WFIRST Project Office Update

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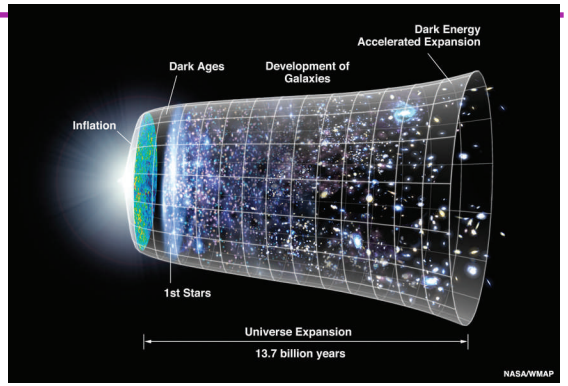
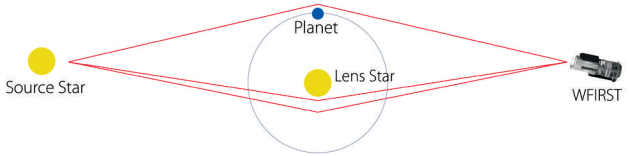
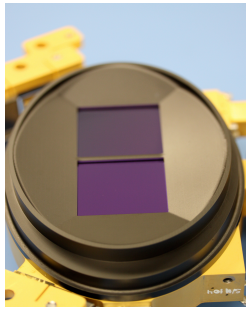
WFIRST Summary

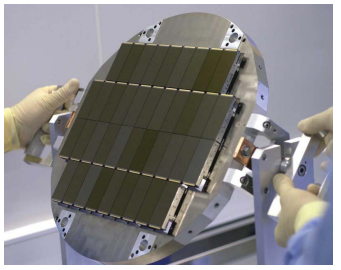


- ❖ WFIRST is the highest ranked large space mission in NWNH, and plans to:
  - complete the statistical census of Galactic planetary systems using microlensing
  - determine the nature of the dark energy that is driving the current accelerating expansion of the universe
  - survey the NIR sky for the community
- ❖Earth-Sun L2 orbit, 5 year lifetime, 10 year goal



- ❖ The current Interim Design Reference Mission has
  - 1.3 m unobstructed telescope
  - NIR instrument with ~36 HgCdTe detectors
  - >10,000 deg^2 5-sigma NIR survey at mag AB=25
- ❖ Space-qualified large format HgCdTe detectors are US developed technology and flight ready





WFIRST Project

- WFIRST Project resides in Exoplanet Exploration Program (ExEP) at JPL
- WFIRST Project is joint effort between GSFC and JPL
- GSFC responsibilities
  - Project management
  - System engineering
  - Instrument & spacecraft management
- JPL responsibilities
  - Telescope design & implementation
  - Participate in system engineering
  - Data center (IPAC)
- HQ program oversight
  - Program Executive: Lia LaPiana
  - Program Scientist: Rita Sambruna

WFIRST SDT

- The WFIRST project is working closely with the Science Definition Team (SDT) on refining the WFIRST requirements and developing a reference mission design

