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U.S. AIR FORCE

ROAD TO WINGS

T-37 CLASS A MISHAP SUMMARY 1972 THROUGH DECEMBER 2005

BY ORDER OF THE COMMANDER
AIR EDUCATION AND TRAINING COMMAND

AETC HANDBOOK 11-209

18 JANUARY 2006

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Flying Operations

T-37 ROAD TO WINGS

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The "ROAD TO WINGS" series is a 34-year account of AETC T-37 and T-38 aircraft mishaps. This particular handbook covers T-37 aircraft. (T-37 Class A Flight Mishap Summaries 1972 through December 2005.) This information in this handbook is not intended to establish procedures nor is it directive in nature. Its sole purpose is to provide pilot training activities with a source of lessons learned from history. The majority of mishaps contained herein involve undergraduate pilot training missions, and it is from this distinction the handbook derives its title. All information is historical with some now-obsolete references (for example, "ATC" is now "AETC"). This publication may be supplemented at any level, but all direct Supplements must be routed to the OPR of this publication for coordination prior to certification and approval. Submit requests for waivers through the chain of command to this Publication OPR for non-tiered compliance items. 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. 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).

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SUMMARY OF REVISIONS

This interim change revises the opening paragraph of this publication to be in compliance with AFI33-360, *Publications and Forms Management*. A margin bar (|) indicates newly revised material.

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PROLOGUE

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

Section A—Takeoff and Departure Mishaps

1. Stall/Loss of Thrust:

1.1. **Mishap (Figure 1.).** The student pilot (SP) and instructor pilot (IP) were on a scheduled training flight. The instructor to ensure takeoff time would be met performed the preflight check and exterior inspection. The takeoff and flight to the auxiliary field were normal. A let-down was made and a straight-in, no-flap approach was flown to the runway. The aircraft performance and engine indications were normal during the straight-in approach, landing, and takeoff. As 100 knots was attained during climb out, the student obtained permission to raise the gear. Gear retraction was normal. The student then raised the flap handle. Altitude was 100 to 150 feet above ground level (AGL) and airspeed was approximately 115 knots indicated air speed (KIAS). Shortly thereafter, the instructor pilot felt a burble similar to that produced by the landing lights when they are extended in the slipstream. The instructor took control of the aircraft and asked the student to check that the gear and flaps were up. The instructor also checked that the speed brakes were in. The instructor lowered the nose to level flight attitude. The aircraft felt like it was "mushing." The right engine rpm gauge indicated 33% with the left indicating 99%. There were no other indications of engine malfunction. The right throttle was full forward and movement of the throttle did not affect the rpm. The airspeed decreased rapidly. The aircraft was approximately 40 to 50 feet in the air when it began to sink. The aircraft contacted the runway tail first in a 5° to 10° nose-high attitude, followed by a whiplash down movement of the forward part of the aircraft. Both crew members were thrown forward until their shoulder harnesses locked. The aircraft skidded down the runway and went off the right side. The student jettisoned the canopy and went over the side. The instructor shut off the engines and followed the student. The instructor pilot and student pilot sustained contusions and muscle strains. Fortunately, there was no fire.

Figure 1. Stall/Loss of Thrust.

1.2. **Investigation:**

1.2.1. **Maintenance Factor.** Maintenance personnel were not familiar with the Technical Order (TO) l-lA-8, requirement to use new self-locking nuts in critical areas. The retaining nut on the connector bolt in the right engine throttle linkage was improperly installed, or a nut was used that had lost its self-locking feature, which allowed a throttle linkage disconnect to occur. This rendered the right engine unusable during a critical phase of flight.

1.2.2. **Supervisory Factor.** The instructor pilot failed to recognize and take appropriate corrective action for a loss of thrust after takeoff.

1.3. **Lesson Learned.** Although the pilot was placed in a difficult situation by the loss of thrust on one engine during a critical phase of flight, it does not follow that this condition should result in a mishap. With the existing altitude, airspeed and minimal remaining runway available, the decision to take off was appropriate. However, the pilot's failure to sufficiently decrease the pitch altitude immediately after engine failure resulted in a stalled condition. Pilots must remember that step one in any emergency is to maintain aircraft control before attempting to analyze the situation.

1.4. **Action Taken.** Maintenance personnel were made aware of all aspects of this mishap. Briefings emphasized the importance of strict compliance with tech data and the necessity for the submission of AFTO IMT 22, **Technical Manual (TM) Change Recommendation,** to effect appropriate changes

when TO deficiencies are recognized. Additionally, all production inspectors were made fully aware of their responsibilities in assuring accuracy and completeness of maintenance actions.

2. Departure Crash:

2.1. **Mishap (Figure 2.).** 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 the 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.

Figure 2. Departure Crash.

2.2. **Investigation - 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 turn out 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.

2.3. **Lesson Learned.** 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.

2.4. **Action Taken.** The governing directive was amended to include minimum airspeed and altitude requirements for traffic departures.

3. Departure Crash/MOA:

3.1. **Mishap (Figure 3.).** 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 3. Departure Crash/MOA.

3.2. **Investigation:**

3.2.1. **Supervisory Factor.** Operational and medical guidance was not sufficiently coordinated to ensure supervisors understood the phenomenon of manifestation of apprehension (MOA). The mishap student exhibited symptoms of MOA 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 MOA, 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.

3.2.2. **Medical Support 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.

3.2.3. **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. MOA contributed to this error.

3.3. **Lesson Learned:**

3.3.1. This mishap revealed the need for better MOA 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 MOA.

3.3.2. 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.

3.4. **Action Taken.** Guidance and an educational program were developed to aid in identifying and handling students exhibiting symptoms of MOA, paying particular attention to students on special monitoring status.

Section B—Disorientation and Loss of Control Mishaps

4. Lost Control—Area/Unintentional Spin:

4.1. **Mishap (Figure 4.).** 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 4. Lost Control—Area/Unintentional Spin.

4.2. **Investigation:**

4.2.1. **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.

4.2.2. **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.

4.3. **Lesson Learned:**

4.3.1. 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.

4.3.2. 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.

4.4. **Action Taken:**

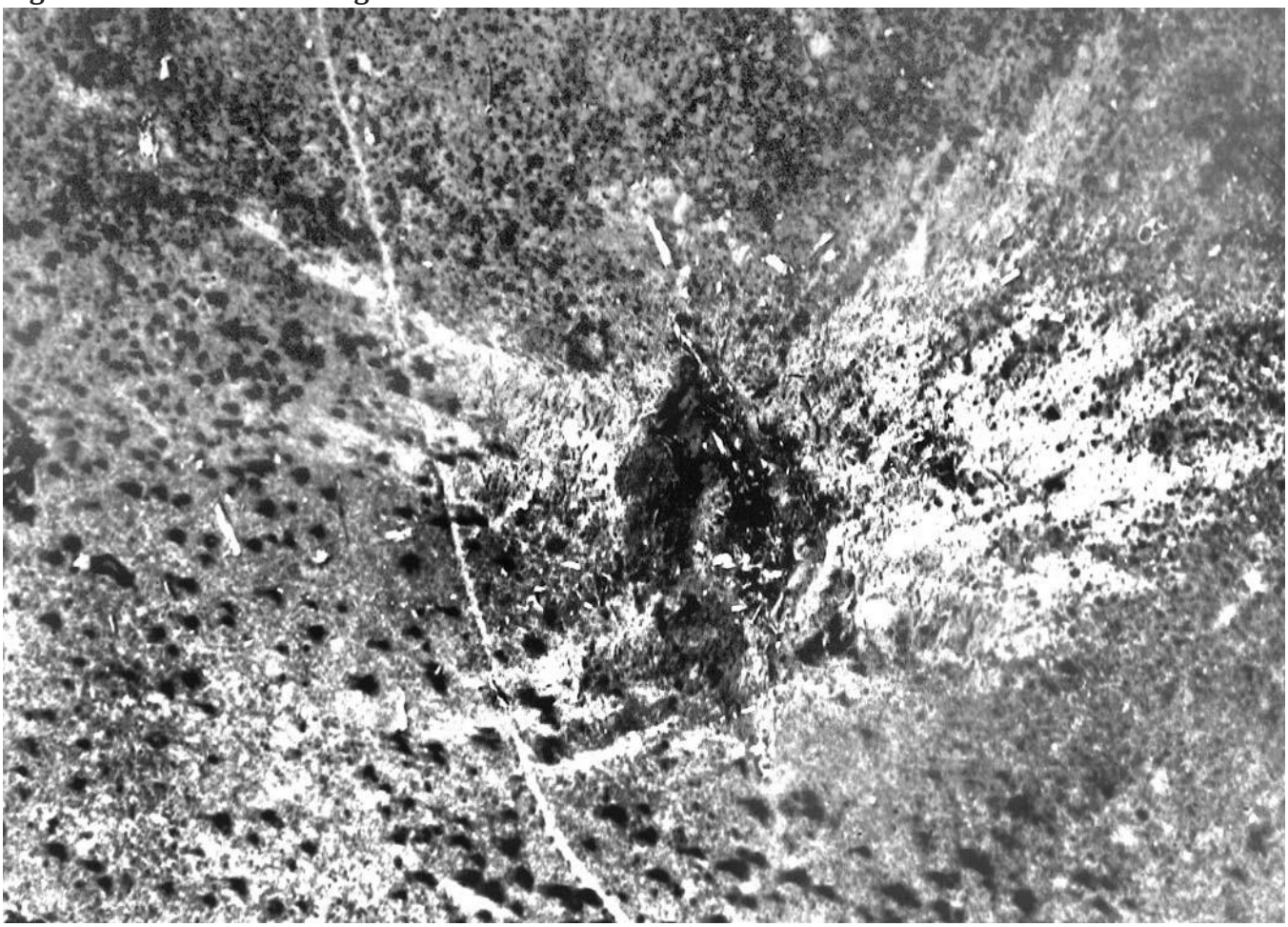
4.4.1. All T-37 pilots were briefed on this accident. The need for alertness and quick control response during slow-flight, stall-entry and recovery training were stressed.

4.4.2. The TO 1T-37B-l, Flight Manual USAF Series, T-37B Aircraft, 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.

5. Disorientation/Night—Area:

5.1. **Mishap (Figure 5.).** 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 160°. 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 5. Disorientation/Night—Area.



