SECRET

[redacted]

Copy [redacted]

15 June 1961

MEMORANDUM FOR : Deputy Director (Plans)

THROUGH : Acting Chief, Development Projects Division

SUBJECT : Interference with CORONA Recovery Operations

1. This memorandum is for your information.

2. Dr. Land has apparently expressed some concern to [redacted] that the Soviets may be able to either interfere with our successful recovery operations or physically recover the capsule themselves. I am not sure of the specifics in Dr. Land's concern since this was reported by [redacted] who himself received the query second hand from [redacted] I understand [redacted] is still intending to raise this question with you at your meeting on Friday, 16 June. The following is a summary of the system and its method of operation.

3. The AGENA vehicle contains the following equipment:

An S-band receiver, 2850 mcs, which receives commands to perform various functions from the ground.

A transmitter, 2920 mcs, which sends back acknowledgement of the receipt of commands.

A telemeter transmitter, 237.8 mcs, which monitors events in the AGENA and sends back confirmation that commands have been executed.

A CW radar beacon, 232.4 mcs, to aid in tracking by ground radars.

The above equipments are turned on and off automatically by the AGENA programmer tape. Nominally the above equipment would be off, unable either to receive or send, except when in range of our ground station network. In addition, an APL beacon sending on 162 and 216 mcs as an acquisition and tracking aid, is on continuously. A flashing light is also programmed on and off at times when the AGENA is expected in view of Smithsonian network ground stations.

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4. The recovery capsule contains its own beacon and telemetry for verification of recovery event occurrence. Ground control stations able to track and command the AGENA are located at [redacted] Additional tracking and telemeter monitoring stations (unable to command) are installed on Christmas and Terne Islands and in the recovery force vehicles. The extent of our ability to command the AGENA is, for example, as follows for a normal one-day operation consisting of 17 orbits. Control could be exerted on pass 1, from [redacted] on pass 2 from [redacted] passes 6 and 7 from [redacted] passes 8 and 9 from [redacted] passes 10 and 11 from [redacted] passes 13 and 14 from [redacted] passes 15 and 16 from [redacted] and pass 17 from [redacted]

5. On the omitted passes, we are not in range to exert control and the vehicle equipment is in the "off" condition. The times when AGENA receiver transmitter equipment is "on" are shown in the attached diagrams of the normal planned orbit for the most recent (unsuccessful) AROCH shot.

6. As mentioned previously, the functions performed by the AGENA orbit, such as turning camera on and off, vehicle orientation, initiation of recovery sequence, etc., are initiated by a pre-punched programmer tape. In order that the commands on the tape will be executed at the proper time in relation to the actual orbit achieved by the vehicle, and in order to make other adjustments in the timing of issuance of certain operational commands, the ground stations mentioned previously transmit an encoded signal to accomplish these functions. These commands can be sent only at times when the AGENA equipment is open to receive in order that the commands will be executed.

7. Six commands are used. These commands are actually combinations of four separate and distinct tones which are sent in pre-set sequence. Command 1 is used to govern advance or retard directions for the function in question. Command 2 governs the extent of the advance or retard. For example, it is necessary to adjust the programmer tape to the orbit period achieved from the one programmed. This is done by the use of commands. Command 3 adjusts the program tape to correspond precisely with pre-selected earth latitudes for the initiation of various functions. Command 4 adjusts the camera V over H setting. Command 5 has been used as an enable or disable signal for recovery on alternate passes. Since DISCOVERER XX, when the programmer timing temporarily stopped, the automatic ejection command has been eliminated from the sequence and the positive issuance of command 5 is the sole means of initiating the sequence of recovery events. Command 6, which is now eliminated, was a skip or repeat command which would in effect

either repeat or omit a program sequence on a given pass. In a representative flight commands 5 and 6 were formerly used in launching to time the start and extent of AGENA engine burning. This has been eliminated with DISCOVERER XXII, which incorporates the Bell Telephone Labs guidance system.

