12004 - The Last Mutual Event between the Satellites of Dwarf Planet Haumea

Cycle: 17, Proposal Category: GO/DD

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
Dr. Darin Ragozzine (PI)	**California Institute of Technology**	
Dr. Michael E. Brown (CoI)	California Institute of Technology	

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) HAUMEA	STIS/CCD	7	19-Jun-2009 21:33:43.0	yes

7 Total Orbits Used

ABSTRACT

The dwarf planet Haumea has a fascinating history, including the formation of two large satellites by an ancient mantle-shattering collision. Haumea also has an exciting future with many observable mutual events between Haumea and the smaller inner moon Namaka predicted for the next several years. The Haumea-Namaka mutual events will provide a wealth of information that is otherwise unattainable: the size, shape, and spin pole of Haumea; the size, albedo, and density of Namaka; and precise orbital constraints. The orbital orientation is not as favorable for the outer, larger satellite Hi'iaka, but the last mutual event between Hi'iaka and Namaka occurs on July 2, 2009 and will not occur again for a century. As a follow-up to our observations of the last satellite-satellite event (Program 11971), we propose a short (7-orbit) STIS resolved photometry program to observe the last of these events, which will occur with an estimated ~93% probability. Even catching a partial event can measure the density of Hi'iaka to within ~15% and provide unique insight in the formation and evolution of this exciting system.

OBSERVING DESCRIPTION

Observations of a satellite-satellite mutual event of the dwarf planet Haumea. The goal is to obtain precise photometry of a (resolved) faint satellite to a moving object (located near 13:36:08, +19:27:00). The observations are designed to maximize overall signal-to-noise (by maximizing total exposure time), while taking multiple observations to produce a high-cadence light curve.

All 7 orbits must be taken as close as possible to (02-JUL-2009 04:45:00). Seven consecutive orbits must be taken, with the first exposure occurring between 01-JUL-2009:21:30:00 and 01-JUL-2009:23:30:00.

ADDITIONAL COMMENTS

These observations could be taken with other instruments or in "engineering time."

Please contact the PI (darin@caltech.edu) at any time for questions.

Visit

Proposal 12004, Visit 01, implementation Sat Jun 20 01:34:40 GMT 2009

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD

Special Requirements: BETWEEN 01-JUL-2009:21:30:00 AND 01-JUL-2009:23:30:00

Comments: Observation of the Haumea satellite-satellite mutual event through resolved photometry. The first observation of seven consecutive orbits should occur between 01-JUL-2009:21:30:00 and 01-JUL-2009:23:30:00, in order to observe the event. The observations are designed to maximize overall signal-to-noise (by minimizing read and overhead time), while achieving high temporal cadence and avoiding saturation of the primary (~58 seconds).Observations should consist of the maximum number of 40 second observations during visible time.

The satellites are directly South of Haumea, so please choose ORIENT near 135 degrees, instead of near 90 degrees, in order to keep the diffraction spikes off of the satellites and to improve the faint satellite search. This orientation is a secondary requirement, and it can be relaxed or dropped if necessary.

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(10)	Pattern Type=STIS-PERP-TO-SLIT Purpose=MOSAIC Number Of Points=10 Point Spacing=0.4056 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=0.0 Angle Between Sides= Center Pattern=false		(4)
(11)	Pattern Type=STIS-PERP-TO-SLIT Purpose=MOSAIC Number Of Points=12 Point Spacing=0.4056 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=0.0 Angle Between Sides= Center Pattern=false		(5), (6)
(12)	Pattern Type=STIS-PERP-TO-SLIT Purpose=MOSAIC Number Of Points=13 Point Spacing=0.4056 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=0.0 Angle Between Sides= Center Pattern=false		(7)
(7)	Pattern Type=STIS-PERP-TO-SLIT Purpose=MOSAIC Number Of Points=6 Point Spacing=0.4056 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=0.0 Angle Between Sides= Center Pattern=false		(1)
(8)	Pattern Type=STIS-PERP-TO-SLIT Purpose=MOSAIC Number Of Points=8 Point Spacing=0.4056 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=0.0 Angle Between Sides= Center Pattern=false		(2)

Patterns (continued)

#	Primary Pattern		Secondary Pattern	Exposures
(9)	Pattern Type=STIS-PERP-TO-SLIT Purpose=MOSAIC Number Of Points=9 Point Spacing=0.4056 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=0.0 Angle Between Sides= Center Pattern=false		(3)

Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	HAUMEA	TYPE=ASTEROID,A=43.1359862,E=0.1949506,I=28.2244,O=122.1032,W=239.18665,M=202.66919,EQUINOX=J2000,EPOCH=30-NOV-2008:00:00:00				EARTH

Comments: At the time of the observations, the approximate RA and Dec are 13:36:08, +19:27:00

