BY ORDER OF THE COMMANDER AIR EDUCATION AND TRAINING COMMAND

AIR EDUCATION AND TRAINING COMMAND HANDBOOK 11-210

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Flying Operations

ROAD TO WINGS

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This publication implements Air Force Policy Directive (AFPD) 11-2, *Aircrew Operations* and AFPD 91-2, *Safety Programs*. It provides flight training activities with a source of lessons learned from over 40 years of aircraft accidents in the T-1, T-6, T-37, and T-38 aircraft. This publication does not apply to Air National Guard and Air Force Reserve Command units. Ensure that all records created as a result of processes prescribed in this publication are maintained IAW Air Force Manual (AFMAN) 33-363, *Management of Records*, and disposed of IAW Air Force Records Information Management System (AFRIMS) Records Disposition Schedule (RDS). Refer recommended changes and questions about this publication to the Office of Primary Responsibility (OPR) using the AF Form 847, *Recommendation for Change of Publication*; route AF Forms 847 from the field through the appropriate functional chain of command. This publication may not be supplemented or further implemented/extended. The use of the name or mark of any specific manufacturer, commercial product, commodity, or service in this publication does not imply endorsement by the Air Force.

FOREWARD

The "Road to Wings" series is a journey in Air Force undergraduate flight training mishaps since 1972…how they happened, why they happened, and most importantly, the lessons learned from those mishaps. Whether you are a student attending undergraduate flying training or an experienced 3,000+ hour aviator employing the world's most advanced aircraft, "Road to Wings" offers all of us the opportunity to learn from past mistakes and improve our airmanship.

This handbook includes selected Class A and Class B mishaps for the T-1, T-6, T-37, and T-38 aircraft. The majority of mishaps contained herein involve undergraduate pilot training (UPT) missions flown by both student and instructor pilots. Students are encouraged to discuss these scenarios with their instructors and with fellow students. What steps would you have taken to break the mishap chain? How would you have reacted if it was you in the scenario?

The information in this handbook is not directive in nature. The vast majority of the information contained in “Road to Wings” was derived from non-privileged sources and has been further “sanitized” so as to not include any references to date or location. For example, the "Mishap" and "Investigation" sections are primarily derived from public releasable Accident Investigation Board (AIB) reports and the "Lessons Learned" sections was written by a long line of aviators discussing the mishaps and applying their experience. Because much of the information in this handbook is historical, it may contain references to documents that are now obsolete.

From your “dollar ride” to your “fini flight,” you will be challenged on every sortie you fly. Stay sharp and stay engaged. Your airmanship and sound decision making is critical to breaking the mishap chain.

SUMMARY OF CHANGES

This document has been substantially revised and must be completely reviewed. Major changes include an addition of the Foreword and compilation of mishaps involving the T-1A, T-6A, T-38 and other relevant aircraft.

Section A—T-1

1. Runway Departure on Landing.

1.1. **Mishap.** Figure 1. On a student night navigation sortie, the mishap crew flew an instrument landing system (ILS) approach. The crew crossed the final approach fix 500 feet high. The instructor pilot allowed the student pilot to continue and the aircraft touched down long and fast on a wet runway. The aircraft could not be stopped and departed the end of the runway with the left wingtip striking the ground followed by the right main and nose gear collapsing. As the right wing impacted the ground, the wing spar cracked and the fuel tank ruptured. The crew egressed without injury.

Figure 1. Runway Departure During Landing.

1.2. **Investigation.**

1.2.1. **Operator Factor.** The IP changed the destination but did not inform squadron supervision. This was required as the change dictated a higher risk management (RM) score and changes to the planned destination had to be approved by the supervisor.

1.2.2. **Operator Factor.** The mishap crew (MC) failed the first step in instrument flying, Tune, Identify and Monitor. Failing to tune the correct tactical air navigation (TACAN) resulted in a loss of situational awareness while flying the ILS approach and led to being 500 feet high at the final approach fix. During an attempt to correct the glidepath, the Ground Proximity Warning System (GPWS) sounded, which was ignored by the MC. The steep, fast final led to a long, fast landing on a short, wet runway.

1.2.3. **Operator Factor.** Upon landing, the MC failed to ensure the throttles were at idle. This combined with landing fast delayed the weight on wheels switch and prevented the speed brakes from deploying. Confusion on which crewmember was applying the brakes caused the aircraft to not decelerate as expected and the MC misdiagnosed this situation as a loss of anti-skid braking. The IP applied the emergency brakes which resulted in the aircraft hydroplaning and skidding until it departed the runway and resulted in damage to the landing gear and the right wing.

1.3. **Lessons Learned:**

1.3.1. RM procedures are there for a reason. Lessons learned from other incidents usually result in rules being imposed to prevent another occurrence. Destination changes are one of the areas that must be addressed. Anytime something changes, or you do something dumb, different or dangerous, RM must be relooked.

1.3.2. Even when asked to do a simple task (fly an ILS) that has been accomplished numerous times, aircrew always need to maintain situational awareness and follow proper procedures. In this case, despite the errors committed by the MC, a timely “Go-around” call could have prevented the end result.

1.4. **Action Taken.**

1.4.1. Guidance added to AFI 11-2T-1V3 emphasizing the availability of cockpit aids to increase situational awareness during night or IMC operations including displaying the flight management system approach on the MFD.

1.4.2. Added crew actions to the T.O. T-1A-1 in response to GPWS warnings at night and IMC.

2. Taxiway Departure During Landing.

2.1. **Mishap.** Figure 2. After a normal pre-brief and takeoff, the mishap crew (MC) flew to an off station base but was unable to conduct the needed training due to thunderstorms in the area. The MC flew back to home station for briefed TACAN approach. As they began the approach, there were thunderstorms in the vicinity of the airfield and light rain showers. As the MC landed for the full stop, the tower failed to pass the wet runway and standing water conditions to the MC. After touchdown, the mishap instructor pilot (MIP) did not feel or hear the anti-skid cycling and released and reapplied the brakes several times. Halfway down the runway, the MC experienced a torrential downpour. The mishap aircraft (MA) started hydroplaning and encountered standing water with about 1,200 feet remaining. The student navigator called out to start the turn for exiting the runway but the MIP lost control of the aircraft in the turn. The MA skidded off the prepared surface and the nose gear collapsed. The MC emergency ground egressed without injuries.

Figure 2. Taxiway Departure During Landing.

2.2. **Investigation.**

2.2.1. **Supervisory Factor.** The contract agency for the T-1A instructor pilots failed to comply with AFI 11-418 by not providing adequate operations supervision. Supervisors of flying (SOF) act proactively to direct appropriate actions to correct and prevent unsafe situations.

2.2.2. **Operations Factor.** Weather issued observations and special observations to Air Traffic Control (ATC) via an electronic means but it did not provide a visual or audio alert feature nor a process to confirm ATC had received the message. Tower controllers either did not notice two special observations for changing weather conditions and thunderstorms or did not react to them due to an on-going extraneous conversation. They also did not relay information on wet/standing water runway conditions and braking action to arriving aircraft. This resulted in a failure of critical airfield information being relayed to arriving aircraft.

2.2.3. **Operator Factor.** T.O. 1T-1A-1 states that "Failure to maximum brake properly will result in exceeding the computed landing/stopping distance" and "To maximum brake properly, immediately depress toe brakes in one smooth, continuous application. Do not release the brakes. Initially, at high speeds or heavy gross weights the aircraft will not appear to decelerate." The MIP repeatedly released and reapplied the brakes which invalidated the calculated landing distance. A preceding T-1 that landed 3 minutes before the MA was able to land and clear the runway 1,000 feet prior to the end of the runway.

2.2.4. **Operator Factor.** Approaching the end of the runway at 50 knots, the MIP elected to start a turn onto the taxiway instead of continuing into the 1,000 foot overrun because the MIP was concerned about the condition of the overrun and an incorrect belief that the tires would grip better on their edges during the turn. This combined with a poor braking technique led to locking up the brakes and reverted rubber hydroplaning.

2.3. **Lesson Learned:**

2.3.1. AETC sorties are not mission critical requiring immediate execution. They can wait a few hours until the front and associated thunderstorms and gusts leave the area. And if they don't, there is always tomorrow.

2.3.2. Following technical order procedures leads to safe execution under normal operating conditions and prevents aircraft damage. Had the MIP correctly applied maximum braking and stopped straight ahead, the mishap would have been prevented.

2.4. **Action Taken:**

2.4.1. Added requirement to perform wet runway landing and maximum braking simulator into T-1A PIT.

2.4.2. Added annual training requirement for critical landing distance and maximum braking simulator for all T-1A IPs.

3. Microburst During Circle to Land.

3.1. **Mishap.** **Figure 3**. The mishap crew (MC) was on their second flight of a day-night out and back. They took off with the intent to fly a Localizer Approach at the departure airfield and circle to another runway, then stay in the pattern for more approaches. The MC was aware of rain showers in the vicinity of the airport, gusty surface winds, blowing dust, and strong winds at altitude of approximately 35-40 knots. During the circling approach as the MC aligned on final, the mishap aircraft (MA) experienced a downdraft with a vertical velocity (VV) of approximately 2,000 feet per minute (fpm). The MA continued to descend during the go around with a peak VV of negative 4,800 fpm. The mishap instructor pilot (MIP) took the aircraft and executed a maximum performance recovery, but the MA continued to descend with a VV between negative 1,500 to 3,100 fpm. The MA impacted a field a half mile short of the runway with a VV of approximately negative 1,000 fpm and received significant damage. The MC egressed the aircraft and were not injured.

Figure 3. Microburst During Circle to Land.

3.2. **Investigation:**

3.2.1. **Supervisory Factor.** Compared to the FAA, the Air Force did not emphasize the same level of windshear and microburst training. Air Force training lacked academic instruction and simulator instruction to cover these topics.

3.2.2. **Operator Factor.** The weather forecast showed an upper level low and associated trough rotating towards the mishap airfield with a chance for isolated thunderstorms. Just prior to the mishap sortie, observed winds and PIREPs indicated a windshear of 18 knots. According to T.O. 1T-1A-1, this indicates a severe windshear and flight crews are required to delay takeoffs and discontinue approaches. The deteriorating conditions were also reaffirmed by other aircraft in the area and the tower controller who reported blowing dust, poor visibility, and moderate to extreme turbulence.

3.2.3. **Supervisory Factor.** The MA's home unit produced a flying area mission execution forecast (FAMEF), but did not include a detailed analysis of the mishap airfield and mandated a "Self-Brief" tool on their local webpage for airfields not covered by the FAMEF.

3.2.4. **Operations Factor.** The Weather System Processor (WSP) at the airfield did not provide accurate alerts to controllers of windshear, microbursts, and gust front hazards due to system limitations and/or undetected system faults.

3.2.5. **Operator Factor.** The MC did not know or reference T.O. guidance about severe windshear, did not know the definition for their aircraft, and as a result took off in conditions prohibited by the T.O.

3.3. **Lesson Learned:**

3.3.1. Mother Nature is unforgiving and is a lot more powerful than the engines on your airplane. Icing, turbulence, and thunderstorms are just a few of the weapons she has at her disposal to wreak havoc on your sortie. In this case, due to flying in conditions prohibited by the technical order, a micro-burst forced the aircraft down in spite of the MC's efforts to stay airborne. Each aircraft has its own published limits and it is solely your responsibility to know and observe those limits to safely execute the mission.

3.4. **Action Taken.**

3.4.1. Windshear and microburst training added to all recurring semi-annual simulator training.

4. Bird Strike During Touch and Go.

4.1. **Mishap.** Figure 4 and Figure 5. The mishap sortie was a two-ship formation sortie that split for patterns at a local outfield. During the climbout following a touch and go, the mishap aircraft (MA) struck at least one mourning dove followed by a loud bang, associated whining noise, and brief violent vibration. Next, the Master Warning System red light started flashing and a right fire detector failure light illuminated followed by a fire bell and associated right engine fire switch light illuminated. The mishap crew (MC) discharged both fire bottles into the mishap engine, but the engine fire light remained on. The MC did not elect to shut down engines in order to provide available thrust. The MIP maneuvered the MA for an uneventful landing and emergency ground egressed on the runway. There were no injuries and no external indications of fire on the MA.

Figure 4. Bird Strike During Touch and Go.

Figure 5. Bird Strike During Touch and Go (cont).

4.2. **Investigation:**

4.2.1. **Logistics Factor.** Four compressor fan blades were liberated from the engine and caused cascading damage to the rest of the engine and damage to the nacelle and engine pylon. In addition, the fan case fractured into two pieces with the forward section loosely attached to the engine. The extensive damage from such a small bird weighing 3 to 6 ounces was found to not meet the bird ingestion requirements set by the FAA since there are civilian variants of the same engine. Further investigation revealed 7 other similar mishaps involving the same engine on the sub-fleet of Beechcraft™ 400/T-1A. The failure mode of this engine is unique to the Beechcraft™ aircraft and a result of an unrecognized design deficiency involving a dynamic interaction between the engine's fan blades and the fan case.

4.3. **Lesson Learned:**

4.3.1. Despite the age and number of hours we have flown, we still find new ways to break things. Not all emergencies will be black and white with an associated checklist. Good systems knowledge and airmanship is required to safely recover the aircraft.

4.4. **Action Taken:**

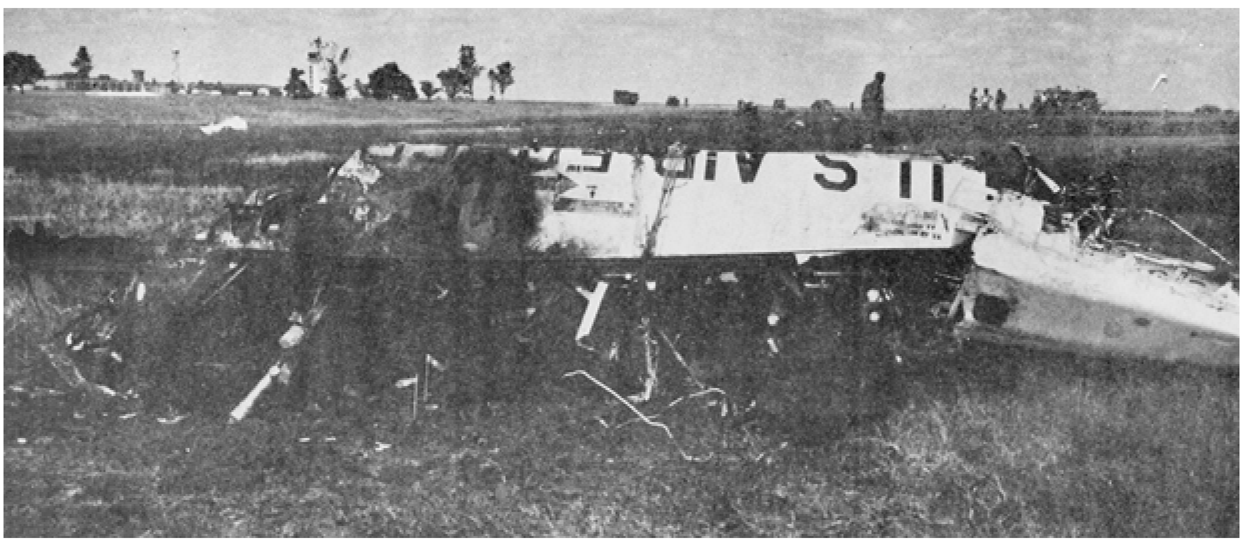
4.4.1. As of January 2020, the engine contractor generated service bulletins to begin the trial installation and testing of modified T-1 engines.

Section B—T-38 Takeoff and Departure

5. Stall.

5.1. **Mishap.** Figure 6. The mishap was a dual mission, and the aircraft crashed shortly after takeoff. Acceleration and rotation appeared normal with liftoff about 3,000 feet down the runway. Once airborne, the aircraft quickly rotated to an abnormally high pitch attitude. As the aircraft climbed to its maximum height of around 150 feet above ground level (AGL), the left wing dropped noticeably and the aircraft began to descend. As the nose appeared to drop toward the horizon, the aircraft suddenly rolled right to approximately 90 degrees of bank. At some point during this sequence, the pilot retracted the gear and flaps. The pilot maneuvered back toward a wings level position, but the rate of descent continued to increase. The pitch attitude remained slightly nose high. The crew was unable to recover the aircraft, and it impacted the ground 6,800 feet from brake release. Parameters at impact were 17 degrees of right bank, 5 degrees nose high, and approximately 198 knot indicated airspeed (KIAS). Neither crewmember ejected and both were fatally injured.

Figure 6. Stall.



5.2. **Investigation:**

5.2.1. **Operator Factor.** The pilot apparently stalled the aircraft just after liftoff with insufficient altitude to recover.

5.2.2. **Supervisory Factor.** It is not certain who was flying the aircraft; but either way, it appears the instructor pilot (IP) allowed the aircraft to enter a stall shortly after liftoff.

5.3. **Lesson Learned:**

5.3.1. IPs and student pilots (SP) must have a thorough understanding of aircraft aerodynamics, stall characteristics, and stall recovery procedures of the T-38. The ability to recognize and avoid this flight regime is especially critical during the takeoff and landing phases of flight. Additionally, IPs must not hesitate to assume aircraft control to prevent a mishap.

5.4. **Action Taken.** None.

6. Engine Failure and Loss of Flight Controls.

6.1. **Mishap.** Figure 7. The mission was a local four-ship formation training flight. Shortly after takeoff, the SP flying as Number 2 solo heard a loud noise and felt a loss of thrust as he retarded the throttles out of afterburner. The right engine revolutions per minute (rpm) dropped to approximately 15 percent. The SP attempted an unsuccessful airstart while lead repositioned himself to scan his aircraft. Lead reported seeing fire through a hole in the bottom of the aircraft. The aircraft then began uncommanded and uncontrollable pitch oscillations. The IP in the lead aircraft directed the SP to eject. (Although the SP ejected without injury, he inadvertently opened his lap belt either before or during the ejection sequence and was forced to manually deploy his parachute.) The aircraft was destroyed upon impact.

Figure 7. Engine Failure and Loss of Flight Controls.

6.2. **Investigation:**

6.2.1. **Maintenance Factor.** The right engine turbine wheel failed due to a fatigue crack. The failure resulted in damage to pitch control linkages and loss of aircraft control.

6.3. **Lesson Learned:**

6.3.1. Emergencies can happen at any time, and the situation can degrade rapidly so be prepared. In this case, the SP and IP handled the situation well, using effective cockpit/crew resource management (CRM) and potentially saving the SP's life.

6.4. **Action Taken:**

6.4.1. Reduced turbine wheel replacement time and accelerated efforts to procure a turbine wheel with a better design.

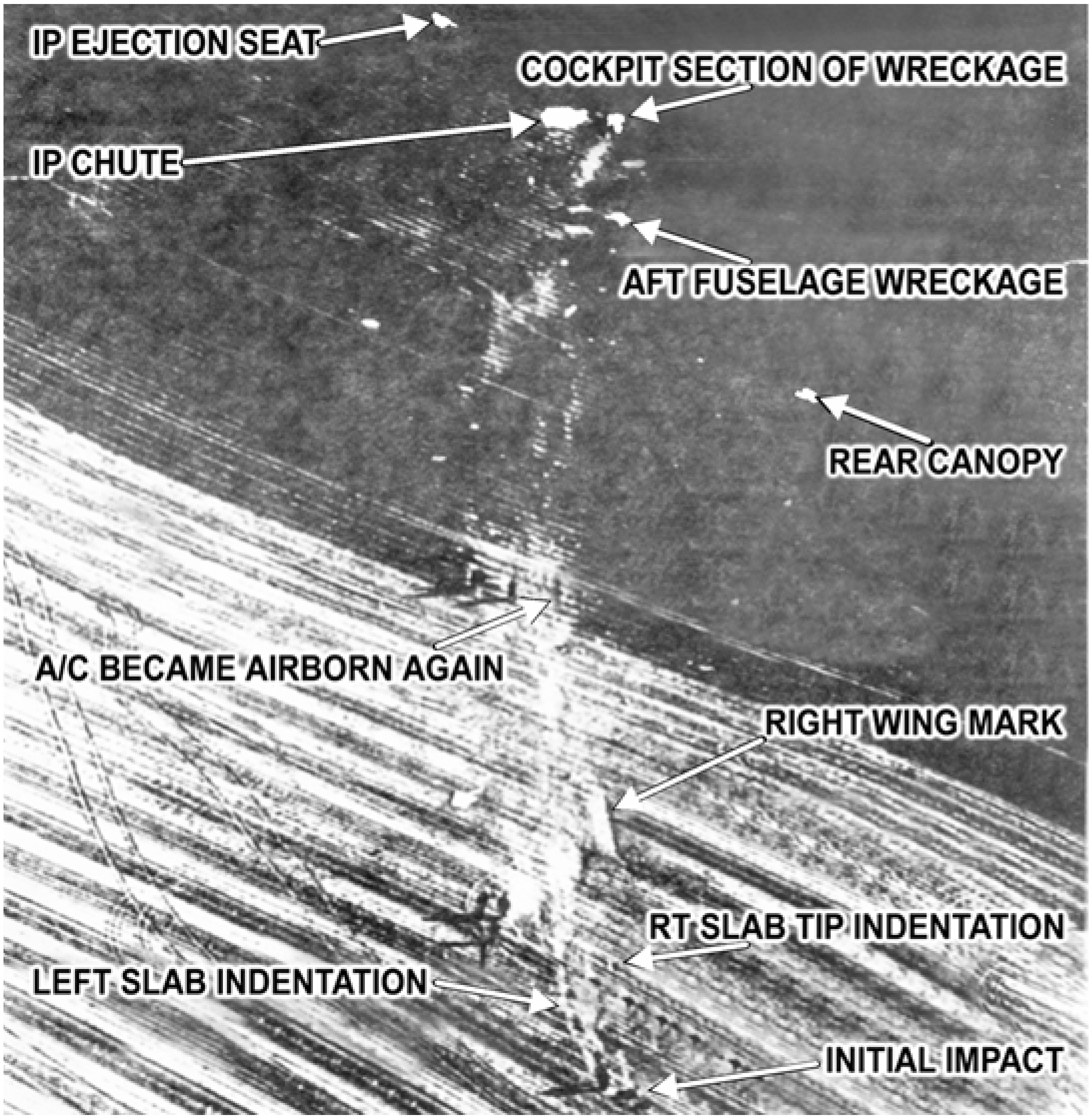
6.4.2. Changed inspection methods and requirements in an effort to improve detection of fatigue cracks.

6.4.3. Installed improved pneumatic fire sensor system (including an automatic integrity monitor) in T-38 aircraft.

7. Bird Strike – Dual Engine Failure.

7.1. **Mishap.** **Figure 8**. The mission was a two-ship formation flight with SPs in the front seats. Preflight, taxi, and formation takeoff were normal. As the formation accelerated to 270 KIAS and climbed to 3,100 feet mean sea level (MSL) (600 feet AGL), several birds struck the lead aircraft front canopy. The front canopy Plexiglas was completely destroyed, and the engines ingested the debris. Neither crewmember was injured by the bird strike, but the damage caused a loss of thrust. The aircraft decelerated immediately and entered a shallow descent. The IP's forward visibility was probably obscured due to bird remains on the windscreen. As the rpm fluctuated, the SP observed what he believed to be throttle movements made by the IP. However, the engines did not respond so the IP ordered ejection. After a slight hesitation, the SP ejected successfully around 300 feet AGL. The IP's seat fired as the aircraft impacted the ground. The aircraft was destroyed, and the IP was fatally injured.

Figure 8. Bird Strike – Dual Engine Failure.



7.2. **Investigation:**

7.2.1. **Operator Factor.** A bird strike shortly after takeoff destroyed the front cockpit canopy. Both engines ingested bird remains and/or Plexiglas fragments, resulting in a loss of thrust and the inability to sustain level flight.

7.3. **Lesson Learned:**

7.3.1. Aircrews should weigh the benefits of using dual visors if conditions permit. Additionally, aircrews must make timely ejection decisions, use proper terminology during critical and emergency phases of flight, and thoroughly brief ejection considerations with and without intercom.

7.3.2. Tower and runway supervisory unit (RSU) personnel rely heavily on aircrew reports of bird activity. Although bird warnings may be commonplace, aircrews must strive to combat complacency. Pilots must be vigilant, especially during the critical takeoff and landing phases where bird strikes pose the greatest threat.

7.4. **Action Taken:**

7.4.1. Bird resistant windscreens installed on all T-38s. Bird-resistant, shatter-resistant forward canopies developed, with installs scheduled on all remaining T-38s in FY20-25.

8. Engine Failure – Touch and Go.

8.1. **Mishap.** **Figure 9** and **Figure 10**. The flight was a rear cockpit (RCP) contact mission for the IP who had recently returned from IP training with a flight examiner (FE) in the front cockpit (FCP). After some area work, the aircraft returned to the pattern to practice some landings. The fourth pattern was a full-flap touch and go with the IP flying the aircraft. Everything was normal until just after liftoff. As the gear and flaps were retracting, the left engine rpm rolled back to between 60 and 70 percent. The FE assumed control of the aircraft and selected afterburner on the right engine. He then selected afterburner on the left engine too, but was unable to sustain level flight and ordered ejection. The FE ejected successfully, but the IP was fatally injured due to late chute deployment.

Figure 9. Engine Failure – Touch and Go.

Figure 10. Engine Failure – Touch and Go (cont).

8.2. **Investigation.**

8.2.1. **Maintenance Factor.** Shortly after takeoff the left engine rpm rolled back to 60 to 70 percent due to an undetermined malfunction. The IP did not initially recognize the rollback and initiated gear and flap retraction.

8.2.2. **Operator Factor.** The FE recognized engine rollback while assuming aircraft control, but did not notice the gear and flap retraction. He failed to take immediate action to establish the correct aircraft attitude and/or flap position.

8.2.3. **Logistics Factor.** The IP's parachute lanyard assembly was severed just below the parachute arming lanyard knob by impact with the FCP ejection seat prior to seat/man separation. This caused the automatic parachute deployment sequence to fail. The IP attempted to manually deploy his chute by pulling the D-ring, but did not get a full chute prior to ground impact.

8.3. **Lessons Learned:**

8.3.1. The current flap selector switch had not yet been incorporated in the T-38. Flaps were controlled by using a method similar to the present day auxiliary flap switch. This method required careful attention to setting the flaps at the desired position, and the poor design contributed to the mishap.

8.3.2. Pilots must develop good habit patterns such as checking the configuration more than once before takeoff or landing, to ensure cockpit checks are complete. Checking the aircraft configuration at multiple points may make the difference in an emergency situation. For example, it is important to check the configuration at the perch, in the final turn, and rolling out on final. Pilots might miss something at the perch, but this technique gives them two more opportunities to catch a problem before touching down.

8.4. **Action Taken:**

8.4.1. Accelerated the T-38 aircraft modification to incorporate the three-position flap switch on a priority basis.

8.4.2. Changed Technical Order (TO) IT-38A and AT-38B Aircraft, Flight Manual USAF Series, Emergency Procedure, Engine Failure During Takeoff, to read as follows:

Table 1. Changed Guidance to TO IT-38A and AT-38B.

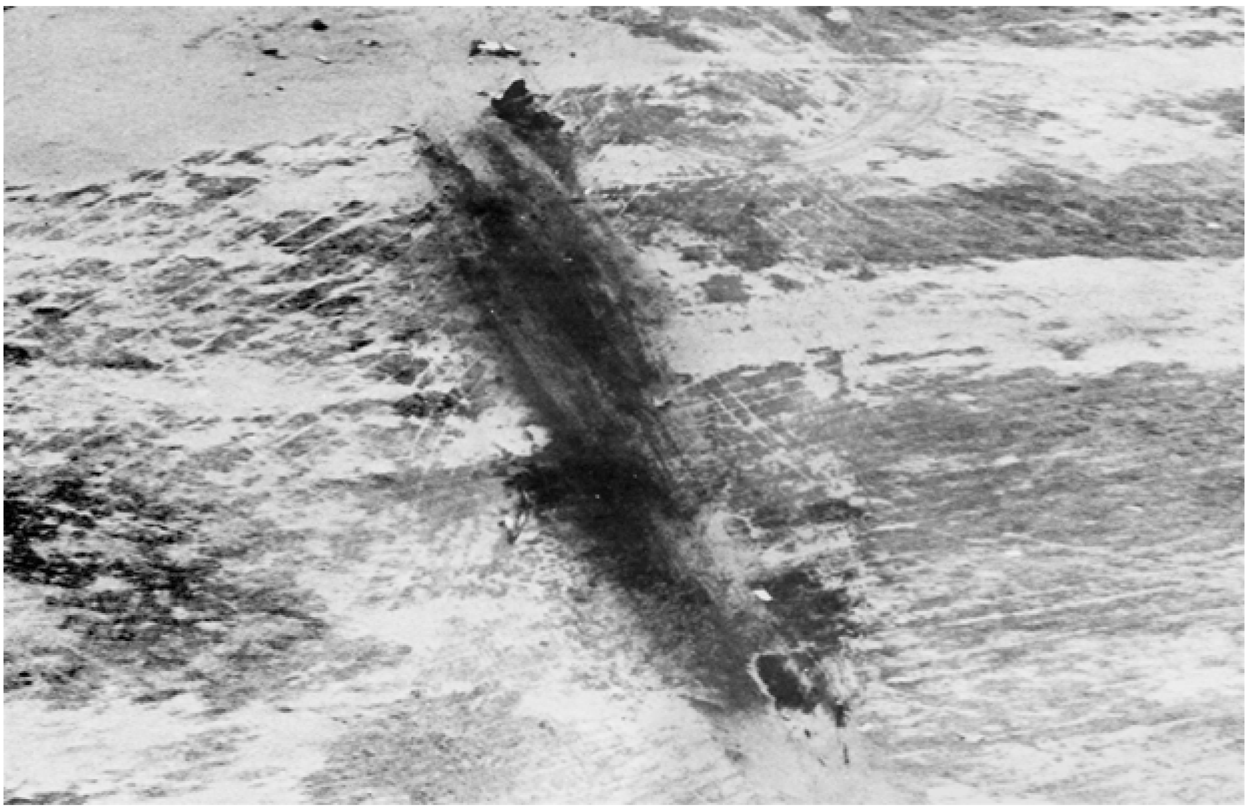
a. If decision is made to stop: Abort.
b. If takeoff is continued:
(1) Throttles – MAX
(2) Flaps – 60 percent
(3) Attain airspeed above single-engine takeoff speed (10 knots desired)
(4) Gear up (as required above single-engine takeoff speed plus 10 knots)
(5) Flaps up (as required above 190 KIAS).

8.4.3. Sequenced, zero-zero ejection system installed in all T-38C aircraft. Awaiting funding to install in T-38A/B.

9. Stall – Touch and Go.

9.1. **Mishap.** Figure 11. The flight was a pre-solo contact mission. The SP flew a simulated single-engine touch and go prior to departing the traffic pattern. The final approach was steeper than normal with a firm touchdown. Immediately after touchdown, the SP pulled the aircraft back into the air in a nose high attitude and idle power. The aircraft encountered wing rock, and the left wing contacted the runway. The aircraft momentarily leveled off in a near-normal takeoff attitude, but then began to climb with an increasingly nose high attitude. The aircraft rolled left to approximately 60 degrees of bank and then recovered to a near wings level attitude. The aircraft then stalled and impacted the ground in 115 degrees of left bank and 15 degrees nose low. The aircraft was destroyed, and both crewmembers were fatally injured.

Figure 11. Stall – Touch and Go.



9.2. **Investigation:**

9.2.1. **Supervisory Factor.** The IP failed to assume control of the aircraft in time to prevent a stall.

9.2.2. **Operator Factor.** The SP applied excessive back stick pressure which caused the aircraft to become airborne in a nose high attitude at idle power.

9.3. **Lesson Learned:**

9.3.1. Stalls during the landing phase leave little to no margin for error. It is critically important to execute proper stall recovery procedures immediately, which may require relaxing the back stick pressure to break the stall condition. Additionally, the loss of aircraft control at a low altitude may not allow time for corrective actions and may require an immediate ejection.

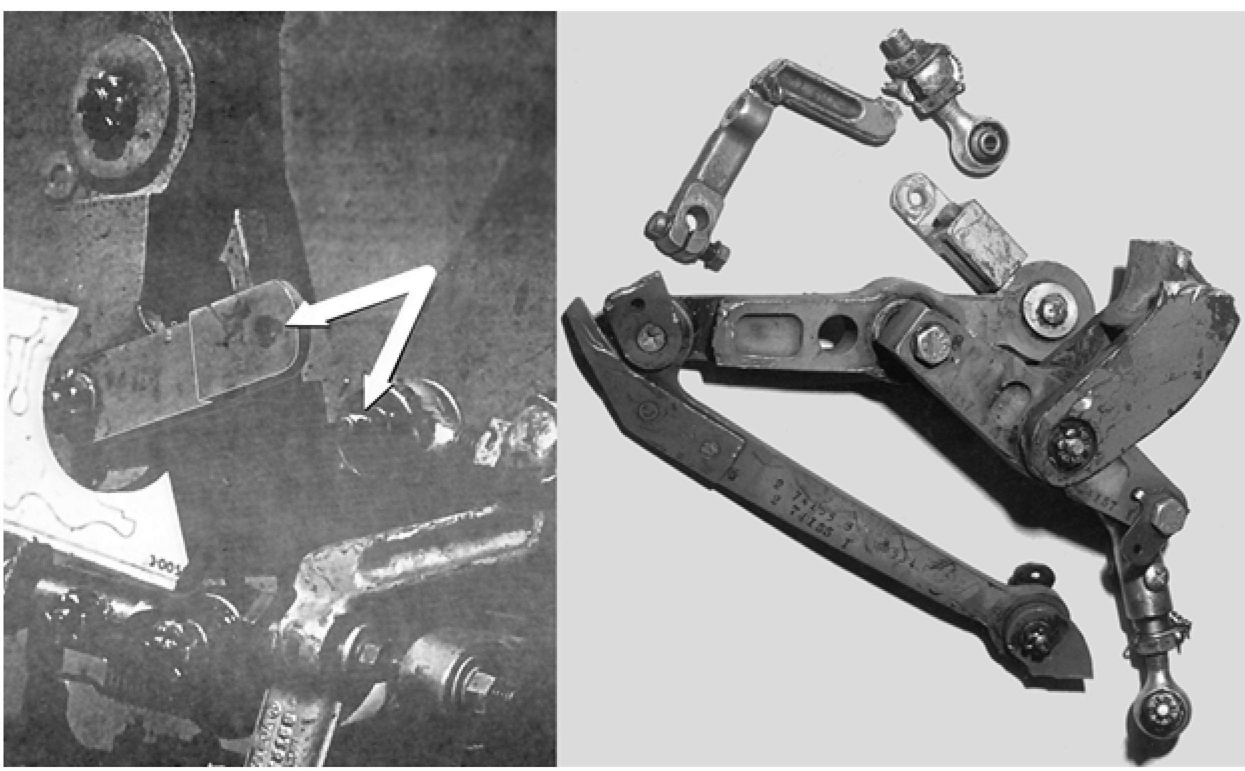
9.4. **Action Taken:**

9.4.1. Expanded the governing directive to include a discussion of takeoff and landing irregularities such as wing rock, balloon, bounce, premature liftoff, and over-rotation.

10. Flight Control Malfunction.

10.1. **Mishap.** Figure 12. The flight was scheduled as a dual contact training mission. The IP performed the takeoff in accordance with (IAW) the mission brief. The left wing dropped immediately after liftoff as if the aircraft had encountered mild wake turbulence or a strong crosswind. The IP applied right aileron and a slight amount of right rudder to correct the bank. As the wings leveled, the IP relaxed the aileron and rudder pressure and the aircraft immediately rolled sharply left to approximately 45 degrees of bank. The IP immediately applied right aileron and right rudder, but the aircraft did not respond as anticipated. He continued aileron and rudder application until he had full right aileron and full right rudder. The aircraft was low to the ground and had veered left away from the runway surface. It was in an extreme skid due to the full right rudder application, but started to roll out of the bank. The IP relaxed some of the control pressure as the aircraft approached wings level; but when he did, the aircraft rolled sharply left again to approximately 90 degrees of bank. He applied full right aileron and full right rudder one more time, managed to bring the aircraft back to a near wings-level attitude, and commanded ejection. The aircraft was now around 300 feet AGL and 220 knots. The SP ejected immediately and was uninjured. As the IP relaxed the control stick to initiate his ejection, the aircraft rolled left to approximately 70 to 90 degrees of bank. Despite the low altitude and aircraft attitude, the IP also ejected successfully. The aircraft continued its descent and impacted the ground in 80 to 90 degrees of left bank and 45 degrees nose low. The aircraft was destroyed upon impact.

Figure 12. Flight Control Malfunctions.



10.2. **Investigation.**

10.2.1. **Maintenance Factor.** An unknown person failed to install the cotter pin that secures the nut on the connecting bolt and valve push rod for the right aileron. The nut backed off, and the right aileron moved to a near full down position, resulting in a loss of aircraft control.

10.2.2. **Supervisory Factor.** Supervision failed to conduct proper post-maintenance inspections.

10.3. **Lesson Learned:**

10.3.1. Flight control malfunctions at low altitude are extraordinarily challenging, requiring timely analysis and decision-making while threatening to saturate your task management ability. You have little time to determine the aircraft's controllability before exceeding the ejection envelope. Consider your ejection criteria before you release the brakes.

10.4. **Action Taken:**

10.4.1. Conducted a onetime inspection on T-38 and F-5 aileron operating mechanisms.

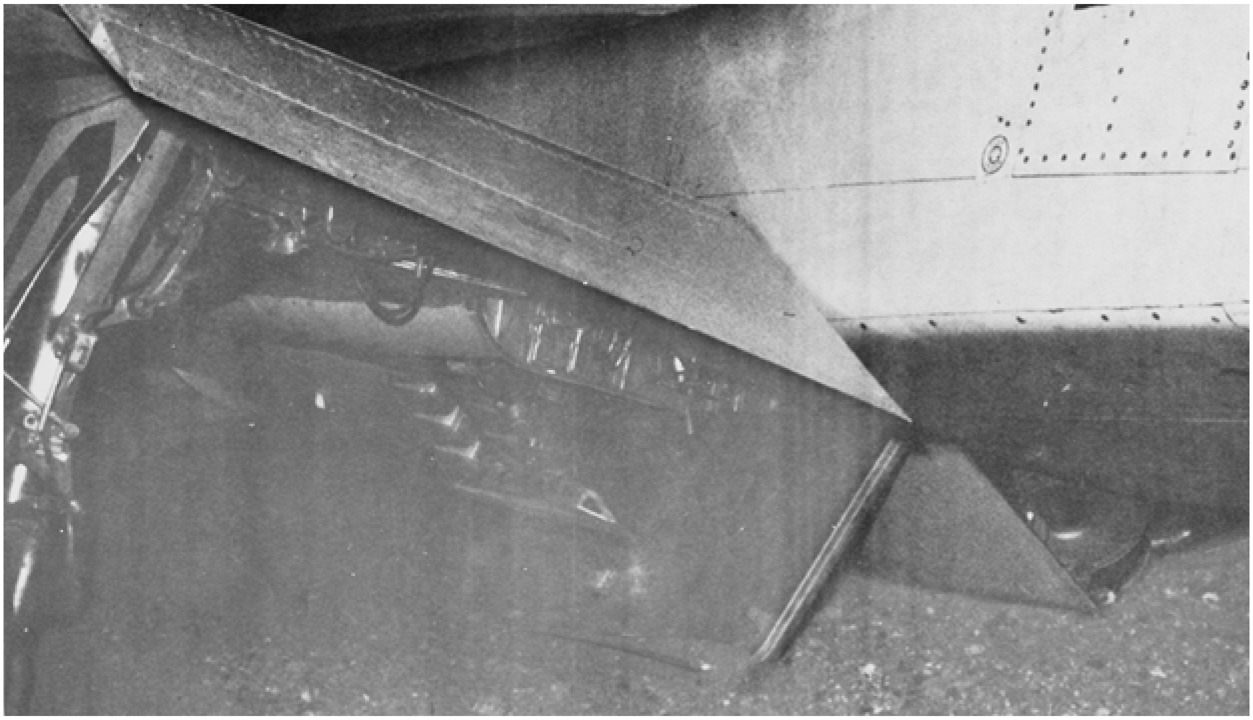
10.4.2. Revised maintenance T.O.s and work cards to clarify installation of key washers, lock wiring, and cotter pins.

10.4.3. Required all critical flight control areas to be inspected by independent, qualified inspectors.

11. Abort – Runway Departure.

11.1. **Mishap.** Figure 13. The mishap aircrew was on an accelerated copilot enrichment (ACE) navigation and cross-country mission. The pilot performed a high speed abort during takeoff at a stopover airfield when the aircraft failed to rotate. The aircraft left the prepared surface and came to a stop 400 feet past the end of the overrun, sustaining major damage. Both crewmembers egressed without injury.

Figure 13. Abort – Runway Departure.



11.2. **Investigation:**

11.2.1. **Operator Factor.** Because crewmembers were accustomed to flying at a location where takeoff and landing data were rarely a factor, they became complacent with their takeoff and landing data (TOLD) calculations. Bottom line: The pilot misjudged the takeoff performance based on poor habit patterns and failed to account for a higher temperature and altitude than he was used to.

11.2.2. **Operator Factor.** The aircraft did not rotate because the pilot failed to attain proper stick position for rotation. He misjudged aircraft response as a malfunction and aborted the aircraft before it had sufficient time to rotate. Additionally, the pilot initiated his abort 6 knots above refusal speed. (The airspeed markers in both cockpits were set at 155 knots as opposed to the actual refusal or adjusted refusal speed of 149/136 KIAS).

11.2.3. **Operator Factor.** Also, due to improper braking technique, the pilot locked the right brake and blew the tire, causing extensive damage to the wheel assembly. The subsequent directional control problems caused a high speed departure from the prepared surface.

11.3. **Action Taken:** None.

12. Engine Failure and Loss of Flight Controls.

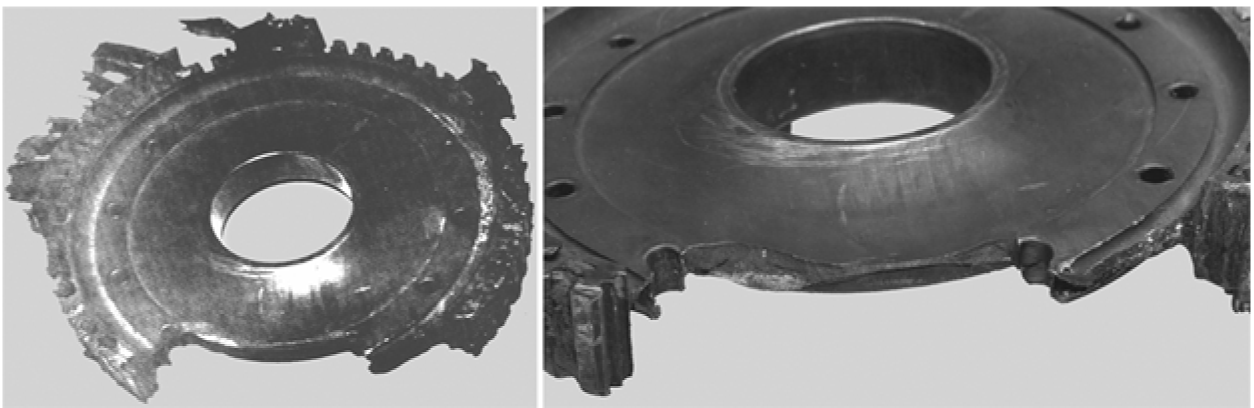
12.1. **Mishap.** Figure 14. The mission was flown by two IPs on a cross-country flight. The RCP pilot completed a normal rolling takeoff. After liftoff, both pilots heard a loud bang as the RCP pilot retarded the throttles out of afterburner. The RCP pilot noted the left engine rpm decaying through 40 percent and retarded the throttle to idle. The FCP pilot assumed command of the aircraft and declared an emergency. The right fire light illuminated 3 to 4 seconds later, and the aircraft began a slight roll to the left with an uncommanded pitch-up.

The FCP pilot commanded ejection as he lost aircraft response, and both crewmembers ejected successfully.

12.2. **Investigation:**

12.2.1. **Maintenance Factor.** The stage two turbine wheel on the left engine developed a crack as a result of a machining defect. During initial takeoff, the stage two turbine wheel failed, causing an uncontained engine failure. Turbine parts penetrated the engine firewall, allowing hydraulic lines to be exposed to hot combustion gases. The hydraulic lines burned through depleting pressure in both hydraulic systems. The aircraft became uncontrollable as the hydraulic pressure depleted.

Figure 14. Engine Failure and Loss of Flight Controls.



12.3. **Lesson Learned:**

12.3.1. This is just another reminder of just how quickly a situation can deteriorate. The transfer of aircraft control happened at a critical stage. However, it was done correctly and did not impact the outcome. The crew made a timely decision to eject, and both were uninjured.

12.3.2. Although catastrophic failures during a critical phase of flight are infrequent, they do happen. In this situation, there was nothing the crew could do to stop the chain of events that started with the disk failure. This mishap also highlighted the difficulty in making risk assessments involving low probability, but high severity. When doing your own personal risk assessments, be sure to critically evaluate the consequences, even if the probability is very low. If your decision could even remotely lead to loss of aircraft (or possible loss of life), take time to reconsider.

12.4. **Action Taken:**

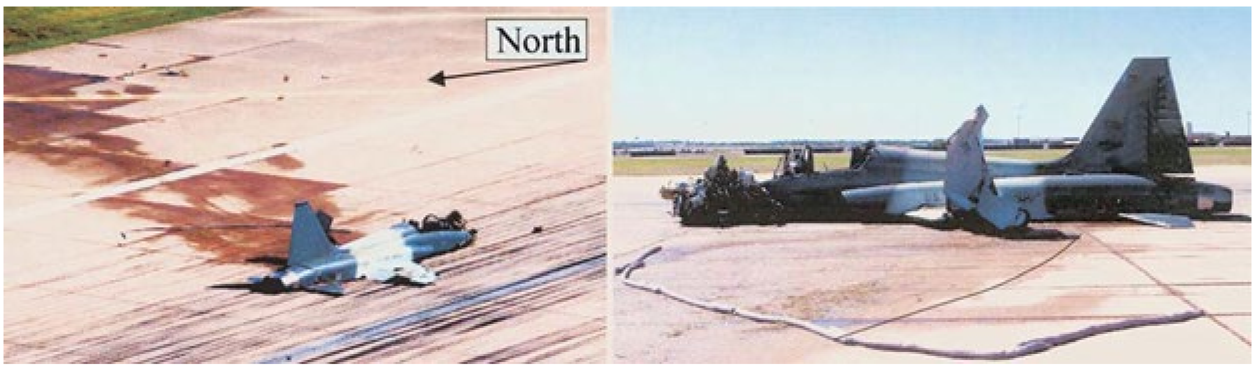
12.4.1. Conducted an urgent engineering analysis on stage-two turbine wheels to identify necessary corrective actions and prevent future occurrences.

