On Organizing the NWTDP (New Worlds Technology Development Program)

Webster Cash

With inputs from many of the exoplanet technology innovators, including:

S. Chakrabarti, T. Greene, J. Kasdin, P. Lawson, C. Noecker, J. Trauger, R. Polidan

It is difficult to speak for all, but we have general agreement on many of the issues. This talk will serve as the starting point for the discussion of how we move forward on a successful NWTDP.

The Situation

What Do We Do Now?

- Decadal recommended a New Worlds Technology Development Program
- It has been over nine months since the Decadal came out
- But we have no plan for implementation of the NWTDP

We must implement a plan that we feel will give us the best chance of success.

It is the Exopag's Responsibility to Define this Program

Why?

Because no other group can do this successfully.

Time to Reboot the Program!!!

- We received top science honors in the decadal
  - But we got no mission
- They named the report New Worlds
  - But we got no mission
- They gave the TPF program $200M and ten years in 2000
  - But we got no mission

Clearly

- If we are to avoid Einstein's definition of insanity we must ***Do Something Different!***

The Renewed Challenge from the Decadal

- They clearly want us to win a flagship in 2020
- Goal is to characterize exo-Earths (spectroscopy/Lifefinder)
- Told us what it would take to win
  - Design to be "shovel ready" by 2020.
    - They need scientific, technical and fiscal confidence
  - Characterize exo-zodis (statistically) so the flagship can be scaled properly
    - Diffraction limited resolution needed to separate planet light
  - Choose key technologies mid-decade
    - In time to properly complete study before 2020

How do we structure a NWTD Program that will succeed?

Change We Can Believe In

What Constitutes Success?

A program that

- Instills confidence in astronomers that it will do the science
  - Will it work?
  - Will it do the science?
- Instills confidence in NASA that it can be built to cost and schedule

How do we do that in the JWST era when nobody trusts anybody?

How Do We Instill Confidence in the Astronomy?

- Two Words: **Do Astronomy**

- We Must Use the Systems to Perform Actual Astronomy
- Papers in the ApJ
- Would you bet $3 Billion on an unproven system?
    - Ground
    - Rockets
    - Balloons
    - Demo Orbital Missions
- Whatever it takes: This is a necessity

How Do We Instill Confidence in the Payload?

- Build and fly small prototypes to do astronomy
  - Throughout the decade
  - Hopefully full orbital demo mission
- Up-select Mid-Decade
  - Downselect implies an actual choice
  - We need multiple, complementary instruments within the 4+m paradigm
- Build and test full scale key components
  - Build a full scale internal coronagraph that meets the specs
  - Build a 50m deployable shade
- Retire all major risks by 2020

How Do We Scale the Mission?

(the exozodi problem)

- Do with ground observatories if at all possible
  - But it probably isn't.
- Use the flight demos
  - One zodi is 10^{-8}, so its much brighter
  - It's extended, so we don't need as high resolution
  - So a small, cheap mission will do
    - Maybe even suborbital
- Whatever it takes. This is a necessity.

One Idea on How to Proceed

Structuring NWTD

Step 1

Set Clear Goals

- Agree on Science Performance Goals for
  - Flagship
  - Exozodi
  - Demos
- Goals should be scientific, not technical
  - Tolerance tables rapidly become outdated as mission develops
  - Designs evolve rapidly until end of Phase A
  - It is the duty of the developer to get around tolerances, not crush them head-on

Structuring NWTD

Step 2

Assemble List of Technology Development Needs

- Split Into Technology Groups
  - Cooperate as much as possible
  - A subset technology should work with appropriate key groups
    - eg formation flying join with starshades
  - Ensure nobody is left out (we all have the right to propose)

- Write a full plan for the decade for each technical approach
  - How well can it do for
    - The flagship
    - The exozodi problem
    - A demo mission
  - Cost and Schedule for development to be included
    - Must meet key milestones

Structuring NWTD

Step 3

Merge Into Single Proposal

- Plans discussed publically at Exopag
- Exopag Merges the Plans Into a Coherent Whole
- Exopag crafts a single, comprehensive proposal
  - Needs to be fully funded. No undercutting with funding cuts or delays
  - PI's job is to send out subcontract money to groups
  - Exopag as a whole publically decides when to terminate non-performing subcontracts

"Give us enough rope to hang ourselves" or Succeed

Structuring NWTD

Step 4

Comments on Moving Forward

- The proposal becomes the voice of the community
  - It should get first crack at all available money because:
  - It is the critical path
  - Avoids the traps of the Navigator Program
- We are just asking for a success scenario level of support
  - Who would want anything else?
- NASA Centers should play a *support* role to the innovators

The NWTD Program

Recap

1. Coordinate and propose as a group for the funding we must have if we are to succeed.
2. Build and test lab prototypes
3. Demonstrate Systems on the ground
4. Fly Systems Suborbitally to do some astronomy
5. MidDecade Selection of Best Approaches
6. Fly Low Cost Demo Mission to do Exozodi Problem
7. Build full scale key components for the flagship

Then we can win that flagship in 2020

Submitted Questions and Comments

Funding exoplanet technology (Breckinridge CALTECH)

- There are 7 architectures for exoplanet science (Charley) – Criteria for down-select is based on technology success.
- There are only 3 funding cycles between now and 2016!
- Not enough $$ to support technologies for all. Do we support those technologies:
  - whose outcomes support the down select?
    - What are these?
  - common to all 7 for readiness/risk reduction?
    - What are these?
- Enabling technology & risk reduction technology may be different
- ExoPlanet panel needs to be engaged in the Functional Requirements for the
  - Guidelines for the RFP for technology and
  - Guidelines to the selection committee's use in recommending awards
- That architecture which has its technology selected will be better understood and thus more likely to be selected without input from the ExoPag?

Gene Serabyn

- Comments on much time and money it will required to have vortex ready in 2015

From Stuart Shaklan

A Point for Discussion:

- How well do demo programs have to perform in order to be convincing?

Draft - Resolved:

- The Exopag wishes to structure a New Worlds Technology Demonstration Program in response to the decadal review
- NWTDP should be defined bottoms-up with the goal of a successful 2020 flagship bid in mind
- NWTDP should feature
  - A well defined program of science goals and milestones
  - An aggressive program of system demonstration
    - Give all viable approaches a chance
    - Publically decide what is viable
  - Science demonstrations as much as possible
    - eg suborbital and Explorer as suggested by decadal
  - Full funding and Reliable Schedule