SPECIAL HANDLING

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SPECIAL PURPOSE PACKAGES FLOWN

PACKAGE	FREQ BAND (MCS)	VEHICLE	DATE LAUNCHED	REMARKS
SOCTOP	2500 - 3200	1057	10 Aug 60	
SOCTOP	300 - 900 2500 - 3200	1058	13 Sep 60	
SOCTOP	300 - 900 1000 - 6000	1061	26 Oct 60	No Agena seperation
SOCTOP	300 - 900	1062	12 Nov 60	
SOCTOP	300 - 900 1000 - 6000	1105	30 Mar 61	No orbit
SOCTOP TAKI	1000 - 6000 160 - 175 100 - 1000	1107	16 Jun 61	
SOCTOP WILD BILL	1000 - 6000 40 - 120	1109	7 Jul 61	
SOCTOP TAKI	1000 - 6000 160 - 175 100 - 1000	1111	4 Aug 61	No orbit
TEXAS PINT	100 - 150	1112	30 Aug 61	
TOPSOC	400 - 800 800 - 1600	1113	12 Sep 61	
TOPSOC	400 - 800 800 - 1600	1114	18 Sep 61	
TOPSOC	400 - 800 800 - 1600	1115	13 Oct 61	

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SPECIAL PURPOSE PACKAGES FLOWN

PACKAGE	FREQ BAND (MCS)	VEHICLE	DATE LAUNCHED	REMARKS
E-16 TOPSOC		1117 ✓	5 Nov 61	
E-17 GRAPE JUICE		1119 ✓	12 Dec 61	
E-18 S.T. LOW		2203 ✓	21 Dec 61	
E-19 TAKI		1120 ✓	13 Jan 62	No orbit.
E-20 WILD BILL		1123 ✓	27 Feb 62	
E-21 ST. LOW		2204 ✓	7 Mar 62	
E-22 GRAPEJUICE		1124	11 April 62	
E-23 TAKI		1121	19 April 62	
E-24 WILD BILL		M 31	26 July 62	
PEPPERMINT STICK		1125	17 [illegible] 62	
E-25 [illegible]				

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PURPOSE	AREA TRACKING DETECTION
RECEIVERS	XTAL VIDEO
PULSE WIDTH	X MC
PULSE REPETITION FREQUENCY	ROUGH INDICATION
ANTENNA PATTERN 200 mile altitude	350 MILES LONG and 1,000 MILES WIDE
DATA STORAGE	BINARY REGISTERS
READOUT	FM/FM TELEMETRY Six commutator points (Three each band)
FREQUENCY	300 - 900 MCS 2500 - 3200 MCS (1000 - 6000 MCS W/FILTERS OUT)

purpose.

A decision had to be made as to whether a radar with a capability to track an artificial earth satellite and, specifically whether Agena vehicles were being so tracked.

Description.

Frequency. - The two-channel system covered the frequency bands 300 to 900 mcs and 2500 to 3200 mcs (an X-Band filter was removed to permit coverage from 1000 to 6000 mcs). Consideration was given to the possibility of including a 70 to 90 mcs band but because of space limitations for antennas this band was not explored.

Power. - It was calculated that, in order to track a satellite at an altitude of a few hundred miles, a radar would have to have a beam power (i.e. including antenna gain) of at least 400 megawatts in the 300 to 900 mcs interval and 5,000 megawatts in the 2500 to 3200 mcs interval.

Receivers. - Because of the expected high power levels it was possible to use simple crystal video receivers. Frequency was defined by band-pass filters and the received power criteron was achieved by adjusting the receiver thresholds to -20dbm (300 - 900 mcs) and -32dbm (2500 - 3200 mcs) respectively.

Pulse Repitition Frequency. - Initially it was assumed that the lowest pulse repitition frequency to be encountered would not be less than 17 pulses per second.

Pulse Counting Circuits. - Each receiver was equipped with two binary registers or accumulators; a counting register and a storage register which

cooperated to provide a coarse measure of pulse arrival rate. The counting register accumulates pulses from the receiver until 255 pulses have been received at which time it sends a single pulse to the storage register and then accepts no more pulses. Every fifteen seconds, however, the counting register is reset to zero so the content of the storage register indicates the number of fifteen second intervals in which 255 or more pulses have been received. The content of the storage register is read out via the telemetry link, after which the register is reset to zero.

Antenna Pattern. - The antenna pattern is such that a ground area approximately 350 miles long by 1,000 miles wide is covered at an altitude of 200 statute miles.

