CANADIAN FORCES COLLEGE / COLLÈGE DES FORCES CANADIENNES
CSC 31 / CCEM 31

EXERCISE/EXERCICE NEW HORIZONS

Fatigue Management and the Canadian Military Aerospace Environment

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ABSTRACT

Canadian aerospace forces currently operate using policies that have not been significantly updated since the end of the Cold War and do not reflect changes in the global conflict environment. In addition, any procedures in place are applicable almost exclusively to aircrew vice aerospace personnel in general. The evolution of new technologies and the expeditionary nature of modern warfare have greatly increased the potential impact of fatigue on personnel performance and consequently operational effectiveness. We cannot afford to ignore fatigue as an operational hazard. The impact of fatigue needs to be understood by all in the aerospace environment and effective countermeasures must be in place to not only mitigate its impact on operations but to ensure the safety of personnel.

This paper proposes that Canada develop a more comprehensive and updated personnel Fatigue Management Program (FMP) for our aerospace forces. The program should be applicable for all aerospace personnel and should be based on the core elements of the United States Navy and Air Force models. Emphasis should be on creating a program tailored to Canadian needs, recognizing our roles and capabilities, and reflecting our unique values and concerns. Education and training, enhanced supervisor awareness and involvement, and physical fitness should all be major aspects of the FMP with the incorporation of medications to be further investigated as required. The benefits of this new FMP would be increased safety and operational effectiveness, not only for aircrew but also for all aerospace personnel.

Technological advances, newly defined asymmetric threats and the nature and scope of conflicts around the globe require aerospace assets to deploy and operate often with little notice at great distances from main support bases. The speed and tempo of modern warfare, inter- and intra-theatre distances and resource constraints have multiplied in the last two decades. All these impact on the ability of aerospace forces to meet the demands placed on them.

> [D]espite the awesome machines and technology that [Air Forces] bring to bear, the mission still relies most critically on those in uniform…it takes dozens of personnel to successfully launch one aircraft in the air…how we care for ourselves and our troops on a daily basis plays an important role in mission effectiveness.[1]

Time zone changes, long crew days with minimum time between missions, demanding environments in terms of threats, procedures and terrain/weather – all serve to amplify the need for an effective program to manage and mitigate the effects of human fatigue. The Canadian Forces, and in particular the Air Force, has not kept pace with the need to adapt our policies to reflect these changes, especially those that impact directly on safety and operational effectiveness. In order to ensure the human dimension of capability is addressed in concert with advances in technology and warfare, Canada must develop a more comprehensive and updated personnel Fatigue Management Program (FMP) for our aerospace forces. The new FMP should provide more encompassing and detailed direction and education to our aerospace personnel

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[1] David O'Brien and T.M. Rock, "Endurance Management: Maximizing the Air Force's Most Vital Asset," *Mobility Forum: The Journal of Air Mobility Command* 12, issue 4 (Jul/Aug 2003): 1.

so that the effects of fatigue are mitigated to the greatest extent possible. The benefits of the FMP will be increased safety and operational effectiveness.

This paper will initially clarify what is meant by the word fatigue and give evidence of its importance and impact relative to aerospace capabilities. Canada's existing limited methods of addressing fatigue in an aviation context will then be examined and the shortcomings identified. What is needed for Canada with respect to a Fatigue Management Program (FMP) to mitigate the impact of fatigue will then be argued. Next, some of the fatigue management options currently in use by our allies will be discussed, including the controversial use of drugs. Lastly, this paper will propose that Canada create a comprehensive program applicable for all aerospace personnel. This program should be based on the core elements of the United States Navy and Air Force models – education and awareness, supervisor involvement, options tailored to the situation, and the use of medications, if required.

FATIGUE: DEFINITION AND IMPACT

Fatigue is defined in the Oxford dictionary as "extreme tiredness."[2] Tiredness in turn means to be in need of sleep or rest. Sleep is a vital physiological function that provides the human body and mind time to rest, recuperate and reenergize. In scientific circles the conditions of fatigue and sleepiness are treated as distinct and different, based on the underlying causes. Sleepiness for example is linked to circadian rhythms and is predominantly used when discussing the impact of time zone changes and jet lag. Fatigue is associated more closely with the decreases in mental

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[2] The Pocket Oxford Concise Dictionary, 9th ed., ed. by Catherine Sloan (Oxford: Oxford University Press, 2001), 326.

abilities caused by sleep loss.[3] The types of operations and conflict environment prevalent since the end of the Cold War "…induce fatigue, sometimes due to jet-lag, to sleep loss, to the intense physical activity, to the stress, and sometimes due to a combination of all these parameters."[4] Because of the overlapping and often domino effects of these parameters or causes, for ease of understanding and consistency within this paper the term 'fatigue' will be used throughout in an all-encompassing context.

