



UPPER ATMOSPHERE RESEARCH SATELLITE JITTER STUDY

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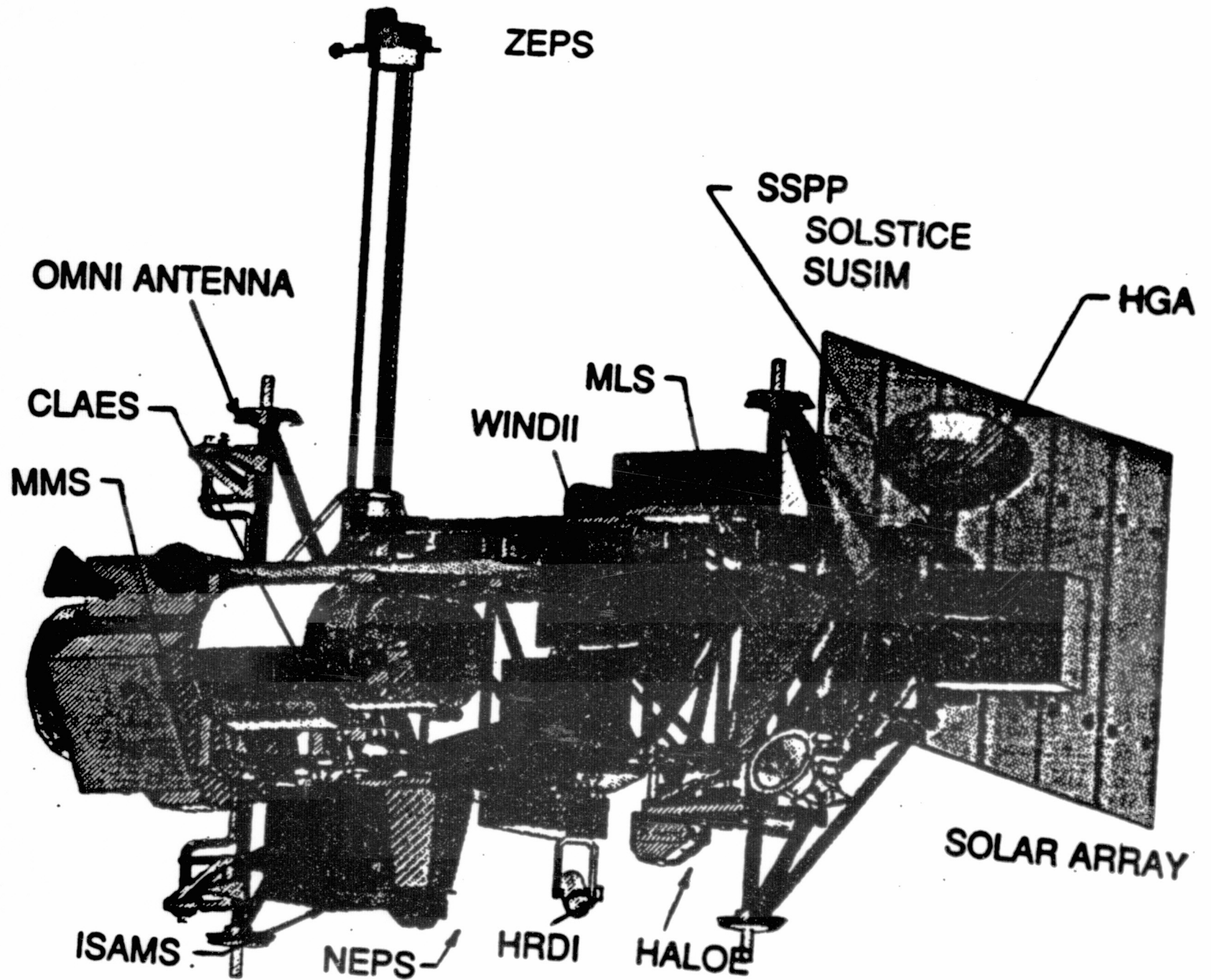
UARS

A Global Probe
of Earth's Upper
Atmosphere



UARS JITTER STUDY OBJECTIVES

- ANALYSIS OF IN-FLIGHT JITTER
- EVALUATE DIFFERENT MODELS OF UARS
- DETERMINE JITTER PREDICTION ACCURACY SUCH THAT ADEQUATE (BUT NOT EXCESSIVE) DESIGN MARGINS WILL ASSUME FUTURE MISSION SUCCESS





UARS CHRONOLOGY

SEPT. 12, 1991

LAUNCH

MAY 1, 1992

DISTURBANCE EXPERIMENT

JUNE 1, 1992

SOLAR ARRAY DRIVE ANOMALY

JUNE 3, 1992

SOLAR ARRAY PARKED

JULY 13, 1992

SOLAR ARRAY NORMAL OPS

DATA CASES :

- DISTURBANCE EXPERIMENT
- NO INSTRUMENT DISTURBANCES
- YAW MANEUVER, ORBIT ADJUST
- NUMEROUS ORBITS OF NORMAL OPERATIONS
- SOLAR ARRAY ANOMALY
- SKEW REACTION POWERED DOWN
- HALOE SUN SENSOR
- MLS, SSPP, HGA, REACTION WHEELS
- THERMAL SNAP



