



Coping with stress in military aviation: A review of the research.

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Author(s)	O'Connor, Paul
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COPING WITH STRESS IN MILITARY

AVIATION

Justin S. Campbell

Paul O'Connor

INTRODUCTION

Military aviation exacts a costly toll in psychological stress from those who choose to pursue the occupation (Stokes & Kite, 1994). A prime example is landing on an aircraft carrier, a task which physiological indices and subjective accounts both rate as one of the most stressful in aviation (Miller, Rubin, Clark, Crawford, & Ransom, 1970). The intense psychological pressure associated with a career in military aviation makes military aviators an ideal population for understanding individual differences in robust functioning in high stress environments. Such an understanding benefits not only those seeking to develop aviation selection and classification instruments, but also those interested in identifying important protective factors relevant to alternative military and civilian occupations in which personnel are expected to operate sophisticated systems

while exposed to profound stress. Unfortunately, popular mythology and stereotypes of aviator stress coping tend to outnumber empirically based profiles of military aviators (Kern, 2006). This chapter is an attempt to provide an empirically grounded starting point for those seeking a better understanding of stress coping amongst military aviators. The chapter will try to provide a brief review of stress coping theories germane to the aviation literature. The objective of the literature review is not to synthesize the variety of approaches and theories encompassed in that literature. Instead, the intention is to provide the reader with a unique opportunity to formulate their own conclusions with respect to the emergence or absence of a theoretical paradigm for this nascent, multi-disciplinary field of study.

Stress Coping

The Transactional Model of Stress Coping. Pioneering stress research conducted by physiologists such as Cannon (1915) and Selye (1956) paved the way for interdisciplinary approaches to the study of stress coping by stoking an interest in the interaction between psychological and physiological aspects of stress. A prominent example of such an approach is the transactional model of stress developed by Lazarus and Folkman (1984). According to the transactional model, stress is defined as “*a particular relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her well-being*” (Lazarus and Folkman, 1984: 19).

Within the transactional model of stress, coping is defined as “*cognitive and behavioral efforts to manage specific external and/or internal demands that are*

appraised as taxing or exceeding the resources of the person” (Lazarus & Folkman, 1984: 141). The transactional model further delineates coping into problem-focused and emotion-focused sub-types. Problem-focused coping starts with an effort to define the problem or source of stress, followed by generation of competing solutions that are subjected to a cognitive cost-benefit analysis that ideally results in selection and initiation of the most desirable coping strategy. Alternatively, emotion-focused strategies aim to reduce or manage one’s experience of unpleasant feelings induced by stressors. Examples of emotion-focused strategies include venting, acting-out, emotional denial, and acceptance.

Avoidant versus Attentive Coping. Another distinction that can be made when discussing stress coping is between avoidant and attentive coping (Krohne, 1993; Suls & Fletcher, 1985). Avoidant stress coping strategies are ways of thinking about stressful situations such as denial, distraction, repression, and suppression that act to shift an individual’s attention away from (a) the stressor and (b) their immediate emotional reaction to the stressor. On the other hand, attentive coping focuses attention on the stressor and one’s response to it. These ways of thinking, or more technically cognitive schemata (Brewer, 1987), can be both conscious and unconscious processes.

The Compass of Shame Coping. The compass of shame (Nathanson, 1993) offers a third theoretical perspective grounded in emotions/affect theory (Tomkins, 1970) that describes how aviators might respond to stress. The compass of shame is comprised of four poles of maladaptive shame coping that constitute stable individual tendencies for

coping with the self-conscious emotion of shame. The first two poles, attack-self and withdrawal, are conceptualized as internalizing coping strategies that focus the unpleasant experience of shame upon the self. The second two poles, attack-other and avoidance, are conceptualized as externalizing coping because both responses cognitively distance the self from the source of shame. Initial studies investigating the relationship between coping styles and general trait dispositions suggest that internalizing coping styles are related to personality styles that are susceptible to anxiety and depressive disorders (Elison, Lennon, & Pulos, 2006). However, it should also be noted that sole reliance upon externalizing coping styles has been linked to a tendency to endorse antisocial personality traits, e.g., emotionally callous, narcissistic, and anti-authority (Campbell & Elison, 2005). More relevant to aviation, evidence suggests that aviators, compared to the general population, may be reluctant to utilize internalizing coping strategies. Pilots and aircrew who are reluctant to utilize a limited but healthy level of internalizing coping when the inevitable error or miscalculation occurs in the cockpit or flight deck may be at risk for disrupted crew communication. Specifically, Brown and Moren (2003) studied commercial aviation students in simulated cockpit exercises and found that aviators may be overly reluctant to engage in attack-self coping, instead focusing exclusively on externalizing coping strategies that make little allowance for the acknowledgement of mistakes.

Objectives and Methods of the Review

With respect to stress coping in military aviation, it remains unclear which theoretical perspective, if any, has come to dominate the literature, much less specify any

specific distinctions between emotion/problem or avoidant/attention coping and their contribution to the adaptation of stress in military flight environments. The literature review that follows is narrative and undertaken to identify some consistent themes regarding coping styles and other mediating factors that impact the manifestation of stress in aircrew confronted with both acute and chronic stress. In doing so, the focus of the review is to create a starting point for unifying the currently disparate theoretical threads that run through the study of stress coping in aviation.

A computerized search of the literature was conducted utilizing PsycINFO, Google Scholar, Medline, and Defense Technical Information Center. Keywords for the computerized search of the literature were: “stress”, “anxiety”, “emotional stability” and “neuroticism.” The review identified a total of ten studies with substantive material concerning psychologically induced stress in military aviators. These studies are described in chronological order below and summarized in Table 1. The term stress coping models will be used to refer collectively to the three stress coping models (i.e. transactional, avoidant/attentive, compass of shame coping) in the narrative reviews of each study.

