~~TOP SECRET~~ [redacted] by Trump



~~WORKING PAPER Draft #1.~~ 25 July 1966 Reference 14 July '66 2nd Draft.

Note the last page of the Reference Document "Tasking Back-Up Table"

1. Average (Band X Revs) Tasked on 7104 during May Shows the following:

   (a) Tasking repeats itself in three-day cycles, each cycle activating 96 collection bands. Thus approximately 230 bands are used / week.

2. Maximum Tasking 'Full down-data-links)
   7104 (8 bands) = 98 orbits/week X 2 birds X 4 bands each = 784

   7105(AB) (9 Bands)= . . . . . 882

   7105(CD) (7 Bands) = . . . . . 686

3. Swath Width = 3500 N M as routinely shown in [redacted] look-angle from the satellite of negative values i.e. minus one or two degrees. (a) below the earths horizon when viewed from the satellite

   = 8.1 looks per day

7104 LOOKS PER DAY WITH CURRENT TASKING

$$8.1 \times \frac{230}{784} \times \frac{90}{360} = .60$$

7105 (AB)

$$8.1 \times \frac{280^{**}}{882} \times 315/360 = 2.25$$

7105 (CD)

$$8.1 \times \frac{280^{**}}{686} \times \frac{315}{360} = 2.89$$

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**Note 230Rev-Bands is not necessarily a true expectation for 7105...In Fact Analysis and ground station restraints will be greatly reduced. ~~Anticipate~~ 5 revs X 4 bands/bird X 2 birds/day = 40 rev-bands/day
= 280

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OUTGOING
NRL SPECIAL PROJECTS CONTROL NUMBER

BYE-62025-92

7/6/94

DATE

~~SEC~~

| ORIGINATOR | SERIAL NO. | ENCLOSURES |
|---|---|---|
| 8000 | BYE-62025-92 | 00 |

| RECEIVED | COPY NUMBERS | RECEIPT NO. |
|---|---|---|
| | 1 | H/C |

SUBJECT
SEJ W/P SYSTEMS DESCRIPTION

DISTRIBUTION INFO

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| 1298 | 1 | 00 | | 920615 | |

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BYE-62025-92

NRL OUTGOING DOCUMENT

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# PRELIMINARY PENNON DESCRIPTION

OBJECTIVE: To intercept and record pulsed signals in the 4.9-5.15 GCS band providing data for processing and locations determination. Coverage of [redacted] target tracking radar is optimized.

SYSTEMS DESCRIPTION:

A spin stabilized P-11 will be utilized to carry the system.

Two fixed tune super-hetrodynes operating at 4.9 to 5.15 GCS. Four antennas will be mounted on the vehicle. Two slotted wave guides mounted 90° to each other will provide location information as in Fanion payloads. Two omnidirectional antenna, one forward looking and one looking aft will provide omnidirectional coverage. The outputs of the slotted wave guides will be combined with the omnidirectional outputs to provide side lobe suppression in the same manner that will be flight tested for the first time on 7314. The use of omnidirectional antennas will provide scan rate in addition to the data normally collected.

The analog recorder to be used will have a 37.5 KCS bandwidth with a nominal 24 min capacity. Overall system sensitivity will be approx -98 dbm.

OPERATIONAL CONCEPT The payload will be launched on a spin stabilized P-11 into a nominal 275/300 nm circular orbit with a mission lifetime of six

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months. The payload recorder capacity is such that it can collect "border to border." A commandable timer should allow turn on over any area of interest. A nominal 5-7 revs a day should be available for tasking.

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MISSION 7317

PAYLOAD: FANION II

OBJECTIVE: To intercept and record pulsed signals in the 4900-5150 mcs band providing data for processing and locations determination. Coverage of [redacted] target tracking radar is optimized.

SYSTEM DESCRIPTIONS:

ANTENNA: Two 48 inch slotted wave guides antennas with fan shaped beams crossed at 90° with respect to each other with 3DB beam widths of 3.8°x41° and 3.1°x50°. Each has a nominal gain of 22-23db. The centers of the beams are at an angle of 60° and fwd to the spin axis.

