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MEMORANDUM TO MAJOR RICHARD WOLFSBERGER

SUBJECT: Space Electric Power Requirements for Advanced MOL Missions

As directed the MOL Program has conducted a study of the future requirements for Space Electric Power, with the associated costs estimates.

The results of this study are summarized below in terms of the specific question asked in Dr. Glen Seaborg's letter to the Secretary of Defense dated 30 July 1968:

a. Probable Requirements: In our advanced planning studies we have considered a continuous years mission utilizing rendezvous and resupply techniques for replinishment of expendables on a 60-120 day basis. This would be a one year mission in low earth polar orbit with an estimated launch date of late 1975. Power requirements for this mission are 3 KW average and peaks up to 15 KW.

b. Alternatives: The present baseline program utilizes fuel cells which could be extended up to 90 days, and replaced on each resupply vehicle. An attractive alternative to this would be a dynamic isotope system launched on the initial vehicle and operating continuously for the year mission. Solar cells are not competitive due to their drag make up problem at low orbits.

c. Weight and Cost Comparison: Estimates for advanced fuel cells show a year's recurring cost of 22M and a total weight of 50,000 lbs. This is to be compared with two isotope systems, the AEC Organic Rankine and the NASA Brsyton. Assuming the relatively cheap cobalt heat source for the Organic Rankine, its recurring costs for a years mission are 16M at a weight of 6500 lbs. The Brayton utilizing an expensive Plutonium heat source is estimated to cost up to 70M and also weighs 6500 lbs. In addition to the stated cost differences between fuel cells and the cobalt organic rankine, the 44,500 lb. weight difference can be converted to a tremendous cost advantage, as launch costs are estimated to be at least $1,000 per lb. in orbit, for a savings of over 44M. This 44,500 lb. weight savings could be utilized to either increase expendables thereby adding to mission duration, or to add more mission equipment and increase operational capability.

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The above data indicates that the cobalt Organic Rankine Systems could be the prime consideration for MOL extended duration missions, however, we are interested in the development of both systems and would prefer to maintain the option of selecting the system that has demonstrated the greatest potential when the selection process begins.

The following MOL Program position should be made very clear:

a. Fuel cell developments indicate a possible life extension up to 90 days for the MOL Program application.

b. The MOL Program as currently defined is for 30 day missions and therefore incorporate the cost competitive developed fuel cells.

c. The second generation MOL systems will probably be for mission durations of 45 to 60 days, also using fuel cells. This second generation MOL program will probably extend into or beyond calendar year 1975.

d. MOL systems beyond the second generation system are in the basic planning stage. The possible extended life (1 year) missions referenced above for which the nuclear electric power systems may be used will be in the latter half of the 1970 decade, if they materialize.

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