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NASA Western Coordination Office

Los Angeles 36, California
April 2, 1959

964102

MEMORANDUM for Director, Space Flight Development

Subject: Attendance at SR-183 Midpoint Briefing March 24-26, 1959 at Air Force Ballistic Missile Division, Los Angeles

1. At the request of Mr. Newell Sanders of NASA Headquarters, I attended the subject briefing on the SR-183 project. Actually I was present on the first two days of the briefing but not on the third day. A copy of the agenda for the meeting is attached hereto.

2. SR-183 is one of a series of space project studies initiated by the Advanced Systems Studies Division of the BMD Military Space Systems Division. The subject matter of these studies is roughly divided into three categories.

Earth orbital systems
Lunar systems
Interplanetary systems

SR-183 is concerned with the establishment of a lunar observatory. The study is scheduled to be of about one year duration and at the time of this briefing had reached the midpoint.

3. The SR (Systems Requirement) concept of which SR-183 is an example, involves the following elements:

a.- Industry-Air Force team
b.- Air Force provides guidance
c.- Industry provides study
d.- Study brings more effort to bear on Air Force programs
e.- Studies lead to development of weapons systems

4. The companies that undertake SR studies for the Air Force do so largely at their own expense. However, as the income of most aircraft companies comes mainly from the government, it is obvious that the studies are paid for by the government with the cost appearing as overhead charges on military contracts.

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5. The companies carrying out the SR studies benefit by the build up of their technical competence in the space field and the improvement of their chances of getting a hardware contract. One wonders, however, whether the hopes for a hardware contract may not tempt companies to present overly optimistic viewpoints on space projects.

6. The objective of SR-183 is to determine a sound and economical approach for the establishment of a manned intelligence observatory on the moon. The moon is considered a favorable vantage point from which to observe enemy actions in space. Also, because of its low gravity, the moon is believed (by some people) to be a good platform for launching defensive vehicles.

7. The general approach used in SR-183 is as follows:

a.- Unmanned exploration of moon and vicinity
b.- Moon exploration by man
c.- Moon base construction
d.- Instrumentation of base

8. The reported purposes of the SR-183 briefing were:

a.- To obtain status report from contractors
b.- Exchange information
c.- Obtain constructive comments on studies

9. The SR-183 study ends on September 30, 1959, at which time, or shortly thereafter, the contractors will submit final reports to the Air Force. These reports can be obtained by the NASA.

10. The SR-183 briefing was attended by 50 to 100 people, few of whom I knew. There were representatives from Space Technology Laboratories, BMD and other branches of the Air Force. The NASA was represented by myself and Dr. Hibbs of JPL. Representatives of the companies making presentations were present but only for the period of their own presentation.

11. In most cases the SR-183 studies are being made by industrial teams rather than individual companies. The teams, and the days on which they made their presentations, are as follows:

North American (Missile Dev Div) AM March 24
RCA

Boeing Westinghouse Aerojet Nucleonics	PM March 24
Douglas Missiles Division	AM March 25
Republic Aviation Systems Corp. of America	PM March 25

12. On March 26, the day I did not attend the briefings, United Aircraft Corporation and Minneapolis-Honeywell made presentations.

13. The presentations proceeded at a fast and furious pace and it was not possible to record much of the information. Nevertheless, some scattered notes were taken and these, in the rough form in which they were originally recorded, are presented in an addenda attached hereto.

14. There is not much of a general nature to be said about the presentations except that they all seemed a little fantastic. The presentations, in the order in which they appealed to me, are as follows: Douglas, North American Aviation, Boeing, Republic. The Douglas presentation was the briefest, most pessimistic and most down to earth - if a lunar venture may be so described.

15. All of the presentations suffered greatly from a lack of basic knowledge about the subject discussed. In them the meager knowledge that exists was over-extrapolated. Fanciful concepts were described which, aside from the intellectual stimulation they produced, are probably of little value. However, the intellectual stimulation of the SR-183 studies is of definite value and if the practical limitation of the material produced is recognized, the studies may be regarded as being a worthwhile effort.

