

# FORMOSAT-3/COSMIC Program Status

**National Space Organization  
Taiwan**

**August 24, 2005**

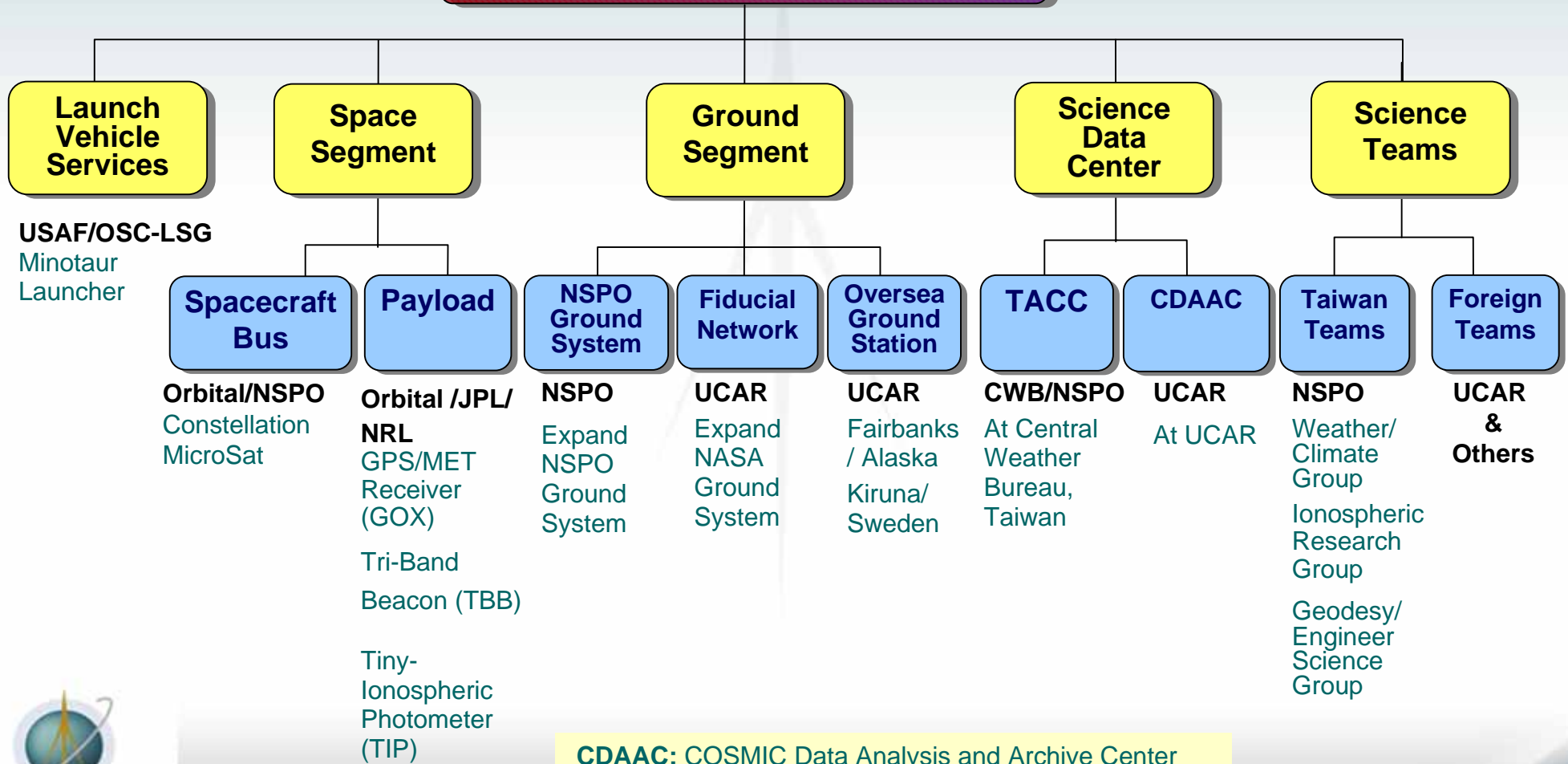


**NSPO**

NATIONAL SPACE ORGANIZATION

# Program Matrix

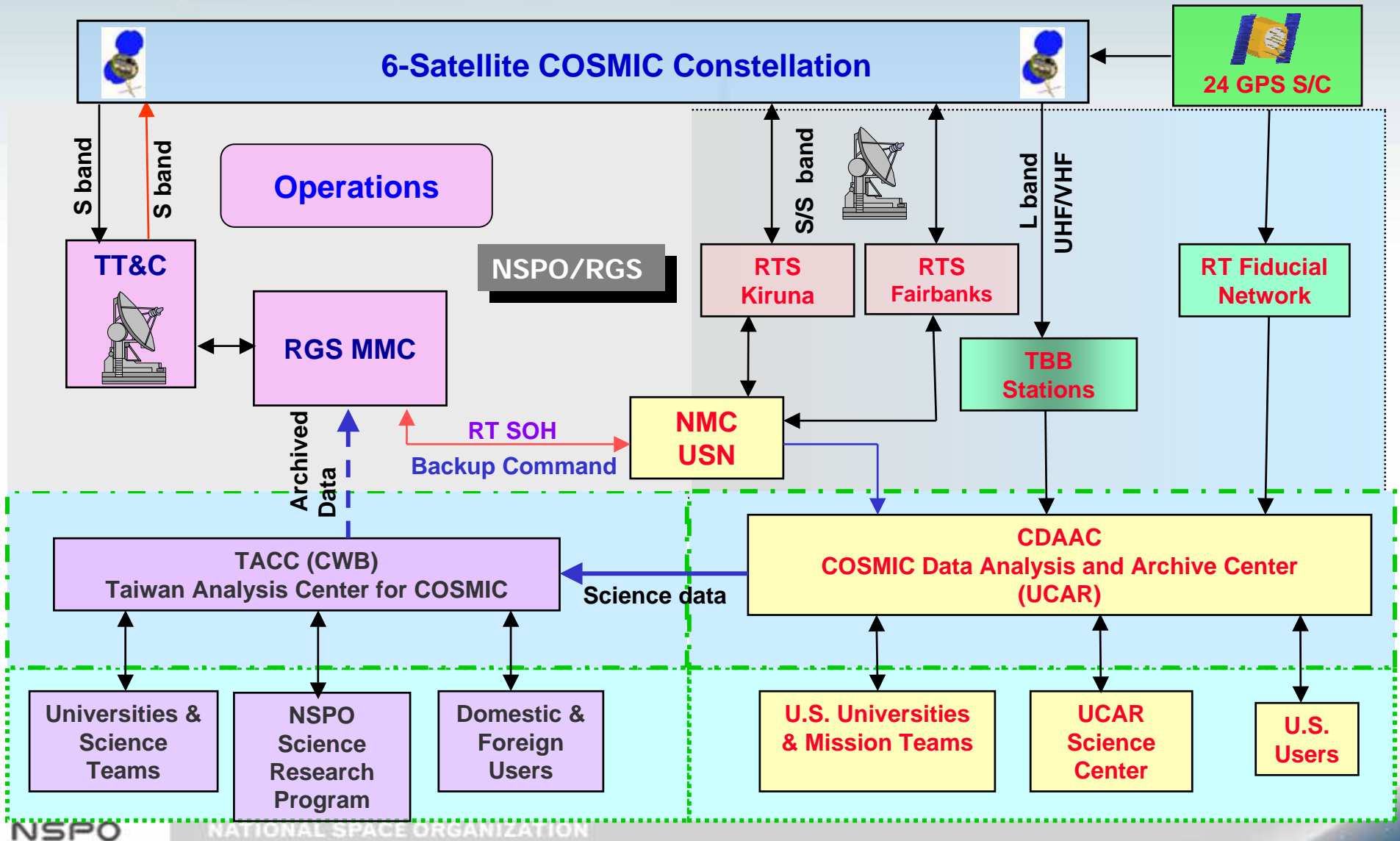
## FORMOSAT-3/COSMIC



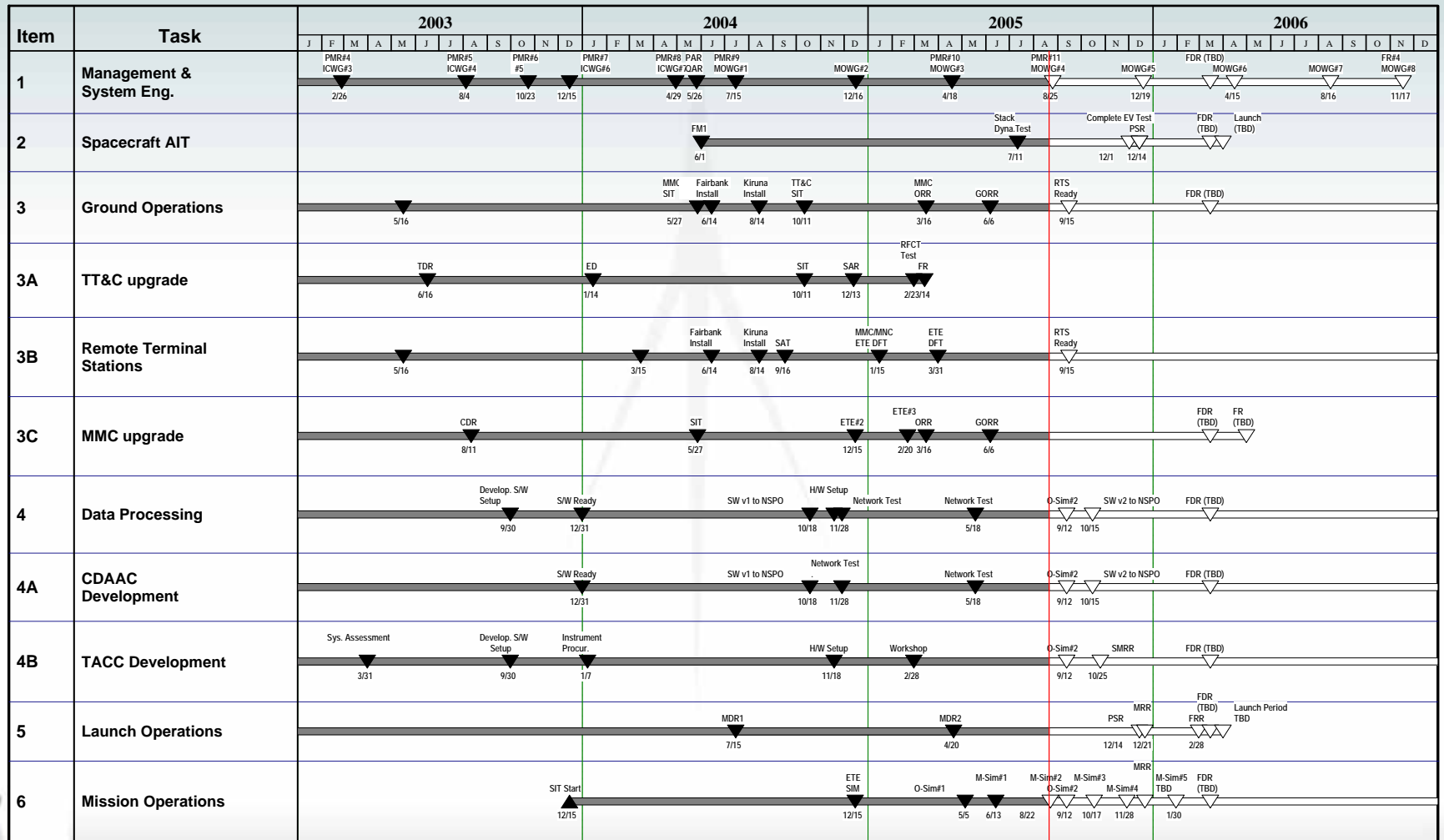
**CDAAC:** COSMIC Data Analysis and Archive Center  
**TACC:** Taiwan Analysis Center for COSMIC



# System Architecture

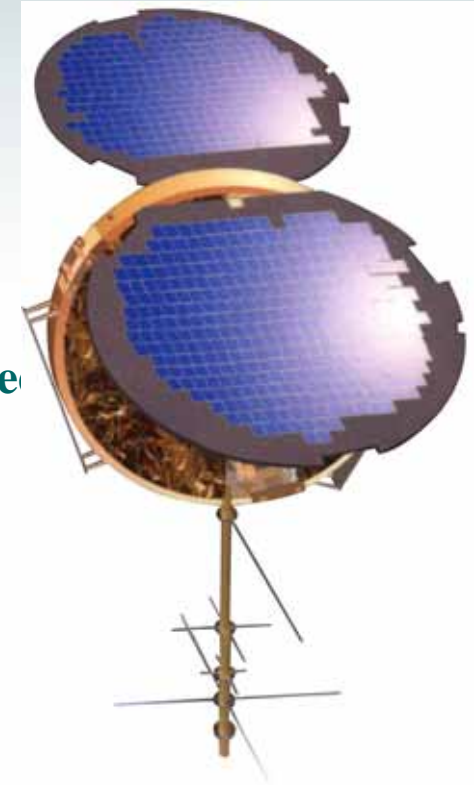


# FORMOSAT-3 Master Schedule



# FORMOSAT-3 Satellite

- **Mission Life : 2 years minimum.**
- **Design Life : 5 years.**
- **Constellation : consist of 6 satellites.**
- **Weight : 70 Kg/each (including propellant).**
- **Dimension : diameter 103 cm, height 16 cm; with two circular solar panel deployed at 121 degrees and 59 degree**
- **Payload Instrument:**
  - ✓ **GPS Occultation Receiver (GOX) By JPL**
  - ✓ **Tiny Ionospheric Photometer (TIP) by NRL**
  - ✓ **Tri-Band Beacon (TBB) by NRL**
- **Orbit Period : ~100 minutes.**
- **Mission Orbit : circular orbit, altitude 700-800 Km, inclination 72 degree.**



