

**DATA SUMMARY**

**LOCATION**

Date and time	<b>Tuesday, 8 May 2012; 07:45 UTC<sup>1</sup></b>
Site	<b>Jerez Airport (LEJR) – Jerez de la Frontera (Cádiz, Spain)</b>

**AIRCRAFT**

Registration	<b>EC-IOT</b>
Type and model	<b>PIPER PA-28-161 "Warrior"</b>
Operator	<b>Flight Training Europe (FTE) JEREZ</b>

**Engines**

Type and model	<b>LYCOMING O-320-D3G</b>
Number	<b>1</b>

**CREW**

**Pilot in command**

Age	<b>21 years old</b>
Licence	<b>Student Pilot Authorization</b>
Total flight hours	<b>119.1 h</b>
Flight hours on the type	<b>119.1 h</b>

**INJURIES**

	Fatal	Serious	Minor/None
Crew			<b>1</b>
Passengers			
Third persons			

**DAMAGE**

Aircraft	<b>Minor</b>
Third parties	<b>None</b>

**FLIGHT DATA**

Operation	<b>General aviation – Instruction – Solo</b>
Phase of flight	<b>Parked – Engine test</b>

**REPORT**

Date of approval	<b>28 February 2013</b>
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<sup>1</sup> All times in this report are in UTC unless otherwise specified. To obtain local time, add two hours to UTC time.

## 1. FACTUAL INFORMATION

### 1.1. Description of the event

The student was preparing to do a solo flight. According to his statement, he started the aircraft after completing the fuel priming sequence three times without noting any anomalies, then he headed to an area of the apron to conduct the engine test. During said test the student closed down on the throttle to check the engine idle, in conformance with the "Check idle" item on the corresponding checklist. Just then the engine made a loud noise, stopped and smoke started issuing from the engine. The student called the school's operations department and performed the checks in the associated engine fire checklist. While he was doing this, flames started to issue from the engine cover. An instructor in another aircraft, alerted to the flames by his student, quickly took a fire extinguisher from another aircraft parked nearby and responded to the scene. By the time he arrived, the student had exited the aircraft and the instructor discharged the extinguisher to put out the fire. Once the fire was out, the instructor entered the cockpit and secured the aircraft, placing the master switch in OFF. According to his statement, there was smoke inside and he decided to take the other extinguisher. On exiting the aircraft, the instructor gave the extinguisher to the maintenance mechanic who had just arrived, who discharged it on the reflashing fire.



Figure 1. Aircraft after being taken to the hangar

The student was not injured. The damage to the aircraft was confined to the area of the engine and its fairing. The aircraft was towed to a hangar and kept there for a subsequent inspection.

## **1.2. Personnel information**

The student, a 21-year old Jordanian national, had a student airplane pilot permit and a class 2 medical certificate, both of them valid and in force. He had a total of 119 hours 6 minutes of flight experience, all on the type.

## **1.3. Aircraft information**

The aircraft, a Piper PA-28-161 Warrior, serial number 2816046, is a single-engine (Lycoming O-320-D3G S/N RL-18641-39A), three-blade propeller, low-wing, fixed bicycle gear design. It had an airworthiness certificate and registration and aircraft station certificates, all of them valid and in force. The aircraft had 7,063:30 total hours and the engine 886 hours. The last flight had been a local LEJR-LEJR flight and had taken place on 3 May 2012. The last inspection of the aircraft (a 50-hr check) had been conducted the day before the incident (07/05/2012), and had revealed nothing unusual, according to the records of the school's maintenance center.

## **1.4. Inspection of the aircraft after the incident**

A visual inspection immediately after the incident revealed that the battery switch was ON, the fuel pump was ON, the right fuel tank was selected, the beacon was on, the throttle closed, the mixture was cutoff (ICO) and the aircraft was properly parked on the T-bar. The student later confirmed that the carburetor heat was not on. According to his statement, the student had primed the engine three times before starting it and it worked correctly until he placed it in idle.

The inspection conducted after the event in the hangar revealed that the hot air intake to the carburetor (from the exhaust pipes) was broken and showed signs of having been subjected to high temperatures. The bottom part of the engine fairing had also been affected by high temperatures. The fuel pipes were checked, along with the area housing the carburetor, but no evidence was found of a loss of fuel or a leak. The fire seemed to have started in the bend in the hot air intake from the exhaust pipes.

The Maintenance Center drafted an engineering report with its final analysis of the associated components and concluded that the incident had not occurred as a result of a component failure. The detailed inspection after the incident did not uncover any fuel component fracture that could have contributed to starting the fire.

The inspection and verification of the aircraft and the study of the Operations Department reports indicated that the fire had most likely started as a result of fuel build-up in the exhaust area, probably due to using the carburetor accelerator pump (fuel pump) to try to start the engine when it was very possibly flooded. It was noted that during each actuation, the fuel pump released about 2cc of fuel, which ended up falling on the lower engine fairing, which showed signs of fuel accumulation.

**1.5. Engine start checklists**

The engine start checklists written by the School and given to the students specify the following:

<b>Engine Start Checks</b>	
Anti-Collision Lights .....	On
Fuel Pump .....	On
Prime.....	As Required
Throttle .....	Exercise & Set
Lookout .....	Area Clear
Starter .....	Operate/Check Light
<i>After start</i>	
Starter Light.....	Out
Throttle .....	1200 RPM
Oil Pressure .....	25 PSI Minimum
Alternator .....	On
Fuel Pump .....	Off
Magnetos.....	Dead Cut Check

As part of the lists the fuel pump is turned on and primed as required. The typical practice at this school is to prime the fuel three times using the throttle lever (though this is not reflected in the checklist).

