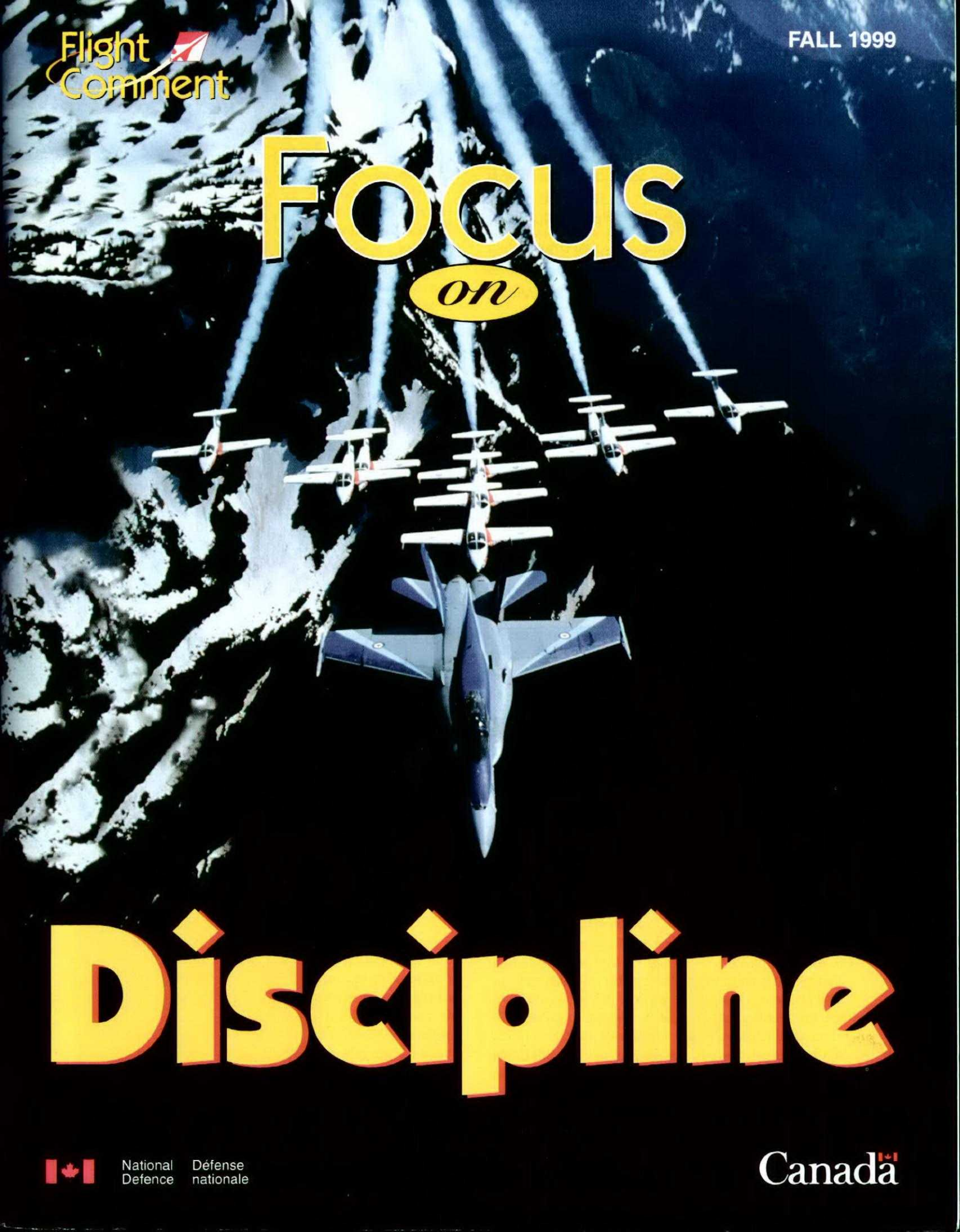
Flight Comment

FALL 1999

Focus on Discipline



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As I See It

While flight safety depends on many factors, flying discipline — or more broadly, self-discipline — is a key requirement for safe and effective air operations. Thus, I consider the theme of this issue of Flight Comment to be very important and am grateful for the chance to contribute.

Over the past decades, many changes have occurred within the air force: base closures; fleet reductions; personnel reductions; privatization of certain activities; and much more. To say that the air force has undergone 'a few adjustments' since I joined over 33 years ago would be an understatement. But, despite the significant changes that have taken place since 1965, it is my opinion that the spirit and moral attributes that characterized the air force I joined then, are alive and well in the air force of today.

Discipline is important in many ways. It demands we work hard to become as professional as possible. We need to know our business 'cold' — doctrine, equipment, procedures, ROE, regulations — everything that relates to our particular area of expertise.

By the time I became a 'sprog', the RCAF had already transitioned from the rather dangerous days of the '50s and early '60s (a time when aircraft losses, particularly in fighters and trainers, had reached truly catastrophic levels). By the early 1970s, the air force was an organization that valued flight safety, understood flying discipline (and the importance of self-discipline) and, more than anything else, considered the concept of honesty in flight safety reporting to be sacrosanct. We were taught and believed that we could 'fess up' and not be punished, the philosophy being that 'lessons learned' would, in the long run, save resources and lives. The fact that accident rates have plummeted over the past thirty years speaks volumes about the wisdom of this philosophy.

The fundamental principles upon which our flight safety program has been based — integrity, honesty, courage, loyalty, self-discipline — are essentially the same principles being promoted today under the rubric ethics in the workplace. Although we don't often refer to flight safety principles as ethics, we do know that, to be successful, we must rely on the personal character and strict self-discipline of every member of the air force team. The commitment to do the job right, without much direct supervision; to readily confess mistakes so that corrective action can be taken; and to do everything possible to learn from our mistakes; these are core air force values of which we can be very proud.

Discipline is important in many ways. It demands we work hard to become as professional as possible. We need to know our business 'cold' — doctrine, equipment, procedures, ROE, regulations — everything that relates to our particular area of expertise. It demands we avoid ad hoc-ism. Even under crisis conditions (perhaps especially under crisis conditions) we must be careful about setting aside the very things that have been proven to prevent losses in 'peacetime'. It demands we stand up for personal convictions. Letting the path of 'least resistance' be our guideline is seldom, if ever, the right course. And, finally, it demands we have faith in one another. If we are to function effectively as an organization, people must feel that their colleagues up and down the chain of command share the same basic values — and that they apply these values when performing tasks or making decisions that impact others.

With respect to such 'faith in the system', I know that it is easy to get discouraged and feel that others — particularly those in charge — are disconnected from reality or don't care about the things deemed important at the 'coal face'. In this regard, while the phrase 'trust me' has taken on cynical connotations over the years, I would implore you to do exactly that. I can assure you that the more senior 'birdmen' in the air force care deeply about its future; about your future as individuals; and about the safety and well-being of every member of the air force team.

UNFORCED ERRORS:

A CASE STUDY OF FAILED DISCIPLINE

By Lieutenant Colonel Tony Kern USAF

"Greater prudence is needed rather than greater skill."
Wilbur Wright (1901)

Author's Preface

This case study is the second in a series written and designed to improve safety and operational effectiveness across the aviation spectrum. The first in the series "*Darker Shades of Blue: A Case Study of Failed Leadership*" is a study of the personal and organizational factors leading up to the crash of a B-52 at Fairchild Air Force Base in June of 1994. It has been adopted by several international aviation safety training programmes, as well as many professional military education and commander's courses offered in several branches of the United States military. Both of these case studies come entirely from public domain sources. However, the first of the two is copyrighted as noted in the author's preface, whereas this one is reproducible in whole or in part for any educational use. The content contained herein does not reflect any official position other than the personal and professional opinions of the author — who has made it his life's work to make flying safer and more enjoyable for all with whom he shares the skies.

The many faces of flight discipline

Flight discipline exists in many forms and at many levels. It is found in the study habits or checklist adherence of each individual flyer, as well as in the decisions made in "top brass" offices of large organizations such as the FAA, commercial airlines, or within the military. It is at once an attitude and a behavior. As an attitude, the disciplined mind harbors no room for complacency, failures of preparation or unnecessary risk-taking. As a behavior, this zero-tolerance attitude manifests itself in our every day decisions and actions. In one form or another, flight discipline exists within nearly every organizational entity that deals with aviation.

Organizations are key in the development of flight discipline, as they establish a culture within which individual flight discipline can either flourish — or perish. The following case study illustrates the many faces of flight discipline at both the organizational and individual levels. Unfortunately, most of the examples highlighted are negative. These failures include organizational compliance with governing directives, failing to train aircrews sufficiently, and putting mission accomplishment ahead of peacetime safety on the institutional priority list. On the individual level, we see both external and internal factors at work upon the minds and bodies of the aircrew members, resulting in a failure to perform the most basic in-flight tasks. There is evidence of failed flight discipline during planning as well as in the air. In short, the following case study is illustrative of breakdowns across the entire spectrum of flight discipline. These errors are identified and discussed through the analysis of a much-publicized accident in the mountains of Croatia that took the life of 35 people. The purpose of this example is not to cast blame or disparage individuals or organizations, but rather to show how single failures of discipline can lead to a deadly chain of events. The details that follow provide ample evidence of the critical importance of inculcating flight discipline at all levels of an organization.

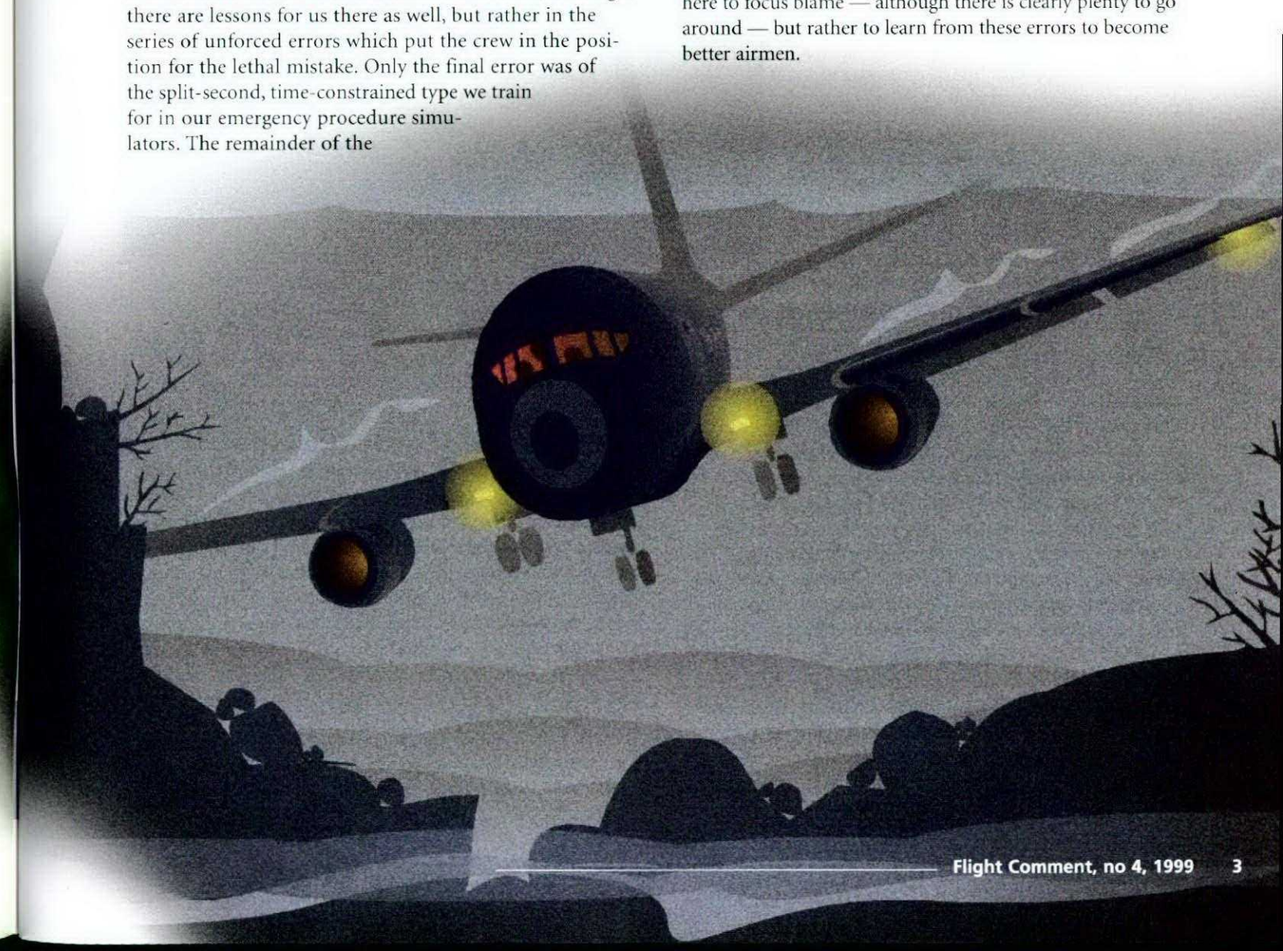
Fifteen seconds to impact

Captain A.J. Davis must have felt something was wrong. Perhaps it was a glimpse of rising terrain through a break in the cloud cover. Maybe it was just a sense that the crew must have over flown the missed approach point by now, which they were having great difficulty identifying. Or perhaps it was a verbal prod from the copilot, Captain Tim Shafer — something like "Hey pilot, something's not right here, let's go missed approach." Although we will never know what actually occurred in that final fifteen seconds, we do know that for some reason, Captain Davis added power and began a shallow turn to the right. (Coolidge 19, 30) While this intuitive correction was indeed appropriate, it was far too late.

At 2:47 p.m. local time on the third of April 1996, a United States Air Force CT-43A (Boeing 737-200) callsign *IFO 21*, slammed into the rocky slope of a mountain nearly two miles north of the intended airport at Dubrovnik, Croatia. All aboard were killed, including six Air Force crewmembers and 29 passengers — among which was the United States Secretary of Commerce, the Honorable Ronald H. Brown.

The significance of this accident lies not in the fact that a high-ranking US cabinet member was killed, or that a critical error was made at the moment of truth, although there are lessons for us there as well, but rather in the series of unforced errors which put the crew in the position for the lethal mistake. Only the final error was of the split-second, time-constrained type we train for in our emergency procedure simulators. The remainder of the errors — the ones that built the labyrinth with only one exit — were made out of inattention, complacency, or convenience. In short, they were failures of discipline.