12.4.2. Performed a research study to determine the feasibility of implementing a nondestructive inspection technique to detect turbine-wheel cracks.

13. Loss of Control—Poor Transfer of Aircraft Control.

13.1. **Mishap.** **Figure 15**. The mishap sortie was a pre-solo contact sortie. The SP performed the takeoff and lifted off at approximately 155 knots. The SP was using stick only to control the aircraft and had his feet flat on the floor. The aircraft rolled right immediately after takeoff, and the SP overcorrected with left aileron causing the aircraft to roll into approximately 60 degrees of left bank. The SP told the IP something was wrong. The IP stepped on the rudder to counter the roll, but did not communicate transfer of control to the SP. The SP continued to fight the roll with ailerons. He did not know the IP was making rudder inputs because his feet were still on the floor. The combined and uncoordinated efforts of both aircrew members resulted in a rolling pilot induced oscillation (PIO). As the aircraft rolled back and forth reaching 90 degrees of bank in both directions, the IP commanded bailout. The crew ejected successfully just prior to the aircraft striking the ground. The aircraft departed the runway, skidded through the grass, and came to rest in the center of the adjacent parallel runway.

Figure 15. Loss of Control—Poor Transfer of Aircraft Control.



13.2. **Investigation:**

13.2.1. **Maintenance Factor.** The aircraft had previously been written up for an uncommanded rolling motion. Maintenance determined the stability augmenter caused the roll, but they did not consult with Operations before releasing the aircraft for flight. If they had, Operations would have known that the type of rolling motion described in the original AFTO IMT 781, ARMS Aircrew/ Mission Flight Data Document, write-up would not have come from a stability augmenter malfunction and would have ordered a functional check flight (FCF) prior to release. The roll was more likely caused by elongated holes in one of the wingtips where the wingtip attached to the main wing, allowing the wingtip to shift out of position.

13.2.2. **Operator Factor.** The SP overcontrolled the aircraft due to inexperience. The SP's attempts to control the aircraft were probably aggravated by the uncommanded rolling tendencies of the aircraft.

13.2.3. **Supervisory Factor.** The IP did not take control of the aircraft with a "positive exchange of aircraft control." This resulted in the IP and SP unknowingly fighting each other for control of the aircraft. Although the aircraft was controllable, the crew thought they were out of control and ejected.

13.2.4. **Operator Factor.** The IP was complacent and not mentally prepared to take control of the aircraft. This led to a "reactive" response as opposed to a deliberate and properly executed transfer of aircraft control.

13.3. **Lesson Learned:**

13.3.1. Although both the IP and SP survived, this was another reminder complacency can kill. You need to be on your game flying high performance aircraft, particularly during critical phases of flight. The IP was complacent and not mentally prepared to take control of the aircraft. Improper execution of a basic task like transfer of aircraft control cost an airplane and nearly the crew. A pilot tends to fall prey to complacency around 400 to 800 hours. (This IP had approximately 450 hours in the T-38.) In addition, the SP's habit of flying with his feet on the floor prevented him from identifying the IP's rudder inputs as one source of the aircraft's rolling motion.

13.4. **Action Taken:**

13.4.1. Amended AFI 21-101/AETC Sup, Aircraft and Equipment Maintenance Management, to require operations coordination for release of aircraft following impoundment for flight control malfunctions.

13.4.2. Recommended publishing a T.O. to help analyze and troubleshoot abnormal aircraft handling characteristics (AHC).

13.4.3. Requested evaluation of the failure detection and fault accommodation capability of the stability augmenter system.

13.4.4. Recommended changing AFI 11-290_AETCSUP, *Cockpit/Crew Resource Management Program*, to require IP complacency and proper transfer of aircraft control during critical phases of flight as an annual briefing topic.

14. Bird Strike on Touch and Go.

14.1. **Mishap.** **Figure 16** and **Figure 17**. During the touch-and-go, the mishap aircraft (MA) struck a white cattle egret causing the near total loss of the front cockpit canopy and induced severe aerodynamic drag forces on the MA. In response to the shattered canopy, the MA slowed. The mishap instructor pilot (MIP) selected MAX power on both engines, and started a climbing right hand turn. The MIP commanded and initiated the low altitude ejection approximately five seconds before the MA hit the ground. The mishap crew successfully ejected, but the nature of the low altitude ejection resulted in nonlife-threatening injuries. The MA hit the ground in a low speed, steep dive impact approximately 2 miles south of the airfield and was destroyed.

Figure 16. Bird Strike on Touch and Go.

Figure 17. Bird Strike on Touch and Go (cont).

14.2. **Investigation:**

14.2.1. **Logistics Factor.** The birdstrike fractured the front canopy and resulted in a compressor stall of both engines, placing the MA in a limited thrust condition. The T-38 canopy did not have any performance requirements for birdstrike resistance when it was designed. Previous mishaps and engineering analysis identified a vulnerability in the front canopy that could lead to the catastrophic fracture of the canopy and possible FOD ingestion into one or both engines. Previous recommendations had been made to redesign the canopy, but the risk was accepted to preserve the through-the-canopy ejection ability and due to prohibitive cost limitations and aircraft performance factors.

14.2.2. **Operator Factor.** The birdstrike occurred at the departure end of the runway and as the MA climbed, it never accelerated to pattern airspeed nor climbed higher than 900 feet AGL which is below the 2,000 foot recommended minimum ejection altitude.

Distraction and confusion led to late recognition of the stall and sink rate which in turn led to a delayed ejection at low altitude and associated injuries.

14.3. **Lesson Learned:**

14.3.1. Although the aircraft has been around for 50 years, some data is still new. In this case, we knew that a bird can destroy the canopy and once in a while it could FOD out an engine. In this mishap debris from the canopy strike was ingested into the engines. But that information was never incorporated into guidance for the aircrew to digest. Unfortunately, it took a destroyed aircraft and near loss of life to get the words down.

14.3.2. Primary actions should have been to maintain aircraft control and execute appropriate BOLDFACE procedures. Only after aircraft control is assured, should EP analysis begin.

14.4. **Actions Taken:**

14.4.1. Warning added to T.O. 1T-38C-1, "A damaged or shattered canopy presents a significant risk of FOD ingestion into one or both engines."

14.4.2. Note added to T.O. 1T-38C-1, "The drag due to a lost front canopy is equal to approximately one-half the drag of a fully extended speed brake."

14.4.3. Bird resistant windscreens installed on all T-38s. Bird-resistant, shatter-resistant forward canopies developed, with installs scheduled on all remaining T-38s in FY20-25.

15. Loss of Directional Control on a Formation Takeoff.

15.1. **Mishap. Figure 18**. The student pilot (SP) and instructor pilot (IP) were number two in a two-ship formation takeoff. While lining up on the right half of the runway, the SP pilot made a delayed left turn and overcorrected back to the right, stopping the aircraft with the nosewheel canted to the right. Upon brake release, the aircraft immediately veered right. The SP made multiple brake and rudder inputs in an attempt to maintain directional control during takeoff roll, causing yaw oscillations of the aircraft. As the aircraft oscillated right a third time and neared the edge of the runway, the IP made the decision to abort the takeoff and took control of the aircraft. The aircraft then veered sharply to the left and departed the runway. Upon departing the runway, the landing gear collapsed, the right wing and horizontal stabilizer dug into the ground causing the aircraft to become airborne and roll 360 degrees while in the air. The aircraft was destroyed and both pilots sustained minor injuries.

Figure 18. Loss of Directional Control on a Formation Takeoff.

15.2. **Investigation:**

15.2.1. **Operator Factor.** The mishap crew did not ensure the aircraft's nosewheel was aligned with the runway heading during lineup and this misalignment also went unnoticed by the flight lead. This required an immediate correction upon brake release and led to a directional control problem in close proximity to the element mate.

15.2.2. **Operator Factor.** During the initial takeoff roll, the SP over-controlled the aircraft which resulted in a pilot-induced oscillation (PIO). Additionally, the student pilot violated the T-38 checklist when he negatively transferred a learned habit from the T-37 and attempted to engage the nosewheel steering during the takeoff roll to fix the PIO. When the instructor pilot initiated the abort and took control of the aircraft, the student pilot was still on the controls with full left rudder, full left brake, and had the nosewheel steering switch engaged. As the instructor pilot brought the throttles out of afterburner, the nosewheel steering system activated and commanded a sharp left turn which put the aircraft into an unrecoverable skid.

15.3. **Lessons Learned:**

15.3.1. From brake release to flipping the aircraft, only 20 seconds elapsed. In those 20 seconds, a lot of things went wrong and contributed to this mishap. First, the SP didn't properly align the aircraft with runway heading during lineup and the error wasn't fixed by the student pilot's instructor or detected by the flight lead. Due to the design of the T-38 nosewheel steering system, it is important to align both the aircraft and the nosewheel with the runway prior to brake release and/or pushing up the power. It is even more important when performing a formation takeoff due to the proximity to other aircraft. This simple oversight, which would have taken only a couple seconds to correct, set up the rest of the mishap sequence. As an aviator, don't accept "close enough." Since AETCMAN 11-251 says "to ensure the nosewheel is centered, allow the aircraft to roll forward once it is aligned with the runway," then be sure to accomplish that even if you need to ask lead to move forward slightly. Not aligning the aircraft with runway heading and ensuring the nosewheel was centered set the stage for the SP's PIO during the takeoff roll.

15.3.2. Know your aircraft's technical orders and applicable guidance to combat negative transfer. This will help you avoid falling into an old habit pattern that might not work in the aircraft you are currently flying.

15.3.3. Finally, in a rapidly deteriorating situation it is critical a proper transfer of aircraft controls is accomplished. First, don't come on to the controls prior to verbalizing you are taking control. Once the other pilot announces they have control, come off the controls immediately. In this mishap, the pilots overlapped control and this contributed to the aircraft entering into an unrecoverable skid.

15.4. **Actions Taken:**

15.4.1. Warning added to T.O. 1T-38C-1," Due to the potential of an out-of-control situation, make sure the nosewheel steering button is not depressed during takeoff roll. Unintentional nosewheel steering activation, especially during an abort, may place the aircraft in an unrecoverable skid."

15.4.2. Verbiage also added to AETC Student Guide, Handout, and AETCMAN 11-251 regarding disengaging the nosewheel during takeoff.

Section C—T-38 Flight Control and Structural Failure Mishaps

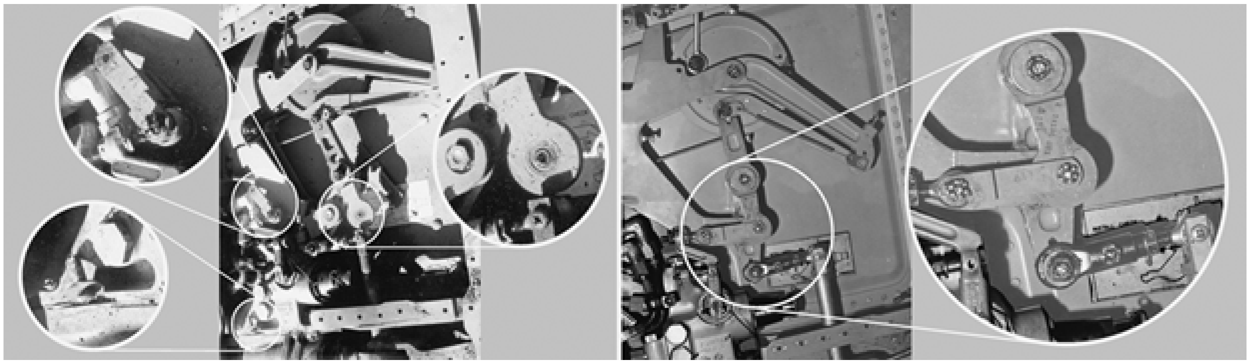
16. Flight Control Malfunction—Area.

16.1. **Mishap.** **Figure 19**. The mishap aircraft was on a local instrument training mission. After level off at 22,000 feet, the SP initiated a descending right turn, but was unable to stop the right roll after entering the turn. The IP took control of the aircraft, reduced airspeed, and regained partial control after several right rolls. The IP had marginal control authority with full left aileron and full left rudder. Two chase aircraft confirmed both ailerons were flush with the flap s, which were set at 60 percent. The crew maintained control of the aircraft for 43 minutes while discussing possible options with operations supervision. The aircrew elected to eject versus attempting to land. The IP began a right turn to proceed to the controlled bailout area. During the turn, the aircraft continued rolling right and would not recover. (The aircraft was at 19,000 feet and 180 KIAS.) The IP ordered ejection, and both crewmembers ejected successfully with only minor injuries. The aircraft was destroyed upon impact.

16.2. **Investigation:**

16.3. **Maintenance Factor.** At an unknown time, maintenance personnel removed the cotter pin securing a screw in the left aileron operating mechanism, but did not replace it. The left aileron operating mechanism became disconnected during the flight, allowing the left aileron to move full down. The aircrew eventually lost control of the aircraft and ejected.

Figure 19. Flight Control Malfunction—Area.



16.4. **Lesson Learned:**

16.4.1. It is impossible to provide definitive guidance for every aileron malfunction or for any other type of flight control malfunction, for that matter. Before commanding ejection, the IP made several logical attempts to regain control. If you have the time, contact the operations supervisor or the supervisor of flying (SOF) to help analyze the situation and develop alternative courses of action.

16.5. **Action Taken:**

16.5.1. Developed aileron operating mechanism inspection procedures to reduce the probability of similar mishaps.

17. Dual Engine Flameout.

17.1. **Mishap.** Figure 20. The mishap sortie was a pre-solo contact mission, including a heavyweight single-engine approach, missed approach, and initial acrobatic maneuvers in the area. The IP was flying the aircraft and setting up the next maneuver when the master caution light illuminated. Parameters were 90 degrees of left bank, military power, nose above the horizon, airspeed decreasing through 240 KIAS, and 17,000 feet. The IP noticed both left and right rpm and exhaust gas temperature (EGT) gauges decreasing, pulled both throttles to idle, and pushed both start buttons. He maintained about 150 KIAS during several more normal air start attempts. The IP then cycled both throttles in and out of MAX afterburner and directed the SP to check the boost pump circuit breakers and ensure his throttles were in MAX. The SP then began to cycle his throttles in and out of MAX. The IP told the SP he was going to eject and for him to follow. The aircraft pitched down after the IP ejected. The SP assumed control and attempted several air starts before ejecting himself. During the descent, the T-38 passed beneath the IP close enough for him to hear the engines running. The IP and SP were both uninjured. The aircraft was discovered in a wooded area 4 days later, destroyed upon impact.

Figure 20. Dual Engine Flameout.

17.2. **Investigation:**

17.2.1. **Supervisory Factor.** The governing directive that covers the monitoring of SPs identified as instructor pilot/fighter/ attack/reconnaissance (IP/FAR) qualified was inadequate. While a student in undergraduate pilot training (UPT), the mishap IP was IP/F AR qualified and selected to become a T-38 first assignment IP (FAIP). However, during the period from his IP/FAR qualification to his graduation from UPT, his performance deteriorated significantly.

17.2.2. **Supervisory Factor.** Unit supervisors counseled the pilot, but failed to change his IP/ FAR qualification IAW the governing directive. Inadequate guidance regarding the monitoring of IP/FAR-qualified students contributed to the problem. Prior to the mishap, the IP had not encountered any situation that would highlight his inability to handle an emergency or other stressful situation.

17.2.3. **Logistics Factor.** It appears the right boost pump failed due to an undetermined electrical interruption, flaming out the right engine. The left engine rpm dropped below generator cut-in speed, most likely due to idle decay.

17.2.4. **Operator Factor.** The IP failed to take proper emergency actions, to include maintaining aircraft control, analyzing the situation, and referring to the checklist. Apprehension and channelized attention were contributing factors. The IP held the aircraft in a low-speed (150 KIAS), high-sink condition outside the air start envelope, which disrupted his air start attempts. After the crew ejected, the aircraft gained airspeed and both engines restarted.

17.3. **Lesson Learned:**

17.3.1. Air start procedures are well defined, but the IP made crucial errors when faced with a stressful situation. The only way to combat the effects of stress is to maintain a very high level of proficiency. Supervisors must ensure IPs get enough emergency procedures training to reach the required level of proficiency. Additionally, supervisors must assess each student's ability to cope with stress prior to and after IP/FAR qualification. Because it is hard to define objective criteria regarding "grace under pressure," supervisors have to use subjective criteria and their personal judgment when evaluating an SP's ability.

17.4. **Action Taken:**

17.4.1. Expanded governing directive to include proper monitoring of SPs after the advanced training recommendation board (ATRB).

18. Left Hydraulic Failure and Right Engine Shutdown:

18.1. **Mishap.** Figure 21. The mishap aircraft was on a single-ship functional check flight (FCF). The pilot noted right engine anomalies during the inverted foreign object check. He rolled the aircraft upright and attempted to correct the engine malfunction. The pilot shut down the engine and then noticed an illuminated left hydraulic warning light with corresponding zero pressure. He still had right hydraulic pressure from the wind-milling engine, but it wouldn't be sufficient to land. He made several unsuccessful attempts to restart the right engine and then decided to go to the controlled bailout area to eject. He ejected successfully, but the aircraft was destroyed upon impact.

Figure 21. Left Hydraulic Failure and Right Engine Shutdown.

18.2. **Investigation:**

18.2.1. **Maintenance Factor.** A maintenance specialist incorrectly installed the left hydraulic system reservoir cap. The cap came loose during engine run-up for takeoff. As a result, the left hydraulic system reservoir was unpressurized. Using the speed brakes and landing gear during the FCF profile resulted in momentary cavitation of the left hydraulic pump. This cavitation was also accompanied by momentary illuminations of the master caution and left hydraulic caution lights.

18.2.2. **Supervisory Factor.** The pilot did not consider the momentary illumination of the left hydraulic caution light to be critical, and he continued the mission. The fact it was an FCF and not a training sortie may have contributed to his decision. Flight manual guidance was also inadequate. The left hydraulic reservoir lost enough fluid during the subsequent inverted negative G flight to cause a system failure.

18.2.3. **Logistics Factor.** The right main fuel control malfunctioned during inverted flight for an undetermined reason, resulting in loss of throttle response.

18.2.4. **Operator Factor.** The pilot failed to fully analyze the situation. He shut down the right engine before realizing the left hydraulic system had failed. The main fuel control malfunction prevented a successful air start. The pilot then correctly determined he could not land the aircraft safely.

18.3. **Lesson Learned:**

18.3.1. Mishaps are usually the result of a chain of events. If you can break the chain at any of the links, the mishap can be prevented. In this case, the pilot failed to thoroughly analyze the situation. If he had, he might have come up with a different "game plan," which would have allowed him to recover the aircraft.

18.4. **Action Taken:**

18.4.1. Added the following note to T.O. 1T-38A-l: "NOTE: Momentary drops in pressure sufficient to cause illumination of the hydraulic caution light may be an indication of an unpressurized system. Land as soon as conditions permit. Avoid zero or negative G flight to prevent fluid loss."

18.4.2. Added the following warning to T.O. 1T-38A-1:

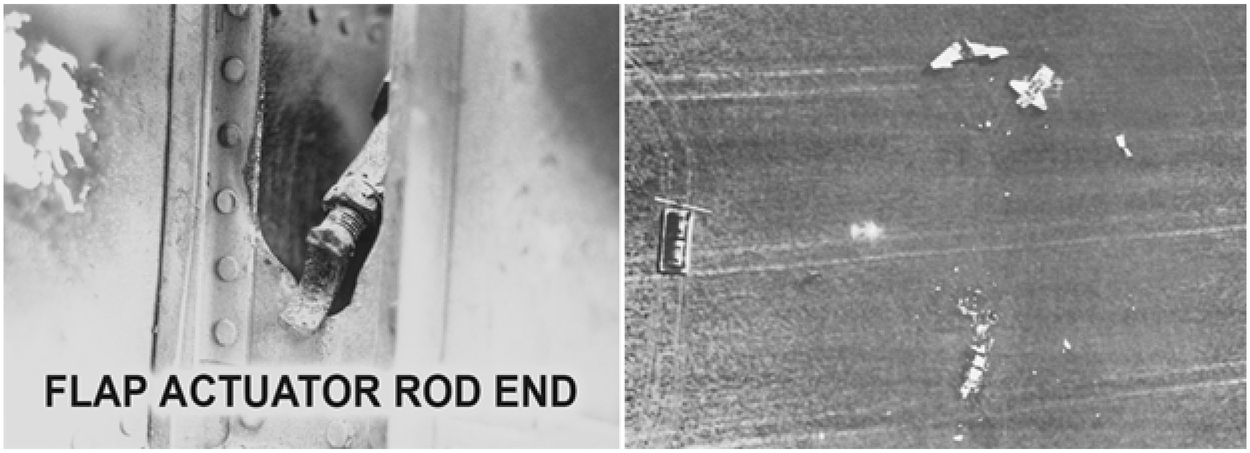
Table 2. Warning Statement.

WARNING
Do not attempt to land the aircraft when a windmilling engine is providing the only source of hydraulic pressure.

19. Flight Control Malfunction—Pattern.

19.1. **Mishap.** Figure 22. The mishap aircraft was on a solo student training mission. Once back in the traffic pattern, the SP heard a loud bang when he extended the gear and flaps on inside downwind. Thinking it was a compressor stall, he scanned the engine instruments to identify the malfunction. When he looked back outside, the aircraft was nearly inverted. The SP decided to eject, but had some difficulty reaching the ejection handles. The aircraft completed roughly two and half revolutions before the SP finally ejected. He was uninjured, but the aircraft was destroyed upon impact.

Figure 22. Flight Control Malfunction—Pattern.



19.2. **Investigation:**

19.2.1. **Supervisory Factor.** T-38 flap actuator rod end failures had been documented as early as 5 years before this mishap. The system manager noted an increase in failures 2 years before the mishap. Logistics managers started the process to design and procure an improved rod end, but they did not update the technical data concerning the old rod ends. Specific issues were:

19.2.1.1. The assigned time change interval did not provide an adequate safety margin to prevent fatigue failures.

19.2.1.2. The length of the periodic visual inspection interval prevented the timely detection of fatigue cracks.

19.2.1.3. T.O. guidance did not require NDI of the rod ends, and the prescribed visual inspection procedure was inadequate to detect cracks.

19.2.2. **Logistics Factor.** The right flap actuator rod end developed a fatigue crack. The fatigue crack gradually grew, weakening the rod end. During the mishap sortie, the rod end failed as the flaps were lowered for landing.

19.2.3. **Operator Factor.** The SP delayed using aileron to counter the roll (or used insufficient aileron) and allowed the aircraft to enter a nose low attitude. Channelized attention was a contributing factor. The SP ejected as the aircraft rolled past 135 degrees of bank and in a 25- to 30-degree dive.

19.3. **Lesson Learned:**

19.3.1. Although flap rod ends had failed prior to this mishap, the seriousness of this malfunction was underestimated. No aircraft were lost in the previous instances due to pilot experience and the timing of the failures. (For instance, one failed in the final turn; but, luckily, it was the top wing. This caused the aircraft to roll out versus rolling over.) The SP's inexperience played a part in this mishap. He did not apply the first basic rule—maintain aircraft control. However, bad timing also played a part.

19.4. **Action Taken:**

19.4.1. Incorporated critical action emergency procedures into T.O. IT-38A-1, emphasizing the different types of flap asymmetry and the need for immediate pilot action to recover the aircraft.

19.4.2. Reduced the time change interval on flap rod ends to minimize the possibility of fatigue failure.

19.4.3. Established adequate NDI procedures to detect fatigue cracks in flap rod ends.

19.4.4. Procured newly designed flap rod ends and expedited T-38 and F-5 retrofit.

20. Bird Strike—Low-Level Sortie.

20.1. **Mishap.** Figure 23. The mission was a two-ship low-level navigation sortie. The mishap aircraft (lead) was flying a syllabus support sortie flown by two IPs. Approximately halfway through the low level, a bird penetrated the front windscreen, fatally injuring the IP in the front seat. The IP in the rear seat was not injured and recovered the aircraft with assistance from the wingman.

Figure 23. Bird Strike—Low-Level Sortie.

20.2. **Investigation:**

20.2.1. **Operator Factor.** The mishap crew saw birds twice on the low-level prior to the mishap. In one instance, the front seat IP assumed control and maneuvered the aircraft to avoid a bird. Approximately 6 minutes later, an adult turkey vulture penetrated the windscreen. The mishap aircraft was in straight-and-level flight, 500 feet AGL, and traveling at 400 KIAS. The front seat IP received fatal head injuries from bird and windscreen debris.

20.3. **Lesson Learned:**

20.3.1. Birds have always posed a threat to aviators. The crew only had about 3.6 seconds to react, taking aircraft speed and bird size into account. That gave the pilot 3.6 seconds to see the bird, assess the collision potential, make a decision, and move the controls in sufficient time for the aircraft to move far enough to avoid hitting the bird.

20.3.2. Reducing the airspeed gives the aircrew more time to react. Changes in lighting and the size of the bird also impacts the ability to acquire the threat and may reduce available reaction time.

20.4. **Action Taken:**

20.4.1. Procured new windscreen and frame assemblies.

20.4.2. Prohibited solo low-level sorties.

20.4.3. Reduced maximum allowable speed on low-level routes.

21. Flaps Extended During Area Maneuvering.

21.1. **Mishap.** **Figure 24**. The mishap occurred on a 2-ship Offensive Basic Fighter Maneuvers (OBFM) training mission. After completing the BFM engagement during maneuvering back to tactical formation, the flaps on the mishap aircraft (MA) extended at approximately 390 knots calibrated airspeed resulting in an abrupt aircraft pitch down. The left flap rod 'Y' broke as the flaps extended, causing the left flap to raise to a streamline position while the right flap remained down, resulting in an uncommanded aircraft left roll. This led to an unrecoverable condition in this configuration. The mishap pilot (MP) ejected safely with only minor injuries. The MA was destroyed upon impact. Property damage was limited to ground depression, damaged trees, and fuel and hydraulic contamination.

Figure 24. Flaps Extended During Area Maneuvering.

21.2. **Investigation:**

21.2.1. **Operator Factor.** The MP was aggressively maneuvering the flight to reposition the wingman from near the 6 o'clock to a line abreast position which required the MP to swap from looking aft left to looking aft right. Under G, this requires using the arms to help twist in the opposite direction and pushing off of something in the cockpit. The MP was concentrating on the wingman and not on precise hand placement in the cockpit. Since the left hand normally rests on the throttles, it was in very close proximity to the flap lever which only takes 4 pounds of pressure to actuate.

21.2.2. **Operator Factor.** The MP inadvertently extended the flaps on the MA above the flap limit speed which caused the left flap rod to fail. This led to an unrecognized flap asymmetry and unrecoverable condition and a proper decision by the MP to eject.

21.3. **Lesson Learned:**

21.3.1. Clearing the sky and keeping track of your wingman is very important, especially when performing maneuvers in close proximity to each other. The area in a small trainer like the T-38 does not lend itself to good rearward visibility. Twisting your cranium as far as you as can will still not effectively clear to the rear. So bracing your hand on something to assist in turning your body is an accepted practice. Just be careful not to place your hand near a switch or lever that might be activated such as the flap lever.

21.4. **Actions Taken:**

21.4.1. Warning added to T.O. 1T-38C-1, "High speed flap deflection can result in an instantaneous failure of one or both flaps. If one flap fails, the sudden asymmetric condition will result in a severe coupled roll and yaw possibly associated with high negative Gs. Immediately return the flap lever to the UP position to ensure recovery."

21.4.2. Note added to T.O. 1T-38C-1, "Detection of unintentional flap deployment at high speed is critical to avoiding a flap failure. Upon flap deflection, there will be an uncommanded pitch down associated with a noise of rushing air and possible buffet. If this condition occurs, immediately return the flap lever to the UP position."

21.4.3. A FLAPS caution on the HUD/MFD with accompanying voice message added to advise when the airspeed approaches or exceeds the airspeed limit for the current flaps setting.

22. Bird Strike on Low-Level.

22.1. **Mishap.** **Figure 25**. The mishap formation (MF) noted that the Avian Hazard Advisory System (AHAS) showed the first leg of the low-level route as SEVERE according to the Bird Avoidance Model (BAM). The decision was made to fly the first leg of the route at the top of the route structure (3,000 feet MSL), then to descend to 500 feet AGL after point BRAVO. The MF spotted a large flock of white birds but continued the route. Approximately 13 minutes into the low-level route, the mishap aircraft (MA) struck multiple mallard ducks. The front cockpit canopy shattered and both of the MA's engines experienced compressor stalls and resulted in an immediate thrust deficient condition. The mishap instructor pilot (MIP) attempted to correct the condition and recover the engines in accordance with all applicable procedures. The engines did not recover and the MIP commanded ejection as the aircraft descended through the recommended minimum ejection altitude. The mishap pilot and MIP ejected without injury and the MA was destroyed.

Figure 25. Bird Strike on Low-Level.

22.2. **Investigation:**

22.2.1. **Logistics Factor.** In accordance with local guidance, the first option when a low-level has a SEVERE leg is to fly another route/mission. The other low level routes available had just been closed for weather. The second option is to enter at an alternate entry point. The third option is to fly the affected legs at the top of the block, 1,500 feet above ground level (AGL) minimum, with Operations Supervisor approval. This guidance was based upon old data and did not take into account changes that significantly changed the BASH threat on local low-level routes due to human activity and changes to avian behavior.

22.2.2. **Operator Factor.** AHAS is a mission planning tool designed to help predict the likelihood of bird at a specific location and minimize assumed risk based upon historical data, predictive models based upon environmental condition, and current data from NEXRAD radars. Once the presence of large numbers of birds is confirmed by first hand observation, the mission risk must be reevaluated to determine if the mission should continue. Pilots did not understand the intent of the local BASH guidance due to ambiguity in the wording. The intent was for aircraft to abort the route if dense bird activity was observed.

22.3. **Lesson Learned:**

22.3.1. In the training command, no mission is so important that it cannot wait until a later time. One risk management control measure is to avoid or defer the event to another time where the risk is lessened. Flying into a bird SEVERE condition, seeing birds and continuing the route was a poor airmanship decision. We were fortunate not to have lost both aircraft that day.

22.3.2. BASH plans and guidance must extend beyond the home airfield to encompass all normal flying areas. Any observed changes to these areas need to be forwarded to the appropriate authority in the wing for risk mitigation or acceptance.

22.4. **Actions Taken. None.**

Section D—T-38 Disorientation and Loss-of-Control Mishaps

23. Loss of Control – Traffic Pattern Stalls.

23.1. **Mishap.** Figure 26. The mission was a pre-solo contact sortie. The SP was practicing no-flap traffic pattern stalls in the area. He lowered the gear and began a right turn at 19,000 feet MSL. He initiated the recovery at the first stall indication by applying left aileron and selecting maximum afterburner. At first, the aircraft rolled farther right, but then it rolled left past wings level until it was inverted. The IP assumed control and made anti-spin control inputs (left aileron, back stick, and full right rudder). The aircraft started oscillating with rapid roll rates and large pitch changes, exceeding both positive and negative load-factor limits. Both crewmembers ejected successfully, but the aircraft was destroyed upon impact.

Figure 26. Loss of Control—Traffic Pattern Stalls.

23.2. **Investigation:**

23.2.1. **Operator Factor.** The IP misinterpreted the aircraft response as a spin and caused the oscillations with his anti-spin control inputs. He became severely disoriented, determined recovery was not possible, and ordered ejection.

23.3. **Lesson Learned:**

23.3.1. The possibility of a T-38 entering a true spin is extremely remote. Applying anti-spin controls when no spin exists will result in cross-control oscillations and severe disorientation.

23.4. **Action Taken:**

23.4.1. Expanded the T.O. 1T-38A-l description of stalls, spins, and recovery techniques to include a variety of stalls, gyrations, and other maneuvers that could be misinterpreted as spins.

23.4.2. Revised the governing directive to state, "If severe wing rock occurs, immediately execute stall recovery procedures."

24. Loss of Control—Intercom Failure.

24.1. **Mishap.** **Figure 27**. This mishap occurred during a day-night, out-and-back navigation training mission. The aircraft departed on the return leg just after sunset. On takeoff, the IP (in the RCP) experienced a complete loss of intercom and ultra-high frequency (UHF) radio, observed the master caution light momentarily illuminate, and assumed control of the aircraft. Although the IP briefed the SP before flight that he (the IP) would assume aircraft control in this contingency, the SP failed to relinquish the controls because he believed the IP was giving him a simulated emergency procedure. Meanwhile, the IP attempted to maneuver the aircraft for a visual landing. The SP's continued control inputs eventually led the IP to believe the flight controls were malfunctioning and a loss of control was imminent. The IP ejected, followed immediately by the SP.

Figure 27. Loss of Control—Intercom Failure.

24.2. **Investigation:**

24.2.1. **Operator Factor.** The SP failed to relinquish control of the aircraft as briefed and vigorously opposed the IP's control inputs, which caused the IP to believe loss of control was imminent.

24.3. **Lesson Learned:**

24.3.1. The loss of inter-cockpit communications in a dual control tandem aircraft seldom results in a major accident. Nevertheless, this mishap proves it can happen! IPs must ensure SPs are thoroughly briefed on what to expect and what is expected of them following intercom failure.

24.4. **Action Taken:**

24.4.1. Amplified transfer of aircraft control procedures in the governing directive to clarify aircrew guidance on intercom failure. Additionally, added the following:

Table 3. Aircraft Control Transfer procedures guidance.

CAUTION

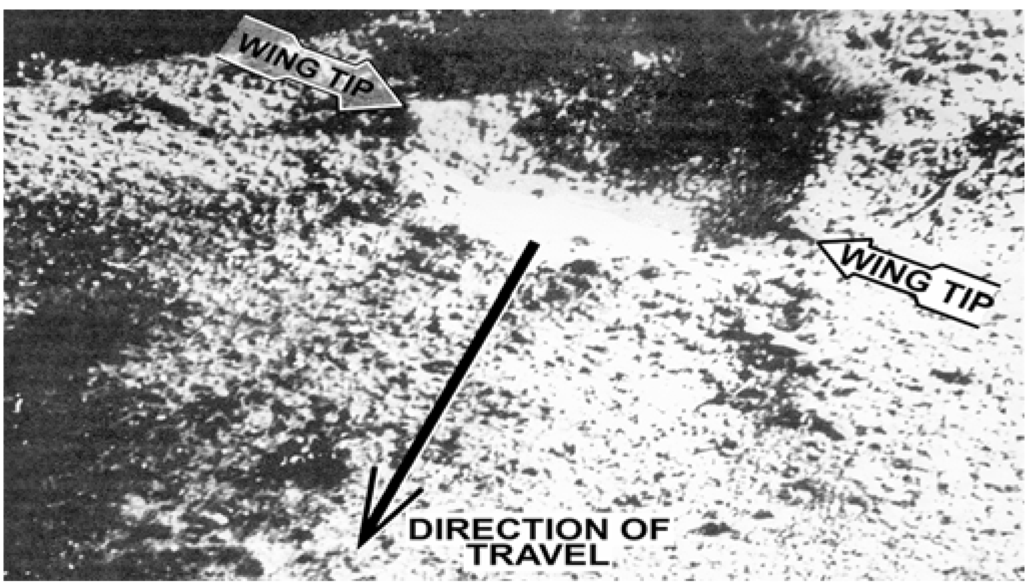
Transfer of aircraft control without intercom can result in disastrous crew confusion if not done in a positive prebriefed manner. If there is any confusion, the aircraft commander must be prepared to immediately assume control. If you, as the other crewmember, at any time feel an unexpected pressure on the stick, momentarily relax your grip to determine if the aircraft commander is attempting to take control. Aircrew confusion can result in two extremely hazardous situations, one in which neither crewmember is flying the aircraft and the other in which both crewmembers are fighting for the controls. Both conditions are potentially disastrous.

24.4.2. Made transfer of aircraft control procedures a mandatory briefing item.

25. Loss of Control – Area.

25.1. **Mishap.** Figure 28. The mishap sortie was a solo contact mission, which included aerobatic maneuvers in the local area and normal traffic patterns and landings back at the field. Air traffic control lost radar contact with the aircraft approximately 13 minutes after it arrived in the assigned area. Subsequent investigation revealed the aircraft impacted the ground nearly vertical at high speed. The SP had not attempted to eject and was fatally injured.

Figure 28. Loss of Control – Area.



25.2. **Investigation:**

25.2.1. **Operator Factor.** Eyewitness statements indicate the SP was performing aerobatic maneuvers below the minimum established altitude. While attempting a high performance aerobatic maneuver, the SP placed the aircraft in a high-speed, vertical dive with insufficient altitude to recover.

25.3. **Lesson Learned:**

25.3.1. Simple errors (like misreading the 10,000 foot increment on the altimeter) while performing usual aerobatic maneuvers could place a student in a high speed dive with little altitude to recover.

25.3.2. Be sure to double check the altimeter and airspeed before beginning each maneuver and during the maneuver. If the parameters do not look right, immediately abort the maneuver and execute the appropriate recovery. Be sure you understand the dive recovery charts in the T.O. 1T-38A-1, Flight Manual (AF 59-1603 and Later Aircraft), and have a plan on how to execute a high-speed, dive recovery.

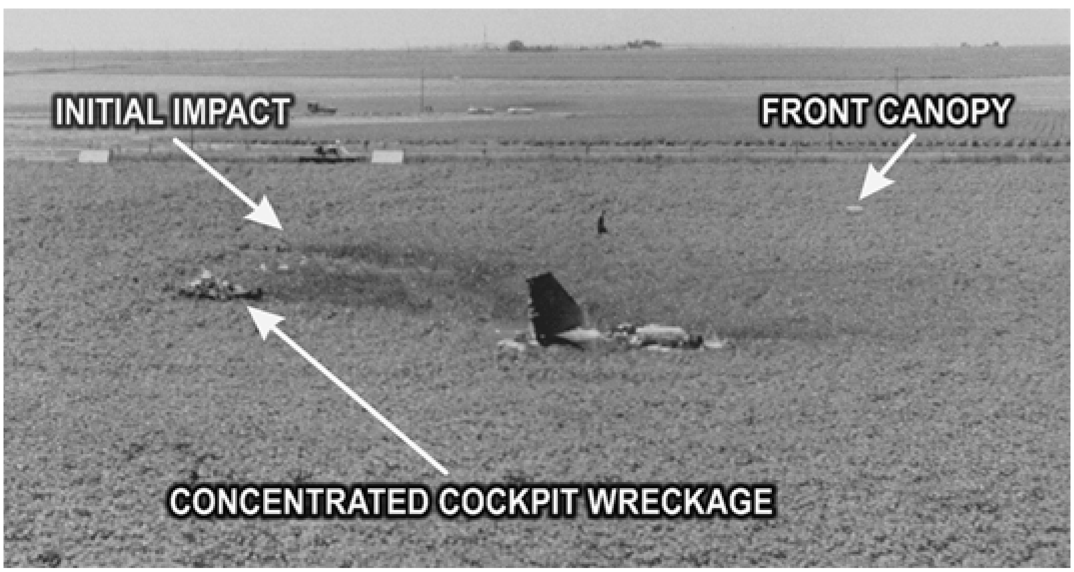
25.4. **Action Taken:**

25.4.1. Conducted a study of procedures that controlling agencies will use to: (1) challenge aircraft not displaying altitude readout to verify their Mode C capability, and (2) visually confirm the pilot's reported altitude with the altitude readout displayed on the radar equipment on each handoff.

26. Disorientation – Night Pattern.

26.1. **Mishap.** Figure 29. The mishap aircraft was on an initial night solo mission. Once established in the traffic pattern, the SP broke out on initial due to a traffic conflict. Approaching the visual flight rules (VFR) entry point, the SP descended from the breakout altitude and started a turn away from the entry point. The aircraft was last observed in a wings level descent on the 90-degree leg to initial before impacting the ground. The SP made no attempt to eject and was fatally injured. The aircraft was destroyed upon impact.

Figure 29. Disorientation—Night Pattern.



26.2. **Investigation:**

26.2.1. **Operator Factor.** The SP probably became disoriented due to G forces, visual illusions, limited visual cues, and limited night experience.

26.3. **Lesson Learned:**

26.3.1. Many of the optical cues (such as depth perception or motion cues) we rely on for attitude awareness are not present at night, making us highly susceptible to unrecognized spatial disorientation, especially while performing visual maneuvers. It is imperative to rely primarily on the instruments at night, even while flying a visual pattern.

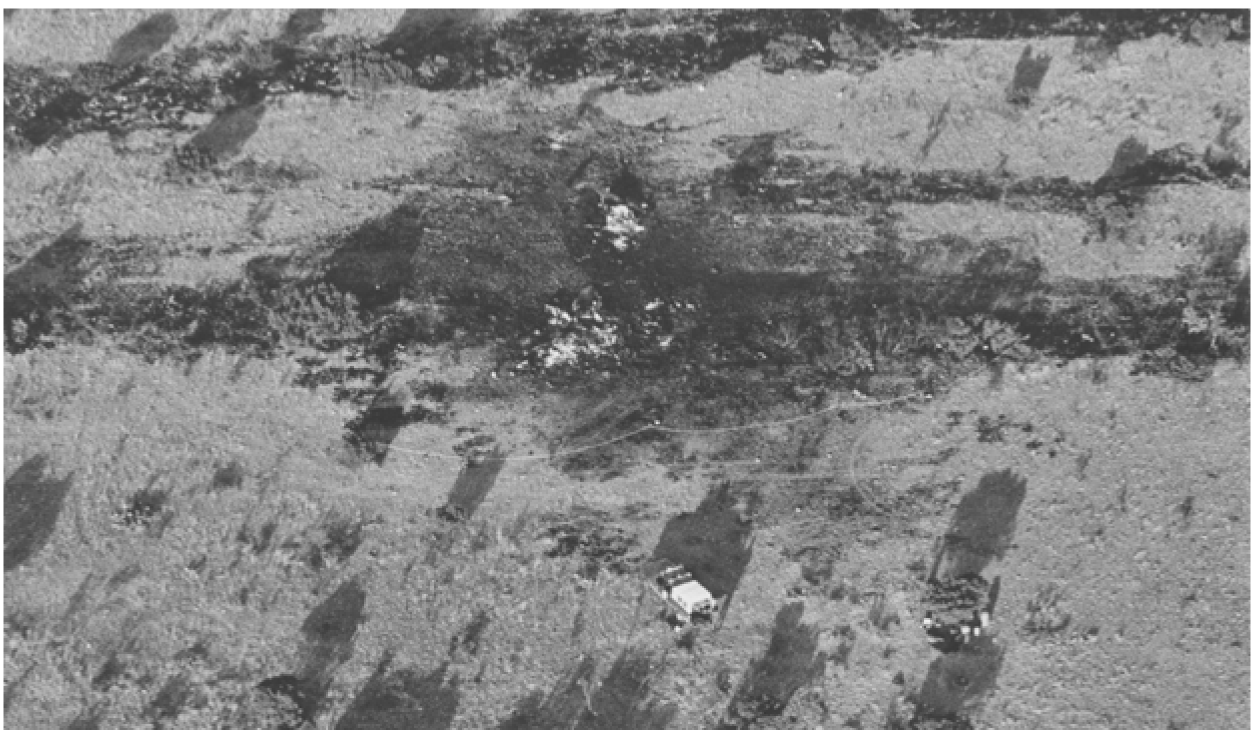
26.4. **Action Taken:**

26.4.1. Changed the command syllabus to require a night breakout and traffic pattern reentry prior to flying a night solo mission.

27. Loss of Control – Area.

27.1. **Mishap.** Figure 30. The mission was the SP's last UPT sortie. After level-off at 23,000 feet, the IP assumed aircraft control, flew into the area, and executed an aileron roll and split S. The IP returned aircraft control to the SP, who began an Immelmann. The SP selected afterburners and began a high G pull at 350 knots to initiate the Immelmann, exceeding aircraft G limits in the process. The SP stated his intention to lower the flaps at approximately 30 to 45 degrees nose high and 300 knots. As the aircraft approached 150 knots and pure vertical, the IP took control of the aircraft to attempt a recovery. The aircraft continued upward, and the airspeed decreased rapidly. The aircraft departed controlled flight at 25,500 feet MSL. The IP made several attempts to recover the aircraft, but all were unsuccessful. The SP ejected at 9,500 feet AGL, and the IP ejected at 2,000 feet AGL. Neither crewmember was injured, but the aircraft was destroyed upon impact.

Figure 30. Loss of Control – Area.



27.2. **Investigation:**

27.2.1. **Operator Factor.** The SP initiated an Immelmann well below the minimum prescribed entry airspeed. In addition, he overstressed the aircraft on pull up.

27.2.2. **Supervisory Factor.** The IP failed to assume control of the aircraft in a timely manner. In addition, he used improper procedures to recover from vertical flight.

27.3. **Lesson Learned:**

27.3.1. The IP was complacent, which delayed him from taking the aircraft at the appropriate time. The SP had completed all required evaluation sorties and would most likely be the outstanding graduate. The IP had flown with him many times and considered him the best student in his flight.

