IBEX Command Approval Checklist Rev 15 incorporates the eclipse constraint addition.

Orbit	314	Special Ops	Lo ISN collection; cross-cal.			
14 R _E asc. Date/Time	01/20 14:18					
Apogee	01/24 16:26	Maneuver Window Start	01/24 16:25	Maneuver Window End	01/24 16:55	
Apogee Target	Sun					
15 R _E desc. Date/Time	01/28 17:30		14 R _E desc. Date/Time	01/28 18:52		
Perigee	01/29 05:27	Maneuver Window Start	01/28 19:21	Maneuver Window Stop	01/29 16:00	
Perigee Target		199999999998 ta 63199999999998	argetY:-0.66814499	99999999		
Eclipse	None	Eclipse Start	N/A	Eclipse End	N/A	
Sun Mnvr	Yes	Apogee/Perigee	Apogee	Sun Angle at DESCENDING		
Approved Version	IBEX_2016_020_o0314a_v001.scr					

Activity	Command Checks	Date Done	Done By
Supporting Materials	 IBEX_CrossingTimes_<date>_v00x.txt on SFTP at /IBEX/fdg/PredictedEphemeris/Orbit Events/.</date> Orbit Events File on SFTP at /IBEX/moc/Moc-Soc/oef/. Command Constraint Violations Report on SFTP at /IBEX/moc/Moc-Soc/cvr/. Contacts this orbit Orbit_oXXX.txt included in the ATS approval email. Science Tasking File at /IBEX/moc/Soc-Moc/stf/. Merged ATS at http://ibex.unh.edu/cgi-bin/ats.cgi. 		
Sun Maneuvers	 Additional contacts should not be planned to support IBEX Sun Precession Maneuvers due to star tracker outages. The standard apogee and perigee contacts should be used to verify that a maneuver has occurred. If it is not possible to plan one of the standard contacts after the star tracker outage is down to 50% and a valid quaternion reading can be made to verify the maneuver, the coarse Sun sensor angle and the thruster pulse count will be used to determine a) whether a maneuver took place, and b) whether the pointing after the maneuver is as expected +/- 2 degrees. 		
	• The nominal off-Sun pointing constraint is 7.25 degrees. Based on the missed maneuver in orbit 114, the payload team has determined that there is no hardware risk associated with off-Sun pointing up to angles of at least 13 degrees. There is a higher background noted in the data starting at around 9.5 degrees off Sun pointing.		
File Input Check	 Current OEF inputs are Forecast STF, last orbit's OEF & latest ephemeris. ATS inputs are this orbit's OEF & STF. (And ABS if present.) ATS filename is of the format IBEX_yyyy_doy_o0xxxa_v0zz.scr. where IBEX is capitalized, yyyy is the year, doy is the day of year, xxx is the 3-digit orbit number and zz is the 2-digit version number. Any special operations ATSs will have another designation between the orbit number and version number (i.e. *o0186a_hgc_v001 for the Hi gain curve). 	1/07/2016	CLR

	1.	Check OEF for eclipses during the orbit.		
Eclipses	2.	Verify long eclipse flag start & stop times reflect Ryan Tyler's recommendations based on his eclipse diagnostic tool. Suggestions made by Ryan after the use of this tool trump the general guidelines below. (Please note, specific timing may shift if the recommendations are relative to eclipse timing. For example, it may say set LE flag to false X hours after the end of the eclipse with a given FALSE time suggested. If the eclipse timing changes as the ephemeris becomes more refined, this command time may shift.)	N/A	N/A
	3.	Verify no contacts planned during an eclipse. Note: If in conflict, the eclipse diagnostic recommendations will trump the general guidelines below. a Verify transmitter OFF from 30 minutes before eclipse start through the end of the eclipse. b For an eclipse where the long eclipse flag is set, schedule a SOH contact directly following the end of the eclipse (or per Ryan's assessment). c Set the LE flag according to Ryan's assessments.		
	4.	Verify no maneuver planned during an eclipse. Note: If in conflict, the eclipse diagnostic recommendations will trump the general guidelines below. a Verify no maneuver or cat bed heaters on from 3 hours before eclipse start through 3 hours after eclipse end. b Verify no maneuver or cat bed heaters are on while the long eclipse flag is set.		
	5.	Verify the following additional constraints (from battery balancing section). a Verify the first command sets the long eclipse flag to TRUE, the second command sets the flag to FALSE. b Verify P/L is in HVSTANDBY or HVENG. c Verify no charging cycle within 2 hours of ASCENDING or DECENDING macro execution. This applies to all eclipses, not just moderate or long eclipses.		
Moon In Lo FOV	1.	Check OEF for Moon in Lo FOV events. • MoonInLoFovStart • MoonInLoFovStop	N/A	N/A
	2.	Check for corresponding Moon in Lo FOV start commands in ATS (timing will not be exact). • PMT_LVL 300 • IF_STAR_ADJ 0 • Note: if the Moon is closer than 30Re, the PMT will be set to 250. The distance to the moon can be found in the STF.		
	3.	 Check for corresponding Moon in Lo FOV stop commands. IF_STAR_ADJ 250 PMT_LVL 800 Note: if the Moon is still in the FOV at the time of DESCENDING, no Moon in Lo FOV stop commands will be present in ATS. The values are reset to the default at next set of ASCENDING macros. 		
	4. 5.	If Moon in Lo FOV starts in arc a & ends in arc b, check Moon in Lo FOV Start commands resent after apogee ASCENDING commands. If Moon in Lo FOV starts within apogee HVSTANDBY period, check Moon in Lo FOV Start commands sent after apogee ASCENDING commands.		

