Scheduling HST

Effects of the Large and Treasury programs

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But first, the news…

ACS Instrument Status/Update:

- ACS has been performing very well since its installation.
- All modes are operational, including coronography.
- Basic calibrations and documentation are in place to allow ground-breaking science with all of the available modes.

ACS CTE degradation

- The most important science is best done sooner, rather than later.
- ACS Charge Transfer Efficiency (CTE) will degrade with time.
  - Currently ~2% loss in center of a WFC quadrant, for “average” situations.
  - This number may grow with ~2% per year.
  - Programs requiring extreme photometric precision most affected.

ACS Hot Pixel Growth

Hot pixels are accumulating in the Wide Field Channel:

- ~2% by mid Cycle 12 (similar to cosmic ray coverage in a 1000 sec exposure)
- ~6% by 2010
- Little science effect expected with proper dithering.

STIS Capabilities

Broadband imaging UV-Optical

- FOV 25x25” (UV, MAMAs) to 50x50” (Optical, CCD)

UV-Optical long-slit Spectroscopy (R ~ 500 – 17,000)

UV Echelle Spectroscopy (R ~ 30,000 – 110,000)

UV Prism Spectroscopy (R ~ 10 – 500)

High Time Resolution Time-tag Capability in the UV

Optical Coronography using Wedge (minimum size 0.3 arcsec)

STIS

Limiting Signal-to-Noise Ratios

- MAMAs
  - Routine calibration supports 50:1 imaging, 100:1 spectroscopic
  - Dithering (or FP-SPLIT) gives at least 300:1
- CCD
  - Routine calibration supports 100:1
  - Dithering gives >300:1

NICMOS

- Still HST's only infrared capability: imaging, polarimetry, coronography, and slitless grism spectroscopy, 0.8 to 2.5 μm
- 20% of awarded orbits in Cycle 12
- Cooled by NICMOS cooling system to 77.15 K to within 0.1 K: stable *T* means stable optics and detectors
- NICMOS will continue to hold unique capabilities:
  - High angular resolution
  - IR beyond 1.7 μm
  - Coronography, polarimetry

WFPC2

- Photometry and astrometry:
  - Good long-term stability
  - Most filters well characterized (< 1 to 2%)
  - Astrometric changes < 0.05 to 0.10 pixels/year
  - More narrow-band filters than ACS; better FOV than LRFs
  - At 5 sq arcmin, ~25x area of ACS/HRC, better in UV
- CTE
  - Slow, linear increase with time; well characterized
  - Worst case is low background with faint targets
  - Much less important for extended targets or broad-band imaging with moderate background
  - WFPC2 supported through SM4

Spacecraft performance after SM3B

- Power system is nominal, places no constraints on observations
- Pointing Control System is performing better than ever
  - New Solar Arrays induce no day/night jitter
  - Jitter less than 7 mas spec at all times
- Thermal control is ok, places no hard constraints on observations
- Data systems are handling increased volume
  - Should be no problem for Treasury programs if general guidelines in Handbooks are followed

Summary

- Telescope and Instruments are working well
- No apparent restrictions on their use in supporting Treasury programs

Why Large programs?

- Pre-launch discussions led to Key Projects, but even those used <100 orbits in any one Cycle.
- “Second Decade Study” demonstrated that larger programs more effective per orbit and recommended emphasizing them.

