



National Transportation Safety Board Aviation Accident Final Report

Location:	Columbus, OH	Accident Number:	CHI08MA270
Date & Time:	09/01/2008, 1206 EDT	Registration:	N587X
Aircraft:	CONVAIR CV-580	Aircraft Damage:	Destroyed
Defining Event:	Flight control sys malf/fail	Injuries:	3 Fatal
Flight Conducted Under:	Part 91: General Aviation - Flight Test		

Analysis

The accident flight was the first flight following maintenance that included flight control cable rigging. The flight was also intended to provide cockpit familiarization for the first officer and the pilot observer, and as a training flight for the first officer. About one minute after takeoff, the first officer contacted the tower and stated that they needed to return to land. The airplane impacted a cornfield about one mile southwest of the approach end of the runway, and 2 minutes 40 seconds after the initiation of the takeoff roll. The cockpit voice recorder (CVR) indicated that, during the flight, neither the captain nor the first officer called for the landing gear to be raised, the flaps to be retracted, or the power levers to be reduced from full power. From the time the first officer called "rotate" until the impact, the captain repeated the word "pull" about 27 times. When the observer pilot asked, "Come back on the trim?" the captain responded, "There's nothing anymore on the trim." The inspection of the airplane revealed that the elevator trim cables were rigged improperly, which resulted in the trim cables being reversed. As a result, when the pilot applied nose-up trim, the elevator trim system actually applied nose-down trim. The flight crew was briefed on the maintenance work that had been performed on the airplane; therefore, when the captain's nose-up trim inputs were affecting his ability to control the airplane, at a minimum, he should have stopped making additional inputs and returned the airplane to the configuration it was in before the problem worsened. An examination of the maintenance instruction cards used to conduct the last inspection revealed that the inspector's block on numerous checks were not signed off by the Required Inspection Item (RII) inspector. The RII inspector did not sign the item that stated: "Connect elevator servo trim tab cables and rig in accordance with Allison Convair [maintenance manual]..." The item had been signed off by the mechanic, but not by the RII inspector. The card also contained a NOTE, which stated in bold type, "A complete inspection of all elevator controls must be accomplished and signed off by an RII qualified inspector and a logbook entry made to this effect." The RII inspector block was not signed off.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The improper (reverse) rigging of the elevator trim cables by company maintenance personnel,

and their subsequent failure to discover the misrigging during required post-maintenance checks. Contributing to the accident was the captain's inadequate post-maintenance preflight check and the flight crew's improper response to the trim problem.

Findings

Aircraft	Elevator/tab attach fitting - Incorrect service/maintenance (Cause) Elevator/tab attach fitting - Inadequate inspection (Cause)
Personnel issues	Post maintenance inspection - Maintenance personnel (Cause) Post maintenance inspection - Pilot (Factor) Maintenance - Maintenance personnel (Cause) Incorrect action selection - Flight crew (Factor)

Factual Information

HISTORY OF FLIGHT

On September 1, 2008, about 1206 eastern daylight time, a Convair CV-580 airplane, N587X, operated by Air Tahoma Inc., was destroyed when it impacted terrain as it was attempting to return to the Rickenbacker International Airport (LCK), Columbus, Ohio. The flight had just departed from runway 5L (11,937 feet by 150 feet, asphalt) at LCK. The captain, first officer, and a company pilot sitting in the observer seat received fatal injuries. The 14 Code of Federal Regulations Part 91 post maintenance check flight departed LCK at 1203, and was en route to Mansfield Lahm Regional Airport (MFD), Mansfield, Ohio. Visual meteorological conditions prevailed at the time of the accident. An instrument flight rules (IFR) flight plan was filed.

The accident flight was the first flight following a maintenance Phase 1 and Phase 2 check, which included flight control cable rigging as part of the check. The flight was also intended to provide cockpit familiarization for the first officer and the observer, and a training flight for the first officer.

The flight contacted LCK air traffic control (ATC) at 1139 for its IFR clearance. At 1147, the flight was cleared to taxi. At 1200, the flight received its takeoff clearance, and the airplane started its takeoff roll about 1203.

