National Aeronautics and Space Administration

"Designing the *New Worlds* technology downselect process"

- or -

The road to 2020 goes through 2015

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ExoPlanet Exploration Program

Topics

- Implications of Decadal Survey *(completed)* — Hudgins
- Planning Framework, Constraints, Budget — Devirian
- Science Goals, Opportunities — Traub
- ExoPAG Plans — Kasting
- Discussion — All

Planning Framework

Why We're Here

- Astro2010, *New Worlds New Horizons*, has provided guidance on the path forward:
  - "The committee's proposed program is designed to allow a habitable-exoplanet imaging mission to be well formulated in time for consideration by the 2020 decadal survey."

- We need to map the path through the next decade with a new worlds mission starting shortly after 2020 Decadal Survey.

… excerpts

- "….a decadal survey implementation advisory committee (DSIAC) should be charged to produce annual reports to the agencies, the Office of Management and Budget, and the Office of Science and Technology Policy, as well as a mid-decade review of the progress made."

- "…. With the success of Pathfinder and a decision by ESA to move forward, LISA could launch by 2025."

  - LISA, perhaps IXO, go ahead of a New Worlds mission (?)
  - "Flagships follow flagships" – J. Morse
  - "We need to get this right or our great-grandchildren will fly New Worlds" – M. Devirian

… excerpts

- "…. In the first part of the decade NASA should support **competed technology development** to advance **multiple possible technologies** for a next-decade planet imager, and should accelerate measurements of exozodiacal light levels that will determine the size and complexity of such missions. The committee recommends an initial NASA funding level of $4 million per year so as to achieve a clear set of design requirements and technology gateways to be passed."
  - ExEP Technology and Mission Concept budget (President's 2011 Request)

Totals and subtotals may not sum precisely due to rounding.	Prior	PY (2009)	2010 Enacted	BY (2011)	BY + 1 (2012)	BY + 2 (2013)	BY + 3 (2014)	BY + 4 (2015)
Technology and Mission Concepts		6000	5900	6400	9600	11000	11370	11833

… excerpts

- "**If**, by mid-decade, a DSIAC review determines that sufficient information has become or is becoming available on key issues such as planet frequency and exozodiacal dust distribution a **technology down-select** should be made and the level of support increased to enable a mission capable of studying nearby Earth-like planets to be mature for **consideration by the 2020 decadal survey**, with a view to a **start early in the 2020 decade**. The committee estimates that an additional $100 million will be required for the mission-specific development."

- Calibration:
  - SIM Technology completed: ~$500M, 10 years
  - TPF Technology and mission design: ~$150M, 7 years

Plan Elements according to Astro2010

- 1st, understand the demographics of other planetary systems, in particular to determine over a wide range of orbital distances what fraction of systems contain Earth-like planets
  - WFIRST to complement Kepler
- 2nd, characterize the level of zodiacal light present so as to determine, in a statistical sense if not for individual prime targets, at what level starlight scattered from dust will hamper planet detection
  - Nulling interferometers on NASA-supported ground-based telescopes (for example, Keck, and the Large Binocular Telescope) and/or on suborbital, SMEX, or MIDEX platforms could be used to constrain zodiacal light levels.
- *"After these essential measurements are made, the need for a dedicated target finder can be determined and the approach for a space-imaging mission will be clear."*

