CONTOUR Mission Operations

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Agenda

- Operational Requirements Division
- Operational Interfaces
- Operations Preparations
- Preparation Schedule
- Post Launch Operations

Division of Operational Requirements

JHU/APL Requirements :

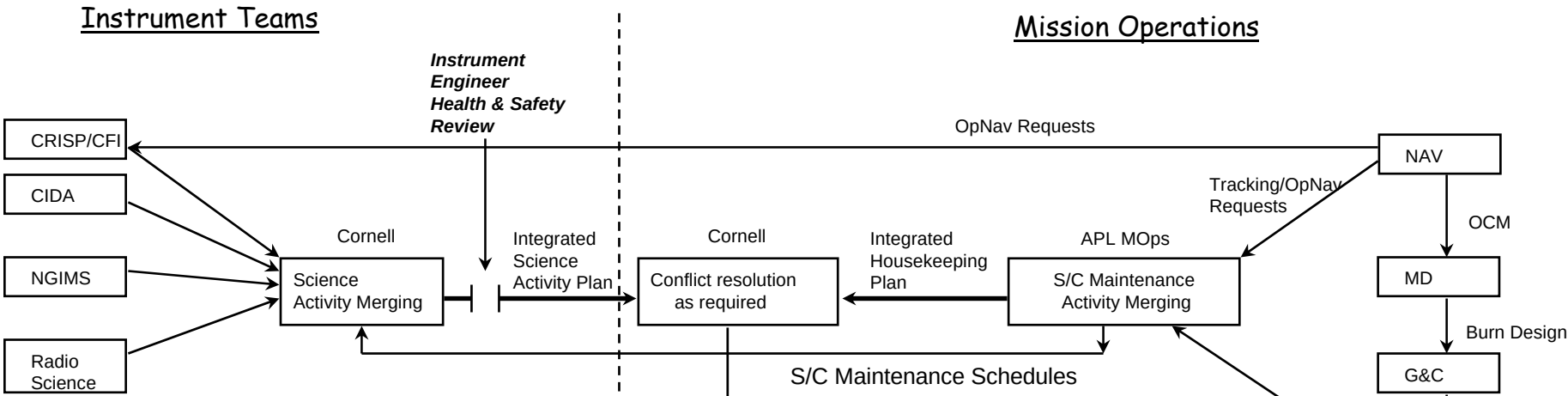
- Uplink of all commands
- Real-time S/C & Instrument Monitoring
- Planning of all S/C housekeeping activities (Buns, SSR ops …)
- Merge Instrument & Housekeeping commands
- Command load review & testing
- Spacecraft health and safety (prime)
- Instrument health and safety check (secondary to instrument teams)
- DSN Scheduling
- Long Term S/C trending
- Post event S/C assessment and process improvement

Planning & Scheduling

Science Team Requirements

- Plan and implement all instrument activities including calibrations
- Instrument activity command review, test, and delivery (SASF format)
- Development and delivery (TBD format) of flight software loads
- Instrument activity planning coordination - conflict avoidance (i.e. CRISP vs. CIDA ops)
- Instrument health and safety checking
- Verify activities within spacecraft operating constraints (“smart requests”)
  - Spacecraft health and safety (secondary)
- Timely delivery of instrument commands as per TBD delivery schedules
- Post event assessment and process improvement

