

Extracts from DDAAFS Safety Magazine “SIFTING THROUGH THE EVIDENCE”

2 April 1987 (F-111C A8-128) – 6th F-111 accident – ground impact near Tenterfield

Overview

During the recovery from a night climb auto¹ weapon delivery profile against a simulated landstrike target near Tenterfield, NSW, the aircraft was observed to over-bank and commence a descent of approximately 10 degrees. The descent continued with decreasing bank angle until just prior to impact when the aircraft commenced an Auto TF fly-up. The aircraft impacted the ground with considerable downwards velocity; with a 5° nose up attitude, slightly right wing low and 3.5–3.7G applied. Aircraft break-up was extensive, with wreckage spread up to 1300 metres downrange. Both crew members were fatally injured.

The sortie was the Final Handling Test (FHT) for the student navigator prior to completing F-111C Conversion Course. It was the first F-111 FHT conducted by the pilot since his F-111C Qualified Flying Instructor (QFI) conversion.

Crew

Pilot: Cat C F-111C QFI – 1776 hrs total time / 873 hrs F-111; current

Navigator: CAT U – 2441 hrs total time / 47.9 hrs F-111; (F-111 Conversion Course student)

Accident summary

The incident crew departed East Sale, Victoria prior to nightfall to lead a two-ship F-111 formation public relations photo shoot (conducted by a chase aircraft) before separating for an 8 nm radar trail night sortie back to Amberley. Prior to the brief, both QFIs had decided (and were authorised) to simulate ‘dying’ on Evans Head air weapons range to assess the student navigators’ reaction to the situation.²

The aircraft took off as planned, completed the photo shoot, separated to 8 nm trail and had completed the first planned sortie attack (climb auto tactic) successfully before proceeding on to the second attack at Tenterfield. The weather was fine, however, the evening was dark with limited moonlight.

The incident aircraft ingressed the target at 200 ft SCP on Auto TF at speeds varying between 480–540 kts and utilising available terrain for terrain shielding (to minimise

¹ The climb auto profile was used for simulated low drag weapon releases, with the tactic enabling the aircraft to remain outside the weapon fragmentation envelope. At 15 seconds prior to the computed bomb release, the pilot overrides the TFR and pulls to 10° nose up, follows the command steering bars (which react to the navigator’s radar update on the target), and at one second after bomb release indications (illumination of the bomb release light) and when above manoeuvre safety height, a 3G turn through 50° (or to egress heading whichever occurs first) is initiated. The aircraft is then established wings level with a 5° nose down pitch attitude, and, after the TFR fail lights have extinguished and the navigator confirms forward terrain radar video, the pilot releases the autopilot release lever and the aircraft automatically descends to the selected TFR SCP.

² The usual inflight diversion used by Training Flight instructors to further test the students on their FHT was not possible due to insufficient fuel remaining (following the planned photo shoot) for such a diversion.

exposure to simulated enemy defences). Following indicated simulated weapons release, for an unknown reason, the aircraft continued on attack heading for about four seconds longer than normal before turning to egress heading. The aircraft did not achieve wings level above manoeuvre safety height (4000 ft AMSL) and in the latter stages of the turn, the aircraft over-banked and commenced a 10° descent. At some stage one of the crew (probably the pilot) set 400 ft SCP on the TFR panel and 325 ft on the radar altimeter. Between 2.5–3 seconds before ground impact, the aircraft commenced an Auto TF fly-up. The aircraft impacted the ground at 2800 ft AMSL.



Ground impact scar – aircraft A8-128

Board findings

The Board made the following findings:

1. The primary cause of the accident could not be determined.
2. The most probable cause of the accident was that the crew lost situational awareness with respect to altitude during a critical flight manoeuvre. Possible contributory causes of their loss of situational awareness included:
 - a. misreading the altimeter;³
 - b. distraction of the crew from the primary task;
 - c. lack of any external visual cues;
 - d. G-loss of consciousness (G-LOC);
 - e. pilot psychological profile (considerable personal life stressors – potential for decreases in performance/vigilance due to subjective fatigue); and/or
 - f. visual impairment or partial incapacitation of the pilot (due pre-existing chronic heart condition revealed at autopsy).
3. The crew were not manually controlling the aircraft at the time of the impact and no ejection was attempted.

