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For Helicopter Pilots, Managing Stress Is Part of Flying Safely

Stress is a normal part of life, and up to a point can be beneficial in critical situations. But pilots must take care that daily stress plus ordinary cockpit stress do not combine to threaten safety at times of severe flying difficulty.

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Many helicopter pilots thrive on the stress and challenge inherent in aviation. Nevertheless, individual differences exist in stress-coping ability, and the cumulative effect of the stresses of daily life combined with those of the cockpit may result in overload. Degraded performance levels, unnecessary risk taking and interpersonal problems may result. It is in the best interests of both pilots and employers to work toward developing ways to eliminate, moderate and cope with stress.

Failure to manage stress often leads to eroded judgment, decreased performance, inattention, loss of vigilance and preoccupation. A pilot suffering from stress tends to forget or skip procedural steps, accept lower performance standards and exhibit a tendency toward spatial disorientation and misperceptions. These misperceptions may result in misreading maps, charts and checklists, misjudgment of distance and altitude and loss of time perception.

Signs of high levels of stress in individuals include:

- Headaches;
- Insomnia;
- Upset stomach or digestive changes;
- Emotional fatigue;
- Nervous habits such as nail biting;
- Irritability with friends and relatives;
- Pessimism;
- A sense of being victimized or unappreciated;
- Inappropriate laughter or aggressive behavior;
- Distraction or difficulty in thinking;
- Tense and aching muscles;
- Decreased coordination;
- Frequent yawning; and,
- Slowed or slurred speech.

The term “burnout” is often used to describe a combination of physical and psychological responses to high levels of chronic stress.

Personal Traits Can Make Coping with Stress Harder

Personal problems or dysfunctional behaviors interfere with coping strategies that can be adopted to reduce the effects of stress. In a study of more than 700 naval aviators who had been involved in major aircraft mishaps over a four-year period, it was discovered that those aviators who exhibited the symptoms of inadequate stress coping were more likely to contribute to an aircraft mishap.[1]

Aviators whose actions were a factor in their mishaps were also more likely to:

- Be poor leaders;
- Be less mature and less stable;
- Lack an adequate sense of their own limitations;
- Lack professionalism and the ability to assess troublesome situations;
- Have financial problems;
- Have trouble with relationships;
- Have trouble with superiors and peers;
- Drink to excess or to have recently increased their alcohol intake;
- Have recently become engaged to be married;
- Be making a major career decision; and,
- Have undergone a recent personality change.

The study found that many of these factors were associated with individuals who had little or no introspective ability. When confronted with a stressor such as the failure to achieve a goal, the aviators turned frustrations outward and projected the cause of their failure onto others. Symptoms of the inability to cope were manifested as "acting out" behavior, which often contributed to trouble in interpersonal relationships and to aviation mishaps.

Stress Has Physical Symptoms

According to the *American Heritage Dictionary*, stress is "a mentally or emotionally disruptive or upsetting condition occurring in response to adverse external influences, and is capable of affecting physical health, usually characterized by increased heart rate, a rise in blood pressure, muscular tension, irritability and depression."[2] A person in a physically or mentally demanding situation is said to be under stress.

But stress is a normal part of life, encountered at home, on the job and during recreational activities. The effect of stress on performance can be graphed as a classic bell curve (Figure 1). Moderate stress is a stimulus that enhances energy, awareness and perhaps motivation to succeed, and tends to positively

