austro CONTROL as PCA of Joint Aviation Authorities	CERTIFICATION REVIEW ITEM DIAMOND DA40	CRI: ISSUE: DATE: STATUS:	O-03 Issue 3 14.2.2006 CLOSED

SUBJECT: **Banner Towing**

REQUIREMENTS: JAR 23

ADVISORY MATERIAL: -

POLICY REF.: -

PRIMARY GROUPE/PANEL: Flight, Structure

NEXT ACTION BY: ---

CRI CLOSURE TARGET: Change Approval, Post TC

STATEMENT OF ISSUE

Diamond applied for Equipment Installation and Operational Approval of Banner Towing in the DA 40 aeroplane.
A Banner is defined as an „uncontrolled banner used for aerial advertising“
Certification for this purpose is not new, but there is no JAA/EASA harmonized technical requirement known.
Until a General JAA/EASA Policy is available this CRI has been issued to develop a DA 40 specific requirement. This shall ensure that the installation is equal in all JAA/EU countries.
This CRI was initially developed under JAA/Joint Local Procedures, closure shall be under the EASA.

DISCUSSION

1. ACG/PCA POSITION

ACG proposed the following Special Condition related to unconventional use of product, based on the certification requirements of aeroplanes and powered sailplanes for banner towing in Austria.
The following additional documents were used as technical background information:

- LBA „Ergänzungen für das Schleppen von nichtgesteuerten Anhängern“ Dez.1997
- FAA Special provisions for banner towing operations
- CAA-UK BCAR Section K 806 “Banner Towing”

A: GENERAL

A1: Applicability

JAR-23, Diamond DA 40 (basic requirement)
It is considered that only banners with known limitations and performance data may be applicable for safe operations (drag, tow speeds,...).
It is also considered that only Day VFR, non acrobatic Operations are applicable for banner towing.

B: FLIGHT

B1: Proof of Compliance

In addition to the basic certification requirement JAR 23.21 a minimum of 3 tows with representative banner types must be shown.
The representative fleet of all kind of requested banners in all critical combinations of max., min. weight, aerodynamic characteristics including drag variations, max. ,min. speeds, ground handling of equipment and environmental conditions (rain) must be shown.
The performance data of the critical banner must be confirmed by flight tests (drag measurements).

B2: Take Off / Pick up

The take-off distance or required safe distance for the established pick-up procedure must be shown under the conditions of 23.45.
The required minimum safe speed for in flight pick up with the most critical banner must be demonstrated.
If the snatch in flight pick up method is used, the safe minimum pick up distance shall be at least 1,25 times the distance from the pick up point to the point where the banner clears a height of 15m.

B3: Climb

The climb performance requirement from JAR 23.65 must be shown for the banner tow formation in the conditions of 23.45 and 23X63.
The climb rate must not be less than 1,5 m/s at 450m MSL at ISA +20°C, at a speed as required in JAR 23.63.

B4: Tow Speeds

The minimum and maximum tow speed must be determined by flight tests under condition of B1.
Minimum tow speed must not be less than 1,2*Vs1.
Maximum tow speed must not be higher than Va, or the limitations of the banner, whichever is lower.

B5: Controllability and Manoeuvrability

The General Controllability, Manoeuvrability and Control forces required in the basic

requirement must be shown for the complete tow formation except for the following conditions:

Speeds more than the established maximum towing speed
Other tow cable length as determined under F2(c)
More than 30°left and right lateral banner position
More than 20° up and 40°down position of the banner, or the maximum deflection determined in flight.
Aerobatic manoeuvres
Power Off Conditions
Elevator Control force in manoeuvres

B6: Stall Warning

The stall warning requirements referenced in the aircraft's Type Certification Basis must be met in each banner tow condition

B7: Tow Cable release

The banner release within the speeds of B4 may not cause an unsafe condition for the towing aircraft.

B8: Landing

A procedure for drop-off the banner must be determined by tests.

C: STRUCTURE

C1: Proof of structure

Compliance with the Strength and Deformation, Structural Analysis and Load Test requirements referenced in the aircraft's Type Certification Basis must be shown for the banner tow condition and installation

C2: Towing loads

(a)The tow must be initially assumed to be in stabilized level flight, with a minimum tow rope load of 50daN or the actual stationary tow rope load at maximum tow speed whichever is higher, acting at the towing hook in following direction:

(1) horizontally rearward
(2) in the plane of symmetry rearward and downward at an angle of 40° to the horizontal or the angle of the most critical banner, whichever is higher.
(3) in the plane of symmetry rearward and upward at an angle of 20° with the horizontal
(4) horizontally rearward and sideways at an angle of 30°with the plane of symmetry

Lower tow rope loads may be only acceptable if shown by detailed analysis

(b)The highest rated ultimate strength of the weak link (Qnom) for the towed banner must be established.

Qnom must not be lower than 300 daN.

(c) The aeroplane, the tow hook installation and its attachments must be designed for a tow initially assumed to be subjected to the same conditions as specified in C2(a) the tow

rope load due to surging and pick up suddenly increases to 1,0*Qnom, assuming a textile rope is used.
Snatch Loads from an in flight pick up of 1,2 Qnom must be considered if applicable, lower loads may only be acceptable if detailed flight analysis is available.
The resulting tow rope load increment must be balanced by linear and rational inertia forces and superimposed onto the loads from C2(a).

C3: Strength of launching hook attachment

The launching hook (complete assembly) attachment to the airframe structure must be designed to carry a limit load of 1,5*Qnom as defined in C2(b) acting in directions of C2(a).