UARS DISTURBANCE EXPERIMENT OBJECTIVES

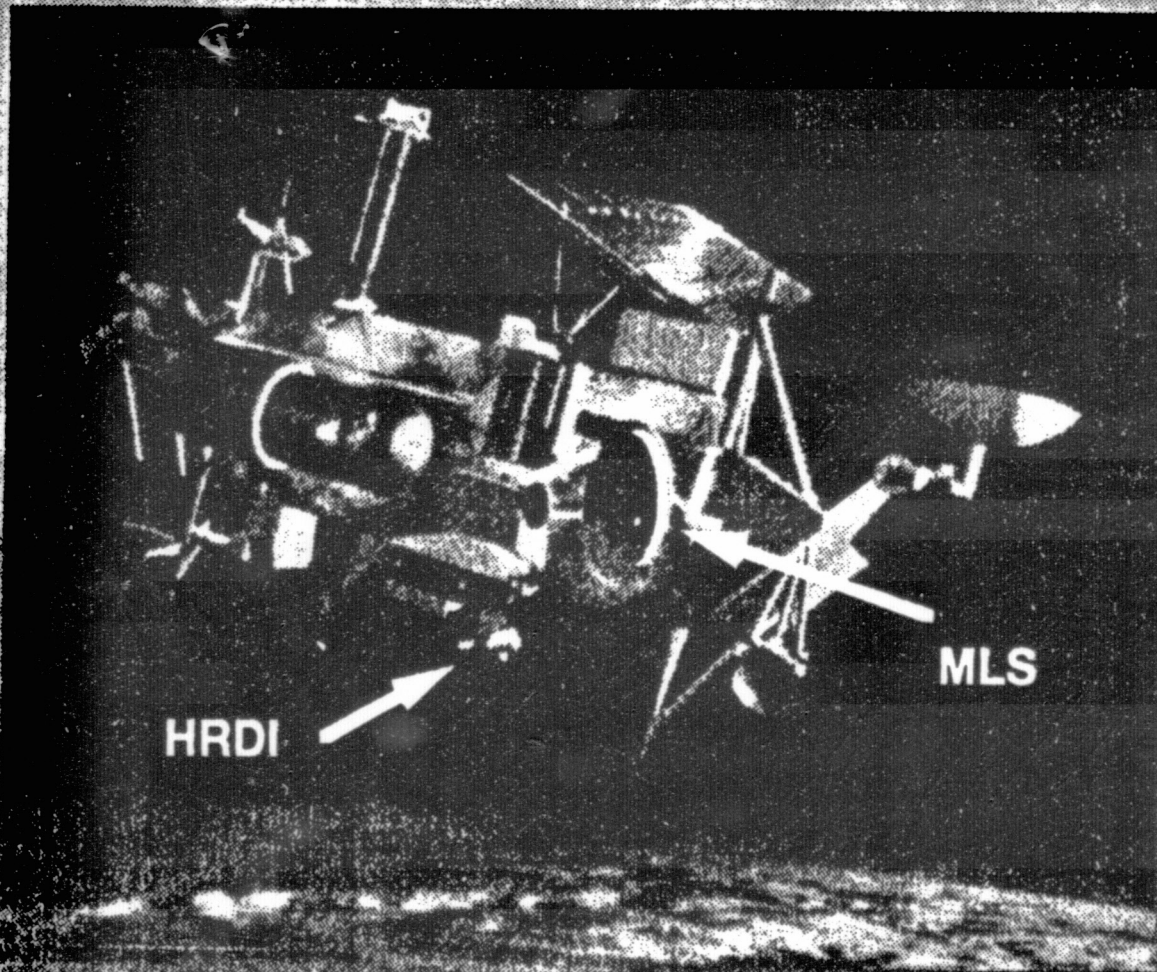
UARS Disturbance Experiment on May 1, 1992

- **Pointing jitter due to each individual instrument**
- **Pointing jitter due to concurrent disturbances**
- **"No disturbance case"**
- **System I. D. responses**
- **Participants : LaRC, GSFC, General Electric**