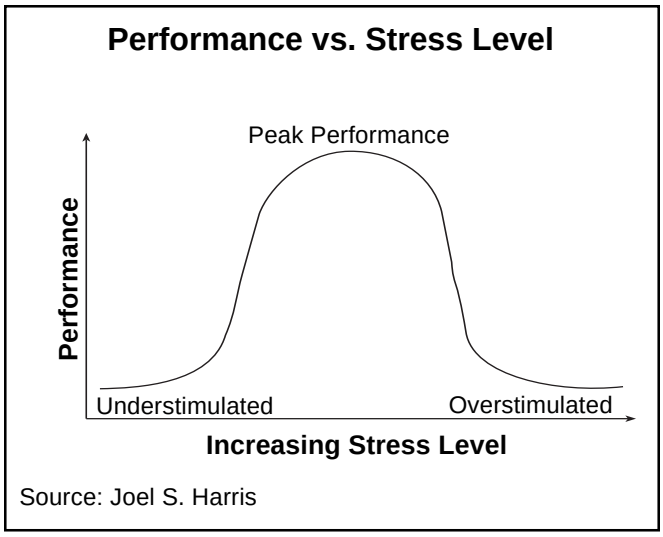

Figure 1

affect performance. Nevertheless, as stress levels increase, eventually performance begins to decrease. When this point is reached varies from individual to individual. The ability to cope with stress also changes during the course of a person's life.

The U.S. Department of Transportation's *Airman's Information Manual* (*AIM*), in a section headed "Fitness for Flight," declares that "stress from the pressures of everyday living can impair pilot performance, often in very subtle ways. Difficulties, particularly at work, can occupy thought processes enough to markedly decrease alertness. Distraction can so interfere with judgment that unwarranted risks are taken, such as flying into deteriorating weather conditions to keep on schedule."

The *AIM* also notes: "Most pilots do not leave stress 'on the ground.' … Certain emotionally upsetting events, including a serious argument, death of a family member, separation or divorce, loss of job and financial catastrophe, can render a pilot unable to fly an aircraft safely. The emotions of anger, depression and anxiety from such events not only decrease alertness but also may lead to taking risks that border on self-destruction."[3]

In a U.S. National Transportation Safety Board (NTSB) safety study of emergency medical service (EMS) helicopter operations, the NTSB included among its findings the observation that " … commercial EMS helicopter pilots work in a high-stress environment with rotating shifts; this predisposes them to acute and chronic fatigue. … Pilots are often under self-imposed and externally imposed pressure to complete EMS missions. These pressures can negatively influence pilot judgment."[4]

The NTSB's distinction between *acute* and *chronic* fatigue applies to stress in general. Acute stress arises from emergency conditions or particularly intense adverse circumstances. Chronic stress is the cumulative build-up of tension

or depression resulting from a multiplicity of stressors in a person's daily life, such as those mentioned in the *AIM*.

When a particularly difficult flying situation — acute stress — is faced by a pilot who is also under chronic stress from personal situations and normal cockpit duties that are often demanding, the potential exists for a stress overload with dangerous consequences (Figure 2).

We cannot know what chronic stress, if any, affected the actions of a twin-turbine Sikorsky S-76 pilot involved in an accident near Angleton, Texas, U.S. But we can be sure that acute stress was present. Experienced helicopter pilots know that a case of inadvertent flight into instrument meteorological conditions (IMC) is inherently stressful. And when it occurs without a qualified copilot and without instrument approach plates, the acute stress is compounded.

The Sikorsky S-76 was on a night instrument landing system (ILS) approach to the Brazoria County Airport (LBX), Texas, when it crashed about one mile from the outer marker. The helicopter was destroyed and the two crew members were killed.

The aircraft had departed the company heliport on a night maintenance test flight to perform an in-flight check of the main rotor system following replacement of a blade dampener. The pilot in command was a fully qualified airline transport pilot (ATP) with more than 6,400 hours total time, and 1,200 hours in the S-76. The left seat was occupied by a maintenance technician.

The weather was reported to be 400 feet (122 meters) overcast and three miles (4.8 kilometers) visibility, with fog and haze. After receiving a full weather briefing, the pilot departed, and shortly after takeoff, contacted base operations on company frequency, reporting that he had inadvertently encountered IMC. Because he had no instrument approach plates on board the aircraft, he asked the radio operator, a fully qualified S-76 captain, to relay information to him from the approach plate for the ILS Runway 17 at LBX. As the radio operator briefed the approach, the pilot replied "check" after each item.

