Advice provided by the C-N LOPB 's Off shore Helicopter Safety Inquiry (OHS I) Implementation Team to the C-NLOPB Board

Advising Document
OHSI Phase I, Recommendation 12
Regarding passenger night flights

In November 2010, the Honourable Robert Wells, QC, submitted the Report for Phase I of the OHSI to the C-NLOPB, containing 29 recommendations for enhancing the safety of helicopter travel offshore. Each Advising Document contains the text of the recommendation for which the advice is offered.

The Team's advice for Recommendation 12 was accepted in principle by the C-NLOPB Board on January 26, 2012. At that time, the C-NLOPB took responsibility for developing its strategy to implement the recommendation.

The following outlines the steps that have been or will be taken before the Board makes its final decision regarding passenger night flight.

1. The Operators were provided the Advising Document and asked to inform the Board whether they were prepared to meet the conditions specified in the Advising Document. The Operators responded several weeks later in the affirmative.
2. The C-NLOPB directed the Operators to submit an action plan to illustrate how they intend to meet the conditions for night flight. The Operators are working to develop this plan.
3. Upon receipt of the Operators' submissions, the action plan will be reviewed by C-NLOPB staff and provided to the Board for approval.
4. If the Board approves the action plan, C-NLOPB staff will monitor the Operators' progress.
5. When all the conditions are met, the Operators will submit their request to resume passenger night flights. The Board will authorize night flight when it is satisfied that the requirements specified in the Advising Document are met.

The OHSI Reports, other Advising Documents, C-NLOPB OHSI Action Plans, and more can be found on the C-NLOPB website: **http://www.cnlopb.nl.ca/ohsi_main.shtml**

Advice to the C-NLOPB: Recommendation 12

Recommendation

Commissioner Wells included the following descriptive recommendation in Phase 1, Volume 1 of the Offshore Helicopter Safety Inquiry (OHSI) Report:

> In my letter of February 8, 2010, to C-NLOPB, I cautioned against night flights and they were curtailed. I cannot recommend a return to scheduled night flying. I recognize that circumstances may arise when night flights may be an imperative. In such cases, the decision to fly should be made by a committee composed of a representative from each of the Regulator, helicopter operator(s), oil operators, and workers. The committee should assess all known risk factors. If there is unanimity that the night flight(s) be allowed, a passenger should nevertheless be entitled to refuse to take a night flight without penalty of any kind.

Method

A multi-phased Operational Safety Risk Analysis (hereafter referred to as "the Safety Study") was conducted to identify the areas in which the level of risk related to night helicopter transportation operations in the C-NL Offshore Industry would exceed that of daytime operations; and to determine if there were ways by which the associated risks could be managed to an acceptable level[1].

An expert panel was convened in May 2011 to:

Determine the most likely accidents that could occur at night;
Identify the antecedent hazards; and
Assess the effectiveness of existing mitigation.

The nine participants represented the key stakeholder groups (i.e., the Operators, the workforce, Cougar Helicopters, the Department of National Defence [DND], and the C-NLOPB), and had significant expertise in:

Helicopter transportation and First Response search and rescue (SAR) operations conducted by Cougar;
DND SAR policies and operations;
The Operators' logistical support of helicopter operations;
Egress and survival training, and the use of personal protective equipment (PPE);
Policies, procedures and practices related to transportation as a passenger in S-92A (and other) helicopters;
The C-NLOPB regulatory framework; and
Weather observation, radio communication, and other functions that support helicopter operations on offshore installations.

The information obtained from the meeting in May was supplemented with information from reports of special studies, risk assessments, occurrence data and formal documents from Canada, and other jurisdictions where offshore helicopter operations take place. A smaller focus group was convened in

[1] For the purposes of the Safety Study, it was assumed that operations in daylight are managed to an acceptable level of risk. Therefore, the Study sought to determine those areas where the risk of night flight exceeded that of daytime operations, and whether that risk could be reduced to the level of daytime operations, hence an equivalent 'acceptable level'.

October to examine specific aspects of mitigation used in the C-NL Offshore Industry, and – where appropriate – to propose additional measures.

All of the information described above was consolidated into a draft report that was critically reviewed by the participants of the meetings held in May and October, and by the OHSI Implementation Team. The subsequent final report became the principal reference document for the Implementation Team, which met in late November.

The Team was inclined towards recommending that night flights be reintroduced progressively. This would have permitted Operators to apply for different 'levels' of night flight, each with different safety requirements. For instance, one option would have prohibited night landings or departures at offshore installations, so that only 'en route' flight would occur at night. Another option with more demanding safety requirements would have permitted all forms of IFR night flight to occur.

After several weeks of intense discussion, the Team was unable to unanimously agree upon criteria for the multi-option proposal, suggesting that further study would likely be required. Therefore, this Advising Document has been prepared to describe the requirements that the Team believes would be necessary for night flight, as it was conducted prior to March 2009, if it were to resume. If the Board agrees in principle and directs C-NLOPB staff to proceed, it is suggested that the Implementation Team provide C-NLOPB staff with information about the other options they examined. C-NLOPB staff could decide what further study is required, and the role that members of the Implementation Team would play. This would be laid out in the Action Plan that C-NLOPB staff would present to the Board.

