tem) freefalls and pulls the bottom of the balloon down. This causes the balloon to stretch out to its maximum length. Transient shock loads are generated in the balloon when its maximum length is reached. These shock loads are held to safe values by ripstitch elements in the flight train that break at a prescribed force and dissipate energy. After a short delay, a valve opens to start the helium flow into the bottom of the balloon through a flexible hose connector. Pyrotechnic cutting devices fire at the end of inflation to stop the helium flow and to separate the parachute and payload module from the balloon. By design, the balloon ends inflation below its nominal float altitude to avoid over-pressurization. It will then rise to its nominal float altitude, typically 2 km or more above the surface, before leveling off. This may require some venting of excess helium through a pressure relief valve.

At the time of this reporting, this technology is at the prototype testing stage. Further development is needed, particularly with end-to-end flight tests showing the balloon surviving deployment and floating afterward, as well as increasing the size of the balloon from its current 10-m diameter to an ultimate size of 20 m in order to support equatorial Mars missions.

This work was done by Tim Lachenmeier of Near Space Corp.; Debora Fairbrother and Chris Shreves of NASA-Wallops; and Jeffery L. Hall, Viktor V. Kerzhanovich, Michael T. Pauken, Gerald J. Walsh, and Christopher V. White of Caltech for NASA's Jet Propulsion Laboratory. For more information, contact iaoffice@jpl.nasa.gov. NPO-44688

Steel Primer Chamber Assemblies for Dual Initiated Pyrovalves

NASA's Jet Propulsion Laboratory, Pasadena, California

A solution was developed to mitigate the potential risk of ignition failures and burn-through in aluminum primer chamber assemblies on pyrovalves. This was accomplished by changing the assembly material from aluminum to steel, and reconfiguration of flame channels to provide more direct paths from initiators to boosters. With the geometric configuration of the channels changed, energy is more efficiently transferred from the initiators to the boosters. With the alloy change to steel, the initiator flame channels do not erode upon firing, eliminating the possibility of burn-through. Flight qualification tests have been successfully passed.

This work was done by Carl S. Guernsey and Masashi Mizukami of Caltech, Zac Zenz of Conax Florida Corp., and Adam A. Pender of Lockheed Martin Corp. for NASA's Jet Propulsion Laboratory. For more information, contact iaoffice@jpl.nasa.gov. NPO-46302

Voice Coil Percussive Mechanism Concept for Hammer Drill

NASA's Jet Propulsion Laboratory, Pasadena, California

A hammer drill design of a voice coil linear actuator, spring, linear bearings, and a hammer head was proposed. The voice coil actuator moves the hammer head to produce impact to the end of the drill bit. The spring is used to store energy on the retraction and to capture the rebound energy after each impact for use in the next impact. The maximum actuator stroke is 20 mm with the hammer mass being 200 grams. This unit can create impact energy of 0.4 J with 0.8 J being the maximum.

This mechanism is less complex than previous devices meant for the same task, so it has less mass and less volume. Its impact rate and energy are easily tunable without changing major hardware components. The drill can be driven by two half-bridges. Heat is removed from the voice coil via CO_2 conduction.

This work was done Avi Okon of Caltech for NASA's Jet Propulsion Laboratory. For more information, contact iaoffice@jpl.nasa.gov. NPO-45712

