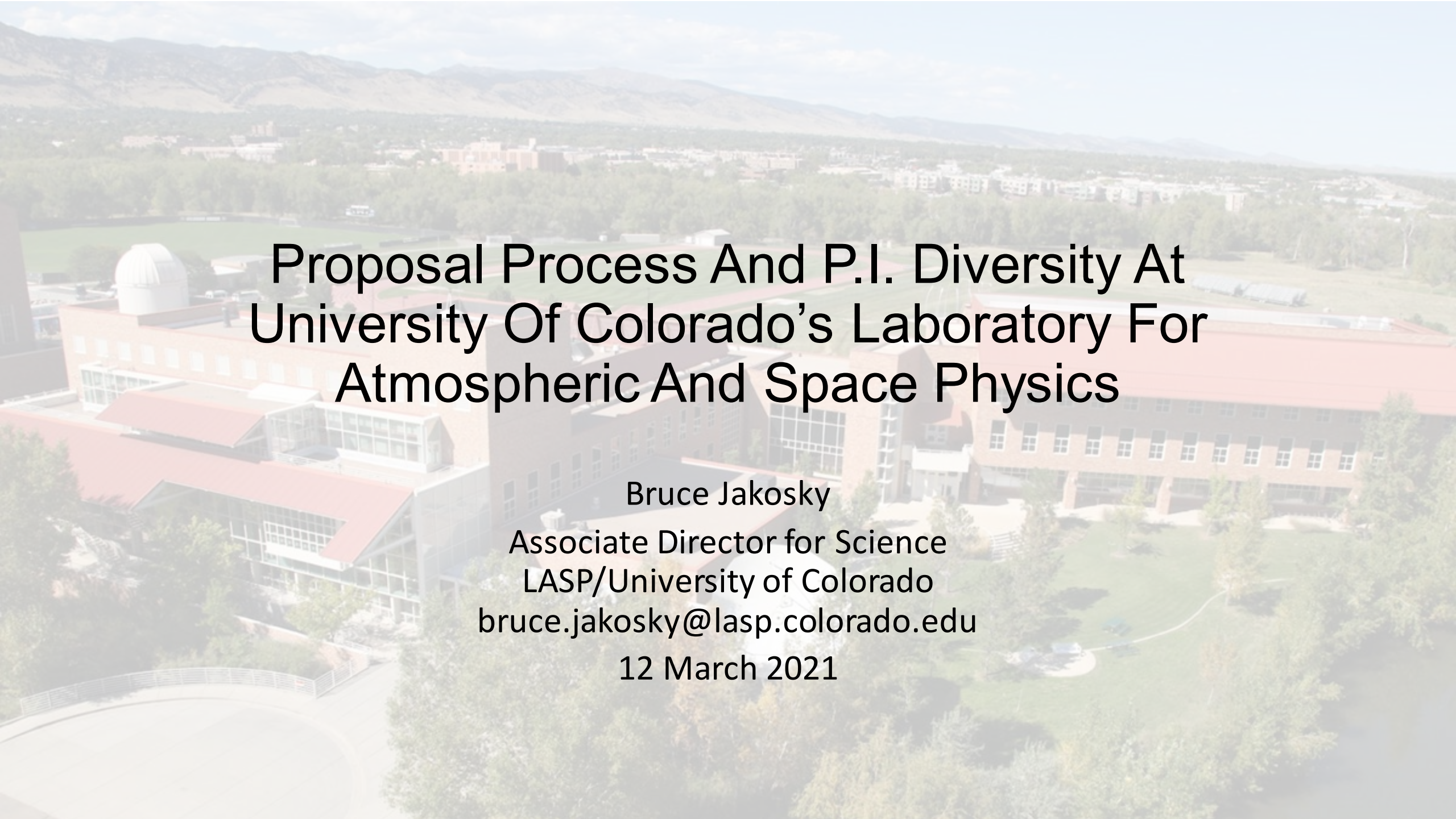


Proposal Process And P.I. Diversity At University Of Colorado's Laboratory For Atmospheric And Space Physics

