

## Space Systems Workshop Summary

The first research strategic planning session on Space Systems, held June 25<sup>th</sup> and 26<sup>th</sup> at UA's Biosphere2, focused on the following sub-topics:

- 1) Earth Sensing;
- 2) Mars;
- 3) Infrastructure & Enabling Technologies;
- 4) Space Situational Awareness & Near Earth Object Analysis;
- 5) Habitable Exoplanets/Life Beyond the Solar System.

These topics were selected by the Steering Committee for this workshop, in consultation with additional interested faculty, to reflect areas of unique university strength, opportunities for growth in external funding, and significant national need. Forty participants from colleges across the campus (see list of invitees, participants, and steering committee members below) gathered for the workshop. Participants were identified for their expertise and diversity across "any system that happens in or observes space", solicited from nomination by deans, campus leadership, department heads, and included self-nomination.

During the workshop, breakout sessions were held to provide for detailed discussions of the above topics, each breakout session was held twice (so that participants could contribute to more than one topic), and was moderated by an expert in the field. Session leads reported back to the full group on the opportunities for growth, new strategic capabilities, proposed project time horizons, resources required, program risks, and strategic issues, focusing on what UA could and should do to ensure success.

The following represent the primary recommendations identified during the full-group discussion:

1. **Consider a singular, shared infrastructure for mission-oriented and/or large, complex projects.**

A common over-arching infrastructure (e.g., Arizona Space Labs, or something similarly conceived) could bring external visibility in a manner that connects and leverages the strong reputation of Steward Observatory, Lunar and Planetary Laboratory, and the College of Optical Sciences, and could enhance capacity by sharing unique and highly trained personnel critical to large projects and missions.

Currently Steward observatory, Optical Sciences, and Lunar and Planetary Laboratory have an ongoing personnel "exchange" where experts appointed in one area work for periods of time on activities for projects housed in the other. Expanding this permeable expertise flow would benefit from a "consortium-like" unifying organizational infrastructure. Care must be taken to ensure the strong identity of the individual participating units remains, however, encouraging investigators to utilize this shared resource could provide the expertise needed for supporting multiple, rotating projects and missions key to growth in each topical area.

- a) Encourage and promote faculty interested in leading missions and large,

complex proposals. Participants suggested that current promotion and tenure requirements at the UA be modified to best encourage and support those junior researchers interested in leading NASA science instruments or entire missions – which can take 10 or more years to obtain – or large, complex research centers.

b) With this visibility, capitalize to an even greater degree on opportunities to interact with industry. Steward, LPL, and Optical Sciences have strong records of successfully partnering with private business, and such partnerships can be further extended in these and related topical areas. Utilizing ORD's new AVP for Business Development, and in collaboration with similarly-tasked college personnel, will be useful to expand industry collaborations to the benefit of all.

2. **Invest in critical research infrastructure.** Many participants became aware as a result of the meeting that new UA facilities and capabilities have been added recently, and suggested that ORD should make information about UA core facilities and services more readily available, by expanding and promoting information already available at <http://rgw.arizona.edu/resources/core-facilities>. Participants also identified the need for additional physical infrastructure on campus, which would obviate the need for off campus travel and may reduce costs to individual researchers, including:

a. A high contrast test bed for exoplanet research. The high contrast imaging test bed is a facility for investigating the hardware and software necessary to detect extremely faint objects in space next to bright objects (e.g. Earth-like exoplanets next to Sun-like stars). The hardware consists of coronagraphs (optical devices to block starlight), deformable mirrors, and cameras in a vacuum chamber, and would be a unique facility at US universities and offer a competitive advantage for grants and hires.

b. An isolated room or building, with separated networks, to hold high-security information and/or execute such projects. Such a facility, with a sustainable business model, would be useful broadly for high security opportunities across campus.

c. Increased capacity for large optics manufacturing. Current manufacturing facilities are at capacity and limiting the number of projects which can be accepted.

d. Infrastructure including thermal vacuum chamber, anechoic chamber, clean rooms and high bays, to increase the technology readiness level of our systems. Currently, much testing of space hardware must occur elsewhere which limits options for competing and choice of collaborators.

3. **Build upon UA's success in data science and analytics.** The recognition and understanding of the capabilities in data science and analysis, under the UA-led iPlant Collaborative, opened potential opportunities for researchers interested in innovative data fusion, that draw upon integrated cloud-based solutions. It was suggested that leaders from the iPlant Collaborative could create "success stories" based on proof-of-concept projects from space systems, to help researchers from fields outside of biology and plant sciences understand the capabilities available and opportunities for implementation in these areas.

4. **Continue support for interdisciplinary follow-on planning meetings in each specific topic.** Session participants sincerely valued gathering as an interdisciplinary group. Participants recognized that many researchers on campus do not interact with faculty outside of their core department and that additional communication channels should be supported to encourage further collaboration to realize the promise of the opportunity in each topical area. Suggestions included:
  - a. Organize follow-on meetings revolving around the core breakout session topic, open to all interested researchers on campus, and (initially) supported/organized by Office for Research & Discovery (ORD).
  - b. Proactively plan for participating in nationally sponsored decadal surveys.
  - c. Reprise the strategic planning process in space systems on an annual basis.
  - d. Create new seminar series in topical areas.
  - e. Hosting the meeting at Biosphere2 enabled researchers to identify new opportunities to utilize the Landscape Evolution Observatory (LEO; See Appendix I for short description, contact Peter Troch, [patroch@email.arizona.edu](mailto:patroch@email.arizona.edu), for more information), where multiple new research concepts, particularly related to earth sensing at the molecular scale and habitable exoplanets, were envisioned. LEO may offer opportunities for systematic experimental study in these areas that complement the traditional observational and theoretical approaches, and should be included in ongoing planning efforts.

#### **Next Steps:**

In immediate response to suggestion 4, groups based upon the breakout discussions will continue meeting through the 2015/2016 academic year to further define initiatives, craft reports and prepare internal proposals, and lay the groundwork for externally-funded projects. For information on the breakout session groups, including how to participate in follow-on meetings, please contact the group lead:

☐ Mars, contact Tim Swindle, Director, Lunar and Planetary Laboratory, [tswindle@lpl.arizona.edu](mailto:tswindle@lpl.arizona.edu)

☐ Space Situational Awareness & Near Earth Object Analysis, contact Michael Hart, Steward Observatory & Colleges of Optical Sciences and Engineering, [michae10@email.arizona.edu](mailto:michae10@email.arizona.edu).

☐ Habitable Exoplanets/Life Beyond the Solar System, contact Marcia Reike, Regents' Professor of Astronomy, [mrieke@as.arizona.edu](mailto:mrieke@as.arizona.edu)

☐ Earth Sensing, currently, contact Jennifer Barton [barton@email.arizona.edu](mailto:barton@email.arizona.edu).

For additional information on the upcoming workshops, please contact Jennifer Barton at [barton@email.arizona.edu](mailto:barton@email.arizona.edu) or Neal Armstrong at [nra@email.arizona.edu](mailto:nra@email.arizona.edu).