Test pilot view of Lancair

AIRCRAFT & AEROSPACE published a feature on the Australian aircraft manufacturing industry last month which included a section on the virtual grounding of the Avetex Lancair and angry comments by the company's managing director, Mr Mike Davies. This is the response from the CAA's test pilots.

Dear Sir,

I read with interest your article in the June issue concerning the local aircraft manufacturing industry.

It is pleasing to see positive publicity for an industry that has such excellent potential in the international market place. It is to be hoped the Federal Government recognises this potential and provides the necessary support.

But there are a few issues raised by Avtex's Mr Mike Davies that require a response. The CAA has no wish to crush Avtex. All problems concern the Lancair aircraft, which fails to comply with some very fundamental stability requirements.

The requirement for longitudinal static stability is not uniquely Australian.

Aircraft designers, manufacturers, operators and certificating authorities have known of the importance of adequate stability for over 70 years. All written airworthiness standards throughout the world demand positive stability.

In most countries amateur built aircraft attract no formal airworthiness requirements and can be assembled and flown without any assessment of the type by the national aviation authority.

This is the case in the US. Despite this, both the FAA and the Experimental Aircraft Association make the strongest possible recommendations regarding the importance of adequate stability, but without any compulsion to comply.

Australia has applied a rudimentary airworthiness standard to amateur built aircraft for many years. In 1987 Parliament, by way of the House of Representatives Standing Committee on Transport Safety Report, titled "Sports Aviation Safety", endorsed this policy.

It is not uncommon for aircraft under development to exhibit negative stability at aft centre of gravity in some configurations. This is a problem that is readily understood and amenable to rectification.

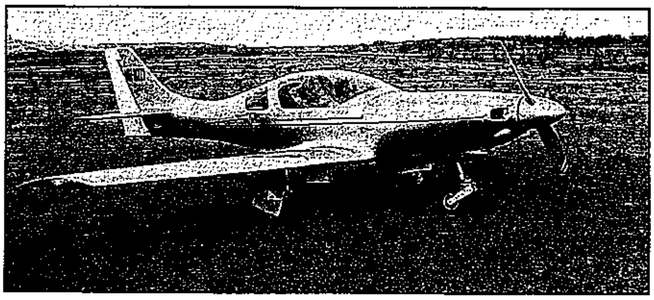
It is the sincere hope of all concerned in the CAA that Australian Lancair builders are able to rectify the problem with a minimum of cost and inconvenience.

Mr Davies laments the fact that the CAA has no charter to "foster and assist aviation" as is the case with the FAA.

Unlike the FAA, the CAA is a Government Business Enterprise, determined by an Act of Parliament, which must earn its entire income by provision of goods and services, and perhaps even a tax.

It is incorrect and unfair to claim the CAA "fought tooth and nail" to avoid a responsibility; as I recall, most fighting was in favor of retaining the opportunity to support and assist the manufacturing industry.

Keith Engelsman
CAA Test Pilot
June 5, 1992



Flight test report — Lancair 320 VH-LPD

Introduction

Flight testing of Lancair 320 VH-LPD was conducted to evaluate the longitudinal static stability, longitudinal dynamic stability, lateral static stability and the aircraft stall characteristics. Four flights were conducted in March/April 1992, however the first three flights were cut short due to aircraft unservicabilities and produced little usable data.

Weather, time and place

All four sorties were flown from Parafield airport in CAVOK conditions. Sorties one to three consisted of only one circuit each. Sortie four, the main data gathering flight, was flown on April 11, 1992 and was of 1:10 hours duration. Weather for the flight was fine with 5 kt surface wind, an OAT of approximately 20 degrees C, and nil to slight turbulence at the test altitude.

Weight and CG

Sortie four was flown with full internal fuel and two crew, placing the aircraft at approximately 1.0 to 1.5 inches forward of the aft limit. The header tank was kept full throughout the flight.

Aircraft flown

Lancair 320 VH-LPD was a brand new aircraft that had not flown before the first test sortie. The aircraft was fitted with an IO-320 engine and a two-bladed constant speed propeller. The aircraft was in an excellent external condition. An electrically operated and actuated laterial trim system was fitted to the aircraft. Between flights two and three, the engine cowls were modified by fitting symmetrical air scoops on either side of the lower aft engine cowl to enhance engine oil cooling. These modifications were not expected to have any significant effect on the aircraft's handling characteristics.