- "Heading one seven four," the radio operator said.
- "Check," the pilot said.
- "ILS frequency one zero nine point one."
- "Check."
- "ADF [automatic direction finder] two three six."
- "Check."

After receiving the information, the pilot contacted Houston approach control and requested the ILS approach. Vectors were provided to him and he was cleared for the approach. The pilot made three separate attempts to establish the aircraft on the approach; the last attempt was a "no-gyro" approach. During the attempts, simultaneous radio contact was maintained with approach control and company operations. Air traffic control (ATC) radar later revealed that the aircraft's ground speed varied from 28 knots to 106 knots.

Just prior to the accident, the pilot said on the company frequency, " … I've got an attitude problem." After a three-second delay he added, " … I am going to crash."

The radio operator replied, " … pull power, cruise power, pull power. Wings level, needle ball and airspeed, altitude. Get a climb going."

There was no reply.

The wreckage was found approximately one mile (1.6 kilometers) northwest of the outer marker. There was evidence that the main rotor blades had struck the tail boom and the radome, and then the blades had separated in flight.

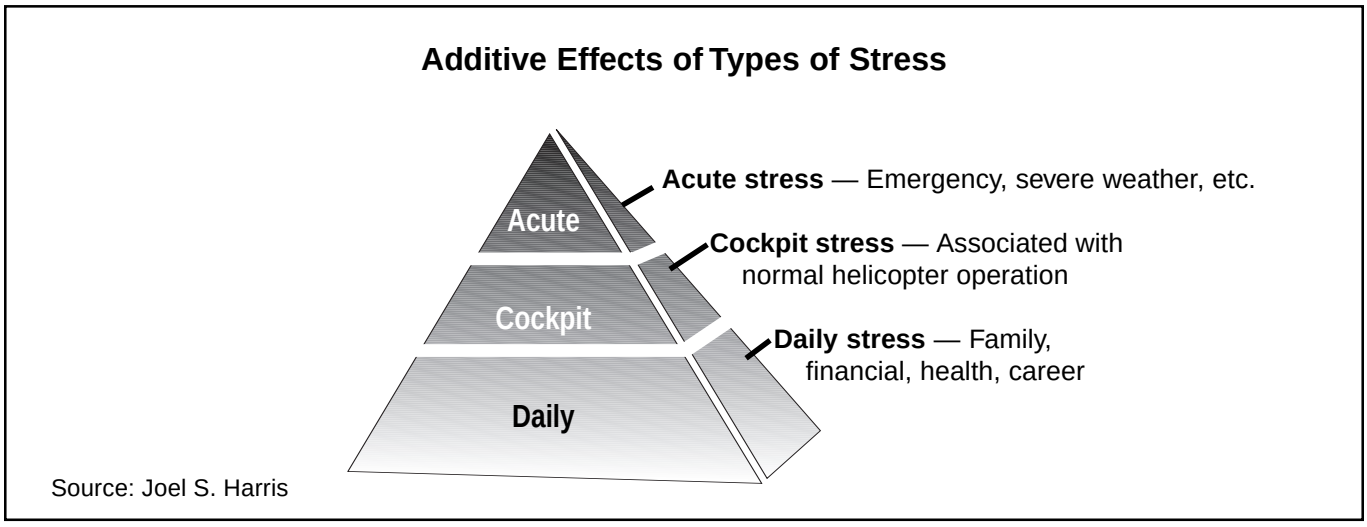

Figure 2

The NTSB determined that the probable causes of the accident were:

- The captain's inadvertent entry into IMC;
- Failure to maintain proper control of the aircraft;
- Spatial disorientation; and,
- Exceeding the design stress limits of the aircraft.[5]

The NTSB found that crew fatigue and stress were contributing factors to the Jan. 25, 1990, Avianca Airlines crash near John F. Kennedy International Airport (JFK), New York, U.S. [The Colombian-registered Boeing 707 was nearing the end of a Bogota–New York flight, and because of poor weather in the northeastern United States was put into holding patterns at three different intersections. By the time the flight crew received clearance to approach JFK, the airplane's fuel supply was critically low. A missed approach further contributed to fuel depletion, and while returning to the airport the B-707 lost power in all four engines and crashed at Cove Neck, Long Island, New York. Seventy-three of the 158 persons aboard died.]