Why is fatigue so important an issue in modern military operations? The following excerpt from a United States Air Force Counter-Fatigue Guide provides a clear and concise explanation as to its relevance in today's conflict environment:

> While militaries have continued to evaluate and embrace technologies to enhance or sustain mission performance, this has sometimes come at a cost to the *human weapon system*. Operation and maintenance of complex military equipment now requires highly trained and very alert service professionals. At the same time [the USAF] air expeditionary force concept of operations can translate into longer work periods, shorter transition times, and fewer opportunities for sleep, recovery, etc. The resultant impact is on individual levels of fatigue, intuitive decision-making, response time, judgment and overall alertness, which ultimately impacts job performance and mission success rates.[5] (emphasis added)

No matter what its cause, fatigue creates problems both for the individual and the force as a whole. In both peace and wartime operations, military personnel at all

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[3] North Atlantic Treaty Organization Research and Technology Organization, Human Factors and Medicine Panel Meeting Proceedings, *RTO-EN-016 Sleep/Wakefulness Management in Continuous/Sustained Operations; 2-1* (Washington, D.C.: US Department of Commerce, 2002); available from http://www.rta.nato.int; Internet; accessed 15 December 2004.

[4] *Ibid.,* 1-5.

[5] United States Air Force School of Aerospace Medicine. *Warfighter Endurance Management During Continuous Flight and Ground Operations (An Air Force Counter-Fatigue Guide).*; 4. Available from http://www.brooks.af.mil/web/enhance/cope/files/Warfighter%20Endurance%20Management.pdf; Internet; accessed 03 January 2005.

levels are counted on to do their job to a certain predetermined standard, often irrespective of the conditions or circumstances that prevail. "[S]leepiness…leads to decrements in essentially all aspects of human performance…[including] decision-making, response time, judgment, hand-eye coordination, and countless other skills."[6] The potential impacts caused by any decrement in performance can have catastrophic effects on the safe execution of modern aerospace operations.

From an aerospace perspective the problem has been exacerbated by the fact that aircraft can now remain airborne much longer than a human can maintain effective cognitive and motor skills. Rapid and accurate processing of information for decision-making is critical and this can't be done correctly and effectively if fatigued. The potential for information overload, failure to discern what is really important or failure to react in time increases with fatigue.

> Despite the many challenges to get adequate rest, getting enough sleep is as critical to our ultimate success as every other part of mission planning…. the very nature of our business…practically guarantees that fatigue will always be looming out there as a factor we must overcome in order to safely accomplish our missions.[7]

Since the end of the Cold War there has been a dramatic upsurge in operational tempo and blurring surrounding the new threats. The resultant lack of a single focused threat from a known quarter, and the consistent reduction in foreign infrastructure and forward deployed assets due to costs, means that for the most part,

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[6] E.L. Co, M.R. Rosekind, J.M. Johnson, K.J. Weldon, and others. "Fatigue Countermeasures: Alertness Management in Flight Operations." *Southern California Safety Institute Proceedings.* Long Beach, Calif., 1994; available from: http://fringe.davesource.com/Fringe/Information/Fatigue_Countermeasures.html; Internet; accessed 23 November 2004.

[7] David A.Hagginbothom, "Combating fatigue," *Combat Edge* 11, issue 6 (November 2002), 8 [journal on-line] available from http://proquest.umi.com; Internet; accessed 27 Sep 2004.

a much higher emphasis is now placed on rapid deployment over greater distances. Deployments to locations with the potential for little in the way of inherent support facilities are now the norm vice the exception. The trend to be 'expeditionary,' to respond to crises with a task-tailored approach on short notice, and to adjust to shorter duration but higher tempo missions all reflect the need to place greater emphasis on the recognition and management of fatigue for all aerospace personnel.

> [T]he combination of 24/7 operations, military manpower reductions, increased ops tempo and an ever-increasing tactical reliance upon continuous and sustained operations, have increasingly stressed the basic biological capabilities of our military personnel.[8]

All this places incredible demands not only on the personnel actually deploying, but also those who plan and coordinate the operation at all levels. "All soldiers are affected by sleep loss, but leaders and command/control personnel who deal with many cognitive tasks and complex decision-making are most vulnerable."[9] The issues and concerns surrounding fatigue are not limited to aircrew but are relevant for all personnel involved in modern military sustained and continuous operations.[10]

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[8]John A. Caldwell, "Fighting Aircrew Fatigue…and Mishaps," *Flying Safety* 60, issue 3 (March 2004), 2 [journal on-line] available from http://proquest.umi.com; Internet; accessed 27 Sep 2004.

[9] North Atlantic Treaty Organization Research and Technology Organization, Human Factors and Medicine Panel Meeting Proceedings, *RTO-EN-016*…, 1-5.

