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NRL SPECIAL PROJECTS CONTROL NUMBER

Logged 7/1/94 SH

BYE-61748-92

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720124

ORIGINATOR	SERIAL NO.	ENCLOSURES
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SUBJECT
LM W/P PL 134C (GREB)

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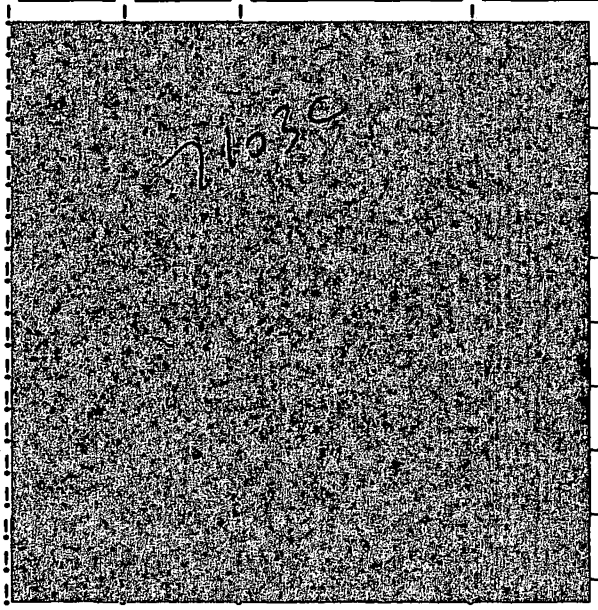

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Payload 134 (GREB)

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Telemetry

Payload 134 (GREB)

IRIG Channels 3 and 4

In this satellite, the housekeeping data is fed to both channel 3 and channel 4.

For channel 3, low band edge is 680, center frequency is 730, and high band edge is 780.

For channel 4, low band edge is 885, center frequency is 960, and high band edge is 1035.

A sixteen position electronic commutator provides the following information at the rate of two segments per second:

Segment	Function
1	0 volt calibrate
2	+5 volt calibrate
3	Package temperature
4	Skin temperature
5	Solar Cell temperature
6	Minus battery voltage
7	Plus battery voltage
8	D.L. #1 relay position indicator
9	D.L. #2/R and D relay position indicator
10	D.L. #3 relay position indicator and separation telltale
11	D.L. #4 relay position indicator and south pole solar aspect telltale
12	Enable relay position indicator and full extension telltale

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Segment	Function
13	Execute relay position indicator and north pole solar aspect telltale
14	Boom motor relay position indicator and battery pressure telltale
15	Battery temperature
16	Command telltale

A more descriptive explanation of these functions follows:

Segment 1

The frequency is at the low band edge.

Segment 2

The frequency is at the high band edge.

Segments 3, 4 and 5

The frequency decreases as the temperature rises.

Segment 6

The frequency decreases as the battery voltage increases; i.e., from -10v to -13v.

Segment 7

The frequency increases as the battery voltage increases; i.e., from +10v to +13v.

Segment 10

When separation occurs the negative going spike is removed.

Segment 11

When spike appears, satellite is oriented North Pole facing the earth.

Segment 12

When Boom is fully extended the spike disappeared.

Segment 13

When spike appears, satellite is oriented South Pole facing the earth.

Segment 14

Boom motor relay position indicator (midband motor off) (High) when +12v is applied to motor. If the battery can pressure is lost, the negative going spike is removed.

Segment 15

The frequency decreases as the temperature rises.

Segment 16

When any tone or combination of tones is being received, the output frequency increases; otherwise the output is a low frequency. The stronger the signal the higher the frequency goes.

Segments 8 thru 13

(First read Command System Description)

	RPI	Reset	Enable	Command On		Execute	Reset
8	D.L. #1	MID	Low	yes no	Mid Low	Mid Low	MID
9	D.L. #2/R&D	MID/MID	Low/Low	yes no	Mid/Low Low/Low	Mid/High Low/Low	MID/MID
10	D.L. #3	MID	Low	yes no	Mid Low	Mid Low	MID
11	D.L. #4	MID	Low	yes no	Mid Low	Mid Low	MID
12	Enable	High	Low	Low		Low	High
13	Execute	High	High	High		Low	High

IRIG Channel 7

For channel 7, low band edge is 2125, center frequency is 2300, and high band edge is 2475.

The Satellite Earth Aspect Instrumentation is telmetered to earth on this channel. This is an optical instrumentation system of limited resolution but covering deviation angles from the local vertical from 0° to 90°. This instrumentation system is of such a nature that quick look data reduction is possible without mathematical calculations.

The chief disadvantage of this system is that aspect data is available only when the satellite sees the earth fully illuminated from horizon to horizon around 360°. Thus, when the sub-satellite point is at local noon for any spot on the earth, aspect data is accurate.

