented to KSC during a meeting at MDAC on Nov. 3 at which time KSC provided comments. (b) KSC was contacted Thursday, Dec. 11, 1969, and was requested to provide official comments to material presented during the Quarterly Review; KSC will respond to us. (c) We have tentatively scheduled Jan. 13-14, 1970, for another presentation by MDAC to KSC and MSFC of updated study results and will again request official KSC response. The presentation will be at KSC, and a tour of KSC facilities will also be arranged. January 15 will be devoted to a KSC review of MSC/NAR study results.

SPACE STATION ENVIRONMENTAL CONTROL/LIFE SUPPORT SYSTEM (EC/LSS) - George Hopson, MSFC representative on the Life Support and Protective Systems Panel, reported that during the recent technology meeting at MSC, chaired by Mr. Pecoraro, MSFC had no technology items in the '71 budget. He got a few items into the budget proposal through the meeting at MSC and by a personal visit to Pecoraro. Mr. Cody, Astronautics Lab, is attempting to assess the Space Station prototype activity underway at MSC so MSFC can establish funding of technical approaches in areas that may not specifically be included in the Space Station prototype. Another justification, however, might be to parallel some of the more important items of this EC/LSS technology. The approach on this is not yet firm. Conclusions of the meeting indicate a need for action on relatively high levels if MSFC is to contribute to the EC/LSS technical area.

Ps 12/23

QUALITY PROGRAM REQUIREMENTS: Representatives of this Laboratory who had visited GE and Pratt and Whitney to obtain information relative to R&QA requirements for commercial jet engines have recently completed a trip to the commercial aircraft facilities of McDonnell Douglas at Long Beach, California, and the Boeing Company in Seattle. Quality control activity as related to the inspection, checkout, and test of engines and aircraft/engine systems was reviewed. In brief, their findings reveal that only visual inspection is performed on engines when received, while extensive leak and functional tests of the engine and related aircraft systems are conducted after installation of the engines on the aircraft. These tests are conducted using auxiliary power to spin the engines, with the final test being a "hot firing" of the engines. In every case, the aircraft is subjected to a test flight.

Both MDAC and Boeing rely on the quality effort of GE and Pratt and Whitney, and neither impose contractual quality requirements on the engine manufacturers or have personnel in residence at the GE or Pratt and Whitney manufacturing facilities. However, their contracts with the engine manufacturers contain a warranty on the delivered engine for a specific period of time, and we believe this warranty is the basis for the exceptional quality efforts of the engine manufacturers.

Again it was found that both MDAC and Boeing perform inhouse acceptance tests on their components, after acceptance test and shipment by the vendor. Both indicated it was more economical to verify the acceptability of a component than to install it on the aircraft and have to remove it later.

*Bill's from
you very
much interested on such a*

A briefing for Dr. Rees is planned for the near future to present the results of these trips and a comparison of the R&QA requirements of our contracts with those of the commercial engine/aircraft manufacturers.

*briefing. I suggest you invite also Dr. Rees, B. Lewis and
Bill Brown (PIA) and some of their people.*

*Unfortunately I will be available only after January 22, 70.
Ps*

R-12/23

1. Integrated Cluster Test: After the decision to go to the dry workshop, CSE was asked by PM-AA to study the alternatives for an integrated cluster test. Of the three possible alternatives, performing the test in the VAB was preferred by S&E and PM-AA management, and CSE was requested to again work with S&E, MSC and KSC through the Verification Panel to establish clearly the extent to which this approach could satisfy requirements. The results of this study were presented to Lee Belew last week, indicating the way that all requirements could be satisfied, either by:

1. Complete functional integration of AAP-1 and AAP-2 (CSM) in the VAB stack, or
2. Functional integration of CSM with the AM/MDA in the MSOB, followed by complete functional integration of AAP-1 in the VAB stack.

In either case, physical docking mate of the CSM with the AM/MDA in the MSOB is required. Mr. Belew decided on the second alternative. His decision will now be reflected into the current test baseline.

2. S-II POGO: Detailed technical discussions to assess the POGO observed on AS-507 and to arrive at a recommendation for AS-508 have been held by the POGO Working Group. AS-507 was unstable at several times in flight prior to CECO. Oscillations of 3.75g peak amplitude (15-17 Hz) at the center engine gimbal pad were observed (twice AS-506 amplitude). These amplitudes were within stage and engine capability. No significant dynamics on spacecraft. The oscillation characteristics observed on 507 in particular and all flights in general indicate a marginally stable system. AS-508, with no fix, should display oscillations similar to 506 and 507. Specific amplitude is not predictable, but there is some technical judgment supporting the existence of a limit cycle amplitude of an acceptable 9 g's. Analyses indicate center engine LOX feedline accumulator to be effective in improving stability margins.

