

This morning I would like to depart from the format and content of the previous Branch reviews [redacted] dwell on the magnitude and extent of the responsibilities of the group under my direction. It should be noted that nearly 10 years ago (9 March 59) Sec Nav gained approval from ARPA for the founding of this program, ~~through which~~ to place an ELINT spaceborne data collection system in orbit. Not only was this the first of the ELINT type satellite system, but it still ranks as one of the major candidates for the Future. *All similarity, NSA posture*

The staff supporting the ELINT portion of this Program "C" here at NRL has grown from the original two men (Myself and Mr. Rose) to a highly capable group of 12 individuals. MAY I HAVE THE FIRST SLIDE PLEASE?

Of these twelve, Mr Tool, [redacted] have joined us during the past 12 months. With Mr Vincent and Mr. Price only about 18 months ago...so our growth of 50% during the past 18 months, is what I would like to defend and justify.

The Work will be described by various individual of our technical Team and if there are questions please stop us, there is an enormous amount of territory to cover in order to describe the "BOW WAVE" of effort which this team has been carrying along this year. I shall only treat briefly that area of the Payload systems since it has been covered adequately in the previous Reviews... This area of endeavor is under the supervision of Mr. Vincent ROSE and as you can see he has two other men in his Unit, They do prepare the total ELINT subsystem compliment for all four of the primary payloads for MISSION 7106, numbering about 88 individual collection bands. Each part of the spectrum is covered in at least two payloads from 155 to 10,000 Mcs and from 14.6 to 15.1 Gcs. Those portions where known ABM signals are to be found, will be covered in all four payloads. MAY I HAVE THE NEXT SLIDE PLEASE???

The major facility which enables this small group to prepare so many collection systems in the period between launches, is shown here. It is an RF Darkroom which is used to determine the Broad-band frequency collection capability of each of the subsystems as they are to be installed in the spacecraft. Particularly, the relationships between the various antenna systems on the spacecraft can be evaluated here and the most favorable design determined. In an endeavor to enhance the capability of this group to design and build and document a similar number of experiments in a faster shcedule in the future it would be ~~extremely~~ vital to duplicate this facility and provide an experie [redacted] Antenna Design engineer, to provide a parallel effort to solve the spacecraft antenna problem. The NEXT SLIDE.....

~~TOP SECRET~~ [redacted] AND THE NEXT SLIDE PLEASE..... CONTROL SYSTEMS ONLY  
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~~TOP SECRET~~

...? The work of the INTERROGATION OR COMMAND systems Unit is under the supervision of Mr. Withrow, who has over the last ten years been devoted to solving the problems associated with the interrogations of our satellites overseas. As the demands for more and more commands have been levied against the spacecraft, more sophisticated command systems have evolved. Also the need to get the interrogations into the payloads more quickly and to appraise the status of the payloads more quickly after interrogation. Each of these goals have levied heavier load of demands on the overseas systems associated in this effort. The first area which was modified was that of the transmitting antenna system. In the past it was able to rotate in azimuth only. Now it has been completely up-dated with a broad band antenna which will move in elevation as well. Broad-band enough to handle both the old and the new command frequencies. The antenna directivity has been improved by addition of the ground screens so that the side and back lobes have been reduced greatly.

PCM telemetry systems will be used for the first time in our spacecraft. This will enable the status of the payload to much more rapidly appraised by using a special Demodulator and Status Description system developed by Code 5170. This system will be deployed to each of our command sites so that the Interrogation of the spacecraft will be expedited to a great extent.

Next SLIDE PLEASE?? 1968 Deployments have extended the ~~XXXXXXXXXX~~ command systems for the future interrogation [redacted]

It is anticipated that the funds and authority to place a digital system in [redacted] will be forthcoming in a month or two. It will take only \$427K and about 9 months to get this going in [redacted] after approval.

The Airconditioning system and humidity control and raised flooring have been installed in the digital system spaces [redacted]. Similar flooring has been placed in the space [redacted].

[redacted] is continuing to become the Test site for payload evaluation, it also has had the flooring and air conditioning systems, so that the digital system could be operated there during the post launch evaluation period... and perhaps as the R & D SITE of the future.