# FORMOSAT-3 Satellite Development

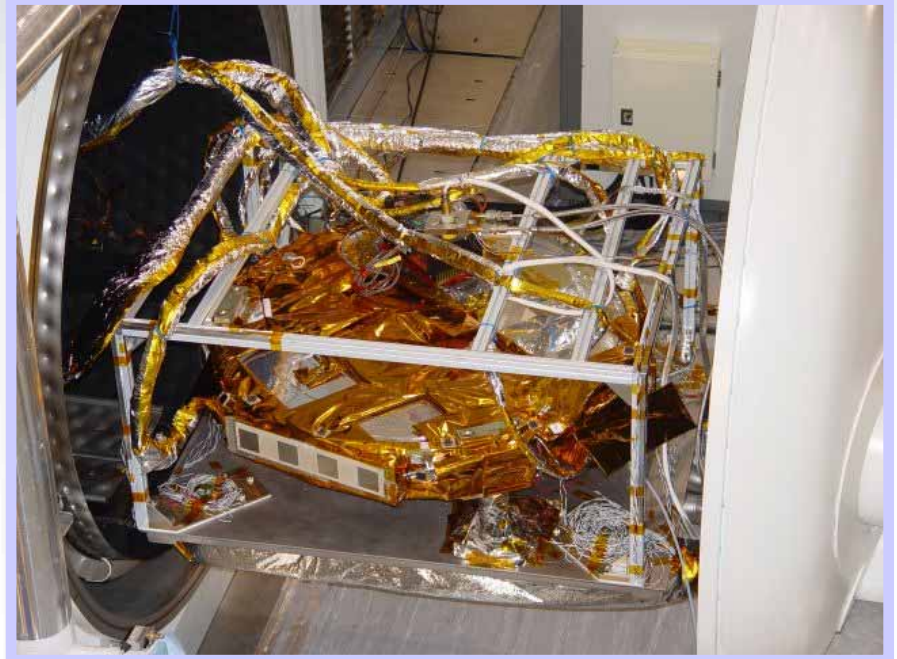
- **FM1 was assembled and tested, with participation of NSPO engineers, at Orbital and delivered to NSPO in July 2004.**
- **FM1 went through additional tests at NSPO.**
- **Kits for the remaining five satellites were shipped to Taiwan in summer 2004 for integration and test by NSPO team.**
- **NSPO started I&T work on June 1, 2004.**

# Satellite I&T Status at NSPO

Activities	FM 1	FM 2	FM 3	FM 4	FM 5	FM 6	Stacked
Assembly	Completed	Completed	Completed	Completed	Completed	Completed	N/R
Initial CPT	Completed	Completed	Completed	Completed	Completed	Completed	N/R
EMC	Completed	N/R	N/R	N/R	N/R	N/R	N/R
Pre-Dynamic Test Alignment	Completed	Completed	Completed	Completed	Completed	Completed	N/R
TV Test	Completed	Completed	Completed	Completed	Completed		N/R
Solar Array Assy	Completed	Completed	Completed	Completed	Completed	Completed	N/R
Mag. Calibration	Completed	Completed	Completed	Completed	Completed	Completed	N/R
Mass Property	Completed	N/R	Completed	Completed	N/R	N/R	N/R
Vibration Test	Completed	Completed	Completed	N/R	N/R	N/R	Completed
Acoustic Test	Completed	N/R	N/R	N/R	N/R	N/R	Completed
Propulsion Leak Test	Completed		Completed	Completed	Completed		N/R
Antenna Boom Auto Deployment Test	Completed	Completed	Completed	Completed	Completed	Completed	N/R
Solar Array Manual Deployment Test	Completed	Completed	Completed	Completed	Completed	Completed	N/R
Post-Dynamic Test Alignment	Completed	Completed		Completed			N/R
Final CPT			Completed	Completed			N/R
Characterization Test							N/R
Final Prep. At NSPO	N/R	N/R	N/R	N/R	N/R	N/R	12/20/2005