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) HAUMEA	STIS/CCD, ACCUM, 50CCD	MIRROR	CR-SPLIT=NO; SIZEAXIS2=200.0	POS TARG 0,15	Sequence 1-1 Non-Int Pattern 7, Exps 1-1 (7)	40.0 Secs X 3	
								[==>(Pattern 1, Copy 1)] *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 1, Copy 3)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]* *[==>(Pattern 2, Copy 3)]* *[==>(Pattern 3, Copy 1)]* *[==>(Pattern 3, Copy 2)]* *[==>(Pattern 3, Copy 3)]* *[==>(Pattern 4, Copy 1)]* *[==>(Pattern 4, Copy 2)]* *[==>(Pattern 4, Copy 3)]* *[==>(Pattern 5, Copy 1)]* *[==>(Pattern 5, Copy 2)]* *[==>(Pattern 5, Copy 3)]* *[==>(Pattern 6, Copy 1)]* *[==>(Pattern 6, Copy 2)]* *[==>(Pattern 6, Copy 3)]*	***[1]***

Exposures (continued)

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
2		(1) HAUMEA	STIS/CCD, ACCUM, 50CCD	MIRROR	CR-SPLIT=NO; SIZEAXIS2=200.0	POS TARG 0,15	Sequence 2-2 Non-Int Pattern 8, Exps 2-2 (8)	40.0 Secs X 3 *[==>(Pattern 1, Copy 1)]* *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 1, Copy 3)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]* *[==>(Pattern 2, Copy 3)]* *[==>(Pattern 3, Copy 1)]* *[==>(Pattern 3, Copy 2)]* *[==>(Pattern 3, Copy 3)]* *[==>(Pattern 4, Copy 1)]* *[==>(Pattern 4, Copy 2)]* *[==>(Pattern 4, Copy 3)]* *[==>(Pattern 5, Copy 1)]* *[==>(Pattern 5, Copy 2)]* *[==>(Pattern 5, Copy 3)]* *[==>(Pattern 6, Copy 1)]* *[==>(Pattern 6, Copy 2)]* *[==>(Pattern 6, Copy 3)]* *[==>(Pattern 7, Copy 1)]* *[==>(Pattern 7, Copy 2)]* *[==>(Pattern 7, Copy 3)]* *[==>(Pattern 8, Copy 1)]* *[==>(Pattern 8, Copy 2)]* *[==>(Pattern 8, Copy 3)]*	***[2]***

Exposures (continued)

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
3		(1) HAUMEA	STIS/CCD, ACCUM, 50CCD	MIRROR	CR-SPLIT=NO; SIZEAXIS2=200.0	POS TARG 0,15	Sequence 3-3 Non-Int Pattern 9, Exps 3-3 (9)	40.0 Secs X 3	
								[==>(Pattern 1, Copy 1)]	
								[==>(Pattern 1, Copy 2)]	
								[==>(Pattern 1, Copy 3)]	
								[==>(Pattern 2, Copy 1)]	
								[==>(Pattern 2, Copy 2)]	
								[==>(Pattern 2, Copy 3)]	
								[==>(Pattern 3, Copy 1)]	
								[==>(Pattern 3, Copy 2)]	
								[==>(Pattern 3, Copy 3)]	
								[==>(Pattern 4, Copy 1)]	
								[==>(Pattern 4, Copy 2)]	
								[==>(Pattern 4, Copy 3)]	
								[==>(Pattern 5, Copy 1)]	
								[==>(Pattern 5, Copy 2)]	***[3]***
								[==>(Pattern 5, Copy 3)]	
								[==>(Pattern 6, Copy 1)]	
								[==>(Pattern 6, Copy 2)]	
								[==>(Pattern 6, Copy 3)]	
								[==>(Pattern 7, Copy 1)]	
								[==>(Pattern 7, Copy 2)]	
								[==>(Pattern 7, Copy 3)]	
								[==>(Pattern 8, Copy 1)]	
								[==>(Pattern 8, Copy 2)]	
								[==>(Pattern 8, Copy 3)]	
								[==>(Pattern 9, Copy 1)]	
								[==>(Pattern 9, Copy 2)]	
								[==>(Pattern 9, Copy 3)]	

Exposures (continued)