Large programs over the years

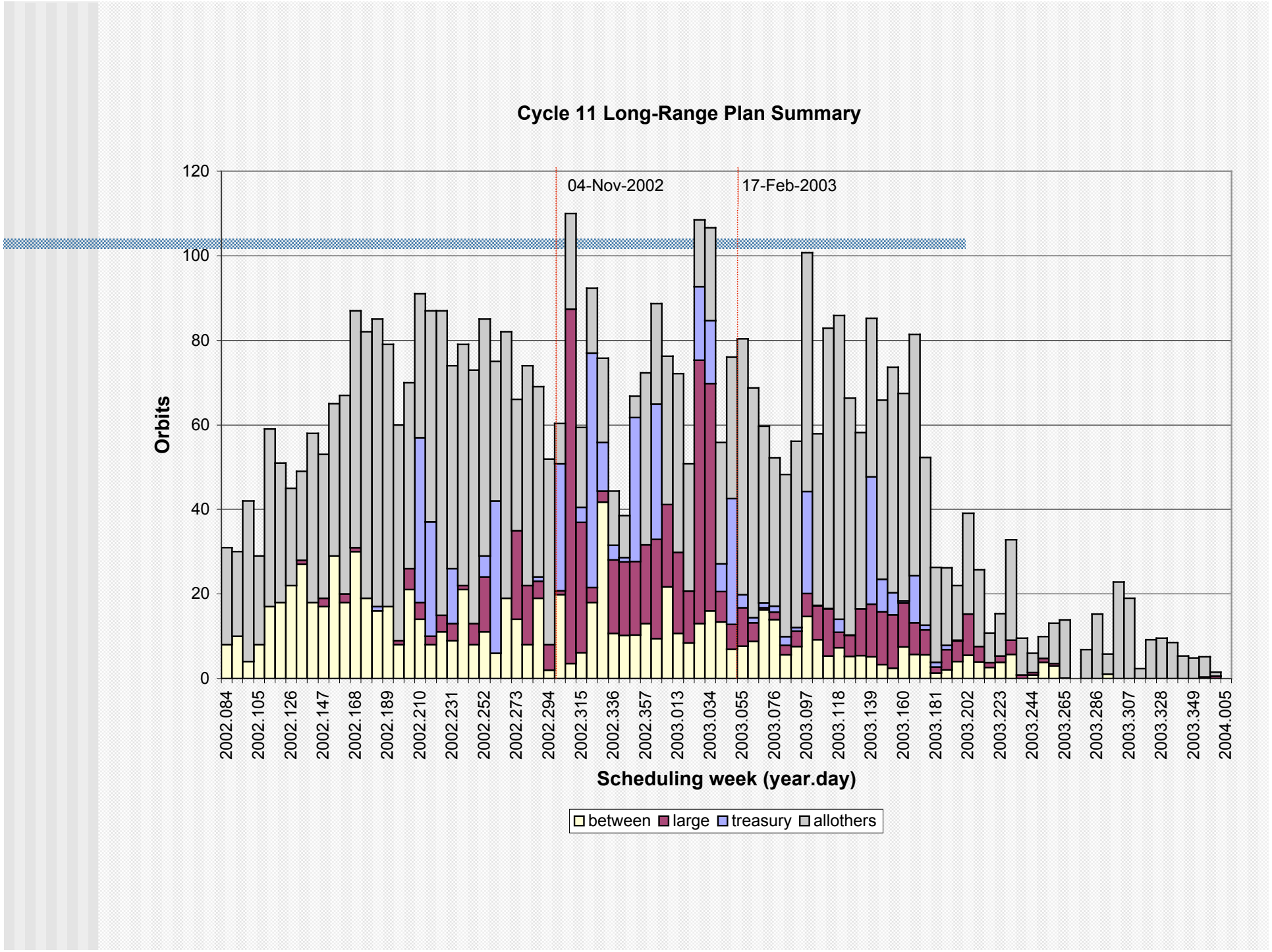
Cycle	Orbits	PI	Subject
5	100	Mould	Extragalactic distance scale
5	150	Williams	Hubble Deep Field
6	150	Mould	Extragalactic distance scale
7	166	Williams	HDF South
8	120	Gilliland	Planets in 47 Tuc
9	105	Schmidt	Testing the accelerating universe
9	123	Richer	White dwarf cooling sequence in M4
9	157	Kulkarni	GRBs
9	112	Lamy	Origin of short-period comets
10	100	Perlmutter	Type Ia SN at high redshift
10	115	Schmidt	Type Ia SN at high redshift
10	116	Tripp	Survey for missing baryons
11	134	Riess	Deceleration test with high-z SN
11	118	Rao	Survey for damped Ly-alpha lines
11	100	Cote	ACS Virgo cluster survey
11	145	Fruchter	Origins of GRBs
11	398	Giavalisco	GOODS
11	116	Bernstein	KBOs
11	126	Brown	Andromeda halo
11	125	Rix	Evolution of galaxy structure