Planning Interfaces

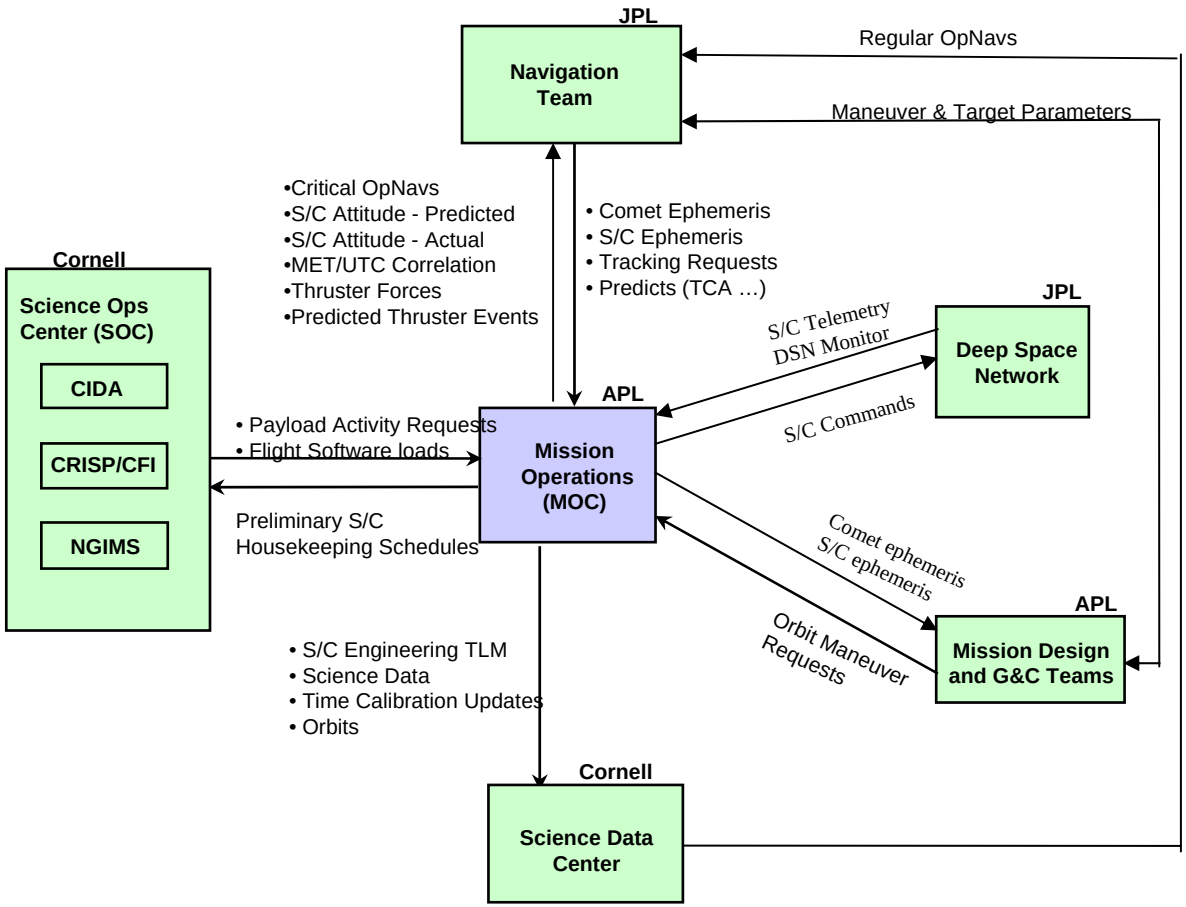


Primary Responsiblities :

- Opportunity analysis
- Integrated instrument plans for all mission phases
- Canned Activity Sequence (CAS) and fragment design with Mops support
- CAS review with Mops
- Participate in sequence testing
- Submit , conflict free, instrument safe, science activity requests to MOPS on mission event driven intervals