Some concern was expressed with respect to center engine accumulator as follows: reliability of the implementation, confidence in dynamics during the accumulator charge, and possible instabilities resulting from higher mode feedline frequencies. The general consensus of the POGO Working Group was that the center engine accumulator was highly desirable on AS-508.

A decision was made to fly AS-508 as is, based on a minimum risk criteria which considered the ramifications of the workload at KSC. Effort and analysis will continue toward possible center engine accumulator fix on later vehicles.

P-14/23

1. Multiple Docking Adapter (MDA): The MDA baseline has been changed to include additional Earth Resources Experiment Package (EREP), re-design the radial docking port to higher bending moment and latch load, relocate the Apollo Telescope Mount (ATM) control and display (C&D) console near MDA/STS interface, relocate the axial docking port, and eliminate window on -Z axis.

Two basic approaches are to be completely reviewed for schedule and cost impacts. One is to modify the existing structural test article only to the extent to qualify the STS/AM. Two component test articles would be required; one with the axial docking port and one with the radial docking port. The second approach is to fabricate a new structural test article which will also be used as the dynamics test article.

2. S-II Stage: At a meeting between NAR-SD and NASA at MTF on December 10, 1969, it was agreed to change the S-II post-tanking purge procedures to a scheme originated by Mr. W. L. Ray of Test Division. This change results in inerting the stage and facility hydrogen systems with gaseous nitrogen in lieu of helium at a savings of approximately \$12,000/tanking.

3. Saturn V Ordnance: The Saturn V launch schedules have changed, causing a storage problem with ordnance components having a design shelf life of 3 years. Many components have undergone tests to confirm or demonstrate a 3-year life, and others have been analyzed for compatibility of materials for a 5-year period. The analysis suggested that while the materials seemed compatible, there should be test firings of those components to validate that analysis. Plans for such tests have been prepared and action will be taken when aged components are received from KSC.

*R. Gougeon
I believe
this is a
good thing
to do.
Ra*

4. Nuclear Engine/Stage Test Facilities: The 90 percent review of the Norman Engineering Company for the nuclear engine/stage test stand was conducted during the week of December 7, to December 14, at NRDS. Norman will complete the work by December 19, 1969, and issue a PER, preparatory to test stand design criteria.

Rs 12/23

1. LUNAR SOIL INVESTIGATIONS: Dr. Costes participated in the debriefings of the Apollo 12 flight at MSC. The 45-Day Mission Report on the Apollo 12 soil mechanics investigations has been submitted for publication. Also, a report on the scientific results of the Apollo 11 soil mechanics investigation authored by Dr. Costes and his co-investigators was included as a separate section in the "Apollo 11: Preliminary Science Report," published as NASA SP-214. Results of Dr. Costes' lunar geotechnical investigations are of vital importance for further lunar exploration, especially for the lunar vehicles.

*Some, get me copy of this report
Rs*

*S. MORSE
Are you informed about this?
2. Rs.*

A penetrometer designed and built by Dr. Costes was evaluated by a suited astronaut during the LRV meeting at MSFC on December 17.

Dr. Haeussermann and several members of CSE visited SSL to discuss lunar soil information as it affects the systems design of the LRV and DLRV. Dr. Costes is in charge of a wheel/vehicle-soil interaction experimental program conducted at the U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, Mississippi, in support of the Manned-Only and Dual-Mode Lunar Roving Vehicle programs.

2. CO-OP SYMPOSIUM: SSL held a two-day co-op symposium on December 16 and 17. Everyone of the 39 co-ops in SSL gave a paper. Mr. Mark Russell and Mr. Hightower from Personnel and representatives from universities were present. The symposium was very successful. I was impressed with the enthusiasm and hard work that the co-ops put into this and with the high quality of their papers. I think that such symposia are a very effective part of our overall training program, and I intend to hold these semi-annually in the future. Some of the co-ops are nearing graduation; I hope that we can bring these young people on board because they constitute a great potential for MSFC's future.

NOTES 12-22-69 HOELZER

B
12/23

NEGATIVE REPORT.

R-12/23

1. MEETING WITH GODDARD SPACE FLIGHT CENTER: On December 18, Dr. Stuhlinger, O. C. Jean, K. Dannenberg, A. Orillion, J. Downey, J. Olivier, M. Nein and I presented to GSFC our activities in the area of future programs. Presentations were given on the Space Shuttle, Space Station, Space Tug and Experiment Modules. The presentations were well received, and stimulated a great amount of discussion. About 100 people attended including all GSFC top management. Dr. Clark attended most of the day.

Goddard displayed considerable interest in the Shuttle and asked many questions about its capabilities. They desire to place some experiment modules in 400-500 n.m. orbits and are therefore also interested in the Tug to augment the Shuttle at these higher altitudes.