Table 1. Summary of Stress Coping Studies.

Study	Population	Theory of Stress	Definition of Stress	Measures	Findings
Ursano (1980)	Three U.S. Airforce officers (case studies)	a. General Adaptation Syndrome (Selye, 1956) b. Life Change: Holmes & Rahe (1967)	a. a threatening event b. any event that causes change	a. N/A b. N/A	Aviators are emotionally stable, but tend to use emotion-focused coping techniques when their stress threshold has been surpassed.
McCarron & Haakonson (1982)	Canadian Forces: 158 aviators, 127 ground crew, and 46 non-aviation officers	Life Change: Holmes & Rahe (1967)	Aviation stress factors: flight conditions, emergency situations, flight related anxiety, and personal risk factors (e.g., divorce, demotion)	a. Recent Life Change Questionnaire b. Social Readjustment Rating Scale	The levels of stress associated with life changing events were significantly lower in aviators than ground personnel, or non-aviation officers.
Alkov, et al (1982)	501 U.S. naval aviators who had been involved in a mishap	General Adaptation Syndrome	The nonspecific response of the body to any demand made upon it.	a. Human Factors Aircraft Accident Investigation b. Psychological Background Questionnaire	At fault aviators were significantly more likely to use emotion focused coping and have particular 'life stressors' than not at fault aviators.
Alkov, et al (1985)	Data obtained, from flight surgeons, on 259 U.S. naval aviators who had been involved in a mishap	Method implies Life Change approach	Not specifically defined, financial difficulties, recent marital engagements, career decisions examples of stressors	U.S. Navy Stress & Personality Questionnaire	Aviators who caused a mishap were more likely to have problems with interpersonal relationships and display symptoms of inadequate stress coping compared to non-mishap aviators.
Picano (1990)	U.S. Army: 465 pilots, 143 aircrew, and 50 non-aviation personnel	Dispositional approach to stress coping	Not specifically defined, implied as emotionally challenging events	Coping Orientation to Problems Experienced (COPE)	The pilots were significantly more likely to use problem focused coping strategies and less likely to use emotion focused strategies than the non-aviators

Table 1. Continued.

Study	Population	Theory of Stress	Definition of Stress	Measures	Findings
Takla, et al (1994)	Literature review	Combat stress	Not specifically defined. Threat of injury or death, injury or death of friends, requirement to destroy,	N/A	Aviators (particularly young pilots) have better psychological well-being than non-aviators
Siem & Murray (1994)	100 U.S. Airforce pilots	BIGFIVE Personality	Emotional Stability	N/A	Conscientiousness was rated as the most desirable trait for aviators.
Parsa & Kapadia (1997)	57 U.S. Airforce pilots participating in combat operations	a. Stimulus model b. Response-based model c. transactional model	A physical or psychological stimulus which, when impinging on an individual, produces strain or disequilibrium	Beck Depression Inventory	The pilots were not experiencing high levels of stress despite participating in combat operations
Otsuka, et al (2006)	Japanese Air Self-Defense Force: 30 student aviators and 33 instructor aviators	a. Stimulus model b. Response-based model	Levels of urinary catecholamine and salivary cortisol.	Levels of urinary catecholamine and salivary cortisol	Students became better able to cope with the stress of flight training as they became more experienced.
Lurie, et al (2007)	57 Israel Air Force Officers: 25 pilots and 22 non-pilots	a. Dispositional approach to stress coping b. Response-based model	The bond between the environmental demands toward the individual and his ability to cope with them.	a. Folkman coping style questionnaire b. Dental assessment	Bruxism was noticeable in 69% of pilots, and 27% of non-pilots. Pilots suffering from bruxism are more likely to use less effective coping strategies than non-pilots suffering from bruxism.

STUDIES OF STRESS COPING IN MILITARY AVIATION

Ursano (1980)

Ursano (1980) presented three case histories to illustrate the necessity of contemplating not just biological origins of presenting symptoms in aviators, but also the individual aviator's personality (e.g., Type A personality), sociocultural background (e.g., marital, childhood), and symbolic representation (e.g., aviation as adult status or childhood dream). In his introduction, Ursano emphasized the need to investigate these three areas, in large part due to a perception that aviators tend to ignore their internal emotional life and focus on tangible concerns. When faced with stress, Ursano argued that aviators are less apt to employ psychological defenses, and consequently the symptoms presented are more tangible physiological symptoms as opposed to psychological. In all three case studies, biological bases for the presenting physical symptoms could not be established. The author concluded that concurrent investigation of personality, socio-cultural, and symbolic histories was essential for identifying the course of psychiatric treatment implemented for the three aviators described in the case histories.