[10] **NATO definitions**: a SUSOPS [sustained operation] is a military operation characterized by a conflict of very high intensity, limited in the time (one or few days) but with no possibility of sleep. A CONOPS [continuous operation] is a military operation characterized by a conflict of relatively low intensity, on a very long period (many weeks or months), with a possibility to sleep but not every time during the night and not during a recovery period of eight hours. (RTO EN-016, 1-5) **USAF Defn differences**…"CONOPS – extend over 72 hours…SUSOPS – performance over 72 hours" (Warfighter Endurance, 7) **Navy Definitions** – CONOPS: extend over 24 hours at a 'normal' rate; not necessarily longer hours per individual; workers are relieved at the end of a shift and return later; individual may work different hours which conflict with circadian rhythm; sleep may be intermittent, broken and unrestorative; most pilots use CONOPS to refer to contingency operations SUSOPS: involve individual continuous performance longer than 24 hrs; work is continued until a goal is reached; sleep deprivation is common; prevalent in ground warfare. (NAVMED P-6410, 3)

Consider the ever increasing 'stand-off' distances of land based aviation assets provided by air refueling, the advent of night vision and other technologies that truly allow 24/7 operations on the battlefield or conflict area. The technical capacity is there to meet the challenges of the new threat environment but can the human machine meet the demand? Since the end of the Cold War and the advent of the supposed peace dividend, Canada has experienced dramatic reductions in resources. Between 1989 and 2003 overall Air Force regular force manpower decreased by 48% and equipment by 56%.[11] On the other hand, the operational tempo and demands on the forces increased significantly. During the four decades of the Cold War we deployed on 24 missions in total but since 1990 have been involved in 70.[12] We are far from alone in experiencing these changes. The magnitude of change in the United States is illustrated by the following quote from the Air Force Research Laboratory:

> Since 1990, there has been an overall 37.7% reduction in military personnel, while contingency deployments have increased by as much as 400%…while Air Force equipment is well suited to such continuous and sustained operations, the performance capabilities of military personnel are not.[13]

This demand can't help but drive all militaries to come up with better ways to do more with less – but this must be done without sacrificing safety for capability or perceived readiness. These statistics clearly illustrate "…the bottom line is that

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[11] Department of National Defence, A-GA-007-000/AF-002 *The Aerospace Capability Framework* (Ottawa: DND Canada, 2003), 45.

[12] Department of National Defence, Homes Page, "Priorities: Optimizing Defence and Security Capabilities," www.forces.gc.ca/site/priorities/priority_3-e.asp; Internet, accessed 29 March 2005.

[13] John A. Caldwell "Fatigue in Aviation Operations," *Air Force Research Laboratory Horizons,* June 2003; 1, available on-line from http://www.afrlhorizons.com/Briefs/Jun03/HE0301.html; Internet; accessed 23 Nov 2004.

improperly managed fatigue is an ever present threat to operational safety and effectiveness."[14]

More important than defining the changes in a numerical context, it is important to examine them from the perspective of personnel performance. The USAF for example has actually defined the performance goal for all its members to be "…optimal job productivity with no or absolutely minimal, adverse impact on safety, health and general well being."[15] How often have you heard that 'the soldier comes first' yet seen that in reality accomplishing the task or mission took precedence over the person? A number of recent articles contain information concerning USAF aviation accidents, including the statistics that almost eight percent of the Class A accidents in the past thirty years have been at least partially attributed to fatigue with estimated costs of over $50 million per year.[16] While the statistics indicate that fatigue is far from a new issue in military aviation, its impact and seriousness are certainly gaining recognition. The same articles cite a growing concern over the risks associated with the increasing gap between military mission demands and human capacity, and the need to instigate an aggressive program aimed at reducing those

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[14] John A. Caldwell Jr, "Fatigue in Aviation Special Operations…, 33.

[15] United States Air Force School of Aerospace Medicine. *Warfighter Endurance Management*…, 4.

[16] Class A accidents in the US are defined as those involving over $1 million damage, loss of aircraft or loss of life (definition courtesy of LCol Saladana who was recently employed as a Flight Safety Investigator with the USAF). Articles with stats include John A. Caldwell, "Fighting Aircrew Fatigue…and Mishaps," *Flying Safety* 60, issue 3 (March 2004) [journal on-line] available from http://proquest.umi.com; and Caldwell, John A. "Fatigue in Aviation Operations," *Air Force Research Laboratory Horizons,* June 2003; available on-line from http://www.afrlhorizons.com/Briefs/Jun03/HE0301.html.

risks. It must be acknowledged and understood at all levels that "the most critical and fragile element of a weapon or support system is the human being."[17]

Fatigue is a recognized operational hazard that needs to be addressed in order to achieve that safe and effective mission accomplishment with minimal adverse effect on the personnel part of the equation. By not having a program designed to mitigate this hazard, Canada is failing to properly take into account the significant impact of fatigue on military aerospace operations. The lack of a comprehensive FMP for our aerospace forces is a shortfall that affects not only the safety of our aircrew but also the operational effectiveness of all our aerospace personnel.