JPL Microwave Limb Sounder Team

University of Michigan - High Resolution Doppler Imager

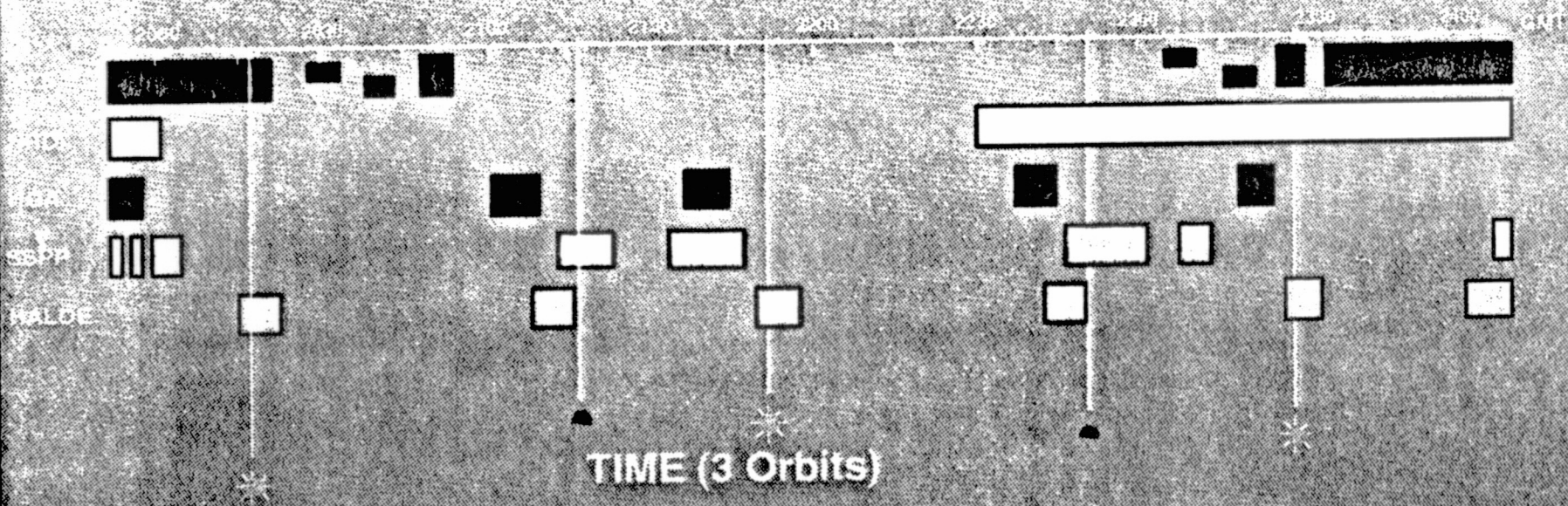
UARS DISTURBANCE EXPERIMENT



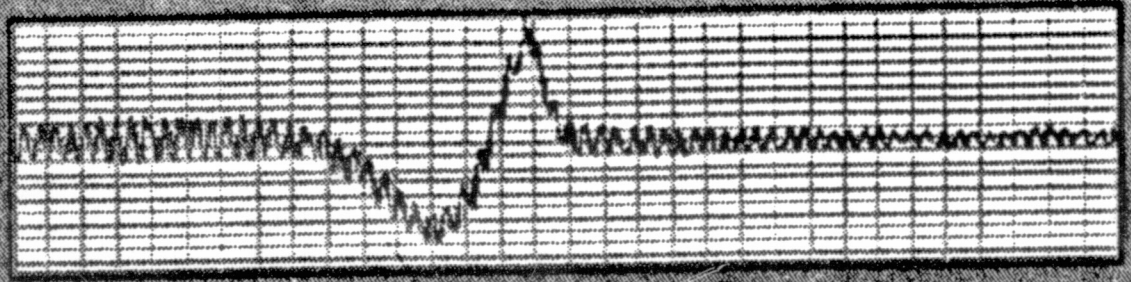


UARS DISTURBANCE EXPERIMENT

NOV 1992



ROLL
ANGULAR
RATE



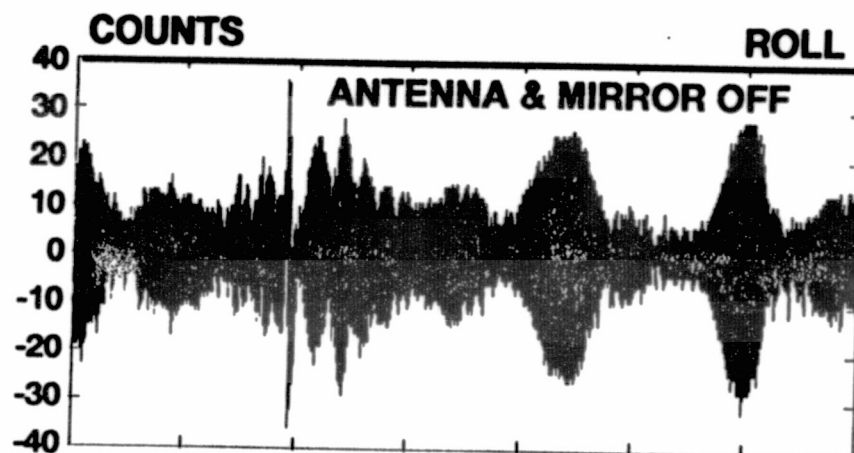
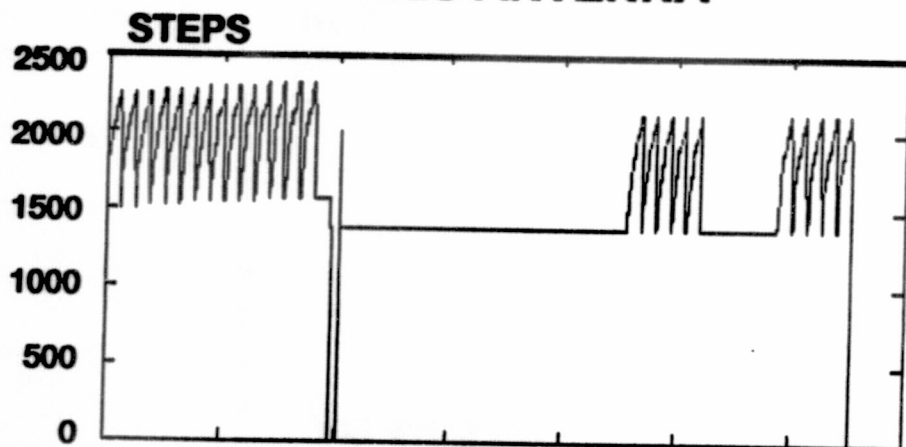
TIME →



