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ADVISORY GROUP FOR AEROSPACE RESEARCH & DEVELOPMENT
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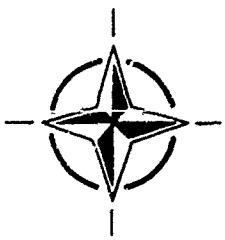
AGARDograph 324

AMP Short Course

Neurological, Psychiatric and Psychological Aspects of Aerospace Medicine

(Aspects Neurologiques, Psychiatriques et Psychologiques de la Médecine Aérospatiale)



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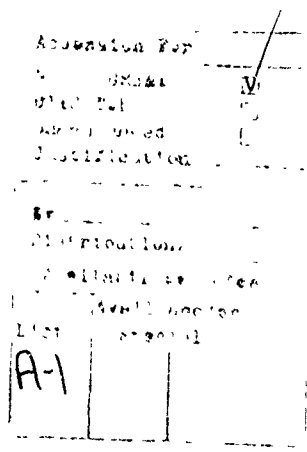

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Neurological, Psychiatric and Psychological Aspects of Aerospace Medicine

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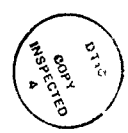
The material in this AGARDograph has been prepared under the sponsorship of the Aerospace Medical Panel of AGARD and was presented as a Short Course at Pensacola, United States from 18th to 20th October 1989, at Brussels, Belgium from 18th to 20th October 1989 and at Ankara, Turkey from 30th October to 1st November 1989.



North Atlantic Treaty Organization
Organisation du Traité de l'Atlantique Nord

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According to its Charter, the mission of AGARD is to bring together the leading personalities of the NATO nations in the fields of science and technology relating to aerospace for the following purposes:

- Recommending effective ways for the member nations to use their research and development capabilities for the common benefit of the NATO community;
- Providing scientific and technical advice and assistance to the Military Committee in the field of aerospace research and development (with particular regard to its military application),
- Continuously stimulating advances in the aerospace sciences relevant to strengthening the common defence posture,
- Improving the co-operation among member nations in aerospace research and development,
- Exchange of scientific and technical information;
- Providing assistance to member nations for the purpose of increasing their scientific and technical potential,
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Preface

This Short Course was offered as part of the North Atlantic Treaty Organization's (NATO) Advisory Group for Aerospace Research and Development (AGARD) program of education. It was offered at the Naval Air Station, Pensacola, Florida, United States (18th to 20th October 1989), Centre of Aerospace Medicine, Brussels, Belgium (25th to 27th October 1989) and Air Force Hospital, Ankara, Turkey (30th October to 1st November 1989) The Course was originally conceived during discussions by the Aerospace Medical Panel of AGARD. In particular, Colonel James R Hickman, Jr, Chief, Clinic Sciences Division, USAF School of Aerospace Medicine, was a primary advocate and supporter of our effort

The faculty was selected from among international experts in aeromedical neuropsychiatry Each faculty member brings a unique experience and background. Similarly, however, the faculty adheres to common principles derived through operational experience and consultation with aviators Each faculty member supports the idea of performance enhancement, health promotion, and prevention as the primary contribution of neuropsychiatry to aerospace medicine. Further, each faculty member advocates the need for careful clinical assessment with specific attention to the unique aspects of the aviation occupation requirement for the central nervous system performance. Finally, the faculty members recognize the strengths and weaknesses shared by individuals drawn to aerospace operations and recognize that while failure can occur, it is rare and often can be prevented or overcome.

In retrospect, the course was very well attended, beautifully supported by each host's institution, and exceptionally well received by the participants Thus, this monograph is the result of presentations by the faculty with additional information added from the participants Clearly, the aeromedical world is advanced by the efforts and support of the Aerospace Medical Panel of AGARD, these faculty members and the participants who so richly added to the course

Aerospace operations and aerospace medicine have had a long, but at times confusing, relationship There is much ahead for this relationship between aerospace operations, aerospace medicine, and neuropsychiatry We all have much to learn and a continuing responsibility to "keep 'em flyin'".

I appreciate our neuropsychiatric pioneers and ancestors who fought the early battles and had the courage to go beyond their traditional training and venture into this frontier The foundation they have provided is solid and their heritage of enthusiasm, coupled with hard work, has been infectious and is perhaps their best gift to us for the future. To the Aerospace Medical Panel, I offer my gratitude, particularly for their foresight in advocating this course Finally, to the faculty members whose hard work in aerospace medicine has brought them well-deserved recognition, I offer my sincere gratitude for their willingness to share their knowledge and make the course the success that it was. To all the participants and readers of this document, I wish you continued success with the hope that this course may make a contribution to your work.

John C Patterson, Ph D.
Course Director

Préface

Ce cours a ete propose dans le cadre du programme du Groupe Consultatif pour la Recherche et les Realisations Aerospatiales de l'OTAN (AGARD) Il a été donné à la Base Aéronavale de Pensacola, Floride, USA du 18 au 20 octobre 1989, au Centre de Médecine Aerospatiale de Bruxelles, Belgique du 25 au 27 octobre 1989 et à l'Hôpital de l'Armee de l'Air d'Ankara, Turquie du 30 octobre au 1er novembre 1989

L'idée du cours trouve son origine dans des discussions qui ont eu lieu entre les membres du Panel AGARD de Medecine Aérospatiale. En particulier, le Colonel James R. Hickmann, Jr, Chief, Clinical Sciences Division, USAF School of Aerospace Medicine, a été l'un des instigateurs du projet et un partisan convaincu de nos efforts

Le corps enseignant a été choisi parmi les experts mondiaux de la neuropsychiatrie. Chaque membre de l'equipe a apporte une compétence et une expérience uniques. De la même façon, chaque membre a souscrit à des principes communs dérivés de l expérience opérationnelle et de conversations tenues avec les aviateurs Chaque membre a reconnu que l'amelioration des performances, la promotion de la santé et la médecine preventive étaient la principale contribution de la neuropsychiatrie a la médecine aérospatiale.

En outre, chaque membre du corps enseignant a preconisé la nécessite d'un contrôle clinique meticuleux ou une attention particulière serait accordée aux aspects uniques du métier d'aviateur en ce qui concerne les performances exigees au niveau du système nerveux central Enfin, le groupe s'est déclaré conscient des points forts et des points faibles des personnes impliquées dans les opérations aerospatiales et a reconnu que, bien que l'échec soit toujours possible, il est rare et peut être évite ou surmonté dans bien des cas

Le cours a été caractérisé par une assistance nombreuse, un soutien logistique remarquable dans chacun des pays hôtes et un accueil très favorable de la part des participants

La monographie de ce cours comprend les présentations données par les membres du corps enseignant, ainsi que certaines informations fournies par les participants Il est clair que la communauté aeromedicale internationale a fait faire un pas en avant grâce aux efforts et au soutien du Panel AGARD de Médecine Aérospatiale (AMP), des membres du corps enseignant et des participants qui, chacun pour ce qui le concerne, a beaucoup contribué au succés du cours.

Les opérations aérospatiales et la médecine aerospatiale sont liées depuis longtemps, malgré la confusion qui a pu caracteriser leurs rapports de temps à autre Il reste beaucoup à faire pour le trio opérations aérospatiales, médecine aérospatiale, neuropsychiatrie Nous avons tous beaucoup à apprendre et nous aurons surtout une responsabilité permanente en ce qui concerne l'aptitude au vol des équipages.

J'ai beaucoup d'estime pour nos ancêtres les pionniers de la neuropsychiatrie qui ont mene les premiers combats et qui ont eu le courage d'outrepasser les limites de la formation classique et d'explorer ces terres nouvelles Ils nous ont fourni des bases solides Leur enthousiasme et leur assiduité, qui sont très communicatifs, sont peut-être les elements les plus importants de l'heritage qu'ils nous laissent

Je tiens à remercier le Panel AGARD de Medecine Aérospatiale, en particulier pour avoir eu la prescience de proposer ce cours Je tiens enfin à exprimer mes sincères remerciements aux membres du corps enseignant dont le travail consciencieux dans le domaine de la médecine aérospatiale leur a valu une reconnaissance bien méritée.

Ils ont bien voulu partager leurs idées avec les participants, assurant ainsi le succes indiscutable du cours. Je souhaite a tous les participants et à tous les lecteurs de ce document la réussite dans leur entreprise, en esperant que ce cours pourra y contribuer

John C Patterson, Ph D
Directeur du Cours

Aerospace Medical Panel Officers

Chairman: Mr C Bates, Jr
Director
Human Engineering Division
AAMRL/HE
Wright-Patterson AFB
Ohio 45433-6573
United States

Deputy Chairman: Prof G Santucci
Sous-Directeur de Recherche
de l'E.A.S.S.A.A. et du
C.E.R.M.A.
Base d'Essais en Vol
91228 Brétigny/Orge Cedex
France

LIST OF CONTRIBUTORS

Short Course Members

Dr John C Patterson (Director of the Course)
Chief, Aerospace Clinical Psychology Function
USAFSAM/NGN
Brooks AFB, Tx 78235-5301
United States

Méd. en Chef J.R. Galle-Tessonneau
Centre Médical des Psychologie Clinique
de l'Armée de l'Air
26, Boulevard Victor
00460 Armées
France

Dr D R Jones, M D
1 Clermont Ct
San Antonio, Tx 78218
United States

Dr G Myhre
Institute of Aviation Medicine
P.O. Box 14, Blindern
0313 Oslo 3
Norway

Dr M S. Katchen, USAF, MC
Chief, Neurology Function
USAFSAM/NGN
Brooks AFB, Tx 78235-5301
United States

Dr J Picano, Ph.D
Psychology Services
Letterman Army Med Center
Presidio San Francisco
CA, 94129-6700
United States

PANEL EXECUTIVE

Major B Lyle, CAF

Mail from Europe:
AGARD—OTAN
Attn: AMP Executive
7, rue Ancelle
F-92200 Neuilly-sur-Seine
France

Mail from US and Canada:
AGARD—NATO
Attn. AMP Executive
APO AE-09777

Tel 33 (1) 47 38 57 60
Telex 610176F
Telefax 33 (1) 47 38 57 99

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Introduction and History

by

John C. Patterson, Ph D
Chief, Aerospace Clinical Psychologist
USAF School of Aerospace Medicine
United States

This course was developed with the interest and help of many prominent aerospace medicine experts This course is the specific result of efforts made by my colleague and friend, Dr Dick Hickman, who has long been a supporter of neuropsychiatry in aviation medicine, though he is an internist, cardiologist, flight surgeon, and epidemiologist Thus, my fellow faculty members and I are deeply indebted to him for his encouragement and leadership in making this course a reality

In this introduction, I will briefly review the history and relevant concepts of neuropsychiatric evaluation, and consultation in aerospace medicine I will discuss the practical and unique contributions of this specialty area to aerospace operations and this introduction will provide an overview and perspective for the rest of the presentations

One of the many difficulties we face in aerospace medicine is the relationship of man to machines and to the aerospace environment Specifically, neuropsychiatric experts and flight surgeons alike are concerned with man's brain and the central nervous system as it acts on and responds to the aviation environment. It is at this crossroad where neuropsychiatry, flight surgeons, and aviators meet and share common goals and problems The faculty will discuss these common goals and problems and ways flight medicine can better use neuropsychiatric consultants and will offer ways flight surgeons can improve neuropsychiatric services and outcomes for aviators, but first we should briefly review the original work in this area

The history of neuropsychiatric involvement in aviation goes back to the very early days of selection for flying training Psychologists and psychiatrists, in particular, were called in to improve the selection process over the "in vivo" selection procedures first used in early aviation Indeed, interviews and psychological tests were developed and showed some promise. Some countries continued this research and now use highly sophisticated neuropsychiatric selection procedures Notably, the United States did not complete its research program and currently does not use neuropsychiatric information in selection Since those days, psychiatry, psychology, and neurology have remained important areas of aerospace medicine due to the importance of the brain and central nervous system to flying

While selection was emphasized in some countries, others developed consultation related to issues of the annual flying physical, return to fly after injury or deficit, administrative recommendations such as which airframe to fly and most recently enhancement programs that deal with improved performance in an already healthy population Needless to say, these aeromedical interests are significantly different from the traditional neuropsychiatric areas such as mental disorder, hospitalization, seizure, and severe head trauma. It is important to recall that as with other medical specialties, the aviation environment brings up many issues not seen in standard clinical neuropsychiatric practice and the converse is true there are many conditions seen in standard clinical neuropsychiatric practice which occur only rarely, if at all, among aviators Thus, errors can occur when neuropsychiatry consultants overdiagnose a healthy aviator or underdiagnose an aviator who is clinically within normal limits but who presents an aeromedical risk Thus, as with other medical specialties, it is advantageous for flight surgeons to consult aeromedically trained and experienced neuropsychiatric consultants. Further, flight medicine specialists must be well-trained in aeromedical aspects of neuropsychiatry to produce occupationally relevant and efficient consultations.

Neuropsychiatry shares common aeromedical concerns with flight medicine and operational managers These common concerns include safety, military readiness, mission completion, human high performance, and the desires of the individual Flight safety is the premiere concern among all areas of aviation medicine Flight safety can be jeopardized through a variety of organic and functional difficulties found in various human systems The neuropsychiatric issues of sudden or insidious incapacitation, performance decrement, and loss of motivation will be covered in this course Military readiness and mission completion also have neuropsychiatric implications for military aviation; in some civilian aerospace operations, readiness and mission completion may be of equal importance to flight safety factors High performance flying most often found in military aviation presents neuropsychiatric implications in areas such as G-loss of consciousness, fatigue, hypoxia, and others Finally, neuropsychiatry can provide information about the individual needs and desires of the aviator which involves evaluating initial motivation sufficient to complete training and then the evaluation of flying motivation as it may change across the life span Thus, neuropsychiatry can provide information in each of these areas of aerospace medicine.

Each medical specialty within aerospace medicine offers unique contributions. In neuropsychiatry, we are most often concerned with the interdependent relationships between emotional/personality functioning and the cognitive/intellectual performance as these areas apply to flying These areas of the central nervous system require specific and careful evaluation and will be discussed in the program Neuropsychiatry also seeks to protect the flying organization as well as the individual aviator against diseases and dysfunctions of the nervous systems, that is to say neuropsychiatry consultants can identify disorders at the time of selection or, in rated aircrew, to provide early warning about those disorders most relevant to aviation operations that might cause sudden incapacitation (e.g., anxiety, seizure), insidious performance decrements and motivational problems Finally, neuropsychiatry as applied to aerospace medicine should hope to prevent disabling

disorders through education and early consultation before disorders require grounding

Thus, this course will cover the important and relevant features of psychiatry, psychology, and neurology as these disciplines relate to the aerospace environment. The course is designed for flight surgeons, as well as consultants in neurology, psychology, and psychiatry It is our hope that flight surgeons completing this course will improve their utilization and supervision of neuropsychiatric referrals and will improve their neuropsychiatric case management skills Secondly, we hope that consultants in psychiatry, psychology, and neurology will improve their understanding of the aviation environment, the requirements of aviators and flight surgeons for neuropsychiatric evaluation and consultation and will improve the relevancy of their knowledge as it applies to aviation

I am delighted to introduce the rest of the faculty to you Each has been a professional resource for me in my work in the aviation community and thus, because I know their work, I have selected them as excellent examples of neuropsychiatric consultants in aviation Each brings a wealth of unique knowledge and experience Dr J R Galle-Tessonneau, psychiatric and flight surgeon, is the Chief of Medicine at the Medical Centre, Psychology Clinic at the Aeromedical Center in Paris, France Dr Galle-Tessonneau's topics are "The Pilot-Flight Surgeon Bond" and "Fear of Flying" Dr David R Jones, psychiatrist and flight surgeon, is the former Chief of the Neuropsychiatry Branch, USAF School of Aerospace Medicine, a long time colleague and friend and now editor of Aviation, Space, and Environmental Medicine Dr Jones will discuss "Psychiatric Diagnoses and Disorders", "Psychiatric Reactions to Medications", "Mishap After Care" and "Personality Disorders" Dr Marc Katchen, neurologist, flight surgeon and research colleague is the former chief of aerospace neurology at the USAF School of Medicine and now is in private neurological practice He will discuss "General and Introductory Issues in Aeromedical Neurology", "Unexplained Loss of Consciousness", "Head Trauma" and "Selected Concerns in Neurological Disease in Aviation Dr Grete Myre, psychologist, and frequent consultant for me, is Chief Psychologist at the Institute of Aviation Medicine in Oslo, Norway She will be discussing "Aviation Psychology in the Operational Setting", "Family and Domestic Problems in the Aviator", and "Mishap Aftercare" Dr Jim Picano, psychologist, is former chief of aviation psychology for the United States Army at Ft Rucker, Al, and a research/clinical colleague He will discuss "Stress as it Relates to Human Performance, Health, and Mishaps in Aviation", "Interview and Psychometric Approaches to Adaptability in Aviation", and "Cognition as it Relates to Pilot Judgment" Finally, I am Dr John Patterson, psychologist and the course director and, as such, I selected the panel members and topics I am the Chief of Aerospace Clinical Psychology at the USAF School of Aerospace Medicine I will be discussing "Psychometric Evaluation of the Aviator", "The Failing Aviator", "Mishap Aftercare" and "Personality Disorders" That completes the course introduction I hope you will find the papers that follow stimulating and useful

The Pilot Flight Surgeon Bond

by

J.R. Galle-Tessonneau
Centre Médical de Psychologie Clinique
de l'Armée de l'Air
26, Boulevard Victor
00400 Armees
France

To become a physician it is necessary to learn medicine and to know diseases But it's also necessary to have some notions about medicine psychology

To become a flight surgeon, it's necessary to know medicine, it's necessary to know aeronautic medicine but it's also necessary to have some notions about pilot psychology and pilot-flight surgeon relationships

Pilots are not ordinary patients; pilots present some particularities about health and diseases, about medicine and physicians

There are few examples of human activities which, like aeronautics, have required such extensive medicalisation, and aeronautic medicine may legitimately seem like one of the most sophisticated and most performing models of occupational medicine. The reasons for this development may be summarized in two major characteristics

The first is associated with the significance of the risks involved. For a long time, these risks have made it impossible to fly Even today, news periodically reminds us of the risk we are exposed to when moving in the air and now in space

The other characteristic is represented by the force of attraction of the conquest of air and space on men and this is despite (or precisely because of) the magnitude of the risk they are faced with.

If aeronautic medicine finds its foundation in the biological and physiological sciences, the role of psychopathology was found there at a very early date In the preface of the first work devoted to aeronautic medicine in 1912, Charles Richet wrote. "The main danger is the psychology itself of the pilot"[1]

This role is still current, whether it be the role it plays in causes of the medical inaptitude of the aircrew or in the predominance of the human factor in air accidents.

However, psychology and aeronautic medicine should not be considered as the only affair of specialists Actually, real specialists are not those researchers or clinicians working in a narrow and restricted space in their necessarily limited field of experience, but those who in contact with concrete realities are faced with multiple and complex facets of daily problems they will have to provide a pluridisciplinary synthesis and assume the responsibility for the flight surgeons

In the psychological cause, our contribution will consist of initiating flight surgeons in theoretical notions and practical attitudes likely to clarify and make understandable phenomena which would otherwise risk appearing unintelligible

Actually, owing to the rigorous medical and professional selection they are subject to, we will find in the aircrew only very few cases of mental diseases that are real in the nosographic sense of the term In contrast we will very often be confronted with the magnitude and psychopathological dimension in adaption disorders

As an introduction, I will stress three specific and important aspects in the psychology of a pilot· his body, his motivation, and his environment.

THE PILOT'S BODY

The body, the object of medical care, is the physiological body, the network of organs and functions whose good functioning is checked by the doctor measuring its patterns during control examinations and aptitude visits. Good health is sometimes defined as "the organ silence", which means that, except for disease, seen as a fault in the organ functioning, the body has nothing to say that could be of interest to the doctor This is often what happens when the pilot, alarmed by a functional disturbance, a new sensation, or an unusual perception, is told that there is no reason for concern and that it does not exist because his complaint cannot be related to any organic lesion needing medical attention.

However, the body is not only the centre for disease, suffering and death, it is also the place for life manifestations, activities, and pleasant or unpleasant sensations, since the pilot's body is certainly engaged in dynamic actions.

Let us imagine being coiled in the tightness of a fighter's cockpit, wrapped in an insulated flying suit, squeezed in straps as fastened to the ejector seat, the head enclosed in a helmet, the nose and mouth covered with a mask, headphones on. "The cockpit is the maternal womb, the pilot is a fetus in its egg.. Above your head, beyond the plexiglass envelope of this closed-in world.. the sky. They feel like supermen, and also like unconcerned children above the world" This excessively lyrical statement from a pilot puts the emphasis on his bodily sensations The contrast between inside and outside the cockpit provides some pleasure Saint-Exupery, pilot and writer, wrote: "The airplane makes my well-being It's the plane that feeds me Nursed by the plane, I feel for it some kind of filial tenderness, some kind of nurse-child tenderness". The fighter pilot is literally at one with the machine which appears as an extension of himself, which is a great pleasure to him. But at what price! You all know the physiological consequences of hypoxia, the changes in atmospheric pressure and the importance of accelerations modifying gravity, the distribution of blood mass and sensory perceptions The wealth and abundance of the body feelings are far removed from the "organ silence" mentioned earlier.

We see, therefore, why the pilot's body is the object of value and an important investment. It is mandatory for the sky-man to feel in good shape for his health is of great concern to the aeronautic and medical services which check him periodically.

To the pilot, physical health is one of the basic components of his professional personality. He needs to be able to control his physical activity, to rely on his perceptions, because it is a matter of his professional identity and, at times, of his very life. To the pilot, good health is what fingers are to the pianist, ears are to the musician, and eyes to the painter, the photographer or the movie maker.

It explains some pilots' attitudes toward the medical doctor, his excessive and dramatized worries regarding symptoms of ailments that will appear to us as meaningless when compared to the rules of medicine, and his tendency to conceal afflictions in an effort to maintain his feeling of good health. We will understand his apprehension before an aptitude examination, his reluctance to show up, and his feeling of triumphant relief, usually hidden behind a cool attitude or a banterly manner, upon his return from the Investigation Center of Aerospace Medicine.

THE PILOT'S SPIRIT

After this observation of the pilot's body, let us now look at his spirit. Long before flight became a human, concrete activity, developed nowadays to a great extent, it existed in human desire and aspirations in the form of myths and legends. In prehistoric times and in antiquity, the sky was seen as the dwelling place for gods and heroes.

In myths, flight appears as a means to escape from terrestrial dangers and constraints, and to get closer to celestial power. A well-known example is Phaeton who demands from his father permission to drive the celestial chariot, but his youth makes him unable to control the team, and Jupiter struck him down in order to avoid a greater catastrophe. One can imagine that the discerning intervention of a mythological flight surgeon could have prevented such tragic results.

Beyond the anecdote, Levi-Strauss tells us that "mythical and scientific thought use the same logic". Such legends, featuring children facing dangers that challenge the limits of their abilities, show that, when the heroes ignore the elders' rule and advice as they are carried away by their desire, they receive capital punishment, downfall and death.

Symptoms called heroic identifications are often found in children and adolescents, they identify with characters which possess superhuman abilities, and are able to overcome dangers. Although the process usually remains limited to familiarity with novels, comic strips or movie heroes, it can enter reality in some cases. In that light, pilots, and now space men, seem to play the role of knights and conquerors of our modern times.

So the aeronautic motivation takes its energy from mental representations based on body enjoyment, a feeling of power and invulnerability, the pleasure to dominate and to destroy, to give and receive death. Numerous guilt feelings are inherent to such fantasies.

If a few pilots easily recognize such ancient origins, most of them only see, in the choice of their profession, some effects of a rational dimension due to existential circumstances. But we know that "he who strongly wants something is always well served by circumstances" (Balzac).

At any rate, the aeronautic motivation to become a fighter pilot is not a simple and unique tendency, or a quality that one has or does not have, we must consider it as a result of an equilibrium and a compromise between different or even opposed tendencies. This should explain why the pilot's motivation is likely to undergo variations, hazards and turmoil.

What constitutes a good motivation and a healthy psychological adjustment? We will distinguish three aspects:

- the first is libidinal: the well-adjusted and motivated pilot feels pleasure in flying, in spite of the dangers and physiological constraints,
- the second is narcissitic self-image of value: the pilot is proud of his activity,
- the third is defensive. On the psychological level, the pilot must be well equipped with a defence mechanism that will protect him against his own anguishing representations, his inner feelings of weakness and inadequacy. He specifically needs to feel protected against fear of death because his profession is a daily challenge with it.

THE PILOT'S ENVIRONMENT

Such a psychological organization does not occur at once. It has to be built up in time. It is not only based on individual capacities, but also relies on a collective organization and on specific factors characterizing the air environment. The pilot's motivation cannot be solely his own pleasure. As an Air Force member, he wishes to be totally accepted by his institution, which is his way to find a socially recognized professional identity. In recognizing the pilot's desires, the institution will contribute to settle and reinforce the necessary protective means and defence mechanism.