CURRENT CANADIAN AEROSPACE POLICIES

The conduct of Canadian aerospace operations is currently regulated by two main sets of reference publications.[18] Of these, only the 1 CAD series, in particular Volume 2 Flying Orders, specifically addresses fatigue in any way. To date no significant amendments have been made to reflect the move towards an expeditionary warfare concept or the realities of operational demands since the early 1990s.[19]

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[17]United States Navy Office of Naval Research, Human Systems Department website, http://www.onr.navy.mil/sci_tech/personnel; Internet; accessed 27 December 2004.

[18] These are B-GA-100-003/AA-000 Flying Orders and 1 Canadian Air Division (1 CAD) Orders. To better understand of our current situation it must be understood that on the dissolution of the different air groups (ATG, 10TAG, FG, and MAG) and the stand-up of 1 CAD HQ in 1997 new orders were published which were intended to provide a single set of coherent and common guidelines for the air community to follow. These orders (eventually comprising seven volumes) were essentially a compilation of those orders previously used and promulgated by each individual group and were constructed using a 'cut and paste' methodology with little in depth analysis done as to the continued relevance and applicability of the contents.

[19] No examination of CF documents that govern the organization and design of schedules for shift work has been incorporated into this paper. This was omitted for the simple reason that these policies are almost exclusively based on home station peacetime factors and criteria.

1CAD Orders address fatigue indirectly by providing policy statements on Crew Duty Day, Crew Rest and Maximum Flying Hours.[20] Duty Day is said to start when the first crewmember reports for duty and ends when the last crewmember is released from duty (this includes the time for mission and weather briefings, maintenance and other delays) while Crew Rest (CR) is defined as "… that time provided for physiological rest to recover from flying duties…."[21] The policies are realistically only guidelines as exemptions and waivers are possible. The regulations for Air Mobility and Maritime Patrol communities specifically state that Duty Day maximums may be exceeded, if necessary, to meet operational requirements but the orders fail to provide a definition of 'necessary'. In addition, they also fail to provide details or guidelines on what constitutes 'operational requirements'.[22] This ambiguity reflects a lack of clear guidance or direction to both aircrew and supervisory staff.

Furthermore, only two communities specifically relate the CR or Duty Day caveats to the very real potential for personnel fatigue. 1 CAD Order 2-003 states that Air Mobility Aircraft Commanders "… may declare unscheduled CR whenever they

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[20] The practice of aviation regulatory bodies setting maximum permissible limits for such things as periods of duty and hours of flight within a set period was established by ICAO (the International Civil Aviation Organization) in 1944 and is followed by almost all civilian and military aviation organizations today. David O'Hare and Stanley Roscoe. *Flightdeck Performance: The Human Factor.* Ames: Iowa State University Press, 1990, 163.

[21] Department of National Defence, *1 Canadian Air Division Orders Volume 2: Flying* Orders (Ottawa: DND Canada, 30 November 1999), 2-003 sect 4 para 39.

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[22] Other workarounds include: (1) for Fighter aircraft: "…flying time limitations may be waived by Unit COs when required by national emergency or by SAR or mercy flight commitment;" (note to Annex A of 2-003) and (2) for Air Mobility: "Aircraft Commanders, Squadron COs, Detachment Comds, and Airlift Control Element (ALCE) Comds …may declare a temporary reduced CR period that fits their operational needs provided at least 8 hrs of uninterrupted rest is assured." (2-003 sect 4 para 40). In addition, individuals may exceed the maximum permissible flying hours on the approval of a Flight Surgeon.

consider crew fatigue could jeopardize the safety of the flight."[23] The Tactical Helicopter community places the onus on Flying Supervisors who are to "… closely monitor aircrew fatigue levels and restrict their aircrew from performing flying duties in order to minimize unnecessary risk due to excessive fatigue, even-though maximum limits …have not been met."[24] Only a single reference is made in the orders as to their possible applicability for personnel other than active aircrew. The Maritime Helicopter community specifies that the Duty Day policy applies:

> …specifically to aircrew, technician

are not well understood or recognized within the CF aerospace community. It is critically important that we expand our considerations and policies to include more wide ranging fatigue fighting options and that we also provide appropriate guidelines and training for all aerospace personnel. Rudimentary crew scheduling and shift worker rotation plans are no longer enough to meet the contingencies of current operational tempo and deployments. Given the potential for fatigue to have a serious negative impact on operations in today's aerospace environment, Canada cannot continue to leave our personnel to their own devices, lacking in both clear direction and appropriate education relating to fatigue.

