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THE RAMO-WOOLDRIDGE CORPORATION

LOS ANGELES 48, CALIFORNIA

INTEROFFICE CORRESPONDENCE

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APR 1956

DATE 22 March 1956

TO: Commander R. Truax (2) CC: A. F. Donovan (2)
 L. G. Dunn
 J. C. Fletcher
 S. Ramo
 A. K. Thiel
 File (3)

FROM: R. Cornog
 W. R. Hughes
 H. I. Shulman

Handwritten:
 117L file

This memorandum confirms the recommendations made to the WS 117L Evaluation Board on Thursday, 15 March 1956. The recommendations were made by Cornog, Hughes and Shulman of The Ramo-Wooldrige Corporation in the capacity of technical advisor to WDD. The recommendations are the result of reviewing the three competing contracting teams at Wright Field on the 12th, 13th and 14th of March. The Evaluation Board is composed of six members, headed by Col. Baines as President, and including Mr. Truax and Lt. Washburn of WDD.

The recommendations were based on the following criteria:

- Confine recommendations to technical matters of which direct knowledge was available.
- Choose recommendations which will result in minimum possible interference with the WS 107 Program.
- Choose a plan of action which will maximize the probability of success of the WS 117L Project.

The following are the recommendations made:

It is felt that none of the contracting teams, or any of the programs which were suggested by these teams, are adequate to meet the requirements of the Project. Consequently, it is recommended that a number of contracts be awarded to various contractors as specified in the tables below, each designed to provide the maximum utilization of the technical people available. Thus, each contractor will work only in the field of his maximum experience, background and ability.

An additional benefit to be derived from the division of responsibility is the provision of backup for all of the important components of the WS 117L Project. In this manner, each of the various contractors is competing with someone else to achieve a workable product.

In addition to the division of contractual responsibility as outlined above, it is recommended that the management of these contracts not be given to any of the three contracting teams. This recommendation is made because it was felt that none of the three contracting teams presented a self-consistent development plan.

The WS 117L Program is of unparalleled breadth and scope. It encompasses new frontiers in many fields. None of the three teams appeared to have provided an administrative organization and talent equal to the program requirements.

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In addition, it appears that the most adequate way of incorporating the experience and knowledge gained in related projects such as the WS 107 Program into the WS 117L Development is by the retention of WS 117L management by the Air Force.

Tables I, II, III and IV summarize the recommendations that were made. The tables indicate contracts that could be made at this time. Some further study is required, particularly in the area of ground-to-ground communications, and the tables indicate no recommendation for this part of the system.

TABLE I
VEHICLE GUIDANCE, ATTITUDE CONTROL, AND
ELECTRIC POWER SUPPLY
(Both visual and ferret vehicles)

<u>Item</u>	<u>Subject</u>	<u>Recommended Contractor</u>	<u>Remarks</u>
1	Guidance from ground to orbit and attitude control	MIT and A. C. Sparkplug	This team is already developing IRBM guidance to be first tested in 1957. This package is suitable for ascent guidance. MIT to do the development and A. C. to do the production design and production.
2	Electric power supply-chemical		See text, part 4d and 4e.
3	Electric power supply-solar	Bell Telephone Labs	See text, part 4d and 4f.
4	Electric power supply-nuclear	North American Aviation	

TABLE II
VEHICLE AND CONTENTS FOR FERRET MISSION

<u>Item</u>	<u>Subject</u>	<u>Recommended Contractor</u>	<u>Remarks</u>
1	Airframe* for ferret mission	Glenn L. Martin	The increased payload of the SM-68, relative to the SM-65, should be useful for ferret. Also priority on ferret is lower than visual.
2	Payload for ferret mission	No recommendation	R-W did not monitor contractor presentations.
3	Guidance, etc.	See Table I	

Airframe contract includes: (1) airframe, (2) propulsion, (3) correlation of vehicle design to provide suitable environment for desired payload, and (4) programming of flight tests.

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**TABLE III
VEHICLE AND CONTENTS FOR VISUAL MISSION**

<u>Item</u>	<u>Subject</u>	<u>Recommended Contractor</u>	<u>Remarks</u>
1	Airframe* for visual mission	Lockheed (or Bell)	Martin is tied too closely to XSM-68 booster. There may be resultant delay in 117L and possible interference with SM-68.
2	Vehicle-borne photographic system	Eastman Kodak	Either the photographic or the TV system should fit in airframes, Item 1.
3	Vehicle to ground photo transmitter	C.B.S.	This transmitter tied to Eastman photographic equipment.
4	Vehicle-borne TV system	R. G. A.	This contract to include equipment for image storage and transmission to ground.

Airframe contract includes: (1) airframe, (2) propulsion, (3) correlation of vehicle design to provide suitable environment for desired payload, and (4) programming of flight tests.

**TABLE IV
GROUND STATIONS FOR BOTH VISUAL AND FERRET VEHICLES**

<u>Item</u>	<u>Subject</u>	<u>Recommended Contractor</u>	<u>Remarks</u>
1	Ground tracking (radar), ground-air link and vehicle receiver	R. G. A.	The G. E. development for the WS 107 Program will serve as backup.
2	Ground-to-ground communications	All proposals inadequate. Further study required.	
3	Data processing	A good operational analysis of WS 117L System is badly needed. Also development contracts should be placed for techniques and machinery to process WS 117L data. International Business Machine is a possible contractor. Eastman minicard storage should probably be included as a part of the system.	

Considerations that were used in arriving at the recommendations include:

- a. By the time the 117L System becomes operational, the visual missions will probably be of greater strategic importance than the ferret missions. ✓
- b. At the present state of the art, it is possible to collect and store better visual images with a photographic system than with an all-TV system.

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- c. It does not appear practical to use a vehicle-borne nuclear power supply if there is photographic film aboard. However, it may be possible to use the nuclear power supply with the videcon equipment.
- d. A satisfactory nuclear power supply for vehicle use will not be available before 1960. There is, therefore, a very strong incentive to push the development of a non-nuclear power supply for use with photographic film equipment.
- e. The open cycle rocket turbine powered generator is considered capable of producing a kilowatt-hour of electrical power with four to seven pounds of propellant mixture. The primary battery requires 12-1/2 pounds of material per kilowatt-hour of output. There is, therefore, an incentive to develop high efficiency rocket turbine-driven generator systems.
- f. The solar power supplies which depend on focusing mirrors and a closed thermal cycle lack appeal. The machinery required to maintain solarcentric orientation is complicated and interferes with the attitude stabilization of the vehicle. Consequently, emphasis on the photovoltaic approach is recommended.
- g. Eastman Kodak has estimated that approximately two pounds of film per week would be required.

In the discussion with representatives of all three contractors, it was indicated that an all-inertial system was preferred, even though this was not officially proposed, due to a misunderstanding of Air Force requirements. The experience which the group at MIT (and A. C. Sparkplug) has gained in the all-inertial field was one of the guiding factors in selecting MIT over North American Aviation for the guidance and attitude stabilization equipment.

It was also recommended that all further work on vehicle-borne star trackers and horizon seekers be carried at a low priority. The passive stabilization system is believed to be better suited for vehicle attitude control.

It was estimated that a twenty member senior technical staff supported by a staff of approximately 200 people would be required to provide adequate systems management for the 117L Project.

None of the three contracting teams has made adequate use of the USAF sponsored supporting contracts or has made full use of information available on other Air Force programs.

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