Now we ~~would~~ would like like to discuss in varying degrees/the of depth portions of the overseas Data-Collection instrumentation which have undergone redesign at NRL (Shown in RED) and those portions which have been up-dated by commercial procurement from vendors (against our specifications) and of course those portions of the systems which remain unchanged over the past year such as the antenna and pre-amplifiers here. It is obvious from the number of red colored blocks on this diagram, the extent to which each of our sites have the equipment re-design. This has been possible only by the devoted effort of many men such as the

~~TOP SECRET~~

BYEMAN CONTINUED ONLY  
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*Withrow*

*who will talk about various portions of this complex system*  
*Next 5 Appendix*

~~TOP SECRET~~ 

## RETEP MODULATOR

DESCRIPTION: Digital switching and timing circuitry.


FUNCTION: To provide modulation for the RETEP transmitter;  
provides fixed number of pulses at fixed burst rate  
with burst interval being selectable.

QUANTITY REQUIRED: Two

STATUS: One prototype

~~TOP SECRET~~ 

HANDLE VIA  
BYEMAN  
CONTROL SYSTEM ONLY

~~TOP SECRET~~ RETEP SUPER-~~HET~~ RECEIVER AND VIDEO AMPRECEIVER:

DESCRIPTION: Solid state low power UHF receiver with video thresholder and pulse width discriminator

FUNCTION: To receive pulse signals from the RETEP transmitter


NUMBER REQUIRED: Two operational and one spare

STATUS: Three units completed

VIDEO AMP:

DESCRIPTION: Low power complementary video amplifier with thresholder.

FUNCTION: Used in crystal video RETEP receiver. Also under development for R&D payload.

~~TOP SECRET~~ 

HANDLE VIA  
BYEMAN  
CONTROL SYSTEM ONLY

~~TOP SECRET~~

## CHANEL A TELEMETRY RECEIVER MODEL RA-304

DESCRIPTION: Solid state VHF AM Receiver with three selectable  
I.F. bandwidths; digital controlled local oscillator.

FUNCTION: To receive telemetry signals in the VHF band

NUMBER REQUIRED PER SITE: Two

TOTAL NUMBER REQUIRED:

STATUS: One prototype under construction; completion about  
15 April start production 15 May 1969.

- ① modular construction. <sup>low</sup> maintenance
- ② select proper polarization
- ③

~~TOP SECRET~~

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CONTROL SYSTEM ONLY

~~TOP SECRET~~

[ ]

1 MHZ DRIVER

MODEL DR-1

① Description: Solid State Active 1 MHz Multicoupler with eight outputs.

② Function: To distribute the 1 MHz Frequency Standard to the RS-1A Receiving Systems.

Number required per site: Two

Total number required: [ ]

Status: One prototype production of [ ] units underway completed 15 April.

~~TOP SECRET~~

[ ]

GROUP 1  
EXCLUDED FROM AUTOMATIC  
DOWNGRADING AND  
DECLASSIFICATION

~~TOP SECRET~~

AUDIO PATCH PANEL

Description: Audio Stereo switching unit with volume control.

Function: To provide selection of the audio output of any of six (four data, 1 Chan. D, 1 Chan. A) receive audio outputs in stereo to two operators.

Number Required per site: two

Total Number required:

Status:  completed.

DATA  
 OPERATOR MUST MONITOR ~~THE~~ ~~WORDS~~ OF  
 ① ~~oper must monitor~~ INTEREST  
~~anything unless~~  
 ② ~~is~~ BEFORE  
 ③ ~~now~~ NOW

~~TOP SECRET~~

HANDLE VIA  
BYEMAN  
CONTROL SYSTEM ONLY

~~TOP SECRET~~

RECORDER/MONITOR PANEL

Description: Switching unit having 7 pole three position video  
switch and Recorder control circuitry.

Function: To be able to monitor the output of seven tracks of any  
of three recorders on a seven channel oscilloscope;  
Provide remote turn on capability of three recorders.

Number Required per site: two

Total number Required:

Status:  completed

~~TOP SECRET~~

HANDLE VIA  
BYEMAR  
CONTROL SYSTEM ONLY



~~TOP SECRET~~

SYSTEM CALIBRATION UNIT

MODEL SCU-2

Description: Solid State unit with 16 crystal controlled oscillators,  
front panel selectable; internal or external pulse type  
modulation; power monitor and attenuator for output power set.