To aid in the analysis of these failures, we must view the event through several lenses, both organizational as well as individual. Throughout the analysis, possibilities are explored that may or may not have actually had a direct bearing on the crash itself. More importantly for our learning purposes, is the fact that these events **could** have contributed to this mishap. We study all possibilities to gain the maximum learning potential from this tragedy, in hopes of preventing the next. Factual analysis of provable cause-and-effect relationships has already been expertly accomplished by a hand-picked team of investigators. While their task was to look for the absolutes — as learners our task is to look at the *maybes*, and analyze the *what-ifs*. As with all of the case study analyses I write, there is no intent here to focus blame — although there is clearly plenty to go around — but rather to learn from these errors to become better airmen.



Background

The story of IFO 21 actually begins with a tale of two wars. Following the fall of the Berlin Wall and the end of the Cold War, dozens of airfields formerly considered primarily as targets by American military aircraft, suddenly became open to western traffic. Since western aviation personnel had little or no access to these formerly hostile airdromes, there were no instrument approach procedures that had been officially "approved" by western aviation standards. This led to some confusion as to what requirements had to be met for US aircraft to fly into these newly opened countries and airfields. More on that later.

The flare-up in the former Yugoslavia only made matters worse. As the war raged on, certain pieces of critical terrain changed hands several times. One of these was the Cilipi airport in Dubrovnik, Croatia. Since the days of Alexander the Great, it has been common practice for a withdrawing force to take a few goodies — the "spoils of war" — with it as it occupies or retreats from enemy territories. Such was the case with the precision approach capability at the Cilipi airport — the primary aerodrome serving the coastal city of Dubrovnik, through which hundreds of would-be peacemakers and various negotiators made their entrance into the still relatively unstable region. During the period of conflict from 1992 to 1995, the Instrument Landing System (ILS) and Very High Frequency Omnidirectional Range (VOR), and a third NDB were all stolen. (Coolidge 41)

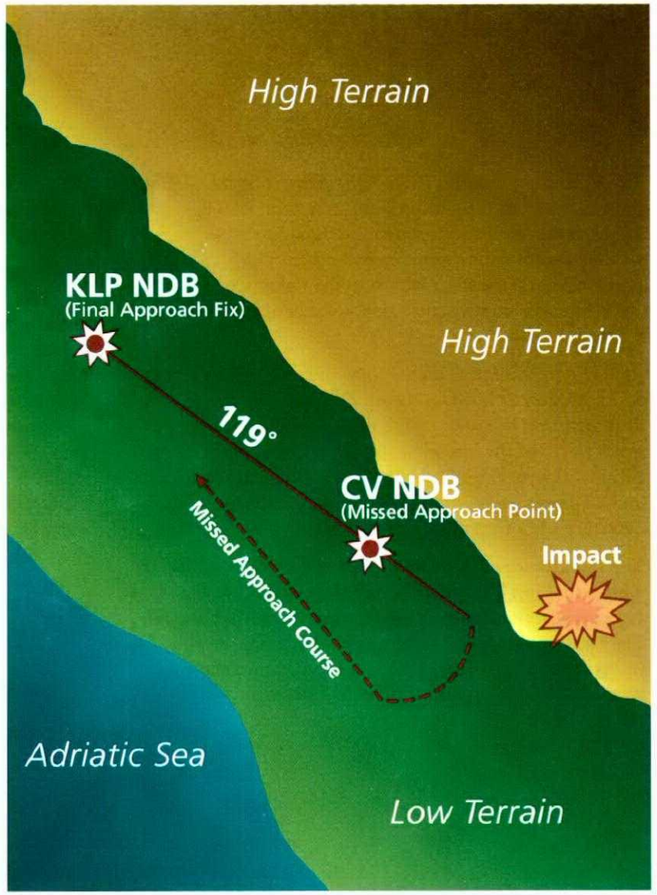


Figure 1. Approach and missed approach procedure

The end result of all of this, was that the critical crossroads in this hot region was only serviced by one non-directional beacon (NDB) approach — the least accurate of instrument approach systems currently in use at major airports. Furthermore, the approach that IFO 21 would be required to execute, used two different NDBs to complete the approach and missed approach procedure. The NDB to runway 12 at Cilipi approach is depicted at Figure 1. It can be seen from this depiction, an aircraft flying this approach would require two Automatic Direction Finding (ADF) receivers to complete both the approach and missed approach — since regulations prohibit "cross-tuning" a single receiver after the final approach fix. The CT-43A has only one. While not exceedingly difficult, NDBs require constant attention and good approach planning to fly effectively, and have a high potential and margin for both pilot and equipment error. (Kelly 1) Theoretically, adequate crew and staff planning should include a review of the equipment required to fly this approach, which would have quickly identified the CT-43 incompatibility. It did not. We will look into that failure more deeply in a moment.

So the composite backdrop of the accident reveals a relatively confusing and somewhat uncertain playing field, primarily due to the recent opening of the eastern block countries as well as the ongoing war in the Balkans. These circumstances presented unique challenges for all levels of command and supervision tasked with insuring safety while simultaneously completing the normal peace time military missions of the United States Air Forces in Europe (USAFE) as well as the peace-keeping operations in the former Yugoslavia. In order to properly analyse this scenario, we need to first understand the relationships between the major organizational players.

The players

The hierarchical command structure between the headquarters USAFE (HQ USAFE) and the 76th Airlift Squadron (76th AS) is fairly straightforward, although there are always several side players in any mission as complex as the one assigned to USAFE. Figure 2 shows the principle players in the decision process relating to airfield and instrument approach suitability for the newly opened countries which were not serviced by an approved Department of Defense (DOD) instrument approach procedure.

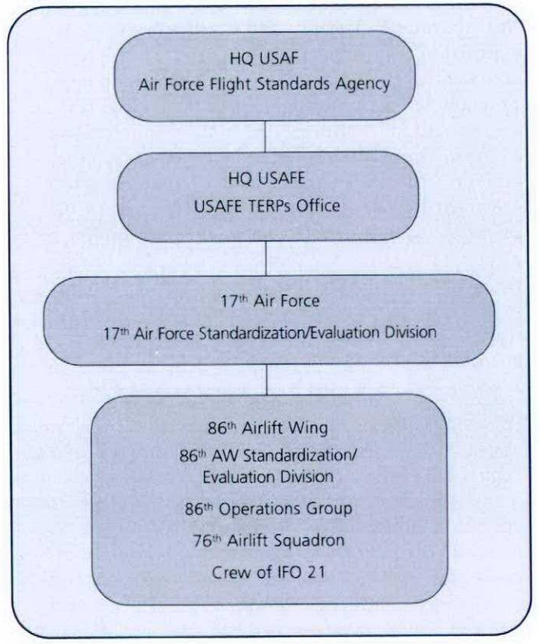


Figure 2. The organizational players in the crash of IFO 21

Organizational failures: A culture of non-compliance

There were several opportunities to break the chain of events which led to this tragedy at multiple levels of command and supervision. It is appropriate and illuminating to start at the upper echelons of command and work our way down to the aircrew level in this analysis. We will see that a willingness to accept less than full regulatory compliance occurs at all levels, and that an organizational culture of non-compliance may well have set the stage for the crash of IFO 21.

Although the formal investigation of the mishap focused a great deal of attention on the fact that the crew flew an instrument approach that did not meet U.S. Department of Defense standards, there were other factors that may have been equally — if not more significant. A myopic or single-focus analysis does not tell the entire story. Accidents are seldom this simple, and this one is no exception. An organizational efficiency expert could probably find dozens of areas for improvement which were identified by the intense scrutiny brought on by this accident, but here we will limit our analysis to two organizational failures at echelons above the 86th Airlift Wing. The first was the failure to implement an effective Cockpit/Crew Resource Management (CRM) programme as required by a regulation nearly two years old at the time of the accident — as this was surely a CRM mishap if ever there was one. The second breakdown was one of enforcement, the inability of the command and supervisory positions at HQ USAFE and 17th Air Force to enforce their orders which told the 86th AW to stop flying to unapproved airfields. It is clear from the investigation that the intent of all echelons above the wing was for the 86th AW to stop flying to unapproved fields immediately upon notification, yet several months of non-compliance were allowed to occur before the cows came home on April third.

The final element of discussion revolves around the communication channels used — or not used — to enforce the directives. Some weak attempts at answering the "why didn't you stop" question seemed to hint at e-mail as the culprit — and not people.

The remaining organizational and individual breakdowns of discipline will be discussed relative to elements internal to the 86th AW, concluding with the crew of IFO 21. Throughout the process there were opportunities to fix the problems and break the accident chain. Critical decisions were made at each of these junctures, and these decisions turned out to have life and death consequences.

Organizational failure 1: Failing to implement CRM training mandate

Cockpit/Crew Resource Management is the flight crew's insurance policy against multiple failures within the hostile flight environment. It teaches aircrew members to identify, access, and utilize all available resources to safely and effectively complete mission objectives, and has been credited with documented and significant accident reduction wherever it has been thoroughly and systematically implemented. Although Air Force Instruction 36-2243, Cockpit/Crew Resource Management required aircraft and mission-specific CRM training for all Air Force crewmembers and had been in force for nearly two years, there was no USAFE CRM programme in place at the time of the crash of IFO 21. (Coolidge 61) This failure to provide the required training resulted in the 76th Airlift Squadron attempting to develop CRM training on its own. Even though this was a noble effort by hard working visionaries at the squadron level, this program clearly did not meet the requirements set forth by the existing regulatory guidance (AFI 36-2243, p. 6).

Because little of the official investigation focused on the lack of CRM training for the IFO 21 crew, and because of the documented effectiveness of the training, let's briefly review the content and history of CRM to demonstrate how important this decision — or non-decision — really was.

Analysis

Cockpit Resource Management is nothing more than a name given to a concept. The concept is simply to *maximize mission effectiveness and safety through effective utilization of all available resources.* What makes CRM unique as a training programme — and why its absence was so critical to this mishap — is the environment and target audience for which the training is designed. CRM is designed to train team members how achieve baseline measures of safety and maximum mission effectiveness in a time-constrained environment under stress. This was precisely the environment that Captain Davis and his crew found themselves in on 3 April 1996.

Organization	Accident Rates
Bell Helicopters Inc. (US Only Jetranger Pilots)	48% decrease
Petroleum Helicopters Inc.	54% decrease
US Navy	28 % decrease
US Navy, A-6 Intruder crews	81% decrease
US Air Force, Military Airlift Command crews	51% decrease

source: (Diehl 1992)

Figure 3. Accident Rates following CRM or Aircrew Decision Making Training

By *all available resources*, we mean just that, including hardware, software, printed materials such as regulations and flight manuals, people power (your own and others), the environment (sun, terrain, etc.), time, fuel, etc.. Research has demonstrated that many crew members cannot **identify** all of the resources at their command, let alone access them in a time-stressed or emergency situation. The multiple aircrew failures that occurred within the cockpit of IFO 21 are identified later in this case study, but exemplify a failure to effectively manage resources across this spectrum. *CRM training is designed to produce team members who consistently use sound judgment, make quality decisions, and access all required resources, under stressful conditions in a time-constrained environment.* Aircrew members who are trained and practice good CRM can — and often do — overcome serious challenges in flight. Unfortunately, those that do not, often fail to respond effectively to the same challenges.

Aviators have been making poor judgments since the day Icarus decided to check out the maximum service ceiling of his new wings. In an Inspector General (IG) report from 1951, *Poor Teamwork as a Cause of Air Craft Accidents*, data from 7,518 major accidents taken between 1948 and 1951 (now that's a database!) determined "poor organization, personnel errors, and poor teamwork" resulted in the majority of aircraft accidents. The study further reported that "the human element…and effective teamwork is essential to reducing the accident rate." The IG report even went as far as recommending, a "teamwork training programme," but unfortunately for the crew of IFO 21, neglected to add a suspense date to the requirement for training. The aviation community re-focused on the need for some type of human factors training following the much publicized crash of a United Airlines DC-8 in Portland, Oregon, in December 1978. Attempting to ascertain the nature of a possible landing gear problem, the aircrew allowed the aircraft to completely run out of fuel while circling near the landing field on a clear night in good weather. The result of this re-focused attention was the amendment of Part 121 of the FARs allowing airlines to train what is now called CRM.

Following CRM implementation, air carriers began to notice dramatic decreases in their accident rates. Military application of these principles lagged behind our civilian counterparts, but in the mid-1980s, the Naval Safety Center and old Military Airlift Command (MAC) began to implement airline-style programmes — with **outstanding** results. The popularity of these programmes grew throughout the 1980's and early 1990s to the point where nearly everyone had some version of CRM. AFI 36-2243 sought to close the loop in MAJCOMs — such as USAFE — that had not yet gotten on the bandwagon by establishing a regulatory requirement for multi-level CRM training. For reasons unknown, USAFE did not recognize the potential benefits of CRM and were unable to follow clear guidance.

An analysis by a former NTSB accident investigator and senior official with the U.S. Air Force Safety Agency, examined accident data from several military and civilian examples. Each organization achieved a thirty to eighty percent improvement in accident rate from pre- to post-CRM training. Figure 3 illustrates these dramatic results. In spite of the mountains of evidence which suggests that organizations should embrace CRM — and the regulatory mandate of AFI 36-2243 — USAFE chose to ignore it or to put the requirement on the "back burner."

This curious disregard for an existing training requirement is only the first verse in a sad song of an organization who was incapable of fully implementing and enforcing governing regulations and policy. Should it have been a great surprise that subordinate organizations took the same cavalier attitude towards regulatory guidance? Oh, and one further question — Who was responsible for insuring that USAFE was implementing Air Force directives? Was there a failure of oversight here as well?

Organizational failure 2: Failing to enforce AM 206-11

Pilots do not question the reliability of printed instrument approaches — at least not until recently. They rely implicitly on the accuracy of the depicted approach plate to provide the required margin of safety above obstacles and terrain. But as discussed earlier, the opening of new airports in previously hostile areas caused the military to question the reliability of these new published approaches and to require a comprehensive safety review. "Air Force Instruction 11-206, paragraph 8.4.1 requires any instrument approach procedure not published in a Department of Defense or National Oceanic Atmospheric Administration flight information publication be reviewed by the major command Terminal Instrument Procedures (TERPS) specialist before it can be flown by Air Force crews" (Coolidge 51) — unless the weather is good enough for a visual approach. These distinctions are made to insure that approaches developed by sources unfamiliar to the US aircrews, meet or surpass our safety requirements. To say that this new restriction would negatively impact on the mission of the 86th Airlift Wing — who serviced the entire European region — would be a huge understatement.

Before we go any further into this discussion, the reader needs to know that if this process had been accomplished for the NDB Rwy 12 approach at Cilipi airport in Dubrovnik, Croatia, the TERPs specialist would have found an error of *at least 400 feet* on the minimum descent altitude (MDA) for the approach. (Coolidge 45) If the directives had been followed, either the crew would not have flown the approach at all, or they would have flown it with correct attitudes that guaranteed adequate terrain clearance. In either case, they would be alive today.