Inherently Ducted Propfans and Bi-Props

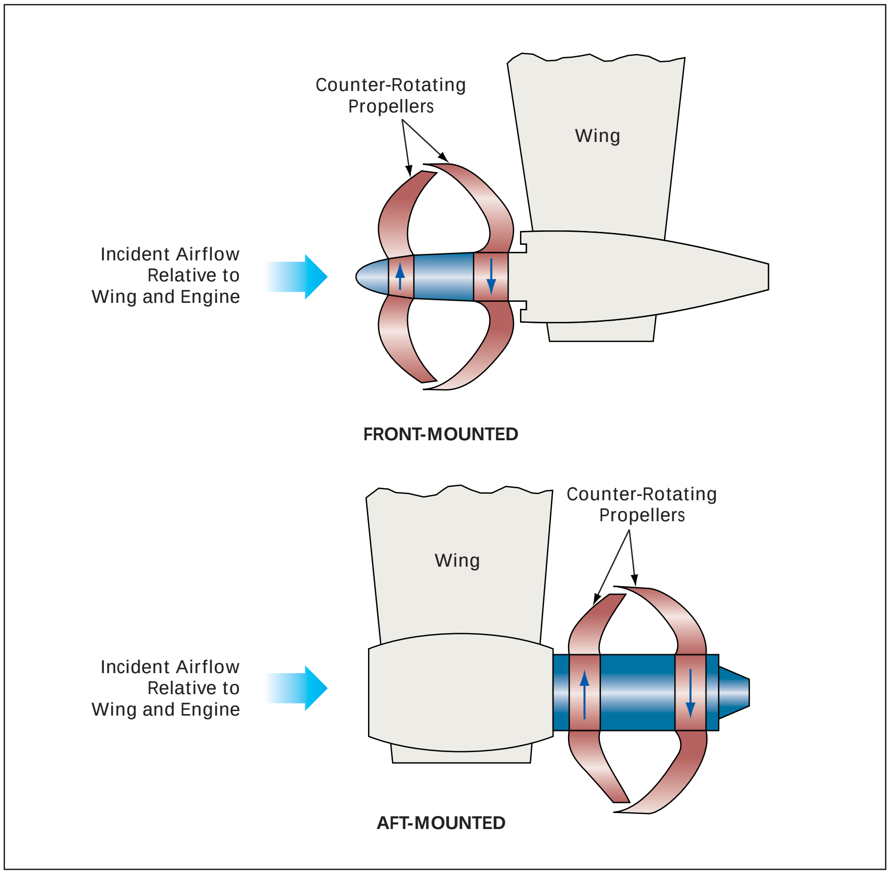
Noise would be reduced without the weight and other disadvantages of shrouds.

Langley Research Center, Hampton, Virginia

The terms "inherently ducted propfan" (IDP) and "inherently ducted biprop" (IDBP) denote members of a proposed class of propfan engines that would be quieter and would weigh less than do other propfan engines that generate equal amounts of thrust. The designs of these engines would be based on novel combinations of previously established aerodynamic-design concepts, including those of counter-rotating propfans, swept-back and swept-forward fixed wings, and ducted propfans.

Heretofore, noise-reducing propfan designs have provided for installation of shrouds around the blades. A single propeller surrounded by such a shroud is denoted an advanced ducted propeller (ADP); a pair of counter-rotating propellers surrounded by such a shroud is denoted a counter-rotating integrated shrouded propeller (CRISP). In addition to adding weight, the shrouds engender additional undesired rotor/stator interactions and cascade effects, and contribute to susceptibility to choking.

An IDP or IDBP would offer some shielding against outward propagation of noise, similar to shielding by a shroud, but without the weight and other undesired effects associated with shrouds. An IDP would include a pair of counter-rotating propellers. The



An **IDP Would Be a Counter-Rotating Propfan** with scimitar type blade design. The propellers could be located forward or aft, relative to the wing.

blades of the upstream propeller would be swept back, while those of the downstream propeller would be swept forward (see figure). The downstream blades would have a geometric twist such that their forward-swept tips could act as winglets extending over the tips of the upstream blades. In principle, the resulting periodic coverage of the upstream-blade tips by the downstream-blade tips would suppress outward propagation of noise, as though a short noise-shielding duct were present. Furthermore, it is anticipated that an IDP would be less susceptible to some of the operational limitations of a CRISP during asymmetric flow conditions or reverse thrust operation.

An IDBP would be based on the same principles as those of an IDP, except for one major difference: In an IDBP, to enhance structural integrity, pairs of the blades of the downstream propeller would be connected by the winglets. This arrangement is particularly suitable for high solidity installations and can reduce overall weight and drag as compared to a rotating shroud concept.

This work was done by M. A. Takallu of Langley Research Center. For further information, contact the Langley Innovative Partnerships Office at (757) 864-4015.
LAR-15031-1