About one minute later at 1204, the flight contacted ATC and stated that it needed to return to LCK. It was cleared to land on runway 5L. ATC asked the flight if it needed equipment and the flight responded, "Negative."

Radar track data indicated that about 1204, the airplane was mid-downwind for runway 5L about 900 feet above ground level (agl) with a 171-knot ground speed. When the airplane was approximately turning to the base leg, it was about 187 feet agl on a southerly heading with a 196-knot ground speed. About 1206, the airplane impacted a cornfield about one mile southwest of the approach end of runway 5L.

PERSONNEL INFORMATION

The captain was an airline transport pilot with multi-engine land and instrument airplane ratings. He held a first-class medical certificate that was issued on July 23, 2008. The captain's total flight time as recorded on his last medical certificate application was 16,087 hours. According to company records, he had flown 170 hours in the Convair (CV) 580 in the last 90 days and 46 hours in the last 46 days. He held airplane type ratings in the following aircraft: Boeing B-727, CV-340, -440, and -580's, Grumman G-100, Lockheed L-382, and IA-1125. He had completed the 6-month proficiency check in the CV-580 on May 17, 2008. On July 16, 2008, the captain was designated by the Federal Aviation Administration (FAA) as a CV-580 Check Airman for employees of Air Tahoma Inc.

The first officer was an airline transport pilot with single-engine and multi-engine land and instrument airplane ratings. He held a first-class medical certificate that was issued on August 6, 2008. The first officer's total flight time as recorded on his last medical certificate application was 19,285 hours. He held airplane type ratings in the following aircraft: Boeing B-727, CV-240, -340, and -440's, McDonnell Douglas DC-4, -7 and -8's, and Lockheed L-1011's.

The observer pilot on the flight was a commercial pilot with single-engine and multi-engine land and instrument airplane ratings. He held a first-class medical certificate that was issued on April 4, 2008. His total flight time as recorded on his resume submitted to Air Tahoma was 498 hours. He also held an Airframe and Powerplant (A&P) certificate and a Flight Engineer certificate.

Air Tahoma hired the first officer and the observer pilot on August 27, 2008, to fill the positions of captain and first officer, respectively. Both were going through the Initial New Hire training program. As of August 30, both had completed 28.5 hours of aircraft systems training which required a total of 63 hours for completion.

The Air Tahoma FAA approved CV-580 Flight Crew Training Manual issued in July 2005 stated the following concerning training progression: "Personnel in training will only be advanced to a higher level after all lower levels have been satisfactorily completed. This applies to all training." The training manual indicated that Basic Indoctrination and Aircraft Systems required completion prior to Flight Training. Air Tahoma's proposed training manual issued September 2007, but not approved by the FAA, stated the following concerning training progression: "Normally, personnel in training will only be advanced to a higher phase after all lower phases have been satisfactorily completed." It further stated, "Progression for subjects listed in paragraph A may be changed if it is in the best interest of the Company."

AIRCRAFT INFORMATION

The airplane was a Convair CV-580, serial number 361, manufactured in 1956 as a 56-seat passenger airplane that was converted to a cargo airplane. The airplane was modified by Supplemental Type Certificate (STC) SA4-1100 with the addition of the two Allison 501-D13D turboprop engines that each produced 3,800 shaft horsepower. The airplane had a maximum gross weight of 58,156 pounds. The last phase inspection was conducted on August 18, 2008. The total airframe time was 71,990.4 hours. The accident flight was the first flight after the phase inspection was completed.

An examination of the Phase 1 and Phase 2 cards used to conduct the phase inspection completed on August 18, 2008, revealed that the inspector's block on numerous checks were not signed off by the Required Inspection Item (RII) inspector. The RII inspector did not sign the Phase 2, card 55-04, item 59a, 59b, 59c, and 59d. Item 59b states, "Connect elevator servo trim tab cables and rig in accordance with Allison Convair M/M, section 8, figure 8.2.108 and 8.2.108A." The item had been signed off by the mechanic, but not by the RII inspector. The Phase 2 card also contained a NOTE, which stated in bold type, "A complete inspection of all elevator controls must be accomplished and signed off by an RII qualified inspector and a logbook entry made to this effect." The RII inspector block was not signed off.