5.2. **Investigation:**

5.2.1. **Supervisory Factor.** The pilot training squadron did not have procedures established to ensure the supervisor of flying (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 miles. This allowed the aircraft to enter weather that may have contributed to the pilot's disorientation.

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

5.3. **Lesson Learned.** 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.

5.4. **Action Taken:**

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

5.4.2. 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.

5.4.3. 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.

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

6. Spin—No Recovery:

6.1. **Mishap (Figure 6.).** 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 6. Spin—No Recovery.

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

6.3. **Lesson Learned:**

6.3.1. Recovery techniques described in TO IT-37B-l 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 T-37 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.

6.3.2. 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.

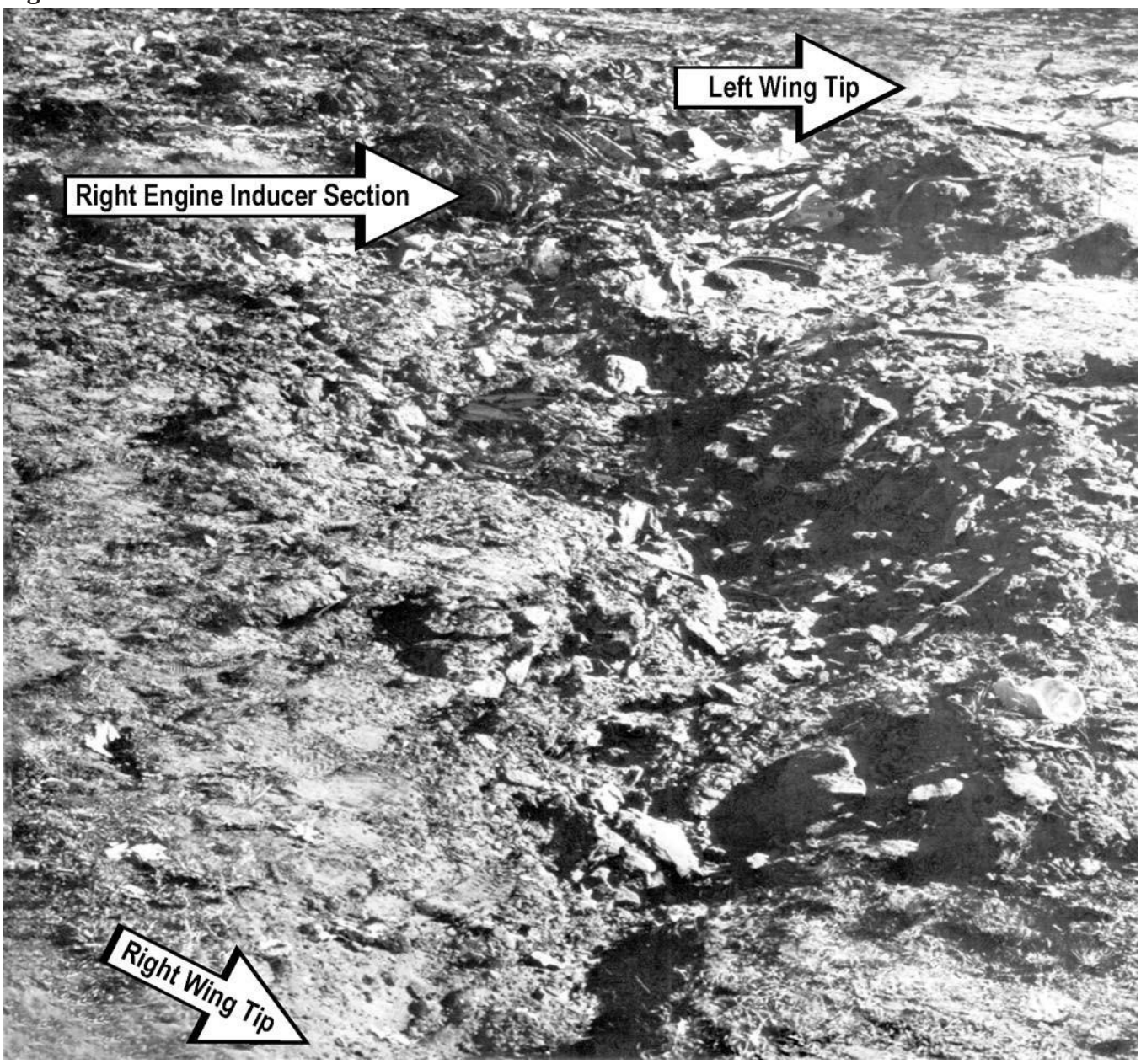
6.4. **Action Taken.** All T-37 instructor pilots were directed to receive a spin demonstration flight at their home stations approximately 6 months after becoming instructor qualified.

7. Lost Control—Area:

7.1. **Mishap (Figure 7.).** 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 7. Lost Control—Area.



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

7.3. **Lesson Learned.** Formulating a lesson learned is impractical because the cause of the mishap could not be determined. One thing we do know is despite the malfunction, the aircrew failed to make a timely decision to eject.

7.4. **Action Taken.** 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.

8. Lost Control—Area/High Speed Dive:

8.1. **Mishap (Figure 8.).** 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.

Figure 8. Lost Control—Area/High Speed Dive.

8.2. **Investigation:**

8.2.1. **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.

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

8.2.3. **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.

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

8.3. **Lesson Learned:**

8.3.1. 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.

8.3.2. 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.

8.4. **Action Taken:**

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

8.4.2. A study was conducted to determine the feasibility of establishing a single nose down elevator trim limit for all T-37B aircraft to avoid possible confusion and simplify maintenance requirements.

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

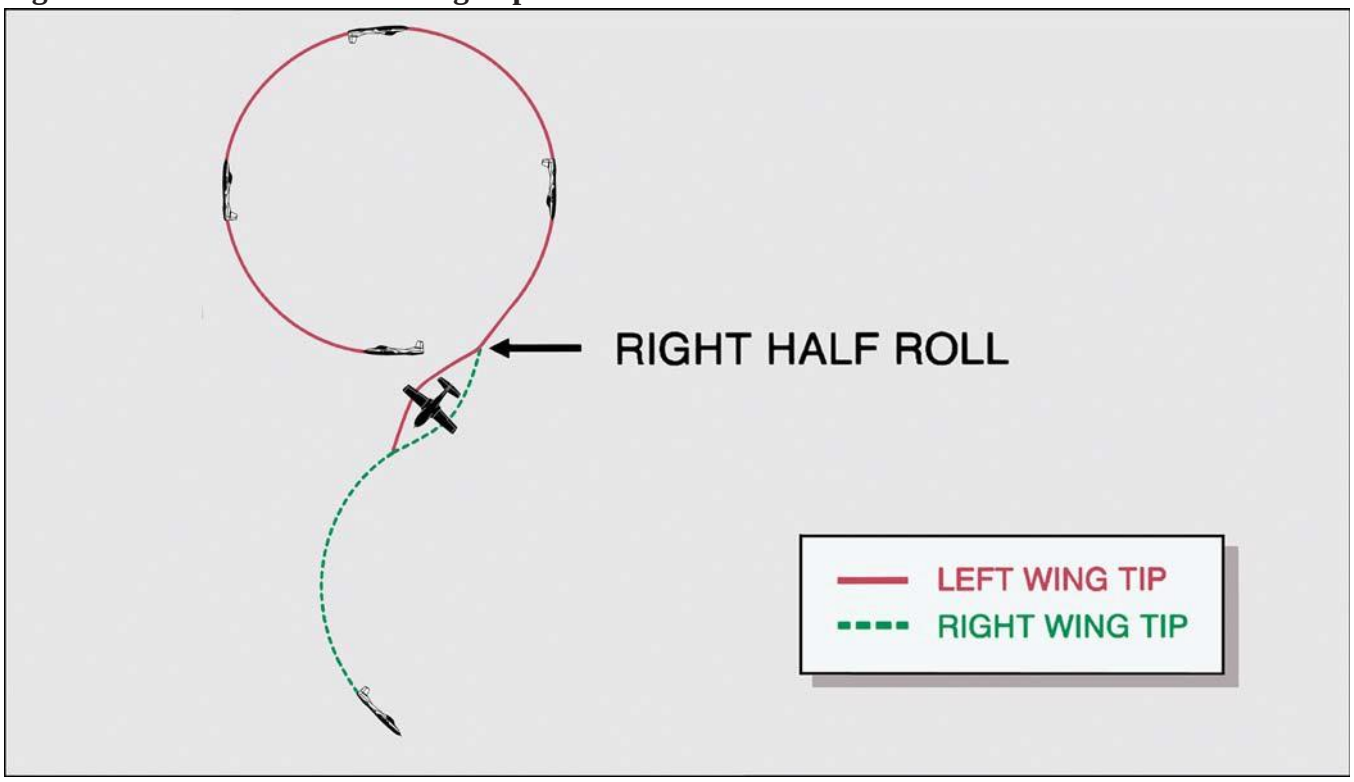
8.4.4. The governing directive was revised to alert pilots to the hazards of inadvertent trim inputs.

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

9. Lost Control—Area/High Speed Dive:

9.1. **Mishap (Figure 9.).** 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 9. Lost Control—Area/High Speed Dive.



9.2. **Investigation:**

9.2.1. **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.

9.2.2. **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.

9.3. **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.

9.4. **Action Taken:**

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

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

10. Lost Control—Area/Unintentional Spin:

10.1. **Mishap (Figure 10.).** 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 10. Lost Control—Area/Unintentional Spin.

10.2. **Investigation - Operator Factor.** The student stalled the aircraft during an attempted cloverleaf 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.

10.3. **Lesson Learned:**

10.3.1. 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.

10.3.2. 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.