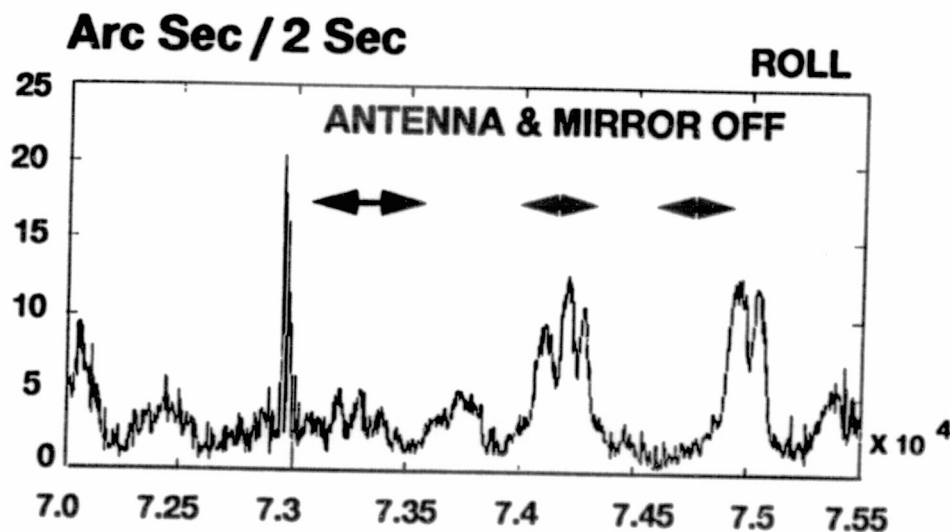
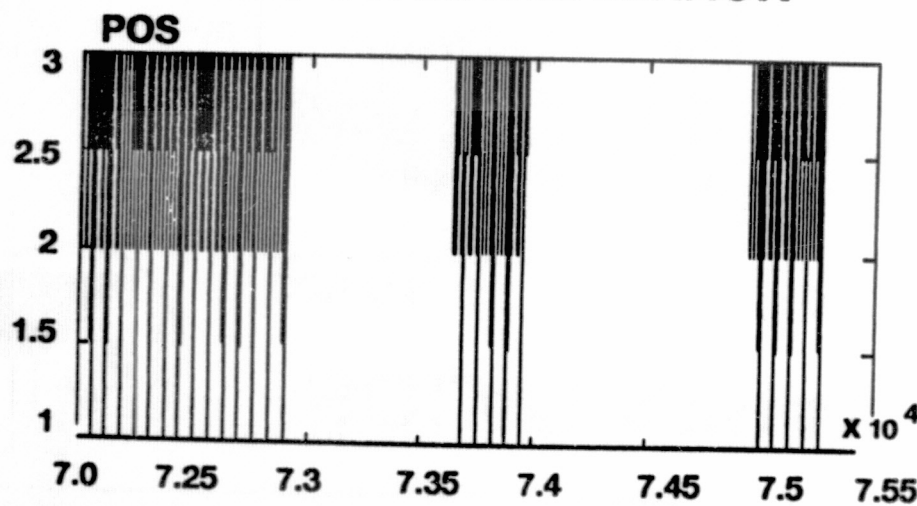
MICROWAVE LIMB SOUNDER