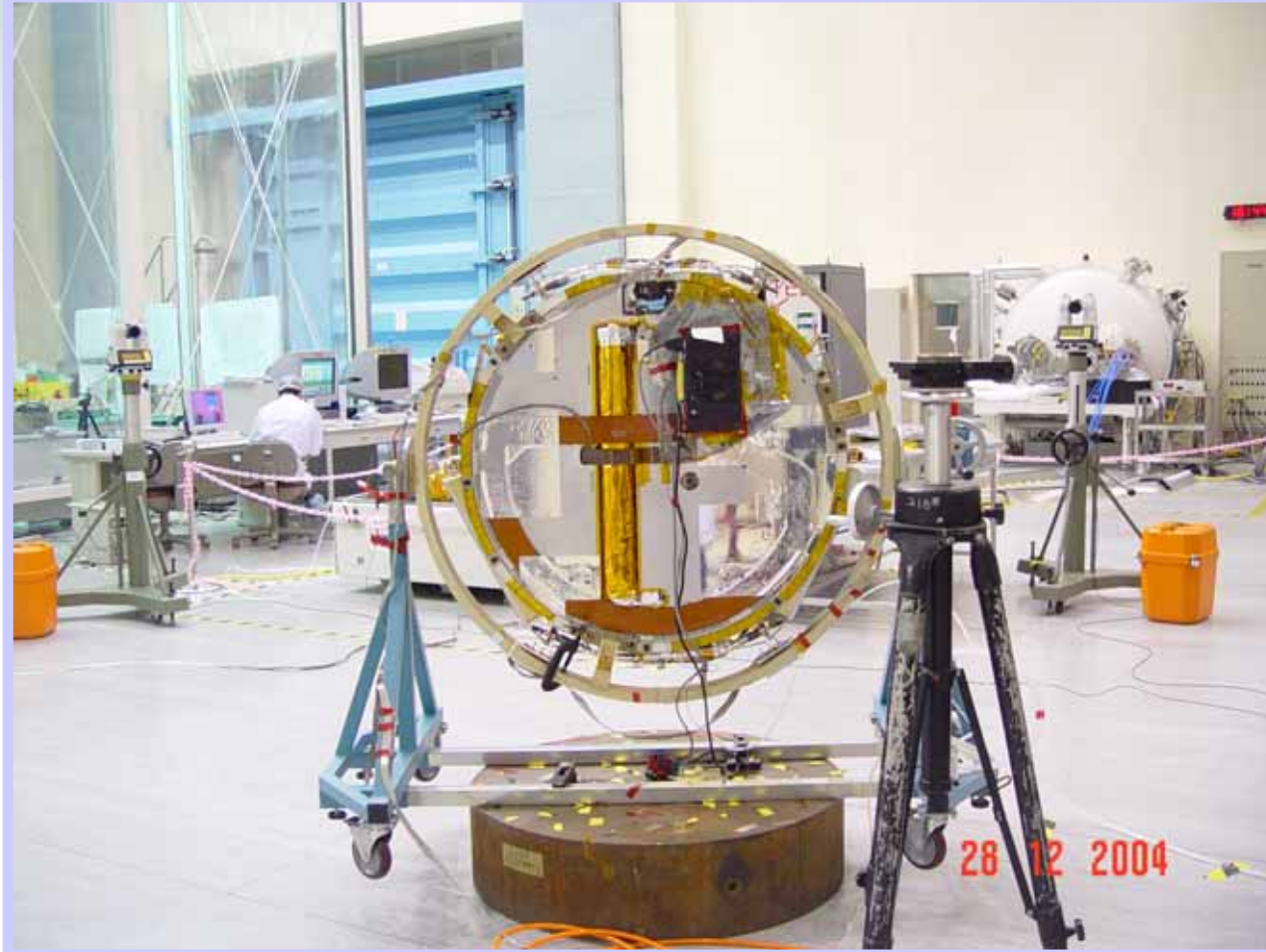


# TV Test

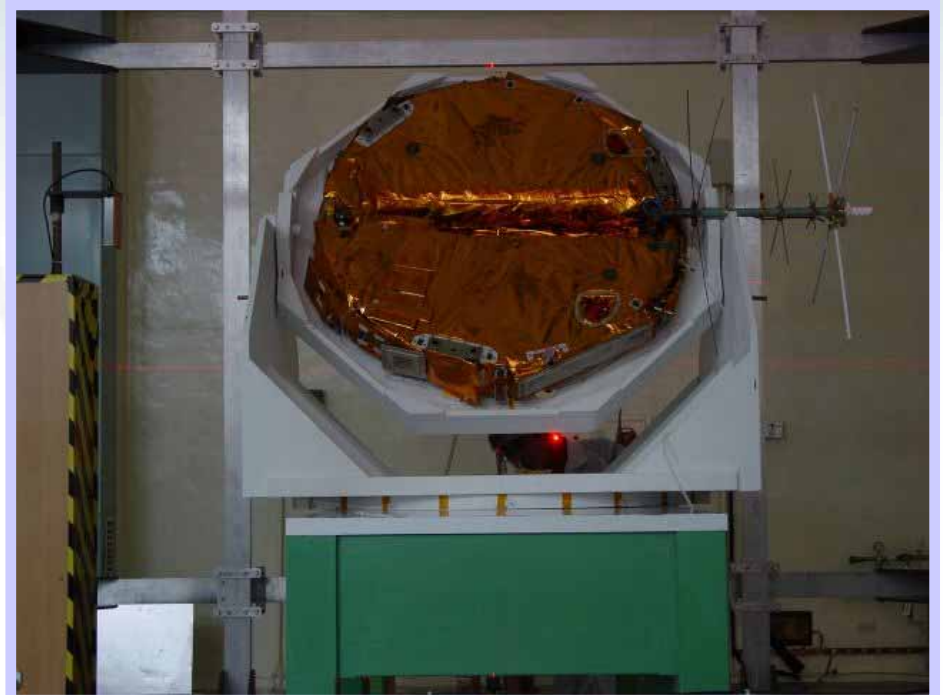




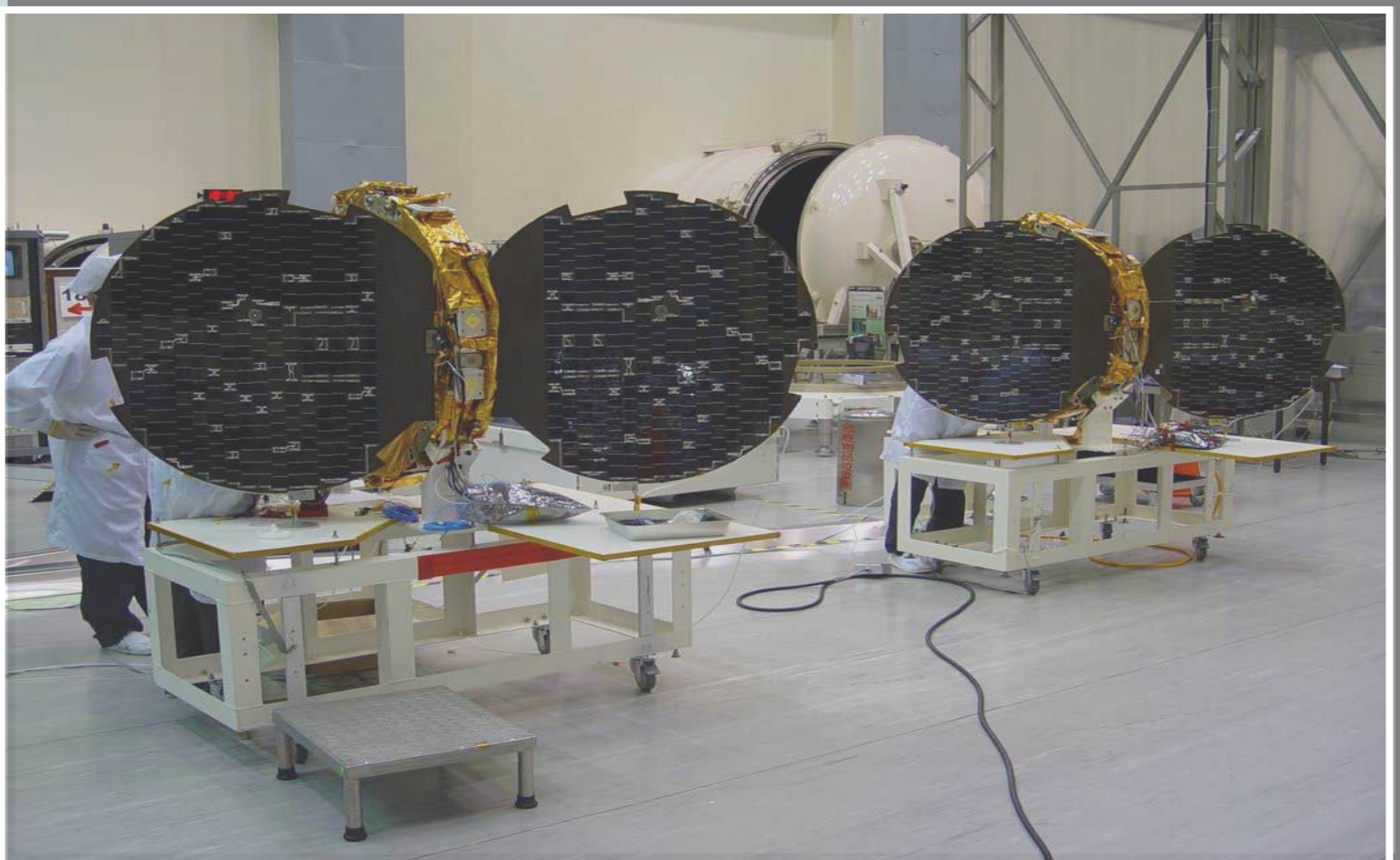
# Alignment Test



# Magnetic Calibration



# Solar Array Deployed Configuration



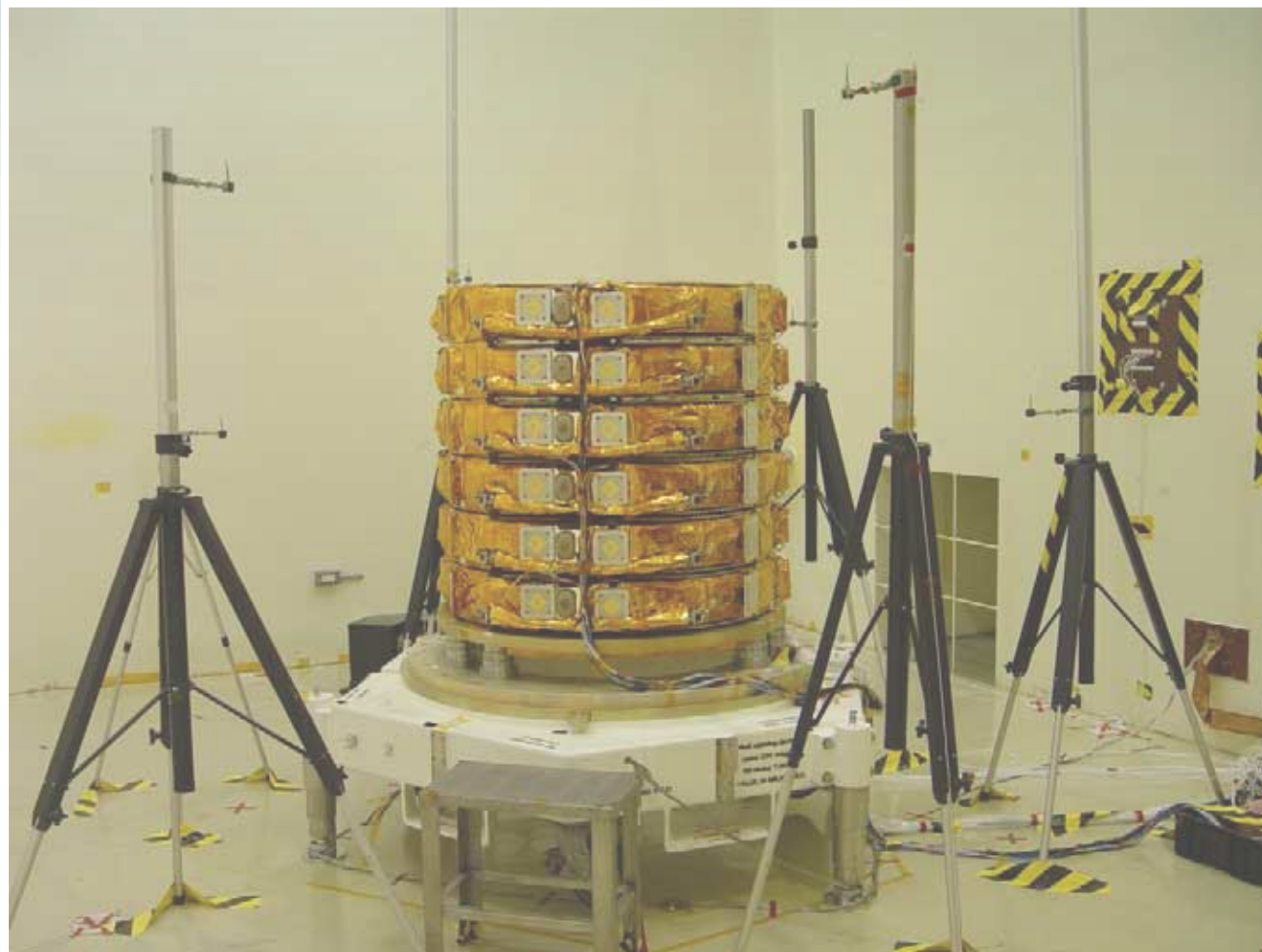
**FM4 (Left)**

**FM6 (Right)**

# Stacked Configuration for Dynamic Test



# Stacked Configuration for Acoustic Test



# NSF/UCAR at NSPO I&T Facility



# Launch Operation

## ➤ **USAF Minotaur LV**

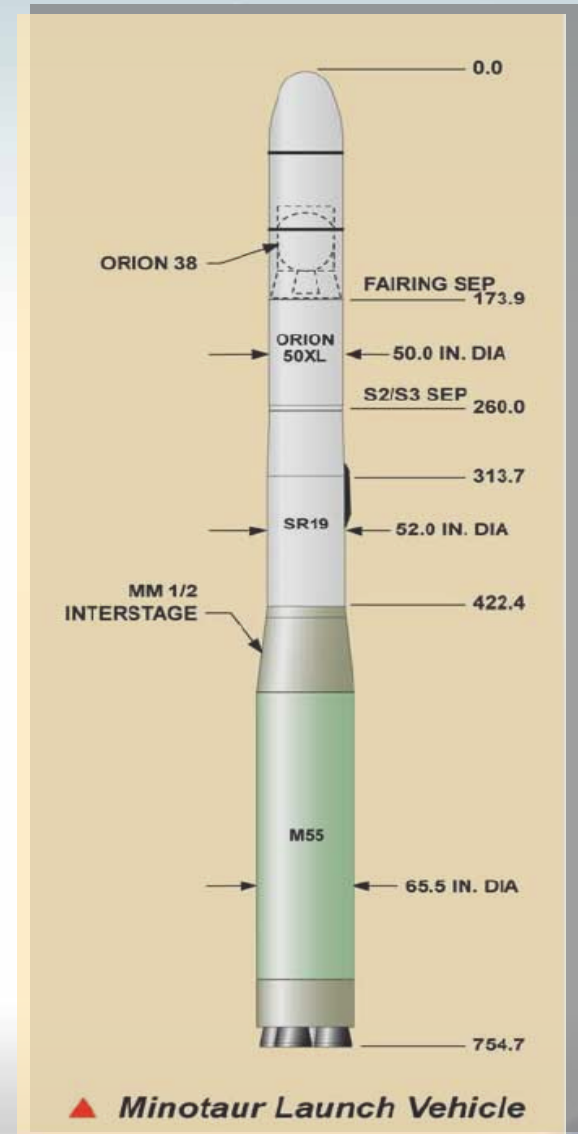
- ✓ **NSPO Funded \$15 M and DoD STP Funded \$4.5 M**
- ✓ **Three successful launches in 1/00, 7/00, and 4/05**
- ✓ **Launch vehicle development in progress**

## ➤ **Launch Campaign**

- ✓ **Launch site survey and range working group meeting hold in August 2005**
- ✓ **Launch window is being coordinated with USAF**
- ✓ **Complete S/C readiness for shipment by yearend**
- ✓ **The launch site operations will take approximately 75 days**

