

United States of America
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Aviation System Standards
Flight Inspection Operations Division
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NIGHT FLIGHT INSPECTION CONSIDERATIONS

ABSTRACT

The United States Federal Aviation Administration has been conducting night flight inspection operations since the mid 1960's. Conducting flight inspection missions at night has become necessary due to the increase of commercial air traffic at some of the nation's busiest airports. The push for night operations has almost exclusively come from Air Traffic Control.

The stated reason for night flight inspection initiatives is to lessen the congestion at busy airports, and might initially be perceived as an enhancement to safety. However, there is a major negative impact on the flight crews involved, and that impact must be considered. Changes in circadian rhythms lead to sleep deprivation and fatigue.

Night flight inspection introduces many logistical concerns. Airport operators routinely plan maintenance projects, which require the closing of one or more runways, during the night, due to the reduction in air traffic operations during those times. Certain flight inspection operations, which require maneuvering the aircraft in close proximity to the ground, cannot be safely conducted at night and must then be coordinated for daylight conditions. This raises new crew, support, and equipment concerns.

Rest periods must be reviewed. Missions which require the crew to remain overnight away from their homes must be carefully coordinated with human needs in mind. Layover hotels must be able to provide quiet rooms, as well as convenient location. The implementation of night flight inspection requires degrees of creativity, coordination, and flexibility in order to be successful.

History

The Office of Aviation System Standards, AVN, of the Federal Aviation Administration has been involved in the Flight Inspection of navigation aids at night, since the mid 1960's. During the year 2001, AVN flew approximately 15,600 hours, conducting the flight inspection mission, of which 587 hours were logged at night. Currently, 17 domestic United States airports are receiving some, if not most, of their flight inspection services at night. Those airports are:

Atlanta, Georgia, Hartsfield	KATL
Boston, Massachusetts, Logan	KBOS
Chicago, Illinois, O'Hare Midway	KORD KMDW (Runway 13C)
Dallas/Ft. Worth, Texas	KDFW
Denver, Colorado	KDEN
Detroit, Michigan, Metro	KDTW
Houston, Texas, Intercontinental	KIAH
Los Angeles, California, International	KLAX
Miami, Florida, International	KMIA
Minneapolis/St. Paul, Minnesota	KMSP

Metropolitan area	KLGA
LaGuardia	
Newark	KEWR
Teterboro	KTEB
Phoenix, Arizona	KPHX
Sky Harbor	
St. Louis, Missouri	KSTL
Lambert	

Certain flight inspection maneuvers cannot be safely accomplished at night. During the early morning hours of November 25, 1968, a flight inspection DC-3, from an AVN Office, was flying a below path clearance run at Chicago O'Hare airport. The aircraft struck a power line, and disrupted electric power to about 60 percent of the city of Elk Grove Village, Illinois, a Chicago suburb located just northwest of the airport. Fortunately, there were no injuries; however, the incident could have had a disastrous outcome.

Suitability

Not every airport is suitable for night flight inspection. In some instances, rising terrain surrounding an airport or obstructions close to a runway may render the airport unsafe for night flight inspection. The San Francisco, California, International Airport, KSFO, has desired night flight inspection for some time, but it has been determined, due to mountainous terrain, to be unsafe for night flight inspection. Close in obstructions may preclude night flight inspection, and may only effect one runway, as is the case at Chicago's Midway Airport. When the determination has been made that an airport or a specific runway is unsafe for night flight inspection, it must be documented. A list must be maintained of those airports and runways so identified.

Air traffic has increased drastically in recent years, saturating the airspace around airports worldwide. Along with that increase has come increased delays and pressure from the airlines to reduce those delays. As the United States Air Traffic Control System has come under fire for contributing to delays, flight inspection has become an increasingly easy entity to blame, and has thus been pressed into night work. Unfortunately, night flight inspection presents problems.

Airport Issues

Airport management routinely plans certain operations for night shift work. Runway

resurfacing, runway light repair, and construction projects of all types are scheduled to occur at night when air traffic is at its lowest volume. On numerous occasions, flight inspection aircraft are dispatched only to be refused the opportunity to work because of runway maintenance. Coordination is an important issue. Airports are unwilling to remove workers and equipment from a runway, due to time constraints.