James Green, U. Colorado/CASA Co-Chair
Paul Schechter, MIT Co-Chair

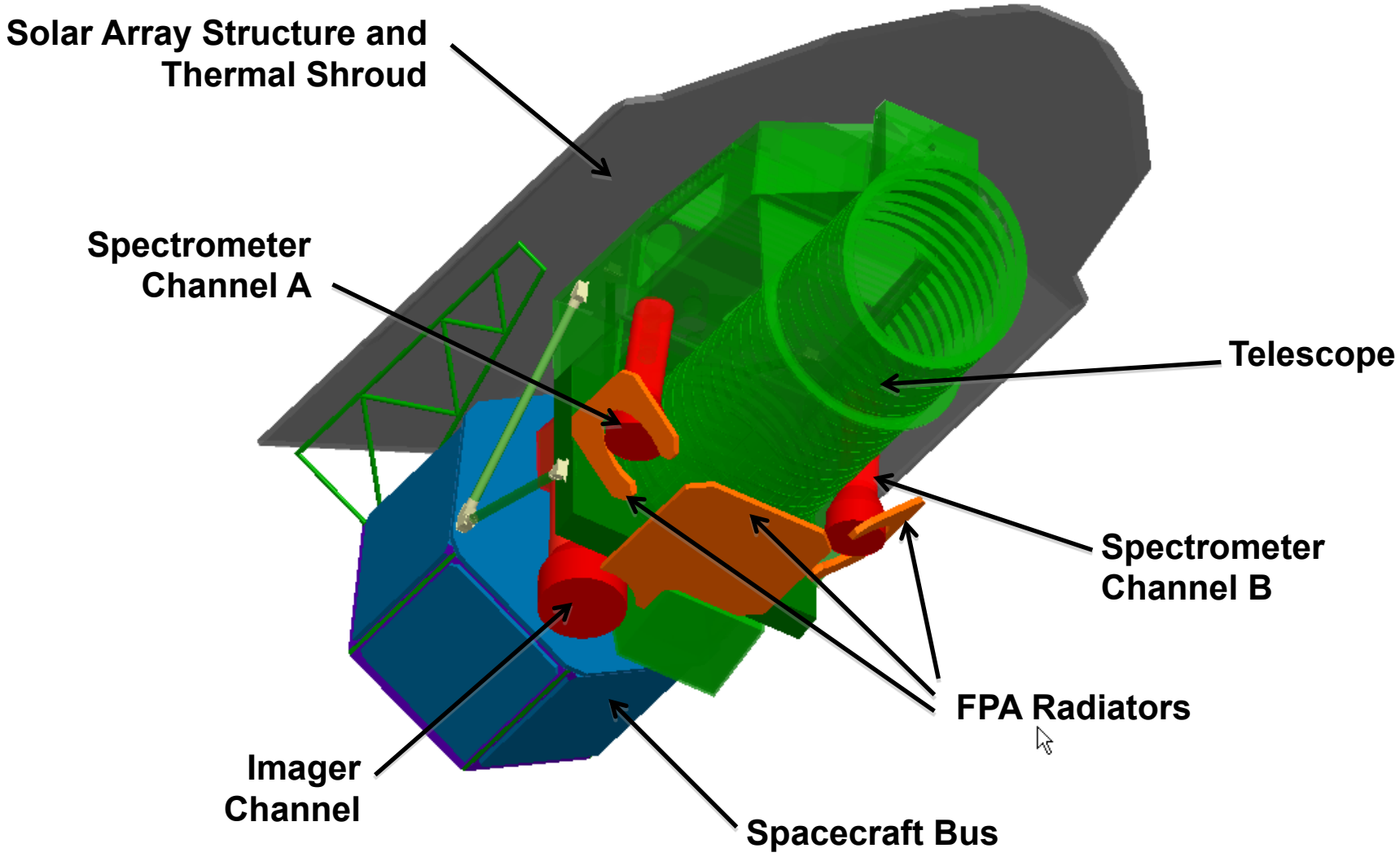
Rachel Bean, Cornell University
Charles Baltay, Yale
Charles Bennett, JHU
David Bennett, Univ. of Notre Dame
Robert Brown, STScI
Christopher Conselice, Univ. of Nottingham
Megan Donahue, Michigan State Univ.
Scott Gaudi, Ohio State Univ.
Tod Lauer, NOAO
Bob Nichol, Univ. of Portsmouth
Saul Perlmutter, UC Berkeley / LBNL
Bernard Rauscher, GSFC
Jason Rhodes, JPL
Thomas Roellig, Ames
Daniel Stern, JPL
Takahashi Sumi, Nagoya Univ.
Angelle Tanner, Georgia State Univ.
Yun Wang, Univ. of Oklahoma
Edward Wright, UCLA

Neil Gehrels, GSFC Ex-Officio
Wes Traub, JPL Ex-Officiio
Rita Sambruna, NASA HQ Ex-Officio

