Aviation Investigation Final Report

Location:	Kissimmee, Florida	**Accident Number:**	ERA11FA133
Date & Time:	February 2, 2011, 17:29 Local	**Registration:**	N415FM
Aircraft:	POTEZ-AIR FOUGA CM 170 MAGISTER	**Aircraft Damage:**	Substantial
Defining Event:	Aerodynamic stall/spin	**Injuries:**	2 Fatal
Flight Conducted Under:	Part 91: General aviation - Flight test		

Analysis

After the repair of a number of hydraulic leaks, a post-maintenance check flight was conducted from the vintage jet trainer's home airport with a visiting pilot/mechanic and the pilot/owner onboard. After the airplane took off, it departed the airport traffic pattern for in-flight tests. About 11 minutes later, the airplane reentered the airport traffic pattern and completed a left, overhead, mid-field break about 600 feet above ground level (agl). A voice recognized as the pilot/mechanic's then advised the tower that the three landing gear were down and locked, and the airplane arrived at the abeam position about 500 feet agl and 215 knots. The airplane then eased out of the turn and briefly flew a straight course that angled toward the runway before commencing a sharp turn toward the runway with an observed 90-degree angle of bank. The airplane was then seen descending rapidly before pitching up, overshooting the extended runway centerline, nosing down, and impacting the ground. Both pilots were ejected when the airplane impacted the ground, and neither of the destroyed cockpits nor an airport security video could provide definitive evidence as to which pilot was in which seat. However, because the pilot/mechanic’s voice was on all radio transmissions, including a transmission that he was unfamiliar with the airport, it is likely that he was in the front seat and flying the airplane.

Wreckage examination revealed that the airplane had impacted the ground in an approximately 45-degree left angle of bank, about 5 degrees nose-low. The landing gear were down and the push button selectors were in the "normal" position, indicating that landing gear were extended normally. The two left-wing flap segments were separated from the extensively damaged wing, and the differing cockpit wing flap indicators were unreliable due to cockpit and airplane damage. However, the two relatively intact right-wing flap segments were up and flush with the wing, consistent with the flaps being up at impact. The emergency airbrake selector was in the "out" position, indicating that the pilot/mechanic had recognized a loss of hydraulic pressure

after lowering the landing gear, but before he could effectively deploy airbrakes or flaps. There are no means to lower flaps following a loss of hydraulic pressure. The pilot/mechanic should have extended the downwind leg for a flaps-up approach, per the abnormal procedures. However, he continued the high angle-of-bank, as-configured approach, but did not maintain sufficient airspeed to preclude an "accelerated maneuver stall."

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot/mechanic's improper decision to continue a tight-turning landing pattern after a loss of hydraulic pressure, and his subsequent failure to maintain adequate airspeed during that pattern, which resulted in an accelerated maneuver stall. Contributing to the accident was a loss of hydraulic pressure after the extension of the landing gear.

Findings

Personnel issues	Decision making/judgment - Pilot
Personnel issues	Incorrect action performance - Pilot
Aircraft	Airspeed - Not attained/maintained
Aircraft	(general) - Not specified

Factual Information

History of Flight

Approach	Sys/Comp malf/fail (non-power)
Approach	Aerodynamic stall/spin (Defining event)
Approach	Loss of control in flight
Uncontrolled descent	Collision with terr/obj (non-CFIT)

HISTORY OF FLIGHT

On February 2, 2011, about 1729 eastern standard time, a Potez-Air Fouga CM 170 Magister, N415FM, was substantially damaged when it impacted terrain during a traffic pattern approach to landing at Kissimmee Gateway Airport (ISM), Kissimmee, Florida. The certificated commercial pilot/owner, and the certificated commercial pilot/mechanic were fatally injured. Visual meteorological conditions prevailed. The flight was not operating on flight plan during the local 14 Code of Federal Regulations Part 91 maintenance test flight.

According to a work order, the flight was being conducted subsequent to the repair of a number of hydraulic leaks.

Federal Aviation Administration (FAA) air traffic control tower transcripts and voice tape information were combined with radar data to produce a sequence of events. Tower transcript times and the more-accurate radar return times did not match, with the tower time of the accident occurring just before 1733:21, and the airplane's last radar return occurring at 1728:52. According to a police officer, he also observed the airplane in the landing pattern at 1728.

Although not exact, a 4 minute, 30 second adjustment was applied to the tower transcript times to more accurately reflect actual transmission times:

At 1705, a pilot, whose voice was identified by a close friend as that of the pilot/mechanic, and whose voice was heard on all subsequent transmissions, called for taxi, and stated: "I'm unfamiliar with the airport." The ground controller then provided progressive taxi instructions to runway 24.

