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STRESS IN HS-50 PILOTS:
A PRELIMINARY STUDY

W.A. LePage

P.J. Dean

R.F. Thatcher

Operational Life Support Division
Defence and Civil Institute of Environmental Medicine
1133 Sheppard Avenue West, P.O. Box 2000
Downsview, Ontario M3M 3B9

DEPARTMENT OF NATIONAL DEFENCE - CANADA

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ABSTRACT

50 / During the first half of 1974 there was a noticeable increase in the number of pilots from HS-50 Squadron either being referred to Central Medical Board or taking their release. This report discusses the various factors that are considered to have contributed to this increase. A conceptual model to describe how these factors interacted is also presented. To alleviate the situation and prevent it from recurring, two studies are recommended: A review of pilot training and selection, and a human factors study of the Sea King operational environment. // (C)

STRESS IN HS-50 PILOTS:

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INTRODUCTION

From the beginning of this year (1974) both the operational and medical branches of Maritime Command (particularly at CFB Shearwater) have been concerned over the high incidence of aircrew from HS-50 being referred to the Central Medical Board (CMB) for psychiatric assessment, and over the number of aircrew from HS-50 either taking their release or requesting transfers from the squadron.

Shearwater personnel initially believed that both of these features might be related to or caused by the stressful and fatiguing aspects of flying the Sea King from DDH's. Accordingly they proposed to Command Surgeon, Maritime Command, that a study be initiated to elucidate these aspects of the operation. Since this type of study must be comprehensive in order to achieve results, the request was passed to the Surgeon General's office (11,12). The Operational Life Support Division (OLSD) and CMB at Defence and Civil Institute of Environmental Medicine (DCIEM) were thus requested by NDHQ/Directorate of Preventive Medicine (DPM) to conduct a preliminary investigation into the requirement for and feasibility of a research project on fatigue and stress within the HS-50 environment (13).

The objective of this initial report is to communicate the results of DCIEM's preliminary investigation into the requirement for a study. Since it is considered that the requirement does exist, a secondary aim is to suggest possible approaches for evaluation by DPM and Maritime Command Headquarters.

PROBLEM DEFINITION

The DCIEM investigation was conducted by both CMB, through a review of their medical files, and by OLSD through an analysis of information on primarily operational facets of the problem. Information was gathered from visits to HS-50, CFB Shearwater and Maritime Command Headquarters, and from staff analyses conducted by Maritime Command Headquarters. Data analysed in this investigation consisted of subjective statements from individual pilots, objective numerical data from operational and medical records, and both operational and medical analyses and assessment.

From this investigation the following objective definition of

the 'problem' evolved:

The pilots HS-50 are tasked to perform a demanding and challenging operation within the ASW environment, in an aircraft that they have little confidence in. The high risk nature of the Sea King operation coupled with the low success rate does not seem to justify, to the pilots, the particular role of HS-50. Also, the pilots are required to live and work under conditions on board ship which appear to be quite stressful. Furthermore they receive minimal recognition, either from within, or from outside the Forces. In the past these factors have been manageable due to the high "esprit de Corps" existing in the Navy (i.e., Navy Tradition). With integration this tradition started to be eroded and has been so diluted that the factors have ceased to be controlled. This erosion was reinforced by the new generation of aircrew with HS-50 who identify with the air element.

The factors involved have not really changed, but the response of the pilots has.

The evidence and analysis which led to this definition will now be discussed. Table I presents data furnished by the Directorate of Personnel Information System (DPIS)

TABLE I

VOLUNTARY RELEASE DATA
(1st Seven Months of 1974)

COMMANDS	MARITIME COMMAND	AIR TRANSPORT COMMAND	AVERAGE FOR AIR TRANSPORT, AIR DEFENCE, MOBILE AND MARITIME COMMANDS
	20/228 = 8.8%	19/218 = 8.7%	59/705 = 8.4%
WITHIN MARITIME COMMAND	HS-50 8/57 = 14%	404, 405, 415 Combined 4/54 = 7.4%	
HELICOPTER SQUADRONS	HS-50 8/57 = 14%	408, 430, 450 Combined (Mobile Command) 4/61 = 6.6%	
RELEASES HS-50 (1973)		1973 4/70 = 5.7%	

NOTE: Captains and Lieutenants only have been considered. The data is based on squadron populations as of December of the previous year.