Programming. - The equipment was programmed "on" and "off" by the vehicle stored program command system. This command system is preset prior to launch. Initially it was programmed on over the entire Soviet area; however, on later flights it was programmed on in segments of orbits over the Soviet area as an aid to location of emitters.

Operations.

SOCTOPS were flown on the following Discoverer vehicles:

Vehicle	Date Launched	Bands Flown
1057	10 Aug 60	2500 - 3200 mcs
1058	13 Sep 60	300 - 900 and 2500 - 3200 mcs
1061*	26 Oct 60	300 - 900 and 1000 - 6000 mcs
1062	12 Nov 60	300 - 900 mcs
1105**	30 Mar 61	300 - 900 and 1000 - 6000 mcs
1107	16 Jun 61	1000 - 6000 mcs

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[illegible]

[illegible]	[illegible]	[illegible]
1107	7 Jul 67	1000 - 3000 nm
1111*	4 Aug 67	1000 - 6000 nm

[illegible] not [illegible] [illegible]; [illegible] antennas not uncovered.

* [illegible] achieve orbit.

[illegible]

[illegible] 1067 and 1068 were tracked in accordance with the frequency [illegible] 300 - 900 mcs; because of the presence of the S-band beacon on board these tracking [illegible] could be derived in S- and.

Vehicle 1068 was tracked in real-time in the low [illegible] orbits [illegible], 9, 10, 17 and 25. On orbit 10, over the Pacific, the [illegible] appeared to have a [illegible] one-third to one-fourth of 25 [illegible].

[illegible] were obtained of long-term tracking activity over the [illegible]; however, the occasional co-[illegible] in both frequency bands are consistent with the existence of a northward pointing fixed-beam [illegible] due north of Moscow.

The high band S-[illegible] carried on vehicles 1107 and 1109 experienced circuit malfunctions.

Conclusions.

The [illegible] answered the question they were designed to ask.

Valuable information can be obtained with extremely modest equipment [illegible] data link requirements --- in the latter case, three commutator points [illegible] a vehicle on carrier.

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Recommendations.

The SOCTOPS have served their purpose and accomplished their primary objective; better location of tracking radars should be performed by Project 102 payloads.

Since it will be desireable to determine whether the pending reconnaissance vehicles are being tracked -- and if so, in what frequency interval -- SOCTOPS are being procured to cover the frequency ranges 300 - 900, 900 to S-Band and S-Band to C-Band.

T A K I

PURPOSE	TALL KING DETECTOR GENERAL ACTIVITY INDICATOR
RECEIVERS	XTAL VIDEO
PULSE WIDTH	2 - 40 MICROSECONDS
PULSE REPETITION FREQUENCY	20 - 1000 PULSES PER SECOND
ANTENNA PATTERN	APPROXIMATELY 400 NM CIRCLE @ 1000 MCS AND 700 NM CIRCLE @ 100 MCS
DATA STORAGE	VEHICLE TAPE RECORDER
READOUT	FM/FM TELEMETRY Sixty point commutator
FREQUENCY	160 - 175 MCS 100 - 1000 MCS
PEAK POWER DETECTION	-22 to 0 DBM
AVERAGE POWER DETECTION	1 to 8% DUTY CYCLE

T A K I

Purpose

The TAKI receiver is a special purpose, light weight receiver. The receiver performs two basic functions: (1) it is a TAL (AFD) detector and (2) it locates and analyses signal parameters of emitters within its overall frequency range.

Description

TAKI "A" - The TAL (AFD) detection portion of the system is a crystal video detector. The signal from the 100 - 1000 mc antenna is fed through a power divider to a 165 - 175 mc band-pass filter. A matched crystal detector mounted tuned to 170 mc demodulates the video pulses. Video bandwidth is approximately 1 mc. The output of the crystal detector is amplified and passed through a threshold to reduce the number of noise pulses. This threshold is preset at 10 db above the tangential signal level to produce a low false alarm rate. Signals with sufficient signal strength pass through the threshold circuit to a flip-flop circuit, a pulse repetition gate of 95 pulses per second or multiple thereof and a 10 microsecond pulse width gate to three log count rate meters. The PRF and PW gates are accurate to within 1%. These log rate count meters serve as both storage and readout devices. The data from the log rate count meters are commutated once each second and stored in the vehicle tape recorder. The data are read out via the FM/FM telemetry link.

TAKI "B" - The TAKI "B" portion of the system is a wide open detection system over a frequency band of 100 - 1000 mcs. Video pulse demodulation is accomplished by a broadband matched crystal. The signal is then amplified by a log video amplifier. Eight outputs are obtained from the system.