The new approach guidance went into effect in November of 1995, and the 86th AW Operations Group Commander immediately recognized its adverse effect on his units' ability to perform their mission. The 86th AW lands at many airfields where the only published approach is a "Jeppesen." Jeppesen refers to a company which merely publishes approaches given to them by host nations, and they are exceedingly clear on this point. In fact, Jeppesen publishes a disclaimer specifically stating that they "do not review or approve the adequacy, reliability, accuracy or safety of the approach procedures they publish." (Coolidge 53) Yet there seemed to be some confusion on this point by several senior officers both at the USAFE headquarters and at the 86th AW, as the following email from the USAFE Director of Operations clearly points out.

> *the implications ($$ + manpower) of this 'new' guidance is significant… especially with all the… countries opening up!! What's the matter with Jeppesens… we've used them for years… don't our airline bro's use them all the time? (Coolidge 58)*

Obviously, he did not understand — or choose to accept — the concept that Jeppesen was merely a reproducer of approach plates of dubious reliability. Somehow he equated the term "Jeppesen" with "safe" or "reliable" — a point the company itself goes to great lengths to avoid.

In spite of the impact and confusion surrounding the new regulation, the staff at USAFE headquarters had little choice but to notify their subordinate commands, including the 86th AW of the new requirements. As soon as he received and reviewed the new regulation, the 86th AW Operations Group Commander (OG) requested a blanket waiver to allow 86th AW crews to fly Jeppesen approaches to minimum weather criteria without the required TERPS review. Upon being advised of this request, the 17th Air Force commander "attempted to intervene" via e-mail to the 86th AW commander, indicating his disapproval of the waiver request.

Analysis

We begin to see the decision process revolving around and between three commanders. The lowest echelon (86th OG) seeing the impact on the mission as paramount, the upper echelon (17 AF commander) clearly concerned about safety (or the appearance of a less than proactive stance towards safety), and the "middle man," the 86th Wing commander, curiously absent from this initial exchange. But what was really going on here? How can a Major General "attempt" to intervene in a subordinate's decision without being effective? The evidence indicates that the waiver request from the 86th OG went forward, in spite of the 17 AF commander's disapproval. It is clear that the 17 AF commander did not weigh-in with the full weight of his two stars, or the situation would have been over right then and there, and the 86th wing would have fell into compliance. For some reason, he did not, but it wasn't long before someone would get another chance to remedy the 86th AW's non-compliance.

Organizational failure 3: Failing to take "no" for an answer

On 2 January 96, the request to fly Jeppesen approaches without a TERPs review was denied by headquarters Air Force after a review by the Flight Standards Agency, and the rationale for the denial provided as follows:

> *The MAJCOM TERPS review of non-DOD/NOAA FLIP products before they are authorized for USAF aircrew use provides a reasonable and prudent balance between operational flexibility and instrument approach development requirements... Some country/regions have approach design/flight check procedures similar to those used by the USAF and probably require little in the way of "hands on" review. Other parts of the world use less reliable practices when applying their approach building procedures and would warrant a closer look... Proper approach development is one factor aircrews take for granted every time they fly an instrument approach. When planning all approach, our aviators assume that if they fly the approach as depicted, they, will have adequate obstacle/terrain clearance. The requirements outlined in 11-206 will help us maintain that high level of confidence — we should keep them as they are. (Coolidge 53)*

On 23 Jan 96, a Major from the USAFE Operations training division delivered the news directly to the 86th OG (via e-mail).

> *HQ AFFSA (Flight Standards Agency) has denied the... waiver request to AR 11-206, submitted to authorize use of Jeppesen approaches without MAJCOM review. The result of this is two-fold. 86th AW FCIF (flight crew information file) 95-20, as presently written, which authorizes the continued use of Jeppesen approaches, will have to be rescinded... Presently, with the waiver being denied and upon rescinding the FCIF, 86th AW aircrews will have no authorized Jeppesen approaches to fly.*

Case closed? Not quite. About two hours after receiving the e-mail, the 86th OG crafted his own message to subordinate squadron commanders' as well as information copies to both 17 AF and USAFE operations offices, stating in part

> *This is a start — will await further guidance ... on fields we've never flown into. My view on this: Safety is not compromised if we continue flying ops normal until approaches are reviewed — then we rescind the FCIF. (Coolidge 55)*

Although the 86th AW commander initially expressed some reservations about the response, he did not countermand his OG's order. In fact, the Accident Investigation Board Report determined that "credible testimony shows that the 86th OG commander's action to not rescind the FCIF was taken with the concurrence of 86th commander." (Coolidge 55) Later, at an Operations Group staff meeting "the consensus from the squadron commanders and the chief of standardization and evaluation as that safety was not compromised, and Jeppesen approaches could continue to be flown pending... review." (Coolidge 55) In relatively short order, the 86th AW had thumbed its nose at higher headquarters. The FCIF that was directed to be rescinded on 23 January, was still in use on 3 April — the day of the mishap. It was rescinded on 4 April.

Analysis

To quote country singer Lorry Morgan, "What part of *no* don't you understand?" The clear and timely dissemination of the waiver denial was categorically dismissed with the concurrence of all relevant commander's in the 86th AW. Although it is highly likely that the lower echelon squadron comanders and chief of standardization/evaluation felt considerable pressure to go along with the boss's recommendation to ignore the waiver denial and continue "ops normal." What would prompt professional military officers — especially ones who had shown the mettle to climb through the ranks to command — to ignore clear directives from both headquarters Air Force and USAFE?

During the investigation for the mishap, two mitigating factors were surfaced to help explain the actions of the 86th AW leadership. First, it was stated that the initial e-mail from the USAFE training branch was an "informal notification" and therefore, did not need to be interpreted as a strictly enforceable order. This legalistic mumbo-jumbo doesn't wash — especially in light of the fact that the 86th AW was already operating in violation of a printed Air Force Instruction — as clear a piece of guidance as exists in the military. It was also pointed out that the e-mail did not contain three important pieces of information that may have changed their interpretation of the waiver denial. The e-mail did not include the information of who actually denied the waiver, it did not mention that safety was a factor in the decision, and third, that the same guidance had been given to all other commands. This excuse also rings hollow. In a military organization, a directive from higher headquarters is to be followed, even if it does not go into detail as to the decision process or include background information. Simply put, when a soldier is told to march, the feet should start moving — not wait for further persuasion or argue with the logic behind the order. This weak nationale for non-compliance sounds like a simply attempt to divert attention (and blame?) away from the responsible parties.

There were several other organizational issues that could be discussed, such as the failure of 17 AF to insure compliance in February 96 after their representative directly informed the 86th AW chief of standardization and evaluation to rescind the FCIF which allowed the aircrews to continue

flying unapproved approaches. However, in the final analysis none of these officers flew the aircraft into the ground, and no number of organizational failures can adequately explain the breakdowns of discipline at the aircrew and individual levels. Yet the multiple break-downs of the organization surely had some impact on the individual aviators who flew within them, and perhaps begins to explain the apparent disregard of directives which occurred at the aircrew level.

Aircrew failures

From the aircrew perspective, the portrait of the final flight of IFO 21 can be viewed as a collage of external pressures, busted crew rest, poor planning, mismanaged resources, violations of, regulations, ignored or misapplied checklists and tech order procedures, distractions, lost situational awareness, and extremely poor judgment. For professional pilots, these guys had a *real bad day.* The accident investigation calls this collection of errors "uncharacteristic mistakes" which included "misplanning the flight... flying outside of a protected corridor... excessive speed and not having the aircraft configured by the final approach fix... beginning the approach without approval (clearance) and without a way to identify the missed approach point." (Coolidge 60)

When you add to these errors the fact that the copilot willingly broke crew rest on two occasions, that the crew was apparently unaware of the active airspace restrictions contained in the special mission instructions (SPINS), that they did not have the required equipment to fly the approach into Dubrovnik, that they had scheduled less than the regulation minimum ground time at Dubrovnik, and that they did not properly manifest the passengers on board the aircraft — it seems that the accident investigation report may have understated the issue when it found "behaviors indicative of a reduced capacity to cope with the normal demands of the mission" were present in the crew of IFO 21. (Coolidge 60, 61) In documenting the crew failures, it is not enough to make a laundry list of errors, or to wag a condescending finger of blame at the dead pilots — who were certainly trying to do their best. We must look into the potential causes of these multiple failures.

External pressures and organizational influences

The flight to Dubrovnik was clearly not a "normal" mission for a crew from the 76th AS. The accident-investigation states "external pressures to successfully fly the, mission were present, but testimony revealed a crew that would have been resistant to this pressure and would not have allowed it to push them beyond what they believed to be safe limits." (Coolidge 59) What external pressures could have been responsible for such deviations from normal performance?

External factor 1: High operations tempo and culture of non-compliance

The 76th AS, and in fact all of USAFE, had been operating at a fever pitch for months, if not years prior to the mishap. The demands of the mission coupled with the military drawdown that has impacted negatively on all branches of the service, simply left too few people to do too many things. Like all good soldiers, each echelon from the senior commanders to the lowest ranking, of the enlisted forces, leaned forward to get the job done. This operations tempo may well have been partially responsible for other accidents and mishaps as well. As we have seen, this combination of high ops tempo and mission-oriented commanders began to create an atmosphere of "can-do at all costs" and caused some to blatantly ignore regulatory guidance in the sacred name of *the mission.*

It is impossible to isolate aircrews from this command atmosphere. In fact, the 76th AS squadron commander had been recently relieved from command by the 86 AW commander for "a loss of faith in his leadership abilities." The relieved commander felt that he was relieved because "of his concern about flying General Officers and on allowing... missions to fly into potentially hostile fire areas." (Coolidge 59) At least one aircrew member was clear in his opinion that the firing of his squadron commander did have an impact on how he approached the mission. "It does force you to find... more ways to get a mission done, I don't know if that is good or bad, but it will get you to thinking of how — to preclude those problems as quickly as you can." (Coolidge Tab EE1/12) The views of the former squadron commander stressed safety over mission accomplishment.

The wing commander may have felt that such views were interfering too strongly with the ability to accomplish the wing mission. The human factors representative on the accident investigation stated:

> *"there were indirect messages from the 86 Wing that even though safety was properly acknowledged and advocated in the formal sense, mission accomplishment...was foremost. Examples include (1) that when there was a safety stand-down day in October 1995, the 75th and 76th AS continued to fly scheduled missions, (2) the day following the mishap, the 76th did not stand down because missions had to be flown, (3) testimony that there was a constant struggle (with the wing) to lessen the flying per day so that the crews could train or obtain rest for the crews; and (4) they could not have a safety down day because there were too many missions to fly. (Coolidge Tab EE-1110)*

Although the accident investigation report stated that "the replacement of the squadron commander and its timing (four days prior to the mishap) were coincidental

to this accident," (Coolidge 59) it seems difficult to believe that squadron crewmembers would not perceive the firing of their boss for stressing safety over mission accomplishment as anything but a clear message to get the job done.

External factor 2: VIP passengers

Although this unit regularly carried distinguished and high-ranking passengers, the combination of a Presidential cabinet member and the flight into a recent combat zone carried certain pressures that were sure to effect the crew. On one previous documented occasion, the Commerce party had attempted to pressure a C-20 pilot to take a potentially unsafe course of action when scheduling difficulties were encountered. (Coolidge 59) The pilot of IFO 21 had demonstrated his capacity to stand up to pressures such as these on previous occasions, including a recent flight where he had transported the Presidents of Croatia, Bosnia-Herzegovina, and Serbia and had to divert from the intended destination of Sarajevo. It is unknown what pressures — if any — might have been generated by the Commerce party on this flight, but it is unlikely that it would have been enough to convince the crew to forsake safety for mission accomplishment by itself. As a contributor to the overall stress level on the crew, however, it could well have been a factor.

External factor 3: Multiple mission changes

A third external stress or that may have been more contributory was the multiple and late arriving mission changes to which the aircrew had to respond. Aviators are controllers by nature, and as such they abhor feelings of unpreparedness. It can be stated with some degree of certainty, that the crew was agitated — more likely damned mad — about the last minute changes to the high-profile mission. The accident investigation states "frequent changes to the mission itinerary contributed to the possibility of inadequate mission planning." (Coolidge 59) Once again, this may be a significant understatement, and the mission changes may have had implications that go beyond mere planning factors. The multiple changes may have effected the basic physiological capabilities of the crew, by contributing to broken crew rest by the copilot — for certain — and perhaps other crew members as well. We will discuss the implications of that in a moment.

Although many, if not most, military missions experience changes prior to and even during, the mission, this flight experienced four separate major changes to the original itinerary, the last of which occurred on 2 April, the day after the crew had "completed" their official mission planning at Ramstein AFB. This may well have created a situation where the crew had to make difficult planning choices related to adequacy, thoroughness, and even regulatory compliance. In fact, it is quite clear that these multiple changes forced the crew to do some mission planning well into the night prior to a 0330 (3:30 a.m.) mission show time on April 3rd.

Apparently, busting crew rest was almost commonplace in the 76th AS. The accident investigation revealed multiple cases of crews who felt the need to violate crew rest minimums to get the mission accomplished. Although the former squadron commander had tried to discourage this practice, he stated "every now and then I hear a trip report come back in and the crew — the aircraft commander will write how they made it happen, four hours away from crew rest. I know some of the guys are still doing that." (Coolidge Tab EE I/ 11 1996)

Internal factors

While many of the factors that effected the crew of IFO 21 were beyond their control, such as the organizational climate of non-compliance, the potential pressure of flying a presidential cabinet member, and the multiple mission changes, there were also internal factors at play. The internal drive for success often found in high achievers like Captain Davis can often manifests itself in negative ways. A hesitancy — or even inability — to say "no" to a tasking from above is one such hazard. Another phenomenon that may have been occurring, was the fact that the pilot was on a rapid career upswing after a less than spectacular start in the 76th airlift squadron. He may have viewed this "second chance" as something he wasn't about to mess up by failing to get this high profile mission accomplished. Although each of these internal factors may have played a small role in the crew's sudden inability to cope with the mission demands, the most serious, and likely internal contributory factor was self-induced fatigue by the copilot, Captain Tim Shafer.

Internal factor 1: Fatigue

Fatigue can severely impair an individual's performance, and in the cockpit of an aircraft, it can have lethal implications. Something caused multiple breakdowns on the crew of IFO 21, and based on the analysis of the copilot's sleep pattern the night before the accident, fatigue must be considered as a likely contributory — if not outright causal-factor.

A former Air Force wing safety officer who specialized in training for the night environment points out the seriousness of fatigue to military pilots.