The numbers give the ratio of pilots (Captains and Lieutenants) taking their release (QR&O 15.01 Categories 4A and 4C) to the squadron populations as of the previous December. Figures for Canadian Forces Europe and Training Command are not included due to the bias imposed by the rotation of pilots in the former and the numbers of student pilots in the latter.

Table II shows the medical data obtained from CMB files.

TABLE II
MEDICAL DATA

- 1970- 1973 - Total of 6 pilots referred to CMB from HS-50 for psychiatric assessment
- Jan-Jul 1974 - Total of 6 pilots (10%) referred to CMB from HS-50 for psychiatric assessment
- Jan-Jul 1974 - Total of 14 pilots (~1%) referred to CMB from remainder of pilot population on flying status for psychiatric assessment

The term 'psychiatric assessment' refers to a variety of symptoms that are difficult to singularly classify but include anxiety, the effects of combined stress situations, 'combat fatigue', alcohol problems, etc.

Rigorous biostatistical analyses were not performed on these data due to the lack of adequate controls. However, the data do demonstrate that MARCOM is not different from other commands (for voluntary release), but that HS-50 had:

- a. A high rate of referral for psychiatric assessment.
- b. A higher rate of voluntary release than other squadrons within MARCOM, and than other (land based) helicopter squadrons.
- c. A marked increase in medical referrals and voluntary releases in 1974.

Using this evidence as a starting point, the correspondence from HS-50, Shearwater, and MARCOM HQ was examined to identify, substantiate, analyse, and organize the factors responsible. This culminated in the model shown in Figure 1. Most of the factors shown on the left are self-evident and are highly interdependent. (The factors are described and substantiated in Annex A.) It should be stressed

FACTORS

- 1. Confidence in A/C
- 2. Hazardous Duties
- 3. Emergency Egress
- 4. Environmental Stressors
- 5. Human Factors
- 6. Disorientation

(mitigated by experience level)

STRESS

- 1. Ship Conditions
- 2. Sortie Length
- 3. Duty/Rest Schedule
- 4. Flying Density
- 5. Ship/Shore Ratio

FATIGUE

- 1. Lack of Recognition for Hazardous Duty
- 2. Aversion to Flying Sea King in present Role
- 3. Tour Length and Extensions
- 4. Ship/Shore Ratio
- 5. Integration
- 6. Dissatisfaction with Forces
- 7. Relevancy of duty
- 8. Crew stability
- 9. Availability of Flight Surgeon

MORALE

(mitigated by motivational level)

EFFECT ON

OPERATIONAL EFFECTIVENESS

MEDICAL NON-EFFECTIVE (GROUNDINGS)

Anxiety over night flying
night dipping

Accident Rates
Flight Safety

OPERATIONAL COMMITMENT

Manning Level
Early Departures
Releases
Refusing Second Tour

Figure 1

that the factors have only been identified as having a possible effect and have not been evaluated or ranked in order of priority. For ease of analysis the factors have been artificially allocated as to their major effect (i.e., stress, fatigue or morale).

The factors thus identified contribute to the overall stress load of the pilot, to his state of readiness (fatigue) and to his morale. A pilot's physiological and psychological state then determine his ability to perform required tasks. When a pilot's physical and mental states are overloaded, he either ceases to perform effectively (as shown by medical non-effectiveness) or refuses to perform at all (as shown by voluntary release and one case of a pilot refusing sea duty).

The factors classified as causing stress can be annotated as being common to all pilots as well as being peculiar to the Sea King operation. How well the pilot will handle the various stresses is a function of his experience level. This can be illustrated by the following matrix:

	<i>Previous Experience on Sea King</i>	<i>Previous Experience on other aircraft</i>	<i>1st Opera- tional Tour after trg.</i>
<i>Early in tour with HS-50</i>	A1	B1	C1
<i>Nearing end of tour with HS-50</i>	A2	B2	C2

The pilots in Group A are confident pilots, capable of performing effectively while coping with the stress of flying the Sea King. These are the pilots (especially in A2) who provide the backbone of supervision and leadership in the squadron. Unfortunately, at the beginning of this year, only five pilots could be placed in this group and none of these had previous experience in flying from DDH's.