TA&I (Cont'd)

[illegible] nt outputs are:

(1) "A" Counter - The "A" pulse counter counts the number of pulses [illegible] the receiver each [illegible]. Its range is [illegible] 1 to 40 pulses per [illegible].

(2) "B" Counter - Function is same as the "A" counter. Its range is [illegible] 40 to 200 pulses per second.

(3) PRF - The pulse repetition frequency is measured from 20 to [illegible] pulses per second.

(4) IPT - The interlaced pulse train detector measures the number of times two pulses arrive in the system within 1 microsecond of each other. Both the PRF and PW measuring circuits are subject to error in the presence of two or more interlaced pulse trains.

(5) PW - Pulse width is measured from 2 to 40 microseconds.

(6) Peak Power Detector - The peak power detector measures the peak input signal power.

(7) Average Power Detector - The average power detector measures the duty cycle of the power received in the system.

(8) Analog - An analog recording is made of a signal by using several consecutive commutator points. A video sample of the peak detector is [illegible] sampled on seven consecutive commutator points.

All of the above measurement devices have their own storage system. The input to the storage system is a voltage commensurate with the measurements obtained by each device. The storage circuits are sampled once each second [illegible] the data stored in the vehicle tape recorder. The data are read out via [illegible] telemetry link.

TAKI (Cont'd)

Antenna Pattern. - The antenna pattern is approximately a 700 NM circle at 100 mcs and a 400 NM circle at 1000 mcs.

Programming. - The system is programmed "on" and "off" by the vehicle stored program command system. These commands are preset prior to launch of the vehicle.

Operations.

TAKIs have flown on the following Discoverer flights:

Vehicle	Date Flown	
1107	16 Jun 61	
1111	4 Aug 61	(Vehicle failed to orbit)

Results.

On vehicle 1107 flown 16 June 1961 the TAKI was operational through 38 orbits. Failure after the 38th orbit was due to loss of power.

The TAKI was programmed "on" 26 of these 38 orbits. Intercept data were collected on 24 of the 26 programmed orbits. An estimated 8,600 data frames of intercept information was intercepted during the flight.

Although the results of this mission have not been completely analyzed, or are not available as of this date, the following results can be stated:

(a) A high number of intercepts were made on orbit #25. (High signal density)

(b) There was a higher than average number of intercepts made on orbit #16.

(c) On orbit #16 an intercept was made of an exceptionally strong signal. This signal had a PRF of less than 100 pulses per second and a pulse width of approximately 22 microseconds.

[illegible]

[illegible] read, [illegible] [illegible] [illegible] in [illegible] [illegible] data.

(c) [illegible] [illegible] seconds. [illegible] [illegible] were not [illegible] [illegible] [illegible].

(d) [illegible] the [illegible] [illegible] to be [illegible] sensitive. However, there are [illegible] with [illegible] calibration curves.

(e) [illegible] [illegible] [illegible] properly.

(f) The video monitor was inoperative [illegible] either malfunction or low sensitivity.

Conclusions.

The recorder that was [illegible] specifically for this project was not received in time for this flight and a substitute recorder was used. This recorder had poor speed compensation and as a result; direct conversion of the data to machine readable form was not possible. However, the manually [illegible] information has been [illegible] on [illegible] cards for further machine processing. Also, recent analysis has shown that by the use of appropriate conversion charts confidence tags can be placed on intercept information with a fairly high degree of accuracy. Stanford University will publish the results in their 4th quarterly report on [illegible] Contract AF [illegible](6?7)-73?. All future data should be amenable to computer processing.

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XXX (. nfo)

[illegible]

[illegible] for remainder processing the interest [illegible]

[illegible] sensitivity be increased in these circuits where it was found [illegible] low.

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[redacted]

[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	10 [redacted]
[redacted]	20 - 2000 [redacted]
[redacted]	[redacted]
[redacted]	[redacted] Sixty [redacted]
[redacted]	[redacted]
[redacted]	-30[redacted] to -37[redacted]
[redacted]	[redacted]
[redacted]	40 - 120 [redacted]

[redacted]

VHF VLL

Purpose.

A special purpose, li ht weight receiver designed to detect high powered CW and pul se modulated signals in the VHF region.

Description.

Receiver. - A sweeping filter with a pass band of 10 mc sweeps the frequency band of 40 - 120 mcs in approximately 0.8 seconds. Upon detection of a signal the sweeping filter dwells on the signal for the remainder of the sweep period. The video output from the sweeping filter is amplified and sent to the measuring circuits.

