Howard University Seminar

GOPEX

Experiment Results

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Task Manager

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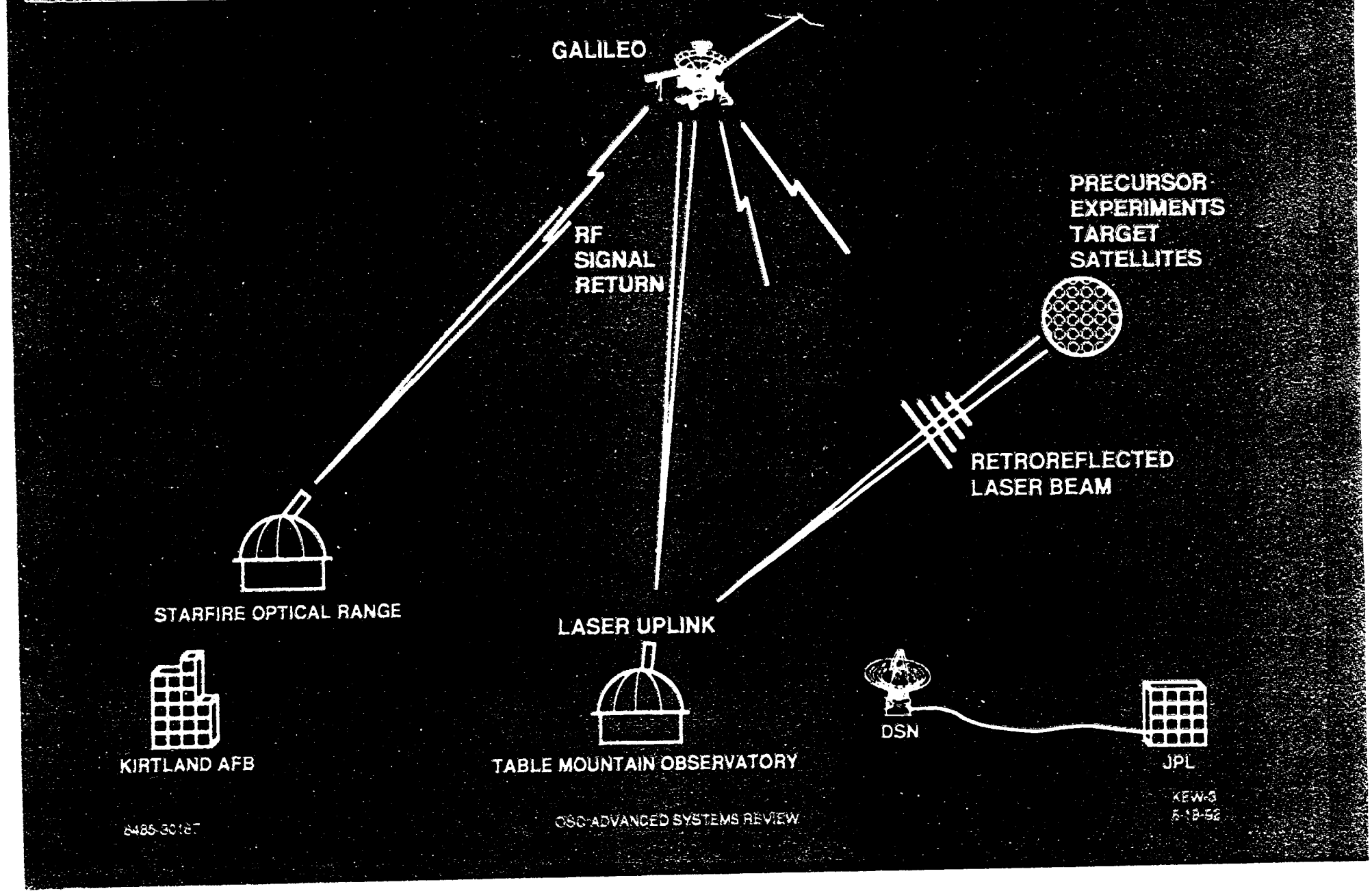
TELECOMMUNICATIONS AND DATA ACQUISITION