Pilots in Group B should be able to compensate for normal stresses of flying, and should be gaining familiarity in piloting the Sea King. However their response to emergency under high stress conditions probably would not be as good as that of pilots in Group A (especially for those pilots with no previous helicopter experience). Group B consisted of only 12 pilots (mostly in B1), all without previous helicopter experience when this preliminary study was initiated.

The majority of HS-50 pilots (45 in total) were in Group C, (the so-called 'pipeliners') still gaining experience in flying and trying to cope with the added stress of flying the Sea King at the same time (14). Add to this the fairly rapid progression of 'pipeliners'

to crew commander, with the increase in responsibilities and concomitant additional stress (6, 14) and the level of experience becomes even more critical.

The motivation of an individual helps to determine his response to the factors affecting morale. The pipeliners on the squadron completed a training program that emphasises high-performance aircraft and most of them probably aspired to this class of aircraft. Also at this time, piloting helicopters was at the low end of the pilot peer-hierarchy. Thus having to go to sea on top of being tasked to fly helicopters was, for many of the pipeliners, adding insult to injury with a resultant low level of motivation. On the other hand, a few of the pilots find the Sea King a challenge to fly, enjoy the voyages etc., and thus have higher motivation and can counteract the effect of negative factors.

It is evident that the majority of the factors shown in Fig. 1 have existed to some extent since the Sea King began to fly in its present role. Why, then, was there a drastic increase in pilot attrition and non-effectiveness at this particular time?

It is felt that this phenomenon can be best illustrated using the conceptual model shown in Fig. 2. The pilot's load shown on the ordinate is his psychological and physiological state resulting from the combined effect of stress, fatigue, and morale. The contributing factors are the types of factors already given in Fig. 1. The total load on the pilot due to the summation of all these contributing factors is given by the 'Total' line.

The total load has probably varied since the introduction of the Sea King but the conceptual model is meant to illustrate the overall trend rather than day-to-day variations. It is believed that there has been a gradual increase in the total pressure on the pilots.

This is not meant to imply that all factors contributing to the pilot load have increased. (Indeed, some factors such as environmental stressors have remained essentially constant, and it is conceivable that some factors have actually decreased over time; certainly the conditions on board the new 280 class destroyers are better than the older destroyers). But other factors such as supervisory problems in a very large squadron, a decreasing overall experience level in the squadron, changing attitudes of new pilots (as a result of changing attitudes in society as a whole), the fact that (contrary to other aircraft) confidence in the Sea King decreases as the pilots become more familiar with it, and increasing general dissatisfaction with the Services have combined to increase the pressure on the pilots.

Two events that probably had significant effect on the pilot load were the integration of the Forces in 1967 (See Annex A), and

