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Subject: **Accident Investigation Eurostar EV-97 – Statement to Investigation Report Proposal**

Dear Sirs,

We are sending to you Evektor-Aerotechnik 's comments to a draft of the Investigation Report concerning the accident of the Danish Eurostar 9-249 at Ova Spin, Zernez, on 24.6.2006.

Inadequate strength of the lower spar cap of the wing is stated as a factor which contributed to the accident.

Reduced material characteristics (Rm, Rp0,2), low design load determined by Evektor, insufficient proofs, failure of quality control are the reasons listed in the Report draft.

In view of seriousness of such findings, the Czech Light Aircraft Association (LAA - supervising authority) ordered among other actions to perform an independent wing load analysis by the Aerospace Engineering (IAE) experts at the Brno University of Technology. Further to compare loads determined by the Evektor, Ruag and IAE .

These analysis, calculations and reports are now finished, available in Czech language, and can be provided after translation into English, if required.

It results from the analyses:

1. The load analysis done by Evektor and used to design and test the wing was correct.

   This opinion is supported by an independent load analysis done by the Aeronautical Institute (IAE) at the Technical University in Brno following the LAA request, and review of the Evektor load done by IAE.

The analyses and review will be of course submitted, as soon as translated.

2. The load differences are due to different methods used to determine air load distribution (Schrenk (RUAG) vs. Weissinger (Evektor) vs. Glauert (IAE)), and consideration or not influence of the fuselage on the wing load.
3. The analysis done by RUAG Aerospace, using Schrenk's method, gives the load distribution with the resultant force of 11% higher and moved significantly to the wing outer section, which causes the bending moment higher of 16% that that one determined by Evektor.

   The Schrenk's method is known for its simplicity and proportionally to this provides loads which are higher than those ones using more complex methods.
4. If the fuselage influence (redistribution to wing) is considered, than the bending moment increases of 5-7%, based on an analysis done by Aerodynamic Dpt. of the Evektor. However it is common practice for the microlights, that the fuselage influence on wing is not applied. This was consulted by experts of the Aeronautical Institute, LAA, Evektor, certif.opponents. Load analysis done by Evektor intentionally did not consider fuselage influence. If considered, the ultimate bending moment would increase of cca 5%, nevertheless even this increase would be sufficiently covered by the wing static test results.
5. The table below shows for information comparison of the bending moments at the point of the wing suspensions, as computed by Evektor, Ruag, and IAE. There are also computed reserve factors by dividing the bending moment achieved at the static test by ultimate bending moment:

Load comparison **Break load at test: 17454 Nm**

	Load case	Weight (kg)	Speed (km/h)	Load factor (-)	Air bending moment (Nm)	Total bending moment (Nm)	Ultimate bending moment (Nm)	R.F. (-)
EVE	Manoeuvre at V_D	450	300	4	11700	9957	14935	1.17
	Manoeuvre at V_A	480	170	4	12087	10344	15516	1.12
	Manoeuvre at V_D	480	300	4	12327	10583	15875	1.10
VUT	Manoeuvre at V_D	472.5	300	4	13143	11410	17115	1.02
RUAG	Manoeuvre at V_D	450	300	4	13612	11892	17838	0.98
	Manoeuvre at V_D	480	300	4		12684	19026	0.92

Data source - reports:

1) EVE: EURO 038/99
2) VUT Brno: LU32-2009-OST.L
3) RUAG: S3344 (29. January 2007)

6. Further a stress at the wing failure point (lower suspension outmost bolt) was compared for all those loads. The results are shown in a table below.
   It is obvious, that a material with the Rm 440 MPa provides reserve factors equal or higher that 1 for all loads.
   In spite of the fact that the spar cap material of the crashed airplane actually did not reach the strength declared by the manufacturer on the material certificate (515 MPa), its static strength was still sufficient to carry above listed loads computed by Evektor, as well as Aeronautical Institute (Minimum strength of sample A was 437 MPa, of sample B 442 MPa, see a Table on page 3 Metallographic Analysis 9-249 DK left wing).

Stress comparison

d_{BOLT} = 158 mm
F_{CAP} = 248.8 mm^2
Rm = 440 MPa

	Load case	Weight	Speed	Load factor	Limit bending moment	Ultimate bending moment	Force in cap	Stress in cap	R.F.
		(kg)	(km/h)	(-)	(Nm)	(Nm)	(N)	(MPa)	(-)
EVE	Manoeuvre at V_D	450	300	4	8860	13290	84113	338	1.30
	Manoeuvre at V_A	480	170	4	9191	13787	87252	351	1.25
	Manoeuvre at V_D	480	300	4	9405	14108	89283	359	1.23
VUT	Manoeuvre at V_D	472.5	300	4	10308	15462	97861	393	1.12
RUAG	Manoeuvre at V_D	450	300	4	10694	16041	101525	408	1.08
	Manoeuvre at V_D	480	300	4	11407	17111	108294	435	1.01

7. It is necessary to agree with the theory, that grain-coarse structure may reduce static as well as fatigue characteristics of a material. However as stated in the report draft, not fatigue failure (only 499 total hours flown) but ductile failure was the cause.

   Strength limits of the samples were determined by the tests and even if found less than on the material certificates (refer to previous par.), they were still sufficient to carry required loads.

   Impact on fatigue life is currently evaluated and necessary corrective actions will be taken.

8. Notch effect

   Following our opinion, the static strength proof is mixed here incorrectly with the fatigue proof. A common static strength tests of the wing was done under supervision of the authorities.

9. Quality Control Failure.

   The Evektor-Aerotechnik applied the same procedures at purchase of the material as used in the General Aviation. I.e. only the material from approved and certified manufacturers/suppliers was bought, accompanied with all required certificates. Following the findings in this case, when it was found, that the supplied material need not have declared properties, the process of material purchase was revised and modified to minimize repetition of such possibility.

Conclusion:

On the basis of above stated load analyses, the Evektor-Aerotechnik strongly does not agree with the wording of the Investigation Report Draft with the intent that, the cause of the accident were Inadequate strength of the lower spar cap of the wing, low load determined by the Evektor, reduced material characteristics, and that the design of the wing suspension construction did not meet the strength requirement of the German LTF-UL.

Evektor-Aerotechnik therefore requires correcting final report accordingly.

Evektor-Aerotechnik does consider, that the crash was caused by overloading the wing construction over the loads, which were correctly calculated and used to design the wing, which were never before questioned by any authority, and which correctness was now confirmed by an independent load analyses and reports.

A cause of thought overloading could be meteorological conditions in the high mountains, like strong turbulence, which may not be excluded at the time of accident, as stated in the report, perhaps construction overloading due to pilot inputs at extreme conditions.

Evektor-Aerotechnik is of course ready to provide above stated analyses and reports (to be translated at first) and further cooperate, as promised in the Letter: “Accident Investigation Eurostar EV-97 – Corrective actions, dated 31.7.2009 and send to the Federal Office of Civil Aviation.

This Statement is sent to the AAIB, FOCA, LAA, Czech Aircraft Accident Investigation Bureau, and IAE.

Sincerely

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