After undergoing highly selective recruiting procedures, the pilot-to-be feels aptly chosen, therefore better than average. During his school training, different apprenticeship stages will signify many rituals of initiation; these challenge the motivations and abilities of students who are confronted with the numerous air demands and realities. Because of physiological and sensory stimuli, modifications will take place in the pilot's mental image of his body. He will learn to know his plane, the rules governing his machine, the ground and air discipline. His psyche will undergo a great deal of work as he gains control over himself and the engine. Trainers, and especially flight surgeons, know well the mishaps arising in such a process.

In diverse somatic manifestations-fatigue, air sickness, hypermotivity, in flight, and behaviour modifications an experienced physician will recognize underlying anxiety, and will offer solutions by providing adequate individual counselling or conferences with trained personnel. He may also suggest, eventually, honourable ways to end the flying career; the physician response is the most efficient solution to both the individual psychological well-being (a medical reason is usually more acceptable than a professional incompetency). An early decision being far better than a latter failure.

In an operational wing-command, the physician must know the aerial environment, its organization and functioning system. The first thing the physician will notice is the contrast between the great number of employees who provide support services at the air base, and the small group of pilots who seem to live among themselves and evolve somewhat separately, in a relatively closed world. He will

have to become familiar with a specific technical language He will learn to know the characteristics of the air mission, the necessity of a long preparation at ground level, and the detailed report during the debriefing of everything that happened in flight He will get acquainted with a very structured and thorough organization where each one has a specifically defined role and place In group cohesiveness, team spirit and solidarity are essential elements, but emulation can take the forms of competition and rivalry Promotion possibilities and career development are related to the type of recruitment, but even more to professional competence, operational abilities and good health, all of these being checked regularly The air group's state of mind is, therefore, close to the statement that Joseph Kessel puts in the words of Didier Daurat, the father of airmail "Give us a collective goal, put it almost beyond reach, in an ideal realm, direct all the effort into competition, into endless emulation, and you will transform formless human matter into a quality substance'

And so, within the group, individual characteristics will shape themselves into the demands of a thorough collective organization capable of creating and maintaining an operational efficiency for the whole, and safety for each individual We will easily understand that such a process will not develop without difficulties, any short coming will be perceived in the group as interfering with the common ideal and with the aerial mission's safety.

THE PILOT'S ADAPTATION DIFFICULTIES

It is the physician's responsibility to prevent such difficulties, since they are not easily recognized by the pilot The most obvious and frequent of these is fatigue the sign of good health in one who just challenged all his abilities for the highest level of efficiency, who feels "worn out but great" There is a deceptive kind of fatigue, which could follow the preceding, which does not go away with rest, which will stay with the pilot, as a shooting pain, without any apparent reason; this fatigue means that the pilot can no longer tolerate the stresses of his profession Do not expect much here from objective methods of measurement, they are deceiving, individual variations and subjectivity are of utmost importance

In these states of fatigue, you will soon recognize the underlying anxiety The latter is visible either through behaviour disturbances, somatic complaints, or in some type of preoccupations

Behaviour modifications are obvious awkwardness in flight, frequent piloting errors, impulsive reactions or too passive ones On the ground, fatigue is followed by an attitude of withdrawal, irritability and often insomnia.

We will recognize anxiety in somatic complaints and sensory dysfunctions which show through painful functional manifestations

In some cases, the psychic expressions of the problem will lead you to preoccupations which reflect a real fear of flight, the latter can be summarized as a feeling of insecurity, expectation or foreboding of a forthcoming danger, and a very careful or exaggerated attitude towards external or internal perceptions

Such disturbances can remain transitory and limited to specific situations They can spread progressively and take on a more obsessive dimension, invading the whole nocturnal and day time psyche Some manifestations are far more obvious and brutal for instance, the eruption of an indisposition during flight Whatever the cause of such discomfort and etiology, the psychopathological aspect must always be considered, because it affects, usually, the pilot's professional future

In the consequence of an air accident, it is not sufficient to evaluate the immediate emotional reactions We must also be concerned with the latter reactions exhibited in the injured pilot and his peers

On the physiological as well as psychological levels, we can see that the main characteristic and uniqueness of aeronautic medicine is the strong and peculiar relation existing between the mental and physical health, on one hand, and the professional activity on the other hand Not only diseases are disruptive of the professional activity, but professional activity also influences the pilot's health As a matter of fact, lack of adjustment manifests itself as a disease with aetio-pathogenetic symptoms directly related to the job performance

One must also remember that minor health disorders which would have no effect in any ordinary profession might result in a physical or psychological inability for the pilot to fly, because of the high risks involved

One must also remember that minor health disorders which would have no effect in any ordinary profession might result in a physical inability for the pilot to fly, because of the high risks involved

LIFE EVENTS

Certain existential events can take on a particular colour and will sometimes brutally reveal the role played by the emotional life in the professional adjustment and motivation Modifications within the group (professional transfer, mission change, an engine type change, a promotion) will bring into light an underlying anxiety which will supersede the usual defence mechanisms A death, an accident, a trivial somatic affection, will damage the necessary feeling of invulnerability which allows the pilot to face challenges and risks Marriage, paternity and accidents in emotional and sexual life can modify and displace the personal investment that was placed in the air profession

The loss of motivation is often blamed for the psychopathological dimension of some disorders In fact, the simple loss of motivation does not represent an overwhelming psychological problem. It is always possible to change one's job without too much pain and trauma The problem lies in the conflicting desires, in a persistent desire to fly as opposed to a lessened capacity for it, creating suffering and symptoms.

We usually say that such patients do not know what they want. They need our help because they no longer find the energy to deal with their contradictory desires The problems cannot be limited to a process of elimination It is more a matter of helping to resolve the conflict, or at least of bringing it to a level which maintains the patient's health, yet allows him to meet the demands of his profession

THE FLIGHT SURGEON'S DIFFICULTIES

But a knowledge of pilots, of their specific pathology and life environment will not be enough for us to be good flight surgeons We will also need to come to a level of knowledge of our own motivations, and of our medical personality. As a Chinese proverb says "Science is knowledge of others, intelligence is knowledge of one's self"

We have built our identity as physicians and checked out our therapeutic motivations in a particular and aseptic environment the hospital and the university, a world organized around disease and patients Since the patient needs to receive care, the physician's need to give medical attention can be satisfied and does not have to be questioned In the air environment, our therapeutic desire will be confronted to other desires that we will not be allowed to ignore In that sense, it is probably easier to be a hospital physician than an air base physician

We will soon perceive, sometimes with frustration, that our good will and our professional consciousness will encounter difficulties First we will have to deal with people who will inflict on us the insolence of their good health, we will be reduced to doing routine exams, and teaching them to guard against disease, and maintaining personal hygiene We will not easily resolve our secret fantasies to wish for them wounds and diseases that would finally allow us to demonstrate our medical abilities We will feel frustrated In front of an anomaly or symptom our jubilated interest in a well-formulated diagnosis will be received with reserve and distrust We will probably not receive much recognition for the prospect of a more thorough examination that could result in a statement of inaptitude The pleasure we will take in our performance may be disrupted by the bitterness of a patient who is reluctant and anxious at the prospect of being declared inapt

In such an eventuality, the flight surgeon may be disappointed, displeased and angry Perhaps he becomes suspicious and thinks that the pilot conceals something and does not say all the truth about his health

So he may increase investigations in a persecutive manner

As a feed-back the pilot may feel threatened by the physician's attitude So the relationship becomes aggressive and threatened for the professional identity of both protagonists

In that case it's frequent that each one thinks the other was first to aggress him Each one says "It is the other who first began!" and he develops a defensive attitude and a manifestation of power

So he accents the situation!

By making such pessimistic suggestions, I should wish to bring your attention to the necessity, for us physicians, to question our own attitudes, in the hope that we will accomplish the means to reach a more satisfying and efficient performance

As the saying goes "The most important and the most neglected conversation is the dialogue with oneself" If our good-will and our science are not enough, we must turn back the uncontrolled impulse of our therapeutic desires, and hold a suspicious look on the flames of a blazing professional ideal In manifesting an exclusive interest for the weakness and the disease and the pilots, we give them an image of themselves with which they cannot easily identify A physician animated with an excessive therapeutic desire can be perceived as a threat against the necessary feeling of invulnerability, and may inflict a narcissistic wound against which the pilot must legitimately defend himself in order to preserve his identity

We first must control our imaginary wish to turn pilots into patients, if we want to give them the real medical care needed in reality If we want to have access to their weaknesses and difficulties, we first have to show interest in what makes their strength in what gives them their worth and the rules and values ordering their professional activity Our medical universe is taken for granted in hospitals, we must conquer it in the air base, we have to be adopted by the air environment

The flight surgeon must adapt his therapeutic desire and his professional personality to the air environment and to pilot psychology

To prepare our young flight surgeons in France we organize small group sessions about pilot case stories Here, for instance is one anecdote told by one of the group

During a flight training course, he was performing a spin flight exercise with an old confirmed pilot They were exchanging feelings about the flight and the pilot wondered about the way the young physician endured the flight After a while the pilot confided himself he suffered from a hernia and sometimes was disturbed in flight But he had never talked about it to any doctor before because he was afraid of a flight inaptitude At these words the young doctor became anxious and asked the pilot to fly safer and more quietly

Back at the base, they talked together about the hernia and the pilot accepted the idea of consulting a surgeon What this old pilot felt unable to confess to confirmed doctors during many medical checks he felt able to confess to a young one with whom he'd been flying

In that case, what appears to be efficient for the pilot's health was not the doctor's science and experience, but his youth and the sharing of an activity

Some years earlier, during a similar flight training course, a confirmed pilot and a young doctor took off together It was the doctor's first flight They never came back They crashed

The official conclusion of the enquiry commission mentioned 'pilot having carried out operations that were not forecast on flight orders probably with a didactic aim for the doctor'

What might have been hidden behind this official statement made us inquisitive, and we asked ourselves the following questions

- what sort of didactic aim?
- was the pilot showing off to impress the young doctor who was flying with him?
- did he have a bone to pick with doctors and with medicine?
- what was the atmosphere like in the cockpit?

From a confidence from a fellow pilot, a very close friend of the one who crashed, we managed to figure out the circumstances and to formulate assumptions that, if they are only assumptions, are not far from the truth

This pilot, aged thirty, became a father a few months earlier The child had health problems, about which doctors did not agree with each other This pilot was particularly irritated with doctors regarding his child This worry had consequences on his professional adaptation that had worried the flight surgeon

On the very day of the flight, the flight surgeon had seen the pilot and the next day, the pilot was to go through medical checking at the investigation center of aeronautic medicine

About the young doctor, we know from his friends that he was a lively and easily provocative young man

They went to fly together, and neve came back

What really happened? Nobody will ever know One can imagine a relationship based on mental challenge and demonstration of power One can also imagine that it was not to be wished that, under these circumstances, that pilot flew on that day with that doctor

THE MEDICAL MOTIVATION

But what are the physician's expectations? What are the physician's motivations?

Like the pilot profession, the profession of the physician requires a strong motivation This motivation is often very archaic and relies on powerful pulsions as in aeronautics The thing is to challenge natural rules, to transgress them by mastering a complex technique and to have a kind of omnipotence upon life disease and death

In medicine, like in aeronautics, both inexperience and too much self confidence are dangerous Doubt and humility must always cool down the doctors hurry to consider themselves omnipotent Desire of omnipotence may sometimes lead a doctor to impose his authority and his power on the patient, sometimes in a sadistic way

A doctor may and must look at and palpate naked bodies, puncture and incise the skin, flow blood, explore outside and inside the body as well as its apertures

A doctor may and must collect confidences, secrets and weaknesses of suffering persons

This power is enormous! It's a source of pleasure and sometimes a source of anguish as well It also gives an important narcissitic value The doctor's power upon his patient is often compared to the mother's one upon her child

But the pilot who needs to feel strong and powerful is reluctant to position himself as depending on the doctor

PILOT AND FLIGHT SURGEON = CONVERGENT POSSIBILITIES

As a matter of fact, he is not ill, he is in good health and this good health deprives the doctor from his power

What makes the profession of flight surgeon interesting is not the pilot's disease, his body being in good health What makes the profession interesting are the risks of the profession of the pilot

Similarly it's the risk of crash that gives aeronautics its prestige But if he is not ill, it is necessary for the pilot to feel protected and secured in order to practise his profession

If the flight surgeon is able to answer this demand of protection and security without competing with the pilot on the grounds of power, he will be a good flight surgeon.

To achieve that a certain knowledge and some identification to the pilot are certainly necessary This is the reason why in most armed forces all over the world, special flight surgeon courses have been created.

But if the flight surgeon has to be close to the pilot, to know well his environment, and his psychology, he will have to ensure that a too powerful attraction would not lead him into such a strong identification with certain military and aeronautic aspects, that he would lose his medical identity Being well integrated into the air environment should not make him oblivious to preserving what inspired him to become a physician in the first place ("Officer, give back to Ceasar what belongs to Ceasar") But as physicians, we must keep to ourselves what does not belong to Ceasar, if we are to respect the deontological rules of our profession We must remember that we are a depository for a suffering person's intimate secrets There will be ethical problems, for instance, how far should a medical action go should it address only the pilot's therapeutic needs, or also the necessity for this man to perform aerial operations better? By the way, one may wonder about this strange alliance and cohabitation between physicians and warriors, between those who are to inflict death and those who are to prevent it, between those whose function is to destroy and those who must preserve and repair Some would quickly drape themselves in the dignity of their professional ego's ideal.

Looking into this closer, we will notice that the medical vocation and the aeronautic vocation tend to realize, in the adult stage, very ancient infantile fascinations, we will notice that both take roots in desires of almighty power and immortality, such desires lead them to face death. And, as physicians and soldiers confront it from different viewpoints finally is not death their common enemy?

Introduction to Aerospace Neurology

by

Marc S. Katchen, M D
USAF School of Aerospace Medicine
United States

The bottom line in aerospace neurology is the evaluation for the

(1) potential of sudden incapacitation, e g post traumatic seizures

(2) possibility of a sudden neurological deficit which would prevent the aircrew member from performing their job and thereby affect mission completion, flight or personal safety, e g neurologic deficits with headaches

(3) risk of any neurologic or neuropsychologic deficit which would persist after the initial injury, e g post traumatic syndrome

What I would like to achieve in these lectures is to present reasonable criteria for making an aeromedical decision in specific neurological syndromes, establish some work up guidelines, identify areas of controversy and raise the aeromedical issues involved The areas of controversy arise from the unique position of the aerospace physician It is often necessary to make a diagnosis on a disease that by definition is recurrent after only the first event The nature of our work does not allow us to follow the natural course of an illness if the risks are too great This task requires long term follow up studies with careful follow up Such studies can show an abnormality which is found to reflect serious illness in the usual clinical population but does not mean the same thing in the healthy pilot population Such epidemiologic tests are underway at USAFSAM and have shown items such as right bundle branch block not to reflect serious illness in the flyer

Aerospace neurology is involved in selection and retention standards The selection process can be divided into two phases The first is a passive phase where diseases syndromes, and significant deficits are screened for The selective process would want to wean out those applicants who have a high potential for seizures, recurrent incapacitating headaches or the possibility of a disabling illness, such as multiple sclerosis The second phase is the newest consideration, that is an active phase where a crewmember is selected specifically for a job, based on their meeting specific standards and criteria set through scientific evaluation and research into each individual position, for a given weapons system or job The active process has not been well defined yet It requires a step by step evaluation of the traits and skills of each individual job This active selection process takes us into the "fringe" areas of aerospace neurology which is discussed later

We should all remember that the reason for the aeromedical service existence came from the need in World War I when more pilots were lost because of poor selection than by hostile actions The take home lesson from history is to match the man or woman to the machine and mission To undertake this task completely, the selection board must know the requirements of the aircraft and be given appropriate medical and behavioral standards that are required for both the vehicle and the mission These factors are no less important than the physiognomy or physical standards and a great deal more complicated We are still learning these lessons day by day when we read of aircraft accidents because of the lack of management skills by the aircrew members or the inability to tolerate the necessary G-forces because the pilot was not appropriately trained A more subtle area is the ability for the aircrew member to have quick and accurate information processing in a multi-modality environment

In the area of retention standards, the problems are just as complex We are faced with a rated pilot who has had an initial neurologic event, which may or may not be the forme fruste of aeromedically significant disease Although many aeromedically significant illnesses are considered clinically benign conditions, they have to be considered in the flying environment It is the role of the aeromedical community to identify areas of aeromedically significant illness based on experience, knowledge of the mission and the known literature The risk of continuing to fly this resource versus the risk of an impairment to flight safety, mission completion or personal safety is an ongoing problem

In the field of aerospace neurology, the question can then be raised whether there is historical evidence that specific illnesses that are considered clinically benign have caused Class A, B or C accidents in the past or affected mission completion This question was reviewed by Colonel Russell Raymond in 1973 in the August, 1973 issue of Aerospace Medicine on causes of sudden incapacitation in the United States Air Force between 1966 and 1971 He found 8 out of 36 cases of loss of consciousness were secondary to seizures and that seizures were the most common cause for loss of consciousness In reviewing these cases, Col Raymond found 7 out of 8 of the seizure cases had normal screening EEGs on file Since these were all witnessed seizures, one can only speculate on the number of unexplained Class A mishaps during that time or since that may be due to seizures of unknown etiology Col Raymond again reviewed the literature between 1970 and 1980 and found 4 out of 146 cases of loss of consciousness identified as seizures in flight In 1989, I participated in a review of the causes of sudden incapacitation from 1978—1987, which has not yet been published. Maj Tim McCormick was the main investigator along with Lt Col Terry Lyons This study looked at total flying hours by multi-placed crews and single seat aircraft separately When looking at medical causes of inflight loss of consciousness in Class C accidents, disorders of the nervous system were the most numerous with 7 seizures and 2 neoplasms Only two cardiovascular causes were identified, one myocardial infarction and one case of Atrial fibrillation When in-flight incapacitation, without loss of consciousness was reviewed during that same period, there was only one case of CNS disease, three cardiovascular and four gastro-intestinal cases. Therefore, in cases where aircrew members

could be observed, neurological causes were the major medical cause of incapacitation Again one might be tempted to extrapulate the potential for neurological causes of Class A accidents based on the flying hours in this study This certainly needs to be done

The concept of "aeromedically significant disease" needs to be explained. It is sometimes a point of contention between civilian "medical authorities", the aircrew member and the aeromedical community Many times the civilian authorities which are often in a university center, does not understand the aeromedical consequence of what is to them a minor problem Let me present two case histories First, is a 27 year old pilot who experienced three episodes of unexplained loss of consciousness One was witnessed clonic movements on one side of his body, followed by confusion and tiredness The aeromedical opinion was that these were seizures and incapatible with further flying duties The pilot was evaluated at two prestigious epilepsy centers with testing performed including prolonged EEGs He was told he did not have seizures but "spells" In their final report they wrote that our pilot could not be given the diagnosis of seizure disorder and he might be able to fly multi-man craft, but suggested he not drive When speaking with the physicians at the epilepsy center, they said that the pilot was such a likeable person and he had asked them specifically not to write the word seizure on his chart They acquiesced thinking we would ground him anyway As you might imagine, this sidestepping of the hard question created new problems Next is a 30 year old pilot who experienced the sudden loss of vision in his right homonymous field followed by a throbbing headache The total event lasted less than one hour and the headache was not incapacitating This pilot presented letters from two neurologists stating that he did not have migraines, because by definition migraines is a recurrent disease They ignored the question of flight safety, especially formation flying, in a subject who loses an entire field But the point I would like to bring out is the dilemma of predicting future developments when faced with the first unexplained event The difficulty in predicting from one event comes from the shortcomings found in civilian studies which will be discussed later on

THE SCOPE OF AEROSPACE NEUROLOGY

Aerospace neurology should be considered a part of a multi-disciplinary approach in aircrew evaluations It addresses many of the standard neurological problems including headaches, syncope, chronic pain, vertigo, sleep disorders and head trauma among others. In addition it searches for forme frustes of aeromedically significant diseases It is also involved in many fringe areas such as subtle effects of head trauma, information processing, laterality, cognitive evoked responses, spatial disorientation and neuroepidemiology These "fringe areas" are really the areas of research, which will help us greatly in the area of active selection discussed above

Now that I have stated the case of aerospace neurology based on historical precedent and modern need, the next step is to suggest how to go about evaluating and researching the problems before us. The focus then is on research There are two ways to gain information from research One is to perform your own and the other is to interpret the work of others and apply it to your own Clinical trials under in-flight or "line" conditions are not plentiful Large controlled studies using pilot or other aircrew controls are even less available That leaves us to review the non-aerospace literature and try and apply it to the flying environment This then raises the differences one finds in adapting clinical studies found in the field to aeromedical decision These include

- Populations studies
- Age of the populations studied
- Sex
- Controls
- End Points
- Severity of Illness

In general the populations studied in clinical research are beyond the usual pilot crew member ages In addition they rarely include individuals that have been prescreened physically and tested as the flying population Therefore extrapolating results from civilian trials is not always applicable The increasing number of female crew members has increased our need to understand all the unique circumstances that must be anticipated in this relatively new part of the aerospace population Controls for studies are intrinsic to any well run study Because of the above problems it becomes essential that controls be drawn from within the aerospace community matching the test subjects as closely as possible for job, rank, flying hours and even command in addition to the usual variables The end points of most civilian literature are usually morbidity or mortality In the aeromedical research we are always searching for subclinical disease or predictive factors and do not have the luxury of following the natural history of an illness once it proves itself aeromedically significant and the crew member grounded This also goes for the severity of illness We search for the forme fruste of disease and the severity is judged with respect to the aerospace environment Because of these reasons "in house" research is required The researchers must be familiar with the weapon frames, missions and the human factors involved if they are to identify problems and provide appropriate support Long term prospective studies are essential to distinguish aeromedically significant disease

The future of aerospace neurology lies in applying these principles in our research In addition, the "fringe areas" represent the avenues for research into the 21st century

I always like to leave some practical hints with my lectures In the next two slides I have what I call the Golden Rules for the flight surgeon and the rules of thumb Following these rules allows the flight surgeon to decide if a problem is grounding without knowing the diagnosis and emphasizes proper but cautious work ups The latter will also be talked about in each of the separate lectures

Rules of Thumb

(1) If it happens suddenly, is incapacitating and occurs unpredictably — it's grounding

(2) If it progresses at an unpredictable rate — it's grounding

(3) If it doesn't have a name but negatively affects flight safety and mission completeness — it's grounding

You can always work up the subject and prove them ready to return to the cockpit but these broad guidelines help with the initial evaluation and decision making

Golden Rules

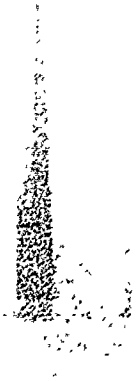
(1) Never speculate or play academic on a crewmember's chart Practice good medicine but don't speculate on long differential diagnosis for its own sake

(2) Always obtain first hand information If it involves head injury get written statements which become part of the permanent record. Neuro-imaging, EEGs etc. are a must Reports several years later may not give enough information or may be lost.

Standard Neurological Problems:
- Headaches
- Syncope
- Chronic pain syndromes
- Vertigo
- Sleep disorders
- Head trauma

"Fringe Areas"
- Circadian rhythm disturbances
- Neuro-behavioral effects of head trauma
- Information processing
- Laterality and decision making
- Cognitive-evoked potentials
- Cognitive enhancement
- Spatial disorientation
- Neuroepidemiology

Points of Contention in Civilian vs. Military Research
- Population studied
- Ages studied
- Sex
- Controls
- End points
- Severity of disease



Aviation Psychology in the Operational Setting

by

Grete Myhre, PhD
Senior Psychologist
Institute of Aviation Medicine
P.O. Box 14
0313 Oslo 3
Norway

Being an aviation psychologist in a small airforce has its advantages, since one has to cover a wide spectrum of tasks compared to the aviation psychologist in a large airforce who has to specialize in one or two fields

The main tasks of an aviation psychologist are

(a) Teaching flying personnel aviation psychology

(b) Act as a consultant to the aviators on personal matters

(c) Perform surveys on the flying personnel's social and working conditions

(d) Assist the flight surgeons on medical boards

(e) Act as a member on aviation accident boards where human factors are involved

(f) Act as a consultant in an operational setting

In large airforces these tasks have to be performed by different psychologists. This has its advantages since one then only gets acquainted with part of the aviator group in a special setting or under special circumstances, instead of getting to know the pilots in many different conditions

It is imperative that the flying personnel have confidence in the psychologist That way one gets information about problems while there are still possibilities to correct them

That part of the job is imperative in a flight safety connection

(a) *Teaching flying personnel psychology*
Statistics from aviation accident investigation boards all over the world imply that human factor limitations cause close to 75% of all aviation accidents and incidents I feel that by lecturing the aviators on perception and perceptual systems and what afflicts them the aviator becomes aware of how his/her systems work, and what precautions to take

Thus the aviator also gets to know how his attitudes influence his perception The effects of learning, overlearning and overstimulation in critical situations have to be demonstrated From the subject of overstimulation there is a logical path to stress and stress reactions It is extremely important for the aviator to be familiar with his own stress reactions and the situations that cause them

Fatigue is another important subject in aviation psychology From studies on the effects of fatigue in a cockpit setting one has learned that fatigue leads to delayed motoric responses and more automatic reactions, instead of carefully considered actions Further, tired subjects are more willing to accept lower standards of performance, in addition they are more forgetful when it comes to checking instruments out of the immediate visual range.

