HANDLE VIA BYEMAN/COMINT
CONTROL SYSTEMS

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BYE-1117-69
SORS 11./40
11 March 1969

UNITED STATES INTELLIGENCE BOARD

SIGINT COMMITTEE

SIGINT OVERHEAD RECONNAISSANCE SUBCOMMITTEE

MEMORANDUM FOR THE MEMBERS OF THE SIGINT OVERHEAD RECONNAISSANCE SUBCOMMITTEE

SUBJECT: Technical Mission Description of WESTON, SIGINT Mission 7313

1. The technical Mission Description of WESTON, Mission 7313 has been forwarded to SORS by the National Reconnaissance Office Staff and is attached herewith for your information.

2. Please note that the NRO requests that SORS Collection Guidance should specify geographical areas/targets in priority order and should recommend the desired recognizer configurations appropriate to each specific geographical area/target.

[redacted] (b)(1) (b)(3)

EXECUTIVE SECRETARY
SIGINT OVERHEAD RECONNAISSANCE SUBCOMMITTEE

Attachment:
a/s

GROUP 1
Excluded from automatic downgrading and declassification

~~(TS)~~ NATIONAL RECONNAISSANCE OFFICE

WASHINGTON, D.C.

THE NRO STAFF

BYE-1117-69
SORS 11./40
11 March 1969

MEMORANDUM FOR CHAIRMAN, SIGINT OVERHEAD
RECONNAISSANCE SUBCOMMITTEE

SUBJECT: Mission Description of SIGINT Mission 7313 (WESTON)

The mission description for Mission 7313 is forwarded as an attachment to this correspondence. This SIGINT reconnaissance system is designed to meet the requirements of USIB S-10.9/8.

Mission 7313 (WESTON) is contained in a spin-stabilized P-11 subsatellite which will be launched into a 275-nautical mile circular orbit by a Thor/Agena booster. WESTON is designed to intercept, recognize, and record MERCURY GRASS and DAWN ROSE communications signals in the 60 to 70 MHz and the 360 to 420 MHz frequency bands. WESTON will measure the frequency and power of the intercepted signal; no geopositioning is done.

The planned launch date, predicated on launch of Mission 7106 (POPPY), is late May 1969. Mission life is expected to be 9 months. The P-11 power system will provide 6 to 12 collection revs per day, depending upon solar array current production. Collection guidance should specify geographic area/target in priority order and the desired recognizer configuration referenced to geographic area/target.

Edwin F. Sweeney
EDWIN F. SWEENEY
Colonel, USAF
Deputy Director for
Satellite Operations

Attachment
As Stated

MISSION DESCRIPTION

WESTON

1.0 INTRODUCTION.

1.1 GENERAL.

The WESTON reconnaissance system is designed to intercept and record MERCURY GRASS and DAWN ROSE communications signals in the 60 to 70 MHz and 360 to 420 MHz frequency bands. The system uses two deployable antennas, one UHF and one VHF, to feed a UHF and two VHF superheterodyne receivers. The video outputs of the three receivers are recorded on three separate tracks of two 13-minute, two track, 75 KHz tape recorders. During tape recorder readout, each video signal is analog-to-digital converted, enciphered, and transmitted to a tracking station.

WESTON has four telemetry links. Three telemetry links are used for the three enciphered video signals and the remaining telemetry link is used for vehicle status information. An engineering drawing of the WESTON satellite is given in Diagram 1; a simplified schematic of the WESTON system is given in Diagram 2.

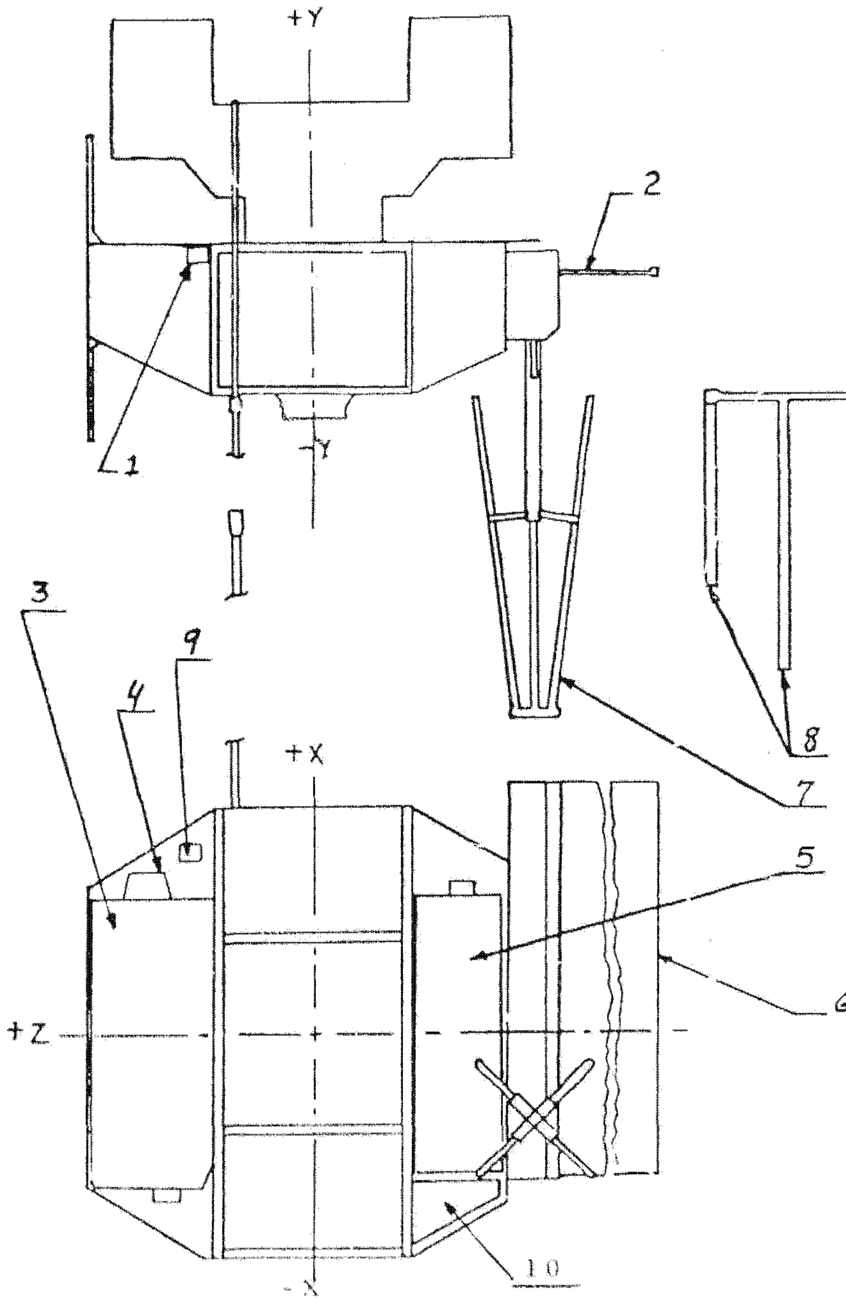
1.2 PARAMETERS.