System Safety Deficiency (SSD)

The results of the Safety Study generally validated the system safety deficiencies that Commissioner Wells highlighted in the "Explanatory Note for Recommendation 12"[2]:

> Night flights pose increased risks:
> (a) for pilots and passengers in takeoffs and landings on offshore installations
> (b) for pilots and passengers in the case of ditching or crashing in darkness
> (c) for pilots and SAR personnel who must try to effect rescue in darkness[3]

Background

The Safety Study examined year-round night helicopter transport operations by S-92A aircraft between St. John's Airport and the offshore installations located in the Jeanne d'Arc Basin[4]. 'Night' is defined by the International Civil Aviation Organization (ICAO) as:

> The hours between the end of evening civil twilight and the beginning of morning civil twilight or such other periods between sunset and sunrise as may be prescribed by the appropriate authority. Civil twilight ends in the evening when the center of the sun's

[2] OHSI, Phase One, Volume One, p. 296.
[3] The scope of the Safety Study was passenger-carrying operations. Consequently, it did not directly address the risks faced by the crews of military SAR and Cougar First Response SAR aircraft.
[4] The *'Report of the Operational Safety Risk Analysis (OSRA) of Night Helicopter Transport Operations'*, OHSI Implementation Team, December 2011 will be posted on the C-NLOPB web site early in 2012.

disc is 6 degrees below the horizon and begins in the morning when the center of the sun's disc is 6 degrees below the horizon.

Night helicopter transport operations were defined as the movement of passengers, baggage, and cargo that would take place between the end of evening civil twilight and the beginning of morning civil twilight during the core hours of 0600 to 1900. If night helicopter transport operations were to resume, there may be occasional requirement to fly past normal core hours. For the purposes of the Safety Study, it was assumed that under no circumstances would transport operations extend beyond 2359 hours or start before 0600 hours.

The expert panel identified five key accident types that could occur in the Jeanne d'Arc Basin at night:

1. Impact with ground during take-off or landing at St. John's Airport (YYT);
2. Ditching en route;
3. Controlled flight into terrain or water (CFIT)[5];
4. Collision with the installation on or in the vicinity of the helideck during the approach, arrival, or landing; and
5. Collision with the installation during take-off, transition, or departure.

Of these, the subject matter experts (SMEs) concluded that the likelihood of an accident during departure and arrival at YYT or of a CFIT en route (i.e., [1] and [3] above) would be the same during day or night operations.

It was determined that if night flights were resumed <u>with only the current mitigation in place</u>, there would be a greater likelihood of an accident during the approach, arrival, landing, take-off and departure phases at an offshore installation at night (i.e., [4] and [5] above); and that a ditching at night (i.e., [2] above) would likely result in more serious injuries to the aircraft occupants than a ditching during the day[6].

Mitigating measures to reduce these risks are described later in the document.

The following hazards were identified.

<u>Migratory Birds</u>

A number of night migratory bird species are known to fly seasonally along the east coast of Newfoundland. These migratory species were identified as a potential system hazard because they migrate in flocks at night and may fly at similar altitudes as helicopters returning from offshore installations. They would likely not be spotted by pilots. If ingested into one or more engines, they could cause sufficient damage to require a ditching (i.e., accident type 2, described above). However, in the absence of formal studies of the behaviours of the bird species that migrate at night in the vicinity of the Avalon Peninsula, it is not possible to determine the degree of risk they pose.

<u>Hazards that impact human performance</u>

a. The SMEs identified a number of human factors-related hazards that would likely play a significant part in most of the five night accident scenarios they examined.

[5] Controlled flight into terrain (CFIT) describes an accident in which an airworthy aircraft under the control of the pilots is unintentionally flown into the ground, water, or an obstacle.

[6] This assumes similar sea conditions, and is more fully explained in the paragraphs that follow.

The key hazards during a night arrival, landing, take-off, or go-around at an offshore site are associated with the conduct of visual manoeuvers in light conditions where visual references can be degraded, misleading, or completely absent. These hazards occur more often at night than during the day, and can lead to the pilot flying (PF) manoeuvring the helicopter inadvertently at an excessive closing rate, or responding inappropriately to a visual illusion such as the 'black hole' phenomenon. Cougar's standard operating procedures and comprehensive training are designed to mitigate these hazards. However, there are many dynamic circumstances that can and will affect the manoeuvring of the S-92A in close proximity to the helideck. For example, a crew with limited or degraded visual references[7], while manoeuvring close to the landing surface[8] may be slow to detect or respond to the start of a gradual descent, especially while dealing with the high workload that accompanies a rapid progression of predictable events (e.g., wind shear, out-of-wind conditions, drift towards the structure, etc.).

b. Pilots of S-92A aircraft use the same procedure to ditch during day or night. They employ an automated procedure to descend close to the surface. They then disconnect the automation, and 'manually' conduct a *visual* manoeuvre to descend to the surface of the water. This last manoeuvre is designed to reduce the energy of the forced landing, and to minimize the possibility of inversion. The key to a successful ditching is the pilot's visual reference to the surface. While there are occasions when the light and sea conditions at night are better than those that can be encountered during the day, with current equipment, it is expected that pilots would normally have few or no visual references to the surface when conducting the final stage of a ditching at night. Consequently, there would be a higher likelihood that the aircraft would strike the water with greater force, which could lead to a higher number of serious injuries to the occupants. This assumes similar sea and weather conditions for a ditching at day or night.