> *Fatigue is potentially the most serious human factor problem associated with...flying. Fatigue, fatigue recognition, quality sleep and fatigue management techniques should be a priority concern for everyone involved with ...flying operations. (Hoey 1992)*

Hoey goes on to list several typical aircrew errors caused by fatigued pilots including despair, short temper, reduction in the will to work, loss of appetite (which can lead to hypoglycemia), **loss of the desire to interact with others** (emphasis added), mental depression, a defeatist attitude, and loss of memory. (Hoey 1992) This list of symptoms identifies several areas critical to successful and safe air operations, and may reflect possible causes behind the "uncharacteristic mistakes" aboard IFO 21 cited by the accident investigation report. Perhaps the most significant, is the finding of a reduced desire to interact with others, which could have been critical during those last few minutes.

Beyond the seriousness of impaired performance lies a more insidious effect of fatigue. Curt Graeber (1990) of the NASA-Ames Research Center states that fatigue not only contributes to serious performance errors, but that crew members can often not accurately assess their own fatigue levels, thereby rendering them less capable of self regulation. Graeber and Hoey's conclusions demonstrate that fatigue may well have a serious impact on the interaction required for effective Crew Resource Management, exactly what was missing on the flight deck of IFO 21. Let's take a moment to review Captain Shafer's actions the evening of April 2, the night before the fateful mission.

At 2200L (10:00 p.m.) the night before the mission, Captain Shafer made a call to the European Operations Center — a controlling agency for the flight — and requested "the latest mission change." He was verbally briefed on the change, which to his surprise added a whole new segment to the pre-planned mission. After his phone call, he was faxed a copy of Change 4, but only the cover sheet survived transmission. (Coolidge 11) This indicates that the copilot did not even begin to plan this added segment of the flight until less than six hours before show time for the mission — a clear violation of minimum crew rest periods. Pilot crew rest requires 12 hours off duty and eight hours of uninterrupted rest prior to showing for a mission. Anyone who has ever waited on technology to deliver a critical piece of information can just imagine Captain Shafer's attitude as he watched the FAX stop after single cover sheet rolled off the hotel machine. Should he call back for a re-transmission? Should he wake the pilot and tell him they were being pushed too far, too late and recommend a safety of flight delay in the mission? Or did he say to himself, "The hell with it. I'll suck it up and get the job done. I'll hack the mission."? There is no information available to indicate what the copilot did with the information after he received it, but a likely scenario would be that he proceeded to plan out the new segment of the mission. After all, why would he not have waited until morning to make the call if he did not plan on using the information at that time. If he did begin to plan the new mission segment, it would have taken a minimum of 45 minutes to an hour to put the new information together, meaning that he would have hit the sack sometime around 2300 hours (11:00 p.m.). Assuming he went to sleep immediately, which is doubtful with the worries of the changed flight fresh on his mind, he would have had the opportunity for about four hours of sleep. But even this short period would not pass without interruption.

Sometime between midnight and one o'clock, a pilot who had recently arrived from Cairo called upon the co-pilot to return some personal items he had brought back from his trip. They talked for a few moments and the visiting pilot also gave Captain Shafer some mission planning materials the crew had prepared, trying to help out because they knew the crew IFO 21 was receiving late changes to the mission. If Captain Shafer went to sleep immediately, he would now be able to add perhaps 2 hours of sleep to the less than one hour he had already gotten. Although the accident report states that "it could not be determined if the copilot had sufficient sleep" it is clear from the testimony that he did not — at least in terms of Air Force regulations. How significant was this? After all, it was only a single crewmember and it was just one night.

Wilkinson (1965), a noted sleep researcher who studied human performance degradation following periods of sleep debt, noted that effects of sleep loss vary widely between individuals from essentially no effect to an almost complete breakdown of performance. In short, Capt. Davis, the aircraft commander of EFO 21, might well have been flying solo and not known it. On a normal mission, he might have hacked it, but the pressure was on and the numbers of distractions present on this approach would have challenged a well-rested and fully functional crew.

Internal factor 2: Pressing

If Captain Davis may have been flying with an impaired copilot, he may also have been competing with himself He had recently seen a rapid upturn in his flying career progression, and may well have been trying to demonstrate that he deserved it. It hadn't always been so. After his arrival at Ramstein in 1994, the squadron commander of the 76th had noted that Captain Davis "did not display adequate procedural knowledge — for upgrade to aircraft commander." (Coolidge 35) In fact, the commander did not approve his upgrade during his entire eight months in command. However, about five months later, in October of 1995, Captain Davis did upgrade to aircraft commander. Less than three months following this upgrade, he was granted a waiver by the Operations Group Commander (for insufficient flying hours as an aircraft commander) and was upgraded to instructor pilot (IP). He completed his instructor checkout on 15 February 1996, *and less than one week later* the Operations Group Commander approved another waiver of requirements to upgrade Captain Davis to evaluator status — the military equivalent

of a check airman. So while Captain Davis had labored in obscurity for nearly 13 months as a copilot, his fortunes had changed dramatically recently. In less than four months, he had upgraded sequentially to aircraft commander, instructor pilot, and evaluator pilot. Although Captain Davis may have been a late bloomer, he was on his way now. As the lone evaluator pilot in the 76th AS, he knew he was viewed as the guy who could get things done. He had come along way in a short time, perhaps too short. This scenario of rapid advancement, may well have set the stage for a hazardous attitude known as "pressing."

Pressing is defined as an unwarranted — and occasionally obsessive — drive to accomplish flight objectives. It has also been called *get-home-itis, get-there-itis, or mission-itis.* By any name, it can lead to unsafe conditions associated with poor risk management. When a pilot presses, he or she places more emphasis on mission accomplishment, and less on safety. The implications are obvious. But would this scenario drive a normally good pilot into a region of bad judgment, one that could lead to the incredible series of "uncharacteristic mistakes?" Perhaps not on its own, but when coupled with a fatigued copilot, and a few unexpected distractions...

Internal factor 3: Distraction

One of the greatest enemies of the aviator is channelized attention, or the inability to rapidly scan and process multiple inputs, commonly referred to by pilots as *crosscheck.* There can be many reasons for channelized attention and lost situational awareness, but the most common is simple distraction — a phenomenon which the crew of IFO 21 was about to deal with in abundance. The accident investigation report explains the source of these distractions. "During the flight from Tuzla to Dubrovnik, the mishap crews misplanning of the route caused a fifteen minute delay in the planned arrival time (an unpardonable sin when transporting VIPs). Pressure may have begun to mount for the crew to make the scheduled arrival time, especially because responsibility for the delay now rested with the crew. As IFO 21 neared the final approach fix, there were two additional distractions: a delay in clearance to descend from 10,000 feet and external communication with a Croatian aircraft, 9A CRO." (Coolidge 60) Testimony indicates that as IFO 21 approached the final approach fix, the pilot of 9A CRO asked them to switch frequencies and proceeded to explain an "unpublished circling procedure" that he had used to get the US Ambassador to Croatia and the Prime Minister to Croatia on the ground only an hour earlier. It appears that the aircraft commander was hand flying (autopilot off) the aircraft and simultaneously talking to the Croatian pilot. The copilot was talking on the tower frequency and most likely running the checklists. Neither was adequately preparing to fly an NDB approach to Cilipi airport.

Final approach

The post accident analysis of radar tapes and aircraft wreckage indicates the following sequence of events took place as IFO 21 passed the final approach fix. The aircraft crossed the final approach fix without clearance and approximately 80 knots above the flight manual final approach airspeed of 133 knots. In addition to being hot, they began tracking approximately nine degrees left of the final approach ground track. The copilot was not backing up the aircraft commander with his navigation instrument settings, and neither pilot had any way of identifying, the missed approach point. At this point, still four minutes from mountain impact, the crew was clearly well behind the aircraft. In addition, their high airspeed was limiting their time to fix the problems and salvage the approach. A well disciplined and normally functioning aircrew should have realized the danger and executed some version of a missed approach at this time — but the crew of IFO 21 pressed on. The crew eventually slowed the aircraft to 150 knots, and descended to the minimum descent altitude (MDA) of 2150 feet. But these actions were being taken at the expense of accurate course guidance. The aircraft was still tracking nine degrees left of course, the weather was poor, and Murphy was waiting patiently on a 2300 foot peak less than 4 miles away at their twelve o'clock position. Simply stated, the crew had broken down as a team entity, and the pilot's individual crosscheck was failing.

The missed approach procedure for Dubrovnik requires a right turn and a climb to 4000 feet, and is identified and executed at the "CV" NDB locator. Post accident analysis found the single ADF receiver on board IFO 21 was tuned to the KLP beacon — which was required for course guidance. In the absence of a second ADF receiver, the crew was unable to identify the missed approach point, and as a result overflew it without executing the required procedure. Although there are several unauthorized procedures that the crew might have been attempting to use to identify the missed approach point, including timing, inertial navigation system coordinates, cross-tuning the single ADF receiver, and visual identification — whatever procedure they used, if any — failed them. The final failure of discipline had occurred, and the crew impacted the rocky mountainside more than one nautical mile past the published missed approach point, killing all aboard.

An analysis of the crews actions and failures

The crew of IFO 21 got behind the aircraft and never caught up. The lack of a complete crosscheck at regular intervals has been responsible for a multitude of pilot-error accidents (Nance, 1986). Fatigue and distraction appears to exacerbate this tendency. Alluisi (1967; 1972) found weighted tasks, those with high priority, caused the fatigued operator to attempt to maintain his performance on the task deemed most important at the expense of secondary, or less important tasks. This is especially dangerous in aviation where "less important" tasks are just as potentially lethal as those considered "primary." In this case, the need to get the Secretary on the ground by a certain time, may well have been deemed the most important task. By focusing on it, the crew — quite probably degraded by the copilot's fatigued state — was unable to function up to normal standards. More significantly, they did not realize the danger of their degraded performance in time to save their passengers or themselves. A combination of a late descent, poor planning which added the pressure of a late arrival, and a relatively difficult approach set the stage for a breakdown of the basic crosscheck and checklist discipline required to fly a safe instrument approach. All of this could have been solved with a single trip around the holding pattern.

An analogy might help in understanding what happened to IFO 21 in those last few minutes. Aviators have been compared to jugglers who are required to simultaneously juggle several different colored balls (tasks). Red balls are primary tasks, require constant attention, and are potentially lethal within seconds. An example of a red ball on this mission was executing the missed approach at the CV locator. Yellow balls are secondary tasks and require frequent but not constant attention — but they will turn red if disregarded. Accomplishing the descent and before landing checklists in a timely manner, and getting clearance for the approach were examples of yellow ball tasks. White balls sit next to the juggler, to pick up *if and when* there is time and attention available. They are external demands or pressures and influences, such as the concern for getting Secretary Brown down on time. They must *never* be allowed to interfere with the real show — the red and yellow balls that are in motion. As the juggler gets tired or distracted, a ball drops. In this case the first balls to drop were the yellow ones — the normal procedures for reviewing an approach, obtaining clearance, and the normal procedures checklists. These yellow balls eventually get picked up — but at the expense of attention needed to keep track of the one truly red ball on this approach — the missed approach point.

The deadly chain of failed discipline

From the moment that USAFE decided they could not find the time to implement the mandated CRM training, they were in effect making a decision to operate at a higher than necessary risk level. When the 86th Airlift Wing decided not to comply with the directive to stop flying Jeppesen approaches that had not been reviewed by DOD instrument specialists, they too made a decision which put all of their aircrews in a region of increased risk. The failure of several levels of oversight to insure compliance on both of these decisions; demonstrate that adequate checks were not in place.

On an individual level, the aircraft commander of IFO 21 allowed his crew to be pushed into a very small corner by accepting mission changes that they did not have time to adequately plan. This resulted in a failure to identify the fact that the CT-43 did not have the required equipment (two ADF receivers) to fly an instrument approach into Dubrovnik. There may have been considerable external and internal pressures at play, but as always in aviation, the buck stops with the pilot in command.

The copilot failed as a team member by not pointing these items out to his aircraft commander, and by violating clearly established crew rest criteria. As a result, he was not as sharp as he needed to be to at the moment of truth. He did not adequately back up the aircraft commander on the approach, failed to accomplish required checklists in a timely manner, and failed to advise the aircraft commander to go missed approach as the situation deteriorated and the crew lost situational awareness.

Good Intentions

All of these decisions were made with good intentions. At the MAJCOM level, CRM training was just not a high priority. Manning was down, operations tempo was up, there were just too few resources to go around. At the wing level, the mission came first. Each tasking was important, and the new restrictions got in the way of priority one — getting the job done. The pilots of LFO 21 were clearly aware of the heavy emphasis on the mission, especially in the wake of their squadron commander being relieved of command. They knew the importance of the Commerce Secretary's mission, and were just trying their best to be "can-do" team players. But good intentions are not sufficient rationale for poor discipline, and that is why this case study is so effective for our learning purposes. As aviators — or those responsible for aviation policy — we must clearly understand and follow established guidance. We must practice sound flight discipline. The road to hell is paved with good intentions.

A final perspective: The tough questions

If Secretary Brown had been delivered in one piece, would we still view this event as a case of misplaced priorities — or as a positive demonstration of a "can-do" attitude? Would Captains Davis and Shafer have professionally benefited from a couple of letters of appreciation from the Secretary's office, or gotten a wink and a pat on the back from the senior staff if they had successfully flown the "special circling procedure" given them by the pilot of 9A CRO? Would all be forgiven and forgotten if they had hacked the mission? Simply put, does the result of a decision — or string of decisions — determine the legitimacy of the process used to get there? Have we reached the point in our decision making processes where the end truly justifies any means of achievement? Has the unwritten motto in aviation at all levels of command become

"don't get caught? " Before you trivialize these questions, ask yourself how many "small infractions" you have witnessed — or perhaps been a part of — during your career that were necessary to "get the job done." Then ask yourself how you would sleep at night if the result had turned out like the one described in this case study.

One final point that should be made is that this case study (as well as my last one) represent *caricatures* of poor judgment. That is to say, the failures in this case were obvious, large and easy to recognize — they stood out like a cartoonist's rendering of W.C. Field's nose. But most failures of discipline are much more difficult to analyze — or even to identify, and it *these* failures which are the most prevalent and dangerous to our day to day operations. Sometimes just acquiescing to a bad idea can be a fatal link. The British novelist and philosopher C.S. Lewis makes this point clearly when he states in *The Screwtape Letters*, "indeed the safest road to Hell is the gradual one — the gentle slope, soft underfoot, without sudden turnings, without milestones, without signposts."

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One of the tests of leadership is the ability to recognize a problem before it becomes an emergency.

—Arnold Glasow

"...even a seemingly small infraction can become a key factor in a set of circumstances that leads to an accident."

ACCOUNTABILITY

BGen Charles M. Burke, Director of Army Safety and Commanding General, U.S. Army Safety Center

Much too often, safety is defined as the absence of accidents. Such a definition can easily lead to an attitude similar to that of a lawbreaker who measures his success by the number of times he gets away with it. As leaders, we must recognize that even a seemingly small infraction can become a key factor in a set of circumstances that leads to an accident. Therefore, we must create a climate of accountability in our units by taking positive action to deal with every breakdown in professional discipline and standards.

