GEAR UP, MISHAPS DOWN

THE EVOLUTION OF NAVAL AVIATION SAFETY, 1950–2000

Vice Adm. **ROBERT F. DUNN**, USN (Ret.)

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Foreword

My first direct involvement with a major aircraft mishap occurred during a Mediterranean cruise in the USS *Saratoga* in 1959. While on the flight deck during night operations, I watched our squadron executive officer get too low in the approach and hit the end of the ship. He then careened up the flight deck and crashed into the water. There was no chance of recovery. It was a stark reminder of the dangers involved in carrier aviation for a young junior-grade lieutenant.

Unfortunately, my experience was all too common. In 1950, some 481 aircraft were destroyed and 227 people killed in naval aviation, both at sea and ashore. In today's terms, that would mean that more than four air wings had been wiped out during the year. It was a nadir; things did get better, as evidenced by the amazing safety performance in more recent years, but not without a great deal of dedicated effort and the development of a new mind-set.

Vice Admiral Dunn details the decades-long process of that effort to improve safety, including refinement of aircraft procurement practices, the embracing of technological improvements, and development of new cockpit-management techniques.

There are not many naval aviators who could equal Dunn's dedication or his experience as a champion of aviation safety throughout the Navy. His long flying experience began in the 1950s with the Douglas AD Skyraider and culminated in 1988 in the F/A-18 strike-fighter. His safety experience includes attendance at the University of Southern California School of Aviation Safety. Throughout his career—as a squadron commander, a carrier skipper, and finally Deputy Chief of Naval Operations for Air Warfare—he put into practice his ever-growing knowledge of the subject covered in this book: naval aviation safety.

The book does a first-rate job of describing the unacceptable rate of mishaps in the early 1950s, then moving through what transpired over more than fifty years so that today's naval aviation mishap rate is as good as or better than that of any other flying organization. While no mishap is acceptable, we now much better understand how a mishap may happen and what needs to be done in the way of prevention. By recounting this impressive record of accomplishment, this book provides a great service to the Navy and to naval aviation safety. It is also a testament to professional achievement and a model for future safety improvement endeavors in other professions.

DAVID M. NORTH
Naval Aviator
Former Editor in Chief, *Aviation Week & Space Technology*

Preface

A Most Remarkable Story

For the better part of a century naval aviation[1] has been at the forefront in defense of the United States. Of all the armed forces it has been the first on scene and the first into action. It is a forward-deployed force of sailors and Marines operating from aircraft carriers, amphibious forces, and other ships, small and large, and land-based patrol aircraft on station around the world. That force is ever ready to carry out the orders of the president, whether for humanitarian relief, mere presence, or even combat.

The downside of this story is that all of this capability began with terrible peacetime losses of people and aircraft. In the 1950s the mishap rate for naval aviation was far higher than that of the Air Force and far higher than it should ever have been. The upside of the story is that by the end of the twentieth century that had been corrected, and this book describes how it was done. Today naval aviation is at least as safe as Air Force aviation, safer than general aviation, and approaches even commercial aviation in terms of mishaps per given time period. Despite the need to maintain high readiness for combat and in the face of continued high-tempo operations prompted by various crises around the world, including those in the Middle East and around the Persian Gulf, saber rattling by North Korea and China, and increasing tensions with Russia, naval aviation has never been safer.

Figures tell the story: while those involved will be quick to declare that improvement must continue, from 1954, when naval aviation lost 536 people and 776 aircraft in 2,213 major mishaps, there has been remarkable improvement, until in 2014 naval aviation suffered only twenty major mishaps. "Still too many," one might conclude, but what a far cry from six decades before! Today naval aviation takes a backseat to no other enterprise in either flying safety or readiness to meet all missions. The following narrative describes how that improvement was wrought. It's a remarkable story.

GEAR UP, MISHAPS DOWN

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Black as Midnight

Lord guard and guide those who fly,
Through the great spaces of the sky.

"Navy Hymn," second verse

It was a dark night at sea. The overcast shut out any possible moonlight or starlight. All was pitch-black; there was no horizon. The only things to be seen in the darkness were a pair of closely spaced red lights, "truck lights,"[1] at the top of the carrier's mast, and two more pairs atop two nearby destroyers. All around it was black as midnight.