The SMEs identified the following hazards associated with a ditching in no- or low-light conditions:

There are inadequate visual cues to successfully conduct the visual manoeuvre;

There is a lack of fidelity in the simulator training for ditching; and

The potential for a number of deficiencies in human performance (e.g., fatigue, degraded proficiency, the effects that the precipitating emergency may have on the crew's decision-making close to the water)[9].

<u>Hazards that affect egress, survival, and rescue at night</u>

The following post-impact hazards were identified:

Survivors may experience difficulty in locating and boarding the life rafts;

There would likely be a longer response time during "after hours" for military SAR aircraft to arrive on-scene[10];

[7] Such as a "black hole effect"

[8] For example, while manoeuvring to land, just before initiating a go-around, or immediately after lift-off.

[9] For example, an uncontained fire might result in acrid smoke that could cause the crew to "speed-up" the procedures, or to be distracted and not coordinate or communicate their activities effectively.

[10] 103 Squadron in Gander provides the primary air SAR capability, and it does so with a fully equipped and manned CH-149 Cormorant rotary-wing aircraft 24 hours a day, seven days a week. The DND SAR response requirements are 30 minutes from 0800-1600 on weekdays and two hours during evenings and weekends.

After locating the accident site electronically, crews of the Cougar First Response SAR aircraft and military SAR aircraft would likely experience increased difficulty in locating individuals who are not in the life rafts. The level of difficulty would increase the longer individuals are in the water; and

Depending on the nature of the survivors' injuries, helicopters might need to return to hospitals, extending the time that the remaining survivors would remain in life rafts or the water.

These situations relating to egress, survival, and rescue might arise whether an accident occurs during day or night[11]. However, there was agreement that visually pinpointing and rescuing survivors takes longer at night than in daylight conditions. The potential for this to result in post-impact casualties would be increased if some of the occupants were seriously injured during the ditching.

Discussion

General

Offshore regulators around the world have adopted different approaches to night flight. This is likely due to differences in culture, the nature of the offshore operations, and the different environmental conditions that prevail in the various jurisdictions.

Night flight in Brazilian offshore operations is not permitted. In Australia, night flight is generally restricted to emergency circumstances, such as MEDEVAC flights. The National Offshore Petroleum Safety and Environmental Management Authority[12], leaves the regulation of helicopter operations to Australia's Civil Aviation Safety Authority.

Night flight is permitted in Norway, where they experience extended periods of darkness during the winter. The hazards of night flight are recognized, and the authorities, Operators and workforce representatives have developed requirements to manage the risks to an acceptable level. The Norwegian oil industry association (OLF) has produced guidelines for helicopter operations offshore, in which it recommends restricting flights to single-hull vessels (Class A) and prohibiting night flights to other vessels or unmanned platforms at night[13]. The guidelines also recommend that pilots not be employed in night flights until they have acquired a minimum level of experience. The Norwegian CAA regulates commercial helicopter flights, and the Petroleum Safety Authority imposes requirements regarding the dimensions, signage, and lighting for helidecks on offshore installations. The 2010 Helicopter Safety Study 3[14], conducted by an independent Norwegian research organization, recommended that night operations at the installations be minimized. To date, this Study's recommendations have not been implemented.

Night flight is permitted in the UK, where – similar to Transport Canada – the CAA imposes general limitations on all commercial operations regarding minimum "recency" requirements. The CAA's CAP 437 guidance document contains direction on helideck lighting. The Operators have adopted additional competency requirements, including some relating to "deck competencies".

[11] For instance, the two-hour military SAR response is not defined by light conditions, but by a pre-determined 16-hour daily period on weekdays, and a 24-hour-period on weekends. Additionally, the SAR aircraft and crew may not be at Gander, but may instead be at points farther from the accident site.
[12] Or NOPSEMA – formerly the National Offshore Petroleum Safety Authority (NOPSA).
[13] OLF, 2011.
[14] SINTEF, 2010.

In the Gulf of Mexico, where very different conditions prevail, nighttime passenger transport takes place on a regular basis. The Federal Aviation Administration (FAA) regulates all aspects of commercial helicopter flights, including night operations, and there are no additional limitations imposed by industry regulation. The FAA refers to guidance prepared by the Helicopter Safety Advisory Conference (HSAC) for offshore operations. HSAC suggests that only twin-engine, two-pilot aircraft be used for night flight, and that pilots use IFR procedures for approaches and departures.