The aviators have a thorough knowledge of their aircraft, its construction, modes of functioning, and strategic operations, to mention some of the subjects they are briefed on through their education and everyday work, while knowledge about their own stress reactions are scarce

The key to effective stress management lies within the person's own ability to identify the problem and thus be able to control the effects of stress

After lectures which include information about initial signs and symptoms of stress that may vary from depression, anxiety and fatigue, followed by physical symptoms of nausea, headaches and gastrointestinal upset, pilots have reported that they have been able to identify their own stress reactions at an earlier stage They feel that they have developed coping mechanisms that did not exist before

Much of the aviators working environment consists of team work, cramped quarters and being short of time It is imperative that people working under such conditions are also able to recognize stress symptoms in their colleagues. This may prevent development of inter-human related problems One is usually more overbearing with other people's poor performance if one knows it is caused by stress. One may also be more alert that the other guy may fail and thus be more prepared to take over Signs to look for in this situation are rigid thinking, decreased problem solving abilities, reduced stimuli processing and angry outbursts Normal sleep pattern, what distorts it and how it is affected are also given much attention in the lectures Knowledge of this aspect has also influenced the programming of duty hours in the airforce

The feed-back one gets after these lectures is that the aviators really realize that the cures to stress lie within themselves and that the first step on the road to accident prevention and recovery is that each pilot has to be responsible for his own well being One also experienced an openmindedness that did not exist prior to this program

It is the psychologist's responsibility to know these people as persons Therefore one should visit the different squadrons, take part in missions, survival courses and dinghy drills whenever it is convenient This will prepare the ground for an open dialogue between the aviator and the psychologist

(b) *Act as a consultant to the aviators on personal matters*
Military pilots represent a rigorously selected group both physically and psychologically This selection is procedures based on the recognition of the fact that some individuals are better suited for some tasks than others and that there are more people who want to do these tasks than required. To some pilots this selection procedure and the fact that they are accepted for undergraduate pilot training make them believe they are invulnerable for ever

Once selected as a superman makes them believe they are able to handle all crises situations they may ever face The realization that military pilots also are vulnerable and also have limitations in critical situations comes as a shock to some of them

It is important to be at hand for questions which the pilots do not like to ask the flight urgeon for fear that they may lose their licence If in doubt that the problem may influence the pilot's performance one should inform the pilot about the doubts before informing anybody else about the matter

Problems that most likely occur during consultations are related to jealousy, marital problems, financial obligations and sleep problems

Up till today less than 10% of such questions have been reported to the aviator's superior The rest of the problems the aviators and the psychologist should be able to sort out together This confidence is of great value and it saves the airforce several sick leaves every year and in addition simplifies the flight safety work

Ten years ago it was not considered appropriate for an aviator to approach a psychologist with personal problems Today this fear of being seen consulting the psychologist has completely disappeared. It has even become popular for pilots to graduate from war college as a major in psychology! This would have been unheard of just some years ago

(c) *Perform surveys on the flying personnel's social and working conditions*
Working as a personal counsellor to the aviators one should also be interested in mapping several aspects of both the social and the working conditions of a squadron Several surveys have been performed in collaboration with physiologists and nutrition advisers in order to look at job satisfaction, stress parameters, and the effects of physical exercise and diets

The purpose of these surveys is manifold *Firstly* The results make it possible to reveal hidden problems and do something about them *Secondly*, the aviators get information about their conditions, instructions for their personal physical training program and diet information, how to obtain better results and how to prevent sports injuries when exercising *Thirdly* the aviators get a feeling that somebody cares about their working conditions and how they are doing in the system

This may act as a gateway to mutual understanding and trust between the aviators and the medical and psychological professions The more information you have about a man, his work and his surroundings, the better service you are able to offer

(d) *Assist the flight surgeons on medical appeal boards*
Whenever a military pilot loses his licence, temporarily or permanently, he has to meet a medical appeal board If the reasons for altering the licence are due to psychological matters there is always a psychologist on the board. The psychologist is a good judge of the pilot's mental development from the time of selection and up to the day of the board's evaluation In Norway all pilots have been psychologically tested before entering undergraduate pilot training The psychologist who has had close contact with the pilot and the squadron in question, should therefore be able to make a fair evaluation of the pilot's total life conditions This sort of information usually turns out to be a valuable supplement to the flight surgeons' physical examination

(e) *The psychologist's performance in connection with aviation accidents*
The psychologists have at least four tasks in connection with aircraft accidents

1) Immediate, on the scene psychological consultations to reduce or eliminate long term psychological and physical symptoms
2) Analyse human factor accident data
3) Research on human factor aspects of flight safety
4) Contribute to the accident investigation

Usually the pilots and the squadron in question want the presence of the aviation psychologist after an accident, as does the flight surgeon who at that time is occupied on the accident investigation board and who is usually happy to leave the aftercare of the persons involved to somebody else

When arriving at a squadron right after an accident has taken place, one is usually briefed by the squadron leader about the accident If the accident was non fatal the psychologist generally starts the session by talking to the pilot and the crew involved It is important that they put words to their immediate feelings and thoughts related to the accident. It is underlined that information given under these circumstances will not be revealed to the accident investigation board.

After the initial conversation in which thoughts and feelings originated in the accident have been revealed, the pilot and the crew are subjected to a short stress management and burn out prevention program

It has proved very useful to brief on common feelings and reactions to disasters What immediate reactions and delayed reactions to expect. In order to get flying personnel back to flying status it is important that they are familiarized with emotions they most likely will experience in the aftermath period They are encouraged to talk openly about these reactions and share them with others instead of keeping them to themselves in fear of losing their licence. This openmindedness also simplifies inter-human relations on the squadron after the mishap Previous experience has shown that pilots who have been involved in accidents need a long time to build up natural relationships with fellow aviators again

I have received feedback from pilots and crews informing me that stress reactions have more easily

been accepted after they have been prepared for them!

Pilots should also be informed that in the immediate future after an accident they ought to stick to a conservative flight program. Even if they have no identifiable serious emotional reactions to the accident, it takes time to build up the old confidence and self esteem again. These pilots are also likely to experience a narrowed attention span and thus more prone to making mistakes. They are also likely to experience gloom and depression which may reduce their alertness and responsiveness in a critical situation.

The rest of the squadron should also be addressed after an accident since stress reactions also are common in people closely related via work or geography to the accident. They may have the same reactions as the afflicted pilot, and if not prepared this response may come as a surprise to many people. It is also important for everybody at the squadron to be mentally prepared for emotional traumas that may evolve so they can be on guard both for themselves or other afflicted persons.

Administrators and officers in command in Norway are aware of this stress reduction program, and most of them leave emotional accident reactions to be handled by qualified people instead of not caring and ascribe the problems as signs of cowardice in the pilot. This alleviates much of the acute and long term stress in their personnel which one had to cope with earlier and which often resulted in the feeling of burn out that is a painful state of fatigue and physical exhaustion.

(f) *Act as a consultant in an operational setting*

The above mentioned points are all parts of the aviation psychologist's work in the operational setting, a close contact with the aviators and their wives under informal conditions, and as lecturer in more formal surroundings.

The aviation psychologist may also act as an adviser to the flight safety inspector and his board. This includes briefings on human factor aspects on actual accidents, teaching management, stress reduction and interpersonal relationship problems to the squadron leaders on the bases and on their premises.

In my situation the flight safety inspector and I have come to the conclusion that addressing the leaders on their home base makes it easier to get to the heart of the matter, than when they are called to a meeting at Headquarters. This is simple psychology in practice: everybody feels more secure in his own territory. If you are serious about getting in contact with someone, do it at his terms.

Last spring the flight safety inspector and I carried out a program with the following heading: The leader, leadership and flight safety. The background for this heading was:

- The recent flight accident statistics, are the leaders to blame?
- Is management style dependent upon the level of experience of subordinates?

It turned out that the actual situation differed so much on the various bases, that the subjects for discussion were different for each place.

After this trip the flight safety inspector and I made a report to the Airforce Inspector General informing about our impressions and made proposals on how to work out the different problems.

Tasks like this make one feel a part of the operational setting even when a civilian in a military system.

The conditions and advantages for this work arrangement are a possibility of multi-way communication. Probably the psychologist and the officers see problems from different view points and are therefore able to have fruitful discussions on the human factor aspects and arrive at new conclusions.

Looking at the increasing number of problems and subjects passing my desk I do have the feeling that the aviation psychologist belongs in an operational setting and should not be considered an intruder in a closed circle.

Case 1

As stressed earlier in my talk I always tell the pilot who has just been exposed to an accident that he should not try to reach new goals or try to prove anything to himself the first six months after a mishap. Even if he has no serious or grave emotional reactions he is not able to perform his job the way he used to do prior to the crash.

One of the reasons is that the pilot needs time to process the incidence and the overstimulation he has been exposed to, and that his vigilance therefore will be reduced for some time. These six months of reasonable caution are also important for building up the self confidence that he needs for feeling safe in the cockpit once more.

The first time I got a confirmation that this was the right procedure was after a fighter accident where the pilot ejected and landed safely in the sea.

We had a critical incident stress briefing right after the accident where I also reminded him that it would take some time making him a champion of the skies again. I also told him to stick to old, well established procedures and to overtrained performance in case of a new emergency. If he wanted to test some new procedures in another, critical situation, most likely his mind would not function as well as prior to the ejection.

Two months after this talk the pilot phoned me and told me about his latest flight. He had been out on a training mission, air-to-air combat which had worked out well. After concluding the training the pilots were expected to land on a nearby airport. Suddenly the weather changed and the only way to land was by instrumental procedures. The pilot could suddenly not remember how to perform an instrument landing, and started to leaf through the handbook, realizing he was short of time and afraid he would have to eject a second time! Then he suddenly remembered the advice one should not be inventive in a situation of crises, but retreat to well established routines. He called ATC and asked for permission to go back to home base. Permission was granted. He went home and landed under exactly the same bad weather conditions, using an instrumental approach! How was he able to do this? Because he had performed landings on his home base innumerable number of times. He knew this procedure like reflex actions and did not have to be aware of them.

This explains also why it is so important to train certain aspects of a flight to the extent that you can do it without

putting your attention to it In critical phases this attention may be useful in performing other tasks

I have had several confirmations of similar experiences

Case 2

A fighter pilot who had ejected five months earlier came to my office . He wanted to talk about some personal problems He had just been to a thorough medical examination because of several physical complaints, upset stomach, a heart condition and severe headaches He was afraid he would lose his pilot licence because of these physical conditions, and would get information about alternative occupations!

This was our first meeting The ejection had taken place before there was any psychologist employed in the airforce The pilot told me he was sent home after he had been through a medical examination after the ejection and that the medical doctor had slapped his back and told him that he had been lucky since he did not have a scratch on his body

After some time he did not feel so lucky, he did not enjoy flying and he felt he had lost contact with his mates after the incident He was also convinced they blamed him for the accident In addition he felt aggressive and had problems with sleeping through the nights

It turned out that all his physical complaints were in his head, it was pure imagination He had the classical reactions of a human being who has been through critical incidence stress without an emotional debriefing.

This incidence gave rise to the post accident stress debriefing program that I have told you about

The actual pilot had to be made aware that all the strange torments he was undergoing were due to crises reactions, and that they were all normal reactions that would vanish after some time if he would accept being guided through a debriefing in order to control the effects of overloading the system

Today this pilot is a well adapted pilot in a civilian airline

Psychiatric Disorders in Aerospace Medicine: Signs, Symptoms and Disposition

by

David R.Jones, M D , M PH., F A C PrM , FAs M A , FA PA
Consultant in Psychiatry and in Aerospace Medicine
One Clermont Court, Oakwell Farms
San Antonio, Texas 78218-1741
United States

INTRODUCTION

This presentation will consider the major categories of psychiatric diagnoses, and how a few that are more commonly seen in aviators may affect flying duties Major psychotic disorders are always disqualifying, as are major affective disorders, manic or depressive Lesser depressive disorders may not be so, depending on the depth of symptoms, the reaction of the flier, and his/her insight into the condition Neurotic disorders may or may not require grounding, again depending on the degree of symptoms Organic mental disorders are generally cause for permanent grounding, unless the cause is reversible and not likely to occur again (e g, acute toxic reactions) Personality disorders are always troublesome, and are likely to be handled through administrative rather than medical channels The general symptoms involved in these disorders will be discussed in a later presentation

Psychiatric disorders are frequently underdiagnosed, both because operational personnel may not recognize these ailments for what they are and because of the tendency of some non-flying psychiatrists and psychologists to "shield" the flier from grounding by not accurately diagnosing what they see, by avoiding its proper name This dangerous practice may allow possibly dysfunctional fliers to fly, and deny them adequate treatment, specifically, medications.

PSYCHOTIC DISORDERS

Psychotic disorders are those which present with a gross impairment of the ability of the flier to perceive reality, creating a personal interpretation of the surrounding world even in the face of evidence which would convince a non-psychotic person. Functional psychoses include such disorders as schizophrenia, manic-depressive psychosis (now known also as bipolar mood disorder), major depression, delusional (paranoid) disorder and others Organic psychotic disorders are also known as dementia and delirium, and are due to some known physical cause such as metabolic disorders, psychoactive substances, infections, or degenerative disorders. Classic symptoms include hallucinations (false perceptions), delusions (firmly held false beliefs about real situations), illusions (misinterpretation of real sensory stimuli), loose associations (illogically connected ideas), depersonalization (a loss of the perception of one's own reality), and others Psychotic disorders disqualify fliers from flying, and should be considered permanently disqualifying unless the cause is unequivocally identified as one which is temporary, has ceased, and is expected never to recur Such judgments may be difficult at times, and one should err on the side of caution, regardless how sympathetic one is to the desire of the flier to fly

ANXIETY-BASED DISORDERS (NEUROSES)

The current American Psychiatric Association nomenclature has renamed the next traditional category of mental illness, the neuroses, and has substituted a number of diagnoses, some of which are relatively unfamiliar (Ref 1) These are now classed as *anxiety* disorders, *somatoform* disorders, and *dissociative* disorders. Classically, neuroses were considered to be based upon underlying unconscious anxiety, which was expressed through symptoms which allowed that anxiety to be dealt with indirectly and symbolically The debate goes on, but the rise of biologically-based psychiatry, and the use of the scientific method to test etiologic hypotheses, allow for some alternate explanations Genetic studies are particularly informative in this regard, and the fact that medications help many of these disorders reinforces the idea that biochemical or metabolic alterations play a part in their etiology.

These disorders include the various forms of clinical depression (except those with psychotic features such as delusions) Anxiety disorders include phobias, panic attacks, obsessions, compulsions, post-traumatic stress disorder, and generalized anxiety disorder Somatoform disorders include hysterical or conversion disorders, hypochondriasis, and some pain disorders Dissociative disorders include multiple personality, fugue, amnesia, and similar conditions

PERSONALITY DISORDERS

The next level of psychiatric diagnoses are the personality disorders, which will be discussed in more detail in a later presentation Briefly, these diagnoses imply enduring and deeply engrained behavioral patterns, inflexible and severe enough either to impair social functioning or to cause symptomatic and subjective distress In their lesser manifestations these are referred to as personality traits, these may exist for years and not cause much problem unless exacerbated by external events or stressors

ADJUSTMENT DISORDERS

These disorders represent maladaptive or counterproductive reactions to recognized external stressors, occurring within three months after the onset of the stressors By definition, they persist no longer than six months, if they do, the diagnosis must be re-classified (as a minor depression, for example) These disorders affect functioning in occupational, scholastic, social, or relationship settings, and exceed the usual or expected reactions to the specific stressors One assumes that the reaction will subside once the stressor disappears, or that a new and less symptomatic level of adaptation will be attained in time.

The stressors may be single or multiple, may be "a one time bad deal" or recurrent, may be intermittent or continuous. They may be associated with the marital or the parental family, with flying, with social relationships, with job relationships, with physical illnesses, or with religious, legal, financial or other such matters. Life events, both foreseen and unforeseen, may precipitate them. The severity of the stressor does not necessarily relate to the severity of the disorder since (a) some people are more vulnerable to one stressor than another, and (b) the amount of stress already present in people's lives may also vary.

A number of such disorders have been described, and there is not time or space to describe them all. Their names, however, give clues to their description: adjustment disorder with anxious mood, with depressed mood, with disturbance of conduct, with physical complaints, with withdrawal, with work inhibition, and with mixed features. Each is characterized by a reaction to an identifiable stressor within three months, by impairment of some aspect of function in excess of the normal or expectable reaction, by being unique (not just another instance of a pattern, that would indicate a personality disorder), and by persistence of less than six months.

SOME SPECIFIC PROBLEMS COMMON TO FLIERS

Psychiatric problems are encountered in all branches of the medical sciences, even among the practioners. Still, the aeromedical physician must be particularly keen to detect them in fliers at a lower level of symptomatic presentation because of the ever-present dangers that exist in flight. As with most somatic disorders, we want to detect psychiatric disorders earlier because of safety implications. The old saying has it that "Flying is hours of boredom interspersed with a few moments of pure terror." Plainly put, although the flier may be able to get along perfectly well, at say, 75% efficiency during the hours of boredom, there is no way to predict at which terror-filled second he or she will suddenly need 100% efficiency to live — and 92% will not do.

All aeromedical practitioners have had some psychiatric training, and I am sure that none would have any particular difficulty recognizing a floridly psychotic patient, or one with a deeply pervasive depression. The problems one is likely to encounter among fliers will seldom be so dramatic, however, and so let us consider a few of the more common ways in which fliers may present with psychiatric difficulties.

DEPRESSION

Depressed fliers are likely not to recognize their emotional status clearly enough to define it as the cause of their difficulty. Since they tend by nature to pay less attention to their internal emotional climate and more to their physical symptoms, they are more likely to complain about the way they feel physically. Thus, depressed fliers may complain of symptoms relating to insomnia, chronic headache, or trouble with memory or concentration. The more common symptoms of depression are listed below in two groups, the somatic and the emotional, to emphasize the difference.

Somatic symptoms
- increase or decrease in appetite, perhaps with weight change
- constipation
- change in sleep pattern
  - difficulty falling asleep, insomnia
  - difficulty staying asleep, early awakening
  - sleep that is not restful, early morning fatigue
  - too much sleeping, hypersomnia
- fatigue or loss of energy and drive
- loss of usual concentration and memory, distraction
- headaches or other minor but annoying aches and pains

Psychological symptoms
- loss of interest in usual activities, apathy
- loss of "joy", anhedonia
- visible slowing, or jumpiness, psychomotor agitation, or retardation
- depressed mood most of the time
- tearfulness
- feelings of worthlessness or guilt, undeserved, self-reproach
  desire to "get away"
- death-related ideas, which may represent or may *be* suicidal

Seen in a clear list like this, few flight surgeons would miss the diagnosis. Seen in a flier who is a friend, in whom these signs and symptoms have slowly developed over several weeks, the picture is not so clear. Some aeromedical physicians identify so closely with "their" fliers that they do not wish to label what they are seeing. Some fear that they will lose favor with the flier and his or her friends if they attach a psychiatric label. Some profess not to believe in psychiatry, and actively avoid the entire issue. Whatever the reasons, we see at times what amounts to an unspoken collusion between flight surgeon and flier. Worse, some mental health professionals allow themselves to be drawn into this state of affairs, even in formal consultation. Symptoms are minimized or explained away. Incorrect "lesser" diagnoses are given, at times with the stated intention of "not hurting his (her) career." While this is unfortunate from the ethical point of view, to say the least, it may have other and more serious consequences. If the disorder is under-diagnosed, it may also be under-treated. If a major depression is labelled an adjustment disorder, the proper medications may be withheld, or under-used.

I do not propose to discuss treatment in any detail, but all flight surgeons have at least a passing acquaintance with anti-depressive medications, the tricyclics such as amitriptyline (Elavil) or nortriptyline (Norpramine). The monamine oxidase inhibitors are somewhat less known, but may be extremely effective. Newer agents are now available, bupropion (Wellbutrin), fluoxetine HCl (Prozac) and others. Such medications must be used properly, with a clear eye to target symptoms, adequate doses, side effects and so on. In my experience this is not done nearly as well in patients labelled "adjustment reaction", "situational reaction", and the like.

The plain fact is that depressive disorders are disqualifying for flight duties. They are also very treatable disorders, and once the flier is free of symptoms *and* off medications for one or two months, flight duties may be resumed with proper documentation. Only in rare instances, and then only with authoritative and knowledgable consultation, should a civilian flier who has been stable on antidepressant medication for years and who relapses when the medication is discontinued be considered for return to flying duties while taking that antidepressant medication. Flight surgeons who are sure of themselves will avoid the traps of overidentification with their fliers, and of sympathetic but misguided under-diagnosis and under-treatment.

ADJUSTMENT (STRESS-RELATED) DISORDERS

In my experience this is the category most likely to apply to aviators. Although all successful fliers must be able to deal with the stresses of flight ability to do so does not necessarily mean the flier can also deal with family stressors, or job stressors or interpersonal stressors from other sources. Although I have never kept statistics on the matter, my impression is that marital or other close relational stressors are the most common source of difficulty, followed by interpersonal job-related stressors and career stressors. Some fliers may be aware of the connection between stressor and symptoms, and others may not.

Marital stressors may include basic control issues, often disguised as repetitive arguments about the same matters (sometimes fairly trivial on the surface) without resolution. The flier may retreat into "logic" and "rational thinking", and the spouse may feel demeaned and ignored.

Job or career stressors may include failure to be promoted, or to get a cherished assignment. Occasionally the flier is trapped in an administrative web that will not allow an otherwise logical career progression to occur, or block access to a desired aircraft. Sometimes such events mark the first time the flier has ever failed to achieve a goal, and this failure may coincide with feelings of getting older, being at a dead end, or even the dreaded "midlife crisis". All of these events share a feeling of loss of control, a lack of power, and some fliers find this intolerably anxiety-provoking.

Some common symptoms are listed below. Please note that these may combine elements of depression, anxiety, and behavioral "acting out" of distress. Some may be exaggerations of a specific flier's normal personality, while others may represent a considerable change from his or her norm.

- thinking about things other than flying while flying, distraction
- loss of usual sense of humor
- mood changes, irritability
- increased use of alcohol
- reckless behavior
- repetitive non-productive thinking about the problem
- sleep disturbance, may be linked to the repetitive thoughts
  feelings of being trapped by the problem
- preoccupation with otherwise minor physical complaints
- barely disguised or overt fear of flying, not related to a mishap

I have written elsewhere about some manifestations of fear of flying (Refs 2, 3), and will not repeat my comments here. Most of the other factors noted will be familiar to flight surgeons or other aeromedical practitioners who work closely with their fliers. In fact, there is some evidence that the more experience a flight surgeon has, the more value he or she places on psychiatric knowledge. I recommend that interested aeromedical practitioners become more familiar with the disorders covered in this presentation, and especially with ways in which stress-related somatic symptoms may be diagnosed positively, rather than by elimination. If flight surgeons overlook psychiatric considerations until all possible somatic causes have been eliminated, the time, effort, and sheer number of tests involved serve to reinforce the symptoms to the flier. If psychiatric causes are included in the differential diagnosis from the first, both the flight surgeon and the flier will find it easier to deal with them later.

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Psychological Factors Influencing Performance and Aviation Safety: I

by

James J. Picano, PhD
Director of Psychodiagnostics
Letterman Army Medical Center
Presidio of San Francisco
California 94129
United States

In this presentation I will discuss two major psychological factors which can adversely affect health, flight performance and decision making in aviation personnel: stress and hazardous thought patterns

PRINCIPLES OF STRESS

In recent years, the topic of stress has received considerable attention in the aeromedical literature I do not intend to systematically review these studies, rather my intent is to organize and summarize major findings around a model of stress which has been adapted from several sources in the behavioral sciences This model is pictured in Figure 1

Most simply, this stress model is a stimulus-organism-response model That is, there is some event in the environment, it is processed by the organism and an appropriate response is made Ultimately, there are consequences which result, and we will focus on performance related consequences of stress later in the discussion This conceptualization of stress is clearly transactional and involves the individual interacting with, and operating upon the environment

THE STRESS RESPONSE

Let us first turn our attention to stress as conceptualized as a physiological response by the body. The stress response was most thoroughly articulated by Dr Hans Selye and was considered to be a non-specific physiologic response by the body to an external threat to the organism's integrity He described a "general adaptation syndrome" to describe the physiological changes occurring over time in the body's attempt to adapt to this threat According to Selye, this response occurs in three stages: *alarm*, *resistance* and *exhaustion*

The *alarm* stage represents an initial "call to arms" of the body's defensive forces It is very brief, lasting usually a matter of minutes to hours and is mediated by the endocrine system It is characterized by an increase in adrenal-cortical secretions Physiologically, resistance to the stress is decreased, and psychologically, the organism is "aroused" with accompanying tension, anxiety and fear.

