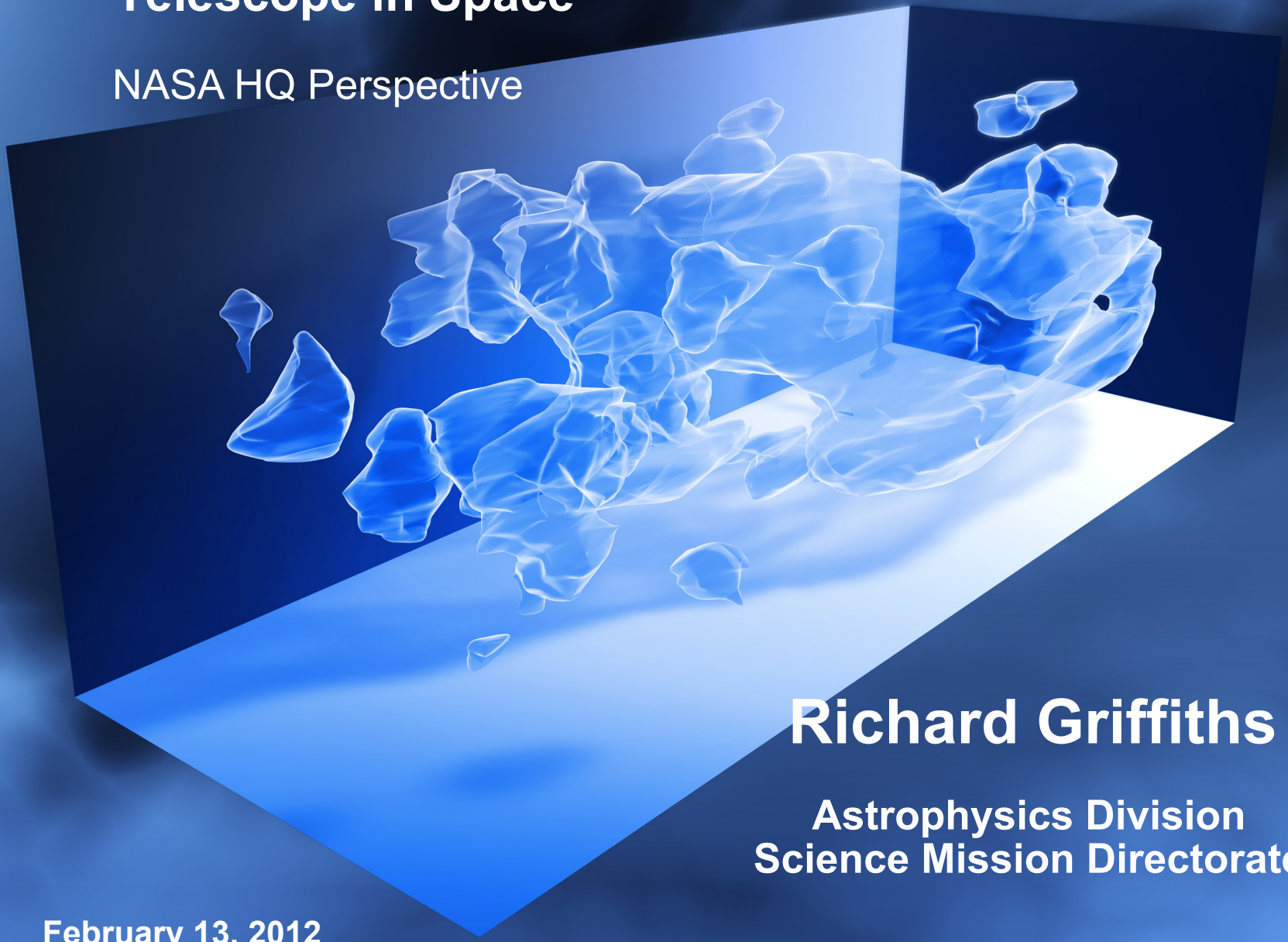
Science with a Wide-Field Telescope in Space