Flight test crew

The pilots were all graduates of recognised military test pilot schools. Crew composition was as follows:

Sortie 1:
Neil Lindorff, Grad Dip Mil Av, BSc, tp, graduate Empire Test Pilots' School, 1986.
Glen Keys, MSc, BEng (Mech), fte, graduate International Test Pilots' School, 1991.

Sortie 2:
Neil Lindorff, tp.
Steven Last, Grad Dip Mil Av, BSc, tp, graduate United States Navy Test Pilots' School, 1989.

Sortie 3/4:
Tony Morris, tp, graduate Empire Test Pilots' School, 1991. Winner of McKenna trophy for most outstanding test pilot graduate.
Peter Denholm, owner/builder.

Test made

Sorties 1 and 2 were cut short due to uncontrollable engine oil temperature. Both sorties were limited to one circuit, with qualitative assessments made of the take-off and landing phases of flight. Sortie three was terminated after one circuit due to a problem with the undercarriage warning system. Sortie one concluded with an engine failure on the runway, shortly after throttle closure in the flare. The fault was traced to a stuck needle valve, causing overfueling of the engine. A qualitative assessment of the static lateral/directional stability was conducted during the downwind leg of the second sortie.

The majority of the testing was conducted during sortie four, with emphasis being placed on those areas of known or suspected deficiencies. These included:

Control circuit mechanical characteristics (climb)

Longitudinal static stability (climb, cruise, take-off, land)

Longitudinal dynamic stability (cruise, land)

Lateral/directional static stability (cruise, approach, land),

Dutch roll and

Stall characteristics (cruise, approach, land).

Tests on the aircraft manoeuvre stability were not conducted due to a lack of an accurate normal acceleration indicator.

Results of tests and discussion

Mechanical characteristics: The control system mechanical characteristics were assessed on the ground and checked airborne in the climb configuration at 100 kias.

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"Hazair AF" Trojan

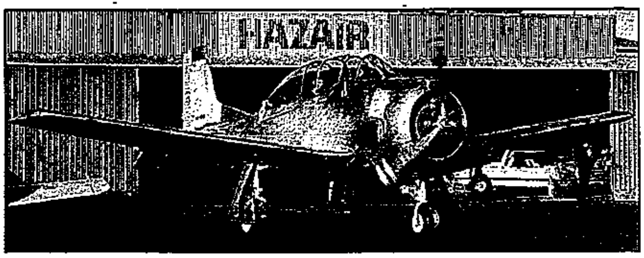
ANOTHER T28 Trojan flew in May after two years' restoration work by father-son team, Keith and Steve Death, of Albury's Hazair.

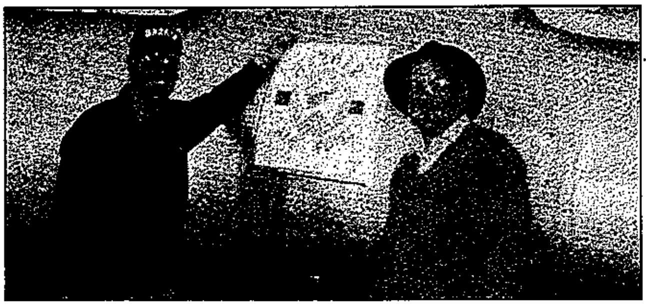
The aircraft, VH-MEO (registered after the hill people of Laos), was one of six ex-Royal Laotian Air Force T28s imported in 1989. It was escorted on its maiden local flight by John Rayner's T28, VH-LOA, which was completed a month earlier.

The Death's T28, looking like the Battle Star Galactica in natural metal finish for the first flight, will also be finished in a Laotian scheme. Its other restorers were Andrew "Stalk" Ronald and Jimmy Williams.

The Deaths slipped a "Hazair Air Force" sign into a multi-national insignia holder on the rear fuselage on -MEO after the flight. (The CIA operated the aircraft in its secret war in the region, slipping the insignia of whichever country the aircraft happened to be flying out of at the time, into the holder.)

A dedicated group, the Ravens, flew T28s and O1 Bird Dogs during the Vietnam War.





