



11969 - Satellite Search for Dawn Mission Targets, Vesta and Ceres

Cycle: 16, Proposal Category: GO/DD

(Availability Mode: SUPPORTED)

INVESTIGATORS

<i>Name</i>	<i>Institution</i>	<i>E-Mail</i>
Dr. Jian-Yang Li (PI)	University of Maryland	jyli@astro.umd.edu
Dr. Lucy-Ann McFadden (CoI)	University of Maryland	mcfadden@astro.umd.edu
Mr. Max Mutchler (CoI) (Contact)	Space Telescope Science Institute	mutchler@stsci.edu
Dr. Stefano Mottola (CoI)	DLR	stefano.mottola@dlr.de

VISITS

<i>Visit</i>	<i>Targets used in Visit</i>	<i>Configurations used in Visit</i>	<i>Orbits Used</i>	<i>Last Orbit Planner Run</i>	<i>OP Current with Visit?</i>
01	(1) CERES	WFPC2	1	06-Jan-2009 21:08:30.0	yes
02	(1) CERES	WFPC2	1	06-Jan-2009 21:08:38.0	yes
03	(1) CERES	WFPC2	1	06-Jan-2009 21:08:46.0	yes
04	(1) CERES	WFPC2	1	06-Jan-2009 21:08:56.0	yes

4 Total Orbits Used

ABSTRACT

We propose to carry out a dedicated satellite search program for asteroids Vesta and Ceres. Despite being the two largest asteroids, and having clear evidence of a violent collisional history for Vesta, Vesta and Ceres do not have any satellites found so far, neither have there been any dedicated satellite search program for them reported. We propose to take short and long exposure mosaics to cover the whole Hill sphere while using specific

observing strategies and image processing techniques to search in close to the center body. In addition to its significant scientific merit, this proposed project will be important for the planning of NASA's Dawn mission. Currently Ceres is moving close to the Earth, making it more difficult to cover the whole stability region of satellites with minimal HST orbit requirement. Similar geometry will not repeat until the second half of 2009.

Therefore we request DD time.

OBSERVING DESCRIPTION

Vesta will not have the visibility to be scheduled until late 2009. Therefore we plan all 4 approved orbits for Ceres. We emphasize searching deep to both cover the whole Hill sphere of Ceres, and as close to Ceres as possible. Four one-orbit visits are planned for this purpose. The four visits are grouped into two two-visit groups, separated by one day. And each visit has one orbit. In the first group, we will put Ceres near the apex in each of the four WFPC2 CCD chips, and take long exposures to search faint objects around Ceres. Also, short, unsaturated, exposures with Ceres at the center of PC1 chip will be taken to be stacked together to model the PSF. In the second group, we will repeat the exposures for near apex pointing of Ceres, but replace the PC1 centered exposures with a four pointing mosaics, taking long exposures, to search for faint objects in a large region around Ceres. In order to avoid potential problem of moving objects tracking, we put together the pointings that are almost along a straightline into one one-orbit visit in each group.

Out detailed observing plan is:

Group 1:

Visit 1, total 17 exposures:

PC1 near-apex pointing, 1 short, 3 intermediate, 2 long

WF3 near-apex pointing, 1 short, 3 intermediate, 2 long

PC1 center pointing, 5 short

Visit 2, total 17 exposures:

WF2 near-apex pointing, 1 short, 3 intermediate, 2 long

WF4 near-apex pointing, 1 short, 3 intermediate, 2 long
PC1 center pointer, 5 short

Group 2, 1 day after the first group:

Visit 3, total 16 exposures:

PC1 with Ceres (30",30") from apex, 1 short, 2 long
PC1 near-apex pointing, 1 short, 2 intermediate, 2 long
WF3 near-apex pointing, 1 short, 2 intermediate, 2 long
WF3 with Ceres (50",50") from apex, 1 short, 2 long

Visit 4, total 16 exposures:

WF2 with Ceres (50",50") from apex, 1 short, 2 long
WF2 near-apex pointing, 1 short, 2 intermediate, 2 long
WF4 near-apex pointing, 1 short, 2 intermediate, 2 long
WF4 with Ceres (50",50") from apex, 1 short, 2 long

We will use F606W filter for all exposures. For WF chips, short exposure is 0.12 sec, intermediate 20 sec, and long 40 sec. For PC1 chips, short exposure is 0.6 sec, long exposure 40 sec. Two visits in each group should be scheduled together (Separation < 2 orbits). Two groups should be scheduled one day apart.