If the stress persists, the organism then enters the *resistance stage* In this more prolonged phase, resistance to stress is greatly increased as the body continues its endocrinological effort to adapt to the threat However, it is also in the resistance stage that we begin to see physiological changes manifested as a result of stress shrinkage of the thymus gland and gastro-intestinal ulcerations.

If the threat is extremely prolonged or intense, the body begins to wear down and "exhaust" its resources During the *exhausted stage* the body's resistance drops below its normal level and over time we begin to see the "diseases of adaptation" manifested such as cardiovascular disorders, hypertension, peptic ulcer disease and psychological disorders.

Although this description of the body's response to stress has been revised slightly over the years with research, it continues to provide a good outline of the physiological response of the organism under stress

STRESS STIMULI

A critical component of the stress model is that something must trigger this response Some stimulus must be present. The stimuli are called "stressors" A stressor is any event or stimulus which forces the individual to adjust or adapt in some way Stressors can be physiological, environmental or psychosocial

Early in stress research, Holmes and Rahe attempted to catalog major life stressors and quantify levels of stress Using expert ratings, these researchers developed the Social Readjustment Rating Scale (SRRS) which listed 43 major life events weighted from a value of 11 (minor violations of the law) to 100 (death of a spouse) To "quantify" levels of life stress, one simply added up the value of the life events experienced over a six month – one year period Later research by Holmes and Masuda found that life change totals over 200 were associated with the development of significant illnesses in over 50% of the general population they studied within one year For values over 300, the percentage increased to 79 Such findings provide the first empirical evidence that excessive stress could lead to physical and psychological illness In a sense, this research was also to promulgate a false notion that stress was undesirable and always resulted in illness

Several points need to be made here about stressors First both positive *and* negative life changes are considered sources of stress Any event which forces a change is stressful Second, stressors include psychosocial or life events, as well as aspects of the environment and the organism's physiological state In its response to stress, the body does not distinguish life events stressors from environmental sources of physiological sources In short, a stressor is a stressor It is virtually impossible to quantify the magnitude of environmental sources of stress, for example noise, heat, cold, acceleration and so on Nor is it possible to appraise individual physiological sources of stress, namely fatigue, caffeine, nicotine, alcohol, etc But there is little doubt that the effects of stressors are cumulative.

Recently, McCarron and Haakonson attempted to catalog sources of stress (stressors) in the aviation environment Although their categories were slightly different than the three used here (i.e., personal, environmental, and

physiologic) they included all of these and added some specific to aviation in their description They described *flying stress factors* (vibration, noise, acceleration, etc), *personal stress factors* (fatigue hunger lack of family support etc), *anxiety stress factors* (level of confidence, unfamiliar airport night flying, etc) and *emergency stress factors* (engine failure disorientation control malfunction, etc) Anxiety and emergency stress factors are particular to aviation, and serve as important immediate situational stressors which can impinge upon flight personnel in addition to other stress factors that might be operating already (e g, major life events and physiological stress states)

Most importantly, using life events rating scales such as the SRRS already mentioned, McCarron and Haakonson demonstrated that routine deployments in their sample of Canadian Forces pilots were associated with levels of life change units which conservatively would predict health changes in over 51% of the general population The point here is that the aviation environment, by its very nature is physiologically and psychologically hostile and stressful in ways we cannot begin to measure With respect to life changes alone, we can expect that pilots routinely function at levels associated with negative health changes

The goal of aviation medicine is to promote and preserve healthy functioning Thus, we are obliged to find ways to help insulate pilots and aircrew from the adverse effects of stress In order to do this, we must understand the organismic factors which mediate the relationship between the stimuli of stress and the stress response

ORGANISMIC FACTORS MEDIATING THE STIMULUS-RESPONSE RELATIONSHIP

Obviously, the relationship between stressors and illness is not a one-to-one relationship It is statistically much more modest but it is consistent, and it is replicated repeatedly in stress research Not everyone under a great deal of stress will become sick as a result Certain organismic characteristics mediate this relationship

An important, but rather immutable, mediator in this relationship is the genetic-constitutional make-up of the individual This factor determines the individual's overall physical health and baseline physiological resilience to stress Rigorous physical (and psychological) selection standards help to ensure that only individuals who have the best chance of retaining their health under very adverse circumstances are selected for careers in military aviation

From a psychological perspective, the individual's response to a stressor is mediated by both the appraisal of that stressor as well as the individual's "vulnerability" or susceptibility to the stressor Appraisal is the process by which the person evaluates the significance of a particular stressor Vulnerability is the extent to which the individual is threatened by the stressor Both processes are influenced by several factors including underlying personality and psychological needs, and coping resources and styles

Generally speaking, personality can be described as a constellation of enduring characteristics or patterns of perceiving, relating to and construing the environment and oneself Research into the pilot personality consistently finds pilots to be active, dominant and extroverted, to have high needs for achievement and mastery, and to be less inclined toward introspection Such personality characteristics are quite similar to those that have been identified by psychologists called 'hardiness" a personality construct which has been associated with increased resistance to stress Thus, the personality traits of typical pilots suggest that pilots typically have effective psychological resources for managing life stress

One of the primary ways in which personality influences resilience to stress is through the development of effective stress-coping strategies Stress-coping strategies are the processes individuals use to manage internal and external demands placed upon them by problem-situations These processes are thought to reflect personality predispositions such that individuals bring preferred ways or "styles" of coping with stress to each coping situation

There have been several empirical efforts to describe the typical stress-coping styles of pilots. In one of the first Fine and Hartman found that pilots predominantly coped with disruptive emotion and life crises by seeking constructive solutions Somewhat less common, but nevertheless utilized processes were arguing, joking and ignoring the situation Only rarely did pilots of their sample (United States Air Force) report withdrawing, blaming or fighting as coping strategies under stress

Sloan and Cooper studied the stress coping strategies reported by commercial airline pilots and found that they emphasized practical versus emotional forms of coping including the use of reason and logic, and social support networks The dominant stress-coping factor identified by Sloan and Cooper was the stability of the marital relationship and home life However, this factor seemed to primarily involve structural descriptive features as opposed to coping processes In fact, one of the problems with the research presented by Sloan and Cooper is that coping resources (supportive wife) are confounded with coping processes (talking to understanding friends)

More recently, I studied stylistic coping processes of United States Army pilots using a new measurement of dispositional coping styles Compared to a reference sample from the general population the pilots were more inclined towards active, problem-solving coping strategies and reported a greater tendency to seek information from others in times of stress More significantly they tended to rely less upon emotional support-seeking, denial and withdrawing from the stressor as coping tendencies. When compared to other aircrew members and military personnel, the pilots still reported a significantly greater tendency to seek information during times of stress and a significantly lesser tendency to disengage from the stressor Thus, these coping tendencies appear to reflect differences in psychological predisposition independent from adaptation to the military or aviation environment

In general, the typical stress-coping styles of pilots emphasizes mastery of problem situations through direct action Such processes can be very effective ways of coping with stressors, and can greatly reduce adverse effects of highly stressful lifestyles.

SUMMARY

The model of stress presented here is clearly transactional The individual interacts with the environmental stress to mediate the physiological response Thus, the stress response is a function of the stressor and the individual's ability to mediate the stress. Let us now direct our attention to the effects of stress on performance and the role of stress in aviation safety

THE EFFECTS OF STRESS ON PERFORMANCE AND AVIATION SAFETY

In order to appreciate the role that stress plays in aviation safety, it is first necessary to understand how stress affects human performance. Studies from cognitive and physiological psychology show that performance and stress are related in the form of an inverted U-shaped function, such that performance is best at some intermediate (optimal) level of stress. Moreover, this optimal level can vary depending upon task difficulty and task novelty. Thus new learning tasks as well as more complex tasks can be disrupted by much lower levels of stress than overlearned or simple tasks.

I have used the term performance in the general sense but let me illustrate this relationship by an aviation-relevant example using the construct of attention. Inattention is frequently cited as a cause of human-error aircraft accidents. Attention is affected by level of arousal. Thinking back to the stress model, the physiological stress response can be understood as impacting the individual's level of arousal such that too little stress is associated with "underarousal" whereas too much stress is associated with "overarousal". Thus attention is best at some optimal level of arousal. Attention anomalies can be evident on either side of the arousal - performance gradient. Inattentiveness as a result of underarousal on the individual's part can be seen with two examples in aviation: boredom resulting from repetitive, mundane tasks, and complacency in which overconfidence in one's ability leads to undermotivation.

On the other side of the gradient, attention anomalies also occur as a result of overarousal. Two such anomalies potentially related to aviation performance problems are internal distraction and fascination. Internal distraction refers to inattention due to non-task related mental processes or emotion, and is similar to the inattention that we experience when we are 'preoccupied' with something. Fascination is an attention anomaly in which the individual observes cues but does not respond to them. Fascination occurs in high stress or crises situations.

INADEQUATE STRESS-COPING AND PILOT-ERROR ACCIDENTS

A review of United States Army accidents between FY 1982–89 indicated that approximately 75% (+ or − 5%) of aviation rotary wing accidents (Class A–C) involved pilot error. About half of these were due to causes which were felt to be "self-generated", and included stress related physiological and psychological changes such as fatigue, motivation and attitude problems, and drug use.

More direct evidence of the role stress plays in aviation safety was provided by the United States Navy in an investigation of Class A aircraft accidents over a four year period (1978–1982). A 26-item questionnaire designed to assess observable facets of stress and personality was completed on each crewmember involved in a mishap by the flight surgeon assigned to the accident investigation board. A number of the items differentiated crewmembers involved in pilot-error accidents from those who were not involved in pilot error accidents. I have organized the results according to the stress model presented earlier.

In terms of stress stimuli, or stressors, pilots involved in pilot-error mishaps were significantly more likely to have been experiencing financial problems, to have made a recent decision to marry, and to have been contemplating a major career decision. Interestingly, both social and occupational spheres of life were in a state of change.

With respect to personality, pilots who were judged to be at fault in their mishaps were seen as lacking in maturity, as having had a poor sense of their own limitations, and as being unable to quickly assess potentially troublesome situations. It is conceivable that the latter two descriptions represent an artifact of the method, in that these evaluations were retrospective and the cause of the accident may have been known. Nevertheless, the implication of 'immaturity' is important as it may suggest a potential personality vulnerability to poor stress-coping.

More importantly, pilots who were at fault in their mishaps evidenced observable behaviors which can be understood as representing maladaptive consequences of poor stress coping. These included difficulties in interpersonal relationships including marital as well as with superiors and peers, excessive use of alcohol, unprofessional flying, and a significant "change in personality".

The results of this study provide empirical evidence of the relationships between poor stress-coping and adverse pilot performance. The study also provides some clues to the observable early manifestations of poor stress-coping in pilots (i.e., 'acting-out") and suggests the potential for identifying pilots at increased risk for human error mishaps on the basis of predisposed susceptibility (personality factors) to stress or inadequate coping ability.

SUMMARY

This section has presented a model for understanding stress and appraising its effects on human performance in aviation. Understanding the effects of stress on health and performance is essential to designing and implementing proactive preventive programs aimed at promoting and preserving the health and welfare of our pilots and enhancing aviation safety.

Unexplained Loss of Consciousness

by

Marc S. Katchen, M D
USAF School of Aerospace Medicine
United States

The differential diagnosis of unexplained loss of consciousness can be divided into two categories, primary cardiovascular disorder or primarily a central nervous system disorder The key to this section is the term unexplained loss of consciousness, such as, massive cerebral vascular accident, heart attack with ventricular failure, known cardiac arrhythmias (such as, ventricular tachycardia), insulin dependent diabetes or known seizure disorders are obviously aeromedically significant disease and do not usually come into play in unexplained loss of consciousness The aeromedical question is usually deciding after a single witnessed or unwitnessed loss of consciousness, whether a cause can be identified and if so, does it pose danger to safe and effective flying

By far the most common cause of loss of consciousness is vasodepressor syncope, also called vasovagal syncope The classic presentation is triggered by a real or perceived threat of threatening circumstances, such as, blood drawing, emotional upset or pain, followed by the symptoms of lightheadedness, nausea, diaphoresis with gradual graying out or tunneling of vision The patient usually slumps to the ground and experiences a brief loss of consciousness lasting seconds Brief tonic/clonic or myoclonic jerks may occur with vasodepressor syncope This is usually associated with syncope in the upright position where the patient cannot fall or is held up in the sitting position A retrospective study by Zigler et al , using blood donors under a controlled setting, reported a rate of syncope of 0 31 percent during 262,935 donations and 0 04 percent of cases developing convulsive syncope Of the total number of syncopal events, the number of convulsive syncopal episodes calculated to be 10 percent A repeat study performed prospectively with trained observers increased the percentage of convulsive syncope slightly

The evaluation of an episode of unexplained loss of consciousness begins with a detailed history, including the events in the preceding several days, events occurring within minutes of the syncope and any prodromal symptoms they may have experienced In addition, the position of the crew member at the time of syncope and approximate time of unconsciousness and time of coherency along with any atypical findings, such as, head injury, tonic/clonic movements, urinary incontinence or tongue biting, the patient's vital signs, such as blood pressure, heart rate as close to the event, is important information in distinguishing syncope from seizures The suggested worksheet is seen in Table 1 In a retrospective study of aircrew members evaluated for unexplained consciousness from 1974 to 1988, performed at USAFSAM, 60 percent were diagnosed as vasovagal syncope and an additional 9.8 percent — venipuncture syncope A complete distribution of cases is seen in Table 2 This list in Table 2 reflects the referral pattern seen at USAFSAM Explainable causes of loss of consciousness, such as, a seizure secondary to a mass lesion, a witnessed seizure or cardiac dysrhythmia would not have been referred. These cases would have been handled at the local hospital The workup after the detailed history has been obtained from both the subject and any eye witnesses should include routine metabolic evaluation, including hematological, biochemical and electrolyte blood work Cardiovascular evaluations include routine screening for cardiac muscle damage, EKGs, 24 Hour Holter Monitors of at least 48 hours duration and an echocardiogram Neurological evaluation, in addition to the neurological examination, include awake and sleep deprived electroencephalograms and a neuro-imaging study, either a CT scan or MRI 24 Hour ambulatory electroencephalograms are being performed with increased frequency for the evaluation of unexplained loss of consciousness when a seizure is strongly considered In some centers, the performance of ambulatory EEGs and EKGs can be performed simultaneously, when there is doubt whether the unconsciousness is primarily cardiovascular on CNS in origin Although not a usual consideration in the aeromedical community, the electrophysiological studies of the heart are performed when there is recurrent unexplained loss of consciousness associated wth cardiac tachyarrhythmias

The distinction between convulsive syncope and primary CNS seizures is sometimes quite difficult Although there are no firm rules to apply, the extent occurrence of multiple seizures, the persistence of postictal confusion and the presence of any focality during the seizure activity are useful in distinguishing the two entities The most useful information, once again, is the history of the event just prior to the syncopal episode Reviewing Table 1 and looking specifically for atypical features, such as, urinary or bowel incontinence, tongue biting or head trauma, may point to a primary seizure disorder, although this is not 100 percent diagnostic Historical features, including a rapid loss of consciousness with little prodrome or an event occurring during sleep or in the horizontal position, along with signs of autonomic discharge, such as, tachycardia and hypertension in the postictal period, point toward a seizure event.

The differential diagnosis of unexplained loss of consciousness is explained in both neurologic and cardiovascular textbooks Benign causes are those which stimulate the vagal response resulting in both a drop in heart rate and blood pressure These can occur in crew members who are debilitated after sleep deprivation or dehydration or healthy members, such as, micturation syncope or under extreme real or perceived threat. Transient ischemic attacks are rarely causes of syncope Transient ischemia to the vertebral basilar system can cause a loss of consciousness, but is usually accompanied by other brainstem signs, such as, nausea, vertigo, diplopia or cerebellar signs The same is true of basilar migraines Anterior circulation transient ischemia should show focal neurological deficits along with

any decreased level of consciousness, as would a cerebral vascular accident. Although sleep disorders, such as, narcolepsy or idiopathic hypersomnilence can sometimes present as an unexplained loss of consciousness, there is always more history such as, excessive daytime sleepiness, cataplexy, sleep paralysis or other distinguishing features, which would separate it from an unexplained loss of consciousness.

In summary, the evaluation of unexplained loss of consciousness requires detailed history from subject and eye witnesses, vital signs and physical and neurological examination, along with both detailed cardiovascular and neurological workups. The cost effectiveness of detailed workups is questioned in the civilian occupation in the Aerospace community, the further cost of this detailed workup is justified.

Table 1
Suggested Worksheet for Syncope in Aviators

History from witnesses

Position at time of syncope	Horizontal Vertical Inclined
Time unconscious	_____
Time until coherent	_____
Atypical findings.	Head injury Tonic-Clonic movements Urinary incontinence Tongue biting

History from patient.

Within one week

Cold symptoms	Flu symptoms	Sleep deprived	Party with alcohol
Family with cold/flu symptoms	Depression	Recent travel	GI symptoms
Excessive alcohol intake	Insomnia		Emotional event (death/divorce)
Dieting with weight loss			Over-the-counter medications

Within minutes of event

Injection	Emotional Shock	Vaccination	Questioning	Sitting
Micturating	Running	Hyperventilating		Valsalva maneuver
High-G stress		Change to vertical postion		Threatened
Bowel movement	Exercise	Blood Drawn		Coughing

Prodrome

Lightheadedness	Hot flashes	Feeling ill	Seeing stars	Sweating
Tinnitus	Hearing loss	Visual aura		Nausea and/or vomiting
Olfactory aura	Tiredness	Headache	Vertigo	Other

Vital Statistics

Age _____ Sex _____ Pulses ____ ____ Regular/Irregular BP _____/_____

Table 2
Final Diagnoses

Diagnosis	Number of Patients (%)
Altitude chamber	1 (0.8)
Exercise-induced	2 (1 5)
G-induced syncope	5 (3.8)
Inflight syncope	1 (0 8)
Micturition syncope	9 (6 8)
Presyncope	1 (0.8)
Syncope, etiology unknown	20 (15 0)
Tussive syncope	1 (0 8)
Vasovagal syncope	80 (60 2)
Venipuncture syncope	13 (9 8)

Assessing Adaptability for Military Aeronautics

by

James J. Picano, PhD
Director of Psychodiagnostics
Letterman Army Medical Center
Presidio of San Francisco
California 94129
United States

The assessment of adaptability for military aeronautics is an important aspect of selection in aviation provided by the flight surgeon as part of the aeromedical evaluation. Adapatibility for military aeronautics is a complex issue which involves motivation to fly, ability to fly, and psychological/emotional suitability for a career in military aviation. Each of these addresses a slightly different facet of adapatability. For example, motivation to fly focuses on the underlying question of who is *willing* to fly, whereas ability to fly deals with the question of who *can* fly. Psychological suitability for flying requires the evaluation of who *should* fly.

Cognitive and psychomotor testing performed elsewhere in the selection process typically ensures that only those individuals with the requisite abilities to master flying will be selected. In the United States Army and Air Force, the determination of a candidate's potential for successful adaptation to military aeronautics is made by the flight surgeon following a thorough physical examination and a brief interview with the candidate. During this interview, the primary task of the flight surgeon is to determine the nature of the motivation driving the individual to pursue military aeronautics, and the psychological/emotional stability of the individual for a career in military aviation.

In this presentation, I would like to review psychometric and interview findings from studies of pilot personality in an effort to identify common characteristics of typical or successful military aviators. In addition, I would like to discuss important issues in the assessment of psychological adaptability which can be addressed in a brief interview of a pilot candidate. The issue of motivation to fly will not be addressed here, but those interested in this topic should refer to two excellent articles on the subject by Dr David Jones (Adams & Jones, 1986. Jones, 1986).

STUDIES OF PILOT PERSONALITY

First, I would like to review findings from psychometric studies of pilot personality which bear on the assessment of aeronautical adapatability. Presumably, the focus of early research in this area was on developing a composite personality profile of an individual who was likely to be successful in military aeronautics. Thus, I will present findings from studies which have identified personality characteristics of typical or successful, well-adapted pilots. Note that there are numerous studies which have used personality measures in order to predict success in flight training. Those interested in this line of research should consult a recent review of the literature by Dolgin and Gibb (1988).

In a now classic study of pilot personality and adaptation in a sample of experienced USAF pilots, Fine and Hartman (1968) found that "typical" pilots tended to be dominant, outgoing and active individuals with high needs to achieve. Such individuals were identified as having strong needs to master their environment and as having a strong desire for novelty and change. These individuals were also described as lacking in introspection and as controlled in the expression of emotion. Similar personality characteristics were also reported in a sample of United States Navy pilots (Reinhardt, 1970), who where nominated as "outstanding" in their flying squadrons (top 10%). More recently, Ashman and Telfer (1983) found similar characteristics in their samples of experienced Royal Australian Air Force pilots. Collectively, these studies suggest that a distinct constellation of personality characteristics distinguish well adapted, or "successful" military pilots. Interestingly, comparable findings have been reported in civilian general aviation pilots for both males annd females (Novello & Youssef, 1974 a & b) providing additional evidence for a core "pilot personality".

The identification of homogeneous personality traits among successful pilots might, at first glance, provide a convenient and useful way for flight surgeons to evaluate the psychological suitability of an individual for military aeronautics. Upon closer inspection, however, it is relatively easy to see the difficulties with this approach. First, psychometric studies of pilot personality have relied on "mean" comparisons among the groups using scale averages for the samples. Such an approach empirically emphasizes homogeneity and obscures variability, or heterogeneity within the sample. Secondly, such studies imply that the nature and degree of the characteristics identified constitute the "right stuff" for military aeronautics and anything less is not adaptive.

However, it is well known in the aviation community that there are at least several different "types" of individuals who successfully adapt to military aeronautics. Recently, Retzlaff and Gibertini (1987) empirically identified three distinct personality subtypes among USAF aviation trainees. The type which characterized the largest percentage (58%) of the sample was described as achievement-oriented, dominant and affiliative, with a structured approach to problem-solving. A second type, which characterized 21% of the sample, was similar in many ways to the one previously described. They were also more aggressive, exhibitionistic, and self-aggrandizing. The third type, which also comprised 21% of the sample was described as cautious, compulsive, and socially retiring. Later research by Retzlaff and Gibertini (1987) showed that none of the three personality types was proportionately more likely than the others to complete flight training.

Although these findings suggest that no one type of

personality is likely to be more successful in completing flight training, it is important to discover whether or not such personality types are equally viable in aviation over a longer period of time. Thus, I collected personality data on a sample of experienced military pilots (United States Army) using a new measure of personality specifically developed for use in occupational settings (Picano, in press). All of the pilots had at least completed their initial aviation career milestones or gates, and in this respect were considered to have made a successful initial adaptation to military aeronautics. Using cluster anlaysis, three distinct personality types emerged from the data. These types closely resemble those described by Retzlaff and Gibertini. The most prevalent type, comprising 48% of the sample, is characterized by traits frequently ascribed to the "pilot personality." These pilots appear to be the most affiliative and outgoing in the sample, and have a structured approach to problem-solving which emphasizes planning, logical analysis, and attention to detail. A second type characterized 36% of the sample. Individuals of this type appear to be the most emotionally controlled, inhibited, apprehensive and socially retiring. Finally, a third type, which included 16% of the sample, appear to be similar in many ways to the first group, but are more highly independent, competitive, and decisive. These individuals appear to be the least concerned with making a good impression, and are the least emotionally sensitive.

The results of this study, along with those of Retzlaff and Gibertini, suggest that the "right stuff" is certainly not the "only stuff" when it comes to personality types likely to be successful in military aeronautics. Likewise, the research to date does not provide clear data on a personality type which it embodies the "wrong stuff." Such findings warn against relying on stereotypes of pilot personality for determining suitability for military aeronautics and further indicate that personality inventories do not yet fulfill the promise of providing an economical means for accurately selecting certain personality types for military aeronautics. Clearly more research is warranted with more differentiated criteria of successful aeronautical adaptation.

With the above discussion in mind, I would now like to review some of the life history findings associated with successful aeronautical adaptation among pilots, and to provide some guidelines for evaluating adaptability within the context of a brief interview.