10.4. **Action Taken:**

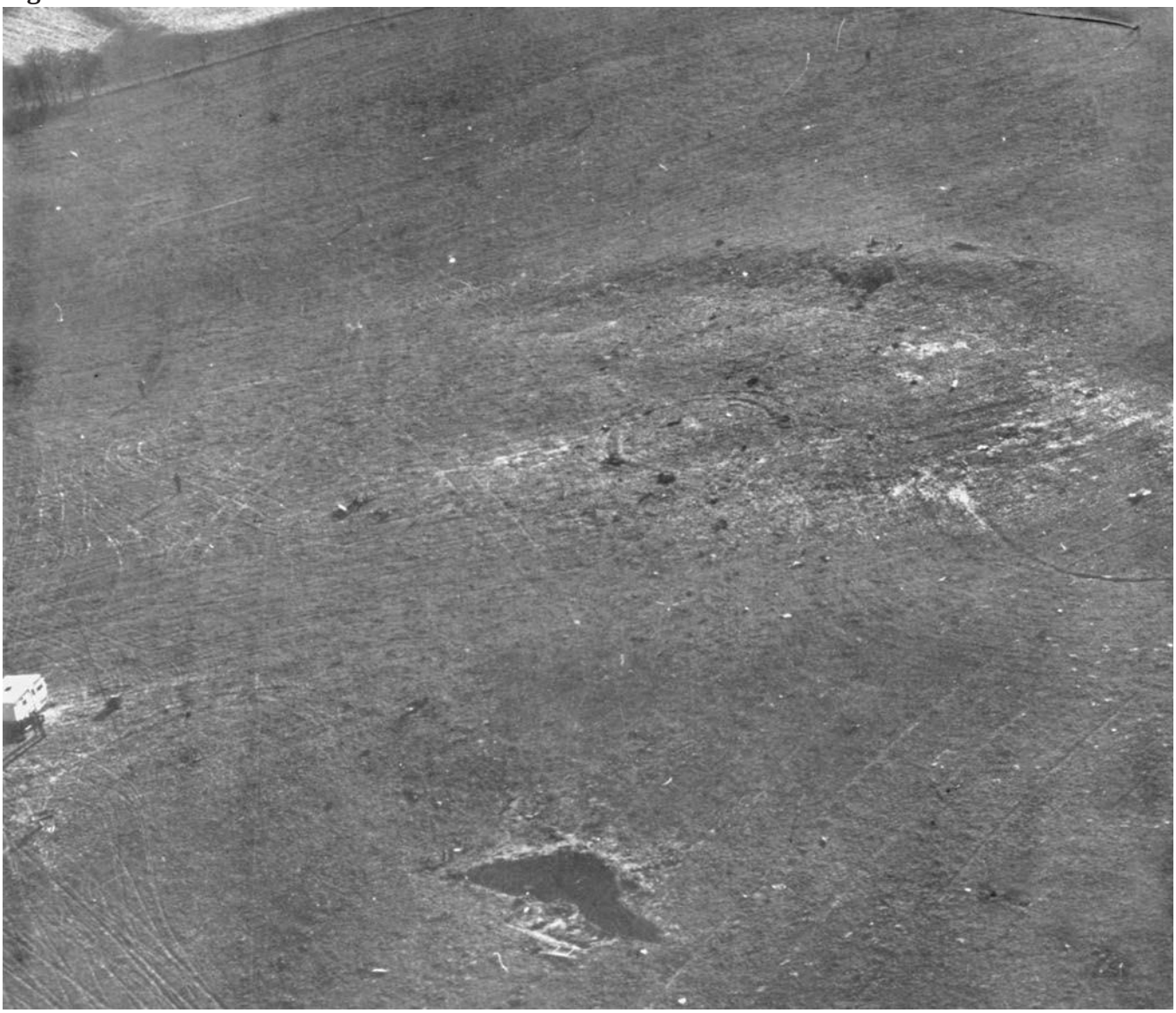
10.4.1. The T-37 syllabus was changed to require students to demonstrate proficiency in the single spin recovery throughout the contact phase of training.

10.4.2. 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 T-37 aircraft can stall in any attitude and at any airspeed.

11. Lost Control—Area:

11.1. **Mishap (Figure 11.).** 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 11. Lost Control—Area.



11.2. **Investigation:**

11.2.1. **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.

11.2.2. **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.

11.3. **Lesson Learned:**

11.3.1. 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.

11.3.2. 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.

11.4. **Action Taken.** 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.

12. Disorientation/Instrument Approach:

12.1. **Mishap (Figure 12.).** 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° and descend to 2,000 feet MSL. Clouds were entered at 2,500 feet MSL. While in a descending right turn approximately 12 nautical miles (NM) from the field, a "dogleg" heading of 290° was given and acknowledged along with a final descent to 1,800 feet MSL. He rolled wings level on a heading of 290°. He felt somewhat dizzy and selected 100 % oxygen. The instructor pilot then was instructed to turn to 315°, and he lowered gear and flaps at 10 miles remaining. The aircraft was left of course and radar control gave successive headings of 320°, 325°, and 330°. 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 12. Disorientation/Instrument Approach.

12.2. **Investigation -** 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 T-37 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.

12.3. **Lesson Learned:**

12.3.1. Location of cockpit instrumentation makes the T-37 only marginally suitable for instrument flight. However, it is unlikely changes will be incorporated in this aircraft due to the age of the aircraft and its replacement schedule. Pilots must recognize and compensate for this deficiency.

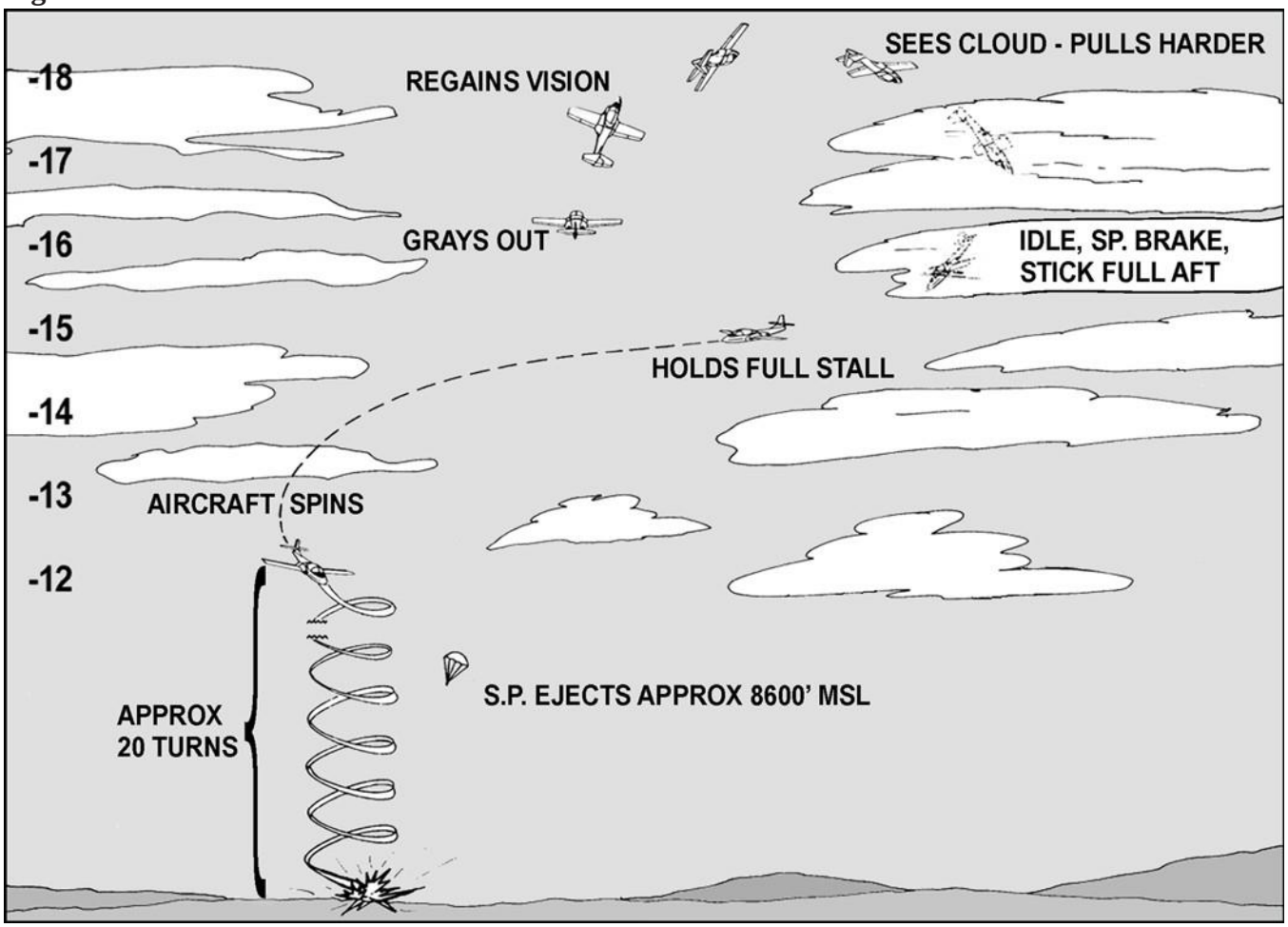
12.3.2. Pilots must understand that spatial disorientation is a killer. It is absolutely essential to concentrate on the instruments and/or transfer control of the aircraft to the other pilot. In this incident, the instructor pilot's decision to abandon the aircraft when he felt he was no longer in control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

12.4. **Action Taken.** TO lT-37B-l oxygen system emergency operation procedure was changed to read, "Breathe at a rate and depth slightly less than normal until symptoms disappear."

13. Disorientation—Area/Weather:

13.1. **Mishap (Figure 13.).** 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 13. Disorientation—Area/Weather.



13.2. **Investigation:**

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

13.2.2. **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.

13.3. **Lesson Learned:**

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

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

13.4. **Action Taken.** T-37 and T-38 mission briefing guides were reorganized, making the "alternate mission profile" a mandatory briefing item.

14. Lost Control—Area/Air Discipline:

14.1. **Mishap (Figure 14.).** 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 14. Lost Control—Area/Air Discipline.

14.2. **Investigation:**

14.2.1. **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.

14.2.2. **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.