Bruce Jakosky

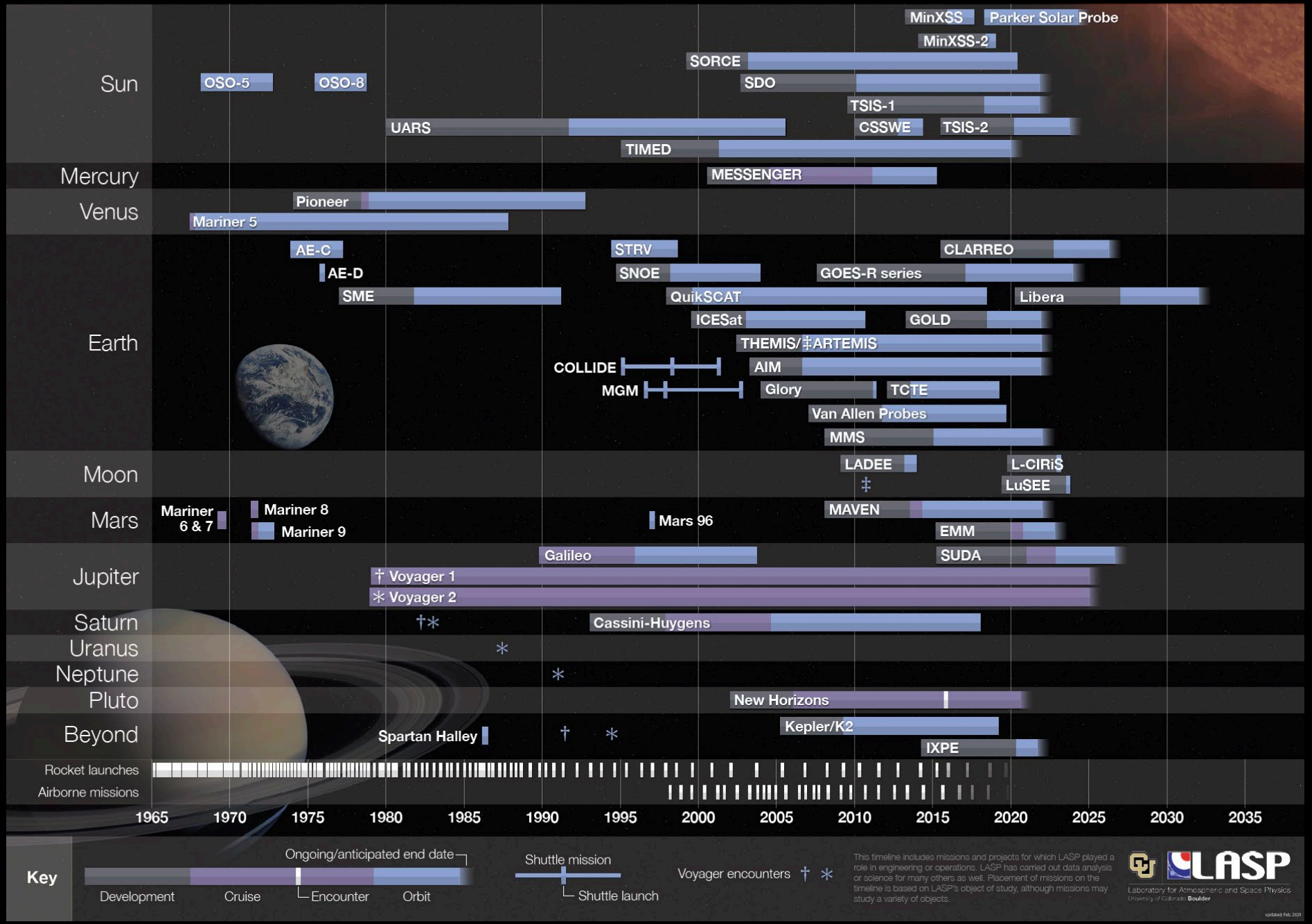
Associate Director for Science
LASP/University of Colorado
bruce.jakosky@lasp.colorado.edu

