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Telemetry

Payload 142 B

IRIG Channels 3 and 4

In this satellite, the houskeeping 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 six teen position electronic commutator provides the following information at the rate of two segments per second:

Segment	Function
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	

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Segment	Function
14	[redacted]
15	
16	

A more descriptive explanation of these functions follows:

Segment 1

[redacted]

Segment 2

[redacted]

Segments 3, 4 and 5

[redacted]

Segment 6

[redacted]

Segment 7

[redacted]

Segment 10

[redacted]

Segment 11

[redacted]

Segments 8 thru 13

(First read Command System Descriptive)

	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	Low	yes no	Mid/High Low/High	Mid/High Low/High	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/Alternate	High	Low	Low		Low/Mid	High
13	Execute	High	High	High		Low	High

Segment 14

Ordnance plug must be in or a mid-frequency reading will occur regardless of relay position.

This is a four level indicator, as follows:

Low Frequency: Boom in, damper caged.

Low-Mid Frequency: Boom out, damper caged.

High-Mid Frequency: Boom out, cage released but damper not uncaged.

High Frequency: Boom out, damper uncaged.

If the battery can pressure is lost, the 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.

IRIG Channels 5 and 6

In this satellite, the earth aspect data is fed to both channel 5 and channel 6.

For channel 5, low band edge is 1200, center frequency is 1300, and high band edge is 1400.

For channel 6, low band edge is 1575, center frequency is 1700, and high band edge is 1825.

Channels 5 and 6 have an eight second cycle as follows:

a) "0" volt calibrate - 1 second

b) Sector #1 Aspect Data - 1 second

c) Sector #3 Aspect Data - 1 second

d) Sector #5 Aspect Data - 1 second

e) +5 volt calibrate - 1 second

f) Sector #2 Aspect Data - 1 second

g) Sector #4 Aspect Data - 1 second

h) Sector #6 Aspect Data - 1 second

The earth aspect system consists of six sectors, each containing twelve phototransistors in a compound emitter follower arrangement. (See Figure 1) The sectors are positioned three to a hemisphere, 120° apart. Phototransistor position #1 is nearest the pole, position #12 is nearest the equator. (See Figure 2) The outputs of the phototransistors occupying the same relative position in a sector are connected in common. Thus there are only twelve inputs to the telemetry system. (See Figure 3)

The one second aspect data segments are divided into quadrants.

Phototransistors 1, 2 and 3 are fed to quadrant 1,

Phototransistors 4, 5 and 6 are fed to quadrant 2,

Phototransistors 7, 8 and 9 are fed to quadrant 3, and

Phototransistors 10,11 and 12 are fed to quadrant 4.

The quiescent level for any quadrant is 1/2 volt.

Phototransistors 1, 4, 7 and 10 produce a $\frac{1}{2}$ volt signal,

Phototransistors 2, 5, 8 and 11 produce a 1 volt signal, and

Phototransistors 3, 6, 9 and 12 produce a 2 volt signal.

Thus any quadrant will have a voltage level varying from $\frac{1}{2}$ volt to 4 volts in $\frac{1}{2}$ volt increments, as follows:

Figure 4 shows a perfect aspect reading, firgure 5 shows a typical reading.

Note that both readings are from sectors 1,3 and 5. Sectors 2,4 and 6 are at the quiescent level. This situation occurs when the satellite is orientated north pole toward the earth. Under this condition the earth illuminates several photo transistors in sectors 1,3 and 5 but the sun, being @ a greater distance would approximate a point source and would illuminate few if any photo transistors in sectors 2,4 and 6.

If the satellite were orientated south pole toward the earth, we would obtain our readings from sectors 2,4 and 6 while sectors 1,3 and 5 would have few photo transistors illuminated.

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Phototransistors On					Signal Level
Quadrant					Volts
	None	None	None	None	$\frac{1}{2}$
	1	4	7	10	1
	2	5	8	11	$1\frac{1}{2}$
	1 & 2	4 & 5	7 & 8	10 & 11	2
	3	6	9	12	$2\frac{1}{2}$
	1 & 3	4 & 6	7 & 9	10 & 12	3
	2 & 3	5 & 6	8 & 9	11 & 12	$3\frac{1}{2}$
	1,2 &3	4,5&6	7,8&9	10,11&12	4

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The tones used in this system are:

N (0) - 7500 cycles

M (1) - 6750 cycles

I (3) - 3950 cycles

J (5) - 4500 cycles

K (4) - 5250 cycles

L (2) - 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:

NL (02)

NI (03)

NK (04)

NJ (05)

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

We now command the desired functions:

Telemetry On, Alternate bands on	JI - (53)
Telemetry Off, antenna string cutter back-up	JK - (54)

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D.L. #1 On	ML - (12)
D.L. #2 On	MI - (13)
D.L. #3 On	MK - (14)
D.L. #4 On	MJ - (15)
R and D On	JL - (52)
Damper Release	LI - (23)
Cage Release	LK - (24)
Reset, Primary Bands On, R&D Off	NM - (01)

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, or 4 "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" (34) 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.

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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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Telemetry and Payload Description changes:

1.) Because of a change in the gravity gradient stabilization experiment in 142, the function of the R.P.I. associated with this experiment has changed.

Seg. 14: Gravity Gradient R.P.I.
This segment is now a 3 level indication.

MID (3.3v level) - Boom clamped and motor not running. (Launch condition)

LOW (.5v level) - Boom unclamped and motor running.

HIGH (4.5v level) - Boom fully extended and motor off.

2.) As the latest G.C. system has no "cage" associated with it, the "LK" command will not be used for this payload.

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