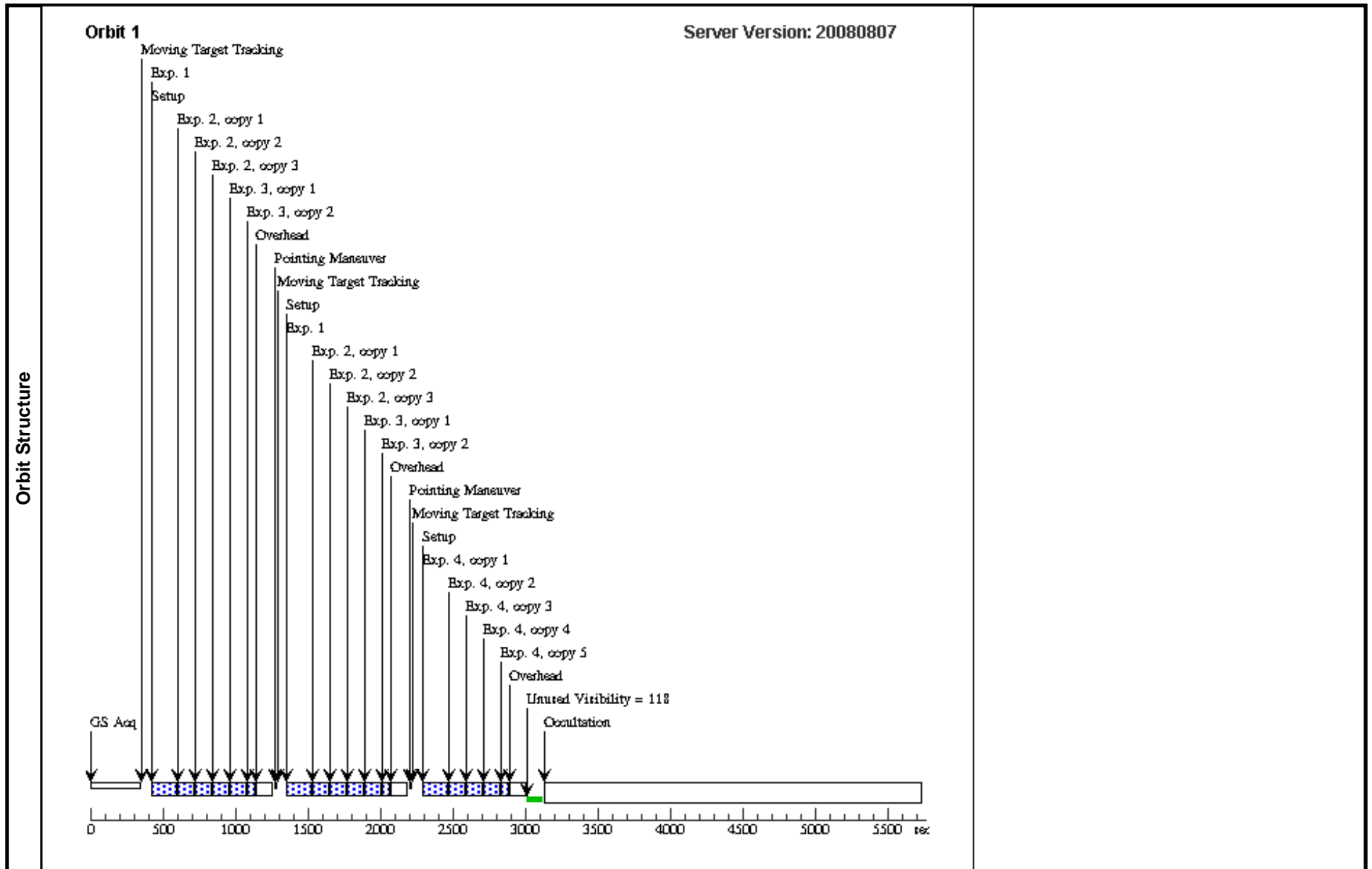
Proposal 11969 - Visit 01 - Satellite Search for Dawn Mission Targets, Vesta and Ceres