WHAT IS NEEDED

What Canada needs is a comprehensive FMP which covers all aerospace forces to ensure we can be effective and safe in mission execution, irrespective of the task, time or location. "[A] well planned fatigue-management strategy can make the difference between success and failure, and even life and death, in the operational environment."[26] Military forces around the world have FMPs in place and so should we. We have personnel on exchange with other countries and pride ourselves on our participation in coalition activities. We need to ensure our personnel are given all the right tools to be able to meet the demands placed on them. It's bad enough that we are often working at a disadvantage because of equipment, but to place our personnel at a further disadvantage because we haven't bothered to keep abreast of programs that could help mitigate some of the potential effects of a known operational and safety

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[26] John A. Caldwell Jr, "Fatigue in Aviation Special Operations…, 30.

hazard such as fatigue is both unprofessional and unethical. That doesn't mean we have to blindly follow the lead of others but we must have mechanisms in place to ensure our personnel maintain operational effectiveness within the scope of procedures we allow and that practices are updated on a continuous basis to meet the changing scenarios of modern conflict.

We need a program that provides us with the means to address the scope and complexity of fatigue. We need "…tools to facilitate development of optimal crew work/rest schedules, techniques to enhance sleep quality and circadian adaptation, and optimization of alertness-enhancing compounds."[27] Many measures are available for inclusion in a fatigue management program such as scheduling, manning, naps, fitness, diet, medications, and monitoring. Some programs go so far as to delineate between preventive and operational countermeasures based on when the strategy is applied:

> Preventive strategies consist of techniques used prior to duty and on layovers to minimize sleep loss and circadian rhythm disruption. Operational countermeasures actively combat fatigue during flight operations…[through masking] the effects of sleepiness rather than relieving the physiological sleepiness.[28]

Operational strategies tend to be more limited in number and application and are currently designed almost exclusively for aircrew use although any aerospace personnel could in theory utilize them for the more active and time critical benefits provided. Things such as the sleep environment (quiet, dark etc), timing of work and

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[27] John A. Caldwell "Fatigue in Aviation Operations," *Air Force Research Laboratory Horizons…,* 1.

[28] *Ibid.,* 6.

rest periods, naps, and stimulants (ranging from caffeine to amphetamines) all need to be considered and their relative merits and efficacy determined.

Whatever measures we implement, it must be recognized that fatigue doesn't solely effect active aircrew in operational scenarios. We tend to overlook the importance and criticality of technicians and other vital personnel in the chain of events that leads to an aircraft mission launch. What about the planners and operations staff, or the maintenance and movements staff, all of whom have critical inputs into the safe operation of the aircraft? What about the intelligence, weather, surveillance and aerospace control personnel who provide vital contributions to the execution of any mission? Or the personnel who will control Unmanned Aerial Vehicles? These individuals currently have neither regulations nor a clear chain of responsibility for governance, monitoring or training concerning fatigue and its impacts. The consequences of fatigue on command and supervisory staff must also be considered as unrealistic demands are often placed on their time and physical presence during operations. Care must be taken that they do not become the single point of weakness in the decision-making cycle. Some form of fatigue countermeasure must be relevant to all these personnel and situations.

All aerospace personnel, no matter what their employment, can be adversely affected by fatigue for reasons as wide ranging as individual susceptibility to manpower issues and the tempo of operations:

> [F]ully staffing three eight-hour shifts with well-rested personnel around the clock for seven days a week in combat and contingency operations is a daunting task. Prolonged work bouts are common, shorter-than-normal sleep periods are unavoidable, and fatigue from both these factors threatens to impact operational readiness.[29]

Stresses occur not only on deployment but also at home bases as well given the readiness demands driven by recent threats to continental North America. Irrespective of job or location all aerospace personnel deserve to have an effective FMP in place to mitigate the impact of fatigue.

One of the elements to be incorporated in any FMP is fitness. The Air Force often belittles the Army for its strong emphasis on the physical fitness of each individual and how it impacts on the capabilities and potential mission success of the unit. We tend to forget that physical fitness is a vital factor in the body's ability to deal with fatigue and stress. Among other things, fitness helps to delay the onset of fatigue, allows for a quicker recovery, and "…is a factor in increasing tolerance to working unusual hours…."[30] Thus physical fitness, beyond the current myopic requirement for an annual or biennial fitness test, should be included in any FMP.

Education and awareness are also key aspects that cannot be overlooked or emphasized enough with respect to a FMP. Most people underestimate the impact of fatigue on performance, particularly their own. "[C]rew members and flight operations managers should be aware of the underlying flaw in assuming that crews can monitor their own fitness for duty…."[31] Fatigued individuals are among the poorest judges of their own levels of impairment because a decrease in the ability to

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[29] John A. Caldwell and Col Lex Brown, "Running on empty? Go Pills, fatigue and aviator safety," *Flying Safety,* March 2003; 2 [journal on-line]; available from http://www.findarticles.com; Internet; accessed 23 October 2004.

[30] North Atlantic Treaty Organization Research and Technology Organization, Human Factors and Medicine Panel Meeting Proceedings, *RTO-EN-016*…, 1-2.