At 1717, the airplane was cleared for takeoff. The tower controller also confirmed the pilot's preference for an overhead entry upon return, and asked how long the flight would last, to which the pilot/mechanic responded, "less than 15 minutes." The controller then advised the pilot to expect a runway 24 "initial to the three sixty overhead."

Radar data indicated that after departure, the airplane proceeded to the southwest at a

groundspeed of about 160 knots, and an altitude of 1,600 feet above mean sea level (msl) until approximately 7 nautical miles from the airport, when it began maneuvering. After about 4 minutes of maneuvering, at groundspeeds varying down to approximately 130 knots, the airplane began proceeding back toward the airport.

At 1724, the pilot/mechanic reported, "we had a good check here, we'd like to come back for landing," and was told to report the "initial" for runway 24. The controller then asked the pilot if he'd like "one thousand or one thousand five hundred," and the pilot/mechanic responded, "one thousand would be fine." The controller then advised, "report the initial for runway two four, right break," to which the pilot/mechanic responded, "right break from the right side."

Radar data indicated that the airplane proceeded back toward the airport, at an altitude of about 1,100 feet msl, with gradually increasing groundspeed.

At 1727, the pilot/mechanic reported, "we're going to plan a tower line break," and the controller responded, "okay then, plan on a left break for runway two four," which the pilot/mechanic confirmed.

Radar data indicated that the airplane flew a right downwind leg, about a 1 nautical mile northwest of the runway, and about 1,100 feet msl and 210 knots groundspeed. Approaching the extended centerline of the runway, the airplane was about 1,000 feet msl at 212 knots groundspeed.

At 1727:50, the tower controller cleared the airplane for a "left break, cleared to land," which the pilot/mechanic read back.

Radar data indicated that the airplane flew over the runway, arriving at a mid-field break position about 700 feet msl and 216 knots groundspeed. The airplane then commenced a left break.

At 1728:35, the pilot/mechanic reported, "three green."

There were no further transmissions from the airplane.

Additional radar data indicated that after the left break, the airplane climbed to 900 feet msl after about 90 degrees of turn. By about 180 degrees of turn, and almost abeam of the runway threshold, the airplane was again at 700 feet msl, at 215 knots.

The last three recorded altitudes were at 600, 500, and 600 feet msl respectively. The last radar recorded position was about 075 degrees magnetic, 2,700 feet from the threshold of runway 24, and 800 feet laterally from the runway's extended centerline. The airplane's groundspeed was then about 202 knots.

A plot of the air traffic pattern radar track, together with the impact location, indicated that

from the overhead position, the airplane made a half-circle turn to the abeam position, then eased out of the turn briefly to a straight course that angled toward the runway. The airplane then entered a sharp turn to arrive at the impact location.

According to a certificated flight instructor who was at the hold short line waiting to take off, he saw the airplane fly overhead to a left break. As the airplane turned toward the final approach course, he saw it pitch up, and the angle of bank increased. The airplane overshot the final approach course, and was banked approximately 90 degrees when it lost altitude and impacted the ground short of runway 24.

Another witness saw the airplane approaching the airport, then make a "steep" descent. It appeared that the pilot attempted "gain control," but the airplane made a "second drop" before the witness lost sight of it.

A third witness was stopped at a red light when he saw the airplane making "almost 90-degree banking turns." The airplane, with the landing gear down, seemed as if it was slowing down and "losing lift." It then appeared that the pilot "tried to lift the nose of the plane and gain more altitude but was unsuccessful." The witness then lost sight of the airplane beyond a tree line.

PERSONNEL INFORMATION

The pilot/mechanic, age 53, held a commercial pilot certificate, with airplane single engine land, multi-engine land, and instrument airplane ratings. He also had Federal Aviation Administration (FAA) authorization to fly eight "classic" military aircraft, including the CM 170, and held an "authorized aircraft instructor" certificate for the CM 170 that expired November 30, 2008. The pilot/mechanic additionally held an airframe and powerplants mechanic certificate with inspection authorization. The pilot/mechanic's latest FAA second class medical certificate was issued on September 9, 2010, and at the time, he indicated 8,300 hours of total flight time. Family members stated that they had the pilot's logbook, but would not provide it to either the NTSB or FAA, nor provide pilot information from it to confirm flight hours, recent experience in model or proof of a biennial flight review, despite multiple requests.