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
4		(1) HAUMEA	STIS/CCD, ACCUM, 50CCD	MIRROR	CR-SPLIT=NO; SIZEAXIS2=200.0	POS TARG 0,15	Sequence 4-4 Non-Int Pattern 10, Exps 4-4 (10)	40.0 Secs X 3	
								[==>(Pattern 1, Copy 1)]	***[4]***
								[==>(Pattern 1, Copy 2)]	
								[==>(Pattern 1, Copy 3)]	
								[==>(Pattern 2, Copy 1)]	
								[==>(Pattern 2, Copy 2)]	
								[==>(Pattern 2, Copy 3)]	
								[==>(Pattern 3, Copy 1)]	
								[==>(Pattern 3, Copy 2)]	
								[==>(Pattern 3, Copy 3)]	
								[==>(Pattern 4, Copy 1)]	
								[==>(Pattern 4, Copy 2)]	
								[==>(Pattern 4, Copy 3)]	
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								[==>(Pattern 5, Copy 3)]	
								[==>(Pattern 6, Copy 1)]	
								[==>(Pattern 6, Copy 2)]	
								[==>(Pattern 6, Copy 3)]	
								[==>(Pattern 7, Copy 1)]	
								[==>(Pattern 7, Copy 2)]	
								[==>(Pattern 7, Copy 3)]	
								[==>(Pattern 8, Copy 1)]	
								[==>(Pattern 8, Copy 2)]	
								[==>(Pattern 8, Copy 3)]	
								[==>(Pattern 9, Copy 1)]	
								[==>(Pattern 9, Copy 2)]	
								[==>(Pattern 9, Copy 3)]	
								[==>(Pattern 10, Copy 1)]	
								[==>(Pattern 10, Copy 2)]	
								[==>(Pattern 10, Copy 3)]	

Exposures (continued)

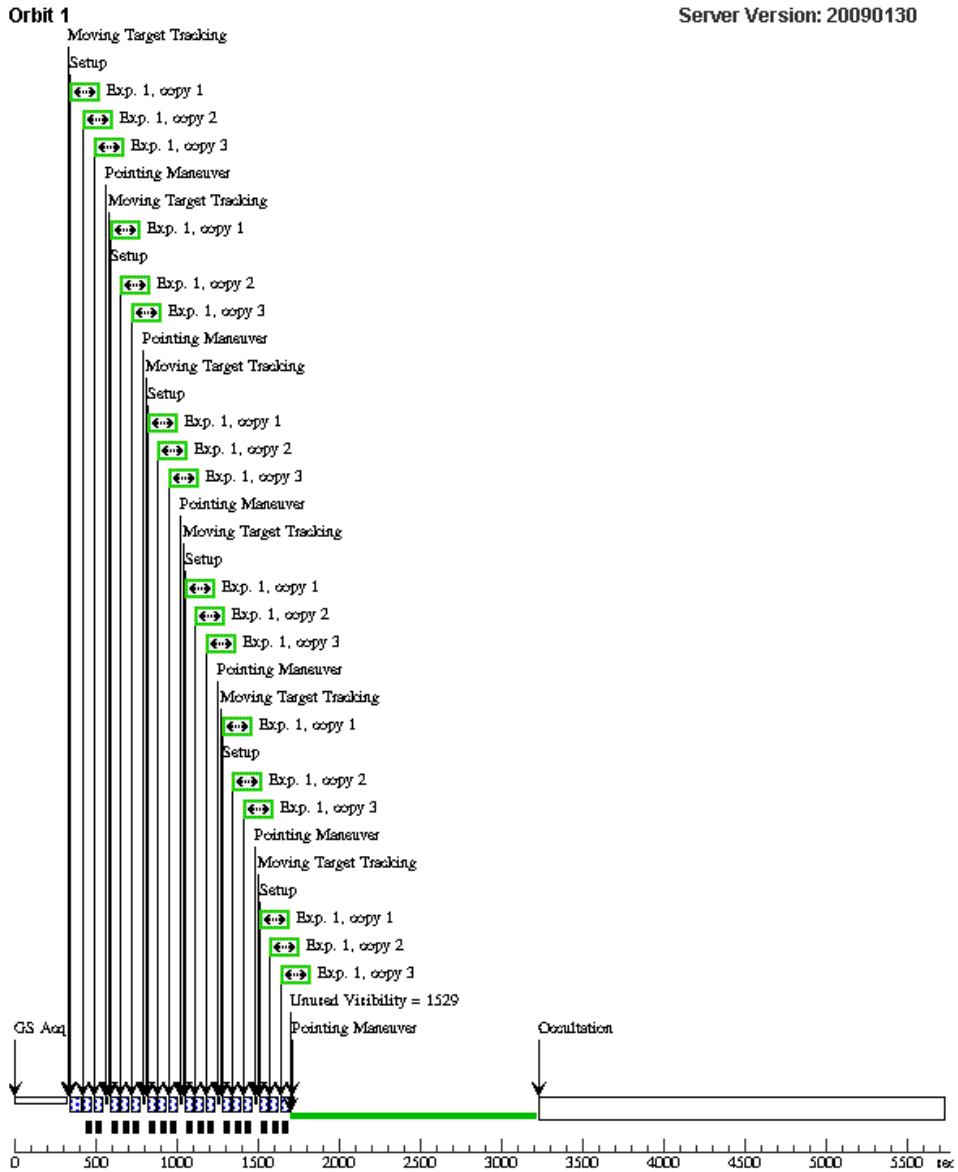
#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