Activity Summary

- Interim Design Reference Mission defined & studied
- Independent cost estimate performed
- Requirement flowdown defined
- Near IR detector array EDU under development
- Studies in progress of HgCdTe detector validation for weak lensing measurement
- Simulations underway, with more planned
- Science outreach events planned

WFIRST IDRM Observatory Layout



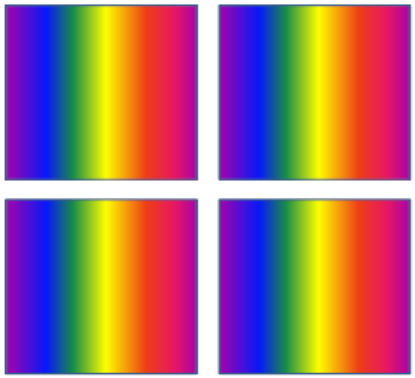
Channel field layout for WFIRST IDRM-1

The Fields of view of the imaging channel (ImC), spectroscopy channels (SpCs), and guiding modes (FGS) are shown to scale with the Moon, HST, and JWST. Each square is a 4Mpix vis-NIR sensor chip assembly (SCA)

Moon (average size seen from Earth)

ImC: 7x4 @ 0.18"/p; SpC 2(2x2)@0.45"/p
[xfield center, yfield center, degrees]

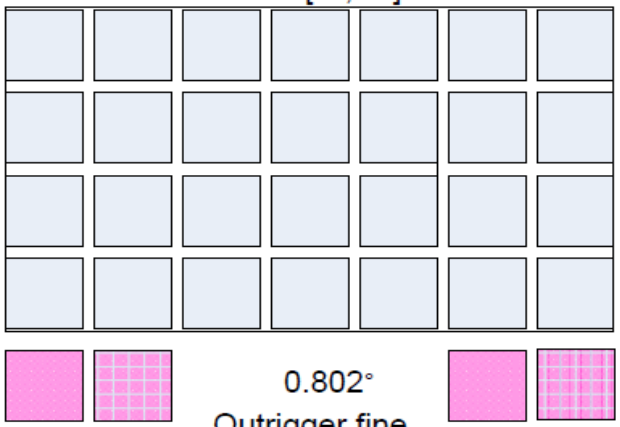
SpC-B [-0.9275°,0°]



0.536°

0.536°

ImC: [0°, 0°]

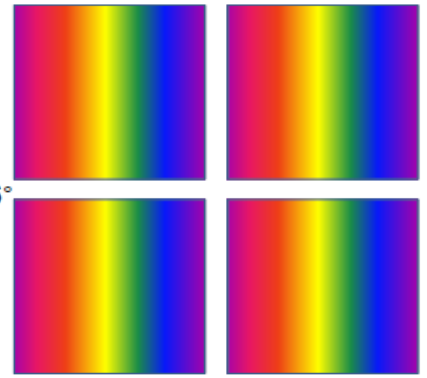


0.463°

0.802°

Outrigger fine guidance sensors

SpC-A [0.9275°,0°]



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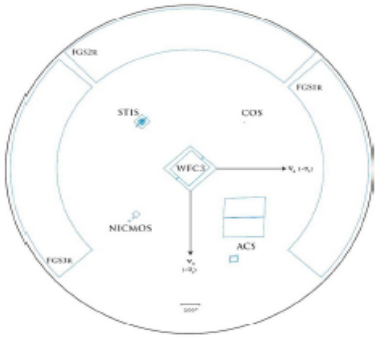
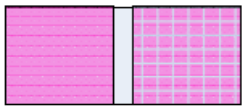


HST [all instruments]



0.142°

0.31°

Auxiliary Fine Guidance System: 2@0.25"/p [0°, -0.6°]

JWST [all instruments]

Independent Cost Estimate

- Performed by Aerospace Corp
- CATE = Cost And Technical Evaluation
- Input was Interim Design Reference Mission
- Aerospace cost estimate is within 7% of $1.6B cost estimate from the Decadal Survey
- **"Project has presented a feasible technical design consistent with stated science goals"**