The examination of the airplane's logbook indicated that the aircraft was released for flight on August 8, 2008. The discrepancy side of the logbook page listed, "AT-23's as required." (AT-23 cards are discrepancy cards used during aircraft maintenance.) The corrective action side of the form stated, "Complied with all AT-23's as required." On July 25, 2008, an AT-23 card, control number 10544, indicated that the right hand horizontal elevator was removed and reinstalled in accordance with the maintenance manual 27-30-0 to facilitate other maintenance. The AT-23 card, control number 10544, had both the mechanic's and the RII's signature.

The airplane was not flown on August 8, 2008, and did not fly until the accident flight on

September 1, 2008. The airplane's logbook indicated that that there were no discrepancies entered into the logbook from August 8 - September 1, 2008, that specifically identified that the elevator trim system had received maintenance or needed to be checked prior to flight. The airplane received a service check on September 1, 2008, and was released for flight.

METEOROLOGICAL CONDITIONS

At 1157, the surface weather observation at LCK was: Winds 080 at 3 knots, visibility 7 miles, clear skies, temperature 28 degrees Celsius (C), dew point 18 degrees C, altimeter 30.18 inches of Mercury.

FLIGHT RECORDERS

The Cockpit Voice Recorder (CVR) and Flight Data Recorder (FDR) were retrieved from the tail section of the wreckage and were sent to the National Transportation Safety Board's (NTSB) Vehicle Recorder Division for inspection.

The FDR was downloaded and approximately 4 hours of data was transcribed. A review of the data showed that the accident flight was not recorded by the FDR. The accident airplane was equipped with a switch in the cockpit to provide power to the FDR. Selection of the FDR switch was a checklist item that required the pilots to select the FDR switch to ON. The CVR tape indicated that the pilots skipped over the checklist item that called for the FDR switch to be selected to the ON position. The CVR recording indicated that there was no discussion between the pilots concerning the FDR switch, whether it should be in the ON or OFF position. The panel that contained the FDR switch was not located in the wreckage.

The CVR recorded 33-minutes, 11-seconds of useable audio information. The recording and prepared transcript began at 1132:47 and covered the preflight, taxi, takeoff, and accident events. The recording and transcript ended at 1205:58. The CVR indicated that during the conversations recorded by the CVR, the pilots did not discuss any special or extra requirements to conduct flight control checks as a result of the maintenance performed on the elevator and rudder.

From 11:33:03 to 12:00:47, the captain, first officer, and the observer were going through the cockpit checklists in preparation for takeoff. As they went through the checklist, the captain pointed out to the first officer and observer where particular gauges, switches, or instruments were located in the cockpit. At 12:00:47, the tower cleared the airplane for takeoff. The CVR indicated that the airplane was taxied onto the runway and the flight crew did power checks of the engines prior to takeoff. At 12:03:18, the first officer transmitted to tower that the airplane was commencing its takeoff roll.

The CVR indicated that the duration of the accident flight from the time of the takeoff roll until the sound of impact was about 2 minutes 40 seconds. During the accident flight, neither the captain nor the first officer called for the landing gear to be raised, the flaps to be retracted, or the power levers to be reduced from full power. From the time the first officer called "rotate" until the impact, the captain repeated the word "pull" about 27 times. The CVR indicated that the cockpit area microphone recorded a "sound similar to trim wheel motion" four times. When the observer pilot asked, "Come back on the trim?" at 12:04:39, the captain responded, "There's nothing anymore on the trim."

The CVR transcript recorded the following:

At 12:03:52, Hot-2 [first officer's microphone] recorded, "rotate."

At 11:03:52, Hot-1 [captain's microphone] recorded, "ohh yeah."

At 12:03:55, CAM [cockpit area microphone] recorded, "Sound similar to trim wheel motion."

At 12:03:55, Hot-1 recorded, "oh # [expletive]."

At 12:03:58, Hot-1 recorded, "oh yah yah yah. Pull pull pull."

At 12:03:58, Hot-2 recorded, "*** [unintelligible word]."

At 12:03:58, CAM recorded, "sound similar to trim wheel motion."

At 12:04:02, Hot-1 recorded, "pull."