LIFE HISTORY CRITERIA OF SUCCESSFUL ADAPTATION

In general, behavior over time should provide a more reliable assessment of adaptability than a one-time psychometric evaluation. Yet surprisingly few studies have investigated the life history characteristics of successful military pilots. Reinhardt (1970) found that an inordinate amount are first born or only sons. This is not surprising given the fairly consistent empirical findings between birth order and occupational achievement and success. It has also been noted that the relationship between father and son in childhood is typically described as "close." The developmental and social histories of well adapted pilots include significant achievements in academics and athletics, and such individuals are typically seen as "team players". Thus, it is reasonable to expect that candidates who have been successful in challenging exploits, and who have been active in team sports or other competitive endeavors are more likely to be successful in aviation than those who have not. Interestingly, Reinhardt noted that despite the active and competitive lifestyle of the men he had studied, their medical histories were significant for few injuries and illnesses. Thus, one marker of suitability for military aeronautics may be a history of excellent health and vitality. As with personality traits, these characteristics perhaps represent the ideal. Certainly, there is wide variability.

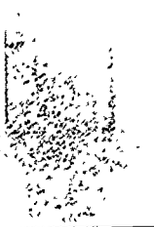
GUIDELINES FOR ASSESSING AERONAUTICAL ADAPTABILITY

For the flight surgeon unfamiliar with the techniques of psychiatric interviewing, some guidelines for assessing aeronautical adaptability within the context of a brief interview might be helpful. The assessment of a candidate's psychological suitability for military aeronautics can usually be assessed fairly thoroughly in a brief (usually 30 minutes) interview. This interview should be somewhat loosely structured to allow for the development of rapport and to permit an assessment of the candidate's poise and adequacy in dealing with the flight surgeon and the stress created by the situation. Thus, in addition to the candidate's remarks, the flight surgeon should attend to any nonverbal cues, as well as the flight surgeon's own feelings about the candidate which may arise during the course of the interview.

The flight surgeon should carefully review the candidate's academic and occupational patterns of achievement. It is especially important to assess the individual's capacity to persevere with challenges and accomplish goals which have been set. Especially significant is the proclivity to set goals which are inconsistent with the candidate's realistic ability to accomplish them. This is usually evident in transfers from more competitive to less competitive colleges, college majors, or career interests and jobs. Helpful data toward this end include number of years required to obtain a college degree, and number (and type) of college majors. I once interviewed a candidate who was having difficulty in flight school who had four different college majors, starting in electrical engineering and ending with a degree in the social sciences. This same student enrolled for 21 credits in his first semester of college! Needless to say, he ended up withdrawing from several classes that semester. Related to the issue of goals and accomplishments, I usually ask a candidate to describe their most significant achievement to me. A life history without significant accomplishment or one with a spotty academic and occupational record might portend of difficulty adapting to the rigors of military aviation.

In addition to achievement, the capacity to relate well with others is important in military aviation, especially with multicrew aircraft. The flight surgeon should be alert to interpersonal difficulties manifested as difficulty making friends, excessive solitude, or on the contrary, excessive egocentricity and self-aggrandizement. Such individuals might be prime candidates for performance problems related to poor cockpit resource management, a topic currently receiving a great deal of attention in the human factors literature.

Another important area of life history to review is the individual's response to structure and authority. Flying is a rule-bound activity and the candidate's past history with respect to conforming his or her behavior to societal expectations and norms can provide an important means to assess whether or not the individual is likely to fly in accordance with the rules and regulations guiding safe flight. A history of conduct problems in school, multiple traffic convictions, or other evidence of excessive risk-taking and bravado should alert the flight surgeon to potential problems in this area.



Finally, as a result of my experience with candidates referred for evaluation because of stress or performance related problems in flight training, I have learned to ask very specifically about past history of psychiatric or psychological consultations. In this way, we have identified several candidates with histories of learning disabilities or other childhood difficulties whom we would have not otherwise discovered.

SUMMARY

It is said that one of the most important sources of information regarding the potential adaptability of a pilot candidate is the flight surgeon's own response and impression regarding the individual. While this is a valid and important source of information, the flight surgeon must be careful not to rely on stereotyped or idiosyncratic ideas of what constitutes acceptable adaptability. As of yet, there is no convenient or accurate way of assessing adaptability for military aeronautics either psychometrically or by life history criteria. The information presented here serves as a guideline for the aeromedical examiner. If there is any doubt about the psychological suitability of an individual for military aeronautics, a consultation with a psychiatrist or psychologist familiar with aviation is recommended.

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Domestic Problems and Aviator Family Support

by

Grete Myhre, Ph.D
Institute of Aviation Medicine
P.O Box 14
N-0313 Oslo 3
Norway

In Norway the flight surgeon has no obligation to take care of the family of an aviator Actually his only task is to see that flying personnel are fit for flying This limitation of the flight surgeon's task leaves the family members out of the system, and they have to address the local general practitioner for their medical problems Usually this arrangement functions adequately, however, there are special situations when the aviator family needs additional support

The spouse of an aviator faces special responsibilities that spouses of husbands in other professions never get to face. She is well aware that her husband's professional performance is very much dependent upon his mood and well being The pilot's wife therefore often feels that she is responsible for her husband being fit for the day's performance, and therefore she has to be very considerate

This responsibility is probably more difficult to handle today than ten to twenty years ago This is partly due to changes in society which among other things are that close to 75% of the pilots' wives have their own profession outside home and thus have become more distant to the problems of the flight squadron. In addition the technical progress of the aircraft require more alertness of the pilots today than the old aircraft did

In the end domestic problems also turn out to be a psychologist's or a flight surgeon's task in an operational setting, and there are several ways of handling this task

In my practice as an aviation psychologist I have experienced that there is no difference in ways of communicating domestic problems related to pilot profession for wives living in an "aviation getto" close to the base, and wives living in assimilated surroundings When it comes to discussing the special problems the aviator's wife often experiences the communication between the spouses as nonexisting This does not mean that these wives do not communicate at all, it just means there are certain subjects they do not talk easily about

It did not occur to me that this was a problem until the first time I approached a wife whose pilot husband had just been killed in an aircraft accident I realized then that very little had been done for the wives after aviation accidents, and decided to do something to the then prevailing or missing routines

During their career flying personnel have to attend a short course in aviation medicine and psychology every third year During this course the participants are taught general medicine, how their body reacts to certain strains during flight operations and how to prevent or reduce this stress Further they are taught aviation psychology and reactions to stressful events The idea behind this choice of subjects is that the aviator will be better prepared to cope with reactions to mishaps and other, critical incident stressful situations

Being concerned with flight safety one also realizes that the wives need some psychological education and consequently should be included in a special teaching program

Consequently it was decided that the psychologist should meet the wives of one squadron at a time The introduction to this group would be the concern about their situation and how to administer social support after an accident Then they would get a short, intensive course in psychology emphasizing emotional reactions in crisis situations and after an accident One should also stress the importance of belonging to and identifying with a group which can be approached in days of depression and grief In other words giving the wives a briefing very much the same as their husbands

In the beginning of this program one usually faces a very quiet group The wives find it difficult to talk about problems they are used to handle themselves, and which they are not used to mentioning to anybody. After a few minutes of reflection one may direct a question straight to the wife of the squadron leader like "Have you always felt on top of the situation?" or "Have you ever wanted to talk to other wives about worries you have in connection with your husband's work?"

If you can get the squadron leader's wife to answer such questions honestly the rest of the session is simple

There is such a relief to the wives to know that others are in a similar situation and have the same worries and problems as they have themselves It makes them feel relieved to share problems they have not dared to share with their husbands, partly because they have been afraid to upset them, and partly because they have been afraid the problem was irrelevant, and that they were the only ones with problems like that! After years as aviators' wives they believe they should be able to cope with every day problems themselves, and not bother the husbands with trivialities since these might interfere with their flight performance

Many Norwegian airbases are in remote places and therefore the wives feel often isolated from their ordinary social safety net which usually consists of family and close friends This is an important aspect to consider when working with these wives They need some sort of substitute for this missing social safety net This substitute may be a group of spouses from the same squadron, which should not be confused with the ordinary officer's wives committee

The wives' squadron group have a common basis in that their husbands have the same working surroundings, and often the same worries which they bring home to their spouses My experience with these groups, which usually meet once a month, is that they function as a safety valve The wives feel they have a place to take their problems, they do not have to burden their husbands and thus give them unnecessary problems to cope with.

Do not jump to conclusions believing that pilot husband and wife should not work through their own problems. The suggested groups only work as a place where one may test worries or thoughts in order to see how realistic they are, and further act as a place to get ideas on how certain problems may be solved. Quite often the aviator's wife feels that she should keep all her worries to herself in order to shield her husband. Such feelings may lead to an experience of unfairness that she has to cope with all the problems and keep things to herself in order not to be the cause of an aviation accident!

This is the way the squadron wives' group works in everyday life. But unfortunately there is also another side of life on a squadron: the accidents and mishaps.

After accidents and mishaps we have evolved one program for the aviators and one program for the spouses. If the accident is a fatal one the spouse is the first to be informed either by a friend from the squadron or the local minister. She is offered help in order to manage the psychological impact of the accident. She may also take part in the debriefing of the accident together with the rest of the wives' group if she wishes.

This debriefing of the wives is imperative. The wives also experience critical incident stress reactions after an accident, not only the aviators. The wives' stress reactions stem from the uncertainty from not getting all the information available, from sitting at home alone, waiting for the husband to come home and fill her in on details concerning the accident.

Often the husband does not want to talk about the accident when he gets home, he wants to relax and put the stressful event behind him. Imagine what it must be like knowing a little, wanting to know more, and not being able to ask because you have to show consideration for your husband and his mood.

After an accident the wives are gathered in a room at the officers' mess. Firstly they are briefed about the accident or mishap and what is known at the actual time. Then they will get a repetition on the psychological reactions to disasters and what reactions to be expected during the next period of time. It is important to repeat this lecture in disaster psychology whether there has been a fatal accident or not. The reactions may be the same, just differing in intensity. By giving the wives such debriefing one also obtains a supporting individual for the aviator at home, instead of two persons in need of support.

This gathering of the wives after an accident has been a success. They feel that they can cope better with realities, both because they are together with other people experiencing the same situation and because they have the extra knowledge that enables them to face the problems in a more relaxed way, because they know what to expect in the times to come, and what are the natural emotions of these situations.

During such debriefings I have also received reports from the wives which imply that the children may have after reactions even if it is not their father who has been involved in the accident. The parents should be aware of this phenomenon and keep an eye on their children during the aftermath of an accident.

Children may often be observed to have bad dreams or sleep problems during this period. I encourage the parents to talk to the children about the accident in simple language, but be sure not to answer more than what the child asks. Many parents are overdoing the explanation instead of just answering the actual questions. Some parents also force the child to listen to explanations they have not even asked for. The only result these parents may gain is that the child withdraws and will be difficult to communicate with in another crisis situation. One should be careful, because we still know very little what such experiences may do to a child's mind later on.

In this connection a word of warning. I have sometimes experienced after fatal accidents that children of other pilots have been persecuted in school and been told that their fathers were killers and a danger to other people! Parents should be on guard for incidents like this. As therapists you should prepare parents that this might happen to their child, and that the child might try to hide these incidents from their attention. Tell the parents to be on the lookout for signs like nightmares, disrupted sleep patterns or social withdrawal symptoms in periods after an accident.

GENERAL PSYCHOLOGY IN RELATION TO CRISIS SITUATIONS

It is important to present a number of key concepts considered fundamental to the understanding of disaster or accident reactions to the wives group.

Stress is reaction of the total organism to a situation or to a condition and may be related to the person's psychophysiological makeup. The strength of these reactions may vary within the individual depending on the context, the stimuli, the state of the individual's health, the types of support in the community, the family network of safety, and last, but not least on the individual's habitual patterns of human interaction.

Crises develop at a point when the intensity of the impressions on an organism exceeds the system's capacity to adjust and adapt.

An accident may in other words be experienced as a situation of overstimulation, when the senses are not able to process the incoming stimuli the same way or at the same rate as usual. Stress and crises are associated with loss and mourning, social and emotional supports and coping and adaption. The levels of stress and the psychological dimensions are of importance in attempting to understand accident victims and to intervene in offering them psychological support.

The most common feelings after an accident are *grieving, loss* and *mourning*. The processes of grieving and mourning involve cognitive elements and may thus be expressed by physical and psychological symptoms. The individual may suffer physical discomfort or increased susceptibility to illness.

It is important to explain to the group of wives that the social and emotional resources after an accident or mishap are related to earlier experience of stress and coping. Stable, social groups tend to promote strong bonds between the members and help them against post crisis pathological outcomes. In times of stress, individuals may use both formal and informal support systems to help them manage their problems. As professional health practitioners our task is to underline the importance of an open climate and trust among the wife group members to the victim or victims. A variety of support systems will aid the victims' coping with accident stress and in retaining personal adaption to the new situation.

Coping is the behaviour that helps the individual manage stress. It depends on the victim's psychological tools. These include a person's ability to communicate, his/her sense of self-esteem and his/her capacity for bearing discomfort without disorganization. Communication skill facilitates expression of the problem and the means to seek help to resolve it.

The first overt emotional reaction occurs in the beginning of the post-impact phase, this is why it is important to have a social network at hand right away which may take action. At this time the wife or close relatives have an imperative need to be with others and to relate their experiences. When such immediate expression is delayed the result may be helpless underactivity and depressed behaviour.

The post-traumatic phase is usually associated with fluctuating anxiety, fatigue, insomnia, nightmares and depressive reactions. To many victims information about normal reaction parterns like those just mentioned, help them adjust and cope with the new reality. A confirmation that their reaction pattern is according to the book is very reassuring and makes the adaption to the new situation less traumatic.

In addition to this general information about reactions to traumatic events some victims may need coaching into the new reality. There is a danger of passivity after a psychological impact. It is extremely important to be attentive to such tendencies and encourage the social support network to help the wife back to a normal situation with meaningful duties. It is also important to remember that victims after accidents will need support in the days to come, after the news has left the media.

CASE STORIES

Case 1

After a fighter accident where the aircraft went into the ground on an island in the northern part of Norway it was my responsibility to visit the family of the unmarried pilot and fill her in on the accident. At the time I got to the house the only thing we knew for sure was that the aircraft had crashed. There was no knowing if the pilot had managed to eject.

This family lived far away from the base, approximately 1000 miles, but the mother had talked to her son on the phone the night before the accident when he had asked her to send his cross country skis and some sportsgear because he was going on a holiday at the end of the week. The boy had been in high spirits. When the mother was on her way from the airport the next day after sending the goods to her son, she got a phone call on her mobile telephone in the car telling her that her son's aircraft was missing. She went straight home and summoned her daughter, sister and parents. Her husband was on a business trip to Switzerland and was difficult to get in touch with.

That was the situation when I arrived at the scene. Even if the pilot was still missing the grieving process had already started. They were of course clinging to the hope that the boy had had time to eject and that he was soon to be picked up from the sea.

I had to be realistic since I knew that the other pilots in the flight had not observed an ejection, and prepare the family for the boy being dead. It was not until one hour after my arrival the telephone from General Headquarters confirmed the worst assumptions. This family easily expressed their grief, they cried and talked incoherently. After a while the crying stopped and they started to talk about the boy and worried if he had felt any pain and how he had experienced the last minutes before the impact. These worries are quite common in pilot relatives. Fortunately I knew that the aircraft had gone straight to the ground after an interception where the pilot probably had been subjected to high G-forces and most likely had lost consciousness.

It is important to look for positive elements in a situation like this. That is one way to pull people under extreme emotional strain back to reality. In this case it was easy to point out how this boy had been able to realize his dreams, how happy he had been when he talked to his mother. It also turned out that he had been a coach for a basketball team, and was highly appreciated as such. That way I got the family to talk about the deceased instead of sitting quietly and not being able to phrase their thoughts.

Of course they cried a lot during this session and also when they got the final message that he was dead. But during this period I was also able to tell them what emotional reactions to expect in the future, and advise them how to cope. When I left I told them to call me whenever they had a problem or if there was something I could do to help.

I talked to the mother on the phone several times. Most of these calls were related to emotions and thoughts she had had — if they were strange or if they were normal?

Fourteen days after the accident the mother phoned me and told me proudly she had been able to comfort neighbours who had just lost their daughter! She felt that this was a kind of work that helped her in her grief.

After this experience she has started a support group consisting of other mothers or wives who have lost their sons or husbands in aircraft accidents in the airforce!

Case 2

The scene was a mid-air collision where one pilot survived and the other pilot followed the aircraft into the ocean and was killed.

After the wife was informed about the accident she wanted to be present when the wives' squadron group met! The other wives were very quiet when the meeting started. They had a hard time putting words to their thoughts until the widow started talking. She told the group that even if she had only been married one year, she was so grateful to have experienced a relationship like the one she and her husband had had. She revealed she had an unhappy childhood and that her husband had taught her to believe in people and relationships again, and she felt sure that this strength he had given her would help her through her grief. She is an open, positive person. Her way of getting through her grief was to support the squadron wives' club. She told me that the group made her feel like she still belonged to the airforce community, and that she was not being left out in the cold.

Fear of Flying

by

J.R. Galle-Tessonneau
Centre Medical de Psychologie Clinique
de l'Armee de l'Air
26, Boulevard Victor
00400 Armées
France

When a flyer talks about his apprehension to fly (about his fear of flying), it becomes a worrying problem for his fellow pilots and leaders

In fact, this problem concerns the foundation of the aircrew professionally

It's certainly the most important problem of aeronautic psychology.

HISTORY

The term fear of flying has been applied to many sets of symptoms afflicting aircrew.

Anxiety associated with flight has been reported throughout history since man first flew A very good historical review of the fear of flying among aircrew was realized by Thimothy Strongin in 1985 I refer my speech to his work. In 1912 in the preface of the first aeronautic medicine book Charles Richet wrote "The main danger is the psychology itself of the pilot" Anderson who was a Royal Air Force flight surgeon during World War I described the presentation, symptoms and prognosis of pilots with fear and anxiety about flying He named the variety of symptoms culminating in the reluctance to fly "Aeroneurosis"

His work was continued by Goth who studies the etiology of aeroneurosis

Following authors such as Pilmore and Bauer noted factors of predisposition in the nervous condition of pilots At this time psychiatry was not yet a nature field and psychology was more involved with child development, theories of learning and tests of intellectual skills Between the two world wars the literature was unconcerned with psychological problems of fliers There were no longer vast numbers of men in training to fly and there was no war to stimulate anxieties and professional interest.

As with so many other areas of science, World War II was an opportunity for many studies and progress for understanding the fear of flight. We must mention Davis, Grinker and Spiegel and especially Douglas Bond During the Korean conflict, fear of flying was studied by Schulze, Lifton, Gatto and Tempereau

Douglas Bond's work, "The Love and Fear of Flying", was the most important contribution for the understanding of the fear of flight based on the psychoanalytic theories

These psychodynamic studies were continued by Eggersten who offered an existential formulation of the motivation to fly and suggested a pervasive (but usually controlled) suicidal dynamic in fliers and especially Morgenstern who described the counter phobic motivation to fly

Among recent contemporary authors we must cite Goorney and O'Connors in Great Britain; Perry, Reinhardt, Macguire and Jones in the United States; Missenard and Gelly in France

DEFINITIONS AND PSYCHODYNAMIC DATE

Some confusion has resulted from the use of the term fear of flying to describe problems arising from anxiety disorders, phobic reactions, traumatic stress, exhaustion, psychosis and motivational changes So first it is necessary to give some definitions to bring more understanding

The term fear generally refers to a set of acute emotional manifestations experienced by people facing a dangerous situation This danger is a real and specific danger existing in outside reality The emotion experienced is associated with such various somatic motor-sensorial and neuro-vegetative manifestations as paleness, sweat, tachicardy, polypnea, etc Fear can have some adaptive function when it remains limited and controlled because it's forewarning the organism of a danger and raising its state of alertness.

When manifestations are unusually intense and repeated and overload the adaptive mechanisms (then we speak of "stress") they can cause lasting functional disorders, even somatic lesions like ulcers, colopathias, hypertension

Habit, training and a strong desire to face the dangerous situation help to develop adaptation capacities and to make the manifestations of fear disappear

Anguish or anxiety correspond to a state borderlining on the manifestations of fear but beyond a situation of concrete present and external danger It is then a feeling of danger from within and, in the absence of a dangerous situation, the subject does not know exactly of what and why he is afraid There is no danger in the outside reality but perhaps there is a danger, in the inside reality But generally the subject fails to recognize this inside reality. It is unconscious

In phobia, anxiety appears in a concrete and external situation generally always the same, but that situation does not have an objectively dangerous nature. Most people are not afraid of it (crowd, empty space, high place, etc). What happens for phobic people? We understand phobic reactions as the result of a stress conditioning, a sort of bad training We also understand it as the effect of the symbolic meaning which this specific situation represents for this person.

At that point the question is: is flying an objectively dangerous situation?

For someone who has never flown, it is conceivable that flying can be a dangerous situation Air crashes are realities But when one asks a flier "What do you think about the dangers of flying?", the most likely answers are "It's not more dangerous than any other situations". It means that combat

flying is certainly a dangerous situation for many people but not for a pilot.

So another question is "Why fliers are not afraid to fly?"

When they fly, they do not only feel safe, but they also enjoy it. We have known for a long time, that flying is not only a dangerous behaviour, but also a symbolic situation of power. In myths and legends, the sky is the place where heroes and gods live. In imaginary the flyer challenges the human condition and terrestrial limitation. Higher! faster! further! But numerous guilt feelings are inherent in such fantasies.

Remember that flying is dangerous in reality and also in imaginary. So what motivates people to do something as dangerous as flying? Generally many people avoid the dangerous situations and the risks. But some choose to challenge the risks and not to avoid them. This behaviour is a typically counter phobic attitude.

In phobia, one escapes from anxiety by avoiding the phobic object, the phobic situation or by using a contra phobic object (an object or an accompanying person whose presence makes one feel safe).

On the other hand, in a counter phobic attitude, the situation that might generate anxiety is actively researched in a kind of forward running. The danger is faced on the outside and the anxiety is overcome on the inside.

This counter phobic attitude motivates people to many other professions. This psychodynamic organization allows an overcoming of the inside anxiety and a facing of the risks with intellectual and physical means, getting pleasure in feeding the desire. In that kind of situation people are not afraid of the idea of death. They enjoy an intensive feeling of life instead of the brittleness of the existence.

But sometimes this organization of personality may be shaken or broken down and then, fear and anxiety may reappear. The adaptive mechanisms are unavailing and the idea of possible death becomes conscious. Fear of flying is transformed into fear to be killed in an air crash, feelings that can be sometimes as heavy as the idea of suicide.

CLINICAL ASPECTS

Overview

A difference should be made between manifestations of reactionary fear which occur in unusual or difficult situations involving unusual flying and mission conditions or a weakness state (operational fatigue, physiological weakness). These manifestations are temporary and easily disappear with rest.

- Many mental disorders such as depression, neurosis or psychosis whose symptoms and manifestations may be disturbing for a flyer and bring a non specific anxiety in flight.
- Lasting anxious manifestations which occur under normal and usual flying conditions, which are recurrent and form actual fear of flying.
- The clinical expression of the fear of flying may be
  - manifest at first, it is then felt and described as such by the flyer. These are the most uncommon cases.
  - manifest, but its expression is only gradual, the subject trying to hide it and minimize his problems. He (she) will express his (her) disorders only after it recurs over a certain period of time and after really fighting against the uncomfortable feelings he (she) is experiencing.
  - most often, the fear of flying will be latent. It is not expressed as such, but through symptomatic manifestations, taking on the form of somatic disorders, or in professional behaviour and personal relations.

The mode of onset is variable.

- either sudden, for example in the form of discomfort while flying often occurring suddenly in a pilot without previous disorder,
- gradually and insidiously by disorders that are small and insidious at first and which gradually become more intense and permanent after lasting a fairly long time.

Triggering or promoting factors of these disorders are often discovered by examination. These are events associated with the professional or personal life and affective life. The significance and role of an event is not so much due to objective reality as to its subjective value whose psychopathological meaning may be assessed only after several psychological discussions.

The circumstances surrounding its onset may be diverse but the disorders may sometimes occur during certain missions or during certain special flight configurations: high or low altitude, formation flying, without visibility, etc.. Limited initially to specific circumstances, the disorders gradually spread to any type of air activity, even transport or displacement means (car, train) or other situations (social phobias).

CLINICAL FORMS

(1) Forms with predominantly somatic expressions

- The most typical and spectacular picture is discomfort in flight with its sufficiently intense acute functional manifestations to disturb or suspend a mission. It is most often associated with neurosensorial disorders, a change in alertness, if not obnubilation or temporary loss of consciousness, painful, respiratory, cardiovascular or digestive manifestations, with a later very intense feeling of anguish. They are primarily observed in fighter aviation where physiological stresses prevail, but they are also found in other types of piloting.

  The psychological approach of the discomfort in flight is always necessary regardless of the etiopathogenic factors involved. In fact, either the discomfort is an expression of a phobic manifestation of flying or it may be the starting point of subsequent anxious manifestations, in which the subject is afraid of seeing the discomfort recur in future flights.