14.3. **Lesson Learned.** There was substantial evidence the mishap pilot may have intentionally departed his assigned area. The student pilot's attitude during UPT, although unnoticed by instructors, reflected a tendency to observe only the regulations and rules he felt were important. This mishap

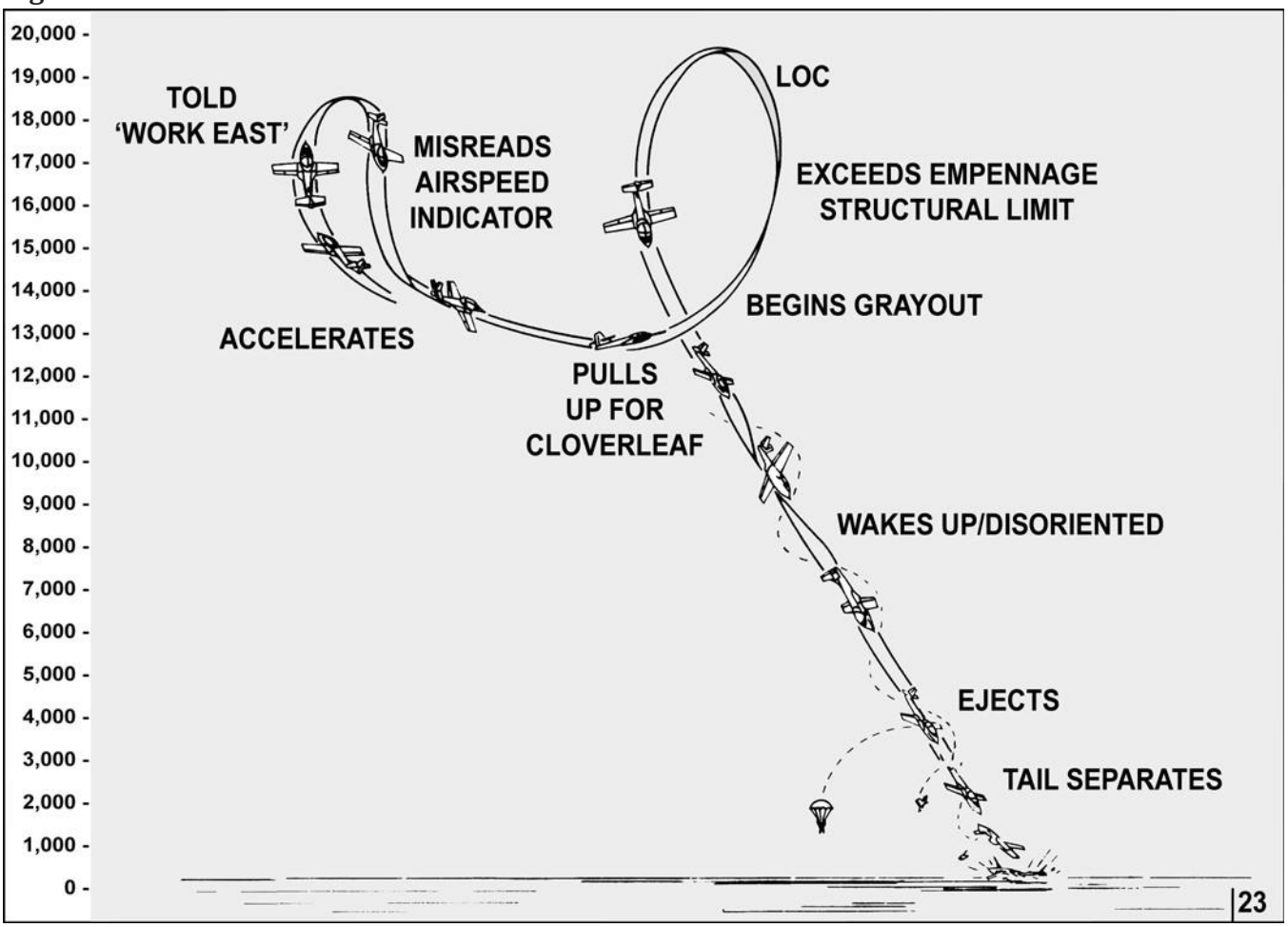
indicates a need for increased awareness by instructors to detect and eliminate from training student pilots who display poor air discipline characteristics. Additionally, peers must not dismiss their responsibilities concerning air discipline by silently condoning such violations. Tolerance of poor air discipline breeds poor air discipline.

14.4. **Action Taken.** UPT Aircraft Mishap Prevention Briefing AMP03, Air Discipline and Judgment, was modified to address individual and peer responsibilities related to flight discipline.

15. Lost Control—Area/Over G:

15.1. **Mishap (Figure 15.).** 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.

Figure 15. Lost Control—Area/Over G.



15.2. **Investigation -** 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.

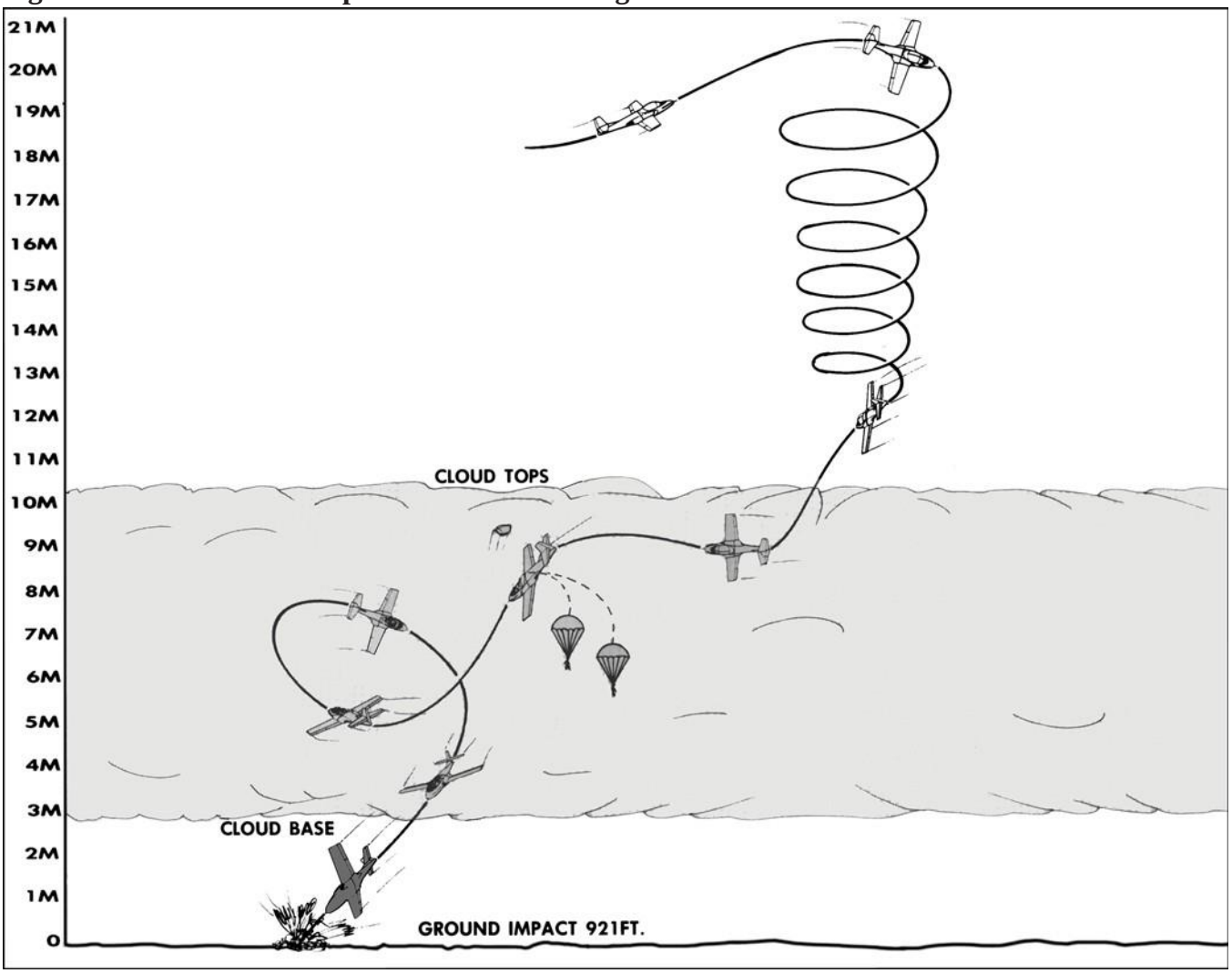
15.3. **Lesson Learned.** Abrupt stick movements can induce a failure load on the stabilizer. These loads can occur within the normal operational flight envelope depending on aircraft weight, center of gravity, roll rate, and rate of elevator deflection. Pilot technique determines the potential for overloading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

15.4. **Action Taken.** TO 1T-37B-l was amended to inform pilots of the hazards of abrupt control movements at high airspeeds.

16. Disorientation/Spin Demonstration Flight:

16.1. **Mishap (Figure 16.).** 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 16. Disorientation/Spin Demonstration Flight.



16.2. **Investigation:**

16.2.1. **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.

16.2.2. **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.”

16.3. **Lesson Learned.** 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.

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

17. Spin—No Recovery:

17.1. **Mishap (Figure 17.).** The mission was a contact tactical navigation training sortie flown by an instructor pilot with a navigator trainee. The purpose of the flight was to familiarize the navigator trainee with fighter-type aircraft performance characteristics. The takeoff, departure, and initial area maneuvers were uneventful. The instructor pilot then performed an intentional spin entry for the purpose of demonstrating a spin and a spin recovery. The instructor pilot applied the spin recovery procedure several times but the aircraft failed to recover. Both crewmembers successfully ejected passing approximately 5,300 feet AGL.

Figure 17. Spin—No Recovery.

17.2. **Investigation - Logistics Factor.** The investigation concluded this mishap was the result of inadequate technical order inspection procedures. These inspection procedures failed to adequately define how to detect internal corrosion of flight control cables. Internal corrosion of the elevator down cable eventually resulted in a frayed, swollen, and significantly weakened cable. When the instructor

pilot moved the control stick abruptly full forward during the spin recovery attempt, the weakened cable broke, rendering the elevator ineffective for nose-down deflection. Without a nose-down elevator, a spin recovery is not possible.

17.3. **Lesson Learned.** Carbon steel flight control cables are susceptible to corrosion. In order to be effective, an inspection procedure of the flight control cables must be able to detect internal corrosion as well as external corrosion.

17.4. **Action Taken:**

17.4.1. Carbon steel flight control cables became a time change item. Replacement cycle is at 2000-hour intervals.

17.4.2. X-ray inspections are now performed at flight control critical points in order to detect any internal anomalies in the flight control cables.

