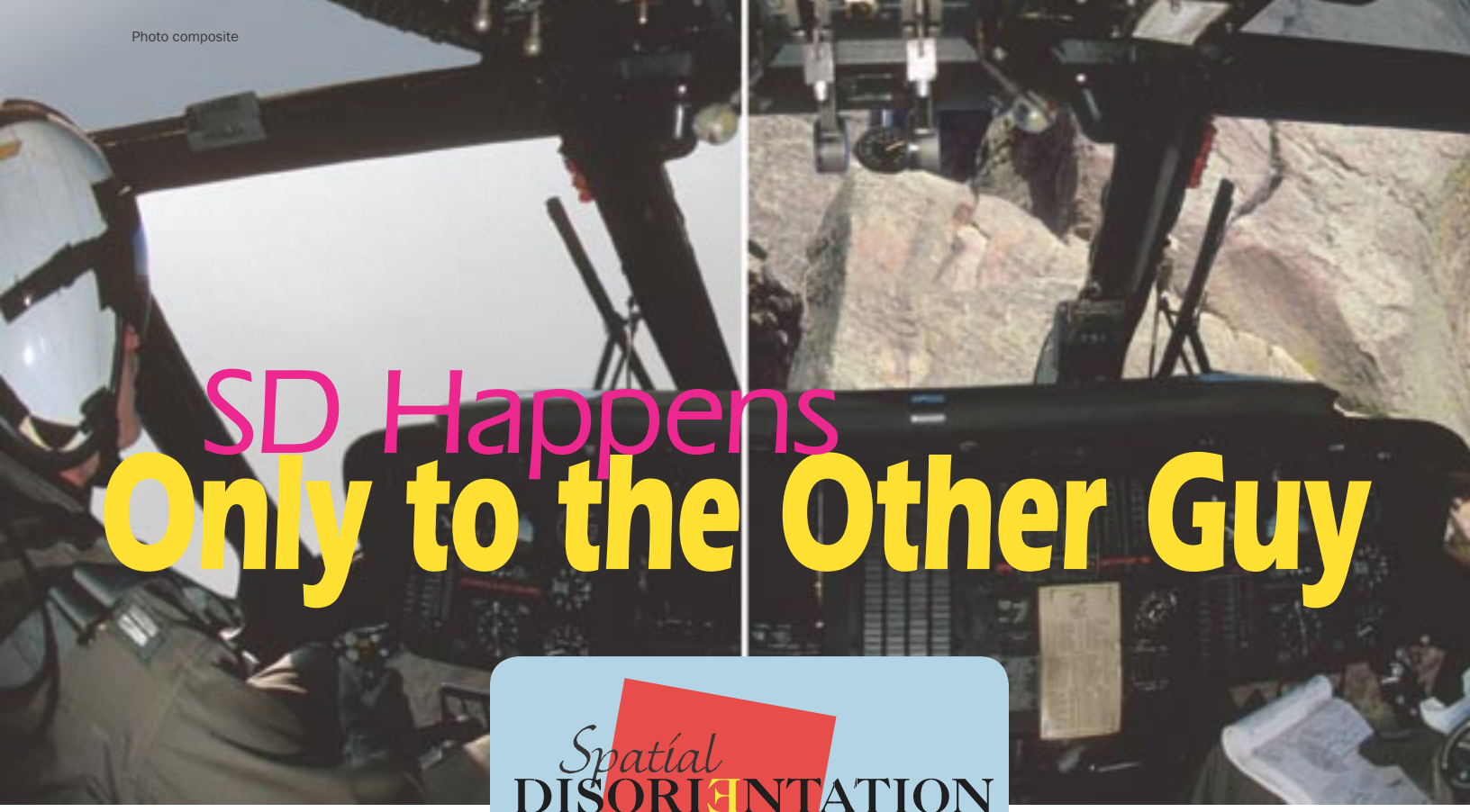

Photo composite

SD Happens
Only to the Other Guy

Spatial DISORIENTATION

By Cdr. Rick Erickson

Accidents always seem to happen to the other guy. How could a good pilot, who's a great stick, be lured into the trap of losing reference to his or her surroundings and end up crashing with no knowledge of impending doom? Where was the breakdown that could lead to tragedy? Was poor leadership, training, or inexperience to blame? Maybe, after exploring all possible causes, we just don't know. Unfortunately, many a top-shelf pilot has fallen victim to this loss of reference, and statistics suggest more mishaps will occur in the future.

Over the last year, the aircraft-mishap boards (AMBs) for several Class A mishaps identified spatial disorientation as the cause. Two recent mishaps illustrate that no community is safe from this aviation hazard. The scenarios were different, but, unfortunately, the results were the same. At the last moment, the pilots realized their predicament but were unable to recover, resulting in fatalities and destroyed aircraft.

The first scenario was a zero-dark-thirty flight. The helo was Dash 3 of a four-aircraft division, and the pilot cued off the No. 2 aircraft to maintain position. The nighttime mission was over featureless landscape that provided minimal visual markers. Before launch, the aircrew had been awake many hours. Although the crew had time to rest, numerous distractions kept any crew member from getting adequate, uninterrupted sleep. Because the flight was during the early morning hours, the crew experienced circadian dysrhythmia, which put them near the daily low of the circadian-rhythm cycle and amplified their fatigue.