- Without reaching the intensity of discomfort in flight, other somatic type disorders may be observed in flight. These are primarily sensorial manifestations (visual, hearing or dizziness) or function disorders such as incapacitation with painful sensations (cramping, muscular pain, pseudoparalysis, etc..). The temporary nature of these disorders, their recurrence, the absence of

organic disorders point to hysterical type adjustment reactions

They are often difficult and delicate to diagnose and require repeated examinations and the collaboration of various experts. Pilots who are victims of these disorders reject, at least at the beginning, any emotional or psychological participation and are convinced that they are suffering from a somatic disorder, rebelling against the negativity of the examinations and against the psychiatric consultation.

Air sickness is an attribute of student pilots and is highly uncommon among confirmed pilots

(2) Forms with anxious expression

- They include a psychic syndrome in the form of an unpleasant and painful state of tension with a feeling of insecurity, anticipation and presentiment of future danger (fear of losing one's self control, losing consciousness, dying, becoming crazy), an attitude of hypervigilance, of exaggerated attention to perceptions from the environment or from oneself, with difficulties in concentrating or reacting

  Somatic effects of anguish may associate with

  - dyspnea, palpitations, pain or thoracic annoyance,
  - perspiration, trembling, muscular shaking,
  - nausea, abdominal pains,
  - sensation of heat or cold,
  - giddiness, dizziness, psychomotor instability

These anxious effects may remain limited to certain situations or may gradually spread and take on an increasingly obsessive form which haunt the pilot in other situations: fear of causing an accident or causing the death of others, for example

(3) Neurotic disorders after an air accident

A distinction should be made between:

- immediate emotional reactions after the accident, anxious manifestations at thinking in retrospective about skirting with death, but most often a state of excitement and euphoria at the idea of having escaped a fatal outcome,
- delayed reactions which combine anxiety with feelings of aggressiveness and guilt, particularly when the accident, the victim is responsible for, had victims

The accident may affect the pilot's feeling of professional integrity and invulnerability. It may cause doubt and a feeling of uncertainty about his aptitudes and capacities. Some subjects often clearly express the impression of "having betrayed" themselves, by the aircraft or by the air institution and lose all or part of their feeling of professional confidence

Finally, in a few cases, after a period of latency, an actual traumatic neurosis may develop with its typical repetition syndrome of the traumatic event which invades the psychic life in the daytime or at night

(4) Behavioural disorders
Some pilots do not express their disorders in a somatic or psychic mode, but draw attention by changes in their behaviour

Disorders in professional behaviour: hesitance to fly, refusal to undertake certain missions, under various pretexts, excessive inspections before and during the flight, missions cut short, flight incidents, frequent mechanical failures whose origin cannot be demonstrated on the ground, attitude of withdrawal toward other members of the airline group

General behavioural disorders: the most common and benign of these is fatigue. This is a lasting fatigue, which may disappear with rest, but reappears as soon as the pilot resumes flying. Fatigue is associated with insomnia, unpleasant dreams, nightmares, irritability, excessive and unusual tobacco, alcohol or drug consumption

(5) Progression
In this context, incidents, even an air accident, professional errors, sometimes disciplinary faults, may occur. Namely it is advantageous and of utmost significance for an early detection by the physician, associating with the airline training authorities. In fact, the pilot gradually loses confidence in himself and in others, and feels worthless and may go into a depressive state with suicidal thoughts

ETIOPATHOGENIC FACTORS

Predisposing factors:
Inadequate adjustments should be briefly mentioned. There are cases of subjects who never fully adapted to aeronautics, had undergone a long and painful training and whose professional history was always tainted with problems. The disorders here are in continuity with previous disorders and are due to inadequate training and insufficient adaptation

In the case of pilots who had been professionally well adjusted until then and without a history of disorders, we may elicit the predisposing role of motivation supported by a neurotic pattern of the personality that had been well compensated until then. On the occasion of a promoting or triggering factor, a breakdown may occur in the pattern of the personality and of the professional motivation leading to a neurotic conflict involving professional activity. Flying is the object of ambivalent feelings that are both positive and negative. The fear of flying then stems directly from this neurotic conflict. These psychopathological mechanisms are quite distinct in contraphobic patterns which cause the subjects to actively seek the situations they unconsciously dread rather than trying to avoid them.

Motivation conflicts may be found in other personality patterns. We may also make the assumption that there are always conflicts in aeronautic motivation at the beginning. Accordingly, it is the magnitude of the psychic conflict or its reactivation on the occasion of risks in the affective and professional life that is a determinant in the onset of fear of flying

Promoting factors:
These factors that may be called "overloads" are capable of causing excessive stresses on the ability of the subject to adjust and break down his defensive mechanisms: intensive operational activities leading to overwork and fatigue, poor

collective environment, difficulties in relating and in communicating within the air group, and of course all personal, affective and somatic problems

Triggering factors:
During the psychological examination of subjects suffering from the fear of flying, it is common to expose special events that the subject is highly sensitive to, from the affective standpoint, and what seems to be the actual factors that trigger the disorders

These are

- events of a personal nature, marriage, promotion, taking on new responsibilities, change in aircraft or in type of mission, air incident or accident.

It is the symbolic and subjective meaning of the event that is important and the alterations it causes in the psychic pattern of the flyer. Thus a somatic disorder affecting the physical integrity and the usual perception of good health alters the feeling of invulnerability. Marriage, paternity, can switch the affective investments from one's professional life to one's family life. One day, an accident may reactivate a latent anguish of death

The pathogenic value of the event is often difficult to establish and assess. However, most often, everything happens as if, because of this event, the balance of psychic forces upon which a professional adjustment is based, is altered

PROGNOSIS

Very summarily, in contrast to practice and to the prognosis, we may describe two forms of fear of flying among confirmed aviators

Phobic reactions which are temporary and limited manifestations, which are followed by an event that is experienced as a trauma at the moment but that does not seriously affect the personality and professional adjustment pattern of the subjects, and plays a simple role of temporary deconditioning

Fear of flying that form of an organized pattern, often over a period of several months, considerably alters the patterns of conflict in aeronautic motivation, the prognosis of which becomes much less favourable

TREATMENT ASPECTS

Preventive treatment:
Recruiting, selection. As with all disorders in aeronautic adaptation, the prevention of disorders begins with the initial recruiting and selection conditions of candidate pilots. Subjects exhibiting psychopathological disorders in their medical history and those with fragile personalities should be excluded. However, the methods of selection have their limits

These limits are associated with the age of the subjects whose motivations and personality are not yet well defined and also to the static and limited nature of the initial selection process because of the number of subjects to be examined. It is therefore necessary that the selection process continues during the training and air instruction in flying schools

Prevention and mental health within the navigating units:
Good cohesion of the air group, high morale, interpersonal quality relations play an obvious and essential role in collective mental health. The preparation of missions, a sustained flying rate, while providing for adequate and necessary rest, relaxation and leisure activities organized jointly ("released"), proper knowledge of the personal traits of each, of his capabilities and his limits are well known principles of the command that assumes responsibility

The flight surgeon can play an essential role in this regard. Although integrated within the group, personally knowing each one, he may encourage members to confide personal stories, give advice and play an informal role as a middleman, detached from the normal formalities of hierarchical relationships

Curative treatment:
When addressing a pilot having problems, the flight surgeon should often understand implicit meanings of the manifested disorders. He may allow the problems to be expressed verbally, provide moral, and often drug support, prescribe rest as needed. Minor disorders, detected early, will often find their solutions within the unit itself

When addressing characterized disorders, specialized examinations will make it possible to form a careful analysis that will examine the mode of onset, the circumstances surrounding its manifestation, the duration and the forms of progression, the characteristics of the previous adaptation and of the personality of the subjects and the quality of their motivations

On the treatment level, we will recommend:

- rest and isolation from stressing situations,
- an anxiolytic drug treatment,
- discussions for psychotherapeutic purposes which will allow the expression and verbalization of potential conflicts,
- relaxation and specific deconditioning techniques which may often be effective

Keeping the subject within his flying unit will be discussed. If this is desirable in the case of minor disorders that can be quickly solved, a transfer will often be preferred to avoid rejection from others and potential loss of self-esteem. Air groups can easily be intolerant to their members who do not carry on the same activities and responsibilities and who give the impression of not sharing the same common ideal of flying. Middle-of-the road solutions may be found with the help of the flight surgeon and with the authorities

Medico-aeronautical decisions will make it possible to restrict the missions and to limit the medical aptitude for a reconversion into another aeronautical activity

If in some cases the onset of fear of flying quickly leads to inaptitude, sometimes, a long psychotherapy is required for a subject to be able to accept his ambivalence of flying and to accept the changes occurring in his motivations to exercise its professional activity

T.A.T. AERO
A projective test derived from the Murray thematic apperception test based on aeronautic topics is able to give some interesting indications about pilots' troubles of adaptation and to focus the medico-psychological examination

This test was realized by Doctor Hadni in 1970 (he was my predecessor — my master but he was also affected with a good gift for drawing)

Plate I

Plate II

Plate III

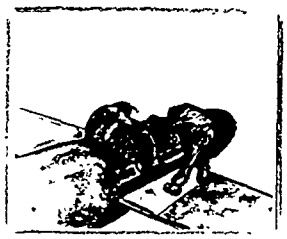

Plate IV

Plate V

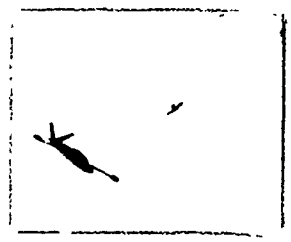

Plate VI

Plate VII

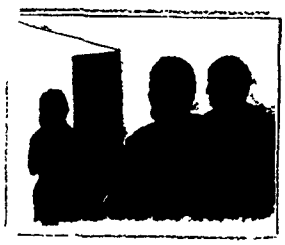

Plate VIII

Plate IX

This test was named AERO T A T

This test is not used in selection, but only for the understanding of cases of pilots presenting some psychological difficulties in flight or a loss of professional motivation

Just like in the classical technique of Murray's T A T, the pilot is given instructions to create a story of his own from each plate he is shown

When the last plate, the blank plate is shown to him, he is asked not only to create a story of his own but also to describe the picture that would be its support

In the theory of the T A T, there is a relation between the story that is told and the everyday-life attitude of the patient

For each plate, we note ordinary stories which are produced by most pilots and more original topics related to personal experience

In Plate I, a young boy is constructing a model aircraft, some tools being displayed on the table Usual stories are about ability to build, aeronautic motivation, the possibility for the model aircraft to fly and what the young boy will become

This plate is the introductory plate and we frequently notice aggressive reactions expressed as detail criticism

Plate II: Here's a young boy with his mother watching some real planes

What are the boy's feelings? His motivation to become a pilot? And his mother, how does she feel about it? She is certainly proud of her son, but also a little anxious. But what about the father? And where is he? Perhaps in the plane And is this a departure or a return? And the boy, is he glad to see his father come back or go away? It's very nice to be alone with one's mother Sometimes there is not even a father

Plate III: The great farewell scene!

"Don't you ever forget me!" or perhaps a great comeback scene This picture illustrates the conflict between the love of flying and the love of a woman This conflict is sometimes very hard, it may either be expressed with guilt or remain, completely avoided (for example a story about a man and a woman who go away together)

Plate IV: Here some men are working on an aircraft

Many stories describe checking, preparations for a mission Other stories deal with crash, rescue and wounded.

Plate V: About this plate, stories concern authority, military orders and also mistakes, scolding and guilt. And sometimes congratulations

Some pilots talk about a medical investigation, strange, isn't it? But disclosed of the pilot's feeling about physicians

Plate VI: This plate suggests stories about crash or fight It's important to note where is the hero. Has he crashed? Is he safe? Is he winner? Or loser?

Plate VII: Anguish — anxiety — fright — panic at the instant which just precedes a crash — what happened? What's the issue? Some pilots don't identify with the hero and are very critical about his behaviour. "He isn't a good pilot", or he is afraid of another drama other than an aeronautic situation or he is simply angry These attitudes are typical of denial

Plate VIII: The usual story suggests that two officers are announcing a pilot's crash to his wife Questions are What happened? Is the pilot safe or was he wounded or killed?

But many patients, choose sadless stories as the pilot's comeback, a friends' meeting and also a story with an erotic signification.

Plate IX: This plate suggests solitude and sadness — some perceive a figure lying in a bed, which suggests disease, suffering and death

But some pilots avoid such bad ideas and talk about a non aeronautic scenario for example a father who says good night to his child, or an intimate scene or a man, thinking

Plate X: The blank plate offers all liberty for choice. It's a possibility of discharge in freedom The stories are various, but generally on optimistic feeling which contrasted with the precedent stories

We analyse protocols in two aspects

(1) A vertical analysis.

Who is the hero? What are his relationships with the environment? What are the most frequent issues? What is the general feeling? Optimistic or pessimistic? What are the original scenarios?

(2) A horizontal analysis:

- Aeronautic motivation (plate one-two-three)
- Conflict type with father-mother-wife
- The importance of aeronautic anxiety and defence mechanisms
- What sort of reactions about the idea of death — The authority relations

This test is not very precise and doesn't give absolute and sure results It's an empiric test which brings out more features concerning a pilot than his behaviour and his speech. With these pictures, a pilot can speak about a hero who is not himself, but who is very close to himself

Some attitudes are different between pilots without difficulties and pilots in difficulties Pilots in good adaptation have an attitude of denial and avoid all family conflict There is no problem with wife, parents or children about their job's danger! There is no problem! Never!

Ideas of death are expressed without anxiety and a dangerous situation (fight or crash) is described with positive issue The hero is a heroic man He's able to overcome dangers without difficulty and to come back safe This attitude is in accordance with the invulnerability feeling which is a characteristic mechanism against the anxiety of death.

At last the adapted pilot is at ease with his hierarchy and he talks about it without guilt or difficulty.

On the other hand, a pilot in professional difficulties is uneasy with hierarchy He expresses some conflict relationships He lost trust in the aircraft and feels it is a dangerous and unsafe object, capable of involving him in a crash. He perceives the aircraft as an ambivalent object with a good and also a bad aspect

The ideas of death are avoided or refused. He cannot easily face the anxiety of death

The aeronautic thematic is generally pessimistic and sad and he cannot rid himself of the dysphoric feeling of the plates

These data are only subjective indications and they have no absolute value, but these indications are sometimes useful when pilot difficulties approach

Psychometric Evaluation Techniques in Aerospace Medicine

by

John C.Patterson, Ph D
Chief, Aerospace Clinical Psychology Function
USAF School of Aerospace Medicine
United States

As noted in the course introduction, neuropsychiatry specialists have been involved in aviation since the beginning Originally, psychologists in particular were asked to improve selection of aviator candidates with psychological tests Unfortunately, research programs in the selection of aviators have waxed and over the years, but for the most part, have not received adequate attention nor funding However, in some civil and military aviation programs, psychological evaluation has become a major component of the selection process. Further, psychological tests and evaluation are important and commonly used in the retention and return to fly decision processes used by many aviation organizations This paper will focus on general issues in psychological testing of aviators, with particular emphasis on retention and return to fly questions

Before I turn to the testing used in occupational retention, I'll say a bit about selection Psychological evaluation for selection can be divided into two areas select-in and select-out Select-in research is not as well developed as select-out research Select-out refers to identifying undesirable and even pathological characteristics of an individual that may be incompatible with flying In this area, psychological evaluation is used in much the same way as it is used for retention and return to fly questions Here, we are looking for pathognomonic signs, psychiatric diagnoses, or even subtle cognitive and personality factors which may result in an individual's failure to learn to fly or, may result in failure to be productive in a flying career

Select-in psychological tests identify highly desirable cognitive, personality, and emotional factors that predict highly successful applicants for flying training and flying careers Though this research is not highly developed, we can propose broad areas of the question Select-in issues can be broadly classified as ability, stability, and motivation All three of these characteristics may be necessary for flying status but may not be sufficient. That is to say, if an individual possesses positive and strong characteristics in each of these categories, it is highly likely that he or she will be successful in flying training and in a flying career as long as these characteristics remain stable throughout the individual's career It may also be true, however, that high levels of all three are not absolutely required for flying training or a successful career For instance, an individual with less ability, but strong motivation and adequate psychological stability may be fully successful Thus, some variability among the three characteristics is likely to be acceptable, though there would be a point at which no amount of motivation or stability could overcome inadequate ability and so forth

We often see individuals who have inadequacies in stability, ability, and or motivation which have likely accounted for the individual's failure. And indeed, ability and stability may be broken down into "who can fly", while motivation may characterize "who will fly" The USAF has limited experience in using psychological assessment for selection so I must defer any further discussion on this topic to experts in the literature, as well as my colleagues in other military and commercial organizations who have, for many years, routinely used psychological assessment in selection (e.g., JAL, Lufthansa Northwest Airlines, Norwegian Air Force, German Air Force, Israeli Air Force).

I will now discuss the use of psychological evaluation in an area with which I am more familiar, that of retention and return to fly. Aeromedical consultations in the area of retention are characterized by such questions as: is there anything new since the last evaluation and can we return this aviator to fly after a medical problem? The first question involves the routine annual flying physical The aviator is usually asymptomatic and is only coming in for a routine checkup Return to fly questions, however, involve returning an aviator to flying status after there has been a medical problem such as head injury, anxiety, or suicide attempt

The psychological evaluation process, in general, involves two components the clinical interview and psychological testing The clinical interview involves history, current functioning, motivation and adaptability to fly and the mental status examination which results in an impressionistic description of the aviator's status History should include information about parents and siblings with particular emphasis on education, health, mental health, and work history of parents and siblings Further, the history should include the educational, social, health, and marital history of the aviator, and any history of legal conflict or entanglement Current functioning refers to the aviator's current situation to include sleep, diet, exercise, and other health habits as well as marital, interpersonal, and leisure time information

A review of the pilot's motivation to fly can be very important as this may change across the lifespan Motivation to fly can be viewed as how one gets interested in flying in the first place, how one deals with the dangers of flying, what continues to draw the individual to flying, and any disappointments or fears about flying Motivation to fly also involves others' perceptions such as those of parents or spouse A good understanding of why the individual chooses to fly is an important part of the assessment. Motivation to fly can be healthy and strong or overdetermined, insufficient, or "for the wrong reasons" A further detail of motivation refers to appropriate motivation for the type of flying private, commercial, schedule airline, military and combat Each of these types of flying requires variations in motivation and often as aviators age, the strength of the components of motivation to fly changes

Finally, the clinical interview should include an assessment of mental status which is reflected in the acronym AMSIT Appearance (behavior and speech), Mood (and affect), Sensorium, Intellectual function, and Thought. There are other methods for assessing the mental status but AMSIT is sufficient The traditional mental status exam requires some modification when evaluating an aviator because of the need to be sensitive to relevant aeromedical concerns That is to say, rarely in the area of sensorium will an aviator need to be evaluated on orientation to time, place, and person However, mood and affect which is usually readily apparent in the psychiatric patient may be highly relevant to assess in an aviator but also difficult to assess Due to the usual aviator psychological defenses of denial, rationalization, etc., mood and affect may be very difficult to assess Thus, the clinical interview is an important part of psychological assessment and indeed is something all aeromedical specialists, neuropsychiatric, and flight surgeon, as well, should use in routine assessment

Psychological testing is the second component of psychological evaluation Psychological tests can be categorized into two broad areas: neuropsychological tests and personality/psychological adjustment tests Neuropsychological tests are those tests which evaluate brain functioning. The areas of evaluation include memory, attention/concentration, information processing, and language Neuropsychological tests involve visual, auditory, tactile, and kinesthetic stimuli, they are based on right or wrong answers and actual performance, and they are often timed. These tests have clinical norms which have been developed mostly from hospital data bases though some aeromedical centers have developed norms for aviators The neuropsychological testing evaluates aeromedical referral questions such as closed-head injury, memory change, aging, training and upgrade issues, and flying deficiency Examples of tests in this category are the Intelligence tests (e g WAIS-R) and the Halstead-Reitan Neuropsychological Test Battery

Personality/psychological adjustment tests comprise the second category of tests used for psychological evaluation of aviators These tests measure both the long standing personality structure of an individual, as well as the aviator's current psychological adjustment These tests measure anxiety, depression, and energy level, as well as self-concept, personality style and traits, and psychological defenses In general, these tests are opinion questionnaires, with no right or wrong answers, and these tests are usually not timed and are self-administered. The aeromedical referral questions appropriate for personality tests include alcohol abuse/use and misuse, somatization, stress reactions, and malingering Examples of these tests include the MMPI, NEO-PI, and projective tests such as sentence completion forms and the Thematic Apperception Test

As noted above, psychological tests are best used when combined with the clinical interview. Both tests and interview have strengths and weaknesses Interview can be highly efficient, and relatively short especially for self-reported and apparent problems. However, most interviews are not standardized or normed and do not develop specific numerical profiles that can be compared with the responses of other aviators. Thus, psychological subtilties may be missed Psychological tests on the other hand are normed and standardized. Therefore, psychological tests provide objectivity, standardized questions to all evaluees and testing provides detailed coverage of all important areas of psychological function. However, testing can be quite time consuming and psychological test results can be misinterpreted if the results are not compared with aviator norms

Both interview and testing are vulnerable to examiners without aeromedical experience Lack of experience in the evaluation of aviators can result in missed critical, subtle, or aeromedically relevant interpretations or may result in overinterpretation of aeromedically insignificant findings Thus, psychological evaluation is best used in the context of the full medical evaluation and should include both clinical interview and psychological testing as the important components to the full psychological evaluation of the aviator

Psychological evaluation should result in relevant recommendations about flying status based on the examiner's experience and the specific evaluation of the aviator These evaluations take time and are highly dependent on the experience and training of the examiner Thus, the psychologically-aware flight surgeon working with well-informed and trained neuropsychiatric experts can produce excellent products which result in highly complex neuropsychiatric and aeromedical questions being resolved with clear and concise diagnoses, recommendations, and dispositions.

Psychological Factors Influencing Performance and Aviation Safety: II

by

James J. Picano, PhD
Director of Psychodiagnostics
Letterman Army Medical Center
Presidio of San Francisco
California 94129
United States

PILOT JUDGMENT AND HAZARDOUS THOUGHT PATTERNS

The next topic I would like to address again involves the psychological status of the pilot as it relates to performance However, I would like to discuss two additional constructs related to these issues pilot judgment and "hazardous thought patterns'

PILOT JUDGMENT

Pilot judgment involves a complex series of psychological processes by which the pilot analyzes and evaluates information about himself, the aircraft and the environment The outcome of this process is a decision regarding the safe operation of the aircraft

In an early study, Jensen and Benel reviewed four years of general aviation accident data and concluded that faulty pilot judgment was implicated in 35% of all non-fatal, and 52% of all fatal, human-factors accidents These researchers speculated that faulty pilot judgment might be related to the pilot's susceptibility to situational factors affecting their psychological status and mental operations

Shortly after this study was completed the FAA contracted with Embry-Riddle Aeronautical University (ERAU) to develop educational materials for pilot judgment training In addressing this issue, the ERAU researchers isolated five specific thought patterns from the literature that might serve as precursors to faulty judgment and labeled them "hazardous thought patterns" These hazardous thought patterns represent mediating constructs between information processing (analyzing, evaluating situations) and judgment or decision-making They are a function of the psychological status of the individual.

THE FIVE HAZARDOUS THOUGHT PATTERNS

The five basic hazardous thought patterns affecting decision-making are *Anti-authority*, *Impulsiveness*, *Invulnerability*, *Macho*, and *Resignation*

Anti-authority is the hazardous thought pattern found in people who cannot tolerate being told what to do. Such individuals may not regard rules, regulations or procedures as necessary, or may not see them as relevant to themselves

Impulsiveness is the thought pattern of people who feel a need to respond immediately Such a thought pattern is reactive and is not typically well thought through Impulsiveness implies doing the first thing that comes to mind

Invulnerability is the thought pattern embodied in the belief that "it won't happen to me" It represents a form of denial of the realistic dangerousness of a situation, and may be prominent in individuals who engage in an excessive amount of risk-taking

Macho involves the thought pattern that one must constantly prove oneself This thought pattern can also be associated with increased risk-taking

Resignation is the thought pattern of individuals who do not seem themselves as impacting their environment Such individuals do not see themselves as "masters of their own fate ' but rather as "victims of circumstances" Typically this thought pattern reflects the attitude that one's actions do not determine what happens to oneself.