Only a handful of aircraft were airborne, and it was time to bring them home. The carrier increased speed and turned slowly into the wind, its four screws churning up a phosphorescent wake giving the airborne pilots just a hint of the
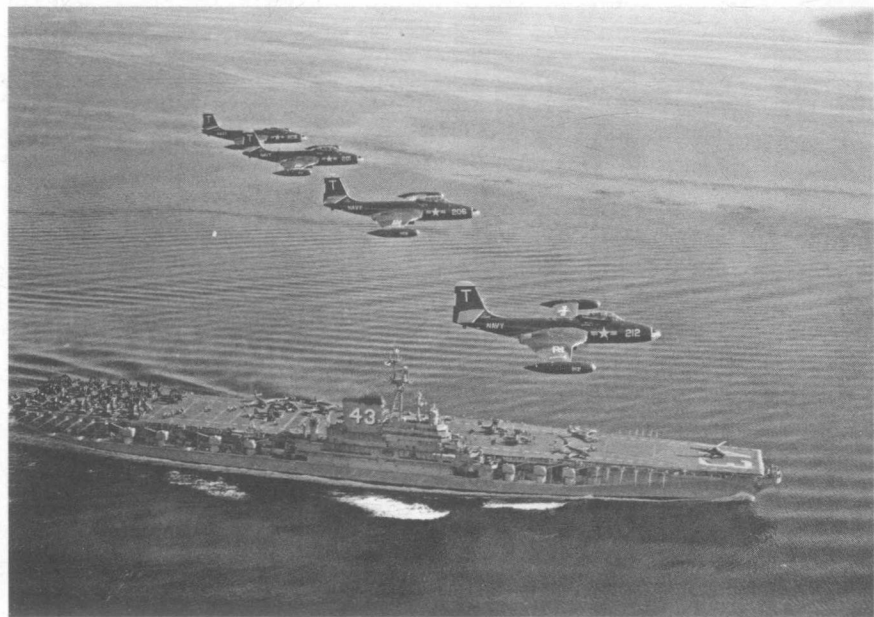
F2H Phantoms in the break by the ship. *NHHC*
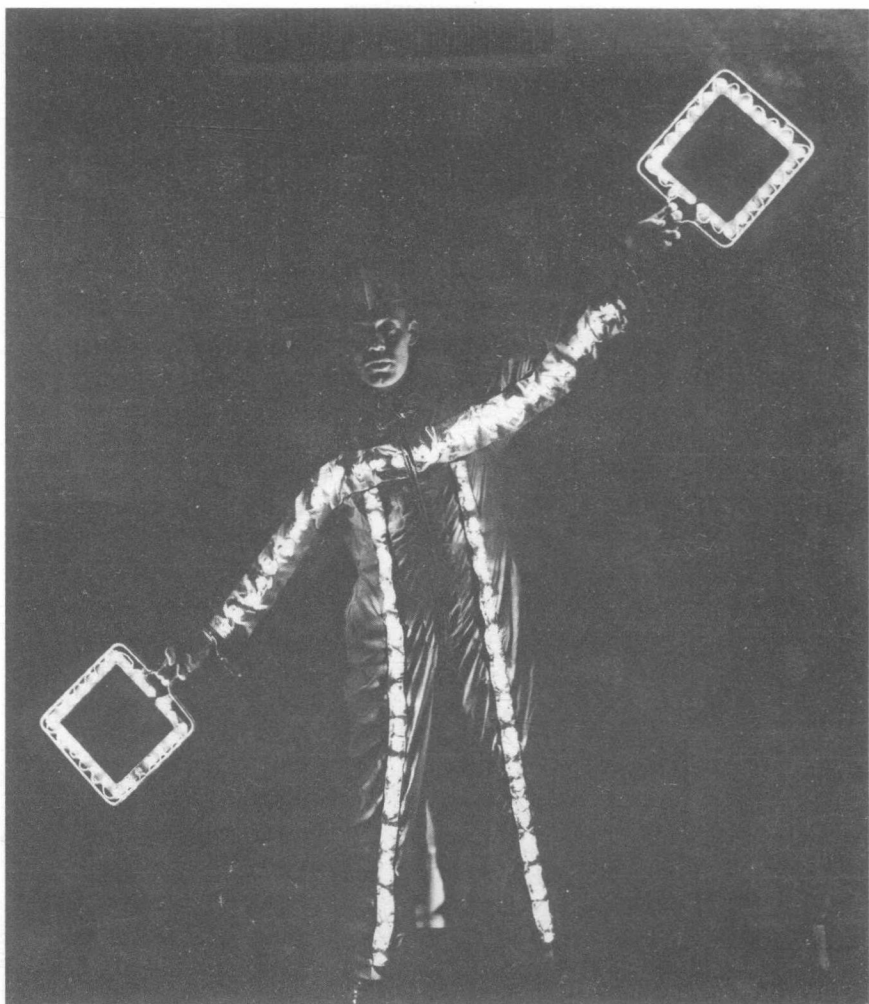
LSO AT NIGHT. *NHHC*

