Extracts from DDAAFS Safety Magazine
"SIFTING THROUGH THE EVIDENCE"

24 August 1979 (F-111C A8-137) – 4th F-111 accident – aborted take-off and ejection Ohakea airbase

During an aborted take-off above refusal speed[1] following a double engine surge and afterburner blowout (caused by ingestion of surface water excited by the aircraft's nosewheels) the aircraft was unable to be stopped within the remaining runway. The navigator initiated ejection at 90 kts and approximately 150 ft from the end of the runway. The aircraft continued down the slope beyond the runway (a drop of 100 ft only 30 ft from the end of the runway) where it impacted a roadway embankment and caught fire. The ejection was successful, however, the pilot suffered considerable back injuries.

The incident crew were Number 3 of a day four-ship F-111 maritime strike mission operating from RNZAF Ohakea airbase, taking part in an Australian/New Zealand Exercise.

Crew

Pilot: Cat D – 1602 hrs total time / 139 hrs F-111; current[2]

Navigator: Cat A – 4172 total time / 1401 hrs F-111; current

Abort above refusal speed – aircraft A8-137

[1] F-111 refusal speed is the maximum speed that can be attained by accelerating with both engines at maximum afterburner and still stop on the remaining runway should the take-off be aborted. Decision speed – the speed at which the pilot commits to the take-off – is rotation speed or refusal speed, whichever is lower.

[2] While the pilot had sufficient currency – he had flown 34 hrs in the last 30 days – his experience was limited. He had only graduated from F-111 Conversion Course approximately 2.5 months earlier where aircraft & simulator unserviceabilities had severely affected the course's progress with regard to continuity of training, achievement of day/night automatic terrain following flight & maritime strike qualifications, and had reduced flying training hours and hence F-111C experience.

Accident summary

The profile of the 7000 ft long WWII vintage runway (RWY 27) at Ohakea that the formation was using is atypical as the centreline is not the highest point. Both sides of the runway slope towards the centre of the southern side of the runway where a slot drain[3] is installed along its length. The runway's irregular longitudinal profile can also cause significant rainwater pooling, particularly along the centre of the southern half of the runway. Around the time of the accident, the runways were often rigged with Type 34-B RAG (Runway Arrestor Gear) hookcables for RNZAF A-4 SKYHAWK operations, however the F-111 squadron Commanding Officer had directed that crews were not to consider the cable on take-off, owing to its incompatibility with F-111C aircraft at normal take-off weights. Weather at the time of the incident was prevailing rain, with a temperature of 11° C.

The incident pilot lined up the aircraft on the left side of the runway and behind the formation lead for the stream take-off. Both crewmembers did not notice the pooled rainwater on the runway and were unaware of existence of the slot drain, however the incident pilot did note the considerable spray that the lead aircraft generated during take-off. Following brakes release, the incident pilot kept the aircraft on the left side of the runway (the pilot stated he was unfamiliar with the procedure of closing to the centreline during a stream take-off) which resulted in the aircraft tracking through pools of water that were up to 25mm deep.

Aircraft performance was normal through the briefed 105 kt refusal speed (which was based on a wet runway and no cable) and 120 knot acceleration time check.[4] Passing 130 knots, (2100 ft after brakes release and with only 4700 ft of runway remaining), the crew heard a bang, the navigator observed the engine nozzle indications closing (indicating a loss of afterburner), and both crew members sensed a marked loss of thrust. (Some of the witnesses, of which there were over 100, observed spray, a fireball and smoke around the rear of the aircraft.) The navigator communicated the loss of afterburners to the pilot [neither crewmember checked the exhaust pressure ratio (EPR) gauge that would have indicated whether the engines were still producing thrust] at which time the pilot unsuccessfully attempted to relight the afterburners by cycling the throttles back to military power and then into afterburner. About 3800–4000 ft to go, the pilot decided to abort because he felt there was insufficient thrust and runway to continue. The attempted abort, 25 knots above refusal speed and in hydroplaning conditions (without a suitable cable[5]), was futile.[6] Reliant on the departure end Type 34B RAG to assist the abort, on passing 1100 ft to go, the crew

[3] The original WWII runway was widened (and lengthened) to accommodate larger aircraft, however the slot-drain that was on the southern edge of the runway was not repositioned and as a result is now located in the middle of the southern side of the runway.

[4] While immaterial to the outcome given the engine problems occurred above refusal speed, the crew should have used an acceleration time check below the briefed refusal speed. For F-111 takeoffs (TF30-P-103 engines fitted), the acceleration time check was used to validate thrust. If the check failed (speed not within 10 kts) then the take-off was to be aborted. The 120 kt check speed was therefore of no value given the 105 kt refusal speed – the F-111 Performance Manual stated that the check speed should be chosen to be less than continuation and refusal speeds to allow a valid decision. *(Author's note – F-111 crews no longer use acceleration time checks and simply prove engine thrust prior to brakes release using EPR gauge indications, as the F-111C is now fitted with the more powerful TF30-P-109 engines and F-111G aircraft are fitted with TF30-P-108 engines).*

[5] A warning in the F-111 Performance Manual at the time stated that if hydroplaning conditions exist, runway condition reading corrections (RCR corrections help provide an indication of aircraft braking effectiveness) are no longer valid and the crew should be prepared for a departure end barrier engagement. The F-111 dynamic hydroplaning speed is 115 kts (i.e. 9√165 psi).