³ During flight profile reconstruction sorties, one of the pilots twice misread the F-111 tape system altimeter during the post-weapon release manoeuvre, mistaking the actual altimeter reading of 4800 ft AMSL as 5800 ft AMSL. A natural reaction to this misread would be to over-bank and establish a nose-low attitude to minimise exposure to possible (simulated) enemy defences. Once the bank angle was reduced through 45°, the TFR fail lights would extinguish as planned, and the navigator's attack radar video would return. The pilot would therefore assume that the TFR would automatically descend the aircraft back to low level (once the autopilot release lever was released) but with the aircraft too close to the ground (due to the misreading of altitude) the aircraft would commence an automatic TFR fly-up (at 68% penetration of the selected TFR SCP). The standard procedure is for the pilot not to take over during a fly-up. Under these parameters, the time between fly-up initiation to ground impact would have been less than three seconds, providing the pilot little time to perceive, analyse and react to the situation.

The following factors also emerged during the investigation:

1. **Standardisation.** A lack of standardisation between crews was evident in several areas:
 - a. The acceptable nose down attitude for the post-attack escape manoeuvre for the climb auto tactic was briefed as 5°, but was not stressed as a maximum (some crews actually used 10° nose down). *(Author's note – This is a flawed procedure anyway as a check for correct climb/dive response of the TFR system at the beginning of the descent cannot be accomplished as the aircraft is already in a dive when Auto TF flight is recommenced.)*
 - b. Variation of pilot scan priorities during TF letdown (some concentrated almost wholly on the ADI, to the exclusion of the TFR E-scope or altimeters – significant ground echo penetration of the Zero Clearance Line on the E-scope would have been displayed during the incident aircraft's post egress descent).
2. **Lack of official sanction for climb auto tactic.** The Board was unable to find any official sanction for the climb auto tactic and, following interviews with a large number of F-111 crews, it was evident that there was a variety in techniques in flying the tactic. It was also apparent that there was a poor appreciation of both TFR system capability and crew monitoring procedures during TF descents. Of particular concern was the adopted procedure of descending straight back to a low SCP setting, even though the flight manual and conversion course student notes advised using an initial 1000 ft SCP. Such a practice also reduced the possibility of the TF system's automatic 68% TF fail protection being able to save the aircraft in many circumstances.
3. **Climb auto tactic out of context and unnecessarily hazardous.** The tactic was recognised as being not operationally significant, yet its execution was much more demanding than the tactics used by the operational F-111 squadron (1SQN tactics were focused on laser guided bomb employment using the F-111C Pave Tack targeting system). It was noted that 90% of the weapon delivery tactics flown on the F-111 Conversion Course were climb autos.
4. **Lack of liaison between F-111 squadrons.** The lack of liaison between the squadrons precluded 6SQN Training Flight from updating the training procedures to optimise student experience for the operational techniques at 1SQN. Similarly, the lack of feedback on graduate performance at 1SQN left an open loop in the training cycle.
5. **High workload of Training Flight.** Training Flight workload was compounded by the shortage of QFIs, resulting in a high workload for the remaining instructors. (As an example, the workload precluded Training Flight from updating the course material in time for the next conversion course that would include new systems – Pave Tack.)