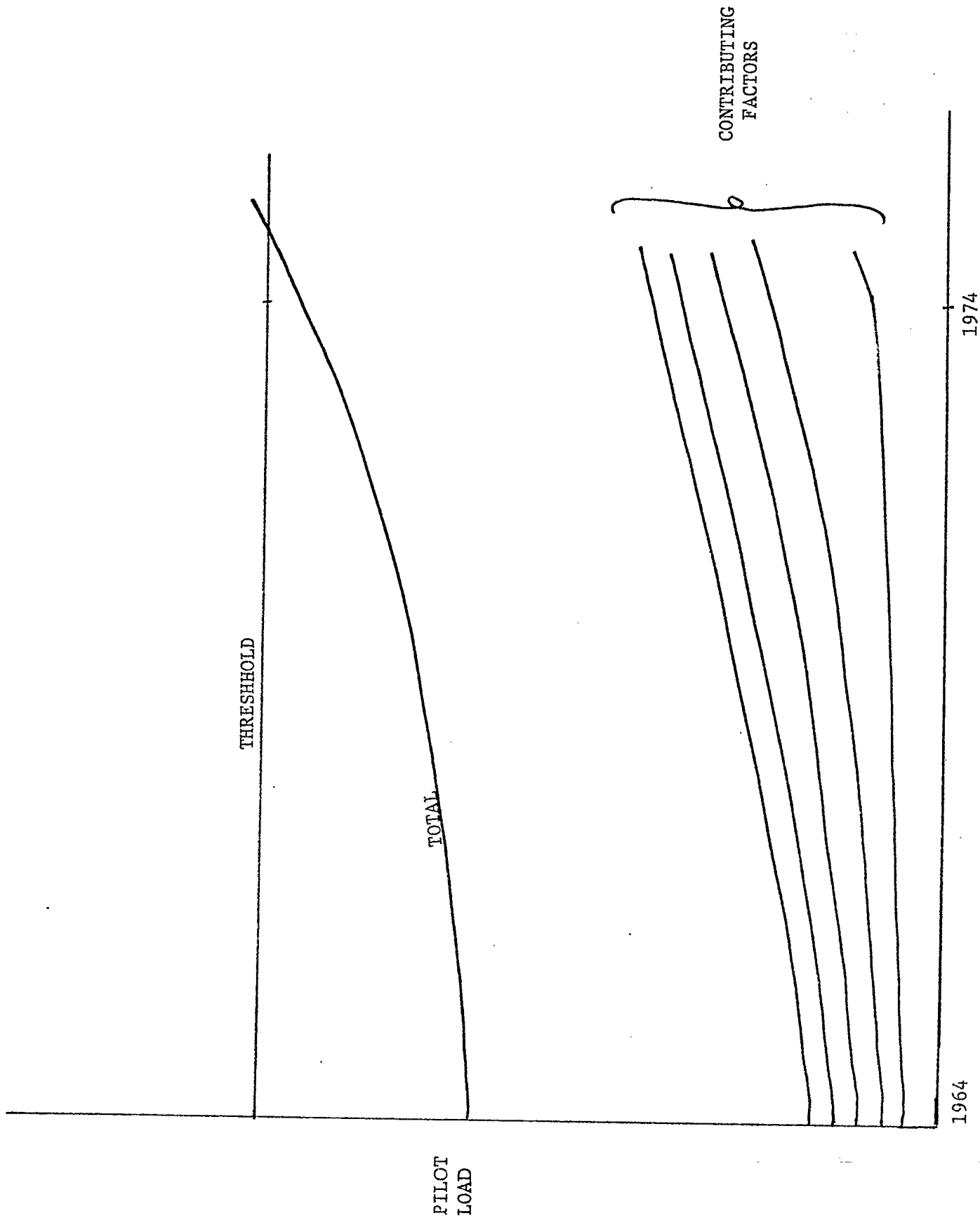


FIG. 2

the cessation of flying Sea King from HMCS Bonaventure in Spring 1969 (thus concentrating Sea King flying as a destroyer-based operation with all the concomitant stresses/problems). These particular incidents did not cause a quantum jump in pilot load but precipitated an insidious increase.

In Figure 2 the 'Threshold' line is used to indicate that for each pilot there is a maximum load that the pilot will carry before he takes action to reduce the load. At the beginning of 1974, it is believed that two factors predominated to push a number of pilots beyond their threshold. These factors were:

- a. An increasing apprehension over reliability due to the apparent slowness in performing the mid-life refit (17) and the poor accident record of the Sea King. (The accident rate data in Fig. 3 illustrate why the pilots might be concerned over the airworthiness of the Sea King).
- b. An increasing concentration in the Squadron of young pipeliners (as noted above) who were not motivated to flying the Sea King, especially from destroyers. These post-integration pilots tended to identify with the air element and underwent a training program that emphasized high performance/fixed-wing aircraft. Also, there was no established selection criteria employed to ensure that the pilots were motivated to flying Sea Kings.