GOPEX DEMONSTRATION

OVERVIEW

JPL



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KEW-3
5-13-92

DIRECTOR'S REPORT AND DISCUSSION

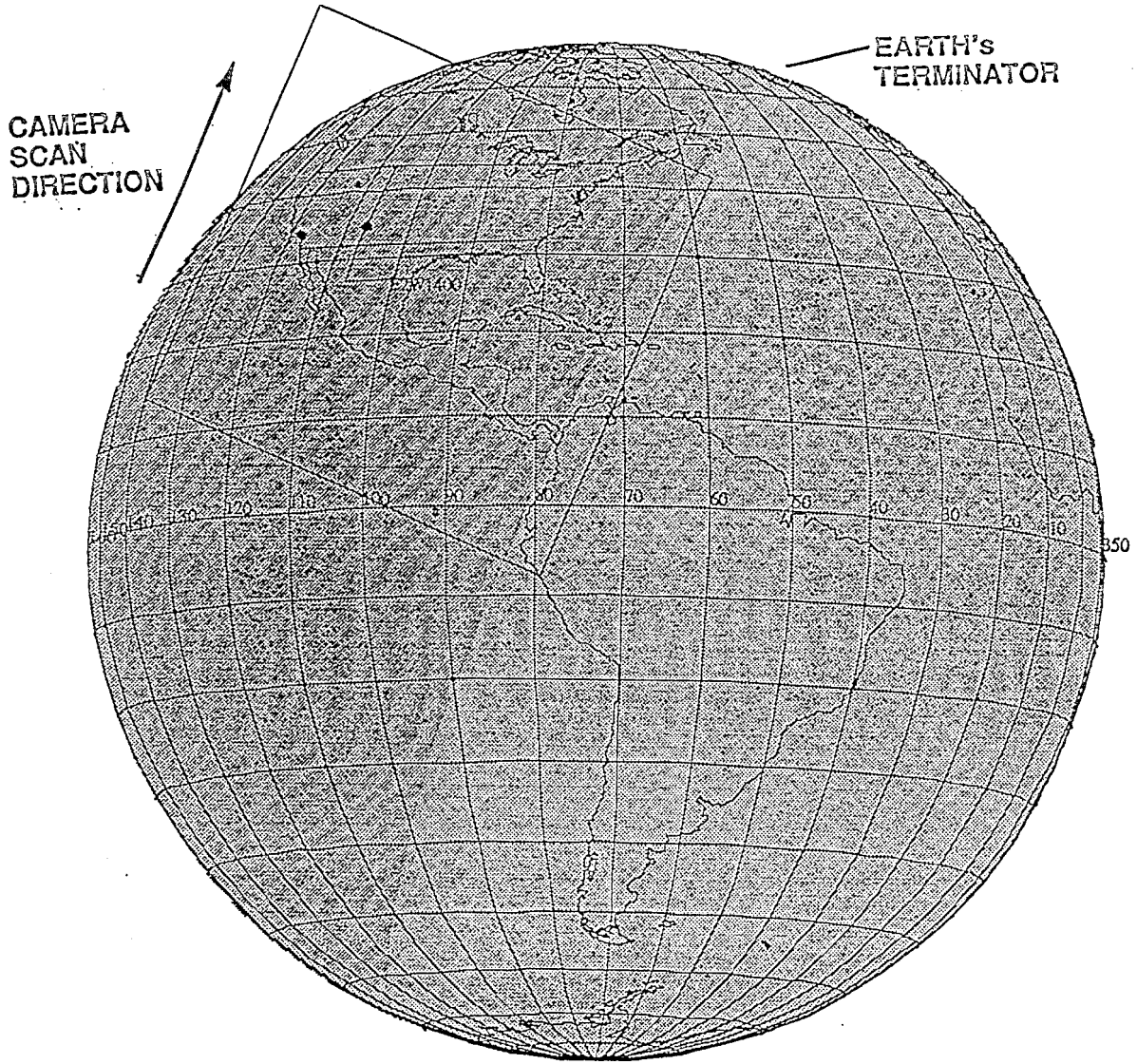
GOPEX OBJECTIVES AND APPROACH

JPL

- OBJECTIVES
  - DEMONSTRATE LASER BEAM TRANSMISSION TO A DEEP SPACE SPACECRAFT
  - VERIFY BEAM POINTING STRATEGIES BASED ON PREDICTS
  - VALIDATE OPTICAL LINK PERFORMANCE MODELS
- APPROACH
  - ***SIMULTANEOUSLY TRANSMIT PULSED LASER SIGNALS FROM*** TELESCOPES AT TABLE MOUNTAIN OBSERVATORY (TMO) AND AF PHILLIPS LAB'S STARFIRE OPTICAL RANGE (SOR) TO THE GALILEO SPACECRAFT ON DECEMBER 9-16
  - USE THE GALILEO IMAGING CAMERA (SHUTTER OPEN DURING SCANNING) TO DETECT SEQUENCES OF INDIVIDUAL LASER PULSES

