ACCIDENT

Aircraft Type and Registration:	Cessna 510 Citation Mustang, OE-FHK	
No & Type of Engines:	2 PW 615F turbofan engines	
Year of Manufacture:	2010 (Serial no: 510-0315)	
Date & Time (UTC):	15 June 2017 at 1128 hrs	
Location:	London Biggin Hill Airport	
Type of Flight:	Training	
Persons on Board:	Crew - 2	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Leading edge of left wing and forward fuselage dented, and cabin access door hinge distorted	
Commander's Licence:	Air Transport Pilot's Licence	
Commander's Age:	50 years	
Commander's Flying Experience:	2,658 hours (of which 450 were on type) Last 90 days - 81 hours Last 28 days - 37 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot and enquiries made by the AAIB	

Synopsis

The aircraft rolled forward from its parked position and struck a fuel bowser when the chocks were removed without hydraulic pressure in the brake system.

History of the flight

At the end of its previous flight the aircraft was parked and shut down before being towed to a second parking position. Approximately 20 minutes later, ground personnel towed the aircraft to a third parking position. The wheels were chocked with the parking brake OFF when the flight crew attended the aircraft in readiness for a local flight. The purpose of the flight was to achieve a series of takeoffs and landings and for the commander, a Type Rating Examiner, to complete the co-pilot's type rating training. All the co-pilot's previous type rating training had been achieved using a flight simulator.

After the aircraft had been refuelled, the fuel bowser was reversed away and the commander believed it was moving clear but it stopped, approximately two metres in front of the aircraft, while the driver waited for other aircraft to move. Before the crew began their flight deck checks, the commander realised there were no ground personnel immediately available so he went outside to remove the wheel chocks. He stood to the left of the aircraft, which was parked on a slight slope, and signalled to the co-pilot to set the aircraft's parking brake. The co-pilot pressed the brake pedals and pulled the parking

brake handle before indicating, using a thumbs-up signal, that he had done what was requested.

The commander removed the wheel chocks and moved away, to place the chocks on the ground clear of the aircraft. When he turned back he saw the aircraft was rolling towards the fuel bowser and called to the co-pilot to apply the brake. He could see the co-pilot was trying to apply the brake but the aircraft did not stop until it hit the fuel bowser (Figure 1). As the cabin door had been forced closed, the co-pilot, who was un-injured, could not leave the aircraft until the fuel bowser had moved away and the aircraft was secured.

Figure 1

OE-FHK after colliding with the fuel bowser

Brake system

A description of the brake system is included in the Pilot Training Manual (PTM) provided by the aircraft operator. This manual stated that the landing gear and normal brakes are powered by a hydraulic system which is pressurised by an electric pump and that an accumulator stores a supply of pressurised fluid. It continued by stating:

> *'During pump inactivity this pressurised fluid maintains pressure against normal internal leakage within the system.'*

There was no guidance regarding the length of time the accumulator might maintain pressure for, or how many applications of the brakes might be possible without the pump running.

The PTM stated that '*the parking brakes are a locked configuration*' of the brake system. By pulling the parking brake handle (situated to the left of the central pedestal), to the PARK position, while pressing on the brake pedals, the pilot will mechanically actuate non-return valves which are designed to trap hydraulic pressure in the mainwheel brakes.

A handle situated on the left side of the flight deck controls the emergency brake system. When the handle is pulled, pressurised nitrogen from a dedicated storage bottle actuates the mainwheel brakes pneumatically.

The electric hydraulic pump is turned on when the battery controller switch is moved to the BATT position but the trainee co-pilot stated that he had not been instructed to ensure this was done before applying the parking brake. The normal brake system functioned correctly when it was checked after the accident.

The commander was surprised to discover after the accident that it is not unusual for the hydraulic system pressure to dissipate within 30 minutes of electric power being disconnected. He had anticipated that there would be pressure available to actuate the brakes without turning on the battery.

The co-pilot had not appreciated that, without electric power, there would be a limited number of brake applications available. He had no previous experience using a pressurised brake system and was not aware of a requirement to complete any checklists before attempting to set the parking brake.

Aircraft operator's procedures

The aircraft operator's Standard Operating Procedures (SOPs) were specified in its Operations Manual (OM) and included an abbreviated checklist for use on the flight deck. The checks that were relevant to this flight were titled '*Quick Turnaround*' and '*Before Starting Engines*' and these were to be conducted using 'challenge and response'; the co-pilot being permitted to read the challenge, check the item and make the response if necessary. In certain circumstances the co-pilot was also allowed to start the right engine while the commander escorted any passengers to the aircraft.

In the '*Quick Turnaround*' checklist, the sixth check was to set the battery switch to BATT while in the '*Before Starting Engines*' checklist, the second check was to ensure the battery was turned on and the voltage correct. The fourth of the seven checks before engine start was written as '*Wheel Chocks / Parking Brakes…Removed/On*'.

Elsewhere in the OM the normal '*Cockpit Preparation*' procedures were listed in an expanded format. Item 10 instructed setting the battery switch to BATT and item 10 instructed setting the parking brake with a note which stated:

> *'Parking brakes are a locked configuration of the brakes. Brakes are locked when the parking brake valve traps hydraulic fluid in the brake lines. The valve can only be set by pulling on the PARKING BRAKE knob on the right lower side of the pilot instrument panel while pressing on the brake pedals or by setting the parking brake and pressing the brakes 2 or 3 times.'*

The aircraft operator stated its normal procedure was for ground personnel to remove the chocks at the appropriate stage during the '*Before Starting Engines*' checklist. However, in '*exceptional*' circumstances, with no ground personnel available, it was acceptable for the flight crew to remove the wheel chocks, provided the checklist was still followed. There was no mention of this latter procedure in the OM.

Safety actions

Following this accident the aircraft operator took the following Safety Actions;

A '*Safety Bulletin*' to flight crew was circulated which stated that the parking brake is only to be set with the battery switch in the BATT position and that the appropriate checklists are always to be followed. This notice also warns crew not to remove chocks if there are obstacles such as a fuel bowser nearby and states that trainee pilots are always to be accompanied by an experienced crew member while operating the aircraft.

The SOPs were modified and additional guidance on operation of the parking brake and the use of wheel chocks was placed in the OM.

Pilot training was revised to try to ensure a comprehensive understanding of the hydraulic system and the aircraft brakes.