THE NASA FACILITY FOR ASTROMATERIALS RESEARCH AT THE JOHNSON SPACE CENTER – A NATIONAL LABORATORY FOR PLANETARY RESEARCH. J. Filiberto[1], A. Burton[1], T. M. Hahn[2], L. P. Keller[1] , E. Rampe[1], K. Righter[1], and J. I. Simon[1], [1]ARES, Code XI3, NASA-JSC, 2101 NASA Parkway, Houston, TX 77058, USA, [2]Jacobs- JETSII, NASA-JSC, Houston, TX, 77058, USA (Justin.R.Filiberto@nasa.gov).

Introduction: The Astromaterials Research and Exploration Science (ARES) Division at the NASA Johnson Space Center houses a unique combination of laboratories, instruments, infrastructure, technical expertise, and other assets for conducting broad-based world-class planetary research. These facilities have been accessed for decades by hundreds of external scientists, including faculty, post-docs, students, and interns, most at no cost and on a collaborative basis.

With funding through NASA's Planetary Science Enabling Facilities (PSEF) program, we have established the NASA Facility for Astromaterials Research (NFAR) to expand access to and enhance these laboratories for a diverse and inclusive external user base, thus maximizing the science return from research funded by R&A programs in NASA's Planetary Science Division (PSD). NFAR enables cutting edge planetary sample analyses, making new scientific discoveries possible, in addition to training the next-generation of planetary scientists. NFAR laboratories are co-located with JSC Curation that houses all NASA-controlled astromaterials collections, thus enabling direct access to both research and curation expertise, to facilitate specialized sample handling and analysis of allocated samples (from JSC and other sample collections) to PIs, particularly those affiliated with institutions that historically have limited or no access to in-house analytical or experimental facilities.

NFAR Laboratories: ARES laboratories operate using a coordinated analysis approach, where multiple analyses are performed on samples in a systematic and sequential pathway (from least-destructive to most-destructive) from hand-samples down to the atomic scale, to maximize science return from precious, and in some cases, unique materials. The NFAR laboratories provide access and training to three major analytical laboratory groups within ARES: 1) Astromaterials Sample Analysis, 2) Planetary Process Simulation, and 3) Planetary Mission Analog Research (Figure 1).

The **Astromaterials Sample Analysis** facilities encompasses the *Electron-beam Analysis Laboratories* housing a suite of scanning and transmission electton microscopes (SEM and TEM), electron microprobe analyzers (EPMA), focused ion beam (FIB), and support equipment, the *NanoSIMS Laboratory* with a broad-beam Ar ion flat milling system, the *Center for Isotope Cosmochemistry and Geochronology* with facilities supporting inductively-coupled-plasma mass spectrometers and thermal ionization mass spectrometer where samples are either chemically processed and purified in the clean laboratories or introduced by laser ablation. The *Light Element Analysis Lab* focuses on stable isotope mass spectrometry was recently expanded to include a laser fluorination line for high precision triple oxygen isotope analysis of silicates, and the *Soluble Organics in Astromaterials Laboratory* includes instrumentation for liquid and gas chromatography-mass spectrometry systems. Insoluble organic materials are analyzed *in situ* using an ARES-designed and -built microprobe two-step laser mass spectrometer system.

The **Planetary Process Simulation** facilities includes the *Experimental Petrology Laboratories* with a 1-bar furnace laboratory to simulate high-temperature, ambient pressure, conditions on a range of astromaterials and piston cylinder and multi-anvil apparatuses for high-pressure experimental petrology. The *Experimental Impact Laboratory* currently houses three separate accelerators: a horizontal 5.56-mm light-gas gun (LGG) (<8 km/sec), a vertical gun that features interchangeable barrels (<3 km/s), and a 25-mm flat-plate accelerator (FPA) (up to 70 GPa), which can launch a variety of projectiles at targets to simulate impacts on the solid bodies of the Solar System.

The **Planetary Mission Analog Research** facilities focus on robotic-mission analog studies and experiments, measurements, and analog research to further interpret data returned from planetary missions and characterize geological processes on planetary bodies. These laboratories contain flight-like versions of instruments operating on martian rovers, including: the CheMin X-ray diffractometer on the Mars Science Laboratory (MSL); the laser-induced breakdown spectrometer on ChemCam and SuperCam on MSL and Mars 2020; the evolved gas analyzer in the Sample Analysis at Mars (SAM) instrument suite on MSL; and the SHERLOC deep-UV Raman spectrometer on Mars 2020. ARES hosts the field's largest collection of extensively characterized rock, mineral, and glass samples in an analog sample library for validation of mission science data. Additional instrumentation located in this lab includes visible near-infrared spectrometers, Fourier transform infrared spectrometer, Mössbauer spectrometers, vibrating sample magnetometer, magnetic susceptibility bridge, and an electron magnetic resonance spectrometer.