SSI CAMERA VIEW

EARTH AS SEEN BY SSI CAMERA 20 HOURS AFTER CLOSEST APPROACH- 3:00 SSI



GOPEX

GOPEX TRANSMISSION WINDOW

- GOPEX SCHEDULED DECEMBER 9, 1992 - DECEMBER 16 1992

- APPROVED TRANSMISSION WINDOW (HOURS AFTER CLOSEST APPROACH)

START TIME	END TIME	DURATION	NO. OF CAMERA FRAMES
• DAY 0 + 20 HRS	DAY 0 + 23 HRS	3 HRS	59
• DAY 1 + 20 HRS	DAY 1 + 22 HRS	2 HRS	40
• DAY 2+ 20 HRS	DAY 2 + 21 HRS	1 HR	20
• DAY 3 + 20 HRS	DAY 3 + 21 HRS	1 HR	10

- DAY 5 ..... LASER UPLINK PRECLUDED BYHIGHER PRIORITY GALILEO ACTIVITIES

• DAY 5+19.5 HRS	DAY 5 +20.5 HRS	1 HR	12
• DAY 6 + 19.5 HRS	DAY 6 + 20.5 HRS	1HR	10
• DAY 7 + 19.5 HRS	DAY 7 + 20.5 HRS	1 HR	8

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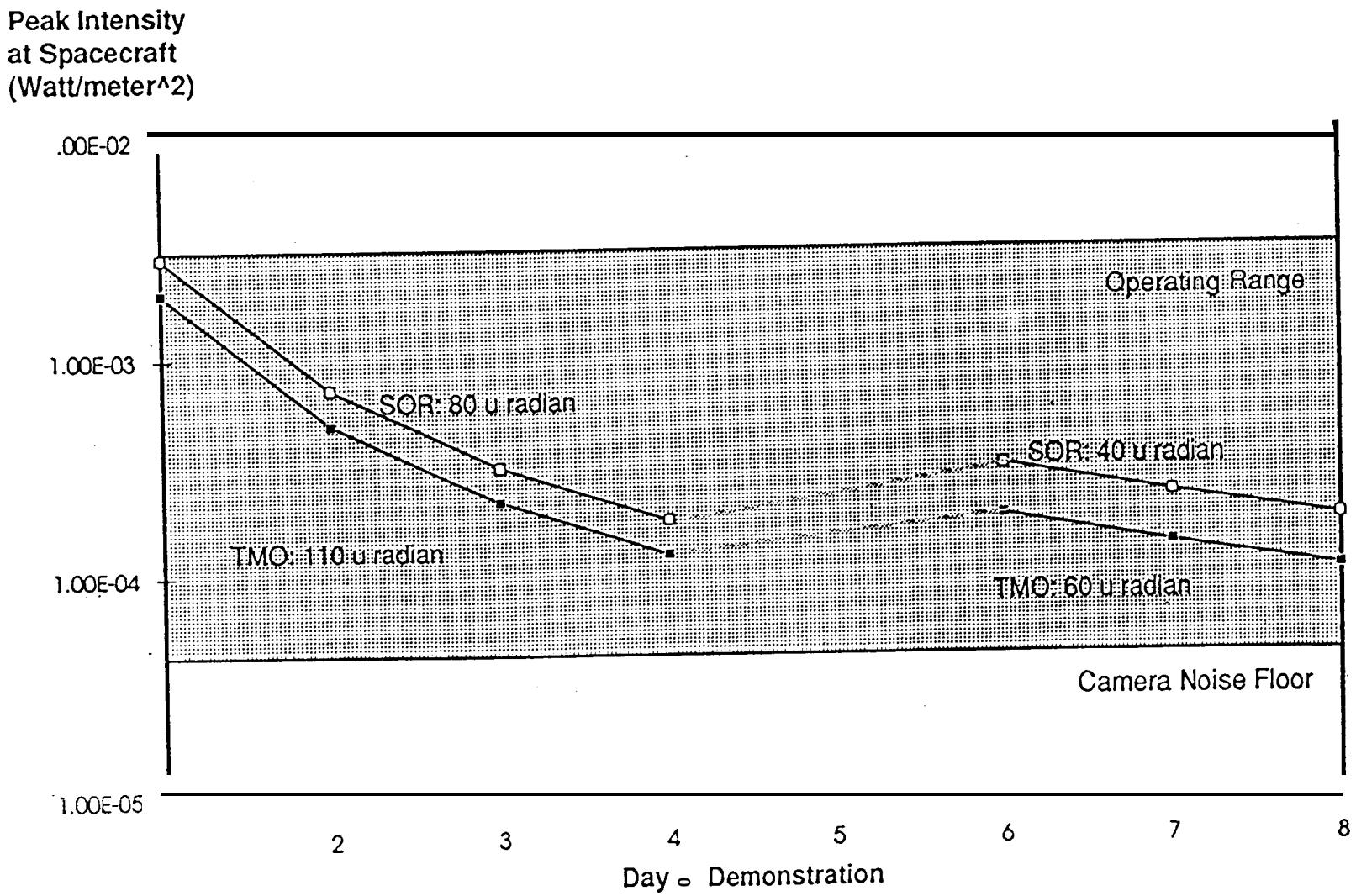
TRANSMITTER BEAM DIVERGENCES