Function: To provide calibration of Receiving System from RF Pre-Amp  
to APU output. (standard deviation software routine)  
To provide standardized sensitivity measurement.

Number Required per site: one

Total Number Required:

Status: One prototype, production of  units underway completed  
by 1 April.

~~TOP SECRET~~

~~TOP SECRET~~

ANTENNA POLARIZATION SWITCH MODEL APS-1

- ① DESCRIPTION: Solid State Digital unit to compare video signals from five RS-1A receivers
- ② FUNCTION: Select proper polarization for each of the four Data Receivers.
- ③ *before ....*  
NUMBER REQUIRED PER SITE: Two

TOTAL NUMBER REQUIRED:

STATUS: Two prototypes completed and  production units scheduled for deployment 15 April 1969.

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HANDLE VIA  
SECURITY  
CONTROL SYSTEM ONLY

~~TOP SECRET~~ 

## DATA PROCESSING SYSTEM

- I. SYSTEM CONFIGURATION
  - A. Central Processor Unit - SEL 810A
    - 1. 16 Bit Word Length
    - 2. 16,384 Word Memory
    - 3. 1.75 Microsecond full cycle time
  - B. Paper Tape Reader/Punch
    - 1. 300 Char/Sec Read
    - 2. 110 Char/Sec Punch
  - C. Magnetic Tape Control Unit
  - D. Magnetic Tape Unit
    - 1. 120 IPS
    - 2. 7 Track
    - 3. 800 BPI
  - E. Line Printer
    - 1. 600 Lines per minute
    - 2. 120 Columns
  - F. Disc File
    - 1. Moveable Head
    - 2. 1,500,000 Words
  - G. Disc File Control Unit

~~TOP SECRET~~ CONTROL VIA  
CONTROL SYSTEM ONLY

~~TOP SECRET~~



## MULTICOUPLER / DIPLEXER

THIS UNIT IS AN RF MULTICOUPLER  
DESIGNED AND DEVELOPED HERE AT NRL.

THIS MULTICOUPLER EMPLOYS RF  
FIELD EFFECT TRANSISTOR AMPLIFIERS, (TO IMPROVE  
INTERMOD PRODUCTS), IRIS COUPLED FILTERS,  
(FOR MAXIMUM SELECTIVITY), AND SOLID STATE  
SWITCHES, (FOR <sup>SWITCHING</sup> SPEED). NOTE NOISE FIGURE

ISOLATION AND OUTPUTS

~~TOP SECRET~~

HANDLE VIA  
BYEMAN  
CONTROL SYSTEM ONLY

~~TOP SECRET~~  
POLARIZATION SWITCH

MAINTAINING PROPER POLARIZATION ON OUR DATA RECEIVERS IN THE PAST HAS BEEN PERFORMED MANUALLY BY THE FIELD OPERATORS. THIS SYSTEM HAS BEEN TRIED FOR THE PAST 3 YEARS WITH LITTLE SUCCESS. SOME OF THE PROBLEMS ENCOUNTERED EXTEND FROM FORGETFUL OPERATORS THROUGH NOT KNOWING WHICH OF MULTIPLE SWITCHES TO THROW AT THE PROPER TIME. THIS SLIDE SHOWS THE EFFECTS OF RECEIVING FOUR SIGNALS FROM MULTIPLE (TWO) PATHS (PAT ---) THROUGH ONE ANTENNA THE FOUR <sup>RSIA</sup> DATA RECEIVERS ON THE GROUND <sup>WHICH</sup> ARE TUNED TO EACH OF THE FOUR SIGNALS. TO INSURE THAT THESE FOUR RECEIVERS MAINTAIN PROPER POLARIZATION REQUIRES THAT EACH RECEIVER INDIVIDUALLY BE CHECKED AND COMPARED. THE BOTTOM TRACE SHOWS EFFECTS OF NOT PROPERLY SELECTING POLARIZATION (NOTE) VARYING AMPLITUDE

THE AUTOMATIC POLARIZATION SWITCH (APS-1) <sup>HANDLE WITH CARE</sup> TO DO THIS JOB <sup>CONTROL SYSTEM ONLY</sup>

~~TOP SECRET~~

~~TOP SECRET~~

3

AUTOMATICALLY, AND UPON TESTING THE BROADBAND  
REVEILED MINOR ...  
...

