

CAPS Activities during and around Saturn Orbital Insertion

SOI timeline:

• Start of quiet period:	91.59 R _S	June 23 00:00
• Ascending ring plane crossing (ARPX):	2.61 R _S	July 1, 00:49
• Start of SOI burn:	2.38 R _S	July 1, 01:04
• Periapsis (23,700 km above ring plane):	1.33 R _S	July 1, 02:39
• End of SOI burn (97 min. duration):	1.33 R _S	July 1, 02:41
• Turn to Earth (est.)	1.48 R _S	July 1, 03:11
• Start of post SOI science:	~1.5 R _S	~July 1, 03:15
• Descending ring plane crossing (DRPX):	2.63 R _S	July 1, 04:35

Quiet period restrictions:

- Spacecraft pointed with $-Z$ to Earth, $+X$ to north ecliptic pole until ARPX
 - Places corotation well inside CAPS field of view for entire period
- Instruments must use less than allocated power (21 W for CAPS)
 - Decreases and variability in power use are ok, peak must be below limit
- No software modifications
- Instruments may execute internal sequences (IEBs) started prior to June 23 00:00
 - Instruments may lower high voltages prior to SOI burn using internal sequence
- No real-time commands
 - This probably includes response to anomalies
- Data may be downlinked until SOI-29 hours
- Only one SSR may be used to record data

SOI burn and CAPS high voltages

- The R-4D main engine produces 148 g/s of various neutrals
 - Mostly water and nitrogen
- SOI burn lasts 97 min.
- No modeling of the spacecraft environment has been done
 - Two studies of near field (backup engine) & optical instrument contamination
- Pressure near CAPS would be orders of magnitude less than $6 \times 10^{13} \text{ cm}^{-3}$
 - Not a useful upper limit: Safe values $\sim 10^{10}$ (few $\times 10^{-7}$ Torr)
- Will this cause the 14.5 kV high voltage to arc?
 - Will this cause arcing with the voltage at 12 kV (sleep level)?

Post SOI observations

- Sleep mode during SOI conflicts with normal IMS science after SOI
 - HVU1 at 12 kV
 - We currently require 2 hours 15 minutes to raise it to 14.5 kV
 - ELS and IBS are turned on in 6 and 8.5 minutes
 - ST and LEF MCP voltages are turned on in 25-30 minutes
- End of SOI to DRPX is the only opportunity for most CAPS rings-related goals
 - This period is ~ 1 hour 20 minutes long
- IMS can operate and take data at 12 kV
 - Lower sensitivity & mass resolution
 - Shift in TOF peak & shape \Rightarrow SAM will not produce viable Ion data

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Suggestions by F. Crary are highlighted

Pre-SOI quiet options:

1. Operate normally

- Real time commanding may not be possible, even for an anomaly
- CAPS has been operating since Sept. 2000 without serious anomalies
- Worst case (?) is ending up in reset w/out replacement heater for 8 days
 - Thermal issues for ELS?
- Would it be safe to actuate?

2. Turn off

SOI burn options:

1. Leave HVU2 at 14.5 kV and take data

- Risks arcing and pulling HVU2 down from 14.5 kV
 - S/c anomaly response (if it turns CAPS off) takes HVU2 down immediately
- Allows us to operate normally after burn

2. Turn HVU2 down to 12 kV and take data

- Quality of IMS data reduced
- ELS and IBS operate normally
- Should we stop the actuator?

3. Go to sleep

Options 2 and 3 limit post-SOI science

When should we change mode? Just before ARPX?

Is 12 kV a safe voltage? Should we reduce it further?

Post-SOI options:

1. Operate normally (if HVU2 was at 14.5 kV during burn)

2. Operate with HVU2 at 12 kV (if HVU2 was at 12 kV or in sleep during burn)

3. Turn HVU2 from 12 kV to 14.5 kV in < 30 min (more than 4x faster than usual)

What is the minimum time to turn CAPS on?

Can IBS & ELS voltages go up at the same time?

Can the LEF and ST MCPs voltages go up at the same time?