Wed Jan 07 02:09:01 GMT 2009

Visit	Proposal 11969, Visit 01, implementation Diagnostic Status: No Diagnostics Scientific Instruments: WFPC2 Special Requirements: SEQ 01.02 WITHIN 2.2 Orbits										
	Patterns	#	Primary Pattern			Secondary Pattern			Exposures		
		(3)	Pattern Type=LINE Purpose=MOSAIC Number Of Points=2 Point Spacing=25 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=45 Angle Between Sides= Center Pattern=false					(1-3)		
Solar System Targets	#	Name	Level 1	Level 2	Level 3	Window	Ephem Center				
	(1)	CERES		TYPE=ASTEROID,A=2.76679153235 1548,E=.07947462245028122,I=10.58 571555748677,O=80.40447317892902 ,W=72.89568694749072,M=344.5452 233474741,EQUINOX=J2000,EPOCH =30-NOV-2008:00:00:00				EARTH			
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit	
	1	(1) CERES	WFPC2, IMAGE, WF3-FIX	F606W	ATD-GAIN=15	POS TARG 30,30; GS ACQ SCENARI O BASE1T3	Sequence 1-4 Non-Int Pattern 1-3 (3)	0.12 Secs [==>(Pattern 1)] [==>(Pattern 2)]	[1]		
	<i>Comments: Short exposure with gain=15 to avoid saturation</i>										
	2	(1) CERES	WFPC2, IMAGE, WF3-FIX	F606W	CLOCKS=YES	POS TARG 30,30	Sequence 1-4 Non-Int Pattern 1-3 (3)	20 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)]	[1]		
<i>Comments: Long saturated exposure to detect faint satellites</i>											
3	(1) CERES	WFPC2, IMAGE, WF3-FIX	F606W	CLOCKS=YES	POS TARG 30,30	Sequence 1-4 Non-Int Pattern 1-3 (3)	40 Secs X 2 [==>(Pattern 1, Copy 1)] [==>(Pattern 1, Copy 2)] [==>(Pattern 2, Copy 1)] [==>(Pattern 2, Copy 2)]	[1]			
<i>Comments: Long saturated exposure to detect faint satellites</i>											

Proposal 11969 - Visit 01 - Satellite Search for Dawn Mission Targets, Vesta and Ceres

Exposures (continued)	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit		
	4	(1) CERES	WFPC2, IMAGE, PC1-FIX	F606W	ATD-GAIN=15	Sequence 1-4 Non-Int	0.6 Secs X 5	[==>(Copy 1)]	[==>(Copy 2)]	[==>(Copy 3)]	[==>(Copy 4)]	[==>(Copy 5)]
<i>Comments: Short exposure with gain=15 to avoid saturation</i>												



