**BUSINESS AVIATION**

**Starship I set for first flight**

**WICHITA**

Beechcraft is working around the clock to make ready the Starship prototype, NC-1, for its maiden flight. While the company refuses to be committed to a specific date, best estimates point to February 15 for the historic moment, reports Robin Blech from Wichita and Mojave.

Chief test pilot “Bud” Francis has already built up considerable experience in the 85 per cent scale proof-of-concept (POC) aircraft. That aircraft, designed by Burt Rutan to demonstrate the advantages and pitfalls of the radically new variable canard configuration, has now completed 500h of test flying at Mojave-based Scaled Composites.

Both Rutan and Francis agree that the POC programme has been an overwhelming success, allowing the pilot to evaluate fully the handling characteristics, together with engine and systems performance, while allowing detailed aerodynamic changes.

Beech has built three flying prototypes in addition to three static test units. NC-1 is now ready for flight, having spent the past two weeks undergoing system checks, engine runs and taxi tests. It will be the only Starship to fly with a conventional electro-mechanical instrument panel and will never have a finished interior.

The first prototype was used for handling, performance, and powerplant evaluation, including dive, flutter, and stall tests. These will be completed in flight hours, and will be the only time that Francis will fly NC-1 solo.

 Provision has been made in NC-1 for a rocket-powered Stencil “zero/zero” ejection seat, to be installed as a fail-safe critical area of handling. To allow the pilot to exit safely, the seat will be mounted on the right side of the cockpit, where the cockpit structure permits easier modification. The upper cockpit composite structure has been cut away and replaced by painted acrylic, through which the pilot will eject in emergency.

The second prototype, NC-2 will be used for systems, autopilot, and icing certification. It is presently being fitted with the first Collins Compact 4 integrated Efis panel, especially developed for Starship, and a partial interior.

NC-3 will be fitted with the first production fuel system, and a full interior. It will fly function and reliability tests, be used to gain single-pilot approval, and undergo cabin noise evaluation. It will also be the first aircraft to feature a single-piece windshield.

The three-year POC development programme has given Beech a great deal of confidence in the Starship’s likely handling and performance, supporting earlier wind tunnel data which showed that the original forward wing required a number of changes to twist, incidence, and dihedral. While stalls in landing configuration were satisfactory, those performed in clean configuration (with forward-wing swept back) required more work, says Rutan.

A series of leading-edge fences, or vortilons, which were later fitted to the POC’s main wing, have been omitted from NC-1. Designed to reduce spanwise flow at high angles of attack, they have no adverse effect on performance. Beech wants to prove that they are unnecessary for certification. Both Rutan and Francis believe that they may have to be replaced to improve deep stall characteristics.

The POC's programme has also allowed reshaping of the inboard trailing edge, a fence to be added between aileron and flap, an extended ventral rudder (operated solely by the autopilot) for improved yaw damping, drag reduction, and improved load distribution. Rutan even sawed off the tip-sails and re-angled them, only to find that his original design was right. They are now back to their original specification.

NC-1 is powered by temporary Pratt & Whitney PT6A-65-4 engines with four-blade metal Hartzell propellers. The new 1,000 s.h.p. flat-rated -67 engines will arrive in two weeks. Kevlar propellers will be added later. While no wing de-icing is fitted to NC-1, all subsequent aircraft will have the British TKS “weeping fluid” system on the main and leading edge.

Propeller heat is supplied by engine exhaust. The forward-wing sweep is tied electronically to the flap system. Two positions are available: flap up with forward-wing swept back at +30° and full 14° flap with foreplane swept forward slightly at -4°. There is no intermediate position, and a fail-safe system is fitted which stops the entire operation in the event of component failure.

Flying the POC has demonstrated that the aircraft can be brought home safely with any combination of flap/forward wing failure, even on one engine.

While a 14° full flap setting seems inadequate to pilots of conventional aircraft, Francis points out that Starship has plenty of aerodynamic drag in the landing configuration and improved propeller reversing effect. In addition, the 200kt gear-limiting speed allows rapid deceleration in the circuit.

Owing to its conventional instrumentation, NC-1 will be the only aircraft to have AC electrical power and inverters. Subsequent “glass cockpit” aircraft will have DC only.

Francis will fly the first flight and much of the test programme. After three years of detailed attention to the programme, he expects few surprises, and plans the first flight to last 1hr 30min. The mission profile calls for a conventional approach after take off at 110-120kt, with flap/forward wing retraction with subsequent acceleration to 180kt. Slow flight, configuration changes, and basic avionics testing, will be completed and Francis will establish a safe threshold speed (Vref) for his first approach.

While simulated asymmetric power will be explored, he feels that actually shutting down an engine would be rash; re-lighting could be a problem. He plans to make a missed approach before coming in for a final landing.

Beech hails Starship as a major milestone in aircraft design, both in aerodynamics and structures. Francis sees a radical improvement in safety and seems relaxed about the flight-test programme. Burt Rutan is more succinct. Is there a place for metal aircraft in the future? “Sure there is—in a museum,” he tells Flight.