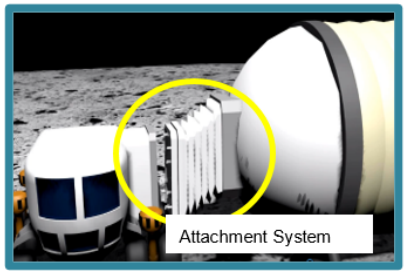
The Standardization of In-space and Surface Docking Systems J. L. Lewis and S. R. Donahoe, NASA Johnson Space Center, Structural Engineering Division, Mailcode ES, 2101 NASA Parkway, Houston, TX 77058 (Primary Contact: james.l.lewis@nasa.gov)

Introduction: The International Docking System Standard (IDSS) aids on-orbit crew rescue and joint operations between different spacecraft. For the International Space Station (ISS), the IDSS has enabled Global interoperability for Commercial Crew and soon JAXA, and the standard is currently being extended to the Artemis Program missions. As more companies, agencies, and nations announce their intentions to explore and occupy low Earth Orbit (LEO), Cis-Lunar space, including the Lunar surface, it is a natural extension that new standards will be developed to support infrastructure build-up for mission-based or permanent occupation and exploration by national and multi-national Agencies, Industries, and Companies.

Image: Space X Commerical Crew Docking System (photo from internet)

A surface version of the IDSS, a.k.a. IDSS-Surface (IDSS-S), is under consideration by the NASA docking discipline leads responsible for the leadership of technical development and negotiation of the original IDSS a little over a decade ago. The IDSS-S, like its predecessor, will detail the physical geometric mating interface and design load requirements to ensure physical interoperability and support a broad set of design reference missions. An IDSS-S, if used, increases the probability of successful Lunar surface docking between different modules enabling the accessibility and inclusivity required for multi-national, sustainable Lunar exploration.

While this paper will not delve much into the background of the development of the IDSS, the experience of developing, implementing, and managing the IDSS as a standard offers valuable insight and lessons learned applicable for creation of a IDSS-S as future Lunar surface element providers pursue development of the modules, systems, and infrastructure required to be assembled and/or connected to enable a permanent sustainable Lunar capability.



Concept depecting Rover and Lunar Surface Module Docking. Docking Adapter concept utilizing the future Standardized Interface and Pressurized Tunnel to overcome misalignment.

NASA JSC Docking designers have on-going activities exploring surface docking and shirt sleeve transfer capabilities which include articulating systems and inflatable tunnels to perform the docking and transfer functions between two elements. A primary objective is to explore and document the features and requirements of a potential international interface standard with the goal this year to create a draft of the new surface standard and begin dialog with commercial and international counterparts heading towards baselining in a few years. Keeping schedule is important in order to be able to support anticipated and ongoing architectural, ground-based, and flight development activities leading towards a future sustained lunar surface operations; including the potential to scar early Artemis elements/vehicles for potential retrofit of a docking interface or by on-ramping this/these capabilities later as they mature.

Efforts are currently underway by the Structural Engineering Division at the NASA JSC seeking substantial active partnering with Industry with the expectation to accelerate work in this area to the benefit of enabling lunar surface sustainability faster, fewer impacts, and decreased overall cost.