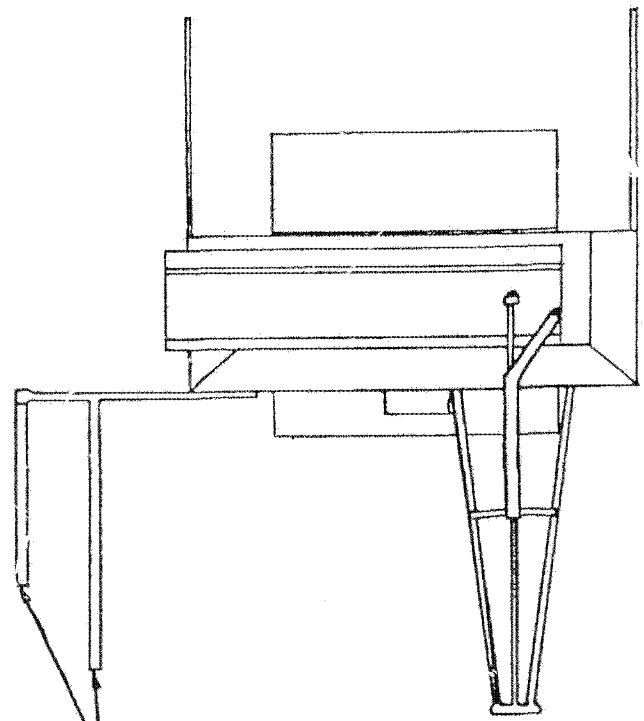
Orbital Parameters:

Altitude:	275 n.m. circular
Inclination Angle:	70 - 90 degrees

Payload Parameters:

Frequency Range:	60 - 70, 360 - 420 MHz
Frequency Measurement Accuracy:	VHF ± 37.5 KHz UHF ± 2.5 KHz





1. Sun Sensor
2,6. VHF - Window Shade Antenna
3. Weston B-Box
4. Shift Register
5. Weston A-Box
7. UHF - Oil Derrick Antenna
8. TM Command Dipole - Tandem
9. Earth Sensor
10. Weston C-Box