# Launch Vehicle (1/2)

- **USAF Minotaur LV**
  - ✓ **The LV consists of 4-stages solid fuel motor**
  - ✓ **Total height : 19.21 meter**
  - ✓ **Total weight : 36.2 tons**
- **Three successful launch since 2000.**

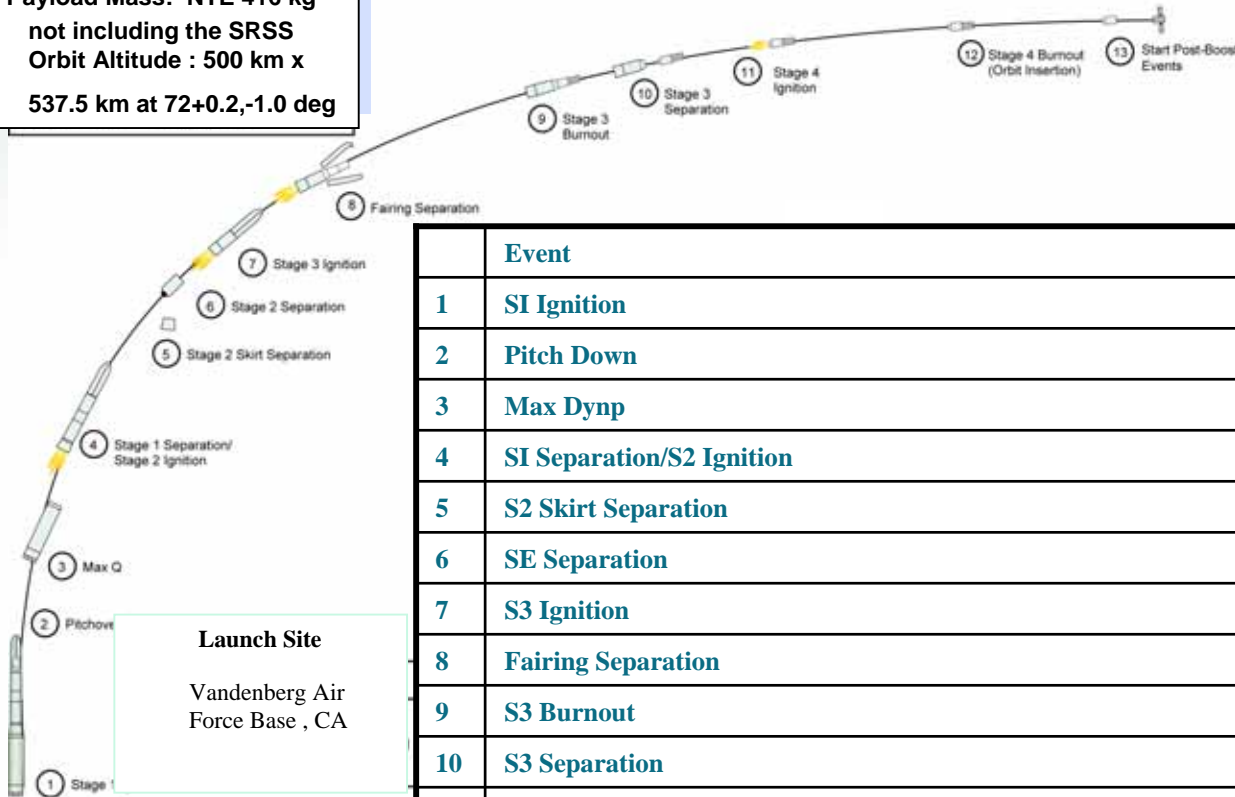




# Launch Vehicle (2/2)

## Mission Parameters

Payload Mass: NTE 416 kg  
 not including the SRSS  
 Orbit Altitude : 500 km x  
 537.5 km at 72+0.2,-1.0 deg



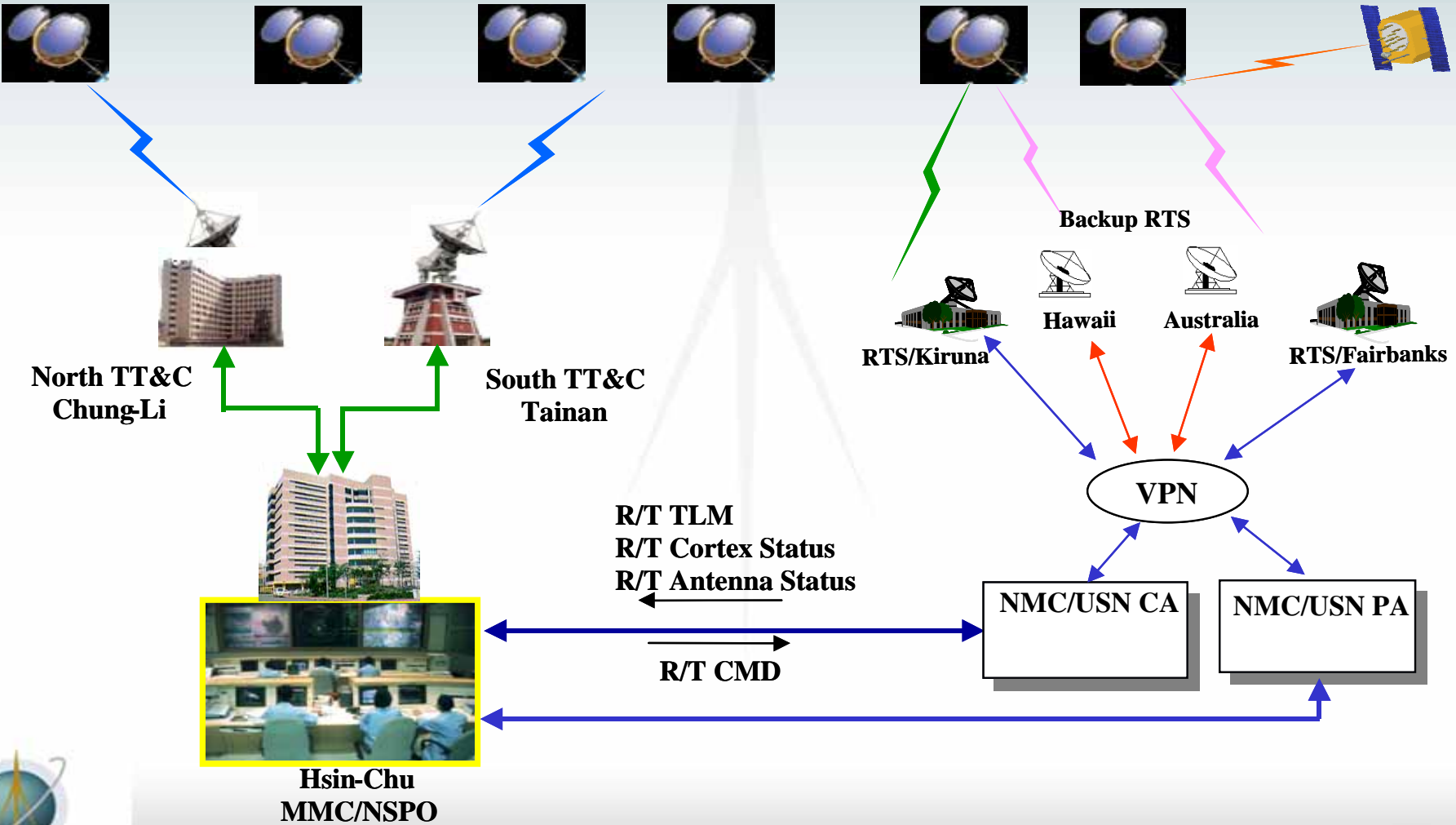
## Launch Site

Vandenberg Air  
 Force Base , CA

	Event
1	SI Ignition
2	Pitch Down
3	Max Dynp
4	SI Separation/S2 Ignition
5	S2 Skirt Separation
6	SE Separation
7	S3 Ignition
8	Fairing Separation
9	S3 Burnout
10	S3 Separation
11	S4 Ignition
12	S4 Burnout
13	Payload Separation
14	CCAM