5		(1) HAUMEA	STIS/CCD, ACCUM, 50CCD	MIRROR	CR-SPLIT=NO; SIZEAXIS2=200.0	POS TARG 0,15; NEW OBSET	Sequence 5-5 Non-Int Pattern 11, Exps 5-5 (11)	40.0 Secs X 3	
								[==>(Pattern 1, Copy 1)]	
								[==>(Pattern 1, Copy 2)]	
								[==>(Pattern 1, Copy 3)]	
								[==>(Pattern 2, Copy 1)]	
								[==>(Pattern 2, Copy 2)]	
								[==>(Pattern 2, Copy 3)]	
								[==>(Pattern 3, Copy 1)]	
								[==>(Pattern 3, Copy 2)]	
								[==>(Pattern 3, Copy 3)]	
								[==>(Pattern 4, Copy 1)]	
								[==>(Pattern 4, Copy 2)]	
								[==>(Pattern 4, Copy 3)]	
								[==>(Pattern 5, Copy 1)]	
								[==>(Pattern 5, Copy 2)]	
								[==>(Pattern 5, Copy 3)]	
								[==>(Pattern 6, Copy 1)]	
								[==>(Pattern 6, Copy 2)]	
								[==>(Pattern 6, Copy 3)]	***[5]***
								[==>(Pattern 7, Copy 1)]	
								[==>(Pattern 7, Copy 2)]	
								[==>(Pattern 7, Copy 3)]	
								[==>(Pattern 8, Copy 1)]	
								[==>(Pattern 8, Copy 2)]	
								[==>(Pattern 8, Copy 3)]	
								[==>(Pattern 9, Copy 1)]	
								[==>(Pattern 9, Copy 2)]	
								[==>(Pattern 9, Copy 3)]	
								[==>(Pattern 10, Copy 1)]	
								[==>(Pattern 10, Copy 2)]	
								[==>(Pattern 10, Copy 3)]	
								[==>(Pattern 11, Copy 1)]	
								[==>(Pattern 11, Copy 2)]	
								[==>(Pattern 11, Copy 3)]	
								[==>(Pattern 12, Copy 1)]	
								[==>(Pattern 12, Copy 2)]	
								[==>(Pattern 12, Copy 3)]	