Facility Access: Access to NFAR can be requested by external users via short proposal requests that are solicited three times each year in March, July, and November. Approved requests will be prioritized such that NASA-funded research in active PSD R&A proposals have the highest priority, followed by users performing research relevant to PSD R&A programs such as proof-of-concept studies to support new R&A proposals. Additional consideration will be given to access requests from early career/next-generation scientists, under-represented minorities, and those PIs from minority-serving institutions. Available instrument time for external users varies across the NFAR labs but is typically 10-20%, at no cost to the external user (travel expenses and per diem would not be provided by NFAR and would be the responsibility of the external user). Both independent and collaborative proposals with ARES scientists are encouraged. Generally, external users would be supported and assisted by ARES staff during their time on-site performing analyses. Independent operation of individual instruments by external users is possible and is approved at the discretion of the individual ARES instrument lead scientist.

New access proposals would first be evaluated for feasibility by ARES instrument scientists/lab leads. Once a proposal's feasibility is established, it would then be evaluated by a Proposal Review Panel (PRP) for scientific merit. If a proposal is considered not feasible, it would be returned with review comments to aid the proposer in submitting a revised proposal. The PRP consists of a group of an equal number of ARES scientists and external members that make access recommendations to the ARES Research Office Branch Chief. Access proposals will be evaluated using a dual-anonymous process and will be reviewed and selected or declined quickly (within 1 month of the proposal due date), with the selected proposals being ranked according to their scientific merit, technical feasibility, and the availability of the required resources. The proposal review score combines the proposal strengths and perceived weaknesses and is the major factor in allocating facility access to external users. The ranked recommendations of the PRP are presented to the ARES Research Office Branch Chief who would determine the final allocations.

Proposals to use NFAR laboratories are <5 pages and are required to address the following items: 1) A description of the scientific purpose and importance of the proposed research; 2) A description and justification of the proposed work to PSD programs (funding source, if any); 3) Identify labs/capabilities to be accessed and justify the use of NFAR resources and capabilities, especially if similar capabilities exist at the user's home institution; 4) Describe the samples and procedures required for the analyses and the milestone basis for the time request; 5) Safety concerns/issues for the NFAR laboratories, e.g., will hazardous chemicals and materials be required; and 6) Provide a Data Management Plan consistent with PSD requirements for R&A proposals.

Users are encouraged to discuss potential proposals with ARES/NFAR staff prior to submission. Finally, publications that result from data obtained from the NFAR laboratories will acknowledge the facility award in the acknowledgements section.

The first call for NFAR access proposals is anticipated to be announced April 2023 with proposals and the first external proposals due to the Proposal Review Panel by July 1, 2023. Inquiries and requests for information should be directed to Dr. Justin Filiberto (Justin.R.Filiberto@nasa.gov).

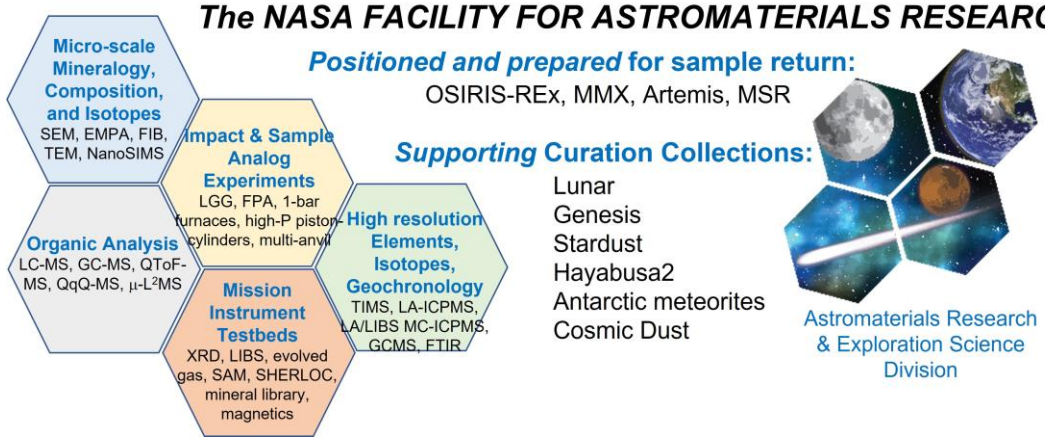

Figure 1. The NFAR structure and connectivity – coordinated analysis among ARES laboratories for world-class sample analysis and support of NASA PSD R&A programs.