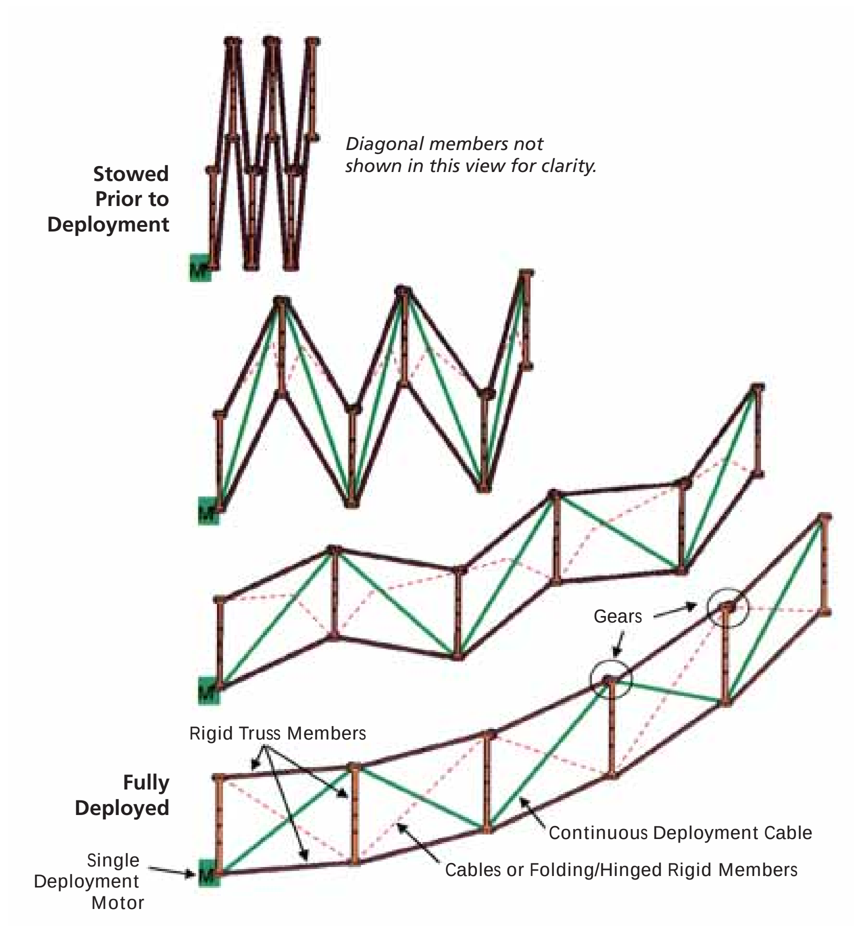

The **Deployment Sequence of the Truss**. The truss is stowed in a compact volume (top), and deployment begins when the motor is activated and begins drawing in the continuous deployment cable (bottom).

arranged vertically and horizontally. To further minimize the time required to deploy such an enclosure, a synchronous deployment with a single degree of freedom is also preferable.

One method of synchronizing deployment of a truss is the use of a series of gears; this makes the deployment sequence predictable and testable, allows the truss to have a minimal stowage volume, and the deployed structure exhibits the excellent stiffness-to-mass and strength-to-mass ratios characteristic of a truss. A concept for using gears with varying ratios to deploy a truss into a curved shape has been developed and appears to be compatible with both space technology applications as well as potential use in terrestrial applications such as enclosure deployment. As is the case with other deployable trusses, this truss is formed using rigid elements (e.g., composite tubes) along the edges, one set of diagonal elements composed of either cables or folding / hinged rigid members, and the other set of diagonal elements formed by a continuous cable that is tightened by a motor or hand crank in order to deploy the truss. Gears of varying ratios are used to constrain the deployment to a single degree of freedom, making the deployment synchronous, predictable, and repeatable. The relative sizes of the gears and the relative dimensions of the diagonal elements determine the deployed geometry (e.g. curvature) of the truss.

This work was done by Louis R. Giersch and Kevin Knarr of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1). NPO-47269

High-Volume Airborne Fluids Handling Technologies To Fight Wildfires

Airborne flame retardants are used in a highly efficient firefighting system.

Dryden Flight Research Center, Edwards, California

NASA recently partnered with the U.S. Forest Service (USFS) on a project to examine mission suitability and recommend policies and procedures for the use of very large aerial firefighting aircraft such as the Boeing 747 and DC-10 aerial retardant delivery aircraft. The aircraft under study included a 10Tanker DC-10 and an Evergreen B-747. NASA's Dryden Flight Research Center and Ames Research Center worked with the USFS to help determine the safe flight envelope for these Very Large Air Tanker (VLAT) aircraft for the USFS and the Department of the Interior (DOI). This new generation of "supertankers" includes aircraft like these that have as much as four times the delivery capacity of the previous generation of aerial firefighting aircraft.

Dryden performed operational test and evaluation assessments and reported findings and recommendations on these aircraft in cooperation with Ames. The team developed, implemented, and directed an evaluation test plan for use in flight test and in simulation. Ames provided support using pilot-in-the-loop simulations and coordinated simulator models, flight profiles, and data analysis with Dryden. The test plan was designed to evaluate the suitability of VLAT aircraft as a function of mission environment. Based on this analysis, NASA generated interim flight envelope limitations to enhance safety and operational utility in the fire-retardant delivery mission. These recommended flight limitations were adopted by the USFS.

The 10Tanker DC-10 has been in use for several years with the California Department of Forestry and Fire Protection(Cal-Fire), but until NASA took on the challenge of reviewing VLAT capabilities and limitations, the USFS was hesitant to add them to the federal wildfire arsenal. The DC-10 delivery system is based on an externally mounted set of tanks and a "bomb-bay style" set of clamshell doors that are opened in precisely calibrated ways to deliver the amounts and concentrations of retardant called for by the specific wildfire situation. The system was manufactured by Jordan Air of Central Point, OR, and was installed by Victorville Aerospace in Victorville, CA. It can deliver 12,000 gallons (45.4 kL) of retardant in as little as eight seconds. The aircraft can deliver a partial load of retardant and make multiple drops on the same flight, or the entire load can be rapidly delivered in one pass if required for maximum coverage.

The Evergreen 747 uses internal tankage and a pressurized delivery system to enable volume and coverage levels that also meet USFS requirements, but enables computer control of flow for desired precision. This system was designed and built by Adaptive Aerospace of Tehachapi, CA and can deliver about 20,000 gallons (75.7 kL) of retardant in approximately ten seconds. The 747 can also make multiple independent drops, or deliver the entire load at once.

NASA found that both of these VLAT aircraft are compatible with the wildfire suppression mission when used to supplement other aerial retardant delivery platforms. The major recommendations for deployment that resulted from this study relate to terrain clearance, the type of terrain in the drop area, availability of qualified lead planes to guide the VLAT approach to the drop area, and low-altitude maneuvering limitations. NASA's analysis suggests that with the appropriate flight procedures, these aircraft will provide a powerful set of tools to fight wildfires.

This work was done by Mark Dickerson and Timothy Cox of Dryden Flight Research Center, Cliff Hale of Evergreen International Aviation, Inc., and Rick Hatton of 10Tanker Air Carrier. Further information is contained in a TSP (see page 1). DRC-010-019