Edwin P. Hartman
Western Coordinator

Enc:
1. Agenda
2. Addenda in 4 parts

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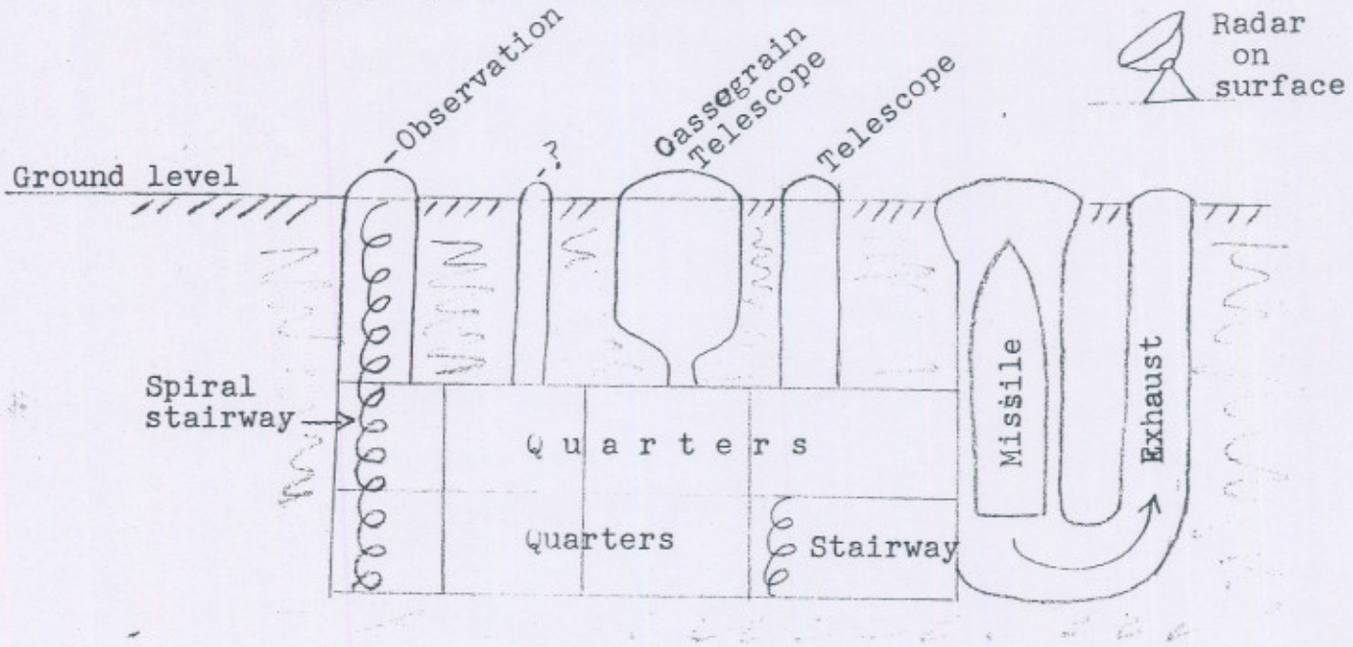
Briefing by Boeing, Westinghouse & Aerojet

1.- Boeing proposes underground base:



2.- Below ground for protection from elements and enemy.

3.- Telescopes:

a.- Large scope 200"
b.- Small scope 50"
c.- Both adaptable for IR surveillance and communication
d.- Base would also have radio telescope and surface vehicles

4.- Possible means of excavation: Hard landing!

5.- Schedule for Lunar Observatory:

A. Missions

a.-	Probing	mid 1958 to 1961
b.-	Data gathering	1959 to 1964
c.-	Exploration	1963 to 1973
d.-	Site preparation	1965 to 1973
e.-	Construction	1966 to 1973
f.-	Instrumentation	1967 to 1973
g.-	Operation	1968 to 1973

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B. Purpose:

a.-	Orbits	1959 to 1961
b.-	Hard landings	1960 to 1962+
c.-	Soft landings	1961 to 1963
d.-	Return	1962 to 1964
e.-	Manned landings	1963+to 1973
f.-	Extended stay	1965 to 1973
g.-	Continuous occupation	1966 to 1973

6.- Hard landing is one in which no instruments survive.

7.- Problem of handling voluminous test data being studied by Boeing.

8.- Because of urgency of mission do not plan to refuel at some satellite station.

9.- Westinghouse problems: Environment, guidance and communications.

10.- Impossible to maintain 24-hour satellite in position without power because of air drag. Atmosphere goes higher than originally believed.

11.- Moon has small but negligible atmosphere.

a.- Moon can probably retain only Kr and Xe in atmosphere.

12.- Spectral energy distribution on moon due to sun (chart).

13.- Compostion of moon - no nickel core as in earth.

a.- Probably includes Al203, MgO and Si 02 which contain water.

14.- Possibility of radiation belt around noon.

15.- Meteorites hitting moon (estimate)

a.- Sporadic - 55,000 Kg per yr
b.- Showers - 10,000 Kg per yr
c.- Total - 65,000 Kg per yr

16.- Daily infall of meteorites on moon

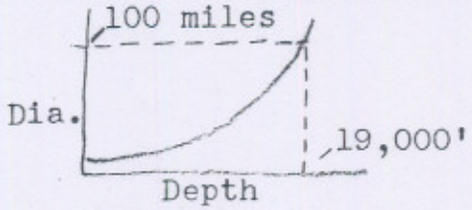
a.- 1 μ gram to 1 $\mu\mu$ gram - 10^{28} particles; 100 Kg

b.- 1 microgram to 1 μ gram $25X10^{10}$ particles; 28 Kg penetrates 1 mm aluminum 1 hit per Km^2

17.- Periodic variation of meteorite fall during lunar day = 3:1

18.- Most probable meteor velocities 38 Km/sec and 63 Km/sec

19.- Diameter vs depth of lunar craters



20.- Noise factor in space communication

a.- 2000 mc best bean-to-beam frequency
b.- Communication frequency 200 to 2000 mc
c.- Need narrow band for low power

21.- Mid course guidance desirable for reliability in achieving missions

a.- Can orient vehicle by measuring curvature of wave from transmitter on earth
b.- Guidance system for moon flights (including mid course) is within current state of art - design no serious problem

