

# Tech focus

This month's section focuses on business jets.

by Patrick Ponticel

## Cessna's Mustang on course for late 2006 deliveries

The Cessna Citation Mustang is on course for customer deliveries later this year with the recent Type Inspection Authorization (TIA) from the FAA (Federal Aviation Administration). The company currently has more than 230 orders for the six-seat business jet.

Although the Mustang has undergone many hours of flight testing to date, only those conducted upon receipt of TIA count toward official certification.

The Mustang prototype and production unit no. 1 had made more than 290 flights totaling more than 490 h as of December 22. In addition, more than two lifetimes (30,000 h) of testing had been conducted on a fatigue test article with no damage to the structure, according to Mustang Program Manager Russ Meyer III. "This [level of fatigue testing] is recognized by the FAA as the baseline to prove the durability of an airplane, and we will continue testing to five lifetimes (75,000 h)," he said.

Cessna claims to conduct more hours of testing of its aircraft prior to certification than its competitors.

With the Mustang, Cessna is trying to grow its customer base to "basically, people that may not be able to afford to get into a CJ1 or CJ2," Meyer said. At \$2.4 million, the Mustang costs about



The Mustang's avionics system is the Garmin G1000.

\$2 million less than a CJ1, according to Meyer, who added that the cabin-class airplane "provides all the speed, range, and altitude capabilities of a jet but at a lower price point. It has a comfortable cabin and advanced avionics that those types of customers are expecting."

Meyer was Program Manager for CJ3 for about a year until he began heading up the Mustang program in fall 2002. Prior to the CJ3 program, he was Product Marketing Manager for the Cessna's 500 series airplane. The Mustang program was announced by Cessna at the National Business Aviation Association Convention in

September 2002.

The Mustang is only Cessna's third brand-new aircraft design in terms of the fuselage, wings, and other major systems, according to Meyer. That contrasts with most of the company's certifications of new airplanes, which are derivatives of existing models. "We're starting from scratch," he said of the Mustang. Also new is how the airplane is built and how the company deals with its suppliers, many of whom are new, according to Meyer.

Although the prototype and several of the first units were built, or partially built, at the company's facilities in Wichita, KS, volume production of the final product and the major subassemblies (excluding empennage, which is assembled at Cessna's Columbus, GA, facility) is taking place at the company's plant in Independence, KS. Unit no. 0004 was the first to be built completely in Independence. Production of that unit began on October 5, 2005. Expansion of the plant to accommodate Mustang production—as well as transfer of production equipment from Wichita to Independence—was to have been completed by the end of 2005. Independence is about 120 mi southeast of Wichita.

The first flight of the prototype took place on April 23, 2005, and first flight of unit 0001 on August 29.



The Cessna Citation Mustang, certification of which is envisioned for later this year, uses Pratt & Whitney Canada PW615F engines for an anticipated cruise speed of 340 knot and maximum operating altitude of 41,000 ft.



*Cessna engineers came up with a new design for the window shades on the Mustang.*



*Expansion of Cessna's plant in Independence, KS, where the Mustang is built, was to have been completed by the end of 2005.*

The Mustang program schedule was extended by a couple of months near the outset, but has stayed close to the timeline since, according to Meyer. His core program team consisted of 15-16 people "from all different departments." The engineering team was much larger, with many of the engineers working on the Mustang and other projects simultaneously; so Meyer could not attach a number to how many engineers were involved in the program.

Although it caused no delays, the use of **Dassault Systèmes'** Catia version 5 software (the first such use on a Citation) was a challenge, according to Meyer. "We had our learning curve problems," he said.

The more difficult engineering challenge was providing the required functionality and reliability while keeping costs low. To that end, Meyer put together design-for-reliability and design-

for-warranty teams. The ability to deliver reliable parts and systems was a key factor in the supplier-selection process, he said.

"Our goals are pretty aggressive in keeping costs down and having the airplane at a very high level of reliability right from the first deliveries," Meyer said. The program team focused on systems that have proved problematic on other Cessna models.

