...... near-IR measurements may put a 1% measurement of $H_0$ within reach. When the new ladder is completed during Hubble’s third and likely final decade, it will be a powerful tool, sturdy enough to probe the mysteries that still remain in the standard cosmological model.
HST Frontier Fields:

- Spitzer DD observations underway
  ~26.5 ABmag in IRAC 3.6, 4.5 μm

- Lensing Maps MAST HLSP website launched:

- First HST observations this week:
  10/17  MACS0717.5+3745
    (2 orbits – pre-imaging of parallel field)
  10/25  Abell 2744 Epoch 1
    (70 orbits - WFC3/IR on cluster, ACS on field)
The Frontier Fields Lens Models

Abell 2744: Overlay of magnification (red) and mass models (blue) on the full-band HST imaging (green)

Bradac et al.  Ebeling et al. (CATS)  Merten, Zitrin et al.  Sharon et al.  Williams et al.
3D-HST and CANDELS surveys
plot from P. van Dokkum
All instruments performing optimally

(See Ken Sembach’s presentation)
In support of New Horizons, Hubble has a unique role

fifth moon discovered significant trajectory adjustments now required
## HST Budget (in $M)

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### Near-term
- Continuing resolution
- Sequestration

### Mid-term
- STScI contract extension to 2016

### Long-term
- Keeping Hubble productive/supported through FY2020 (JWST L+1yr)

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## HST Budget (in $M)

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### Near-term
- Continuing resolution
- Sequestration

### Mid-term
- STScI contract extension to 2016

### Long-term
- Keeping Hubble productive/supported through FY2020 (JWST L+1yr) “Hubble 2020 Vision”


EPO cut from HST budget

Through April 2016 only.
$36.9M for full FY equivalent
On June 1, 2013, STScI received a Request for Proposal from the HST Project for a rebaselining of HST Science Operations in FY14-FY16.

- Proposal deadline is July 31, 2013
- Note: This proposal does not cover work beyond April 2016

HST Project expects a proposal for full Science Operations at a (flat) funding level of ~$37M/yr.

Our response shows that it is still possible to continue to grow HST’s science return while decreasing staff size.

- Multi-mission efficiencies and synergies at STScI are vital
- Staffing profile designed to achieve maximum return on investments made during and after Servicing Mission 4

JWST still on track 3 years after rebaseline in response to Casani report
Looking Ahead - 14 months of funded schedule reserve available

Spacecraft
- Spacecraft Component Development
- Sunshield Des. & Development
- Spacecraft Fabrication and Assembly
- Flight Sunshield Fabrication, Assembly and Test
- Spacecraft Structure to I&T
- Spacecraft I & T
- Observe I&T
- Spacecraft panels to I&T

Science Instruments
- ISIM Integration
- ISIM Cryo Testing & Detector Changeout
- ISIM one month from critical path

Telescope
- Segment Gear Motor replacement
- Optical Telescope Element Fabrication and Testing
- Optical Telescope Element (OTE)

OTE = Optical Telescope Element
OTIS = Optical Telescope + ISIM

months of critical path (mission pacing) slack

- Northrop-Grumman
- Goddard Space Flight Center
- Ball Aerospace
- ATK
- Johnson Space Center
- Guiana Space Center

Optical Telescope Simulator (OSIM) + ISIM @ GSFC

~10m
To meet a 2018 launch, and stay within a the $8B cap requires funding above the FY12 level for FY13 - FY17.
Experience shows that deferred work potentially doubles or triples costs, due to the impact of the deferrals on other work. This leads to a cascading effect wherein the cost of delayed activities further reduces the limited real reserves available to the project in later years, creating an escalating spiral for project life cycle cost.
such as entry, descent, and landing.

Astrophysics.—Within funds provided to advance scientific knowledge of the origins of the universe, the Committee provides the budget request levels of $93,500,000 for the Hubble Space Telescope and $32,900,000 for the Balloon Project.