18. Lost Control—G-LOC (Solo-Contact Sortie):

18.1. **Mishap (Figure 18.).** 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 18. Lost Control—G-LOC (Solo-Contact Sortie).

18.2. **Investigation - 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 air-

craft 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.

18.3. **Lesson Learned.** 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-made a timely decision to eject.

18.4. **Action Taken.** 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.

19. Lost Control/G-LOC:

19.1. **Mishap (Figure 19.).** The mission was the student's fourth T-37 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 19. Lost Control/G-LOC.

19.2. **Investigation - 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.

19.3. **Lesson Learned.** 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.

19.4. **Action Taken:**

19.4.1. Training has been revised to ensure T-37 instructors teach AGSM techniques that are consistent with AF level guidance. Specifically, the T-37 Instructor Techniques guide needs to fully describe breathing techniques for the AGSM.

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

19.4.3. Additional information was to be included in AFMAN 11-249, T-37B Primary Flying, to more adequately describe how to perform the AGSM.

19.4.4. A proposal was made to make the AGSM a graded maneuver for T-37 contact and formation missions.

Section C—Miscellaneous Mishaps

20. Unconfirmed Aircraft Fire/Engine Shutdown:

20.1. **Mishap (Figure 20.).** The student pilot was on a solo aerobatics mission. The flight proceeded without incident until entering a lazy-8 maneuver when the student noted both engine fire-warning lights were illuminated. He leveled the aircraft and turned toward home base. He then noted smoke in

the cockpit, an erratic rpm and a high exhaust gas temperature on both engines. He also noticed smoke billowing over the right wing. He shut down both engines, zoomed the aircraft, and ejected. The aircraft was destroyed upon ground impact. The student was uninjured.

Figure 20. Unconfirmed Aircraft Fire/Engine Shutdown.

20.2. **Investigation:**

20.2.1. **Undetermined Factor.** For some reason, the student pilot perceived that both fire warning lights were illuminated. Smoke was entering the cockpit, which was possibly due to cockpit glare from sunlight or an aircraft system malfunction other than engine fire.

20.2.2. **Operator Factor.** While investigating for further evidence of a fire, the student pilot misinterpreted engine instrument indications, saw an illusion of smoke billowing over the right wing, and incorrectly analyzed the emergency, probably due to apprehension. As a result, he ejected from a flyable aircraft at approximately 10,000 feet AGL.

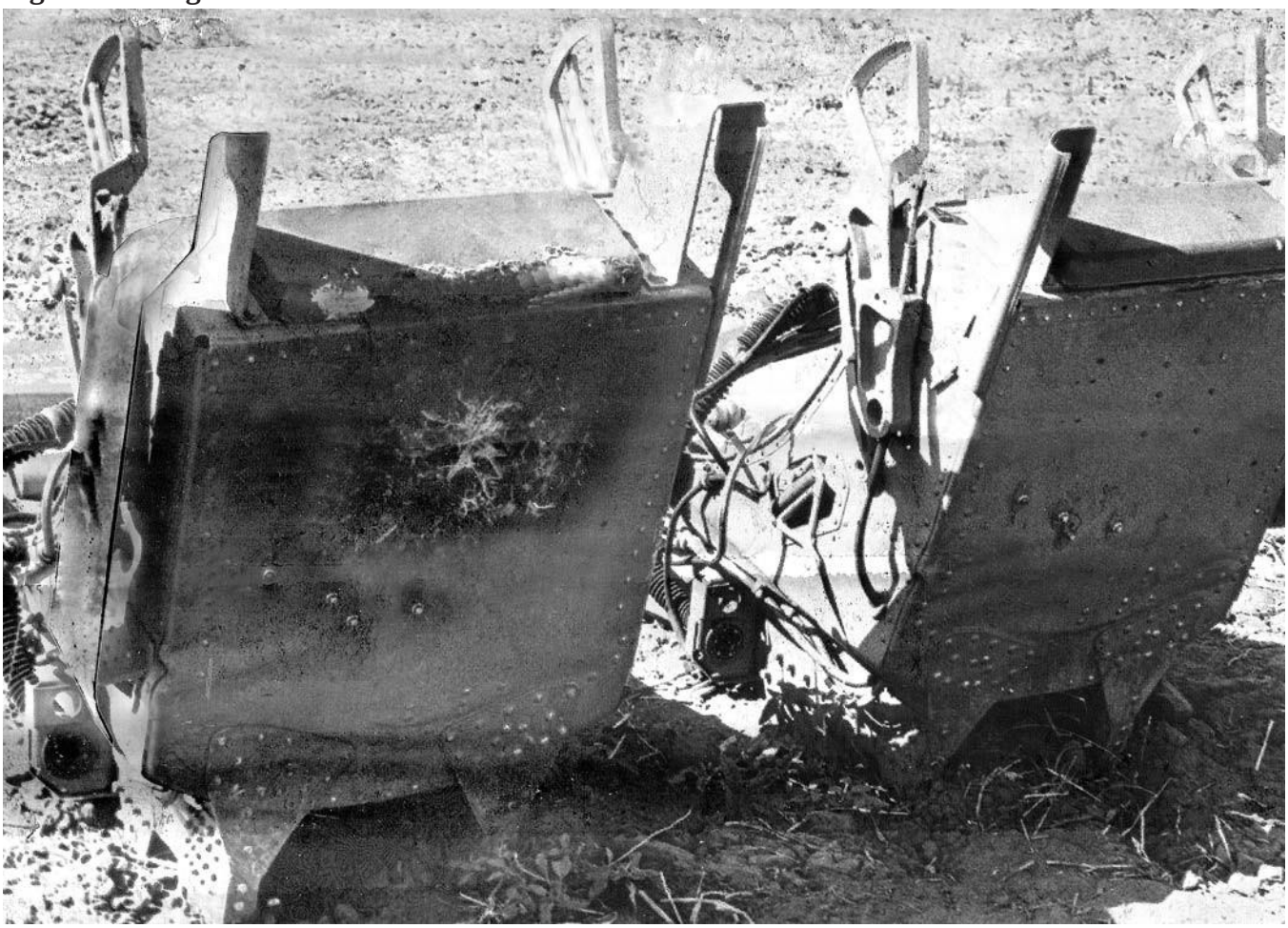
20.3. **Lesson Learned.** This mishap touched on several areas of human frailty that are difficult to evaluate and even more difficult to prevent. Human factors—pilot errors—are the most frequent causes of mishaps. Over 80% of all Class A mishaps are directly attributed to human error. Pilots should understand inherent human limitations and realize the best defense against a pilot-error mishap is adequate training and complete system and mission knowledge.

20.4. **Action Taken.** Research was conducted to determine the effects of anxiety in high stress situations; for example, aircraft in-flight emergencies effect on air crewmembers' abilities to analyze problems and execute appropriate emergency procedures. The studies addressed variables in air crewmember experience, proficiency and training, and whether or not the flight was solo.

21. Engine Fire—Area:

21.1. **Mishap (Figure 21.).** The mishap aircraft was on an advanced contact mission. The student pilot had just completed slow flight when both the student and instructor pilot heard a thump behind and between the seats. This was immediately followed by illumination of the overheat warning light for the right engine. The instructor pilot assumed control of the aircraft, shut down the right engine using the T-handle and then the throttle, declared an emergency and turned toward the home station. Smoke entering the cockpit prevented the instructor pilot from seeing the instrument panel, and the canopy was jettisoned. Shortly thereafter, the instructor pilot ordered ejection due to fire entering the cockpit near his right leg. Both crew members ejected, sustaining no significant injuries. The aircraft was destroyed upon ground impact.

Figure 21. Engine Fire—Area.



21.2. **Investigation:**

21.2.1. **Logistics Factor.** TO guidance was inadequate to ensure sufficient protection was provided to J-69 fuel hoses to guard against chafing. A maintenance TO was inadequate because it did not contain sufficient guidance to ensure a proper fire seal after identification and repair of the throttle linkage cutout (an opening where the throttle cable passes through the fire seal). The flight manual was inadequate because its guidance concerning a high fuel flow indication was incomplete and misleading. Sometime prior to flight as a result of the inadequate TO guidance, mainte-

nance personnel enlarged the throttle linkage cutout so the cover for the firewall seal was no longer effective.

21.2.2. **Maintenance Factor.** Personnel failed to perform an adequate inspection of the firewall in accordance with TO guidance. During flight, as a result of the inadequate TO guidance regarding protection of the J-69 fuel hoses, a fuel hose in the right forward engine nacelle developed a leak, probably due to chafing. The instructor pilot detected a fuel flow imbalance but, as a result of the inadequate guidance in the flight manual, he did not analyze this as a high fuel flow situation and possible fuel leak. The leaking fuel and/or vapors passed through the enlarged throttle linkage cutout in the fire seal and ignited on the hot section of the engine. The fire spread immediately through the hole into the forward engine nacelle. When the fire warning light illuminated, the instructor pilot immediately shut down the right engine by pulling the fuel shutoff T-handle and placing the throttle in cutoff.

21.2.3. **Logistics Factor.** For an undetermined reason, the fuel shutoff valve failed to close, allowing the fuel to continue leaking, thus sustaining the fire. Excessive smoke necessitated jettisoning the canopy; shortly thereafter, the fire penetrated into the cockpit and the crew ejected.

21.3. **Lesson Learned:**

21.3.1. In this mishap TO guidance did not sufficiently emphasize the criticality of the lower engine fire seal or require adequate checks of this area. The guidance did not provide the necessary criteria to perform adequate inspections.

21.3.2. The crew properly applied emergency procedures in an attempt to control a serious situation. When it became apparent the fire was not controllable, they appropriately elected to abandon the aircraft.

21.4. **Action Taken:**

21.4.1. Basic post flight inspection was revised to include checking fuel lines for chafing or cuts, leakage, and security; and the following warning was added to the maintenance TOs:

WARNING

An undetected chafe, cut, or leaking fuel line could result in an in-flight fire.

21.4.2. An engineering analysis was made to determine the serviceability of the present engine fire seal.

21.4.3. A paragraph was added to the maintenance TO to carefully detail the specifications for repair and modification to the throttle linkage cutout in the engine fire seal.