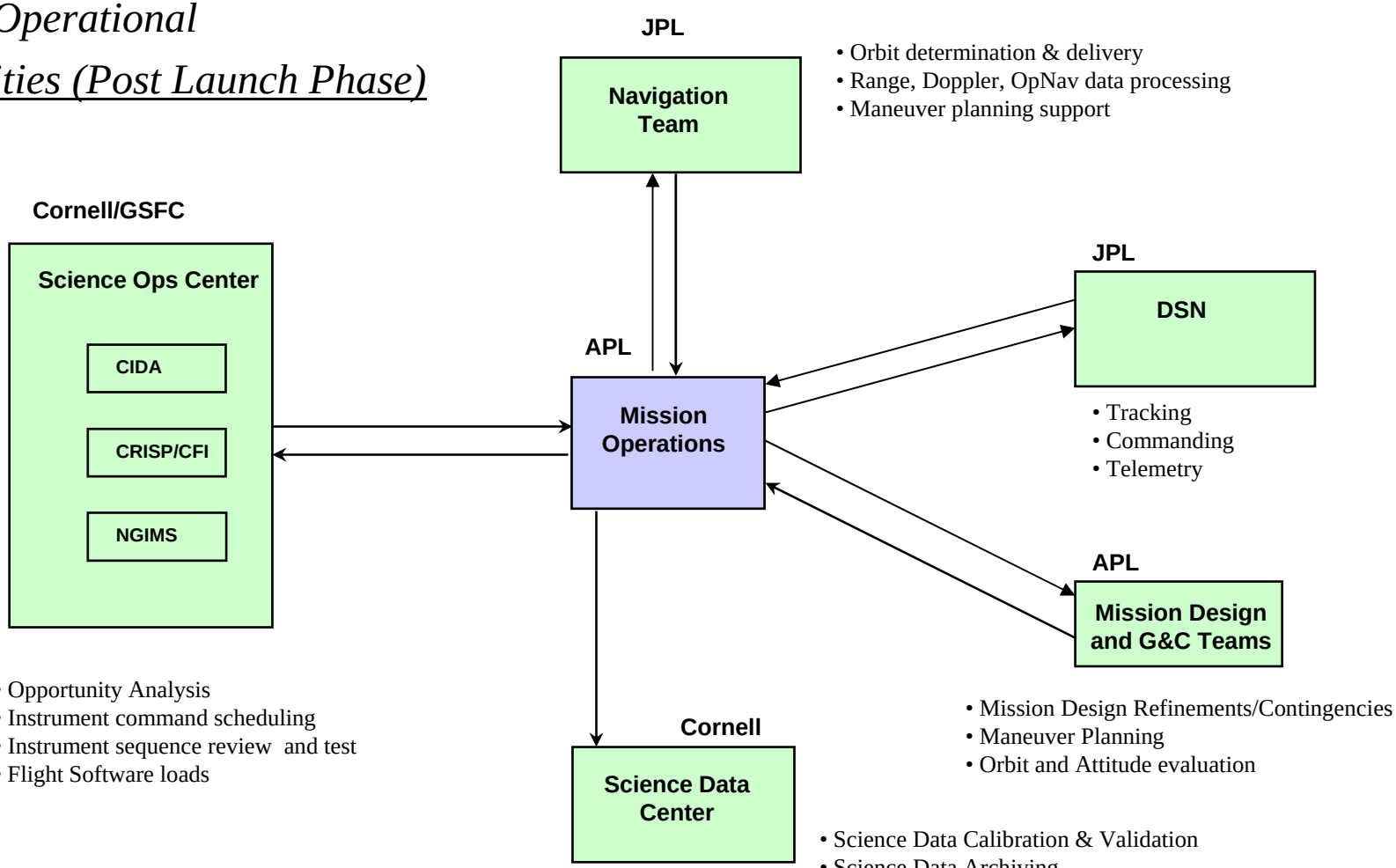
Primary Responsibilities :

- CAS and fragment development & test for S/C , assist for instruments
- Merge all command requests into S/C command loads.
- Perform S/C health and safety checks on all command loads
- Uplink commands
- Assess S/C performance


JPL
Navigation Team
Regular OpNavs
Maneuver & Target Parameters
•Critical OpNavs
•S/C Attitude - Predicted
•S/C Attitude - Actual
•MET/UTC Correlation
•Thruster Forces
•Predicted Thruster Events
• Comet Ephemeris
• S/C Ephemeris
• Tracking Requests
• Predicts (TCA …)
Cornell
Science Ops Center (SOC)
CIDA
CRISP/CFI
NGIMS
JPL
Deep Space Network
S/C Telemetry
DSN Monitor
S/C Commands
APL
Mission Operations (MOC)
• Payload Activity Requests
• Flight Software loads
Preliminary S/C Housekeeping Schedules
Comet ephemeris
S/C ephemeris
Orbit Maneuver Requests
APL
Mission Design and G&C Teams
• S/C Engineering TLM
• Science Data
• Time Calibration Updates
• Orbits
Cornell
Science Data Center

Division of Operational

Responsibilities (Post Launch Phase)