Safe aviation operations require elimination of undisciplined actions before they cause an accident. But many times, in the name of "protecting" an aviator's career, we hesitate to hold aviators accountable for breaches of flight discipline, disregard of procedures, and failures to perform to standard. We sometimes treat such violations as isolated incidents that don't warrant disciplinary action. However, doing this can allow a climate of tolerance to develop, a command climate in which breaking the rules is overlooked.

This must stop. We must create a command climate of accountability in which violations of regulations and procedures are not tolerated. And we must do it before an accident happens.

There is no better predictor of future performance than past performance. The insurance industry knows this to be true. Their studies have shown, for example, that a person convicted of a first offense of drunk driving has gotten away with it many times before being caught. This is why insurance rates go up immediately upon the first conviction: the insurance companies know it wasn't the first time the driver drove drunk; it was simply the first time he or she was caught.

There's a lesson here for commanders. Few of us will ever deal with a true first-time violator; what most of us will see are repeat violators who are caught for the first time. And that's why we must take action at the first sign of a regulatory or procedural violation. If we do not, we as leaders set a new standard — a lower standard.

This is not to suggest that every infraction should result in the violator being removed from the cockpit; rather, every infraction should be dealt with appropriately. We have powerful tools — harsh and not so harsh — we can use to show that we will not tolerate even the slightest infraction. And we can do this without ruining the careers of aviators who deserve a second chance.

All it takes is consistent enforcement of standards. We have the tools — actions ranging from counseling to removal from flight status — to make the "punishment" fit the "crime." There is no excuse for a commander ever to overlook an infraction, even a minor one because overlooking violations creates a tolerant command climate that will eventually result in an accident. Let me give you an example.

Several years ago, an Army aviator flew his helicopter into a lake while flying at 90 to 100 knots within 5 feet of the water. In the 12 months before the accident in which he died, this aviator had had four operational hazard reports (OHRs) filed against him in addition to at least two verbal reports about his flying.

Although the unit commander knew about the OHRs, written and verbal, and rumors about the aviator's "cowboy" style of flying and reputation as a "hot dog," the commander apparently looked at each report as a separate incident and never considered them as an indication of a pattern. As a result, this aviator got a "second chance" one time too many, and it cost him his life.

Many years ago, the Army Safety Center surveyed three aviation organizations that consistently maintained excellent safety records to determine the characteristics that led to their exceptional safety records. Each of them — a combat aviation battalion, an air cavalry squadron, and an aviation battalion — had a different organizational structure. And mission-wise, they had little in common except their success. But their commanders had one important characteristic in common: Each of them consistently took immediate and effective action against deviations from established standards.

Undisciplined behavior rarely corrects itself. It's the commander's job to deal appropriately with violations as they occur. And, as commanders, we must take it one step further: We must document infractions so that habitual violators don't revert to "first-time" violators when a new commander comes in or the aviator moves on to a new unit. Where soldiers' lives are at stake, we cannot afford to forgive and forget.

Leaders save soldiers.

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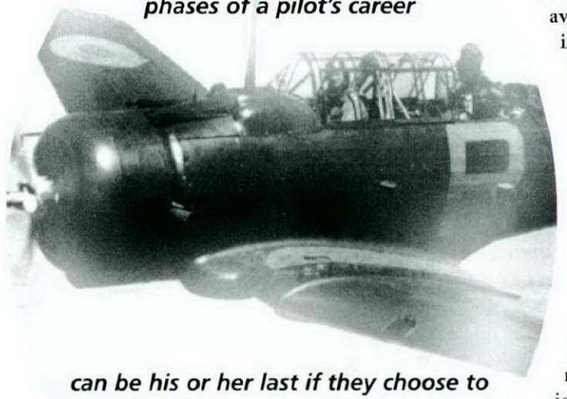
YOUTHFUL EXUBERANCE or IRRESPONSIBLE BEHAVIOUR?

For those who have experienced it, there will be little argument that learning to fly is truly an exhilarating experience and, arguably, one of the real pleasures in life. Coming to grips with something so different to what one has been used to; mastering the third dimension of height; mixing it with the birds and the stars has to be experienced to appreciate the wonder of it all. And, in the military of course, after the learning there is the eagerly awaited conversions and operational flying at squadrons and units. (But do we ever really finish learning?)

Sadly, however, some pilots don't make it beyond the learning stage. There is little doubt that learning is a phase of flying when lowhours pilots are at some risk, especially when flying alone. It takes skill and maturity to get through this phase of flying without a mishap. Countless investigations carried out into aviation accidents involving relatively inexperienced pilots, continue to pinpoint one factor in youthful pilots that places them at considerable risk when flying alone: that overwhelming desire to do something daring when no one in authority is thought to be watching.

The early flying training phases of a pilot's career



can be his or her last if they choose to bend the rules, and fail to develop proper cockpit discipline and airmanship habits.

Looking back though our files embracing quite a few years, we have lifted a few examples of overexuberance, irresponsibility, etc, that have almost invariably finished with fatal results.

At the time of all the accidents discussed, weather conditions and visibility were good cloud base was generally around 4 000 ft and winds light (10–15 kts).

Irresponsible behaviour

One afternoon in May 1950, two trainee pilots took off from Point Cook in two Wirraways to carry out a period of air-to-air gunnery practise, using cine guns. Each pilot's flight was authorized for 50 minutes, equally divided into 'attacker' and 'attacked' aircraft. The heights to be observed were stated as 4000 ft for the attacking aircraft and 2500 ft for the target aircraft.

After takeoff, both aircraft (A20-614 and A20-722) proceeded to the stipulated training area. Initially A20-722 assumed the role of the target aircraft at 2500 ft, whilst A20-614 acted as attacker. A20-614 made 78 attacks, all of which were pressed to approximately 50 yards, instead of breaking away at the minimum permissible separation distance of 100 yards.

After completing his turn as target aircraft, A20-722's pilot requested the pilot of the other Wirraway to assume the role of target aircraft; this was acknowledged by the pilot of A20-614. However, almost immediately A20-614 dived toward the ground. Watched by the pilot of A20-722 and eyewitnesses on the ground, the Wirraway dived almost to ground level over a train which was travelling north toward Moorabool railway station. The aircraft was observed to pull up steeply and then dive down again over the train. This time, as the pilot pulled up sharply, he attempted to execute an upward roll. When in the inverted position, at a height of approximately 150 ft, the nose of the aircraft dropped and it appeared as though the pilot was trying to dive out of the half roll. The aircraft dived almost vertically into the ground, bursting into flames on impact. The student pilot was killed instantly.

Clearly, the accident was caused by the trainee pilot losing control of the Wirraway whilst engaged in unauthorized low flying and aerobatics. Tragically, he was only 20 years old. He had no previous flying experience before joining the RAAF a year earlier and on Pilots Course had accrued 161 hrs (95 in Wirraways). During his training he had been highly assessed as an aerobatic pilot; however, he was also assessed as displaying an overconfident attitude.

This is an old story. If unauthorized low flying and 'shootups' didn't finish so tragically, perhaps they could be treated in a lighter vein. But, unfortunately, the outcome is often the same somebody killed and an aircraft destroyed.

Yield not to temptation

In April 1944, a trainee pilot with 150 hrs flying experience, was authorized to carry out a crosscountry flight: Uranquinty–Garema–Frampton–Uranquinty. The duration of the flight was planned for two hours with a minimum authorized height of 4000 ft.

On reaching Garema, instead of proceeding on to Frampton the pilot diverted to Forbes 15 nm to the north — well off the authorized course. After arriving at Forbes, the pilot proceeded to 'shootup' the town in a series of dives and stall turns. On the last occasion the aircraft 'fell out of the sky' and commenced to spin. The pilot was too low to effect a recovery and the Wirraway crashed into the town sports ground. The pilot was killed.

As the pilot was considered a reliable pupil, it was unnecessary to look any further than the fact that his mother was living in the town to find a reason for his being off-course and acting in the manner that he did.

Moral? If you get the urge to 'shoot up' during your flying; think again and think about what has happened before, in some cases, to far, far, better pilots than yourself!

A moment of rashness

In October 1951, an RAN Probationary Naval Airman (Pilot) took off from Point Cook in a Wirraway for a one hour solo period of general flying practice, to be followed by a period of low flying practice; minimum authorized height was 250 ft. Weather was fine with good visibility and light winds.

A little over one hour later, the aircraft was observed by another RAN Probationary Naval Airman to be carrying out routine low flying manoeuvres in the authorized low flying area. Aircraft control personnel at a nearby aerodrome and a group of civilians in the low flying area also observed the Wirraway's manoeuvres. Soon after, however, the civilians observed the aircraft to dive to approximately 100 ft AGL, pull up to 300 ft and commence to execute a roll manoeuvre. The aircraft completed the roll, but continued to lose height until it crashed into an open field, killing the pilot instantly.

Earlier briefing by the accident pilot's instructor included:

- general instructions regarding normal low flying and precautionary low flying;
- emphasis on a local flying order requiring students carrying out low flying to climb to 500 ft prior to changing fuel tanks or carrying out cockpit checks etc;
- emphasis on minimum height of 250 ft above all obstacles; and
- a warning to keep a good lookout for other aircraft operating in the same area.

The pilot's flying experience totaled only 160 hrs. A study of his progress sheet revealed no unusual entries. He was half way through the applied stage of his training and had carried out a number of low-level exercises, including a dual low-level navigation exercise prior to the accident. His standard of aerobatics was considered to be 'average'.

The aircraft crashed heading directly for the 1000 ft hills known as the You Yangs, which were approximately two miles distant. Although it seems unlikely that the pilot would attempt a low roll in such a position, it is possible that his intention in doing so was to use the peaks as a reference point a procedure frequently followed in the area in the case of normal aerobatics.

The accident occurred due to disobedience of orders on the part of the Probationary Naval Airman. A contributory cause was that the length of the pilot's period of low flying practice (60 minutes) may have induced boredom, leading to a temptation to indulge in the beating up of targets of opportunity. (It was also a possibility that the accident pilot and some other student pilot in another aircraft were engaged in some form of competitive indiscretion, but no firm evidence arose during the investigation to support this.)

The pilot had reached that dangerous period when pilots generally feel that they know just about all there is in the book. Personal discipline is then so essential until this phase gives way, through the passage of time, to maturity and discretion, borne of the accumulation of experience. Flying Orders are intended to save pilots from themselves observe them and you will live by them.

Daydreaming? overloaded? reckless?

At 1012 hrs on 22 May 1952, a trainee pilot set course from Point Cook in a Wirraway to carry out a solo low-level navigation exercise along the route Point Cook–Scott's Creek–Lismore–Point Cook. At approximately 1130 hrs the aircraft was observed by a civilian in the Rokewood area to come into view from the west, flying at a height of about 40 ft AGL. The aircraft made a turn to the right,

followed by another turn to the left, straightened up and thereupon collided with the only tree within several hundred metres and situated on gently rising ground. The aircraft then rolled to the right through approximately 110° before striking the ground and crashing some distance further on. The pilot was killed instantly.

Earlier, a mass briefing to students, conducted by the Flight Commander, emphasised the following:

- a minimum height above all obstacles of 200 ft;
- a warning to avoid populated areas, dwellings, livestock, etc; and
- reiteration of a local flying order requiring pupils carrying out low flying to climb to 500 ft prior to making flight log entries, changing fuel tanks, carrying out cockpit checks, etc.

The pilot was engaged in an authorized lowlevel navigation exercise. He had apparently concluded the first two legs of the exercise uneventfully and, according to his flying log (portion of which was found in a legible state in the wreckage), he had departed Lismore for Point Cook at 1119 hrs. Twelve aircraft were despatched from Point Cook around the same route at five minute intervals during the morning. An average groundspeed of 140 kts was achieved by the three aircraft which traversed the Lismore Point Cook leg nearest to the time at which the accident Wirraway crashed. Assuming this groundspeed, the accident pilot must have arrived at the position on the track at which it crashed at 1129 hrs, had the pilot flown directly along the briefed route.

There was one eyewitness to the accident, a man riding on horseback through the paddock in which the aircraft crashed at about 1130 hrs. He described the aircraft as appearing at a height of approximately 40 ft above the terrain to the west and flying in an easterly direction. The aircraft weaved slightly to the right and then to the left. The wings were then leveled and almost immediately the aircraft flew into the tree (see photograph), before striking the ground. The witness stated that there was no apparent change in the aircraft's height prior to it striking the tree. There was no suggestion of a 'beatup' and engine noise sounded normal.

> The tree was 22 ft high and the aircraft struck it 4 ft from the top.

The evidence of the eyewitness was borne out to a degree by the circumstantial evidence of the pilot's flying log. If the time at which the aircraft departed Lismore was accurately logged, no time existed for anything but a direct flight to the scene of the accident. From this, and the eyewitness's evidence, it was assumed that the pilot was not diverting in any serious way from the briefed task of flying from Lismore to Point Cook. It was clear, however, that he was doing so at considerably below his briefed minimum height.

It is probable that the pilot's first reaction to the collision (and resultant yaw to port) was to pull the control column hard back and apply right rudder, which resulted in a flick roll to the right. After initial contact with the ground, the aircraft apparently cartwheeled before disintegrating. Had the pilot not reacted so violently, it's possible that the outcome might not have been fatal; indications were that the collision with the tree did not damage the aircraft extensively.

On the face of it, it was difficult to understand why the pilot did not observe the tree, in view of his 'weave' prior to striking it. However, a number of possibilities existed:

- the 'weave' may have been insufficient for the tree to have come into the pilot's vision;
- the apparent 'weave' may merely have been due to inadvertent movement of the control column while the pilot was engaged in some check or adjustment in the cockpit (in which case, of course, he should have been at 500 ft);
- he may have been looking for a particular navigation pinpoint. In this case his attention could have been to the right and a nearby road (with the tree on his left); and/or
- he may have intended to impress the witness with his ability to 'lift' his left wing over the tree.

It seems unlikely that the pilot was looking at the witness at the time with a view to 'beating him up', as the tree would surely have been in his view had he been doing so.

The pilot was relatively inexperienced in lowlevel flying. He had carried out only 2.7 hrs dual and 0.7 hrs solo of such flying in Wirraways and, earlier in his flying training, two periods of dual low flying training in Tiger Moths.

On the balance of probability, the pilot was looking out of the right side of the cockpit, and probably at the road, when the left wing struck the tree. Nevertheless, the root cause of the accident was a disobedience of orders in that he was maintaining a mean height of approximately 30 ft (in lieu of 200 ft) above the general terrain in the vicinity of the scene of the accident, thus permitting his aircraft to collide with the only obstruction on an area of slightly rising ground.