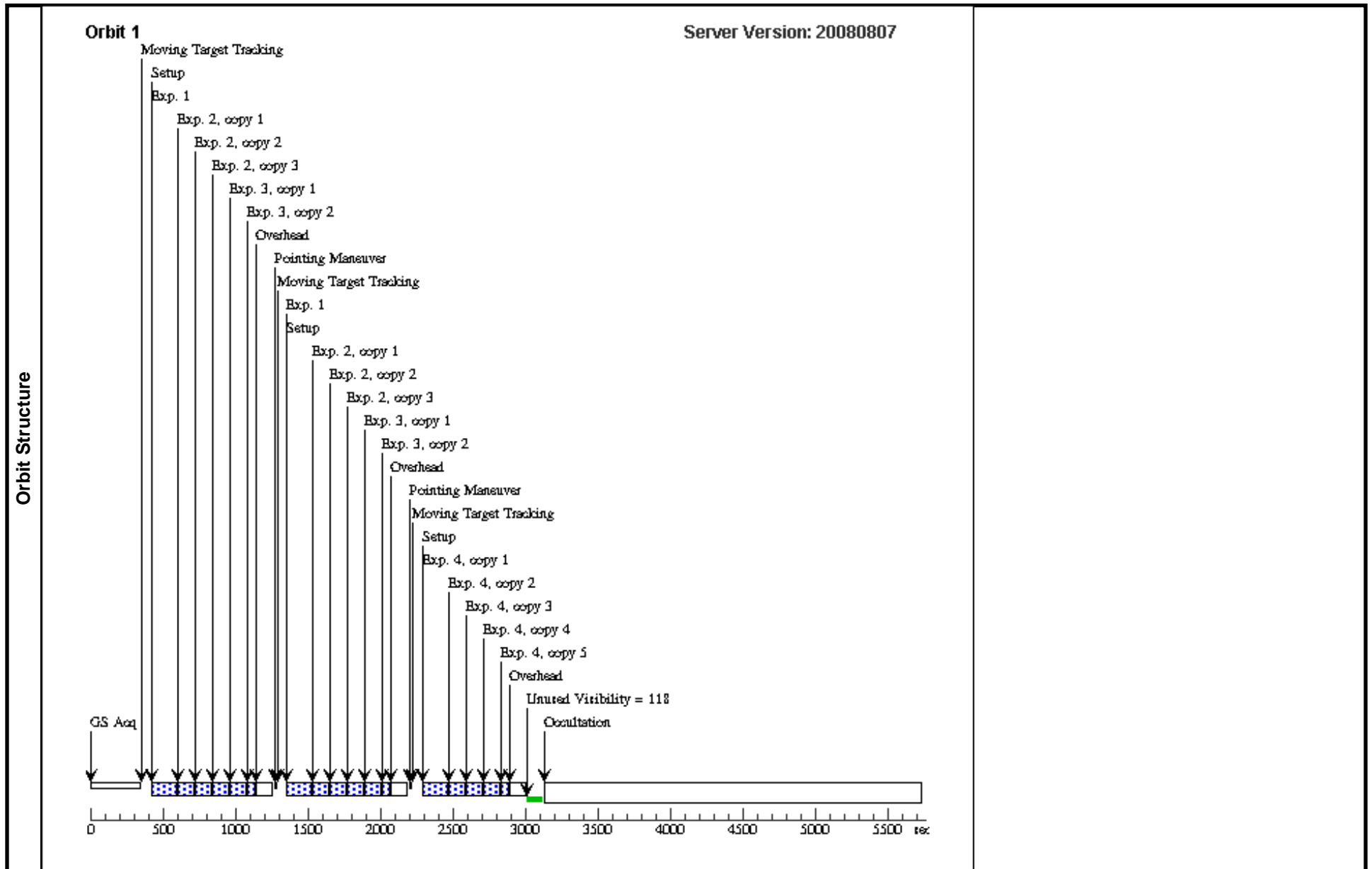
Proposal 11969 - Visit 02 - Satellite Search for Dawn Mission Targets, Vesta and Ceres

Wed Jan 07 02:09:02 GMT 2009

Visit	Proposal 11969, Visit 02, implementation Diagnostic Status: No Diagnostics Scientific Instruments: WFPC2 Special Requirements: (none)										
	Patterns	#	Primary Pattern			Secondary Pattern			Exposures		
		(4)	Pattern Type=LINE Purpose=MOSAIC Number Of Points=2 Point Spacing=25 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=315 Angle Between Sides= Center Pattern=false					(1-3)		
Solar System Targets	#	Name	Level 1	Level 2	Level 3	Window	Ephem Center				
	(1)	CERES	TYPE=ASTEROID,A=2.76679153235 1548,E=.07947462245028122,I=10.58 571555748677,O=80.40447317892902 ,W=72.89568694749072,M=344.5452 233474741,EQUINOX=J2000,EPOCH =30-NOV-2008:00:00:00				EARTH				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit	
	1	(1) CERES	WFPC2, IMAGE, WF2-FIX	F606W	ATD-GAIN=15	POS TARG 30,-30; GS ACQ SCENARI O BASE1T3	Sequence 1-4 Non-Int Pattern 1-3 (4)	0.12 Secs [=>(Pattern 1)] [=>(Pattern 2)]	[1]		
	<i>Comments: Short exposure with gain=15 to avoid saturation</i>										
	2	(1) CERES	WFPC2, IMAGE, WF2-FIX	F606W	CLOCKS=YES	POS TARG 30,-30	Sequence 1-4 Non-Int Pattern 1-3 (4)	20 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)]	[1]		
<i>Comments: Long saturated exposure to detect faint satellites</i>											
3	(1) CERES	WFPC2, IMAGE, WF2-FIX	F606W	CLOCKS=YES	POS TARG 30,-30	Sequence 1-4 Non-Int Pattern 1-3 (4)	40 Secs X 2 [=>(Pattern 1, Copy 1)] [=>(Pattern 1, Copy 2)] [=>(Pattern 2, Copy 1)] [=>(Pattern 2, Copy 2)]	[1]			
<i>Comments: Long saturated exposure to detect faint satellites</i>											