Prelaunch Operations

- Define planned instrument activities (activation, calibration, Encounter …)
- Develop STOL procedures for Real-time operations (S/W loads, contingencies…)
- Develop reusable command blocks for activities initiated via onboard C&DH timetagged command sequences and macros.
  - Use Fragments defined to basic operations (On, Off, Mode changes …)
  - Collect Fragments into Canned Activity Sequences (CAS) for more complex operations
  - Build 1 - Launch and early operations
  - Build 2 - Encounter operations
- Test STOL scripts and Seg_gen generated commands with CONTOUR spacecraft (as available) and simulators (Statesim and S/C Simulator).
- Test instrument flight software (CFI/CRISP DPU's, CIDA and NIGMS flight processors) with sequences developed

Prelaunch Operations Continued

- Support testing of MOC, SOC, and CONTOUR interfaces, rehearsals ….
- Define and develop operating constraints/rules/models for load check process
- Integrate operating constraints/rules/models and command blocks into SEQ_GEN
- MOps to work with subsystem engineers to develop S/C user's Guide. Instrument teams are strongly encouraged to do the same for instrument operations (hint hint …).
- Develop Spacecraft and Ground System Standard and Contingency Operating procedures for launch and cruise operations. Instrument contingency procedures also required to expedite instrument recovery and safeing.

Key Dependencies of Operations Preparations Schedule

- Instrument TLM & CMD Specifications
- Instrument TLM & CMD Database Definitions
- Ground & Flight Systems Availability :
  - Real-time MOC (Epoch 2000)
  - MOC Planning and Scheduling (Seq-Gen) Systems
  - Command “Glueware” between Epoch and Seq-Gen
  - Flight Software availability
  - CONTOUR Spacecraft Availability
  - CONTOUR Spacecraft Simulator Availability

Key Dates - Spacecraft and Ground System Development

Instrument Deliveries :

- NIGMS Delivery 9/01
- CIDA Delivery 9/01
- CRISP Delivery 11/30/01
- CFI Delivery to 11/01/01

S/C integration and Test:

- CIDA 9/14/01
- NIGMS 9/05/01
- CFI 11/02/01
- CRISP 12/03/01

S/C and Instrument Environmental Tests 1/29/02-5/03/02

Proposed Schedule for Operations Preparations	Proposed Dates
Instrument Activity and Operating Rule Definitions - Build 1 (Early operations)	**3/01 - 4/01**
MOC Planning & Scheduling Initial Delivery	3/01 (desired)
Instrument & S/C Flight Software Initial Delivery (required for software simulator)	3/01 (desired)
Initial Command Database	3/01 (desired)
Translate Build 1 Activities and Rules to Software	**4/01 - 6/01**
Instrument Activity and Operating Rule Definitions - Build 2 (Encounter Operations)	**4/01 - 7/01**

Translate Build 1 Activities and Rules to Software	**6/01 - 9/01**
MOC S/C Software Simulator and MOC command processing Initial Delivery	**8/01 (desired)**
Command Block and Rule Testing w/Statesim	**9/01 - 5/02 (desired)**
Command Block and Rule Testing w/Flight hardware	**9/01-5/02 (desired)**
MOC/SOC Data Flow Simulations and Testing	**11/01 - 5/01**
Freeze Build 1 CAS, Frags, Rules	**5/02**

