

PLANETARY SCIENCE INSTRUMENT DEVELOPMENT PROGRAMS. R. N. Simons, Planetary Science Division, Science Mission Directorate, NASA Headquarters, Washington, DC 20546, USA;
Email: Rainee.N.Simons@nasa.gov

Introduction: NASA's Planetary Science Division (PSD) combined existing independent technology and instrument development programs into three baseline programs; Planetary Instrument Concepts for the Advancement of Solar System Observations (PICASSO), Maturation of Instruments for Solar System Exploration (MatISSE), and Development and Advancement of Lunar Instrumentation (DALI). The PICASSO program is expressly designed to develop instruments from the idea or conceptual stage of "basic principles observed and reported" (technology readiness level (TRL) 1) up through "component/subsystem validation in laboratory environment" TRL 4. MatISSE addresses the Decadal Survey's guidance of "improvements of existing instruments" by funding the improvement of the PICASSO or other programs' TRL 3 to 4 instruments, and maturing them to TRL 5 to 6. TRL 6 systems or instruments are defined as systems/subsystem models or prototypes that are demonstrated in a relevant end-to-end environment. The intention is to advance innovative instruments under the PICASSO program, and then to mature the most promising of them in the MatISSE program to the point where they could be proposed as flight instruments. The DALI is similar in scope and TRL requirements as MatISSE, however, includes a special emphasis on Lunar science instruments.

PICASSO: The goal of the PICASSO program is to advance spacecraft-based instrument components and systems that show promise for use in future planetary missions in support of PSD. Thus, the proposed instrument component or system must address specific scientific objectives of likely future planetary science missions. The PICASSO program seeks proposals to develop new proof-of-concept instruments or instrument components and technologies that enable new science by significantly improving instrument measurement capabilities for planetary science missions. The objective of the program is to develop new low TRL instruments to enhance the scientific capability in planetary science missions to the maturity level where they may be proposed for the MatISSE program for further development for flight. In most cases this will mean demonstrating that meeting key performance targets is feasible.

MatISSE: The goal of the MatISSE program is to develop and demonstrate spacecraft-based planetary

science instruments to the point where they may be proposed in response to future announcements of flight opportunity without additional extensive technology development. The proposed instrument must address specific scientific objectives of likely future planetary science missions. The objective of the program is to develop new technologies that significantly improve instrument measurement capabilities for planetary science missions. The technologies must address significant scientific questions relevant to stated Planetary Science Division's strategic goals and objectives. The MatISSE Program is intended to enable technology infusion into NASA planetary science missions in a timely and efficient manner. As such, MatISSE supports progressing instruments from an entry of TRL 4 to 5 to an exit TRL of 5 to 6. Instrument development activities must be planned and initiated so that major technological risk is retired prior to proposal for flight opportunities. This program permits appropriate funding to be applied at each stage of readiness associated with the development and demonstration of key and enabling technologies, such as breadboarding, brassboarding, and testing of critical components and testing the instruments in a relevant environment.

DALI: The goal of the program is to develop and demonstrate Lunar science instruments to the point where they may be proposed in response to future Lunar missions including expected commercial ventures. The instruments should support NASA's broader Lunar exploration goals, including human exploration and in situ resource utilization, as well as Lunar science. The objectives of the program are to develop new technologies that significantly improve instrument measurement capabilities for Lunar science missions. While all lunar instrument types, including rover-based and orbital, are considered, instruments for small stationary landers are especially of interest.

OTHER RELEVANT PROGRAMS: Although PICASSO and MatISSE are the focus of the PSD instrument development efforts, PSD does on occasion solicit more narrowly targeted instrument development efforts as well. Recent examples include Concepts for Ocean worlds Life Detection Technology (COLDTech), which supports the development of spacecraft-based instruments and technology for surface and subsurface exploration of ocean worlds such as Europa, Enceladus, and Titan and Instrument Con-

cepts for Europa Exploration 2 (ICEE-2), which supports the development of instruments and sample transfer mechanism(s) for Europa surface exploration. Unlike PICASSO and MatISSE, these target specific exploration efforts that Congress has directed NASA to undertake are funded by those programs. They may be either low TRL programs for far term goal, such as with COLDTech or they may be mid-TRL programs supporting shorter-term goals, such as ICEE-2.

AWARDS: The PICASSO program is competed on every year. Proposals may request funding for up to three years. The budget for new PICASSO awards each year is \$3.5M, and it is anticipated that there will be about 12 new awards per program year.

The MatISSE program is competed on even numbered years. These proposals can request funding for three years, and under some circumstances, a fourth year may be proposed. The budget for new MatISSE awards is \$6M, and about 6 proposals are projected to be awarded per program year.

The DALI program is competed on every year. These proposals can request funding for three years. The budget for new DALI awards is \$5M, and about 5 proposals are projected to be awarded per program year.

PROGRAM FOCUS: The nature of specific efforts selected for funding will vary - with emphasis given to innovative technologies that improve instrument measurement capabilities. It is anticipated that the science payloads on most future planetary science spacecraft will be limited to small, low mass, and low power instruments.

PSD endeavored to keep the portfolio broad, so that there would be increased instrument sensitivity and improved measurement accuracies from wide variety of instruments developed for planetary scientists to maximize science return for future missions.

EXAMPLES: Examples of PICASSO, MatISSE, DALI, and ICEE-2 awards that were made in the past several years will be highlighted at the conference.