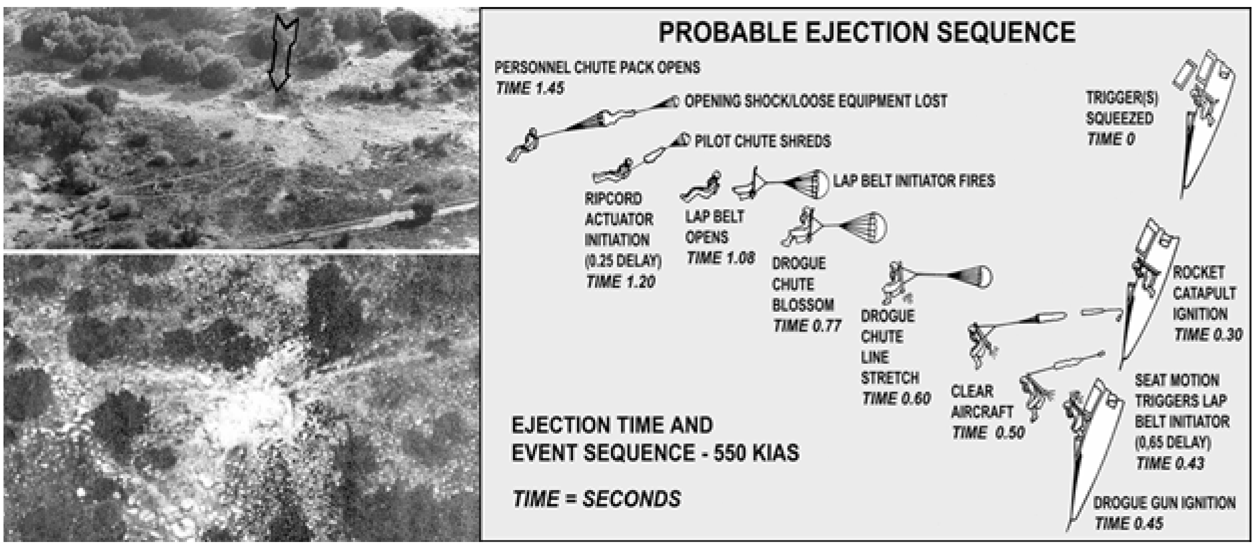
27.4. **Action Taken:**

27.4.1. Prohibited the use of flaps during aerobatic maneuvers.

28. Loss of Control – Area.

28.1. **Mishap.** Figure 31. The mishap aircraft was on a single-ship team sortie (two students). The SP in the RCP was acting as an observer. Takeoff and departure to the working area were uneventful. Thirteen minutes after the crew entered the area, air traffic control lost radar and radio contact. The SP in the FCP had attempted a high speed ejection, but was fatally injured. The SP in the RCP had not ejected and was also fatally injured. The aircraft was destroyed upon impact.

Figure 31. Loss of Control – Area.



28.2. **Investigation:**

28.2.1. **Operator Factor.** It appears the SP in the FCP entered a high-speed dive during the last portion of a barrel roll, possibly due to disorientation. He determined recovery was impossible. He ejected at high speed and sustained fatal injuries during the ejection.

28.3. **Lesson Learned:**

28.3.1. Disorientation seems to be the most plausible explanation and is supported by SP's previous performance along with the planned maneuvers and prevailing sky conditions for this mission. Fatigue may have intensified the disorientation. The SP was pushing the flight duty limitation (12 hours) with a long day of activity (nearly 11 hours, including two academic classes, a physical training period, and two flights).

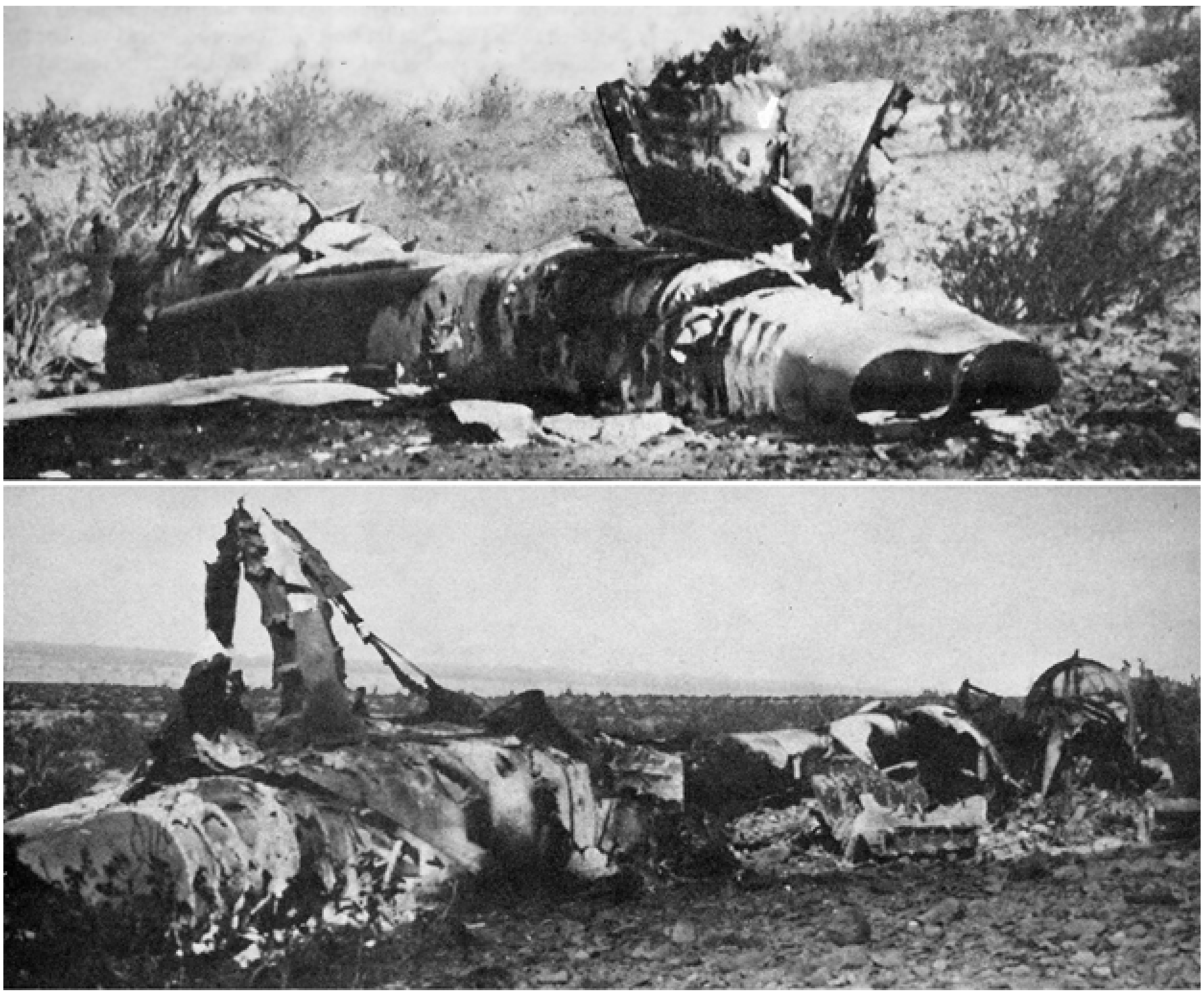
28.4. **Action Taken:**

28.4.1. Established policies enforcing compliance with flight and duty restrictions to ensure pilots obtain proper crew rest.

29. Loss of Control – Night Cruise.

29.1. **Mishap.** **Figure 32**. The mission was a single-ship, navigation flight evaluation. After 40 minutes of uneventful flight, the aircrew declared an emergency for a flight control problem. The crew started a descent and proceeded to an emergency airfield. During the descent, the IP transmitted the crew's intention to eject. Both crewmembers ejected successfully and were uninjured, but the aircraft was destroyed upon impact.

Figure 32. Loss of Control – Night Cruise.



29.2. **Investigation:**

29.2.1. **Logistics Factor.** An undetermined component of the stability augmenter system (SAS) malfunctioned during straight-and-level, unaccelerated flight. The aircraft suddenly yawed to the left and then began rolling left.

29.2.2. **Operator Factor.** After assuming control of the aircraft, the IP failed to fully evaluate the flight control abnormality and incorrectly assumed the left rolling tendency was caused by an aileron control malfunction. The IP may have jumped to this conclusion based on his knowledge of a previous T-38 aircraft mishap caused by an aileron disconnect.

29.2.3. **Operator Factor.** During the descent, the SP improperly interpreted a shake of the control stick as a nonverbal signal transferring aircraft control to him, even though the intercom was working perfectly. The SP attempted to assume control of the aircraft, unknowingly applying control inputs in opposition to the IP.

29.2.4. **Operator Factor.** The IP did not recognize the conflicting control stick inputs as coming from the SP and assumed the supposed aileron control malfunction had degraded enough to prevent a safe landing. The IP directed ejection, and both crewmembers ejected successfully.

29.3. **Lesson Learned:**

29.3.1. Because the IP had recently lost a friend in a mishap caused by an aileron malfunction, he may have had a perceptual set that led him to misinterpret this malfunction as aileron induced. A stability augmenter malfunction could easily be misinterpreted as an aileron malfunction. Therefore, if practical, get a chase ship or just look outside at the wings to determine if the ailerons are responding appropriately. That is, thoroughly analyze the indications when time and conditions permit. In addition, improper transfer of aircraft control has caused several aircraft losses so be sure to discuss verbal and nonverbal transfers in detail.

29.4. **Action Taken:**

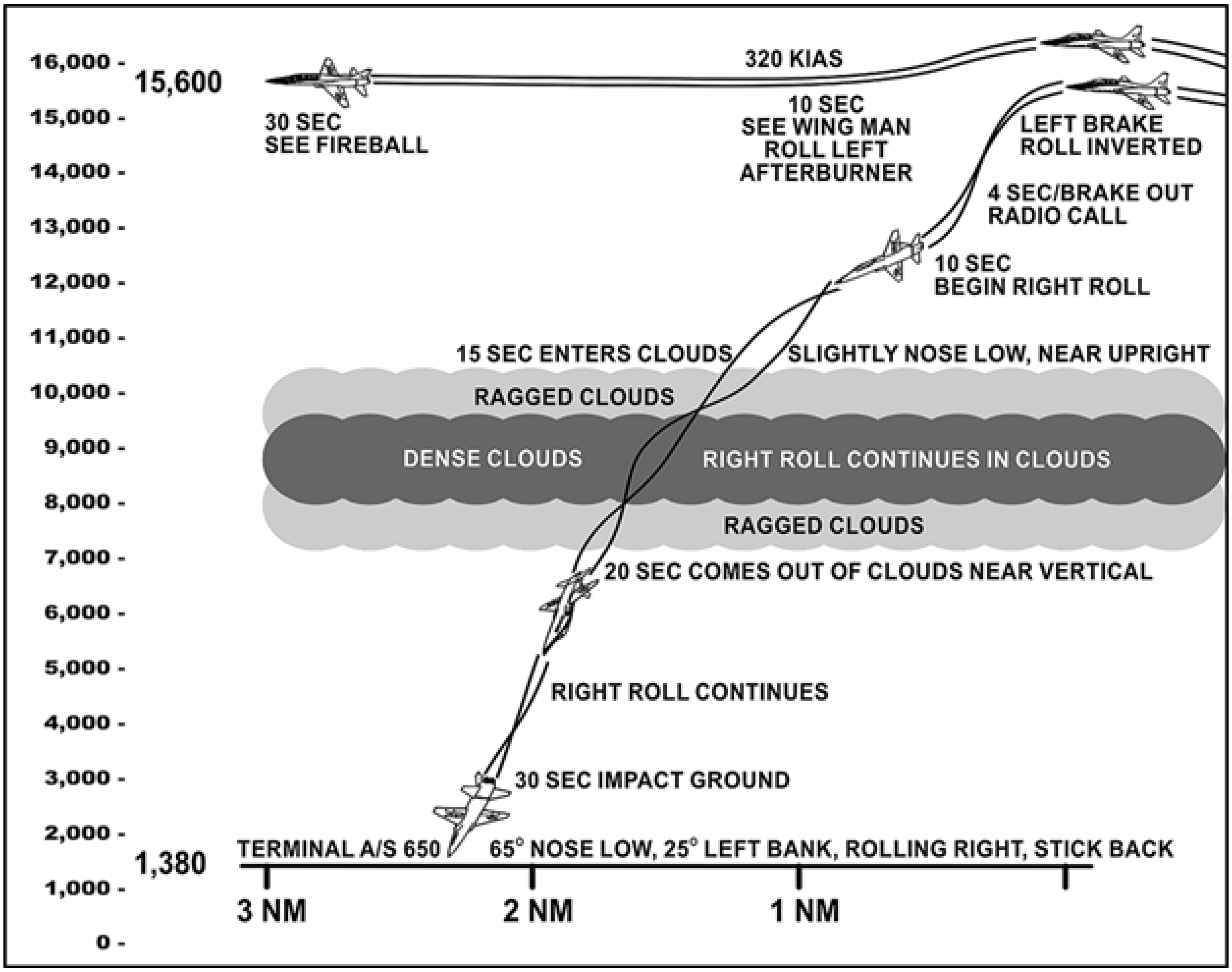
29.4.1. Expanded the transfer of air craft control procedures in the governing directive and changed the paragraph on intercom failure or transfer of control to read: "Under some unique circumstances, subsequent transfer of control may be necessary. Walking the rudder pedals or yawing the aircraft will indicate transfer of aircraft control to the other aircrew member who will acknowledge control by a noticeable shaking of the stick. These unique circumstances must be thoroughly briefed."

29.4.2. Revised the T-38 syllabus to specifically include a requirement to demonstrate proper transfer of aircraft control both with and without inter-cockpit communications.

30. Disorientation – Night Formation.

30.1. **Mishap.** **Figure 33**. The mission was a night formation sortie. The wingman called "breaking out" while the flight was in a shallow descent passing 16,000 feet MSL. The lead aircraft observed the wingman descending in a left-hand turn with the afterburner selected. The wingman appeared to level off and retard the throttles from afterburner just prior to entering instrument meteorological conditions (IMC). Moments later, the lead aircraft pilot observed a fireball. He orbited the mishap site and reported the situation to local radar control and the SOF. Neither mishap crewmember attempted to eject and both were fatally injured.

Figure 33. Disorientation – Night Formation.



30.2. **Investigation:**

30.2.1. **Operator Factor.** The mishap aircrew became spatially disoriented prior to, during, or after the breakout due to one or more of the following:

30.2.1.1. Weather conditions.

30.2.1.2. Night formation.

30.2.1.3. Mishap IP's minimal training and experience in night formation.

30.2.1.4. Rapid roll and/or G load associated with the breakout.

30.2.1.5. Fatigue (third flight of the day).

30.2.2. **Operator Factor.** Meteorological conditions at the time of the crash were broken cloud layers from 1,500 to 25,000 feet with little-to-no moon illumination.

30.3. **Lesson Learned:**

30.3.1. Although spatial disorientation is deadly, it can be defeated by a disciplined application of the proper procedures. Your inner ear and "the seat of your pants" will lie to you, but you can still recover the aircraft by making the instruments read correctly. The rules are simple, yet effective:

30.3.2. Recognize. Something does not look right in your cross-check.

30.3.3. Confirm. Ensure the primary and standby attitude directional indicators (ADI) both read the same.

30.3.4. Recover. Make the ADIs read correctly and then check that the other instruments have stabilized.

30.3.5. The governing directive also states, “Upon losing sight of the leader or if unable to maintain formation due to disorientation, the wingman will simultaneously execute the applicable lost wingman procedure, while transitioning to instruments. Smooth application of control inputs is imperative to minimize the effects of spatial disorientation.” Although the lost wingman procedures may be more applicable to IMC, the same procedures apply equally well during marginal VMC, whether day or night.

30.3.6. Although this mishap involved a relatively inexperienced IP, the history of disorientation mishaps (44 in the previous 10 years) shows that experienced pilots are just as susceptible to disorientation.

30.4. **Action Taken:**

30.4.1. Reevaluated the requirement for a UPT night formation mission.

30.4.2. Reevaluated the adequacy of IP training.

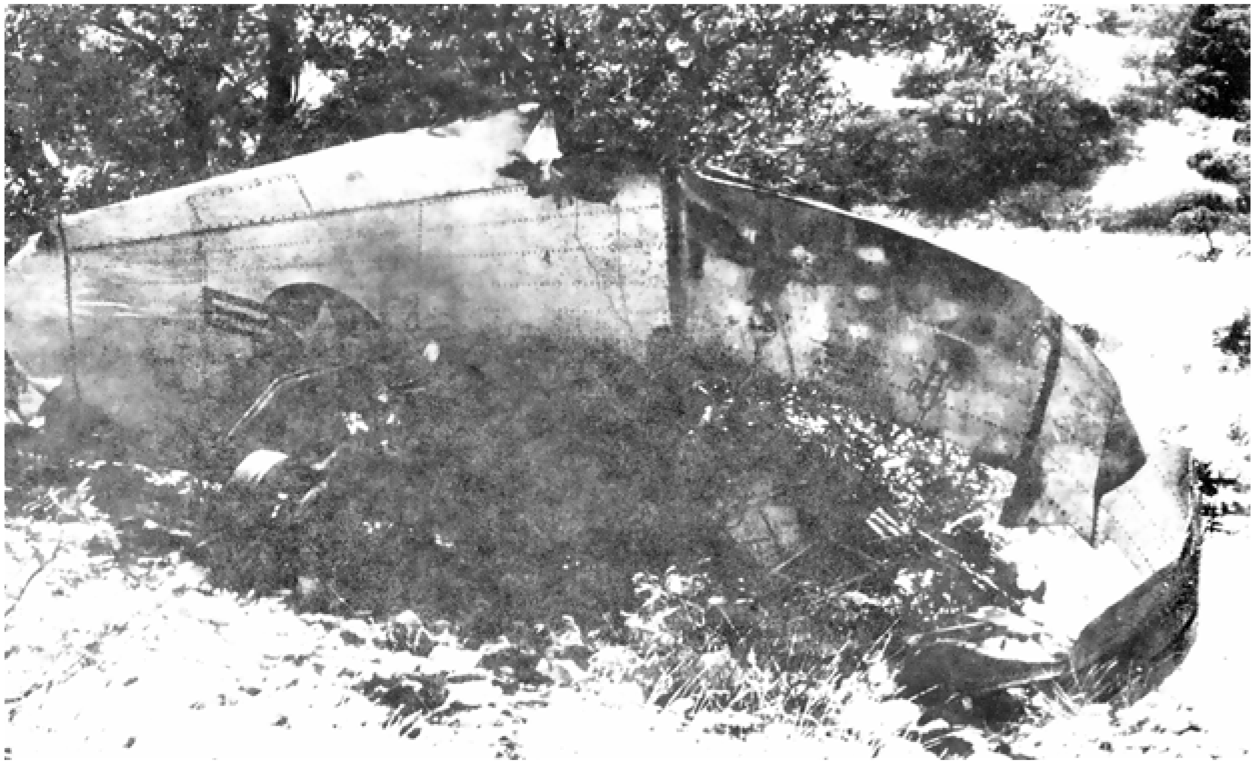
30.4.3. Restricted SPs and IPs from flying night formation missions on their third flight of the day.

30.4.4. Added more aircraft instrument and spatial disorientation training to command training programs.

31. Loss of Control – Flight Control Malfunction.

31.1. **Mishap.** **Figure 34**. The mission was the SP’s initial solo formation flight, and he was assigned to lead the formation takeoff. During takeoff roll, the mishap aircraft appeared to over rotate and pitch up when breaking ground. The wingman moved abeam and then passed the mishap aircraft, losing sight. The mishap SP regained control of the aircraft and notified the wingman of a pitch control problem. He regained the lead and continued the departure. The SOF suggested the flight burn down fuel and come back for a straight-in approach. The SOF also suggested the SP do a controllability check with landing gear up and 60 percent flaps. The SP lowered the flaps at FL 190. The aircraft began to pitch up and then rolled into a steep left bank. The wingman initiated a breakout, losing sight of the mishap aircraft. When the wingman reacquired the mishap aircraft, it was inverted, rotating, and descending. The SP ejected successfully, but the aircraft was destroyed upon impact.

Figure 34. Loss of Control—Flight Control Malfunction.



31.2. **Investigation:**

31.2.1. **Maintenance Factor.** The flap and slab interconnect cable was not connected to the horizontal tail's operating mechanism during installation of the boat tail the night before the mishap sortie. Additionally, the required post-maintenance inspections failed to identify the discrepancy.

31.2.2. **Operator Factor.** The SP and crew chief did not check for proper movement of the flaps and slabs IAW appropriate checklists.

31.2.3. **Operator Factor.** The mishap SP failed to properly analyze the situation and provide an accurate and complete descript ion of the conditions to his wingman IP or the SOF. The SP extended the speed brakes to expedite fuel burn, which compressed the time available for analysis.

31.2.4. **Supervisory Factor.** T.O. lT-38A-l does not adequately address the characteristics of flap and slab interconnect failure. Additionally, the structural damage or controllability check procedure contained misleading guidance if applied to suspected flap and slab interconnect problems.

31.2.5. **Supervisory Factor.** Neither the wingman IP nor the supervisory of flying (SOF) adequately analyzed the malfunction. This led the SOF to suggest lowering the flaps during the controllability check.

31.2.6. **Operator Factor.** During the controllability check, the SP failed to maintain aircraft control. The aircraft probably entered a stall as the flaps extended. Delayed pilot reaction or incorrect flight control inputs to recover the aircraft may have led to the loss of control.

31.3. **Lesson Learned:**

31.3.1. This mishap resulted from a series of errors, similar to links in a chain. Breaking one link or eliminating even one error would have prevented the mishap.

31.3.2. The first link in the chain involved maintenance errors. Maintenance personnel failed to connect the horizontal tail's operating mechanism during installation of the boat tail, most likely due to complacency. This was their third boat tail installation on shift, and they may have rushed the job to get done before shift change. In addition, the quality control augmenter failed to use the two-man challenge and response checklist. Instead, he or she performed the checklist without assistance and did not ensure all checks were accomplished.

31.3.3. The second link broke when the SP failed to visually confirm slab movement as directed in the before-taxi checklist. He depended totally on the crew chief to ensure correct positioning of the slab, but the crew chief did not confirm movement either. The SP failed to properly analyze the malfunction and eventually lost control of the aircraft.

31.3.4. The third and final link in the chain occurred when the SOF and wingman IP failed to thoroughly analyze the malfunction. The SOF may have been overly concerned with the SP landing with no flaps due to inadequacies in T.O. 1T-38A-1 that lead the SOF to suggest lowering the flaps in the controllability check.

31.3.5. Bottom line: Comply with the checklist, visually confirm that your flight controls move correctly, and do not rely exclusively on ground personnel for confirmation.

31.4. **Action Taken:**

31.4.1. Expanded T.O. lT-38A-l guidance regarding the flap-horizontal tail interconnect system.

31.4.2. Changed T.O. IT-38A-l to clarify the objective of and the guidance for a controllability check.

31.4.3. Changed maintenance T.O.s to require door #47 be sealed by the quality assurance team after completion of the challenge-and-response inspection following boat tail installation.

31.4.4. Changed maintenance T.O.s to require an operational check of the flap-horizontal tail interconnect system following boat tail installation.

32. Loss of Control – Area.

32.1. **Mishap.** **Figure 35**. The mission was a dual contact sortie and the SP's first ride in the T-38. Takeoff and departure were uneventful. The IP was demonstrating a split-S. As the aircraft approached a nose-low, inverted attitude, he sensed the nose was not tracking or the G-load increasing as expected. The IP made several attempts to regain the proper nose track with no perceptible success. He decided the aircraft could not be controlled and commanded a bailout. Both crewmembers ejected successfully, but the aircraft was destroyed upon impact.

Figure 35. Loss of Control – Area.

32.2. **Investigation:**

32.2.1. Unknown Factor. For an undetermined reason, the aircraft pitch trim actuator was positioned to the full nose-down position. An electrical short in the control stick trim circuit, a stuck trim button, or an inadvertent pilot input may have induced the full nose-down trim position.

32.2.2. **Operator Factor.** The IP was possibly distracted by the lack of aircraft response to control stick inputs and did not recognize the full nose-down trim position. He cycled the control stick rapidly fore and aft several times within a 3-second period in an unsuccessful attempt to regain aircraft control.

32.3. **Lesson Learned:**

32.3.1. When aircraft trim is full nose up or nose down, the stick forces required to position the horizontal stabilizer may be several times greater than what the pilot might expect. It will most likely require both hands on the control stick to execute a proper recovery at low altitudes or during a steep nose-low dive. In addition, heavy fuel weight will affect AHCs as well as the altitude required to perform specific maneuvers. Crewmembers must be alert for unusual flight control and trim inputs, which can be disorienting because of their effect on the aircraft's feel and performance.

32.4. **Action Taken:**

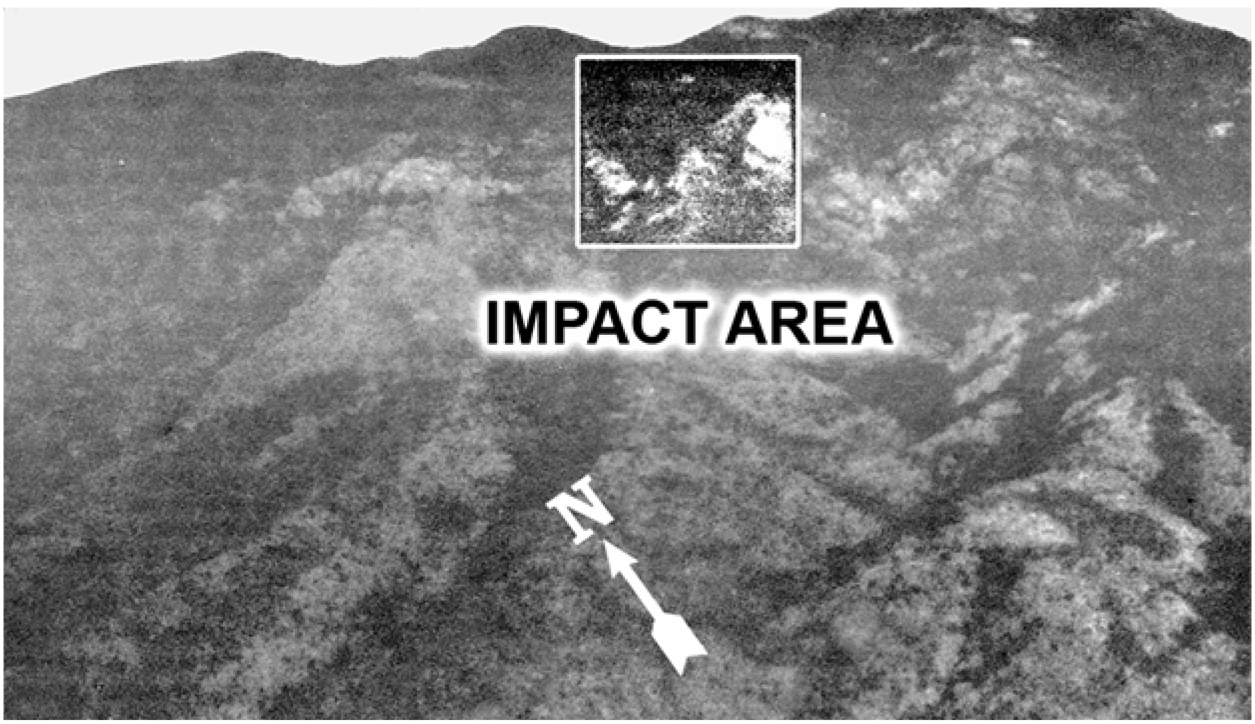
32.4.1. Changed the command's study guide, T-38 Instructor Techniques, to increase IP awareness of and ability to instruct trim malfunctions and other factors influencing aircraft performance.

32.4.2. Incorporated a ground demonstration in the UPT and pilot instruction training (PIT) syllabi to demonstrate the effects of full nose-down trim on stick forces required to achieve a known horizontal stabilizer response.

33. Ground Collision – Low Level.

33.1. **Mishap.** Figure 36. The mission was a dual, low-level student training sortie flown in the local area. The aircrew departed VFR to the entry point and then obtained an instrument flight rules (IFR) clearance to fly the low-level route in accordance with local filing procedures. The aircraft impacted the ground between points B and C of the low level route. Neither crewmember attempted to eject and both were fatally injured. The aircraft impacted the ground and was destroyed.

Figure 36. Ground Collision – Low Level.



33.2. **Investigation:**

33.2.1. Supervisor Factor. Command directives did not provide adequate guidance for accomplishing route aborts when encountering IMC on low level navigation sorties.

33.2.2. Supervisor Factor. Due to rapid changes in the flying schedule, the IP was scheduled to fly a low-level mission at the last minute, with less time for mission preparation than required by governing directives. The flight and squadron supervisors were aware and approved.

33.2.3. **Operator Factor.** The IP agreed to fly the low level without the required mission prep time. The IP failed to ensure he and the student were properly prepared for the mission.

33.2.4. **Operator Factor.** The aircrew continued the route despite deteriorating weather conditions and inadvertently entered the weather. The aircrew mistakenly believed they had adequate terrain clearance and initiated a shallow descent to regain VMC.

33.3. **Lesson Learned:**

33.3.1. Minimum brief times are prescribed for a reason. We cannot say for sure the crew would have used the extra minutes for planning or whether the extra time would have prevented this mishap. However, we can say the crew was not given the opportunity to adequately prepare.

33.3.2. Low-level flying, particularly with marginal weather, can be extremely demanding. The surest way to gain and maintain situational awareness on the route is good map preparation and study while still on the ground, but both take time. Be sure to study the terrain and forecast weather conditions.

33.3.3. In addition, treat entering IMC on a low-level route as an emergency situation. If you cannot avoid IMC, transition to instruments and immediately climb to your emergency route abort altitude. Do not attempt an IMC descent to re-establish VMC!

33.4. **Action Taken:**

33.4.1. Required an emergency route abort or exit escape altitude for each low-level route. This altitude provides 2,000 feet clearance from the highest obstacle within 25 nautical miles (NM) of either side of course for the entire low level route. (Editor's note: Computations for route abort altitudes have changed since this mishap. See the applicable directive for specifics.)

34. Bird Strike on Low-Level.

34.1. **Mishap.** **Figure 37**. The mishap occurred during a low-level navigation sortie for the student pilot (SP) who occupied the front cockpit. Approximately 14 minutes into the low-level route, the aircraft's front canopy was struck by a black vulture, causing near total loss of the front cockpit canopy transparency and inducing severe aerodynamic drag forces on the airframe. The instructor pilot (IP) assumed control of the aircraft, began a climb and turned towards home base. Due to the sudden increase in drag, the IP perceived either dual engine failure or compressor stalls in both engines and began analyzing the engines by adjusting the throttle on each engine. This resulted in the aircraft losing altitude and airspeed until entering a stall almost two minutes after the bird strike. The pilots initiated their ejection at extremely low altitude. The aircraft was destroyed and the SP suffered no injuries. The IP suffered major injuries due to the low altitude ejection.

Figure 37. Bird Strike on Low-Level.

34.2. **Investigation:**

34.2.1. Technical analysis found no damage to either engine from organic or inorganic objects (bird remains or canopy fragments) and that both engines were operating normally until impact with the ground. Drag from the damaged front canopy was approximately half the drag of a fully extended speed brake.

34.2.2. **Operator Factor.** Additional analysis determined at some point following the bird strike, the SP had inadvertently extended the speed brake to the full open position, most likely with his left leg as the right throttle was moved forward. The total drag on the aircraft from the canopy loss and the extended speed brake required both engines to remain near military power to maintain level flight.

34.2.3. **Operator Factor.** The chaotic environment degraded the IP's ability to calmly and accurately assess the situation. Channelized attention and task saturation led the IP to focus solely on engine analysis to the exclusion of basic aircraft control, airspeed and altitude. Temporal distortion caused the IP to rapidly reposition the throttles without allowing adequate time for the engines to settle at selected power settings. The stall resulted from decreasing airspeed due to the IP adjusting the throttles while attempting to assess the perceived engine malfunctions. Low altitude is not the flight regime to analyze a malfunction and the proper response to a loss of thrust at low altitude would be to execute the BOLDFACE, THROTTLE(S) – MAX. The aircraft remained in a stalled condition for 30 seconds until the pilots initiated their ejections well below the checklist recommended controlled ejection minimums.

34.3. **Lessons Learned:**

34.3.1. The loss of the front cockpit canopy transparency due to the bird strike and the undetected extension of the speed brake were not insurmountable problems for this crew.

While both aircraft engines were operating normally throughout the mishap sequence, the chaotic environment of the cockpit following the loss of the front canopy transparency degraded the crew's performance and resulted in the crew channelizing their attention on perceived engine malfunctions instead of maintaining airspeed and altitude. Following an emergency of this nature, the first priority is to fly the jet (Aviate, Navigate, Communicate). Troubleshooting which adversely impacts our ability to maintain a safe airspeed or altitude should be immediately terminated. Additionally, troubleshooting should never divert both pilots' attention away from monitoring basic aircraft performance parameters.

34.3.2. At the time of this mishap, pilots relied on "seat of the pants" indications to determine when the speed brake was extended. While this has since been corrected with a modification, it demonstrates you cannot always rely on your "seat of the pant" instincts to tell you what is going on with the aircraft. Catastrophic events, like the loss of the front cockpit canopy transparency, can greatly impact the feel of the jet, so rely on your instruments to monitor aircraft performance.

34.4. **Actions Taken:**

34.4.1. Changed ALTERNATE AIRSTART boldface to:

Table 4. Alternate AIRSTART.

THROTTLE(S) – MAX
SPEED BRAKE – CONFIRM CLOSED

34.4.2. Warning added to T.O. 1T-38C-1, "Make sure the speed brake is not unintentionally extended from either cockpit when the throttle is advanced. The close proximity of the speed brake switch to the pilot's knee makes unintentional activation likely." An avionics modification was also added to display "SB" for speed brake near the airspeed indicator in the HUD and MFD when the speed brake is not fully closed.

Section E—T-38 Formation Mishaps.

35. Formation Approach – Runway Departure.

35.1. **Mishap.** **Figure 38**. The mission was a dual four-ship formation flight. The mishap crew experienced an electrical problem accompanied by smoke in the cockpit. The FCP pilot turned off both generators and the battery and the smoke subsided. One of the other aircraft led the mishap aircraft back to the final approach course, where the mishap crew configured for a no flap landing. The lead aircraft flew the final approach well above the recommended final approach airspeed. The mishap aircraft took the lead after gaining visual contact with the runway. It touched down approximately 20 KIAS above the final approach airspeed (200 KIAS) and blew both main tires. The aircraft departed the left side of the runway 200 feet before departure end and struck an access road, shearing the right main gear. Both crewmembers egressed uneventfully and were uninjured.

Figure 38. Formation Approach—Runway Departure.

35.2. **Investigation:**

35.2.1. **Supervisory Factor.** The lead aircraft placed the mishap aircraft in an unfavorable position for landing (high airspeed).

35.2.2. **Operator Factor.** The mishap crew remained above final approach airspeed until after touchdown. High airspeed and an improper aerobrake blew the main tires and led to the loss of directional control.

35.3. **Lesson Learned:**

35.3.1. Having too much wingman consideration is a common flight lead error, particularly when the wingman has a problem. The flight lead's main task at this point is to safely recover the formation, which means flying a good approach. By being overly concerned with his wingman, the flight lead failed to monitor his airspeed, which directly contributed to the mishap.

35.4. **Action Taken:**

35.4.1. Added the following caution to T.O. lT-38A-l:

Table 5. Caution to TO 1T-38A-1.

CAUTION
Extreme caution must be exercised when applying wheel brakes above 120 KIAS as locked wheels or tire skids are difficult to recognize. If tire skid is detected, immediately release both brakes and cautiously reapply.

35.4.2. Developed a distance chart for a no-flap landing.

36. Midair Collision – Breakout.

36.1. **Mishap.** Figure 39. The mishap mission was an IP formation continuation training (CT) sortie. The flight was performing an extended-trail, lazy-eight maneuver. The wingman was on lead's right side as the formation descended to enter the maneuver. During the descent to the start of the pull-up, the wingman crossed behind lead to the left side. Lead pulled up into the nose high portion of the lazy eight and then began to roll left. On the inside of the turn, the wingman closed to what he estimated to be 1,000 feet and just aft of line abreast. Because he felt he was too far forward, constituting a hazard to the flight, he called "breaking out." Both crews lost sight of each other during the breakout and collided. All four crewmembers ejected successfully, but both aircraft were destroyed.

Figure 39. Midair Collision – Breakout.

36.2. **Investigation:**

36.2.1. **Supervisory Factor.** The flight briefing did not adequately cover overshoot or breakout procedures from trail formation.

36.2.2. **Operator Factor.** The wingman maneuvered into a hazardous position and failed to properly execute a breakout.

36.3. **Lesson Learned:**

36.3.1. There are several lessons learned, most concerning the use of or reliance on mirrors to monitor the wingman. (At the time of this mishap, the T-38 was not equipped with mirrors.)

36.3.2. First, all crewmembers must maintain sight during extended trail. As lead, your primary method for monitoring the wingman should be looking over your shoulder, using the mirrors as a last resort. If you lose sight as lead, ask for your wingman's position.

Maneuver predictably until you regain the visual or terminate the maneuver. As a wingman, avoid flying near lead's six o'clock where it is harder to see. In general, if you have a clear view of lead's canopy, he or she can see you. If you lose sight or need to break out of the formation, lag lead's last known position. Always think about your "out" while flying in formation. That is, think about where you need to maneuver the aircraft to avoid a collision if you lose sight or get too close.

36.3.3. Second, there are several drawbacks to relying on mirrors to monitor your wingman, so use them smartly. First drawback—it is very difficult to accurately assess your wingman's range and closure, using the mirrors. Second drawback—the mirrors provide only a limited field of view. If your wingman maneuvers outside that field of view, it will be difficult for you to reacquire visual contact.

36.3.4. One technique for using mirrors is to adjust them on the ground so you can just see part of your fuselage along the inner edge of the mirror. When airborne, fight to keep the visual by looking over your shoulder. However, if your wingman collapses to 6 o'clock, cross-check the mirror. If you have adjusted the mirror properly, you should be able to see the wingman. As he or she moves back toward the outside edge of the mirror, look back over your shoulder to reacquire the wingman.

36.4. **Action Taken:**

36.4.1. Revised the governing directives to include the following:

36.4.2. The maneuvering cone for trail formation, defined as a 60 degrees cone, 30 degrees out from the extended longitudinal axis of the lead aircraft. (Editor's note: Extended trail cone has changed since this mishap. See applicable directives for details.)

36.4.3. Wingman techniques regarding trail formation and breakout or overshoot procedures.

36.4.4. Initiated action to retrofit the T-38 aircraft with rearview mirrors to improve the lead IP's ability to monitor the wingman.

37. Midair Collision and Four-Ship Rejoin.

37.1. **Mishap. Figure 40** and **Figure 41**. The mishap mission was a four-ship formation training sortie. All aircraft were dual with IPs in the RCPs. Takeoff, departure, and area entry were uneventful. During the profile, the flight executed a pitchout for a left turning rejoin at 24,000 feet MSL. Lead was at 45 degrees of bank for the rejoin IAW the brief. Number 2 rejoined uneventfully to lead's left side. Numbers 3 and 4 were aft of the normal rejoin line, placing the lead element in the sun. Number 4 IP, who was flying the aircraft, lost sight of the lead element and asked the SP if he had them in sight. The SP said he did. Number 4 IP had sight of Number 3 and continued his rejoin. Number 3 crossed behind the lead element to the outside of the turn in a slight overshoot. Lead watched Number 4 stagnate momentarily on the inside of the turn and then cross under. Lead looked to the other side of the aircraft where he expected Number 4 to appear. In the meantime, Number 4 had moved behind Number 2 and continued forward and up, striking Number 2 in the left aft section. Both aircraft sustained extensive damage. Number 4 SP was fatally injured in the collision. Number 4 IP suffered severe back injuries, but was able to eject. Both crewmembers in the

Number 2 aircraft were able to eject without injury. Both aircraft were destroyed upon ground impact.

Figure 40. Midair Collision – Four-Ship Rejoin.

Figure 41. Midair Collision – Four-Ship Rejoin (cont).

37.2. **Investigation:**

37.2.1. **Supervisory Factor.** Operational guidance was inadequate and implied element rejoins at altitude were permitted.

37.2.2. **Operator Factor.** Number 4 IP failed to reacquire visual contact with the lead element, likely due to complacency and the belief his SP had them in sight.

37.2.3. **Operator Factor.** Number 4 SP failed to inform his IP that he had lost sight of the lead element during the latter portion of the rejoin.

37.3. **Lesson Learned:**

37.3.1. This mishap highlights several crew resource management issues:

37.3.1.1. If you lose sight as the pilot flying the aircraft, do not rely on the other crewmember to ensure flightpath deconfliction. Viable options would be to terminate the maneuver, transfer aircraft control to the pilot with the most situational awareness, or call "blind" on the radio so other formation members are aware and can assume responsibility for deconfliction.

37.3.1.2. It is imperative for crewmembers to communicate the complete picture. The SP may have assumed the IP had reacquired the visual because he continued the rejoin, while the IP may have assumed the SP still had the lead element in sight. The IP could have pressed the SP for more information, such as clock position and range, to aid reacquisition. This would have alerted the SP that the IP was still blind, and it would have alerted the IP that the SP had lost sight as well.

37.3.1.3. Bottom line: When flying dual aircraft, do not make assumptions about the other pilot's situational awareness.

37.4. **Action Taken:**

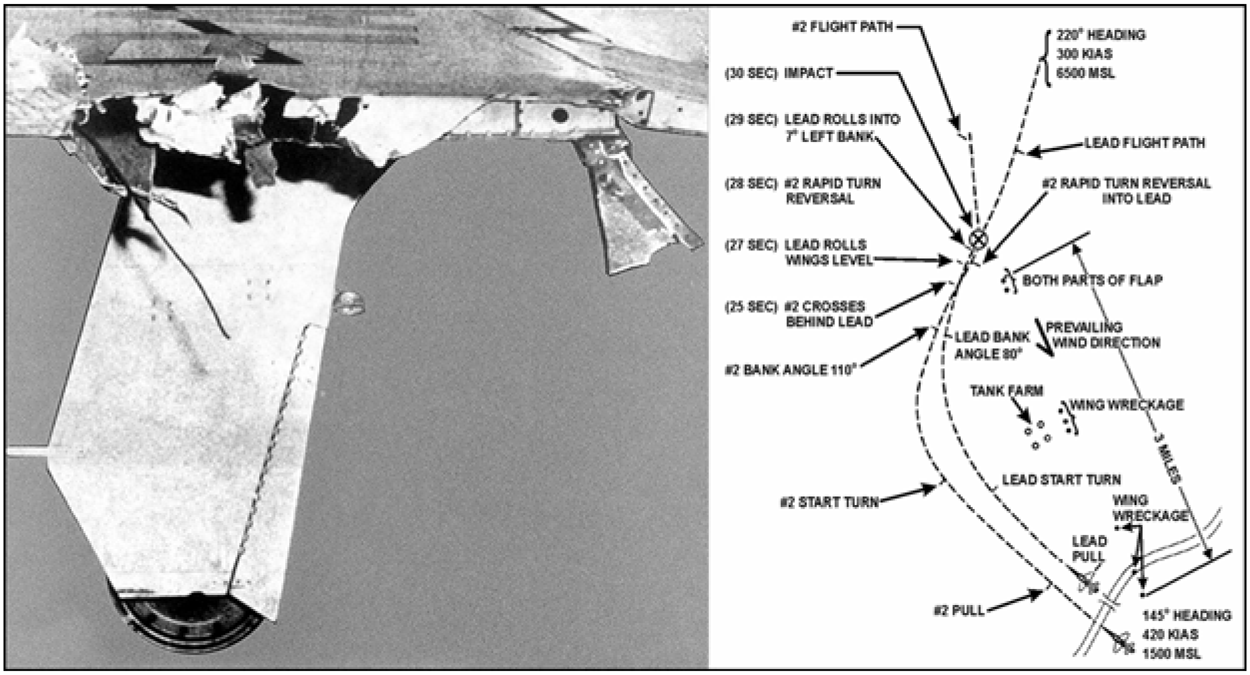
37.4.1. Issued specific guidance to UPT wings, eliminating element rejoins except for immediately after takeoff.

37.4.2. Revised four-ship procedures in the governing directive to provide increased emphasis and specific guidance on individual aircrew responsibilities during rejoins.

38. Midair Collision – Formation Low Level.

38.1. **Mishap.** **Figure 42**. The mission was a two-ship, low-level, advanced-formation sortie. The flight proceeded normally through the low level with Number 2 maintaining an attack formation position (300 to 400 feet aft) on the left side of lead. After passing the target, lead started a climbing right turn for return to base. The two aircraft collided as lead rolled out on the recovery heading and altitude. Each aircraft did a controllability check and landed without further incident. Both aircraft sustained major structural damage, but no one was injured.

Figure 42. Midair Collision – Formation Low Level.



38.2. **Investigation:**

38.2.1. **Operator Factor.** While departing the low level, Number 2 SP was slow to react to lead's climbing turn and dropped well below and 1,000 to 1,200 feet aft of lead. The SP selected and maintained military power to get back into position, but stayed directly behind lead and failed to perceive the rapidly developing overtake.

38.2.2. **Supervisory Factor.** Number 2 IP allowed his SP to close to the forward edge of the cone with 50 to 70 knots of closure without taking any action.

38.2.3. **Operator Factor.** Number 2 SP abruptly reversed from 60 degrees of right bank to 60 degrees of left bank when lead rolled out. The IP assumed control of the aircraft and applied full forward stick and left (bottom) rudder to avoid a collision. However, the aircraft did not respond in time.

38.3. **Lesson Learned:**

38.3.1. It is extremely difficult to judge overtake from directly behind another aircraft. There are very few line of sight cues to aid in assessing closure. You will eventually sense line of sight as the aircraft expands. However, by that time, you may already be too close for comfort. You may occasionally find yourself trapped at lead's dead 6 o'clock, but should try to maneuver back to a higher aspect as soon as possible. An aspect of 30 degrees works pretty well. This will place lead's wingtip on the nose of his aircraft. It also places you in a position where lead can monitor your position more easily.

38.3.2. Lastly, the IP intended to allow the SP to overshoot to gain some experience, but let it go so far it exceeded even his ability. An IP must stay cognizant of his or her personal abilities and be sure to take the aircraft before the SP can exceed those abilities.