Measuring Circuits. - The following measurements are made on signal parameters:

(a) Pulse counter - The pulse counter counts the number of pulses entering the receiver each second.

(b) The interlaced pulse train detector measures the number of interlaced pulse trains which enter the system each second.

(c) PRF - The pulse repition frequency is measured between 20 and 1000 pulses per second.

(d) PW - Pulse width is measured between 10 microseconds and 4 milliseconds.

(e) Peak Power - The peak power detector will measure input signal power between approximately -50dbm and -37dbm. The AGC circuit will limit the amplitude of all signals greater than -40dbm. This circuit will serve pimarily to indicate the effectiveness of this action. In this manner signals not quite strong enough to be accepted by the measuring circuits will be detected.

[redacted]

III. [redacted] (Cont'd)

(f) Average Detector - The average modulation detector will measure the average modulation in the case of [redacted] intermittently modulated R-F, or the duty-cycle, in the case of a pulse modulated signal.

( ) Frequency - Intercept frequency is determined by a reference voltage from the sweep filter.

Comment. - All of the above data are fed to a [redacted] point commutator and sampled at the rate of once each second. Narrow band video and wide band video is also commutated. In addition other measurements are commutated; i.e. temperature, voltage readings, etc. Certain pulses reset the storage system each second. The data are stored in the vehicle tape recorder and transmitted to ground via the [redacted] telemetry link.

Programming. - The system is programmed "on" and "off" by the vehicle stored program command system. These commands are preset prior to launch of the vehicle.

Operations.

(1) [redacted] Discoverer 1109 on 7 July 1961. The vehicle was successfully orbited, however, the following two phenomena caused a [redacted] loss of information:

The vehicle was to have carried an eight minute endless-loop tape recorder; last minute failure of the recorder, however, necessitated substitution of a four minute endless-loop recorder so connected that, by using two tracks, eight minutes of storage time was achieved. Readout, however, was destructive and could not be repeated.

[redacted] (Cont'd)

[redacted] cause of a faulty cable, or loose connection the receiver sometimes failed to operate [redacted] all, or a part, of a reconnaissance pass and sometimes failed to operate, during all, or a part, of a readout pass. This erratic behavior not only caused a loss of information but also made extremely difficult the task of determining precisely whence the data were acquired. Figures ___ and ___ illustrate the method whereby the receiver operating history was plotted by team.

[redacted].

In the information that was retrieved, at no time was the sweeping filter observed to stop on a signal, indicating that a signal was encountered which was strong enough to set the level of the automatic gain control. In several cases, however, it was possible to read peak power measurements.

[redacted]

[illegible]	[illegible]
RECEIVER	[illegible]
DATA STORAGE	[illegible]
WEIGHT	P./T. TELEMETRY LINK ANALOG
ANTENNA PATTERN @ 200 mile altitude	250 - 350 N.M. CIRCLE
FREQUENCY	200 - 300 MCS 800 - 1600 MCS

TOPSOC

Purpose.

A [redacted] detection device with a special capability of detecting [redacted] -frequency radars [redacted]

Description.

Receiver. - TOPSOC is a two-channel detection system. One band of the receiver covers the frequency range 400 - 800 mcs and the other band covers the frequency range 800 - 1600 mcs. Both channels of the receiver are superheterodyne. The system is capable of intercepting signals with a PRF of 100 to 5000 pulses per second, a PW of 5 microseconds to 1 millisecond and a signal strength of -25dbm to -95dbm. Scan time for both bands is 12 seconds. Bandwidth of the receiver is 4 mcs.

Antenna Pattern. - The antenna pattern is approximately a 350 NM circle at 400 mcs and a 250 NM circle at 1600 mcs.

Output. - The system has an analog output. A positive voltage output is used for the amplitude and pulse width of the received signal and a negative voltage is used to determine intercept frequency. Data are returned to the ground on the P.A./FM telemetry link. The vehicle tape recorder is used to store the information until it can be read out.

Programming. - The system is programmed "on" and "off" by the vehicle discrete program command system. Events are preset prior to launch of the vehicle.

Operations.

TOPSOCs have flown on the following Discoverer vehicles:

TIPCOC (Cont'd)

Vehicle	Date Launched
1113	12 Sep 61
1114	18 Sep 61
1115	13 Oct 61

Magnetic tapes have been received from the first two vehicles and indicate that the equipment functioned properly.

Results.

Processing of the analog records is being performed at NSA and SAC Omaha. It has been confirmed, however, that useful information was obtained.