The NTSB found that during an attempt to execute the ILS approach, the captain did not fly the approach in a stabilized manner, which led to a serious deviation below the glideslope. The crew executed a missed approach while at 200 feet (61 meters) above ground level (AGL) but still 0.8 miles (1.3 kilometers) short of the missed-approach point. The aircraft's fuel supply was exhausted while the aircraft was being vectored for a second approach. The NTSB determined that crew stress (possibly chronic, but certainly acute) was one of the factors that led to the unsuccessful completion of the first approach, and thus contributed to the accident.[6]

Stress Produces Autonomous Mode Behavior (AMB)

Acute stress produces a high state of psychological and physiological arousal. This state of arousal is known as autonomous mode behavior (AMB). AMB may be brought on by the abrupt onset of an in-flight emergency and is often detrimental to pilot task performance. Some symptoms of AMB are sweaty palms and increased heart rate, increased breathing and increased blood pressure. Another effect of AMB is that a pilot will tend to focus on one problem, while ignoring more critical information. This is commonly known as "tunnel vision." Situational awareness is severely diminished. Studies have shown that AMB is a contributing cause of some pilot-error aircraft accidents.[7]

Pilots know that high stress (resulting in AMB) has a negative influence on task performance and decision making. Thus, many pilots exert conscious effort to maintain a calm and relaxed outward demeanor as a means of coping during periods of high stress. Nevertheless, outward calm may only mask states of high physiological and psychological arousal.

The S-76 pilot evidenced no alarm when he found himself in IMC, and his responses to the radio controller were only the repeated "Check." In a statement to the NTSB the company radio operator reported that "at no time did [the pilot] seem anxious, excited, concerned seriously, as if he had a real problem going for him. In fact, the statement of '...I am going to crash' sounded the same as his 'check' answers."

After the Avianca accident near JFK, ATC controllers who had been handling the flight said that the crew never communicated the severity of the aircraft's fuel state either through proper terminology, i.e., "mayday" or "emergency," or through tone of voice. Instead, the first officer, when faced with impending fuel exhaustion, sounded calm and matter-of-fact.

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Autogenic Feedback Training Can Counter Stress

No training can, or should, eliminate the stress a pilot feels in an emergency situation. Up to a point, stress is a valuable mechanism for energizing mind and body for fast, decisive action. There is even evidence that training can reduce acute stress to a level where it is a stimulus rather than an additional safety threat.

The U.S. National Aeronautics and Space Administration (NASA) has sponsored research into pilot stress and AMB's negative impact on performance, which has yielded some interesting data. In a study co-authored by Patricia Cowings of the NASA Ames Research Center, a group of 17 active-duty U.S. Coast Guard pilots were subjected to an intense "emergency flying conditions" check ride. Seven of the pilots were fixed-wing rated (in the Lockheed Hercules HC-130) and 10 were rotary-wing rated (in the Aerospatiale HH-65).[7]

To assess the individual pilot's performance during high levels of stress, compound in-flight emergencies were simulated. During the HH-65 emergency-flight scenario, for example, the pilot was asked to simulate a hoist operation lifting an injured boat crewmember aboard the aircraft.

While in a 50-foot (15-meter) hover, the pilot was given a servo-jam warning followed by a secondary hydraulic failure indication resulting in locked tail-rotor pedals. On returning to base in the "impaired" aircraft, the pilot was given a simulated No. 1 engine stall while on short final to the helo-pad.

Instructor pilots served as observers and graded each pilot's performance in:

- Knowledge of aircraft and procedures;
- Technical proficiency;
- Control smoothness;
- Crew coordination;
- Internal and external communications;
- Motivation;
- Command ability;
- Vigilance; and,
- Situational awareness.