recovery course, the course they would need to fly to land aboard. The destroyers took positions matching the carrier's course, one half-mile abeam the carrier, the other aft and slightly to the starboard of the carrier's wake.

A flight of four McDonnell F2H-2 Banshees appeared out of the gloom and flew by the carrier's starboard side, parallel to its course, at three hundred feet and three hundred knots, tailhooks down. Once ahead of the ship, the leader signaled with his lights and made a sharp left turn, a "break," away from the other three aircraft, turning until he was on a heading reciprocal to the ship's course, "downwind."[2] Simultaneously he descended gradually to 125 feet over the water, extended his speedbrakes and lowered his landing gear and flaps, all the while

slowing to 125 knots. The other three aircraft followed in timed succession and landed without incident.

When the fourth aircraft was abeam the carrier, he began a slow descending 180-degree left turn to arrive with about ninety degrees more to turn at ninety feet over the water. Simultaneously slowing the aircraft to the optimum landing speed that he had mentally calculated for his weight (usually about 105 knots), he continued his turn to the same heading as the ship and slightly slowed his descent until he sighted the glow of the landing signal officer's (LSO's) lighted wands. At the same time, he saw the landing-area center-line lights and the "dustpan" lights illuminating the outboard edges of the landing area. Otherwise, the ship was completely dark.

Fellow pilots gathered in "vultures' row" in the carrier's island, and personnel on the flight deck sighted the aircraft as it came out of its descending turn and lined up with the flight deck. The approach seemed steady when, unexpectedly, there was an excited call on the radio from the LSO, "Power. Power!! Power!!!" The approaching aircraft was settling more than it should. Despite the darkness of the night the nose of the aircraft seemed to be moving higher, the taillight going ever lower, and the aircraft sinking below the glide path. Then, over the radio, "Wave off! Wave off!! *Wave off!!!,*" followed by a flash, a burst of light, a screeching flight-deck-crash alarm, and a call on
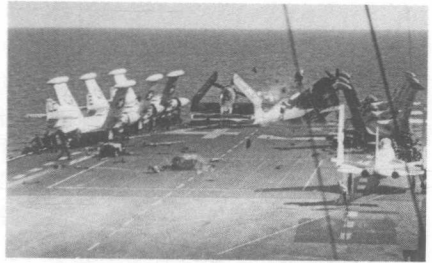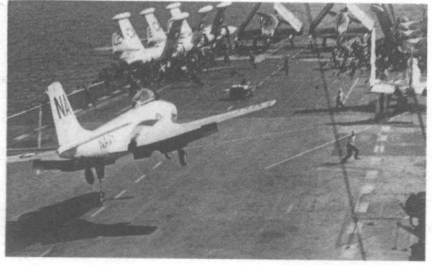
DECK CRASH. *NHHC*

the shipwide announcing system, "Fire on the flight deck! Fire on the flight deck!" The Banshee had hit the ramp, the rounded end of the flight deck at the stern of the ship. There was no ejection, no chute. The fuselage broke apart and exploded. Part of it fell into the sea. The rest skidded up the flight deck in a fireball, killing and injuring deck crewmen as it went, coming to rest against aircraft parked forward.

An experienced pilot was dead. A family and a squadron despaired. A shipmate lost, an aircraft lost, another statistic to add to the horrendous safety record of naval aviation in the 1950s.