Dr. Clark, in his summary, emphasized that at present the experiments are not stampeding to get onboard the Space Station and we need to develop their support if we are going to sell the station. He emphasized the past cooperation between Goddard and Marshall and sees that the capabilities of the Centers for the most part augmenting each other rather than competing. His prime concern seems to be that NASA will put all our resources into the development of major new systems and not support follow-ons of current programs.

Dr. Stuhlinger proposed (and Dr. Clark accepted) that Goddard come here in February to present their ideas. Also, he proposed that Goddard participate more strongly in our Shuttle work.

These meetings can do a lot to improve relations between the two Centers.

2. AEROJET NUCLEAR DIVISION MANAGEMENT: Mr. Al Feldman has been named manager of Aerojet's Nuclear Division, with a major responsibility in the NERVA engine development. Mr. Feldman was previously in charge of the Titan engine project for Aerojet. Mr. Bill Wetmore, who has been acting manager of the Nuclear Division, will become Mr. Feldman's deputy.

3. SCHRIEVER-MCKEE CONTRACT: An assumed baseline plan for the purposes of studies of facilities and personnel utilization has been forwarded to Schriever-McKee, as was requested in an earlier meeting with Dr. von Braun. This assumed plan includes Shuttle and Space Station operations beginning in 1977, and phased initiation of Shuttle/Space Station developments.

B 12/22

Information Concerning Flying After Scuba Diving: NASA medical personnel accept that most people can breathe air indefinitely at two atmospheres (33 feet of water) and decompress rapidly to one atmosphere with no ill effects. However, further decompression to pressures less than one atmosphere without allowing adequate time for nitrogen elimination from the body's tissue does carry a significant risk. USAF regulations specify that flying and altitude chamber exposure are prohibited for 24 hours following hyperbaric exposure. NASA administrative aircraft crew members are also restricted by NASA regulations from flying within 24 hours after using compressed air (or other gas) in a dive. Dr. Charles A. Berry, MSC Director of Medical Research and Operations, reports he feels this standard is reasonable and is mandatory for optimum flying safety.

The U. S. Navy Diving Manual states that the maximum depth of water in which a man can work for 1.5 hours breathing air, and then ascent to surface without stage decompression is 50 feet for 100 minutes. However, it should be recognized that the Navy tables are so calculated as to permit a low percentage of cases of decompression sickness in the diving population even when the tables are properly applied. Dr. Berry contracted with the J&J Marine Diving Company to study the problem and their report, "Interval at Sea-Level Pressure Required to Prevent Decompression Sickness in Humans Who Fly in Commercial Aircraft After Diving," is available in the Safety Office and the Medical Center. It provided the basis for an MSC-approved table specifically for use by the astronauts when participating in tests in our neutral buoyancy simulator.

- a) Limit the first dive of the day to less than 120 minutes.
- b) Allow a minimum of a 3-hr period on the surface between the first dive and the beginning of the second dive.
- c) Limit the second dive to less than 120 minutes.
- d) Use the following guidelines for flying:

<u>Dives</u>	<u>Time on Surface Prior to Going to:</u>	
	<u>8,000 ft. cabin altitude</u>	<u>10,000 ft. cabin altitude</u>
#1	1.5 hrs	2.5 hrs
#2	2.5 hrs	4.0 hrs

Note: As you go above 10,000 ft. cabin altitude, the probability of suffering bends increases markedly.

Scott Fellows, acting as our Aviation Safety representative, has been working closely with Dr. Friarson and Dr. Spraul of the MSFC Medical Center in coordinating the flying and diving restrictions with MSC personnel.

In conjunction with the Medical Center and pending issuance of an MMI on the subject, I am in the process of alerting MSFC personnel to the potential hazards involved in flying after diving.

By Hans Hueter. I think this is very important since more and more MSFC people become aware their lives. E. P.

B 12/23

Research Achievements Review - On December 18, a Review of Materials Research for Shuttle and Space Station was held in Morris Auditorium. The presentations were extremely well prepared and informative. Attendance was good. A larger than usual number of the more than 250 attendees were the academic community. Audience interest, as reflected by the questions asked and by the number of intensely probing technical discussions underway during the break, was exceptionally high. This Review appears to have been well worth the effort which went into its preparation.

Bioscience SRT - Approval of additional work in the OSSA Bioscience Supporting Research Program has been received from Dr. Reynolds. The new work will be supported at the \$300,000 level. It consists of three tasks, two of which are study efforts to define Bioscience payload concepts and configurations for the Space Station. The third, which is being supported at the \$10,000 level, is for in-house efforts to be performed by S&E; however, the precise nature of the research being undertaken in-house has not yet been defined so far as I can now determine.

NOTES 12/22/69 MOHLERE

No submission this week.