21.4.4. TO IT-37B-l, section III, guidance for engine fire and overheat, was revised to include guidance concerning positive indications of fuel shutoff valve closing (such as fuel flow and rpm drop), possible malfunctions and alternatives available if the fuel shutoff valve does not close.

21.4.5. TO 1 T-37B-l, section III, was changed to correct information regarding indications of a high fuel flow imbalance. This revision, based on a detailed engineering analysis, provides aircrews with information upon which to base their corrective action.

22. Engine Fire—Area:

22.1. **Mishap (Figure 22.).** The mission was a solo-contact training mission. As the student pilot was performing a loop, the right engine failed. The student then noted illumination of the left engine overheat light. The student initiated an emergency recovery to the auxiliary airfield. Smoke and fumes entered the cockpit, gradually becoming very heavy, and the student jettisoned the canopy. The heavy smoke was still present, and the student ejected. The aircraft impacted the ground and was destroyed. The student was not injured.

Figure 22. Engine Fire—Area.

22.2. **Investigation:**

22.2.1. **Supervisory Factor.** The discussion of spiral wrapping the engine oil hoses in the maintenance TO was inadequate. Training and supervision of personnel performing 90-day inspections and basic post flight inspections were inadequate. As a result of the TO deficiency, the left engine oil pressure hose was spiral wrapped under a support clamp, making it difficult to fit the prescribed clamp over the hose. The engine technician used a larger clamp than the one that was authorized in the TO to clamp the oil pressure hose. Over time, the rubber insert in the improper clamp aged and was lost, and the clamp began to chafe the hose.

22.2.2. **Logistic Factor.** At an undetermined time, a bolt in the front main bearing cage group of the right engine became detached. The bolt may have failed or it may have been improperly torqued during the bearing cage assembly. As the student pilot was performing a loop, the detached bolt entered the accessory drive, resulting in failure of the right engine. As the student attempted to cope with the right engine problem, the left engine oil pressure hose chafed through. Smoke entered the cockpit and an oil fire occurred, giving the student indications of engine over-

heat. The smoke reduced cockpit visibility and did not abate even after the student jettisoned the canopy.

22.3. **Lesson Learned.** In evaluating the student pilot's performance, we must understand the difficult situation facing him. The student was tasked with handling a compound emergency while shrouded in smoke. The student's decision to eject was well founded because the situation—a failed right engine and an overheating left engine—prevented him from accomplishing the procedures necessary to handle the aircraft malfunctions. His efforts to recover the aircraft placed him near the minimum recommended ejection altitude when he made a timely decision to bailout.

22.4. **Action Taken:**

22.4.1. Each flying wing reviewed the adequacy of supervision and training of personnel conducting aircraft basic post flight inspections as well as the quality of those inspections.

22.4.2. Specific guidance was placed in the maintenance TO directing inspection of engine and engine compartment hoses for chafing and security.

22.4.3. Maintenance TOs were revised to identify specific hoses and clamps to be installed on the J-69 engine with additional instructions on the proper use of Teflon spiral wrap to prevent chafing.

23. Dual Engine Failure—Area:

23.1. **Mishap (Figure 23.).** The mission was a solo-contact sortie. The student pilot entered the assigned area and accomplished pre-briefed aerobatic maneuvers. While performing an aileron roll, the fuel boost pump failed during less than a one-G flight and both engines flamed out. The student pilot performed several unsuccessful attempts to restart the engines. A successful ejection was performed at approximately 4,000 feet AGL. The aircraft was destroyed upon ground impact. The student pilot sustained a major leg injury during the parachute-landing fall.

Figure 23. Dual Engine Failure—Area.

23.2. **Investigation:**

23.2.1. **Logistics Factor.** A design limitation exists in the T-37 fuel boost pump bypass mode, which prevents engine restart after a flameout during less than a one-G flight, caused by a failed fuel boost pump. The student pilot initiated an aileron roll, which probably resulted in less than a one-G flight. The fuel boost pump failed as a result of an electrical short in the motor or circuit wiring. Air was drawn into the fuel lines, which cavitated both engine driven fuel pumps and prevented an engine restart.

23.2.2. **Operations Factor/Supervision.** A warning in TO 1T-37B-1 was misleading when it indicated, "maneuvers resulting in prolonged negative "G" forces (5 seconds or more)" are required in order for an engine flameout to occur if the fuel boost pump has failed. This mishap occurred when less than one-G was maintained for less than 5 seconds after the fuel boost pump failure.

23.3. **Lesson Learned.** The bypass system in the lower fuel boost pump housing does not have a free-floating pickup which makes it susceptible to cavitation when the fuel boost pump fails at less

than one-G flight. This mishap emphasizes the importance of the pre-aerobatic check to ensure the fuel boost pump is operating.

23.4. **Action Taken:**

23.4.1. Acquisition of a replacement fuel boost pump with a higher mean time between failures has been expedited.

23.4.2. The following warning was added to TO 1T-37B-l:

WARNING
If boost pump is inoperative, the engines will flame out during less than one-G flight conditions and an airstart will be prevented by an airlock. If boost pump is inoperative, land as soon as practical.

24. Engine Failure/Fire:

24.1. **Mishap (Figure 24.).** The mission was a local dual-contact sortie flown with a student from the Fixed Wing Qualification Course. This was the first sortie of the day for the instructor and the second for the student. The crew departed the base, asked for, and received permission to fly the standard routing to the auxiliary airfield. While in the traffic pattern, the student accomplished a no-flap straight-in approach and landing and a normal overhead pattern and landing. The instructor pilot then flew a pattern and returned control back to the trainee for a simulated single-engine pattern and landing. On climb out and accelerating through 115 KIAS, both crewmembers heard a loud bang from the left side. A scraping noise and vibrations followed the bang. At the same time the bang was heard, crew members from a trailing T-37 and the RSU observer saw smoke coming from the aircraft. The instructor pilot took control, checked both throttles in military, and lowered the nose-to accelerate. A closed pattern was begun while emergency procedures were accomplished. Smoke began to enter the cockpit and at times became so thick the IP had difficulty seeing the instruments in the cockpit. The instructor checked the fire light and, seeing it on steady, directed an ejection. The ejection was successful; the aircraft impacted the ground and was destroyed.

Figure 24. Engine Failure/Fire.

24.2. **Investigation - Logistics Factor.** The engine failure and crash were the result of the failure of the number one compressor inducer rotor assembly. The failure originated from fatigue or stress corrosion cracks on the balance ring of the rotor. These cracks developed at an unknown time. The cracks were most likely the result of maintenance mishandling, storage in a corrosive environment, or improperly manufactured compressor rotor.

24.3. **Lesson Learned:**

24.3.1. In this mishap, TOs did not give sufficient guidance for the handling, storage, and repair of compressor rotors to prevent the formation of stress corrosion and high-cycle fatigue cracks.

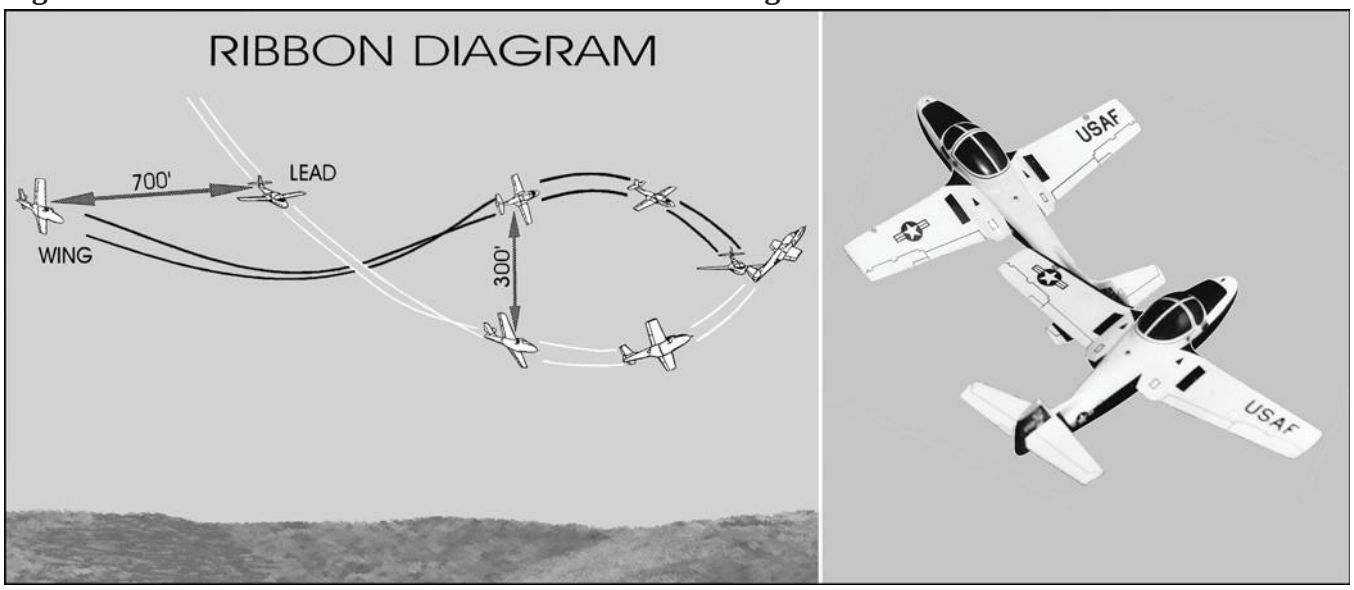
24.3.2. In this instance, the crew properly applied emergency procedures in an attempt to control a serious situation. When it appeared the fire was not controllable, the crew appropriately elected to abandon the aircraft.

24.4. **Action Taken.** Quality assurance inspectors were tasked to perform in-house, followup inspections of J-69 engine buildup with special emphasis on inspection of the compressor rotor.

25. Midair Collision/Extended Trail Maneuvering:

25.1. **Mishap (Figure 25.).** 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 25. Midair Collision/Extended Trail Maneuvering.



25.2. **Investigation:**

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

25.2.2. **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.

25.3. **Lesson Learned.** 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.

25.4. **Action Taken.** Breakout and knock-it-off terminology was redefined.

26. Midair Collision/Practice Breakout:

26.1. **Mishap (Figure 26.).** 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 26. Midair Collision/Practice Breakout.