It was not only carrier accidents, and not all accidents were at night. In the Naval Air Training Command, midair collisions and spins into the ground were all too common. Patrol squadrons chalked up numerous disappearances over the water. Weapons deliveries by all sorts of aircraft were plagued with pulling out too low from their dives and flying through their own bomb blasts or flying into the ground. Transports had their share of mishaps. In July 1953, a twin-engine R4Q transport crashed on takeoff from Whiting Field in northwest Florida. Forty-five people were lost. In 1954, one of the worst years in naval aviation, 536 people died in aircraft accidents and 776 aircraft were destroyed. The accident rate grew to the point that three people were killed every two days, and more than two major accidents happened every day of the year. The senior leadership was at a loss as to what to do to reduce the cost. Personal correspondence between aviation flag officers of the period often lamented the frequency of "crashes," but mentioned or suggested no new ways of doing business. One admiral probably expressed a widespread sentiment when he wrote in a personal letter, "We continue to have airplane accidents that I am afraid will always be with us. We continue to crack 'em up."[3]

Fortunately, many refused to accept that accidents "will always be with us," and they sought ways to save lives, conserve treasure, and increase readiness. As a result of their efforts and the efforts of so many others through the years, we find that in the first three months of calendar year 2011, the all-Navy/Marine accident rate was less than one accident per hundred thousand flight hours. More recently, the F/A-18 Hornet, one of the most demanding aircraft in the Navy/Marine inventory, completed fiscal year (FY) 2013 with no major mishaps; an amazing feat. Even more amazing, the principal concern of the Naval Safety Center today is no longer aircraft accidents (although there is still a vigorous accident-prevention and analysis program) but motorcycle mishaps.

This book tells how it came to pass.

2

Difficult Days
A Soaring Mishap Rate

Naval aviation's first recorded fatal accident occurred near Annapolis on 20 June 1913. A thunderstorm upset the hydroaeroplane flown by Lt. John Towers and Ens. William Billingsley. Ensign Billingsley was tossed out and fell to his death. There were other accidents after that, not all fatal, but all adding to lessons learned at the cost of people, aircraft, and reputations. In the early years all aviation, not just naval aviation, was recognized as a dangerous, even daredevil, business. In 2014, in an unpublished paper, Professor Roger Bohn of the University of California, San Diego, termed these years the "heroic era" of aviation.[1] Although the total number of flying hours was low, between 1913 and 1917 nineteen pilots and crewmen died in naval aviation aircraft mishaps. Then, as naval aviation entered World War I, the numbers of flying hours and deaths rose. In 1918 alone, nineteen deaths were recorded, only four due to combat.

Following the war, mishaps, including deaths, closely paralleled flying hours. They seemed to have had little to do with whether the flying was from carriers, other ships, afloat, or ashore, although, as one might expect, the accident rate while training was somewhat higher than it was in the fleet. Flight into bad weather, sometimes purposeful, sometimes inadvertent, was a leading cause of accidents.

Before World War II, accidents resulting in the loss of life, injury to personnel, damage to material, or the loss of aircraft were investigated by a board of inquiry, which was often made up of local senior personnel assigned to the naval command or the naval district in which the event occurred. Other than that, mishap investigation was informal. Beyond boards of inquiry, a written report may or may not have been required by the unit commander, and determination of facts was most often limited to how not to make the same mistake again or making a particular component more reliable or safer. For example, seat belts resulted from the Billingsley accident, and instrumentation was developed to address lessons learned during flights at night and in bad weather. In addition, engineers and flight surgeons often participated in accident investigations, which contributed much to the knowledge of the effects of the flight environment on humans and of the resultant need for safety equipment. While that approach may not have been

particularly scientific or all-encompassing, it began to pay off. At the same time, the Bureau of Aeronautics (BuAer) and the Naval Aircraft Factory in Philadelphia also attempted to learn lessons from each accident. Thus, naval aviation, along with the rest of aviation, moved gradually into what Bohn calls the "rules plus instruments" era.

Increasing involvement of flight surgeons in selection of flight candidates and systems improvements, better weather forecasting, simulators (such as Link Trainers), standardization of the various flight instruction schools, and more also played important roles. Nevertheless, the safety record during World War II was hardly a model. In the four war years of 1942–45, there were 8,836 deaths and 25,678 major accidents, not counting combat losses.