Low hours pilots need to realize that this type of accident rarely happens to experienced pilots. When a low-flying accident, due to a disobedience of orders and/or overconfidence, occurs, the pilot involved is invariably under training or has recently graduated.

Remember, low aerobatics and unduly low flying are strictly nonhabit forming. To form habits, you must stay alive!

Another fatal temptation

At 1000 hrs on 2nd February 1957, a Mustang took off from Mallala, SA to conduct a onehour general flying exercise consisting of IF, VDF and a line-astern chase. The exercise was to be carried out in company with another Mustang; however, owing to this aircraft becoming unserviceable, the accident pilot proceeded on the exercise by himself. It was agreed that the other aircraft would join up as soon as the problem was rectified.

Just 15 minutes later the aircraft was seen circling a farmhouse at Stow, 31 nm north of Mallala. The pilot made a fast diving run past the farmhouse at a height of about 400 ft AGL, turned left, and then disappeared from view behind the farmhouse in an easterly direction. Shortly afterward, engine noise ceased and a crash was heard, simultaneous with a large cloud of dust rising. The aircraft was destroyed and the pilot killed.

The pilot had only fairly recently completed his flying training and had accumulated 335 hrs military and civil flying experience. His experience on Mustangs totaled 96 hrs, of which only six hours involved low-level training.

Two people at the farmhouse, cousins of the pilot, witnessed the accident. According to their evidence, the Mustang flew past in a slight dive at about 400 ft AGL close to the farmhouse. The aircraft was low enough for them to clearly see the pilot wave. During the left turn when the aircraft was out of view, the left wing tip struck the ground, followed by a violent impact and disintegration. (Measurements taken at the accident site revealed that the aircraft could not have been any higher than 175 ft above the terrain when it disappeared from the view of the two eyewitnesses.)

It must have been a severe shock for the cousins to witness such a tragic event and its aftermath. When later interviewed, the cousins revealed that the pilot frequently circled the farmhouse at low level in either a Wirraway or Mustang.

Just one year earlier the pilot had been reprimanded by his Flight Commander for a low flying incident in a Wirraway. (He had been authorized to carry out a period of aerobatics in the local area with a reservist doctor as passenger. After the flight the doctor reported that they had conducted low flying along a beach in St Vincents Gulf, so low that the doctor, as passenger, had considered the flight to be hazardous.)

The evidence showed that the pilot disobeyed orders by flying at a height that was below his authorized minimum height and departing from the briefed exercise. Further, the evidence of the doctor, who had been a passenger in the earlier reported sortie by the pilot, and the evidence of the cousins regarding the habit of the pilot to regularly circle the farmhouse, indicated that he was prone to indulge in unauthorized low flying.

Lack of flight discipline proved lethal

At 1040 hrs on 4 November 1957, two student pilots at a RAAF College Annual Camp Detachment took off in Wirraways from Wagga and proceeded to carry out a line-eastern chase exercise in the local flying area. During the exercise and approximately 25 minutes after taking off, Wirraway A20-749 failed to recover from a series of flick manoeuvres and crashed in open country three miles northwest of Junee. The aircraft exploded and burned on impact, killing both occupants instantly.

The pilot, a Senior Air Cadet, entered the RAAF College at Pt Cook as a cadet in January 1954 and had completed the applied phase of his flying training. His flying experience totaled 237 hrs, of which 107 hrs was on Wirraway aircraft.

The passenger was a radio technician and a member of the RAAF College Detachment at Wagga. It was customary for the cadets, whilst engaged on local flying exercises at the flying camp, to take maintenance crew as passengers.

The flight was authorized by the RAAF College Detachment Flight Commander. The exercise was detailed as 'line astern chase, minimum height 4 000 ft, time 45 minutes'. The accident pilot was to perform the exercise in conjunction with another Wirraway piloted by a Cadet Under Officer (CUO). The Flight Commander conducted the briefing in which he stressed the necessity to maintain the correct terrain clearance of 4 000 ft and to keep a sharp lookout for other aircraft in the area.

Both Wirraways reached the general flying area at 1045 hrs and commenced the lineastern chase exercise from a height of 6000 ft. In this exercise the aim was to get on the opponent's tail and remain there until he called a breakoff.

Two engagements were completed in which the CUO was able to assume a favourable attacking position but, on both occasions, he had to call a disengagement when the aircraft flew below the minimum height. The CUO had little difficulty in maintaining an advantage over his adversary, because in both engagements the accident pilot was using flicking manoeuvres as evasion tactics.

At about 1100 hrs the two pilots began another line astern chase and, after a brief interval of flying, the CUO once again positioned his aircraft about 100 ft line astern of his adversary. He then called the accident pilot to break off the exercise because both aircraft were, again, below the minimum altitude. However, the lead pilot did not break off the engagement but instead initiated a flick roll to the left through 360°, losing height rapidly. Lateral level was regained but with a marked nosedown attitude. From this position the aircraft performed a full flick rotation to the right, pausing again at the wings level position, but with the nose down at an even greater angle to the horizontal. The aircraft then flicked to an inverted attitude with the nose pointing approximately 15° beyond the vertical. At this stage it appears that a 'pullthrough' was attempted, during which time the aircraft struck the ground.

At no time during the flight did the accident pilot report any aircraft malfunction.

Evidence obtained from eyewitnesses, who viewed the accident from opposite directions, established that the first of the series of flick manoeuvres from which the aircraft crashed had been performed from a height of 1000-1500 ft, and that the final flick occurred at about 800 ft.

Discussion with other RAAF College cadets revealed that since they had arrived at Wagga, the accident pilot had contracted the habit of executing flick type aerobatics in the Wirraway. A number of cadets had flown with him during the flying camp when he had performed this manoeuvre, which is difficult to control. (Flick manoeuvres were prohibited because of structural considerations, and the flying instructor with the College detachment had warned the pilot not to carry out any such manoeuvres. The Flight Commander too, had ordered the pilot not to perform flick manoeuvres in Wirraways.)

The investigation established that the accident was caused by the pilot carrying out a prohibited manoeuvre, one that he was unable to control in the altitude available.

Perhaps with the benefit of hindsight the student pilot should not have been permitted to carry passengers, or should have been scrubbed from flying training, or both. Clearly, the onus is on us all to act responsibly when operating aircraft, more so perhaps today when the costs of training replacement aircrew, replacing expensive aircraft and the enormous costs of legal compensation, are taken into considerations.

Orders and instructions ignored

A Macchi student was briefed to conduct a general flying solo sortie from Pearce. His request to conduct low flying training was refused.

During the exercise he flew to a populated area and conducted a series of unauthorized and unbriefed manoeuvres at a low height for about five to ten minutes. This was witnessed by several people, one of whom had been alerted the day before by the student pilot.

Witness statements indicated that the Macchi flew over the built-up area at or below 700 ft performing various manoeuvres including a wingover and a 360° roll. The manoeuvres were clearly premeditated by the student pilot.

An investigation determined that the flying violations consisted of:

- operating over a built-up area below 1500 ft;
- conducting aerobatics below 4000 ft;
- not operating in a safe and professional manner as briefed by the CFI the morning of the incident and the student's QFI in the preflight briefing;
- defying instructions regarding *Avoidance of Noise Complaints;* and
- contravening DIs by not ensuring that the requirements of the various relevant orders and instructions were observed.

The student pilot was duly suspended from flying training. He was not punished for an error in skill, nor an error of judgment, but for a premeditated disregard of orders and instructions.

Reprinted courtesy of ADF Flying Safety Spotlight Vol 2 1996

Canadian Comments

I expect you are wondering about the Canadian experience.

The following examples are from RCAF and CF reports.

- The student was on a VFR cross-country flight when he disobeyed the briefing and entered cloud. After 5 minutes had passed he turned back and once clear of cloud decided to do 30 minutes of aerobatics over a broken layer. Unable to locate the Station after completing his aerobatics he successfully ejected when his engine flamed out due to fuel exhaustion. Result — one destroyed CT-133.

- The student was performing a series of aerobatics below the minimum allowable height. The pilot failed to recover from one of his dives and crashed. Result — one dead student pilot and one destroyed CT-133.

- The wings standard pilot was briefed for a local aerobatics flight, but proceeded to his hometown and beat-up the local airfield — including high-speed low-level rolls. He turned and dived towards his home, leveled off at high speed at 150 feet. As he passed over the house he rolled inverted, nosed down, and hit a tree. Result — two dead pilots and one destroyed CT-133.

- During a low-level exercise, to be flown at 800 feet AGL, the aircraft flew through the tops of trees and crashed. Result — an unsuccessful ejection attempt and another destroyed T-bird.

- Two CF-104's took off and joined up for unauthorized aerobatics including loops and rolls. During the RTB the two aircraft collided. One pilot remained with his aircraft and was killed at impact; the other pilot ejected successfully. Result — two less Starfighters and one dead pilot.

- While flying along railroad tracks the helicopter pilot approached a road crossing and struck a wire. Result — a damaged Iroquois and a very embarrassed pilot.

- A Twin Huey had its tail rotor and right elevator damaged during a compass swing. The pilot had allowed the crew chief to attempt a take off. Result — questionable career enhancement.

- While flying as part of a four-plane of Twin Hueys in a "loose trail stepped up" formation the pilot failed to follow the planned return route to Base. Over a public highway at a height of 23 feet the aircraft hit a set of wires. Result — one destroyed Twin Huey and two very serious injuries.

- A student pilot was scheduled, briefed, and authorized to fly his first solo low-level navigation mission. Since the trip was scheduled during bird migration season the flight was to be flown at 1000 feet AGL instead of the normal limit of 500 feet AGL. The target was a bridge in a river valley. The aircraft flew into rising ground 1.5 mile past the target. Result — the CT-114 was destroyed and the pilot was killed.

Regrettably, there are more examples of similar behavior that can be culled from our files. On the positive side, there have been fewer examples of disobedience in our recent past, but it still happens. The recent gross contravention of orders by a helicopter crew is a good case in point.

Why do a few people disobey orders? Perhaps they think that the rules were devised by staff wallah's hell bent on restricting mission accomplishment, stifling creativity, and otherwise ruining what should be the best job in the country — nothing could be farther from the truth.

Regulations are made to protect you from yourself. Regulations are a supplement for good judgement that inexperienced personnel have yet to acquire. The rules are often written in blood, and areoften the result of bitter experience.

Be disciplined. **If you want to buy the farm — pay in cash.**

LESSONS LEARNED

Lesson Learned from Tragedy

by Bruce MacKinnon, Wildlife Control Specialist, Aerodrome Safety, Transport Canada

In the business of risk management, we frequently discuss abstract concepts such as active failures, latent conditions, causal effects as well as links in the chain of events that contribute to an accident. On July 15, 1996, a Belgian Air Force C-130 Hercules crashed at Eindhoven Air Base in the Netherlands, resulting in 34 fatalities and 7 serious injuries. The tragic circumstances surrounding this accident provide a poignant message that dramatically shifts abstract concepts into gut-wrenching reality.

The Hercules departed Melsbroek, Belgium, for Eindhoven Air Base via Villafranca and Rimini in Italy. On board were 37 passengers, and 4 crew members. Of the 37 passengers, 36 were armed forces musicians who had given several performances in Italy. It was during the flight from Italy to Eindhoven that a chain of events began that, when examined carefully, can provide a valuable lesson.

The Hercules arrived ahead of schedule at Eindhoven, and was cleared for a visual approach to Runway 04. The airport bird control officer had previously been asked to report to the tower when it was assumed that the Hercules would arrive later in the day, although normal procedure required him to be on the field monitoring bird activity during flight operations. These circumstances required the bird control officer and air traffic control (ATC) staff to fire pyrotechnics from the tower to disperse a flock of birds that was observed shortly before the Hercules was due to land. The bird control officer and ATC staff failed to detect that a large, mixed flock of lapwings and starlings was sitting near the runway in grass, which had recently been mowed but had not been raked.

Just prior to touchdown, approximately 500 to 600 of these small birds were observed by the flight crew, who elected to carry out a missed approach. During the overshoot, the No. 1 and No. 2 engines were severely damaged by bird ingestion. The crew also feathered the No. 3 engine, likely believing that this engine was also damaged. With only the No. 4 engine producing power, the aircraft yawed approximately 70 degrees to the left, banked approximately 35 degrees to the left, lost altitude and crashed into the ground. The fuel tanks ruptured and flames engulfed the aircraft.

While the aircraft was still airborne, ATC staff activated the crash alarm, and emergency response staff reacted immediately. A misunderstanding during the initial calls resulted in the assumption that only the flight crew was on board the aircraft, with the result that backup fire fighters did not respond. A further assumption that the flight crew could not have survived the fire led to the decision not to enter the severely damaged aircraft. Because of these assumptions, more than 25 min were lost in the rescue effort. Meanwhile, survivors were unable to evacuate the aircraft because the doors had been damaged in the crash. Survivors were evacuated to the local hospitals 40 min after the accident.

It appears from the available information that quite a few links in the chain of events could have been broken to prevent this accident. For instance, the bird control officer could have been sent back to the field prior to ATC giving a landing clearance to the aircraft. Aircraft arriving early or departing late are common to any operation and the short delay that would result from the bird control officer returning to the field would have been a minor one.

Freshly mowed grass that is left unraked near a runway is an inviting site for birds. Had the mowed grass been properly disposed of, the probability of having a large flock of birds resting there would have been reduced, and it may also have offered a better view of the birds from the tower. Had more effective communications taken place during the initial calls, especially regarding the number of people on board, the fire fighters would have responded accordingly and possibly reduced the number of casualties.

Finally, the initiation of a missed approach in such a situation is something to reflect on seriously, and perhaps this issue could be discussed among pilot groups. We have received a number of reports describing incidents in Canada where pilots initiate an overshoot once they see birds in the runway environment, often resulting in aircraft control problems. Harm to turbine engines involved in bird-strike incidents is greater when the engines are operating at high power settings.

Although we fully realize that the critical decision to either overshoot or continue with the landing rests with the aircraft captain, bird-strike reports suggest that it may be advisable to continue with an assured landing, instead of applying full power and flying through a "cloud" of birds.

Perhaps the Eindhoven tragedy may have been prevented had one link in the chain of events been broken. The fact that the Dutch military has a state-of-the-art bird control programme proves that if such an accident can happen there, it can happen anywhere.

Reprinted courtesy of Transport Canada Aviation Safety Letter

Flight Safety and Discipline

1 Canadian Air Division Chief Warrant Officer's perspective,

CWO B. Lapointe MMM CD

Some readers may wonder how we can relate discipline with a valuable flight safety awareness programme at the workplace. Flight safety has been articulated in various ways achieving a tremendous amount of success over the last 10 years, and statistics are there to prove it.

