Lancets Flights Probe Supersonic Shockwaves

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(PhysOrg.com) -- NASA is concluding a series of flight tests to measure shock waves generated by an F-15 jet in an effort to validate computer models that could be used in designing quieter supersonic aircraft.

The Lift and Nozzle Change Effects on Tail Shock, or Lancets, project embodies research aimed at enabling the development of commercial aircraft that can fly faster than the speed of sound without generating annoying sonic booms over land. Supersonic flight over land generally is prohibited because of annoyances caused by their noise.

A sonic boom is created by shock waves that form on the front and rear of an aircraft. The boom loudness is related to the strength of the shock waves. The formation of the shock waves is dependent on the aircraft geometry and the way in which the wing generates lift.
During the flight tests at NASA's Dryden Flight Research Center in Edwards, Calif., one of two F-15s generally followed 100 feet to 500 feet below and behind the other, measuring the strength of the leading aircraft's shock waves at various distances using special instruments. Global Positioning System relative positioning was used to guide the pilot of the probing aircraft to a test position and for accurate reporting of measurement locations.

Lancets is the latest in a series of NASA projects investigating the effects of aircraft geometry and lift on the strength of shock waves.

NASA previously teamed with private companies to study the effect of

aircraft shape on the strength of shock waves and whether adding a nose spike to an aircraft affects the strength of its shock waves in order to validate design tools for aircraft fore-bodies.
A NASA F-15B was used as the test aircraft for the flights. It was ideally suited for Lancets because its canards and engine nozzles can be adjusted in flight.

Canards are small airfoils in front of the wing that are designed to increase the aircraft's performance. Adjusting the canards changes the lift of the main wing, which varies how much wing lift contributes to the strength of the shock waves. This cannot be done on a conventional aircraft without making expensive modifications to the wing. Adjusting the engine nozzles alters the exhaust plumes from the engines, which varies how much the rear of the aircraft contributes to the strength of the shock waves.

A second NASA F-15B was the probing aircraft. It was fitted with a special nose spike for taking shock strength measurements.
The flight results will be used by computational fluid dynamics researchers at NASA's Langley Research Center in Hampton, Va.; NASA's Ames Research Center at Moffett Field, Calif.; and at Dryden to develop and validate improved tools that incorporate aft-shockwave effects in the prediction of sonic booms. The flight data also will be made available to interested university and industry partners in order to further their research objectives.

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