Following the checkride, approximately half of the pilots (eight of 17) were subjected to 12 45-minute sessions of autogenic feedback training (AFT). The other nine pilots received no AFT.

AFT combines biofeedback with autogenic training, and is designed to increase a pilot's ability to control his body's responses — heart and respiratory rates, perspiration, blood pressure and muscle tension — to stress. Autogenic training provides specific instructions on ways to control these responses. During a typical training session subjects are instructed in, and practice, such methods.

The training includes visual and auditory feedback indications of the body's responses. A case study of the effectiveness of AFT revealed that after six hours of training, one subject could voluntarily increase and decrease his heart rate by an average of 25 beats per minute.

At the conclusion of the training, all 17 pilots flew the simulated emergency scenario checkride again at approximately the same time of day and with the same check pilots as in the initial flight. The check pilots did not know which pilots had received AFT and which had not.

Comparison of the results of the final checkride revealed that AFT pilots showed significant improvements in every performance category, while pilots who did not receive the training showed no improvement. The success of this study should lead to further research and possibly the incorporation of AFT into some pilot training.

Chronic Stress Rooted in Day-to-day Activities

Chronic stress among helicopter pilots is found both in the line of duty and in daily life. Stress in the cockpit may be caused by difficult schedules, maintenance problems, personality conflicts, adverse weather, extended duty days, night operations and boredom.

Helicopter pilots operating at low altitudes, where traffic is dense and the weather situation is unavoidable (and making multiple takeoffs and landings per hour), may be under particularly high stress.

Keith McCuthen, chief pilot of Indianapolis Helicopters, also sees stress as a generational symptom of the helicopter pilot population. Many U.S. commercial helicopter pilots began flying during the Vietnam era in the 1960s and early 1970s. "I see some of these pilots suffering from the effects of stress caused by frustration and worry over career and retirement," McCuthen said. "The room for advancement for pilots within a company is often very narrow. Pilots begin to wonder if this is really what they want to do for the rest of their lives. As we get older, we also begin to consider the possibility of retirement and all its ramifications. These can be sources of stress and may affect a pilot's job performance, if he becomes preoccupied by them."[8]

Chronic Stress Can Be Managed

Some stressors in daily life and in the cockpit can be reduced or can be eliminated. Stressors that an individual can control include excess travel time to and from the airport (by moving closer to work), harmful personal habits, ongoing interpersonal conflicts and unsafe flying conditions.

One important stress reduction strategy is setting aside regularly scheduled free time for relaxation. Other strategies include learning to communicate better, thus helping to reduce interpersonal conflict and maintaining a positive mental attitude. Gaining proper perspective on problems is not always easy. Many pilots believe that they are responsible for, and need to be in control of, every situation. This creates an unrealistic burden on the pilot and those around him. Gaining a realistic perspective can help eliminate this problem.

Although many things can be done to eliminate or to reduce the effects of stress and to relieve the discomfort it causes, some stress is inevitable. Accepting situations that cannot be changed is one form of coping. Good diet, adequate rest and exercise are also methods of coping with stress. Researchers at Stanford University, Palo Alto, California, U.S., studied more than 350 middle-aged men and women and found that those who engaged in regular exercise experienced a 30-percent reduction in levels of stress, anxiety and depression.[9] According to the International Society of Sport Psychology, the benefits of physical activity include relief of tension, depression and anxiety and the development of positive coping strategies.[10]

Laughter is a proven stress-coping mechanism. Laughter lowers blood pressure and lowers heart rate, and reduces production of the hormone cortisol, which is associated with stress.[11] Keeping a balance between work, family and recreation minimizes the effects of stress.

Still, it is sometimes wise to seek professional help in dealing with personal stress. Stress in the cockpit can be managed by

thorough planning before flight, avoiding stressful decisions by following regulations and company standard operating procedures (SOPs), taking a few deep breaths during stressful situations, keeping a disciplined focus on task performance to the exclusion of other worries, sharing the workload with other crew members, using all available resources including ATC and company operations, and recognizing and taking action to avoid stress and overload.♦

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