NASA HQ Perspective



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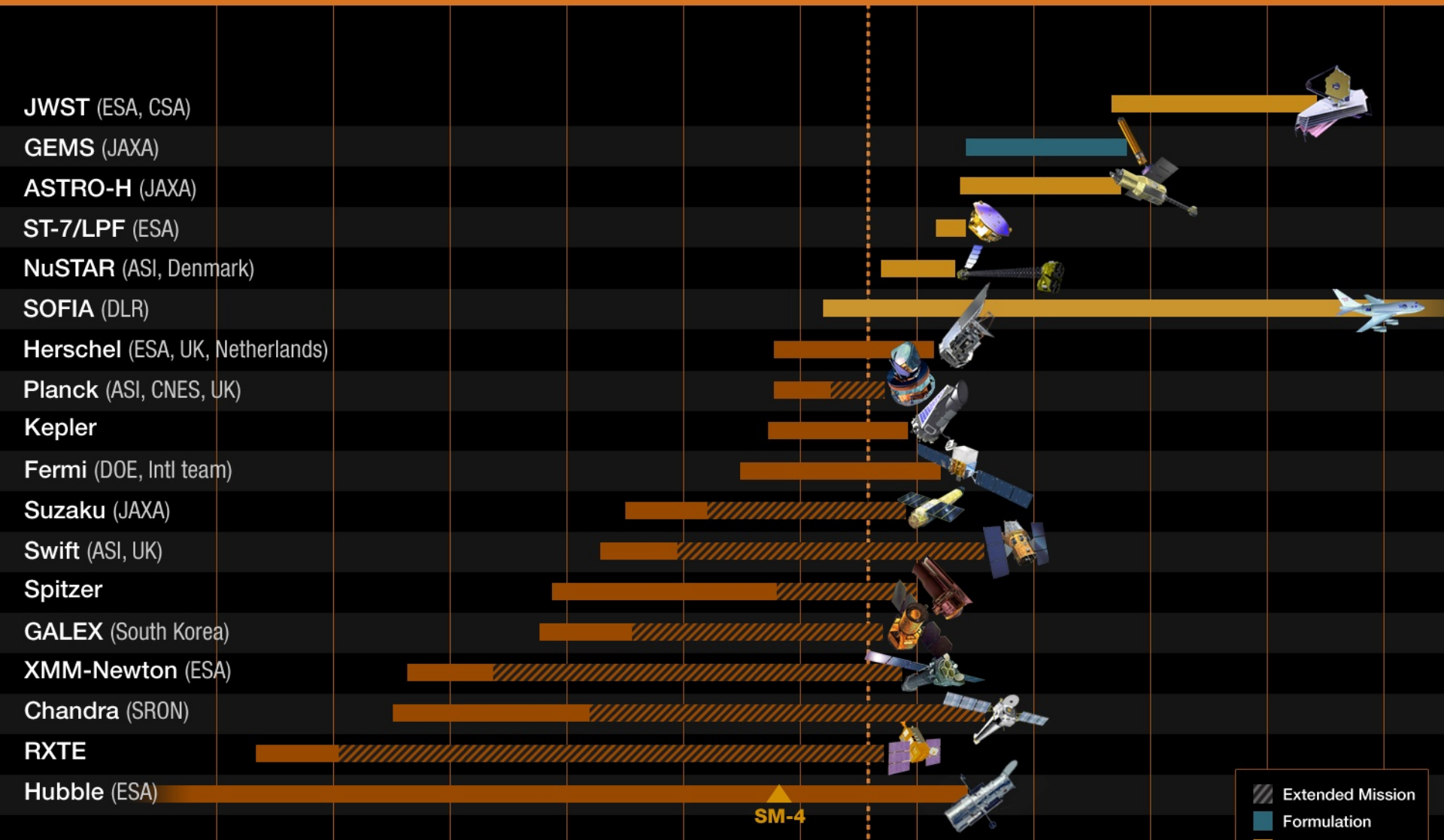
Astrophysics Missions timeline