Though money was less of a constraint than in peacetime, leadership could not and did not ignore the dramatic rise of costs in terms of lives and money. Increased emphasis was put on safety education, but more importantly, the "system" reacted too. In August 1943, the Chief of Naval Air Intermediate Training directed that an aviation safety board be established at each training center under his command. A few months later, the Chief of Naval Operations (CNO) took up the idea and issued a similar directive to all primary and operational commands. Next, in early 1944, the Deputy Chief of Naval Operations for Air Warfare (DCNO [Air]) and Chief BuAer announced jointly their intention to issue consecutively numbered bulletins concerning the safe operation of naval aircraft. These bulletins turned out to be forerunners of *Approach*, the now long-running Naval Safety Center publication. That June, DCNO (Air) directed the establishment of Aviation Safety Boards in all commands and the appointment of a flight safety officer in each squadron. Safety boards were in fact established in most major aviation commands, but aviation safety officers, when assigned, were mostly on the basis of collateral duty within the operations department. Finally, in July 1944, a Flight Safety Section was established in the office of the DCNO (Air) in the Pentagon, and it was assigned the responsibility for the direction and supervision of the aviation safety program.

While it took some time to devise and promulgate safety programs, others in other offices and in the fleet were designing their own programs. Among the first to be heard from were cartoonists who gave birth to "Dilbert" (and his companion "Spoiler" the mechanic), "Grampaw Pettibone,"[2] and "Anymouse,"[3] all with us to this day.

Supplementing and expanding on the cartoons were a series of *Sense* pamphlets, humorously written and illustrated and filled with important information like gunnery, recognition, ditching, Aleutian weather, parachute operation and survival, and warnings about such things as flat-hatting and flying through clouds without a clearance. A favorite of the latter genre centered on a cartoon picturing two vultures perched on a mountain top, surrounded by clouds beneath them and

"Dilbert" was created by then-captain Arthur Doyle and Lt. Cdr. Bob Osborn in early 1942. Doyle had seen the carton gremlin characters used by the RAF to train its pilots and mechanics to become more safety conscious. "Dilbert" became the fat, dumb, and happy pilot, and Spoiler became his mechanic. They appeared on posters and flyers throughout the fleet in ready rooms and in hangars, each one conveying a succinct message of how not to do something. Even though lighthearted, they carried lessons that invariably struck home. To this day, pilots who flew in the 1940s and 1950s remember clearly "Dilbert's" lessons. Closely associated with "Dilbert," "Spoiler the Mechanic" posters were equally effective.

"DILBERT" CARTOON
Naval Aviation Museum Library, with permission

"Grampaw Pettibone" was created and written by Lt. Cdr. Spencer "Seth" Warner, a naval aviator who headed the Office of Safety Counselor in the Bureau of Aeronautics Training Division. His idea was to develop a character who would impart his wisdom about flying, thus helping in the safety effort. In January 1943 he teamed with Bob Osborn, creator of "Dilbert," to produce a column in the *BuAer Newsletter* (later named *Naval Aviation News*) featuring "Gramps." Following a description of a mishap, "Grampaw Pettibone" railed at young fliers for making stupid mistakes. It was a hit from the beginning, and accidents lessened as pilots took "Gramps'" advice to use the checklist, buckle safety belts, and more. "Gramps," with his sage advice, still appears today as one of the most popular features in *Naval Aviation News.*

"GRAMPAW PETTIBONE" CARTOON
Naval Aviation News

"ANYMOUSE" CARTOON
Approach, *Naval Safety Center magazine*

"Anymouse" was brought into naval aviation in 1945 by Lt. Cdr. Trgve Holl, the VR-31 squadron safety officer. He provided a form to squadron personnel, pilots, and maintenance troops alike, encouraging them to make anonymous reports of near-accidents, incidents, mistakes, or even hairy tales, tales told either on themselves or others. In this way nameless, and therefore blameless, pilots and crewmen could gain valuable knowledge from the experience of others.

The concept was highly successful, and from the time "Anymouse" reported to the Naval Aviation Safety Center in 1953, many of his exploits were published in *Approach* for all naval aviation to read and learn from.

Since then the "Anymouse" concept has been adopted by the U.S. Air Force, several foreign air forces, and several commercial airlines as well.