If a decision is made by the C-NLOPB to resume passenger transport flights at night, the Team believes that activities must focus on strengthening existing mitigation, so that the *likelihood* of an accident is reduced. The goal is to achieve at least a similar – and preferably a lower – probability of an accident than is currently experienced during day operations. If this can be achieved, the probability of an accident occurring at night is diminished. There will be less likelihood that helicopter occupants will endure the challenging conditions that could be encountered during egress, survival, and rescue at night. The Team suggests that this strategy become the foundation for managing the risks if night flight is resumed.

Activities to reduce the risk of night flight

The Implementation Team believes that the following activities would reduce the risk associated with night operations:

a. Reduce the exposure of human factors-related hazards;

b. Employ methods such as night vision goggles (NVGs) or other technology to enable pilots to successfully conduct a ditching in no- or low-light conditions;

c. Continuously improve methods to search for and rescue survivors of a night ditching; and

d. Determine the behaviours of nocturnal migratory birds, and if appropriate, implement mitigation strategies to reduce the likelihood of a bird strike while transiting at cruise speed.

These are discussed below.

The Implementation Team noted that if a decision is made to return to night flight, the Operators and the Helicopter Service Provider will each employ their respective management of change process. The Team believes that in addition to this, a *centralized* change management plan should be employed to assist Cougar Helicopters and the different Operators to coordinate and implement their risk management activities. A centralized plan would enable the C-NLOPB to oversee the progress that the industry makes as it prepares to resume night flight.

a. Implement additional measures to reduce the exposure of human factors-related hazards

Cougar Helicopters expends significant resources to ensure that flight crews perform with a high level of proficiency. This level of proficiency is necessary for daytime operations. Therefore, if night flight were to resume, additional enhancements would be required to specifically address the human factors-related hazards that are most significant during night operations. Skills would be enhanced, and pilots flying night operations would perform optimally.

The Implementation Team believes that a critical evaluation of simulator training for night operations might reveal areas where the content and frequency of simulator sessions could be improved. If the simulator could be enhanced to closely approximate the conditions experienced during an actual ditching, it would do more than just improve flight crews' skills in ditching the S-92A. It would also

enhance their decision-making and communications skills, and engender confidence in handling extremely demanding circumstances at night.

Additional mitigation that would enhance flight crews' performance during night operations would include, among other things:

A carefully designed, implemented, and monitored program for crew pairing;

A restrictive, risk-based protocol to govern the dispatch or the continuation of a flight in darkness; and

The development of a formal fatigue management program (FMP)[15].

Fatigue is a known hazard that in the long term has a negative impact on the health, behaviours, cognitive functions, and moods of individuals. In the short-term, a fatigued individual can often experience difficulties in concentrating, identifying or responding to cues, setting priorities, making timely decisions, and communicating. A fatigued person is more susceptible to a loss of situational awareness, and is less able to manage stress effectively. In short, the effects of fatigue can degrade the performance of a highly experienced, well-trained, and motivated professional.

Fatigue can be a factor during day and night operations. It would take on increased significance if night helicopter transportation were to resume because:

There would be potential for the crews to experience variable duty periods, and to fly a mix of taskings during core and non-core hours over their 21-day rotation;

The conduct of visual manoeuvres in less-than-optimal lighting conditions during night arrivals, landings, take-offs, and departures at an installation could lead to stress and fatigue; and

Numerous studies suggest that fatigued pilots are more susceptible to CFIT accidents, the majority of which occur while conducting approaches at night.

The Operators currently specify criteria that govern maximum duty periods and the accumulation of flying hours in short- and long-term periods, as well as minimum rest periods. All meet or exceed guidance provided by the International Association of Oil and Gas Producers (OGP) and Transport Canada. Such limitations provide a solid foundation for a formal FMP by prescribing the boundaries that will normally not be exceeded. An FMP is a comprehensive and proactive method by which operational and technical staff at Cougar Helicopters could proactively and systematically reduce exposure to fatigue, and combat the effects of fatigue when they occur – whether during day or night operations.

Very little research has been published on the nature of fatigue in offshore helicopter operations[16]. There is an increasing body of research on the causes and effects of fatigue in short-haul, multi-segment, commercial, *fixed wing* operations, but few of the findings are transferable to C-NL Offshore Industry operations. A study of helicopter operations in the North Sea identified three factors that contribute to fatigue[17]:

Operating in harsh and demanding environmental conditions;

[15] See IATA, ICAO, and IFALPA, 2011.
[16] There are some exceptions. See for instance: Foushee et al., 1986; and Gander et al., 1998; and most recently Simons et al., 2011.
[17] Gander et al., 1998.

Operating aircraft near their limits for range and performance; and

Conducting approaches, arrivals, landings, take-offs, and departures at challenging offshore sites.

The parallels to the C-NL Offshore environment and operating circumstances are obvious.