Exposures (continued)

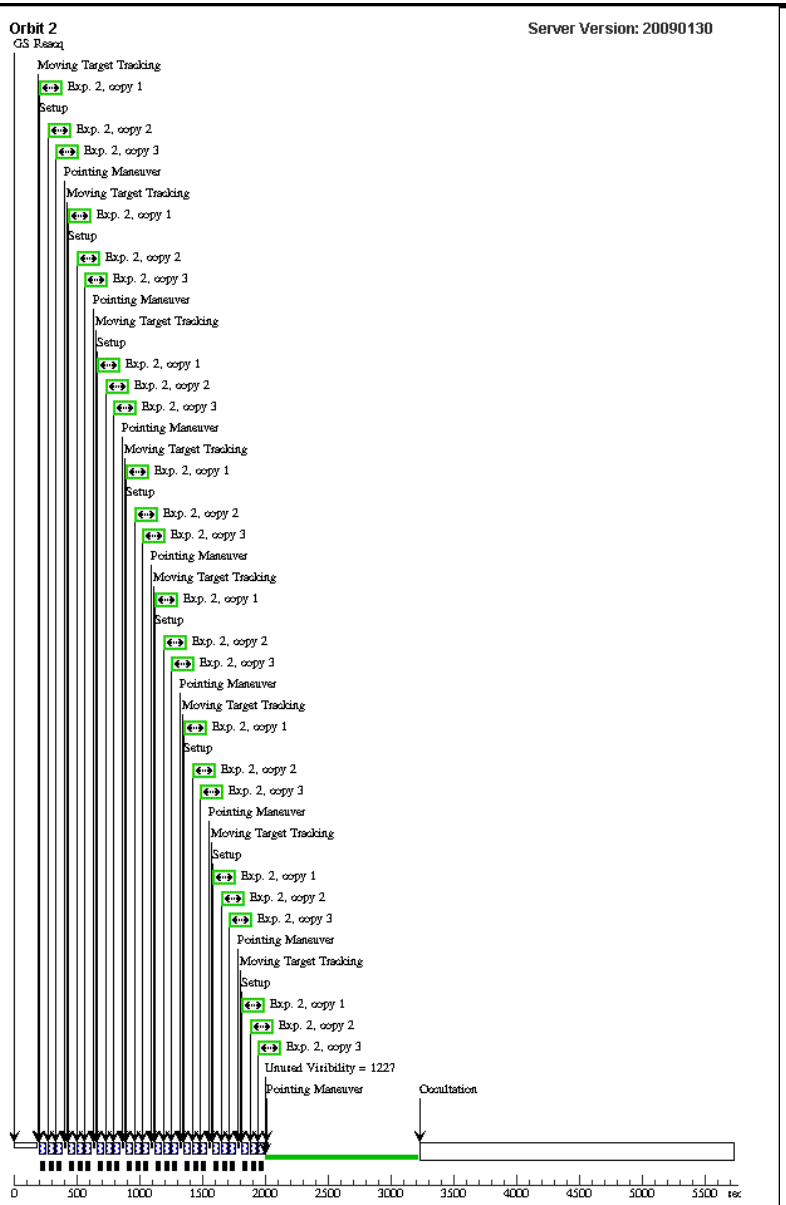
#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
6		(1) HAUMEA	STIS/CCD, ACCUM, 50CCD	MIRROR	CR-SPLIT=NO; SIZEAXIS2=200.0	POS TARG 0,15	Sequence 6-6 Non-Int Pattern 11, Exps 6-6 (11)	40.0 Secs X 3	
								[==>(Pattern 1, Copy 1)] *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 1, Copy 3)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]* *[==>(Pattern 2, Copy 3)]* *[==>(Pattern 3, Copy 1)]* *[==>(Pattern 3, Copy 2)]* *[==>(Pattern 3, Copy 3)]* *[==>(Pattern 4, Copy 1)]* *[==>(Pattern 4, Copy 2)]* *[==>(Pattern 4, Copy 3)]* *[==>(Pattern 5, Copy 1)]* *[==>(Pattern 5, Copy 2)]* *[==>(Pattern 5, Copy 3)]* *[==>(Pattern 6, Copy 1)]* *[==>(Pattern 6, Copy 2)]* *[==>(Pattern 6, Copy 3)]* *[==>(Pattern 7, Copy 1)]* *[==>(Pattern 7, Copy 2)]* *[==>(Pattern 7, Copy 3)]* *[==>(Pattern 8, Copy 1)]* *[==>(Pattern 8, Copy 2)]* *[==>(Pattern 8, Copy 3)]* *[==>(Pattern 9, Copy 1)]* *[==>(Pattern 9, Copy 2)]* *[==>(Pattern 9, Copy 3)]* *[==>(Pattern 10, Copy 1)]* *[==>(Pattern 10, Copy 2)]* *[==>(Pattern 10, Copy 3)]* *[==>(Pattern 11, Copy 1)]* *[==>(Pattern 11, Copy 2)]* *[==>(Pattern 11, Copy 3)]* *[==>(Pattern 12, Copy 1)]* *[==>(Pattern 12, Copy 2)]* *[==>(Pattern 12, Copy 3)]*	***[6]***

Exposures	*An item that belongs under the heading Exposures could not be fit on a full page so it will not be displayed. You can look above and below this entry in the table to discover what was omitted.*