In contrast, the manufacturer’s checklists consider several possibilities for starting the engine, which include hot and cold priming:

**BEFORE STARTING ENGINE**

- Brakes ..... set
- Carburetor heat ..... full OFF
- Fuel selector ..... desired tank
- Radios ..... OFF

**STARTING ENGINE WHEN COLD**

- Throttle ..... 1/4" open
- Master switch ..... ON
- Electric fuel pump ..... ON
- Mixture ..... full RICH
- Starter ..... engage
- Throttle ..... adjust
- Oil pressure ..... check

If engines does not start within 10 sec., prime and repeat starting procedure.

**STARTING ENGINE WHEN HOT**

- Throttle ..... 1/2" open
- Master switch ..... ON
- Electric fuel pump ..... ON
- Mixture ..... full RICH
- Starter ..... engage

The school was asked about explicitly adding the priming item to its checklists, since the manufacturer made no such reference. The school reported that the aircraft had previously been used at a flight school in Scotland and, after checking with that school’s flight safety office, it was concluded that the checklists had been modified as a result of the cold temperatures there, which always made it necessary to prime the engine before starting it. These lists had not been adapted to reflect the temperatures in Spain after the airplane was taken to Jerez.

**1.6. Aerodrome information**

The Jerez Airport is located within the city limits of Jerez de la Frontera, 8 kilometers northeast of the city proper. Its ARP is at an elevation of 93 ft (28 m).

The airport has one 2,300-m long, 45-m wide asphalt runway in a 02/20 orientation.

The school’s aircraft park at point 1 and engine tests are normally conducted at point 2 (see Figure 2).





Figure 2. Route taken by the aircraft to conduct the engine test

## 2. ANALYSIS AND CONCLUSIONS

The student was going to conduct a solo flight. He had a valid and in force license and medical certificate and 119 hours of experience on the aircraft type. He started the engine as per the instructions provided by the school in its corresponding checklists, which require turning the fuel pump on and then priming the engine as needed, typically (as per the expanded checklists) three times, by advancing the throttles. The fuel pump is then turned off (see Section 1.5).

The student started the engine and taxied to the area of the apron where engine tests are usually run. While performing the “check idle” checklist item, the engine made a loud noise and stopped. Smoke, and then flames, started issuing from the engine. The student carried out the engine fire procedure. A subsequent inspection revealed that the fuel pump was on.

The procedure envisaged in the manufacturer’s manuals considers various engine start scenarios, including cold and hot starts. In the case of a cold start, the engine is not primed unless it fails to start in the first ten seconds, in which case it must be primed (the number of times is not specified, though presumably it is only one) and the start procedure repeated.

Due to the differences between the manufacturer's checklists and those provided by the school, the latter was asked about the reason for explicitly adding the priming requirement in its checklists, something that was missing from the manufacturer's. The school told investigators that the aircraft had previously been used at a flight school in Scotland. Further checking revealed that the checklists had been modified as a result of the cold temperatures there, which made it impossible to start the engine without priming it first. These lists had not been adapted to reflect the temperatures in Spain after being taken to Jerez. That is why the school drafted a modification to the expanded checklists to adapt them once more to the manufacturer's, though the "Prime: As required" item was kept in the normal checklists, along with a flight crew notice (see Appendix A) on the conditions in which to perform this step. The school committed to revising all of the expanded checklists and incorporating them in the Operations Manual.

The incident is considered to have occurred due to excessive priming of the engine and to the possible operation of the fuel pump during the engine test, which resulted in the excess fuel contacting a hot spot and igniting the fire.

The investigation revealed that the excess priming of the engine before starting was a common practice among the school's students, since the checklists required this step. It was noted that the manufacturer's checklists did not by default recommend priming the engine, and that the operator's checklists had been modified as a result of the aircraft's previous operating environment (colder temperatures), modifications that had not been considered when the airplane was transferred to Spain.

No safety considerations are warranted since the operator was in the process of modifying the expanded checklists to conform to the manufacturer's in terms of priming the engine before start.





## **APPENDIX A**

### **Flight Crew Notice**



**Flight Crew Notice No. 91  
Warrior Starting Procedures**

A discrepancy exists within the FTE Operations Manual version of the PA28 (Warrior) checklist and the aircraft's Pilot Operating Handbook (POH).

The discrepancy lies with the expanded checklist on page W-13 of the Operations manual which currently states:

**Prime..... As Required**  
 If engine is hot,(oil temperature in the green arc) priming is not required.  
 If engine is cold, unlock primer, prime 3-6 full strokes, lock primer.

The POH states, on page 4-6:

**"If engine does not start within 10 sec., prime and repeat starting procedure."**

and on page 4-15:

**"If the engine does not fire within five to ten second, dis engage the starter, prime the engine and repeat the starting procedure."**

There is no mention of priming dependant on engine oil temperature. Nor is there any suggestion to prime for the first start attempt.

Therefore, with immediate effect, the expanded checklist is to be changed to:

**Prime..... As Required**  
 Initial attempt to start, no prime.  
 Subsequent start attempt(s), prime 3-6 full strokes, lock primer.

Later, on the same page of the expanded checklist (W13) it states in a note that "Maximum cranking time is 30 seconds." This note should be amended to also comply with the POH to read "Maximum cranking time is 10 seconds.

The checklist cards do not need to be amended as the response "as required" to priming can be "not required for the first start attempt" or "prime 3-6 times for subsequent start attempts."

A handwritten signature in black ink, appearing to read 'Charles Auty', is written over a faint circular stamp or watermark.

Charles Auty (CFI, FTE Jerez)