[6] The pilot also did not initiate maximum effort braking techniques immediately, despite being below maximum braking speed. Moderate braking was initially used followed by maximum braking.

realised that the hookcable was not rigged [it had been removed prior to the F-111s' take-off so that the RNZAF A-4s did not have to land beyond a rigged hookcable during their ground controlled approaches (GCAs) to RWY 09]. With 800 ft of runway remaining, the navigator realised that ejection was the only chance of survival and informed the pilot. With the pilot still attempting to stop the aircraft, the navigator initiated ejection about 150 ft from the end of the runway. The crew module separated as the nosewheel left the pavement at the end of RWY 27. The aircraft continued down the 100 ft drop-off, impacted a roadway embankment and caught fire before sliding to a halt, some 100 ft below and 500 ft from the departure end of RWY 27. The ejection module landed approximately 145 ft from the burning wreckage. Fearing the fire may spread towards the module, the navigator extracted and carried the injured pilot from the module.

Board findings

The Board made the following findings:

1. The primary cause of the accident was selection of the least prudent take-off track.

2. Contributing factors included:

    a. The lack of chined[7] nosewheel tyres caused surface water excited by the passage of the nosewheels to be ingested by the engines causing the engine surge and afterburner blowout. (The modification to fit chined tyres had been suspended owing to problems experienced by the USAF).[8]

    b. Failure of the crew to diagnose complete engine condition following the afterburner blowouts (no check of EPR gauge readout).

    c. Delaying ejection decision by deciding to abort some 25 knots above briefed refusal speed.

    d. Lack of a compatible aircraft arresting system.

    e. Pilot's failure to adopt the ejection posture prior to ejection.

3. The F-111C flight manual (and checklist) was deficient as it did not address the matter of double engine failures during take-off.

4. The 82 Wing F-111C Standard Operating Procedures (SOPs) were deficient as tracking of individual aircraft during the take-off roll for formation take-offs was not addressed.

[7] Chined tyres have a protruding lip around the sidewall of the tyre to deflect the displaced surface water sideward rather than its normal upwards travel towards the engine intakes.

[8] Corporate knowledge learnt from previous USAF trails regarding the dangers of water ingestion on F-111 engine performance was not retained at the RAAF operator level at the time of the accident. However, the F-111 Flight Manual did contain a warning stating that engine stalls may be caused by water ingestion if take-off is attempted with excessive water or slush on the runway.

Board recommendations

Board recommendations included:

1. F-111 flight manual (and checklist) be amended to incorporate emergency procedures for double engine failures during take-off (abort if below refusal speed; eject if above refusal speed).

2. Consideration be given to the method and frequency of testing boldface emergency procedures.

3. The F-111C mission simulator be used more often to practice boldface emergency actions and immediate ejections.

4. Rebriefing crews on crew coordination concerning comparison of groundspeed versus distance to go during landings and aborted take-offs.

5. Rebriefing crews on the correct techniques for identifying and analysing engine malfunctions.

6. If pilots without a fighter background are selected for manning the F-111 force, then these pilots complete a full fighter introductory course (FIC) at 2 Operational Conversion Unit (2OCU).[9]

7. Priority be given to the purchase and fitment of a suitable chined nosewheel tyre for all RAAF F-111C aircraft.

Air Command comments

The Air Commander (ACAUST) disagreed with the BOI and concluded that the primary cause of the accident was a double engine failure on take-off at a position from which a successful abort could not be accomplished. He stated that the major reason why this situation arose was because the RAAF had accepted F-111 operations on runways without hook cables, which as demonstrated by this accident, extended to operating from short runways in very wet conditions.

ACAUST recommendations included:

1. RAAF F-111 aircraft not be operated in circumstances where a successful aborted take-off cannot be accomplished.

2. RAAF F-111 aircraft not be operated from wet runways unless hook-cables are available.

Changes attributable to this accident

Changes to F-111 procedures and aircraft modifications that were more than likely influenced by this accident are as follows:

1. The introduction of chined nosewheels.

[9] Such a requirement was not previously considered as F-111 manning had historically come from Mirage or Canberra backgrounds. The incident pilot (as was another pilot on his F-111 Conversion Course – lead for the incident mission) was posted to Caribou's from pilot's course before later being posted to F-111s.

2. Requirement for aircrew selected for F-111 conversion that are of non-fighter background to first complete Introductory Fighter Course training.

3. Incorporation of emergency procedures for double engine failure on take-off.

4. The introduction of a Student Air Training Guide (SATG) requirement to close on the centreline by rotation.

5. The development of 82WG SI wet runway limitations which:

   a. prohibits operations where total dynamic hydroplaning is possible;

   b. prohibits departures from runways where pooled water is visible (and cannot be avoided) if a departure end cable is not available; and

   c. assuming that total dynamic hydroplaning and pooled water does not exist, allows a take-off without a cable only if V_{CONT} is less than V_{REF}.

Crew module proximity to crash site – aircraft A8-137