Due to vehicle problems, it is not known whether the satellite will stabilize top up or top down. Therefore, it was necessary to instrument the satellite for either possibility.

It was decided to use six optical sectors of five detectors each, a total of 60° wide, located symmetrically 120° apart on the top and bottom hemispheres of the satellite. The earths horizon at 500 nautical miles is at the approximate center of these sectors (the 60° angle) for an earth stabilized satellite.

B^{+} power is switched sequentially to each of the six sectors. Thus at any particular time one sector of five sensors (or detectors) has power applied to it and its outputs routed to the level detectors (Schmidt Triggers) which are followed by mixing resistors, switching circuits, and a subcarrier oscillator (SCO).

Given an output reading at a particular time, each of the five sensors increases the reading by one volt when it is illuminated by reflected light from the earth. Thus the Earth Aspect output has six discrete levels of "0" v, 1v, 2v, 3v, 4v, or 5y, which are changed to corresponding frequency levels by the SCO.

Sectors #1, 3 and 5 are located on the top or north hemisphere, and give valid Aspect data if a spike is present on segment 11 of housekeeping data.

Sectors #2, 4 and 6 are located on the bottom or south hemisphere, and give valid data if the spike appears on segment 13 of housekeeping data.

A complete frame of data is available every four seconds, as follows:

A) "0" volt calibrate - $\frac{1}{2}$ second

B) +5 volt calibrate - $\frac{1}{2}$ second

C) Aspect Data - 3 seconds

If there is a spike on segment #11 of the housekeeping data, we use sectors #1, 3 and 5 for aspect data.

In this example

sector #1 - 3v

sector #3 - 4v

sector #5 - 2v (see figure #1)

Placing the 500 mile horizon template over the satellite template as shown, we get an angle from the vertical of 7-16 degrees. (see figure #2)

Using these templates, we can determine all possible satellite outputs for a particular altitude before the satellite is in orbit.

Depending on orbit results and length of time in orbit, the position of the satellite will probably be known to better than 5°.