TMO AND SOR LASER SIGNAL INTENSITIES AT GLL SPACECRAFT FOR DESIGNED DIVERGENCES



TELECOMMUNICATIONS AND DATA ACQUISITION

DIRECTOR'S REPORT AND DISCUSSION

SOR 1.5M FACILITY

JPL

JRL/KEW-6
1-11-93

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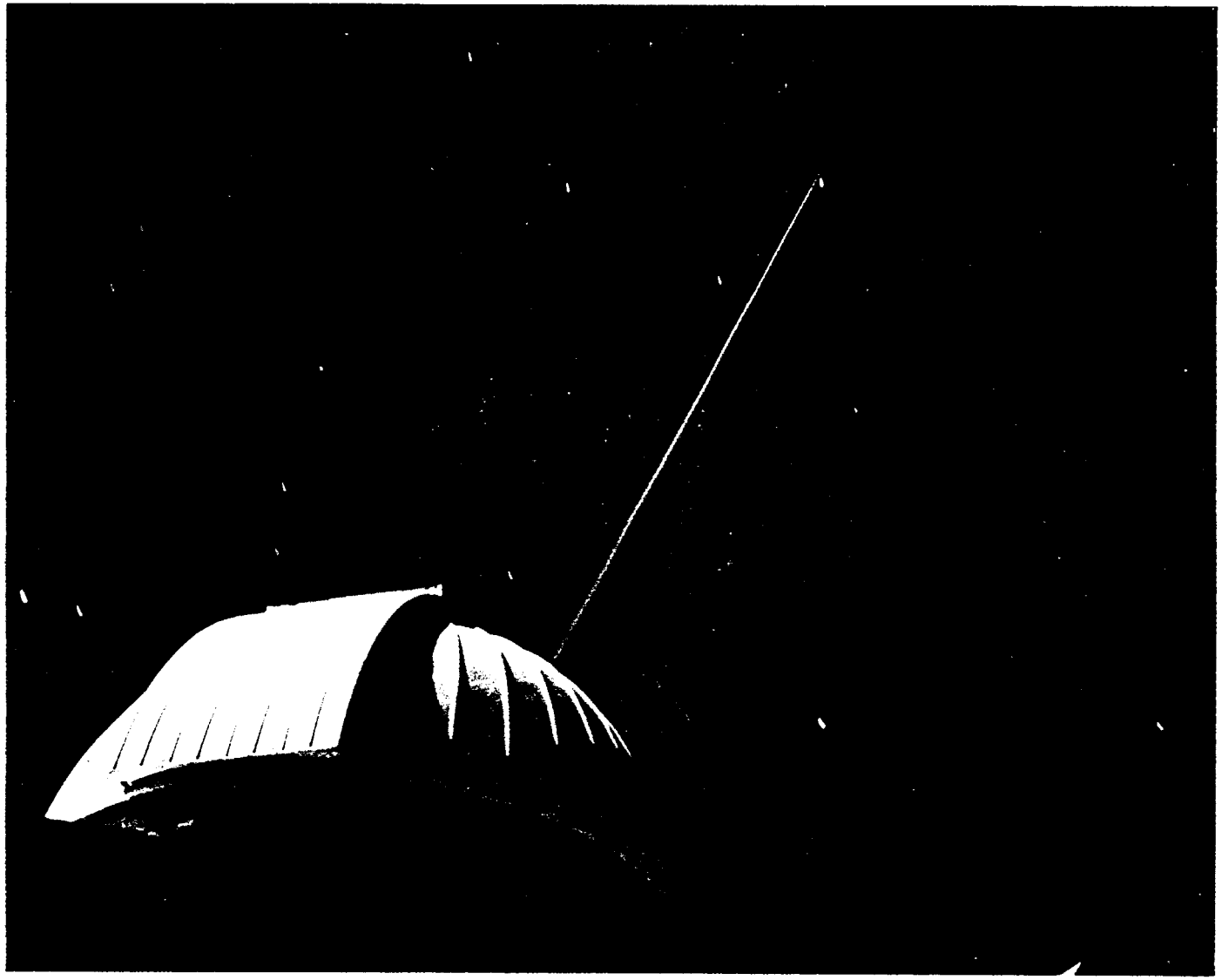
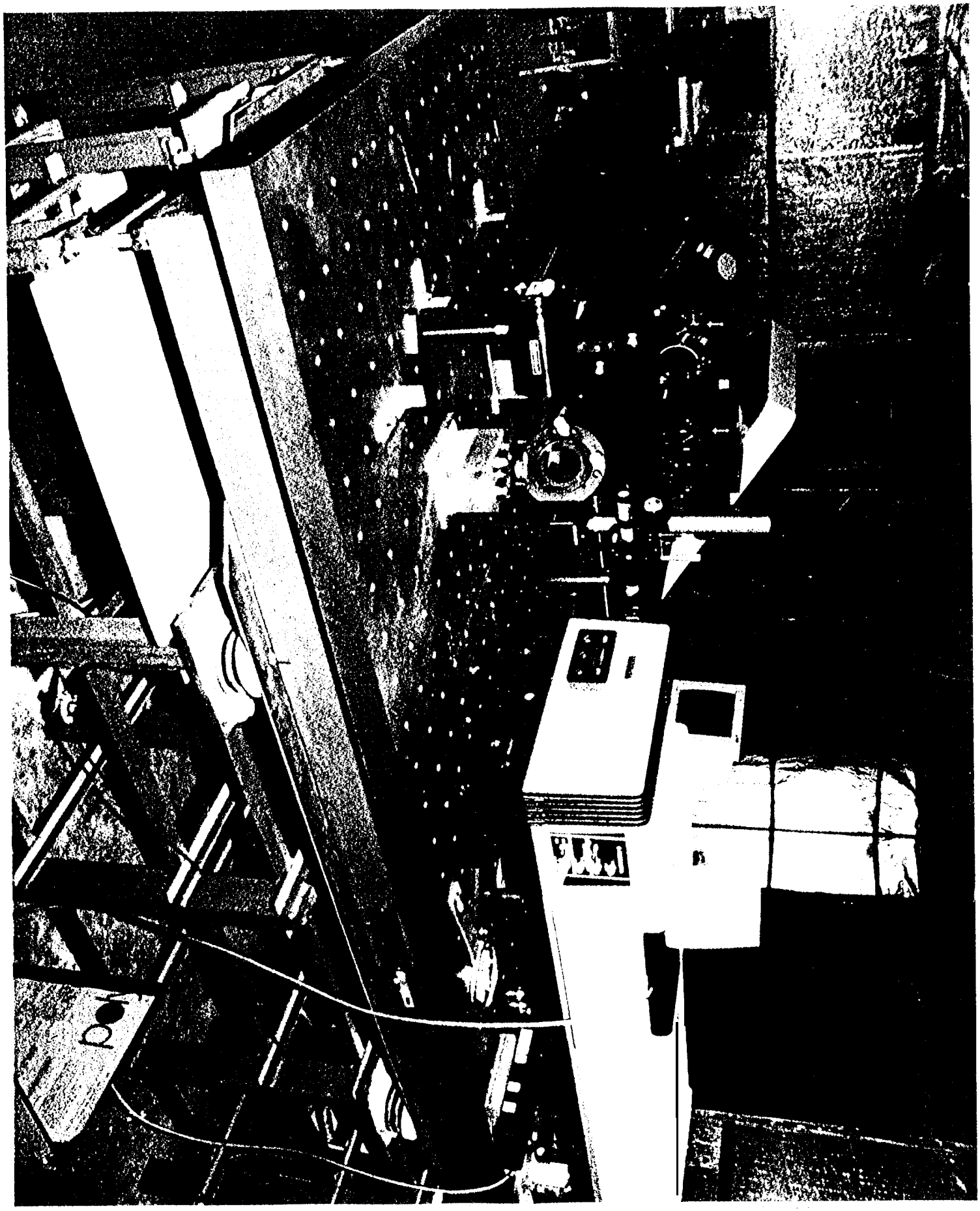
DIRECTOR'S REPORT AND DISCUSSION

