In-flight thrust reverser deployment, Boeing 717, February 19, 2001

Micro-summary: This Boeing 717 experienced an in-flight thrust reverser deployment following takeoff.

Event Date: 2001-02-19 at 0730 CST

Investigative Body: National Transportation Safety Board (NTSB), USA

Investigative Body's Web Site: http://www.ntsb.gov/

Cautions:

1. Accident reports can be and sometimes are revised. Be sure to consult the investigative agency for the latest version before basing anything significant on content (e.g., thesis, research, etc).

2. Readers are advised that each report is a glimpse of events at specific points in time. While broad themes permeate the causal events leading up to crashes, and we can learn from those, the specific regulatory and technological environments can and do change. Your company's flight operations manual is the final authority as to the safe operation of your aircraft!

3. Reports may or may not represent reality. Many many non-scientific factors go into an investigation, including the magnitude of the event, the experience of the investigator, the political climate, relationship with the regulatory authority, technological and recovery capabilities, etc. It is recommended that the reader review all reports analytically. Even a "bad" report can be a very useful launching point for learning.

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National Transportation Safety Board NTSB ID: CHI01IA124 Aircraft Registration Number: N2410W								
FACTUAL REPORT	Γ	Occurre	nce Date: 02/19	9/2001	Most Critical Ir	njury: No	one	
ÁVIATION	ſ	Occurre	nce Type: Incid	ent	Investigated B	y: NTSI	В	
Location/Time				I				
Nearest City/Place	State		Zip Code	Local Time	Time Zone			
Milwaukee	WI		53207	0730	CST			
Airport Proximity:	Distan	ice From	Landing Facility:		Direction Fro	m Airport	t:	
Aircraft Information Summary								
Aircraft Manufacturer			Model/Series	6			Type of Aircraft	
Boeing			717-231				Airplane	
Sightseeing Flight: No			Air Medical Tr	ansport Flight: No				
Narrative								
<pre>On February 19, 2001, about 0730 central standard time, N2410W, registered as a Boeing 717-231, operated as Trans World Airlines (TWA) flight number 73, piloted by Airline Transport Pilot rated captain and copilot, sustained an in-flight thrust reverser deployment following a takeoff from General Mitchell International Airport (MKE), near Milwaukee Wisconsin. The flight landed at MKE without further incident. The scheduled domestic passenger flight was operating under 14 CFR Part 121. Visual meteorological conditions prevailed at the time of the incident. The 2 flight crewmembers, 3 cabin crewmembers and 62 passengers were uninjured. The flight was on an IFR flight lambert-Saint Louis International Airport, near Saint Louis, Missouri. Excerpts from that flight's debrief stated: During the cockpit preflight, the right engine's EPR display included an amber "T/R" light. The flight crew researched the QRH (quick reference handbock) and the flight handbock, and found no guidance for this problem. The Captain called the Kansas City maintenance coordinator (MCIMD) and discussed the problem with him. It was agreed that the engine would not be started with the T/R displayed. Two procedures were to be attempted by the flight crew before contract maintenance would be called: 1) presurization of the hydraulics, followed by movement of the thrust reverse lever; and 2) an electrical "depowering" of the aircraft, followed by a total reboot of the computers. The loading was complete and the ramp service man was on the interphone; the Captain asked the agent to close the door and the flight blocked at 0614L. The flight crew completed the two procedures, with the ground crew verifying that the right engine's thrust reverse lever was not moving the buckets. Neither procedure cleared the problem T/R amber light; the flight was blocked-in at 0620 without having started an engine or moving the aircraft. (The gate in use at MKE does not involve a pushback.)</pre>							a Boeing 717-231, sport Pilot rated ag a takeoff from ght landed at MKE ander 14 CFR Part at. The 2 flight on an IFR flight was destined for	
The Captain phoned MCIMD and informed the coordinator that the procedures were not helpful and [contract maintenance] had been called. When the [contract maintenance] mechanic arrived, the Captain explained the problem and stated that the proposed solution was to lock out the right engine's thrust reverser and placard it as inoperative. The [contract maintenance] mechanic was careful								