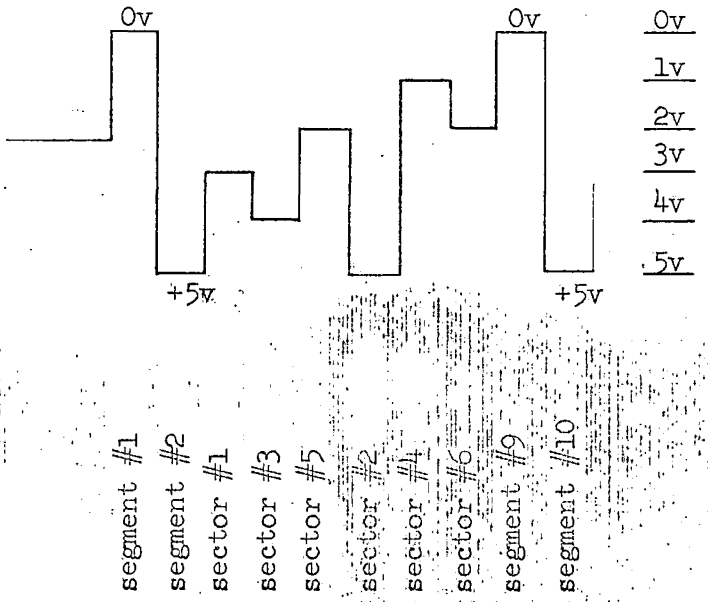

Figure #1

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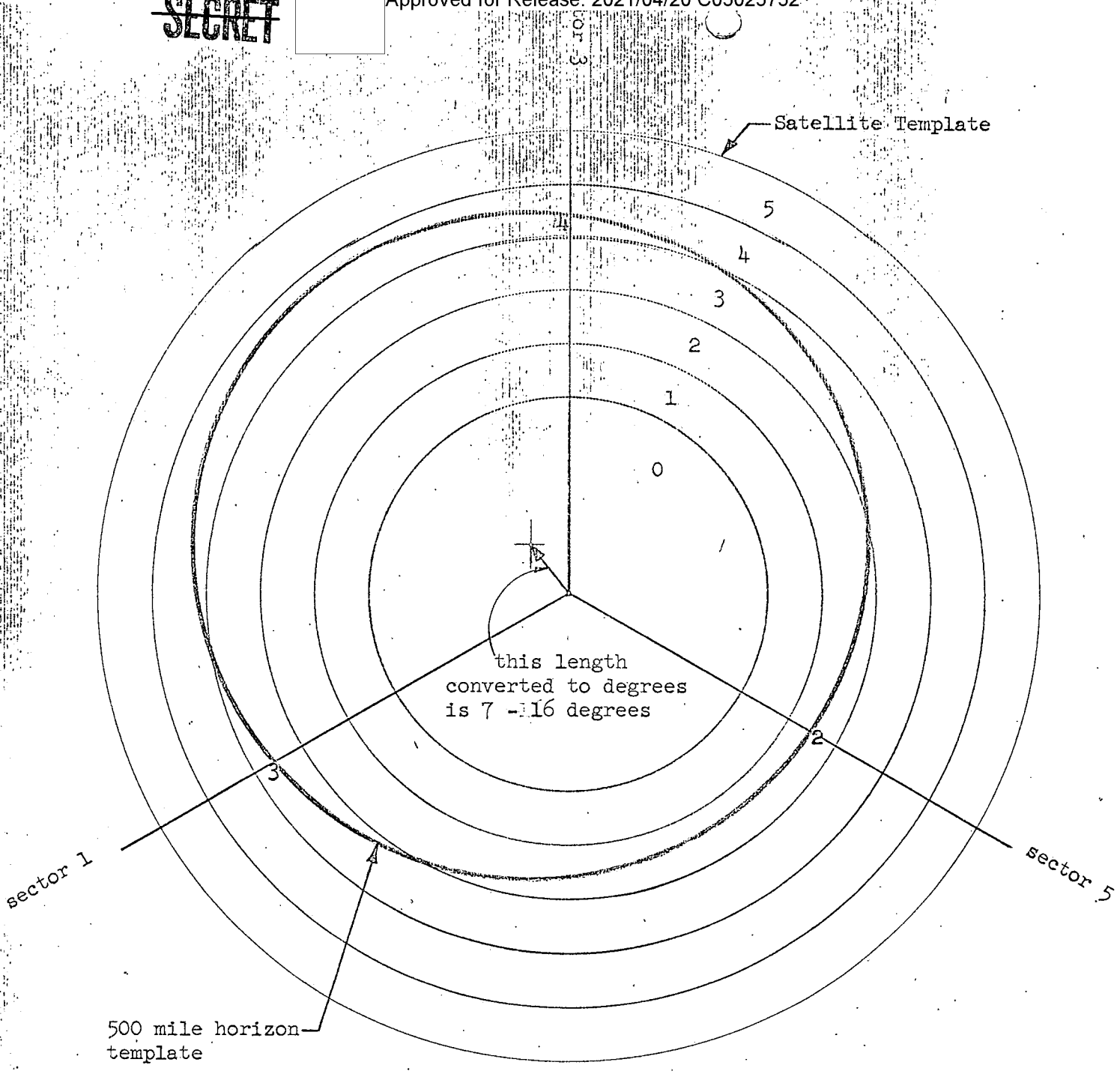

Figure #2

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Command System

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The tones used in this system are:

N (0) - 7500 cycles

M (1) - 6750 cycles

I (5) - 3950 cycles

J (2) - 4500 cycles

K (3) - 5250 cycles

L (4) - 6000 cycles

Commands are sent to the system by means of a series of chopped tone pairs.

First the system is addressed. This is accomplished by sending four chopped tone pairs in the following sequence:

NJ (02)

NK (03)

NL (04)

NI (05)

The reception by the satellite of these four tone pairs in the proper sequence will automatically throw the enable relay, and apply +12 volts to the D.L. transmitters.

We now command the desired functions:

Telemetry On	JI - (25)
Telemetry Off	JK - (23)
R & D On	LJ - (42)

D.L. #1 On	MJ - (12)
D.L. #2 On	MK - (13)
D.L. #3 On	ML - (14)
D.L. #4 On	MI - (15)
Boom Out	LI - (45)
Motor Stop	LK - (43)

Note: "R and D" and "D.L. #3" cannot both be on at the same time. D.L. #2 must be on for R & D to be operational.

The sending of the telemetry on or telemetry off command will place +12 volts on or remove it from the telemetry system.

The sending of D.L. #1, 2, 3, 4, or "R and D" "ON" merely establishes relays in the proper position. +12 volts will not be placed on the arms of the relays until the execute command is sent. At this time +12 volts is also applied to 48 minute timer.

The execute command is the "IK" (53) tone pair.

With our existing Digital Command Tone Generator, a maximum of ten tone pairs may be sent in any one series, four address tone pairs, a maximum of five function command tone pairs, and the execute tone pair.

This entire series takes approximately 2 seconds.

After the 48 minute timer, which was activated by the execute relay, times out, an internal reset pulse is generated, returning the command system to reset condition.

If for any reason, during the 48 minute timing period, it is desired to reset the system, tone pair "NM" (01) will perform this function.

If for any reason a satellite is only partially addressed, sending the execute command will reset it.

Note: LI command is the same as IL command.

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