# FORMOSAT-3 Ground System



# Ground System (1/2)

## ➤ Multi-Mission Center

- ✓ Upgrade NSPO system to accommodate the mission operations of FORMOSAT-3 constellation.

- » *System integration and test completed in October 2004.*

- » *Operation readiness review successfully conducted in March 2005.*

## ➤ TT&C Stations Upgrade

- ✓ Upgrade Taiwan TT&C stations with CORTEX, Up/Down Converters, and Monitor and Control Unit.

- » *System integration and test completed in October 2004.*

- » *The systems have been in operation since May 2005.*

# Ground System (2/2)

## ➤ Remote Tracking Stations

- ✓ **Construct RTS sites in Fairbanks, Alaska and Kiruna, Sweden.**

- » *Complete system acceptance test in September 2004.*

- » *Establish communication line (VPN/ADSL) between Mission Control Center and RTS.*

- » *End-to-end test is on-going.*

# Multi-Mission Center at NSPO



# TT&C Stations at Northern/Southern Taiwan



**S/S-Band TT&C Station  
(NCU, Chung-Li)**



**S/S-Band TT&C Station  
(NCKU, Tainan)**

# Remote Tracking Stations



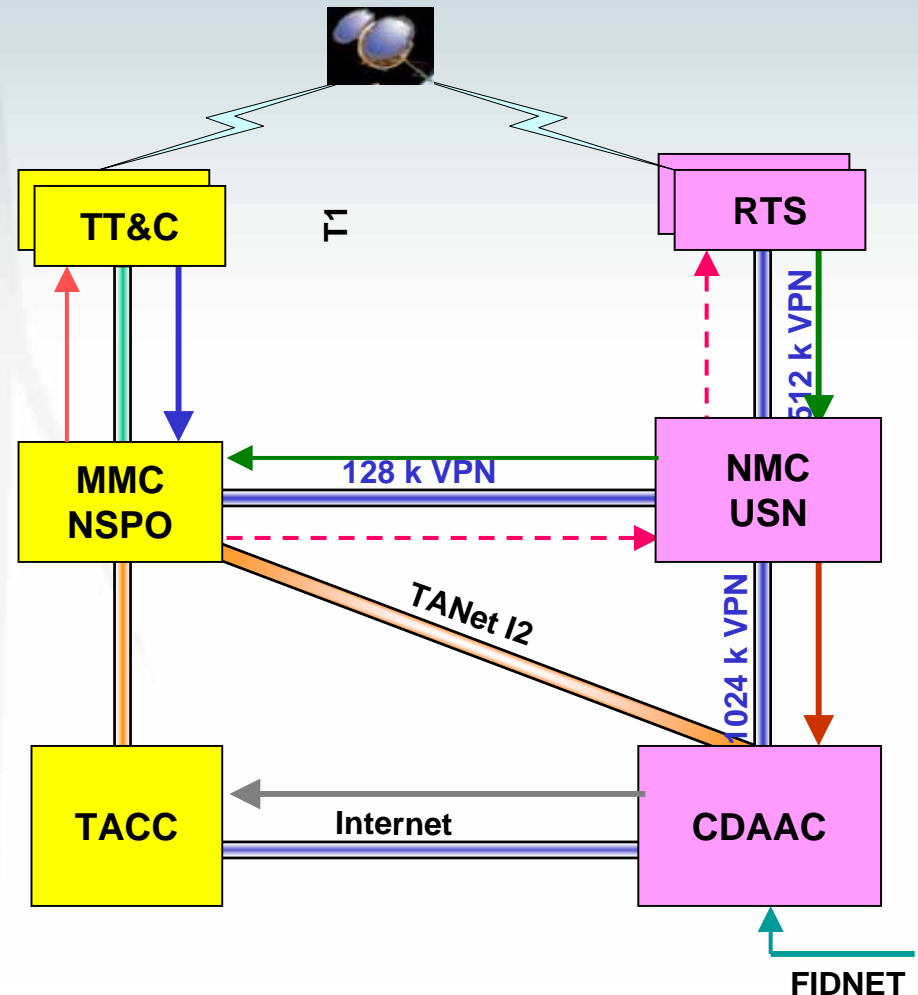
**RTS at Alaska**



**RTS at Kiruna**

# Ground Communication Network and Science Data Flow

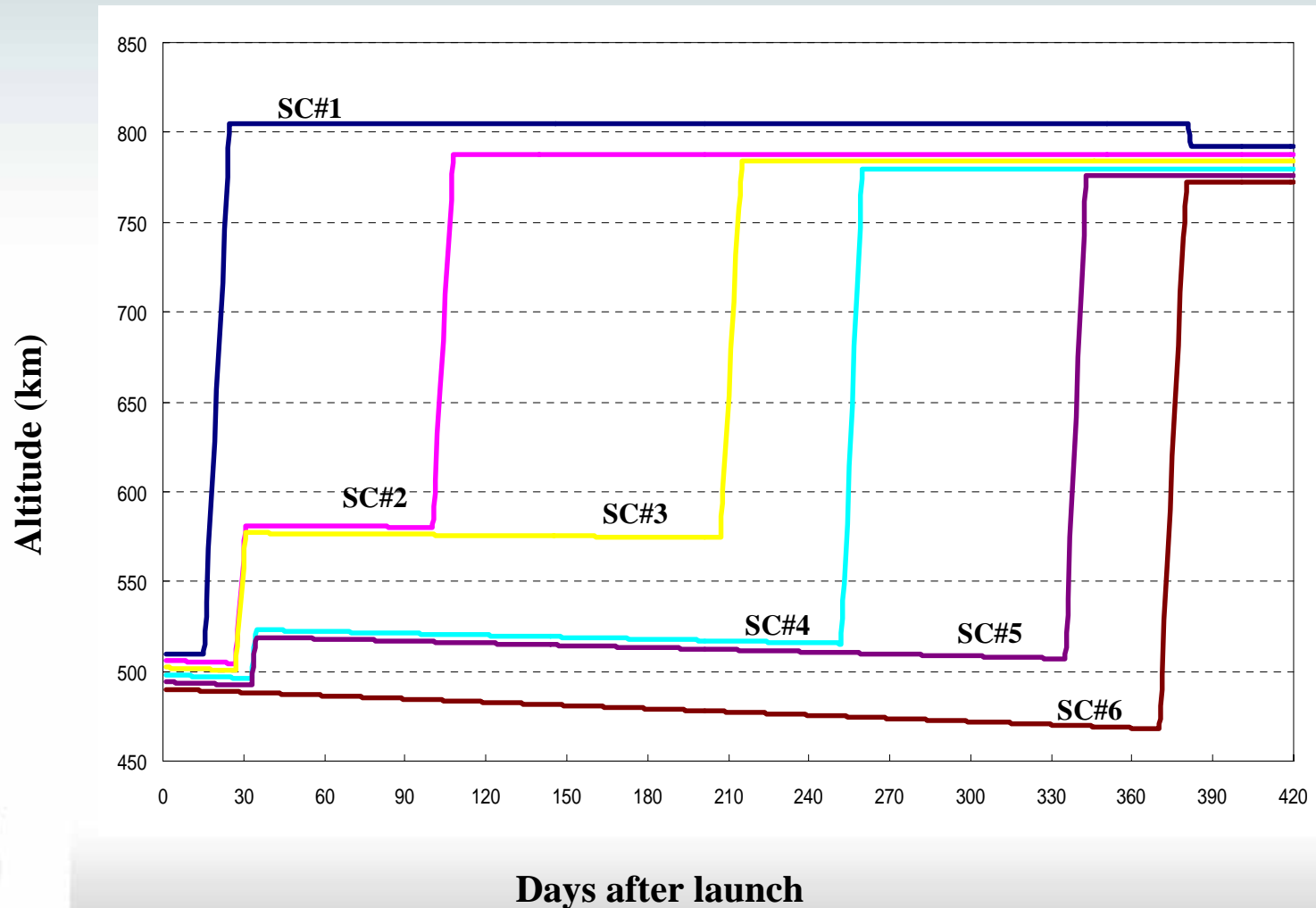
- **Command:**
  - ✓ Normal: MMC → TT&C → SC
  - ✓ Backup: MMC → NMC → RTS → SC
- **Telemetry:**
  - ✓ Real-time:
    - SC → TT&C → MMC
    - SC → RTS → NMC → MMC
  - ✓ Back Orbit
    - Normal: SC → TT&C → MMC
    - Backup/L&EO: SC → RTS → NMC → MMC
- **Payload science data (GOX & TIP)**
  - ✓ SC → RTS → NMC → CDAAC
- **Other science raw data (GPS FID, TBB)**
  - ✓ FIDNET → CDAAC
- **Science data Re-transmission**
  - ✓ CDAAC → TACC



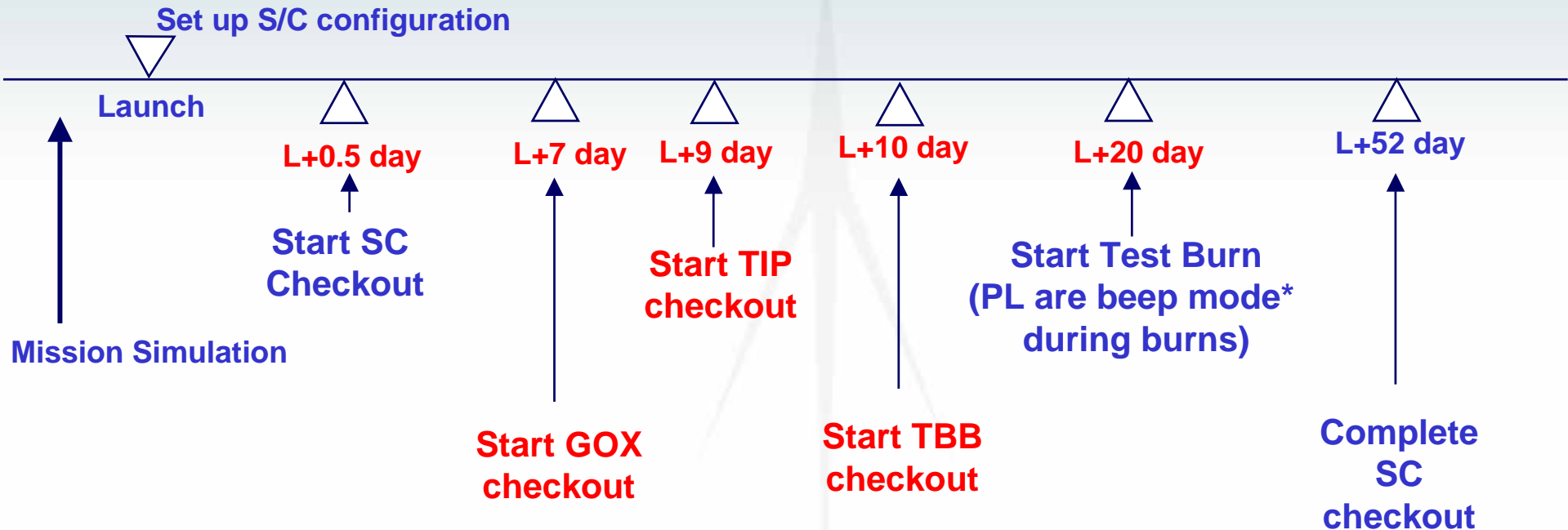
