Advanced Docking Berthing System

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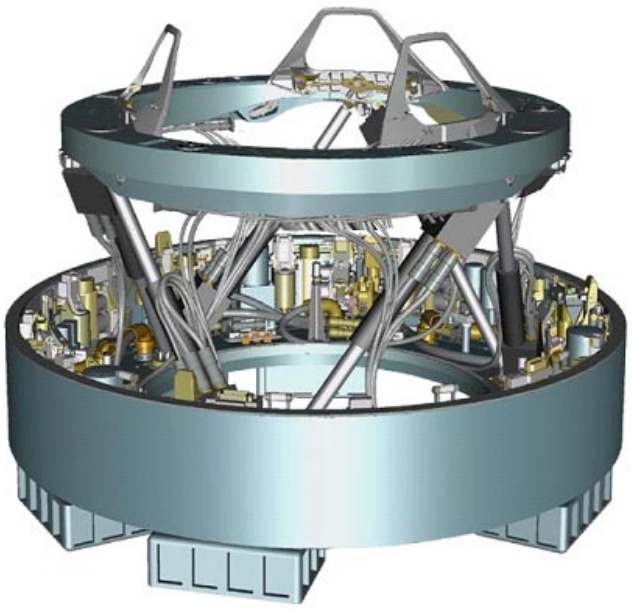
The Advanced Docking Berthing System (ADBS) Project, a Johnson Space Center activity, develops the next-generation space vehicle mating system required for the Constellation Program. The Constellation Program consists of exploration activities that include crew exploration vehicles, launch vehicles, and future communication/navigation systems. The vision for the ADBS Project is to develop and establish a standard interface for mating spacecrafts. This standardization will reduce the life cycle costs of mating systems through efficiencies and economies of scale since all future spacecraft would use the standard interface. A major benefit to using a standard mating interface is that future projects and programs can focus on their spacecrafts without having to expend resources to understand the complexities of mating operations or to develop a means to mate two spacecrafts together.

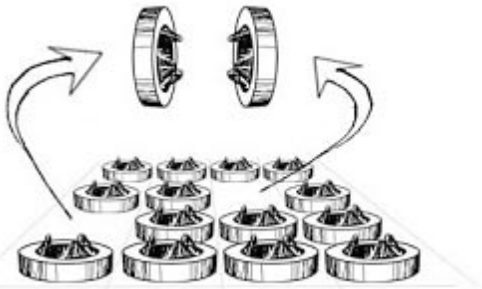
The main tenet of the ADBS effort is to provide a standard system that is compact, lightweight, smart, and low impact, and that reduces the dynamics required and risks associated with mating spacecraft. From early pathfinder development and testing that incorporated lessons learned from previous programs and requirements development efforts, it was established that an advanced mating system with a standard interface design using modern technology to achieve low-impact operations is practical and achievable. The low-impact capture approach simplifies spacecraft docking operations by eliminating high-impact loads and lowering the criticality of operations needed for beyond low Earth orbit. The standard low-impact design is also compatible with spacecraft berthing operations and is easily real-time re-configurable to support a wide range of spacecraft and mating operations; it thus becomes one system with many uses.

Generally, any time spaceflight hardware can be standardized and used in multiple mission profiles, the overall development costs are reduced as are the certification and life cycle costs to the projects and programs. In addition, with early implementation and by defining a standard interface, NASA can more effectively prescribe many of the larger mission architecture parameters, even when different contractors and foreign partners provide space modules and vehicles.

The ADBS is two identical interfaces with one interface each integrated into separate space vehicles. A single interface represents a unique technological feature that can be replicated many times across multiple spacecraft, allowing each spacecraft to mate with another. This capability, which is known as fully androgynous, does not exist in current mating mechanisms. It offers the benefit of a system-level mating system redundancy and an unprecedented spacecraft-to-spacecraft rescue capability.



Single design *Multiple clones*



Random androgynous mating

In 2005, the ADBS Project, leveraging on the X-38 Low-Impact Docking System work that has been occurring over the last eight years, will begin fabricating the first new, fully integrated human transfer-rated docking system in more than 20 years for ground demonstration purposes. An additional effort in 2005 will be to begin identifying the driving Constellation Program requirements and to assess ADBS applicability to meet the anticipated range of vehicles, missions, and operations. One current expectation is that the Constellation Program will consist of a large array of vehicles in terms of size and mass. Therefore, we will begin assessing whether a single ADBS design is capable of supporting the large majority of applications and establishing whether there is a need for a very large class mating system, the size and mass of which are impractical to impose on the majority of missions using the optimal standard. The ADBS Project will address applying the standard ADBS mating system modular design, systems, and technology to create a familial solution that allows two different size interfaces to coexist concentrically in the same mounting location in some applications.