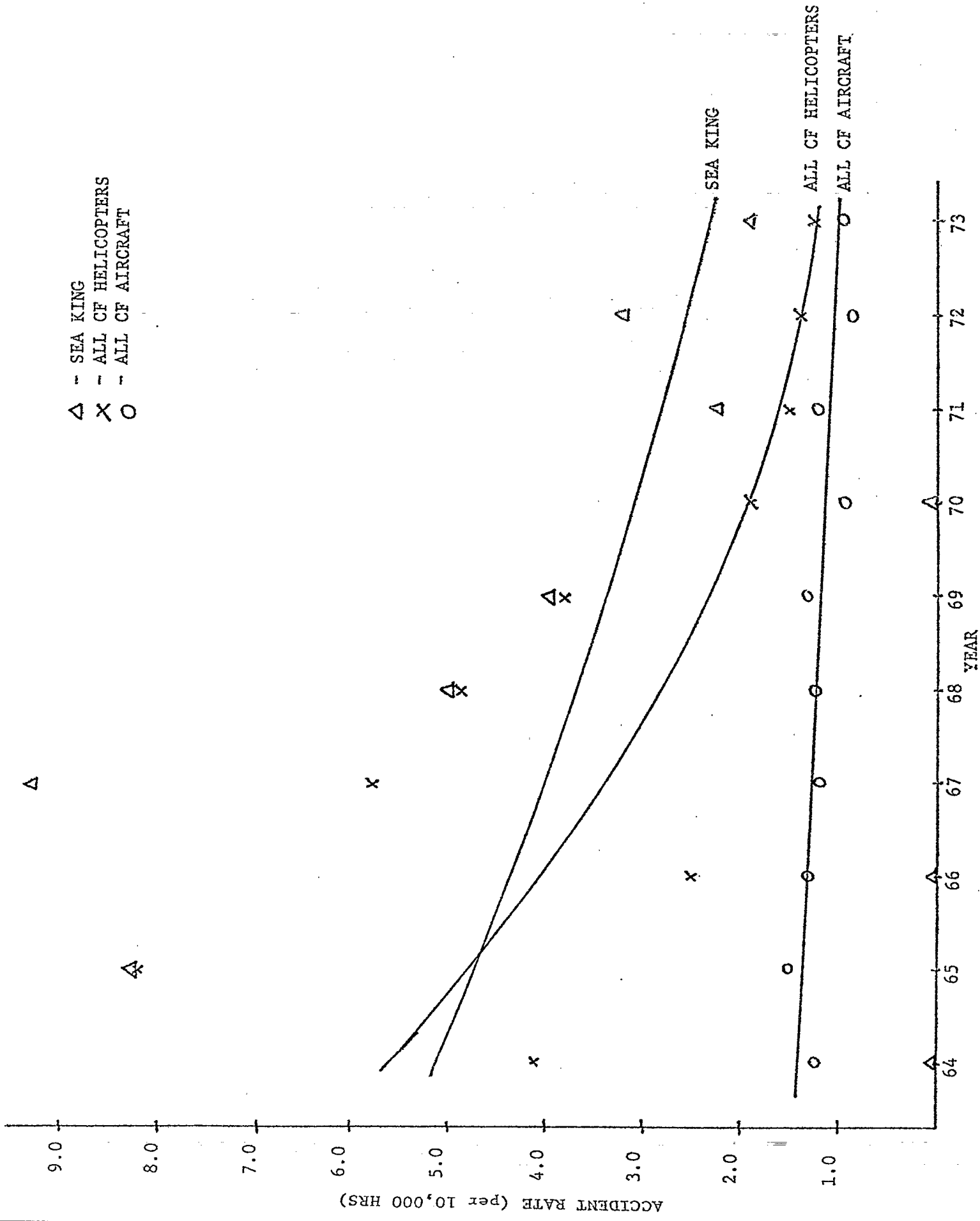
The overstressed pilots thus attempted to diminish the pressure by finding ways to avoid flying the Sea King. As noted above, those not motivated towards a Forces career chose to take their release. The others who wanted to, or had to, continue in the CF, found a sympathetic doctor and a convenient medical route to restrict themselves from flying the Sea King (or from going to sea, which amounts to the same thing).