[31] Curtis R. Graeber, "Aircrew Fatigue and Circadian Rhythmicity," in *Human Factors in Aviation,* ed. by Earl L. Weiner and David C. Nagel, 305-343 (San Diego: Academic Press, Inc., 1988), 335.

self-judge is one of the cognitive abilities that suffer along with the level of performance when fatigued. Even basic levels of knowledge and familiarity will make it easier to recognize the warning signs of fatigue in aerospace personnel.

> We need to properly manage the sleep-wakefulness cycle in our daily life as well as in SUSOPS and CONOPS in order to keep our vigilance and performance levels optimal. We are responsible for our own safety and sometimes that of our crews and friends. We have to be persuaded of the importance of the sleep-wakefulness cycle management in SUSOPS and CONOPS and we have also to persuade our colleagues, as well as our commanders of this reality.[32]

The importance of awareness and education cannot be overstressed. All rank levels must appreciate the impact of fatigue on performance and operational effectiveness. Countermeasures and procedures must be applicable to all aerospace personnel, irrespective of their individual job or classification, and all personnel need to be educated in the recognition of fatigue in themselves and others.

We need to create a progressive program with different types and levels of countermeasures suitable to the mission/situation – countermeasures that can be applied not only to aircrew but also Command and Control and supporting personnel. To do that we must accurately envision the types of capabilities and roles our aerospace forces will be tasked to fulfill and the environmental factors they could be facing. We need to realistically tailor our program and scope of countermeasures based on both our current and projected aerospace assets and roles to allow for flexibility and longer-term relevancy of the FMP.

Any program we implement needs to incorporate the most suitable combination of measures or tools to meet our specific aerospace needs while

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[32] North Atlantic Treaty Organization Research and Technology Organization, Human Factors and Medicine Panel Meeting Proceedings, *RTO-EN-016*…, Executive Summary.

remaining within the parameters of accepted practices based on Canadian values and laws. This could mean that the use of certain substances for the maintenance of performance may or may not be acceptable options for consideration. The intent is not that we arbitrarily adopt all features of a foreign model given the scope and some of the more controversial aspects but that it form a baseline for designing our own unique program suitable to Canadian priorities and circumstances.

FATIGUE MANAGEMENT CONTROVERSIES

Perhaps the most controversial aspect of any FMP is the potential use of pharmaceuticals or 'psycho-stimulants.' The most common and well known of these aids are the so-called 'go-pills' or amphetamines, a controlled drug requiring prescription and monitoring by a physician. The friendly fire deaths of four Canadian soldiers in Afghanistan in 2002 brought the issue of fatigue and go-pills into the public consciousness. The idea of giving drugs to pilots was not well received by many in the general public but it has been a practice (sometimes widespread) for many years in combat scenarios for a number of nations. After a brief time in the headlines of both nations, the issue has now disappeared but the practice has not stopped.

For some people the controversy meant little. For others it raised the question that, aside from the expected risks associated with a career in the military, are we now jeopardizing our personnel's health to get the job done? Are psycho-stimulant fatigue countermeasures an operational necessity in today's threat environment or are they a

shortcut to fatigue management and a hypocritical approach to getting the highest return out of the fewest number of forces?

> The [US] Air Force has consistently defended pilots' use of the drugs [go pills] as not only safe but crucial to completing the long missions pilots have been forced to fly during Operation Enduring Freedom….fatigue kills [and] prescribing the pills is vital to the safety of the pilots….[33]

Current US policy (valid for all aviation services) is that 'go-pills' should only be used in conjunction with other fatigue management tools or after all other tools have been exhausted. Members must complete trials in a controlled environment before the drug can be use in operations to determine possible individual side effects.[34] The US position on drug use is very much reflected in the following quote:

> Using drugs to enhance performance in sports may be 'immoral,' but war is not a sporting event. Success in combat is not a question of fairness but of power; our weapons and training are designed to maximize combat power…we seek to obtain every advantage for our forces.[35]

While the scope of this paper does not allow a thorough examination of this issue, it must be addressed during any discussion of comprehensive FMPs. People need to be aware that many countries, including Canada, are actively using or researching substances to counter fatigue and that amphetamines are not the only choice. The hypnotic *Temazepam:*

> "… has been used by both military and civil aircrew in the United Kingdom for the last 20 years…[including] in support of real intensive air

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[33] Bruce Rolfsen and Gordon Trowbridge, "A Tough Pill to Swallow," *Air Force Times* 63, no. 28, February 3, 2003, 14.

[34] Any operational use is done through informed consent (a signed consent form is kept on the individual's medical file), under the supervision of a Flight Surgeon, and within the limitations of approved operational criteria.

[35] Rhonda Cornum, John A. Caldwell and Kory Cornum, "Stimulant use in Extended Flight Operations," *Airpower Journal* 11, issue 1 (Spring 1997)[journal online]; available from http://welinks3.epnet.com; Internet; accessed 27 October 2004, 3.