Requirements Flowdown

- Early substantiation that IDRM can achieve the science objectives mandated by NWNH.
- Block diagram of the requirements has been developed with SDT
- Traces science requirements from top level objectives

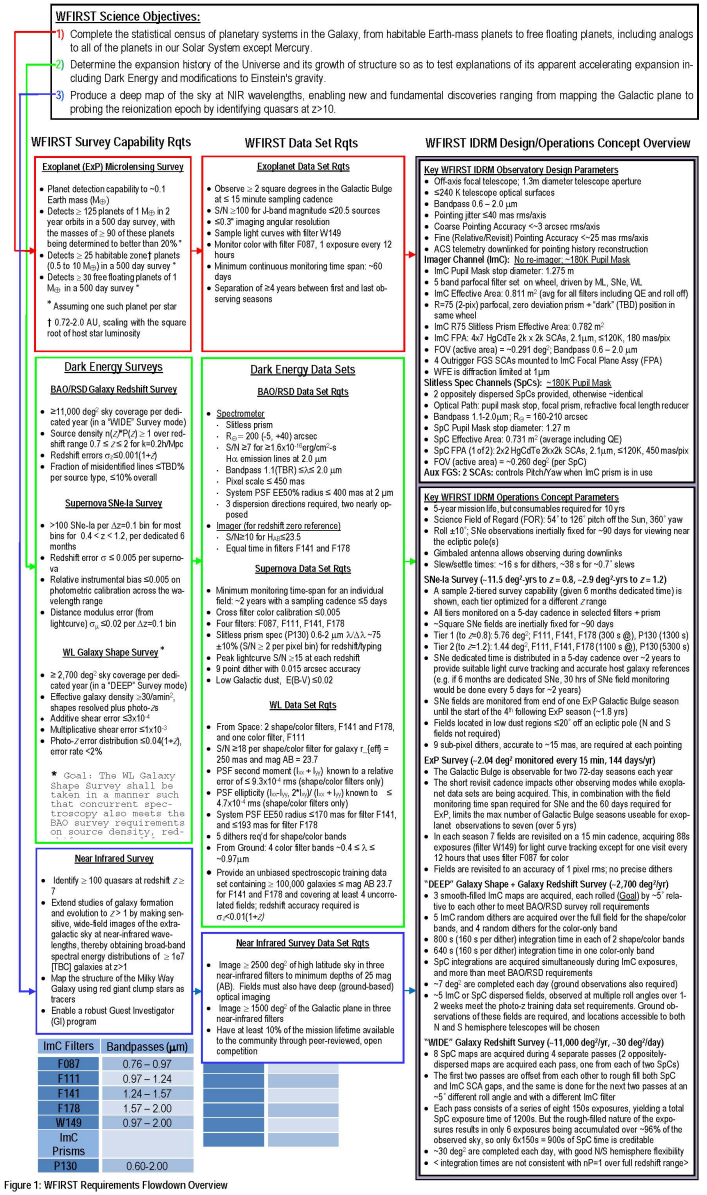
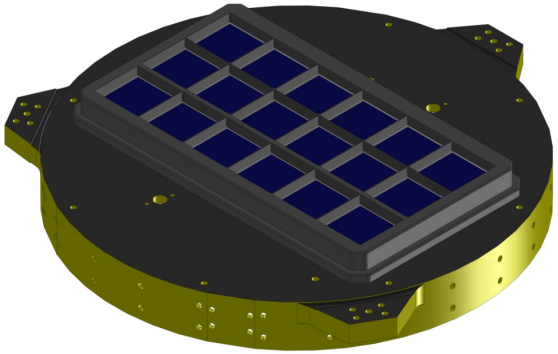