FACTUAL REPORT - AVIATION

Nationa	Transportation Safety Board	NTSB ID: CHI01IA124					
FA	CFUAL REPORT	Occurrence Date: 02/19/2001					
	AVIATION ETYBON	Occurrence Type: Incident					
Narrative	(Continued)						
Narrative	(Continued) and apprehensive as he revi would need a full hardcopy pages. He asked if there w crew said there was not. T are generally received by f agreed-upon course of actio The [contract maintenance] (one day of ground school at MCIMD during a phone call a the procedure. The Captain coordinator, who was a diff occurred at MCIMD. The fax manager's office and delive by the MKE operations agent reviewed the procedure with breaker collar were obtaine maintenance] mechanic compl the "pinning" of the right signoff was reviewed with M was still displayed in the	ewed the problem and stated that of the appropriate maintenance m as one on the airplane, and the he Captain explained that these ax from MCIMD, which became the n. mechanic explained his level of nd no "hands on" experience with s he requested a faxed, full cop had introduced the mechanic to erent individual as a shift chan was sent to the MKE station red to the [contract maintenance] me the Captain; a placard and a ci d from the station personnel. T eted the procedure that involved engine thrust reverser, and the CIMD. The amber T/R indication cockpit.	<pre> the anual flight pages training the B717) to y of the lige had e] mechanic cchanic .rcuit The [contract l logbook m m m m m m m m m m m m m m m m m m</pre>				
	runway 19R, followed by two turns to a westerly heading. Prior to slat retraction, at an altitude approximating 1400AGL and an airspeed of 200K, the right engine thrust reverser deployed. The airplane shuddered and rolled hard right; the T/R light was red. The Captain immediately closed the right throttle; the engine was secured shortly after the first officer was able to notify MKE departure control of an emergency and immediate need to return for landing. ATC cleared the flight for an immediate return with clearance to land on any runway. The wind at takeoff was southwesterly at 13 to 19 knots, which would require a landing on either 19R or 25L. The position of the flight was crosswind for 19R, and the distance to touchdown was shortest for 19R.						
	A right turn to the downwin officer of a 1500 fpm sink downwind and 200K, slats ex engine thrust lever through permitted, the first office concerning our emergency co cabin should be prepared fo ground shortly.) A tight t 6 minutes of airtime	d resulted in a call from the fi rate. To maintain a 1200AGL tended, the Captain forced the 1 the gate to obtain max thrust. r made a PA announcement to the ndition; that we were returning r landing; and that we would be raffic pattern resulted in a saf	.rst .eft (When time cabin and the on the Ee landing after				
	When the Captain arrived in the MKE operations office a few minutes later, the [contract maintenance] mechanic was present and involved in a phone conversation with MCIMD. When he completed the phone call, he stated that MCIMD had not sent a fourth page that graphically depicted the pinning of the B717 thrust reverser. The B717 requires three pins to lock out the thrust reverser, and only one had been installed as had been normal with the DC9 and MD80.						
The th	rust reverser was removed	from the incident engine an	nd shipped to the manufacturer for				

National Transportation Safety Board NTSB ID: CHI01IA124										
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AVIATION	Occurrence Type: Incident									
Narrative (Continued)										
examination. A Federal Aviation Ad data showed that after the prior find not lock. The examination revealed pins and their fork shaped lockin mating surfaces.	dministration engineer oversaw th light the reverser, when stowed, d that the thrust reverser doors ng triggers were inspected. Nicl	ne examination. Retrieved system moved to stowed position and did had over deployed. Four locking and gouges were found on their								
Subsequent to the incident, Boeing revised its 717 Dispatch Deviation Guide (DDG). The revised DDG included that maintenance would have to verify that "no more than one Thrust Reverser Proximity Sensor indicates Open" and that operators verify that the thrust reverser unlock indication is not present and red lockout pins are present on the inoperative reverser.										
Subsequent to the incident, Boes REVERSER DEPLOYED OR U/L OR REV I nearest suitable airport.	Subsequent to the incident, Boeing revised its Flight Crew Operating Manual (FCOM) procedure for REVERSER DEPLOYED OR U/L OR REV DISPLAYED IN FLIGHT. A step was added to the FCOM to land at the nearest suitable airport.									
Subsequent to the incident the overcenter links were redesigned. Boeing and the thrust reverser manufacturer issued service bulletins (SB) to retrofit the existing engines with the new link's design change, the link's associated hardware, and rub plates. Airplanes in production will incorporate the SB items as a production change.										
An excerpt from Boeing's SB 717-78-004 stated:										
BACKGROUND Operators have reported five instances of thrust reversers failing to deploy and ten instances of side beam gouging. Inspections revealed that gouging had occurred between the over center link bolts and side beam assembly. One recent event resulted in a relatively new thrust reverser having side beam gouging so deep, it required a doubler to restore airworthiness. Rohr Incorporated Service Bulletin R715.78-008 provides instructions to modify the thrust reverser actuation system. The purpose of modifying the thrust reverser actuation system is to minimize the possibility of gouging and inadvertent in-flight thrust reverser deployment. procedures given in this service bulletin										
An excerpt from Rohr, Inc.'s SB R715	5.78-008 said:									
Based upon field experience and test data, it has been found necessary to introduce a number of thrust reverser actuation system improvements. This group of improvements will result in a better-functioning, more durable, more reliable thrust reverser actuation system. NOTE: This Service Bulletin provides terminating action for ALERT Service Bulletin R715.78-A008.										
ACTIONS: Install rub plates on the ou Install new overcenter links (greasable bearings). Install new overcenter link clearance and provide lubric Modify the thrust reverser a Modify deflector door seal n door overstow).	ACTIONS: ACTIONS: Install rub plates on the outboard surfaces of the side beams. Install new overcenter links (prevent in flight deployment) (greasable bearings). Install new overcenter link attach hardware (improve side beam clearance and provide lubrication facility). Modify the thrust reverser actuators. Modify deflector door seal retainers (lower profile for better deflector door overstow).									

