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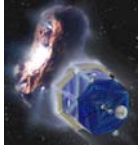
PDR



CONTOUR Science Sequencing

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October 2, 2000

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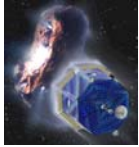
Roles of Science Scheduling Coordinator

WORK WITH MOPS AND SCIENCE TEAMS TO DEVELOP SEQUENCE GENERATION PROCESS:

- Want a process that fits needs of each instrument team as well as Mission Ops
- Responsibilities differ for each instrument

ASSIST WITH DEVELOPMENT OF SCIENCE SEQUENCING TOOLS:

- Provide feedback to CRISP/CFI/G&C command definition process, make sure that calibration and encounter activities as envisioned are commandable
- Support development and testing of SEQGEN CAS/Fragments, implementation of modeling and constraint checking in SEQGEN for all instruments
- Develop conceptual design for simulation and sequence generation s/w for CRISP/CFI which will include guidance commanding



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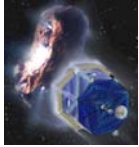
Roles of Science Scheduling Coordinator

COORDINATE PLANNING OF ALL SCIENCE ACTIVITIES:

- Maintain cognizance over planning and execution of all science activities, including real-time commands, and in-flight tests.
- Interact with MOps for scheduling and integration of normal science activities, work instrument or operational conflicts and other operational issues
- Prepare schedules and timelines for science sequence development, and make sure we keep to deadlines (nag, nag, nag)

SEQUENCE DEVELOPMENT:

- Detailed design of observations for CRISP, CFI (includes OpNav)
- SEQGEN implementation of CIDA sequences
- Merge and run all instrument SEQGEN input files (CRISP, CFI, CIDA and NGIMS), coordinate reviews and correction of conflicts or constraint violations
- Deliver final sequences to MOps



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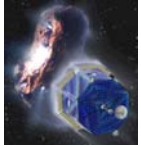
Science Sequencing Processes

Normal Sequence Generation Process:

- Scheduling requests for science activities must be made to Mops via standard SEQGEN request file using approved CAS and Fragment blocks.
- How those files are created is at the discretion of each individual instrument team
- Final merge of all science instrument files and constraint check will occur at Cornell
- We are required to deliver a set of files (one for each instrument, or a merged file) that is conflict free and will not violate health and safety of s/c or any instrument.

Real-time Command Generation Process:

- Not defined yet
- Real-time commands will be generated by different process than above.
- Probably will not pass through SEQGEN process as described above. Instrument engineers probably will deliver these directly to MOC. SSC will be cognizant but not directly in the loop.



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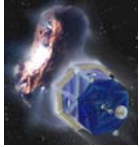
Science Sequence Generation Software => Two-step process

INSTRUMENT SEQUENCE GENERATION S/W:

- Instrument-specific software which assists with ‘opportunity analysis’, and also with generation of command sequences
- Unique for each instrument
- Ultimately must convert command sequences into standard SEQGEN sasf input file based on approved CAS/Fragment definitions

SEQGEN

- Project-maintained s/w, final validation of sequences, models s/c resource usage
- Graphical representation of instrument and engineering activities, DSN contacts, simulation of s/c resource use, etc
- May run with individual instrument input, all science instruments merged, or with engineering activities merged



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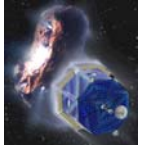
Science Sequence Modeling & Constraint Checking

INSTRUMENT SEQUENCE GENERATION S/W

- May evaluate instrument health and safety
- May evaluate s/c health when pertinent (CRISP/CFI s/w will model s/c pointing)
- Must address the question of whether the activity makes sense (SEQGEN will not do this)
 - Validity of planned calibration or science activity
 - Will the commanded s/c pointing produce expected results?