Above right: *Steve Death (front seat) and Andrew "Stalk" Ronald taxi for the first flight in the restored ex-Royal Loatian Air Force T28 Trojan on May 30 at Albury.*

Right: *Steve and Keith Death with "Hazair Air Force" insignia on their resored T28.*

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Lancair saga

A zero to 50 lbf hand-held force gauge was used for the tests. The breakout and friction on the longitudinal control system was less than one lbf, and on the aileron control system was less than one half lbf. Breakout and friction on the rudder circuit was not measured. Freeplay was negligible for all axes. Stick raps produced deadbeat oscillations in the elevator and aileron circuits and one overshoot on the rudder. Control centring was positive for all axes.

Longitudinal static stability: The longitudinal static stability was assessed at 80 kias in the climb, at 100 and 120 kias in the cruise, at 80 kias in the approach (5 flap and landing gear extended) configuration, and at 75Tkias in the land (full flap and landing gear extended) configuration. The largest stick force gradient in the cruise configuration was approximately 0.5 lbf/10 kias at 120 kias trim speed. This gradient reduced to neutral-/marginally positive at 100 kias and at 80 kias in the climb. The stick force gradient in the approach configuration at 80 kias was neutral, and in the Land configuration at an approximate trim speed of 75 kias, negative — both stick fixed and stick free.

At airspeeds away from the trim speed of 75 kias, releasing the stick produced an aperiodic divergence.

The longitudinal static stability characteristics were demonstrated to be poor under the best conditions and would not provide an adequate indication to the pilot of even a substantial deviation from the trim airspeed. The longitudinal instability in configuration 'land' would cause difficulties in accurate airspeed and glidepath control on finals, and coupled with the low breakout and friction, may lead to large and rapid deviations from glidepath under turbulent or high workload conditions.

The longitudinal static stability characteristics were unacceptable.

Attitude at time of stall in the cruise configuration was approximately 5 degrees nose up. There was no noticeable nose drop at the stall; however the aircraft rate of descent rapidly increased.

The aircraft was held in the stall in the cruise configuration only. The aircraft rapidly flicked inverted from the -20 degrees to the -200 degree position in less than one second. The aircraft was rolled wings level, and a 2g recovery initiated. A total of 1000 ft was lost in the recovery.

At no time during the approach or recovery did the aircraft display any tendency to depart controlled flight.

Recovery from the stall in the approach and landing configurations was initiated at first sign of wing drop. With recovery action initiated at first sign of wing drop in any of the configurations tested, height loss during recovery was minimal.

The pre-stall warning was unacceptable and must be improved. Further investigation of the stall characteristics are required at the aft CG limit, and after improvement of the longitudinal handling characteristics of the aircraft.

Other observations

Longitudinal trim system: A qualitative assessment of the longitudinal trim system was made throughout the test flight.

The trim system is a frictional spring bias system and coupled with the poor longitudinal stability characteristics of the aircraft, made accurate and quick adjustments to (its) trim a laborious task. Some trim points required up to three minutes of adjustment before the test could be conducted.

Assessment of handling during take-off and landing: A qualitative assessment of the aircraft handling qualities during take-off and landing was made during each flight.

The aircraft was found to be prone to pilot induced oscillation (PIO), especially on take-off. (It) suffers large pitch trim changes with flap selection and this characteristic further exacerbates the PIO tendency on take-off.

Forward field of view is poor during the landing phase, further complicating the landing task. In a crosswind, or with an inexperienced pilot, the PIO may lead to contact with the runway after lift-off or a heavy landing.

Conclusions

Lancair 320 VH-LPD displayed unacceptable handling characteristics in several areas. (It) displayed unacceptable longitudinal stability characteristics in all configurations, poor lateral static stability, unacceptable pitch trim changes with sideslip and unacceptable stall warning.

The aircraft was tested forward of the aft CG limit and it is expected that the longitudinal handling characteristics will only deteriorate as the CG is moved further aft.

The combination of poor handling characteristics results in an aircraft that is difficult to fly accurately and inattention in a high workload environment could result in large and dangerous deviations from the desired flight path.

Rectification of these characteristics must be conducted before the aircraft is released for general use.

Recommendations

The aircraft requires an increase in tail volume and an increase in dihedral effect. If the stall warning remains unchanged after modification to improve the longitudinal handling characteristics, an artificial stall warning device should be installed. Further investigation of the longitudinal dynamic stability, dutch roll and longitudinal manoeuvre stability is required.

Neil Lindorff
Project Test Pilot