FACTUAL REPORT - AVIATION

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Narrative (Continued)	

Narrative (Continued)

Parties to the investigation were Boeing, the Federal Aviation Administration, and Trans World Airlines.

Boeing reported that the Boeing and Goodrich service bulletins were completed for the entire fleet including stored aircraft by December 2003.

National Transportation Safety Boar	rd	NTSB	ID: CHI01	IA124							
FACTUAL REPORT	Irrence Date: 02/19/2001										
AVIATION Occurrence Type: Incident											
Landing Facility/Approach Inform	nation										
Airport Name		A	Airport ID:	Airport Eleva	ition	Run	way Used	Runwa	ay Length	n Rur	nway Width
GENERAL MITCHELL INTERNATI		MKE	/IKE 723 Ft. MSL 19R 9690				20	0			
Runway Surface Type: Asphalt; Conc	Runway Surface Type: Asphalt; Concrete										
Runway Surface Condition: Dry											
Type Instrument Approach: NONE											
VFR Approach/Landing: Full Stop											
Aircraft Information											
Aircraft Manufacturer Boeing			Model/SeriesSerial717-2315507						Serial N 55077	lumber ,	
Airworthiness Certificate(s): Transport											
Landing Gear Type: Retractable - Tricycle											
Homebuilt Aircraft? No Nur	Certifie	d Max Gross W	/t.		118000	LBS	Number	of Engine	es: 2		
Engine Type: Turbo Fan				Engine Manufacturer:Model/Series:Rolls-RoyceBR715-A1-30						Rated Power: 18500 LBS	
- Aircraft Inspection Information											
Type of Last Inspection			Date of Last Inspection Time Since Last Inspection						4	Airframe T	otal Time
Continuous Airworthiness			02/2001					Ho	ours		770.3 Hours
- Emergency Locator Transmitter (ELT)	Information										
ELT Installed?	ELT Installed? ELT Operated?					ded i	n Locating Ac	cident S	Site?		
Owner/Operator Information											
Registered Aircraft Owner			Street A	Address 79 S. Ma	ain Stree	et					
First Security Bank NA Trustee			City State Z							Zip Code	
				Street Address							
Operator of Aircraft	11495 Natural Bridge Road										
TRANS WORLD AIRLINES INC				City Bridgeton						State MO	Zip Code 63044
Operator Does Business As: Operator Designator Code: TWAA											
- Type of U.S. Certificate(s) Held:											
Air Carrier Operating Certificate(s): Flag Carrier/Domestic											
Operating Certificate:				Operator (Certificate	e:					
Regulation Flight Conducted Under: Pa	art 121: Air Ca	rrier									
Type of Flight Operation Conducted: Se	cheduled; Don	nestic;	Passenge	rOnly							
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FACTIAL PEPERT Occurrence Date: 02/19/2001														
				Occurrent	a Tana la	_/ 10/20	01		-					
	Occurrence Type. Incident													
First Pilo	ot Information													
Name						City					State	Da	te of Birth	Age
On File On File On File 59										59				
Sex: M Seat Occupied: Left Principal Profession: Civilian Pilot Certificate Number: On File														
Certificate	Certificate(s): Airline Transport													
Airplane R	ating(s): Mult	i-engine La	nd: Sinale-	engine Land	: Sinale-er	naine S	ea							
Rotorcraft/	/Glider/LTA:	- 3	-, - 3 -	5	, - 3	<u> </u>								
Instrument	t Rating(s): Airol	lane												
Instructor	Rating(s):													
Type Ratin	ng/Endorsement fo	or Accident/Ir	ncident Aircr	aft? Yes			С	Current E	Biennial Fl	ight R	eview? 0	2/200)1	
Medical Ce	ert.: Class 1	Medica	al Cert. Statu	us: Valid Me	dicalw/ w	aivers/	lim.		Date	of La	st Medica	l Exa	m: 10/2000	
- Flight Tir	me Matrix	All A/C	This Make and Model	Airplane Single Engine	Airplane Mult-Engine	Ni	ght	Actual	Instrument	trument Simulated		aft	Glider	Lighter Than Air
Total Time	9	15744	335											
Pilot In Co	mmand(PIC)	10326	335										ļ	
Instructor						_								
Last 90 Da	ays	181	181			_								
Last 30 Da	ays	62	62			_								
Last 24 Ho	burs	4	4				Taula					<u></u>		
Seatbelt U	sed? Yes	Shou	ulder Harnes	s Used? Yes			IOXICO	biogy Pe	errormed?	NO		Seco	ond Pliot? Ye	S
Flight Pla	an/Itinerary													
	ght Plan Filed: IF	R												
Departure	Point						State Air			irport Identifier		Departure Time		l ime Zone
Same as Accident/Incident Location							М		MKE	<i>I</i> KE		0720		CST
Destination							State Ai			irport Identifier				
ST LOUIS MO STL														
Type of Clearance: IFR														
Type of Airspace: Class C														
Weather	Information													
Source of	Source of Briefing: Company													
Method of	Briefing: Unkno	wn												
				FACTUAI	REPORT	- AVL	ΑΤΙΟΙ	N						Page 3

