Accounting for ~1/2% of NASA’s Annual Budget

The Hubble Space Telescope is:

• The most scientifically productive observatory in history
• Synonymous with science excellence
• A universally recognized NASA “brand”
• A community science selection standard

• Changing the field of astrophysics
• Rewriting science textbooks
• Reaching millions of students in all 50 states
• Inspiring the public and enriching our culture
Hubble is As Powerful As Ever

Deep, precise, stable pan-chromatic imaging
Slitted and slitless spectroscopy, coronagraphy, astrometry

Architecture of the universe
Life stories of galaxies
Mysteries of dark matter and dark energy

Births and deaths of stars
Recipes for building planets
If all works as planned, Hubble should be able to peer even deeper into space and farther back in time than it has before. The telescope, circling some 350 miles above Earth, is expected to perform for at least five more years. That should be long enough to bridge the gap until its successor, the James Webb Space Telescope, is sent to a perch almost a million miles from Earth.
Operate Hubble out to 2020 or beyond so that there is at least one year of overlapping science observations with the James Webb Space Telescope, performed in a manner that maximizes the science return of both observatories by taking full advantage of Hubble's unique capabilities and the astronomical community's scientific curiosity.

**How long will Hubble continue to operate?**

As long as it remains scientifically productive

**What is needed to keep Hubble scientifically productive?**

- An operating observatory
- Capable science instruments
- Scientific drivers (demand)
- Adequate staffing and user support
- Appropriate funding
- Common purpose teamwork

TAC - June 2014
# Hubble is in Excellent Health

## Observatory Systems Status

<table>
<thead>
<tr>
<th>System</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACS</td>
<td>Operating well. Charge transfer degradation corrections in place for WFC.</td>
</tr>
<tr>
<td>COS</td>
<td>New blue mode extends $\lambda$ to 900 Å. Far-UV sensitivity remains excellent (initial decline has arrested).</td>
</tr>
<tr>
<td>STIS</td>
<td>Operating well. Imaging, spectroscopy, coronagraphy.</td>
</tr>
<tr>
<td>NICMOS</td>
<td>Safed, warm.</td>
</tr>
<tr>
<td>WFC3</td>
<td>Excellent stability, sensitivity. Spatial scanning available. Charge transfer corrections for UVIS channel. Persistence maps available for IR channel.</td>
</tr>
<tr>
<td>Fine Guidance Sensors</td>
<td>Slow degradation being monitored, understood.</td>
</tr>
<tr>
<td>Electrical and Power System</td>
<td>Batteries and solar arrays - no serious issues.</td>
</tr>
<tr>
<td>Pointing and Control System</td>
<td><strong>Gyro 5 ceased operation on March 7, 2014.</strong> Remaining complement of five gyros remains robust.</td>
</tr>
<tr>
<td>Data Management System</td>
<td>Lockups are rare (1-2x per year) and understood.</td>
</tr>
<tr>
<td>Thermal Control System</td>
<td>Excellent, no serious issues.</td>
</tr>
</tbody>
</table>
The recent failure of Gyro 5 in March 2014 does not substantively change the overall gyro lifetime assessment.
# The Road to 2020+

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td><strong>Observatory Health</strong></td>
<td>Excellent (even better than expected 5 years ago)</td>
<td>• Good reliability of science instruments and major systems through 2020 (NESC)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Known modes of degradation</td>
</tr>
<tr>
<td><strong>Orbit Decay</strong></td>
<td>Nominal orbit</td>
<td>• Orbit stable until mid-2030s</td>
</tr>
<tr>
<td><strong>Scheduling Efficiency</strong></td>
<td>~50%, near all-time high</td>
<td>• Efficiency declines to ~40-45% upon transition to reduced-gyro mode</td>
</tr>
<tr>
<td><strong>Scientific Productivity</strong></td>
<td>~800 papers per year; ~40 PhDs per year</td>
<td>• Publication rate remains high</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• New discoveries continue</td>
</tr>
<tr>
<td><strong>Demand</strong></td>
<td>&gt;1000 proposals per year; 6:1 oversubscription (time)</td>
<td>• No near-term decrease expected</td>
</tr>
<tr>
<td><strong>Staffing</strong></td>
<td>Lean operations</td>
<td>• Work efficiencies are harder to achieve beyond FY16 without loss of capability</td>
</tr>
<tr>
<td><strong>Mission Funding</strong></td>
<td>$98.3M/year total budget (~2/3 ops, ~1/3 grants+EPO)</td>
<td>• Flat mission budget presents challenges</td>
</tr>
<tr>
<td><strong>Grant Funding</strong></td>
<td>$28.6M/year in grants to the community</td>
<td>• Grant funding is stable through FY15-FY16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• May decline as JWST grants start</td>
</tr>
</tbody>
</table>
Your Work This Week Matters!

- 12,147 science papers based on HST data, with nearly 500,000 citations
- 13,176 individuals have (co)authored a paper based on HST data
- More than 500 PhD theses have been based on HST data
Data from the Programs You Select Will Produce Science for Years to Come

- HST archive size is ~100 TB (1.2 million observations)
- HST archive retrievals doubled after Servicing Mission 4 in May 2009
- >12,000 registered archive users (85 countries, 50 states)
Frontier Fields will require observations at specific times, but visibility for all of these fields is very good
  - No significant impact on Cycle 22 program scheduling (2 of 6 fields to be observed in Cycle 22)

In reviewing Cycle 22 proposals, panels and TAC should focus on the best science
  - Leave scheduling constraints to us to consider in the context of the entire Cycle 22 pool of recommended proposals
Hubble Press Releases Can Reach Hundreds of Millions of Viewers

Hubble News Circulation - Calendar 2013 (Source: Meltwater News)
Please Share Your Science with the Public

- Scientist PR submission form
  - Alerts News Chief
  - Automatically logs entry for news team
  - Initiates follow-up from STScI to PI

- Archive auto-notice
  - Reminds PI of pending “end of program”
  - Encourages communication to STScI about publications and newsworthy results

Congratulations! Your program, GO-12345, “Amazing HST Observations”, is nearing completion. As your program draws to a close, we would like to ask you to coordinate with Space Telescope Science Institute to improve the dissemination of your results and help us better follow HST usage……
**Hubble Hangouts (on Google+)**

- Round table discussion for public
  - Guest team +
    - T. Darnell - moderator
    - S. Lewis - commentator
    - C. Christian – outreach scientist
  - Internet Q&A
  - Thursdays 3PM (usually)

- Upcoming
  - Frontier Fields STScI team update (12 June)
  - Dark Universe and UV HUDF (R. Windhorst)
  - PanSTARRs (A. Rest and conference attendees)
  - Citizen Science with HST + amateurs (B. Gaensicke)
  - How do we schedule HST? (TAC process + schedulers behind the scene)
  - Calibration of HST (calibration workshop)
  - JWST updates

Follow at: https://plus.google.com/+hubblespacetelescope/posts, archived on YouTube
Hubble may be 24 years old, but its best years are still ahead....