TOP SECRET
EARPOP

Approved for Release: 2020/12/08 C05131531

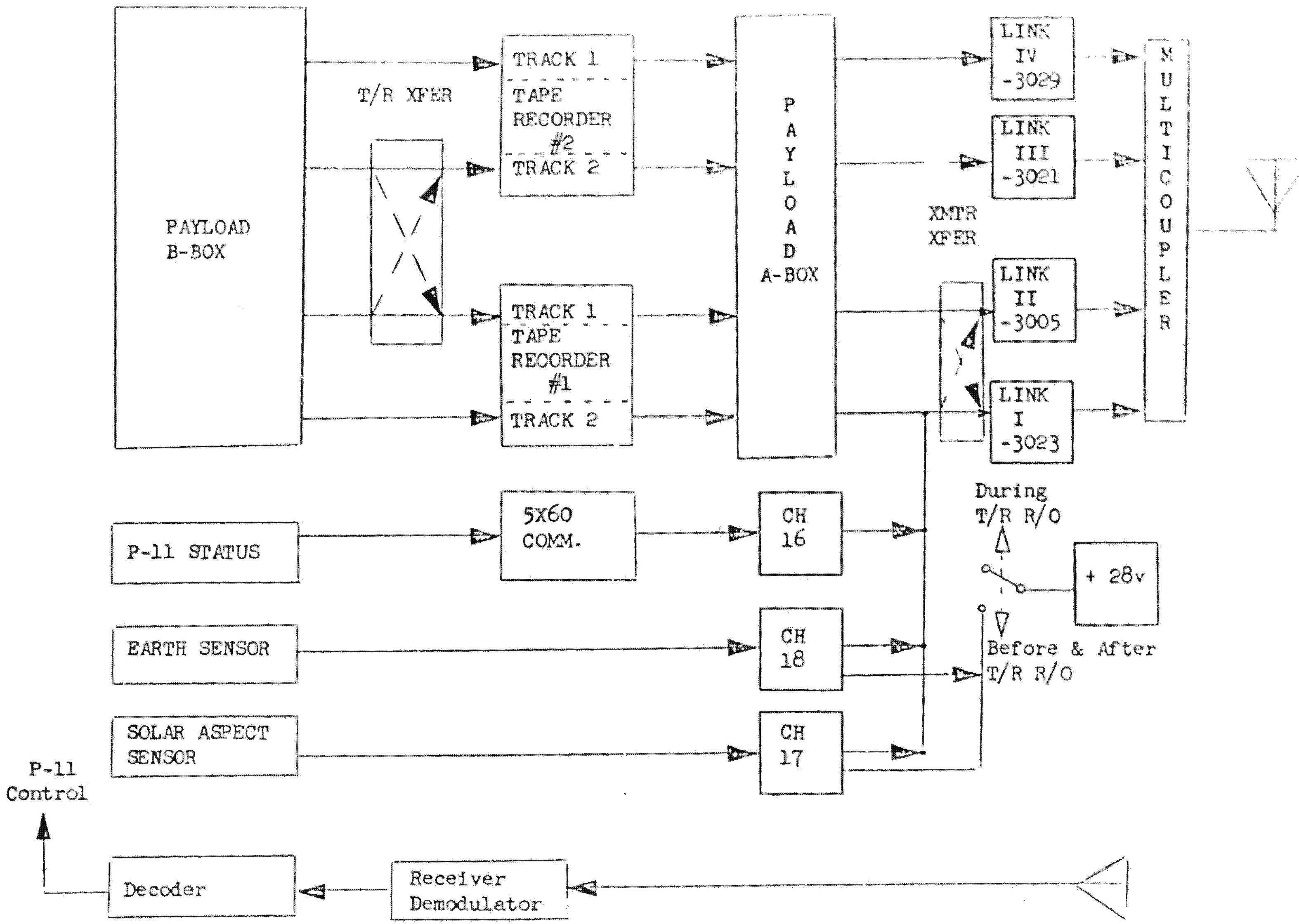


DIAGRAM 2. WESTON Simplified Block Diagram

Sensitivity: -110 dbm

Location Accuracy: No location capability

2.0 PAYLOAD ANTENNAS.

The Oil Derrick-Window Shade Sensor Assembly is comprised of two separate sensors--the "Oil Derrick Sensor" and the Window Shade Sensor". The sensors are packaged in a rectangular aluminum box 32 inches by 10 inches by 4 inches. Two detachable covers are ejected by a squib-fired cover release mechanism which assist centrifugal force in ejecting the covers from the package. The over-all assembly weight is 7 pounds.

2.1 UHF ANTENNA - OIL DERRICK.

2.1.1 Mechanical Characteristics.

The Oil Derrick Sensor is deployed by a spring-loaded, oil-damped actuator which pivots the sensor out of the base shell. Simultaneously, four fiber glass tubes are pivoted out from the longitudinal axis of the sensor by lanyards attached to the base and the tubes. the tubes form a frame reassembling the frustum of a four-sided pyramid. Wires which are threaded through and spiraled up the tubes are stretched taut between the tubes by the erection action. These wires form the sides of the frustum. The wires are encapsulated in a sheet of mylar to prevent snagging during deployment. The frustum formed measures approximately 24 inches high, 9 inches square at the base, and 3 inches square at the other end.

2.1.2 Electrical Characteristics.

The electrical design is a modified log periodic conical spiral. The conical portion is modified as a four-sided pyramid. This change has little effect on the antenna pattern. The antenna windings are modified and a constant pitch helical is used instead of a logrithmic winding.

2.2 VHF ANTENNA - WINDOW SHADE.

2.2.1 Mechanical Characteristics.

The Window Shade Sensor deploys by centrifugal force which unrolls it 57 inches out from the aluminum base. The sensor forms a dacron sail measuring 30 inches by 57 inches with a gold platted spiral pattern on its surface. A coaxial cable is also stitched in a spiral pattern to its surface.

2.2.2 Electrical Characteristics.

The Window Shade Antenna is basically a Planar Equiangular Spiral using one and one-half turns. The radiating element is a non-conducting dacron slot which forms the spiral. The balance of the antenna is formed by a conducting material. An infinite Balun is formed by stitching the feed cable directly to the cloth with wire. In order to preserve symmetry, a dummy cable is stitched on the opposite side. The pattern is that of a dipole. The radiation is bidirectional with equal beams radiated from the front and the back of the structure. This beam is circularly polarized on its axis; the axial ratio becomes greater as you approach the plane of the antenna.

3.0 PAYLOAD RECEIVERS.

3.1 VHF RECEIVERS.

3.1.1 Introduction.

WESTON uses two VHF receivers. These receivers are single conversion superheterodyne units with computer controlled local oscillators and tracking preselectors. The computer tunes the local oscillator and the preselector to 134 predetermined frequencies across the band until a valid intercept is made. Each predetermined frequency constitutes a channel. When an intercept is made, the local oscillator frequency is measured.

3.1.2 Circuit Description.

The RF input to the VHF receiver is connected to a coaxial relay which switches between the antenna and the RF calibrator. This coaxial relay opens the antenna path and applies a -90 dbm simulated signal for system check during the first 20 seconds of readin cycle. The output of this relay, either antenna or simulated signal, is passed through a band pass filter and a multicoupler to the RF input of the receiver. The signal from the multicoupler is coupled to the preselector which is being tracked by the scan generator voltage from the synthesizer. The preselector output and the sweeping local oscillator from the synthesizer are combined at the first mixer to provide a difference frequency of 21.4 mc. The mixer output is amplified by the first stage, applied to a crystal filter and a mixer, and further amplified by additional IF stages. The IF output is amplitude limited and coupled to the discriminator through an isolating buffer amplifier. One video output of the discriminator is amplified and a low pass filtered for application to the tape recorder. The second discriminator output, which is amplified but not filtered, is used to drive the recognizer circuitry.