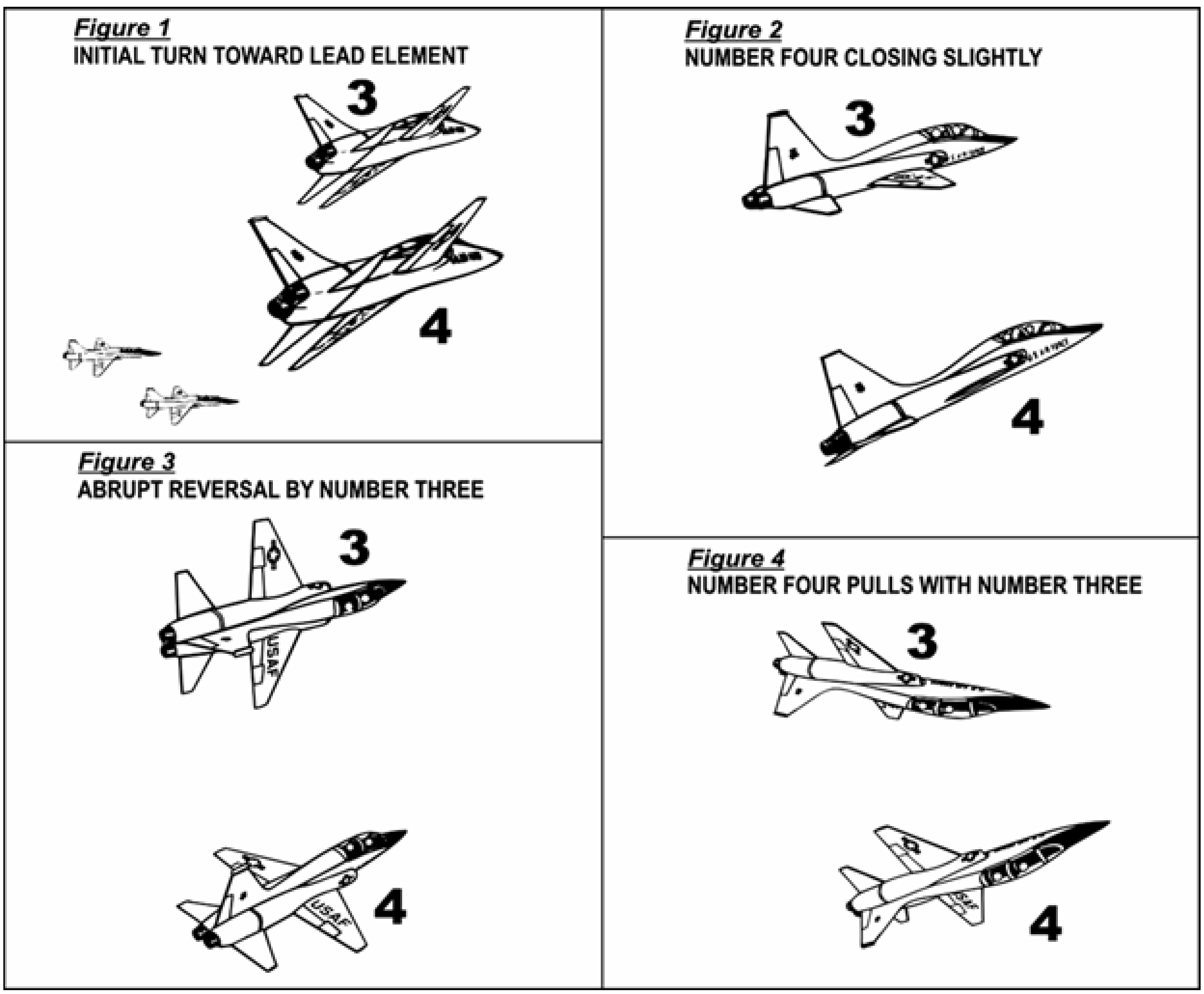
38.4. **Action Taken:**

38.4.1. Clarified wingman collision avoidance responsibilities in flight training manuals.

39. Midair Collision – Four-Ship Tactical Rejoin.

39.1. **Mishap.** Figure 43. The mishap aircraft were on a routine four-ship training mission. All aircraft were dual with three of the students flying their first four-ship mission. The flight proceeded normally through the first two lead changes. After completing a 90-degree fluid turn, the flight lead directed a right turning tactical rejoin into the mishap element. (Numbers 3 and 4 were in tactical on the right side, with Number 4 on Number 3's right.) Number 3 IP and Number 4 SP were flying. At the beginning of the rejoin, Number 3 started a climb and slight left turn. Number 4 stayed on the right, but moved forward and closed slightly. Number 3 abruptly reversed his turn to the right as he crossed over the lead element's flightpath and went right into his wingman. Number 4 IP took control of the aircraft, flew unloaded, and rolled further left toward Number 3. He then rolled right to match Number 3's bank angle and increased his G loading. Both aircraft collided shortly thereafter. Number 4 SP ejected after the collision and sustained major injuries. The other three crew members were fatally injured, and both aircraft were destroyed upon ground impact.

Figure 43. Midair Collision—Four-Ship Tactical Rejoin.



39.2. **Investigation:**

39.2.1. **Supervisory Factor.** Number 4 IP did not sufficiently brief his SP on proper procedures and techniques for executing a tactical turning rejoin. The IP failed to provide instruction on how to fly the maneuver, although this would be the SP's first attempt.

39.2.2. **Operator Factor.** Number 3 IP failed to monitor his wingman and initiated an abrupt turn reversal directly into him.

39.2.3. **Operator Factor.** Number 4 IP failed to ensure his SP maintained the proper position for the rejoin. He also failed to break out when appropriate, which failed to ensure aircraft separation.

39.3. **Lessons Learned:**

39.3.1. There were several lessons to be learned from this mishap:

39.3.1.1. IPs must tailor their instruction to the SPs ability and experience level, review the previous grade sheets, and focus the instruction on weak areas or new maneuvers. IPs must be conscientious and disciplined in this approach.

39.3.1.2. A flight lead should monitor the wingman's position at all times. If lead does not have situational awareness on his or her wingman's position, Lead SHOULD NOT make any sudden turn reversals or abrupt maneuvers.

39.3.1.3. Wingmen are primarily responsible for deconfliction and should fly in a position that allows lead to maneuver, as required, without being a hazard to the flight. They should always leave themselves an out, assuring nose-tail and/or vertical separation when possible and visualizing the actions necessary to take if lead suddenly reverses right into them. For instance, as Number 4 in the turning rejoin, the wingman should not get closer than fighting wing until Number 3 is stabilized in route and moving to fingertip.

39.4. **Action Taken:**

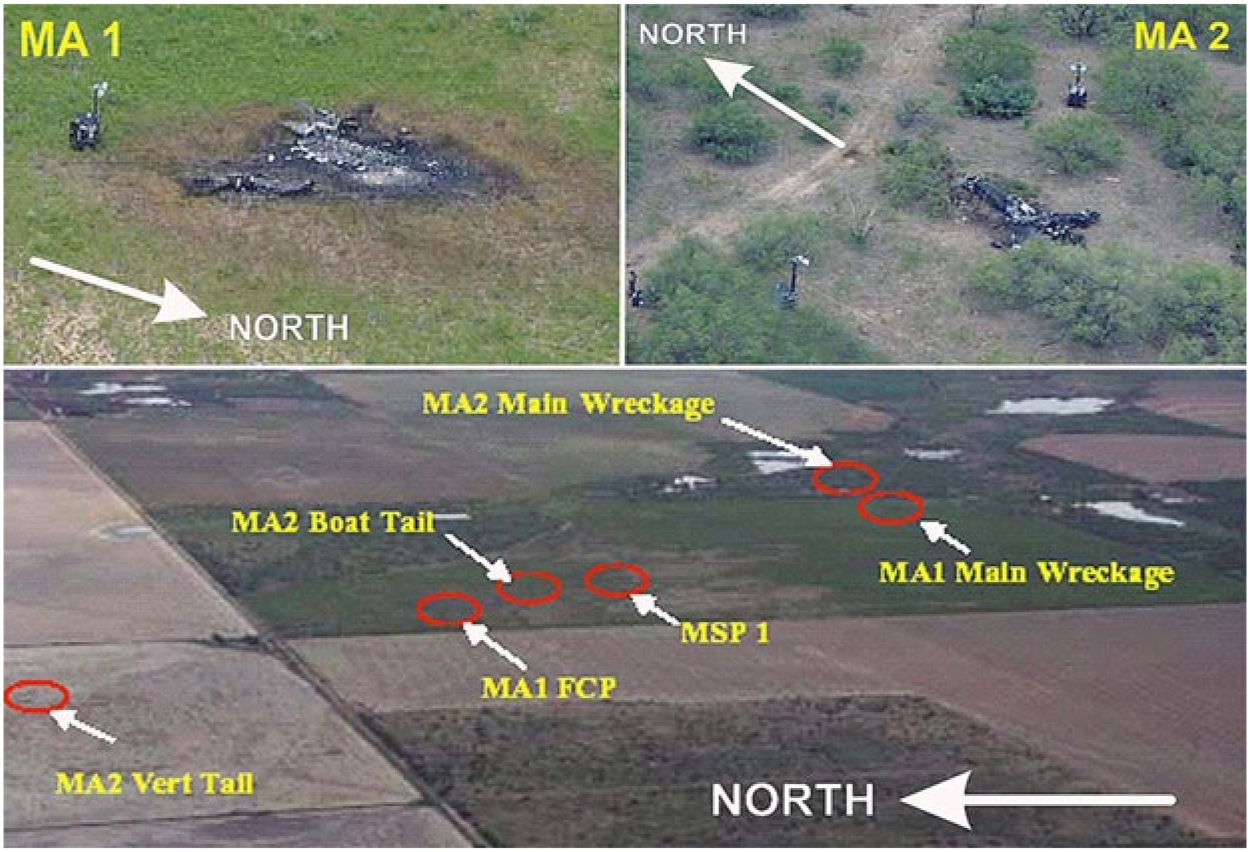
39.4.1. Removed four-ship tactical maneuvering from the UPT syllabus.

39.4.2. Incorporated a four-ship check ride into the PIT syllabus.

40. Midair Collision – Two-Ship Fighting Wing.

40.1. **Mishap.** **Figure 44**. The mission was formation training with one dual crew and one solo SP. The solo SP led the formation to the military operating area (MOA) and sent his wingman to fighting wing. The dual crew maneuvered from the left side to the right side and into the fighting wing cone (30- to 45-degree line), but then pressed forward toward the 3/9 line. As the solo SP began a barrel roll to the right, the IP in the wing aircraft realized his aircraft was out of position and directed his SP to "go lag." The IP failed to recognize the developing conflict as the barrel roll continued. The final link in the chain was the sun glare that caused the dual crew to go blind during the last half of the barrel roll. The two aircraft collided, and the solo SP was fatally injured. The dual crew ejected successfully with minor injuries. Both aircraft were destroyed upon ground impact.

Figure 44. Midair Collision – Two-Ship Fighting Wing.



40.2. **Investigation:**

40.2.1. **Supervisory Factor.** Due to a lack of experience, the IP did not recognize the developing conflict caused by the rapid changes in the lift vector and aspect and the closure resulting from the barrel roll.

40.2.2. **Operator** and **Supervisory Factor**. Both the IP and SP in the wing aircraft went blind due to sun glare, but neither communicated this situation to the other.

40.2.3. **Operator Factor.** The solo SP did not clear his flight path or maintain positional awareness on his wingman.

40.3. **Lesson Learned:**

40.3.1. The barrel roll is probably the most dynamic maneuver flown with a wingman in the fighting wing position. The plane of motion, lift vector, aspect, and closure are all changing rapidly. If the wingman is close to the aft range limit, it is common practice to fly on the inside of the roll to make up some range and get closer to the front limit. However, if the wingman is forward of the cone (30 to 45 degrees), this position rapidly leads to a conflict. Lead's constantly changing plane of motion makes it difficult to get to a lag position to manage closure and aspect. Under these conditions, IPs and SPs should be extremely wary and should consider terminating the maneuver early.

40.3.2. Dual crews must be disciplined with inflight communication and should avoid ambiguous statements as much as possible. Crewmembers must be very clear and direct in their comments and questions. For instance, the phrase, “I have it” can mean several different things—“I know what I’m doing,” “I have the aircraft,” “I see the flight lead,” etc. The easiest way to alleviate the problem is to say what you mean. If you go blind during a maneuver, consider using the following example, “I’m blind, do you see lead?” It is concise, but conveys the appropriate information. A good answer is, “Yes, 2 O-clock, 1,000 feet, slightly high.” An example of poor communication is, “Do you have him?” with the answer, “I got it.”

40.3.3. Although wingmen are responsible for flight deconfliction, the flight lead is ultimately responsible for the safe conduct of the flight. Flight leads should constantly strive to maintain positional awareness of their wingmen. If the flight lead loses awareness, he or she should avoid abrupt maneuvers or sudden reversals and remain predictable, realizing that this is not fail-safe. Wingmen can and do go “blind,” but they do not always call it on the radio. Lead must watch them closely when they are near his or her aircraft and be ready to maneuver if it becomes necessary to avoid a collision.

40.4. **Action Taken:**

40.4.1. Incorporated additional guidance and procedures into flying manuals to provide SPs and IPs with the rationale behind the parameters and desired learning objectives of flying the fighting wing formation and exercise. Also included procedures and techniques for maintaining position near the 500-foot limit for separation.

Section F—T-38 Landing Mishaps

41. Gear Up Landing.

41.1. **Mishap.** **Figure 45**. The mission was a solo contact flight. The SP accomplished area work and returned to the traffic pattern to practice normal patterns. He accomplished three normal patterns, but then had to divert when the only usable runway was closed due to a barrier engagement. (Another solo student inadvertently landed no flap.) The SP received clearance from RAPCON and proceeded to the alternate base along with two dual T-38s. He arrived with minimum fuel and was given landing priority. Approach control vectored the SP to final approach, told him to perform his landing check, and released him for a VFR landing. He touched down 2,000 feet past the approach end with the landing gear retracted. The aircraft skidded approximately 4,000 feet before stopping. The SP egressed the aircraft without injury.

Figure 45. Gear Up Landing.

41.2. **Investigation:**

41.2.1. **Supervisory Factor.** The senior RSU controller did not maintain control of traffic during an upgrade and allowed an SP to land no flap and engage the barrier, closing the runway.

41.2.2. **Operator Factor.** After diverting to the alternate base, the SP failed to lower the landing gear or check aircraft configuration before landing.

41.2.3. **Supervisory Factor.** The divert plan did not ensure positive coordination with the divert base or provide adequate supervision of solo aircraft during the landing phase.

41.3. **Lesson Learned:**

41.3.1. This mishap was the consequence of poor checklist discipline on two occasions. The first SP failed to accomplish the before landing checklist and inadvertently landed no flap. He was unable to stop in the runway remaining and engaged the barrier, closing the runway. The second SP was possibly distracted from having to divert, causing him to break his habit patterns. He also failed to perform the before landing checks and landed gear up.

41.3.2. Because some checks are simple enough to memorize, pilots do not always refer to the checklist to do them so the checks become habit. The problem with a habit, however, is that it is easily disrupted. Be sure to build redundancy into your habit patterns to combat distraction. For instance, do the before-landing checks at three different locations (at the perch, in the final turn, and rolling out on final). Although you might get distracted and miss one, you are not likely to miss all three.

41.4. **Action Taken:**

41.4.1. Revised divert procedures to provide adequate supervisory control of solo students during recovery to a divert field.

42. Stall – Final Turn.

42.1. **Mishap.** Figure 46. The mishap was a four-ship formation training flight with the mishap SP flying solo. The mission proceeded normally, and the flight returned for landing with the SP as Number 4. The pitchout and pattern spacing appeared normal to witnesses. The SP made his gear down call entering the final turn and indicated he would full stop. Six seconds later he called, "on the go." The RSU controller noticed the SP was approximately 10 degrees nose low and transmitted, "In the final turn, pull your nose up! Burners! Roll your wings level! " The aircraft continued to roll left, and the nose continued to drop until it impacted the ground. The SP ejected less than 1 second before impact and was fatally injured. The aircraft was destroyed.

Figure 46. Stall – Final Turn.

42.2. **Investigation:**

42.2.1. **Operator Factor.** The SP stalled the aircraft with insufficient altitude to recover.

42.3. **Lesson Learned:**

42.3.1. The number one priority during a final turn stall is to properly execute a stall recovery. Flying the proper pattern ground track is not a consideration unless a greater hazard exists (for example, dual runway operations with another aircraft on final). Simultaneously advance both throttles to MAX, relax backstick pressure, and roll the wings level. Rudder can be an effective way to initiate the roll to wings level; however, use caution to avoid over-controlling.

42.4. **Action Taken:**

42.4.1. Accelerated AOA indicator installation.

42.4.2. Added following warning to T.O. 1T-38A-l:

Table 6. Warning to TO 1T-38A-1.

WARNING
If a high sink rate is allowed to develop, excessive altitude loss will occur and recovery may not be possible.

43. Stall – Touch and Go.

43.1. **Mishap.** Figure 47. The aircraft departed as lead aircraft on an initial formation training flight. Join-up, departure, area maneuvers, and position change were uneventful. The flight progressed normally and returned to initial for landing, with the mishap aircraft as Number 2. The SP made a "gear down" call and began a normal final turn. He lined up on final appropriately for the wind conditions (18 knot crosswind). The SP flared slightly high crossing the runway threshold, and the RSU controller directed a go-around. The IP in the RCP acknowledged. The aircraft touched down approximately 800 feet down the runway, skipped back into the air, and began a slight wing rock. It then rolled inverted, contacted the runway, and slid to a stop approximately 338 feet from the point of impact. The throttles, which had been in afterburner, were shut off during this sequence. The SP received fatal head injuries, and the IP sustained major head injuries. The aircraft was damaged beyond repair.

Figure 47. Stall – Touch and Go.

43.2. **Investigation:**

43.2.1. **Supervisory Factor.** The IP delayed taking the aircraft, allowing the SP to place the aircraft in an unrecoverable position.

43.2.2. **Operator Factor.** The SP overcontrolled the aircraft during the go-around. After allowing the situation to deteriorate, the IP could not overcome SP's control inputs to apply corrective actions.

43.3. **Lesson Learned:**

43.3.1. New IPs commonly ask, "How far is too far?" It is impossible to list all the possible scenarios where taking aircraft control would be the appropriate action. If the situation feels not quite right, even if you are not sure why, it is probably time to take action. Until you build more experience, be conservative and take the jet early.

43.4. **Action Taken:**

43.4.1. Clarified guidance in training manuals concerning transfer of aircraft control, especially during critical phases of flight.

44. Stall – Final Turn.

44.1. **Mishap.** **Figure 48**. The mishap aircraft was Number 2 in a two-ship formation. Number 2 was a solo SP. The flight had returned early due to a minor malfunction on Number 2 aircraft. The flight entered initial and pitched out. As the lead aircraft rolled out on final, the crew observed the wingman had insufficient spacing so lead initiated a go-around to allow the wingman to land. However, the RSU controller directed Number 2 to go around because he was halfway through the final turn. Shortly thereafter, the RSU controller observed Number 2 aircraft in an excessive bank and nose-low attitude and directed, "burners and pull it up." As the aircraft continued to descend, the RSU controller directed afterburner again. The aircraft recovered to a near level attitude, but impacted short of the runway in a shallow right bank with very little sink rate. Although the SP survived the impact, he later succumbed to burn injuries. The aircraft was destroyed.

Figure 48. Stall – Final Turn.

44.2. **Investigation:**

44.2.1. **Operator Factor.** The solo SP flew a tighter pattern than lead and inadvertently established a cut off angle on lead in the final turn. The SP was most likely distracted by his aircraft's malfunction and failed to clear for his flight lead. The SP began an evasive maneuver when he finally recognized the conflict, but did not advance the power, thus developing a high sink rate.

44.2.2. **Supervisory Factor.** Although there were only two aircraft in the pattern, the RSU controller did not sufficiently monitor their activities and failed to anticipate the conflict until it was too late.

44.3. **Lesson Learned:**

44.3.1. Wingmen are responsible for many things, notably ensuring flight deconfliction. Their job becomes much more difficult when faced with an aircraft malfunction, even a minor one.

44.3.2. Situation awareness begins to shrink as malfunctions draw your focus inside the cockpit versus outside the aircraft. Flights should consider transferring the task load by placing the bad aircraft in the lead when conditions permit. If that is not practical, attempt to land the bad aircraft first as a minimum.

44.3.3. Even if it does not make sense for the bad aircraft to lead back, there are still several reasons to land the bad aircraft first. If the good aircraft lands first, it could blow a tire or have some other problem, causing it to close the runway. Also, the bad aircraft would have to manage its malfunction, monitor the good aircraft's pattern spacing and position to get appropriate spacing for landing, and possibly contend with wake turbulence in the flare.

44.4. **Action Taken:**

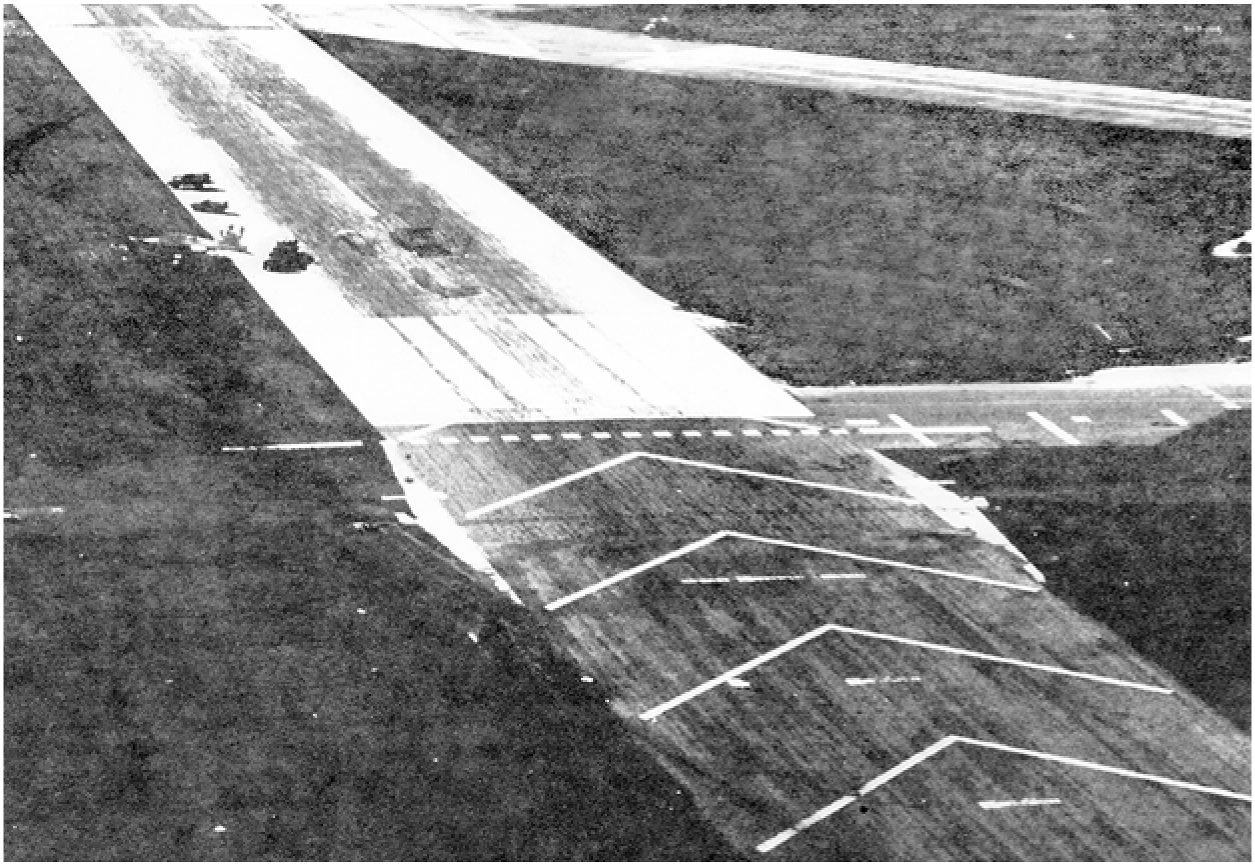
44.4.1. Clarified instructions for pattern breakouts and go-arounds in the governing directives. Increased emphasis on breaking out of the pattern when losing sight of the proceeding aircraft.

44.4.2. Increased the fire resistance of aircrew flight clothing (gloves, flight jackets, underwear, and G-suits).

45. Final Approach Crash – Traffic Conflict.

45.1. **Mishap.** Figure 49. This mishap occurred because of a traffic pattern conflict between two T-38s during final approach and landing. Both aircraft were SP solos. The mishap aircraft was Number 2 in a four-ship formation and had rolled out on final from an overhead pattern when another aircraft passed it on an emergency straight-in approach. The emergency aircraft continued to an uneventful landing. The mishap aircraft attempted a go-around, but apparently encountered wake turbulence and impacted the runway overrun. Although the aircraft was destroyed, the SP egressed with only minor injuries.

Figure 49. Final Approach Crash – Traffic Conflict.



45.2. **Investigation:**

45.2.1. **Supervisory Factor.** The RSU controller did not take positive action to prevent a dangerous conflict between aircraft in the traffic pattern. Although the straight-in aircraft made an inaccurate position report that detracted slightly from the controller's situational awareness, the RSU still had sufficient visual cues to see the conflict developing.

45.2.2. **Operator Factor.** The mishap SP failed to clear properly.

45.3. **Lesson Learned:**

45.3.1. Quite often an investigation reveals that several failures, human or mechanical, interact to create a mishap. Eliminating one action or inaction can make the difference. In this case, the RSU controller failed to maintain positive control of the pattern, and both SP's made errors in judgment. Bottom line: Do not make assumptions about another pilot or controller's situational awareness because that leads to complacency.

45.4. **Action Taken:**

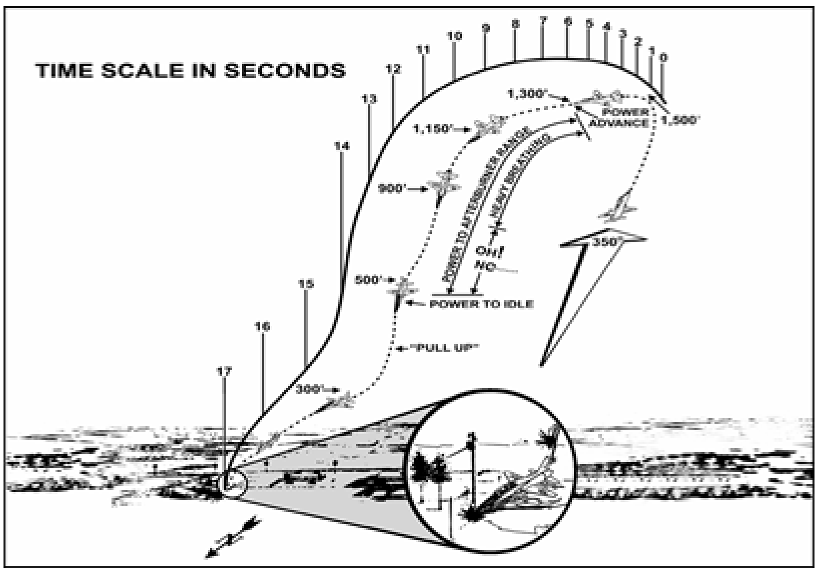
45.4.1. Changed operating procedures to require 9-mile and 4-mile position reports during a straight-in approach.

45.4.2. Established local procedures to alert appropriate agencies (approach control, SOF, RSU, control tower, etc.) of an emergency aircraft in time to plan for its recovery.

46. Stall – Final Turn.

46.1. **Mishap.** Figure 50. The SP completed a normal takeoff and departure for a contact mission. He reported an 8-mile initial approximately 35 minutes later. He pitched out and configured normally, made his gear down call, and began the final turn. He initially rolled to 30 to 35 degrees of bank, but slowly increased the bank to approximately 60 degrees. The aircraft pitched down to an extremely nose low attitude, and the aircraft continued rolling through inverted back to nearly wings level. The aircraft nose came up slightly, but the aircraft continued its rapid rate of descent. The aircraft impacted the ground 30 degrees nose low and with 8 degrees of left bank. The SP was fatally injured, and the aircraft was destroyed.

Figure 50. Stall – Final Turn.



46.2. **Investigation:**

46.2.1. **Operator Factor.** The SP stalled the aircraft in the final turn and was unable to recover. Maintenance investigation determined the aircraft was functioning properly.

46.3. **Lesson Learned:**

46.3.1. This is another grim reminder that stalls in the final turn can kill you. If the traffic pattern does not look good, go around and try again. You do not have much altitude or time available to correct a poorly flown traffic pattern. You must detect and correct deviations, such as slow airspeed, excessive bank, and high sink rates, as early as possible. Do not hesitate to execute the stall recovery procedures if it does not look or feel right.

46.3.2. In the event of an actual stall, execute the recovery immediately. In this mishap, it is highly possible the SP allowed his airspeed to decrease below final turn airspeed prior to leaving the perch. Instead of increasing airspeed and/or breaking out, he began his final turn and immediately stalled.

46.4. **Action Taken:**

46.4.1. Expanded discussion in the governing directive on flight control effectiveness, particularly the rudder. Cautioned pilots on possible violent aircraft reactions when overcontrolling the rudder during stalls and slow-flight maneuvering.

46.4.2. Directed minimum airspeed on downwind to be no less than computed final turn airspeed.

47. Short Landing – Wind Shear.

47.1. **Mishap.** Figure 51. This mishap occurred during landing at a cross-country airfield. The mishap aircraft was lead of a two-ship formation, which had split to perform individual instrument approaches. The mishap aircraft was directed to go around from its first approach because another aircraft was on the runway. Lead flew a closed pattern rather than another radar pattern due to rapidly approaching bad weather. The aircraft encountered a severe wind shear on final associated with the storm. The IP was unable to compensate; and the aircraft impacted short of the runway, sheared the gear, and skidded approximately 1,600 feet. The aircraft came to rest 700 feet left of the runway. Neither crewmember was injured.

Figure 51. Short Landing – Wind Shear.

47.2. **Investigation:**

47.2.1. **Operator Factor.** The pilot was advised of violent weather 3 NM west of his destination, but underestimated the potential impact on his recovery.

47.2.2. **Operator Factor.** The aircraft was struck by a strong wind gust (a 45- to 65-knot tailwind) associated with a thunderstorm.

47.3. **Lesson Learned:**

47.3.1. Crewmembers were concerned about weather conditions at the destination airport and updated their weather information enroute. They received an advisory of violent weather in close proximity to the destination airport, but chose to continue on to the destination. The prudent decision would have been to divert to the alternate. The crew should not have taken chances with severe weather. Also, approach control and tower personnel knew of the storm's position and severity and expressed their concern over the phone, but did not relay appropriate details to the pilot.

47.4. **Action Taken:**

47.4.1. Modified the Instrument Refresher Course (IRC) to include information on gusts, wind shear, and other hazards associated with thunderstorms.

48. Gear Extension Failure.

48.1. **Mishap.** Figure 52. The mishap occurred at the conclusion of a two-ship formation training mission. The formation split for individual overhead approaches for full stop landings after a precision wing approach. A solo SP flew the mishap aircraft. In the final turn, the SP noticed that the right main landing gear indicated unsafe. A chase aircraft and the RSU confirmed the gear was partially extended. All attempts to fully extend the right main gear were unsuccessful, including shutting down the left engine and depleting utility hydraulic system pressure. The right engine flamed out from fuel starvation enroute to the controlled bailout area. The SP ejected successfully, but the aircraft was destroyed.

Figure 52. Gear Extension Failure.

48.2. **Investigation:**

48.2.1. Maintenance Factor. The side brace trunnion of the right main landing gear failed due to fatigue, preventing the right main landing gear from extending fully.

48.3. **Lesson Learned:**

48.3.1. The SP needlessly placed himself and civilians on the ground at risk during the latter stages of the mishap. He failed to plan for the ejection and ran out of gas before completing the before-ejection checklist and before reaching the designated bailout area.

48.3.2. Set a bingo fuel when working a malfunction, just like you set a bingo in the area. Once you reach bingo, transition to the next stage. In this case, the SOF or operations supervisors could have helped out by calculating the fuel required to reach the bailout area.

48.4. **Action Taken:**

48.4.1. Established an inspection requirement to provide a more detailed ultrasonic inspection to identify cracks in the casting of the side brace trunnion.

48.4.2. Revised SOF guidance to include the following statement:

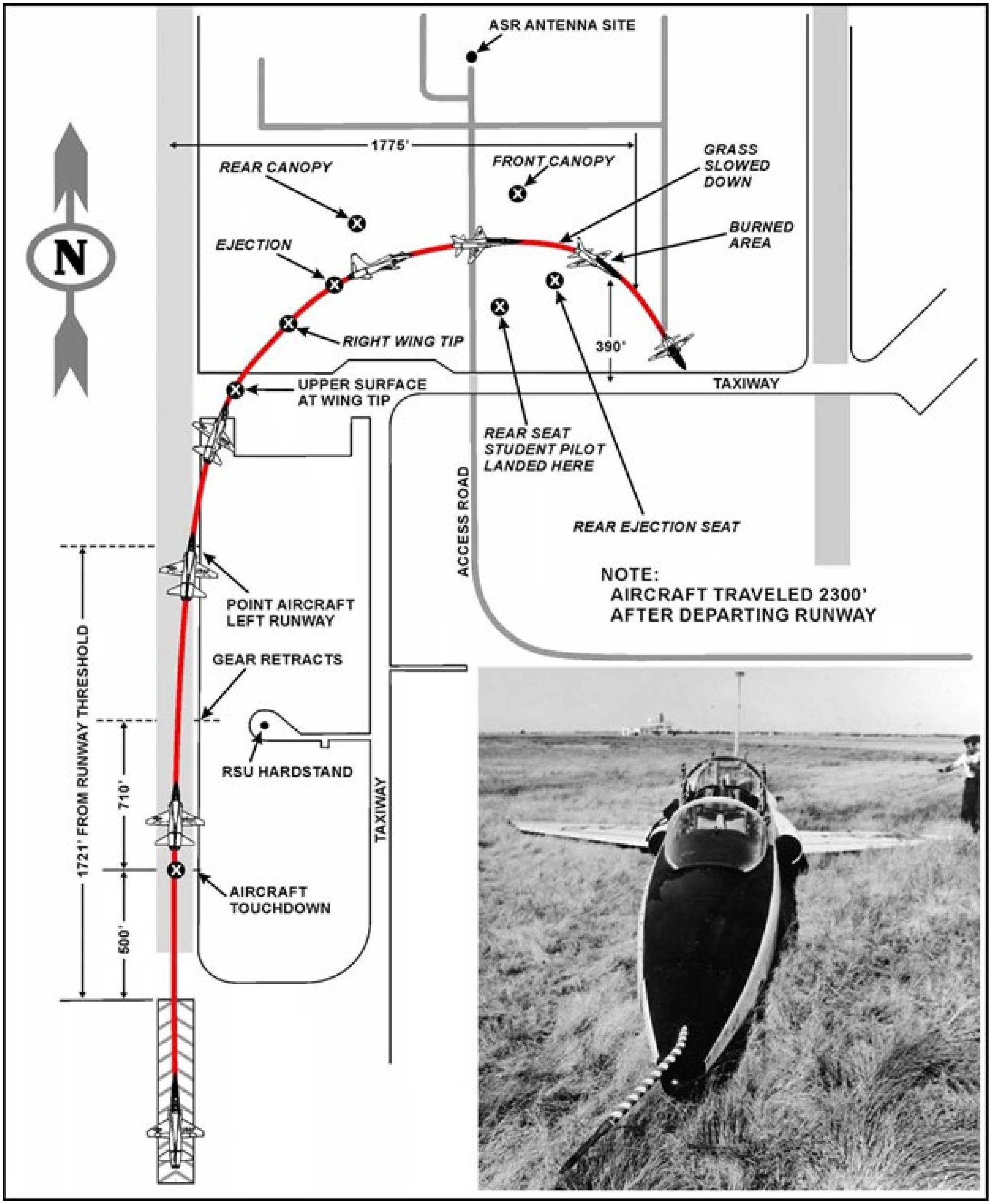
Table 7. Revised SOF guidance.

Attempts to correct airborne emergencies that could result in aircrew ejection or bailout if not corrected should be terminated with sufficient time or fuel remaining to permit the disabled aircraft to reach the designated bailout area.

49. Premature Gear Retraction – Touch and Go.

49.1. **Mishap.** **Figure 53**. The flight was briefed as a pattern-only mission. A senior class SP occupied the FCP as the aircraft commander, and a junior class SP occupied the RCP as a dynamic observer. After completing three circuits around the pattern to burn down fuel, the FCP SP flew two successful touch-and-go landings. The aircraft touched down slightly hard and fast on the third touch-and-go. As the air craft passed the RSU, the RSU crew observed the landing gear doors were open, indicating the gear were in retraction. The aircraft settled to the runway and drifted to the right. It departed the runway approximately 1,200 feet from touchdown with the gear retracted and traveled another 2,300 feet before stopping. The RCP SP ejected shortly after the aircraft departed the runway, and the FCP SP egressed after the aircraft stopped. Neither crewmember was injured.

Figure 53. Premature Gear Retraction – Touch and Go.



49.2. **Investigation:**

49.2.1. **Operator Factor.** The FCP SP had been directed to give no instruction to the back seat observer, but he did not follow those directions. Instead, he became preoccupied with explaining his approach, which detracted from basic aircraft control. Unhappy and possibly embarrassed with the fast and slightly hard landing, he hastily executed touch-and-go procedures, raising the landing gear handle prior to becoming airborne.

49.3. **Lesson Learned:**

49.3.1. The FCP SP failed to follow the three basic priorities: aviate first, navigate next, and communicate last. Even IPs prioritize incorrectly on occasion, letting instruction take precedence over flying the aircraft. Just remember to aviate, navigate, and communicate in that order.

49.3.2. In addition, the SP let his emotions get the best of him and deviated from his habit patterns, raising the gear early. There is little room for error when flying high performance aircraft. Stay focused!

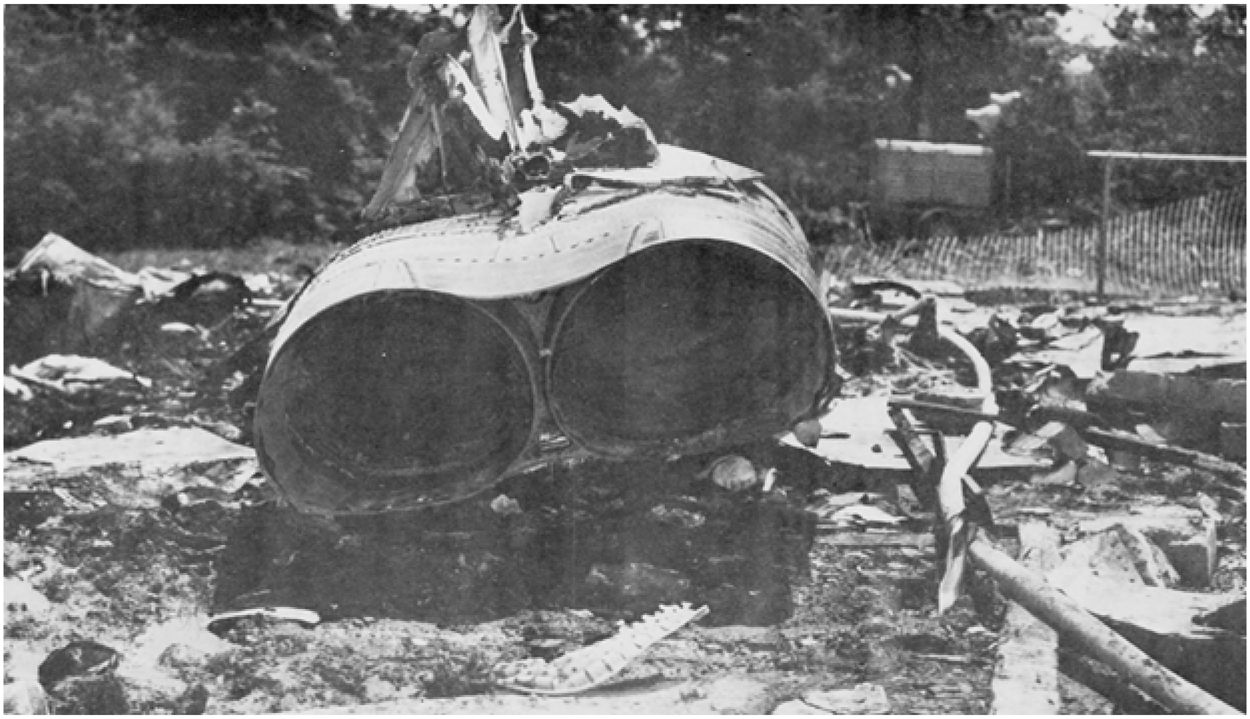
49.4. **Action Taken:**

49.4.1. Reevaluated the dynamic observer program.

50. Final Approach Crash – Wake Turbulence.

50.1. **Mishap.** **Figure 54**. The mission was an instrument navigation check ride for the student. The aircraft crashed while going around on a TACAN final. Approach control had asked the aircrew to slow to final approach speed during the penetration because they were following a LOGAR L-382 (a civilian stretch C-130). The aircrew was also followed by a T-39 carrying a code 06 (very important person) and had discussed keeping their speed up on final to accommodate the T-39. The aircrew reported the FAF to the tower, who told them the L-382 was on short final. The tower then instructed them to go around due to in sufficient spacing. (The L-382 was 1 1/2 to 2 NM in front, and the T-39 was 4 NM behind.) Just after the aircrew acknowledged the go-around instructions, the aircraft abruptly rolled left to 60 to 90 degrees bank, slightly nose low. It flew through several small trees 2 1/ 2 NM north of the runway approach end, struck a curb, became airborne again, and finally crashed into a brick home. The home was unoccupied at the time. Both crewmembers were fatally injured, and the aircraft was destroyed.

Figure 54. Final Approach Crash – Wake Turbulence.



50.2. **Investigation:**

50.2.1. **Supervisory Factor.** The aircrew and air traffic controller had not been given sufficient information or guidance concerning the severity of "heavy" aircraft wake turbulence.

50.3. **Lesson Learned:**

50.3.1. The T-38 is highly susceptible to wake turbulence. Air traffic controllers are not always aware of the spacing requirements. Therefore, the pilot is ultimately responsible for ensuring adequate separation to avoid jet wash. As a minimum, the pilot should stay 1 NM behind a fighter-size aircraft, 2 minutes behind a large aircraft (equating to roughly 5 to 8 NM), and 4 minutes behind a "heavy" aircraft (10 to 16 NM).

50.4. **Action Taken:**

50.4.1. Incorporated additional guidance concerning spacing requirements between dissimilar aircraft in Air Force and command flight directives.

50.4.2. Added the following warning to the TO 1T-38A-l:

Table 8. Warning to TO 1T-38A-1.

WARNING
The T-38, because of its short wingspan, is particularly susceptible to wake turbulence upset. The vortex-produced rolling moment can exceed the aileron authority of the T-38 in landing configuration. The rapid changes in lift can result in a stall without sufficient altitude to recover.

51. Instrument Approach.

51.1. **Mishap.** Figure 55. The flight was the return leg of a solo day/night, out-and-back navigation mission. The night mission was planned with an enroute descent and radar vector to an instrument landing system (ILS) approach at the home station. The flight progressed normally until air traffic control directed the pilot to change radio frequencies from arrival control to the final approach controller. Radio contact was lost for approximately 2 minutes and 6 seconds. Arrival control finally reestablished radio contact on their frequency, and they told the SP to remain on their frequency to complete the approach. In accordance with local procedures, RAPCON terminated radar service when the aircraft was on 2-mile final. However, the RSU was unaware of the aircraft's exact position and did not realize it was in the unit's sphere of responsibility. The aircraft began a rapid descent after transitioning from ILS to VASI glide path guidance and impacted the trees short of the runway. The student was fatally injured, and the aircraft was destroyed.

Figure 55. Instrument Approach.

51.2. **Investigation:**

51.2.1. **Operator Factor.** The SP did not attach his zero delay lanyard, set his final approach speed index improperly, was not wearing flight gloves, and had consumed portions of a box lunch in flight. He also remained off frequency for more than 2 minutes on final approach. For an unknown reason, he descended below the normal final approach glidepath, impacting the trees short of the landing runway.

51.3. **Lesson Learned:**

51.3.1. It is possible the SP suffered some sort of visual illusion or spatial disorientation on short final. He was obviously behind the aircraft, as indicated by his zero delay lanyard being disconnected and improper airspeed index. He also exhibited poor flight discipline and mis-prioritization by not wearing his gloves and eating in flight during a night sortie.

51.3.2. The SP was obviously not focused on the task at hand, which made him even more susceptible to nighttime spatial disorientation. Bottom line: Night missions may seem somewhat benign compared to daytime contact or formation missions, but they require just as much focus, if not more. Pilots rely heavily on vision to maintain attitude awareness, and many of those visual cues just are not there at night. They must be disciplined with the cross-check.

51.4. **Action Taken:**

51.4.1. Expanded instrument procedures training to include night lighting systems and procedures for transitioning from precision approaches to visual final.

51.4.2. Stressed aircrew discipline to all command aircrews.

52. Runway Departure – Brake Malfunction.

52.1. **Mishap.** Figure 56. The flight was the first sortie of a solo student out-and-back navigation mission. The SP lost aircraft control while braking during a landing at the non-Air Force out base. The left main landing gear departed the left s ide of the runway and struck an exposed concrete lighting pad, destroying the left main gear and substantially damaging the left wing and horizontal stabilizer. The aircraft came to rest on a taxiway at the departure end of the runway, and the SP egressed without injury.

Figure 56. Runway Departure – Brake Malfunction.

52.2. **Investigation:**

52.2.1. Maintenance Factor. Maintenance personnel had not properly corrected a previously identified defective brake. The defect created a differential braking action, causing the aircraft to drift left as the SP applied the brakes.

52.2.2. **Operator Factor.** The SP failed to use the remaining brake, rudder, and/or nose wheel steering to remain on the runway.

52.3. **Lesson Learned:**

52.3.1. Although the flight manual did not specifically include guidance for directional control problems on landing, pilots were expected to use good judgment and common sense. In this case, the SP allowed the aircraft to drift versus using all available means to remain on the runway.

52.4. **Action Taken:**

52.4.1. Incorporated guidance for landing with a blown tire, locked brake, or directional control difficulty into T.O. 1T-38A-l and added the following warning:

Table 9. Warning within 1T-38A-1.

WARNING
If one brake system fails or failure is suspected, plan to land in the center of the runway. Stop the aircraft by using aerodynamic braking followed by a combination of wheel brake and nose wheel steering. Rudder pedals should be neutralized prior to engaging the nose wheel steering to prevent violent swerving and possible loss of directional control.

53. Circling Approach.

53.1. **Mishap.** **Figure 57**. The mission was a day dual out-and-back navigation training sortie. The SP needed a circling approach to complete syllabus training requirements. The flight proceeded normally until the approach at the destination base. The crew requested a TACAN to circle for an opposite direction low approach, followed by radar vectors to initial. The SP flew the TACAN final approach to the north and then circled to the east. The aircraft crashed in the final turn, impacting an open field approximately 1 1/4 mile s from the runway approach end and 350 feet right (west) of the runway extended centerline. The aircraft slid another 650 feet after impact and struck a residential home. Neither crew member attempted to eject and both were fatally injured. The aircraft was destroyed upon impact.

Figure 57. Circling Approach.

53.2. **Investigation:**

53.2.1. **Supervisory Factor.** The IP had never flown a circling approach in the T-38 as a rated crewmember. Circling approaches were not a required maneuver during local upgrade training or on standardization evaluations.