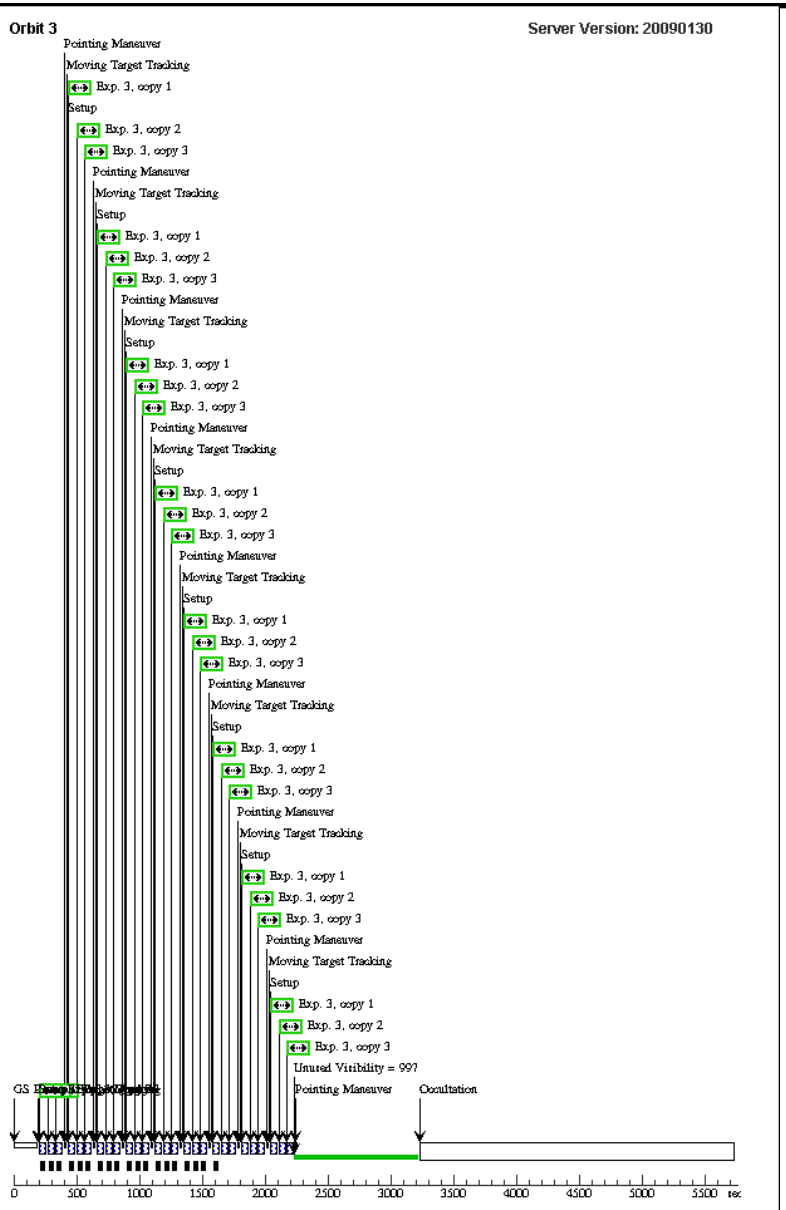
Orbit Structure



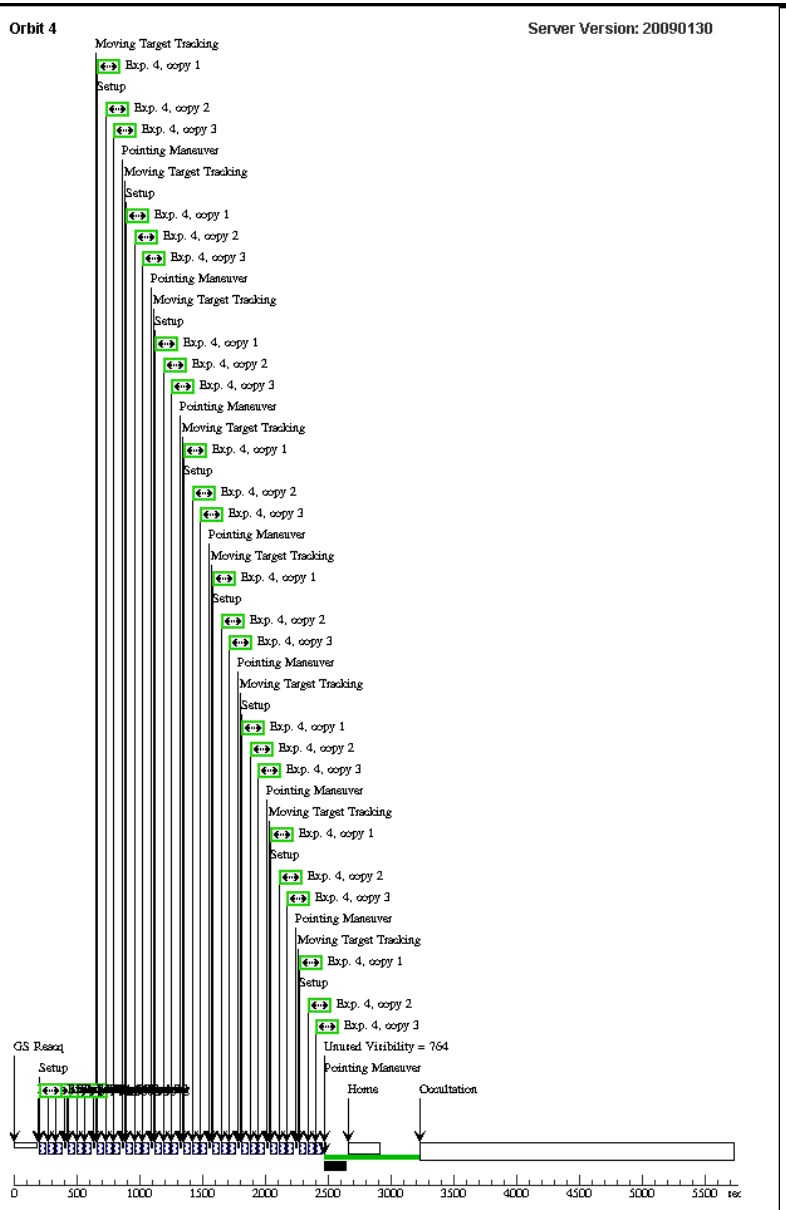
Orbit Structure (continued)