D: DESIGN and CONSTRUCTION

D1: Cable Systems

Each cable system installed with the tow installation must comply with the relevant requirements of the in the aircraft's Type Certification Basis and with this CRI.

D2: Release mechanisms

There must be a release mechanisms installed to give the tow pilot the ability to quickly disconnect the banner.

(a) The release mechanisms must be approved.

AMC D2(a)

Lufttüchtigkeitsforderungen für Schleppkupplungen (LFK) issued 11.8.1976 or later by LBA is an acceptable approved specification.

(b) It must be extremely improbable for bolts or other projections on the release mechanism itself or the structure surrounding the mechanism, including the landing gear, to foul the towing rope.

(c) It must be shown that the release force will not exceed 350N, with a minimum of 20N, when a cable Qnom (see C2(b)) is applied in any direction described in C2(a) and that the release mechanism functions properly under any operating condition.

(d) The range of travel of the release lever in the cockpit, including free travel, must not exceed 120 mm.

(e) The release lever in the cockpit must be arranged and designed so that the pilot force as defined in D2(c) can be easily applied

(f) A visual inspection of the release mechanism must be easily possible.

IEM D2(f)

The possibility to open the release mechanism on the tow hook assembly for ground handling is recommended.

(g) The release mechanism must be so installed that there is no interference between the tow rope and any control surface when the towed banner is in any position of C2(a) and the controls are operated through their full angular movement.

(h) The towing hook must be suitable protected against inadvertent release.

(i) The release control system must be designed to actuate the release mechanism of each launching hook at the same time, where more than one launching hook is fitted or a clear method must be established to prevent confusion in the operation of the individual emergency releases.

D3: Colour marking and arrangement of cockpit controls

Towing cable release must be of yellow/red colour (Yellow and Red alternating marking) and installed for an operation with the same pilots hand as the power lever.

D4: Rope deny
The tail section must be designed in a way to avoid inadvertent hang up during the in flight pick-up procedure .

D5: Pick up hook stowage
If the system require a pick up hook, a safe stowage must be established, which allows the pilot to safely deploy the hook without unacceptable workload.

E: POWERPLANT

E1: Engines

No Change to JAR 23

E2: Fuel System

No Change to JAR 23

E3: Cooling test procedure for reciprocating engine

The cooling test procedures referenced in the aircraft's Type Certification Basis must be carried out with the critical speeds and power settings for the banner tow formation established in Section B of this CRI.

The most critical engine temperature must be determined".

F: EQUIPMENT

F1: Powerplant Instruments
A cylinder head temperature indicator or an indicator of the most critical temperature determined in E3 must be installed.

F2: Miscellaneous equipment
For towing flights the following additional equipment must be installed:

(a) A adjustable mirror so that the pilot, when strapped in his seat, has full and unrestricted view of the towed banner in the positions according C2.

(b) An indication to the pilot for the attached position of the tow rope according D2(f) or a second mirror to the tow hook if not covered by F2(a)

(c) A tow rope of approved type including at least one weak link and connecting ring, this includes also a pick up hook if required.

The tow rope strength, length and flexibility must be established, assuming a textile material.

The type of pick-up hook is a part of the tow rope and must be defined as part of the design definition.

(d) Placards determined by certification including a Limitation which kind of towing is approved (glider, banner)

Information about the additional required ground equipment must be furnished.

G: OPERATING LIMITATIONS and INFORMATION

G1: Maintenance Manual
The Maintenance Manual must be amended for the additional installations.

G2: Operating Limitations
The following additional Information must be furnished in the AFM:

(a) Maximum weight and drag for the banner.
(b) A clear reference to the limitations of the banner to be used.
(c) Maximum and minimum permissible towing speed.
(d) Minimum and maximum tow cable length.
(e) Strength and Definition of tow rope and weak link as necessary
(f) Additional C of G and maximum takeoff weight Limitations if required.
(g) All other limitations as a result of Section B
(h) Maximum Number of Occupants in Tow
(i) Limitation to Day VFR Operations only, non Icing Conditions, no acrobatics.

G3: Operating data and procedures
Information concerning normal and emergency procedures for the banner tow and other pertinent information necessary for safe operation must be furnished, including:

(a) approved pickup or takeoff method
(b) C of G determination for the banner if required
(c) different type of banners
(d) minimum and maximum in flight pick-up speed
(e) drop-off procedure
(f) procedure for stowage and safe release of the pick-up hook if a pick up hook is installed.
(g) inadvertent pick up with the landing gear
(h) the pick-up procedure
(i) additional preflight procedures
(j) emergency Landing with banner attached

G4: Performance Information
The following information must be in addition furnished:

(a) demonstrated crosswind velocity for pick-up and drop-off
(b) cruise performance
(c) take off distances or minimum pick-up distance
(d) climb performance

2. **DIAMOND POSITION**

TBD

3. **JAA/EASA POSITION**

e-mail dated 3.12.04
Thanks for sight of the banner towing CRI. I have made a few editorial changes (Version Issue 1a) but made no technical changes; it seems pretty complete. The question arises as to whether this should be a Special Condition, subject to consultation.

Personally, I think that this should be treated as a special condition, but should not be offered for consultation because it basically only puts into a single document what has been done by various member states for years. If it is an SC, we can then propose it for addition to the rulemaking programme for CS-23.

4. **CONCLUSION**

TBD

Andreas Winkler
ACG-PCA Team Leader DA-40

Revision Record:

Draft 3	all NAA initial comments, Team comments
Issue 1	CAA UK requirements
Issue 1a	EASA editoral changes
Issue 2	EASA Position included
Issue 3	inclusion of comments, closure