A study on the effects of fatigue on spatial disorientation[18] suggested that overall, experienced pilots are more likely to recognize that they are experiencing conditions that could lead to spatial disorientation[19]. However, the same study also found that older and more experienced pilots were slightly more susceptible to the effects of at least one form of visual illusion. It is not known whether the findings from this unique study of fixed-wing pilots are relevant for helicopter pilots.

In summary: there are a number of human factors-related hazards that could affect the performance of pilots operating in the C-NL Offshore Area at night. The hazards are mitigated principally by precise piloting and effective crew coordination and communications. Fatigue is known to impede performance, yet there is very little scientific information about the causes and effects of fatigue in multi-crew, offshore helicopter operations. This is significant in the C-NL Offshore Industry because of the:

Particularly demanding environmental conditions in which helicopter transportation takes place;

Very demanding operating environment when arriving at or departing from an installation;

Criticality of effectively managing the advanced technology of the S-92A aircraft;

Demographics of Cougar's experienced pilots; and

Scheduling policy of pilots working 21 days, followed by 21 days off.

Therefore, the Implementation Team believes that consideration should be given to conducting a specialist study of the causes and effects of fatigue on flight crew operating in the C-NL Offshore Industry. The findings from this study could be employed to help guide the design and implementation of an integrated FMP.

The Implementation Team also believed that Cougar's maintenance personnel would benefit from the introduction of a formal FMP. Many work night shifts, and any degradation in the quality of their work has the potential to cause a technical failure that could lead to a ditching.

Recent studies indicate "that fatigue is a major challenge in the maintenance workforce" in aviation worldwide[20]. Emerging best practices include interventions associated with scheduling, policies and practices, education, organizational strategies, raising awareness, improving "healthy sleep", vehicle and environmental strategies, and research and evaluation[21].

By custom-designing FMPs for flight crew and maintenance personnel, Cougar could provide increased assurance that:

[18] Which, for instance can cause a pilot to experience and respond inappropriately to a 'black hole' effect.
[19] Previc et al., 2007.
[20] Hackworth et al., 2007.
[21] Hobbs et al., 2011.

The predictable conditions that decrease flight crew performance during night and day would be managed proactively, and consequently, the likelihood of an accident at or in the vicinity of an installation at night would be reduced; and

Maintenance staff would perform their duties with less likelihood of human error caused by fatigue, reducing the likelihood of a mechanical failure during night or day.

The FMP for pilots would be an important mechanism to supplement the many measures that currently exist to reduce the incidence of human error occurring, going undetected, or being inappropriately managed during night operations.

b. Determine the feasibility of using NVGs or other technologies to enhance vision in low- or no-light conditions

It was determined that there will normally be insufficient visual references to conduct a successful ditching or autorotation at night. The Safety Study determined that the likelihood of such an event in the Jeanne d'Arc Basin at night is 'improbable'. However, if night flights were resumed, and if crews are not confident that they could successfully ditch at night, the Implementation Team was concerned that flight crew might extend the time they remained airborne after identifying a problem. This would increase the likelihood of an uncontrollable emergency and an uncontrolled ditching, or a loss of flight control and subsequent impact with the water.

Pilots equipped with and trained in the use of NVGs would have adequate visual reference to conduct a ditching or autorotation at night[22]. However, equipping, training and maintaining proficiency in NVGs requires considerable initial and ongoing expenditure of resources. Furthermore, although the FAA has certified NVGs[23] and equipment requirements have been specified by the European Authority[24] and the Canadian military, Transport Canada has not yet certified NVGs for use in Canadian commercial flight operations.

Therefore, a feasibility study should be conducted if consideration is given to the use of NVGs or similar advanced technology that enhances pilots' vision at night.

c. Continue to seek methods to reduce the likelihood of impact and post-impact casualties

The Team noted that the Commissioner's concerns regarding night flight were linked in large part to SAR response, and – to a lesser degree – to fleet capacity[25].

The Team noted that many measures already exist to reduce injury during a ditching, and to affect a successful egress, survival, and rescue. Additionally, numerous initiatives are being implemented as a result of the OHSI to improve:

Egress and survival training (Recommendations 10, 13, and 14);

Personal protective equipment (Recommendations 10 and 16);

[22] Considerable progress is being made in developing and improving the functionality of what is termed "night or low visual environment enhancement devices". Forward Looking Infrared (FLIR) systems and Enhanced Vision Systems (EVS) are examples of such technologies. Therefore, pilots in the future may be able to enhance their vision at night using technology other than NVGs (EASA-FAA, 2011).

[23] FAA TSO-C164, approved in accordance with 14 Code of Federal Regulations Part 21.8.

[24] EASA RTCA DO-275, Section 2

[25] For the former, see OHSI, Phase I, Vol. 1, Issue 6, particularly pp. 189-192. For the latter, see Issue 11, p. 205.

Cougar's first response capability (Recommendations 1 and 2);

The coordination of activities between the DND and Cougar Helicopters (Recommendations 3 and 4); and

Guidelines related to maximum sea states and minimum visibilities (Recommendation 9).