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Contact	1.	Each contact has 5 commands.	01/07/2016	CLR
Commands	1.	Verify STX on/off times, downlink rate against <i>Orbit_oXXX.txt</i> file.		
	2.	Verify contacts in the previous ATS have not been duplicated.		
	3.	Verify all currently planned contacts in Orbit_xxx.txt are in the ATS.		
	4.	Verify each contact contains the following 5 commands.		
		SetRelay stx,on		
		 SetDownlink2K (2K, 40K, 64K, 160K, or 320K) 		
		 SetBilevelOutputControlReg STXMODE_Strobe,ON 		
		SetBilevelOutputControlReg COHERENT,ON		
		SetRelay stx,off		
	5.	If contact is near an eclipse		
		a. Verify transmitter OFF from 30 minutes before eclipse start through 30 minutes after eclipse		
		end.		
	_	b. If additional transmitter constraints exist, they will be captured in Ryan's recommendations.		
	6.	If an APL contact is being used for an SSR Dump, the data rate should be at least 160 ksps & the SSR		
		DUMP_NEW command should be included in the contact commands:		
		 SetRelay stx,on SetDownlink160K 		
		SetBilevelOutputControlReg STXMODE_Strobe,ON		
		SetBilevelOutputControlReg STANIODE_Strobe,ON SetBilevelOutputControlReg COHERENT,ON		
		SSR_DUMP_NEW		
		SetRelay stx,off		
SC State	1.	Transition to Science state will be first 3 commands of each ATS (at 14 Re).	01/07/2016	CLR
Science:		• SetSpinPulseProtectEnable Disable 01:20:14:18		
arc a		SetScState science		
		SetSpinPulseProtectEnable Enable La acience mode will be the most command (at 14 Pa)		
	2.	Lo science mode will be the next command (at 14 Re). • Lo_science_mode Normal		
	3.	Verify no transition to Science again at the end of the ATS. The ATS commands go from 14 Re		
	٥.	to 14 Re in each orbit.		
	4.	Verify the transition to Science commands for this orbit are not part of the previous ATS using		
		http://ibex.unh.edu/cgi-bin/ats.cgi.		
	5.	Verify that the beginning of this ATS does not overlap with the end of the previous orbit's ATS		
		using http://ibex.unh.edu/cgi-bin/ats.cgi.		
Payload	1.	Verify w/ Crossing Times report that it occurs about 15Re ascending. The arc a ASCENDING	01/07/2016	CLR
Mode		commands can start any time at or above 15Re ascending.		
HVSCI:	2.			
arc a		• ASCENDING_PL1 01:20:15:40		
		ASCENDING_HI		
		• SET_PARAMETER 1, TLM_RATE_SOH		
		• SET_PARAMETER 4, HV_STEP_DWELL		
		SET_PARAMETER 3, HV_STEP_FRAC		
		HI_COL_NEG_LVL 1400		
		CEU_HI_CEM_1_LVL 1780		
		• CEU_HI_CEM_2_LVL 1780		
		• CEU_HI_CEM_3_LVL 1780		
		CEU_HI_CEM_4_LVL 1900 CET_PARAMETER 0. TIMA_RATE_COURS		
		SET_PARAMETER 0, TLM_RATE_SOH ACCENDING BL3		
		ASCENDING_PL2 ASSENDING_RIA		
		ASCENDING_PL1 ASSENDING_LO		
		ASCENDING_LO ASSENDING_DIS_01:30:16:04		
	<u> </u>	• ASCENDING_PL2 01:20:16:04		