The pilot/owner, age 61, held a commercial pilot certificate, with airplane single engine land, multi-engine land, single engine sea, multi-engine sea and instrument airplane ratings. He also had an FAA authorization to fly the CM 170. The pilot/owner also held a flight instructor certificate with airplane single engine, multi-engine, and instrument airplane ratings. The pilot/owner's latest FAA second class medical certificate was issued on January 9, 2009, and at the time, he indicated 1,500 hours of total flight time. According to family members, the pilot's logbook could not be located.

Both pilots were ejected from the airplane at the impact site, and neither cockpit contained personally identifiable items to determine which pilot was seated in which seat. An airport video of the airplane taxiing was not sufficiently clear to determine seat positions by the helmets worn.

AIRCRAFT INFORMATION

The French-designed, tandem-seat, V-tailed CM 170 Magister, serial number 415, was manufactured in Toulouse, France, in 1963, and registered to the pilot/owner in 2000. There was no hour meter found in the wreckage, and aircraft logbooks were not located, either at the airport or by the pilot/owner's family. The airplane, which was based at ISM, was not equipped with an angle of attack (AOA) indicator.

The airplane was powered by two single-spool, centrifugal compressor Turbomeca Marbore IIC turbojets. Each engine was capable of producing 880 pounds of thrust at 22,600 rpm.

A trailer-mounted fuel bowser used by the pilot/owner contained fuel, consistent in odor and red color with off-road diesel fuel. A sample taken from the bowser was clear and absent of debris.

According to a "discrepancy and correction sheet" pertaining to the airplane and found in the pilot/mechanic's truck:

1. R/H main gear actuator leak – found small line…fractured. Replaced and serviced.
2. L/H wing root hyd leak – flap actuator down line cracked…removed and replaced.
3. Left hand engine high pressure fuel control seal is leaking after shutdown.
4. Left main gear, two leaks in wheel well.
5. Jack aircraft and perform gear swing.
6. Leak on down line for nose gear.
7. Leak on emergency line R/H main.
8. Leak on down line #2 fuselage to wing.
9. FAA program letter.
10. Test flight.

AIRPORT INFORMATION

Runway 24 was 5,001 feet long and 150 feet wide. Runway heading was 243 degrees magnetic. Field elevation was 82 feet.

METEOROLOGICAL INFORMATION

Weather, recorded at the airport at 1739, included winds from 240 degrees true at 3 knots, scattered clouds at 4,500 feet, visibility 10 statute miles, temperature 25 degrees C, dew point 19 degrees C, and an altimeter setting of 30.11 inches Hg.

U.S. Naval Observatory sun azimuth information indicated that at the time of the accident, the sun was 6.1 degrees above the horizon, with an azimuth of 247.4 degrees east of north.

WRECKAGE AND IMPACT INFORMATION

The initial ground impact scar was located in an open field, in the vicinity of 28 degrees, 17.79 minutes north latitude, 081 degrees, 25.57 minutes west longitude, about 1,750 feet, 060 degrees from the runway 24 threshold. Ground scars continued for about 175 feet, along a heading of 225 degrees, to the main wreckage.

The initial ground scars contained red paint chips of the same color as the wing tip tanks. About 20 feet beyond the initial ground scars, began another ground scar, about 40 feet in length that led into a shallow impact crater. On the left side of the crater, protruding vertically into the ground, was a piece of windshield. Sandy, loamy soil and airplane debris emanated from the crater in a fanlike pattern, with most of the heavier debris, including both separated main landing gear, on the right side of the debris path.

The main wreckage came to rest in three major sections: the inverted cockpit area, the inverted tail section, and a center section connected to a relatively-intact right wing and a partial left wing.

The outboard half of the left wing, including the left wing tank, was separated from the remainder of the wing.

Crush damage to the left wingtip tank was consistent with ground impact at 40 to 45 degrees left-wing down, and an attitude indicator from the rear cockpit was jammed in a 45-degree left wing down, 5-degree nose-down position.

All flight control surfaces were located at the accident site. Flight control continuity could not be confirmed due to the extensive damage to the airplane.

The landing gear lever in both cockpits was in the down position, and damage to both separated main landing gear and the attached nose landing gear was consistent with their being down at the time of impact. The emergency landing gear push button selectors were in the "normal" position.

The airbrakes would have been operated by a throttle-mounted thumb toggle switch. The emergency airbrake selector was found in the "out" position, and the hydraulic hand pump handle was not extended. The left airbrakes were found in the stowed position, and the right airbrakes were found extended about 1 inch.

The "artificial feel" for the hydraulically-assisted aileron was not disengaged.

The flap toggle switch was centered, and the flap position gauges indicated 15 degrees in the front cockpit and 20 degrees in the rear cockpit. The two Fowler-type left wing flap segments were separated from the wing, and the two right wing flap segments were found in the full up position, flush with the wing.