In terms of stress susceptibility, the authors appeared to support the notion that military aircrew are elevated in emotional stability, while the coping strategy of choice for the aviator whose stress threshold has been surpassed is often some form of externalizing response in which direct confrontation of unpleasant emotions is avoided but manifest as physiological or somatic complaints. The implication of this study, when discussed from the perspective of the stress coping models introduced at the start of this chapter, is that aviators who rely upon avoidant/internalized stress coping may have a

tendency to clinically present with physical ailments that are an unconscious manifestation of their underlying battle with stress

McCarron and Haakonson (1982)

McCarron and Haakonson (1982) adopted Holmes and Rahe's life change conceptualization of stress (Holmes & Rahe, 1967) in their study of life change stress amongst Canadian aviators. The life change theory attributes stress to the frequency of life change events, which regardless of emotional valence of the event, leads to more stress as the frequency of life changes increases. The Recent Life Change Questionnaire (RLCQ as cited in McCarron & Haakonson, 1982) was used to compare life change units across health, work, family, social, and financial domains, between pilots ($n = 158$), aircraft maintenance ground crew ($n = 127$), and non-aviation officers ($n = 46$). No significant differences emerged between the various aviation communities with respect to the number of life change events (the mean number for pilots, aircraft maintenance, and no aviation personnel were 11.8, 13.4, and 13.1 life changing events respectively). The results indicated the aviator sample had fewer life change units overall compared to other communities, especially ground crew ($p < .05$). Significant differences in life change units (a numerical value ranging from 11 to 100 units describing the quantity of life changing events) indicated aviators experienced less life change stressors compared to ground crew for health ($p < .01$), family ($p < .05$) and social ($p < .05$) domains. Compared to the much smaller sample of non-aviation officers, only one significant difference from the aviation sample emerged for the family domain ($p < .05$). The findings from this study highlight the potential differences between aviators and other members of the aviation community with respect to the frequency and intensity of

stressors encountered. Potential reasons for the differences between the groups were not discussed.

Referencing the stress coping models introduced at the start of the chapter, the Life Change model of stress avoids discussion of specific coping strategies in favor of a model that equates the quantity of stressful events with the outcome, thus assuming that at some point too much stress simply outstrips one's ability to cope. Such an approach is contradictory to the transactional, avoidant/attentive, and compass coping models which share the assumption that stable individual differences in coping strategies account for at least some between-person variability in the degree to which stress adversely impacts an individual.

Alkov, Borowsky, & Gaynor (1982)

Alkov and colleagues (1982) attempted to test the hypothesis that inadequate stress-coping strategies contribute to mishaps (i.e., substantial destruction of property or bodily injury) in U.S. Naval Aviation. The authors instructed U.S. Navy flight surgeons to complete a 22-item questionnaire about life style changes and personality characteristics they had observed among Naval Aviators involved in mishaps. Completed questionnaires (N = 501) were returned to the authors, who later divided the questionnaires into two groups, (a) "at-fault" aviators (n = 248) with an attributed mishap and (b) "not-at-fault" aviators (n = 230) not implicated in a mishap. Twenty-three aviators were involved in a mishap for which the cause was undetermined. These 23 questionnaires were omitted from the final analysis, resulting in a final N = 478. A one-tailed Fisher Erwin Exact significance test was conducted to examine differences in non-

normal responses between the at-fault and not-at-fault groups. Significant differences were found between the at-fault and not-at-fault aviators for nine of the 22 questions. Among the items with significant differences, five were significant at the $p < .01$ level, and four were significant at $p < .05$ level. The content of the items with significant differences suggests deficits in stress coping for the at-fault aviators. The at-fault group was more likely to have: (a) marital problems, (b) problems with interpersonal relationships, (c) recent trouble with supervisors, and (d) recent trouble with peers.

Relating this study to the stress coping models, Alkov et al (1982) concluded that ineffective coping strategies, namely 'acting-out' aggression (an emotion focused coping strategy) contribute significantly to the probability of an aviator being involved in a mishap. Therefore, the authors urge that individuals in supervisory positions should be alert to signs of ineffective stress coping such as acting out behaviors, denial, defensiveness, over-sensitivity to criticism, argumentativeness, arrogance, and chronic interpersonal problems, as indicators of suitability for flight duty.

In terms of trait dispositions, the sample itself was again described as relatively free of neuroticism. Yet there is a potential liability for emotional stability: when the stress coping envelope of an aviator is finally breached, such individuals are relative novices at dealing with their emotions. Aviators in this study who may have crossed this threshold were described as being over-reliant upon externalizing coping strategies (e.g., attack-other) that can have deleterious impact upon performance and ultimately, safety.

Alkov, Gaynor, and Borowsky (1985)

In a second expanded study, Alkov et al (1985) asked U.S. Navy flight surgeons to rate Naval Aviators involved in mishaps (1980 – 1982) on 26 items that assessed dimensions of externalizing stress coping (poor familial and work relationships, risk taking, absent-mindedness on the job). Although Alkov and colleagues acknowledged that military aviators, as a group, are “*recognized as high stress copers*” (p. 244), they hypothesized that certain stress coping personality traits could differentiate between mishap involved pilots who were, and were not, identified as contributing to a mishap. From the Lazarus and Folkman perspective (Lazarus, 1983; Lazarus & Folkman, 1984), Alkov and colleagues suggested that young aggressive Naval aviators, forced into emotion focused coping, are more likely to adopt externalizing or ‘acting out’ strategies likely to be manifested in interpersonal relationships problems (familial and job-related), rather than adopt internalizing coping strategies characterized by quiet anxiety and depression.

The questionnaire was completed by flight surgeons for 381 mishap-attributed and 356 non-mishap attributed Naval aviators. A significant proportion of the sample (Fisher-Irwin Exact Test, $p < .001$, one-tailed) endorsed the following four items: (a) recent major decision, (b) not professional in flying, (c) trouble with superiors, and (d) incapable of quickly assessing trouble. Mishap attributed aviators appeared more likely to engage in externalizing stress coping compared to the non-mishap attributed aviators.