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
DATA STORAGE	[illegible]
[illegible]	[illegible]
ANTENNA PATTERN	APPROXIMATELY 700 NM CIRCLE
FREQUENCY	100 - 150 MCS

TEXAS PINT

Purpose.

To recognize the presence of a specific data link signal which employs a keyed, tone-modulated signal.

To record, in suitably small increments, the carrier frequency of the signal.

To record whether the signal carrier was amplitude modulated, frequency modulated or both.

To record the presence of either or both of two possible tone modulations.

Description.

Receiver. - A mechanically scanned superheterodyne which sweeps the band 100 to 150 mc in approximately 200 seconds. Local oscillator frequency is digitized in increments to provide signal frequency resolution to 0.25 mc or better.

Recognition Circuitry. - Digital logic requires the presence of three pulses within 120 milliseconds, and requires that the pulses be from 3 to 15 milliseconds wide. Audio frequency filters and a discriminator provide the remainder of the recognition.

Output. - Quantized levels between 0 and 5 volts appearing on three pins for application to the telemetry commutator.

Operations.

The Texas Pint was successfully orbited by Vehicle 1112 on 30 Aug 61. On orbit #1 the recorded reconnaissance information was successfully read out at the Kodiak Tracking Station as was the information from real-time operation.

Following orbit #1 a blown fuse in the "command readout" circuit prevented readout at the regular tracking stations; however, an auxilliary command, associated with the Vela Hotel experiment, permitted readout at Ascension

TEXAS PINT (Cont'd)

Island. The result of this failure was that, after a readout at Ascension, the equipment would follow the preprogrammed timer schedule and collect reconnaissance information until the tape was full; at this point an end-of-tape signal prevented further recording until the next readout had been accomplished.

It is estimated that, because of this failure, a 75% information loss was suffered.

RESULTS.

The commutated wave-train of real time information from Orbit #1 was reduced manually at Lockheed and is presently being more carefully reduced at USAFSS. Almost every possible combination of "recognition" was observed, and it is tentatively concluded that one of the two calibration transmitters, operating at Elmendorf AFB, was observed at least once.

A digital decommutation has been tried on two of the readout tapes from the Ascension Island and has produced data of good quality. It is to be hoped, therefor, that all of the information can be processed by machine.

Tapes have been received from Ascension through orbit #90; how many contain useful information must await data reduction.

~~SPECIAL HANDLING~~

LEAPS [illegible]

PAYLOAD	DETECT AN/FRD-1 TYPE SIGNAL
RECEIVER	SUPERHETERODYNE
RECORDER	TELEMETRY CHANNELS
STORAGE	VEHICLE TAPE RECORDER Commutator
READOUT	R.F./AIR TELEMETRY LINK
ANTENNA PATTERN	APPROXIMATELY 700 NM CIRCLE
FREQUENCY	62.5 - 71 MCS

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[redacted]

[redacted]

[redacted]

To recognize an [redacted] (in frequency) [redacted] be A/ [redacted]-1 type. [redacted] completely, [redacted] the carrier frequency [redacted] signal. [redacted] best either [redacted] be two teletype channels (with priority [redacted] be if both are present) [redacted] correct [redacted] direction carried thereon. To record the extracted digital [redacted] in a [redacted] suitable for presentation [redacted] volts [redacted] connected [redacted] key points.

[redacted]

The receiver is a conventional [redacted] superheterodyne, electronically tuned [redacted] a staircase voltage generator, and feeds detected [redacted] to the demultiplexer-recognition [redacted]. The demultiplexer decomposes the signal into individual channels, performs a recognition function, and feeds the desired signal to the coding and storage circuit, where the teletype portion of the signal is converted into [redacted] suitable for storage and retransmission.

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VI.

Purpose.

To acquire all of the AN/ASC-1 type signal of which the GRAPE JUICE equipment acquires only a part.

Description.

The equipment has not been completely defined but will probably be similar to the GRAPE JUICE equipment.

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
ANTENNA PATTERN 200 mile altitude	[illegible]
[illegible]	100 - 150 [illegible]

SPECIAL HANDLING

ELM JERSEY

[illegible].

[illegible] recognize and stop scan on a specific data-link signal -- a [illegible] [illegible] the signal after the target [illegible] SIGINT. To record, for [illegible] retransmission, the signal content. To record a fine history of the [illegible] the received signal as an aid to position fixing.

[illegible]scription.

[illegible] equipment is not yet designed, but it will have to be for more complex [illegible] SIGINT.