12 March 2021

Topics to be addressed

- LASP as a Research Institute at the University of Colorado
- Outline of the steps of proposal development
- Current institutional policies/criteria, if any, for selecting P.I.s and team members
- The institutional supports, if any, that are available to potential P.I.s
- Issues and concerns for proposals
- P.I. diversity issues

LASP Missions And Projects Across Science, Engineering, And Operations



LASP as a Research Institute at the University of Colorado (1 of 2)

- **High-level objectives include**
  - Designing, building, testing, operating spaceborne, airborne, and balloon instruments to obtain measurements that address fundamental science questions
  - Analyzing data from these and other instruments/missions, laboratory, and theoretical approaches to reach science conclusions
  - Identifying follow-on science questions to be addressed and implementations to do so
  - Training the next generation of scientists and engineers
- **Science disciplines**
  - Solar/stellar physics
  - Space physics
  - Earth atmosphere and upper atmosphere
  - Planetary science
  - Interdisciplinary areas (e.g., astrobiology, space weather, exoplanets)
- **LASP is divided into divisions that work closely with each other**
  - Science
  - Engineering
  - Mission Operations and Data Systems
  - Administration/IT
- **622 employees total, predominantly soft money**
  - 107 Ph.D. scientists; 27 are University-supported in tenured/tenure-track faculty (joint with academic departments)
  - ~275 professionals in Engineering and MODS
  - 154 students (grad plus undergrad, mostly in science and mission ops)

LASP as a Research Institute at the University of Colorado (2 of 2)

- LASP is the only research lab in the world to have flown instruments to all the planets (whether there are 8 or 9 planets)
- ~23 LASP-built instruments currently operating in space on 14 different missions, from Earth orbiting to Mars to the Kuiper Belt
- Instruments for ~20 different missions in development, from cubesat to GOES to Europa Clipper
- Currently carrying out science ops for 142 instruments and mission ops for 3 spacecraft
- LASP has built spacecraft with size class varying from cubesat (e.g., MinXSS) to small spacecraft (SNOE) to interplanetary (Hope Emirates Mars Mission, in collaboration with UAE)
- P.I.-led missions include (most recent first, not including cubesats or sounding rockets):
  - Libera, P.I. Peter Pilewskie (in development)
  - *Hope Emirates Mars Mission, not P.I.-led but many similar attributes*
  - Total and Spectral Solar Irradiance Sensor (TSIS, on ISS), P.I. Peter Pilewskie
  - Global-scale Observations of the Limb and Disk (GOLD, on a commercial comm sat), P.I. Richard Eastes
  - Mars Atmosphere and Volatile Evolution (MAVEN), P.I. Bruce Jakosky
  - Aeronomy of Ice in the Mesosphere (AIM), P.I. James Russell III
  - Solar Radiation and Climate Experiment (SORCE), P.I. Gary Rottman
  - Student Nitric Oxide Experiment (SNOE), P.I. Charles Barth
  - Solar Mesosphere Explorer, P.I. Charles Barth

Outline of the steps of proposal development

- **Origination of mission concept**
  - Grass roots – potential P.I. comes forward with an idea (P.I. can be internal or external to LASP)
  - Focus-group discussion (mainly among scientists) – what missions are compelling or are called out in the NASEM Decadal Strategies or NASA Strategic Planning documents
  - Identification of potential missions/opportunities from senior leaders in the lab or externally
- **Evaluation by Proposal Development Committee**
  - PDC consists of senior people from science, engineering, ops, admin, lab leadership
  - First evaluation – leads to detailed development of concept
    - Is it a credible/viable concept?
    - Is the proposed teaming appropriate, are there gaps?
  - Science evaluation
    - Is the science high priority, is it responsive to the anticipated AO?
    - Will the science close? Will it make the right measurements, will they answer the questions?
  - Second evaluation – is the concept mature enough and is the team ready to write a proposal?
- **Budget review, throughout and just prior to submission**
  - Is the budget in scope, complete, adequate reserves, etc.?
- **LASP cannot support all of the good ideas, so some concepts may get dropped at each stage**

Current institutional policies/criteria, if any, for selecting P.I.s and team members