WITH A 10B DIFFERENCE BETWEEN  
HORIZONTAL + VERTICAL SIGNALS AND  
ONLY THREE PULSES RECEIVED IN THE 3 SECOND  
TIME SAMPLE. THE UNIT CORRECTLY  
CHOSE PROPER POLARIZATION WITH A  
99.9% ACCURACY.

DESIGN GOALS ARE TO MINIMIZE  
AMPLITUDE VARIATIONS THEREBY IMPROVING  
SIGNAL ACCURACY, AND TO RELIEVE  
OPERATORS OF IMPOSSIBLE TASKS FOR  
MORE ESSENTIAL ANALYSIS AND NOTING  
INTERESTING SIGNALS FOR COMPUTER  
PROCESSING.

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HANDLE VIA  
BYEMAN  
CONTROL SYSTEM ONLY

~~TOP SECRET~~

4

## POLARIZATION SWITCH / MULTICOUPLER SYSTEM

THIS SLIDE SHOWS THE INTERFACE BETWEEN THE MULTICOUPLER RECEIVERS AND ANTENNA POLARIZATION SWITCH

THE TIMING AND SEQUENCE CONTROL SELECTS SEQUENTIALLY ONE OF THE FOUR DATA RECEIVERS AND TUNES THE  $R_s$  RECEIVER TO THE SAME FREQUENCY. THE  $\Sigma$  AMPLIFIER SUBTRACTS

VIDEO SIGNALS (A AND B) ~~AND~~ TO OBTAIN A DIFFERENCE SIGNAL "A-B"

THIS "A-B" SIGNAL REPRESENTS, ON A PULSE BY PULSE BASIS, THE AMPLITUDE DIFFERENCE RECEIVED ON THE HORIZONTAL AND VERTICAL ANTENNAS. THIS

A-B SIGNAL IS ACCUMULATED OVER TIME "T" (3 SECONDS) SO THAT AN INTEGRATION OF N PULSES IS OBTAINED IMPROVE ACCURACY.

~~TOP SECRET~~

HANDLE VIA  
BYEMAN  
CONTROL SYSTEM ONLY

~~TOP SECRET~~ [redacted]

ADDIS

I (Front panel) - As Mr. Mayo has pointed out the ground station ~~to~~ consists of 8 receivers ~~the output of~~ each ~~receiver~~ <sup>receiver</sup> is translated to a digital word & multiplexed with <sup>the</sup> time of ~~the~~ Day ~~is~~ this data is then ~~and~~ multiplexed with ~~schedule~~ all other receivers ~~and~~ organized for output to a digital tape recorder with each pulse having a receiver #, [redacted] band designator and the time of day accurate to [redacted] ~~described to~~ ~~in~~ ~~digital~~ in ~~units~~ of IBM ~~compatible~~.

#2 slide

Here we have a more detailed look in the Addis this is a highly complex unit consisting of 2000 integ. circuits which ~~is~~ might be over 25,000 individual circuit elements. The construction of this unit was in a book structure as seen with this page open, with functional

~~TOP SECRET~~ [redacted]

for having a

HANDLE VIA STEPHAN CONTROL SYSTEM ONLY



~~TOP SECRET~~

Next slide

Logic function <sup>23</sup> and the minimum # of interconnecting wires.

Next slide # 24

Here we summary of ~~best~~ some of the new points of the APP/S

1. ~~total~~ 7106 ~~was~~ 32 Bands

~~was~~ for reference old system on 7105 used in power dumping mode with all bands turned on (or in other words seeing ~~the~~ a very large # of the ~~same~~ Soviet ~~radar~~  simultaneously ~~was~~ the DPU used only 20% of its capacity.

2. ~~no~~ better resolution

3. 7105, 7106 or ~~any~~ other such as long pulses or

4.