In addition to identifying and defining the five basic thought patterns, the researchers at ERAU also developed a ten scenario self-assessment inventory to measure them The inventory yields scores that reflect the relative strength of the five hazardous thought patterns in an individual but does not provide an independent measure of the strength of each

Subsequent empirical research with hazardous thought patterns did show modest relationships with some measures of personality suggesting that these pattens might represent stable, response dispositions This same study also found that three of the five hazardous thought patterns (Invulnerability, Impulsivity, Macho) subsumed 77% of all subjects, and nearly half the subjects studied displayed a predominantly invulnerable hazardous thought pattern This finding suggests that this may be a major indicator of irrational pilot judgment and may be reflected in a great deal of faulty pilot judgments

The five hazardous thought patterns represent an interesting exploration into pilot-centered processes which may mediate between an event and a pilot's decision-making outcome These constructs are in need of further validation, but education about hazardous thought patterns and the individual's appraisal of their own decision-making processes could be easily incorporated into an aviator's continuing aeromedical education and training

SUMMARY

The role of the pilot's psychological status in human factor mishaps has begun to receive increasing attention in the aeromedical literature I have focused on two factors which can impact flight performance and decision making in aircrew Ultimately, our understanding of these psychological processes might help to guide future selection and training procedures, and serve to enhance both the performance and well-being of our flight personnel

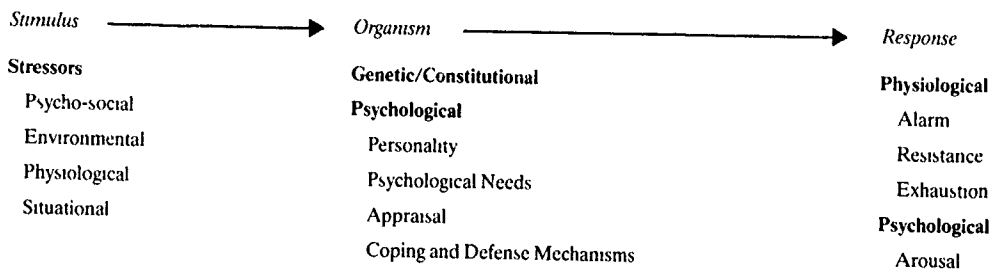

Fig 1 The Stress Model

Psychiatric Reactions to Common Medications

by

David R. Jones, M D , M P.H., F.A.C.Pr.M., F.As.M.A., F.A.P.A.
Consultant in Psychiatry and in Aerospace Medicine
One Clermont Court, Oakwell Farms
San Antonio, Texas 78218-1741
United States

While flight surgeons are responsible for the health care of their fliers, a wide variety of non-prescription medications is available to fliers through drugstores and other sources, and non-flight surgeons may also prescribe medications without realizing the need to suspend flying duties. The somatic effects of these sorts of medications are usually well known to the flight surgeons, but some of their effects on mental processes may not be as well understood, and I propose to review some of these We will consider a case study involving an idiosyncratic reaction to sympathomimetic amines, the use of a neuroleptic medication for an unusual purpose, and review a few hypnotic medications commonly used for sedation

PHENYLPROPANOLAMINE HYDROCHLORIDE

Phenylpropanolamine hydrochloride (PPA) is a sympathomimetic amine found in most common remedies for colds and allergies In the individual sensitive to it, PPA may precipitate a full-blown manic psychosis which may not be recognized for what it is without a careful history

Case history

Capt A's history centered about two events In 1981 this 34 year old flier was on temporary non-flying duty, and decided to lose some weight He took Dexatrim, an over-the-counter medication containing 50 mg of PPA in sustained release form. He also took Vit A 5000 IU and Vitamin D, 400 IU per day, and ate low calorie food which he prepared himself. He maintained this regimen for about six weeks, during which time he noted an elated mood, a feeling of pressured speech and thought, and a sort of inner conviction that his decisions must reflect God's will because they made him feel so good Apparently this did not affect his ability to function in any way detectable to other people, and the symptoms disappeared a few days after he went home, discontinued the Dexatrim, and resumed his normal life habits

About five days later, he joined a team investigating a fatal aircraft accident He found this particularly distressing, because he knew all the dead fliers. During this time he experienced no depressive symptoms, in spite of the grievous circumstances. Shortly after, his excellent performance resulted in a significant job promotion He continued to function well, even though his mother died the next year Obviously, he was not in psychiatric difficulties

Two years after the initial episode, he was grounded for a minor upper respiratory infection, and was given Ornade (a combination of chlorpheniramine maleate, an antihistamine, and PPA) and Afrin (oxymetazoline HCl), a long-acting sympathomimetic nasal spray prescribed for use twice a day He was sent on temporary duty again, and took these medications while living alone in a hotel. He used the Afrin about every three hours. He noted a decreased need for sleep, and again felt that all his decisions were being ratified by a higher power. Upon his return to his home base, he was returned to flying status but continued to use the Afrin as well as taking Sudafed tablets (pseudoephedrine HCl, a non-prescription sympathetic amine). He noted continuing insomnia, hypersexuality, and a feeling of divine mission in his life His wife noted symptoms of elation, euphoria, pressured speech, and progressively inappropriate behavior at home, although apparently his work and his flying were going well Matters came to a crisis when he awoke one night with a strong conviction that Armageddon was coming, and that he and his family had to go naked in order to demonstrate their faith His wife took him to the Emergency Room the next morning, where the physician on duty gave him Valium (diazepam), a benzodiazepine His condition worsened over the next few hours to the point that he felt as if he were dying, and that his children would die also. Returning to the Emergency Room, he was admitted and given Navane (thiothixene HCl), an antipsychotic agent. He slept well that night, and the next morning was coherent, logical and cooperative, showing no evidence of the pressured speech, thought disorder or abnormal thought content present on admission.

Review of family history revealed that his father had had two episodes of significant depression, seven years apart, which responded well to antidepressant medications, and had not recurred No family history of manic disorders was elicited

He continued to do well from the second hospital day He received a brief course of lithium, but all psychotropic medications were discontinued by the sixth hospital day, and he has required none since After an extensive medical and psychiatric workup he was diagnosed as having had two episodes of an organic manic syndrome He was thoroughly counselled on his vulnerability to sympathetic amines, and educated in their names and presence in prescription and non-prescription formulations He was observed in a non-flying status for one year, and continuing to do well, was returned to full flying duties. He has had no recurrences

As of our last contact, Capt A was psychiatrically normal He was relaxed, pleasant, balanced and serene He understood his condition well, and knew that any sympathomimetic drug, and possible parasympatholytic drugs as well might trigger manic episodes He understood that he must never take any medications on his own authority, and that any physician treating him in the future must be given this history. He was instructed to trust his wife's assessment of his personality, should she detect any manic tendencies. His functioning was worthy of our trust, and he has continued to fly safely.

We were concerned if these toxic manic episodes indicated any tendency toward spontaneous manic disorders After an extensive review of the literature and conversations with several authorities in the field, we could find no data either

way. We concluded that there was ample history of people becoming manic on clinical levels of PPA, and that discontinuing the PPA would quickly reverse the symptoms There were no follow up data over one year, and some of the cases reported were multiple drug abusers, and had other psychiatric history Review articles noted that PPA could be synergistic with caffeine, and implied that other sympathetic amines, such as Sudafed or Afrin

TRIFLUOPERAZINE (Stelazine)

In addition to being a report of a rather unusual case, the previous example underscores the need to educate fliers on the dangers of flying on any medication, whether prescribed, borrowed, or bought on the open market. We are all familiar with the slowed mentation and drowsiness resulting from many antihistamines. I have recently encountered a case in which a flier was taking trifluoperazine (Stelazine), a high-potency piperazine phenothiazide which is related to cholorpromazine (Thorazine), 2 mg each night for bruxism This medication had been refilled for some ten years by flight surgeons who did not have any record of why he was taking it, and who did not use the drug in their ordinary practice None appeared to know that this family of medications, ordinarily used to treat psychotic patients, has a slow rate of biological clearance, and may be found in the body up to six months after the last dose is taken. None appeared to know that there is absolutely no literature (at least, I could find none) that supports the use of Stelazine for treatment of bruxism And none could recall telling the flier not to fly while on the medication. Indirect evidence indicated that he did not take the medication on nights before he was scheduled to fly, but this was clearly not sufficient time to clear the medication

I mention this case also to remind you that prochlorperazine (Compazine), widely used to suppress motion sickness symptoms, is another member of the phenothiazide family Although such drugs require a prescription, family members tend to share medications which they regard as used for everyday symptoms such as nausea Fliers may easily acquire such medications in this manner

BENZODIAZEPINES

Diazepam (Valium) and Chlordiazepoxide (Librium)

I wish now to consider a few facts about the benzodiazepines. This family of drugs is so commonly used that one year during my tour as a hospital commander, physicians in my hospital prescribed more tablets of Valium than of aspirin! Sharing another person's Valium is not at all uncommon, because this medication is regarded as so safe in everyday life, and my perception is that fliers tend to believe that 24 hours is enough for any drug to clear their bodies Actually, the biological half life of Valium and its metabolites may be as long as 48 hours, this is also true of the similar medication chlordiazepoxide (Librium) Please recall that it takes about seven half-lives for a medication to achieve a biological steady state in the body, and about seven half-lives for a medication to clear once it is discontinued This assumes that the measurements in serum or urine reflect the general presence in the body, and one must recall that some medications are more firmly bound to tissues which are not so easily assayed Thus, once a patient has been taking Valium or Librium steadily for a week, it may take two weeks (7 times the 2-day half life) for these medications to clear

Flurazepam (Dalmane)

Dalmane, another benzodiazepine used for nocturnal sedation, is widely regarded as of no concern 24 hours after use, since its mean apparent half life is about 2 3 hours. However, the half life of one of its metabolites, N1-desakyl-flurazepam, which accounts for about 1% of the dose, ranges from 47—100 hours Recalling that Dalmane reaches a steady state in the body after taking it for 7—10 days, and that, once in this steady state, it can be detected in the body for two weeks after discontinuation, one begins to get a little uneasy about fliers using the medication at all!

Triazolam (Halcion)

Another benzodiazepine commonly used for brief sedation is Halcion This drug reaches its maximum effect in about two hours, and it appears to have no long-acting metabolites One distressing effect has been reported in a few individuals, however, which in my opinion would disqualify its use in fliers Rare cases of transient global amnesia have occurred on the day following the use of Halcion for sedation, amnesia of up to several hours in which the individuals functioned in apparently normal ways, but which they could not remember the next day The aeromedical implications of this need no emphasis to this audience

Temazepam (Restoril)

Restoril has been used by the RAF as a hypnotic for its fliers It, too, has a rapid onset, with peak levels at 2—3 hours It has a very clean metabolic path, with no active metabolites being formed Although it should be used with caution, and only after adequate pre-testing, it appears to be the medication of choice for sedating fliers. As always, the flight surgeon must be responsible for an informed choice as to which forms the greater hazard to safety for the flier to fly without adequate sleep, or to fly after adequate sleep obtained through use of a medication with known risks Clearly, this set of choices obligates the flight surgeon to understand the consequences of use of the hypnotic medication, its metabolism, the bioactivity of its metabolites, its biological elimination pathways and schedules, and the reactions of each individual flier to the drug.

Sequelae of Head Injury

by

Marc S. Katchen, M.D
USAF School of Aerospace Medicine
United States

I will only be discussing closed head injury The risk of seizures and permanent disability from open head trauma is extremely high and is usually not considered for return to flying status Reviews in the literature by Dr Caveness and colleagues in their post-war studies, including Korea and Vietnam, have documented open head injury sequelae quite well The Aeromedical questions, after closed head injury, can be divided into three categories

1. The risk of permanent neurological deficit,
2 The risk of sudden incapacitation and
3 Transient neurologic and neuro-psychological deficits

The first category represents deficits, such as, loss of motor function, decreased cognitive ability or dementia, the loss of language, such as an aphasia or the development of a speech problem, ie dysarthria The deficits from this type of injury usually are aeromedically significant and remove the crew member from their flying position Their evaluation usually reveals the deficits without any difficulty, although mild aphasias may require full neuro-psychological testing in order to document the problem In the past four years at USAFSAM, there has only been one evaluation for possible aphasia related to head injury. The second category, the risk of sudden incapacitation, includes those individuals who are at risk for post-traumatic seizures This category causes great concern in the aeromedical community, since, as mentioned in my introduction, seizures account for a significant number of aircraft accidents The problem of predicting who will have a seizure following head injury and what are the safe limits for followup after head injury remains a problem. The risk of post-traumatic seizures is related to the degree of head injury received. The difficulty with predicting how long an aircrew member should be followed for before returning them to their flying duties is complicated for the lack of good information from the literature on which to make a prognosis. In 1979, there was a panel discussion and a publication in the Archives of Neurology on "Neurological Conditions Associated with Aviation Safety" This panel addressed the problem of post-traumatic seizures and produced the statement "new seizure cases level off after one year, and beyond two to three years, new cases are rare but do occur" They also address the role of the electroencephalogram and stated "the EEG is firm diagnostic confirmation when it shows a paroxysmal abnormality and correlates with the attack pattern Less specific abnormalities are of no diagnostic aid" The obvious message from this conference was that closed head injury is a risk for post-traumatic seizures, but the timing for safe return to the cockpit is somewhere after one year They did not breakdown the risk by degree of head trauma In 1985, Damier and Leventon reported an assessment of epidemiologic literature in post-traumatic seizures in the journal Central Nervous System, Volume 2 In their article, they reviewed the post-traumatic seizure literature and found only two articles that included a controlled matched population in predicting the post-traumatic onset of seizures One article was in the pediatric population and the other was by Annegers reported in Neurology, 1980 Volume 30. From my review of the literature, this remains the only controlled study and is the one most often referred to in books and articles on post-traumatic seizures In their article, they broke down the risk of post-traumatic seizures by the degree of head trauma. Fortunately, their definitions of severe, moderate and mild head trauma are the same as used in the United States Air Force regulations. Severe head trauma is defined as a loss of consciousness or post-traumatic amnesia lasting greater than 24 hours Other causes of severe head trauma, such as, brain CSF leaks greater than 7 days or depressed skull fractures, and intracranial or intracerebral bleeds all are included as severe head trauma Moderate head trauma is defined as loss of consciousness or post-traumatic amnesia, lasting greater than 30 minutes and less than 24 hours, or the presence of a skull fracture Mild head trauma is defined as loss of consciousness or post-traumatic amnesia less than 30 minutes It is important to note that the definition of post-traumatic amnesia is defined as the return to continuous memory function after head trauma. This requires a continuous laying down of memory tracts by the injured person One should be careful when trying to determine the extent of post-traumatic amnesia not to include times when the patient was intermittently remembering events or had events told to them by family members, which they have now incorporated into their memory. This will give a false early reading of their post-traumatic amnesia The Anneger study calculated the relative risk for post-traumatic seizures at one and five years The severe group had a risk of 7 1 percent and 13.3 percent for those years respective This shows a significant risk at both cut off dates The moderate head trauma group showed a 0.6 percent risk at one year and a 1 6 percent over 5 years This group represents the most difficult in the decision making process Since this is the best data available, there appears to be minimal risk at one year with a slight increase in risk over the next four years Unfortunately, there was no cut off at 2 and 3 years to define the extent of this risk The mild head trauma group did not show any increased risk at one year An important point, which cannot be found in the data, is that this study is in a civilian population who return to their usual work following head trauma Their work did not include the stresses which accompany the aerospace environment This environment is one of high stress, including chronic fatigue, circadian rhythm changes, intermittent hypoxia or hypobaric conditions, sleep cycle alterations and sleep deprivation. A similar study to that of Annegers, using military subjects, would be much more applicable Until such a study can be done, the return to flying status is best made on a conservative basis.

The third category consists of transient neurologic or neuro-psychological deficits. This, for the most part, is the post-traumatic syndrome. This syndrome is a complex of

signs and symptoms, including poor concentration, increased irritability, headaches, vertigo and behavioral changes which can be a sequelae to mild head injury or injuries with no loss of consciousness, such as, in whiplash. This type of sequela is the most difficult for the flight surgeon to evaluate. The aircrew member will probably not come and complain of the difficulties they are having. If the flight surgeon is not thinking about this possibility, it may be missed. It is unknown how this sequela of head trauma has affected flight safety because there were no studies that could be found. It is well documented in the literature that neuro-cognitive processing is affected by mild head trauma. There have been many reports of neuro-psychological testing following mild head trauma showing processing deficits. In addition, there is an abundance of literature on the symptoms of the post-traumatic syndrome, which have caused people to miss weeks to months of work. Most of the jobs are not as demanding as the aerospace environment. At USAFSAM, we have seen several cases where neuro-psychological testing has been abnormal following head injury, but this is usually after at least moderate type. Recently, there has been one case with well documented decrements in the neuro-psychological functioning, followed mild head trauma, which improved with time. It is important that the flight surgeons make the post-traumatic syndrome known to their aircrew members as part of their safety briefings. This will raise the aircrew members' awareness and allow them to understand that symptoms after mild head injury can present a danger in the flying environment, but yet do not pose a danger to their career. It can be emphasized that with time, these symptoms will subside and they will return to the flying environment.

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The Failing Aviator

by

John C. Patterson, Ph.D.
Chief, Aerospace Clinical Psychology Function
USAF School of Aerospace Medicine
United States

This might be one of the most difficult topics in aerospace medicine. Many of us spend our professional time supporting the aviator. Our practice is prevention of problems, and we deal with a highly personable, bright, and enjoyable group of people who are aviators and, in time, some become friends. Thus, to discuss the process of failure somehow seems disloyal and a betrayal of the "bond" Dr Galle-Tessonaneau discusses in h... paper in this series. This combination of denial, rationalization, administration, and honest intention may make it difficult for us to consider or accept the idea that even healthy bright, friendly aviators have problems so significant that they are incapable of effectively maintaining their flying status. Thus, this is an area that has not been discussed in the open literature very often. The papers that are available are anecdotal leading us to believe that aviator failure is an isolated, and insignificant, low incidence occurrence. Further, it is difficult, partly due to our own reluctance to ask the question, and partly due to the aviator's resistance to scrutiny, to know the true prevalence of psychological and emotional failure among aviators and whether those who are identified only represent the "tip of the iceberg". It is likely that most signs and symptoms of failure in aviators are not directly detected, but rather show up subtly in performance, satisfaction, safety, and retention problems.

Perhaps, the biggest problem with the failing aviator is the individual's failure to recognize early signs of failure. Often no one else in the flying organization including peers, flight surgeons, or supervisors will notice or say anything about the concerns they may have about the aviator. In fact, we may prefer not to notice even obvious signs of failure. Another part of the problem is that the failure process is insidious. There are a variety of conditions which cause sudden incapacitation in aerospace medicine. The psychological and emotional failure of aviators, however, tends to occur over a long period of time and thus change comes in very small increments that are difficult to recognize. Another part of the failure-to-recognize syndrome discussed above has to do with the stigma associated with psychological failure. It is well understood among aviators that one would much rather have a cardiovascular defect rather than be found to have a psychiatric diagnosis or emotional disorder. This stigma is a significant part of the aviation culture which promulgates the idea that loss of self-control is cause for personal humiliation and shame. Whatever the source, the stigma associated with psychological issues and problems among aviators promotes avoidance, and ignorance of the early signs of failure. This difficulty in recognizing failure as a process rather than an acute event, often leads us to wait for an acute event such as a mishap or suicide gesture before help is offered or before formal evaluation is requested.

To understand the process of failure in the aviator, one must first understand the aviator. Simple stereotypes of daring, carefree men and their machines have romantic appeal. However, such stereotypes greatly underestimate the rich diversity of style, expression, and ability found among those who fly.

Many such stereotypic aviator descriptions are nothing more than caricatures which may be humorous and actually contain grains of truth but tend to oversimplify, overgeneralize, and lead us to inaccurate assessments and conclusions about individuals. However, several studies have found common personality themes among groups of aviators. Aviators as a group tend to be achievement oriented, adventurous, self-reliant, healthy, and disciplined. They also tend to be emotionally controlled and cautious and they often use a variety of defense mechanisms such as denial and rationalization. They tend to be socially gregarious but superficial and actually are interpersonally distant especially in intimate relationships. It is here in the generally healthy aviator personality that we begin to see the potential for failure. That is, while aviators are selected for their general health, there are areas of psychological vulnerability, which when combined with environmental stress, tend to lead to psychological distress and can then develop into emotional dysfunction.

One author (Ursano, 1980) notes that the aviator is "likely to fail when unavoidably confronted with his emotional life having few mechanisms available to deal with this long denied part of his personality". Indeed, Ursano's description is a common theme in numerous neuropsychiatric consultations. As described above, aviators are an unusually intelligent, often well educated, and generally healthy group of people who, however, may also be uninformed about or actually avoidant of the psychological part of their lives. Thus, when faced with emotionally ladened issues such as marital problems, family illness, etc., they often ignore (deny) their emotional reaction and when denial fails, they become frightened or depressed in reaction to feelings of loss of control, helplessness and hopelessness. Usually, these feelings develop after long periods of emotional stress lasting from months to years but finally, if there is no resolution of the problem, though the aviator has been able to "keep up a good facade" the insidious process that has been working for so long may become an acute event demanding immediate attention and intervention.

The early warning signs of failure begin in the family, and then progress to the social and work environment, and finally, but most importantly, to the cockpit. Escalating or new signs of family conflict are often associated with the failure process. Most of us, but in particular aviators, view family as a safe haven or sanctuary from other stresses in the wo ld. Indeed, this may be the only place of respite. If this also becomes a source of stress instead of a source of support, the failure process is accelerated. In fact, this formerly dependable source of safety and comfort may be the original beginning of the failure process. The aviator

studies which describe personality attributes of emotional control and interpersonal cautiousness help us understand how family life may be difficult for and with an aviator Thus, it may be that other family members demand change in the aviator and the aviator may agree that change is required but does not know how to change and may not even know what needs to be changed

In the social setting, or work place, early signs of failure include alcohol abuse, somatization, cynicism, procrastination, distraction, signs of fatigue, and a change in level of friendliness or social participation Again, these changes are often slow but one can begin to perceive these changes and notice the difference over a matter of months Failure signs in the cockpit are often the last to appear but may include distraction, incomplete or late briefings, poor cockpit resource management, and other things best described by professional pilots If the failure process reaches the cockpit, the end of the failure process (an acute event) may not be far off We find that conflict is most often seen first in the family environment, then if not resolved, it extends to the social then work environments but the last place problems will arise is in the cockpit.

These subtle signs of withdrawal, loss of humor, fatigue, and procrastination can lead to a collection of signs and symptoms associated with mild, moderate, or severe psychiatric diagnoses. The common diagnoses seen among aviators include anxiety, depression, somatization, marital discord, alcohol abuse/misuse and overuse, personality disorder or acute situational adjustment reactions At this level, the failure process is essentially complete and depending on the judgment of the consultants involved, temporary removal from flying is often wise The aviator will feel an initial sense of betrayal and extreme failure but in some ways, he may also feel a sense of relief that long months of struggling against uncertain problems with few skills are over and help and improvement are available

The purpose of this paper has been to increase the awareness and alertness in those of us who work with aviators about the early signs and symptoms of failure The solutions, prevention, and treatment of aviator failure are beyond the scope of this paper. However, solutions can start by addressing the failure process early, by providing training in these areas of psychological functioning such as parenting and marriage communication, by changing the selection process to include not only competitiveness and achievement, but also openness to emotional experience and finally by improving the relationship between mental health providers, flight surgeons, and aviators. Our problems remain stigma, denial, lack of understanding of the emotional problems of aviators and how these problems may lead to failure even as far as failure in the cockpit.

Selected Concerns/Excessive Daytime Sleepiness

by

Marc S. Katchen, M D
USAF School of Aerospace Medicine
United States

The evaluation of an individual with excessive daytime sleepiness requires an extremely careful history and a systematic approach that we will review in this lecture Much of this information was published in an article in "Aviation Space and Environmental Medicine" authored by Dr Gary Gronseth and myself in 1987.