DISCUSSION

The factors noted above contribute to stress, fatigue, or reduced pilot morale. It is believed that these effects have been gradually increasing over time. With the low motivation of the newer pilots at HS-50 and the increasing lack of confidence in the aircraft, a number of pilots were pushed beyond their threshold. This resulted in a dramatic increase in medical restrictions and voluntary releases.

Since this study commenced, Maritime Command, recognizing that the problem existed, has initiated a number of important changes which should help to mitigate the situation. The most significant modification was a division of HS-50 into two separate autonomous units. The resultant reduction in span of control for the Commanding Officers should alleviate some of the peripheral issues by furnishing more opportunity for direct leadership and supervision. Furthermore, experienced

- △ - SEA KING
- x - ALL CF HELICOPTERS
- - ALL CF AIRCRAFT



senior Sea King pilots have been posted into the squadrons to help provide this leadership and supervision.

Administrative changes include establishing the tour length in the HS environment at a maximum of four years, and a policy of asking pilots to volunteer for extension (with no penalties for refusing) when an extension is contemplated. It has also been proposed that pilots who make a sincere effort to adapt to the Sea King and sea environment but fail to do so, be posted to another operational environment (with no restrictions except to 'prove' themselves there).

On the operational side, a concerted effort will be made within Maritime Command to avoid tasking the HS squadrons beyond their capability, even if this necessitates going to sea without the helicopter detachments. Also, the first Sea King to undergo the mid-life refit has been received by the Aeronautical Engineering Test Establishment, Cold Lake for acceptance tests. This should have a beneficial effect on confidence in the aircraft. All these changes appear to have improved the situation.

RECOMMENDATIONS

While the alterations noted appear to have produced a beneficial effect, the effect may be only temporary. Some undesirable factors have been minimized, decreasing the total load on the pilot, but it may be only a matter of time before the other factors predominate to continue the upward trend toward the threshold of Figure 2. In the interest of effective Sea King operation, the following actions are recommended:

- a. A thorough review of the pilot training and selection system should be carried out to determine selection criteria for these pilots who are both suitable and motivated to the Sea King operation. This study should include Maritime Command (Operations), Training Command, Personnel Applied Research Unit, and NDHQ (Manning and Careers) with assistance from DCIEM if required.
- b. The HS environment should be fully investigated to elucidate those factors contributing to stress and fatigue, and to modify the factors without diluting the operational effectiveness (where possible). Included should be human engineering (including habitability), safety systems, and associated disciplines. This study should, however, only be undertaken when requested by and in cooperation with Maritime Command in order to allow the newly instituted alleviating measures discussed above to proceed without interference.

- c. The possibility of providing aerospace medical training (or refresher courses) to Medical Assistants employed on destroyers with helicopter detachments should be investigated. This could probably be accomplished by CFB Shearwater medical personnel with assistance from DCIEM. If the doctors on the supply ships are not Flight Surgeons, then similar training for them would be beneficial for the operation. (This is not to suggest that the training would replace the Flight Surgeon's Course, but some aeromedical training is better than none at all.)

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ANNEX A

FACTOR IDENTIFICATION

FACTORS LEADING TO STRESS

1. *Confidence in Aircraft*

The pilots and senior officers in HS-50 have expressed their lack of confidence in the Sea King in its present configuration and role. For the main part this lack of confidence stems from a distrust of crucial system components employed during the dipping operation and a low confidence level in the Sea King engines and transmission (6, 14, 15). They are also concerned over the maintenance of the helicopter, especially while deployed at sea. However, the attitude of the pilots is to 'press on regardless', while at the same time not trusting the aircraft. This conflict situation can lead to psychological stress, besides having possible flight safety implications.

2. *Hazardous Duties*

The Sea King operation has been described as one of the most demanding and hazardous tasks existing in the air element (3). A quote from a memorandum from one of the first pilots to be seen by CMB pinpoints the main area of concern: (1)

"For the last year or so I have become increasingly apprehensive about flying. This apprehensiveness is present in advance of going flying as well as in the aircraft. Once in the aircraft I find that I become very tense. The apprehensiveness and tension seem to be proportional to the amount of risk involved. The area of flight which bothres me the most is night, low level, over the water. Night departures and approaches to the ship as well as transitioning in and out of the dip, seem to be the most trying."