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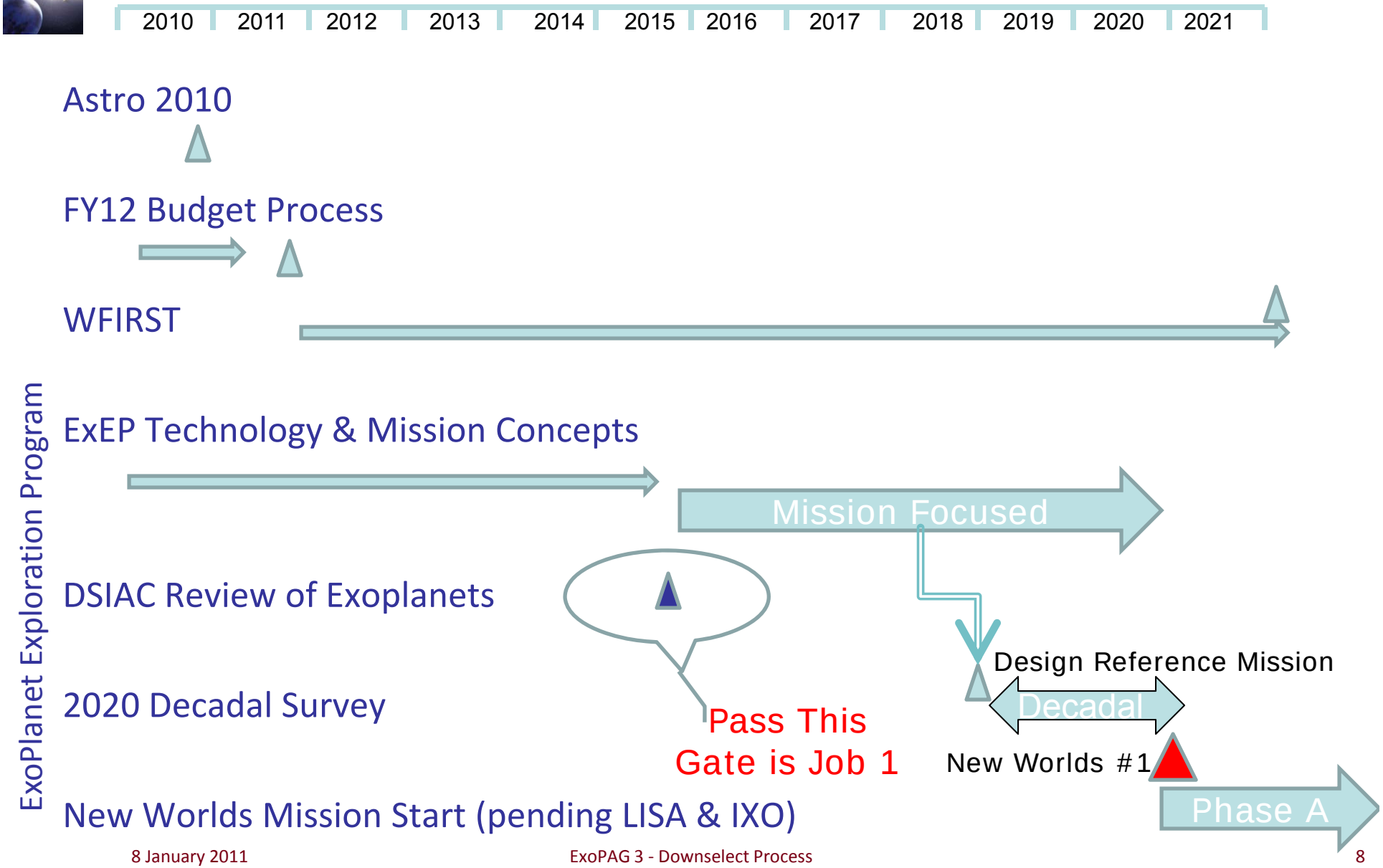
10 Year Planning Framework



Requirements on the Plan

- What is needed to pass the Gate?
  - Technology
  - Exoplanet census
  - Exozodi
  - Community alignment on approach

- How do we fund activities to achieve this?
  - Minimal ExEP funding – choices will have to be made on a combination of scientific, technological and programmatic criteria.
  - Downselect on other than lab demonstration
    - At $10M/year, let alone $4M/year, insufficient to demonstrate.
  - The sooner we can thin the herd, the more we can focus on the hardiest survivors.