6. **Supervision.** Training Flight Commander (TFC) supervision was compromised with the need for the TFC to contribute significantly to course instructional flying due to a shortage of QFIs (high loss rate to airlines). As a result, some TFC directives were not being followed, namely:
 - a. requirement to 'bug' manoeuvre safety height on the altimeter command bar (the incident pilot had not – it was set to the leg safety height of 6000 ft AMSL); and
 - b. noise considerations for the target area dictated a climb auto weapon delivery profile (one crew had planned a level attack).
7. **FHT complexity.** The incident pilot did not seem to share the TFC's view that the FHT was to be 'low key – an ordinary trip'. (The incident pilot had thought up the idea of testing the student navigator by 'dying' on the range and the delay in pull-up for the climb auto tactic may have been to compress the time available for the student to locate the target on radar.)
8. **Route surveys.** Authorisation to fly at 200 ft SCP seemed to be based on the AGL altitude that the radar prediction for the target had been drawn for (a 200 ft prediction implying a 200 ft route survey had been conducted). There was no record kept of when the routes were surveyed and who had conducted the survey. The Board could not find any guidance or instructions in relation to the method of surveying, the recording of survey results or a requirement for a periodic re-survey. (At the time masts up to 199 ft high were not printed on the types of maps that were used by the squadrons.)
9. **TFR letdowns.** For at least 3.5 years, F-111 crews had descended to ingress SCP after a simulated attack. The extant flight manual recommended an initial level altitude of 1000 ft, then step down. USAF F-111 procedures were in accordance with the flight manual. Regardless, evidence pointed to the incident pilot using a 200 ft SCP ingress and then re-selecting 400 ft SCP during the recovery. While non-standard, and a possible distraction to task priority, the Board noted that it indicated caution on the pilot's part with respect to TF descent straight down to 200 ft AGL in an aircraft with a history of flying low on SCP.
10. **Safety height calculation.** The two F-111 squadrons used different methodologies for calculating target area manoeuvring safety heights. Additionally, the students flying the incident mission had calculated safety heights individually, and results varied from 4000 to 4900 ft AMSL.
11. **Differences between TFR warnings and cautions in F-111C flight manual vice USAF F-111A flight manual.** The RAAF F-111C flight manual lacked some of the warnings and cautions relating to TFR operations that were contained in the USAF F-111 flight manual. One warning that was omitted described a potentially dangerous situation where video returns of approaching terrain could be insufficient for TF forward-looker computation yet preclude LARA (low altitude radar altimeter) over-ride operation. (Aircraft manufacturer representatives at the time stressed that the key to safe night or IMC low level TF is crew vigilance and cross checking of all available information.)

12. **Requirement to wear anti-G suits.** There was no policy or requirement for F-111 crews to wear anti-G suits (the incident crew were not wearing anti-G suits).
13. **Crew aide-memoirs.** The Board found it 'disturbing' that the Conversion Course students were encouraged to develop their own aide-memoirs (handwritten versions of selected checklist sections). The Board noted that this practice had many possible adverse implications in checklist currency and in the worst case, flight safety.

Board recommendations

Board recommendations included:

1. Review the F-111 operational role and training requirement to ensure tactics development is supported within the squadrons by specialist training and adequate supervision.
2. Review current tactics and profiles to ensure that they are a realistic compromise between operational requirements and flight safety.
3. Ensure F-111 Conversion Course training is conducted in accordance with the approved syllabus. *(Author's note - The Board noted that 13 targets were flown at 200 ft SCP vice five on the approved syllabus, and therefore did not provide a building block approach to learning.)*
4. Establish procedures that ensure that F-111 conversion training is relevant to Strike Reconnaissance Group (SRG) requirements and that feedback on recent graduates is provided to 6SQN Training Flight.
5. Review capability of 6SQN Training Flight to adequately perform its present level of tasking in view of the declining experience levels.
6. Establish guidance and instructions for performance, recording and review of route surveys for 200 ft SCP TFR flight.
7. Assess the requirement for marking of obstructions on maps for F-111 operations.
8. Re-evaluate the decision not to adopt USAF series trim tie-in checks into F-111C TF Ground Operational Checks.⁴

⁴ These checks were adopted by the USAF in 1983 following two fatal accidents. (There was concern at the time of the RAAF investigation about series trim tie in of the incident aircraft.)

9. Evaluate F-111C/USAF flight manual differences for F-111C flight manual amendment action.
10. Review the current policy on wearing of anti-G suits.⁵
11. Review the present practice of F-111 aircrew taking the Weapons Systems Performance Document (WSPD⁶) document on land away exercises (the WSPD for the incident aircraft was destroyed in the accident).

Air Command comments

The Air Commander at the time made the following comments.

1. There was a need for the introduction of a stress management education program.
(Author's note – This comment regards the lack of supervisor awareness of the incident pilot's high stress levels.)
2. Preservation of assets must take precedence over realism of operational training – the ADF cannot afford training programs which unduly risk aircraft and crews. Balance is needed between peacetime training limitations versus the wish to strive for realistic operational training (particularly given the current strategic outlook).
(Author's note - The general consensus amongst F-111 crews revealed during the Inquiry regarding descent straight to 200 ft SCP was that the 'aircraft should be able to hack it' and 'it is the way we would go to war'.)