Occurrence Date: 0/19/2001 Occurrence Type: Incident Weather Information WCP ID Observation Time Time Zone WOP Elevation WOP Distance From Accident Site: Direction From Accident Site: MKE 0452 CST 723 Ft. MSL VOP Distance From Accident Site: Direction From Accident Site: Direction From Accident Site: Lowest Ceiling:	Nationa	al Transportation Safety	Board	NTSB ID:	NTSB ID: CHI01IA124								
Occurrence Type: IncidentVertication TimeCocurrence Type: IncidentWOF IDObservation TimeTime ZoneWOF ElevationWOF Distance From Accident SiteDirection From Accident SiteMKE0452CST723 FL MSLCondition: FlatDirection From Accident SiteDirection From Accident SiteSkyrLowest Cloud Condition: FlatCST7 °CVisibility: 10SMAltimeter:29.91*HgLowest Cloud Condition: FlatGuste: 19Visibility: 10SMAltimeter:29.91*HgTemperature:-2 °CDew Point:-7 °CVisibility: Cloud Site: Visual ConditionsFL9.91*HgMind Speed:12Guste: 19Weat+Conditions at Accident Site: Visual ConditionsDensity Altitude:FLVisibility (RVR):FLVisibility (RVR):SMAltimeter:29.91*HgAccident InformationNoneAltirati Flat: NoneAltirati Flat: NoneAltirati Flat: NoneAltirati Flat: NoneFlat:SeriesNoneTOTALAltirati Flat:SeriesNoneTOTALSeries Plat:SeriesNoneTOTALSeries Plat:SeriesSeriesSeriesPlat:SeriesSeriesSeriesPlat:SeriesSeriesSeriesPlat:SeriesSeriesSeriesPlat:SeriesSeriesSeriesPlat:SeriesSeriesSeriesPlat: <td>FA</td> <td colspan="7">ACTUAL REPORT Occurrence Date: 02/19/2001</td> <td></td> <td></td> <td></td> <td></td> <td></td>	FA	ACTUAL REPORT Occurrence Date: 02/19/2001											
MKE Odservation Time Time Zone WOF Elevation WOF Distance From Accident Site Direction From Accident Site MKE O452 CST 723 F. MSL VMOF Distance From Accident Site Direction From Accident Site SkyLowest Cloud Condition: Few 4900 FL AGL Condition of Light: Day Lowest Ceiling:		AVIATION		Occurrent	Occurrence Type: Incident								
Note of the method of the service of the se	Weather												
MKE 0452 CST 723 F. MSL 0 NM 0 Deg.Mag. Sky/Lowest Cloud Condition: Few + 4900 Fl. AGL Condition: - - - - Visibility: 10 SM Altimeter: 29.91 *Hg Temperature: -2 °C Dew Point: -7 °C Wind Fleeton: 210 Density Altitude: FL Wind Speed: 12 Guts: 19 Veative Conditions at Accident Site: Visual Vortions Density Altitude: FL Visibility (RVR): FL Visibility (VV SM Intensity None State Type of Precipitation: None Aircraft Fire: None Aircraft Fire: None Aircraft Fire: None Aircraft Fire: None State None TotAL Classification: U.S. Registered/US Sali Minor None TOTAL 1 1 Statedim Plot Gut I I 1<	WOF ID	Observation Time	Time Zone	WOF Elevat	ion	WOF D	stance Fror	n Acci	dent Site		Direction Fro	om Accident Sit	e
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Second PilotI1Student PilotIIFlight InstructorIICheck PilotIIFlight EngineerIICabin AttendantsIIOther CrewIIPassengersIIOther GroundIIOther GroundII- GRAND TOTAL -III	First Pi	lot				1	1]					
Student PilotImage: Constraint of the second se	Second	d Pilot				1	1						