Last updated: January 4, 2012



TIMELINE 1995 1998 2001 2004 2007 2010 2013 2016 2019 2022 2025

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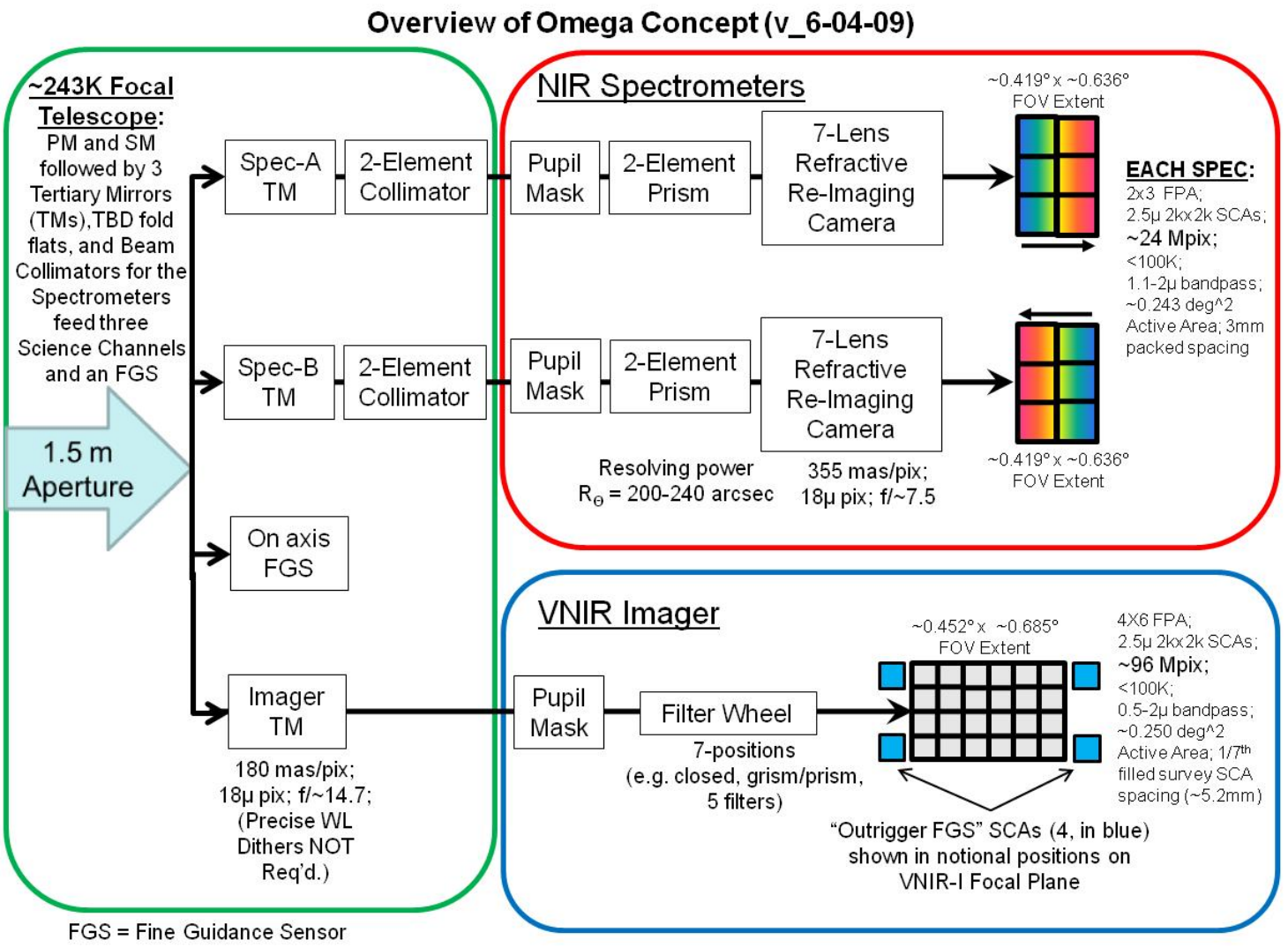
A Brief History of Wide-Field Surveys in Space

2000-01 DOE SNAP proposal
2005-07 DE Mission Concept Studies - 3 selected: SNAP, Destiny, ADEPT
2005 Dark Energy Task Force (theory group) – FoM (no GR)
2007 BEPAC Recommendation - JDEM Highest Priority of Einstein Probes
- search for partners
2007-08 RFI + TMC reviews of Mission Concept Studies (> $1B)
2007 Fall: Joint planning initiated with DOE, under guidance of OSTP
2008 Nov. JDEM MoU signed by NASA/DOE
2008 Figure-of-Merit Science Working Group (theory)
2008-09 Science Coordination Group - Reference Mission defined
2008 GSFC JDEM Project Office established
2008 Pre-A.O. Announcement Oct 15
2009 Joint NASA/ESA Study of IDECS (JDEM/Euclid)
2009 Joint NASA-ESA AO written for IDECS instruments/teams; blocked
2009 White Papers submitted to Astro-2010 Decadal Review
2010 NWNH recommends WFIRST, based on JDEM-Omega concept, with obs. program extended to include IR surveys and microlensing
2010 ESA invites 20% US contribution in Euclid (max 30%), blocked
2011 WFIRST Science Definition Team
2012 NRC recommends that NASA join Euclid at low level ($20-30M)

2009: JDEM-Omega Block Diagram



See also : JDEM-probe concept studies (exhaustive, unobscured, Including single-channel mode)

2009: JDEM Science

- JDEM was to be a dark energy mission. 'Ancillary science' came as a by-product of DE surveys.