ANTENNA & MIRROR TIME PROFILES

MLS ANTENNA

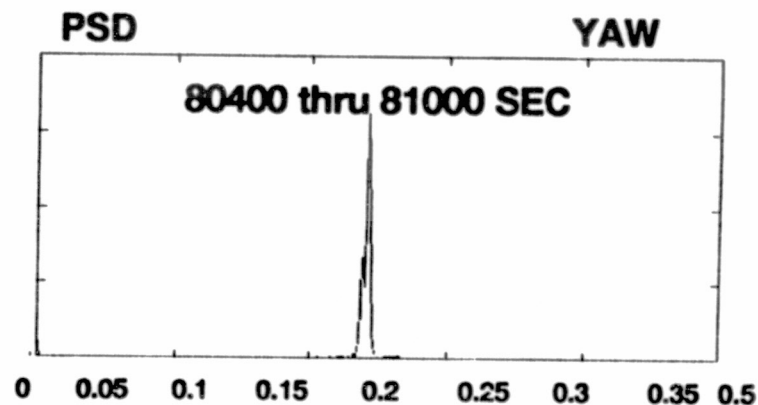
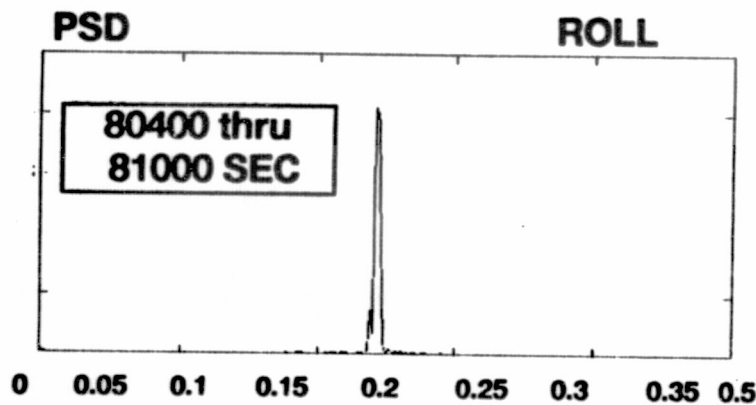
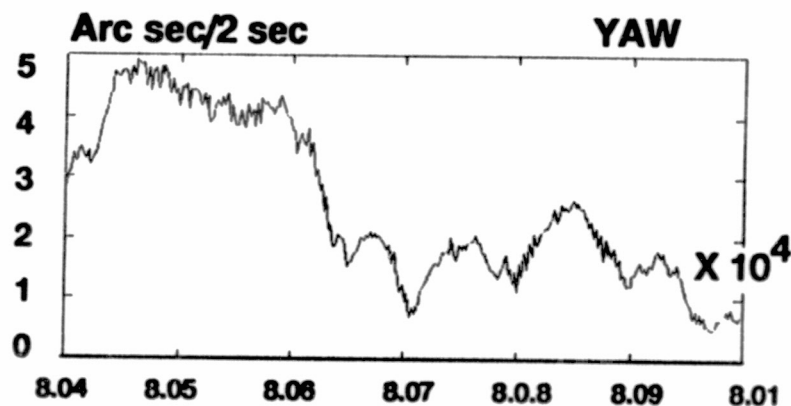
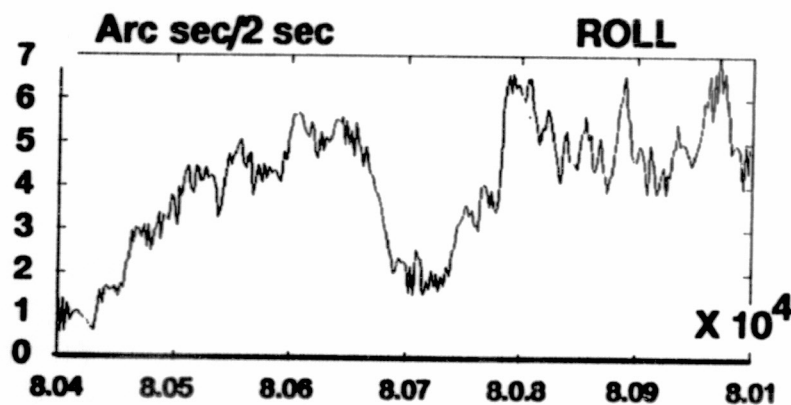
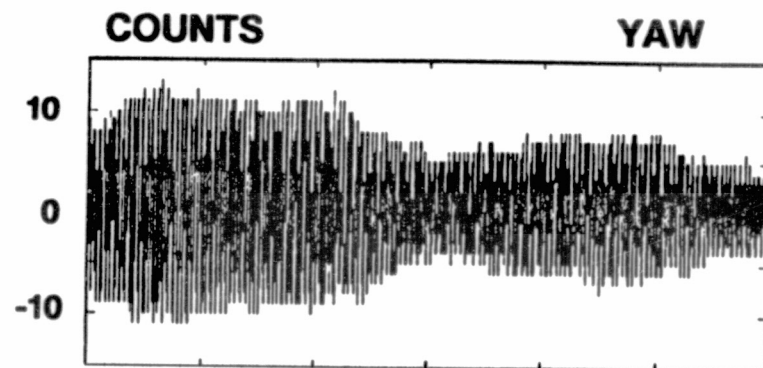
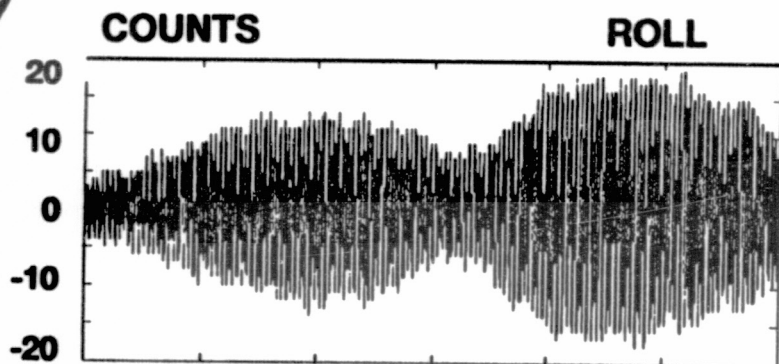


