THRUSTER GEMINI STABILITY ISSUE

AIRWORTHINESS ADVISORY

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Pitch Unstable Thruster Gemini Aircraft.

Page 17 of the March 1998 issue of *Australian Ultralights* carried the notice: "*Warning –All Thruster Gemini TST/300 Owners*" issued on 20 January 1998. This warned of a possible pitch instability problem associated with an accident and it requested feedback from the membership if any other occurrences were suspected.

This was followed in the April 1998 issue with an article on page 19 noting that feedback was very slow but that there were some indicators and conditions that should be brought to attention. It noted the importance of correct CofG for each specific variant and the correct positioning of the muffler. It stated that if owners did not possess this information, they should obtain it from the Thruster Factory.

Since that time there have only been two respondees to the AUF Office on the problem: one a member and a LAME who has advised that the problem has been corrected on one notoriously pitch unstable aircraft; the other a member, Thruster Devotee and convenor of the Thruster Operator Support Group (TOSG). The history and research surrounding the problem is far too great to publish in this magazine, but it is superbly documented by Mr Hayes of the TOSG from whom a copy of the document can be obtained (he should really charge you for it because of the research involved, its size and printing cost!). However, with his blessing, the causes and cures are copied below in the interest of safety.

In reading the following, members are advised to reflect on what certification is because the problem seems largely the result of owners not abiding by certification discipline: ie strict adherence to the approved design (ie no illegal or minor modifications which separately or in combination can have deleterious effects) and adherence to specified maintenance.

The Symptoms of the Problem:

- Nodding, where the aircraft oscillates gently of its own accord in pitch.
- Heavy Back Pressure is required as if the nose is too heavy.
- Departure into Steep dives where elevator "heaviness" is present: and
- Loss of Elevator Authority after reduction in engine power.

Contributing Factors:

The major factors contributing to the problem have been identified in flight testing as:

1. High Mounted Exhaust System. Mufflers raised even 1" extra at the wing leading edge to avoid heat effect on the skin have been known to be a major factor due to disturbed airflow.
2. Incorrect Weight and Balance – CofG. On a Thruster, the CofG should be 25-32% of Mean Aerodynamic Chord behind the wing leading edge. However, it should be set in accordance with the approved aircraft manual.
3. Exhaust Manifold Angled upwards. Manifolds of the Rotax 503/532/582 can be mounted angled upward or downwards and when mounted upwards can be a contributing factor, particularly with high mounted mufflers. This sometimes occurred with after market dual ignition installations:

Other factors known to contribute are:

4. Tailplane/Elevator Security of Attachment. The all-alloy tail on the Gemini can suffer from loosening rivets which hold the tailplane/ elevator together
5. Changed Wing Washout. Wing rigging should be strictly to manufacturer's specifications. Changes to wing geometry at rebuild by fitting parts for other model Thrusters, incorrect lift struts and incorrect rigging such as incorrect rigging wire tensions have effects on wing wake which in turn affects the aerodynamics of tailplanes.
6. Undertensioned Wing Skins. Correct wing skin tensioning is very important to maintaining proper wing aerodynamics such as centre of pressure position and wake.
7. Slack Centre Section Shroud. Slack shrouds covering the wing centre section can affect propeller wash and wing wake over the tailplane interfering with its effectiveness.
8. Distorted Wing Battens. This can occur under pressure of skin tensioning, flight loads or just sheer ageing and should be checked periodically for correct profile.
9. Slack Tailplane Skins. Rippling of skins in the airflow can affect function of control surfaces.
10. Excessive Droop on Ailerons. It is normal to rig ailerons with a slight amount of droop so that they acquire neutral under influence of airflow. The practice of rigging excessive droop effectively changes wing incidence and camber which not only reduces cruise performance and increases fuel consumption, but it also affects wing wake over the tailplane.
11. Control and Bracing Cable Tensions. The effects of this on the structure and its functioning are significant.

The Cause:
All of the above contributing factors are maintenance related and do not relate to the certificated type design of the aeroplane.

Action Required:
Owners of all Thruster Gemini Aircraft (and any AUF aircraft for that matter – particularly the type certificated ones) are to ensure that the maintenance practices and procedures specified in the manuals are strictly adhered to. This includes conformity with the approved design (ie no modifications that are not specified and approved), condition of the aeroplane, weight and balance, as well as servicing status.
The Technical Manager.