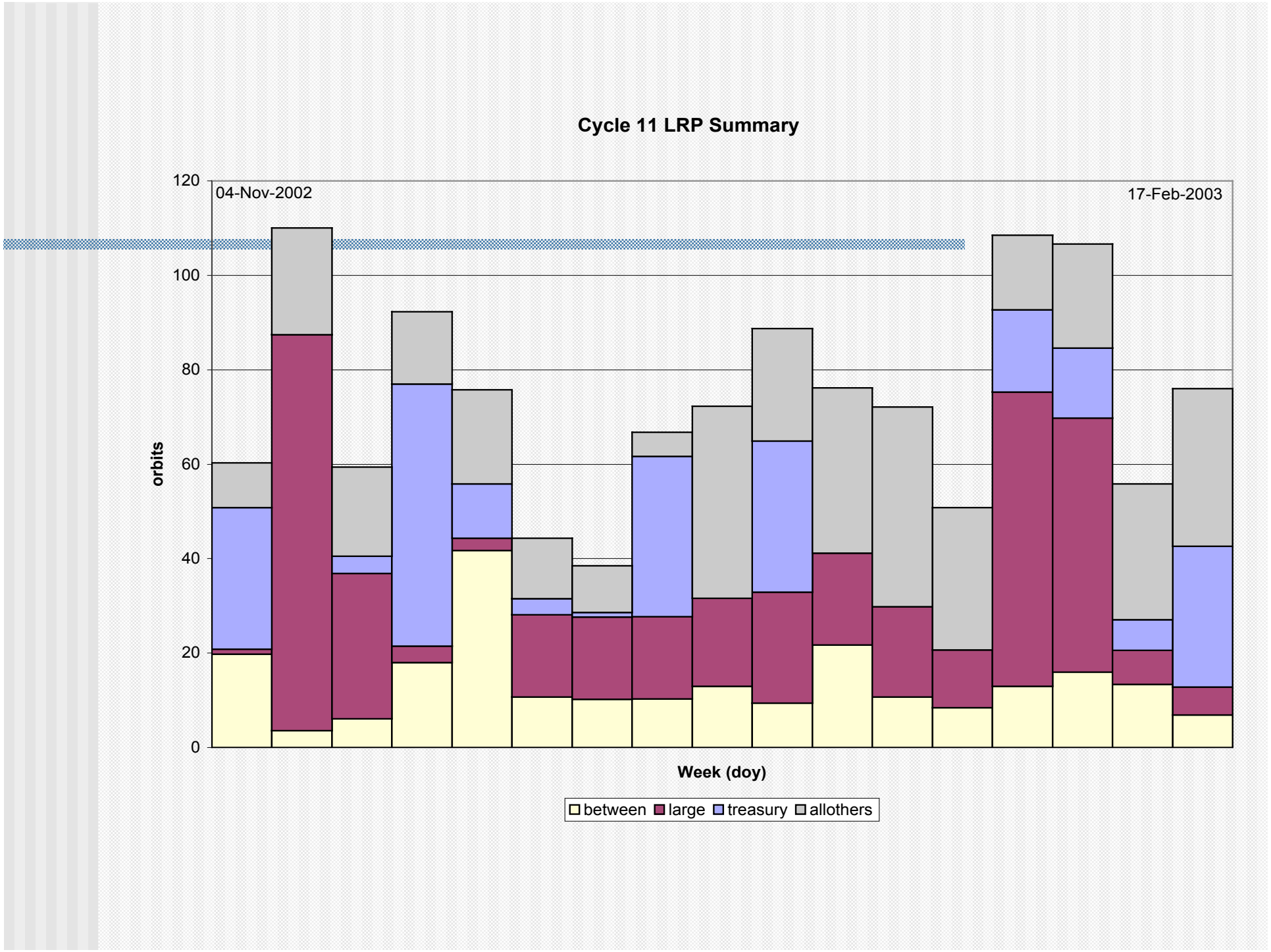
Scheduling restrictions

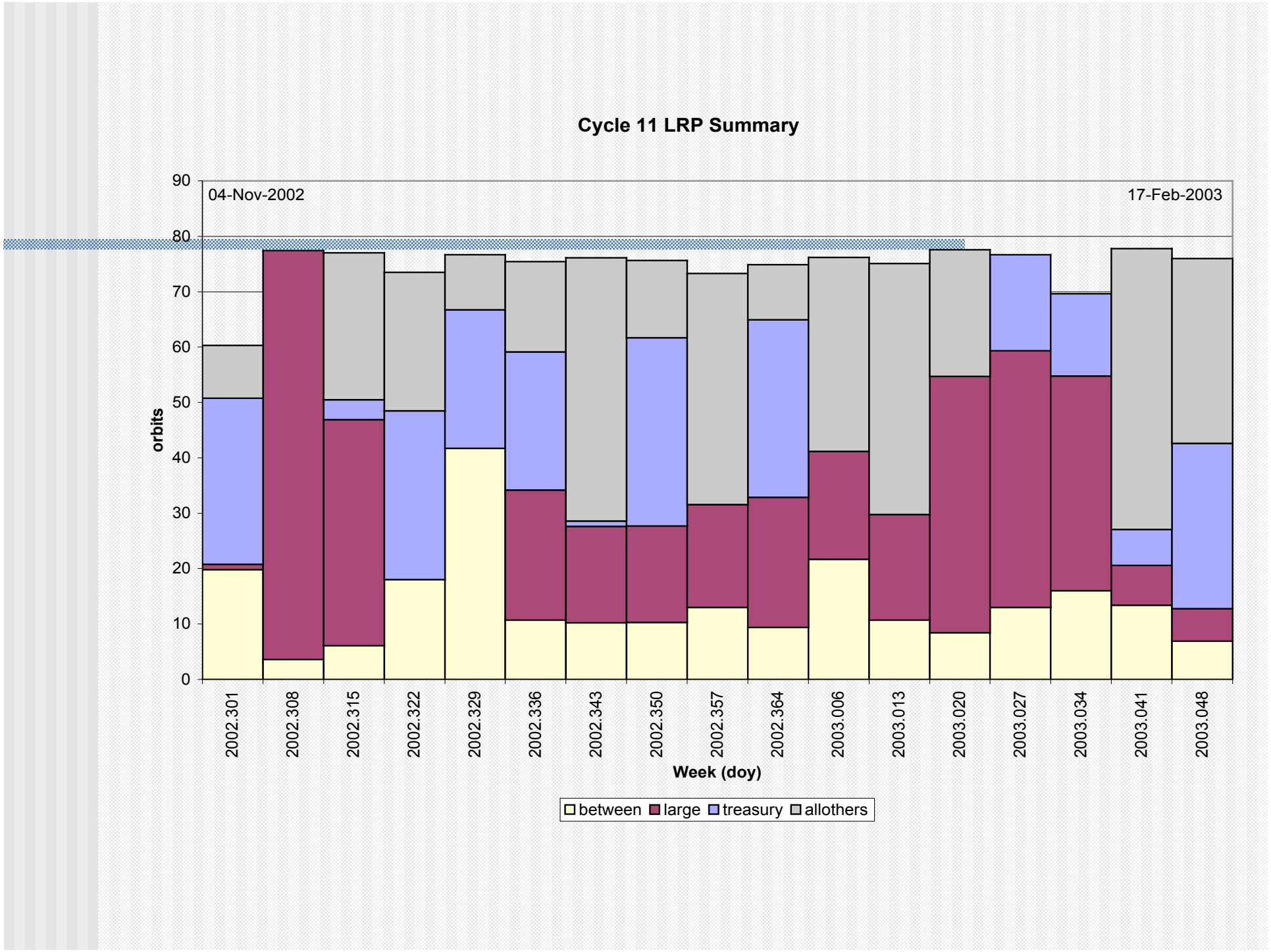
- Physical
  - South Atlantic Anomaly (SAA)
  - Bright regions (Sun, Earth, Moon)
  - Earth occultation
  - Solar array orientation (power)
- Science-driven
  - Orientation
  - CVZ
  - Guide star availability
  - Timing requirements
  - Observational sequencing
  - Background light

Percentage of orbits by program size

Cycle	*1-8*	*9*	*10*	*11*
Small (1-29 orbits)	76	50	45	44
Medium (31-99)	19	35	44	18
Large (100+)	4	15	10	38
ToOs (orbits)		289	288	436


Cycle 11 Long-Range Plan Summary
04-Nov-2002
17-Feb-2003
Orbits
120
100
80
60
40
20
0
2002.084
2002.105
2002.126
2002.147
2002.168
2002.189
2002.210
2002.231
2002.252
2002.273
2002.294
2002.315
2002.336
2002.357
2003.013
2003.034
2003.055
2003.076
2003.097
2003.118
2003.139
2003.160
2003.181
2003.202
2003.223
2003.244
2003.265
2003.286
2003.307
2003.328
2003.349
2004.005
Scheduling week (year.day)
between
large
treasury
allothers


Cycle 11 LRP Summary
04-Nov-2002
17-Feb-2003
120
100
80
60
40
20
0
orbits
Week (doy)
between
large
treasury
allothers


Cycle 11 LRP Summary
04-Nov-2002
17-Feb-2003
orbits
90
80
70
60
50
40
30
20
10
0
2002.301
2002.308
2002.315
2002.322
2002.329
2002.336
2002.343
2002.350
2002.357
2002.364
2003.006
2003.013
2003.020
2003.027
2003.034
2003.041
2003.048
Week (doy)
between
large
treasury
allothers

Summary

- Cycle 12 L&T programs are now being placed in Long-Range Plan with difficulties similar to Cycle 11
- Guidelines for Cycle 13 L&T proposals being considered to help balance competition for limited resources with overall science needs and effective scheduling of all HST programs, large and small
- Flexibility in scheduling mosaics and surveys, with minimal constraints (esp. ORIENTs), is critical