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# FIRS Architecture Assessment Plan: Getting to August and Beyond

FIRS STDT Meeting

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# FIRS Architecture Decision Statement

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- What are we trying to do here?
  - Recommend a basic mission architecture concept for the FIR Surveyor detailed study plan due August 26, 2016
  - Study schedule does not allow a full quantitative analysis of well-developed competing architectures
  - We understand this to be a preliminary assessment that will likely be refined during FY 2017
- What is success? How about:
  - “The process will be successful when the STDT has reached consensus on a single FIRS mission architecture concept or else has significantly narrowed the range of concept options”*
  - Is this definition OK with the SDT and the Study Office?

# FIRS Architecture Assessment (repeat)

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- 1) Define science, performance, and program requirements, separate into Musts and Wants
  - Requirements defined before August meeting
  - Apply weights to the Wants (start before Aug meeting)
- 2) Develop basic mission concepts with some performance estimates before August meeting
- 3) Evaluate how well each mission architecture concept meets the requirements
  - Quantitative scoring based upon Musts and Wants
  - Assess risks and opportunities of each architecture
- 4) Make a rational decision based on scores. Goal is consensus but dissents will be allowed and noted. Process will be documented as part of FIRS study

# Recommended Assessment Approach

- Adapted from Kepner-Tregoe methods. The Rational Manager, Kepner and Tregoe, 1965 (New edition...)

Decision Statement				Option 1	Option 2	Option 3
<b>Description</b>	Feature 1					
	Feature 2					
	Feature 3					
<b>Evaluation</b>	<b>Musts</b>					
	M1			✓	✓	✓
	M2			✓	?	?
	M3			✓	✓	✗
	<b>Wants</b>		<b>Weights</b>			
	W1		w1%	Rel score	Rel score	
	W2		w2%	Rel score	Rel score	
	W3		w3%	Rel score	Rel score	
			100% Wt sum =>	Score 1	Score 2	
	<b>Risks</b>			C	L	C
Risk 1			M	L	M	L
Risk 2			H	H	M	M
<b>Final Decision, Accounting for Risks</b>						
C = Consequence, L = Likelihood						

From Gary Blackwood, JPL

Risk is the chance that we will not get what we expect

# Example Evaluation: WFIRST Coronagraph

**Decision Statement: Recommend one Primary and one Backup coronagraph architecture (option) to focus design and technology development**

Description		Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Name		SPC	PIAACMC	HLC	VVC	VNC - DA	VNC - PO
<b>Musts</b> (Programmatic)							
M1 - T	Science: Meet Threshold requirements? (1.6, x10)						
M2	Interfaces: Meets the DCIL**?						
M3	TRL Gates: For baseline science is there a credible plan to meet TRLS at start of FY17 and TRLS at start of FY19 within available resources?						
M4	Ready for 11/21 TAC briefing						
M5	Architecture applicable to future earth-characterization missions						
<b>Wants</b>							
W1	Science	40					
a	Relative Science yield (1.6, x10) beyond M1-T						
W2	Technical	30					
a	Relative demands on observatory (DCIL), except for jitter and thermal stability						
b	Relative sensitivities of post-processing to low order aberrations						
c	Demonstrated Performance in 10% Light						
d	Relative complexity of design						
e	Relative difficulty in alignment, calibration, ops						
W3	Programmatic	30					
a	Relative Cost of plans to meet TRL gates						
Wt. sum =>		100%					
<b>Risks</b> (all judged to be High consequence)		SPC	PIAACMC	HLC	VVC	VNC-DA	VNC-PO
		C L	C L	C L	C L	C L	C L
Risk 1	Technical risk in meeting TRLS gate						
Risk 2	Schedule or Cost risk in meeting TRLS Gate						
Risk 3	Schedule or Cost risk in meeting TRLS Gate						
Risk 4	Risk of not meeting at least threshold science						
Risk 5	Risk of mnfr tolerances not meeting BL science						
Risk 6	Risk that wrong architecture is chosen due to assumption that all jitter >2Hz is only tip/tilt						
Risk 7	Risk that wrong architecture is chosen due to any assumption made for practicality/simplicity						
Risk 8	Risk that ACWG simulations (by JK and BM) overestimate the science yield due to model fidelity						
<b>Opportunities</b> (Judged to be High benefit)		SPC	PIAACMC	HLC	VVC	VNC-DA	VNC-PO
		B L	B L	B L	B L	B L	B L
Oppty 1	Possibility of Science gain for 0.2marsec jitter, x30						

