Docket No. SA-522

Exhibit No. 2-S

NATIONAL TRANSPORTATION SAFETY BOARD

Washington, D.C.

Letter from Captain Tribout (American Airlines) to Mr. William Wainwright (Airbus)

(6 Pages)

TD

Post-it® Fax Note 7671	Date	# of pages ▶
To	From	
Co./Dept.	Co.	
Phone #	Phone #	
Fax #	Fax # 817-967-5	

22 May 1997

To: Mr. William Wainwright
Chief Test Pilot - Airbus

From: Captain David Tribout
A300 Technical Pilot - American Airlines

Subj: Use of Rudder and Roll Control

Hello Bill,

American Airlines pilots are attending a course called "Advanced Aircraft Maneuvering Program". It is an attempt to teach and reinforce basic aerodynamics and how to handle large transport aircraft in the event of an upset.

I am very concerned that one aspect of the course is inaccurate and potentially hazardous. As you can see from the handout pages attached with this letter, it states that at higher angles of attack, THE RUDDER becomes the primary roll control. The program infers that aileron application in these situations is undesirable since it will create drag caused by spoiler deflection. The instructor teaches that in the event of a wake turbulence encounter, recovery from stall, ground escape maneuvers, etc., THE RUDDER should be used to control roll.

Would you please give us your thoughts on this subject. Captain's Paul Railsback (Manger Flight OPS Technical), Tom McBroom (Manager Flight OPS Technical - Line Operations) and I would like to set up a telecom with you or your representative at your convenience. Monday, May 26 might be good.

We would like to have a general discussion on the subject and ask some specific questions on the following:

1. The chance excessive use of rudder at high AOA might cause a spin or snap roll.
2. Yaw damper activity at high AOA and any unpredictable consequences of rudder use for roll control.
3. Can excessive yawing cause twisting moments on wing mounted engines that might result in engine damage or even separation from the aircraft?
4. How effective are the A300-600's ailerons at slow speeds and high AOA.
5. How much drag is caused by spoiler deployment at low speeds? Is the drag caused by yaw potentially greater?

(2)

Thank you Bill for any information and advice you can give us. We are also having discussions with John Cashman (Boeing) and Tom Melody (McDonnell Douglas) on this subject.

Best Regards,

Captain David Tribout
817-967-5159 (voice)
817-967-5443 (fax)
david_tribout@amrcorp.com (internet)

3

1 ROND-POINT MAURICE BELLONTE
31707 BLAGNAC CEDEX FRANCE
TELEPHONE 05 61 93 33 33
TELEX AIRBU 530808 F

AIRBUS INDUSTRIE

Captain David TRIBOUT
A300 Technical Pilot - American Airlines

DATE: 23-May-97
YOUR REFERENCE: AI/CV-P N° 477.0032/97
OUR REFERENCE:
DIRECT LINE:
FAX: 33(5)61-93.29-34

FAX Larry Rockliff

Hello David,

I share your concern over the use of rudder at high angles of attack and will be pleased to talk to Paul Railsback, Tom McBroom and yourself to discuss the matter.
At the moment, Monday May 26 should be alright, but please let me know roughly what time would be convenient to you. I will telephone on Monday to confirm the arrangements.

Regards

W. WAINWRIGHT

4

AI/EV-P to AI/ST-F (M.Brandt/M.Trémaud) A-I/EV-P FT 10/06/97

copies AI/EV; AI/EO; AI/EV-T (G.Robert/B.Schaefer)

Unusual Attitudes

I was approached by American Airlines (Technical Group) to give my views on the use of rudder at low speed, as recommended by their Advanced Maneuvring Program - they had already spoken to the CTPs of Boeing & McDD. Here are my general views on this subject & 2 other related ones which I discussed today with Cpt Dave Tribout, Chief Technical Pilot. I have deliberately stayed clear from developing procedures, & I consider that this is the best approach for us to take; we should give general recommendations & facts & not get involved in detailing lists of actions for events which will never be exactly identical.

Use of Rudder

1 Although rudder becomes more effective for roll control as speed is reduced, the normal lateral control (aileron + spoilers) is effective down to the stall on a/c such as the A300/310.

2. However, as speed is reduced, use of lateral control (particularly spoilers) produces increasing amounts of sideslip, & thus it is recommended to coordinate roll with rudder at very slow speeds.

3. Large sideslip angles should be avoided at low speed; it can provoke an early stall & can cause loss of control (it is pro-spin). Therefore, it is recommended to avoid large lateral & directional control inputs at speeds close to the stalling speed.

4. Rudder alone generates roll due to sideslip, thus its use at very low speed will result in large sideslip angles which will tend to provoke loss of control.

5. We remove turn coordination when below VSW on A300/310 (& in Alternate law on FBW a/c) precisely to avoid having rudder applied at high alpha.

6. Airbus Recommendations: rolling the a/c is done by normal use of lateral control with coordinated rudder to avoid sideslip. Thus, rudder is used as necessary; it is not the primary source of roll. Furthermore, very high bank angles, like the 70° can also be dangerous at low speed if they are not well-coordinated since they lead to high sideslip angles.

Stall Recovery

7. The most important action is to push forward to reduce AOA. Once, & only if, the AOA is reduced the a/c is controllable with normal use of control.

8. The second action should be to increase thrust; but on a/c with underslung engines, such as A300/310, this gives a nose-up trim change that has to be countered by a further push nose-down.

9. Recovery from the stall inevitably leads to some height loss. Minimum height loss occurs if a positive nose-down recovery is made. The a/c must be fully unstalled before an attempt is made to recover from the ensuing dive, & such nose-up recovery action should be made carefully to avoid restalling the a/c. No attempt should be made to recover from a stall without any height loss; it will inevitably lead to restall, & increased height loss.

10. Use of lateral control should be minimised until the a/c is unstalled; therefore, unstall the a/c, then recover to wings level flight.

Training Flight Simulators

11. A word of caution on the use of flight simulators to train for upset manoeuvres. One must not expect Training Simulators to be accurate at the edges of the flight envelope.

5

12. Modern training simulators use a comprehensive data package obtained from flight tests & are verified by comparing their performance to that of the real a/c for certain manoeuvres; but, the data package does not include dynamic manoeuvres outside the normal flight envelope (eg only stalls with 1kt/sec deceleration rates are normally included) & the manoeuvres that are verified are within the normal flight envelpoe (ie those that are of interest during conventional training).

13. Furthermore, simulators are not accurate in non-linear parts of the flight envelope. They are particularly inaccurate for large sideslip angles, & a pilot may draw the wrong conclusion from manoeuvres involving use of rudder at low speeds.

WW 11/6/97

(6)