3. *Emergency Egress*

Consciously or not, all Sea King aircrew are aware that they might have to ditch the helicopter into the North Atlantic Ocean. The pilots have indicated their concern over egress from the Sea King after a forced water landing and their subsequent survival and rescue.

The CO HS-50 has nicely summarized the above factors. "The combination of component unreliability, normal hover instability, potential sudden water entry, difficult survival, location and

recovery conditions, when combined with night and adverse weather, presents too many problems for many pilots who, in another operating environment, would serve useful tours" (14).

4. *Environmental Stressors*

There are a number of normal environmental stressors (i.e, ones experienced in flying in general) that are encountered during Sea King operations. These stressors such as heat/cold, vibration, noise, smell of exhaust fumes and other environmental aspects probably do not overtax the pilots in, and of themselves. However, they do contribute to the overall stress load carried by the pilot.

5. *Human Factors*

As with environmental stressors, human factor aspects (general comfort, poor seat design, poor instrument layout, necessity to wear immersion suits and so on) contribute to the overall stress level.

6. *Disorientation*

Spatial disorientation is a recognized hazard of flight, but the helicopter can magnify the problem through its ability to produce rapid changes in any of its axes. However in addition to the 'normal' disorientation, Sea King pilots have to overcome the disorientating effect of hovering and landing (on a pitching, rolling destroyer deck) at night without a visual horizon for reference. This situation creates varying degrees of psychological stress (anxiety) which itself might contribute to further disorientation (23).

FACTORS LEADING TO FATIGUE

1. *Ship's Condition*

Pilots have stated that they are more fatigued when flying Sea King from DDH's than when they are flying from shore-based installations (22). The ship's motion, living conditions (habitability) and lack of privacy combine to interfere with the pilot obtaining adequate rest (15). In addition, the disabling effects of motion sickness hinders adequate rest in some of the pilots.

2. *Sortie Length*

One of the most difficult phases of a mission landing on the DDH, occurs at the end of the mission when the pilot is likely to be

most fatigued. The typical 2-3 hr ASW night operation flying at very low level with numerous 'dips' and absolute dependence on instrument flying has to be one of the most exhausting operations performed by any pilot (14).

3. *Other Factors*

The duty/rest schedule on board ship involves periods of relative inactivity, interspersed with occasions of intensive, 'back-to-back' flying. The former can produce boredom and 'drowsy' fatigue (a form of fatigue wherein the individual feels bored or satiated with the events around him, whether he is involved in some productive activity or not). The latter contributes to a combination of 'exhaustion' fatigue (in which the individual feels bodily uncomfortable due to the maintenance of a required level of muscular activity) and 'nervous' fatigue (wherein the individual feels disorganized and discouraged after carrying out an intellectual task over a period of time) (24). The ratio of time-at-sea to time-on-shore can also have an effect on chronic fatigue, and has been mentioned in the subjective statements of some of the pilots seen at CMB (22).

FACTORS ACTING TO DECREASE MORALE

1. *Lack of Recognition for Hazardous Duty*

Notwithstanding that the Sea King ASW operation is a very demanding and potentially hazardous task, it is not the only one. The low-level high-speed attack role of the CF104 aircraft is comparable in complexity and danger, yet the morale in the 104 Sqns seems to be high. It can be speculated that the difference in morale may be one of recognition, both within the pilot population and externally. (The emphasis in recruiting, public relations (air shows), and, indeed, training is on high performance jet aircraft with very little mention of ASW operations).

2. *Aversion to Flying Sea King in Present Role*

The CO HS-50 has noted that a good majority of pilots in the squadron would rather fly other aircraft (usually fixed wing) than the Sea King (3, 6). This may be a reflection of their attitude to flying the Sea King, but it should be realized that this preference is prevalent before the student pilots graduate. Table III compares the posting requested to those received for two recent pilot courses (25).