22.- Communication knowledge is available but not all required hardware

23.- Propulsion system:

a.- Chart of launch weight vs I sp
b.- Payload (3 or 4 men included) 30,000 lb
c.- For land on moon and return need 7 stages
d.- Propellant loading fraction now 0.9; hope for 0.95 by 1965
e.- Vehicle size

Propellant	Gross wt, lb.	Height, ft
Lox-RP1	$55X10^6$	563
H204-UDMH	$53X10^6$	508
Lox-H2	$7.3X10^6$	354
F2-H2	$6.7X10^6$	288

All 60 ft in diameter

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24.- Tank design

a.- Pressure stiffened vs structure stiffened
b.- Would prefer pressure stiffend
c.- Would build in field, from scaffold, from top down
d.- For lunar impact, nose designed to crush, or penetrate, to protect instrument package

25.- Stabilization systems

a.- Liq. reaction jet controls - 6 motors - mono-propellant
b.- Flywheel stabilizers
c.- Gas jet vs flywheel - for high angular rates fly-wheel heavier - optimum is combination of the two
d.- Simulator now under consideration by Boeing. Reaction controls. Pilot sits on air-bearing

26.- Human Factors:

a.- Ability of man to lift weights and do work on moon
b.- Closed ecological system
c.- Potential source of oxygen from lunar rocks
Fe_2O_3 reduction → steam-condens-water-electrolysis → O_2 etc.

27.- Electric power sources for vehicle and moon base

a.- Boeing undertaking considerable research in this field
b.- studies of cryogenic engine, fuel cells, solar and nuclear power sources
c.- Heat pump system for use on moon
d.- Ultimate achievable solar heat engine effy. - thermionic generator - 65%
e.- Boeing making study of praaboloidal (single curv-ature) mirror
f.- IBM-704 study shows optimum absorber configuration for solar mirror to be flat - not cylindrical as expected
g.- Development of cadmium sulphide photovoltaic cell represents breakthrough. Does not lose efficiency with temperature nearly as much as silicon cell

28.- Energy storage

a.- H_2O_2 best means

b.- Nuclear power plant needs no energy storage but does involve shielding weight penalty
c.- Boeing and Aerojet Nucleonics in joint study of best nuclear power plant
d.- Currently a fast neutron reactor with Rubidium working fluid seems best
e.- Boeing expects to develop adequate research programs on all types of power plants for space vehicles and bases. Will collaborate with other agencies

29.- Boeing Program:

30 probes in 3 years
? orbiting vehicles in 3 years
10 hard landings in 3 years
20 soft landings in 3 years
30 return vehicles in 2½ years
18 manned vehicles
25 extended stay trips after 1967
    3 men/vehicle
    2 trips first yr
    4 trips per yr thereafter
Total missions - about 160
Passengers carried to moon
    First man 1964
    116 men by 1973
Payload (tons) to moon - 50 by 1965
                         550 by 1967-8
                         600 by 1973
Annual launch weight (gross) reaches peak 1965-8 of about 900 million pounds
Mass ratio: Launch wt/payload weight for trip to moon and return 2200

30.- Launch weight costs $/lb

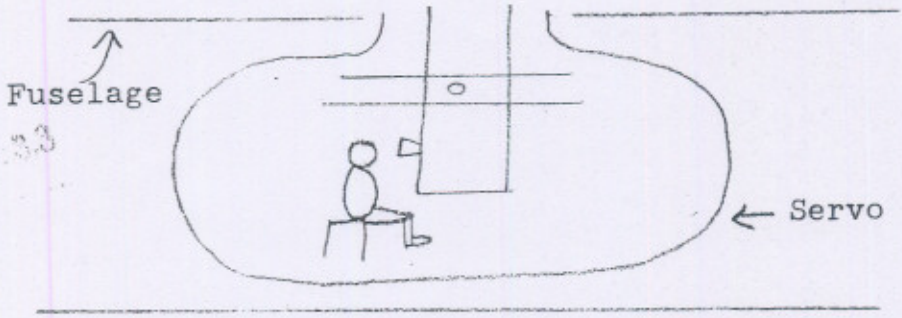
a.- Current: 1 to $200/lb
b.- 1963 50
c.- 1968 10
d.- 1973 5

31.- Costs of Boeing lunar observatory project:

a.- Cumulative starting 1958
    $8 billion by end of 1965
    $30 billion by end of 1967
b.- Annual rate reaches peak of about $10 billion in 1967

32.- Astronautical observation

a.- Boeing recommends installing 40" (240" focal l.) telescope in large airplane (B-52 ?) and taking pictures above tropopause which is at 40,000 ft level over Seattle.



b.- Also recommend gamma-ray astronautical observations from airplane, balloon or Dyna Soar.

33.- Westinghouse (?) developing "Exposphere Flight Navigation Trainer."

34.- Slingshot Satellite Replacement

a.- Interchange of energy between satellites via wire!

35.- Suggestion of lunar jamming station

a.- 50 ft crater on moon
b.- 300 mc band jamming

36.- Recommend USA standardize on coordinate system for moon flights