



Captive Fastener Device for Demanding Applications



NASA's Marshall Space Flight Center (MSFC) has developed a unique captive fastener device that withstands the rigors of space travel. The technology combines a National Aerospace Standard (NAS) 1351/1352 screw and a NASA-approved spring, with a specially designed housing attached to one of the components to be joined. Together, these components provide a captive feature that holds the fastener clear of the interface plane when the fastener is not engaged. NASA is seeking partner companies to commercialize this novel fastener for a variety of applications.

Benefits

- **Uses standard fastener and hole sizes** – The key aspect of the invention is that a standard fastener is used and no modifications of the mating part are required. Current captive designs typically require a smaller or modified screw, or require a larger hole to be drilled and tapped into the mating part to secure a retainer nut.
- **Space-qualified** – Qualified by NASA and flown on several Space Shuttle (STS) and International Space Station (ISS) missions.
- **Maintains strength** – Use of standard fasteners and hole sizes means there is no loss in joint strength, despite the captive capability.
- **Floating design** – The cup washer permits “floating” of the screw so that it aligns with the threaded hole without binding. This enables more generous tolerances and eases installation.

technology opportunity



For More Information

For more information about this technology or NASA's technology transfer program, please contact:

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The Technology

NASA developed the captive fastener to meet three primary capabilities for securing instruments within the Space Shuttle's existing equipment racks:

- Provide a means for removing instruments from the racks during flight, without completely detaching any aspect of the fastener.
- Use an unmodified NAS 1351/1352 screw and an off-the-shelf spring from an approved NASA supplier.
- Maintain the strength of the fastened connection without the captive feature.

The primary features of the technology are a cup washer and a housing. The cylindrical cup washer fits beneath the head of the screw, and has a circular flange around its top. This flange provides a bearing area for the helical spring, which fits below it. The screw, spring, and cup washer are contained within the cylindrical housing. The base of the housing is attached to the instrument frame. When the screw is disengaged, all components of the captive fastener are held within the housing, and the screw is completely clear of the interface plane with the mating rack (see Figure 1).

When an Allen wrench or screwdriver is inserted into the housing, the spring is compressed and the screw threads are extended. The screw is threaded into the equipment rack until the spring is completely compressed (see Figure 2).

Vibrational testing demonstrated the fastener's ability to resist loosening, and the fastener has flown aboard the Space Shuttle and the ISS.

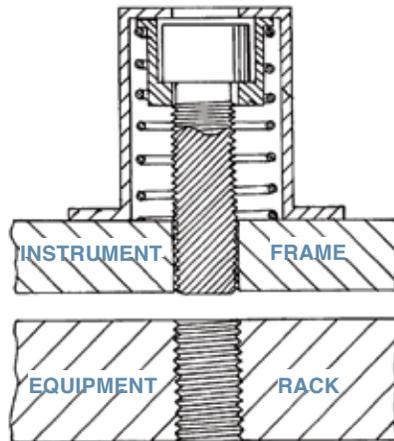


Figure 1: Captive screw in the disengaged position

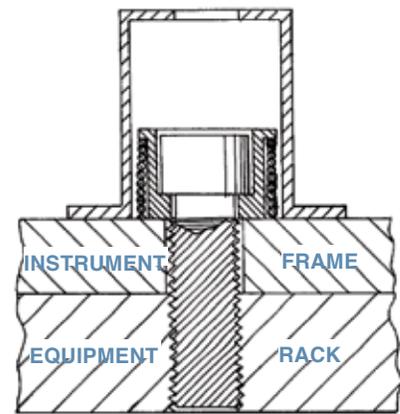


Figure 2: Captive screw in the engaged position, securing the bottom plate to the top plate.

Commercial Applications

The captive fastener accommodates a 1/4 -28 socket head cap screw, but is easily scaled to accommodate other threaded fastener designs, sizes, and materials. Potential applications:

- Aerospace avionic and equipment racks
- Automotive, truck, recreational vehicle, and marine equipment mounting
- Heavy machinery
- Computer mounting racks
- Automation equipment

Opportunity

This technology is part of NASA's technology transfer program that seeks to stimulate development and commercial use of NASA-developed technologies. NASA is flexible in its agreements, and opportunities exist for joint development, patent licensing, or other mutually beneficial relationships.