



Proposed lifetime	2024 - 2034	2023 - 2030	2027 - 2032
Mirror size (m)	6.5 (effective diameter)	1.2	2.4
Survey size (sq deg)	~20,000	15,000	~2,000
Median z (WL)	0.9	0.9	1.2
Depth (5 σ AB mag point source)	~27	~24 (NIR) ~26 (Vis)	~27
FoV (sq deg)	9.6	0.5 (Vis) 0.5 (NIR)	0.28
Filters	u-g-r-i-z-y	Y-J-H-Vis	Y-J-H-F184
PSF Size	~0.7"	~0.2" (Vis)	~0.1" (NIR)
Mode	Photometry	Photometry/Grism	Photometry/Grism/Prism

- I became the SuperNova Acceleration Probe (SNAP) weak lensing project scientist in 2003, SNAP→JDEM →WFIRST →Roman
- In 2022 I am the JPL Roman Project Scientist (Deputy to Julie McEnery @ GSFC)
- I started work on the Dark Universe Explorer (DUNE) in 2005, DUNE →Euclid
- I chair the governing body of the Euclid science consortium and lead a 75 person NASA-funded Euclid science team
- ***I have been thinking about complementarity of these missions a long time***

AFTA and Euclid have complementary strengths for dark energy studies

Slides I presented in July 2013, when Roman (then WFIRST) acquired a 2.4m telescope
AFTA= 2.4m version of WFIRST (compared to 2010 1.5m version)

AFTA:

Deep Infrared Survey (2000 sq. deg)

Lensing:

- High Resolution (70 -250 gal/arcmin²)
- 5 lensing power spectrum

Supernovae:

- High quality IFU spectra of 2700 SN

Redshift survey

- High number density of galaxies
- Redshift range extends to $z = 3$

Euclid:

Wide optical Survey (15000 sq. deg)

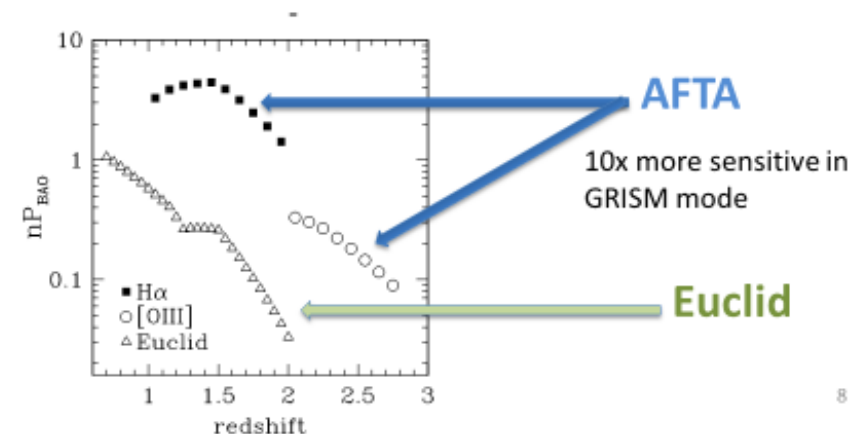
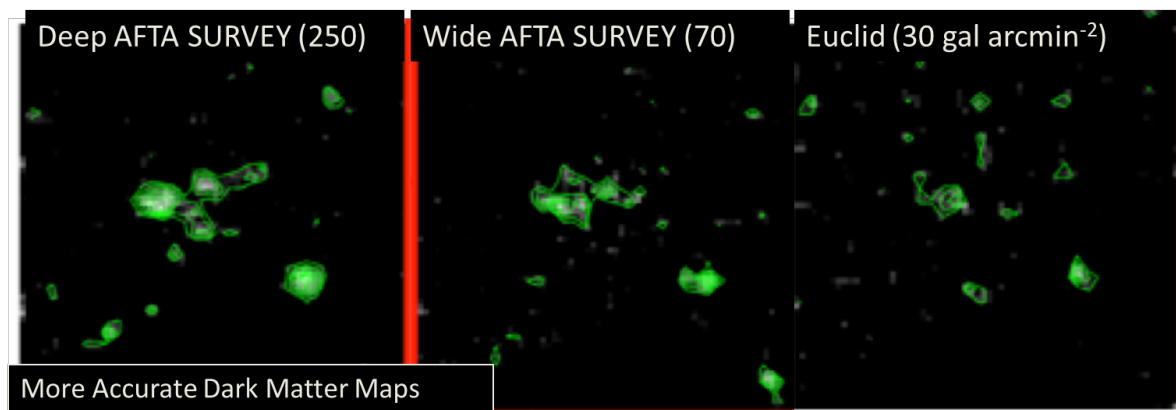
Lensing:

- Lower Resolution (30 gal/arcmin²)
- 1 lensing power spectrum

No supernovae program

Redshift survey:

- Low number density of galaxies
- Significant number of low redshift galaxies





What is complementary or redundant between Euclid and Roman in terms of their cosmology objectives?