53.2.2. **Operator Factor.** The aircrew used inadequate downwind displacement, exceeded bank angle limits, and descended below the circling minimum descent altitude (MDA) with a high sink rate, which neither recognized.

53.3. **Lesson Learned:**

53.3.1. Pilots are ultimately responsible for their own training and should never fly a new maneuver without doing their homework. The mishap IP may have assumed a circling maneuver was just like a normal overhead, but there are some important differences. Pilots must take time during mission preparation to identify unfamiliar areas and do the appropriate study.

53.4. **Action Taken:**

53.4.1. Revised governing directives to expand circling approach guidance.

53.4.2. Established requirement for all T-38 and T-37 aircrews going through PIT or local upgrade training to display proficiency in circling approaches.

54. Circling Approach.

54.1. **Mishap.** Figure 58. The flight was the first sortie of a dual student overnight cross-country training mission. The SP executed a high altitude penetration, ILS low approach, missed approach, and practice no-gyro ASR approach at the first cross-country base. The IP (in the RCP) assumed control of the aircraft to demonstrate a circling approach to a full-stop landing. The IP rolled out on a half to three-quarter mile final at 600 to 800 feet AGL. He was steep with a higher-than-normal rate of descent. He pulled back on the stick and added power just before touchdown in an effort to reduce the rate of descent and extend the touchdown point. It was not enough, however, and the nose gear and right main gear failed upon runway contact. The left main gear remained extended, and the aircraft skidded approximately 1,500 feet on the left gear, nose section, and right wingtip before departing the left side of the runway. The aircraft skidded an additional 400 feet after departing the runway. Both crewmembers egressed without injury, but the aircraft sustained substantial damage.

Figure 58. Circling Approach.

54.2. **Investigation:**

54.2.1. **Operator Factor.** The IP flew a poor circling approach, resulting in an excessively steep final. He failed to recognize the approach was unsafe and landed with an extremely high rate of descent.

54.3. **Lesson Learned:**

54.3.1. The IP was young, inexperienced, and on his first student cross country. He allowed his emotions to get the best of him in an unsure situation instead using of good judgment to dictate his actions. In an effort to save face in front of an SP, he failed to properly assess the danger or initiate a go-around. IPs need to set the standard for good judgment, as well as good flying skills. As the old saying goes, a superior pilot is one who "uses his superior judgment to keep from having to use his superior skills."

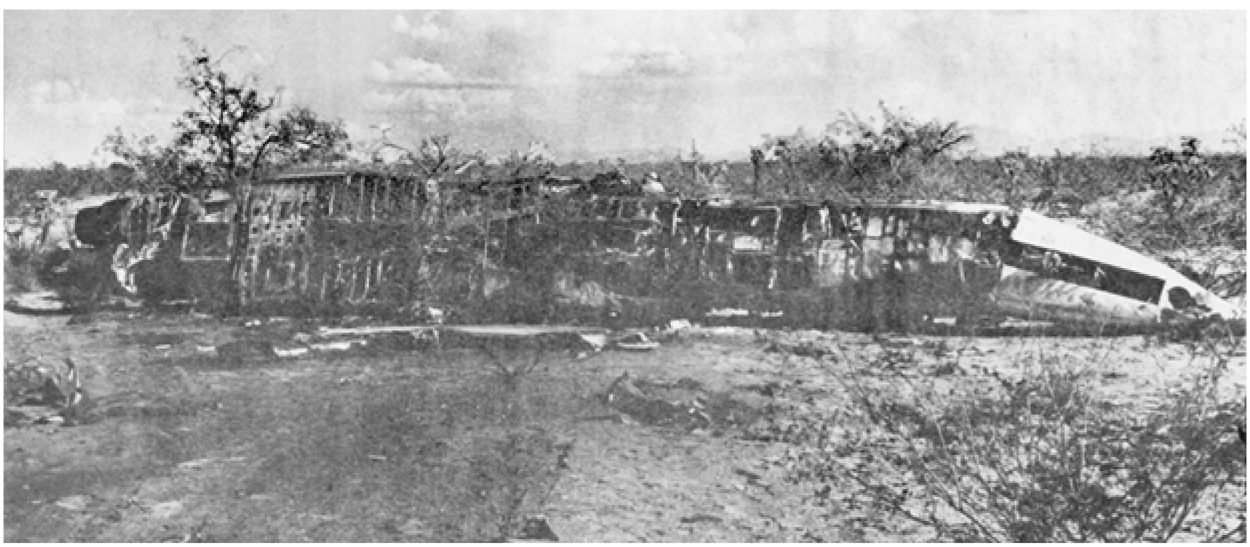
54.4. **Action Taken:**

54.4.1. Expanded governing directives to provide additional guidance on circling approaches.

55. Instrument Approach.

55.1. **Mishap.** Figure 59. The mishap aircraft was on an instrument proficiency flight for two IPs with approaches at an enroute field. Air traffic control cleared the crew for a TACAN penetration and approach at the initial approach fix. Weather was VMC with 7 statute miles (SM) visibility. The RCP pilot flew the penetration and was 2,000 feet high at the FAF. He initiated a steep descent to get to the MDA, but overshot the level off and descended rapidly through the MDA about 2 NM from the approach end. The FCP pilot took control of the aircraft and selected maximum afterburner on both engines. However, the aircraft continued its descent and touched down 500 feet short and 1,400 feet to the right of the runway. The aircraft skidded for approximately 1,500 feet, struck a large area of vegetation and a flood control ditch, and finally came to rest. The aircraft was engulfed in flames. The RCP pilot egressed without assistance, but firefighters had to extract the FCP pilot, who was unconscious. Both pilots received major injuries, and the aircraft was destroyed.

Figure 59. Instrument Approach.



55.2. **Investigation:**

55.2.1. **Operator Factor.** The RCP pilot flew a TACAN penetration and was 2,000 feet above the minimum FAF altitude. He flew an excessively steep final to get down to the MDA by the missed approach point, but did not use enough power at level off to stop the high sink rate and descended below the MDA.

55.2.2. **Supervisory Factor.** The FCP pilot was probably complacent and delayed correcting the RCP pilot's errors. The RCP pilot was his flight commander and was a highly qualified IP.

55.3. **Lessons Learned:**

55.3.1. Complacency can kill you. It takes great effort to fight complacency because it can be very insidious. If you ever feel relaxed in the aircraft, take a hard look at what is going on—you are probably missing something. Most pilots experience their first mishap or incident around 500 hours, which is when they start to get comfortable in the aircraft.

55.3.2. A high sink rate on final can be even more deadly than a stall. A stall is more easily identifiable than a sink rate due to increased buffet level and aircraft feel at high AOA. Be sure to bring the vertical velocity indicator (VVI) into your cross-check because it may be the only reliable means of gauging your sink rate. Do not rely on ground rush because it is already too late by then. Depending on the aircraft's gross weight, temperature, and pressure altitude, consider executing a stall recovery any time you see a VVI greater than 3,500 to 4,000 feet per minute in the traffic pattern.

55.4. **Action Taken. None**.

56. Runway Departure – Crosswind.

56.1. **Mishap. Figure 60**. The mission was an accelerated copilot enrichment (ACE) team sortie. The flight was uneventful until the crew returned to base for an overhead pattern for a full-stop landing. The crosswind component at the time of landing was 12 to 23 knots from the right. The aircraft touched down about 500 feet down the runway in the center. It shortly became airborne again, in left bank. As it departed the left side of the runway, the left wing struck a 3-foot-high snow fence that was 150 feet from the runway edge. The aircraft bank increased to 50 degrees, and the left wing struck the ground. The aircraft rolled back to the right, and all three landing gear impacted the ground. The RCP pilot ejected successfully. The aircraft continued forward on the ground, crashed through another snow fence, crossed a closed runway, and became airborne once more at the edge of a bluff. The FCP pilot ejected as the aircraft became airborne. Although the seat separated from the aircraft, the pilot did not get a full parachute before landing and was fatally injured upon impact. The aircraft continued another 836 feet before impacting an unprepared field 45 feet below the top of the bluff.

Figure 60. Runway Departure – Crosswind.

56.2. **Investigation:**

56.2.1. **Operator Factor.** Both pilots failed to adequately plan for the gusty crosswinds. The RCP pilot indicated they had computed the correct airspeed to include a gust factor, but the airspeed reference markers were both set at the basic approach airspeed. The mishap pilot failed to use prescribed crosswind landing procedures. (Proper procedures are to crab for landing, land on the upwind side, and perform no aerobrake.) He landed without a crab in the center of the runway and performed a normal aerobrake, causing the aircraft to drift and become airborne. The pilot overcontrolled during the go-around and inadvertently stalled the aircraft.

56.3. **Lesson Learned:**

56.3.1. Know and follow T.O. procedures. Flying is a dangerous business and requires a disciplined approach to do it safely.

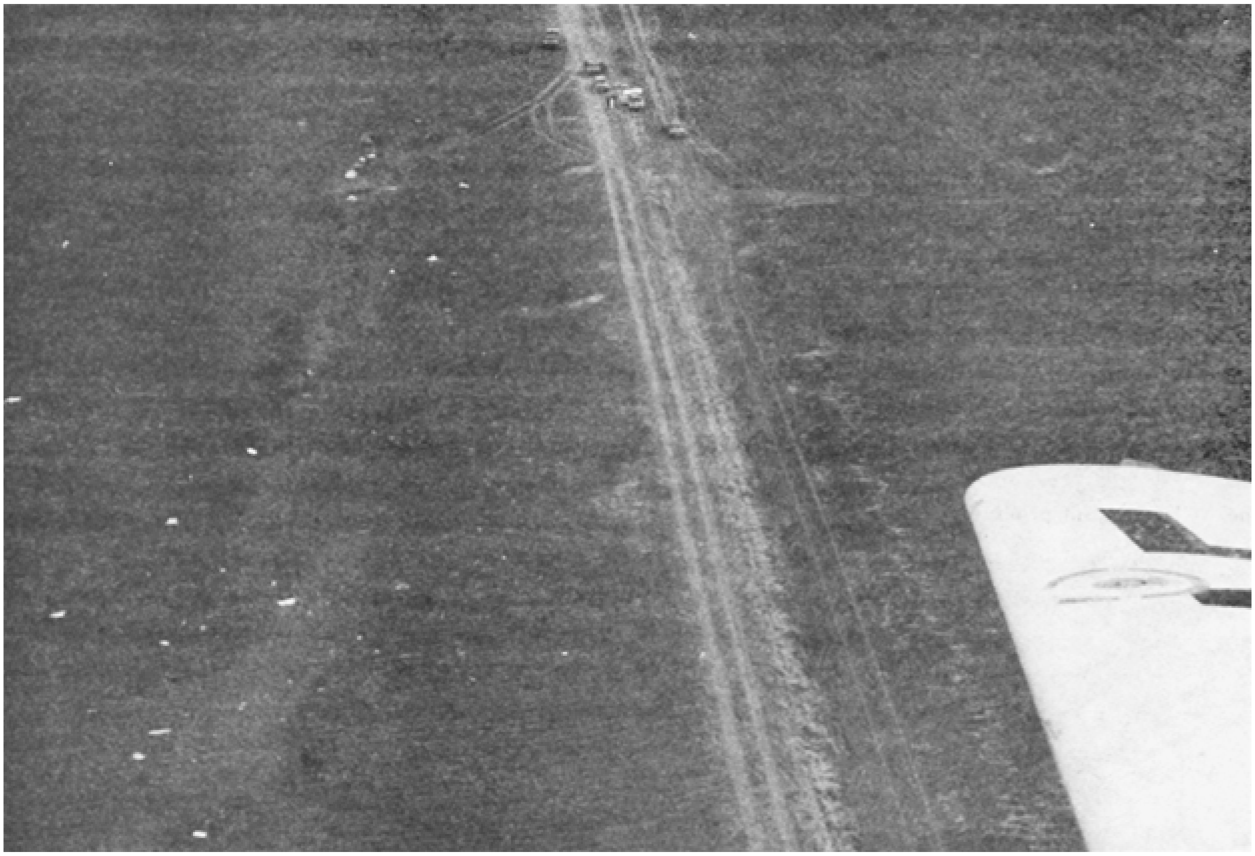
56.4. **Action Taken:**

56.4.1. The ACE program was thoroughly reviewed for adequacy, standardization, and safety.

57. Stall – Final Turn.

57.1. **Mishap.** **Figure 61**. The SP was on his second solo contact sortie. Departure and area work were uneventful. The SP was on his third traffic pattern when he overshot final. The RSU controller advised the SP that there was no conflict with traffic on the center parallel runway. The SP acknowledged and indicated he was going around. He increased his bank to about 60 degrees and inadvertently developed a high sink rate. The RSU controller noted the descent and told the SP to use his afterburners. Just moments later, the aircraft impacted the ground and was totally destroyed. The student made no attempt to eject and was fatally injured.

Figure 61. Stall – Final Turn.



57.2. **Investigation:**

57.2.1. **Operator Factor.** The SP configured the aircraft with landing gear, but failed to lower the flaps. He initiated his turn to final, using normal full-flap airspeeds. As he increased bank during the ensuing overshoot, the aircraft developed a high sink rate. The RSU controller directed the student to use afterburners, but the student had insufficient altitude to recover.

57.3. **Lesson Learned:**

57.3.1. The SP probably failed to lower his flaps due to inattention and/or distraction. Habit patterns are fragile things, so plan for disruption or distraction. That is, develop habit patterns that can withstand interruption. The gear check has been mentioned before. Check its configuration at the perch, in the final turn, and rolling out on final. It is unlikely you will miss all three.

57.3.2. In addition, the SP concentrated on flying the correct pattern ground track at the expense of aircraft control. The basic priorities still apply when executing a stall recovery—aviate, navigate, and then communicate. Concentrate on missing the ground instead of navigating the ground track!

57.4. **Action Taken:**

57.4.1. Stressed the importance of AOA in determining the proper aircraft configuration and performance to all T-38 aircrews.

58. Circling Approach.

58.1. **Mishap.** Figure 62. The mission was a dual contact sortie with touch-and-go landings at an alternate base. The SP became confused by tower instructions on TACAN final and started a go-around at about 90 feet AGL. The IP took control and tried to salvage the approach. He got into a high sink rate, and the aircraft landed hard about 130 feet past the runway threshold. The aircraft sustained substantial damage from the impact and came to rest approximately 3,000 feet from the threshold and 160 feet right of the runway. The crew egressed after the aircraft came to a stop. The IP sustained major back injuries, but the student was uninjured.

Figure 62. Circling Approach.

58.2. **Investigation:**

58.2.1. **Supervisory Factor.** The IP assumed aircraft control in the overrun to salvage the approach. He lowered the nose to establish a visual glide path and developed an excessive rate of descent. He did not recognize the developing hazard and continued the approach to impact.

58.3. **Lesson Learned:**

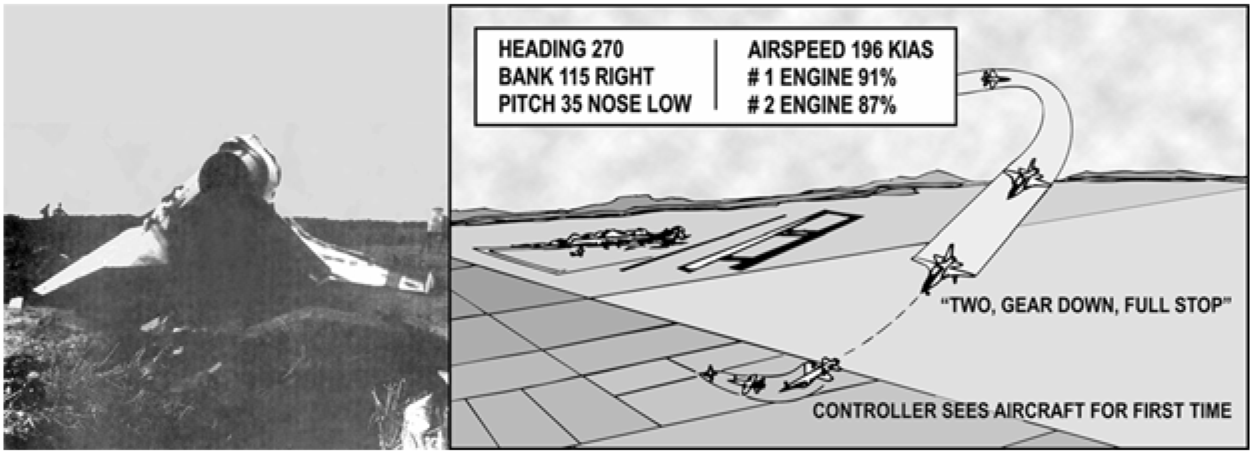
58.3.1. Go-around and missed approach procedures are established and practiced for a reason—not every landing is salvageable. If it does not look right, take it around. IPs, let your SPs make decisions, even if they are more conservative than you would be. Be sure to debrief it, but avoid second-guessing them in the air unless safety is an issue. Conservative decisions will rarely get you into trouble, but second-guessing and indecision will get you nearly every time.

58.4. **Action Taken.** None.

59. Stall – Final Turn.

59.1. **Mishap.** Figure 63. The mishap aircraft was on a solo two-ship training mission. Departure and area work were uneventful, and the flight was back in the pattern for landing. The SP pitched out normally and called, "gear down, full stop." The aircraft impacted the ground approximately three-quarters through the final turn. The SP did not eject and was fatally injured.

Figure 63. Stall – Final Turn.



59.2. **Investigation:**

59.2.1. **Operator Factor.** The SP approached a stall or developed a sink rate shortly after beginning the final turn. He failed to recognize the impending stall or sink and did not initiate a stall recovery. He may have been slow to react due to fatigue. The investigation revealed a lack of sleep and high activity in the 3 days prior to the mishap, compounded by hot weather.

59.3. **Lessons Learned:**

59.3.1. Each of us has limits. Know what yours are and do not push them. If you do not feel up to a mission, cancel and do it another day.

59.3.2. It is more effective to avoid a stall than to recover from one. However, it is harder to recognize an impending stall than a fully developed one. Keep the AOA and VVI in your cross-check. Consider executing a stall recovery anytime you see greater than 0.8 AOA or 4,000 feet per minute in the traffic pattern.

59.4. **Action Taken:**

59.4.1. Added guidance on the effects of fatigue, stress, and improper nutrition.

60. Stall – Final Turn.

60.1. **Mishap.** Figure 64. The mishap aircraft was lead in a two-ship formation sortie. The mission was uneventful until returning to the traffic pattern. The aircraft impacted the ground during the final turn and was destroyed. Both crewmembers were fatally injured.

Figure 64. Stall – Final Turn.

60.2. **Investigation:**

60.2.1. **Operator Factor.** The SP performed the pitchout and angled about 10 to 20 degrees into the runway, flying to an extremely tight inside downwind position. It is possible he mistook the center runway for the landing runway. At any rate, he was too close to fly a normal final turn and used excessive bank and back stick pressure to prevent an overshoot. He failed to recognize the hazards associated with a high sink rate and impending stall and continued the turn until the IP took the aircraft.

60.2.2. **Supervisory Factor.** The IP was likely complacent or not paying attention and allowed the SP to begin the final turn. (The SP had over 4,000 flight hours.) The IP failed to recognize the excessive sink rate and impending stall until it was too late. When the IP finally took control of the aircraft, he executed a go-around instead of a traffic pattern stall recovery. The aircraft entered a full stall with insufficient altitude to recover. Both pilots ejected out of the safe ejection envelope and were fatally injured.

60.3. **Lesson Learned:**

60.3.1. The SP was tight to the landing runway so he used excessive bank and back stick to make the turn. He would also have had to fly a steeper turn to lose the altitude in the shorter distance to the runway. Under these conditions, it is actually possible to fly the final turn at the correct final turn airspeed and AOA, masking the danger. The only indication of a problem would be the VVI, which would be much higher than normal.

60.3.2. Most pilots experience ground rush at 10 percent of the VVI. For example, ground rush occurs around 400 feet at 4,000 feet per minute (fpm) rate of descent. The combination of high sink and low altitude requires an immediate stall recovery, and even that might not be enough. It is likely the IP recognized the ground rush and instinctively executed a go-around, but either entered a stall or was unable to stop the descent at the low altitude.

60.3.3. Bottom line: Keep the VVI in your cross-check. As a rule of thumb, a 1,500-foot pattern generates around 2,000 to 2,500 fpm in the final turn, a 1,800-footpattern generates 2,500 to 3,000 fpm, and a 2,000-foot pattern generates 3,000 to 3,500 fpm. Consider going around if your pattern spacing requires an additional 500 fpm over the upper limit, and seriously consider executing a stall recovery if your VVI exceeds the upper limit by more than 1,000 fpm.

60.4. **Action Taken:**

60.4.1. Reviewed ways to teach practice traffic pattern stall recognition and recovery to maximize the learning transfer to actual traffic pattern stalls.

61. Stall – Final Approach.

61.1. **Mishap.** Figure 65. The profile consisted of a heavyweight single-engine pattern followed by departure to the area. The crew spent approximately 15 minutes in the area and then returned to the pattern for a no-flap, straight-in approach to the center runway followed by overhead patterns to the outside runway. The first four overhead patterns were uneventful, but the aircraft impacted 40 feet short of the overrun on the fifth pattern. The aircraft departed the left side of the overrun and rolled inverted, shattering the IP's windshield frame and causing him fatal injuries. The SP survived, but was seriously injured.

Figure 65. Stall – Final Approach.

61.2. **Investigation:**

61.2.1. **Operator Factor.** The SP got slow on final and failed to add power in time to stop the ensuing sink rate.

61.2.2. **Supervisory Factor.** The IP failed to recognize the developing danger and take effective action.

61.3. **Lesson Learned:**

61.3.1. More T-38 aircraft and crews have been lost in the final turn than in any other phase of flight. Stay vigilant in the traffic pattern and keep the airspeed, AOA, VVI, and power in your cross-check.

61.3.2. Avoid the temptation to relax because you are near the end of the sortie. It is not over until you are back in the crew van. Crews may also be fatigued at the end of a demanding sortie. Combat fatigue by staying hydrated, getting plenty of rest, eating healthy, and getting the right amount of exercise.

61.4. **Action Taken.** None.

62. Stall – Final Turn.

62.1. **Mishap.** Figure 66. The mission was a solo contact training sortie. The mishap aircraft reported initial, pitched out, and reported gear down uneventfully. The RSU noticed a problem approximately 12 seconds later and transmitted, “Final turn, monitor altitude, (pause) final turn, go around, use burners.” The mishap aircraft went below the tree line seconds later and impacted the ground. The SP was fatally injured

Figure 66. Stall – Final Turn.

62.2. **Investigation:**

62.2.1. **Operator Factor.** The SP allowed the aircraft to enter a high sink rate during the final turn.

62.3. **Lesson Learned:**

62.3.1. Once the RSU crew recognized the gravity of the situation, they made every effort to warn the pilot. However, it was too late once the high sink rate developed. While RSU controllers exercise positive control over the traffic pattern by paying special attention to solos, they cannot fly the aircraft for them.

62.3.2. Solo SPs should be extra conservative in the pattern. As a SP, if the spacing does not look right or you are behind at the perch, break out. If the final turn is not quite right, go-around early, but do not exceed your maximum allowable AOA while doing it.

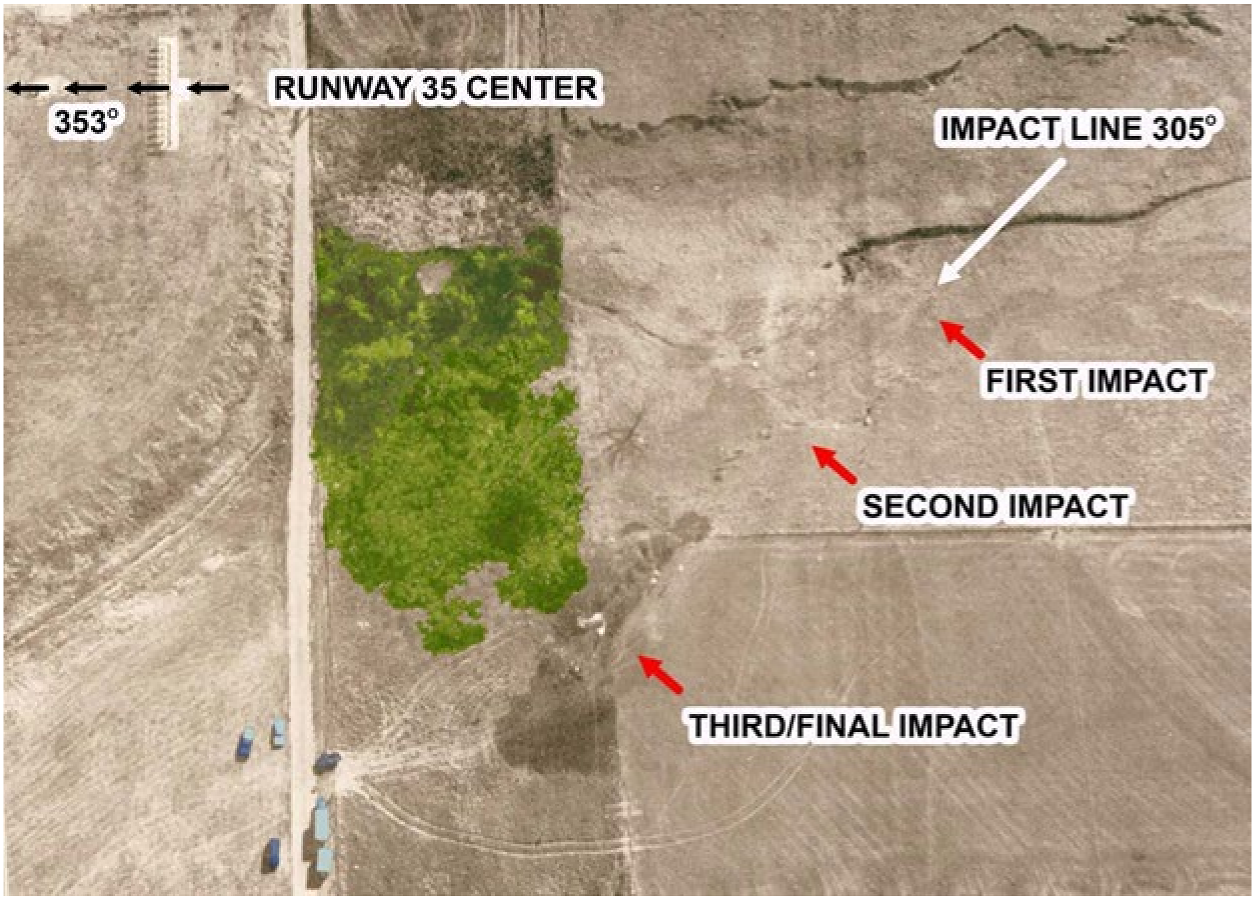
62.3.3. As an SP, you probably do not have enough experience for the hairs to stand up on the back of your head when they should, but if you ever find yourself thinking “oh, this is bad,” execute a stall recovery immediately! It is better to be back on the ground explaining your actions to the RSU controller or the flight commander than to have someone else explaining your mishap to your parents or other loved ones.

62.4. **Action Taken.** None.

63. Circling Approach.

63.1. **Mishap.** **Figure 67**. The mishap occurred on the final leg of a 3-day cross country. This sortie was the second of the day (the sixth overall) and was uneventful from takeoff to arrival at the home airfield. The SP was in the RCP for syllabus-directed instrument training. The SP flew two ILS approaches before the IP executed a closed pattern. The IP ended up on downwind between the circling MDA and the normal overhead pattern altitude. The IP configured the aircraft, using circling procedures and planning to full stop. The IP overshot final and was correcting to the runway when the aircraft impacted the ground. The aircraft was one-third of a mile short of the approach end on a 45-degree intercept heading. Both pilots were fatally injured, and the aircraft was destroyed.

Figure 67. Circling Approach.



63.2. **Investigation:**

63.2.1. **Operator Factor.** The IP had not performed a circling approach for approximately 5 months. He misjudged the base turn and overshot so far that he could not get back on runway centerline until he was inside one half mile to the threshold.

63.2.2. **Operator Factor.** The IP decided to salvage the landing versus going around. He may have been so focused on making the runway that he failed to notice the aircraft entering a stall. Contributing factors may have been (1) impaired judgment due to fatigue (only 5 to 6 hours of rest the night before), (2) a lack of recent solid food intake (16 hours since last meal), (3) a lack of self-discipline, (4) pride and overconfidence (not wanting to lose face in front of the SP and overshooting before and been able to land), and (5) channelized attention due to a perceived low-fuel state.

63.3. **Lesson Learned:**

63.3.1. Previously during the cross country, the IP had given the SP an unsatisfactory grade for a circling approach. He may have been frustrated at his own poor performance and let his pride get the better of his judgment in an attempt to salvage the approach as well as his credibility. The IP had occasionally overbanked to correct previous overshoots with the erroneous justification that “momentary deviations” in bank angle were allowable.

63.3.2. The IP's loose interpretation of directives and poor flight discipline, combined with pride, inadequate crew rest, and lack of nutrition, may have influenced him to continue the approach versus taking it around. The main lesson for IPs is that the sure way to regain or maintain your credibility is to acknowledge your mistakes. You lose more by covering them up because SPs notice and take your actions as the example.

63.4. **Action Taken:**

63.4.1. Reevaluated the need for an aural AOA in the T-38 training environment. The IP's attention may have been focused on visual cues to the exclusion of al l else. An aural tone may have alerted him to a problem, reminding him to cross-check his parameters.

63.4.2. Expanded command guidance concerning proper crew rest and nutrition.

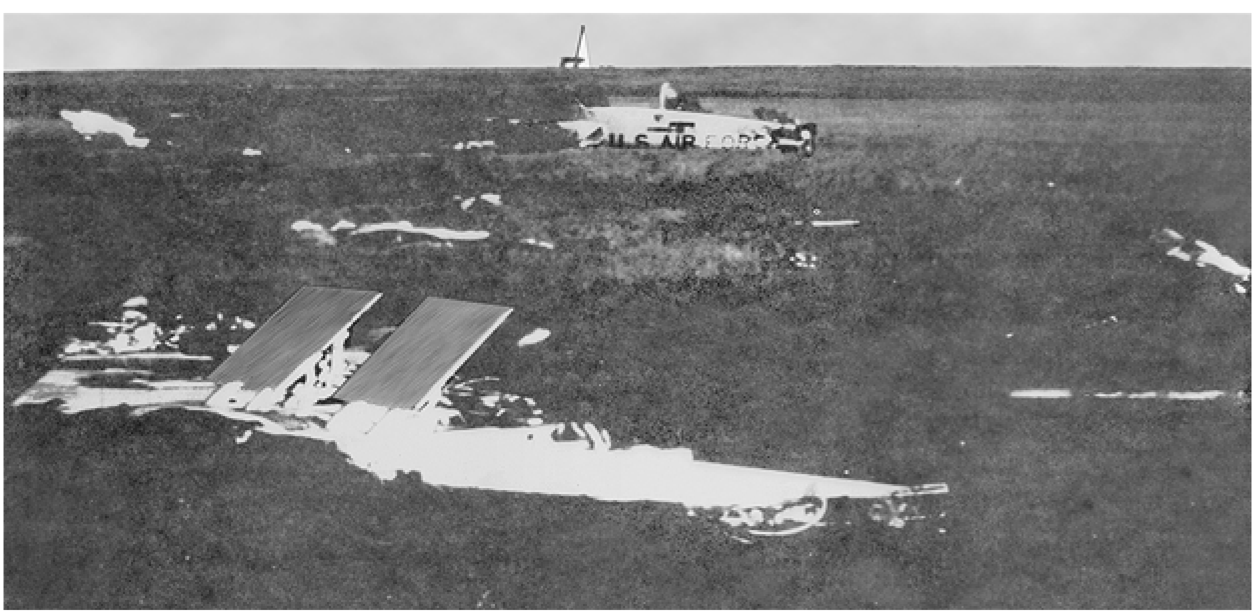
63.4.3. Continued emphasis on command programs to educate T-38 aircrews on excessive sink rates and traffic pattern stalls—specifically causes, early recognition, and recovery procedures.

63.4.4. Changed circling approach requirements from semiannually to quarterly.

64. Stall – Touch and Go.

64.1. **Mishap.** Figure 68. The flight was a pre-solo contact review sortie. The crew returned to the overhead pattern after completing the area work. The SP flared high and pulled the throttles to idle on the first no-flap landing. The IP directed the student to add power, and the RSU controller transmitted "flare go-around" on the radio. The SP failed to add power as directed by the IP, and the aircraft started to wing rock. Just after the left wingtip contacted the runway, the RSU controller transmitted "go around, use burners," and the IP assumed aircraft control. The aircraft departed the left side of the runway and went abruptly airborne in a very nose-high attitude. The SP perceived the aircraft would impact the ground and pulled both throttles to idle. The IP initiated ejection, but was fatally injured during the attempt. The SP did not eject and sustained major injuries that were not life-threatening.

Figure 68. Stall – Touch and Go.



64.2. **Investigation:**

64.2.1. **Operator Factor.** The SP flared high and pulled both throttles to idle during an attempted no-flap landing, placing the aircraft in a hazardous position. The SP was task saturated with the resultant wing rock and failed to respond to IP and RSU controller inputs.

64.2.2. **Supervisory Factor.** The IP delayed taking the aircraft and allowed the situation to develop.

64.2.3. **Operator Factor.** The SP interfered with the IP's recovery by retarding both throttles to idle.

64.3. **Lesson Learned:**

64.3.1. IPs routinely let situations progress in order to maximize learning, but there is a fine line between far enough and too far. In this case, the IP let the situation progress beyond his ability to correct it. Pilots, particularly IPs, should strive to make as accurate an assessment of their capabilities as possible. They should never let a situation progress to the limit, always giving themselves some slack for things like SP interference during transfer of aircraft control.

64.4. **Action Taken:**

64.4.1. Reviewed existing flight manuals and other training documents to ensure adequacy of landing and go-around guidance. Increased emphasis on the IP's responsibility to quickly identify and correct potentially hazardous situations before they progress too far. Proper transfer of aircraft control continues to be a high emphasis item during all preflight briefings.

65. Final Approach Crash.

65.1. **Mishap.** Figure 69. The mission was an instrument qualification training sortie at a nearby out base for the pre-PIT SP in the back seat. This was the SP's second instrument sortie in the aircraft. The IP and SP were interrupted during their mission briefing due to a schedule change and departed the building without a complete briefing. The crew conducted several nonstandard procedures throughout the flight. At some point in the mission, the IP filled out the AFTO Form 781 with final landing and mission times. In addition, all of the IP's flight publications were found stored in the map case. Evidence implies the crew did not work jointly to accomplish the mission. The first penetration approach to an ILS final with missed approach was uneventful. There was some confusion on the second approach over whether the SP would fly an ILS or localizer approach. He began his descent to the MDA passing the FAF, but kept descending and crashed 2.2 NM short of the runway. The SP attempted to recover the aircraft before impact, but he was too low and slow to be successful. He ejected from the RCP as the aircraft rolled across the ground and began to break up, but was fatally injured in the attempt. The IP stayed with the aircraft and egressed after it came to rest.

Figure 69. Final Approach Crash.

65.2. **Investigation:**

65.2.1. **Operator Factor.** The IP was complacent and overestimated his abilities due to his extensive familiarity with the training environment. His inflated self-image also led to a disregard for established procedures.

65.2.2. **Operator Factor.** The SP descended below the MDA due to his limited proficiency and lack of exposure to non-precision approaches.

65.2.3. **Supervisory Factor.** The IP failed to correct the SP's deviations during the approach. Most importantly, the IP did not take control of the aircraft once the dangerous situation developed.

65.3. **Lesson Learned:**

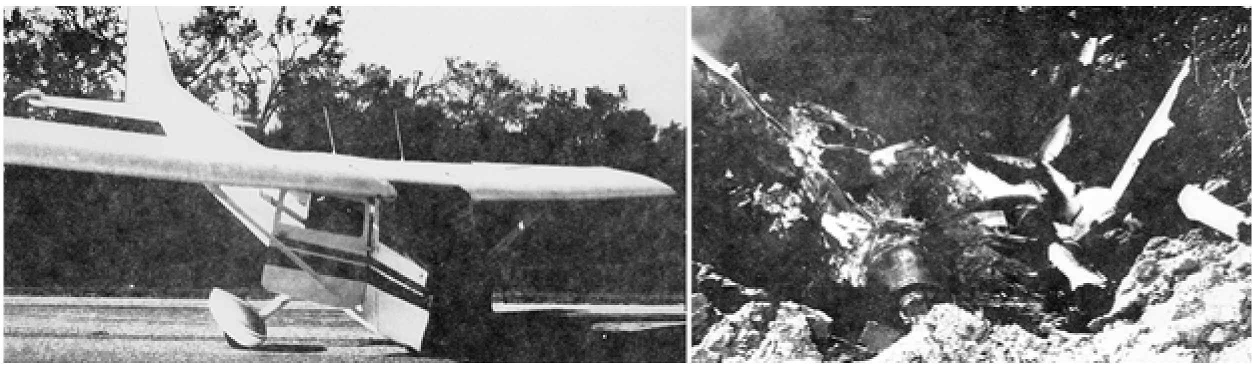
65.3.1. As we have said before, complacency can kill you. This mishap provides an addendum—if your complacency does not kill you, it may kill someone else. Do not get comfortable. Force yourself to keep a good cross-check going, keep your mind actively engaged by setting challenging objectives for every flight, and enforce strong flight discipline.

65.4. **Action Taken.** None.

66. Instrument Approach.

66.1. **Mishap.** Figure 70. The mission was a navigation sortie on the last leg of a weekend cross country. The mishap crew departed from an out base and planned to drop in at a nearby field for an instrument approach. The SP was flying from the front seat to fulfill syllabus requirements. Air traffic control was providing radar vectors for the drop-in approach and initially directed the SP to climb to 5,000 feet. After handoff, the next controller directed a descent to 3,000 feet. Immediately after the SP leveled off and made his approach request, he collided with a civilian Cessna™ 172. (The SP had been airborne for about 6 minutes.) The Cessna™ had a civilian flight instructor and SP on board and had taken off approximately 18 minutes prior to the collision. The civilian crew had taken off from a local airfield and flown south to a practice area. Once they were outside the 20 NM outer limit of the airport radar service area (ARSA), the controller had terminated radar service and cleared the Cessna™ VFR. The Cessna™ crew had performed a series of stalls and was making a turn to the northwest when it collided with the T-38. The Cessna's™ engine was sheared off at the firewall, and the aircrew performed an emergency landing on a nearby highway. The T-38 aircrew ejected with minor injuries, but the T-38 was destroyed upon ground impact.

Figure 70. Instrument Approach.



66.2. **Investigation:**

66.2.1. **Operator Factor.** The T-38 IP had limited visibility in the RCP. The SP in the FCP had better visibility, but was focused in the cockpit while setting up his navigational aids (NAVAID) for an ILS approach. The SP saw the Cessna™ prior to impact, but did not have enough time to avoid colliding with it.

66.2.2. **Operator Factor.** The Cessna™ IP exhibited poor airmanship. He was operating VFR on the edge of a major military base's ARSA. Furthermore, his location was in the vicinity of the radar transition to final approach.

66.2.3. **Operations Factor.** The radar controller did not provide aircraft separation or traffic advisories.

66.3. **Lesson Learned:**

66.3.1. Civilian pilots are not always familiar with operations at a military base so aircrews should expect to see them pressing through the traffic pattern on occasion. Aircrews should use good CRM below 3,000 AGL to ensure both pilots are not focused inside the aircraft at the same time. And as always, clear, clear, clear.

66.4. **Action Taken.** None.

67. Stall – Touch and Go.

67.1. **Mishap.** Figure 71. This was the SP's first sortie in the T-38. The mishap crew completed area work and then returned to the home field to practice patterns and landings. During the second pattern, the SP flared high while attempting to land. The RSU controller directed the mishap crew to go around. The aircraft continued in the high flare until the left wing stalled and dropped, rolling the aircraft into approximately 90 degrees of left bank. The RSU directed the mishap crew to "use burners"! The aircraft entered a heavy wing rock and began oscillating in yaw, all with a nose high attitude. The RSU transmitted, “lower your nose.” The aircraft nose came down and the oscillations dampened as the aircraft veered off from the runway at less than 80 feet AGL. It appears that the IP raised the flaps from full down to 60 percent some time during this sequence. The aircraft seemed to gain altitude, but the nose pitched up again after just a few seconds. The aircraft rolled abruptly to nearly 135 degrees of right bank and the nose dropped rapidly. The aircraft impacted the ground and was destroyed. Neither crewmember attempted to eject and both were fatally injured.

Figure 71. Stall – Touch and Go.

67.2. **Investigation:**

67.2.1. **Supervisory Factor.** The IP failed to recognize an impending stall and did not execute a proper stall recovery in a timely manner.

67.2.2. **Operator Factor.** The IP failed to ensure the engines were operating in full afterburner during the initial wing rock. I t is possible he focused his attention on raising the flaps to reduce induced drag.

67.2.3. **Operator Factor.** After the RSU directed the aircrew to lower the nose, the IP released sufficient back pressure to break the stall. As the aircraft angled away from the runway, it was heading toward the control tower and some other buildings. The IP increased back stick pressure and selected afterburner to avoid the structures, but induced a secondary stall in the process.

67.3. **Lesson Learned:**

67.3.1. The IP would have been able to recover from the wing rock sooner if he had used the afterburners immediately. A high flare can be very dangerous because of two interacting factors: The airspeed decreases while AOA and induced drag increase. This increases the power required to accelerate or sustain level flight. The throttles are most likely at idle which creates a lag in your ability to command more thrust. Even if you throttle burst to military power, it will take a few moments before the engines are actually generating military thrust. By the time the engines are cooking, you have already lost more airspeed and/or altitude. For these reasons, consider using afterburners any time you initiate a go-around after beginning the flare. Keep flying the aircraft while the engines spool up and realize the aircraft may touch down in the process. Allow the aircraft to touch down on the runway versus increasing back stick pressure to the point of stalling the aircraft.

67.4. **Action Taken:**

67.4.1. Implemented a stall training program in which an IP must complete a stall training sortie conducted by a specially trained stall pilot before the IP's qualification checkride. Program requirements also include an annual stall seminar and a semiannual requirement to practice stalls and recoveries with another IP during a CT mission.

68. Bird Strike, Engine Failure – Touch and Go.

68.1. **Mishap.** **Figure 72**. The mishap crew was on a dual pre-solo formation sortie flown in the local area. After completing area work, the mishap crew returned to the home field for a formation approach and pattern work. The SP saw a brown flash on the left side of the aircraft on departure from the first touch and go. The flash turned out to be a bird, which went down the left intake. The aircraft was at 165 knots and 30 to 50 feet AGL with 6,000 to 7,000 feet of runway remaining. Both crewmembers heard a loud crunch or bang as the left engine failed catastrophically. The master caution, left hydraulic, and left generator lights illuminated. The aircraft yawed and rolled left. The SP applied rudder to straighten out the aircraft. The IP assumed control of the aircraft and placed the right throttle in afterburner. He directed the SP to open the throttle gate. The IP checked the airspeed (now 145 knots) and set the flaps at 60 percent. The mishap aircraft would not accelerate above 145 knots and remained at or below 50 feet AGL as it continued down the runway. With only 1,500 feet of runway remaining, the IP told the SP "Prepare to eject." The aircraft began to descend, and the IP commanded ejection. He saw the flash from SP's ejection and simultaneously noticed the barrier passing under the nose of the aircraft. The main landing gear contacted the barrier webbing, pulling the barrier cable to the bottom of the mishap aircraft. The cable became lodged in the hinge point of the left stab and tore the stab from the aircraft, causing the aircraft to pitch down. The IP initiated his ejection, leaving the aircraft as the nose impacted the ground. Although the IP's ejection and initial parachute deployment were normal, the parachute collapsed and did not inflate prior to ground impact. The IP sustained serious injuries on landing. Once on the ground, his parachute dragged him until the SP released him. The aircraft continued to skid another 1,500 feet across a highway embankment and onto a railroad track, sustaining major damage.

Figure 72. Bird Strike, Engine Failure – Touch and Go.

68.2. **Investigation:**

68.2.1. **Operations Factor.** The left engine ingested a horned lark on the departure leg of a touch and go, causing a compressor stall and engine failure.

68.2.2. **Logistics Factor.** The right engine failed to achieve maximum afterburner due to a binding cam in the T-5 motor.

68.2.3. **Operations Factor.** The barrier became entangled with the bottom of the aircraft, ultimately severing the left stab.

68.2.4. **Operator Factor.** The IP failed to make a timely ejection decision.

68.3. **Lesson Learned:**

68.3.1. Several unrelated events interacted and rapidly placed the aircrew behind the power curve. Emergencies during the takeoff and landing phase leave little room for error, and there is a very small difference between successful and unsuccessful ejection parameters. Waiting that extra second may place you outside the envelope. Think about your ejection decision beforehand and be prepared to execute. Decide now what you will do if you apply a boldface or recovery procedure, but the aircraft does not respond as expected.

68.4. **Action Taken:**

68.4.1. Expanded command guidance for emergency procedures simulators to include compound and multiple emergency situations, scenarios requiring ejection, and thrust-deficient, single-engine go-arounds.

68.4.2. Continued development of a CRM program for UPT and specialized UPT.

69. Blown Tire and Runway Departure.

69.1. **Mishap.** Figure 73. The mishap sortie was a CT mission for the IP in the RCP. The mishap crew was executing a no-flap touch and go with a left crosswind of 19 knots. The RCP IP heard a loud bang soon after touchdown and determined the left tire had blown. He initiated an abort by bringing the throttles to idle and directing tower to raise the BAK-15 barrier. The IP began to max aerobrake with approximately 5,200 feet of runway remaining without lowering flaps. At 4,000 feet remaining, the aircraft drifted right, causing the right tire to blow as well. The RCP IP used a combination of braking, rudder, and nose-wheel steering in an effort to maintain directional control. Despite these efforts, the aircraft departed the runway at 50 to 80 knots and struck a barrier stanchion (a 5.5 inch steel pole). The pole impacted the left side of the aircraft, causing substantial damage. The pole and nose gear sheared off, and the right main gear collapsed. Impact forces caused the FCP ejection seat to fire. The ejection was outside the envelope under high wind conditions, and the FCP IP was fatally injured. The RCP IP egressed without injury.

Figure 73. Blown Tire and Runway Departure.

69.2. **Investigation:**

69.2.1. **Supervisory Factor.** Technical Order, Air Force Instructions, and courseware contained conflicting guidance regarding go/no-go decisions and guidance for no-flap touch and go and tire wear limits during crosswind landings was nonexistent.

69.2.2. **Maintenance Factor.** The left tire blew for an unknown reason. Crosswinds, gross weight, pilot technique, and runway surface were possible contributing factors.