•The system is expected to receive ~200 occultation events for every orbit. The system will then process, archive, and transmit within 3-hours to weather forecasting models.



# FORMOSAT-3 Deployment Timeline



# Payload Checkout Plan



- ◆ **PL Beep mode:**
  - GOX at Beep mode**
  - TIP and TBB at Off mode**

# Data Policy (1/2)

- **The Data Distribution Policy is effective for the first two years**
- **FORMOSAT-3/COSMIC data will be provided at no cost or at the cost of reproduction and distribution.**
- **A “data use agreement” is required for the use of data and products.**
- **Users will register through Taiwan (TACC) site.**
- **The review and approval are to be made jointly by both NSPO and UCAR.**

# Data Policy (2/2)

- **The neutral atmosphere data products will be distributed near real-time after processing to NESDIS which will distribute via the GTS to weather centers.**
- **All Data and Product are available each day for Science Research.**
- **The raw FORMOSAT-3/COSMIC data (e.g., GPS phase and amplitude data) will not be distributed in real time. Requests for the real-time raw data will be reviewed jointly by the NSPO Director General and the UCAR President.**
- **Some additional limitations may be placed on data products at the request of the specific Principal Investigator's requiring data check-out times.**

# Conclusions

- **Satellite I&T are progressing well.**
- **Ground system upgrade is completed.**
- **Mission operation simulation and training are on-going.**
- **Launch vehicle development is on track.**
- **Range operation activities are being coordinated.**
- **Launch target date is March 2006**
  - ✓ **Launch slot finalization still needs coordination among all parties.**