Operational safety considerations have different characteristics in night operations. Foreign objects of various types can appear on runways and are not readily detectable. Deer on the runway are a concern for daylight operations in AVN and would be during nighttime hours. If the flight inspection aircraft operates from an airport whose air traffic control tower operates part time, vehicles of any type might become disabled on the runway, without anyone's knowledge. The simple actions of taxiing the length of the runway prior to takeoff, or making a low pass prior to landing, help mitigate the risk of this situation.

In some cases, when an air traffic control tower closes, the airport it serves no longer has weather reporting capability. The flight inspection aircraft may be impacted in this case if operations specifications or regulations preclude the commencing of an approach to the airport of intended landing when weather reporting is not available. When local control facilities are closed, air traffic control services are transferred to a remote facility. When this occurs, should an aircraft experience an emergency requiring the services of airport Crash, Fire, and Rescue, normal notification means are not available.

Fatigue, Sleep Loss, and Circadian Rhythm Disruption

The effects of fatigue, sleep loss, and circadian rhythm disruption are additional factors which affect night shift work. NASA and the FAA have, since 1981, been studying these factors and their impact on the ability of pilots to perform their duties. There are many individual elements which contribute to the overall problem. Fatigue can result from continuous wakefulness and attention to monotonous tasks. Sleep loss is cumulative and will result in a sleep debt and a greater propensity to sleepiness. Circadian rhythms dictate the scheduling of all measure of bodily functions, including the digestive system, temperature, the body's tendency to sleep, and wakefulness. The body's circadian "clock" produces two natural low points, 3:00 p.m. to 5:00 p.m., and 3:00 a.m. to 5:00 a.m., and two natural high points, 9:00 a.m. to 11:00 a.m., and 9:00 p.m. to 11:00 p.m. The early morning low point, which is often referred to as the circadian trough, and the late night high point are the most significant concern to night operations. During the early morning low, the body's temperature is at its lowest, and its desire for sleep is at its greatest. During the late night high, the body's temperature is high, as is its alertness. If an early morning schedule, with a start time prior to 4:00 a.m., is utilized, the body is subjected to trying to be awake at a time it craves sleep. To intensify the problem, the attempt to obtain sleep early the night before likely will not have been successful. Circadian rhythms have been proven to naturally seek a "day" of greater than 24 hours. The rhythms are reset and the body "recharged" by bright light. If a night shift results in the crew observing morning daylight, obtaining sleep will be difficult. Sleep deprivation will result in increased sleepiness on the next night shift. Research has indicated that it is advisable to protect "core" sleep from the individual's home sleep schedule. That is, the individual should always attempt to be asleep during the early morning low point. Shifts should be scheduled, wherever possible, to terminate prior to 3:00 a.m., or begin after 5:00 a.m.

The most insidious concern regarding fatigue and sleepiness is that the individual is a very poor subjective judge of personal alertness. NASA studies have shown that a sleep-deprived subject is likely to state that they are awake and alert, when, in fact, they are about to fall asleep.

There are two stages of sleep, Rapid Eye Movement (REM) during which the brain is recharged, and Non-Rapid Eye Movement (NREM) during which the physical aspects of the body are recharged. Both are necessary for a successful night's sleep.

Countermeasures

Napping before duty can be beneficial since it decreases the body's period of continuous wakefulness. A nap immediately prior to duty should be limited to 45 minutes duration, to avoid the body's entering the deepest stages of NREM sleep. Once the body enters these stages, awaking will likely be difficult, taking as much as 15 minutes to accomplish, and may leave the individual feeling sluggish for some time. A 45-minute nap may be beneficial during the early morning fuel stop. The FAA has thus far not approved in-flight napping on the flight deck, however NASA has recommended rule changes to allow its use. Napping during flight should be considered only in a low workload environment, such as cruise flight. Consequently, even if napping were approved by the FAA, it would be of limited value for night shift flight inspection.