The front cockpit engine rpm gauge indicated 19,200 rpm for the right engine, and 7,500 rpm for the left engine. The rear cockpit gauge indicated about 9,500 rpm for both engines. Neither engine exhibited any catastrophic failures. The left engine, which remained attached to the fuselage, had leading edge nicks to many of the compressor blades, and the spool (shaft) could be rotated freely. The right engine, which only remained attached to the fuselage by a single cable, had little compressor blade edge impact damage, but did display leading edge soil and sand buildups and heavy burnishing. Most of the compressor section exhibited ingestion of a large amount of sand, soil and grass. After removal of most of the debris, the spool (shaft) could be rotated, but with more difficulty as residual debris was still caught between the compressor blades and the engine casing.

MEDICAL AND PATHOLOGICAL INFORMATION

Autopsies were performed on both pilots by the Florida Office of the Medical Examiner, District Nine, Orlando, Florida, with cause of death listed for both as "multiple traumatic injuries."

Toxicological testing was subsequently performed by the FAA Forensic Toxicology Research Team, Oklahoma City, Oklahoma. No anomalies were noted for the pilot/mechanic, while hydrochlorothiazide and salicylamide in blood and urine, and valsartan in blood only, were detected in samples from the pilot/owner.

ADDITIONAL INFORMATION

- Fouga CM 170 Additional Information -

Quoted excerpts from the English version of the "Crew Manual for FOUGA CM 170 Aircraft" issued June 1977, include:

Under "Section I – Description"

1.6.1 - General Description of Hydraulic System

The hydraulic system of the CM 170 is designed to operate the landing gear, brakes, wing flaps, airbrakes, machine gun recocking system and aileron servo-control.

Normal operation: The pressure (250 hpz) is provided by a pump mounted on the accessory gearbox driven by the LH engine.

Emergency operation: The pressure is delivered by a hand pump which is operated by the front cockpit pilot. The only actuations which can be performed with this hand pump are: - landing gear extension, - airbrake operation.

1.6.2 - Landing Gear Actuating System

Normal operation: Actuating the control lever supplies electrical power to a solenoid selector valve. This solenoid selector valve supplies pressure fluid to the three landing gear actuating cylinders and to the main landing gear uplocks.

Emergency operation (extension only): The pressure fluid from the hand pump is fed to the actuating cylinders through the emergency selector valve provided that the latter is set to "EMERG".

1.6.4 - Wing Flap Actuating System

In normal operation: When the pilot operates the control selector switch, this supplies electrical power to either solenoid of the solenoid selector valve which supplies pressure fluid to either chamber of the wing flap actuating cylinder while returning the hydraulic fluid expelled from the other chamber to the reservoir.

(No emergency operation procedures were provided.)

1.6.5 – Airbrake Actuating System

Normal Operation: When the pilot operates the control rocker switch, this supplies electrical power to either solenoid of the solenoid selector valve which supplies pressure fluid to either chamber of the airbrake actuating cylinders while returning the hydraulic fluid expelled from the other chamber to the reservoir.

Emergency Operation: With the emergency selector valve in the "OUT" or "IN" position, pressure fluid from the hand pump is fed through the emergency slide valve to the same system as in normal operation.

Controls: In each cockpit, the normal control rocker switch is on the RH face of the power lever handgrip. The emergency selector valve is on the LH console of the front cockpit. It is a rotary selector switch with three positions: "IN – NORMAL – OUT". When either the "IN" or "OUT" position is selected, the hand pump has to be actuated to operate the airbrakes.

1.6.6 – Aileron Servo Control Actuating System

The servo control is operating when the hydraulic system is pressurized, the servo control circuit breaker is pushed in and the servo control switch is "ON". The servo control is disengaged when either the switch is "OFF" or there is a hydraulic or electrical failure. Piston friction is added to the aerodynamic reactions of the aileron. To avoid excessive control forces, the pilot should disengage the artificial fell unit.

Under "Section IV – Special Cases of Flight"

4.1.2 – Stall in a Turn

In a turn, the stall features a rather sharp rolling movement which is preceded by light buffeting.

Under "Section VI – Operating Troubles, Failures and Associated Emergency Procedures"

6.1.1 – Landing Gear

The landing gear can only be extended on the emergency system. In the case of normal hydraulic system failure, if the accumulator pressure is normal (250 hpz), this is sufficient to extend and lock the landing gear in the down position without using the emergency system. The pressure still available enables two airbrake actuations and twelve brake applications. However, in order to save the braking capacity, it is mandatory to extend the landing gear on the emergency system and to cut the aileron servo-control under the following failure conditions:

- low hydraulic pressure
- LH engine failure
- complete electrical failure

The landing gear is extended as follows:

- Reduce the airspeed below 140 knots…

6.1.9 – Airbrakes

The airbrakes can be extended and retracted on the emergency system. Only a hydraulic system failure with zero pressure in the accumulator makes it necessary to use the emergency system.