SEQGEN and STATESIM

- In most cases, will evaluate instrument operating rules required to maintain instrument health
- Will evaluate spacecraft health and safety
- Will model common use resources (SSR usage, s/c commanding rates, pointing control)

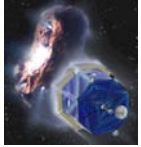


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'Flyby': CRISP/CFI Opportunity Analysis and Sequence Generation Software

- reads SPICE (comet and s/c ephemerides, etc)
- generates visual representation of comet and other targets, instrument FOVs
- simulates s/c pointing and CRISP mirror motion
- simulations generated by structures equivalent to defined CASs and Fragments for CRISP/CFI instrument operation and guidance & control commanding
- *modeling and constraint check:*
 - s/c pointing constraints
 - check that we are using valid CAS and fragments, parameters within range, but will not check instrument operating rules
 - quality of science return
- *output:*
 - archive request files for each observation, equivalent to CAS format
 - SEQGEN 'sasf' in standard format for input
 - image frame data files (viewing geometry, sun angles, s/c orientation, smear, etc)
 - plots



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Science Activity Conflict Avoidance

SPACECRAFT POINTING:

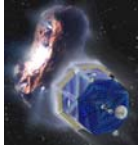
- All s/c pointing for science operations will be commanded through the CRISP/CFI CASs
- Any conflict of desires among instruments for s/c pointing will be resolved before sequence generation and I will implement what ever is agreed upon
- SEQGEN will catch any pointing conflicts between science and engineering

SSR USAGE

- Allocations for each instrument will be distributed with ops guidelines for calibrations or encounter activities
- It is the responsibility of each instrument team to stay within those allocations
- SEQGEN modeling will check any violations

COMMANDING RATES

- SEQGEN modeling will flag any problems



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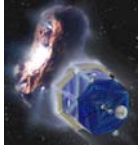
Science Sequencing Process Definition - Where are we?

For CRISP, CFI and CIDA (including G&C commanding):

- Process proposed by Mops has been agreed to

For NGIMS

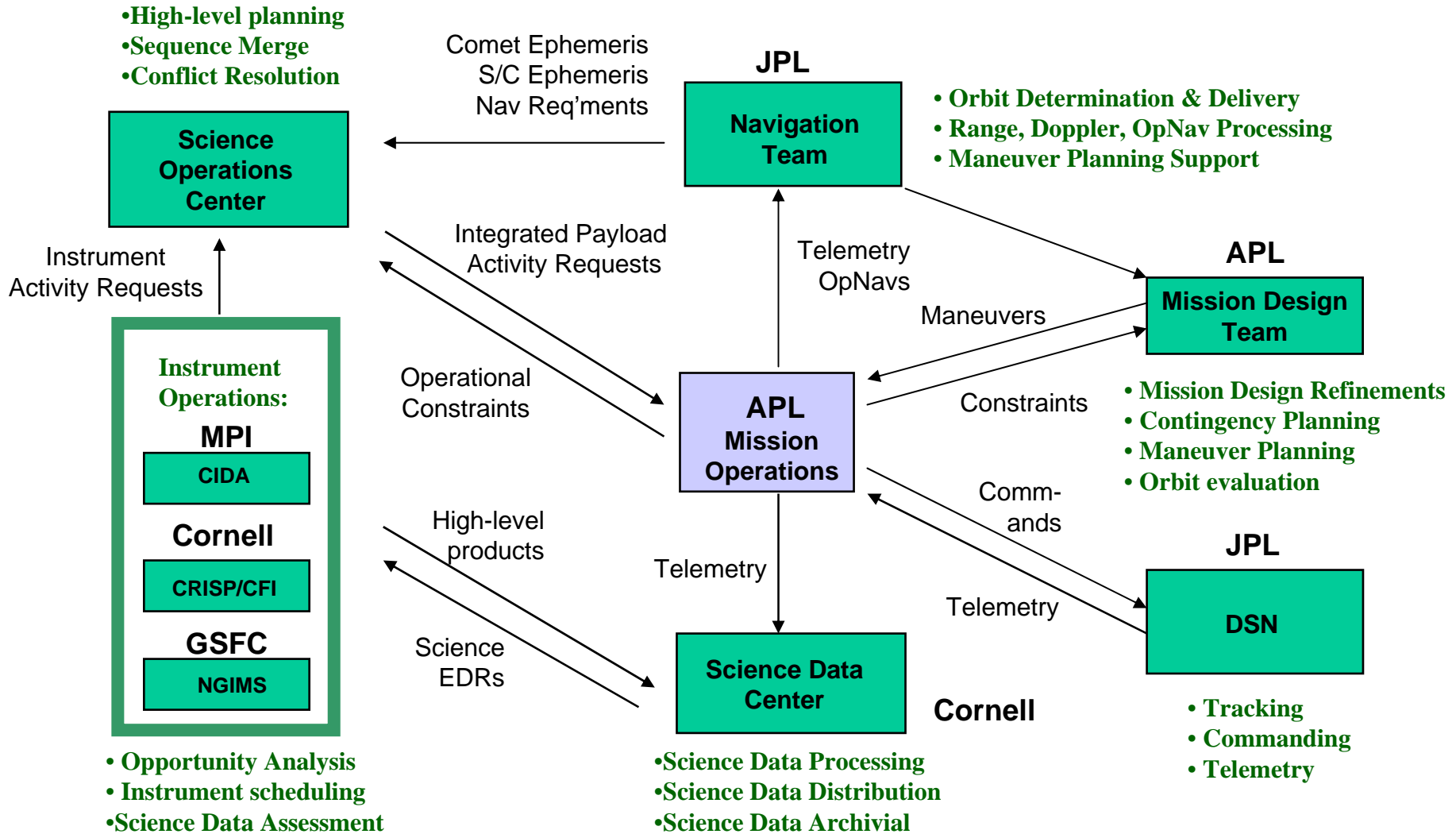
- NGIMS process still under discussion
- NGIMS team desires to circumvent SEQGEN if possible
- 'GSE' software can produce fully tested and checked sequences
- Encounter sequences can be loaded directly into instrument memory
- Probably can't eliminate SEQGEN completely from process, must somehow model common use resources (mainly SSR usage)