Unfortunately, it is difficult to make much of the findings reported in this study given the dearth of psychometric information regarding the questionnaire (e.g., neither reliability nor validity information reported). Moreover, the use of single item

comparisons may have elevated experiment-wise (Type I) error, especially in conjunction with the use of a one-tailed p -value. Notwithstanding, the findings provide a descriptive survey of how flight surgeons have come to conceptualize the failing aviator as being more stress prone than their adaptive counterparts, combined with an over-reliance upon externalizing/avoidant coping mechanisms when forced to engage in emotion-focused coping.

Picano (1990)

Picano (1990) conducted a survey of aviator coping styles to examine the belief that aviators emphasize problem-focused coping strategies. Using a mail-in survey procedure, the Coping Orientation to Problems Experienced (COPE; Carver, Scheier, & Weintraub, 1989) questionnaire was completed and returned by U.S. Army pilots ($n = 465$), aircrew ($n = 143$), and non-aviation military ($n = 50$) personnel. The COPE has an empirically supported factor structure that groups several sub-scales into the following coping styles: problem-solving, support-seeking, avoidance, acceptance, and religion. To reduce potential confounds due to gender, 35 surveys completed by females were not included in the final sample of Army personnel. First, the pilot sample ($n = 465$) was compared to a collegiate norm sample ($n = 1030$). Using Cohen's d (1977) as a reference, only three scales reached the "large" effect size of .5 or greater. Two of these scales were facets of the support-seeking dimension (support-seeking for emotional reasons, venting of emotions), on which pilots scored significantly lower than the college sample. Pilots also scored significantly lower than the college sample on the mental disengagement facet of the avoidance dimension.

These findings offer further support for the portrayal of pilots as individuals who are reluctant to engage in emotion-focused coping and prone to externalize if confronted with emotion. When compared with aircrew and non-aviation military samples, the pilot sample again evidenced significantly lower emotional venting, mental disengagement, and denial. Another significant difference was observed with respect to the support-seeking dimension, as pilots scored significantly higher on this facet than aircrew or non-aviation military personnel. Picano further attempted to delineate the coping styles of the pilot sample by comparing COPE scores across the various aircraft flown by the sample (utility, scout, attack, cargo, fixed-wing utility). However, no significant differences emerged. Despite the amount of psychometric support for the COPE that distinguishes this study from that of Alkov and colleagues (Alkov et al. 1982; Alkov et al, 1985), the self-selecting nature of the sample raises questions about the generalizability of the findings. Taken in conjunction with the other studies reviewed thus far, the Picano effort lends additional support to the description of pilots as predominately externalizing, avoidant, and problem-focused when confronting stress.

Takla, Koffman, & Bailey (1994)

In their extensive literature review, Takla and colleagues (1994) noted a paucity of data devoted to the subject of combat induced stress in modern military aviation. Applying a Freudian psychoanalytic perspective, the authors reviewed the dynamics of general combat stress reactions, noting that aviators' ability to aggress against an enemy can aid in stress coping by providing the opportunity to discharge anxiety. The authors argued that a loss of narcissistic (self-admiration, self-centeredness and self-regard)

defenses is a predisposition that often leads to combat fatigue. Takla et al (1994) further declared that military aviators, especially between the ages of 21 and 28, sustain psychological well-being better than other aircrew in combat deployments, especially when compared to ground crew. The authors argued that aviators may be less susceptible to stress than ground crew because the aviators' active participation in combat duties facilitates an internal locus of control that is psychologically protective. Oppositely, ground crews are less likely to perceive an internal locus of control for the outlet of their stress while performing the more passive duties of support staff.

Takla and colleagues also noted that support staff may be more likely to adopt feelings of helplessness because of the fixed position of their bases, which renders them more susceptible to random attacks from the enemy. One limitation of this paper, as the authors were quick to note, is the dearth of empirical evidence substantiating the proposed psychodynamic perspective on combat stress coping in aviators and aircrew. Nevertheless, the authors clearly stipulated that aviators prefer externalizing coping styles as a group and tend to be emotionally stable when contrast against other members of the flight crew. In some cases, externalizing coping may take the form of engaging the enemy during combat operations. Given such a perspective, it creates the expectation that aviators, relative to other combat operators, have less of a risk for developing stress related disorders in conjunction with combat deployments. Returning to the stress coping models, this study again portrays aviators as problem-focused, avoidant, and externalizing, and in doing so suggests these traits are psychologically protective when aviators are exposed to the stress and danger of air combat operations.

Siem and Murry (1994)

Siem and Murry (1994) provided limited empirical evidence to paint a portrait of personality traits pilots themselves desire in successful combat pilots. In their study, 100 U.S. Air Force pilots, 43 with combat experience in Operation Desert Storm, were asked to utilize six personality dimensions to create a composite personality profile of a highly effective combat pilot. Those six dimensions derived from interviews with pilots were (a) flying skills and knowledge, (b) compliance (with flight rules/regulations), (c) crew management and mutual support, (d) leadership, (e) situational awareness, and planning. Comparing the relative desirability of specific personality traits within those dimensions, a personality trait that resembles the BIGFIVE (Barrick & Mount, 1991) trait of conscientiousness (dependable, responsible, and decisive) was rated as the most important. The next most desirable personality factors were: culture (“bright” or appearance of intelligence) for flight skills, leadership, situational awareness, planning, and emotional stability. Conscientiousness also emerged as the most highly valued personality type for combat pilots across aircraft type.