The obvious reason for incorporating a Flight Safety programme is to minimize cost, in term of injuries, fatalities and equipment damage. The part that is often forgotten is the discipline required from the ground crews and aircrews to operate in a stressful environment to achieve organizational- mandated missions.

In my career, I have seen a lot of great things on the other side of the fence, called "flight line", but also a lot of bad habits related directly to a lack of self-discipline which required education and corrective action in the operating procedures. Discipline doesn't have to be authoritative to be effective. It just needs to be incorporated as an integral part of our daily activities.

A good supervisor is normally recognized as a good disciplinarian if he is successful in influencing others to control themselves under various conditions. Therefore self-discipline is one of the most important behavioral element in an individual's mind. It helps you control your personal behavior especially during unwanted high stress periods affiliated with the ever increasing operational tempo and makes you much more capable of making sound decisions.

Lately, one of the predominant intentional cause factors is pressing. Because people have the tendency to believe that the faster the job is done, and many times a short cut is used, the more they will be recognized as being effective. Other times, the supervisors or operational demand imposes it and people are rushed in doing things they would not do under normal circumstances. Here are a few words of advice, be aware of your areas of responsibility, be current with the local operational orders, be observant and take corrective action, and most important of all, if in doubt, ask.

From the supervisors, I solicit your exemplary leadership in maintaining a safe air force and to take a personal interest in the use of our important resources.

From the Editor

Welcome to the first 'Focus' issue of Flight Comment. I'll readily admit that I shamelessly stole the idea of a thematic issue from our friends at the Directorate of Flight Safety of the Australian Defence Force. What I didn't borrow was the idea of having the concept of discipline as a theme.

Many people wince when they hear the word discipline— I suspect they have visions of field punishment number one dancing through their heads, but there is certainly more to the concept of discipline than punishment. We have all read of certain crews performing brilliantly in unbelievably trying circumstances. Some examples immediately come to mind — the crew of the Sioux City DC-10 that lost their flight controls, the crew of the 747 that lost all four engines over south east Asia. These guys didn't give up. They continued to perform effectively under conditions of unbelievable stress in seemingly hopeless scenarios — and they won despite the odds! What quality did these crews exhibit that marks them as being at the true apex of their profession?

I don't know any of these gentlemen, but I'd bet you dollars to donuts that they shared one quality — they were disciplined in ALL aspects of their flying — no matter how routine. It would NEVER occur to them to cut corners or be in any way less than completely professional. They could be trusted implicitly by their peers, superiors, and subordinates. Their personal discipline afforded them the tools to succeed.

A few short notes

- I'd appreciate your comments about the "Focus" issue. I have plans for a couple of more if you think it worthwhile. Possible "Focus" topics are 'Ops Tempo and Fatigue' and a selection of the best 'There I Was'.
- The Flight Comment survey results will be published next issue. If you haven't made a submission it's not too late. Check the DFS Intranet site.
- I'm still receiving some excellent photo caption submissions — you'll see the results in the winter issue along with another evocative photograph.

SICOFAA

Flight Safety Award

The text of the Citation is as follows:

The Air Cadet Gliding Programme has been in operation for over 30 years and has flown in excess of 1,000,000 glider flights. Its aim is to provide practical aviation experience to Royal Canadian Air Cadets. Using a fleet of approximately 57 gliders, 28 tow planes, several winches and a few automobiles, the organization runs a Spring and Fall Familiarization Flight programme and a Summer Glider Pilot Training course. This fleet of aircraft and equipment is dispersed across the country at 56 locations from Terrace BC to Gander Nfld. Control and supervision of these resources is centred at five Regional Headquarters, some of which are up to 1600 km from the gliding sites. A milestone was reached during 1998 when, for the first time ever, there were no accidents recorded during the entire year on any Cadet aircraft. This achievement is truly remarkable considering the young age of the participants and the relatively little aviation experience that most of the instructors and on-site supervisors possess. The zero accident rate attained in 1998 is a testament to the dedication and devotion of the supervisors at the local level, the staff at the Regional Headquarters, as well as the staff at the National Headquarters in Ottawa who oversee the entire operation and maintain a strict programme of rigid standards. Success in 1998 is also attributable to the aggressive and proactive Flight Safety Programme that is clearly evident at all levels. In recognition of their outstanding contribution to safe flight operations, the personnel of the Air Cadet Gliding programme are recipients of this year's SICOFAA Flight Safety Award.

A milestone was reached during 1998 when, for the first time ever, there were no accidents recorded during the entire year on any Cadet aircraft. This achievement is truly remarkable...

Flight Safety Sayings

- In the 5th century AD, there were a series of Indian animal fables called Panchatantra. One of them says: "Not a gift of a cow, nor a gift of land, nor yet a gift of food is so important as the gift of Safety, which is declared to be the greatest gift among all the worlds gifts."
- Aviation Creed. "Love me and know me and you shall be blessed with great joy. Love me and know me not and you are asking for real trouble."
- "Hindsight is great, but foresight is even better and less expensive."
- "After all is said and done, a lot more is usually said than done."
- "If you have moved the landing gear handle up more times than down you are most likely not in the ideal landing configuration."
- And finally from the Venezuelan Air Force. "A pilot graduates from our academy carrying two bags — one bag of luck which is full when he graduates and one bag of experience which is almost empty. A successful pilot uses his luck to gain experience. If a pilot wastes his luck, uses it all up without gaining experience, he will most likely fail."

Courtesy of Major Mike Gibbs 19 Wing FSO

Epilogue

TYPE: CT114 TUTOR 048
DATE: 25 Sep 97
LOCATION: 55 NM South of Moose Jaw, Sask.

The CT-114 Tutor crew was on an instructional mission to introduce low level navigation to the student pilot at Moose Jaw, Sask. The aircraft departed the 15 Wing airport at 1532 hrs local (2232 UTC) and shortly after commencing the second leg of the route at about 500 feet above ground (AGL) a bird was struck and ingested through the engine. The flying pilot (instructor) traded airspeed for altitude while simultaneously reducing power and activating the airstart. The engine Exhaust Gas Temperature (EGT) was reading about 800 degrees and when the throttle was advanced there was no discernible thrust. A glide profile was established, a procedure one relight attempted and the student prepared for ejection while setting the transponder to emergency and the radio selector to guard. Again the EGT reading was 850 degrees and no thrust was detected as the power lever was advanced. A quick "mayday" call was made and then the instructor pilot gave the command to eject. The aircraft parameters were approximately 130 knots, 800 feet per minute descent rate and about 850 feet above ground when the crew exited.

Both crew tumbled during the sequence, although in opposite direction, and both experienced seat/man interference. In the student pilot's case, the interference was severe as the seat was completely entwined in the parachute shroud lines. This eventually resulted in a high velocity parachute landing causing a major injury. The instructor pilot suffered only minor injury during the ejection sequence although he was struck on the back of the helmet by his ejection seat.

The aircraft continued for about 1000 meters, and crashed into a ploughed field at 1603 hrs local. The aircraft was low energy and high angle but flat attitude on impact and caught fire. Stubble in the ditch to either side of the impact caught fire and was extinguished by a local fire department. The pilots were stabilised, loaded into an ambulance and enroute to hospital in Assiniboia within 55 minutes of ejecting.

Although the bird strike was determined as the cause of the engine compressor stall, the investigation focused on peripheral issues.

The seat/man interference that both occupants experienced has been a frequent occurrence in the history of this ejection system. The characteristic of this ejection seat is to tumble before, during and after seat/man separation. The direction of tumble would be effected by the individuals centre of gravity. This poses a problem when the parachute begins to extract and has potential to impact the seat. It also poses a problem as the individual may contact the seat during the separation phase. The CT-133 Silver Star utilises the same basic ejection system as the CT-114 and has had a similar history of seat/man/parachute interference.

The student, in this case, had extensive parachuting experience, which enabled him to manipulate his entwined parachute enough to slightly decrease his fall rate. He still, however, suffered a major injury. Since this mishap, parachute-landing training has been conducted on CT-114 aircrew and will continue to be an annual requirement. The investigation has also recommended that this type of training be formalised for all CF ejection seat aircrew.

Neither pilot wore dual layer undergarments. The CF flight suit is designed to offer fire protection only if the dual layer principle is followed. Without dual layer, personnel have minimal fire protection. The investigation also showed that the instructor pilot wore single layer, British style, leather flying gloves. The CF Aerospace Life Support Equipment (ALSE) authorities discarded this style of flying glove because of the shrinking characteristic of the leather when heated and the associated debilitating injuries suffered to the back of the hand in casesof fire contact.

Neither pilot wore a Life Preserver Survival Vest (LPSV). Although local flying orders dictate an LPSV is only required over large bodies of water, had the student pilot landed in any water, regardless of depth, he would not likely have survived with the injuries he sustained and no LPSV. There were several large lakes and sloughs in the area of the accident.

Other ALSE issues investigated and addressed included the loss of the helmet visor during the ejection and the hard kneeboard worn by the student, which cracked his oxygen mask on impact.

The ejection system investigation showed incorrect and incomplete information was in the aircraft record set with respect to the ballistic charges and gas generators in the ejection system. Further investigation into the possible "slow burning" ballistic charge lead the engineering staff to discover discrepancies in the expiry times for materials used in the build-up of cartridges and charges in the ejection systems of the CT114 and CT133 fleets. A Special Inspection (SI) was initiated to replace and inspect all CT114 seat initiators within 60 days. Furthermore, 1 CAD COS OPS directed that all time expired initiators were to be replaced and the rest of the seats in the fleet were to be inspected. This direction has been carried out. The CT133 fleet was grounded for a short period while an engineering disposition was undertaken and it was decided to extend the time expiry date for affected intitiators.

This occurrence involved a classic bird strike, followed by an unclearable engine compressor stall. It is very concerning that the aircrew were not wearing sufficient ALSE for their mission. Much time and effort are placed in procuring the highest quality life support equipment available but aircrew must wear this equipment to enjoy its benefits. In an effort to mitigate the risk associated with the seat/man separation problem, a working group was assembled in January 1999 to create a harmonized risk analysis on this issue. A team was subsequently formed in April 1999 to make recommendations to CAS for risk mitigation. In the meantime, all CT114 and CT133 aircrew must continue to set their personal ejection parameters before flight so that no time is lost to indecision should ejection be the only viable course of action.

TYPE: **Schweizer 2-33 GLIDER C-GCLG**

LOCATION: **Iroquois Falls, Ontario**
DATE: **26 September 1999**

The glider was being flown in support of the Air Cadet Gliding Programme Fall Familiarization Session at the Arctic Watershed Gliding Site, Iroquois Falls Municipal Airport. The site was using a winch to launch the glider to provide familiarization and motivational flights for a group of Air Cadets. The pilot was a Familiarization Qualified Glider Pilot and had already completed two flights without incident immediately prior to the occurrence. The winds at ground level were strong (approx 10-20 mph) but within limits for the operation. Strong winds were also noted to be present at circuit altitude.

With the famil pilot in the front seat and the cadet in the rear, the glider was once again launched and achieved an altitude of 800-900 ft after the cable was released. After a brief session of turns at altitude, the glider joined left downwind for runway 18. The Launch Control Officer at the launch point noted the glider was proceeding downwind at a faster rate than previously seen and radioed the pilot to warn him of this fact. The pilot did not recall hearing the transmission and proceeded to fly his circuit using the same check altitudes and ground references that had resulted in a successful and effective approach only seven minutes earlier on his previous flight. He used crab on base leg to account for the wind but found himself turning final further away from the runway. Once established on final he realized, that although he had added 20 mph to his final approach speed (to compensate for the wind), he was barely making any headway towards the runway but was headed for trees just north of the airport boundary. With few off-field landing sites available around the airport and none within reach once on final, the pilot elected to fly the glider between the trees and avoid stalling. The left wing struck a large pine tree approx 25 feet above the ground. This caused the glider to pivot about the point of impact and the right wing to rise to a near vertical position. The glider eventually struck the ground with the left wing folding under the fuselage and the right wing parallel to and up against the trunk of another large pine tree. The pilot and passenger were able to egress unassisted through the broken canopy. The crash site was about 2000 feet from the launch point and 1100 feet short of the button of the runway.

DFS Remarks

We were indeed fortunate that the injuries suffered in this accident were limited to some bruising and post occurrence emotional trauma. Once again the robustness of the glider used in the Air Cadet Gliding Programme and the four-point harness securing the occupants saved them from more serious physical injuries.

This investigation is continuing. It is focussing on the pilot's recent training and the follow up of famil pilots that do not continue to gain qualifications in the Air Cadet Gliding Programme. Other issues that will be explored are duty times and adequate rest for the staff while participating in gliding operations.

TYPE: CH124 SEA KING 12419
LOCATION: 12 Wing Shearwater NS
DATE: 4 May 1999

The aircraft had undergone maintenance for Ng fluctuations on the number 2 engine and required an engine run and leak check to be declared serviceable. The pilot briefed the three-person start crew that he would start the number 2 engine without the aircraft rotor system in the 'flight spread' position. The pilot was the only person in the aircraft at the time of the start.

In order to accomplish the briefed start procedure, the pilot used the 'emergency start' switch to override the 'safety interlocks' designed to ensure the number 2 engine cannot be started without the rotor system spread and number 1 engine running with the utility hydraulic system pressurised. Rotor brake pressure was about 470 PSI before the start was attempted.

With the number 2 engine started, the pilot observed the Ng was fluctuating while two members of the start crew joined the pilot in the aircraft. In an attempt to stabilise the fluctuations, the pilot selected the fuel boost pumps on and off several times, then he elected to advance the number 2 Speed Selector Level (SSL). When the SSL was advanced to between 85 -95 % Ng, the rotor head shifted causing damage to the folded rotor blades, the tail rotor and the pylon structure. During this action, a loud bang was noted in the cockpit and the pilot secured the number 2 engine.

The mechanism causing the damage was quickly understood. Without the rotor in the 'flight spread' position, the only mechanical device stopping the main rotor head from rotating was the rotor brake. It is designed to hold the head in a fixed position once the main rotor is in the folded position. Its maximum holding capacity is about 80 shaft horse power. The output shaft horsepower of a normal operating Sea King engine is up to 1350 shaft horsepower. When the SSL was advanced from ground idle towards the normal operating range (85-95 % Ng), the engine shaft horsepower exceeded the design holding capacity of the rotor brake and the main rotor head began to rotate. The rotation of the main rotor head in the folded position directly caused all of the observed damage. The aircraft sustained C category damage and there were no injuries sustained in this occurrence.

The AOI for the CH124 contains a 'Caution' about not starting the number 2 engine without the rotor system in the flight spread position. Also, the ground crew voiced concerns to the pilot about the proposed procedure; however, a passive voice was used to express their reluctance. The pilot did not pick up this passive voice warning and then used an 'emergency start' switch to override a 'safety interlock' with the result being a badly damaged aircraft. Areas that are still being explored on this occurrence are in the deficiencies related to Crew Resource Management (CRM) and Human Performance in Maintenance (HPIM) that were apparent.