TABLE III
PILOT POSTING PREFERENCES

	<u>Requested</u>	<u>Received</u>
<i>High Performance Aircraft</i>	15	6
<i>Other Fixed Wing Aircraft</i>	12	13
<i>Rotary Wing Aircraft</i>	2	10

This attitude could have a demoralizing effect on the entire squadron.

3. *Tour Length and Extensions*

There has been a certain amount of discontent expressed by aircrew over the normal tour length at HS-50 (four years). However, more pertinent is the seeming necessity to extend the tours of a number of pilots in order to meet operational commitments. The CO HS-50 has referred to the detrimental effects this has on the squadron (15). Certainly, some pilots have indicated their negative attitude to extensions of tour length in an environment where they have little confidence in their aircraft and where they do not want to be in the first place (20, 22).

4. *Ship/Shore Ratio*

Both the CO HS-50 and B. Comd. Shearwater have mentioned that the ship-to-shore ratio and time-at-sea play a definite role in this problem (11, 15). The effect on morale probably varies among pilots but can certainly play a major role in some cases.

5. *Integration*

The problems created by the 'vested rights' retained by pre-integration personnel have been thoroughly treated by CO HS-50 (3). The consent-to-serve aspect prevents HS-50 from tapping a large source of experienced pilots. In addition, since many tour-expired pilots do not renew their waiver, this group of experienced Sea King pilots is also lost. On the other hand, ex-Navy and post-integration aircrew consider themselves to be 'locked-in' to flying Sea Kings and serving at sea. (They may be posted to other environments after their tour has expired, but as experienced Sea King pilots, they are almost certain to return to the Sea King/ASW operation.) Furthermore, the aircrew

'on waiver' and most of the post-integration aircrew identify themselves as being air element. In the latter case this stems directly from the pilot training system. This fact is quite evident from the statements of both student and experienced pilots in one aircraft accident Board of Inquiry (25) (in which the Board was directed to study the general attitudes of the student pilots). This identity attitude creates social problems in fitting into and being totally accepted by the ship's crew. There is the additional frustration of not being given worthwhile duties to perform while not occupied with flying duties. These aspects of air-element officers at sea tend to decrease the overall morale of the squadron.

Since most of the post-integration pilots identify with the air element, it is natural that many of them aspire to the traditional operational roles of the air arm, especially high performance. This ambition is further encouraged by the pilot training program that stresses high-performance jet aircraft to the detriment of other aircraft and roles. Thus the majority of the pipeliners were unmotivated even before arriving at HS-50. (Contrast this with pre-integration pilots who had a good idea of what type of flying they would be involved with after training. These pilots probably remained highly motivated when posted out to their units. This is reported to be true for pilots performing a similar role in the Royal Navy (26).)

6. Dissatisfaction with Forces

There is a general feeling of dissatisfaction that seems to prevail in the CF at the moment. Aspects such as pay, promotion opportunities, bilingualism, and the Francophone policy have their effect on overall morale. The lack of a definite career plan for HS pilots is also detrimental to the morale of the HS-50 squadron.

7. Relevancy of Duties

Pilots interviewed at CMB and HS-50 have questioned the validity of the ASW operation carried out in the Sea King. This concern was recognized by B. Comd. Shearwater, who suggested that the tactical effectiveness of the Sea King be re-assessed (18). It is not difficult to see where this concern would have a detrimental effect on morale.

8. Crew Stability

Delays and changes in ship's programs have caused excessive movements of detachments among the ships, and officers among the detachments (15) e.g., one officer indicated he was on four different ships over a four-month period. This lack of stability has resulted in much dissatisfaction.

9. *Flight Surgeon Availability*

The medical assistants employed on board ships are highly trained, competent people. However, they lack the specialized training in aerospace medicine required when working with pilots. There have been instances when the Medical Assistants have given the pilots drugs (i.e., anti-motion) that are contra-indicted while flying. The knowledge that they do not have access to a qualified Flight Surgeon while at sea has an adverse effect on the pilot's morale. (Occasionally there is a qualified flight surgeon on the accompanying supply ship. However, the majority of the time the doctor on the supply ship is a general duty M.O., who again, does not have the aviation medicine background).

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