The swept local oscillator output is also amplified and mixed with a crystal transfer oscillator at the second mixer. This mixed output is low pass filtered and amplified by an integrated circuit amplifier followed by a two transistor high gain video amplifier. This output is used to drive the frequency readout circuitry.

A peak detector circuit will indicate a dc voltage proportional to the RF input whenever the receiver is stopped on a signal.

3.1.3 Discriminator.

The discriminator is tuned to a center frequency of 21.4 mc and has a linear bandwidth of 40 kc. The input impedance is 1 K-ohm and the output impedance is 100 K-ohm. Input voltage must not exceed 1.5 V rms. The output is 25 mV per kc input deviation with a 1 V rms input.

3.1.4 Video Amplifier.

An emitter follower and single stage amplifier comprise the video amplifier. The output of the discriminator is capacitor coupled to the base of the emitter follower which provides the high input impedance to match the 100 K-ohm discriminator output. A variable resistor in the emitter follower provides amplitude adjustment. The video amplifier output is capacitor coupled through a 13 kc low pass filter to the system recorder. The output of the video amplifier is 1 V rms into a 10 K load.

A second video amplifier is provided to drive the recognizers. This amplifier is identical to the above except that the 13 kc low pass filter is omitted. This output is 1 volt rms into a 2 K load. The recognizer utilizes band pass filters and the 13 kc low pass was redundant and consequently omitted.

3.2 UHF RECEIVER.

3.2.1 Introduction.

WESTON uses one UHF receiver. This receiver is a dual conversion superheterodyne with a voltage tuned local oscillator. The local oscillator steps across the frequency band until a valid intercept is made as determined by the recognizer. At this time the local oscillator frequency is measured. The limited pull Automatic Frequency Control is always enabled.

3.2.2 Circuit Description.

The RF input to the UHF receiver is connected to a coaxial relay which switches from antenna to the RF calibrator. Upon command, the coaxial switch opens the incoming signal lead and applies a -90 dbm simulated signal for receiver system check. The signal then passes through the RF band pass filter to the preselector. The preselector and the swept local oscillator are tracked together. These outputs are applied to the first mixer and provide a 120 mc output to the first IF amplifier.

Following two stages of IF gain, the output is mixed with a 141.4 mc crystal oscillator to provide the second IF of 21.4 mc. The 21.4 mc is amplified by a one stage IF amplifier, coupled through a 21.4 mc, 200 kc bandwidth crystal filter, amplified by two more IF amplifiers, followed by two limiter stages and a buffer amplifier which is used to isolate the limiter stages from the discriminator. From the buffer amplifier, the IF signal is coupled to the 21.4 mc, 200 kc bandwidth discriminator. The detected output from the discriminator is then coupled to two video amplifiers--one to drive the recognizer and one to drive the recorder. The video amplifier that drives the recorder is fed through a 13 kc low pass filter.

The swept local oscillator output is also amplified by a 480 mc to 540 mc 3 stage isolation amplifier and mixed with either a 479 mc or 541 mc oscillator which is selected by a voltage from the scan generator. The mixer output is applied to a 32 mc low pass filter and then amplified by an integrated circuit amplifier and a two stage video amplifier. This output is applied to the external frequency measurement circuit. An output from the collector of one of the two transistors in the switch circuit used to select the 479 mc/541 mc output is provided for frequency readout monitoring of UHF sector.

The AFC voltage is obtained from the discriminator and is applied to the swept local oscillator. The AFC capture range is about 100 kc.

The peak detector circuit will indicate a dc voltage from approximately .1 Vdc to 3 Vdc as the signal strength varies from -90 to -60 dbm whenever the receiver is stopped on a signal. This is accomplished by taking the RF signal after the third stage of the second IF amplifier and before the limiter stage and applying it to a one stage amplifier and peak detector.

3.2.3 Discriminator.

The discriminator is tuned to a center frequency of 21.4 mc and has a linear bandwidth of 200 kc. The input impedance is 1 K-ohm and the output impedance is 100 K-ohm. Input voltage should not exceed 1.5 V rms. The output is 5 mV per kc input deviation with a 1 V rms input. Two outputs are provided. The first provides video to the video amplifier and the second provides AFC. The AFC output is coupled through a low pass filter to the scanning local oscillator. The time constant of this AFC circuit has been set at about 75 ms. This is long enough to pass the lowest frequency of interest (300 cps) and short enough to center the receiver early in the 500 ms primary lock period.

3.2.4 Video Amplifier.

An emitter follower and a single stage amplifier comprises the video amplifier. The output of the discriminator is capacitor coupled to the base of the emitter follower which provides the high input impedance to match the 100 K-ohm discriminator output. A variable resistor in the emitter follower is used to provide an amplitude adjustment. The video amplifier output is capacitor coupled through a 13 kc low pass filter to the system recorder. The output of the video amplifier is 1 V rms into a 10 K load.

A second video amplifier is provided to drive the recognizers. This amplifier is identical to the above except that the 13 kc low pass filter is omitted. This output is 1 V rms into a 2 K load.