RECEIVERS: Two fixed tune super-hetrodynes operating at 4900 to 5150 mcs. The video outputs of these two receivers feed a logic circuit that provides (a) the sum of the two receivers at all times to track 1 and (b) the sum only when both have the same signal to track 2 of the recorder. Over-all system sensitivity is - 98dbm.

ANALOG: Dual track with a frequency response of ± 3DB from 300 CPS to 37.5KCS providing a nominal 24 minutes capacity. The receiver output (stretched video pulses) will be recorded with a 20KCS band width.

COMMUTATED: 14 data point, solid state, operating at 15 points per second providing payload housekeeping.

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Altitude ?

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PAYLOAD: TRIPOS II

OBJECTIVE: To intercept and record pulsed signals in the 4000-8000 mcs band providing data for subsequent processing in satisfaction of General Search requirement. The system as designed has a capability for location finding and also the detection of CW signals.

SYSTEM DESCRIPTION:

ANTENNA: Three foot deployable parabolic antenna with a nominal 3DB beam width $4^{o}$ and a nominal gain of 26DB. It is positioned at an angle of $60^{o}$ to the spin axis of the vehicle.

RECEIVER: Crystal video covering 4-8GC's with a tunnel diode amplifier and a traveling wave tube per amplifier which when combined with the antenna gain provide a system sensitivity of -101 dbm. Frequency is determined by filtering the R-F output of the T.W.T. through a series of eight filters with a 500 mcs band width centered on 4.25, 4.75, 5.25, etc. mcs.

RECORDER:

ANALOG: Dual track with a frequency response of ± 3 DB from 300 CPS to 375 KCS providing a nominal 24 minutes recording capacity. The receiver output (stretched video pulse) will be recorded with 15KCS band width.

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COMMUTATED:

a. Low speed commutator operating at a speed of 125 points per second provides frequency measurement.

b. High speed commutators operating at 875 points per second, providing

OPERATIONAL CONCEPT

These payloads are to be carried by a spin stabilized P-11 subsatellite in a planned nominal 270/300 n mile circular orbit. The planned launch date, predicated on the launch of the primary payload is Sept 1966. Mission life is expected to be 6 months.

The recorder capacity is such that the payload can operate from "border to border". Data will be dumped to the usual ZI collection facilities. A relatively simple on-orbit command system (delay and on/off) will allow about five (seven) collection revs per day. The combinations of spin and

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narrow-antenna beams will enable the

processor to determine emitter locations

to varying accuracies depending on the

position of the emitters. (Nadir to 700NM).

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MISSION 7314

PAYLOAD: SAMPAN

OBJECTIVE: To intercept and record pulsed signals in the 2.0-4.0 ~~GCS~~ GHZ band providing data for processing and location determination.

SYSTEM DESCRIPTION:

ANTENNAS: The deployable antennas for this payload consists of two conical spirals effectively positioned back to back for omnidirectional coverage and a three foot parabolic reflector to provide a narrow directional beam. The gains of omnidirectional antennas match the forward and rear side lobes of the directional antenna to permit a side ~~lbe~~ LOBE cancellation technique to be utilized.

RECEIVERS: Three crystal video receivers with a total of five video channels which provide the following measurements: radio frequency, peak received power, [redacted] PRf, scan rate and data for geopositioning of emitters. The omnidirectional system consists of two identical receivers. Each of these receivers has a wide band video channel and a YIG filter video channel. The wide band channels covers the 2-4 ~~GCS~~ GHZ band with a sensitivity of -56 dbm tangential which will prevent the data rate from being excessive by insuring intercepts only from main beams and significant first order side lobes. The YIG filter channel can be commanded to cover four ranges 2-4 ~~gHz~~, 2.0-2.6 ~~GHz~~, 2.6-3.2 GHZand 3.2-4.0 GHZ.

The D.f receiver provides 3 video channels, a wideband video, a sweeping YIG filter and a [redacted] The wide band channel covering 2-4 GHZ provides the necessary data to measure the prf and the ground location of the emitter. Only intercepts from the main beam of the

3 ft parabola will be seen in this channel because of the inhibit action of the receiver. The YIG filter channel can be commanded to cover the same frequency ranges as the YIG in the omni system.

The Df receiver has a system tangential sensitivity of 87-90 and 93-96 dbm.

RECORDERS: All receiver outputs are recorded on a 75KC bandwidth, dual track tape recorder. The readin time is approximately 12.5 min.