Payload Mode		Payload DESCENDING commands end 1.5h before thruster enable. DESCENDING PL1 01:24:14:29	01/07/2016	CLR
HVSTANDBY		DESCENDING_FET 01:24:14:25 DESCENDING_FET 01:24:14:25		
: arc a		ASCENDING PL2		
		DESCENDING_PL1		
		DESCENDING_HI DESCENDING_DIA_01/24/14/E2		
	-	DESCENDING_PL2 01:24:14:52 Spacecraft Housekeeping command occurs 1h before thruster enable.		
SC State HK	1.	SetScState housekeeping 01:24:15:25	01/07/2016	CLR
: arc a				
Inertial	1.	Use this command sequence if an apogee inertial maneuver is used, otherwise skip to the 'Sun	N/A	N/A
Maneuver :		Precession Maneuver : Apogee' sequence below.	IN/A	IN/A
Apogee	2.	Verify Thruster enable command occurs within STF maneuver window.		
Apogoo		Verify no eclipse occurs from cat bed heater on through set FC mode Mission.		
	4.	Verify cat bed heaters come on 55 min before burn.		
		• CATBED_5N_HTR,ON		
	5.	Verify Kalman Filter input select is ground command & estimator update is disabled.		
		• SetKFInputSelect GND_CMD, 0, 0, 0, 0		
		SetEstUpdateEnables ENABLE, DISABLE		
	6.	Verify in FC mode Burn.		
		SetFcMode burn		
	7.	Compare SetInrDir in ATS with pointing as defined in the Forecast STF & verify the vectors		
		match.		
		• SetInrDir		
	_			
	8.	Verify inertial maneuver chosen.		
	_	SetLrTarget ACS_INERTIAL		
	9.	Verify thrust time set to 11 min.		
		SetThrustTime 660		
	10.	Verify thruster enable command matches RepointingManeuverStart time in OEF.		
		SetThrustEnable ENABLE		
		RepointingManeuverStart		
	11.	Verify 10 minutes after thrusters enabled: thrusters disabled, cat bed heaters off, thrust time set		
		to 0.		
		SetThrustEnable DISABLE		
		SetHTRCmd CATBED_5N_HTR,OFF		
		SetThrustTime 0		
	12.	Verify 25 min after thrusters enabled: Static Z rate set, outage %valid set, FC mode Mission.		
		SetStaticZrate ESTIMATOR, 0.418		
		 SetKFInputSelect STA_PCT_VALID, 48,18,23,53 		
		SetFcMode Mission		