WFIRST Science Mission.—Within the funds provided, the Committee provides $56,000,000 for NASA to proceed with design studies, further technical risk reduction, and detailed formulation on a science mission that meets the exoplanet and dark energy science objectives of WFIRST. This recommendation corresponds with findings from NASA’s May 23, 2013, report on Astrophysics Focused Telescope Assets, and should build upon the Agency’s work with both the Hubble Space Telescope and the James Webb Space Telescope to ensure that the synergies and discoveries from those missions enhance WFIRST’s scientific objectives so that they can be achieved in a way this is both cost effective and advances the field of study in astrophysics to guarantee world class results.

James Webb Space Telescope.—The Committee maintains strong support for the completion of the James Webb Space Telescope (JWST), and provides $658,200,000, the same as the budget request. In 2011, the Committee asked for an independent assessment of JWST. That assessment, led by Dr. John Casani, found that while JWST is technically sound, NASA had never requested adequate resources to fund its development.

In response to the Casani report, NASA submitted a new baseline study, which included a reorganized and cost effective development plan.
A New Window on the Universe

Hubble Ultra Deep Field
~10,000 galaxies in one image

WFIRST2.4 AFTA Deep Field
>1,000,000 galaxies in each image
WFIRST 2.4 AFTA enhances JWST Science

WFIRST2.4 discovery of high-z galaxies
WFIRST2.4 finds first stellar explosions
WFIRST2.4 wide field survey of galaxies
WFIRST2.4 maps of halo tidal streams
WFIRST2.4 monitoring of exoplanets

→ JWST NIR and MIR detailed spectroscopy
→ JWST light curves and host galaxy properties
→ JWST SNe spectra with pre-detonation images
→ JWST ages, abundances of substructure
→ JWST transit spectroscopy of atmospheres
Short term threats

**HST**

FY13 operating plan fully funds HST

*but* Government Shutdown remains unresolved and funding level under a CR remains unclear

HST Presidents FY'14 budget looks promising MODULO EPO...

*but* EPO removed and Senior Review 6 months away, however will be “modified” SR

**JWST**

FY13 Operating Plan fully funds JWST

*but* House cut JWST by $75M, Government shutdown remains unresolved, and funding under a CR remains unclear - though NASA committed to “protecting JWST”
“Beyond JWST” Charter and Focus

Charter - Study possible missions and programs for UVOIR astronomy in space in the first decades following the JWST era in order to significantly advance our understanding of the origin and evolution of the cosmos and the life within it.

Focus - Primarily on science opportunities with particular attention to breakthroughs requiring a space-based facility, in the context of a decade of JWST data as well as data from 30-40 meter class ground-based telescopes and large ground-based radio arrays.
 Participants

**Current Committee Members:**
Steve Battel (Battel)
Niel Brandt (Penn State)
Charlie Conroy (UC Santa Cruz)
Lee Feinberg (GSFC)
Suvi Gezari (U. Maryland)
Olivier Guyon (Subaru Obs.)
Walt Harris (LPI)
Chris Hirata (OSU)
John Mather (GSFC)
Marc Postman (STScI)
Dave Redding (JPL)
Phil Stahl (MFSC)
Jason Tumlinson (STScI)

**Co-Chairs**
Julianne Dalcanton (U. Washington)
Sara Seager (MIT)

**NASA Observer:**
Paul Hertz
(Mike Garcia is NASA back-up)

**ESA Observer:**
Arvind Parmar

**AURA Facilitator:**
Heidi Hammel
Notional Schedule

Teleconferences began in October

Assignments to working groups (October/November 2013)

Initial Face-to-face meeting at MIT in December 2013

Initial input to GSFC/JPL concept studies (late 2013)

Interactions at AAS (January 2014) and at Science with HST Meeting in Rome (March 2014)

Preliminary draft (mid-2014)

Review cycle (fall 2014)