26.2. **Investigation:**

26.2.1. **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 T-37'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.

26.2.2. **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.

26.3. **Lesson Learned:**

26.3.1. The T-37's side-by-side seating makes it difficult to see the other aircraft cross-cockpit without using the mirror. This problem is more manifest in the T-37 than with tandem seating arrangements like the T-**38.** 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.

26.3.2. 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 of this mishap.

26.3.3. 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.

26.4. **Action Taken:**

26.4.1. AFMAN 11-249, *T-37B Primary Flying,* 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.

26.4.2. AFMAN 11-249 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.

26.4.3. Greater emphasis to be placed on T-37 formation breakout, formation crew coordination and lost sight procedures.

27. Midair Collision/Civilian Aircraft:

27.1. **Mishap (Figure 27.).** 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 T-37'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 T-37 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 27. Midair Collision/Civilian Aircraft.

27.2. **Investigation - 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.

27.3. **Lesson Learned.** 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.

27.4. **Action Taken.** None.

Section D—Landing Mishaps

28. Traffic Pattern Stall:

28.1. **Mishap (Figure 28.).** 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 28. Traffic Pattern Stall.

28.2. **Investigation:**

28.2.1. **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.

28.2.2. **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.

28.3. **Lesson Learned:**

28.3.1. 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.

28.3.2. 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.

28.4. **Action Taken:**

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

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

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

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

28.4.5. More detailed information on the modes of failure of the T-37 air-conditioning system was incorporated into appropriate academic syllabi and learning center programs.

29. Engine Failure:

29.1. **Mishap (Figure 29.).** 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 29. Engine Failure.

29.2. **Investigation:**

29.2.1. **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.

29.2.2. **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.

29.3. **Lesson Learned:**

29.3.1. Perhaps some experienced pilots feel somewhat annoyed when a flight manual directs something so inherently obvious as maintaining aircraft control during an emergency situation. The fact remains that a lot of aircraft are unnecessarily lost by momentary inattention during emergencies. Maintaining aircraft control is the most important action a pilot must take when faced with any emergency situation. Analyzing the situation is important, but not very productive when accomplished from the bottom of a smoking hole.

29.3.2. 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.

29.4. **Action Taken.** None.

30. Dual Engine Failure:

30.1. **Mishap (Figure 30.).** 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 30. Dual Engine Failure.

30.2. **Investigation:**

30.2.1. **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.

30.2.2. **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.

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

30.3. **Lesson Learned:**

30.3.1. 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.

30.3.2. 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.

30.4. **Action Taken:**

30.4.1. 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.

30.4.2. TO lT-37B-l, Section 1, Description and Operation, was changed to emphasize the importance of checking fuel total, balance, and fuselage tank quantity.

30.4.3. TO IT-37B-l Section II, Normal Procedures, 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.

30.4.4. TO lT-37B-l, Section III, Emergency Procedures, was changed to revise information concerning indications of impending double-engine flameout and to provide additional guidance on corrective actions.

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

31. Short Landing:

31.1. **Mishap (Figure 31.).** 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 31. Short Landing.

31.2. **Investigation:**

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

31.2.2. **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.

31.2.3. **Operator Factor - Other Crewmember.** The first pilot (also an instructor pilot) failed to take action or provide assistance.

31.3. **Lesson Learned.** 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.

31.4. **Action Taken:**

31.4.1. Instruction was incorporated in UPT and PIT T-37 academics on the region of reversed command with various aircraft configurations.

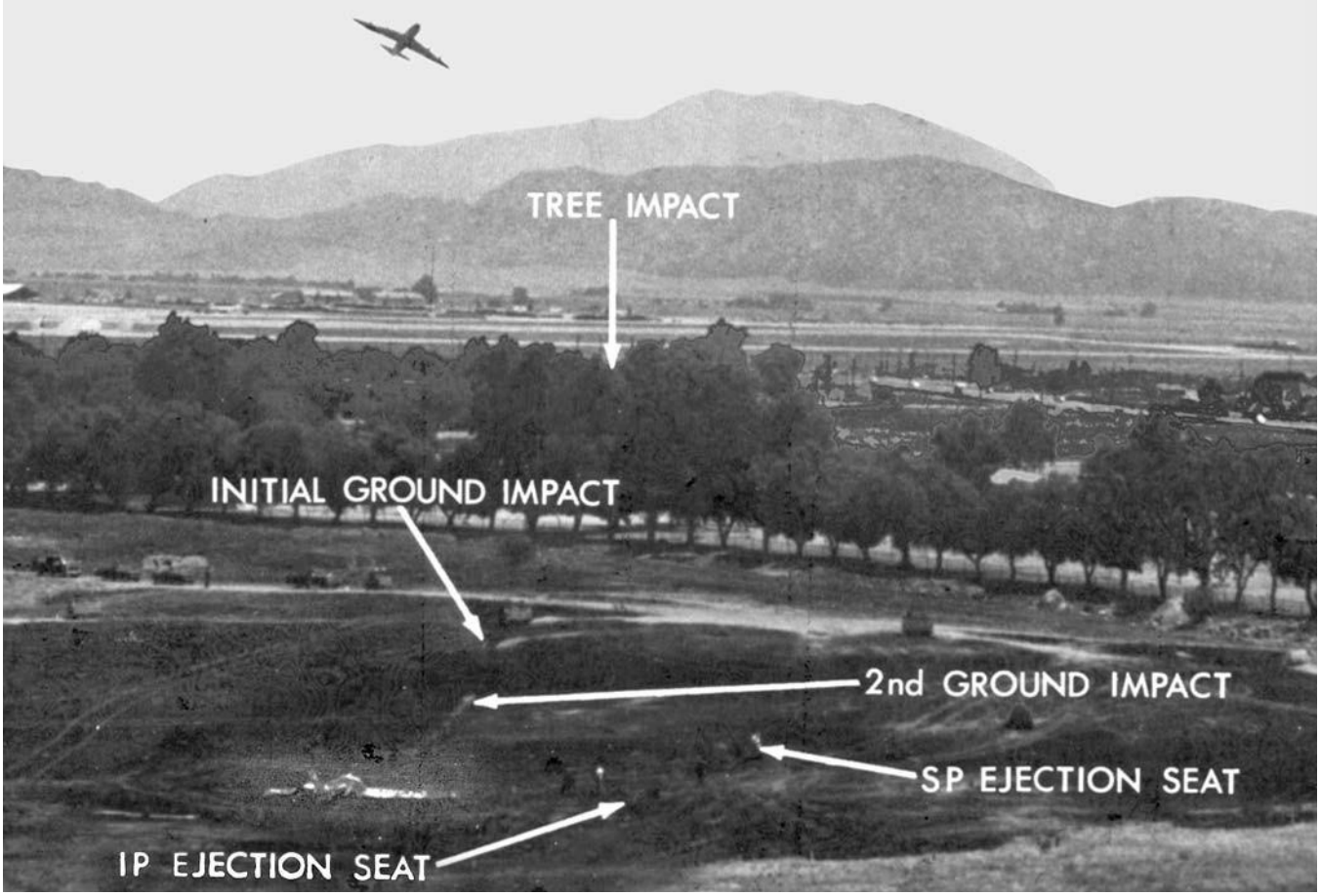
31.4.2. The governing directive was changed to require traffic patterns be planned so a minimum of 50% RPM is used on final approach until landing is assured.

31.4.3. A note was added to TO lT-37B-l, emphasizing to aircrews that lowering 50% flaps, while decreasing stall speed, will significantly increase thrust required.

32. Single Engine Go-Around:

32.1. **Mishap (Figure 32.).** 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 32. Single Engine Go-Around.



32.2. **Investigation:**

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

32.2.2. **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.

32.3. **Lesson Learned.** 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 situa-

tions 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.

32.4. **Action Taken.** Single-engine performance data and the published minimum single-engine airspeed contained in TO 1T-37B-l were reevaluated and confirmed.

33. Stall—Final Turn/Loss of Control:

33.1. **Mishap (Figure 33.).** The mishap sortie was the student pilot's second T-37 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 miles short of the runway threshold. The student pilot made no attempt to eject and was fatally injured. The aircraft was destroyed.

Figure 33. Stall—Final Turn/Loss of Control.

33.2. **Investigation:**

33.2.1. **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 T-37 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.

33.2.2. **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.

33.3. **Lesson Learned:**

33.3.1. 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.

33.3.2. 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.

33.3.3. 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.

33.4. **Action Taken:**

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

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

33.4.3. 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.

34. Stall—Final Turn/Go-Around:

34.1. **Mishap (Figure 34.).** The mission was a dual contact sortie and was the student pilot's third T-37 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 34. Stall—Final Turn/Go-Around.

34.2. **Investigation - 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.

34.3. **Lesson Learned:**

34.3.1. 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.

34.3.2. 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.

34.4. **Action Taken:**

34.4.1. It was agreed that final turn go-around procedures in AFMAN 11-249 should be expanded to emphasize the importance of basic aircraft control.

34.4.2. The addition of an advanced handling characteristics sortie to T-37 Pilot Instructor Training and making it an annual refresher requirement was evaluated.

35. Short Landing:

35.1. **Mishap (Figure 35.).** 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 35. Short Landing.

35.2. **Investigation:**

35.2.1. **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 in UPT received adequate instruction on T-37 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.

35.3. **Lesson Learned.** 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 guid-

ance was still not available to aircrews. Supervisors must realize that timely dissemination of critical guidance is essential to mishap prevention.

35.4. **Action Taken:**

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

35.4.2. TO lT-37B-l 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."

35.4.3. The governing directive was revised to include the following:

> "How To Use the Throttles: In a thrust deficient situation when time is critical, rapid throttle movement is the most effective procedure to achieve maximum engine acceleration. Acceleration time is approximately 40 % less when accelerating from 50 % RPM vice idle to military power."

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

35.4.5. The T-37 Academics for Contact Course was expanded to include the performance limitations and flight characteristics of heavyweight, no-flap approaches. Emphasis was placed on how the use of power affects the rate of descent.

35.4.6. The T-37 syllabus was changed to include a special requirement in C24XX and C3IXX instructional units for heavyweight, no-flap patterns at a "fair" grade level.

36. Stall—Traffic Pattern Reentry:

36.1. **Mishap (Figure 36.).** 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 36. Stall—Traffic Pattern Reentry.