At 12:04:03, CAM recorded, "sound similar to trim wheel motion."

At 12:04:04, Hot-3 [observer], "want me to help."

At 12:04:05, Hot-1 recorded, "pull."

At 12:04:08, Hot-1 recorded, "let's go *. We have to go back. Pull pull."

At 12:04:10, Hot-2 recorded, "okay."

At 12:04:11, Hot-? recorded, "sound of heaving breathing."

At 12:04:13, RDO-2 [first officer's radio transmission] recorded, "and Tahoma five eight seven's got to come back."

At 12:04:16, Hot-1 recorded, "pull."

At 12:04:17, TWR [tower] stated, "five eight seven right or left traffic?"

At 12:04:19, RDO-2 recorded, "left traffic Tahoma five eighty seven."

At 12:04:21, TWR stated, "alrighty."

At 12:04:23, Hot-1 recorded, "pull."

At 12:04:23, Hot-? recorded, *

At 12:04:29, Hot-? recorded, "sound of heavy breathing."

At 12:04:32, Hot-1 recorded, "pull."

At 12:04:33, Hot-1 recorded, "pull."

At 12:04:34, Hot-1 recorded, "pull."

At 12:04:37, Hot-1 recorded, "pull."

At 12:04:38, Hot-2 recorded, "pulling."

At 12:04:39, Hot-3 recorded, "come back on the trim?"

At 12:04:40, CAM recorded, "sound similar to the trim wheel motion."

At 12:04:41, Hot-1 recorded, "there's nothing anymore on the trim."

At 12:04:44, Hot-? recorded, "sound of heavy breathing."

At 12:04:78, Hot-1 recorded, "pull..pull you pull two pull."

At 12:04:49, TWR stated, "Tahoma five eighty seven check wheels down the wind's zero seven

zero at four and cleared to land."

At 12:04:54, RDO-2 recorded, "clear to land Tahoma five eighty seven."

At 12:04:55, Hot-? recorded, "sound of heavy breathing."

At 12:04:59, TWR stated, "need any equipment or anything?"

At 12:05:00, Hot-1 recorded, "no-no."

At 12:05:01, RDO-2 recorded, "uh negative."

At 12:05:03, TWR stated, "okay."

At 12:05:04, Hot-1 recorded, "pull."

At 12:05:10, Hot-? recorded, "sound of heavy breathing."

At 12:05:15, Hot-1 recorded, "pull."

At 12:05:16, Hot-2 recorded, "sound of grunt."

At 12:05:18, Hot-1 recorded, "let's go on the left side."

At 12:05:21, Hot-1 recorded, "pull."

At 12:05:23, Hot-3 recorded, "I got it I'm pulling."

At 12:05:24, Hot-1 recorded, "pull..left left left."

At 12:05:29, Hot-1 recorded, "pull."

At 12:05:31, Hot-1, recorded, "sound of heavy breathing."

At 12:05:32, Hot-2 recorded, "sound of grunt."

At 12:05:38, Hot-2 recorded, "sound of grunt."

At 12:05:38, Hot-1 recorded, "pull."

At 12:05:39, Hot-2 recorded, "Jesus."

At 12:05:42, Hot-1 recorded, "pull."

At 12:05:45, Hot-1 recorded, "pull."

At 12:05:46, Hot-1 recorded, "pull."

At 12:05:47, Hot-2 recorded, "sound of grunt."

At 12:05:48, Hot-1 recorded, "sound of grunt."

At 12:05:50, Hot-1 recorded, "pull pull."

At 12:05:53, Hot-1 recorded, "sound of screaming."

At 12:05:58, Hot-3 recorded, "God help us."

At 12:05:58, CAM recorded, "sound of impact."

At 12:05:58: End of recording.

The NTSB's Vehicle Recorder Division conducted a Sound Spectrum Study. The study attempted to determine the takeoff power setting of the engines as well as any subsequent

power changes prior to impact. The data indicated that until 12:05:45, the engines likely operated at or near their maximum power output. At 12:05:45 and for the last 15 seconds of the flight, the increased noise levels obscured blade passage harmonics so the engine power trends could not be determined.