Proposal 11969 - Visit 02 - Satellite Search for Dawn Mission Targets, Vesta and Ceres

Exposures (continued)	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	4		(1) CERES	WFPC2, IMAGE, PC1-FIX	F606W	ATD-GAIN=15		Sequence 1-4 Non-Int	0.6 Secs X 5 [=>(Copy 1)] [=>(Copy 2)] [=>(Copy 3)] [=>(Copy 4)] [=>(Copy 5)]	[1]
<i>Comments: Short exposure with gain=15 to avoid saturation</i>										



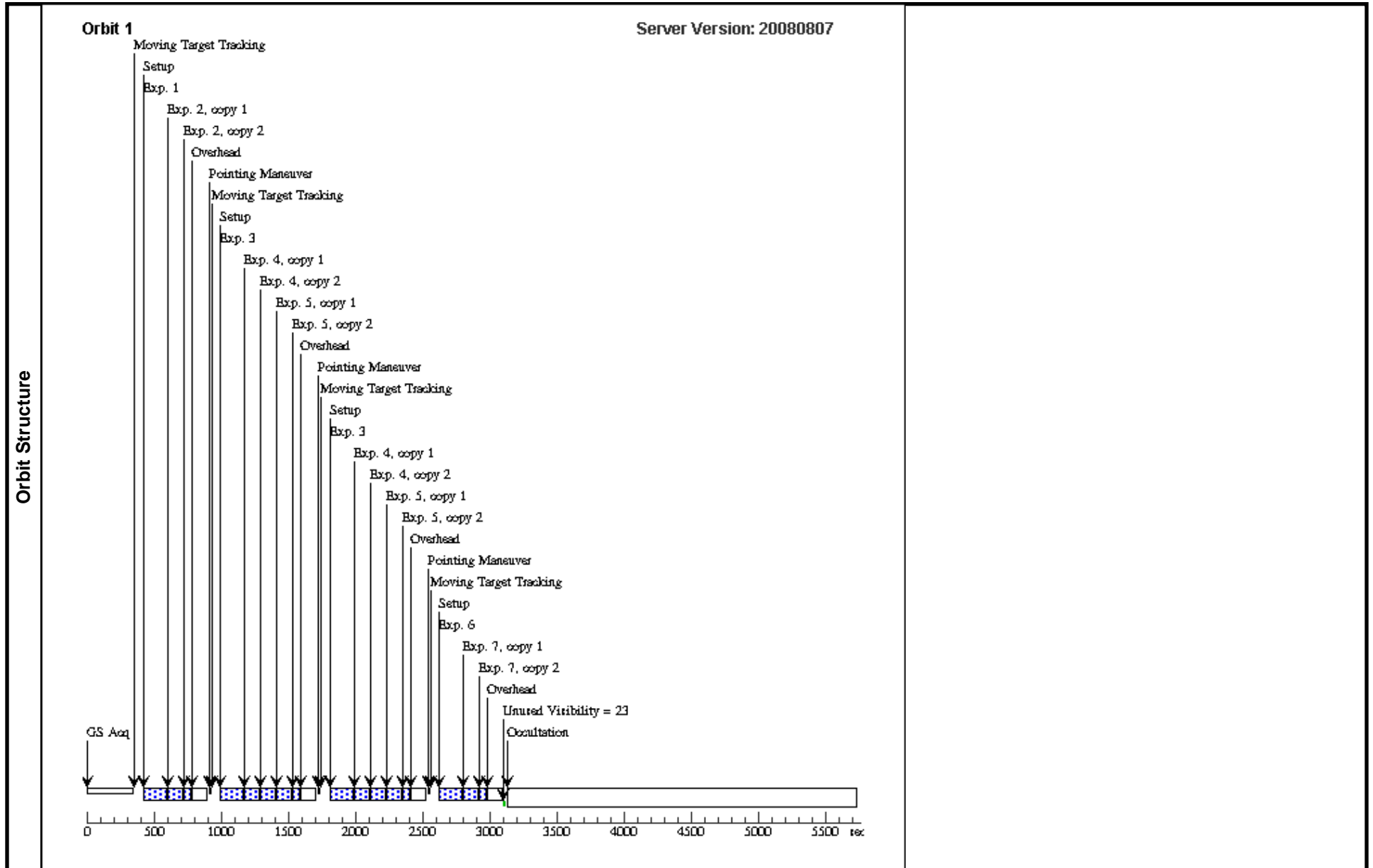
Proposal 11969 - Visit 03 - Satellite Search for Dawn Mission Targets, Vesta and Ceres