With the exception of some of the initiatives proposed in the preceding pages (e.g., relating to enhanced night vision systems such as NVGs), there are very few additional forms of mitigation that the Team can suggest to reduce the severity of an accident (i.e., reduce the number of post-impact casualties).

However, the Team felt that if night flight is resumed, the activities currently underway to implement the above-noted OHSI Recommendations need to be considered and – if necessary – revised to take into account the hazards related to night operations. If the overlapping activities are not coordinated, systemic hazards might be inadvertently introduced, and the risks to day and night operations increased.

The Team noted that it is common in most safety-critical industries to practise responding to an accident, so that if an accident does occur, loss of life is minimized. This often takes the form of a joint exercise to verify that response plans remain relevant, and that the individual and collective activities of the various organizations are coordinated and effective. This has been the practice in the C-NL Offshore Industry. If night flights were resumed, there would be benefit in continuing and –if appropriate – enhancing joint exercises involving all of the key responders to a ditching at night in the C-NL Offshore Area.

Additionally, there would be benefit in reviewing the current protocols between the DND and Cougar in the context of this report. For instance, at any given time, the DND primary SAR aircraft may be operating some distance from Gander. This can lengthen the transit time of the military aircraft if a night ditching were to occur off the east coast of Newfoundland. Such a review might lead to the requirement, for instance, to consider the availability of the DND SAR vehicle as part of the flight planning requirements for night flights offshore.

d. Conduct research on nocturnal behaviours of migratory birds

A study of the nocturnal behaviours of birds that seasonally migrate along the east coast of Newfoundland would determine their significance to night helicopter transportation. The resulting information could be used to determine the likelihood and severity of a bird strike at night, and – if necessary – to implement appropriate mitigation. The mitigation might be operational or technical. For example:

When feasible, pilots on night transportation flights during the migratory season could consider flying return legs at higher altitudes, where there is less chance of encountering migratory birds[26]; or

If appropriate, Cougar might consider the operational use of radar to detect and predict the movement of flocking birds, thereby helping pilots plan their routings and altitudes at night during the migratory seasons. In recent years, small, portable radar systems designed specifically to detect birds are being deployed during migratory seasons at select "high risk"

[26] Of course, these would not exceed the altitude restrictions that enable a ditching to be conducted in the event of a main gearbox malfunction.

military and civilian airports, so that flocking activity can be better factored into flight planning decisions[27].

Summary

The Implementation Team concluded that if the appropriate measures – as specified in this document – are taken, then the risk of night helicopter transport operations can be reduced to a level similar to the current level of risk of daytime operations. Furthermore, if several suggested forms of mitigation (such as improvements in simulator training and the introduction of FMPs) were implemented, current risk management practices would be enhanced. The already high safety performance achieved during day operations would be improved.

Recommendations

The Implementation Team determined the requirements they believe are necessary to enable a return to night helicopter transport operations. They also considered several additional options by which 'limited' night flight might be introduced. It appears that additional study is required to define the requirements for these options, and to determine whether they are feasible. It is more appropriate that these studies be conducted or commissioned by the C-NLOPB if the Board approves in principle that night flight *could be* resumed. Therefore, the Team recommends that:

Recommendation 1: The C-NLOPB remove the restriction on night helicopter transport operations provided the requirements described below are met.

This would permit the movement of passengers, baggage and cargo during the core hours of 0600 and 1900, and occasional flights past normal core hours. Flights would be prohibited from extending beyond 2359 or starting before 0600. Night flight would not resume until the Operator(s) had demonstrated to the C-NLOPB that the requirements, proposed below, were met. The privilege of night flight could be removed if an Operator did not demonstrate adherence to the requirements.

The Implementation Team recommends that the following requirements be met before night helicopter transport operations resume:

1. The First Response SAR aircraft dedicated to the C-NL Offshore Industry is equipped with an automatic flight control system (or 'auto hover'), and the crew are able to meet the wheels-up time specified in OHSI Recommendation 1.

2. The Helicopter Service Provider demonstrates that pilots conducting night flights are capable of successfully ditching in no-light conditions.

3. The fidelity of the S-92A simulator enables pilots undergoing night training to experience circumstances that closely approximate those that can be expected during an actual ditching in no- or low-light conditions.

4. There is a night simulator training program that enables pilots (as individual pilots, and as a crew) to demonstrate proficiency in normal and abnormal operations while conducting approaches, arrivals, landings, take-offs, departures, or go-arounds at offshore installations while experiencing dynamic operating and environmental conditions.

[27] See for instance: http://www.detect-inc.com/

5. A Fatigue Management Program (FMP) is in place for helicopter transport pilots and First Response SAR pilots. The FMP is customized to account for the operating conditions in the C-NL Offshore Area and the demographic make-up of helicopter pilots working in the Industry.

6. An FMP for maintenance personnel is in place, and the FMPs for pilots and maintenance personnel are integrated with the Helicopter Service Provider's safety management system (SMS).

