nitrogen would keep ambient air out of the chamber.

To prepare for reconnection, the umbilical plate of the mating fitting would be brought into contact with the EIP-CP chamber and the supply of nitrogen would be turned off. Then a vacuum pump would be used to deflate the nitrogen from the outer chamber, so that the chamber could be pressed flat against its umbilical plate and the mating QD connectors pushed together.

This work was done by Ivan I. Townsend III of Dynacs, Inc., For further information contact the Technology Programs and Commercialization Office at (321) 867-8130 for **Kennedy Space Center**.
KSC-12460

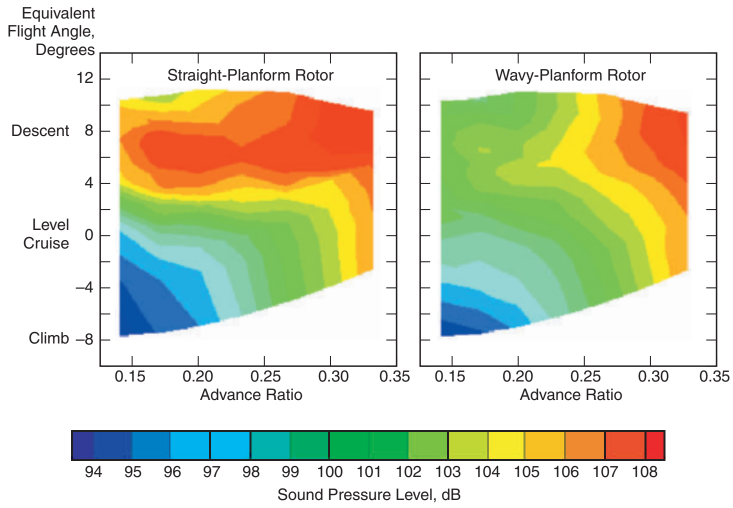
Wavy-Planform Helicopter Blades Make Less Noise

Improved designs reduce strengths of BVI-noise and thickness-noise sources.

Langley Research Center, Hampton, Virginia

Wavy-planform rotor blades for helicopters have been investigated for the first time in an effort to reduce noise. Two of the main sources of helicopter noise are blade/vortex interaction (BVI) and volume displacement. (The noise contributed by volume displacement is termed thickness noise.) The reduction in noise generated by a wavy-planform blade, relative to that generated by an otherwise equivalent straight-planform blade, affects both main sources: (1) the BVI noise is reduced through smoothing and defocusing of the aerodynamic loading on the blade and (2) the thickness noise is reduced by reducing gradients of thickness with respect to listeners on the ground.

Wavy-Planform Rotor on Model Helicopter in Wind Tunnel



Wavy-Planform Rotor Blades on a model helicopter in a reverberant wind tunnel were found to generate less noise than did rectangular-planform blades.

Noise tests were performed in a reverberant wind tunnel on a model helicopter (see photo). In the tests, sound-pressure levels were measured over a range of flight angles and advance ratios (the advance ratio is defined as the ratio between the horizontal speed of a helicopter and the speed of the tip of a rotor blade). Sound-pressure levels were also measured under the same conditions using a baseline rotor that had a rectangular-planform blade with linear twist.

The figure presents color contour plots of some of the data from the tests. These plots show that during descent (landing) flight conditions, which are most strongly dominated by BVI noise, sound-pressure levels of the wavy-planform blades were more than 4 dB below those of the rectangular planform blades. Some mild reduction in noise was also found for other flight conditions of climb and level cruise over all frequency ranges. Further testing and analysis of data will be needed to farther quantify reduction of noise, vibration, and performance benefits, leading eventually to refinements in the designs of wavy-planform blades.

This work was done by Thomas F. Brooks of **Langley Research Center**. *For further information, contact the Langley Commercial Technology Office at (757) 864-3936.*
LAR-16084