- Extend or retract the airbrakes as required by setting 'EMERG. AIR BRAKES' lever to 'IN' or 'OUT'.
- Pump until desired deflection is obtained or until feeling a resistance when extending them completely (7 pump cycles). (In case of emergency extension of the landing gear and airbrakes at the same time, the airbrakes are extended first.)

6.1.10 – Wing Flaps

Wing flaps cannot be operated on [the] emergency system.

6.1.10.3 – Flaps-Up Landing (Same as Landing Pattern with Hydraulic Failure)

- Lengthen downwind leg (30 seconds under zero wind condition from runway threshold.

Subtract 1 second for each knot of headwind component.)
- Fly over runway threshold at 105 knots.
- On ground, if speed seems excessive, shut down engines.

6.1.11 – Ailerons

In case of hydraulic pressure drop, the aileron control becomes automatically direct. In such a case, to reduce undesired control forces:

- Switch servo-control "OFF"
- Disengage artificial feel
- Apply right and left ailerons to engage the locking plungers of the servo-actuators

- Accelerated Stall Information -

According to FAA-H-8083, "Airplane Flying Handbook:"

"At the same gross weight, airplane configuration, and power setting, a given airplane will consistently stall at the same indicated airspeed if no acceleration is involved. The airplane will, however, stall at a higher indicated airspeed when excessive maneuvering loads are imposed by steep turns, pull-ups, or other abrupt changes in its flight path. Stalls entered from such flight situations are called “accelerated maneuver stalls,” a term which has no reference to the airspeeds involved.

Stalls which result from abrupt maneuvers tend to be more rapid, or severe, than the unaccelerated stalls, and because they occur at higher-than-normal airspeeds, and/or may occur at lower than anticipated pitch attitudes, they may be unexpected by an inexperienced pilot. Failure to take immediate steps toward recovery when an accelerated stall occurs may result in a complete loss of flight control, notably, power-on spins."

Pilot Information

Certificate:	Commercial	**Age:**	53,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Front
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 2 Without waivers/limitations	**Last FAA Medical Exam:**	September 9, 2010
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	8300 hours (Total, all aircraft)		

Other flight crew Information

Certificate:	Commercial	**Age:**	61,Male
Airplane Rating(s):	Single-engine land; Single-engine sea; Multi-engine land; Multi-engine sea	**Seat Occupied:**	Rear
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine; Instrument airplane	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	January 9, 2009
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	1500 hours (Total, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	POTEZ-AIR FOUGA	**Registration:**	N415FM
Model/Series:	CM 170 MAGISTER	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Experimental (Special)	**Serial Number:**	415
Landing Gear Type:	Retractable - Tricycle	**Seats:**	2
Date/Type of Last Inspection:		**Certified Max Gross Wt.:**	12499 lbs
Time Since Last Inspection:		**Engines:**	2 Turbo jet
Airframe Total Time:		**Engine Manufacturer:**	TURBOMECA
ELT:		**Engine Model/Series:**	MARBORE IIC
Registered Owner:	On file	**Rated Power:**	880 Lbs thrust
Operator:	On file	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	ISM,80 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	17:39 Local	**Direction from Accident Site:**	240°
Lowest Cloud Condition:	Scattered / 4500 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	3 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	240°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.11 inches Hg	**Temperature/Dew Point:**	25°C / 19°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Kissimmee, FL (ISM)	**Type of Flight Plan Filed:**	None
Destination:	Kissimmee, FL (ISM)	**Type of Clearance:**	VFR
Departure Time:	17:21 Local	**Type of Airspace:**	

Airport Information

Airport:	Kissimmee Gateway Airport ISM	**Runway Surface Type:**	Asphalt
Airport Elevation:	79 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	24	**IFR Approach:**	None
Runway Length/Width:	5001 ft / 150 ft	**VFR Approach/Landing:**	Full stop;Traffic pattern

Wreckage and Impact Information

Crew Injuries:	2 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Fatal	**Latitude, Longitude:**	28.296388,-81.426109

Administrative Information

Investigator In Charge (IIC):	Cox, Paul
Additional Participating Persons:	Robert Hendrickson; FAA/AVP-100; Washington, DC David Sutton; Red Star Aviation Museum, Inc.; Hackettstown, NJ
Original Publish Date:	June 28, 2012
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=78271