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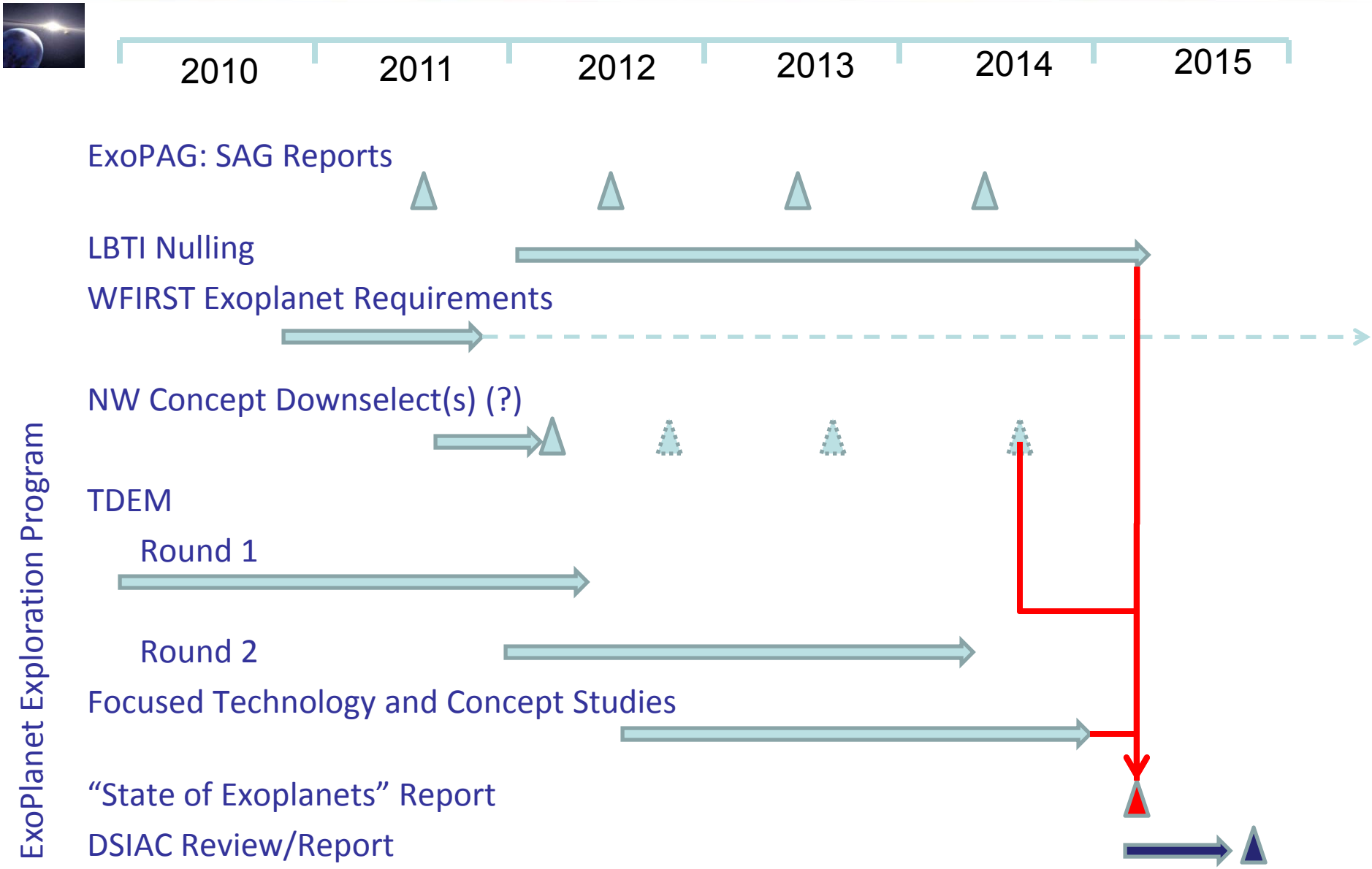