69.2.3. **Operator Factor.** The RCP IP performed an aggressive aerobrake instead of prioritizing directional control. The aggressive aerobrake allowed the aircraft to drift right, blowing the right tire.

69.3. **Lesson Learned:**

69.3.1. This mishap revealed several areas needing clarification regarding the go/no-go decisions. Additionally, the impact of crosswinds on directional control and tire stress needed to be addressed in more detail to prevent another such occurrence.

69.3.2. Aggressive aerobraking can significantly degrade directional control during strong crosswinds. Due to too much aerobraking (trying to stop the aircraft), the RCP IP allowed the aircraft to drift off the runway. The priority should have been to properly maintain aircraft control (thereby preventing runway departure) even if it made barrier engagement likely.

69.4. **Action Taken:**

69.4.1. Directed comprehensive review and revision of all written guidance in the Technical Order, Air Force Instructions, and courseware that pertains to go/no-go decisions for takeoff, landing, and touch and go, including no-flap and single engine situations.

69.4.2. Developed and published additional guidance regarding no-flap crosswind procedures.

69.4.3. Recommended additional guidance regarding tire wear during crosswind landings. Maintenance directives were changed to include additional guidance on T-38 tire inspections.

69.4.4. Sequenced, zero-zero ejection system installed in all T-38C aircraft. Awaiting funding to install in T-38A/B.

70. Excessive Sink Rate – Final Approach.

70.1. **Mishap.** **Figure 74**. The MP was flying his fourth sortie of the day as a night solo continuation training sortie into the civilian field on a cross-country mission. The MP requested a visual approach to a runway. The MP misidentified another runway as the landing runway and maneuvered to land on the misidentified runway. Due to the mismatch between what he was seeing outside and what his instruments indicated he allowed his airspeed to decrease well below a safe airspeed and descended at an insufficient rate, placing him well above a normal glide path. In an attempt to fix his glide path, he developed an excessive sink rate. The MP did not detect the slow airspeed nor excessive sink rate in time to prevent a hard landing and runway departure that caused damage to the MA's landing gear, engines, right wing, and tail section and minor damage to the runway. The MA came to rest 2,500 feet from the point of impact. The MP accomplished a safe ground egress and suffered minor injuries.

Figure 74. Excessive Sink Rate – Final Approach.

70.2. **Investigation:**

70.2.1. **Operator Factor.** The MP's originally approved cross-country plan was changed one week prior to the mishap due to direction from squadron leadership. In order to meet the squadron requirements and personal objectives, an aggressive high-risk plan was developed that included flying a fourth sortie solo, single-ship on the MP's first night arrival to civilian field. Risk Management (RM) was inadequate on three fronts: inadequate risk analysis of the overall cross-country weekend plan as well as the MP's individual plan, an inadequate risk assessment matrix, and a culture of risk tolerance in the squadron. Inappropriate supervisory policy, combined with inadequate RM, led to the MP flying a high-risk mission profile relative to the real benefits.

70.2.2. **Operator Factor.** While being vectored, the MP was cleared for and accepted a visual approach prior to having the airfield and landing runway in sight. He then saw and maneuvered for a visual approach, contrary to AFI guidance, on what happened to be another runway due to not sufficiently monitoring his position and becoming geographically disoriented 3 NM from the airfield. This coupled with fatigue led to a series of perception and performance errors that ultimately resulted in the runway impact.

70.3. **Lesson Learned:**

70.3.1. A long day for this pilot got worse when he tried something new. He was out of crew duty day, flying his fourth sortie of the day, at night, into a field he never had flown into. Perfect storm? Actually, yes it was. The risk versus reward for both the plan and mishap sortie did not justify pushing as hard as he did to complete the mission and deviate from AFIs in the process which coupled with fatigue resulted in a recipe for disaster. The best news out of this was no one was seriously injured but it could have been so much worse.

70.4. **Actions Taken:**

70.4.1. Established a 10 hour duty day for T-38 night flying events.

70.4.2. Require OG/CC approval for more than three sorties in one flight duty period.

70.4.3. Clarified guidance for execution of RM to include cumulative risk on multiple sorties.

71. Engine Failure on Touch and Go.

71.1. **Mishap.** **Figure 75**. On a dual sortie, the mishap student pilot (MSP) flew a simulated single engine heavyweight (full fuel load) approach with an alternate gear extension without the heads-up display (HUD) for a planned touch and go. At or near the time the mishap aircraft (MA) touched down, the mishap instructor pilot (MIP) took control of the aircraft because the aircraft was outside the parameters for a successful landing on the main runway surface. The MA made a hard landing in the overrun throwing debris from the overrun surface into the number 2 (right) engine intake resulting in compressor stall two seconds after touchdown and complete engine seizure four seconds after touchdown. Eight seconds after the right engine failed while climbing away from the ground, the MIP retracted the landing gear and flaps. Eleven seconds after the engine failed the MIP selected maximum power (MAX) on the left engine. The mishap crew (MC) ejected 24 seconds after engine failure. At the time of ejection, the aircraft was 5-10 degrees nose low, 25-40 feet above the ground and in a fully developed stall. The near simultaneous ejection of the MC caused contact between the two ejection seats, disrupted their trajectories, and resulted in an unsuccessful ejection sequence. Both pilots were fatally injured upon impacting the ground. The aircraft came to rest approximately 6800 feet down the runway and was damaged beyond repair.

Figure 75. Engine Failure on Touch and Go.

71.2. **Investigation:**

71.2.1. **Operator Factor.** The proper procedure following an engine failure during either the takeoff or landing phase is to immediately select MAX power, set flaps to 60 percent and attain a safe flying airspeed. The lack of power and airspeed, and the MIP's failure to leave the flaps positioned at 60 percent, resulted in a high angle of attack and subsequent stall.

71.3. **Lesson Learned:**

71.3.1. Obviously, there is a fine line on how far you let a student go. Yes, they have to be able to make mistakes and learn from them. But you need to give them enough rope to hang themselves, but not enough to hang the both of you. The MIP should have stepped in earlier. And when the MIP did take aircraft, the proper boldface emergency procedures were not followed resulting in two fatalities and a loss of the aircraft.

71.4. **Actions Taken:**

71.4.1. Sequenced, zero-zero ejection system installed in all T-38C aircraft. Awaiting funding to install in T-38A/B.

71.4.2. Incorporated updates to AETCMAN 11-251 concerning T-38C landing aimpoints to prevent short touchdowns in the overrun.

72. Blown Tire During Crosswind Landing

72.1. **Mishap.** **Figure 76**, **Figure 77**, **Figure 78** and **Figure 79**. The mishap aircraft (MA) landed in a very strong crosswind near the limits of the aircraft and the downwind tire blew during rollout leading to directional control problems. The mishap crew (MC) was unable to keep the aircraft on the paved landing surface. The aircraft departed the runway at 71 KCAS/62 GS approximately 5,551 feet down the runway. The left main landing gear (MLG) impacted a buried concrete block used for runway edge lighting approximately six feet from the runway edge at 59 KCAS/50 GS. This resulted in the left strut being driven through the top of the wing and catastrophic failure of the left MLG. The left MLG door separated from the aircraft and was partially buried into the ground. As the aircraft continued its track, the left horizontal stab suffered damage when it impacted the left MLG door. The aircraft came to rest 5,842 feet down the runway and 52 feet right of the paved runway surface with engines running in idle. The mishap instructor pilot (MIP) shutdown the engines and both pilots safely egressed the aircraft.

Figure 76. Blown Tire on During Crosswind Landing.

Figure 77. Blown Tire on During Crosswind Landing (cont).

Figure 78. Blown Tire on During Crosswind Landing (cont).

Figure 79. Blown Tire on During Crosswind Landing (cont).

72.2. **Investigation:**

72.2.1. **Supervisory Factor.** At the time of the mishap, T-38s were operating near the maximum crosswind limit. Multiple T-38s had already blown tires prior to the mishap sortie. Wing leadership accepted risk under the assumption that aircraft and tire wear limitations provided a sufficient margin of safety for recovery.

72.2.2. **Logistics Factor.** The maximum crosswind limit in the T-38 is currently 30 knots, but there is no documentation or technical data as to who or why the limit was set at this speed. The original crosswind limit was 22 knots and was changed at an unknown time in the past.

72.2.3. **Operator Factor.** The mishap occurred because the MIP lowered the nose to the runway immediately following MLG touchdown, increasing compression on the downwind strut. This compression created right drift that, combined with an imperceptible left crab, increased tire wear. Upon brake application at approximately 108-117 KCAS, the right MLG tire failed. This failure at relatively high speed, in conjunction with maximum recommended crosswinds, made the aircraft uncontrollable and led to a runway departure.

72.2.4. Operations Factor. The majority of damage occurred when the left MLG struck a concrete pad housing a runway edge light. Current criteria requires the runway edge lighting and concrete pads to be within a paved 10’ shoulder. This runway did not meet this new criteria and had a waiver to this requirement.

72.2.5. **Logistics Factor.** No deliberate testing had been conducted on the main tires to determine how many takeoffs and landing can be accomplished prior to failure in maximum crosswind conditions. Leadership and pilots assumed the T.O. limits would provide a sufficient safety margin to operate at or below the crosswind limit.

72.3. **Lesson Learned:**

72.3.1. Crosswind procedures are there for a reason. They work. The 1T-38C-1 states, “Lowering the nose prematurely in a crosswind will produce a compression of the downwind strut. This hampers directional control and may be minimized by use of aileron. Early downwind strut compression combined with weathervaning usually results in damage to the downwind tire.” Also, doing anything on the edge of limits can sometimes place you over limits. In this mishap, the limits of the aircraft and crew were put to the test and resulted in significant damage to the aircraft.

72.3.2. Airfields may contain unknown hazards to pilots, especially at older and unfamiliar facilities.

72.4. **Actions Taken:**

72.4.1. Tire testing is in progress to determine an appropriate crosswind limit based upon engineering data.

73. Landed Short of Runway

73.1. **Mishap.** Figure 80. The mishap sortie was planned and briefed as an instrument profile continuation training (CT) sortie with an instrument approach at an out base then return to home station for another instrument approach and visual flight rule (VFR) patterns. The front cockpit was occupied by the Mishap Upgrade Pilot (MUP), a T-37 First Assignment Instructor Pilot (FAIP), and the rear cockpit was occupied by the mishap instructor pilot (MIP). The MIP flew an uneventful ILS approach, breaking out of the weather at approximately 600 feet above ground level (AGL) and 2 NM from the runway threshold. The MIP transitioned to a visual approach lowering his aim point to the runway threshold. The MIP maintained a steady 3 degree glide path until he began the transition to land. The mishap aircraft (MA) landed approximately 25' short of the runway threshold in the unprepared overrun. The MA continued to roll through the grass and impacted a 2-3 inch lip at the threshold of the runway. The left tire suffered a gouge and deflated. The right wheel assembly disintegrated upon impact with the pavement and the right tire departed the MA. The left main landing gear strut door destroyed a raised threshold light and the right brake assembly rotated 90 degrees and gouged the runway surface for approximately 320'. The right main landing gear strut door departed the MA at an undetermined time after the impact. The MIP executed a go-around with no apparent directional control difficulties. The MIP requested a return to home base and a climb above the weather in order to troubleshoot their problem. After coordination with supervision, the MIP decided to execute an intentional gear up landing. The MIP flew an uneventful visual approach with the MA touching down approximately 800' down the runway and came to a stop 3,800' from the approach end on runway centerline. The pilots ground egressed uneventfully. The MA sustained damage to the speed brakes, flaps, both horizontal stabilizers, both inboard main gear doors, the nose gear door and numerous antennas/lights on the underside of the fuselage.

Figure 80. Landed Short of the Runway.

73.2. **Investigation:**

73.2.1. **Supervisory Factor.** The MIP had just returned from SOS with only 2 sorties in the previous 40 days and had accomplished the required re-currency sortie to fly with students with no issues at the home field. The MUP was in the Introduction to Fighter Fundamentals spin-up program with limited proficiency and currency of experience in the T-38.

73.2.2. **Operator Factor.** The runway where the original impact occurred has a slight upslope which led to a visual illusion and shallower flight path.

73.2.3. **Operator Factor.** Enroute, the MIP suspected a gear sequencing problem and referred to the "Landing Gear Retraction Failure" checklist. During this time, the MIP over-sped the gear door limit of 240 knots calibrated airspeed (KCAS) by 26 KCAS. Not IAW checklist procedures, the MIP cycled the landing gear in an attempt to reset the gear door indication.

73.3. **Lesson Learned:**

73.3.1. Just because the minimum sorties and events have been accomplished does not mean a high level of proficiency has been regained for all events and profiles that must be flown. After extended breaks, full proficiency will not be regained until a normal flying lookback and exposure to most events are accomplished. In the meantime, conservative decisions and actions must be used to ensure safe execution.

73.3.2. Mission planning and familiarity with the airfield and its hazards can help anticipate problems and mitigate the risks they impose. The runway in question did not have an overrun and any landing short of the threshold will be on an unprepared surface. When encountering these conditions, the desired touchdown point may be altered where prudence would dictate a slightly longer aimpoint, such as in runways where there are hazards in the overrun environment, no overrun, or raised lights at the threshold. Generally, an aimpoint 100 to 200 feet past the threshold (around the top of the numbers on an instrument runway) is sufficient to provide a margin of safety and still ensure adequate runway remaining for landing rollout. Premature touchdowns can result from insufficient backstick pressure in the transition, early or rapid power reduction causing a sink rate, or an incorrect perception of aircraft height and descent rate. This, coupled with the lack of an overrun and illusions led to landing short of the runway.

73.3.3. Dash 1 checklists are developed to safely recover an aircraft once a malfunction has occurred based upon known design limitations and failure modes. Deviations from the checklist may cause additional damage or lead to an un-landable configuration. During emergencies is not the time to rush and make rash decisions, it’s time to maintain aircraft control, analyze the situation, and land as soon as conditions exist.

73.4. **Actions Taken. None.**

Section G—T-37 & T-6 Takeoff and Departure Mishaps

74. The Last Closed Pattern:

74.1. **Mishap. Figure 81**. The crew consisted of two instructor pilots. They planned the first leg of their cross-country mission to depart their home station and land at a civilian airfield where they would stay the night. The crew departed home station under Visual Flight Rules (VFR) and performed several airshow style maneuvers on their way to their destination. Four airshow-style events were recorded with high speeds passes (313 kts max), aggressive banks (max of 130 degrees), and high pitch angles (max of 80 degrees) accomplished as low as 50 feet above the ground. The crew continued to their destination where they accomplished five aggressive closed patterns. After completing their post-flight inspections, the IPs met several friends and went out to a local bar, alcohol was consumed by both IP’s. The crew paid the bar tab around 2300 hrs and departed for crew rest. At 0700 one of the IPs got up and called the other IP requesting an early departure. They left the hotel at 0800 and performed a quick preflight around 0850 hrs, taxied a short distance for takeoff, and requested one pattern before departing to the west. No evidence of a filed flight plan was found, and the crew brushed off a friend’s question of whether they needed to file and get weather. When the IPs began their takeoff roll, only ten and a half hours had elapsed since their last drink of alcohol. They had slept for less than seven hours and had had minimal food or water on this tragic day. The IPs rotated normally and cleaned up the aircraft, but kept the aircraft in ground effect for 21 seconds accelerating to 170 kts before pulling closed. The IP flying then snapped an aggressive left turn with high G similar to the maneuvers flown on the previous day. The IP began the closed pull-up with full left aileron and nearly full aft stick. The IP then slowly moved the stick to full right aileron, but the aircraft continued to roll left. The front IP recognized the aircraft was out of control and ejected the ejection occurred with the aircraft nearly inverted and at low altitude, the parachute did not have time to fully deploy. Normally, this would initiate the ejection sequence for both seats; however, the IPs failed to complete their normal checklist items prior to departure. While the ejection occurred, the rear seat IP brought the PCL to idle and neutralized the controls. The aircraft impacted the ground nearly inverted and 40 degrees nose low. Both IPs were fatally injured.

74.2. **Investigation:**

74.2.1. **Operator Factor.** Due to a combination of over-aggressiveness, complacency, flagrant rule violation, and lack of flight discipline, both IP's were comfortable with aircraft attitudes considered unsafe at low altitudes.

74.2.2. **Operator Factor.** Rear seat IP executed an aggressive closed pull up maneuver, failed to maintain minimum airspeed, and exceeded the bank angle limit which resulted in an accelerated stall below 500 feet AGL.

74.2.3. **Operator Factor.** Due to channelized attention and habit interference, rear seat IP misapplied flight control inputs while attempting to rollout.

Figure 81. The Last Closed Pattern.

74.3. **Lesson Learned:**

74.3.1. This mishap represents a gross breakdown of flight discipline. Rules are established for good reason and are frequently written in blood. One of the greatest risk-mitigation strategies we have is ensuring units have high levels of discipline where flyers abide by the rules and recognize that the rules will be enforced. Enforcing the rules involves commanders at every level, supervisors, instructors, and peers, as well as subordinates. The CSAF's commented after he received the fatality briefing: "This is the most disappointing mishap I've seen in my 39-year career. In no way was any portion of this mishap crew's behavior acceptable or excusable. This is a severe bruise to the combat reputation we've built, particularly over the last 15 years. This is NOT our Air Force."

74.4. **Action Taken:** None.

75. Departure Crash:

75.1. **Mishap.** **Figure 82**. This accident occurred after takeoff from an auxiliary airfield. The crew had performed runway supervisory unit (RSU) duties at the auxiliary field and were returning to home base. A right turn out of traffic was started early, using a steeper bank than normal. The copilot, bending forward to retrieve a pencil from the cockpit floor, inadvertently applied pressure against the control stick, causing the aircraft to continue to roll to the right to an inverted position. The pilot attempted recovery by continuing to roll to an upright attitude. During the recovery attempt, the left wing brushed the ground 3,700 feet from the departure end of the runway. The aircraft then struck a telephone pole and came to rest inverted on a farm road. The aircraft configuration was gear up, flaps up, and thrust attenuators and speed brake in. Neither crewmember attempted to eject. The pilot received minor injuries; the copilot received major injuries.

75.2. **Investigation:**

75.2.1. **Operator Factor.** The pilot initiated an unexpected, abrupt turn out of traffic while the copilot was bending forward to retrieve a pencil from the cockpit floor. The copilot inadvertently interfered with control of the aircraft during the turnout of traffic, causing the aircraft to enter an unusual attitude. The unusual attitude disoriented the pilot, causing a delay in initiating proper corrective action until recovery was highly improbable.

Figure 82. Departure Crash.

75.3. **Lesson Learned:**

75.3.1. This mishap was clearly preventable. It occurred with two experienced instructor pilots who were lulled into complacency with the simplicity of a return trip to the home field. Although the aircraft commander gave a short briefing, it was inadequate in that the copilot was surprised by the pilot's abrupt turn after lift-off and unintentionally interfered with the flight controls. The need for every crew member to be alert, not just riding along, is especially important during critical phases of flight.

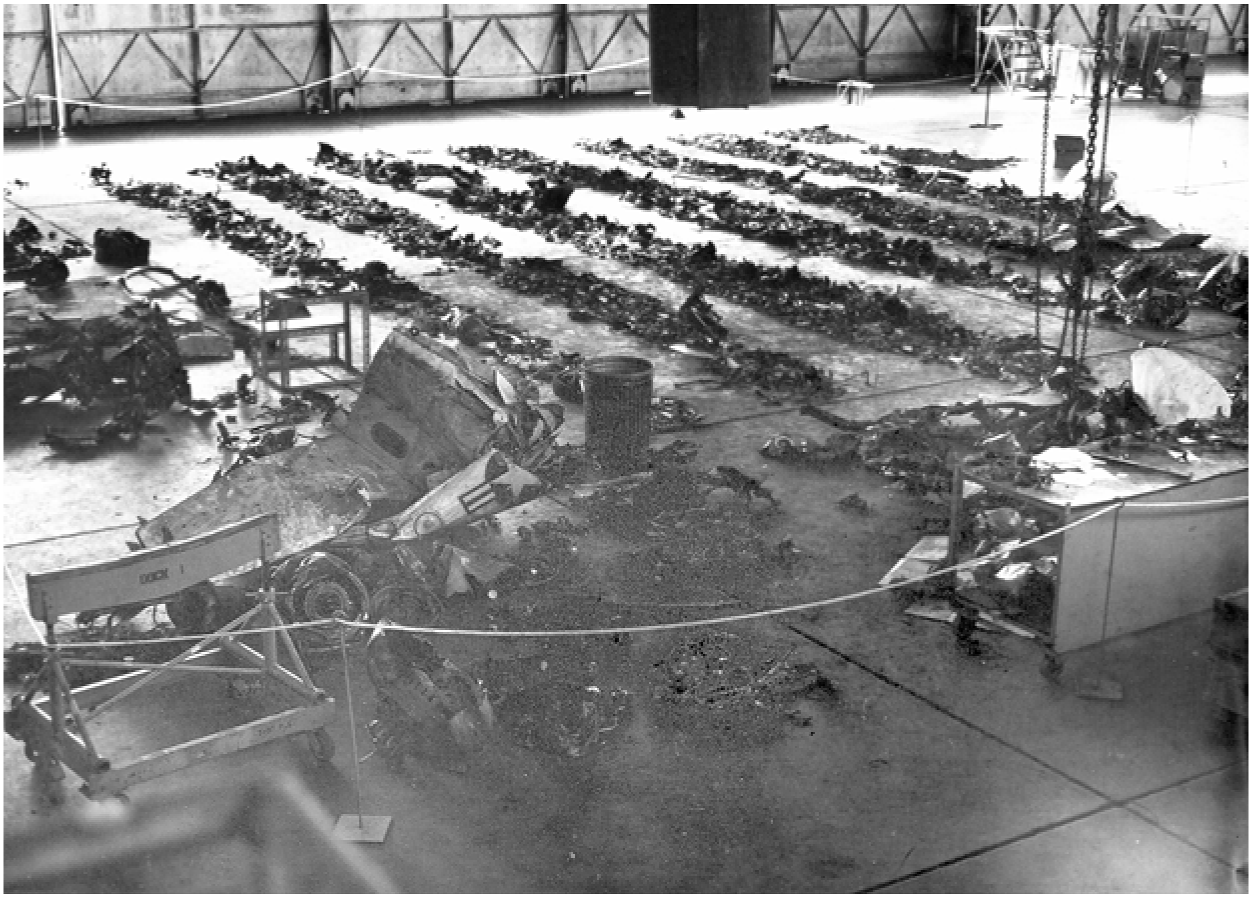
75.4. **Action Taken:**

75.4.1. The governing directive was amended to include minimum airspeed and altitude requirements for traffic departures.

76. Departure Crash/MOA:

76.1. **Mishap.** Figure 83. The mission was a solo pattern-only profile to the auxiliary airfield. Two overhead low approaches were accomplished (runway construction limited the pattern to a 300 foot AGL low approach). The student pilot departed the auxiliary field enroute to home base when the aircraft impacted the ground. The aircraft was destroyed and the pilot was fatally injured upon impact with the ground.

Figure 83. Departure Crash/MOA.



76.2. **Investigation:**

76.2.1. **Supervisory Factor.** Operational and medical guidance was not sufficiently coordinated to ensure supervisors understood the phenomenon of manifestation of apprehension. The mishap student exhibited symptoms of manifestation of apprehension as defined in the governing directive, and these symptoms degraded his performance. The symptoms were masked and difficult to detect; and because of the absence of coordinated guidance on manifestation of apprehension, the problem was not recognized and the student remained in training. Ten days before the mishap, the student's performance began to deteriorate markedly. Two days before the mishap he performed a mission poorly and became airsick. Unit supervisors failed to ensure that applicable training directives were complied with and the student was not placed on special monitoring status as required, thereby depriving the student of the special attention he needed. On the day before the mishap, the student twice performed poorly on his emergency procedure examination, but the instructor pilot did not fail the student as required. Additionally, the flight commander failed to ensure the student was adequately briefed for the solo flight.

76.2.2. Operations Factor. The student visited the flight surgeon and was directed to return for another visit before going solo. However, the flight surgeon did not inform the squadron supervisors of this restriction.

76.2.3. **Operator Factor.** The student did not return to the flight surgeon before going on a solo mission (the mishap flight). The student flew the solo mission to an auxiliary field, accomplished two low approaches, and initiated a climb to 3,500 feet AGL. During the departure from the auxiliary field, the student initiated a rapidly descending right turn. This turn may have resulted from confusion over the departure procedures. During or just before the turn, the elevator trim ran to near full nose down limit for an undetermined reason. The trim may have been applied by the pilot or may have resulted from a mechanical malfunction. The student failed to correct the critical aircraft attitude, and the descent angle increased. Manifestation of apprehension contributed to this error.

76.3. **Lesson Learned:**

76.3.1. This mishap revealed the need for better manifestation of apprehension identification procedures and increased communication between flight surgeons and squadron personnel. Education programs must ensure instructor pilots and squadron supervisors are able to identify students who exhibit the symptoms associated with manifestation of apprehension.

76.3.2. There is no doubt that all instructors do their best to ensure the safety of students. However, being subject to human emotions, instructors may too often give students the undeserved benefit of the doubt. Instructors and supervisors must not fall prey to subconscious rationalization of a student's poor performance or make attempts at boosting a student's morale by inflating grades.

76.4. **Action Taken:**

76.4.1. Guidance and an educational program were developed to aid in identifying and handling students exhibiting symptoms of manifestation of apprehension, paying particular attention to students on special monitoring status.

Section H—T-37 & T-6 Disorientation and Loss of Control Mishaps

77. Lost Control – Area/Disorientation:

77.1. **Mishap.** **Figure 84**. This student pilot was scheduled for an area solo sortie. He would take the aircraft, without an instructor pilot in the back seat, fly out to the MOA, and practice basic and advanced aerobatics. The student began the sortie according to plan. He departed the airfield, flew the departure, and completed normal checks in his assigned MOA. After completing some basic maneuvers, the student then performed some advanced aerobatic maneuvers: two leafs of a cloverleaf followed by a loop. The student then attempted a second loop, beginning with an inadequate 2.6 G pull-up at 240 knots. The student continued the insufficient pull, bleeding airspeed until the aircraft was 90 degrees nose high. At this point, the student became disoriented and stopped the pull. Due to the nose high attitude, the aircraft's airspeed quickly decreased and the aircraft momentarily departed controlled flight. This caused the aircraft to pitch down and tumble back towards the ground. The rapid change in aircraft attitude caused the student pilot to believe the aircraft was in a spin, and he brought the PCL to idle. As he retarded the PCL, he inadvertently mashed down on the rudder trim button and ran the trim to the full right position. The aircraft stabilized in a nose low attitude and regained flying airspeed. However, the unknown change in rudder trim caused the aircraft to remain in a right turn. The student perceived the turn as a spin and continued to apply spin prevention flight controls: PCL idle and controls neutralized. The aircraft continued to accelerate as it descended. The student continued to apply spin prevention flight controls as the aircraft accelerated past 250 knots and descended through 7,000 feet. The student made no changes to the flight controls. At 310 knots and 2,500 feet above the ground, the student determined the aircraft could not be recovered and pulled the ejection seat handle. Following the ejection sequence, the student descended under canopy through several large trees receiving minor injuries. The aircraft was destroyed upon ground impact.

77.2. **Investigation:**

77.2.1. **Operator Factors.** Improper nose high and nose low recover procedures coupled with a misperceived post stall gyration and NL attitude as a spin due to one or more of the following human factors: misperception of operational conditions, channelized attention, and inexperience.

77.3. **Lesson Learned:**

77.3.1. Pilots need to recognize and meet entry parameters for acrobatics or abort early. Additionally, they must understand spin recognition (i.e. when is it NOT a spin). IP's must prepare their students for success. Lastly, when a students need to rely on the instruction they have received and techniques/procedures they have learned.

Figure 84. Lost Control – Area/ Disorientation.

77.4. **Action Taken:**

77.4.1. A runaway trim demonstration has been added to the syllabus as a special syllabus requirement (SSR).

78. Lost Control – Area/Unintentional Spin:

78.1. **Mishap.** Figure 85. The student pilot performed the takeoff and flight to the training area. The student practiced traffic pattern stalls. The instructor pilot then assumed control to demonstrate control effectiveness and steep turns in the slow-flight regime. Following the demonstration, the instructor rolled the aircraft into a steep right turn to demonstrate a rapid loss of altitude associated with steep bank turns in slow flight. As the aircraft approached 45 degrees of bank, the instructor attempted to roll it back to wing-level attitude. When left aileron was applied, the aircraft rolled abruptly right with the nose lowering. Spin prevention procedures were applied immediately, but the aircraft continued to rotate. Two single spin recoveries were attempted without apparent effect. When the altimeter was passing 9,000 feet MSL (6,500 feet AGL), the instructor ordered the student to eject. The student responded immediately and the instructor followed. They were not injured.

Figure 85. Lost Control – Area/Unintentional Spin.

78.2. **Investigation:**

78.2.1. **Supervisory Factor.** The spin prevention description in the flight manual and governing directive at the time of this mishap may have encouraged premature abandonment of the spin prevention attempt. The instructor pilot had not been briefed or instructed on recovery procedures in connection with landing configuration spins. This led to a lack of confidence on the part of the instructor in the effectiveness of the “single spin recovery” in recovering control of a configured aircraft.

78.2.2. **Operator Factor.** During the slow-flight demonstration, the instructor pilot failed to recognize that the aircraft had reached a stalled condition and was unsuccessful in recovering from the resulting inadvertent spin.

78.3. **Lesson Learned:**

78.3.1. The capability of the spin prevention maneuver and the importance of allowing enough time for a correct “single-spin recovery” procedure to take effect is critical. The fact that practice landing configuration spins are prohibited should not prevent pilots from understanding their flight characteristics and having confidence in the recovery procedure. The possibility of such a situation developing is present during several flight maneuvers.

78.3.2. Although the pilot should have been able to recover the aircraft, he perceived his actions were not producing the desired results and correctly chose to abandon the aircraft within the ejection envelope.

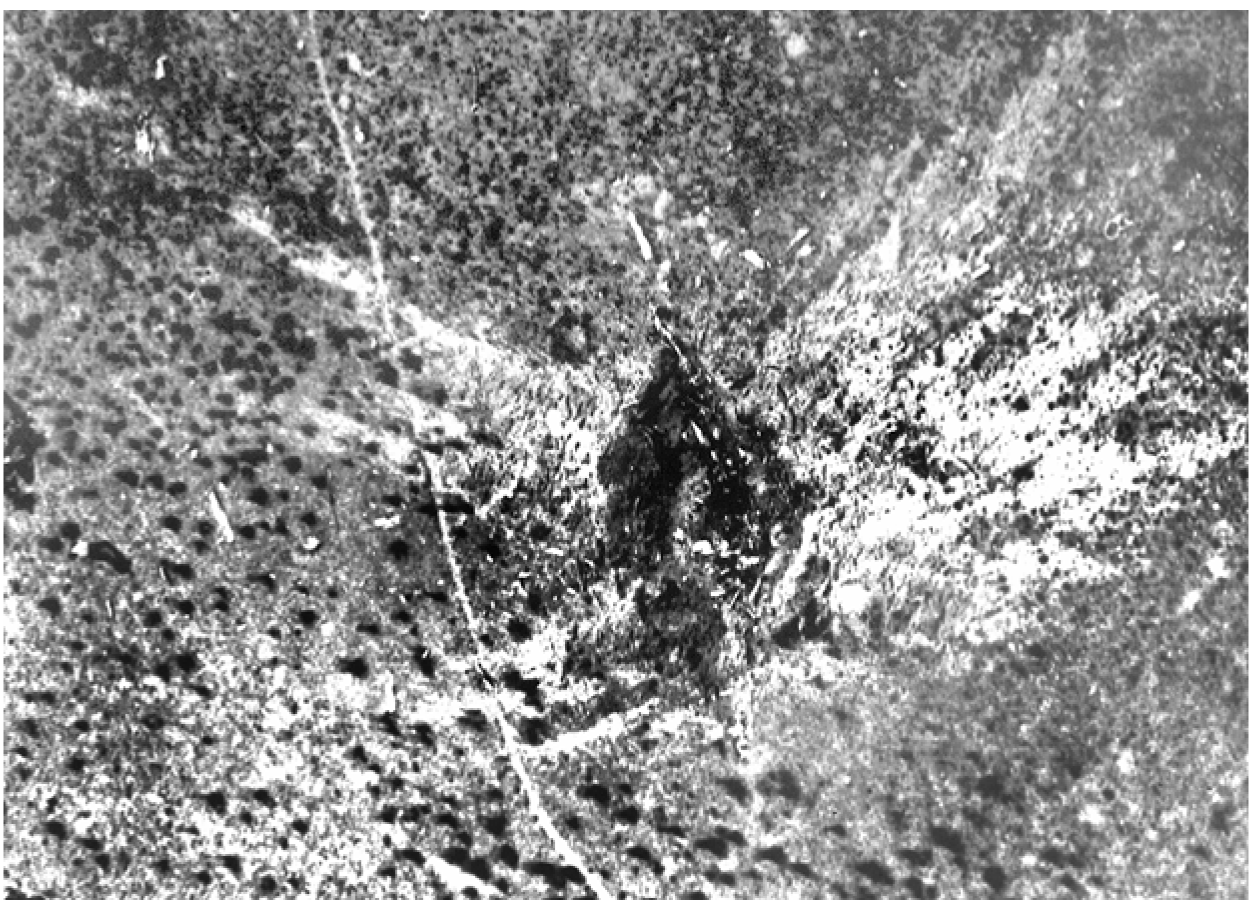
78.4. **Action Taken:**

78.4.1. The T.O. reference to stalls with gear and flaps extended was amended to include a warning that when the aircraft is stalled, the use of aileron will be ineffective, will aggravate the stalled condition, and could lead to an inadvertent spin.

79. Disorientation/Night – Area:

79.1. **Mishap. Figure 86**. The aircraft was on a dual night orientation flight. The night orientation mission profile was part of a four-leg, round robin navigation route, during which night unusual attitude recoveries were to have been practiced. The aircraft was second in a sequence of four aircraft. The takeoff and initial route flown were uneventful. Although the aircraft were on a VFR clearance, radar approach control (RAPCON) provided radar monitoring and made one transmission to the number two aircraft, stating that the aircraft was going outside assigned route airspace. The pilot responded he was correcting back to course. On the third leg of the route, the mishap aircraft was observed north of course. The pilot then overshot the inbound course for the final leg. Approximately 2 minutes later, he reported encountering heavy rain and requested a turn to the south with vectors to the entry point. The pilot acknowledged instructions to fly a heading of 160degrees. This was the last transmission received from the aircraft. The aircraft crashed in an open field in a near vertical attitude with the left wing low. The student pilot ejected, but was too low for seat/man separation. The instructor pilot made no attempt to eject. Both pilots were fatally injured.

Figure 86. Disorientation/Night – Area.



79.2. **Investigation:**

79.2.1. **Supervisory Factor.** The pilot training squadron did not have procedures established to ensure the SOF was promptly advised of all pertinent data that might affect the flying operation, including weather conditions. The instructor pilot allowed the aircraft to be flown past the depicted inbound course by approximately 7 NM. This allowed the aircraft to enter weather that may have contributed to the pilot's disorientation.

79.2.2. **Operator Factor.** The instructor pilot became disoriented and allowed the aircraft to enter an attitude from which it did not recover.

79.3. **Lesson Learned:**

79.3.1. Aircrews must continuously combat the hazardous effects of spatial disorientation, especially during night weather operations. If spatial disorientation occurs and subsequently progresses to a point where aircraft control is lost, pilots must force themselves to make the ejection decision within the prescribed ejection parameters.

79.4. **Action Taken:**

79.4.1. A discussion on the multiple causes and hazards of spatial disorientation while practicing night unusual attitudes was incorporated in the governing directive.

79.4.2. Pitch and bank limitations which prevent inverted attitudes and minimum recovery altitude were established for night unusual attitude practice and were included in the governing directive.

79.4.3. An engineering feasibility study was conducted and resulted in installation of an attitude indicator on the instructor pilot's side of the instrument panel to assist the instructor pilot in maintaining aircraft orientation.

79.4.4. Procedures were established to ensure the SOF is promptly advised of all pertinent data that might affect the flying operation.

80. Spin – No Recovery:

80.1. **Mishap.** **Figure 87**. The mission was a dual contact review flight for the student pilot. It was flown as briefed until the instructor pilot assumed control following a spin prevention maneuver by the student. The instructor stated he would demonstrate a proper spin prevention maneuver. He initiated a left spin entry for a spin prevention. During the maneuver the aircraft went into an erect left spin. The instructor initiated the single spin recovery, but he released the forward stick pressure before he saw any pitch change. This procedure was aborted after two turns. The instructor then neutralized rudders, applied full aft stick for approximately three turns and reconfirmed left rotation. Right rudder was then applied and approximately one and one-half turns later, full forward stick was applied. The stick again was not held against the forward stop. When the nose did not pitch down, the instructor moved the stick full forward again. Almost simultaneously, the student informed the instructor the aircraft was passing through 14,000 feet MSL. The recovery attempt was aborted and another unsuccessful single spin recovery attempt was made. At 11,000 feet MSL the instructor ordered the student to eject. He had to repeat the command. The student and instructor pilot ejected successfully.

Figure 87. Spin – No Recovery.

80.2. **Investigation:**

80.2.1. **Operator Factor.** The instructor pilot applied improper spin recovery techniques due to a lack of proficiency in the maneuver.

80.3. **Lesson Learned:**

80.3.1. Recovery techniques described in T.O. guidance would have recovered the aircraft. The instructor pilot's failure to recover from the spin resulted from misapplication of the flight controls. The instructor pilot had performed only two actual spin recoveries since his instructor pilot qualification 10 months before. As pilots, we are tasked to monitor our own proficiency in many areas and must professionally strive to maintain this proficiency at or above the required level to accomplish our mission safely.

80.3.2. Although the pilot should have been able to recover the aircraft, he realized his actions were not producing the desired results and correctly abandoned the aircraft within the ejection envelope.

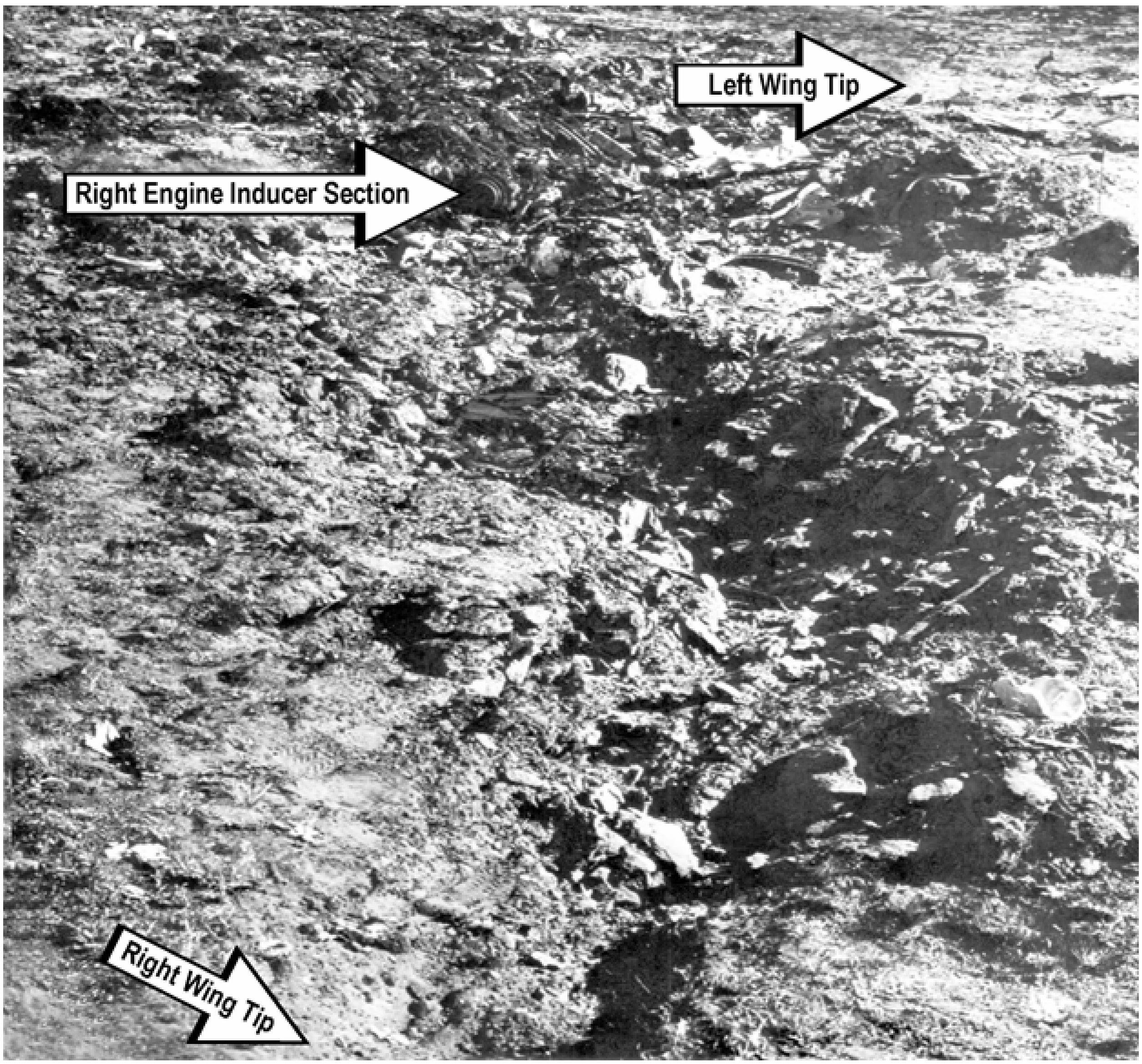
80.4. **Action Taken:**

80.4.1. All instructor pilots were directed to receive a spin demonstration flight at their home stations approximately 6 months after becoming instructor qualified.

81. Lost Control – Area:

81.1. **Mishap.** Figure 88. This mishap occurred during a dual contact training sortie. Thirty-five minutes after the aircraft entered the working area, the radar controller lost both radar and radio contact. The altitude readout 7 minutes prior to loss of contact was observed by the controller to be 16,700 feet MSL. The aircraft was later found to have impacted the ground in a near vertical attitude with a 100-degree-per-second roll rate to the left. Aircraft configuration was gear and flaps up, speed brake down, and the power at approximately 90 % RPM on both engines. The aileron trim was full left wing down upon impact. The instructor pilot had initiated ejection and cleared the aircraft just before impact. The student pilot did not eject. Both crewmembers were fatally injured.

Figure 88. Lost Control – Area.



81.2. **Investigation:**

81.2.1. No direct cause could be determined due to the lack of survivors, witnesses, evidence of aircraft malfunction and/or indications of pilot incapacitation.

81.3. **Lesson Learned:**

81.3.1. The aircrew failed to make a timely decision to eject. Ability to recover the aircraft and ejection envelope considerations should be taken when departing controlled flight.

81.4. **Action Taken:**

81.4.1. Statements in all present and future aircraft flight manual TOs (dash one series) referring to ejections under uncontrolled conditions are (or will be) written as a WARNING item.

82. Lost Control – Area/High Speed Dive:

82.1. **Mishap.** Figure 89. The mission was a pre-solo contact training sortie. After entering the assigned training area, the instructor pilot pointed out ground references and demonstrated traffic pattern stalls, slow flight, and straight-ahead power-on stalls. Following these demonstrations, the student pilot attempted power-on stalls. On the student's second attempt, the instructor (who had been giving maximum assistance) assumed full control of the aircraft just before or at the stall. The aircraft entered into a series of nose-low unusual attitudes during which the instructor ordered the student to eject. The student ejected successfully and was recovered with only minor injuries. The instructor pilot did not (or could not) recover the aircraft from the ensuing high-speed dive. Although he initiated ejection, the sequence was terminated by ground impact resulting in fatal injuries. The aircraft was destroyed upon ground impact.

82.2. **Investigation:**

82.2.1. **Supervisory Factor.** The pilot instructor training (PIT) school supervisors allowed the instructor pilot to graduate from PIT on a conditional status even though he had demonstrated repeated marginal or unsatisfactory performance.

82.2.2. **Supervisory Factor.** Wing operations supervisors allowed the instructor pilot to fly syllabus missions with undergraduate pilot training students even though he had demonstrated repeated marginal or unsatisfactory performance since graduation from PIT.

82.2.3. **Operator Factor.** The instructor pilot failed to properly execute a power-on stall recovery. The aircraft entered a high-speed dive and impacted the ground.

82.2.4. Undetermined Factor. For some reason, full nose down trim was introduced during or subsequent to the power-on maneuvers.

82.3. **Lesson Learned:**

82.3.1. This mishap graphically illustrates the need for supervisors and senior flying training managers to be acutely aware of the low experience level of the instructor force. Instructor pilots whose flying proficiency is suspect must be identified by routine and no-notice evaluations. Supervisors must ensure the additional training required to maintain a highly qualified instructor force is effectively utilized.

82.3.2. Students must realize instructors are subject to human frailties and do make mistakes. If circumstances appear dangerous or erroneous to students, they must bring the situation to the immediate attention of the instructor.

Figure 89. Lost Control – Area/High Speed Dive.

82.4. **Action Taken:**

82.4.1. Technical data was reviewed and changed to reflect the requirements to inspect the elevator trim tab systems on a continuing basis.

82.4.2. A study was conducted to determine the feasibility of establishing a single nose down elevator trim limit for all aircraft to avoid possible confusion and simplify maintenance requirements.

82.4.3. Trimming in a dive at a speed above 362 KIAS, unless essential to relieve excessive stick forces was added to the prohibited-maneuver list.