➡ Indicates Sig. Discriminator

← Science Threshold

← This is more detailed than what we will do for FIRS

← Science Beyond Threshold



Where is Science Considered?

Where is Technology Plan and Risk Considered?

← Risk of not meeting Threshold

← Oppty: Science if Jitter lower, Speckle subtraction better

# Step 1: Define Science Requirements

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- STDT defines science & performance requirements before August
  - Quantitative performance requirements need to flow from your science requirements and science questions
  - Separate into Musts (absolute requirements) and Wants
  - Both Musts and Wants could include sensitivity, spatial resolution, spectral resolving power
  - Consider key program requirements (e.g. launch, lifetime) as well
- Understand the relative values of the Wants Ideal to have a handful of key requirements (< 10)
- Do some preliminary weighting (of Wants) before August meeting
- Question: Are we ready to get quantitative like this?

# Step 2: Define Mission Architectures

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- STDT defines >1 mission architecture concepts that have some chance of meeting eventual science needs:
  - Must define well enough to understand basic performance capabilities and risks
    - *More defined than just 'Interferometer' and 'Filled Aperture'*
  - Do not need final values yet: performance & risk ranges OK
  - Do in parallel with science requirements
- STDT should agree very soon (May?) on the basic performance parameters that need to be evaluated (e.g., spatial & spectral resolution, sensitivity, mapping speed, etc.)
- Document the major features and performance estimates of each architecture before August meeting
- Question: Is this realistic to do in time?

# Step 3: Weighting Requirements

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- STDT needs to weight the different science and performance requirements:
  - e.g., are spatial resolution and sensitivity (above the minimums) equally important? Is mapping speed the most important?
- Establishing science & technical figures of merit before the meeting would be helpful!
- Obvious weights should be done before August meeting
- We can finalize the harder weights during the August meeting via discussion
- Question: How much can be done before August?

# Step 4: Architecture Assessment

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- STDT will assess the performance of the different architectures during the August meeting:
  - Score each architecture against the requirements
  - Evaluate any obvious major risks (e.g. technical readiness) and opportunities
- Scoring will be done by group discussion
  - Everybody can provide information or argue for a rating value on a rational basis
  - Poll the group after arguments aired: ask for agreement on a score and also ask for any dissents
- Entire rating process will be recorded by a neutral third party, including scores, dissents, and actions
- Results and dissents will be included in FIRS study docs
- Questions?

# Working version of Consensus (NASA policy)

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- Prefer consensus in the time available, else, dissent will be captured and we will move on
  - Will follow 7120.5E, Ch 3.4, “Process for Handling Dissenting Opinion”
    - Three options: (1) Agree, (s) Disagree but fully support the decision (agree that the process was followed well), (3) Disagree and raise a dissenting opinion
    - Treat (1) and (2) as consensus for STDT
    - Dissents (3) will be documented and delivered to senior NASA management (APD DD) per 7120.5E

# What Happens After August Assessment

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- Preferred architecture(s) will be included in the Detailed Study Plan due August 26
  - Describes concept maturity and plans for maturing concept
- Further architecture refinement and assessment may be needed depending on August results
- We currently expect to refine the architecture assessment at some level in mid-FY2017 (early CY 2017):
  - Is the concept still responsive to the requirements?
  - Any further refinement or assessment needed?