OPERATIONAL CONCEPT: These payloads are to be carried by a spin stabilized P-11 subsatellite in a planned nominal 270/300 n mile circular orbit. The planned launch date, predicated on the launch of the primary payload is 12 August 1966. Mission life is expected to be 6 months. The recorder capacity (12.5 min) is such that the payload will not be able to cover "border to border". However, coverage of China will be optimized by proper utilization of the command/delay system. A nominal five to seven collection revs per day will be available. The combination of spin and narrow antenna beams will enable the processor to determine emitter locations to varying accuracies depending on the position of the emitters. (NADIR to 700 NM)

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ADVANCED ENGINEERING FEATURE

A unique feature of the Sampan system is the manner in which signals intercepted in the sidelobes of the DF antenna are eliminated from the output.

This is done by careful gain matching of the three rf front ends and by careful design of the antenna system. The design requirements for the antenna system were to provide a pencil beam pattern of maximum gain and mimimum sidelobes and to provide an omnidirectional pattern which had higher gain than the pencil beam in all areas but the main beam.

With this gain characteristics in the antenna system and with front ends of equal sensitivity it is possible to make a decision in the receiver, on the basis of amplitude, whether or not an intercept occurred in the DF antenna's main beam or in its sidelobes. The two omnidirectional wide band videos are summed together to generate the total omniwide band signal which is then subtracted from the DF channel wideband video. If the pulses in the omni channel were of greater amplitude than the pulses in the Df channel, the output is negative.

Conversely, if the pulses in the omni channel were of smaller amplitude, then the output would be positive. A baseline clipper circuit eliminates all negative pulses from reaching the output. Therefore, only pulses whose Df amplitudes were greater than omni amplitudes will be recorded at the Df output. If the omni receiver sensitivity exactly matches the Df receiver sensitivity, false alarms or pohe throughs will exist at any point that the omni antenna gain falls below that of the Df antenna gain (with the legitimate exception of the main beam). To protect against this, the normal operating mode of the Sampan system is to operate the Df receiver with 6 db less gain than the

omnidirectional receiver. This provides a margin of protection against pattern poke throughs.

[redacted]/FM DETECTION IS ACCOMPLISHED IN THE SAME MANNER AS FOR SOOSEA.

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PAYLOAD: SOUSEA

OBJECTIVE: To intercept and record pulsed signals in the 8-12 GHZ band providing data for processing and location determination.

SYSTEM DESCRIPTION:

ANTENNAS: The deployable antenna system for the Sousea payload consists of an omnidirectional antenna and a three foot parabolic reflector with a dual band conical spiral feed. The omnidirectional antenna is a planar spiral and has a pattern approaching that of a circularly polarized dipole.

RECEIVERS: Two identical R.F. front ends which are designated as omnidirectional and direction finding (D.F.) channels. Each front end covers the frequency range of 8.0-12.0 GHZ. A total of six video channels are derived which provide the following measurements: radio frequency, peak received power, P.R.F., scan rate and data for geopositioning of emitters. The omnidirectional receiver has a wide band video channel for long-term intercepts and a sweeping YIG filter to measure frequency. The wide band channel has a system tangential sensitivity of -68.5 dbm and the YIG filter channel has -77.5 dbm. The DF receiver provides four ~~video~~ VIDEO channels. Two channels separate the 8-12 GHZ range into a high density channel (8.9-9.7GHZ) and a low density channel (8-8.9GHZ and 9.7-12GHZ). A commandable YIG filter channel is available to sweep any one of eight narrower frequency bands within 8-12GHZ. The fourth channel provides pulse width and pulse interval measurement. The DF receiver hi density channel has a system tangential sensitivity of -110.5 dbm, the low density

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channel -103.5 dbm and the YIG filter channel -112.5 dbm.

A capability for detecting high duty emitters such as [redacted] radar, FM transmission link is incorporated in the YIG filter channel.

RECORDER: All receiver outputs are recorded on a 75 KC bandwidth, dual track tape recorder. The readin time is approximately 12.5 min.