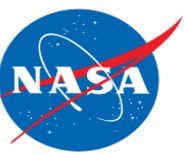
- Roman, Euclid, and Rubin all have somewhat redundant cosmology *objectives* ($\sim 1\%$ accuracy on w without assuming $w'=0$)
- The approach to *systematics control* and *internal redundancy/cross checks* is complementary

Euclid	Roman
Maximizes statistics with very wide, single pass survey	Systematics control from narrower, deeper, multi-pass survey
Single very wide shape measurement band (systematics from chromatic effects); no color information in WL shape measurement	Three shape measurement bands for cross checks
No transient component	Thousands of SN out to $z \sim 1.7$
Two primary probes (WL, GC)	Three primary probes (WL, GC, SN)
Relatively shallow (WL $z \sim 0.9$; GC to $z=2$)	Deeper (WL $z \sim 1.2$; GC to 3)
As wide as possible to maximize statistics	Will set gold standard for systematics control

- Our constraints on dark energy and modified gravity in ~ 2033 will depend on our ability to control systematics and (in my opinion) will require cross-project cross checks and comparisons
- Neither Euclid or Roman are taking a wrong approach and both are needed to address DE, modified gravity, and emerging cosmological tensions



How important are Roman's cosmology objectives in light of cosmology data that will become available over the next 5 years?



- Roman was selected in 2010 with full knowledge of DESI, PFS, Rubin, Euclid, DES, HSC, KiDS
 - Stage IV DE experiments rely on recently concluded Stage III projects
 - Stage IV DE experiments have individual strengths and weaknesses
- Roman was made more competitive and complementary by move from 1.5m→2.4m
- Co-evolution of project and observing plans have kept Roman relevant
- Subsequent reviews have confirmed Roman's relevancy
- Emerging cosmological tensions may be the result of new physics or systematics
 - Roman data may be required to break degeneracies, understand systematics
 - Roman will be gold standard for systematics control
 - Only Roman is capable of doing robust measurements in all three primary DE probes
- Roman could do the best WL survey, Roman could do the best GC survey, Roman **will** do the best SN survey

Roman's capabilities could be the key to understanding DE and Roman's flexibility is the key to capitalizing on data we will get in the coming 5 years

- Euclid, Rubin, DESI, and Roman were all approved and passed subsequent reviews with the expectation that other experiments would be successful
- Roman has unique flexibility in adapting its survey strategy to findings from Euclid and Rubin
 - Can focus more or less on any of the three probes
 - Can focus on higher redshifts if earlier effects of DE are detected
 - Can tighten or loosen systematics control
- We should not assume early success by Euclid/Rubin will solve DE or modified gravity
 - Adjust Roman surveys to best make use of prior data
 - Adjust Roman surveys with full transparency and community input
 - Adjust Roman survey to maximize non cosmology science
- Over a decade has been spent ensuring Roman's cosmology surveys are making best use of telescope for other science areas

Roman's high latitude CCS can be optimized within the context of early Euclid/Rubin results and make the best use of the telescope for a wide range of science.



Any additional comments you have about optimizing Roman observing time allocations.



- Euclid, Rubin, and Roman are designed and built as survey telescopes; they should all do large, ambitious surveys
- Roman and Euclid wide surveys meet cosmology objectives but are designed to provide data for galaxy evolution and many other astrophysical problems
- Data pipelines for cosmology are demanding and require many years of prep; cannot be divorced from survey planning or science analysis
 - Cosmology optimized data pipelines will produce products better than required for much other science
 - By ~2030 Roman/Euclid wide field papers for general astrophysics >> cosmology
- Euclid Consortium has 1600 people (most not in cosmology) → wide participation in survey planning
 - Roman CCS process as defined by Roman Project will engage wide swaths of community to design surveys that meet cosmology objectives but enable widest possible use for other science
 - Do not need winners and losers in survey definition