

# **KSC Core Technical Infrastructure Support Success Stories**

## Fail-Safe Jackscrew

### Operations Need

There are more than 4000 jackscrews in applications installed at KSC. Some applications represent single-point failures of critical hardware, the failures of which could cause damage to flight hardware, personnel, and ground support equipment. The recent failure of the gaseous oxygen (GOX) Vent Arm jackscrew could have been catastrophic if the failure had occurred during arm retraction prior to launch. A fail-safe design was needed to mitigate the possibility of such single-point failures and the potentially catastrophic events that could result.

### Solution Provided

A retrofit kit was developed for two different types and sizes of jackscrews used on the GOX Vent Hood (figure 1) and Tail Service Mast (TSM) Mast Positioner. Each kit was designed to use as much of the existing hardware as possible and to minimize the length added to the actuator (figure 2). The basic concept of the design is the addition of a follower nut to the system (figure 3). The original primary nut from the jackscrew is used to save cost and is only slightly modified to allow for the mounting of a rotator that couples the two nuts together (figure 4). The two nuts rotate together but only the primary nut carries the load. In the event of a failure of the primary nut the load is transferred automatically to the follower nut. In addition, a mechanical or electronic indicator provides a nonintrusive measurement of the wear of the primary nut.



Figure 1. Current Jackscrew Used on the GOX Vent Hood

### Implementation and Follow-On

Sixteen retrofit kits are being built to upgrade the jackscrews used on the GOX Vent Hood and TSM Mast Positioner.

### Time Frame

FY01 – Initial design and prototype.

FY02 – Extensive long-term testing, production of hardware, and installation.

### Benefits to Operations

This project will eliminate single-point failure of jackscrew assemblies when nut wear and subsequent thread shear occur. It will also provide the capability to determine thread wear without requiring intrusive inspections or tests. This design will improve the operational safety of flight vehicles, facilities and ground support equipment for the 4000 jackscrews in use throughout KSC.

### Intellectual Property and Technology Transfer Aspects

This design has tremendous technology transfer aspects for the aerospace/aeronautics industry (both military and

commercial). Alaskan Airline Flight 261 crashed and killed all 88 people onboard because of the failure of the jackscrew used on the horizontal stabilizer. A failsafe jackscrew system might have prevented that tragedy. It will certainly provide an easy, cost-efficient way to check for nut and thread wear thereby increasing the likelihood of preventive maintenance. In the event the primary nut does fail, it can provide a backup and enable the craft to be landed safely.

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Figure 2. Assembled Fail-Safe Jackscrew



Figure 3. Follower Nut, Rotator, and Primary Nut (from left to right)

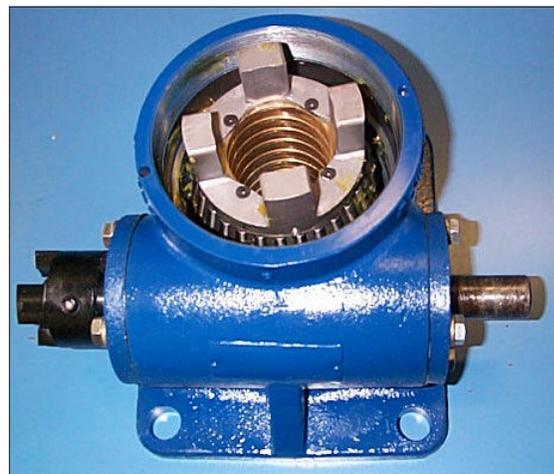


Figure 4. Rotator and Primary Nut Installed in Jackscrew Housing

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