4.0 PAYLOAD RECOGNIZERS.

4.1 GENERAL.

The system has been provided with two recognition indicators referred to as "primary lock" and "secondary lock." The function of primary lock is to take a cursory look at the signal environment and, if certain criteria are met within 10 milliseconds, to force the receiver to dwell at that frequency location for an additional half (.5) second. If during the .5 second interval the more stringent signal criteria are met, the system is placed in an unlimited lock situation. That is, the receiver is forced to remain at that frequency location (channel) for the duration of the signal. To protect the system against periodic signal fading or interference due to noise or clutter, the system has also been provided with a "hold through fade" function. Once the recognizer has made secondary lock, and for one reason or another the signal being monitored fails to continue to meet the recognition criterion, the receiver will be forced to remain on that channel for a fixed interval of time.

The recognizers operate in three modes and each mode is a unique combination of the three signals of interest. The signals of interest are: a dual channel FSK signal, a pulsed 300 cps tone, and a predetermined combination of signal presence in three filters. The manner in which these signals are processed is dependent upon the mode of operation of the system.

4.2 MODE A.

Recognition is based on the characteristics of the FSK signal only.

Primary Lock: If during the 10 milisecond dwell time of the receiver the signal meets the relationship

$$(A \overline{B} + \overline{A} B) + (C \overline{D} + \overline{C} D),$$

the receiver will be held on that channel for 0.5 seconds. A, B, C, and D represent the 8.5 kc, 9.1 kc, 12.2 kc, and 12.8 kc tones respectively. This is accomplished by filtering the video output of the receiver, detecting the envelope of the filtered output and slicing the detector output. The reshaped video is then processed in an "exclusive or" gate. The detector time constant is adjusted so that the signal must be present for at least 4 to 6 milliseconds. As soon as the "exclusive or" relationship has been satisfied by the signal, a 500 millisecond one-shot is triggered which is the "primary lock" output.

Secondary Lock: During the half-second hold generated by primar lock, the signal is examined for tone switching. The signal must switch from the lower tone to the upper tone at least five times during this half second interval and at the same time must continue to satisfy the "exclusive or" criterion. On the fifth transition, a control binary is triggered which represents secondary lock. The output of this binary holds the receiver at this frequency location for the duration of the signa A "recognition monitor", which is initiated the first time the signal satisfies the recognition criterion, senses the output of the circuitry counting the transitions from one tone to another to guarantee that the signal continues to meet the recognition criterion. If due to fading or noise interference, the signal fails to make the required five transitions in half-second interval, the recognition-monitor will trigger a 3-second hold-through-fade circuit. The function of the hold-through-fade circuitry is to force the receiver to remain at that particular location until it is certain that the valid signal is not going to return. If during this 3-second interval the recognition criterion is again satisfied, the holding circuit is reset and the system placed in a valid secondary lock. This process will repeat itself indefinitely until the signal fades or goes down for a period of time greater than 3 seconds.

A monitor on the "exclusive or" gate has been added to the Mode A recognition criterion. The function of this monitor is to force the two tones satisfying the exclusive function to have a minimum delay between switching. That is, assume tone A is up, when tone A goes down, tone B must come up within a preset time interval.

4.3 MODE B.

When the recognizers are placed in Mode B there are two signal characteristics of interest--the FSK signal described under Mode A and the two voice channels. These two characteristics are processed simultaneously by two independent circuits.

For the UHF band and the 60 mc to 65 mc VHF band, Mode B operates as follows:

Primary Lock: For the FSK signal, the primary lock is the same as was described in Mode A. The receiver will also stop for a 0.5 second if the signal satisfies the equation $(X + Z)\overline{Y}$, where X represents energy in the 300 cps to 1200 cps band, Y represents energy in the 3.3 kc to 3.7 kc band, and Z represents energy in the 7.2 to 7.1 kc band. This criteria must be satisfied for approximately 4 milliseconds within the 10 millisecond step for primary lock.

Secondary Lock: Once the receiver has been stopped on a potential valid signal (primary lock), the video XYZ parameters will be examined in detail. A valid secondary lock can occur on either the FSK signal as defined for Mode A or if the $(X + Z)\overline{Y}$ equation is satisfied for a predetermined time within the 500 millisecond secondary lock.

For the 65 to 70 mc band, Mode B operates as follows:

Primary Lock: A 500 millisecond primary lock can only occur on the FSK signal as described in Mode A.

Secondary Lock: After the receiver has been stopped on a possible valid signal by the FSK, secondary lock can occur on either FSK as described in Mode A or the $(X + Z)\overline{Y}$ equation. In all cases, the hold-through-fade (HTF) circuits work the same. There is a 3 second HTF if the receiver is locked on FSK and the signal fails to meet the recognition criteria (see Mode A). There is a 10 second HTF if the receiver is locked on the $(X + Z)\overline{Y}$ equation and the signal fades, drops out, or otherwise fails to meet the criteria for recognition. If the signal returns within the 10 second HTF and meets the recognition criteria, the system will remain locked; if not, the system will start to scan.

4.4 MODE C.

When the recognizers are placed in Mode C, there are two target signals of interest--the FSK signal described under Mode A and a pulsed 300 cps tone. These signals are processed in parallel by two independent circuits.

Primary Lock: For the FSK signal, primary lock is identical to that which was described in Mode A. For the 300 cps tone, primary lock is based on signal presence only, because of the short dwell time of the receiver (10 msec). The receiver video is passed through a 300 cps low pass filter. The filter output is amplified and passed through a full wave rectifier. The output of the rectifier is sliced (thresholded) by a Schmitt trigger, integrated and sliced again. The output of the second Schmitt-trigger is buffered by an emitter follower and used to trigger a 500 msec one shot. The output of this one shot is the primary lock output. Primary lock is, as was the case for Mode A, a 500 millisecond hold which stops the receiver from scanning.