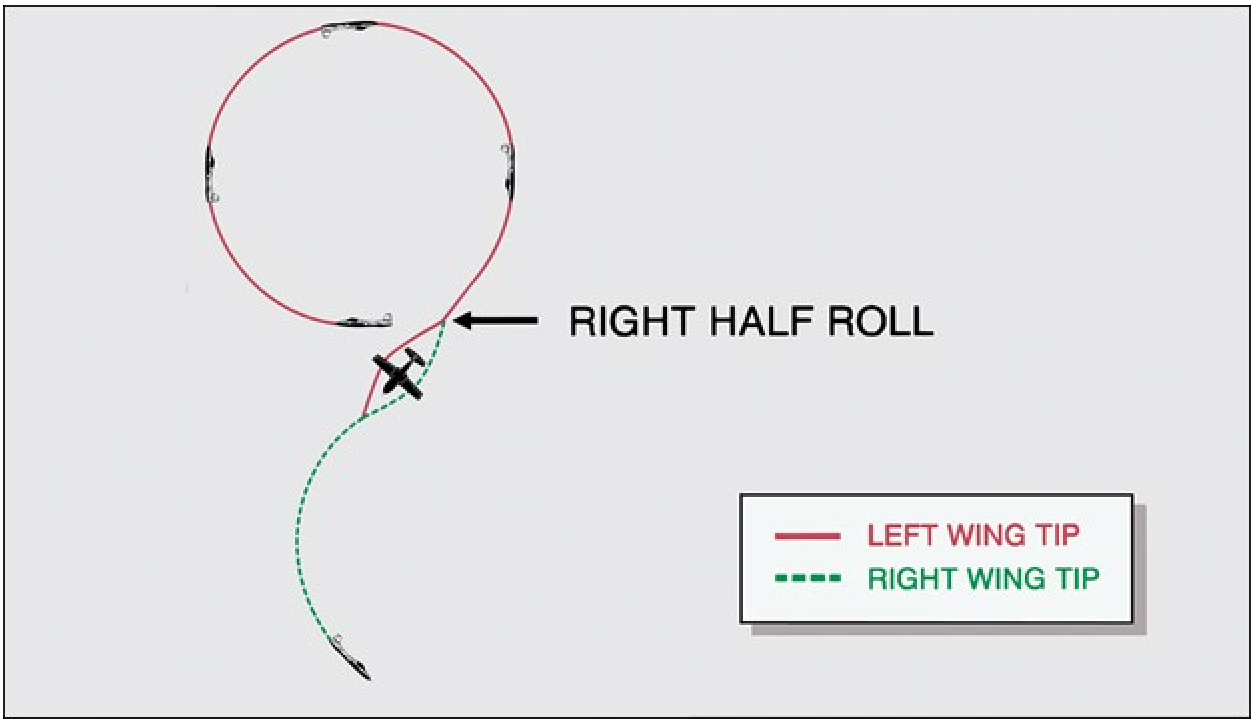
82.4.4. The governing directive was revised to alert pilots to the hazards of inadvertent trim inputs.

82.4.5. A study was conducted to determine the feasibility of including, in the specifications for future training aircraft, a requirement for command sequenced ejection systems.

83. Lost Control – Area/High Speed Dive:

83.1. **Mishap.** **Figure 90**. The mission was a solo contact sortie to the local MOA. While performing a Cuban Eight, the student pilot lost control of the aircraft in a high-speed dive. The student pilot successfully ejected sustaining minor injuries. The aircraft was destroyed on ground impact.

Figure 90. Lost Control – Area/High Speed Dive.



83.2. **Investigation:**

83.2.1. **Supervisory Factor.** The flight commander did not place the student pilot on the commander's awareness program (CAP) in a timely manner to ensure efficient training. The IP authorized the student pilot to perform advanced aerobatics solo, by grading him "good" in situational awareness, despite his demonstrated problems of maintaining awareness of position in space. Instructional guidance on abnormal flight recoveries did not ensure appropriate training in the termination of unsafe aerobatic maneuvers.

83.2.2. **Operator Factor.** The student pilot failed to maintain situational awareness, which led to spatial disorientation. The SP did not terminate the abnormal Cuban Eight in a timely manner and at some point, the SP induced full nose-down trim.

83.3. **Lesson Learned.** Supervisors must be aware of and take proper precautions when student performance consistently falls below standards. Instructors must strive to accurately convey student performance on the grade sheet. An IP who does not call it like it is on a grade sheet is not helping the next IP who flies with the student, the flight supervisors, or (as was evident in this mishap) the student.

83.4. **Action Taken:**

83.4.1. CAP has been restructured to ensure squadron supervisors monitor below average students as necessary.

83.4.2. Air Force publications on abnormal flight recovery instruction have been redefined to emphasize development of judgment on when to terminate abnormal flight maneuvers.

84. Lost Control – Area/Unintentional Spin:

84.1. **Mishap.** Figure 91. The accident occurred during a student solo contact training mission. The student pilot was briefed to go to a local training area, perform air work maneuvers, and return to the traffic pattern. During an attempted cloverleaf, the student experienced moderate aircraft buffeting, and entered a spin. The student attempted a spin prevention and a single spin recovery without success before ejecting at approximately 8,000 feet MSL. The student was recovered uninjured, but the aircraft was destroyed.

Figure 91. Lost Control – Area/Unintentional Spin.

84.2. **Investigation:**

84.2.1. **Operator Factor.** The student stalled the aircraft during an attempted clover-leaf and failed to recover before the aircraft departed controlled flight. The student misinterpreted the stall as an incipient spin and performed the spin prevention procedure incorrectly. This aggravated the stall and resulted in a developed spin. The student attempted the single spin recovery procedure but prematurely abandoned the anti-spin controls, resulting in failure to recover from the spin. Due to low altitude, the student correctly ejected from the aircraft without attempting a second spin recovery.

84.3. **Lesson Learned:**

84.3.1. Instructors and students need to remember that the procedures used daily during training are the same procedures that should be applied during entry into an unplanned maneuver or actual emergency situation.

84.3.2. The student should have been able to recover the aircraft. However, he realized his actions were not producing the desired results and made a timely decision to abandon the aircraft within the ejection envelope.

84.4. **Action Taken:**

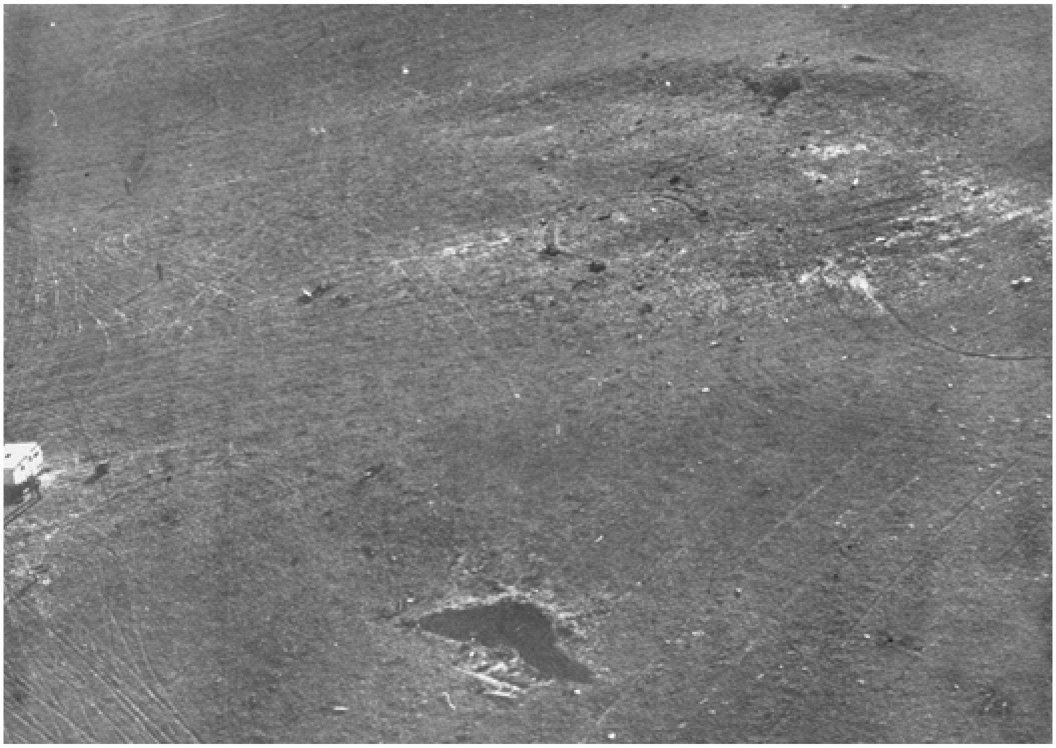
84.4.1. The syllabus was changed to require students to demonstrate proficiency in the single spin recovery throughout the contact phase of training.

84.4.2. The wording and format of the stall recovery procedures were modified to diminish the emphasis on the stall as a "maneuver" and more graphically portray the fact that the aircraft can stall in any attitude and at any airspeed.

85. Lost Control – Area:

85.1. **Mishap.** **Figure 92**. The mission was a solo contact sortie, which was to include aerobatics. The student pilot made a radio call when established in the area and began performing aerobatic maneuvers. Radar and radio contact with the aircraft were lost 14 minutes later. Radar tapes showed the mishap maneuver was a barrel roll. The aircraft impacted the ground and was destroyed. The student did not eject and was fatally injured.

Figure 92. Lost Control – Area.



85.2. **Investigation:**

85.2.1. **Undetermined.** During a barrel roll, full nose-down trim was introduced for an undetermined reason. It is possible the student may have inadvertently applied trim or an unknown aircraft malfunction may have caused the trim to run full nose-down.

85.2.2. **Operator Factor.** The student failed to correct the nose-down trim condition. The student failed to abort a poorly performed barrel roll and recover after the first half of the maneuver did not go well. A high speed dive ensued in which the student did not recover or attempt to eject. The student's history revealed a strong motivation to succeed. Additionally, the student's training and medical records documented several cases of hyperventilation.

85.3. **Lesson Learned:**

85.3.1. The human factors of spatial disorientation, excessive motivation to succeed, and hyperventilation may have had some bearing on the student's failure to eject. Disorientation may have distracted and confused the student to the degree that the seriousness of the situation was not realized. The sequence of events in this mishap may have resulted in the student pilot hyperventilating, resulting in partial incapacitation. Pilots must realize early recognition and recovery from poorly performed maneuvers is essential to prevent severely disorienting situations.

85.3.2. When aircraft control is lost and recovery does not appear possible within the ejection envelope, abandoning the aircraft is the only acceptable action. The student's extremely strong desire to succeed may have resulted in motivation to stay with the aircraft rather than eject.

85.4. **Action Taken:**

85.4.1. Manuals were amplified to stress the urgency of controlling airspeed in a dive situation and the ramifications of failing to do so. Additional guidance was provided regarding how to recognize an improperly performed maneuver, when to discontinue the maneuver, and how to recover.

86. Disorientation/Instrument Approach:

86.1. **Mishap.** **Figure 93**. The student pilot and instructor pilot were on an instrument training mission. After basic instrument work, the aircraft was radar vectored for a ground control approach, full-stop landing. The instructor flew a right-hand box pattern with the downwind flown at 3,000 feet MSL in the clear. The instructor pilot was instructed to turn to a base leg heading of 230 degrees and descend to 2,000 feet MSL. Clouds were entered at 2,500 feet MSL. While in a descending right turn approximately 12 NM from the field, a "dogleg" heading of 290 degrees was given and acknowledged along with a final descent to 1,800 feet MSL. He rolled wings level on a heading of 290 degrees. He felt somewhat dizzy and selected 100 % oxygen. The instructor pilot then was instructed to turn to 315degrees, and he lowered gear and flaps at 10 NM remaining. The aircraft was left of course and radar control gave successive headings of 320, 325, and 330 degrees. The instructor was advised he was well left of course. At 8 NMs, he felt lightheaded and somewhat disoriented and was experiencing heavy breathing. The instructor asked the student to assist him on the controls. The student recognized a slight left bank, but could not move the stick against the instructor pilot's control and released the stick. The instructor again asked the student to get on the controls. The student added power and leveled the aircraft. The instructor felt he was about to pass out and noted a 1,000 to 1,500 fpm rate of descent. He wisely ordered the student to eject and then ejected himself. The student ejected 4 seconds later. Both ejections were successful.

Figure 93. Disorientation/Instrument Approach.

86.2. **Investigation:**

86.2.1. **Operator Factor.** The instructor pilot was unable to cope with a combination of spatial disorientation and hyperventilation after entering instrument meteorological conditions. A possible contributing factor was the location of the attitude indicator and other essential instruments, which required the instructor to look across the cockpit, thereby increasing both the difficulty of interpretation and the likelihood of spatial disorientation.

86.3. **Lesson Learned:**

86.3.1. Pilots must understand that spatial disorientation is a killer. It is absolutely essential to concentrate on the instruments and/or transfer control of the aircraft to the other pilot. In this incident, the instructor pilot's decision to abandon the aircraft when he felt he was no longer in control was appropriate.

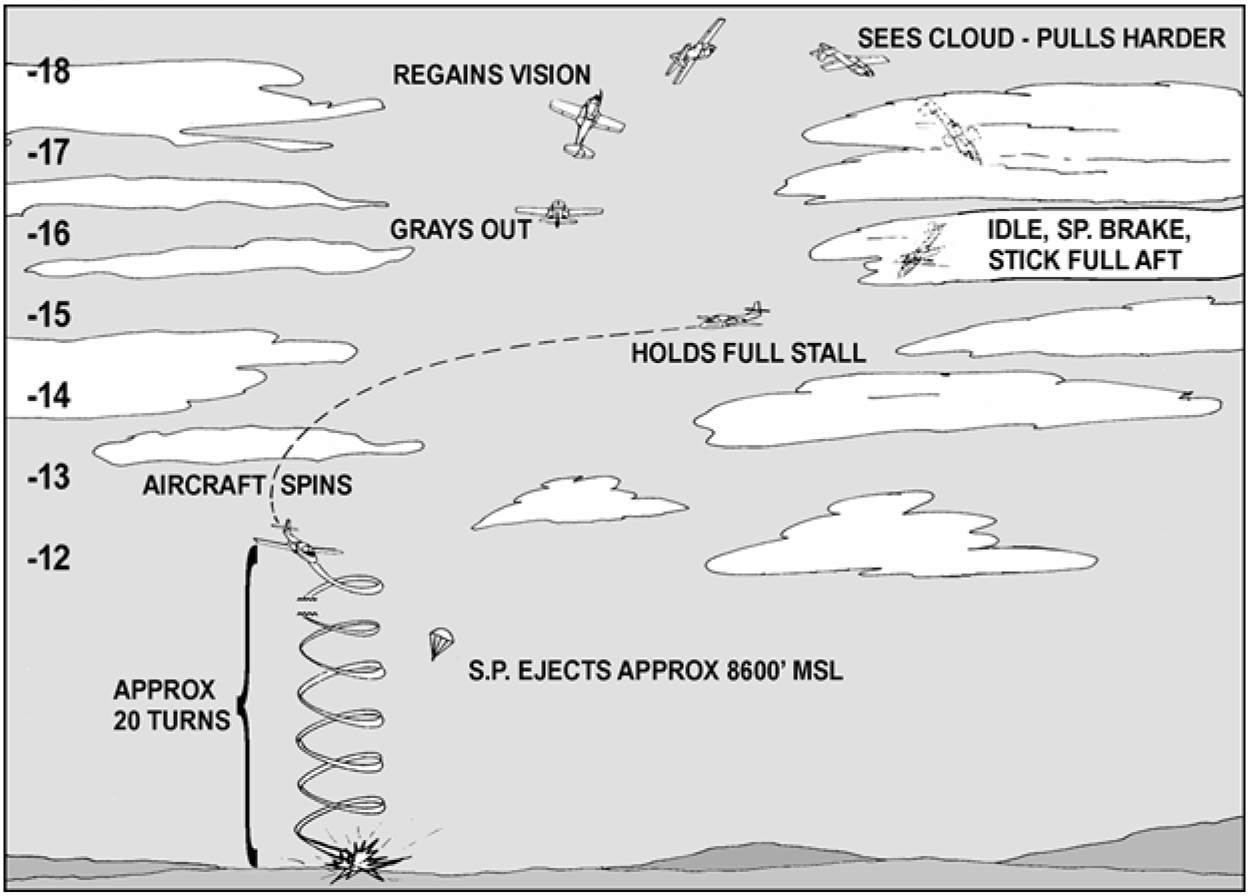
86.4. **Action Taken:**

86.4.1. The T.O. oxygen system emergency operation procedure was changed to read, "Breathe at a rate and depth slightly less than normal until symptoms disappear."

87. Disorientation – Area/Weather:

87.1. **Mishap.** Figure 94. The student pilot was briefed for a pattern-only sortie because weather conditions did not permit solo operations in the training areas. The SOF determined the weather had improved enough to warrant a flying status with solo students limited to the low sectors of the areas. The student proceeded to an auxiliary field for practice approaches and then to a training area for aerobatics. Subsequently, the student ejected sustaining no significant injuries. The aircraft impacted the ground and was destroyed.

Figure 94. Disorientation – Area/Weather.



87.2. **Investigation:**

87.2.1. **Supervisory Factor.** The SOF changed the flying status, but failed to ensure RAPCON was notified to keep solo students in the low sectors only.

87.2.2. **Operator Factor.** The student was notified the flying status had been changed and departed the auxiliary field for the training areas despite being briefed for a pattern-only sortie. RAPCON cleared the student to operate in both high and low sectors of a training area. The student began practicing aerobatic maneuvers in unsuitable weather conditions. While attempting a loop, the student inadvertently entered the clouds and became apprehensive, confused, and disoriented. He misapplied the controls and lost control of the aircraft. The student exited the clouds still suffering from apprehension, confusion, and disorientation causing him to hold a full aft stick stall until the aircraft entered a spin. He attempted a spin recovery, but misapplied the controls and failed to recover before minimum recommended ejection altitude for uncontrolled flight. The student correctly ejected within the ejection envelope. The aircraft impacted the ground and was destroyed.

87.3. **Lesson Learned:**

87.3.1. Flying supervisors must adhere to established procedures to ensure all agencies are notified of the proper weather status and any restrictions.

87.3.2. The student made several gross errors, but he realized he could no longer control the aircraft and correctly elected to eject.

87.4. **Action Taken:**

87.4.1. Mission briefing guides were reorganized, making the "alternate mission profile" a mandatory briefing item.

88. Lost Control – Area/Air Discipline:

88.1. **Mishap. Figure 95**. The mission was an advanced solo-contact sortie. After reaching the assigned training area, the aircraft impacted the ground and was destroyed. The pilot was fatally injured.

Figure 95. Lost Control – Area/Air Discipline.

88.2. **Investigation:**

88.2.1. **Operator Factor.** For an undetermined reason, the student pilot lost control of the aircraft. The student may have intentionally descended below his assigned airspace to perform unauthorized low altitude flight and lost control of the aircraft, or he may have performed a maneuver in his assigned area and lost control of the aircraft.

88.2.2. **Operator Factor.** The student pilot initiated a low-altitude out of the ejection envelope, and was fatally injured. The aircraft impacted the ground and was destroyed.

88.3. **Lesson Learned:**

88.3.1. There was substantial evidence the mishap pilot may have intentionally departed his assigned area. The student pilot's attitude during training, although unnoticed by instructors, reflected a tendency to observe only the regulations and rules he felt were important. This mishap indicates a need for increased awareness by instructors to detect and eliminate from training student pilots who display poor air discipline characteristics. Additionally, peers must not dismiss their responsibilities concerning air discipline by silently condoning such violations. Tolerance of poor air discipline breeds poor air discipline.

88.4. **Action Taken:**

88.4.1. Air Discipline and Judgment instruction was modified to address individual and peer responsibilities related to flight discipline.

89. Lost Control – Area/Over G:

89.1. **Mishap. Figure 96**. The mission was a solo-contact mission. The student pilot flew to his assigned area and performed aerobatic maneuvers. During the initiation of a cloverleaf, structural failure occurred. The student ejected at an altitude of 2,850 feet AGL. The aircraft impacted the ground and was destroyed. The student sustained minor injuries during his ejection.

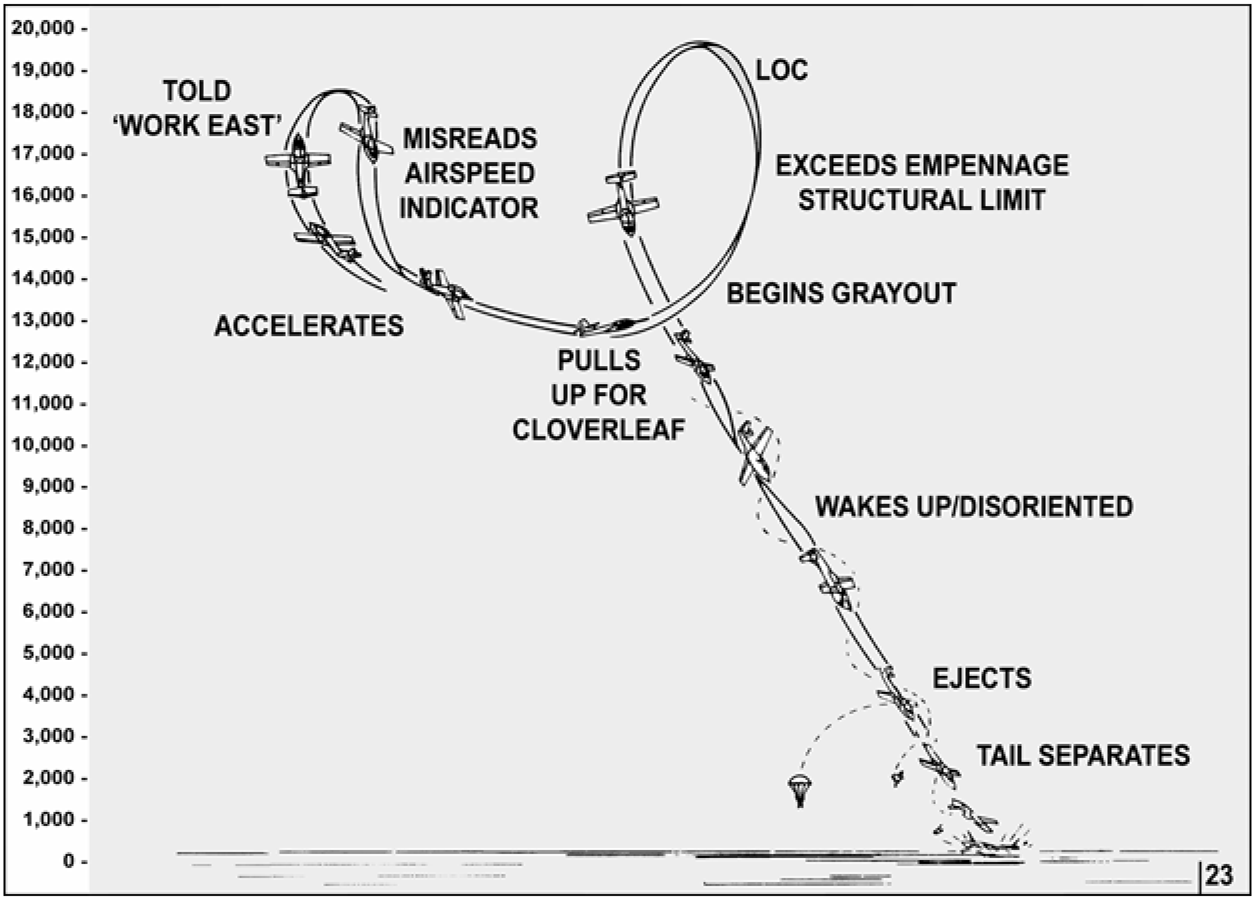
89.2. **Investigation:**

89.2.1. **Operator Factor.** While accelerating for a cloverleaf, the student misread the airspeed indicator. He accelerated the aircraft to an airspeed 100 knots greater than the airspeed specified in the governing directive. The student did not sufficiently trim the aircraft for the higher airspeed and initiated the cloverleaf, using a rapid elevator input. The improper trim, combined with the student's rapid control input, created a critical loading condition on the horizontal stabilizer, which resulted in deformation of the forward spar. The student lost consciousness due to the rapid, high G onset. The student regained consciousness, perceived he was out of control, and successfully ejected from the aircraft. The deformation of the forward spar culminated in the catastrophic failure of the empennage. The aircraft impacted the ground and was destroyed.

89.3. **Lesson Learned:**

89.3.1. Abrupt stick movements can induce a failure load on the stabilizer. These loads can occur within the normal operational flight envelope depending on aircraft weight, center of gravity, roll rate, and rate of elevator deflection. Pilot technique determines the potential for overloading the stabilizer. Therefore, pilots must be aware of the danger in abrupt stick movement at high airspeeds, particularly in an untrimmed condition.

Figure 96. Lost Control – Area/Over G.



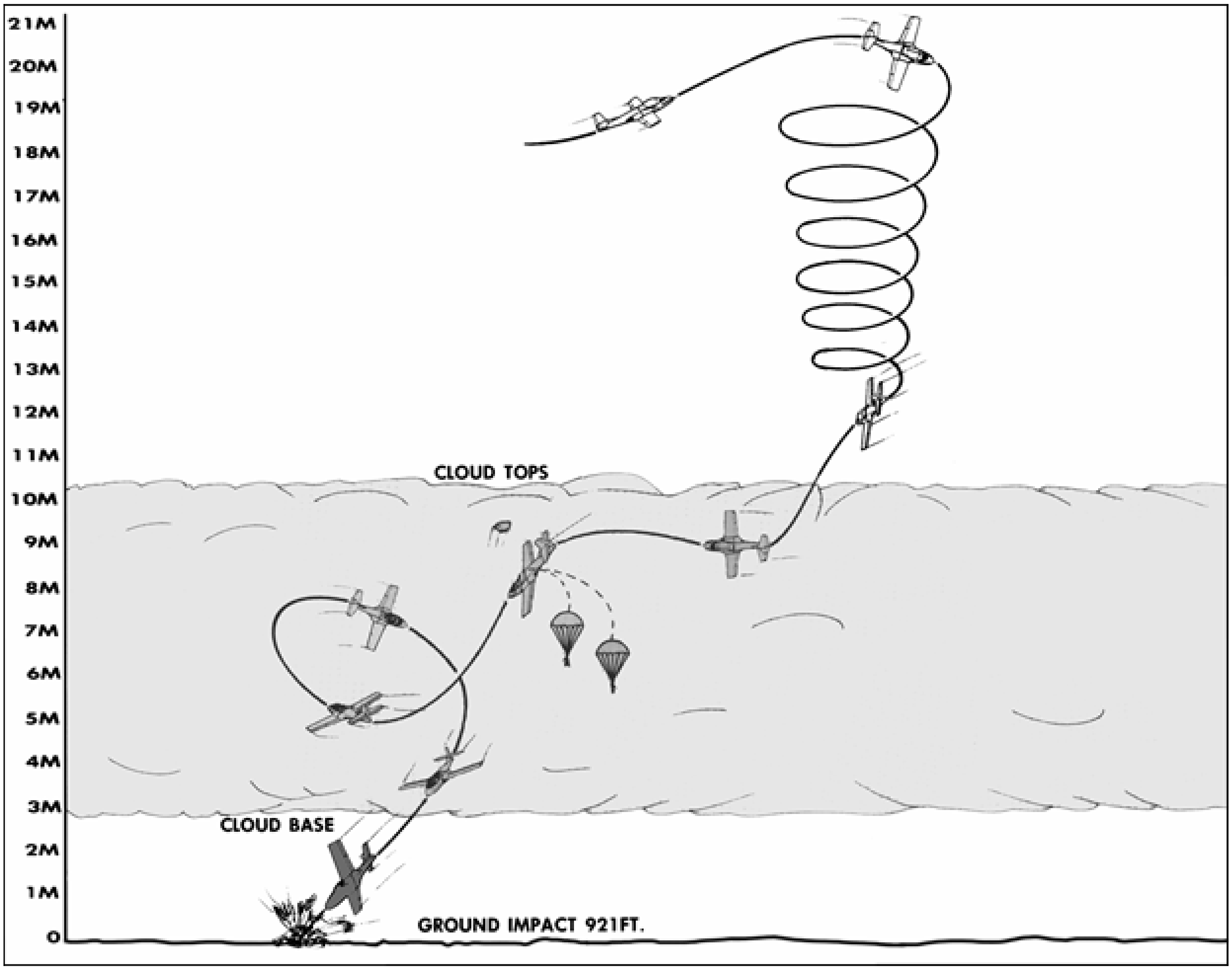
89.4. **Action Taken:**

89.4.1. T.O. guidance was amended to inform pilots of the hazards of abrupt control movements at high airspeeds.

90. Disorientation/Spin Demonstration Flight:

90.1. **Mishap.** Figure 97. The sortie was planned and briefed as a Stan/Eval spin demonstration flight. The mission proceeded normally until the "slow prevention" demonstration. At that time, the spin pilot started the maneuver from a right entry at 20,300 feet MSL. He demonstrated the attempted slow spin prevention and, after reaching full control deflection, transferred aircraft control to the other pilot for the spin recovery. During the dive recovery portion of this maneuver, the aircraft entered a cloud deck at approximately 10,500 feet MSL. Both crewmembers were unsuccessful in recovering the aircraft, but ejected safely. The aircraft was destroyed upon ground impact.

Figure 97. Disorientation/Spin Demonstration Flight.



90.2. **Investigation:**

90.2.1. **Supervisory Factor.** Based on available PIREPs, the spin pilot decided to launch the sortie with the intent to check the weather once airborne. On departure, the aircrew broke out of the clouds at 8,000 feet MSL and thought the cloud tops looked level. While proceeding at 13,000 feet MSL to the assigned working area, the mishap aircrew was unable to discern the cloud tops sloping up to 10,500 feet MSL. Without checking actual cloud tops, the spin pilot entered a spin to demonstrate the attempted slow prevention.

90.2.2. **Operator Factor.** During the dive recovery after spinning stopped, the aircraft entered the clouds. Once in the clouds, the pilots lost visual outside orientation and experienced severe vestibular spatial disorientation. This disorientation prevented the pilots from focusing on the instruments, and combined with the low altitude, prevented aircraft recovery. The spin pilot recognized an out-of-control situation and commanded, “bail out.”

90.3. **Lesson Learned:**

90.3.1. The spin pilot's failure to check the cloud tops caused this mishap. However, concern centers on the strong possibility that under similar circumstances this kind of misjudgment might occur again. During spin demonstration flights, always knowing exact cloud tops within a working area can be impractical. The mission requires at least six spins and each uses a significant amount of time to climb above the minimum entry altitude to begin the next demonstration. During the time between spins, cloud tops can rise significantly. The spin demonstration flight further compounds the problem due to the large variations in recovery altitudes associated with some of these maneuvers. A final concern is the severe disorientation problem associated with entering clouds during a spin or shortly after recovery. As demonstrated in this mishap, without sufficient time and altitude, recovery may be impossible.

90.4. **Action Taken:**

90.4.1. Specific cloud clearance and cloud-top verification requirements were published in the governing directives for spin demonstration sorties and other spin training.

91. Lost Control – G-LOC (Solo-Contact Sortie):

91.1. **Mishap.** Figure 98. The mission was an area solo-contact sortie. After reaching the assigned area, the student pilot accomplished several low-G aerobatic maneuvers. As the student pilot was performing an Immelman, he noticed his vision begin to gray out. He then made a conscious effort to bear down on his anti-G straining maneuver (AGSM) and to continue the Immelman. The student pilot then experienced G-induced loss of consciousness (G-LOC), and the aircraft continued in a vertical attitude before entering a spin. The student pilot regained consciousness shortly afterward, and noticing his aircraft in an apparent spin decided it was unresponsive to his control inputs. As he passed the bottom of his area, he ejected. The aircraft impacted the ground in a left spin and was destroyed. The student pilot was not injured.

Figure 98. Lost Control – G-LOC (Solo-Contact Sortie).

91.2. **Investigation.**

91.2.1. **Operator Factor.** During the pull-up for the Immelman, the student pilot failed to initiate the AGSM prior to the onset of G-forces. As a result, he experienced a disorienting grayout/blackout. He elected to continue the Immelman and, in an attempt to regain his vision, improperly altered his AGSM technique. Because of this, he experienced a G-LOC episode. The aircraft continued in a near vertical attitude. During his post-G-LOC state of relative incapacitation (where he was conscious, but had not yet regained control of his extremities), the student pilot made inadvertent control inputs as the aircraft approached its apex. This caused the aircraft to enter a left spin. While still disoriented and confused, the student pilot improperly applied spin prevention controls and the aircraft continued to spin. At the bottom of his altitude block, he ejected successfully.

91.3. **Lesson Learned:**

91.3.1. During an examination of the student's G-LOC susceptibility in the centrifuge, he was evaluated to have an above average ability to tolerate G-forces. This implies we are all susceptible to G-LOC every time we fly. This student did not accomplish an AGSM prior to the application of G-forces. He continued the maneuver after he identified a problem with his G-tolerance that day. In this situation, the student should have aborted the Immelman. In addition, he changed his AGSM techniques. This effectively kept the blood from returning to his heart, which put him to sleep. His attempted spin prevention failed predominantly because it was attempted during a period of relative incapacitation. That is, he still did not have full control over his arms and legs even though his situational awareness was rapidly improving. By the time the student pilot noticed the bottom of his area on the altimeter, he had regained mental and physical control and did as he had been taught (i.e. made a timely decision to eject).

91.4. **Action Taken:**

91.4.1. Changes to the governing directive were published adding the requirement to accomplish a G-awareness exercise prior to any profile, which includes high-G maneuvers. The directives were also changed to expand the discussion on high-G maneuvering to include its effects on the human body.

92. Lost Control/G-LOC:

92.1. **Mishap.** **Figure 99**. The mission was the student's fourth solo training mission and planned to practice basic aerobatic maneuvers. The student pilot entered the low MOA, completed required aircraft checks, and started a G-awareness exercise. Shortly into the turn, the student pilot noticed a low pitch attitude and airspeed nearing upper limits. While focusing on reducing airspeed, the student pilot experienced a G-LOC. When the student pilot regained consciousness, he was descending and the aircraft was in a spiral or spin. After initial control inputs did not recover the aircraft, the student pilot ejected safely. The aircraft impacted the ground and was destroyed.

Figure 99. Lost Control/G-LOC.

92.2. **Investigation:**

92.2.1. **Operator Factor.** Due to channelized attention on the increasing airspeed, the student pilot failed to maintain an effective AGSM. As a result, the student pilot experienced gray-out and a subsequent G-LOC. During the post-GLOC reduced state of consciousness, the student pilot probably made bad control inputs resulting in a spin.

92.3. **Lesson Learned:**

92.3.1. It is imperative that aircrew members remain ahead of the jet and anticipate possible problems that may occur. Implementing proper techniques in a timely manner can prevent an undesirable situation from becoming an unmanageable chain-of-events. In this mishap, the student pilot's channelized attention on the increasing airspeed caused him to neglect the AGSM, leading to a G-LOC, improper control inputs, a spin, and the loss of an aircraft. The decision to eject however is not in question.

92.4. **Action Taken:**

92.4.1. Training has been revised to ensure instructors teach AGSM techniques that are consistent with AF level guidance. Specifically, the instructor techniques guide needs to fully describe breathing techniques for the AGSM.

92.4.2. The subject of task management during AGSM being incorporated in Physiological Training courseware was addressed.

Section I—T-37 & T-6 Miscellaneous Mishaps

93. Second Inadvertent Engine Shutdown/Straight Ahead Rejoin:

93.1. **Mishap.** **Figure 100**. This mission was the second ride of the formation phase of pilot training. The formation departed the airfield and completed normal in-flight checks once established in their assigned MOA. The formation completed their maneuvers as planned and initiated recovery back to base. As the formation leveled at 6,000 feet, the Lead Aircraft directed Aircraft 2 to rejoin to the fingertip position. Aircraft 2 was in trail and set up for a straight-ahead rejoin. Following procedure, Lead maintained 200 knots and level flight while Aircraft 2 attempted the rejoin. Shortly thereafter, Lead inadvertently descended 200 feet and initiated a correction back to their assigned altitude. This correction caused the aircraft to slow while climbing back to 6,000 feet. Lead returned to the proper altitude but was flying at 190 knots instead of 200. As Lead leveled off, Aircraft 2 attempted to rejoin the formation at 220 knots. The IP in Aircraft 2 recognized the excessive closure, took control of the aircraft from the student, and aggressively retarded the PCL to idle. Unfortunately, instead of grabbing the PCL, he unintentionally grabbed the PCL cutoff finger lift and moved the PCL to off which initiated the engine's shutdown sequence. The IP immediately recognized his error and instinctually brought the PCL forward towards max (62%). Data showed this action prevented the engine from completing the shutdown sequence, and the engine would have remained operational. However, the IP misanalysed the engine displays, perceived the engine was shutting down, and returned the PCL to the off position. This resulted in shutting down the aircraft's only engine. The operating manual directs that, in the event of an air start, the pilot should turn towards the nearest landing surface and zoom the aircraft to trade airspeed for altitude until reaching the desired glide speed of 125 knots. The IP accomplished neither of these steps, and instead focused on restarting the engine. If the IP had zoomed the aircraft properly, he would have gained nearly two minutes of flight time. The IP rushed through the emergency procedure checklist for 'IMMEDIATE AIRSTART" and misapplied the steps. The engine failed to relight due to his errors. Frustrated, the IP then brought the PCL back to the off position and reattempted the checklist. This time he correctly completed the first three steps of the checklist and the engine relit. The checklist states that following a successful airstart, the PCL must remain at idle until the engine completes the start and returns to normal operating parameters. The checklist notes that this will take approximately 40 seconds. The IP prematurely advanced the PCL out of idle creating high fuel flow, raising engine temperature, and causing catastrophic engine failure. At this point, the aircraft was below 5,000 feet at 125 knots without an emergency landing airfield within gliding range. As the engine began winding down following the PCL advance, the IP became exasperated and channelized his attention on restarting the engine. The IP attempted the airstart four more times before the student pilot suggested they eject. The crew bailed out at 580 feet above the ground and was safety recovered by local emergency responders. The aircraft impacted the ground and was destroyed 14 seconds after the crew ejected.

Figure 100. Second Inadvertent Engine Shutdown /Straight Ahead Rejoin.

93.2. **Investigation:**

93.2.1. **Logistics Factor.** Due to the acquisition policies/design process, the USAF accepted the aircraft with a deficient Power Control Lever (PCL) cut-off gate handle design. This deficiency has been identified as causal in 11 mishaps over ten years, including two class A and one class B.

93.2.2. **Operator Factor.** Mishap Instructor Pilot (MIP) The MIP completed the BOLDFACE portion of the T.O. "IMMEDIATE AIRSTART (PMU NORM)" checklist. However, he did not properly apply the remainder of the checklist. The MIP prematurely advanced the PCL prior to engine stabilization at IDLE RPM due to inadequate technical/procedural knowledge.

93.3. **Lesson Learned:**

93.3.1. Analyze the situation, take the appropriate action, and land as soon as conditions permit is drilled into every USAF aviator. Appling these measures have a common theme of slow the situation down as much as possible and be methodical in your actions and application of the proper procedures. Procedural trainers can help train proper procedures and practice especially boldface item in real time scenarios. However no simulator can instill the fear factors that will be present during an actual emergency but should develop your knowledge and confidence to handle a scenario. Please take the time you're given seriously as you may need to rely on it someday. Finally be aware of minimum safe ejection altitudes and be mentally prepared on every sortie to use the lifesaving devise if needed.

93.4. **Action Taken:**

93.4.1. The PCL retrofitted with a cutoff safety guard to prevent inadvertent shutdown estimated completion date of 1 December 2016. A warning referencing the dangers of advancing the PCL prior to engine stabilization at IDLE has been added to the T.O.

94. Midair Collision/Pattern Breakout:

94.1. **Mishap.** **Figure 101**. This mishap began like many pilot training sorties with a trip down to one of the auxiliary airfields. On this day, Texan 1 departed the local pattern for the auxiliary field, and Texan 2 followed seven minutes later. The auxiliary field pattern was set up similarly to the traffic pattern at home station; however, the VFR entry point was also the radar termination point. Aircraft that broke out of the pattern and aircraft that just arrived at the auxiliary field would use the same point to intercept the outside downwind ground track. For decades, aircraft had been operating at the auxiliary field under these procedures without incident. But procedures are not necessarily safe just because nothing tragic has happened yet. After a normal pattern, Texan 1 climbed above pattern altitude to 2,000 feet above the ground and turned towards the VFR entry point. Texan 1 complied with local guidance while executing this maneuver and made a radio call: "Texan 1, perch point, breaking out." Two seconds after that transmission, Texan 2 switched to the auxiliary field's frequency and announced that they would be entering the pattern through the same VFR entry point. According to local guidance, Texan 2 would maintain 1,000 feet above the ground while they entered the pattern. Texan 1 and Texan 2 were safely separated by 1,000 feet of altitude as they both converged towards the same entry point. The auxiliary field's control tower advised Texan 2 of the current winds and landing runway. Texan 2 heard this transmission but did not hear Texan 1's transmission and assumed they were the only aircraft in the pattern. As Texan 2 approach the entry point, the crew searched the sky for aircraft established in the pattern at their nine to ten o'clock position. Texan 1 was hidden at their high 1 o'clock position. Still assuming they were the only aircraft operating at the auxiliary field, Texan 2 initiated a climbing turn away from the pattern and back towards the entry point in order to practice the traffic pattern entry again. According to local guidance, this was the correct procedure to follow if there was another aircraft in the traffic pattern at 1,000 feet. Additionally, the guidance directs the aircraft to make a radio call "Texan 2, VFR entry, breaking out." Texan 2 never made the radio call, and as a result Texan 1 had no idea that Texan 2 was changing course. Texan 2 initiated this maneuver for training to practice the traffic pattern entry again. As Texan 2 climbed, their left wing sliced through the fuselage of Texan 1, missing the rear cockpit seat by inches. Texan 1 instantly plummeted and spiraled uncontrollably. The crew immediately recognized an impending impact and exited the aircraft. Texan 2 completely lost its left wing in the collision. The crew quickly elected to bail out of the aircraft and launched up the ejection rails, out of the aircraft. All four crew members found themselves safe under their parachutes, and three of them managed to land without harm in the densely wooded countryside. The fourth pilot's parachute caught a tree, which left him suspended 60 feet above the ground. After hanging in the harness for an hour, he was brought down to safety by local firefighters. All four crew members survived this mishap with minor injuries.

Figure 101. Midair Collision/Pattern Breakout.

94.2. **Investigation:**

94.2.1. **Supervisory Factor.** OG published guidance lead to non-standardized interpretations and ultimately fails to provide procedural deconfliction of aircraft at a fixed point where maneuvering aircraft are directed to converge.

94.2.2. **Operator Factor.** Mishap crews failed to successfully visually clear for conflicting aircraft. Flightpath geometry made visually acquiring either aircraft very difficult at the time of the event.

94.2.3. **Supervisory Factor.** Runway supervisory unit (RSU) failed to notify Texan 2 of the current pattern traffic advisory and Texan 1's location.

94.3. **Lesson Learned:**

94.3.1. Pilot error, once again, caused the loss of over ten million dollars' worth of aircraft. The pilots, from both aircraft, failed to adequately clear their flight paths. This incident is a striking example where a series of small initial errors combine to a catastrophic result. The control tower failed to make an advisory call that there was another aircraft established in the pattern. Texan 2 failed to be on frequencies prior to making their radio call. Texan 2 failed to clear their intended flight path prior to making a practice break out, and then failed to make a radio call when initiating their breakout. Too much has been written on situational awareness to repeat here, but the lesson is that if you lose situational awareness, you are relying on luck. A problem that seems so obvious now, after the fact, of having Radar Entry and VFR Entry as the same point was not questioned back then; and if it was questioned, nothing was done about it. It's important as aviators and future leaders to listen to anyone that speaks up and points out an unsafe situation to an established procedure. Certain procedures may have stood the test of time, but that does not mean they are the safest possible options. Unfortunately, sometimes it takes an accident to realize a procedure is faulty. Professional aviators rely on other aviators (and even students) to speak up when things appear unsafe so that a change can be made. Procedures can become so ingrained in veteran pilots that it sometimes takes a fresh set of eyes to see the glaring deficiencies. One could take a step back from this mishap and say it was unlucky. But how many times in previous years had there been an indication of increased risk at that traffic entry point? There may have been a few close calls that went unreported because nothing went wrong. The crew then safely landed and said, "That was close!" They never reported the incident because nothing actually went wrong. What would have happened if a crew saw a risk and imagined a different way to mitigate that known risk?

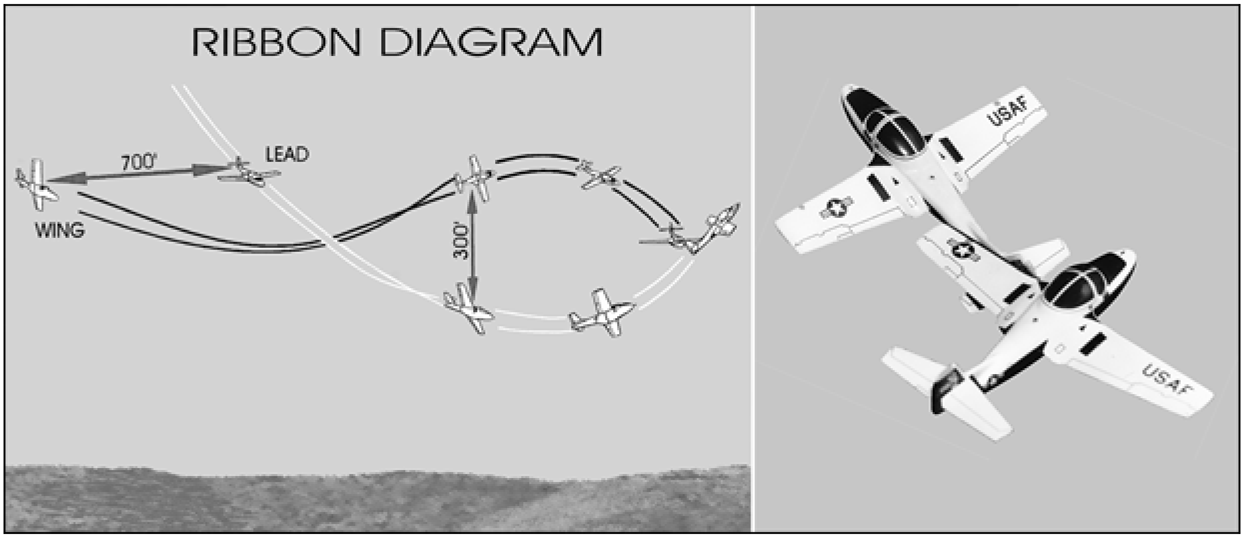
94.4. **Action Taken:**

94.4.1. Local guidance was corrected and the fleet has been fitted with TAS to aid in identifying conflicting aircraft.

95. Midair Collision/Extended Trail Maneuvering:

95.1. **Mishap.** **Figure 102**. This mishap occurred during an instructor pilot formation continuation training mission. The flight was performing an extended trail, Cuban-8 maneuver. On completion of the Cuban-8, the wingman attempted to reposition to the inside of lead's left turn. Excessive angular cutoff resulted in the wingman departing the maneuvering cone to approximately line abreast with rapid closure on lead. The wingman attempted a late breakout. The wingman's left wing impacted the aft fuselage of lead, severing the tail section. Both aircraft were uncontrollable, but all four ejected successfully.