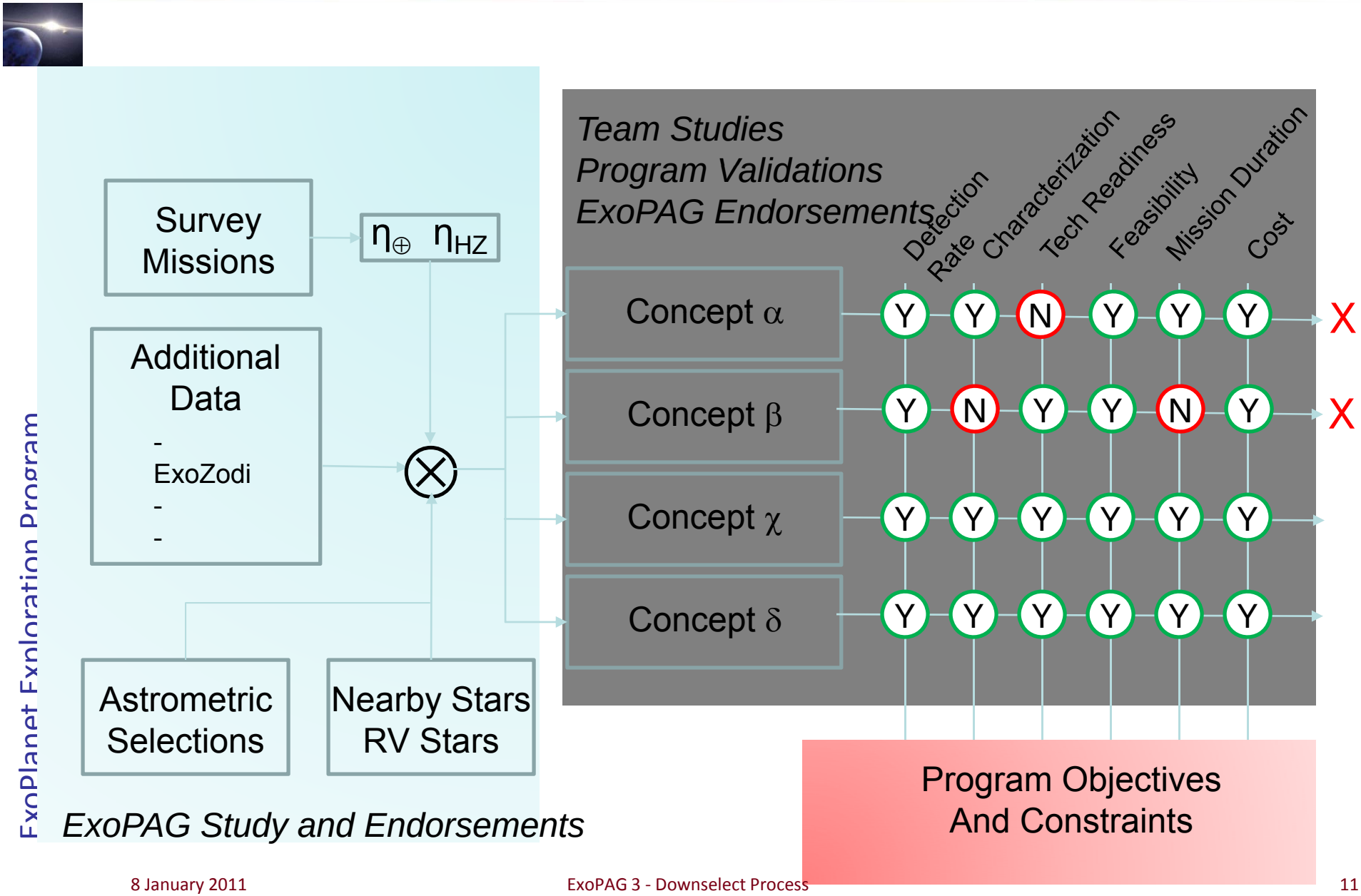
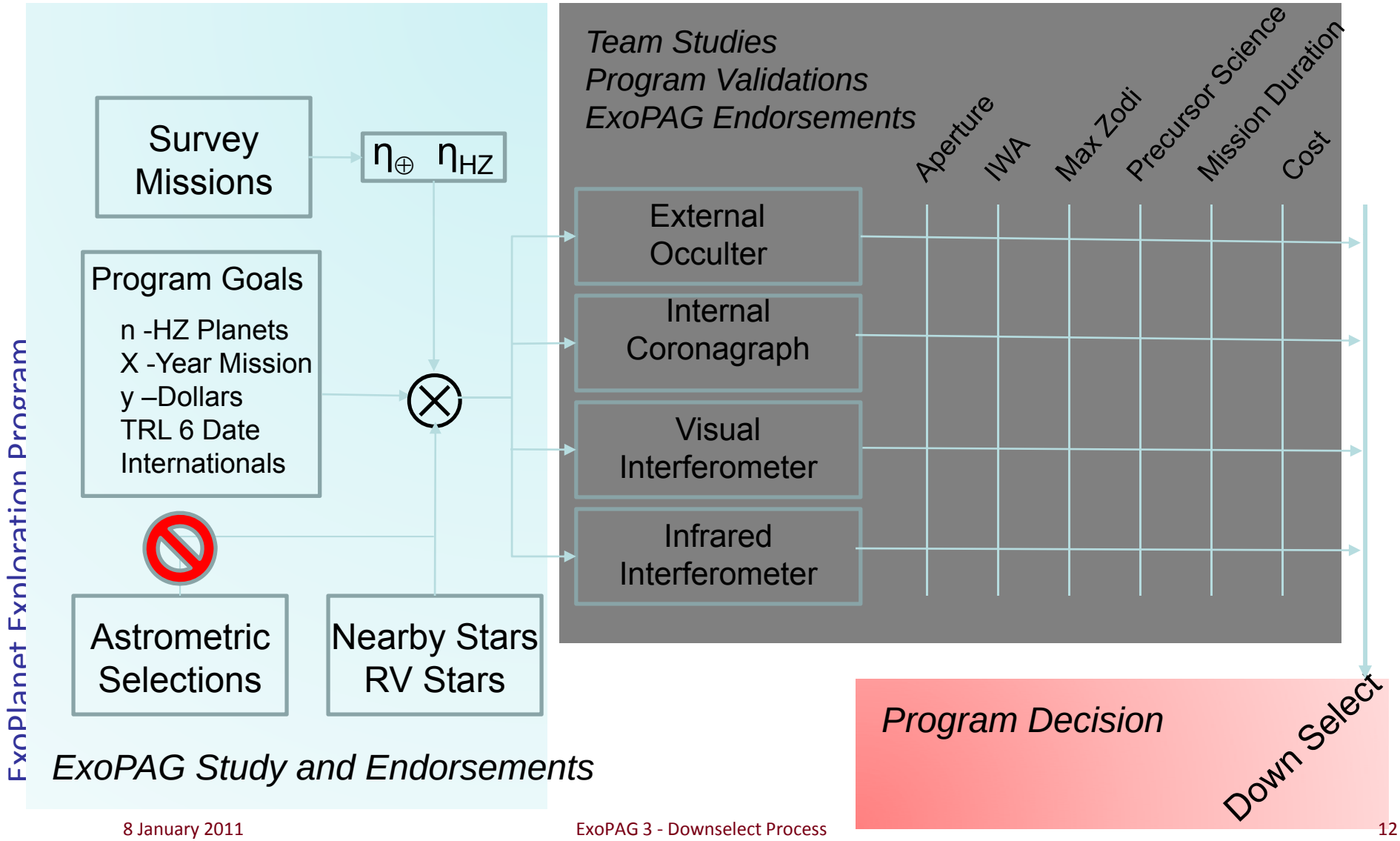
A 5-Year Horizon



Process Schematic



Process Diagram - examples



Wes Traub

SCIENCE GOALS & OPPORTUNITIES

Jim Kasting

EXOPAG PLAN

DISCUSSION