The weather conditions were worse than forecast and added to a growing list of cascading events for the crew. Other pilots reported visibility of less than one-half mile. Blowing sand and smoke diminished the effectiveness of night-vision goggles. The visible horizon did not exist. Despite numerous factors, including

fatigue, poor weather, NVG use, and formation flying, the flight was launched.

As the flight proceeded on the planned route, they approached a checkpoint identified as an intersection of two roads. Approaching this intersection, the mishap aircraft was observed to pitch up slightly, followed by a downward pitch, and then departed from the section. Dash 4 of the division made a radio call for Dash 3 to pull up—to no avail. Dash 3 struck the ground at high speed, killing everyone aboard.

By noting the position of the cyclic at the crash site, postflight analysis showed the pilot tried to recover the aircraft. The AMB surmised the deteriorating weather conditions caused the pilot to mistakenly believe the road was the horizon. Consequently, the pilot perceived he was too high and needed to correct.

Adverse weather conditions, combined with formation flying, contribute to scenarios conducive for spatial disorientation. Formation flying minimizes the opportunity to scan instruments. The pilot's attention is directed at maintaining visual contact with the lead aircraft, isolating the pilot from any source of accurate orientation information. False visual and vestibular cues supply the pilot with inaccurate information and results in improper control inputs. In this case, the blowing sand and smoke could have created an illusion of drifting off course. The dark road, in the absence of other visual cues, provided a false horizon, giving the impression of an inaccurate flight altitude and attitude. Fatigue can rob a pilot of the ability to adequately perform instrument crosschecks.

In the second scenario, a tactical aircraft was returning to base on a daytime mission. During descent, the aircraft entered IMC conditions with heavy precipitation and low ceilings. The mishap aircraft hit the ground in a nose-low attitude, with a significant right bank. Aircraft-mishap evidence indicated the pilot recognized his predicament and tried to recover with a high-G pull moments before impact. The safety investigation concluded the pilot was time-sharing his attention between IFR and VFR scans in an IMC environment, thinking he would break out into VFC on final approach.

Laurence Young, in his chapter on "Spatial Orientation," in the book *Principles and Practices of Aviation Psychology* observes, "A particularly dangerous period for the pilot occurs when making the transition from instrument flying to flying by external cues. There is not a specific illusion associated with the transition but, rather, a period of uncertainty concerning orientation. A pilot who has been concentrating on the instruments in lining up for landing may easily experience SD during the several seconds after looking up and trying to find the runway and horizon through broken clouds. Just as disturbing is the loss of orientation when a pilot in a turn enters a cloud and must reorient on the instruments. The delay in distance accommodation, which becomes more severe with age, is another factor in this problem."

The pilot unsuspectingly placed the aircraft in an unusual attitude by not staying on instruments, allowing incapacitating disorientation to encroach on him. Fatigue also may have played a significant role in this mishap. Although given sufficient time to rest, the pilot experienced self-imposed, interrupted-sleep problems.

SD is a normal response of the body's neuron system to abnormal environments. Humans orient themselves with peripheral cues. Removing or altering these cues during flight causes SD.

Though many of you have gone through the Naval Aviation Survival Training Course, and are between your quadrennial refresher training, a quick reminder on the types of SD may help keep you alert to this hazard.

Type I – Unrecognized disorientation is when the pilot does not perceive any disparity between artificial and real orientation perceptions. The pilot feels the aircraft is responding correctly to inputs, but he is oblivious to the false cues and maneuvers the aircraft to match the false perceptions.

Type II – Recognized disorientation is when the pilot is able to rectify a conflict between the artificial and natural and take corrective actions to maintain safe flight. Pilots talk about vertigo where they may recognize that trouble exists in maneuvering the aircraft.

Type III – Incapacitating disorientation, as defined by A. J. Parmet in the *Fundamentals of Aerospace Medicine*, is when the pilot "experi-

ences an overwhelming—for example, incapacitating—physiologic response to physical or emotional stimuli associated with a disorientation event." The bottom line is the pilot may be aware of the disorientation but is unable to respond to correct the situation.

For more information on spatial disorientation, contact your local wing aeromedical safety officer or the Aviation Survival Training Center. Remember, to the other guy, you are the other guy.

Cdr. Erickson is an aeromedical analyst at the Naval Safety Center.

Can We Prevent SD?

By Braden McGrath, Ph.D., LCdr. Gustavo Gierber, MSC, and Capt. Angus Rupert, MC

Spatial DISORIENTATION

The Tactile-Situation-Awareness System

Spatial disorientation (SD) and its effects and remedies have been discussed repeatedly over the years in every ready room; yet, we continue to lose aircraft and lives. Based on accident rates for the Air Force, Navy, and Army, SD mishaps result in the tragic loss of 40 lives per year on average. The cost of SD mishaps also includes mission failure, the impairment of mission effectiveness, and the cost (in billions of dollars) of aircraft and equipment loss.

The losses are staggering when compared to how many could have