Wed Jan 07 02:09:03 GMT 2009

Visit	Proposal 11969, Visit 03, implementation Diagnostic Status: No Diagnostics Scientific Instruments: WFPC2 Special Requirements: AFTER 02 BY .9 D TO 1.1 D; SEQ 03,04 WITHIN 2.2 Orbits										
	Patterns	#	Primary Pattern				Secondary Pattern			Exposures	
(3)		Pattern Type=LINE Purpose=MOSAIC Number Of Points=2 Point Spacing=25 Line Spacing=		Coordinate Frame=POS-TARG Pattern Orientation=45 Angle Between Sides= Center Pattern=false					(3-5)		
Solar System Targets	#	Name	Level 1	Level 2	Level 3	Window	Ephem Center				
	(1)	CERES	TYPE=ASTEROID,A=2.76679153235 1548,E=.07947462245028122,I=10.58 571555748677,O=80.40447317892902 ,W=72.89568694749072,M=344.5452 233474741,EQUINOX=J2000,EPOCH =30-NOV-2008:00:00:00					EARTH			
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit	
	1	(1) CERES	(1) CERES	WFPC2, IMAGE, PC1	F606W	ATD-GAIN=15	POS TARG 12,12; GS ACQ SCENARI O BASE1T3	Sequence 1-7 Non-Int	0.6 Secs [==>]	[1]	
	<i>Comments: Short exposure with gain=15 to avoid saturation</i>										
	2	(1) CERES	(1) CERES	WFPC2, IMAGE, PC1	F606W	CLOCKS=YES	SAME POS AS 1	Sequence 1-7 Non-Int	40 Secs X 2 [==>(Copy 1)] [==>(Copy 2)]	[1]	
	<i>Comments: Long saturated exposure to detect faint satellites</i>										
3	(1) CERES	(1) CERES	WFPC2, IMAGE, WF3-FIX	F606W	ATD-GAIN=15	POS TARG 30,30	Sequence 1-7 Non-Int Pattern 3-5 (3)	0.12 Secs [==>(Pattern 1)] [==>(Pattern 2)]	[1]		
<i>Comments: Short exposure with gain=15 to avoid saturation</i>											
4	(1) CERES	(1) CERES	WFPC2, IMAGE, WF3-FIX	F606W	CLOCKS=YES	POS TARG 30,30	Sequence 1-7 Non-Int Pattern 3-5 (3)	20 Secs X 2 [==>(Pattern 1, Copy 1)] [==>(Pattern 1, Copy 2)] [==>(Pattern 2, Copy 1)] [==>(Pattern 2, Copy 2)]	[1]		
<i>Comments: Long saturated exposure to detect faint satellites</i>											

Proposal 11969 - Visit 03 - Satellite Search for Dawn Mission Targets, Vesta and Ceres

Exposures (continued)	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit	
	5	(1) CERES	WFPC2, IMAGE, WF3-FIX	F606W	CLOCKS=YES	POS TARG 30,30	Sequence 1-7 Non-Int Pattern 3-5 (3)	40 Secs X 2	[==>(Pattern 1, Copy 1)] [==>(Pattern 1, Copy 2)] [==>(Pattern 2, Copy 1)] [==>(Pattern 2, Copy 2)]	[1]	
	<i>Comments: Long saturated exposure to detect faint satellites</i>										
	6	(1) CERES	WFPC2, IMAGE, WF3-FIX	F606W	ATD-GAIN=15	POS TARG -10,-10	Sequence 1-7 Non-Int	0.12 Secs	[==>]	[1]	
<i>Comments: Short exposure with gain=15 to avoid saturation</i>											
7	(1) CERES	WFPC2, IMAGE, WF3-FIX	F606W	CLOCKS=YES	SAME POS AS 6	Sequence 1-7 Non-Int	40 Secs X 2	[==>(Copy 1)] [==>(Copy 2)]	[1]		
<i>Comments: Long saturated exposure to detect faint satellites</i>											