TYPE: CH124A SEA KING 12414
LOCATION: 12 Wing Shearwater NS
DATE: 16 June 1999

The mission was a proficiency training flight for water take-offs and landings and the crew had just completed a crew change of the right seat pilot, a qualified co-pilot from an operational squadron.

Because of the proximity of other aircraft, the crew believed that a sharp turn would be required to ensure aircraft separation while taxiing clear of the parking area.

The co-pilot commenced a rapid turn to the right to depart the ramp. As both pilots turned their heads to the right to confirm clearance from any obstacles, they noticed that the rotor tip path plane was moving down the windscreen. The co-pilot reacted with two shots of aft beeper trim, but the aircraft began to rotate forward about the main landing gear. The co-pilot then reacted by pulling back on the cyclic.

As a result of the aft cyclic input, the tailwheel hit the ground and failed. The main rotor continued aft, striking the #4 section of the tailrotor driveshaft, causing the loss of tail rotor drive. The crew felt and heard some bangs; the aircraft bounced several times and yawed 30 degrees to the right. The instructor pilot took control, ordered an emergency shutdown and the crew evacuated the aircraft safely. There were no injuries in this occurrence.

Areas that are being explored on this occurrence relate to crew performance, pilot technique and loss of situational awareness due to fixation of attention on one aspect of a manoeuvre at the expense of aircraft control.

Corporal Karen Macdonald & Corporal Dave Smith

Corporal MacDonald and Corporal Smith were tasked to replace a Hercules main landing gear ball-screw. A requirement of this tasking is the inspection of an oil seal. The seal required replacement. Technical orders were consulted to obtain a stock number and a replacement was ordered. A thorough before installation examination of the new seal revealed subtle difference between it and the older item. Although the stock number was double-checked and confirmed as correct; the part number on the new seal did not match the one quoted in technical orders.

Corporal MacDonald and Corporal Smith decided to investigate further. Working in conjunction with technical services they were able to confirm that the seal was incorrectly identified. On their own initiative they purged one dozen of the misidentified items from maintenance storage cabinets.

Corporal MacDonald and Corporal Smith's attention to detail and professionalism resulted in the elimination of a potentially significant safety hazard. *Well done.*

Corporal Robert Canning

Corporal Canning was tasked to be a spotter for the parking of a transient Polaris aircraft. The aircraft taxied onto the tarmac area and parked without incident; however, a wing tip passed within six feet of a transport trailer parked on the corner of the ramp. The transport trailer and other equipment had been parked much closer to the painted centre taxi line than they should have been.

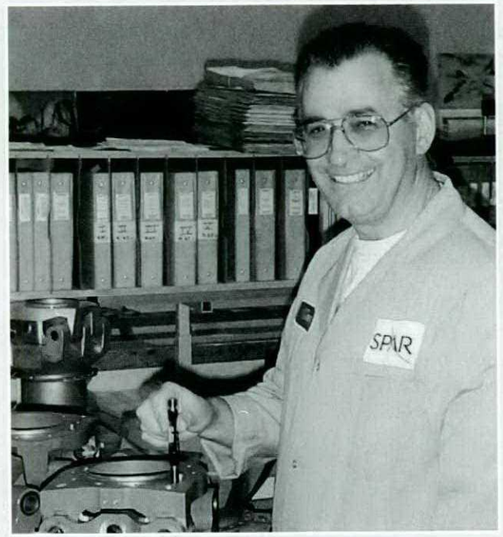
Corporal Canning realized the seriousness of the situation and immediately notified management through the use of an observation sheet. As a direct result of his submission the area around the ramp was cleaned up and safety lines were painted to ensure the accurate placement of equipment. A programme to periodically inspect the ramp area was also initiated.

Corporal Canning's diligence and perseverance eliminated a safety hazard that could have easily resulted in significant damage to an aircraft. *Well done.*

Mister Tony Ferracane

A civilian repair and overhaul contractor had experienced a sudden rash of oversized stack bearing bores in the sleeve and hinge assemblies of Sea King main rotor heads. The sub-contractor suspected a bad batch of stripping solution, but Mister Ferracane, an employee of SPAR Aerospace, suspected that there was more to the issue. He realized that over years of performing repair and overhaul support for the main rotor head that there had been a steady increase in the number of dowel pins that required oversize bushings.

Mister Ferracane decided to investigate further by re-checking main rotor blade bolt attachment holes that had been previously verified as meeting overhaul limits before undergoing chemical stripping of the cadmium coating. He discovered that some of the attachment holes failed the go no-go thread test — the threads had been inadvertently chemically milled during the stripping process. Mister Ferracane immediately notified his supervisor and within hours a fleet-wide special inspection was issued. The inspection resulted in the discovery and removal of two sleeve and hinge assemblies that were not within technical limits.



Mister Ferracane's professionalism and outstanding technical knowledge eliminated a serious flight safety hazard. *Well done.*

Corporal Sylvie Tremblay

Corporal Tremblay was tasked to install an essential alternating current bus relay on a Hercules aircraft that was undergoing a periodic inspection. The part had recently been delivered as an immediate operational requirement.

Corporal Tremblay noticed that despite having the correct stock number the relay did not appear to be quite the same as others she had installed in the past. Not satisfied with the situation she decided to investigate further.

A search of technical orders and specifications revealed no reason for the suspected anomaly, but correspondence with the manufacturer revealed that the ampere rating for the new relay was less than half of what was demanded by specifications. An audit revealed that a further three of the deficient units had been purchased and one had already been installed in a different Hercules. Had one of these units been subjected to a heavy electrical load it would have shorted with potentially hazardous results.

Corporal Tremblay's exceptional attention to detail and professional actions when confronted with a seemingly insignificant difference between parts prevented what could have been a serious in-flight emergency. *Well done.*

Corporal Jim Houston

Corporal Houston, the duty ground controller, was scanning the aerodrome when he observed a fire in the port engine of a Labrador helicopter that was parked on a taxiway. Corporal Houston contacted the fire-hall crew who were conducting arrestor cable training and directed them to the site of the fire. He then initiated a two-bell emergency and activated the remaining elements of the response team.

Corporal Houston restricted all non-essential vehicular traffic from the vicinity of the aircraft because of his concern about a possible explosion. Lacking communications with the aircraft, Corporal Houston was initially unable to determine whether there were any personnel onboard. He continued to scan the scene and noticed two technicians in the cockpit of the aircraft. Corporal Houston promptly advised Red Leader and the individuals were quickly evacuated from the cockpit.

The elapsed time from when Corporal Houston first sighted the fire until the arrival of the firefighters was one minute and the entire emergency was secured within nineteen minutes. Corporal Houston's initiative, and quick response, prevented the possible loss of life and minimized damage to the aircraft. *Well done.*

The Captain and Crew of HMCS Vancouver

HMCS Vancouver was enroute home from a lengthy deployment to northeast Asia. The ship's Sea King helicopter was conducting routine operations nearby. Approximately thirty minutes into its mission an intermediate gearbox emergency arose which required the helicopter to land as soon as possible. HMCS Vancouver immediately came to emergency flying stations.

The helicopter was only six miles from HMCS Vancouver and would be in position to land within three minutes. The ships' company was closed up and the Captain gave permission to land three minutes and thirty seconds after the emergency was declared. The helicopter landed safely and the emergency was secured. The fleet standard for ships closing up for emergency flying stations is six minutes.

The performance of the Captain and crew of HMCS Vancouver is a testament to their professionalism, teamwork, and dedication. The alacrity and enthusiasm they displayed prevented the Sea King from having to ditch. *Well done.*

Master Corporal Vaugh McCabe

Master Corporal McCabe and an apprentice were tasked to replace a propeller on an Aurora aircraft. While explaining the relationship between a locally approved procedure checklist and Canadian Forces technical orders to the apprentice, Master Corporal McCabe noticed a discrepancy between the value quoted for propeller nut torque in each of the documents. Master Corporal McCabe decided to investigate further.

Research showed that the technical orders had been amended two years previously and that the checklist should have been purged from the system. Further scrutiny showed that seven propellers had been installed on unit aircraft using the incorrect torque value. Scrutinization of all locally produced checklists revealed others with outdated or questionable content. All checklists have subsequently been revised and are now subject to rigid control.

Master Corporal McCabe's professionalism, attention to detail, and superior investigative efforts culminated in the rectification of serious inadequacies in the content and control of unit maintenance checklists. His efforts also resulted in the retorquing of several propellers thereby eliminating a further flight safety hazard. *Well done.*

Corporal Mike Ireland

Corporal Ireland was tasked to proceed to the designated loading area to await pilot acceptance of aircraft loaded with heavy weapons. While waiting for the pilots to arrive Corporal Ireland noticed that a release band on one of the aircraft was touching the pylon fuel probe. He rotated the band clear of the fuel probe and then decided to double-check the loads on all the other aircraft.

During his inspection Corporal Ireland noticed that on one of the aircraft an arming swivel was attached to a hard point. If the pilot attempted to jettison or drop the weapon in a safe condition it would have armed and detonated. He immediately detached the arming swivel and reattached it to the nose arming solenoid. After the pilot had accepted the aircraft Corporal Ireland returned to servicing and notified his supervisor who raised an occurrence report.

Corporal Ireland demonstrated superior initiative by conducting an additional and thorough inspection of all loaded aircraft. His discovery averted a potentially disastrous accident. *Well done.*

For Professionalism

Master Corporal Steve Shrewsbury-Gee

Master Corporal Shrewsbury-Gee was tasked to perform the avionics portion of a primary inspection of a Hercules aircraft. During the required visual inspection of the dry-bay-cover area he decided to physically check the security of all the antennas. During his check he discovered that the TACAN antenna did not appear to be properly secured.

Further investigation revealed that a crack was present on the natural seam of the antenna mount. The antenna was being held in place by only two guide pins and the conductor was sheared off at the base. The antenna would have likely separated in-flight causing serious damage to the aircraft.

Master Corporal Shrewsbury-Gee's professionalism and initiative allowed him to discover a significant flight safety hazard. Through physically checking the security of the antennas he was able to locate a fault that was undetectable by visual means alone. *Well done.*

Corporal Terry White

Corporal White was tasked to complete an avionics before-flight check on a Labrador helicopter. While carrying out his duties he noted that the bolts securing the rotor brake assembly did not have any threads protruding through the locking nuts. Knowing that that the situation left the mounting bolts unsecured he decided to investigate further.

Corporal White consulted technical orders and confirmed that the mounting bolts and nuts were of the wrong type. Subsequent removal and disassembly of the rotor brake assembly verified that it had been installed incorrectly. Further adjustments had utilized improperly built up shims and washers. The assembly was replaced and the aircraft was declared serviceable.

Had the rotor brake come apart in-flight serious damage to the aircraft and a critical emergency would have resulted. Corporal White's superior technical knowledge, attention to detail, and perseverance eliminated a critical flight safety hazard. *Well done.*

Corporal Paul Marcotte

Corporal Marcotte was tasked to carry out a special inspection to check for cracking of the aft number-two hydraulic reservoir supports of a Hornet aircraft. During his inspection he discovered a ballpoint pen within the bay. Not satisfied that all the FOD had been located, Corporal Marcotte decided to carry out a detailed examination of the area using an inspection mirror and a flashlight.

While vetting the locale, Corporal Marcotte discovered another ballpoint pen wedged between two bulkheads. The number two hydraulic bay also houses the aircraft's mechanical mode flight cables — a system essential for the safety of flight.

Corporal Marcotte's meticulous attention to detail and tenaciousness allowed him to locate and remove hazardous foreign objects from a confined area of an aircraft. His efforts may well have averted a potentially tragic flight safety incident. *Well done.*

Captain Maurice Ricard

Captain Ricard was flying a Tutor aircraft with a pre-solo student passenger on a routine cross-country flight. Forty nautical miles east of Thunder Bay at FL370 they heard a loud bang followed by cockpit indications of an engine failure. Initial actions failed to restart the engine. An emergency was declared and the aircraft was turned west towards the Thunder Bay airport.

Faced with a solid undercast layer at two thousand feet, Captain Ricard initiated load shedding to prepare for the upcoming cloud break procedure. He directed the student pilot to assist with emergency procedures and radio work.

Although initially above the required glide profile, a one hundred-knot headwind soon resulted in the aircraft being unable to reach the aerodrome. Confronted with poor weather, and the possibility of an ejection over Lake Superior, Captain Ricard successfully performed a procedure 2 relight. He then completed the cloud break procedure and a precautionary forced landing.

Captain Ricard's calm and thoroughly professional response to multiple emergencies undoubtedly prevented the loss of his aircraft. *Well done.*

Flight Safety Word Search

By Captain J.J.P. Commodore

C	A	L	A	M	I	T	Y	B	O	E	N	I	G	N	E
P	I	D	R	A	W	R	O	F	G	A	E	E	L	K	X
D	R	H	A	B	I	T	U	A	L	N	T	B	I	N	I
E	F	R	P	S	T	A	B	L	E	A	A	D	A	A	T
T	R	E	V	O	C	S	I	D	V	N	I	G	H	T	Y
A	A	M	M	R	R	N	E	O	O	S	T	A	L	L	L
R	M	O	E	L	R	T	N	I	A	N	I	G	L	E	D
T	E	V	I	A	E	N	S	D	F	O	N	A	O	L	E
S	E	A	E	R	I	O	V	A	P	I	I	R	C	B	T
N	B	L	M	C	L	A	C	U	T	T	N	N	A	I	B
O	U	I	O	P	N	T	N	C	N	A	A	I	T	S	U
M	N	L	X	T	U	C	E	E	T	L	C	S	E	S	O
E	D	E	A	A	T	P	T	E	C	U	U	H	H	E	D
D	L	G	L	U	S	O	N	I	C	S	S	C	E	C	N
W	E	A	R	N	P	R	E	V	E	N	T	E	D	C	U
D	S	E	I	W	I	N	D	S	H	I	E	L	D	A	K

HINT 8 LETTERS "Y2K EXERCISE....."

ACCESSIBLE
AIRFRAME

BAIL
BOTTOM
BUNDLES

CALAMITY
CATASTROPHIC
CHECK

DEMONSTRATED
DETERMINE
DISCOVER
DISADVANTAGED

ENGINE
EXIT

EXPLOSION

FACTUAL
FORWARD

GANG
GARNISH

HABITUAL
HAIL

INITIATE
INNOVATE

INSPECTING
INSULATION
ITCH

LEARN
LOCATE

NEVER
NICOL
NIGHT

ORNATE

POTENTIALLY
PREVENTED
PUNCTURE

REMOVAL

SONIC
STABLE
STALL

TANK

UNDOUBTEDLY

WEAR
WINDSHIELD