Flight InstructorImage: Check PilotImage: Check PilotImage: Check PilotCheck PilotImage: Check PilotImage: Check PilotImage: Check PilotFlight EngineerImage: Check PilotImage: Check PilotImage: Check PilotCabin AttendantsImage: Check PilotImage: Check PilotImage: Check PilotCabin AttendantsImage: Check PilotImage: Check PilotImage: Check PilotOther CrewImage: Check PilotImage: Check PilotImage: Check PilotPassengersImage: Check PilotImage: Check PilotImage: Check PilotOther GroundImage: Check PilotImage: Check PilotImage: Check PilotOther GroundImage: Check PilotImage: Check PilotImage: Check PilotOther OTAL -Image: Check PilotImage: Ch	Studen	t Pilot						4					
Check PilotImage: Check PilotImage: Check PilotFlight EngineerImage: Check PilotImage: Check PilotCabin AttendantsImage: Check PilotImage: Check PilotCabin AttendantsImage: Check PilotImage: Check PilotOther CrewImage: Check PilotImage: Check PilotPassengersImage: Check PilotImage: Check PilotOther GroundImage: Check PilotImage: Check PilotOther GroundImage: Check PilotImage: Check PilotIm	Flight li	nstructor											
Flight EngineerImage: Cabin AttendantsImage: Cabin AttendantsImage: Cabin AttendantsCabin AttendantsImage: Cabin AttendantsImage: Cabin AttendantsImage: Cabin AttendantsOther CrewImage: Cabin AttendantsImage: Cabin AttendantsImage: Cabin AttendantsPassengersImage: Cabin AttendantsImage: Cabin AttendantsImage: Cabin AttendantsPassengersImage: Cabin AttendantsImage: Cabin AttendantsImage: Cabin AttendantsOther GroundImage: Cabin AttendantsImage: Cabin AttendantsImage: Cabin AttendantsOther GroundImage: Cabin AttendantsImage: Cabin AttendantsImage: Cabin Attendants- GRAND TOTAL -Image: Cabin AttendantsImage: Cabin AttendantsImage: Cabin Attendants	Check	Pilot											
Cabin AttendantsImage: Cabin AttendantsImage: Cabin AttendantsOther CrewImage: Cabin AttendantsImage: Cabin AttendantsPassengersImage: Cabin AttendantsImage: Cabin Attendants- TOTAL ABOARD -Image: Cabin AttendantsImage: Cabin AttendantsOther GroundImage: Cabin AttendantsImage: Cabin Attendants- GRAND TOTAL -Image: Cabin AttendantsImage: Cabin Attendants	Flight E	Engineer											
Other CrewImage: Constraint of the constr	Cabin A	Attendants				3	3						
Passengers 62 62 - TOTAL ABOARD - 60 67 67 Other Ground 60 60 67 - GRAND TOTAL - 60 67 67	Other C	Crew											
- TOTAL ABOARD - Image: Constraint of the second seco	Passen	ngers				62	62						
Other Ground Image: Comparison of the second s	- TOTAL A	ABOARD -				67	67						
- GRAND TOTAL - 67 67	Other G	Ground]					
	- GRAND	D TOTAL -				67	67						
				FACTUAL	REPO	RT - AV	IATION						Page 4

National Transportation Safety Board	NTSB ID: CHI01IA124								
FACTUAL REPORT	Occurrence Date: 02/19/2001								
AVIATION	Occurrence Type: Incident								
Administrative Information									
Investigator-In-Charge (IIC)									
Edward F. Malinowski									
Additional Persons Participating in This Accident/Incident Investigation:									
Bob Henley Inspector Federal Avaiation Administration 800 Independence Avenue, S.W. Washington, DC 20591									
William Steelhammer Senior Investigator Boeing 3855 Lakewood Blvd, MC D035-0035 Long Beach, CA 90846									
Jim Walters Captain Trans World Airlines 11495 Natural Bridge Road, Room 438 Bridgeton, MO 63044									