7. Periodic exercises involving the key responders (e.g., Cougar First Response SAR resources and DND SAR resources) are conducted to simulate the search for a helicopter that has ditched at night, and the rescue of its occupants.

8. Studies of nocturnal behaviours of birds that seasonally migrate along the east coast of Newfoundland be commenced, and there is a formal commitment to employ findings to develop appropriate mitigation if the studies demonstrate elevated risk caused by nocturnal bird movements.

Table 1 – Summary of the Effects of the Proposal to Return to Night Flight

Accident/Event Type	Current level of daytime risk achieved	Current level of risk of day operations[28] improved	Cumulative Effect on Day & Night Operations
1. Accident on or near YYT	Yes	Yes	↑
2. CFIT en route	Yes	Yes	↑
3. Event leading to ditching	Yes	Yes	↑
4. Ditching	No[29]	Yes	≈
5. During arrival at installation	Yes	Yes	≈
6. During departure from installation	Yes	Yes	≈
	Index: ↑ Improvement in safety performance; ≈ Similar level of risk; ↓ Decrease in safety performance		

The Team concluded that if the requirements listed above were met, the risks related to the resumption of night flight would be managed to an acceptable level[30] for the following reasons:

> The additional mitigation that would be implemented before night operations were underway would decrease the likelihood of a ditching, while enhancing the Helicopter Service Provider's safety performance during day and night operations[31].

[28] In part due to FMPs, enhanced simulator fidelity, simulator training, etc.
[29] Because of the longer period that aircraft occupants might be in the water awaiting rescue.
[30] A similar level of risk as that experienced during current daytime operations. See Table 1.
[31] In other words: new or enhanced 'defences' would be introduced so that the likelihood of a ditching en route is reduced.

> The likelihood of a ditching while at cruise during day or night is very low (i.e., "improbable"), and the proportion of total flying that would be conducted at cruise in darkness would be considerably smaller than during the day[32].

Initiatives to enhance joint SAR capabilities at night should be pursued, but should not cause the prohibition of night operations.

Recommendation 2: The Team recommends that if night flight is resumed, a measurement framework needs to be developed.

Two performance goals would be required:

> Performance Goal 1: Verify that the structure to reduce the risks of night flight is in place and functioning before night flight is resumed; and
>
> Performance Goal 2: Measure the ongoing attainment of an acceptable level of risk of night flying.

The high-level goal of the measurement framework would be to demonstrate that the risks of night helicopter transport operations resulting from this option are being managed to an acceptable level of risk.

More information regarding this framework is contained in the Appendix. The performance goals overlap. Additionally, many performance goals that are being developed as part of other OHSI Recommendations (e.g., 2, 9, and 18) apply.

Recommendation 3: The Team recommends that the C-NLOPB consider different 'levels' of night flight.

As noted in page 2 of this Advising Document, the Team examined a number of different levels of night flight for the C-NL Offshore Industry. If the Board accepts Recommendations 1 and 2, the Team recommends that C-NLOPB staff examine the feasibility of operating a multi-tiered system with different levels of night flight.

Conclusion

The Safety Study of night helicopter transport operations in the C-NL Offshore Industry concluded that:

> The likelihood of an accident during departure and arrival at St. John's International Airport, and of a controlled flight into terrain (CFIT) accident en route would be similar during day and night operations (rare);
>
> With the current mitigation in place, there would be a greater likelihood during night operations of an accident during the approach, arrival, landing, take-off, and departure phases at an offshore installation (remote);

[32] This is supported by the finding in the Safety Study that the risk of an accident at night (a) in the vicinity of St. John's International Airport; (b) of a CFIT accident en route; and (c) of a mechanical failure en route would be similar to the risk during daytime operations.

There could be a higher likelihood that a ditching at night would result in a greater number of casualties; and

The increased risk of night operations noted above could be reduced to a similar level as the current level of risk for daytime operations if a number of mitigating measures were implemented.

Much of the mitigation proposed in this document focuses on managing the human factors-related hazards to which pilots are more likely to be exposed at night. A performance measurement program would help determine whether the mitigation is achieving the desired effects. Measuring improvements in human performance is complex. The program would likely need to be structured on a framework that explicitly maps the objectives of the mitigation strategies with inputs, outputs, and outcomes. Appropriate indicators of performance would be identified. Data would be collected that would provide the key stakeholders with feedback on the effectiveness of the mitigation, so that changes to the mitigation would be incorporated when required.

OHSI Recommendation 12 contained two other considerations if night flights were resumed:

That for each night flight, "the [unanimous] decision to fly should be made by a committee composed of a representative from each of the Regulator, helicopter operator(s), oil operators, and workers."

That a passenger "be entitled to refuse to take a night flight without penalty of any kind."

The Implementation Team respects the intent of these requirements, but does not support them for the following reasons:

The spirit of forming a committee to assess the risks of night flight has been met by the considerable work completed in 2011. Representatives from the key stakeholder groups have been active participants in the analysis. Therefore, the Team feels that the committee mentioned in the Recommendation was formed, and the Team has done the necessary work to assess the risks specified by the Commissioner.