B
12/23

NOTES 12/22/69 MOORE

R 12/23

1. CELESTIAL SENSORS ADDITION: A new C of F addition to Building 4467 was turned over to us by the contractor last week for installation of laboratory equipment. When outfitted, this 2000 square foot addition will enhance our capability in development and test of electro-optical devices used in guidance and control systems, such as star trackers, sun sensors, horizon trackers, and related hybrid systems.

2. MLRV: At a meeting with MSFC representatives last week, Boeing made the MSFC recommended decision to use a directional gyro to determine heading angles and two accelerometers to determine pitch and roll angles for the manned LRV. This simplified approach replaces Boeing's initial proposed strapdown inertial navigation subsystem.

3. MAN-MOTION TEST: A zero-gravity experiment aboard the USAF Wright-Patterson KC-135 aircraft will be conducted for us next month to determine man-motion forces. Force measurements will be obtained from five different subjects pushing off and rebounding to a test jig set up at distances of 10, 15, and 20 feet. A total of 45 measurements will be furnished for analysis of wall push-off perturbations to be used in the SVWS attitude and pointing control systems studies.

4. 507 POSTFLIGHT EVALUATION: The shape of the Z axis downrange guidance error during 507 boost indicates a Z accelerometer scale factor error as a major contributor to the observed error in position at translunar injection. This correlates with the fact that the Z scale factor was out of tolerance at launch (spec was 7.5×10^{-4} meters/second²; actual was 8.57×10^{-4} meters/second², and was waived). A more major contributor known at this time is the deviation of orbital venting forces from nominal. An evaluation approach is being pursued which should verify whether these error sources represent all the contributors.

5. HAPPY HOLIDAYS: The Astrionics Laboratory wishes you a Merry Christmas and a Happy New Year.

R. Godfrey
R. Moore
Is it necessary
to do some
thing about
this on
future
missions?
E.P.

NOTES 12-22-69 SIEBEL

B
12/23

1. ATM Thermal Systems Unit: Last Friday, December 19, we turned over to S&E-QUAL the ATM TSU Spar for checkout. We worked in parallel with QUAL all week correcting some cabling discrepancies as they were discovered.

2. ATM Radiators: A decision was made to tool up and fabricate the radiators for the Vibration Unit in-house to the new configuration and so to have backup capability in case the vendor cannot deliver for the prototype and flight units. The vendor will continue to process the vibration radiators to the old configuration for which he has the machined parts as a backup for the in-house effort.

3. S-II: The closeout (cyl 2/3) weld on S-II-15 was completed on December 11 with zero X-ray or dye penetrant defects. One area of .071 offset was dispositioned acceptable "as is". This completes the welding on the present S-II contract. Approximately 95% of the weld crews will be lost to the program by January 9, 1970.

NOTES 12/22/69 SPEER

R₂ 12/23

1. AAP Data Flow Management: As a result of several meetings we have reached agreement with MSC to perform data redundancy removal at the remote sites in order to manage the largely increased data volume expected during the entire mission sequence. We have participated in a successful demonstration of this technique between GSFC and MSC and are now evaluating the best ways and means to process this incoming data at MSFC. Bill Schneider is being advised of our agreement with MSC.

2. Wideband Communications Working Group: The third meeting of the Wideband Communications Working Group was held at NASA Headquarters last week. The use of two Intelsat satellites (one Atlantic and one Pacific) to bring all data from the three networks (MSFN, STADAN and DSN) back to a central data handling facility in the U.S. has been favorably received by all affected Centers. The approach will eventually reduce the cost and size of the remote site data processing operation. The next activity of the group will be to define the remote site, central data handling facility, and Mission Control Center configurations for alternative allocations of data handling and network operational control functions. A test operation using a single station and the present GSFC data system is being considered.

3. AS-508 Flight Mission Rules: The MSFC inputs to the AS-508 Flight Mission Rules (FMR) were supplied to MSC on 12/19/69. The FMRs are presently being reviewed for items affecting the AS-508 lunar impact accuracy (navigation update) and enhancement of the probability of a successful impact under off-nominal conditions. Mission Rule changes resulting from this review will be forwarded to MSC at a later date.

NOTES 12/22/69 STAMY

B 12/23

Univac 3-G Purchase - A procurement request was processed on December 18, 1969, to MSFC Purchasing Office in the amount of \$7,000,000 for the purchase of the 3-G system to be installed at the MAF Slidell Computer Operations Office, Slidell, La.

Computer Operations Activity - Over the Thanksgiving holiday weekend, data from several previous S-II static and flights were processed to isolate oscillation problems experienced with the S-II-507.

NASA/MAF and STC personnel continued to work with NASA/MAF, GE and NAR personnel to ensure accurate data interpretation, provide full understanding of methods used, and further establish communication in preparation for possible similar support for the AS-508 flight.

NOTES 12-22-69 Stuhlinger

B
12/23

No submission this week.