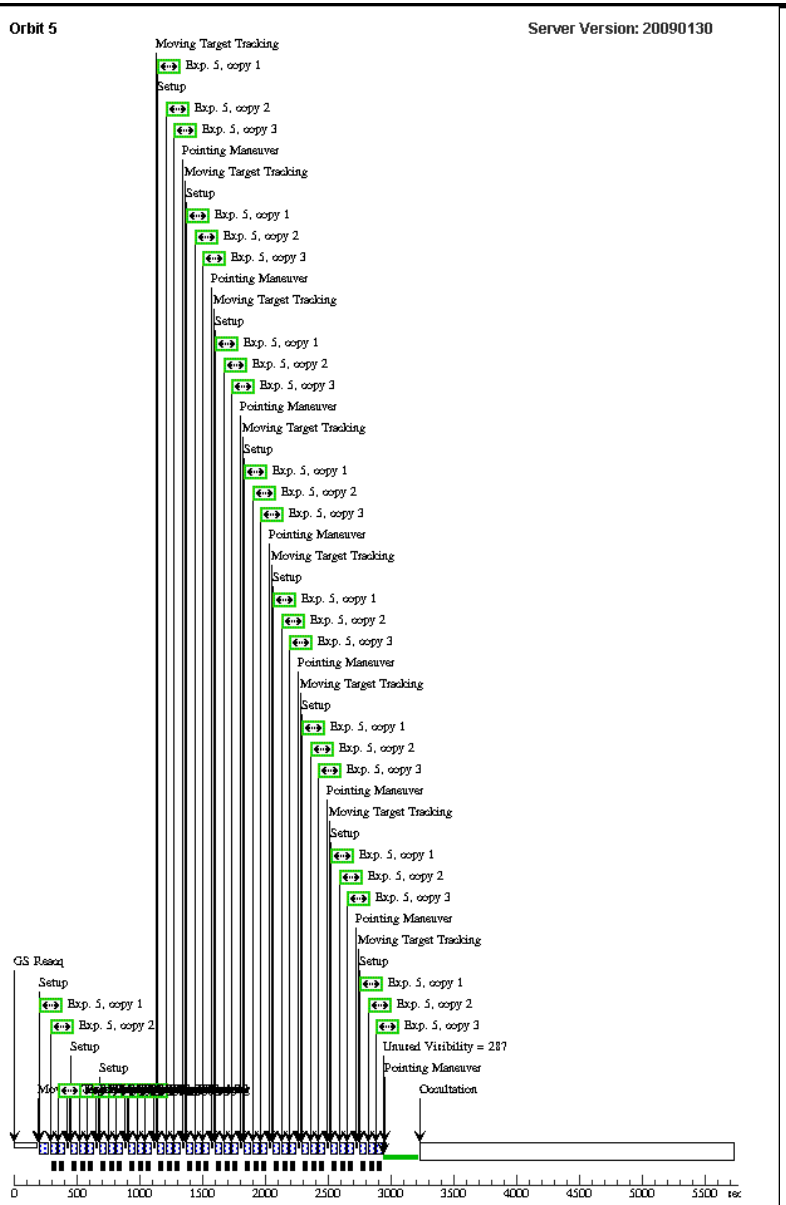
Orbit Structure (continued)