WRECKAGE AND IMPACT INFORMATION

The airplane had impacted the terrain on a southerly heading. The cut through the high corn made by the airplane's landing gear, fuselage, and wings indicated that it was in a slight right wing down attitude on a glide path of about 10 degrees at impact. The initial contact with the corn revealed three parallel cuts consistent with the landing gear being in the down position. Both left and right propeller gearboxes separated from the engines and were found near the initial impact point. All four blades from both propeller assemblies were separated from the hubs and were found throughout the wreckage path. Both propeller hubs were located about 1,250 feet from the initial impact point, the furthest wreckage found in the debris field. The main wreckage was found about 825 feet from the initial impact point.

Approximately the forward 10 feet of the airplane, which included the cockpit, separated from the fuselage. It came to rest on the right side of the airplane and was consumed by post impact fire. The fuselage was partially consumed by fire just forward of the vertical stabilizer between Fuselage Station (FS) 623.00 and FS 798. The left wing had separated from the fuselage and was about 50 feet from the fuselage. It was partially consumed by fire, and fragments of the wing were found in the debris field. The right wing had separated from the fuselage. Part of the wing came to rest under the cockpit section, and was consumed by fire. Sections of the lower right wing were found in the debris field. Both engines had separated from the wings and were found with the main wreckage. A ground fire had consumed a swath of corn along the debris field.

The elevator pitch control system was inspected. The cockpit and pedestal, upon which the elevator trim was mounted, was destroyed. The trim wheels were still connected to the axle, which was broken and torn from the structure. The elevator trim indicator was not visible nor was the trim drum or forward cables. The elevator trim cables were still routed through the floor beam fairlead holes to the empennage where they were attached to the elevator trim jack drum in the right horizontal stabilizer. The aft turnbuckles were intact, joined to both cables and lockwired. Although the pulleys and rubber fairleads were consumed by fire, the cables were still captured in location by their individual fairlead holes. The inboard cable at the FS 798 floor beam exited through the fuselage lower fairlead hole at FS 850 to the lower side of the elevator trim jack drum.

The Allison Maintenance Manual 1CC2-1, 8-2 page 18, Figure 8.2.108, indicated that the elevator trim inboard cable at the FS 798 floor beam, when correctly installed, exited through the fuselage upper fairlead hole at FS 850 to the top of the elevator trim jack drum. The inspection of the elevator pitch control system revealed no anomalies except the reversed elevator trim cables aft of FS 798.

MEDICAL AND PATHOLOGICAL INFORMATION

The autopsies of the captain and first officer were conducted at the Montgomery County Coroner's Office, Circleville, Ohio, on September 2, 2008. The cause of death for both pilots was multiple blunt force trauma. Forensic Toxicology Fatal Accident Reports were prepared by the FAA Civil Aeromedical Institute. The captain's toxicology report indicated the results were

negative for all substances tested. The first officer's toxicology report indicated that Pioglitazone was detected in the blood and liver. The co-pilot had reported and the FAA had approved his use of the medication for the treatment of diabetes.

ADDITIONAL INFORMATION

A maintenance technician briefed the pilot on the maintenance that had been accomplished on the airplane prior to the flight on September 1, 2008. The maintenance technician reported that he briefed the pilot on the following maintenance actions:

1. Both propellers were off the aircraft.
2. The propeller gearbox for the number one engine was split for level one inspection.
3. The number one engine turbine was removed and some new parts were installed.
4. The right main gear shock strut was replaced.
5. The nose gear was split and resealed.
6. A full gear swing was completed.
7. Both elevators and rudder were removed and replaced.
8. The right horizontal stabilizer was removed and all items were inspected and reinstalled.
9. All empennage flight control cables were disconnected and reconnected, rigged and checked.

The operator's Vice-President of Maintenance reported that in accordance with the Air Tahoma's Maintenance Manual, the only item that required a test flight after N587X came out of maintenance was for the removal and reinstallation of the propellers.

The on-site inspection of the accident airplane revealed that the elevator trim cables were reversed. As a result, when the pilot applied nose-up trim, the elevator trim system actually applied nose-down trim.