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PRELIMINARY SETTER IA DESCRIPTION

OBJECTIVE:

The Setter IA system is an electomagnetic reconnaissance system designed to locate ground emitters from a satellite space vehicle. This system is capable of accurate, instantaneous direction finding on a two-pulse confirm basis and can sort and process interleaved pulse trains during a single orbital pass. This sorting process is on the basis of D/F phase measurements and frequency.

SYSTEM DESCRIPTION:

Setter 1A is integrally mounted with the prime payload (Mission 7161) on a fully stabilized Agena D vehicle. It is a six channel -85dbm sensitivity system using six circular horn antennas arranged in an interferometer array feeding six superhetrodyne receivers each tuned in 256 steps 2960.5 - 3215.5 mc with 1.5 mc bandwidth. The dwell time on each step is 7.8-100 millisec depending on signal density. During this time the 120x340 ~~n.m.~~ NM. field of view is scanned and the radio frequency, [redacted] and repetition interval of received pulses are digitized and stored.

ANTENNAS:

All received signals are picked up in a specially designed array of six antennas. Five of the six antennas are identical and the sixth one is similar except the effective aperture is reduced so that it has approximately 3 db less gain at boresight than the

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other five. The gain of the larger antenna is approximately 9.5 db with respect to an isotropic antenna.

The direction of arrival of a wavefront emanating from a distant emitter is reflected in the difference in time of arrival between pairs of antennas in the array. Since If the wavelength (or frequency) of the received signal is known, these differences in time of arrival may be interpreted as relative phase difference. It is by measurement of these phase differences that the system is able to determine direction to the emitter.

OPERATIONAL CONCEPT:

The Agena D will be launched by a thorad booster to a nominal 275 n mi 75° inclination circular orbit with a mission lifetime of thirty days. The recorder will normally be programmed border to border. All data will be dumped and recorded at ZI facilities. The digital material will be sent electronically to the processors. Location accuracy of Setter is [redacted] on a single intercept ~~with even increased confidence and minimized system errors possible from~~ multiple hits.

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~~PRELIMINARY~~ MISSION 7161 ~~DESCRIPTION~~

OBJECTIVE:

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To locate ground emitters by intercept ground signal emission ~~with Setter I-A payload~~; analyze and record certain critical characteristics of these data while on orbit, ~~and retrieve~~ these data are retained by transmission in digital and wide-band analog form via the data links upon command.

SYSTEM DESCRIPTION:

A full (3 axis) stabilized nadir-pointing Agena is used with Mission 7161. The multigroup I payload is an electronic reconnaissance system that intercepts pulsed, electronic emissions from ground radiations in the 125 MC to ~~21 or~~ 2100 MC frequency range. Analog video signals from the receivers are recorded on a wideband recording system. Digital data containing frequency, time, and operating mode information, are compiled periodically and recorded on an AR-400 tape recorder. Emitter parameters, such as frequency, PFR, [redacted] and PA, are also recorded. The signals recorded on the wideband system will be transmitted to a ground station via a wideband UHF data link, the digital word recorded on the AR-400 tape recorder will be read out to a ground station via a narrowband VHF data link.

ANTENNA: The antenna is a single log-spiral antenna covering all four frequency bands. It is an unfurlable structure of nylon MYLAR and aluminum and is stored during launch in a deflated condition within a hermetically sealed canister.

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The antenna radiation pattern develop a coverage cone come by the difference between the amplitude of the signal received by the signal and inhibit antenna pair. The size of the coverage cone angle is mainly influenced by (1) the signal and inhibit channel gain settings, (2) the payload altitude, ~~and ground speed, and (3) the scanning rates of the receiver~~. A cone angle of 30 degrees at 275 N. mi orbital altitude producing a circular coverage area of 150 N. mi. diameter is used.

RECEIVERS: The 125 mc to 2100 mc frequency range of the payload is divided into four electronically scanned receiver bands: Band 2 - 125 to 260 MC, Band 3 - 260-530 mc, Band 4 - 530 to 1060 mc, and Band 5 - 1060 to 2100 mc. Each band utilizes two identical complete receivers consisting of an RF front end, an IF/video section, ~~and an amplitude comparator~~.