Secondary Lock: Once the receiver has been stopped on a potential valid signal (primary lock), the video parameters will be examined in detail. Valid recognition (secondary lock) for Mode C is based on the FSK signal and the pulsed 300 cps tone. The recognition criterion for the FSK signal is identical to that described for Mode A. The 300 cps tone is periodically gated on for 75 msec and off for 35 msec. The video is examined first for the 75 msec on time, then for the 35 msec off time. If these criterion have been satisfied and the signal makes at least three transitions, it is considered valid. A transition is defined as 75 msec of a 300 cps tone followed by 35 msec of no 300 cps tone.

5.0 ANCILLARY SYSTEMS.

5.1 FREQUENCY SYNTHESIZER.

The frequency synthesizer works in conjunction with the system programmer and the VHF receiver to provide channel-by-channel tuning. The RF range of 60,000 to 69,975 mc is covered in 134 discrete steps resulting in an incremental frequency change of 75 kc per step. One additional step is utilized (59.925 mc) to permit the synthesizer to reset. The worst case accuracy of the synthesizer is such that the maximum tuning error is 3 kc. The synthesizer receives its commands from the system programmer in the form of an 8 bit binary word.

5.2 RF CALIBRATOR.

The primary function of the RF calibrator is to provide a test signal capable of exercising the receivers, recognizers, and other system circuitry. The calibrator is initiated each time the 26 Vdc readin power is applied. The total test cycle requires 20 seconds. During this time the target signal is simulated by an FSK signal corresponding to channel 3. The FSK signal is gated on for approximately 8 seconds, off for 4 seconds, then on again for 4 seconds. This sequence provides the modulation necessary to check the operation of the recognition circuitry. The output of the amplifier provides the modulation waveforms for the oscillator section of the calibrator. In addition, control voltages are provided to operate the RF coaxial relays which disconnect the antennas and apply the calibrator output to the receivers. Regulated power (+ 15 Vdc) is applied to the oscillator section only during the 20 second test interval.

5.3 RF FREQUENCY MEASUREMENT.

Accurate measurement of the receiver RF frequency is accomplished by heterodyning the local oscillator with a stable reference frequency to provide an output which varies from a few hundred kilocycles to 34 megacycles as the receiver frequency is changed. This frequency is counted for a short, very accurate period of time. The resulting digital count is converted to analog form and applied to the system commutators for readout. Since there are three receivers to be measured, the frequency counter is switched between the receivers in synchronism with the VHF commutator so that during one frame of the commutator the frequency of receiver number one is read out, during the next frame the frequency of receiver number two is read out, etc. A four level analog output to the commutators is also provided to identify the receiver and VHF sector being measured.

The incoming frequency from the receivers is applied to a trigger circuit which provides a rapid transition to meet the 50 nanosecond per volt fall time required at the input of the integrated circuit flip-flop. The output of the trigger in the UHF receiver channel is applied to a special high speed binary to reduce the maximum input rate to 17 megacycles which can be counted by the integrated circuits.

The frame marker pulse from the VHF commutator is also passed through a trigger to ensure compatibility with the integrated circuit elements. This shaped frame pulse runs a scale-of-three counter to gate the discrete component three point commutator. The outputs of the three RF triggers are commutated by this network into a discrete component gate which performs the function (A + B + C) D, where A, B, C, are the three RF's and D is the 156.25 microsecond count period gate. This 156.25 microsecond gate is derived from the 6.4 kc crystal master oscillator in the computer.

The output of this gate is a 156.25 microsecond burst of the selected receiver heterodyned output and is applied to a 12-stage binary counter. At the end of the gate period, the counter status is read out via six ladder-type D/A converters and applied to six commutator points. The arrival of the next frame mark clears the counter, unlatches the count period flip-flop, and advances the scale-of-three to select the next receiver heterodyned frequency.

An additional four level ladder network is provided to indicate which receiver is being sampled. This readout also indicates which protion of the UHF band is in use.

5.4 PROGRAMMER.

The function of the programmer is to control the two VHF receivers. The primary mode of operation for the programmer is to provide each frequency synthesizer an 8-bit binary coded address which changes in a sequential fashion. The synthesizer in turn causes the receiver to scan the RF range in 134 discrete steps (channels). The rate of scan is 100 channels per second.

Control inputs to the programmer are provided by the recognition circuitry. There are two inputs per VHF subsystem--primary lock and secondary lock. The significance and duration of these controls is described in the section of signal recognizers. Primary lock inhibits the master clock pulses and prevents the programmer from scanning the respective receiver. Secondary lock forces the programmer to perform the operational procedures as described in the following paragraphs.

A valid signal intercept (secondary lock) on receiver A will automatically inhibit recognition of the same signal by receiver B. Receiver B will stop on the "unallowed" channel for 10 msec, then proceed to the next channel regardless of any signal presence.

When receiver A is in secondary lock and receiver B is scanning, receiver B will be automatically directed to one of two possible "cooperating channels" for one second. Should receiver B go into secondary lock during this one second interval, it will remain on this channel for the duration of the signal. If, however, no signal is present, receiver B will proceed to the second cooperating channel. Again, if receiver B goes into secondary lock during the one second interval, it will remain on this channel for the duration of the signal. Should no valid signals be present on either cooperating channel, receiver B will return to the scan mode. The scan will begin with the channel immediately following the last cooperating channel examined.

When receiver A is in secondary lock and receiver B is also in secondary lock, the cooperating channel identification will be put into a temporary storage register. Should receiver B lose secondary lock and return to the scan mode, it will automatically be directed to the cooperating channels of the receiver A intercept.