- Typically, P.I. proposes mission concept to the lab, rather than the lab selecting a P.I.
- Evaluation of mission concept necessarily includes an evaluation of the capabilities of the P.I.
- P.I. typically selects team members, with input/advice from PDC
  - Science team members: Advice typically centers on whether the necessary expertise is there, whether there are gaps, size of team, diversity of team; necessarily involves evaluation of the individuals
  - Instrument providers: Are they the right instruments, are the providers credible?
  - Spacecraft providers: Selected by P.I. with input from PDC and senior members of the lab
- LASP is continually looking to identify potential instrument or mission P.I.s and to help them develop

The institutional supports, if any, that are available to potential P.I.s

- Some (limited) internal funding available to all scientists to help with proposal development
- Internal R&D funding available for advance development of relevant technology or concept; open across the entire lab, via short proposal
- Internal workshops on all aspects of flight proposals and missions, to aid those interested in proposing hardware or missions; open to all scientists
- Opportunity for early interaction of scientists with engineering staff on viability of concept and approach
- Internal funding required for supporting concept and proposal development
  - Support both for developing concept and for writing the proposal; includes science, engineering, ops, budget, admin support
  - Investment necessary from all institutional partners

Issues and concerns for proposals (1 of 2)

- **Resources necessary to support competitive mission proposals are becoming prohibitive**
  - Proposal competition has gotten more intense over the last several decades, requiring investment of increasing funds up front to support development even before a proposal is written
  - There are fewer flight opportunities, so that, increasingly, each one is a “must win” for every institution; space-research laboratories are at risk
  - Movement toward small spacecraft (such as cubesats) is potentially problematic for maintaining and enhancing cutting-edge research capabilities at hardware institutions
  - A Discovery- or New-Frontiers-class mission proposal requires an investment of $2-3M or more to develop and write the proposal
    - Costs typically shared among partner institutions
    - Missions often require additional technology development in order to be credible; we’ve heard stories of investments of close to $10M
    - These investments typically have to come from within the LASP operating budget, and are not provided separately from the University

Issues and concerns for proposals (2 of 2)

- **General concern over developing the next generation of instrument and mission P.I.s**
  - We recognize that there is not a single pathway to being a P.I.; can include starting with smaller projects (sounding rockets, cubesats, instrument P.I.), being Co-I on preceding instruments/missions, being IDS on a mission, being a senior researcher
  - Few opportunities for scientists to develop broad science, mission, and management background that will help in being credible in a proposal or in succeeding as a mission P.I.
  - The community must ensure that we have well-prepared scientists in general who can fill the P.I. role
    - The highest-priority goal has to be mission success; to help ensure that, we need knowledgeable and effective individuals in the P.I. role
    - We must ensure that women and under-represented minorities have the training/educational opportunities to be prepared for these roles and are not discriminated against in lead-up opportunities, in P.I./mission selection, or in team-member selection
      - Has to be done at all levels – the community, SMD, individual labs like LASP, individuals

P.I. Diversity Issues

- **Everybody has a compelling interest in ensuring equality of opportunities leading up to becoming P.I.**
  - Cannot separate P.I.-diversity issues from general issue of P.I. and mission development
- **Long-term, the best ways to ensure P.I. diversity are:**
  - Provide early-career opportunities to get relevant experience along the career ladder (science Co-I, management opportunities, NASA and NASEM committees, smaller missions such as cubesat/rocket)
  - Provide educational opportunities along the way, along the lines of the JPL summer schools or the P.I. workshops; keep these open to everybody to ensure we have the best chance to have effective P.I.s
  - Enhance opportunities for one-on-one mentoring by senior scientists; again, not limited to diversity categories
- **Short-term, there absolutely are diverse candidates who can be effective P.I.s today**
  - Ensure no intentional or unintentional impediments to their assembling teams, submitting proposals, and being selected
  - A wide range of individuals can be effective as P.I. if paired with an appropriate Project Manager and team
    - Trade-off between leadership by P.I. versus by P.M.; risk of losing value of having a P.I.-led mission
- **No education or training courses can take the place of personal experience in real situations**
- **Enhancing diversity among P.I.s requires a long-term, broad-based approach, operating throughout individuals' careers rather than just when selecting a P.I.**