MLS SCANNING MIRROR



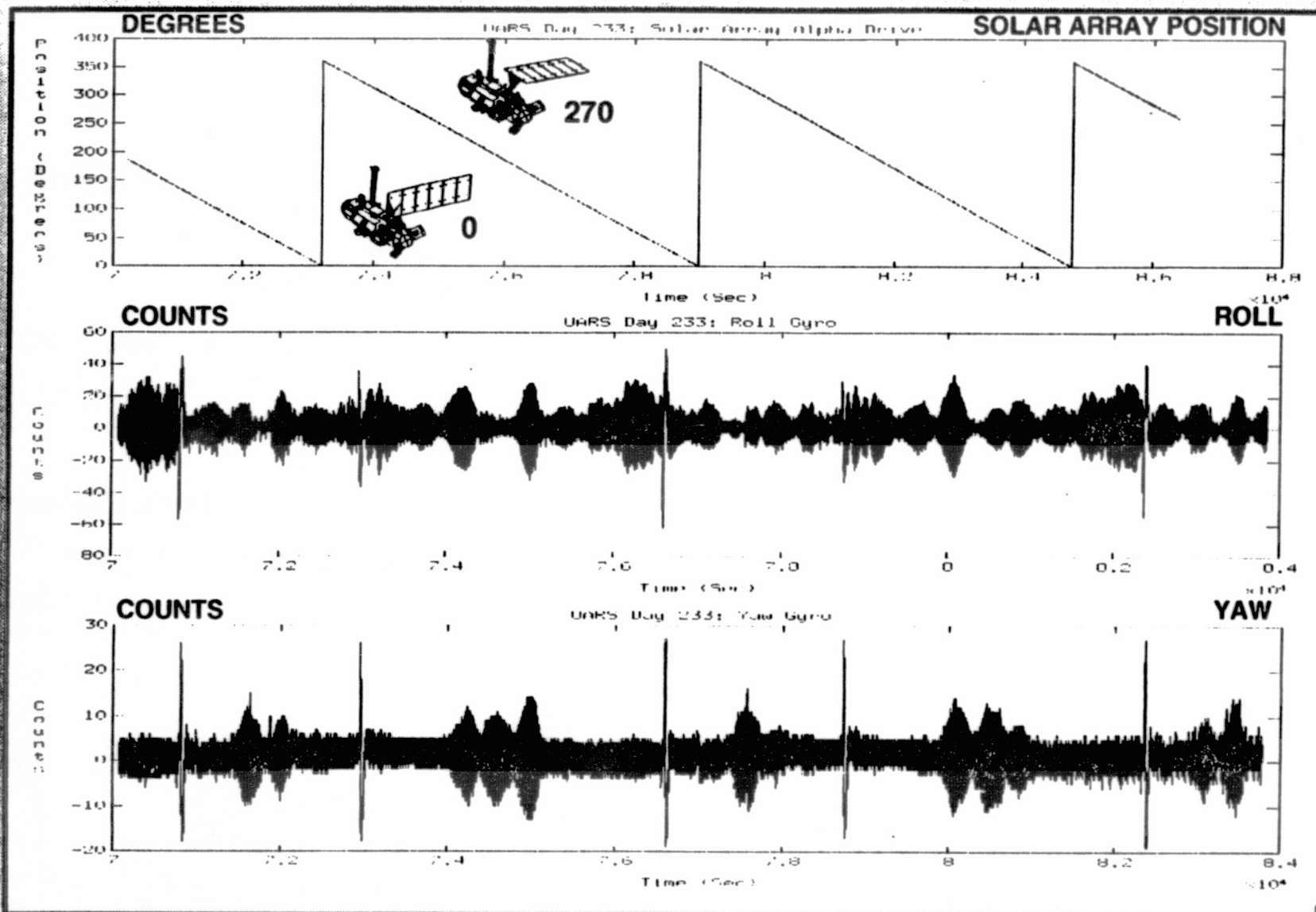


SOLAR ARRAY DRIVE DISTURBANCE





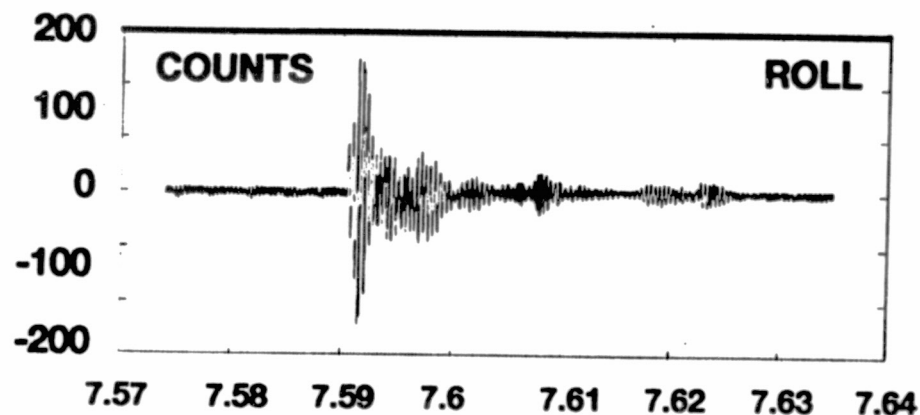
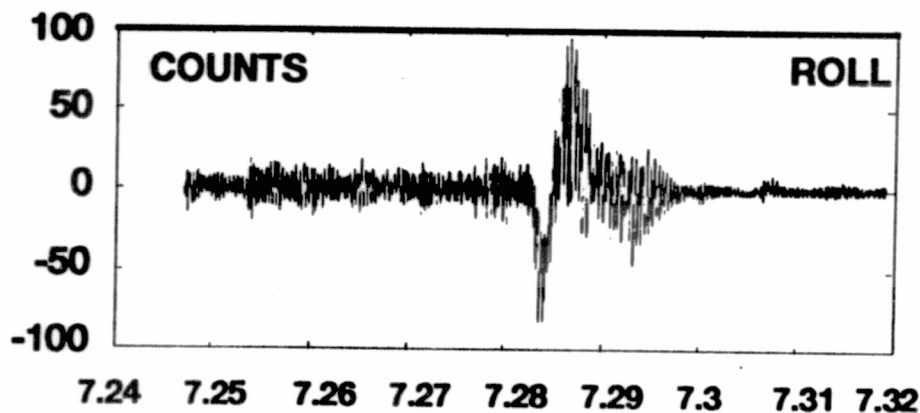
ROLL & YAW JITTER CORRELATION WITH SOLAR ARRAY POSITION