Furthermore, the Team believes strongly that the safety of night flight is dependent on a systematic and structured approach to manage risk. Mitigation is multi-layered. The Team believes that the mitigation it has proposed in this document will result in a sound infrastructure that will enable the risks of night operations to be managed consistently. The actions of a committee – although well intended – could lead to the undermining of the infrastructure, and introduce randomness in decision-making. The Team concluded that when the mitigation it has recommended is in place, there will be no need for ad hoc decisions by a committee.

The study has demonstrated that with appropriate mitigation, a level of risk similar to daytime operations – and therefore an "acceptable" level of risk – can be demonstrated for night flight. The Team does not believe that individuals should be given the option to decline a night flight because of personal preference. If an individual believes there is a condition or specific issue related to the night flight that he/she believes is dangerous to his/her health or safety, then the existing legislative right to refuse unsafe work shall apply.

Appendix – Measurement Framework

The goal of the measurement framework is to demonstrate that the risks of night helicopter transport operations are managed to an acceptable level of risk.

The performance goals overlap. Additionally, many performance goals that have been developed as part of other OHSI Recommendations (e.g., 3, 4, 9, and 18) apply. Some performance requirements and measures described below currently exist, and would likely be included in the future measurement framework.

Performance Requirement 1: First Response SAR crews successfully locate and evacuate aircraft occupants from water in no-light conditions.

Measures of PR1

A First Response SAR aircraft, dedicated to the C-NL Offshore Area, is equipped with a functional automatic flight control system (or 'auto-hover').

All First Response SAR crews demonstrate the capability of being wheels-up in the specified time, and demonstrate proficiency in all SAR functions in no-light conditions. The functions include SAR flight operations, and the visual search, rescue, and evacuation of survivors.

Performance Requirement 2: Dedicated SAR resources (of the C-NL Offshore Industry and DND) effectively coordinate and successfully complete the search for, rescue, and evacuation of occupants of a helicopter that has entered the water in the C-NL Offshore Area.

Measures of PR2

Night helicopter transport operations occur only when DND and the Helicopter Service Provider's SAR resources are known to be able to meet performance standards (e.g., related to aircraft serviceability, weather conditions, and aircraft within 'reasonable' range).

Periodic joint exercises are conducted that closely simulate conditions that would be encountered, including no- or low-light conditions. Performance deficiencies relating to Operator-provided SAR services are identified, documented, and addressed. Performance deficiencies regarding DND SAR services are forwarded to the DND for their consideration. Subsequent activities are monitored by the Operators so that – if necessary – residual risk can be managed.

Performance Requirement 3: Pilots of night helicopter transport flights successfully perform normal and abnormal operations.

Measures of PR3

Night proficiency requirements are employed that verify pilots conducting helicopter transport flights are proficient and current in normal and abnormal operations at night.

Training and standards programs that are based on night proficiency requirements are implemented (the training program to acquire and maintain skills; the standards program to demonstrate proficiency). The programs are periodically evaluated to verify their effectiveness.

Simulator training closely approximates the conditions that would be encountered in night operating conditions in the C-NL Offshore Area.

Performance Requirement 4: Pilots successfully conduct a ditching in no-light conditions

Performance would be demonstrated in a simulator that would approximate the conditions that would be encountered during a ditching in the C-NL Offshore Area at night (i.e.; no light, high sea states, high winds, effects of pack ice, etc.).

Performance Requirement 5: The risk of fatigue degrading the proficiency of flight crew and maintenance personnel is managed to a level as low as reasonably practicable.

Measures of PR 5

Fatigue Management Programs (FMP) are designed to take account of the demographic make-up of air crew and maintenance staff of the Helicopter Operator(s) and of the safety-criticality of their tasks.

Criteria relating to the flight crew FMP are integrated with the contents and application of policies and procedures for crew scheduling and pairing.

Information regarding the effectiveness of the FMPs for maintenance personnel and flight crew are sought and used on an ongoing basis. For instance:

- RAM reports, hazard and event reports, and training and flight check reports are evaluated for indicators of fatigue-related performance deficiencies;
- There are periodic studies and surveys of fatigue and wellness of flight crew and maintenance staff, the results of which are analysed and – where appropriate – employed to enhance FMP performance; and
- Studies from other jurisdictions are periodically evaluated and incorporated where appropriate. When required, R&D is initiated.

Performance Requirement 6: Risk mitigation of night flight is periodically evaluated and, when appropriate, modified.

Measures of PR6

A study of night migratory birds has been initiated.

Advice to the C-NLOPB: Recommendation 12

System-wide, macro analyses of ongoing night helicopter transportation operations are periodically conducted, and – where appropriate – employed to revise the requirements for night operations.

Information from other jurisdictions is sought through such mechanisms as safety conferences, and – when appropriate – joint R&D is initiated to enhance the management of risks related to night operations.

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