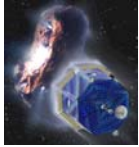


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Operational Interfaces and Responsibilities





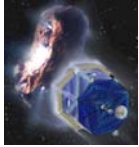
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Science Team Roles for Sequence Generation

CRISP/CFI:

- Instrument Lead (Scott Murchie or tbd)
 - Create high-level observation desires
 - Iterate on design details with science coordinator
 - review SEQGEN sasf input file (will not operate SEQGEN)
- Science Scheduling Coordinator (Ann Harch)
 - Work scheduling and operational issues with MOC
 - Prepare and distribute activity development timelines
 - Create detailed sequence designs using local s/w
 - Work any s/c pointing issues with G&C engineers
 - Create SEQGEN sasf file for review
 - Merge with all instruments, coordinate review of final delivery files
- Instrument Engineer (Jeff Warren?)
 - Available for consultation during design of instrument activities
 - Review and approve final SEQGEN input files



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CRISP/CFI Sequence Generation

APL, other

CRISP/CFI leads

- Create high-level observation plans, requirements

- Iterate with SSC on design details

- Review SEQGEN sasf file

- Engineer review, approve final SEQGEN file

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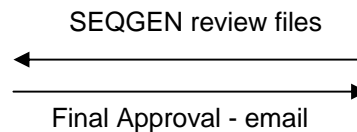
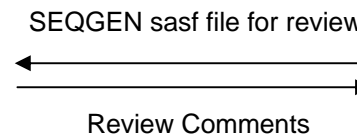
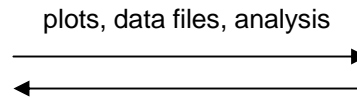
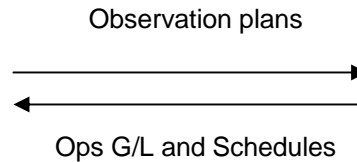
SSC

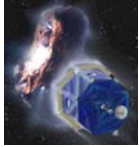
- Work high-level scheduling issues with MOC, schedule observations

- Design detailed observations using Cornell op analysis s/w, iterate with science lead

- Create SEQGEN file, run SEQGEN, constraint check and model

- Run final individual CRISP/CFI file in SEQGEN with all instrument files, deliver to MOC following engr. approval





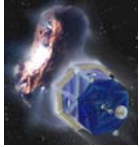
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Science Team Roles for Sequence Generation

CIDA:

- Instrument Lead (Jochen Kissel)
 - Create high-level observation desires using local opportunity analysis s/w
 - Iterate on design details with science coordinator
 - review SEQGEN sasf input file (will not operate SEQGEN)
- Science Scheduling Coordinator (Ann Harch)
 - Work scheduling and operational issues with MOC
 - Prepare and distribute activity development timelines
 - Create detailed sequence designs using SEQGEN
 - Create SEQGEN sasf file for review
 - Merge with all instruments, coordinate review of final delivery files
- Instrument Engineer (?)
 - Available for consultation during design of instrument activities
 - Review and approve final SEQGEN input files