> operations [South Atlantic campaign in the Falklands and the Liberation of Kuwait/Gulf War 1]."[36]

In addition, both the Royal Australian Army Medical Corps and the Italian Air Force have done studies on the use of the drug. Unfortunately the same reference indicates that *Temazepam* has become a drug of abuse within society in the United Kingdom and is now controlled, adding to the controversy over prescribing it to aircrew. In Canada DRDC (formerly DCIEM) did a study on fatigue in long-haul transatlantic flights for CC130 crews in the mid 1990s that focused on circadian rhythm disruption and sought to determine the efficacy of a naturally occurring substance called *Melatonin*.[37] More recently caffeine has been touted as a strong candidate for use in fatigue management with DRDC working on perfecting caffeine gum for issue in Army ration packs to help personnel sustain alertness during long patrols/sentry duty etc.

It is not the intention of this paper to advocate the use of drugs (controlled or otherwise) or criticize those countries that incorporate them into their programs. Nations must decide how far they want to go with their programs based on their own national objectives and doctrine. It is an option available to Canada that requires additional research and careful consideration. Any potential incorporation into a FMP must include the use being of a controlled nature with specific restrictive regulations

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[36] North Atlantic Treaty Organization Research and Technology Organization, Human Factors and Medicine Panel Meeting Proceedings, *RTO-EN-016*…, 9-5.

[37] As of September 2000 NATO information indicates that an operational study is being prepared to investigate the use of *Melatonin* in the CF as a sleep aid for circadian rhythm adjustment. Additionally, *Modafinil* and *Zipiclone* are being studied as options for maintaining crew alertness during operations. No further details or timelines are currently available.

as to applicability or approved reasons/situations for use, dosages, personal consent and oversight (to include medical) mechanisms.

OPTIONS FOR CONSIDERATION

Given our historic operational and doctrinal ties to the United States it only makes sense that we turn to them first in our examination of FMPs currently in place with other militaries. In addition, very limited information is readily available in an unclassified/open source context for other western nations. In fact a recent attempt by a NATO Working Group to compile a database on medications approved for aircrew use was less than successful as "some NATO nations chose not to provide data … perhaps this reflects the sensitivity…regarding the use of medications by aircrew and the fear of generating the perception of chemically affected aircrew."[38] The Working Group did however confirm that the use of medications within military aviation communities was more restrictive than that of civilian industry. Discussions with CSC 31 Course members indicated that FMPs are in place in Australia, France and the UK, however they were not as comprehensive as those of the US. Germany in particular does not authorize the use of drugs for the Luftwaffe at all. Unfortunately the information that was available for most nations concentrated exclusively on the issue of pharmaceuticals and did not discuss other fatigue counter measures in use.

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[38] North Atlantic Treaty Organization Research and Technology Organization, Human Factors and Medicine Panel Meeting Proceedings. *RTO-TR-014 Medication for Military Aircrew: Current Use, Issues, and Strategies for Expanded Options.* Washington, D.C.: US Department of Commerce, June 2001; available from http://ftp.rta.nato.int/pubfulltext/RTO/TR/RTO-TR-014/TR-014-$$ALL.pdf; Internet; accessed 15 December 2004, section V, 147.

Both the United States Navy (USN) and Air Force (USAF) have conducted considerable research into fatigue issues in their respective services**.** The USN was the first to focus their efforts into a coherent and well defined 'endurance management' program meant to assist naval aviators (and their supervisors) in managing the effects of fatigue.[39] Drawing on the naval program as a baseline, the USAF School of Aerospace Medicine devised a program called 'Warfighter Endurance Management.' The aim of the program was to develop tools and strategies to " facilitate optimal crew work/rest schedules, enhance off-duty sleep quality, overcome shift lag and jet lag, and sustain alertness in high-intensity operations…"[40] In addition, great emphasis was placed on the education of Air Force personnel about fatigue in general and the management program in particular. Courses are conducted throughout the air force community aimed at not only aircrew but also all aerospace personnel, running the gamut from flight surgeons to maintenance personnel, schedulers, and safety officers.

In addition to the education portion, other aspects of the program include specific pharmaceutical and nutritional interventions designed to improve the endurance and enhance physical performance of 'warfighters' (aircrew). All products from the program must function to enhance military readiness while having minimal negative impact on operational capability. In other words, the products cannot have side effects that seriously restrict the aircrew's availability or suitability for mission

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[39] The impetus for the program came from the realization that existing methods of addressing fatigue were inadequate during continuous and sustained operations. These situations dramatically increased the levels of fatigue and performance degradation experienced by naval aviators and additional measures needed to be explored that would allow for more effective fatigue management.

[40] John A. Caldwell, "Fighting Aircrew Fatigue …, 21.

tasking and employment (grounding/restriction of flying duties for example after taking medication, etc).