In addition to keeping Mustang purchase and operating costs down, Meyer also was intent on "keeping things simple" for the pilot and those servicing it. "But we have learned in some areas that we had gone maybe a little bit too simplistic and we couldn't quite achieve a certification goal, or a reliability goal, or the system just wasn't working properly," he said. "We really kind of pushed the envelope to keep the weight down, to keep the cost down, and to keep the

airplane simple. And as we've been flying two airplanes in the development process, there have been some [problems] that have come up."

For instance, Meyer said, the landing gear system as originally designed proved inadequate in terms of the non-engine-driven hydraulic system; the gear was coming up too slowly. The resolution was "beefing it up," Meyer said, adding cost and weight to deliver the required performance.

Another engineering change involved the windows. As originally planned, the Mustang had no window shades. Meyer said it was unacceptable to offer such an aircraft without them. After more engineering work than one might imagine, Meyer said, the result was a new accordion-style manual shade. Though simple, the shade design works so well that it has been copied for use in the CJ1+, he noted.

## **Boeing adds to its business jet brood**

Based on its next-generation 737-900ER, **Boeing** Business Jets will sell a business jet more spacious than the company's BBJ and BBJ 2 offerings.

Boeing announced the new business jet, the BBJ 3, in the Middle Eastern country of Dubai, United Arab Emirates, during the recent Dubai Air Show.

The jet will offer 1120 ft<sup>2</sup> of cabin space, 35% more than the BBJ and 11% more than the BBJ 2. It will have a maximum range of 4765 nmi using up to five auxiliary fuel tanks. The jet is just



*With up to five auxiliary fuel tanks, the BBJ 3 will have a range of 4765 nmi.*

over 138 ft long.

Whereas the BBJ 3 is based on the 737-900ER, the BBJ and BBJ 2 are based on the Next-Generation 737-700 and 737-800, respectively.

Boeing Business Jets President Steven Hill said during a media briefing at the Dubai Air Show that, "It is fitting that we announce our intention

to offer this airplane at the Dubai Air Show, because we believe the airplane will have wide appeal in this region." More than 25% of the BBJ worldwide fleet is based in the Middle East; the majority of BBJ 2s have been ordered from this region and make up almost half of the area's BBJ fleet.

To date, 102 BBJs have been sold

since program launch in 1996. There are currently 83 BBJs in service around the world. The fleet has generated more than 168,000 flight hours to date and 66,250 flights, with an industry-leading 99.9% dispatch reliability, according to the company.

## Improvements inside and out for Pilatus PC-12

Better performance, improved handling, increased comfort, and greater reliability are planned for the flagship PC-12 from Pilatus in 2006.

The new PC-12 offers greater range-payload through a gross weight increase. The change adds 530 lb to the aircraft's useful load, bringing it from 3600 to 4130 lb for a typically equipped PC-12 in an executive configuration. Maximum takeoff weight increases from 9920 to 10,450 lb.

Better handling comes from improved control harmony and new winglets. The new winglets, derived from technology developed for the high-performance Pilatus PC-21 military trainer, reduce drag and improve crosswind control, according to the company. In addition, Flettner tabs have been added to the PC-12's ailerons. Roll control forces have been reduced by 60% at low speeds and 72% at high speeds. These improvements offer pilots a sportier, more responsive feel in all phases of flight.

New crew seats provide pilots with increased comfort, Pilatus says. The seats have contoured cushions and offer a wide range of adjustments for lumbar supports, seat back, arm rests, thigh supports, and headrests.

PC-12 reliability is improved thanks to new LED lighting systems. The LED cabin lights last 20,000 h and are color-balanced to create a warm, inviting glow. LEDs are also now used as part of the PC-12's navigation lighting system, providing lower operating temperatures, longer operating life, and better visibility.

Pilatus says the PC-12, which seats up to nine passengers, has been the top-selling turbine-powered business aircraft



Enhancements for the Pilatus PC-12 include LED lighting (interior and exterior), new crew seats, and new winglets.

for the past three years. The Switzerland-based company expects to generate greater demand for the aircraft because of the upgrades, and so is planning to

increase production in 2006. It delivered 80 PC-12 business turboprops in 2005. About 75% of production goes to the U.S.