When interpreting this result it is important to keep in mind that this profile is a subjective reflection of self-rated “desirable” traits in combat aviators as opposed to a performance based profile. Therefore it is best to interpret the profile as a type of “ideal” character type aviators hope to find in their colleagues, especially during combat situations. Given the complementary nature of conscientiousness and “culture,” it is not surprising that pilots find these to be desirable characteristics in fellow pilots, regardless of whether or not the setting is a combat zone. Moreover, the results from this study do not provide any empirical evidence that links conscientiousness (or any other personality

factors) to mental well-being and adjustment under combat conditions, an outcome variable that may be, in some cases, distinct from combat performance.

Linking the BIGFIVE model to the three stress coping models discussed at the start of the chapter could prove to be a valuable integration, especially considering that individual differences in coping styles may very well be a function of larger underlying personality traits (Buss, 1996). Some obvious linkages are that elevated conscientiousness, emotional stability, and extroversion described here as desirable in fighter pilots, are traits consistent with a problem-focused personality that can flexibly move between avoidant and attentive coping as situations dictate, but decidedly oriented towards externalizing emotional coping.

Parsa and Kapadia (1997)

Parsa and Kapadia (1997) compared U.S. Air Force pilots ($N = 57$) across five different squadrons (all of which were involved in combat operations at the time) with respect to their scores on the Beck Depression Inventory (BDI; Beck & Steer, 1994). Individuals who scored 10 or greater, according to the BDI manual, were identified as experiencing excessive stress. A significant ($p < .01$) test of proportions was observed using a positive screen for depression as the criterion. The results indicated the sample was not experiencing elevated stress levels despite their participation in combat operations. Moreover, no significant differences in BDI scores were observed between the squadrons. The small sample size utilized in this study render it descriptive, yet again, whatever evidence can be gleaned from the data continue to support the supposition that

on average, military pilots are emotionally stable individuals who are not easily given to depressive and anxiety disorders.

The results from this study are consistent with the problem-focused, avoidant, emotionally externalizing portrait of an effective combat aviator also described by Takla (et al., 1994), as well as Siem and Murry (1994). In particular, avoidant and externalizing emotional coping are thought to be protective with respect to internalizing disorders such as depression (Elison, et al., 2006).

Otsuka, Onozawa, & Miyamoto (2006)

Otsuka and colleagues (2006) attempted to differentiate between student and instructor pilots at different stages of flight training using physiological stress indicators that consisted of urinary adrenalin and noradrenalin levels, in addition to salivary cortisol. The sample of 30 students and 33 instructors were sampled from initial phase I training that involved instruction on a T-3 dual seat propeller aircraft. A sample of 17 students and 15 instructors were sampled from the more advanced phase II training that involved instruction on a T-4 jet engine aircraft. Urine and saliva samples were taken pre and post flight for all participants, with the ratio of pre, to post-flight adrenalin, noradrenalin, and cortisol utilized to indicate the amount of stress incurred during the flights.

The results indicated that during the early training level (phase I), students evidenced significantly higher differences from instructors for all three hormones (from pre to post-flight). On the other hand, no such student/instructor differences were observed in students at more advanced stages of training. The disappearance of student/instructor differences in stress related physiology at advanced stages of training supports the notion that training helps students acclimate to the stressors of flight

training. Perhaps more importantly, this study was the first in the review to introduce objective indicators of individual differences in stress response by employing physiological indicators of stress, which in conjunction with the comparison of students against instructors at various levels of training, made the design possibly the most methodologically rigorous in the present literature review.

With respect to individual trait differences in stress susceptibility, the findings from this study suggest that while pilots seem to experience stress when they first encounter the demands of military aviation, successful student aviators have the capacity to physiologically adapt to the stressors of aviation training. From another perspective, the results suggest that performance might interact with stress susceptibility, such that students who are unable to improve their performance in a timely manner are also more likely to experience greater stress for a longer duration. The result of this interaction is deteriorating performance and a greater likelihood of training attrition. Further application of this methodology combined with an analysis of coping styles might shed light on the degree to which coping strategies mediate such habituation. Establishing bio-physiological markers for a personality (Canli, 2006) oriented towards problem-focused, flexibly-avoidant, and emotionally-externalizing coping could provide a powerful new approach to aviation training selection as well as those interested in studying stress resilience in other applied areas.

Lurie, Zadik, Einy, Tarrasch, Raviv & Goldstein (2007)

Lurie et al (2007) evaluated work-related stress as a potential cause of bruxism in Israeli Air Force officers (35 pilots and 22 non-pilots). Bruxism is a common habit which

causes grinding of teeth by rhythmic contractions of the masseter and other jaw muscles (Attanasio, 1997). Abnormal tooth wear is a symptom of bruxism. Following a dental examination, it was found that 69% of the pilots suffered from bruxism, compared to 27% of the non-pilots (the incidence of bruxism is between 5 and 10% of western populations; Lurie et al, 2007). The participants also completed a coping style questionnaire based upon the Folkman and Lazarus model (1980). There was not a significant difference in the levels of stress reported by the pilot and non-pilot groups. However, Lurie et al (2007) reported that pilots suffering from bruxism were relatively more likely to use emotion-focused coping styles and denial when compared with socio-economically matched non-pilots suffering from bruxism. It was not reported whether this difference was significant. This study represents an interesting use of objective physical markers as a measure of stress. However, the sample size was extremely small and there was little detail regarding statistical analysis, particularly in the reporting of significance testing.

DISCUSSION

Considering that adaptive stress coping is a necessity for aviators who function at high-levels of competency under tremendous psychological and physiological stress, we were surprised to find so few studies devoted to the topic. Nevertheless, it is possible to draw a number of conclusions regarding the role of personality and coping styles with respect to the impact of stress on military aviators. These conclusions and recommendations for further inquiry are presented next.

