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DEPARTMENT OF THE AIR FORCE
WASHINGTON 20330

OFFICE OF THE SECRETARY

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27 December 1967

MEMORANDUM FOR COLONEL WORTHMAN

SUBJECT: Space Applications Summer Study 1967 Interim Report Volume 2

The "Economic Benefits" are based on two major assumptions as stated in Appendix C:

1. Forecasts of 5-14 day activity must be sufficiently accurate within an area encompassing one or, at most, two average-sized counties. Comment: "Sufficient" accuracy is hard to define. As the letter from the Pennsylvania Power and Light Company pointed out, "the accuracy of these long-range weather forecasts must be investigated, since complete reliance on a long-range weather forecast and the resultant scheduling of maintenance could prove economically unsound and could be catastrophic to the system should these long-range weather forecasts be inaccurate by a factor of 1 or 2 days." This introduces an interesting conundrum - how accurate should a weather forecast be? If it is very very accurate people will place more of their welfare in possible jeopardy should the forecast prove wrong. Thus, the result of a bad "very accurate" forecast might be a national disaster. If forecasts are not considered to be very accurate, people tend to distribute their losses and avoid catastrophe. Isn't it better to have wet feet most of the time if the alternative is to have dry feet but risk drowning? Any "hedging" action one may take establishes a situation exactly equivalent in economic benefit to having a less accurate forecast, except that you will have paid extra for the too accurate prediction. The point is, it is insufficient to state that more accurate or longer term forecasts are of real value without showing the mechanism for using the forecasts which will produce value. If the mechanism must protect itself from occasional great losses then the cost of that insurance must be added to the cost of the improved forecast before a saving can be claimed.

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The sounding system most strongly touted in the paper as a basis for the new forecasting capability is the multiple co-orbiter radio occultation system. Assuming that it works perfectly, it would produce data on a 400 km grid at time intervals of 6 to 12 hours. The time scale is appropriate to weather phenomena of the spacial scale represented by the 400 km grid. It is not reasonable to expect to produce highly accurate forecasts on a one-to-two-county-sized scale from such grossly scaled data. Which points up a basic falicy in the synchronous-oribt-sensor syndrome - we do not need data more broadly integrated in space and time nearly so much as we need more specific measurements in terms of space, time and parameter. The measurements we need are extremely difficult to obtain by indirect sensing, and going 22,000 miles away doesn't help a bit.

2. The economic analysis is considered to be realistically conservative because all possible benefits weren't considered nor were those considered extrapolated world-wide. Comment: Convervative as estimates go, yes; but realistic, no. The basis for the estimate of savings to the construction industry was a paper by John Russo of Travelers (results are immediately suspect based on bias alone). Russo said we could save $X per year if we had 5 day forecasts of imperfect accuracy because we could save $\$ \frac{X}{y}$ per year if the presently available 24 hour forecasts were used and a 5 day forecast is y times as useful as a one day forecast. The falicy is underlined and is the same one noted above. People simply won't (and probably shouldn't) place full faith in weather forecasts. It will never be possible to "recover" all the losses sustained by the construction industry because of imperfect use of forecasts - the imperfect use of forecasts is that hedging operation we will always use when risk is high. The paper also adds a "saving" based on Russo's estimate of the value of a perfect 24 hour forecast. This argument makes better sense to me. The observation systems pushed in the paper probably would improve short range forecasts (of large areas) and this could save money without inviting disaster if the forecast were bad.

The estimated savings in agriculture seems reasonable to me, accepting the assumptions as stated earlier. They are based on the occurrence or avoidance of catastrophe - hence the farmer can only gain, being totally committed anyway. (Unlike the Power Company or the Builder who can hedge

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a forecast, the farmer either seeds or not, there is no advantage in half seeding, etc.).

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PS. Technically, it is an interesting report, and the ideas are probably well worth some time & dollars from the basic R&D labs to do the preliminary investigations which obviously haven't been done yet. This panel's problem was to make an idea-stretcher all the way to a full blown program and then justify it. Too hard to do!

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