Nutrition becomes extremely important when an individual is unable to avoid the circadian low points and sleepiness. Research stresses the value of maintaining hydration and recommends exercise, although exercise should be avoided immediately prior to attempting to obtain sleep. Continuous, low volume snacking, colloquially called "grazing," during the shift is advisable and is preferable to eating a large meal during the early morning refuel break. The snacks selected should be high in protein and low in sugar to avoid a sugar "high," which leads to a nutritional "low" later. Peanuts or "trail mix" are a good grazing snack. Strategic use of caffeine may be beneficial; however, it should not be used during periods of natural wakefulness, nor should it be used immediately prior to going to bed.

Certain substances have been used as an aid to sleep. Alcohol has often been used for this purpose; however, its overall effect is to suppress REM sleep, leading to withdrawal and more disrupted sleep. Alcohol should be consumed in moderation and should not be consumed immediately before going to bed. Melatonin is a substance that mimics the body's naturally produced hormone, which promotes sleep. Its

use has become popular recently; however, caution should be exercised. Melatonin is not a controlled or regulated substance. NASA's research has shown that the concentration of melatonin in commercially available capsules varied from no melatonin to 600 mg for capsules advertising a 200 mg content. NASA's research also found that a dose of just 6 mg seemed to have the most positive effects towards promoting sleep. Sleeping pills, while presenting a level of effectiveness, often have unacceptable side effects and may not be legal for use by flight crews.

Daylight Only Maneuvers

Virtually any maneuver which requires flight below minimum instrument altitudes is not advisable at night. Treating each flight as an instrument operation, whether or not operating in instrument meteorological conditions, is a good policy. There is a necessity for several maneuvers, such as below path clearance runs, obstacle verification for instrument procedures, or PAR lower safe limit "B" cursor runs, which simply cannot be safely accomplished during darkness. In those cases, a Sunday morning flight can often accomplish all the necessary work. In the United States, many late Saturday night and early Sunday morning airline flights are not scheduled to operate. This provides a time block on Sunday morning from sunrise to approximately 10:00 a.m. that low altitude work can be accomplished. Summertime conditions of early sunrise can be utilized to advantage, and wintertime's short periods of daylight will be detrimental. Some airports, by the nature of their traffic flow patterns can support periods of daylight flight inspection, which, however brief they may be, are enough to accomplish the necessary daylight maneuvers. Care must be exercised to avoid being caught with critical work remaining in flight inspection when the window of opportunity ends and air traffic control terminates flight inspection operations due to traffic saturation. Coverage inspections, while generally not able to be flown at night, are likely not a problem since they are usually far enough from the airport as to not be a great issue and can be accomplished during daylight hours.

Weather

Even when the utmost care has been taken to make the night shift as smooth as possible, when the weather turns bad, any preset plan will be changed. A significant weather event, such as low fog or thunderstorms, can impact

the system as much as twelve hours later, delaying flights and resulting in late night traffic saturation. In the same light, bad weather on either coast can result in Midwestern airports remaining busy up to four hours later than usual. If the flight inspection mission operates in instrument meteorological conditions for the entire shift, the crew may be effected by greatly increased workload, stress, and fatigue. Nighttime snow events will result in snow removal operations being performed and may delay the flight inspection.

CONCLUSION

When scheduling night flight inspection missions, the late night, early morning time frame is most desirable, finishing prior to 3:00 a.m. Some crewmembers may actually express a willingness to volunteer to fly nights, and their services should be utilized. The best policy regarding night flight inspection remains avoidance. Wherever possible, resist the change to night work. It must be remembered that night operations for flight inspection are primarily based on convenience for air traffic control. There are many issues affecting flight crews charged with dispatch of the duties of flight inspection at night. Unique complications are probable in every flight operation. The negative effects of the physiology of fatigue and sleep loss must be remembered and respected. While most flight inspection can be accomplished safely at night, the operational risk of such a program can never be as low, overall, as it will be during daylight. Flight inspection can be accomplished successfully during nighttime hours; however, it requires careful, thorough coordination; common sense; flexibility; and, most of all, a healthy respect for the inherent decrement to safety.