Changes attributable to this accident

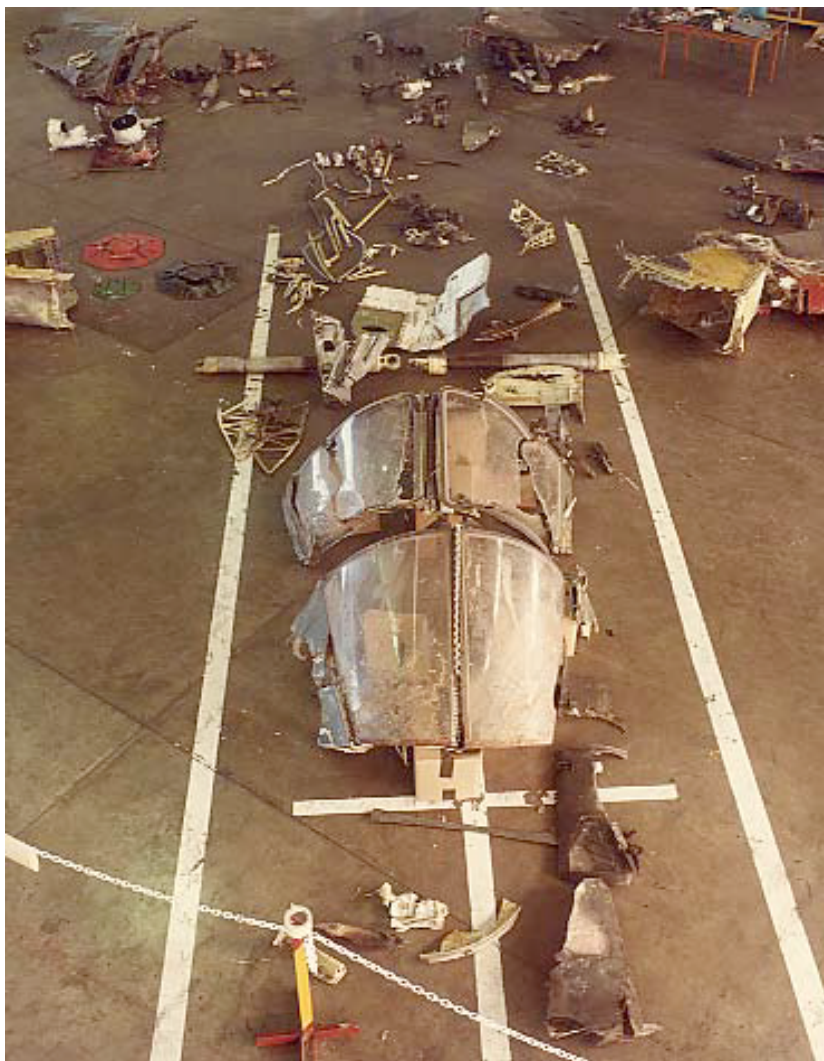
Changes to F-111 procedures and aircraft modifications that were more than likely influenced by this accident are as follows:

1. The climb auto tactic was eventually revoked (mainly due to lack of tactical applicability).
2. Auto TF descents are initiated from 5000 ft AGL minimum (i.e. above the 1700 ft AGL minimum to account for the flight manual warning stating that 1700 ft AGL is the minimum altitude at which the pullout should commence on an auto-TF letdown).
3. 1000 ft SCP is now selected as the initial SCP for all auto TF descents (in line with flight manual advice). Subsequent SCP stepdown is done so progressively, with a check for level-off response at each setting.

⁵ The Board did not agree with the belief of one of the witnesses that anti-G suits should be worn for all F-111 sorties but would support recommendation that anti-G suits should be worn for all sorties involving repetitive G or tactics.

⁶ The WSPD book is used by F-111 aircrew to document information of a nature relevant to aircrew interpretation of the performance of applicable aircraft systems (e.g. inertial navigation system accuracy/inaccuracy, weapon system delivery accuracy, TFR ride heights.) The intent of the document is for the next crew using the aircraft to be able to check the history of the aircraft's performance prior to flight.

4. Route surveys are conducted in accordance with Defence Instructions for all new low level routes outside surveyed areas. If flight is to be conducted on unsurveyed routes, then further restrictions are placed on authorised flight altitudes (including 400 ft SCP day VMC and not below 750 ft SCP night/IMC).
5. 200 ft SCP flight (day/night/IMC) can only be conducted within surveyed air weapons ranges. If 200 ft SCP flight is desired for additional surveyed routes, then specific authorisation from the Officer Commanding 82WG must be sought.
6. Anti-G suits must be worn by all F-111 crewmembers.
7. Abbreviated checklists (aide-memoirs) for select normal procedures are now included in the F-111 flight manual for crews to copy and use.



Wreckage reconstruction – aircraft A8-128