- JDEM was to provide a comprehensive sky survey data set (300 TB) to the world community. Examples of key science goals:
  - Constraints on inflation (flatness, tensor-to-scalar ratio, non-Gaussianity - f_{NL})
  - Neutrino mass
  - Galaxy evolution
  - Complete inventory of star formation incidence & AGN in galaxies to z=3
  - Extension of brown dwarf census to cooler objects: IMF below substellar limit

  - + Microlensing for exoplanets ! [included in DUNE proposal]

2010 -- Astro-2010 combined 3 science areas into one mission, WFIRST : DE, IR surveys, microlensing for exoplanets, GO Programs

WFIRST

- Science Definition Team delivered its interim report in July 2011.

  http://wfirst.gsfc.nasa.gov/science/WFIRST_Interim_Report.pdf

  - Interim Design Reference Mission is a proof of concept compliant with the Astro2010 recommendation for Dark Energy, Exoplanet and NIR sky surveys.
- Updated guidance given to Science Definition Team Dec 8, 2011.
  - Accounts for updated events since initial kickoff meeting.
  - Second DRM needs to avoid duplication of capabilities of Euclid, LSST, and JWST in advancing science objectives of WFIRST.
  - DRM2 assumes the success and data from those missions wherever possible in order to reduce requirements for WFIRST.
  - Major challenge is potential science overlap with Euclid
- Final report due June 2012.

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ESA Cosmic Vision Status : Astrophysics

ESA and NASA are 5 years out of sync

M-Class Missions (M1 and M2)

- ✓ October 2011, the Science Programme Committee (SPC) met and approved the SSAC decision on two missions, Euclid and Solar Orbiter, for the release of the industrial 'Invitation to Tender'.
- June 2012, following 'consolidation' of member-state partnerships and agreements, the Science Programme Committee will consider 'adoption' of missions (Cost-at-Completion and Payload Formal Agreement).
- June 2012, Euclid enters Implementation Phase immediately after adoption by the SPC for launch late in 2019.

M-Class Mission M3

- ✓ EChO, LOFT, MarcoPolo-R and STE-QUEST selected for Assessment Phase and further downselect for launch in 2022. (PLATO may be included if the mission re-proposes per AWG recommendation.)

Timeline for selection of M-Class missions from: http://sci.esa.int/science-e/www/object/index.cfm?fobjectid=42370

Euclid

- ✓ On September 19, 2011, ESA sent its recommendations to the Science Programme Committee (SPC).
  - ✓ ESA recommended that Solar Orbiter and Euclid be selected as M1 and M2, respectively, and will propose that PLATO continue in the competitive process for the M3 mission.
  - – ESA has asked for a longer definition phase for Euclid than previously planned and ESA will propose that the SPC adopt the mission in June 2012 instead of February 2012. The launch would be in Q4 2019.
- ✓ October 2011, SPC decision on two missions for Industrial Invitation to Tender (ITT) release.
- • June 2012, SPC adoption of missions (Cost-at-Completion, Multi-Lateral Agreements and Payload Formal Agreement). 13/19 member states
- • June 2012, missions enter Implementation Phase.

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National Academies Report on Euclid

- ✓ The National Research Council organized an ad hoc study to assess if a proposed NASA plan for a U.S. hardware contribution to the Euclid mission, in exchange for U.S. membership on the Euclid Science Team and science data access, is a viable part of an overall strategy to pursue dark energy, exoplanet detection, and infrared survey science goals articulated in the Astro2010 decadal survey report.

From the Feb 2012 NRC Report on NASA Participation in Euclid

- While WFIRST dark energy measurements are expected to be superior to Euclid's, U.S. participation in Euclid will have clear scientific, technical, and programmatic benefits to the U.S. community as WFIRST and Euclid go forward.
- NASA should make a hardware contribution of approximately $20 million to the Euclid mission to enable U.S. participation. This investment should be made in the context of a strong U.S. commitment to move forward with the full implementation of WFIRST in order to fully realize the decadal science priorities of the 2010 Decadal report.
- In exchange for this small, but crucial contribution, NASA should secure through negotiation with ESA both a U.S. position on the Euclid Science Team and the inclusion of a team of U.S. scientists in the Euclid Consortium with full data access that would be selected by a peer-reviewed process.

The Look Forward

- Astro-2010 decadal review NWNH recommended WFIRST
- Budget does not allow WFIRST launch in this decade (2018 + 7 years = 2025)
- No growth anticipated in astrophysics budget in foreseeable future
- WFIRST SDT report, especially DRM2, will inform mid-decadal review and FY14 budget submission (RSD?, control of systematics)
- Mid-Decadal Review will comment on NASA's balance between working toward five large missions for the next decadal survey and realizing the science of WFIRST and NWNH within the current budget reality.
- Contribution to Euclid arguably does not slow down development of WFIRST: there is reduced budget flexibility in FY13-FY17 for making significant progress on WFIRST; JWST launch anticipated for late 2018, no 'new start' till then