: arc b an hour before the maneuver if the maneuver occurs less than 1 hour after 14 Re desc).	1			1	
Procession 2. Vorify inclusive anable command occurs within SIT in anieuwer window. Another Vorify cat bed heaters powered on 55 min before thruster enable. Vorify cat bed heaters powered on 55 min before thruster enable. Vorify though power of the second power o	Sun			01/07/2016	CLR
Maneuver : Apoges 4. Verify one both beaters powered on 55 min before thruster enable. 4. Verify cat be deheaters powered on 55 min before thruster enable. 5. Verify in For Gode Burn and Sun target. 5. Verify in For Gode Burn and Sun target. 5. Verify thrust time set to 16 min. 5. Set*EvMode burn 01:24:15:25 5. Set*EvMode burn 01:24:15:25 5. Set*EvMode burn 01:24:15:25 5. Set*EvMode Durn 01:24:15:25 5. Set*EvMode Durn 01:24:15:25 5. Set*EvMode Minutes after thrusters disabled, cat bed heaters off, thrust time set to 0. FC mode Mission. Set*EvMode Mission 01:24:16:40 5. Set*EvMode Mission. Set*EvMode				3.,51,23.0	
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Mode HVSCI: arc b ASCENDING_H SET_PARAMETER 1, TLM_RATE_SOH SET_PARAMETER 3, HV_STEP_DWELL SET_PARAMETER 3, HV_STEP_DWELL SET_PARAMETER 3, HV_STEP_FRAC HI_COL_NEG_LVL 1780 CEU_HI_CEM_1_LVL 1780 CEU_HI_CEM_2_LVL 1780 CEU_HI_CEM_4_LVL 1900 SET_PARAMETER 0, TLM_RATE_SOH ASCENDING_PL2 ASCENDING_PL2 ASCENDING_PL1 ASCENDING_PL1 ASCENDING_PL0 ASCENDING_PL0 ASCENDING_PL0 ASCENDING_PL0 ASCENDING_PL0 ASCENDING_PL0 ASCENDING_PL0 ASCENDING_PL0 CUMPTION OF THE ARCH OF THE	Davidand	1.	Payload ASCENDING commands	01/07/0010	CLD
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arc b * SET_PARAMETER 1, TLM_RATE_SOH * SET_PARAMETER 3, HV_STEP_DWELL * SET_PARAMETER 3, HV_STEP_FRAC * HI_COL_NEG_LVL 1400 * CEU_HI_CEM_1_LVL 1780 * CEU_HI_CEM_2_LVL 1780 * CEU_HI_CEM_2_LVL 1900 * SET_PARAMETER 0, TLM_RATE_SOH * ASCENDING_PL2 * DESCENDING_PL3 * DES			ASCENDING_HI		
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HVSTANDBY : arc b 2. Verify commands take ~23 minutes to execute. • DESCENDING_PL1 01:28:17:04 • DESCENDING_PL2 • DESCENDING_PL2 • DESCENDING_PL1 • DESCENDING_PL1 • DESCENDING_PL2 • DESCENDING_PL3 • DE		1.		01/07/2016	CLR
: arc b DESCENDING_PL1 01:28:17:04 DESCENDING_PL2 ASCENDING_PL1 DESCENDING_PL1 DESCENDING_PL1 DESCENDING_PL2 01:28:17:27 SC State HK : arc b Verify with Crossing Times report that Transition to Housekeeping state occurs at 14 Re desc (or an hour before the maneuver occurs less than 1 hour after 14 Re desc).		2.			
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DESCENDING_PL1 DESCENDING_HI DESCENDING_PL2 01:28:17:27 SC State HK : arc b 1. Verify with Crossing Times report that Transition to Housekeeping state occurs at 14 Re desc (or an hour before the maneuver if the maneuver occurs less than 1 hour after 14 Re desc). O1/07/2016 CLR					
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SC State HK 1. Verify with Crossing Times report that Transition to Housekeeping state occurs at 14 Re desc (or an hour before the maneuver if the maneuver occurs less than 1 hour after 14 Re desc).					
: arc b an hour before the maneuver if the maneuver occurs less than 1 hour after 14 Re desc).					
, ,		1.		01/07/2016	CLR
CatCaCtata hausakaaning 01:20:10:23	: arc b		·		
Setscstate nousekeeping			SetScState housekeeping 01:28:18:22		

Inertial	1.	Use this command sequence if a perigee inertial maneuver is used, otherwise skip to the 'Sun Precession Maneuver : Perigee' sequence below.	01/07/2016	CLR
Maneuver:	2.	Verify no eclipse occurs from cat bed heater on through set FC mode Mission.		
Perigee		Verify cat bed heaters come on 55 min before burn.		
	0.	CATBED_5N_HTR,ON 01:28:18:26		
	4.	Verify in Housekeeping state.		
	5.	Verify Kalman Filter input select is ground command & estimator update is disabled.		
	6.	SetKFInputSelect GND_CMD, 0, 0, 0, 0		
		SetEstUpdateEnables ENABLE, DISABLE		
	7.	Verify in FC mode Burn.		
		SetFcMode burn		
	8.	Compare SetInrDir in ATS with target vector in the Forecast STF & verify the vectors match.		
		• SetInrDir 0.630752,-0.668145,-0.394632		
		<pre>•targetX:0.63075199999999999 targetY:-0.6681449999999999999999999999999999999999</pre>		
	9.	Verify inertial maneuver chosen.		
		SetLrTarget ACS_INERTIAL		
	10.	Verify thrust time set to 11 min.		
		SetThrustTime 660		
	11.	Verify thruster enable command matches RepointingManeuverStart time in OEF.		
		SetThrustEnable ENABLE 01:28:19:21		
		RepointingManeuverStart		
	12.	Verify 10 minutes after thrusters enabled: thrusters disabled, cat bed heaters off, thrust time set		
		to 0.		
	•	SetThrustEnable DISABLE 01:28:19:31		
		• CATBED_5N_HTR,OFF		
		SetThrustTime 0		
	13.	Verify 25 min after thrusters enabled: Static Z rate set, outage %valid set, FC mode Mission.		
		SetStaticZrate ESTIMATOR, 0.418 01:28:19:47		
		 SetKFInputSelect STA_PCT_VALID, 48,18,23,53 		
		SetFcMode Mission		
Sun	1.	Use this command sequence in the event of a perigee Sun maneuver.	N/A	N/A
Precession	2.	Verify Thruster enable command occurs within STF maneuver window.	IN/A	IN/A
Maneuver :	3.	Verify no eclipse occurs from cat bed heater on through set FC Mode Mission.		
Perigee	4.	Verify cat bed heaters come on 55 min before burn.		
. ogee		• CATBED_5N_HTR,ON		
	5.	Verify in FC mode Burn and Sun target.		
		SetFcMode burn		
		SetLrTarget ACS_SUN		
	6.	Verify thrust time set to 16 min.		
		SetThrustTime 960		
	7.	Verify thruster enable command matches SunMvrBegin time in OEF.		
		SetThrustEnable ENABLE		
		SunMvrBegin		
	8.	Verify 15 minutes after thrusters enabled: thrusters disabled, cat bed heaters off, thrust time set		
		to 0, FC mode Mission.		
		SetThrustEnable DISABLE		
		SetHTRCmd CATBED_5N_HTR,OFF		
		SetThrustTime 0		
		SetFcMode Mission		