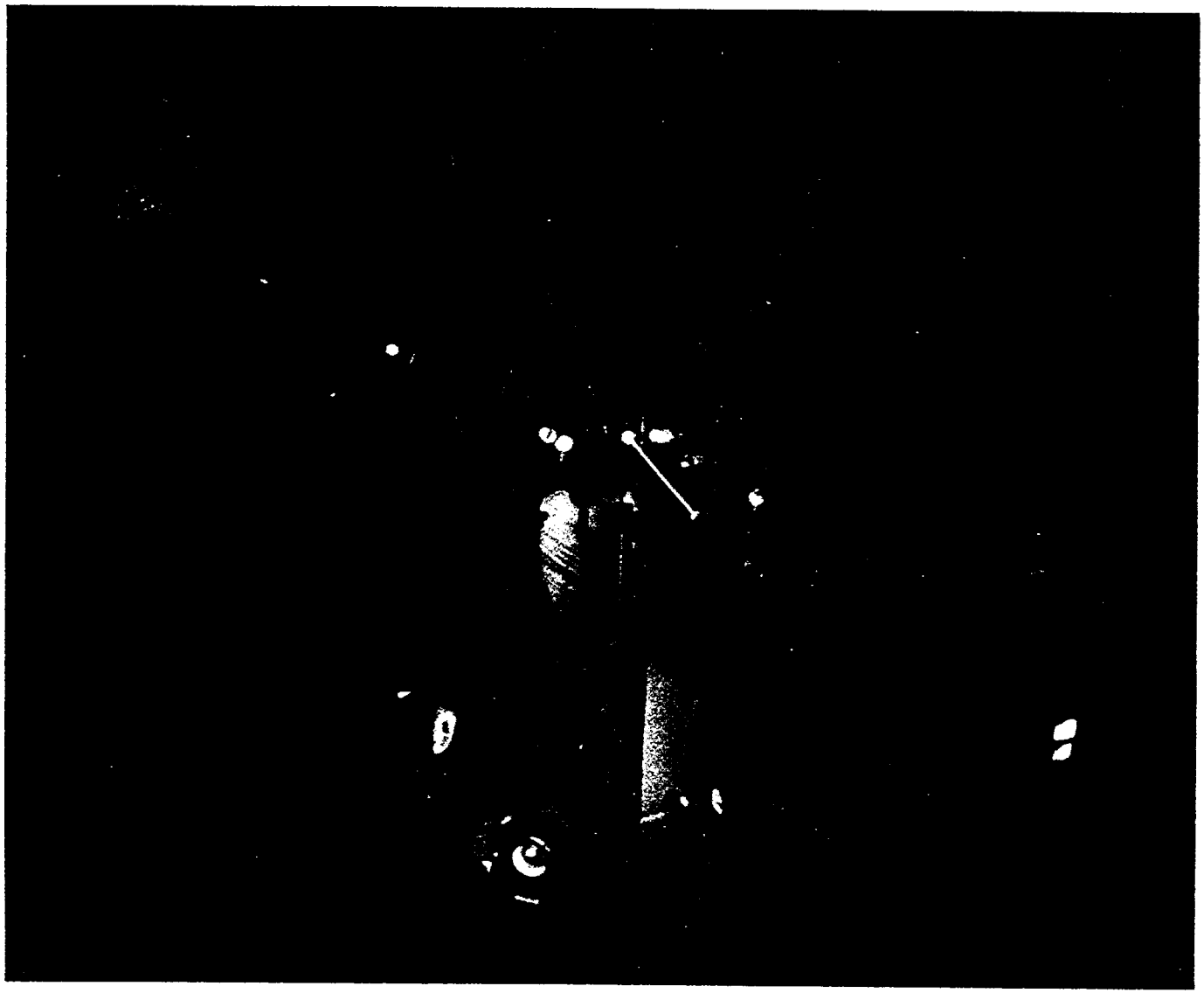
TMO 0.6M FACILITY





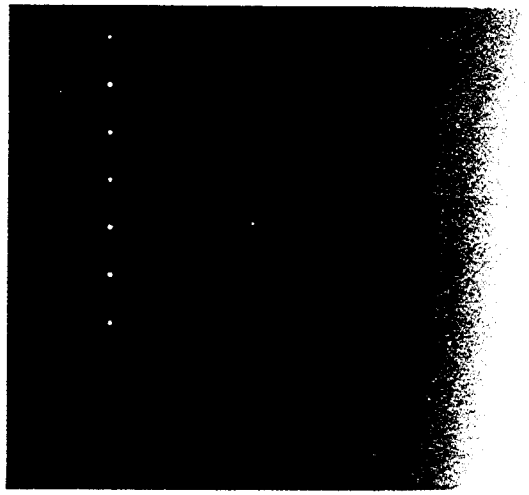
DIRECTOR'S REPORT AND DISCUSSION

TMO LASER TRANSMITTER

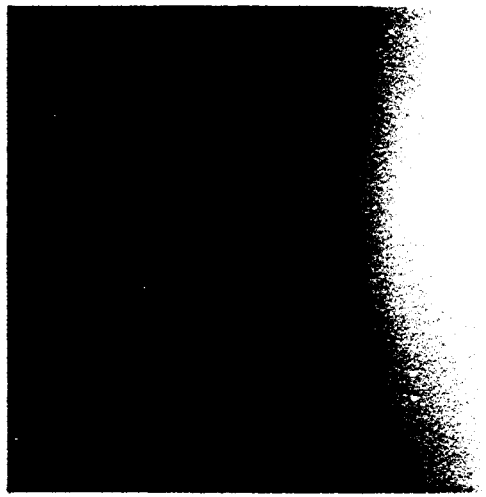


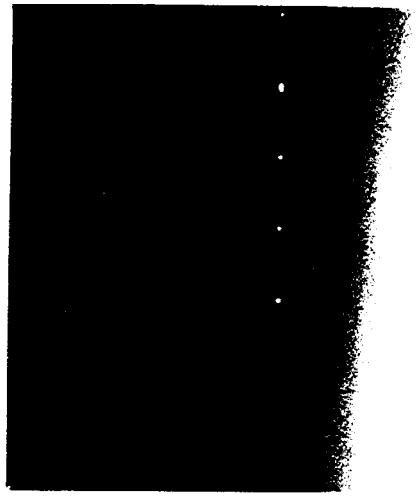
DIRECTOR'S REPORT AND DISCUSSION

SAMPLES OF DETECTED LASER TRANSMISSIONS

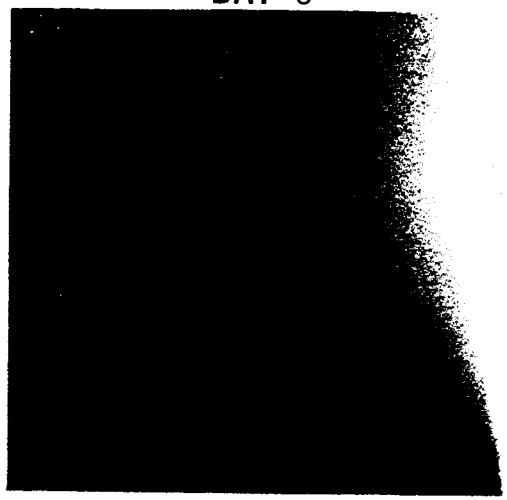


DAY 7





DAY 8



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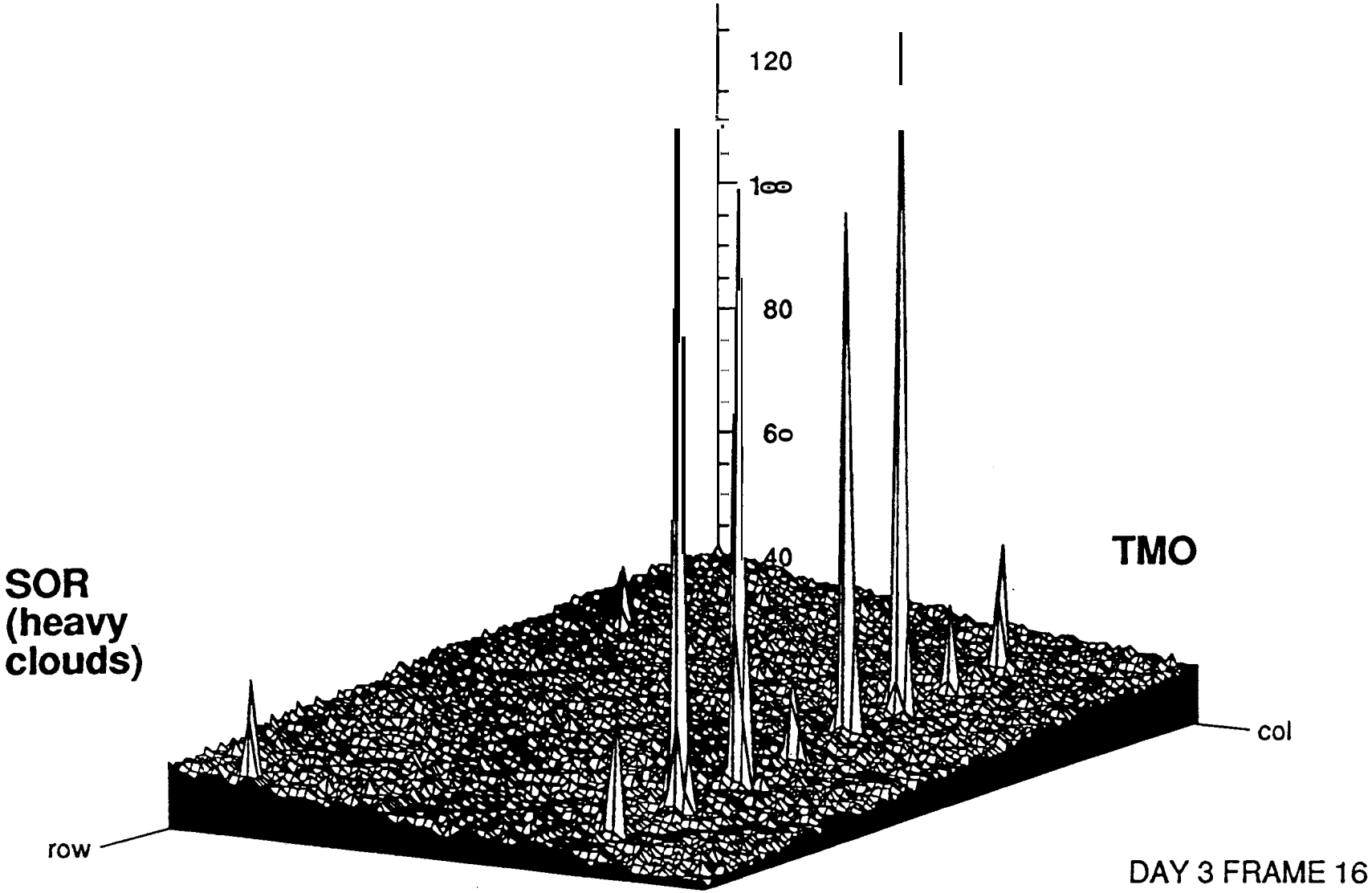
JRL/KEW-7
1-11-93

LASER SIGNALS FROM EARTH

RECEIVED BY THE GALILEO SPACECRAFT AT A RANGE OF 2.2 MILLION KM



Daily Frame Counts

DAY	Shutter Speed (ms)	Frames Received	Frames with Detections	