Sum and difference mode signals from the antenna forming the signal and inhibit channels, respectively, are amplified, mixed, amplified again, detected from each the paired receivers and routed to an amplitude comparator. The amplitude comparator examines these signals for relative amplitude difference, and determine whether they come from an emitter within the desired circle of coverage. If so, an accept pulse is generated within the comparator and sent to the Data Handler for processing. An in-band detector inhibits the generation of an accept pulse for an off-channel response (those signals appearing from detuned signals outside the IF passband). A discriminator receives the limited IF output from the signal log IF amplifier and delivers a discriminator video output to the payload control.

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TAPE RECORDERS: The digital tape recorder (AR 400) records digital information in a start-stop fashion on magnetic tape and, on command, plays back this information continuously in either a forward or a reverse direction. The tape recorder stores the processed digital data from the Data Handler during an intercept. During readout, the stored data are read out to the DH for reprocessing.

DIGITAL RECORDER CHARACTERISTICS:

Number of tracks - Four

Tape Capacity - Sufficient for 6200 recorded words minimum

Bit Desnity - 4444 ~~recorded words minimum~~ bits per inch

Tape Length - 310 feet

The Analog recorder (DSU-1) records analog and digital information and operates in a steady state condition. On command, playback is obtained continuously in a reverse direction, with the last recorded information being read out first.

Analog tape recorder characteristics:

Recording time - 40 min.

1:1 readin/readout 6 MC pre-detection

Number of channels - 1 video and 1 digital.

OPERATIONAL CONCEPT: The Agena will be launched by a Thorad booster to a nominal 275 n mi 75° inclination circular orbit with a mission lifetime of thirty days. The digital recorder will be programmed border to border. The analog recorder and payload

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modes will be pre-programmed for operation over specific locations according to COMOR guidelines.

All data will be dumped and recorded at ZI facilities. The digital material will be sent electronically to the processors and the analog data will be forwarded by courier. Location accuracies will be ± [redacted] for one intercept and less than ± [redacted] for multiple intercepts.

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PRELIMINARY STRAWMAN DESCRIPTION

OBJECTIVE:

To intercept, (a Automatically) locate, measure signal parameters and record radar emissions in the 125-3300 mc range ~~and~~ provide (no pre-processed digital data for EOB analysis and selected wideband analog data for directed search and technical intelligence analysis.

SYSTEM DESCRIPTION:

A full (3 axis) stabilized nadir-pointng AGENA is used with the following subsystems and capabilities.

THRESHER

For 125-1800 mc, four ~~(4)~~ electronic scanning superheterodyne receiving systems are operated sequentially through any group of bands or parts of bands. Receiver sensitivities are-85 dbm. Antennas are flat spirals, cavity-backed providing a 150 nmi swath and automatic azimuth angle and radius measurements from nadir to target location on a single intercept (each) pulse.

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REAPER

Covering 1800-3300 mc two -95 dbm sensitivity systems electronically scan in sequence and measure angles right-left and fore-aft of nadir on a signal pulse.

RECORDERS

Digital two 10,000 ~~bps~~ 4 track recorders for intercept signal characterictics measured in the payloads including location data.

Analog: 40 minutes, 1:1 readin/readout 6 mc predetection recorder.

OPERATIONAL CONCEPT:

The AGENA will be launched by a THORAD booster to a nominal 275 nmi, 75° inclination circular orbit with a mission lifetime of six months. The digital recorder will normally be programmed border-to-border. The analog recorder and payload modes including r_f coverage can be programmed in-flight for operation over specific locations according to COMOR guidelines and based on the results of mission data processed only 24 hours earlier. All data will be dumped and recorded at ZI facilities. The digital material will be sent electronically to the processors

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within 24 hours and the analog readout ~~[illegible]~~ limited to 50 minutes per day, will be forwarded by courier.

Location accuracies will vary from less the[redacted] in the upper bands and in portions of the lower bands to [redacted] for the remainder depending on the number of intercepts and the density of the signal environment. Interfering signals will be minimized but in some cases will preclude accurate performance. All signal parameter measurements ~~[illegible]~~ will be more accurate than Multigroup so as to meet the EOB requirements stated in COMOR 69-32. In case of MG, scan rate is not measured. A special signal recognizer can be reprogrammed on-orbit to detect a variety of radar parameters at specific geographical locations. This will enable the ~~WIDEBAND~~ wideband recorder to collect Technical details on new radars or old targets suspected of operating in new modes.

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