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CIDA Sequence Generation

MPI

CIDA leads

- Create high-level observation desires, requirements

- Design detailed observations using local op analysis s/w

- Review SEQGEN sasf file

- Engineer review, approve final SEQGEN files

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SSC

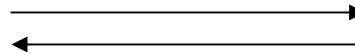
- Work high-level scheduling issues with MOC, schedule observations

- Create SEQGEN sasf file based on design

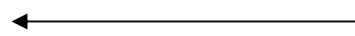
- Run SEQGEN, constraint check and model; iterate with CIDA lead if problems

- Run final individual CIDA file in SEQGEN with all instrument files, deliver to MOC after engr . approval

Observation plans



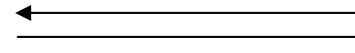
Ops G/L and Schedules



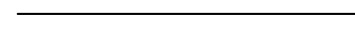
Detailed observation plans - descriptive format



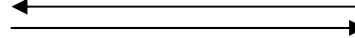
SEQGEN sasf file for review



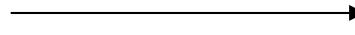
Review Comments

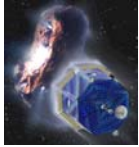


SEQGEN review files



Final Approval - email





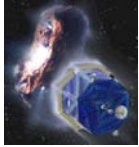
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Science Team Roles for Sequence Generation

NGIMS (Normal Activity Mode):

- Instrument Lead (Paul Mahaffy)
 - Create high-level observation desires, deliver to SSC
 - Create detailed sequence designs using local s/w, constraint check and model
 - Write to SEQGEN file (will operate SEQGEN), deliver to SSC
 - review SEQGEN sasf input file
- Science Scheduling Coordinator (Ann Harch)
 - Work scheduling and operational issues with MOC
 - Prepare and distribute activity development timelines
 - Receive final SEQGEN sasf file for review
 - Merge with all instruments, coordinate review of final delivery files
- Instrument Engineer (Mike Paulkovich)
 - Review and approve final SEQGEN input files



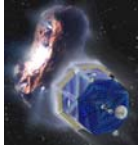
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Science Team Roles for Sequence Generation

NGIMS (Encounter Activity Mode):

- Instrument Lead (Paul Mahaffy?)
 - Create high-level observation desires, deliver to SSC
 - Create detailed sequence designs using local s/w, constraint check and model
 - Deliver flight s/w upload to MOC (not through SEQGEN)
 - Write simplified SEQGEN request file that tracks instrument on, SSR usage (deliver to SSC)
 - review SEQGEN sasf input file
- Science Scheduling Coordinator (Ann Harch)
 - Work scheduling and operational issues with MOC
 - Prepare and distribute activity development timelines
 - Receive final SEQGEN sasf file for review
 - Merge with all instruments, coordinate review of final delivery files
- Instrument Engineer (Mike Paulkovich)
 - Review and approve final SEQGEN input files



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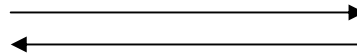
NGIMS Sequence Generation

GSFC

NGIMS leads

- Create high-level observation plans, requirements

Observation plans



Ops G/L and Schedules



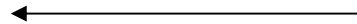
- Design detailed observations using GSE op analysis and seq dev s/w, constraint check and model
- Write SEQGEN sasf file, run SEQGEN? deliver to SSC

Final SEQGEN sasf?

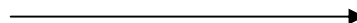


- Engineer review, approve final SEQGEN files

SEQGEN review files



Final Approval - email



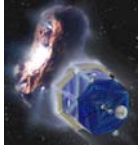
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- Work high-level scheduling issues with MOC, schedule observations

- Run NGIMS sasf file in SEQGEN?, constraint check and model?

- Run final individual file in SEQGEN with other instrument files, deliver to MOC after final engr. approval



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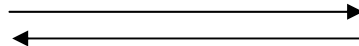
NGIMS Sequence Generation

GSFC

NGIMS leads

- Create high-level observation plans, requirements

Observation plans



Ops G/L and Schedules



Final SEQGEN sasf?



- Design detailed observations using GSE op analysis and seq dev s/w, constraint check and model, Engineer review
- Write dummy SEQGEN sasf file, deliver to SSC
- Write instrument memory load, deliver to MOC

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SSC

- Work high-level scheduling issues with MOC, schedule observations

- No constraint check or model in SEQGEN for instrument
- Run final individual file in SEQGEN with other instrument files (check SSR use), deliver to MOC

APL

MOC