Figure 1: WFIRST Requirements Flowdown Overview

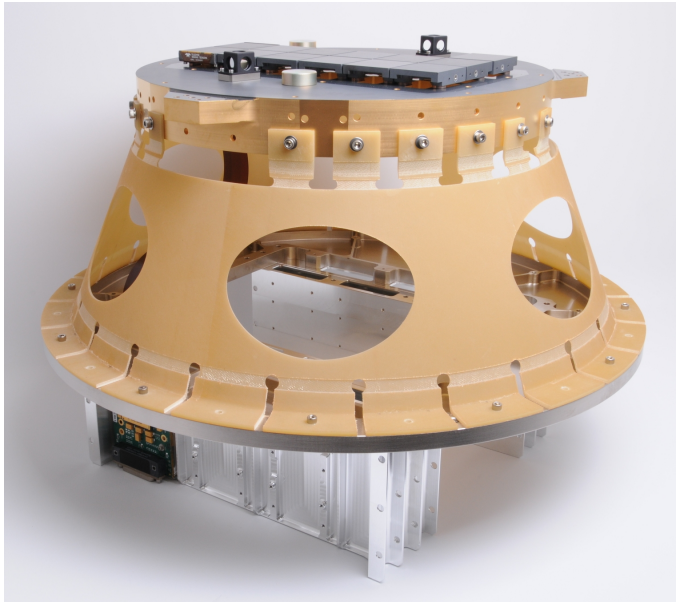
Detector Array EDU

- Development of 3x6 HgCdTe Engineering Development Unit detector array at GSFC

Light shield (silicon carbide)



EDU Focal Plane Array



EDU FPA with structural assembly

- Silicon carbide mounting of HgCdTe detectors is under development and will be space qualified with EDU

HgCdTe Detector Studies

- Potential issues with HgCdTe capabilities for weak lensing galaxy shape measurement include:
  - Interpixel capacitance
  - Persistance
  - Linearity & reciprocity
- Laboratory test program in place to assess issues and find workarounds (GSFC, JPL, Caltech, Teledyne, STScI, U Hawaii)
- Initial results are encouraging that HgCdTe detectors can be used for galaxy shape measurements and photo-z's with needed precision

Simulations

- Pixel scale study for WL at JPL / Caltech (Rhodes, Hirata, Rowe)
  - Shapelet simulations, image combination software, dithering study
  - Results show that 0.18 "/pixel of WFIRST Imager is adequate for weak lensing shape measurement
  - Working on making widely used WL image simulation software "simage" available to community via IPAC
- Sky tiling sims for BAO & SNe at GSFC (Weiland, Kruk, Hinshaw)
- Exoplanet microlensing sims at Notre Dame (Bennett, Rhie, Gaudi)

Science Outreach

- Science calculators and estimators being deployed to the community through IPAC
- WFIRST booth developed and displayed at key conferences
- Science workshop planned for Feb 13-15, 2012 at IPAC
- WFIRST "Meeting-In-A-Meeting" proposed for June AAS in Anchorage

Conclusions

- Strong team using unique expertise of GSFC & JPL
- Project Office is working closely with SDT
- Independent costs estimates are consistent with WFIRST cost assumed by NWNH.
- Project Office and SDT have produced capable Interim Design.
- Simulations and laboratory studies are underway.
- Outreach to science community is proceeding.
- Project is well prepared to continue development of the Design Reference Mission and consideration of partnership opportunities.

BACKUPS

WFIRST – Euclid Comparison

	WFIRST	Euclid
Aperture	1.3m unobstructed (equivalent to 1.5m obstructed)	1.2 m obstructed
Wavelength	760nm - 2μm	500nm - 2μm
Pixel size	018'' NIR imaging 0.45'' NIR spectro	0.1'' optical imaging 0.3'' NIR imaging and spectro
Lifetime	5 years primary, 10 years goal	5.5-6 years primary
Instruments	1. NIR imaging instrument with filter wheel 2. 2 NIR spectrographs	1. Optical imager with fixed filter(s) 2. NIR instrument with filter wheel

WFIRST uniquely has

- exoplanet microlensing
- SNe
- WL shape measurements in NIR, complementary to LSST
- BAO survey with dedicated spectrometer (prism instead of grism on wheel)
- 5 times as many BAO galaxies
- deeper NIR sky survey with finer pixels