5.  ~~top~~ ~~set~~ pulse

~~with~~ addition information relating the

BTS - take Random Elint

~~TOP SECRET~~

Buffers it to steady rate

ty packing on ~~to~~ tape

HANDLE VIA  
BYEMAN  
CONTROL SYSTEM ONLY

George

~~TOP SECRET~~

BACKGROUND

- 1. 10 YRS IN OPER.
- 2. LARGE CHANGES
- 3. IMPACT OF RESULTS ON COMMUNITY

① TECH STAFF AT NRL

- 1. STRESS GROWTH
- 2. 4 DIFF. GROUPS

② RF - PRE-AMP

③ TD RECVR

④ ANECHOIC CHAMBER

⑤ COMMAND SYS - ANT @ HYBLA VALLEY

UPDATED: ①

② PCM

⑥ DEPLOYMENT IN 1968

⑦ RECVR & COMMAND ANT IN

⑧ ~~TOP SECRET~~

IN

HANDLE VIA  
BYEMAN  
CONTROL SYSTEM ONLY

~~TOP SECRET~~ [ ]  
TM RECL [ ] R

(20)

(21) ADDS PICTURE

(22) ADDS

(23) CARD

~~(24) ADDS LIST~~

L.H.

(25) BTS

(26) BTS

(27) COMPUTER (GREY)

(28) COMPUTER (GREY) line printer - disk

(29) Tape Trans-A/C' ~~line printer - disk~~

F.H.

(30) 2<sup>ND</sup> & 3<sup>RD</sup> GEN. SOFTWARE

(31) ANALYSIS SOFTWARE

~~TOP SECRET~~ [ ]

HANDLE VIA  
BYEMAN  
CONTROL SYSTEM ONLY

~~TOP SECRET~~

9

[Redacted]

SITE

10

HARDWARE

SYSTEM BLOCK DIAGRAM

10

RS-1A SYSTEM

11

RS-1 MAINLINE

MVD

12

SCU

13

~~POLARIZ. PICTURE~~ MULTI-CONP

14

POLARIZ. PICTURE

JOC

15

POLARIZ. SYSTEM

16

POLARIZ. SW.

17

RECORD MON. PANEL

18

AUDIO MON. PANEL

~~TOP SECRET~~

[Redacted]

DRIVER

HANDLE VIA  
BYEMAN  
CONTROL SYSTEM ONLY

32

~~TOP SECRET~~ FLIP [redacted]

33

RESULTS FROM [redacted]

34

[redacted]

35

- 1969 - FUTURE EFFORTS -

36

R.D. LOAD

37

FUTURE R.D. LOAD

38

RETEP

39

EPH. EVAL.

40

LOGISTIC SUPPORT

41

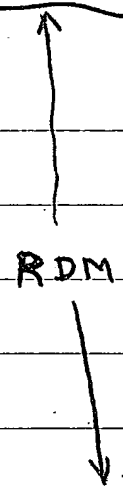
LOGISTIC SUPPORT

42

PROB. AREAS

43

WHAM!!! [redacted]  
~~TOP SECRET~~



RDM

GP

LN

MV

HANDLE VIA  
BYEMAN  
CONTROL SYSTEM ONLY

~~TOP SECRET~~RECORDER MON PANEL

1. This unit replaces a 7 POLE 3 POSITION VIDEO SW. and RECORDER CONTROL CIRCUITRY
2. ~~RE~~ allows the ~~as~~ OUTPUT OF 7 TRACKS OF 1 OF 3 RECORDERS to be monitored on a 7 CHAN SCOPE
3. PROVIDES REMOTE TURN ON CAPABILITY

AUDIO MON PANEL

1. ~~before~~ previous to this la... an operator could listen to our 2 chan. 1 in each ear.
2. NOW 4 CHAN. - ANSWERS SWITCH. NEED FOR 2 OPER.