The cooperating channel information is held in the storage register until one of two things occur. If receiver A has made secondary lock and receiver B is available and has been directed to monitor the cooperating channel, the information is destroyed (removed from the storage register) after it has been transferred into the receiver B control register. If receiver B is not available when secondary lock has been made by receiver A, receiver A drops out of secondary lock and resumes scanning. The cooperating channel information will remain stored until receiver A makes valid recognition again. At this time the register will be erased and the cooperating channel information corresponding to the new intercept will be stored. Once cooperating channel information has been stored, the association slave receiver will be directed to monitor those channels as soon as it becomes available.

Cooperating channel information will not be stored when a receiver makes a valid intercept while monitoring a cooperating channel. That is, if receiver A is in secondary lock and receiver B is directed to one of its cooperating channels, receiver B will not store cooperating channel information if it goes into secondary lock.

5.5 DELTA MODULATOR.

Delta modulation is a pulse modulation system which is a form of pulse code modulation. The delta modulator is an analog to a digital converter in which the transmitted pulses carry the differentiation of the amplitude of the input signal. At the receiver these pulses are integrated to obtain the original signal function. The conversion of the signal at the transmitter into a pulse pattern is achieved by using a quantized feedback circuit in which the output pulse train is integrated and compared with the original input function. A decision is then made on the basis of the output of the comparator as to whether a pulse or an absence of a pulse should be transmitted. An "echelon curve" is formed from the pulse train when integrated. Each pulse exercises a corrective influence on the output signal and thus the echelon curve fluctuates, approximating the original analog signal.

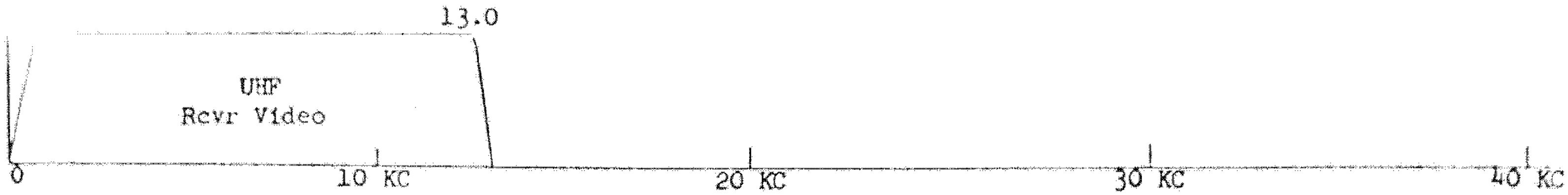
6.0 DATA STORAGE AND TRANSMISSION SUBSYSTEM.

6.1 DATA STORAGE.

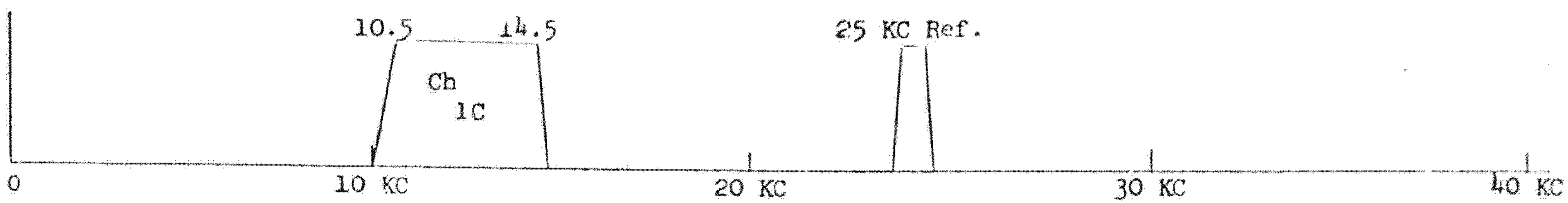
WESTON stores data on two, dual-track, 75 KHz, 13-minute tape recorders. Recorder readout is done at a 2:1 ratio, which allows 6 1/2 minutes for a full readout. Delayed commands from the orbit programmable module are used to turn on the recorders for readin; readout is accomplished by real-time command. Diagram 2 shows the relationship between each recorder track and the four telemetry transmitters. Diagram 3 shows the utilization of the tape recorder spectrum.

6.2 DATA TRANSMISSION.

The telemetry links are configured as shown in Diagram 2. Each transmitter is rated at two watts minimum output. The output of each transmitter is applied via a multicoupler to a common telemetry antenna. Vehicle status data are transmitted via telemetry link number one, except when transmitters one and two are reversed. Vehicle and payload telemetry are on a 5 rps, 60 point commutator which frequency modulates on IRIG channel 16 VCO. Earth and sun sensor data modulate IRIG channel 18 and channel 17 VCO's respectively. Diagram 4 shows the utilization of the transmitter spectrum.