Integrating the Findings with Stress Coping Theories

The transactional, avoidant/attentive, and compass of shame coping models can be described as cognitive-affective psychological theories characterized by an interaction between cognitive coping schemas and the affective states to which they are responding (Nathanson, 1992; Tomkins, 1970). The transactional and avoidant/attentive models suggest that a person and situation interaction determine the foci of cognitive information processing during exposure to psychological stress: either towards one's emotions or the specifics of the stress evoking environment. In cases where attention is focused on one's emotional reaction to the stressor, attentive coping takes place. Attentive coping opens the door to the influence of stable individual differences in emotional coping (e.g., internalizing/externalizing shame coping). Individual differences in emotional coping tendencies describe how an individual is most likely to integrate their emotional coping with their more long-term schema of the self (Lewis & Junyk, 1997). When taken to an extreme, internalizing coping strategies magnify tendencies towards depressive and mood disorders, while excessive externalizing coping might take the form of personality disorders such as narcissism, antisocial personality, and various somatoform disorders (Nathanson, 1992).

Based on the literature review, the coping style most consistent with attaining a career in military aviation is a problem focused, and avoidant coping style. Further, for those aviators who do engage in emotion focused or attentive coping, the tendency is to minimize the impact of emotions through externalizing coping strategies that result in somatic complaints or aggressive, acting-out behavior which minimize direct confrontation with unpleasant emotion. Therefore, one could say that the psychological

stress coping literature for military aviators portrays a sub-population more likely to have a problem-focused, avoidant cognitive focus, and when pressed to deal with emotions, given to externalizing coping.

How is the emerging military aviator stress coping portrait relevant to human performance? To start, it would appear aviators are ideally equipped to deal with acute, high stress situations that benefit for maximal allocation of attention to purely cognitive and physical aspects of the stressor (Wickens, 2003). Emergency scenarios which require split-second decisions with life and death consequences are not uncommon in military or civilian aviation. Cockpit emergencies call for a problem-focused, emotionally avoidant, individual to flawlessly execute rehearsed trouble-shooting procedures under life-threatening pressure. Yet when it comes to dealing with chronic stress, aviators may suffer from an inability to switch to attention-based coping. Over the long-term, self-reflection and refinement are more likely to follow from attention-based coping (Suls & Fletcher, 1985). Moreover, the literature review indicated that when aviators do attend to their emotions their particular style of coping is likely to be externalizing. Unfortunately, aviators' infrequent encounters with emotion-focused coping may mean their coping skills lack refinement; thereby predisposing aviators to engage in various forms of socially inappropriate acting-out behavior when forced to confront their emotions (Alkov et al, 1982; Alkov et al, 1985; Ursano, 1980). A similar finding from another applied domain was reported by Glendon and Glendon (1992), who found that ambulance staffs experiencing increased stress were likely to adopt emotion-focused coping strategies. In sum, the literature indicated aviators tend to avoid dealing with the emotional aspects of stress. In doing so, aviators are not immune to stress, but instead more prone to utilize

externalizing coping. When taken to the extreme, externalizing coping may prove to be as equally debilitating and socially maladaptive as internalizing coping styles.

Personality

A consistent theme in the literature review was that military aviators are emotionally stable and therefore less prone to anxiety and depressive disorders associated with neuroticism (Alkov et al, 1982; Alkov et al, 1985; Parasa & Kapadia, 1997; Takla et al, 1994; Ursano, 1980). Such a personality profile is indicative of individuals who are able to perform well under stressful conditions (Flin, O'Connor, & Crichton, 2008; Musson, Sandal & Helmreich, 2004). This finding is fairly unsurprising. Given the stress placed upon military aviators during flight school, those individuals who are unable to cope with stress are unlikely to become military aviators as they would attrite during training. Indeed, a recent meta-analysis of personality measures as predictors of military aviation training (Campbell, 2006) found a significant, negative, mean effect for the relationship between scores on measures of neuroticism, its' sub-facet anxiety, and the dependent variable of success in military aviation training. These findings are also consistent with empirical findings that military aviators as a group, tend to be lower than normative samples with respect to neuroticism (Lambirth, Dolgin, Rentmeister-Bryant, & Moore, 2003; Retzlaff & Gilbertini, 1987).

Life changing events

McCarron and Haakonson (1982) found no significant differences in the number of life changing events when comparing military aviators with military ground personnel

and non-aviation military officers. However, when military aviators experienced life changing events, the level of stress they experienced was significantly lower compared to ground personnel, or non-aviation military officers. The authors of the study did not attempt to account for these findings, but from examining the study it is possible to offer some explanations. To start, military aviators are arguably less likely to suffer from medical issues as their health is carefully screened. Military aviators may also benefit from a uniquely strong social support network due to the camaraderie that accompanies squadron membership. The aviators were more homogenous in rank than the ground personnel or non-aviation officers, making sampling differences more of a plausible explanation for the differences between the two groups. Lastly, aviators may under report health concerns because it is a major determinant as to whether they can fly or not. Therefore, care should be taken when extrapolating these findings to military aviators in general.

Turning to Alkov's finding that mishap involved military aviators are prone to major life stressors (Alkov et al, 1982; Alkov et al, 1985), this finding is consistent with the results reported by other researchers who have examined accident causation (Li, Chen, Wu, & Sung, 2001; McCarron & Haakonson, 1982). For example, Loewenthal, Eysenck, Lubitsh, Gortin, & Bicknell (2000) found a significant relationship between the levels of psychological stress of civilian pilots and whether or not they had been involved in an air traffic incident. Taken together, these studies suggest the identification of abnormally high stress in aviators should be considered an important function of mishap intervention programs that emphasize stress management techniques.