8. Once on orbit, commands 1 through 4 are sent as appropriate to adjust tape to the actual orbit period achieved, set camera V over E, control camera active passes according to latest weather information, etc. The recovery sequence begins with a final vernier timing adjustment on the pass prior to the recovery pass. Command 5 is then sent to initiate recovery on the succeeding orbit.

9. To illustrate this more clearly, the program for DISCOVERER XXIV, unsuccessful, is used. In this instance the tape was cut to permit recovery on the following and only the following passes: 10, 15, 16, 17, 25, 26, 30, 31, 32, 33, 40, 41, 46, 47, 48, 55, 56, 57, 62, 63, 64, 77, 78, 79. The last three would delay recovery until the fifth day. Recovery is programmed on these passes, and these only, to include a nominal recovery, alternate recovery orbits as needed by inexact achievement of pre-planned orbit, and emergency recovery orbits, including recovery at night to take care of emergency situations. So long as the orbit achieved falls within the extreme limits of our ability to communicate with the AGENA, the recovery area would fall within either the North or South Pacific Ocean areas. The extreme case in the program for DISCOVERER 24 is orbit 57 on the third day and presuming the highest limiting orbital period. In this case the recovery capsule would descend over a track in the North Pacific, east of Japan, extending about 600 miles across the Chukotsk Peninsula and into the Arctic. This would be a night time descent. Under such circumstances, for others than ourselves to effect capsule separation, it would be necessary to know the times when the vehicle will transmit and receive, the appropriate frequencies which will be used, and the functions commanded by the various signals sent. In the worst case, the vehicle could be sent a command to initiate the capsule separation on orbits 2 and 17 when out of range of our stations. These commands can be sent from the Chukotsk Peninsula area. However, in the case of orbit 2, re-entry could not take place until orbit 10 and the impact area would be the South Pacific at night. In the meantime we would have orbits 5 through 9 to determine that a false command had been inserted and to transmit nullification of this. If the command were issued on orbit 17, we would have no opportunity to countermand, but the re-entry would take place in the South Pacific area during daylight along a track crossing 180 degrees west longitude, or in mid-ocean.

10. Enemy attempts to exploit this situation would probably be rather noticeable inasmuch as our recovery forces consist of the following:

A planned minimum of 7 C-119's and, if possible, 1 C-130 recovery aircraft.

4 EC-121 radar tracking aircraft

3 EC-54 telemetry receiver aircraft

1 Electra telemetry receiver aircraft

3 telemetry receiving and tracking surface ships aligned north and south on nominal recovery track

2 radar tracking ships offset from recovery track

1 destroyer for recovery from the ocean

11. It is quite likely that, with considerable expenditure of effort, including the gathering of the necessary information mentioned above, and by positioning surface ships either off the Atlantic coast or in the Pacific off California and/or between Hawaii and Alaska, it would be possible to disrupt our recovery operations. On the other hand, it seems unlikely that within the extreme limits of the AGENA orbits which permit our successful recovery, it would be possible to simultaneously negate our attempts and perform a successful recovery of one's own. In a situation where the AGENA vehicle reaches an orbit beyond the bounds which permit our planned successful recovery, it is possible to communicate with the vehicle and to initiate the recovery sequence at locations elsewhere than described above. However, the exact geographic alignment would depend entirely upon the degree of eccentricity of the orbit. So far we have had but one instance of this which was DISCOVERER VIII.

12. The automatic initiation of the recovery sequence has been eliminated from the program tape after the experience of DISCOVERER XX when the program timing failed temporarily, causing the entire sequence to be about one/half cycle out of phase.

13. We have queried both CEI and NSA as to whether strange transmissions on our frequencies have been heard at times when our vehicles were aloft. Although incomplete, so far we have had negative reports. We did, quite a few months ago, request NSO to look

into the possibility of changing the command keying sequence. This was rejected because of the possibility of human error in transmission of commands which would differ in function from one shot to the next.

/S/

EUGENE P. KIEFER
SA/TA/NPD-ED/P

Attachment:

Chart (w/copy 1 only)

[redacted]

Distribution:

[redacted]