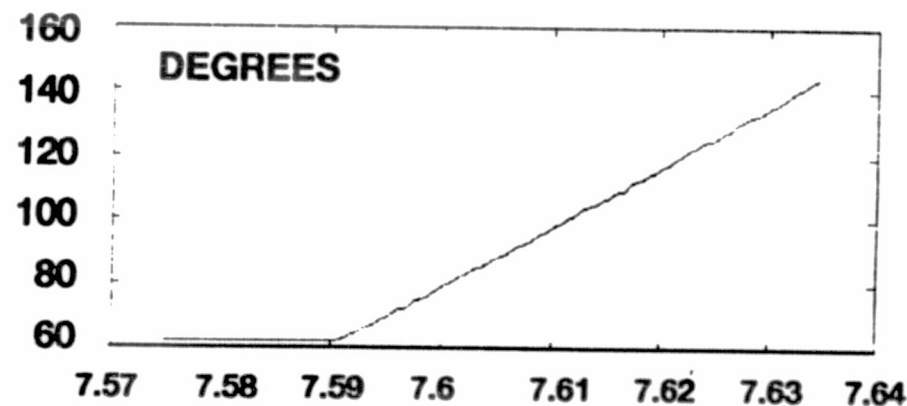
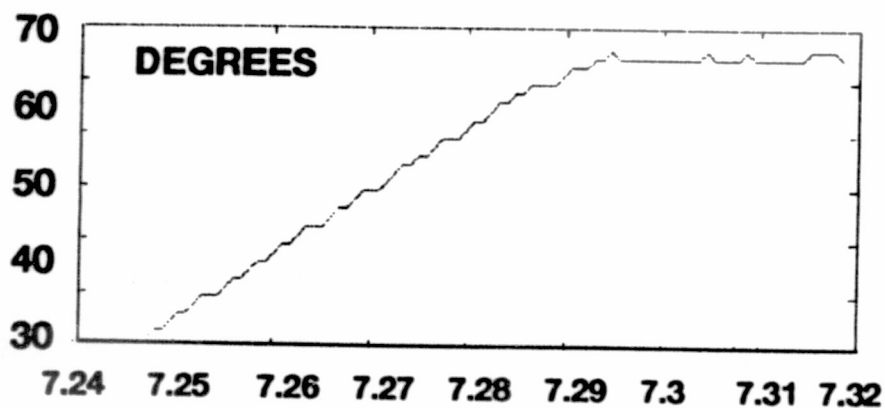


SOLAR ARRAY ROTATION

JUNE 2, 1992



SOLAR ARRAY POSITION



Solar Array is Dominant Disturbance Source

Damping 2.8%



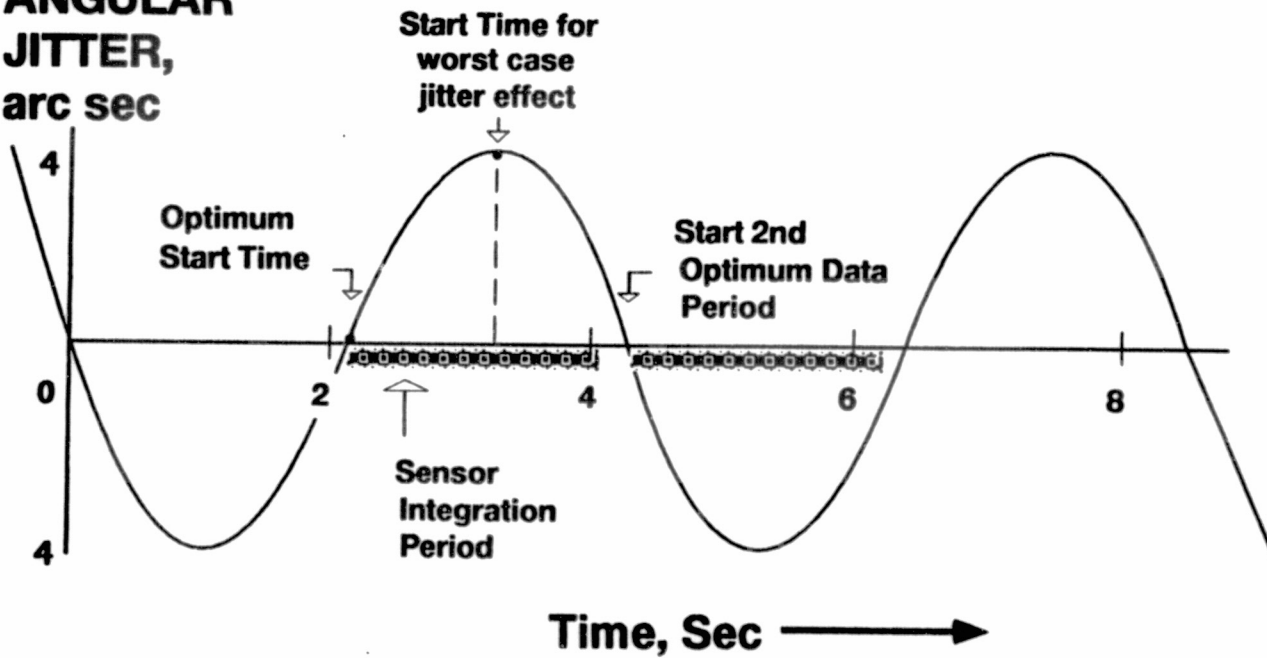
UARS DISTURBANCE SUMMARY

SOURCE	RIGID-BODY PLATFORM MOTION			JITTER (ARC SEC/2 SEC)			FLEXIBLE MODES EXCITED (HZ)		
	ROLL	PITCH	YAW	ROLL	PITCH	YAW	ROLL	PITCH	YAW
MLS	YES	NO	NO	2.25	0.50	0.50 0.10	0.256 0.988 1.005	0.2622 0.2837 2.2110	2.9329 0.2407
HALOE **	YES	YES	YES	2.50	1.80	1.40	0.951	0.8070	0.9510
HRDI DAY ** SCAN	YES	YES	YES			1.60	0.2478 0.2404	0.2709	2.9330 0.2365
HRDI NIGHT ** SCAN	YES	YES	YES			1.90	0.945 0.2365	0.9664 0.2450	0.9492 2.9286
SOLAR ARRAY	NO	NO	NO	17.0, VARIES WITH POSITION/DIRECTION			0.240	0.2686	0.2422
WHEELS WITH CONSTANT RPM	NO	NO	NO	0.50	0.50	0.50	2.942 0.245	0.2454 1.9627	2.9420 0.2454