Training

The arduous selection and qualification process through which military aviators must pass necessitates the ability to perform effectively while exposed to stress. Further, the stress exposure endured during military flight training improves the ability of the flight students to cope with stress in the aircraft (Otsuka, et al, 2006). The finding that stress exposure improves the ability of individuals to cope with stress in the future is supported elsewhere. For instance, in their review of 37 articles concerned with stress exposure training, Saunders, Driskell, Johnston, and Salas (1996) found the majority of studies supported the effectiveness of stress exposure training. Further, there is evidence that the skills learned during exposure to a specific stressor or stressful situation can be generalized to novel settings and stressors (Driskell, Salas, & Johnson, 2001).

CONCLUSION

The purpose of this paper was to consolidate the disparate literature pertaining to stress coping in military aviators. Although this review of stress coping in military aviation did not uncover a dominant theoretical or methodological paradigm, one consistent theme was that military aviators on average tend to be one of the most stress resilient populations in the military and by extension, the general public. Aviators as a whole were commonly described as being emotionally stable (low in neuroticism), a trait well suited to preventing acute stress from interfering with the performance of complex flight skills under intense time pressure. Yet with respect to chronic stress (e.g., divorce, failed relationships), the evidence suggested that aviators who do succumb to this type of

stress (i.e., forced to engaged in emotion-focused coping) are prone to engage in externalizing and often self-destructive behavior (e.g., acting-out/attack-other behavior, presentation of somatic complaints while avoiding direct acknowledgement of emotional problems). In conclusion, few attempts have been made to replicate or extend the aviation stress coping literature. To address this limitation, we recommend the development and utilization of a standardized method for evaluating individual differences in the ability to withstand and cope with stress. Aviation and military psychology might look to the developmental literature on emotional regulation (Cicchetti, Ackerman, & Izard, 1995) as an example of a more theoretically and methodologically developed approach to dealing with issues of individual differences in coping. The development of a standardized method for measuring and discussing stress coping would add a new dimension to human performance in aviation with the potential to improve the selection, training, and sustainment of military aviators, while providing a basis for comparing stress responses in personnel across a range of high risk industries.

ENDNOTES

All opinions stated in this paper are those of the authors and do not necessarily represent the opinion or position of the U.S. Navy, Navy Bureau of Medicine and Surgery, or the Naval Postgraduate School.

BIBLIOGRAPHY

- Alkov, R.A., Borowsky M.S. & Gaynor, J.A. (1982). Stress coping and the U.S. Navy aircrew factor mishap. *Aviation, Space, and Environmental Medicine*, 53, 1112 – 1115.
- Alkov, R.A., Gaynor, J.A., & Borowsky, M.S. (1985). *Aviation, Space, and Environmental Medicine*, 56, 244 – 247.
- Attanasio, R. (1997). An overview of bruxism and its management. *Dental Clinics of North America*, 41, 229-241.
- Barrick, M.R., & Mount, M.K. (1991). The big five personality dimensions and job performance: A meta-analysis. *Personnel Psychology*, 44, 1 – 26.
- Beck, A.T. & Steer, R.A. (1994). *The Beck depression inventory manual*. San Antonio, TX: Harcourt, Brace, & Co.
- Brewer, W.F. (1987). Schemas versus mental models in human memory. In P. Morris, Ed., *Modeling Cognition*. Chichester, UK: Wiley, pp. 187 – 197.
- Brown, N.M. & Moren, C.R. (2003). Background emotional dynamics of crew resource management: shame emotions and coping responses. *International Journal of Aviation Psychology*, 13, 269 -286.
- Buss, D.M. (1996). Social adaptation and Five Major Factors of Personality. In J.S. Wiggins (Ed.), *The Five Factor Model of Personality*. New York: The Guilford Press.
- Campbell, J.S. (2006). Personality Assessment in Naval Aviation. In: *Proceedings of the Annual Convention of the American Psychological Association*. New Orleans, LA: 258.

- Campbell, J.S & Elison, J. (2005). Shame coping styles and psychopathic personality traits. *Journal of Personality Assessment*, 84, 96 – 104.
- Canli, T. (2006). *Biology of Personality and Individual Differences*. New York: The Guilford Press.
- Cannon, W.B. (1915). *Bodily changes in pain, hunger, fear, and rage*. New York: Appleton.
- Carver, C.S., Scheier, M.F. & Weintraub, J.K. (1989). Assessing coping strategies: a theoretically based approach. *Journal of Personality and Social Psychology*, 56, 267 – 283.
- Cicchetti, D., & Ackerman, B.P., & Izard, C.E. (1995). Emotions and emotion regulation in developmental psychopathology. *Development and Psychopathology*, 7, 1-10.
- Cohen, J. (1977). *Statistical Power Analysis for the Behavioral Sciences*. San Diego: Academic Press.
- Driskell, J.E., Salas, E., Johnson, J. (2001). Stress management: Individual and team training. In: Salas, E, Bowers, C. & Edens, E. (Eds.). *Improving teamwork in organizations: Applications of Resource Management Training*. Mahwah, NJ: Lawrence Erlbaum Associates: 55-72.
- Elison, J., Lennon, R., Pulos, S. (2006). Investigating the Compass of Shame: The development of the compass of shame scale. *Social Behavior and Personality*, 34, 221 – 238.
- Folkman, S. & Lazarus, R.S. (1980). An analysis of coping in a middle-aged community sample. *Journal of Health & Social Behavior*, 46, 159-162.

