**B-2 pitch oscillation mystifies US pilots**

**GUY NORRIS/BEVERLY HILLS**

US AIR FORCE test crews flying the Northrop Grumman B-2A bomber have been unable to pin down the cause of a mysterious residual pitch oscillation which affects the aircraft at low altitude and high speed.

The 1.5Hz pitch oscillation which has been observed with magnitudes of up to ±0.5g, causing the wing tips to “flap” by up to 1.83m (6ft), says the USAF's 412th Test Wing tips to “dither” by up to ±0.5g, causing the longitude and high speed.

Investigations focused on observed close relationship between acceleration and the onset of the phenomenons. "We got decreasing damping with increasing Mach numbers," says the team, which also looked into the theory that the oscillation was related to “dithering” of the flight controls.

The team also tested a NASA theory that the phenomenon was caused by close coupling between the aircraft's short body and large wingspan in a condition called “body-freedom flutter”. This was believed to be a complicated feedback loop which involved the flight-control system, but after tests this was also eliminated.

Investigators believe that the oscillation could be related to interaction between the aircraft's short body and a strong shockwave which forms just aft of the engine intake area at about one-sixth-chord and extends over the exhaust area. The shockwave was revealed by condensation effects captured on video taken of the aircraft on low-level, over-water, runs.

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**Boeing steps up Central European F-18 effort**

**ANDREJ JEZIORSKI/MUNICH**

BOEING HAS ADDED momentum to its F-18 marketing campaign in Central Europe, signing industrial agreements in the Czech Republic and Poland covering future co-operation.

The US company has struck an agreement with the Polish Aviation Institute (IL), outlining co-operation in 20 advanced-technology fields related to the US company's F-18 Hornet programme.

It has also signed a memorandum of understanding with Skoda in the Czech Republic to investigate and pursue "viable business opportunities in the Czech Republic and international markets", which will open the door for Skoda subsidiaries to become F-18 subcontractors.

The Polish agreement covers the testing and development of structures, as well as direct technology transfer from Boeing and its F-18 partners: principal subcontractor Northrop Grumman, engine manufacturer General Electric and radar supplier Hughes.

Boeing says that the deal will include materials testing, composites technology, wind-tunnel testing and numerical-analysis work. The partners will also work towards identifying new possibilities for joint projects, direct orders and technical co-operation with IL.

Boeing is pushing its F-18 as a candidate to meet fighter requirements in the Czech Republic, Hungary and Poland. It is competing with Lockheed Martin, which is offering its F-16, Saab, offering its Jas39 Gripen, and Dassault, with its Mirage 2000-5.

Earlier this year, Lockheed Martin signed an agreement with Polish manufacturer PZL-Mielec, offering the company an F-16 assembly line. The Polish group has a similar assembly-line agreement for the F-18. Saab is also offering Polish manufacture of the Gripen, while Dassault has made lower-key statements about the possibility of allowing Central European customers to manufacture Mirage subassemblies.

In the Czech Republic, Boeing has a further edge in having been selected, together with its partner Czech Airlines (CSA) – a Boeing customer – to become an investment partner in Czech aircraft manufacturer Aero Vodochody.

Boeing says that it is hoping for confirmation in the fourth quarter that it and CSA are to take over 34-40% of Aero. The US company confirms that it has presented an offer of joint F-18 production with Aero, but declines to comment on suggestions that Aero will be given work hitherto carried out by Northrop Grumman starting in 1998, before any fighter-purchase decision by the Czechs.

According to Boeing, Northrop Grumman remains a "strong member of the Hornet industrial team", manufacturing centre and rear fuselage elements.

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**USAF considers DC-X and X-33 for military-spaceplane testing**

BOEING AND LOCKHEED Martin have received US Air Force contracts to begin developing technologies and concepts for a military spaceplane.

The Integrated Technology Testbed programme is aimed at demonstrating military-spaceplane operational concepts early next century.

Boeing's demonstrator concept uses a re-usable rapid-response launch vehicle, derived from the McDonnell Douglas DC-X, which would carry a piggyback re-usable orbiter based on Boeing's Reffy Space Maneuver Vehicle.

The DC-X would take off vertically, release the Reffy, then land vertically. The Reffy would continue into orbit, then re-enter to land conventionally on a runway.

Lockheed Martin's Skunk Works' concept would mount the Reffy vehicle on the back of a spaceplane derived from the X-33 technology demonstrator which it is developing for NASA. The X-33 is a half-scale prototype of the proposed VentureStar re-usable vehicle.