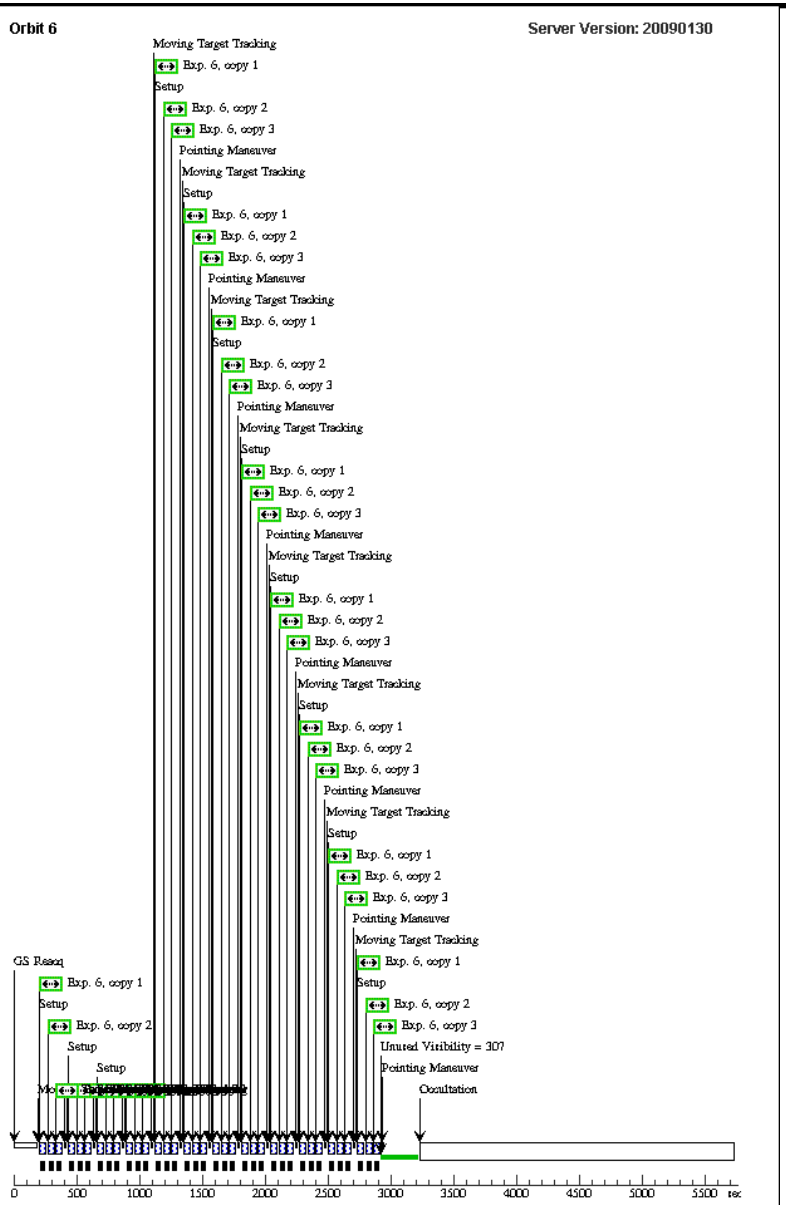
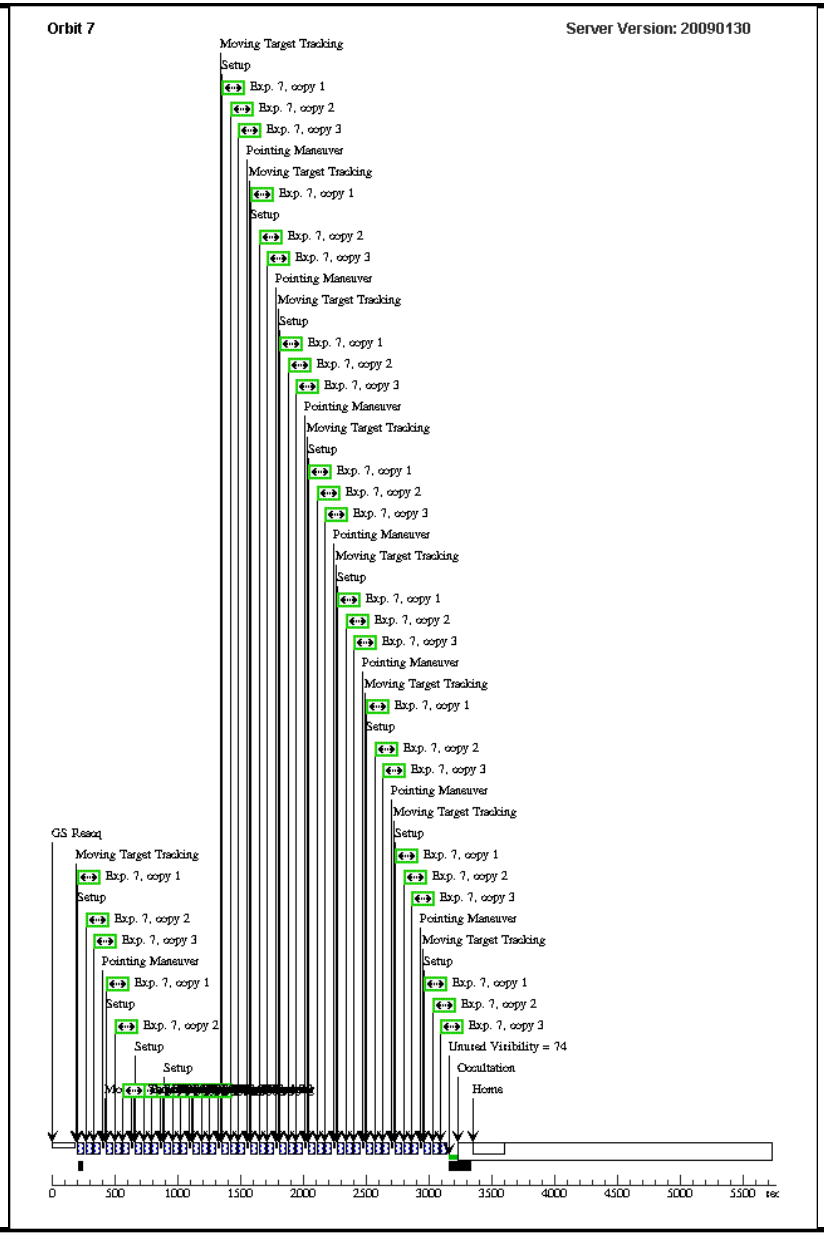
Orbit Structure (continued)



Orbit Structure (continued)



Orbit Structure (continued)



Orbit Structure (continued)