Both USN and USAF programs focus primarily on the aircrew or aviator but do make occasional (and mostly passing) reference to non-active fliers such as planners, supervisory or operations staff and ground support personnel. While not specifically designed for them, fatigue countermeasures and 'suggestions' are equally valid for these aerospace personnel as no aircraft launches itself – it takes many people to get a mission safely and successfully off the ground and back again. Fatigue at any juncture by anyone with a direct impact on or input to the mission can cause potentially catastrophic results. The USN document in particular stresses the idea that:

> "…fatigue is a commodity to be managed…, everyone's resistance to fatigue will be different…, planning/ground duties fatigue [senior personnel] and department heads prior to first [launch]…" and that it is important to "…establish 'grounding' procedures for both overly fatigued aircrew and ground support personnel."[41]

These concepts, plus products similar to the USAF Warfighter Endurance Management guide and associated training course should be incorporated into any program Canada adopts. The need to raise awareness and educate our personnel of all ranks and trades about the issue of fatigue is crucial to the success of any FMP.

Given the extensive research and testing that the United States military has conducted into the effects of fatigue in aviation, Canada should strongly consider using the main elements of the USN Performance Maintenance and USAF Warfighter

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[41] United States Naval Aerospace Medical Research Laboratory. *Performance Maintenance During Continuous Flight Operations – A Guide for Flight Surgeons (NAVMED P-6410).* Pensacola, FL.: Naval Strike and Air Warfare Center, 01 January 2000, 12.

Endurance models as the baseline for any fatigue countermeasure program we create. While we lack that need to incorporate all aspects of the model into our own eventual program, we can certainly benefit significantly from the funding, effort and experience of a nation whose aerospace capabilities and activities cover the complete spectrum.

CONCLUSION

Considerable changes to the operational tempo and threat environments of military operations have occurred since the end of the Cold War. The incredible technological advances and how they have been incorporated into military systems have led to a significantly increased reliance on maintaining peak performance of highly trained personnel. The cognitive abilities needed to control, operate and maintain most of a modern aerospace force's assets are now more than ever before affected by fatigue. In addition, the emphasis on global reach, the emerging expeditionary focus of forces and the associated need for rapid mobility, overall personnel reductions, and the changing scope of modern conflict all serve to create new challenges to aerospace forces. Human beings have physical and physiological limitations, one of which is the body's need for restorative sleep. Fatigue can be caused by a number of factors including lack of sleep, time zone changes, poor coordination of work/rest cycles, etc. and has been proven to have a significant negative influence on the safe and effective execution of any modern mission. It can affect such varied aspects of personal performance as reaction time, motivation, attention, memory, endurance and perhaps most importantly, judgment.

The impact of fatigue needs to be understood by all in the aerospace environment and effective countermeasures must be in place to not only mitigate its impact on operations but to ensure the safety of personnel. In a world of highly technical and time sensitive operations, we cannot afford to ignore fatigue as an operational hazard. Military individuals and supervisors at all levels have a responsibility to recognize the signs of fatigue in themselves and others and act on that knowledge. Mechanisms must be in place to see that mission demands do not so dominate personnel considerations and capabilities that fatigue becomes a dangerous factor. Traditionally much attention has been paid to the aircrew in any equation involving fatigue but little attention has been given to other members of the aerospace team. Combined Air Operations Centre, Intelligence, Maintenance and Surveillance and Reconnaissance staffs are all critical aspects of a mission. Look at the chain of decision-making and inputs to a mission these days and consider the consequences of error caused by fatigue at any step. How often have you seen understaffed Operations or Planning cells? How many supervisory staff are routinely double- and triple-hated to get the job done, working on few hours sleep daily for long periods? Who is monitoring their fatigue levels?

Limited DRDC studies notwithstanding, Canadian aerospace policies and regulations are out of date and inconsistent with the demands of 21st century warfare. We have neglected to change the rudimentary programs in place to meet the challenges of the changing threat environment and exponential advances in technology. While we may not need to radically change our current policies regarding Crew Duty Day and Crew Rest we do need to seriously examine adopting some of the

measures used by significantly larger, more involved military forces around the world. We can take advantage of their extensive research and tailor a program suitable to Canadian values, needs and circumstances. Every military today is striving to do more with less in the way of personnel and equipment. We have to examine all reasonable options in an effort to maximize the capabilities of all our resources without jeopardizing personnel safety or operational effectiveness. Program elements must incorporate such issues as adequate education, timely supervisor involvement, proper sleep hygiene, scheduling factors and consideration of the use of medications. We owe it to our aerospace personnel to ensure they are given the direction, training and tools they need to get the job done. **"We manage maintenance, fuel and weapons; we can also manage fatigue."**[42] Now more than ever before, it is important to embrace this idea and essential to act upon it within the Canadian military aerospace environment to safely optimize our personnel's capabilities and 'be all that we can be.'

[42] United States Naval Aerospace Medical Research Laboratory. *Performance Maintenance…,* 2.

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