- Flin, R., O'Connor, P., & Crichton, M. (2008). *Safety at the Sharp End*. New York: Lawrence Erlbaum.
- Glendon, A.I. & Glendon, S. (1992). Stress in ambulance staff. In: Lovesey, EJ (Ed.). *Contemporary ergonomics 1992: Ergonomics for industry*. London: Taylor & Francis: 174-180.
- Holmes, T.H. & Rahe, R.H. (1967). The social readjustment rating scale. *Journal of Psychosomatic Research*, 11, 213-218.
- Kern, T. (2006). *Darker Shades of Blue: The Rogue Pilot*. Weston, FL: Convergent.
- Krohne, H.W. (1993). *Attention and Avoidance*. Seattle: Hogrefe & Huber Publishers.
- Lambirth, T., Dolgin, D., Rentmeister-Bryant, H., & Moore, J.L. (2003). Selected personality characteristics of student naval aviators and student naval flight officers. *International Journal of Aviation Psychology*, 13, 415 – 427.
- Lazarus, R.S. (1983). The costs and benefits of denial. In: Breznitz, S (Ed.). *The Denial of Stress*. New York: International Universities Press: 1-30.
- Lazarus, R.S., & Folkman, S. (1984). *Stress, Appraisal and Coping*. New York: Springer Publishing Company.
- Lewis, M.D., & Junyk, N. (1997). The self-organization of psychological defenses. In F. Masterpasqua & P. Perna (Ed.s), *The Psychological Meaning of Chaos* (pp. 41 – 74). Washington, DC: American Psychological Association.
- Li, C.Y., Chen K.R., Wu, C.H., & Sung, F.C. (2001). Job stress and dissatisfaction in association with non-fatal injuries on the job in a cross-sectional sample of petrochemical workers. *Occupational Medicine*, 51, 50-55.

- Loewenthal, K.M., Eysenck, M., Lubitsh, G., Gortin, T., Bicknell, H. (2000). Stress, distress and air traffic incidents: Job dysfunction, and distress in airline pilots in relation to contextually-assessed stress. *Stress Medicine*, 16(3), 179-183.
- Lurie, O., Zadik, Y., Einy, S., Tarrasch, R., Raviv, G. & Goldstein, L. (2007). Bruxism in military pilots and non-pilots: tooth wear and psychological stress. *Aviation, Space, and Environmental Medicine*, 78, 137-139.
- McCarron, P.M. & Haakonson, N.H. (1982). Recent life change measurement in Canadian forces pilots. *Aviation, Space, and Environmental Medicine*, 53, 6 – 13.
- Miller, R.G., Rubin, R.T., Clark, B.R., Crawford, W.R., Ransom, J.A. (1970). The stress of aircraft carrier landings I. Corticosteroid responses in naval aviators. *Psychosomatic Medicine*, 32(6): 581-588.
- Musson, D.M., Sandal, G.M., & Helmreich, R.L. (2004). Personality characteristics and trait clusters in final stage astronaut selection. *Aviation, Space, and Environmental Medicine*, 75, 342 – 349.
- Nathanson, D. (1992). *Shame and Pride: Affect, Sex, and the Birth of the Self*. New York: Norton.
- Otsuka, Y., Onozawa, A., Miyamoto, Y. (2006). Hormonal responses of pilots to training flights: The effects of experience on apparent stress. *Aviation, Space, and Environmental Medicine*, 77, 410 – 414.
- Parsa, B.B., & Kapadia, A.S. (1997). Stress in Air Force aviators facing the combat environment. *Aviation, Space, and Environmental Medicine*, 68, 1088 – 1092.
- Picano, J. (1990). An empirical assessment of stress-coping styles in military pilots. *Aviation, Space, and Environmental Medicine*, 61, 356 – 360.

- Retzlaff, P.D., Gilbertini, M. (1987). Air Force personality: Hard data on the right stuff. *Multivariate Behavioral Research*, 22, 383 – 389.
- Saunders, T., Driskell, J.E., Johnston, J., & Salas, E. (1996). The effect of stress inoculation training on anxiety and performance. *Journal of Occupational Health Psychology*, 1, 170-186.
- Selye, H. (1956). *The Stress of Life*. New York: McGraw-Hill.
- Shontz, F.C. (1975). *The Psychological Aspects of Physical Illness and Disability*. New York: Macmillan.
- Siem, F.M., Murry, M.W. (1994). Personality factors affecting pilot combat performance: A preliminary investigation. *Aviation, Space, and Environmental Medicine*, 65 (A, Suppl): A45 – A48.
- Suls, J. & Fletcher, B. (1985). The relative efficacy of avoidant and nonavoidant coping strategies: A meta-analysis. *Health Psychology*, 4: 249 -288.
- Stokes, A., & Kite, K. (1994). *Flight Stress: Stress, fatigue, and performance in aviation*. Burlington, VT: Ashgate.
- Takla, N., Koffman, R. & Bailey, D. (1994). Combat stress, combat fatigue, and psychiatric disability in aircrew. *Aviation, Space, and Environmental Medicine*, 65, 858 – 865.
- Tomkins, S.S. (1970). Affect as the primary motivational system. In M. Arnold (Ed.), *Feelings and emotions* (pp. 101 – 110). New York: Academic Press.
- Ursano, R.J. (1980). Stress and adaptation: The interaction of the pilot personality and disease. *Aviation, Space, and Environmental Medicine*, 51, 1245 – 1249.

Wickens, C.D. (2003). Pilot actions and tasks: Selections, execution, and control. In P. Tsang, & M. Vildulich (Ed.s), *Principles and Practice of Aviation Psychology*