1MHz. DRIVER

1. IMC. Multicoupler - 1 INPUT, 8 OUTPUT
2. Supplies IMC. TIME STRD TO RECURS
3. 2 @ ea. site

TM RECEIVER

1. VHF - AM
2. 3 IF bandwidths

SYSTEM 3. DIG. CONT. OSC + 2 RF PORTIONS  
out. Pick best polarization

~~TOP SECRET~~

HANDLE VIA  
BYEMAN  
CONTROL SYSTEM ONLY

*See*  
~~TOP SECRET~~  
BACKGROUND

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⑤ COMMAND SYS - ANT @ HYBLA VALLEY

UPDATED: ①

② PCM

⑥ DEPLOYMENT IN 1968

⑦ RECVR & COMMAND ANT IN

⑧ RECV ANT IN

HANDLE VIA  
BYEMAN  
CONTROL SYSTEM ONLY

~~TOP SECRET~~

~~TOP SECRET~~

9. SITE

HARDWARE  
SYSTEM BLOCK DIAGRAM

10. RS-1A SYSTEM

11. RS-1 MAINLINE

12. SCU

13. ~~POLARIZ. PICTURE~~ MULTI-COUP

14. POLARIZ. PICTURE

15. POLARIZ. SYSTEM

16. POLARIZ. SW.

17. RECORD MON. PANEL

18. AUDIO MON. PANEL

19. ~~TOP SECRET~~ RIVER

HANDLE VIA  
BYEMAN  
CONTROL SYSTEM ONLY



~~TOP SECRET~~

20 TM RECEIVER

21 ADDS PICTURE

22 ADDS

23 CARD

~~24~~ 24 ADDS LIST

L.H.

25 BTS

26 BTS

27 COMPUTER (GREY)

28 COMPUTER (GREY) line printer - disk

29 Tape Trans - A/C' ~~line printer - disk~~

F.H.

30 2<sup>ND</sup> & 3<sup>RD</sup> GEN. SOFTWARE

31 ANALYSIS SOFTWARE

~~TOP SECRET~~

HANDLE VIA  
BYEMAN  
CONTROL SYSTEM ONLY

~~TOP SECRET~~

32

FLIP CHART

33

RESULTS FROM

RDM

34

35

- 1969 - FUTURE EFFORTS -

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LOGISTIC SUPPORT

42

PROB. AREAS

~~TOP SECRET~~

HANDLE VIA  
BYEMAN  
CONTROL SYSTEM ONLY

EPHEMERIS EVALUATION

- I. The location system depends upon accurate prediction of satellite positions
- II. Present predictions are based upon separate NAVSPASUR tracking of each satellite.
- III. Efforts are underway to evaluate and improve system accuracy:
  - (a) Comparison with TIMATION navigation satellite predictions
  - (b) New hardware (RETEP) will improve estimation of the orientation of the vehicles one to the other
  - (c) In progress is software for RETEP and efforts to refine orbit prediction.

~~TOP SECRET~~

~~TOP SECRET~~

HANDLE VIA  
BYEMAN  
CONTROL SYSTEM ONLY

~~TOP SECRET~~

## BACKGROUND

1. 10 YRS IN OPER.
2. LARGE CHANGES
3. IMPACT OF RESULTS ON COMMUNITY

① TECH STAFF AT NRL

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⑧ RECV ANT IN

~~TOP SECRET~~HANDLE VIA  
BYEMAN  
CONTROL SYSTEM ONLY

~~TOP SECRET~~

HARDWARE

SYSTEM BLOCK DIAGRAM

9  
10 RS-1A SYSTEM

11 RS-1 MAINLINE

12 SCU

13 ~~RS-1 MAINLINE~~ MULTI-COUP

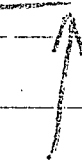
14 POLARIZ. PICTURE

15 POLARIZ. SYSTEM

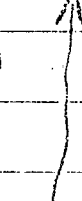
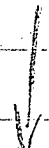
16 POLARIZ. SW.

17 RECORD MON. PANEL

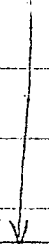
18 AUDIO MIX. PANEL



MVD



JOC



GP

~~TOP SECRET~~

VER

HANDLE VIA  
BYEMAN  
CONTROL SYSTEM ONLY

XERO COPY

XERO COPY

XERO COPY

XERO COPY

(20)

~~TOP SECRET~~ [ ]  
T.M. RECEIVER

(21)

ADDS PICTURE

(22)

ADDS

(23)

CARD

(24)

ADDS LIST

L.H.

(25)

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(29)

Top Trans - A/C' ~~line printer - disk~~

F.H.

(30)

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