Proposal 11969 - Visit 04 - Satellite Search for Dawn Mission Targets, Vesta and Ceres

Wed Jan 07 02:09:04 GMT 2009

Visit	Proposal 11969, Visit 04, implementation Diagnostic Status: Warning Scientific Instruments: WFPC2 Special Requirements: (none)										
	(Visit 04) Warning (Orbit Planner): MERGING RULE VIOLATED DURING AUTOMATIC MERGING (Visit 04) Warning (Orbit Planner): MERGING RULE VIOLATED DURING AUTOMATIC MERGING										
Diagnosics											
Patterns	#	Primary Pattern		Secondary Pattern		Exposures					
	(4)	Pattern Type=LINE Purpose=MOSAIC Number Of Points=2 Point Spacing=25 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=315 Angle Between Sides= Center Pattern=false			(3-5)					
Solar System Targets	#	Name	Level 1	Level 2	Level 3	Window	Ephem Center				
	(1)	CERES	TYPE=ASTEROID,A=2.76679153235 1548,E=.07947462245028122,I=10.58 571555748677,O=80.40447317892902 ,W=72.89568694749072,M=344.5452 233474741,EQUINOX=J2000,EPOCH =30-NOV-2008:00:00:00				EARTH				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit	
	1	(1) CERES	WFPC2, IMAGE, WF2-FIX	F606W	ATD-GAIN=15	POS TARG -10,10; GS ACQ SCENARI O BASE1T3	Sequence 1-7 Non-Int Same Guide Stars	0.12 Secs [==>]	[1]		
	<i>Comments: Short exposure with gain=15 to avoid saturation</i>										
	2	(1) CERES	WFPC2, IMAGE, WF2-FIX	F606W	CLOCKS=YES	SAME POS AS 1	Sequence 1-7 Non-Int Same Guide Stars	40 Secs X 2 [==>(Copy 1)] [==>(Copy 2)]	[1]		
<i>Comments: Long saturated exposure to detect faint satellites</i>											
3	(1) CERES	WFPC2, IMAGE, WF2-FIX	F606W	ATD-GAIN=15	POS TARG 30,-30	Sequence 1-7 Non-Int Same Guide Stars Pattern 3-5 (4)	0.12 Secs [==>(Pattern 1)] [==>(Pattern 2)]	[1]			
<i>Comments: Short exposure with gain=15 to avoid saturation</i>											

Proposal 11969 - Visit 04 - Satellite Search for Dawn Mission Targets, Vesta and Ceres

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
Exposures (continued)	4	(1) CERES	WFPC2, IMAGE, WF2-FIX	F606W	CLOCKS=YES	POS TARG 30,-30	Sequence 1-7 Non-Int Same Guide Stars Pattern 3-5 (4)	20 Secs X 2 [==>(Pattern 1, Copy 1)] [==>(Pattern 1, Copy 2)] [==>(Pattern 2, Copy 1)] [==>(Pattern 2, Copy 2)]	[1]
	<i>Comments: Long saturated exposure to detect faint satellites</i>								
	5	(1) CERES	WFPC2, IMAGE, WF2-FIX	F606W	CLOCKS=YES	POS TARG 30,-30	Sequence 1-7 Non-Int Same Guide Stars Pattern 3-5 (4)	40 Secs X 2 [==>(Pattern 1, Copy 1)] [==>(Pattern 1, Copy 2)] [==>(Pattern 2, Copy 1)] [==>(Pattern 2, Copy 2)]	[1]
	<i>Comments: Long saturated exposure to detect faint satellites</i>								
6	(1) CERES	WFPC2, IMAGE, WF4-FIX	F606W	ATD-GAIN=15	POS TARG 10,-10	Sequence 1-7 Non-Int Same Guide Stars	0.12 Secs [==>]	[1]	
<i>Comments: Short exposure with gain=15 to avoid saturation</i>									
7	(1) CERES	WFPC2, IMAGE, WF4-FIX	F606W	CLOCKS=YES	SAME POS AS 6	Sequence 1-7 Non-Int Same Guide Stars	40 Secs X 2 [==>(Copy 1)] [==>(Copy 2)]	[1]	
<i>Comments: Long saturated exposure to detect faint satellites</i>									