CONCEPT for REDUCTION of JITTER EFFECT

**ANGULAR
JITTER,
arc sec**



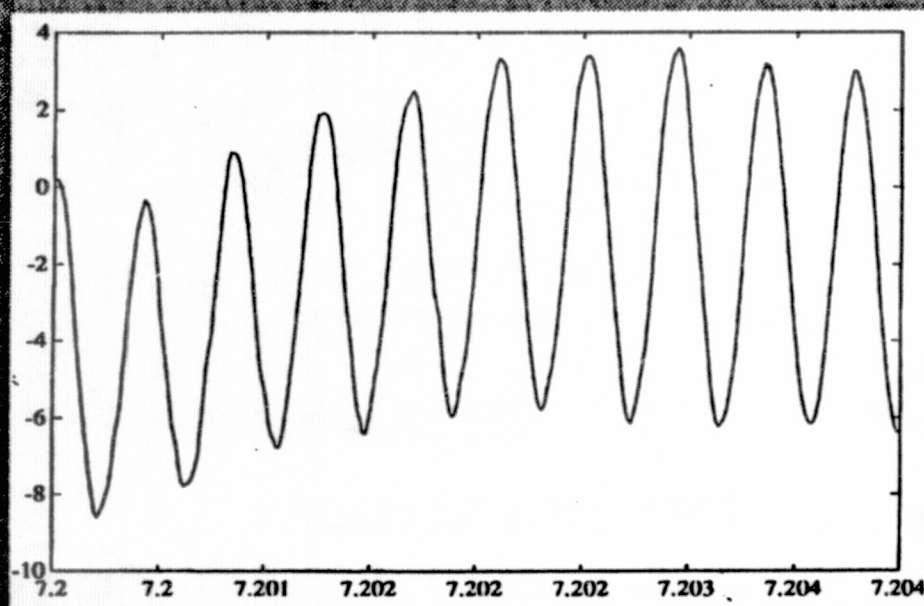


JITTER REDUCTION USING WINDOW SCHEDULING

ROLL DISPLACEMENT

Arc Sec

Roll

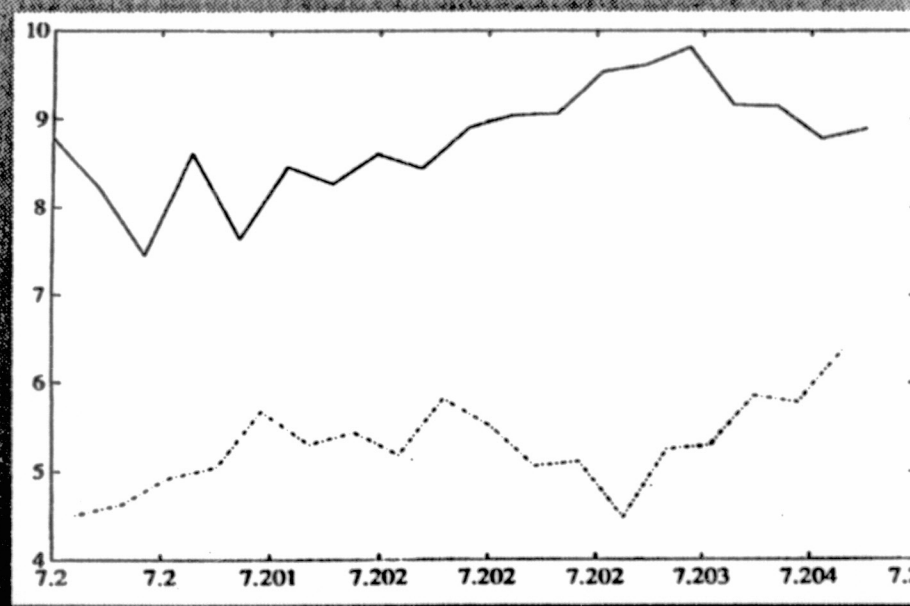


Time (Sec)

ROLL JITTER

ArcSec/ 2 Sec

Roll



Time (Sec)

MAY 1, 1992 - UARS DAY 0233



HIGHLIGHTS / LESSONS LEARNED

- **NEED FOR JITTER STUDY AND ACCELEROMETER**
- **INSTRUMENT / SUBSYSTEM DISTURBANCE ANALYSIS**
- **SOLAR ARRAY DRIVE**
 - Major jitter source correlated with ground track
- **UARS DISTURBANCE EXPERIMENT**
 - May 1 experiment data used solar anomaly analysis

JITTER REDUCTION METHOD FOR WIND II

DAMPING

RESULTS APPLIED TO EOS :

- SOLAR DRIVE DYNAMICS
- REACTION WHEEL DYNAMICS