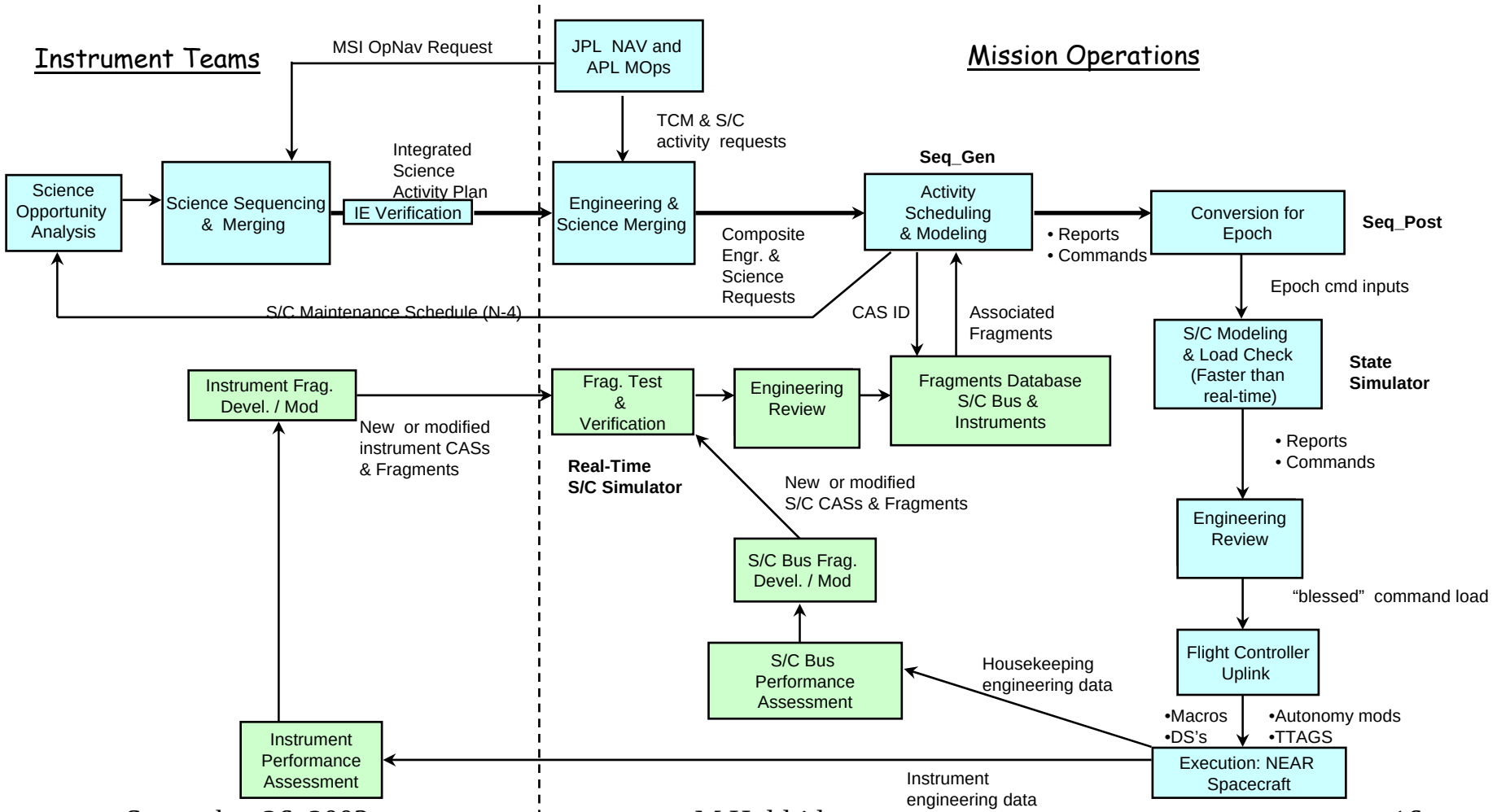
Key Dates - Post Launch Flight Operations

Launch	7/01/02
Phasing Orbits	7/1-8/15/02
SRM Firing	8/15/02
Instrument Checkouts	7/01 - 10/01/02
Hibernation Entry	~10/01/02
Complete Build 2 Sequence Creation & Test	10/01/02 - 7/1/03
Hibernation Exit/Encke (Build 2) Preparations	~7/1/03

Post-Launch Operations (non-hibernating)

- Refine and test reusable command blocks for encounter operations.
- Coordinate review and testing of command sequences (flight and ground)
- Perform necessary commanding via tested and approved command sequences
  - Δ V's, Spin Attitude Maneuvers
  - Housekeeping activities (SSR operations, Subsystem configuration control …)
  - Encounter operations
- In close coordination with spacecraft engineering team, monitor critical spacecraft and instrument health and status parameters verses operating limits and timeline during real-time DSN supports. Instrument teams to monitor long term health of instrument.

Command Process - Nominal



CAS = Canned Activity Sequence = Composed of fragments that include all commands required to accomplish a given S/C activity/objective

Critical Command Loads

Definition: A critical spacecraft activity is defined as one that could pose a significant risk to the spacecraft or mission if its contents are not executed successfully on time (i.e., SRM Firing & Encounter).

Process: Put commands through all the same checks as a nominal load plus:

- Sequence Preliminary Design Review
- S/C Simulator end-to-end real-time testing
- Sequence modification
- Final command and simulator test results review
- Sequence final "go" / "no go" decision