IBEX Command Approval Checklist C. Reno

Rev 15 Last update 8/24/2015

Battery Cell Balancing	1. 2. 3. 4. 5. 6. 7.	There will be battery cell balancing every 2 out of 3 orbits. Battery cell balancing this orbit? Y/N Verify charging cycle (Long eclipse flag=TRUE) is 90 minutes long. Verify the first command sets the long eclipse flag to TRUE, the second command sets the flag to FALSE. Verify P/L is in HVSTANDBY or HVENG. Verify no charging cycle within 2 hours of ASCENDING or DECENDING macro execution. Verify no charging cycle within 1 hour of maneuver. Verify no charging cycle during an eclipse.	N/A	N/A
Cmd Violation	1.	Review CCVR. If you have any questions Reply All to the ATS Approval email and ask the team.	01/07/2016	CLR

Activity		Anomaly Response : Non-nominal burn	Date Completed	Completed By
	•	If the maneuver has not occurred or the spacecraft pointing as designated by either the star tracker or coarse Sun sensor is off by more than 2 degrees from the expected pointing, an anomaly has occurred. • If the spacecraft is in Contingency state all stored commands are flushed from the command queue. Follow standard anomaly process. • If the Sun maneuver did not occur and the spacecraft is in either Science or		
		 Housekeeping state follow the steps below. If a partial Sun maneuver has occurred and the spacecraft is in either Science or Housekeeping state follow the steps below. 		
	•	Please note that there is no anticipated hardware damage associated with exceeding the 12.5 degree constraint; this constraint is in place because we should not exceed the largest pointing achieved thus far in the mission.		
	1.	If the payload is in HVSTANDBY, LVENG or OFF, and there are no commands loaded to bring it to HVSCI voltages, no operational pointing constraints will be violated. Follow		
	2.	standard anomaly process. If the payload in HVSCI mode or there are uploaded commands to bring the payload to HVSCI mode,		
		a. Determine current off Sun pointing. If the off Sun angle has already exceeded 12.5 degrees, the MOC should notify the MOM and immediately send the DESCENDING command suite in real-time, as described below. If this cannot be done in the contact where the pointing anomaly was discovered, another contact will be planned as soon as possible to execute these commands. @CEU_MACRO_EXEC DESCENDING_PL1 (< 1 min) @CEU_MACRO_EXEC DESCENDING_LO (~ 10 min) @CEU_MACRO_EXEC DESCENDING_HI (~ 8 min) @CEU_MACRO_EXEC DESCENDING_PL2 (< 1 min) Please note: The only scenario where hitting 12.5 degrees is expected is when a perigee Sun precession maneuver is completely missed after an inertial apogee maneuver which occurs late in the maneuver window (near apogee + 10 hours). b. If current Sun pointing is below 12.5 degrees, the ISOC should input ST Sunpointing angle into ibex_rotate to determine the Sun angle at the time of DESCENDING. Sun-Angle at payload DESCENDING c. If 12.5 degrees is not exceeded by the time of DESCENDING, no payload-specific action is needed for this arc. Follow standard anomaly response process. d. If 12.5 degrees is exceeded by the time of DESCENDING, a new command set should be sent. i. The ISOC will generate the new STF which has the DESCENDING commands executing early such that 12.5 degrees is not exceeded while the payload is in HVSCI. ii. The MOC will create an associated ATS. iii.Approval is needed by the MOM, MOC & ISOC prior to upload.		
		iv. The MOC will assess whether an additional pass is needed in order to upload the commands prior to exceeding the 12.5 degree constraint. The onboard DESCENDING commands do not need to be deleted.		