T/R #1 TRK #1



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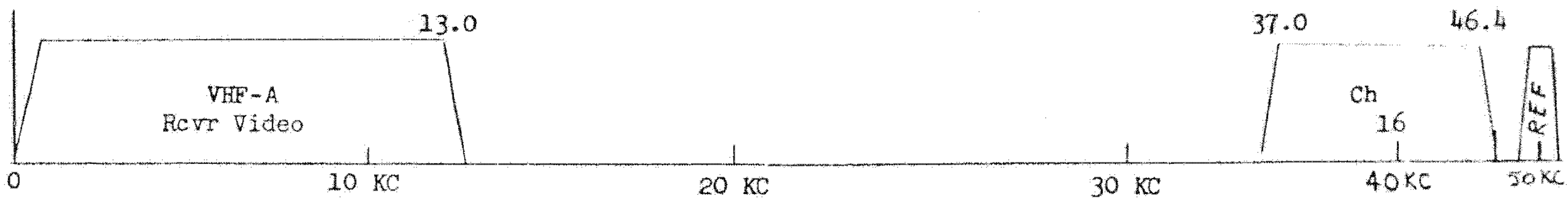
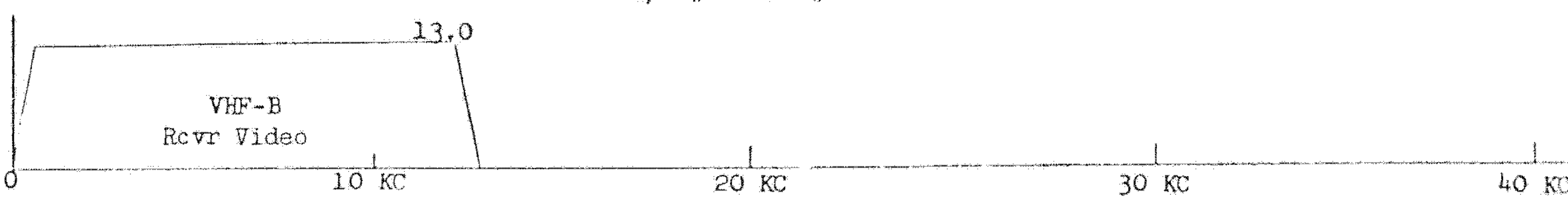


T/R #2 TRK #1



T/R #2 TRK #2

NDLE VIA BYEMAN/COMINT
ANNELS JOINTLY

TOP SECRET
EARPOP

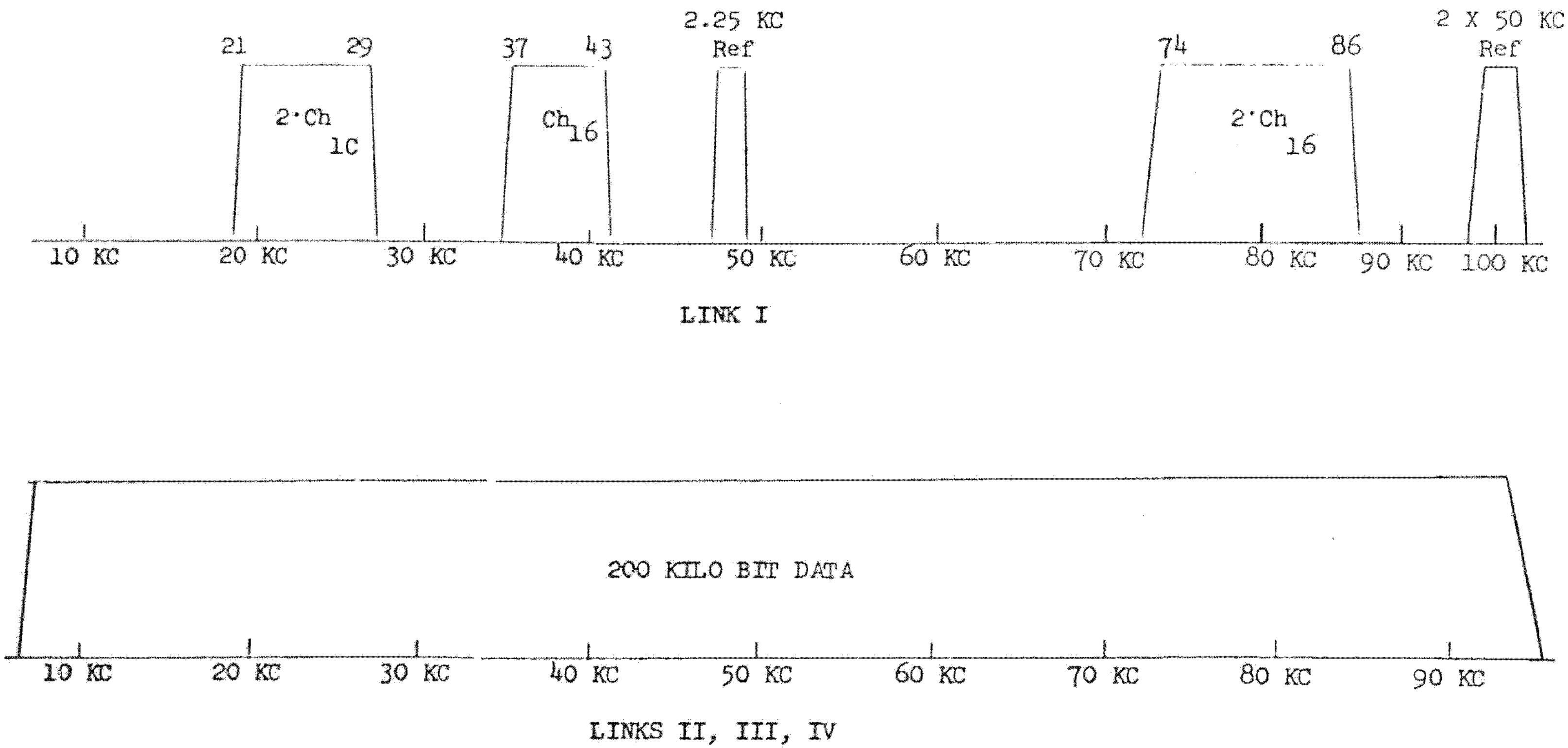


DIAGRAM 4. Transmitter Spectrum Usage During Tape Recorder Readout

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