12/9	133	9 of 10	0	(Partial clouds at SOR,
	200	24 of 25	0	USAF restricted some
	400	19 of 20	6*	transmissions, and GL
	800	5 of 5	4	aborted one frame)
12/10	200	5 of 5	0	
	267	15 of 15	0	
	533	15 of 15	11	
	800	5 of 5	5	
12/11	200	5 of 5	0	(TMO and SOR
	267	10 of 10	0	partially cloudy)
	533	5 of 5	5	" "
12/12	200	3 of 3	1*	(TMO off - weather
	267	4 of 4	0	SOR cloudy)
	533	3 of 3	2	" "
12/13	No Activity planned			
12/14	133	3 of 3	0	(SOR cloudy)
	267	6 of 6	0	" "
	533	3 of 3	3	" "
12/15	200	3 0f 3	1*	(SOR off - weatner)
	400	3 of 4	3	" "
	800	3 of 3	3	" "
12/16	267	2 of 2	0	(SOR off - weather)
	533	4 of 4	4	" "
	800	2 of 2	2	" "

* Tentative - based on only 1-3 possible detection spots on image

JPL

SUMMARY OF GOPEX RESULTS

- SUCCESSFULLY DETECTED LASER TRANSMISSION ON ALL 7 DAYS OF DEMONSTRATION
- DAY 4 TRANSMISSION DISTURBED OBSCURED BY WEATHER
  - FALLING SNOW PREVENTED TRANSMISSION FROM TMO
  - SOR TRANSMITTED THROUGH THICK CLOUDS
- TRANSMISSION FROM SOR ON LAST THREE DAYS PRECLUDED BY FALLING SNOW
- DAY 1 OF DEMONSTRATION
  - UNEXPECTED CAMERA POINTING BIAS, RESULTED IN NO DETECTIONS ON 90 FRAMES WITH EXPOSURES SHORTER THAN 400 MS
    - TRANSMISSIONS DETECTED ON 70% OF REMAINING FRAMES
      - 61% ON DAYS 1-4
      - 100% ON DAYS 6-8
- TOTAL OF 48 CAMERA FRAMES RECEIVED WITH DETECTED LASER PULSES