36.2. **Investigation - 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.

36.3. **Lesson Learned:**

36.3.1. 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.

36.3.2. 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.

36.4. **Action Taken:**

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

36.4.2. The syllabus was revised to require the C26XX solo mission be flown at the home field.

36.4.3. A special syllabus requirement was added to include breakout and reentry at the auxiliary field prior to C26XX solo.

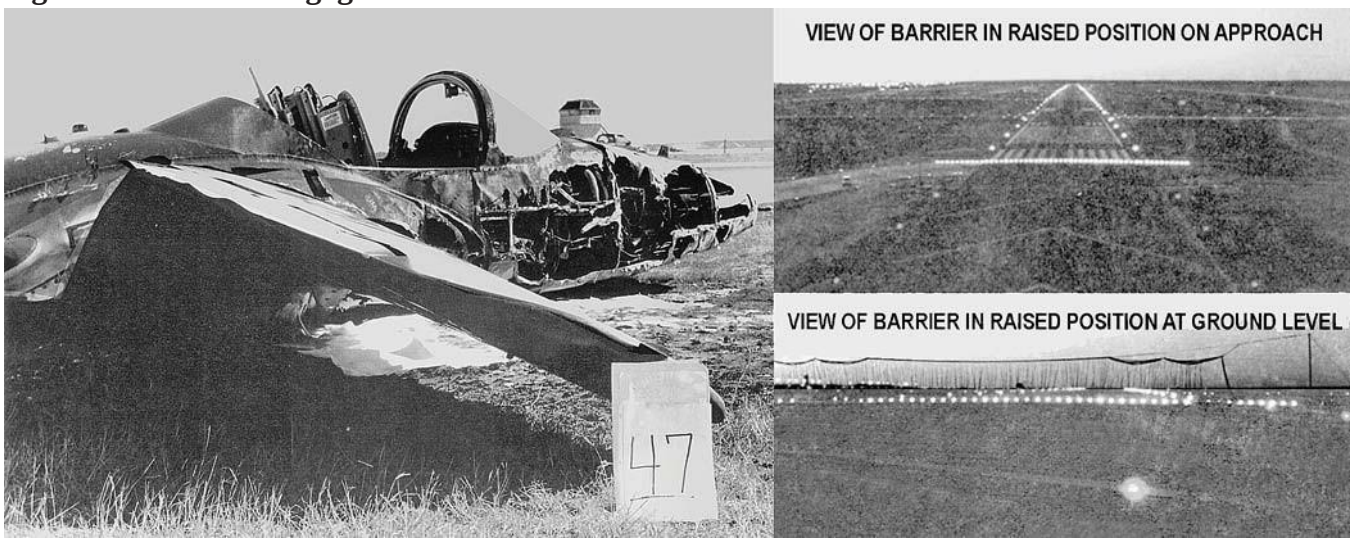
36.4.4. Photographic visual aids were developed to help student pilots with ground references and traffic pattern orientation.

36.4.5. Learning center films for the auxiliary airfield were reevaluated and updated where necessary to include breakout and reentry procedures.

37. Barrier Engagement:

37.1. **Mishap (Figure 37.).** 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 37. Barrier Engagement.



37.2. **Investigation:**

37.2.1. **Supervisory.** Group acquisition allowed a BAK–15 barrier to be installed on a runway without obstruction lights as required by AFI 32-1042, Standards for Marking Airfields. Complacency in the squadron resulted in the aircrew conducting a night sortie, opposite direction traffic, without adequate planning or proper coordination.

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

37.2.3. **Operations.** Inadequate risk assessment resulted in a Numbered Air Force policy requiring the barrier to remain in the raised position where UPT 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).

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

37.3. **Lesson Learned.** 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.

37.4. **Actions Taken:**

37.4.1. Barrier guidance was to be revised to read:

> Select one of the following options: Leave the departure end barrier in the down position except:
>
> a) When requested by the pilot
>
> b) During T-38 CAT III Operations
>
> c) During T-38 operations.

Additionally, it was directed that barriers be illuminated as required by existing regulations.

37.4.2. Aircrew, SOF, and ATC training programs and checklists at all command flying operations should include references to barriers in their opposite direction traffic guidance.

37.4.3. It was decided that USAF guidance in AFI 13-203, Air Traffic Control, should be revised to require a barrier advisory call for any aircraft executing opposite direction traffic.

37.4.4. Regarding risk assessment, it was deemed more appropriate to develop a command risk assessment program prior to tasking a wing to develop one on its own.

38. Stall/Final Turn Breakout:

38.1. **Mishap (Figure 38.).** 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 38. Stall/Final Turn Breakout.

38.2. **Investigation:**

38.2.1. **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.

38.2.2. **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.

38.3. **Lesson Learned.** There were numerous pilot and supervisory errors that caused this mishap. The student pilot's break with an aircraft between 5 NM and 2 NM was not in accordance with directives. Although the student probably did not hear the other crew report "5 NM," it was still the student's responsibility to know the position of the other aircraft. His error led to a situation where he believed the only course of action available was to perform an unfamiliar breakout maneuver. 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 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.

38.4. **Action Taken.** Local straight-in procedures were revised to eliminate potential conflicts with aircraft in the overhead pattern.

Section E—A Final Thought

39. What Have We Learned? The "ROAD TO WINGS" is demanding and unforgiving, exacting heavy tolls in terms of human life and material resources. While these losses are tragic, the greater tragedy would be failing to learn history's lessons and paying the same tolls again. We hope the knowledge we've presented here bolsters the experience of those who follow and smoothes the road ahead.

FRANK A. PALUMBO, JR., Colonel, USAF
Director of Safety

Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

References

AFI13-203, *Air Traffic Control*

AFI32-1042, *Standards for Marking Airfields*

AFMAN11-249, *T-37B Primary Flying* AFMAN37-

123, *Management of Records*

19 AFI 11-204, *Runway Supervisory Unit (RSU) Operations*

UPT Aircraft Mishap Prevention Briefing AMP03, *Air Discipline and Judgment*

TO IT-37B-1, *Flight Manual USAF Series, T-37B Aircraft*

Abbreviations and Acronyms **AGL—**

above ground level **AGSM—**Anti-G

straining maneuver

BASH—bird aircraft strike hazard (program)

CAP—commander's awareness program

CRM—cockpit/crew resource management

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

G-LOC—G-induced loss of consciousness

IAF—initial approach fix **IAW—**

in accordance with **IFR—**

instrument flight rules

IMC—instrument meteorological conditions

IP—instructor pilot

KIAS—knots indicated airspeed

MDS—mission design series (for example, T-6, T-38, F-16, etc.)

MACA—midair collision avoidance (program)

MOA—military operating area or manifestation of apprehension

MP—mission pilot **MSL—**

mean sea level **NM—**nautical

miles

RAPCON—radar approach control

RCP—rear cockpit **RPM—**

rotations per minute **RSU—**

runway supervisory unit **SA—**

situational awareness **SM—**statue

miles **SOF—**supervisor of flying

SP—student pilot

TO—technical order **UIP—**

upgrade instructor pilot **UPT—**

undergraduate pilot training

VFR—visual flight rules

VMC—visual meteorological conditions

Attachment 2

THE ROAD TO WINGS T-37 CLASS A FLIGHT MISHAP SUMMARY 1972 THROUGH JUNE 2005

YEAR/MISHAP	CREW	CAUSE
1972		
INSTRUMENT APPROACH DISORIENTATION	DUAL	OPERATOR
SPIN-NO RECOVERY	DUAL	OPERATOR
NIGHT-AREA CRASH	DUAL	UNDETERMINED
SPIN-NO RECOVERY	DUAL	OPERATOR
1973		
TAKEOFF CRASH	DUAL	OPERATOR
LOST CONTROL DEPARTURE	IP/IP	OPERATOR
LOST CONTROL-AREA	DUAL	OPERATOR
1974		
TRAFFIC PATTERN STALL	SOLO	OPERATOR
1975		
LOST CONTROL-AREA	DUAL	OPERATOR
1976		
LOST CONTROL-AREA	SOLO	OPERATOR
ENGINE FAILURE	SOLO	MATERIAL
1977		
COCKPIT SMOKE	SOLO	OPERATOR
1978		
FUEL STARVATION	DUAL	OPERATOR/MAINTENACE
SHORT LANDING	IP/IP	OPERATOR
ENGINE FIRE	DUAL	MATERIAL
1979		
SHORT LANDING	DUAL	OPERATOR
1980		
LOST CONTROL-AREA	SOLO	OPERATOR
DEPARTURE CRASH	SOLO	OPERATOR
ENGINE FIRE	SOLO	OPERATOR
FINAL TURN BREAKOUT	SOLO	OPERATOR
1981		
LOST CONTROL-DISORIENTATION	SOLO	OPERATOR

YEAR/MISHAP	CREW	CAUSE
LOST CONTROL-AREA	DUAL	OPERATOR
1982		
SINGLE-ENGINE GO-AROUND	DUAL	OPERATOR
LOST CONTROL-AREA	SOLO	OPERATOR
1983		
LOST CONTROL-PATTERN	SOLO	OPERATOR
1984		
SPIN-NO RECOVERY	DUAL	OPERATOR
1985		
LOST CONTROL-AREA	DUAL	OPERATOR
1986		
FUEL STARVATION	SOLO	OPERATOR
1988		
GLOC	SOLO	OPERATOR
1989		
ENGINE FAILURE/FIRE	DUAL	MATERIAL
1992		
MIDAIR COLLISION	IP/IP	OPERATOR
1995		
LOST CONTROL-AREA/HIGH SPEED DIVE	SOLO	OPERATOR/SUPERVISION
1996		
BARRIER ENGAGEMENT	IP/IP	SUPERVISION/OPERATOR
2000		
STALL-FINAL TURN/LOSS OF CONTROL	SOLO	OPERATOR/SUPERVISION
2001		
LOST CONTROL/G-LOC	SOLO	OPERATOR
2002		
STALL-FINAL TURN/GO-AROUND	DUAL	OPERATOR
MIDAIR COLLISION/PRACTICE BREAKOUT	DUAL	OPERATOR
2005		
MIDAIR COLLISION/CIVILIAN AIRCRAFT	DUAL	OPERATORS