Figure 102. Midair Collision/Extended Trail Maneuvering.



95.2. **Investigation:**

95.2.1. **Operator Factor.** The wingman inadvertently achieved excessive closure on lead and failed to execute proper evasive action in a timely manner.

95.2.2. **Supervisory Factor.** The instructor pilot not at the controls of the wing aircraft failed to intervene. The lead crew failed to adequately monitor the wingman.

95.3. **Lesson Learned:**

95.3.1. Pilots must know their personal limitations and always leave themselves an out. The wingman's failure to maintain position or execute a timely breakout was directly responsible for this mishap. Complacency of the second instructor pilot in the wing aircraft cannot be discounted. As formation lead, pilots must know their wingman's capabilities and maneuver accordingly.

95.4. **Action Taken:**

95.4.1. Breakout and knock-it-off terminology was redefined.

96. Midair Collision/Practice Breakout:

96.1. **Mishap.** Figure 103. The mission was a dual two-ship formation syllabus flight. It was the first flight of the day for all four pilots and the third formation flight for both students. Planned area work for the flight consisted of wingwork, echelon turns, pitchouts and crossunders. Lead began the second set of planned wingwork with the wingman positioned on the left. As lead began a climbing left turn, the wingman initiated a practice formation breakout. As the SP in the wing aircraft attempted a radio call, his IP's attention was momentarily diverted away from the maneuver. At this time, both the IP and SP in the lead aircraft lost sight of their wingman. The lead aircraft continued the maneuver and began the descending portion of the leaf in spite of not hearing an expected rollout call. The IP in the wing aircraft assumed separation was adequate and directed a rollout to look for lead. As the IP and SP in the wing aircraft were looking right, the lead crew was looking left and descended upon the wing aircraft. The left wing of the wingman's aircraft impacted the bottom of the nose of the lead aircraft. The wing aircraft pitched over and spiraled away from the lead aircraft out of control. The crew successfully ejected. The lead aircraft coordinated with a chase ship and RTB for a gear-up landing. The crew egressed successfully.

Figure 103. Midair Collision/Practice Breakout.

96.2. **Investigation:**

96.2.1. **Operator Factor.** The SP in the lead aircraft failed to effectively use crew coordination when he lost sight of his wingman by not communicating such to his IP who was already blind due to the aircraft's cross-cockpit design. The crew in the lead aircraft did not hear and RAPCON did not record the wing SP's breakout radio call.

96.2.2. **Supervisory Factor.** The wing IP misprioritized his tasks when he placed priority on the radio call ahead of ensuring the SP pulled enough G's (not just bank) to provide adequate separation. The IP in the lead aircraft knew he was blind but made no attempt to ensure adequate separation between aircraft. The IP in the wing aircraft directed his SP to rollout prior to ensuring adequate separation from lead.

96.3. **Lesson Learned:**

96.3.1. The aircraft's side-by-side seating makes it difficult to see the other aircraft cross-cockpit without using the mirror. Without constantly adjusting the mirror, it is difficult to keep the wingman in sight. During formation work, the instructor in the lead aircraft frequently loses sight for short periods as the students flying in the wing position struggle (bobble) while attempting to maintain the proper fingertip position. This requires the IP in the lead aircraft to rely on their own student to keep sight of the other aircraft for short periods of time.

96.3.2. All crewmembers must be active in crew coordination and in ensuring situational awareness. Lack of crew coordination combined with misprioritization of tasks were the causal factors in this mishap.

96.3.3. Another possible factor was complacency. Experience usually keeps IPs out of trouble, however, IPs must avoid complacency, which can occur with experience (been there a hundred times and done that attitude). The more experience an IP has can lead to an elevated comfort level, which the situation does not deserve.

96.4. **Action Taken:**

96.4.1. AFMAN guidance was reviewed for possible expansion on the discussion on collision avoidance. Specifically addressing the limited visibility afforded when looking cross-cockpit and emphasizing the importance of crew resource management.

96.4.2. AFMAN guidance on formation breakouts was examined to see if changes were necessary to increase emphasis on crew coordination, task prioritization and also to require all practice breakouts to be initiated by the lead aircraft.

96.4.3. Greater emphasis to be placed on formation breakout, formation crew coordination and lost sight procedures.

97. Midair Collision/Civilian Aircraft:

97.1. **Mishap.** Figure 104. The IP and SP were flying a syllabus contact sortie with planned area work followed by pattern work at the auxiliary field. The mission was uneventful up to the recovery to the home field. The SP contacted RAPCON and requested vectors. Radar contact was made and the crew was given radar vectors and an IFR clearance to 5000 feet MSL. The IP took control of the aircraft as they leveled at 5000 feet MSL. After several moments the SP asked the IP a question and the IP turned toward the student. When the IP turned back he saw an airplane out of the corner of his eye but did not have time to react. The two airplanes collided at an approximate 100-degree heading-crossing-angle. The aircraft's right wing was sheared off at the right wing root and sustained severe damage to the tail section. The civilian airplane received severe damage to the fuselage in front of and including the cockpit. The aircraft went into a tumbling inverted spin and the crew ejected successfully. It is unknown if the civilian pilot was killed during the midair or during ground impact and was found in the aircraft. The aircrew was transported to a medical facility where they were treated and released.

Figure 104. Midair Collision/Civilian Aircraft.

97.2. **Investigation:**

97.2.1. **Operator Factor.** Although not required, it was determined that the civilian pilot did not file a flight plan, have a transponder, or use his hand held radio to communicate with RAPCON. Additionally, the civilian pilot did not fly the appropriate VFR hemispheric altitude or properly use see and avoid or take advantage of the MIDAIR COLLISION AVOIDANCE (MACA) PROGRAM material available regarding military flying operations in the area. The IP and SP did not properly use see and avoid to prevent the midair collision with an aircraft that was not detected by RAPCON.

97.3. **Lesson Learned:**

97.3.1. Despite adequate Air Force guidance and practical techniques in regard to clearing a midair collision still occurred. As aviators we understand that clearing will have moments of interruption due to other cockpit duties and distractions however, let us never forget the results can be devastating. Additionally, this mishap is a reminder of the limitations of radar in detecting aircraft that are not squawking.

97.4. **Action Taken. None.**

Section J—T-37 & T-6 Landing Mishaps

98. The First In-Flight Engine Shutdown:

98.1. **Mishap.** Figure 105. The crew consisted of two IPs and they will be referred to as FCP and RCP. The sortie was part of the Instructor Enrichment Program that allows IPs to fly with IPs of different aircraft. One IP briefed the other IP on the egress procedures and cockpit familiarization, but failed to point out where the flap lever was located. As the rear cockpit pilot flew an instrument approach, he lowered the landing gear, but could not locate the flap lever. The front cockpit pilot attempted to describe how to find the lever, but the RCP still could not locate it. The RCP continued to search the side panel for the flaps. Finally, he located the label "FLAP" just in front of the Power Control Lever (PCL, similar to a throttle). The label was located in the middle of the panel equidistant from the PCL cutoff finger lift and the flap lever. The RCP IP saw the label, grabbed the PCL cutoff finger lift, lifted it, and moved it aft shutting off the engine. At the time of engine shutdown, the aircraft was flying 1,500 feet above the ground traveling at 120 knots. The aircraft's oxygen system is driven by the engine. As soon as the engine lost power, the oxygen system shut down. This forced both pilots to drop their masks to breath. As the aircraft lost thrust, the FCP took control of the aircraft and attempted an air start. The engine failed to relight as it descended through 1,000 feet. Again, the FCP attempted another air start, and again the engine failed to relight. At this point the aircraft was just 500 feet above the ground. Both pilots recognized impact was inevitable and initiated ejection. The pilots ejected at 200 feet above the ground. Both pilots had their oxygen masks down, exposing their faces during the ejection sequence. Fortunately, their eyes were not injured, but their faces were permanently scarred as the canopy fracturing system fired during the ejection sequences. The FCP also broke his ankle during his parachute landing. The aircraft was destroyed.

98.2. **Investigation.**

98.2.1. **Supervisory Factor.** Leadership failed to establish appropriate command wide and local requirements, guidance, and training for instructor enrichment programs (IEPs).

98.2.2. **Operator Factor.** FCP failed to ensure adequate pre-flight cockpit orientation for the planned profile.

98.2.3. **Operator Factor.** RCP misidentified the PCL cutoff finger-lift as the flap selector and inadvertently moved the PCL to cutoff, shutting down the engine.

98.3. **Lesson Learned:**

98.3.1. Several lessons are learned from this mishap, but the two major lessons are cockpit familiarization and ejection criteria. To be successful in pilot training, a student must thoroughly understand the cockpit and be able to locate the correct switches. Like any other skill this requires practice, practice, and more practice. The second lesson is ejection criteria. The IPs delayed the decision to eject in order to accomplish the engine air-start checklist. Due to their close proximity to the ground, they were not able to complete the checklist, and the engine did not relight. Prior to this sortie, both pilots reviewed their ejection criteria: controlled bailout at 2,000 feet above the ground. That means that they would not descend below 2,000 feet without an operating engine unless they are able to maneuver to a suitable landing surface. The IPs delayed ejecting in an attempt to save the aircraft and nearly ejected outside of the safe ejection envelope.

98.4. **Action Taken.**

98.4.1. Following this mishap, the Air Force added cockpit familiarization training prior to instructor enrichment sorties; installed anti-suffocation valves on the pilots' oxygen hoses, which allow breathing through a relief valve if the oxygen supply is cutoff; painted the PCL cutoff finger lifts red; and added the label "ENGINE CUTOFF." An emergency boldface procedure was written for immediate engine air-starts. After subsequent inadvertent in-flight engine shutdowns, a finger lift guard was also installed.

Figure 105. The First In-Flight Engine Shutdown

99. Traffic Pattern Stall:

99.1. **Mishap.** Figure 106. The mission was a solo traffic-pattern-only sortie. On the takeoff leg from the first touch-and-go landing, the student pilot requested an emergency closed pattern. The closed pattern was approved, and the closed pullup was performed with the gear still extended. On downwind, the student angled toward the landing runway and the RSU directed a heading change to parallel the runway. The student made the appropriate heading change. The RSU crew noted the aircraft appeared slower than normal in a slightly nose-high attitude. The crew directed use of 100% power three times before the aircraft nose pitched down to approximately 40 degrees. The nose of the aircraft was observed to rise slightly and then drop near vertical with a rapid roll to the right. The aircraft impacted the ground in a nose low attitude and exploded on impact. The solo student received fatal injuries.

Figure 106. Traffic Pattern Stall.

99.2. **Investigation:**

99.2.1. **Undetermined.** The temperature modulating valve was positioned fully open, either as a result of an unidentified malfunction or as a result of the student moving the temperature selector to the full HOT or near full HOT position.

99.2.2. **Operator Factor.** For unknown reasons, the student pulled the defrost control to the ON position, allowing hot air to enter the cockpit through the defrost system. On takeoff leg from a touch-and-go landing, the student requested and received approval for an emergency closed traffic pattern. The student failed to retract the landing gear before starting the closed pattern. After rolling out on downwind leg, the student pilot, most likely as a result of preoccupation and continued distraction caused by the hot cockpit, prematurely lowered flaps, reduced power, and allowed the airspeed to dissipate until the aircraft stalled.

99.3. **Lesson Learned:**

99.3.1. The inherent danger of broken habit patterns caused by distractions during emergency situations proved disastrous in this mishap. A pilot's primary concern during an emergency or unusual situation is the responsibility to maintain aircraft control. It was probably a poor decision on the part of the student pilot to request a closed pattern when attention should have been directed at maintaining basic aircraft control and analyzing the situation.

99.3.2. The RSU controller's approval of the student pilot's request for a closed pattern received close examination. However, considering the limited information provided by the student, the controller's actions were considered appropriate. When an emergency situation develops, the aircrew is in the best position to evaluate the situation while delays caused by the RSU evaluating the emergency may aggravate the problem. Therefore, an RSU controller should approve a request by a pilot unless it is immediately perceived to be disadvantageous.

99.4. **Action Taken:**

99.4.1. All aircrews were briefed on this accident with emphasis on the following items:

99.4.2. The seriousness of an air-conditioner malfunction to the full HOT position and the necessary corrective actions to be taken.

99.4.3. Landing the aircraft should not take priority over analyzing the emergency and taking complete and proper corrective action.

99.4.4. The inherent danger of broken habit patterns caused by distractions during emergency or unusual situations.

99.4.5. More detailed information on the modes of failure of the air-conditioning system was incorporated into appropriate academic syllabi and learning center programs.

100. Engine Failure:

100.1. **Mishap.** Figure 107. The mission was a student pilot solo-pattern-only sortie. The student's first pattern was flown satisfactorily until final approach where he was sent around by the RSU controller because of a high flare. The student had to break out of the traffic pattern during the second pattern due to a potential traffic conflict. A normal pattern and touch-and-go landing followed this breakout. Just after a turn to the crosswind leg, the student alerted the controller to a problem. The student's next transmission concerned a loud noise in the cockpit. At this time, the RSU controller directed a turn toward the inside downwind. The student then transmitted he had smoke and fumes in the cockpit. The RSU controller requested the status of engine instruments. The student stated the left engine was at 80% RPM, which the RSU controller interpreted as both engines were at 80% RPM. The RSU controller next directed that the air-conditioner be placed in "vent." Shortly thereafter, the RSU controller noticed smoke trailing from the aircraft and saw the aircraft begin a descent. The RSU controller directed a bailout. The ejection was successful; the aircraft crashed and was destroyed.

Figure 107. Engine Failure.

100.2. **Investigation:**

100.2.1. **Logistics Factor.** A number one engine turbine blade was manufactured with surface discontinuities, which contributed to a fatigue crack. The manufacturer's quality control inspections did not detect the defects in the blade. Supervisors failed to ensure the turbine rotor blade inspection requirements were completed, resulting in the blade defects going undetected during maintenance inspections. During flight, a number one engine turbine blade failed.

100.2.2. **Operator Factor.** The student pilot failed to adequately and clearly communicate his known engine malfunction to the RSU controller. The RSU controller misinterpreted the student's response as indicating normal engine operation and directed that the air-conditioning system be placed in the vent position instead of directing engine shutdown. While reaching for the vent control lever, the student allowed the aircraft to enter a 10-degree dive from traffic pattern altitude. The RSU controller saw smoke trailing the aircraft, interpreted the nose-down pitch as a loss of aircraft control, and directed the student to bail out.

100.3. **Lesson Learned:**

100.3.1. Perhaps some experienced pilots are annoyed when a flight manual directs something so inherently obvious as maintaining aircraft control during an emergency situation. Aircraft are unnecessarily lost by momentary inattention during emergencies. Maintaining aircraft control is the most important action taken when faced with any emergency situation.

100.3.2. Although the RSU and SOF are available to provide assistance to pilots in distress, the ultimate responsibility for analyzing the situation and taking the appropriate action rests solely with the pilot in command.

100.4. **Action Taken.** None.

101. Dual Engine Failure:

101.1. **Mishap.** **Figure 108**. The mishap mission was a student pilot contact training sortie. The mission had progressed to the landing phase of the sortie. A touch-and-go landing had just been completed when the RSU asked the mishap crew to check the base of the clouds in the pattern. The instructor pilot assumed control of the aircraft, broke out of the pattern from the crosswind leg, checked the cloud bases, and passed the information to the RSU. The instructor pilot then descended to traffic pattern altitude and entered outside downwind at the entry point. Shortly thereafter, the crew transmitted they had experienced a dual-engine flameout and were ejecting. Both crewmembers ejected at about 800 feet AGL. The instructor pilot sustained major injuries during his parachute landing fall; the student sustained no significant injuries. The aircraft was destroyed upon ground impact.

Figure 108. Dual Engine Failure.

101.2. **Investigation:**

101.2.1. **Maintenance Factor.** The flight before the mishap flight, a fuel transfer malfunction occurred, resulting in the premature illumination of the low-level and gravity-feed lights. Maintenance personnel did not adequately troubleshoot the system and failed to correct the fuel transfer malfunction by removing and replacing the float switch assembly. As a result, during the mishap flight, the lower float of the float switch assembly stuck at the midlevel switch position, preventing the transfer of fuel from the wing tanks to the fuselage tank.

101.2.2. **Operator Factor.** During the approach-to-field check, the student either did not perform the fuel check or failed to recognize a fuel transfer malfunction.

101.2.3. Supervisor Factor. The instructor pilot failed to ensure that the student performed a proper approach-to-field fuel check.

101.3. **Lesson Learned:**

101.3.1. The human factor of complacency helps to explain why the instructor failed to ensure that the student performed a proper approach-to-field fuel check. The student pilot was considered an excellent student, and the instructor pilot made the error of not questioning the techniques the student employed while performing the fuel check.

101.3.2. Checklist discipline is one of the basics of flying. Checklists provide a timely, methodical means to inspect the aircraft systems and identify malfunctions before they become catastrophic. Neglecting to accomplish required checks is not only a breach of air discipline but also an invitation for disaster.

101.4. **Action Taken:**

101.4.1. The two-float system was closely evaluated to determine its suitability for continued use due to the possibility of fuel starvation with one malfunctioning float.

101.4.2. T.O. guidance was changed to emphasize the importance of checking fuel total, balance, and fuselage tank quantity.

101.4.3. T.O. guidance was changed to revise information concerning a fuel transfer system malfunction and to emphasize the importance of checking fuel total, balance, and fuselage tank quantity at frequent intervals during flight.

101.4.4. T.O. guidance was changed to revise information concerning indications of impending double-engine flameout and to provide additional guidance on corrective actions.

101.4.5. Study guides and academic workbooks used in training were changed to correctly describe fuel transfer system operation and malfunctions with emphasis on the significance of performing fuselage fuel quantity checks.

102. Short Landing:

102.1. **Mishap. Figure 109**. The aircraft was scheduled to transport the crew to an auxiliary airfield for the purpose of opening the RSU. Approaching the auxiliary airfield, the pilot began an idle power descent and then elected to fly a no-flap approach to landing. The aircraft touched down 19 feet short of the overrun, traveled 87 feet across a corner of the overrun, and continued 328 feet before coming to a stop 50 feet off the opposite edge of the overrun. The crew ground egressed with no significant injuries; the aircraft was destroyed.

Figure 109. Short Landing.

102.2. **Investigation:**

102.2.1. **Supervisory Factor.** Squadron supervision was inadequate to ensure the aircrew flew a proper pattern upon arrival at the uncontrolled airfield.

102.2.2. **Operator Factor.** The instructor pilot attempted to make a descent, approach, and landing without adjusting the power from the idle position. While on final approach, the instructor pilot allowed the airspeed to decrease well below that required for the selected configuration and failed to initiate a go-around. In an attempt to salvage the planned idle power approach, the pilot lowered 50 % flaps and delayed adding power due to inadequate knowledge and understanding of basic aerodynamics. The sink rate continued, and the aircraft stalled just before impact.

102.2.3. **Operator Factor.** The first pilot (also an instructor pilot) failed to take action or provide assistance.

102.3. **Lesson Learned:**

102.3.1. Before this mishap there had been four accidents at uncontrolled airfields. Examination revealed that each mishap resulted from poor aircrew judgment or a breach of aircrew discipline rather than an inherent danger in the operation. Pilot testimony and board analysis identified a significant lack of understanding concerning the effects of drag, the use of flaps, thrust required, and the region of reverse command. The pilot's lack of understanding in aerodynamics revealed itself when he lowered the flaps in a thrust deficient situation. This only increased the thrust deficiency. Further, the pilot's misunderstanding that flying the aircraft "on the tickle" was achieving max performance aggravated the situation by increasing the sink rate and time needed for recovery. This deficiency in knowledge combined with a violation of aircrew discipline led to the mishap. One of our goals should be for pilots to be their own checks and balances by not tolerating unprofessional conduct from fellow pilots.

102.4. **Action Taken:**

102.4.1. Instruction was incorporated in training academics on the region of reversed command with various aircraft configurations.

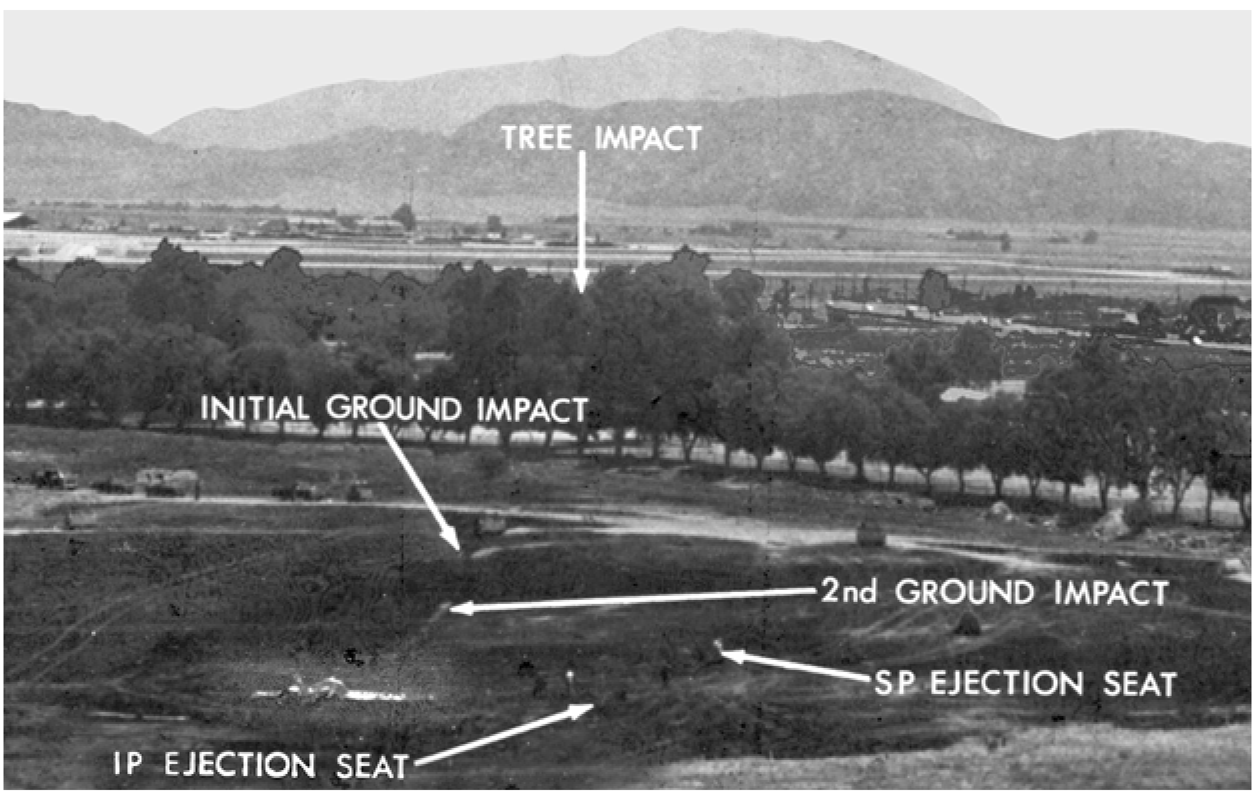
102.4.2. The governing directive was changed to require traffic patterns be planned so a minimum of 50% RPM is used on final approach until landing is assured.

102.4.3. A note was added to the T.O. guidance, emphasizing to aircrews that lowering 50% flaps, while decreasing stall speed, will significantly increase thrust required.

103. Single Engine Go-Around:

103.1. **Mishap.** Figure 110. The mission was a dual cross-country navigation sortie. On takeoff leg, the number one engine overheat warning light came on. The engine was shut down, and the instructor pilot maneuvered the aircraft to accomplish a single-engine overhead pattern and landing. Difficulties were encountered during the pattern resulting in a single-engine go-around attempt; the aircraft impacted a tree 1 NM from the runway. The instructor pilot and student pilot ejected out of the envelope and were fatally injured. The aircraft impacted the terrain and was destroyed.

Figure 110. Single Engine Go-Around.



103.2. **Investigation:**

103.2.1. **Logistics Factor.** Immediately after takeoff, the number one engine overheat light illuminated for an undetermined reason. No evidence of fire or overheat was found.

103.2.2. **Operator Factor.** The instructor pilot flew an angling downwind, positioning the aircraft too close to the runway for a safe landing. The instructor pilot overshot the final approach, initiated a heavyweight single-engine go-around, retracted the landing gear, and turned back toward the runway. As the aircraft angled toward the runway, the instructor pilot inappropriately discontinued the go-around, reduced power, descended, and turned the aircraft to align it with the runway in an apparent attempt to land. The instructor pilot discontinued the landing attempt for an unknown reason (perhaps realizing at the last minute the gear was up) and added full power for a second go-around with the aircraft in a thrust deficient flight regime. The aircraft yawed and rolled left as a result of asymmetric thrust and high angle of attack at low airspeed. The instructor pilot reestablished level flight and flew the aircraft in a thrust deficient condition toward rising terrain. Both crewmembers ejected outside the safe envelope and were fatally injured. The aircraft impacted the ground and was destroyed.

103.3. **Lesson Learned:**

103.3.1. The mishap pilot disregarded accepted practices by attempting to salvage a landing after making a timely decision to go-around. When a second single-engine go-around was attempted at very low altitude, the mishap was certain. The decision to eject versus attempting a forced landing was a last-ditch attempt to survive. Although, pilots must reevaluate emergency situations on a moment-to-moment basis because of changing conditions, they must not fall subject to the hazards of indecision. Once an acceptable plan is put into action, stick with it, and make it work.

103.4. **Action Taken:**

103.4.1. Single-engine performance data and the published minimum single-engine airspeed contained in T.O. guidance were reevaluated and confirmed.

104. Stall – Final Turn/Loss of Control:

104.1. **Mishap.** **Figure 111**. The mishap sortie was the student pilot's second solo flight. Prior to the mishap the student pilot had been duties not including flying (DNIF) for 10 of the 12 previous days. After takeoff the student pilot entered the local pattern and reported initial for the first overhead pattern. The student pilot broke early and established a normal offset for downwind. The mishap aircraft was observed overshooting final at an altitude of approximately 400 feet AGL. When crossing the extended runway centerline, the aircraft's ground track was perpendicular to the runway with approximately 90 degrees of turn remaining. The student pilot abruptly rolled left to 80-90 degrees of bank. The aircraft's nose tracked aggressively toward the runway heading, then stalled and entered a steep nose-low altitude. The aircraft impacted 0.9 NM short of the runway threshold. The student pilot made no attempt to eject and was fatally injured. The aircraft was destroyed.

104.2. **Investigation:**

104.2.1. **Supervisory Factor.** The student pilot's flight supervisors did not adequately consider risk factors prior to allowing the student pilot to fly solo. Although the requirements in the syllabus were met, the intent was overlooked. The student pilot had not practiced traffic pattern stalls, slow flight, or contact recoveries within the previous 12 days; and traffic pattern stalls, slow flight, and contact recoveries had only been flown two times in the preceding 28 days. In addition to currency issues, supervisory considerations regarding the SP's DNIF periods and overall appropriateness of letting the SP fly solo prior to the mishap appeared lacking. Wing-level RSU training and operations did not place appropriate emphasis on early detection and correction of solo student traffic pattern errors. The RSU did not intervene in a timely manner when observing the solo SP overshooting final turn.

104.2.2. **Operator Factor.** Approaching the extended runway centerline, with approximately 90 degrees of turn remaining, the student pilot attempted to prevent an overshoot. The student pilot abruptly rolled into 90 degrees of bank causing the aircraft to rapidly track toward the runway. The abrupt control inputs caused the aircraft to go into an accelerated stall. The aircraft's nose then dropped and impacted the ground.

Figure 111. Stall – Final Turn/Loss of Control.

104.3. **Lesson Learned:**

104.3.1. The recognition of deficiencies in training and the importance of recent experience are critical. In this mishap, supervisors did not adequately perform a risk assessment. The student pilot's poor academic and flying skills combined with his recent DNIF status (off and on for 10 days) should have been considered prior to allowing the student to fly a solo syllabus sortie.

104.3.2. Regarding pattern operations, it is important that RSU training stress the importance of early detection of the development of an unsafe situation as well as the importance of issuing instructions in a timely enough manner to allow proper crewmember reaction. Additional emphasis on the control of solo students in the pattern was identified.

104.3.3. It must also be noted that the SP had a history (known by his peers) of making abrupt control inputs without regard to personal safety.

104.4. **Action Taken:**

104.4.1. Prerequisites for solo student sorties should include maneuver currency requirements such as traffic pattern stalls (dual only maneuvers).

104.4.2. The local flight commander training seminar should include IP mentorship and formalize risk assessment during the scheduling of student flight training.

104.4.3. Human factors training should be incorporated into the AETC Pilot Instructor Training Syllabi to improve an instructor pilot's ability to recognize student pilots at increased risk and to provide timely intervention.

105. Stall – Final Turn/Go-Around:

105.1. **Mishap.** Figure 112. The mission was a dual contact sortie and was the student pilot's third sortie in the program. The winds were strong and gusty and the status was dual (no student solos) for winds. Upon arrival at the auxiliary airfield the student pilot flew a straight-in approach and performed a touch-and-go landing. Following a normal box pattern back to initial, the RSU controller noticed the aircraft's ground track was offset to the left of the runway. A break to the right resulted in rolling out on downwind well inside of the normal ground track with a higher than normal ground speed. In response, the RSU controller issued an advisory of "late turns to final, overshooting finals." Immediately after, the aircrew made an aggressive correction to normal downwind spacing followed by an early turn to final. Concerned about spacing, the controller asked the mishap crew if they had the straight in traffic in sight. The IP replied "negative" and began go-around procedures. After trying to locate the traffic, the IP rolled into 60-80 degrees of right bank to avoid a perceived conflict. The RSU controller observed the dangerous situation developing and directed a go-around. In an attempt to avoid a perceived collision the IP further increase bank to 90 degrees and increased backpressure. The aircraft departed controlled flight and was destroyed on ground impact. Neither pilot attempted to eject and were fatally injured.

Figure 112. Stall – Final Turn/Go-Around.

105.2. **Investigation:**

105.2.1. **Operator Factor.** Inattention led the mishap crew to fly the overhead traffic pattern unaware of straight-in traffic (mishap crew missed at least 6 radio calls pertaining to traffic location). Fearing a collision, the instructor pilot over controlled the aircraft by using excessive bank (90 degrees) and backpressure, entered an accelerated stall, departed controlled flight, and crashed.

105.3. **Lesson Learned:**

105.3.1. Aircrews must remember that maintaining aircraft control is their number one priority during flight; misprioritization of tasks can lead to mishaps. In this mishap, limited instructor experience, strong winds, and the task of teaching a beginning student increased the IP's workload and decreased his situational awareness. However, the IP did not have an inordinate number of tasks. He was basically flying a normal student sortie for which he had been well trained.

105.3.2. Regarding RSU operations, the possible creation of additional radio terminology for final turn directives was evaluated. Specifically addressed was the governing instruction, 19 AFI 11-204, Runway Supervisory Unit (RSU) Operations, statement: "This phraseology is not intended to cover every situation or restrict use of additional terms." It was decided that additional phraseology would only reinforce the misconception among RSU controllers that only standard phraseology may be used. This statement is not found in the current AETCI 11-204.

105.4. **Action Taken:**

105.4.1. It was agreed that final turn go-around procedures in the AFMAN should be expanded to emphasize the importance of basic aircraft control.

105.4.2. The addition of an advanced handling characteristics sortie to Pilot Instructor Training and making it an annual refresher requirement was evaluated.

106. Short Landing:

106.1. **Mishap.** **Figure 113**. The aircraft was on a dual contact training sortie. Shortly after takeoff, the aircrew attempted to fly a heavyweight, no-flap, straight-in to a planned low approach. During the transition to the low approach, the aircraft impacted a drainage ditch 228 feet short of the overrun and came to rest 22 feet past the threshold. The crew ejected without injury. The aircraft was destroyed.

Figure 113. Short Landing.

106.2. **Investigation:**

106.2.1. Supervisor Factor. Following a previous mishap, MAJCOM supervisors failed to provide a timely change to directives concerning minimum RPM on final approach. MAJCOM supervisors also failed to ensure instructor pilots and students received adequate instruction on performance and flight characteristics during heavy-weight, no-flap approaches. Unit supervisors failed to discontinue use of the auxiliary field when the crash response capability was below that required by directive. Due to inadequate training, the student flew a steeper than normal no-flap glide path with a heavyweight aircraft and the power at idle. The instructor pilot failed to direct timely discontinuation of the poor approach and failed to take control of the aircraft in time to make a safe recovery. While attempting to shallow out the steep final approach, the student did not use enough power, and the airspeed bled off 10 knots below the required minimum speed. The instructor pilot failed to prevent the bleed-off of airspeed, but took control of the aircraft and attempted a go-around. However, the steep descent and slow speed prevented a safe recovery. The aircraft impacted the ground short of the overrun and was destroyed.

106.3. **Lesson Learned:**

106.3.1. The mishap was caused by numerous instances of supervisory errors. Investigation of a similar mishap 14 months before had identified the need for additional command directives concerning minimum power settings during approaches. At the time of this mishap, necessary guidance was still not available to aircrews. Supervisors must realize that timely dissemination of critical guidance is essential to mishap prevention.

106.4. **Action Taken:**

106.4.1. The governing directive was changed to provide a thorough discussion on performance limitations and flight characteristics during heavyweight, no-flap approaches.

106.4.2. T.O. guidance was revised to include, “in a thrust deficient situation when time is critical, rapid throttle movement is the most effective procedure to achieve maximum engine acceleration.”

106.4.3. Increased emphasis was placed on heavyweight, no-flap approaches in instructor pilot continuation training.

106.4.4. The syllabus was changed to include a special requirement for heavyweight, no-flap patterns at a “fair” grade level.

107. Stall – Traffic Pattern Reentry:

107.1. **Mishap.** **Figure 114**. This mission was scheduled and flown as a solo pattern-only sortie. The student pilot took off, proceeded to the auxiliary airfield and accomplished two patterns with only minor deviations. During his third pattern, the student initiated a breakout due to a falsely perceived traffic conflict. The controller became concerned when the student pilot failed to arrive back in the pattern in the normal amount of time needed to accomplish a breakout and re-entry. After questioning the student about his position, the RSU controller stepped outside the RSU in order to visually or aurally acquire the aircraft. The aircraft was spotted at approximately 500 feet below traffic pattern altitude and descending, headed perpendicular to the approach end of the runway. At approximately the same time as the RSU controller spotted the aircraft, the student pilot initiated an abrupt left turn using excessive back pressure. This resulted in an accelerated stall, followed rapidly by a transition to a spin. The mishap pilot did not initiate the ejection sequence and was fatally injured. The aircraft was destroyed by ground impact and post-impact fire.

Figure 114. Stall – Traffic Pattern Reentry.

107.2. **Investigation:**

107.2.1. **Operator Factor.** The mishap student pilot over controlled the aircraft by abruptly entering a left turn, resulting in an accelerated stall followed by a spin.

107.3. **Lesson Learned:**

107.3.1. This mishap occurred when the student pilot became geographically disoriented while searching for pattern references. When the student pilot suddenly realized he was almost on top of (approaching) the runway, his initial reaction was to abruptly break away from the runway. When lost in the pattern, pilots must not delay in admitting they are lost and climb to breakout pattern altitude. Pilots can see and be seen better from a higher altitude.

107.3.2. Human reaction to problems is magnified by stress. Everyone suffers from self-imposed stress, particularly the fear of failure. The mishap student perceived danger and a sense of failure because he was not on the appropriate ground track. Individual stress may have led him to over control the aircraft. To minimize the effects of stress, pilots should have a basic plan. Preparation helps them remain calm and aids in analyzing the situation. Above all, regardless of the situation, they must maintain aircraft control.

107.4. **Action Taken:**

107.4.1. The contrast of runway and surrounding terrain was enhanced by 3-foot-wide edge stripes painted on the runway.

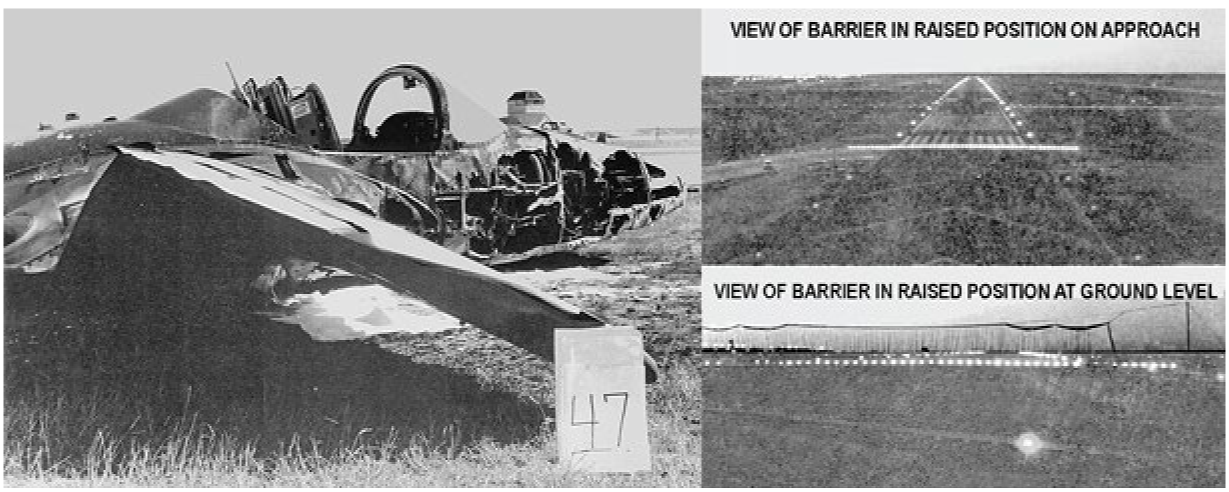
107.4.2. A special syllabus requirement was added to include breakout and reentry at the auxiliary field prior to flying solo.

107.4.3. Visual aids were developed to help student pilots with ground references and traffic pattern orientation.

108. Unintentional Barrier Engagement:

108.1. **Mishap.** Figure 115. The mishap sortie was a local airfield lighting flight check with the primary objective of evaluating threshold lighting in response to a hazardous air traffic report. The mishap crew consisted of two instructor pilots who took off shortly after sunset. After two overhead patterns were flown and lighting was reported satisfactory, clearance was given to fly an overhead approach to a different runway in an attempt to compare lighting intensities. On a normal four-degree final approach, at 100 knots, with full flaps and speed brake, the mishap aircraft struck the raised BAK-15 barrier. The aircraft impacted the overrun approximately 25 feet short of the threshold, main gear first. The impact resulted in the aft wing spars failing, rupturing the fuel cells, and causing a fire. The aircraft settled on the runway on its belly, and as it departed the runway, the aircrew shutdown the engines. The aircraft came to rest one thousand feet down the runway and off to one side. One IP received a back injury and the other was treated and released with only minor injuries. The aircraft sustained major fire damage and was destroyed.

Figure 115. Unintentional Barrier Engagement.



108.2. **Investigation:**

108.2.1. **Supervisory Factor.** Group acquisition allowed a BAK–15 barrier to be installed on a runway without obstruction lights as required by AFI. Complacency in the squadron resulted in the aircrew conducting a night sortie, opposite direction traffic, without adequate planning or proper coordination.

108.2.2. **Operator Factor.** For unknown reasons the aircrew forgot the barrier was raised in the approach overrun.

108.2.3. Operations Factor. Inadequate risk assessment resulted in a Numbered Air Force policy requiring the barrier to remain in the raised position where training operations were conducted. This policy created an unnecessary risk without any potential gain for other aircraft training operations. An inadequate risk assessment existed. Local MAJCOM guidance existed as required by directive, but no discussion of barriers was included (focus was on deconfliction and interagency coordination).

108.2.4. Human Factor. Limited experience combined with habit patterns, inattention, negative transference, distraction, and complacency created memory lapses in individuals involved in the mishap.

108.3. **Lesson Learned:**

108.3.1. The regulations and common sense required the barrier to be illuminated for obvious reasons. Regarding complacency, the crew consisted of two IPs as opposed to an instructor flying with a student, which may have led to complacency. Additionally, being familiar with the home field probably made them feel comfortable and added additional complacency. Another possible factor was risk assessment. A more thorough risk assessment by supervisors and the aircrew may have significantly reduced the likelihood of this accident.

108.4. **Actions Taken:**

108.4.1. Barrier guidance was revised and it was directed barriers be illuminated as required by existing regulations.

108.4.2. Guidance in AFI 13-204 Volume 3, Airfield Operations Procedures and Programs, was revised to require consideration of airfield conditions and flight profiles (tactical procedures) that may affect opposite direction operations.

109. Stall/Final Turn Breakout:

109.1. **Mishap.** **Figure 116**. The mission was a solo contact training mission. The student pilot proceeded to an auxiliary airfield and entered the pattern for practice approaches. The aircraft impacted the ground 9,000 feet from the runway and was destroyed. The student was fatally injured.

Figure 116. Stall/Final Turn Breakout.

109.2. **Investigation:**

109.2.1. **Operator Factor** . In violation of established directives, the student began an overhead pattern after another pilot reported at 5 NM on a straight-in approach. The RSU perceived no conflict and allowed both aircraft to continue on the approaches. This mishap student configured his aircraft for landing and started the final turn. In response to a query by the RSU, the straight-in pilot reported, “3 miles” followed 10 seconds later by, “2 miles, gear down”. Perceiving a conflict between the two aircraft, the RSU did not clear the straight-in aircraft for landing. The instructor pilot in the straight-in aircraft did not initiate a go-around when he was not cleared to land at 2 miles. The mishap student heard the straight-in call, “2 miles,” perceived a conflict, and initiated an improper breakout from the final turn. The student failed to add military power, and instead of going around, reversed his turn on the base leg. He inadvertently applied right trim as he rolled the aircraft. The student failed to maintain control of the aircraft and entered a right banked dive from which recovery was impossible. Channelized attention contributed to this error. The student ejected outside the safe ejection envelope and was fatally injured.

109.2.2. **Supervisory Factor** . The RSU failed to resolve the conflict by ensuring the straight-in crew went around. The RSU failed to provide adequate guidance to the mishap student when noting the improper breakout.

109.3. **Lesson Learned:**

109.3.1. There were numerous pilot and supervisory errors that caused this mishap. The rules require the straight-in aircraft to discontinue the approach when clearance is not received. Failure to follow procedures resulted in a conflict. The conflict led to the student's decision to break out, which was not in accordance with directives, and lessened his attention to aircraft control. The sequence of events resulted in unnecessary complications for the student. The human factor of channelized attention may have contributed to the student's failure to control his aircraft. The student may have been confused by the gear-warning horn and light activation when he raised the gear with the throttles retarded. Or, he may have been watching the straight-in aircraft as he passed it with minimal separation. In either case, he was not paying adequate attention to what should have been his top priority-maintaining aircraft control. RSU controllers must not be content to merely issue guidance to pilots in the traffic pattern. They must ensure directives are followed to maximum extent of their capabilities.

109.4. **Action Taken:**

109.4.1. Local straight-in procedures were revised to eliminate potential conflicts with aircraft in the overhead pattern.

Parting Thought

After reading through a number of the mishaps described within this handbook, it is clear that no one is exempt from making a mistake. I challenge each of you to take some time during your busy schedules to discuss these mishaps with your peers, students, and instructors. Focus not only on "what" happened, but more importantly "why" it happened. While a good number of these mishaps occurred long ago and some in an aircraft we no longer employ, there is a common theme in all of them – Airmanship. Airmanship is a skill that you are never finished developing. Each of you play a vital role by equipping others with the tools you have used through your learning experiences. Flying is a dangerous job and learning from each other is how we mitigate risks to an acceptable level. If we fail to maintain that cross flow of information, the next generation may end up repeating history. I think this idea is best summed up by the anonymous quote below…

We should all bear one thing in mind when we talk about a troop who rode one in. He called upon the sum of his knowledge and made a judgment. He believed in it so strongly that he knowingly bet his life on it. The fact that he was mistaken in his judgment is a tragedy, not stupidity. Every supervisor and contemporary who ever spoke to him had an opportunity to influence his judgment. So a little bit of all of us goes in with every troop we lose.

-Anonymous

DAVID J. HORNYAK, Colonel, USAF
Director of Safety

Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

References

AETCMAN 11-251, T-38C Flying Fundamentals

AETCI 11-204, Runway Supervisory Unit (RSU) Operations

AFI 11-290, Cockpit/Crew Resource Management Program, and its AETC Supplement

AFI 11-2T-1, Volume 3, T-1A Operations Procedures

AFI 11-418, Operations Supervision

AFI 13-204, Volume 3, Airfield Operations Procedures and Programs

AFI 21-101, Aircraft and Equipment Maintenance Management, and its AETC Supplement

AFMAN33-363, Management of Records

TO 1T-38A-1, AT-38B-1, TO 1T-38C-1, Flight Manual USAF Series T-38 Aircraft

Prescribed Forms

No Forms Prescribed

Adopted Forms

AF Form 847, *Recommendation for Change of Publication*

Abbreviations and Acronyms

ACE—accelerated copilot enrichment (program)

AGL—above ground level

AGSM—Anti-G straining maneuver

AHC—aircraft handling characteristics

AOA—angle of attack

ARSA—airport radar service area

BASH—bird aircraft strike hazard (program)

CAP—commander's awareness program

CRM—cockpit/crew resource management

CT—continuation training

DNIF—duties not including flying

FAF—final approach fix

FAIP—first assignment instructor pilot

FCF—functional check flight

FCP—front cockpit

FE—flight examiner

FP—first pilot

fpm—feet per minute

G-LOC—G—induced loss of consciousness

IAF—initial approach fix

IAW—in accordance with

IFR—instrument flight rules

ILS—instrument landing system

IMC—instrument meteorological conditions

IP/FAR—instructor pilot/fighter, attack, reconnaissance

IP—instructor pilot

KIAS—knots indicated airspeed

MACA—midair collision avoidance (program)

MDA—minimum descent altitude

MOA—military operating area

MP—mishap pilot

MSL—mean sea level

NAVAID—navigational aid

NDI—nondestructive inspection

NM/nm—nautical mile

PIO—pilot induced oscillation

PIT—pilot instructor training

RAPCON—radar approach control

RCP—rear cockpit

RPM/rpm—revolutions per minute

RSU—runway supervisory unit

SA—situational awareness

SM—statute miles

SOF—supervisor of flying

SP—student pilot

TACAN—tactical air navigation

TOLD—takeoff and landing data

TO—technical order

UHF—ultra high frequency

UIP—upgrade instructor pilot

UPT—undergraduate pilot training (now Specialized UPT or SUPT)

VFR—visual flight rules

VMC—visual meteorological conditions

VVI—vertical velocity indicator