History of Flight

Prior to flight	Aircraft maintenance event
Initial climb	Flight control sys malf/fail (Defining event) Collision with terr/obj (non-CFIT)

Pilot Information

Certificate:	Airline Transport	Age:	57, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	
Instrument Rating(s):	Airplane	Second Pilot Present:	Yes
Instructor Rating(s):	None	Toxicology Performed:	Yes
Medical Certification:	Class 1 Without Waivers/Limitations	Last Medical Exam:	07/01/2008
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	05/01/2008
Flight Time:	16087 hours (Total, all aircraft), 170 hours (Last 90 days, all aircraft), 46 hours (Last 30 days, all aircraft)		

Co-Pilot Information

Certificate:	Airline Transport; Commercial	Age:	58, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	Seat Occupied:	Right
Other Aircraft Rating(s):	None	Restraint Used:	
Instrument Rating(s):	Airplane	Second Pilot Present:	Yes
Instructor Rating(s):	Airplane Multi-engine; Airplane Single-engine	Toxicology Performed:	Yes
Medical Certification:	Class 1 With Waivers/Limitations	Last Medical Exam:	08/01/2008
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	
Flight Time:	19285 hours (Total, all aircraft), 15599 hours (Pilot In Command, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Manufacturer:	CONVAIR	Registration:	N587X
Model/Series:	CV-580	Aircraft Category:	Airplane
Year of Manufacture:		Amateur Built:	No
Airworthiness Certificate:	Normal	Serial Number:	361
Landing Gear Type:	Retractable - Tricycle	Seats:	3
Date/Type of Last Inspection:	08/01/2008, AAIP	Certified Max Gross Wt.:	58156 lbs
Time Since Last Inspection:		Engines:	2 Turbo Prop
Airframe Total Time:	71965 Hours	Engine Manufacturer:	Allison
ELT:	Installed, not activated	Engine Model/Series:	501
Registered Owner:	Air Tahoma Inc	Rated Power:	4000 hp
Operator:	Air Tahoma Inc	Air Carrier Operating Certificate:	Flag carrier (121); Supplemental

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	Condition of Light:	Day
Observation Facility, Elevation:	LCK, 744 ft msl	Observation Time:	1145 EDT
Distance from Accident Site:	1 Nautical Miles	Direction from Accident Site:	60°
Lowest Cloud Condition:	Clear	Temperature/Dew Point:	29° C / 18° C
Lowest Ceiling:	None	Visibility	7 Miles
Wind Speed/Gusts, Direction:	6 knots, 80°	Visibility (RVR):	
Altimeter Setting:	30 inches Hg	Visibility (RVV):	
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Columbus, OH (LCK)	Type of Flight Plan Filed:	IFR
Destination:	Mansfield, OH (MFD)	Type of Clearance:	IFR
Departure Time:	1203 EDT	Type of Airspace:	

Airport Information

Airport:	Rickenbacker International (LCK)	Runway Surface Type:	Asphalt
Airport Elevation:	744 ft	Runway Surface Condition:	Dry
Runway Used:	5L	IFR Approach:	None
Runway Length/Width:	11937 ft / 150 ft	VFR Approach/Landing:	None

Wreckage and Impact Information

Crew Injuries:	3 Fatal	Aircraft Damage:	Destroyed
Passenger Injuries:	N/A	Aircraft Fire:	On-Ground
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	3 Fatal	Latitude, Longitude:	39.798333, -82.979167

Administrative Information

Investigator In Charge (IIC):	James P Silliman	Adopted Date:	06/22/2009
Additional Participating Persons:	Richard Leister; FAA Columbus FSDO; Columbus, OH Michael Weber; Rolls-Royce; Indianapolis, IN Matt Palmberg; Kelowna Flightcraft Ltd.; Kelowna, BC Canada, Walter Raleigh; Air Tahoma; Columbus, OH		
Publish Date:	05/11/2012		
Investigation Docket:	NTSB accident and incident dockets serve as permanent archival information for the NTSB's investigations. Dockets released prior to June 1, 2009 are publicly available from the NTSB's Record Management Division at pubinq@ntsb.gov , or at 800-877-6799. Dockets released after this date are available at http://dms.nts.gov/pubdms/ .		

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