We performed a retrospective study involving all patients referred to USAFSAM for the diagnosis of excessive daytime sleepiness between 1958 and 1987 We then performed a review of the literature and compared our findings with those reported from United States Sleep Laboratories It should be noted that the evaluation of sleep disorders and the growth of sleep medicine has undergone tremendous changes in the past 10—15 years It was only in the mid-1950s when the phases of sleep, including rapid eye movement sleep, were described on the electroencephalogram Since that time, there have been great strides and changes in the technology for evaluating sleep disorders The establishment of sleep centers utilizing polysomnography has increased the precision of diagnosis, especially in the areas of sleep apnea and parasomnias I mention this before reviewing our results, since our retrospective study included years when this type of sophisticated evaluation was not available In our evaluation of 15 crew members, we found 33 percent with narcolepsy, 7 percent with primary hypersomnolence, 13 percent with insufficient sleep 7 percent with no disease and 40 percent with an unknown diagnosis When compared to the United States Sleep Lab Experience, sleep apnea accounted for 25 percent, narcolepsy — 30 percent, primary hypersomnolence — 10 percent, insufficient sleep — 5 percent and other — 20 percent There was only a 10 percent unknown diagnosis category. When comparing these two results, there is an obvious lack of the diagnosis of sleep apnea in the USAFSAM experience This may have been from the different time periods and lack of polysomnography in the period reviewed by our paper In addition, it may be that many patients with sleep apnea have a physiognomy, which is incapatible with military selection The obese patients known to have sleep apnea would be excluded from military service This certainly does not make up the entire category of sleep apnea patients, but may be a contributing factor The percent of narcolepsy cases were almost equal, as were the primary hypersomnolence diagnoses The other major difference is that the current United States Lab Experience reported less than 10 percent with an unknown diagnosis, whereas our study showed 40 percent unknown Again, this may be from the difference in times when the information was collected and the current use of sleep centers and polysomnography By way of review, it should be remembered that the diagnosis of narcolepsy requires a history of irresistable daytime sleepiness, cataplexy, sleep paralysis, and hypnagogic hallucinations during the episodes of sleep attacks In addition, the finding of early onset rapid eye movements with the onset of sleep on the EEG is characteristic of narcolepsy Recently, there have been reported HLA types which are characteristic of narcoleptics The HLA type DR-2 has been found in 98 percent of caucasians in the United States with narcolepsy This finding is not found with such high incidence in the black population, but there may be a separate marker in this population This means that a patient who is a narcolepsy suspect who does not have a HLA DR-2 marker is unlikely to be a true narcoleptic In the past several years, there have been reported cases of "monosymptomatic" narcolepsy These are reported cases of narcolepsy, which do not fit the classic tetrad of signs and symptoms, but have characteristic EEG findings along with excessive daytime sleepiness It is unknown at this time whether these patients will evolve the full narcolepsy syndrome or are a sub-population within narcolepsy patients

What is needed by the flight surgeon is a paradigm with which to evaluate cases that are referred for excessive daytime sleepiness Such a paradigm is copied on the last page of the article attached (Fig 1)

The first part of this evaluation includes a thorough physical examination, some routine blood work such as, a CBC thyroid profile, liver function tests, etc , looking for the more obvious causes of daytime sleepiness The most important part of this initial contact is the history A careful review of the patient's past medical history, looking for signs of excessive sleepiness which preceded their military career is very important If there is no obvious cause to the excessive daytime sleepiness and it is a persistant problem, the obtaining of a 21 day sleep diary is essential to get objective measures of the patients nocturnal sleep, daytime napping and overall sleep hygiene It is not enough for the patient to self report that he sleeps well or sleeps poorly, since many of these patients do not have insight into their sleep habits Once the sleep diary is obtained and you are satisfied that there is no evidence of a neurologic or psychiatric disorder which can be contributing, one can move to the left of the paradigm In reviewing the sleep history, you can determine if there is an inadequate quantity of sleep or an adequate quantity of sleep If there is an inadequate quantity of sleep then one breaks this down into either voluntary or involuntary The voluntary poor sleep quantity is usually related to poor sleep hygiene These are the people who are burning the candle at both ends and do not realize it These may be very high performing individuals who are over extending their work days or allowing extracurricular activities to interfere with their sleep cycle These cases are best managed with the help of some type of counselling or psychological evaluation. The involuntary causes of inadequate quantity of sleep lead to the many problems that cause insomnia. In more specific terminology, this is considered a disorder of the initiation and maintenance of sleep. The causes for insomnia are many and will not be reviewed at this time. It is important to distinguish an acute

problem from a chronic one, so that the proper referrals are made

The last part of the paradigm reviews those patients who have had an adequate quantity of sleep, according to their sleep history These patients will require referral for sleep studies The initial sleep study, which is called a "mean sleep latency study", will distinguish those patients with early onset rapid eye movements from non-rapid eye movement sleep The obvious diagnosis with early rapid eye movement, along with early onset sleep, is narcolepsy This has already been discussed The patients who have early sleep on their EEG without early rapid eye movement will require a nocturnal polysomnogram to distinguish the diagnoses of sleep apnéa vs primary hypersomnolence or parasomnias The parasomnias include restless leg syndromes and nocturnal myoclonus The former diagnosis will most likely be told to you by the patient, since it is a consciously annoying problem, where the patient develops recurrent urges to move their feet at night and this keeps them from initiating sleep The latter diagnosis, nocturnal myoclonus may not be reported by the patient, but by their bed partner. The recurrent jerking movements during sleep do not arouse the patient to conscious awareness, but do cause intrusions in their sleep The bed partner is usually the recipient of these jerks and many times keep them awake This is important to note, because interviewing the bed partner may give you a hint to the cause of the excessive daytime sleepiness early on and avoid an excessive workup Using this paradigm should allow the flight surgeons to establish a diagnosis in over 90 percent of his cases I would like to mention that flight crew members, like residents, interns and many physicians, often experience daytime fatigue As residents and interns, many have witnessed their associates falling asleep during morning report and conferences after a 36 hour shift Physicians, in general, are very lenient when it comes to other members being sleepy during the day Aircrew members, many times, are the same way because of the hectic schedules and extra work that is many times placed upon them It is usually not until the aircrew member is considered unsafe or unable to perform their job on a recurrent basis, that they are referred to the flight surgeon Therefore, a red flag should go up from the beginning when an aircrew member is referred for an evaluation of excessive daytime sleepiness

The first case is a 27 year old KC135 pilot who fell asleep during one mission. His physical examination and neurological evaluation were within normal limits. There was no hint of psychiatric illness Review of his past sleep history, especially in the previous week, revealed obvious sleep deprivation, which was reported in the initial evaluations This pilot was thought to have poor sleep hygiene and he was allowed to return to flying status This case illustrated how important it is to take a careful sleep history

The second case is a 29 year old B52 pilot who was brought in for recurrent episodes of falling asleep during missions. This pilot gave definite history of sleep paralysis and hypnagogic hallucinations upon falling asleep. It became evident that this pilot did have narcolepsy and was disqualified

In summary, it is important to emphasize the need for a careful history during the initial evaluation, obtaining a good 21 day sleep history, if necessary, before embarking on an extensive evaluation Speaking with the bed partner will help understand if the patient has any parasomnias Talking with his crew members to establish if this has been a chronic problem or if they are under any underlying difficulties which could be contributing is also essential

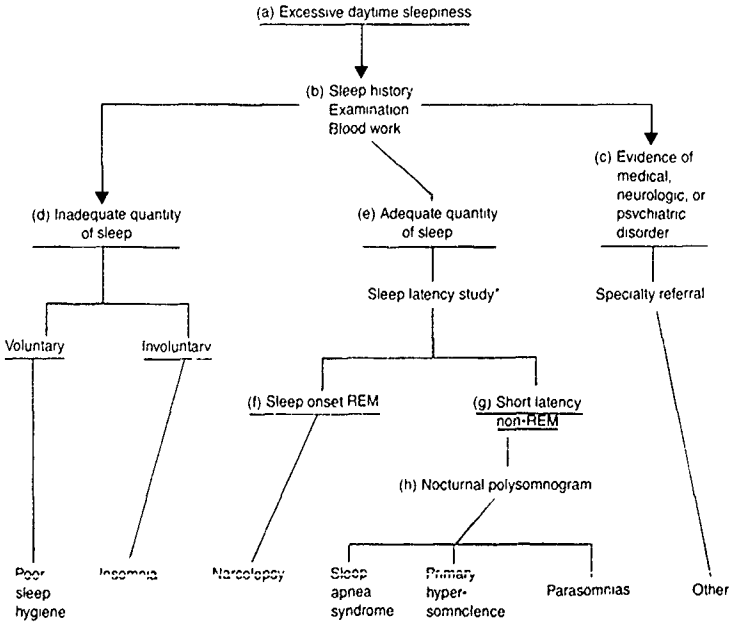

Fig 1 Suggested algorithm for evaluating excessive daytime sleepiness. *A normal sleep-latency study suggests that the patient's complaint is related to fatigue or malaise and not to a formal sleep disorder

Multiple Sclerosis and Optic Neuritis

by

Marc S. Katchen, M D
USAF School of Aerospace Medicine
United States

The following paper entitled *Selected Aeromedical Concerns The relationship of optic neuritis in multiple sclerosis* was the review paper from which this lecture was derived It contains greater details and a bibliography, which was not part of the original lecture, therefore, I have submitted this in lieu of the lecture itself This paper was prepared by myself and Colonel Wade Baldwin, D O M PH F.S., United States Army

Optic neuritis (ON) occurs relatively infrequently (Ref 14) It may be a complication of measles, mumps, chickenpox, pertussis, follow a wide variety of other infectious diseases, or immunization procedures (Ref 14) It has also been reported following exposure to toxic agents and a number of drugs (Ref 14) An isolated attack of ON may also be the first sign of multiple sclerosis (MS) followed by other symptoms years later Finally, ON may occur as an isolated episode having a self-limited course and carrying no prognostic implications with respect to central nervous system disease Reports of an interval of 20 or more years between an initial attack of ON and later disseminated involvement have caused authors to consider an episode of (ON) of unknown etiology at any age a manifestation of MS (Ref 14)

Most studies over the years have used several schemes for the diagnosis and clinical classification of MS The best known and most widely used had been the criteria published by Schumacher et al These criteria were established in order to select patients for participation in therapeutic trial and pertain only to what might be called definite MS

As no one laboratory test is diagnostic of MS, the diagnosis remains a clinical one However, several laboratory and clinical procedures contribute to establishing the diagnosis Besides a detailed history and clinical evaluation in MS, immunological observations, cerebrospinal fluid (CSF) tests, neurophysiological procedures (including visual-, brain stem auditory-, trigeminal-, and somatosensory-evoked potential measurements), evoked blink reflexes, a variety of physiological and psychophysiological procedures, neuropsychological assessments, tissue-imaging procedures such as computer-assisted tomography (CT scanning) and magnetic resonance imaging (MRI), and urological studies of bladder, bowel and sexual dysfunction have been used The MS suspect may undergo any number of the above tests, although not all are performed in every case

The aeromedical significance of the relationship of ON to MS applies to both the selection and retention of aircrews The potential for loss of a special sense as a result of symptomatic MS makes a rated aircrew member a threat to flight safety and mission completion The potential for long-term disability and loss of trained crewmembers makes the cost of selecting an MS suspect as an aircrew member prohibitive

It is our goal to review the world's literature to

(1) see what subpopulation of ON has been identified to be at high risk for MS;

(2) present a standard for working up and diagnosing MS, and

(3) suggest a policy or establish research guidelines for handling ON in the aircrew population.

In addition, we reviewed the cases of ON and MS evaluated at USAFSAM over the past 15 years to look for patterns and effects on retention and flight safety We present two recent cases to illustrate the difficulties evaluating the above diagnoses

Approximately 37% to 50% of MS patients have a clinical episode of ON at some time during the course of their disease The risk of developing MS later in patients with isolated ON is less certain The published incidence varies between 13% and 85% (Refs 2, 6, 7, 13, 21, 27, 28) Most studies indicate that 25% to 35% of patients with ON will develop MS. The length of follow-up is an important variable in assessing the risk of developing MS, since many years may intervene between ON and symptoms of MS Intervals of 24, 29 and 37 years have been recorded. Kurlan et al found that the proportion of patients developing MS continued to rise with prolonged follow-up, which agreed with the work of McAlpine (Ref 1) However, serial studies reviewed in Kurlan's article demonstrated that most patients who develop MS do so within 5 years (Refs 1, 14, 24)

Despite many studies on the rate of conversion of ON to MS, the subject remains controversial. There are hardly two studies that have treated the problem in quite the same manner This reflects the fact that many variables affect the described outcome Most investigators accept a close relationship, since many patients with clinically definite MS have had ON at some point in the course of their disease The longest follow-ups have been in some of the studies with the lowest conversion rates This has led to isolated ON enjoying a diagnostic status approaching that of a specific disease despite the fact that ON is not a clinical pathologic entity (Ref 3). Variables used and the period of follow-up obscures the relationship of the criteria for both the diagnosis of ON and of MS. Kurtzke (Ref.17) showed this in his tables comparing the rate of MS in studies group by like variables such as criteria for MS (see Table 1).

How can we identify those people with ON who will go on to MS and what tools are available to make this differentiation? Most patients with one episode of ON do not have any workup outside of ophthalmological care and follow-up. Little attention is given to the etiology because of its status of a benign, self-limited disease When studies are performed where idiopathic ON patients are worked up as MS the predictive value of the standard MS workup battery shows a

TABLE 1
Progression to MS after Isolated Idiopathic ON[a]

Source, year	Total MS %	Confidence interval[b]	Possible MS %[c]	Notes
A. Series Reporting Percentages in excess of 40%				
McAlpine, 1964	85	74–93	—	Withdrawn
Rischbieth, 1968	83	74–89	—	Part of MS prevalence survey
Haller et al., 1980	80	61–92	—	Abstract only
Nikoskelainen et al., 1980	75	63–86	19	1 eye clinic, prior symptons 19%
Landy, 1983	62	51–72	—	1 N[a], traced cases
Perkin & Rose, 1979	58	46–69	21	1 HR(O)[a], traced cases, not all ON onset bouts
Nikoskelainen & Riekkinen, 1974	56	45–66	13	1 eye clinic, traced cases
Rose, 1970	55	44–65	—	Abstract only
Landy, 1983	54	44–64	—	1 N; all ON cases
Hutchinson, 1976	53	44–62	22	Input bias
Bradley & Whitty, 1968	52	39–64	32	1 HR(N), traced cases
Lynn, 1959	49	39–59	—	No details, presidential address
Taub, 1954	46	33–60	—	Mayo Clinic, ages 20–44, traced cases
Stendahl-Brodin et al., 1978	44	32–56	—	1HR(O), traced cases
Hyllested, 1950	44	31–58	some	1 HR, traced cases
Bradley & Whitty, 1968	41	31–52	26	1HR(N); all ON cases
B. Series Reporting Percentages of 30%–40% inclusive				
Collins, 1965	40	27–55	—	Cleveland Clinic, ages 20–44, traced cases
Hyllested & Moller, 1961	39	24–56	32	1 HR(NO), traced cases
Hyllested, 1950	38	27–51	some	1 HR, all ON cases
Compston et al., 1978	36	28–44	11	1 physicians clinic eye hospital, traced cases
Taub, 1954	34	24–46	—	Mayo Clinic, ages 20–44, all ON cases
Cohen et al., 1979	32	21–45	3	1 HR(NO); traced cases
Stendahl-Brodin et al., 1978	32	23–42	—	1 HR(O); all ON cases
Collis, 1965	52	22–44	—	Cleveland Clinic, traced cases
Kahana et al., 1976	32	22–43	—	Population survey, includes RON, traced cases
Tatlow, 1948	32	15–53	12	1 eye clinic, traced cases
Taub, 1954	32	22–43	—	Mayo Clinic, traced cases

[a]Abbreviations
MS = multiple sclerosis
ON = optic neuritis RON = recurrent optic neuritis
HR = hospital records; HR(N) = all inpatient hospital records limited to neurology; HR(O) = all inpatient hospital records limited to ophthalmology; HR(NO) = all inpatient hospital records limited to neuro-ophthalmology
[b]Confidence intervals (95%) from binomial distribution
[c]Percent possible MS included in total MS

hierarchy of findings with the MRI being the most predictive (Refs 9, 10, 11, 12, 15, 21, 22, 23, 26, 28) The MRI is now proven to be the most sensitive imaging technique for displaying MS plaques (Refs 9, 10, 11, 12, 18, 22, 23, 26) The MRI is now the standard for discovering both the symptomatic and asymptomatic lesions, especially in the area of the brain stem and spinal cord (Ref 1) In addition, MS plaques do not fade as they do in CT scans (Ref 10) It is also reported that the MRI can differentiate between active and inactive plaques (Ref 19) It is for this reason that researchers have begun to apply the MRI in cases of idiopathic ON after an initial episode in an attempt to differentiate cases of idiopathic ON from ON as an initial symptom of MS By doing this, they can distinguish two groups of patients

(1) those with ON, a normal MRI and normal neurological findings, and

(2) those with MRI consistent with a diagnosis of MS and normal neurological findings

Recently, Poser et al established research guidelines (see Table 2) using clinical and laboratory data in diagnosing MS (Ref 26) These criteria provide several levels of diagnostic certainty and are currently used as guidelines for research protocols

Before continuing a review of the literature and discussion, two case studies are presented to illustrate the aeromedical problems

CASE 1 – MULTIPLE SCLEROSIS

Major G was a 35-year-old right-handed navigator with a history of 3,000 total flying hours His first complaint was diplopia on left lateral gaze which persisted for one month At that point, he was seen by an optometrist who diagnosed a left VIth nerve palsy and a right upper quadrantanopia The only significant preceding history was that his entire family had come down with the flu just before he had become symptomatic Major G admitted to a tingling sensation in his left arm when he moved his neck anteroposteriorly, but denied any other symptoms On his USAFSAM evaluation, his neurologic and ophthalmologic examinations were normal, but he had a subjective complain of difficulty in "keeping track of where cars are" while driving This was worse during the evening

Comments

Major G had two hard neurological findings, both within the same time frame. There were VIth nerve palsy on the left and a right upper quadrantanopia on the right These would place possible lesions in the left brain stem and the left optic radiations The most likely diagnosis would be dysmyelinating disease He had an abnormal MRI, consistent with dysmyelinating disease, and a lumbar puncture with a mildly increased protein and IgG synthesis rate Other testing included visual evoked potentials and brain stem auditory-evoked potentials These were normal The categories established by Poser et al (Ref.26) allows the combination of the history and supportive lab material to give a degree of certainty in diagnosing MS In Major G's case there were two positive laboratory findings and a positive history This combination allowed us to make the diagnosis of definite laboratory-supported MS It is also possible that Major G's inability to track cars while driving was a subtle deficit as a result of a plaque in the tracking integration area which could not be tested directly No waiver was granted

CASE 2 – OPTIC NEURITIS

Capt J was a 35-year old left-handed pilot who was healthy until June 1983, when he complained that he could not clear the vision in his right eye The following day, he noticed that

TABLE 2
New Diagnostic Criteria for Multiple Sclerosis (MS)

	Category	Attacks	Clinical evidence		Paraclinical evidence	CSF OB/IgG*
A.	**Clinically definite MS (CDMS)**					
	CDMS A1	2	2			
	CDMS A2	2	1	and	1	
B.	**Laboratory-supported definite MS (LSDMS)**					
	LSDMS B1	2	1	or	1	+
	LSDMS B2	1	2			
	LSDMS B3	1	1	and	1	+
C.	**Clinically probable MS (CPMS)**					
	CPMS C1	2	1			
	CPMS C2	1	2			
	CPMS C3	1	1	and	1	
D.	**Laboratory-supported probable MS (LSPMS)**					
	LSPMS D1	2				+

*OB/IgG = oligoclonal bands or increased IgG in cerebrospinal fluid (CSF)

his central vision was decreasing. An ophthalmologic examination that day revealed the visual acuity in his right eye to be 20/200 and the diagnosis of retrobulbar optic neuritis was made. He was treated with oral steroids. Two days later, his vision was 20/400 and he was referred to an academic neuro-ophthalmologic center. Their examination revealed finger counting only in the right eye and no other abnormalities. He had a CT scan which was reported as normal. He was treated with pulse high-dose steroids for three days. Six to eight weeks later, he had improved although his vision was still not 20/20. He was last seen at the neuro-ophthalmologic center in October 1983. At that time, his visual acuity was reported as 20/20 and he had a positive color vision deficiency. He remained disqualified from flying duties until January 1985, when he received a waiver. His USAFSAM evaluation in 1987 revealed a normal neurologic examination except for a positive Marcus Gunn pupil on the right. An MRI, performed prior to the USAFSAM evaluation, revealed multiple lesions in the periventricular and deep white matter, consistent with MS plaques. The rest of Capt. J's workup was normal including a lumbar puncture and evoked potentials.

Comments

The question was then raised whether an episode of ON, followed by an abnormal MRI, was substantial enough evidence for the diagnosis of MS. There is great controversy in the literature over this, and the decision was to wait 4—6 months and repeat the MRI to look for evidence of ongoing CNS lesions. The repeat MRI revealed no change in the lesions seen on the previous MRI, nor did it reveal any new lesions. At that time, the decision was to recommend waiver. It should be noted that a review, looking at the specific question of optic neuritis and MS, is ongoing at the present time in a multi-center study in the United States. In addition, all cases of ON are currently being entered into a study group at USAFSAM.

REVIEW OF LITERATURE

From our review of aeromedical concerns of ON and MS, we've decided to focus on the MRI as a tool in predicting MS in ON patients.

In answering the question "Does the MRI predict MS in ON patients?", we have selected the following articles to be presented in depth. This can be done under this special case, since the literature using the MRI to specifically diagnose MS in cases of new-onset ON is limited.

MRI in the Diagnosis — A Prospective Study with Comparison of Clinical Evaluation, Evoked Potentials, Oligoclonal Banding, and CT

Authors: D. W. Paty et al. (Ref 22)

Multiple sclerosis is diagnosed clinically by the demonstration of white matter dysfunction disseminated in time and space [clinically definite MS (CDMS)] (Ref 26). In recent years, paraclinical evidence for dissemination in space has been accepted for research protocols. The presence of oligoclonal banding (OB) or evidence for increased rates of immunoglobin in CNS is required to meet criteria for laboratory-supported definite multiple sclerosis (LSDMS). MRI of the brain is more sensitive than CT for demonstrating MS lesions. Lukes et al. studied ten patients with CDMS and found MRI lesions in all of them. Gebarski et al. found that 26 of 30 (87%) CDMS patients had MRI lesions. Paty's experience shows that 124/133 (93%) of CDMS patients have abnormal MRI scans. Of these 133, 117 (88%) had "MRI strongly suggestive of MS". The frequency of abnormal studies in "suspected MS" patients is lower than in CDMS. The ability of MRI and the category of LSDMS to predict the clinical diagnosis of MS (CDMS) has not been determined.

Paty et al. examined 261 patients referred to our MS clinic and to other university neurologists for the diagnosis of suspected MS. When possible, within a period of six weeks, they performed the following on each patient:

(1) neurologic examination,
(2) high-volume delayed CT (HVDCT),
(3) visual-evoked potentials (VEP),
(4) somatosensory-evoked potentials (SEP),
(5) CSF analysis for OB, and
(6) MRI.

They did not use brain stem auditory-evoked potentials because they had not been of major utility in their experience.

Two hundred of these patients form the basis of this report. They analyzed the data on these 200 patients to answer the following questions.

(1) What is the value of MRI studies in comparison with other paraclinical tests in demonstrating dissemination in space?

(2) Can a logical, systematic approach be developed to determine which paraclinical test would be most useful in certain clinical situations?

(3) What percentage of patients suspected of having MS can be moved into the category of LSDMS by using these paraclinical tests?

They herein report their initial findings. Only long-term clinical follow-up will allow comparison of the results of this study with the diagnosis of CDMS.

Results

Two hundred patients have completed all studies. Table 3 gives the clinical characteristics of these patients. They separated them into clinical subcategories of optic neuritis (ON), CPM (chronic progressive myelopathy), patients with a completely normal neurologic examination (NNE), and patients with brain stem and cerebellar presentations. Table 4 gives a summary of the positive results of the various tests, broken down by clinical categories. MRI, evoked potentials, and CSF all had an approximately 50% abnormality rate of 25%. The frequency of VEP abnormality in ON was 87%, and the frequency of SEP abnormality in CPM was 75%. The MRI was "strongly suggestive of MS" in 25/38 (66%) of ON and 31/52 (60%) of CPM patients. The frequency of MRI abnormality was less in the NNE group. Table 5 gives the other paraclinical results for all categories of MRI abnormalities. For the 9 patients with only a single lesion on MRI, 7 (78%) were OB-positive. These findings support a proposition that a single, appropriate and asymptomatic lesion on MRI can be useful as evidence for dissemination in space when used in conjunction with independent clinical and CSF findings appropriate to MS. The other studies (except for CT) were abnormal in 16% to 26% of patients with normal MRIs. The other MRI diagnoses were two cortical infarctions, one cerebral and one cerebellar atrophy, one brain stem and one cerebral tumor, and one brain stem arteriovenous fistula malformation.

Discussion

Paty et al. have previously found pathologic correlation of

TABLE 3
Clinical Characteristics in 200 Suspected MS Patients

	Female	Male	Total
Number	134	66	200
Age (mean)	42 yrs	46 yrs	43 yrs
Age (range)	12—79 yrs	22—74 yrs	12—79 yrs
Duration of disease (mean)	7.6 yrs	7.4 yrs	7.6 yrs
Duration of disease (range)	0—48 yrs	0—43 yrs	0—48 yrs

TABLE 4
Frequency of Paraclinical Abnormalities in 200 Patients with Suspected MS and Clinical Subcategories

	VEP	SEP	CT	MRI SS	MRI AA	OB
All patients (N = 200)	92 (46%)	98 (49%)	50 (25%)	98 (49%)	124 (62%)	93 (47%)
ON (N = 38)	33 (87%)	13 (34%)	8 (21%)	25 (66%)	29 (76%)	23 (61%)
CPM (N = 52)	28 (54%)	39 (75%)	11 (21%)	31 (60%)	36 (69%)	32 (62%)
NNE (N = 34)	7 (21%)	10 (29%)	4 (12%)	6 (18%)	13 (38%)	9 (27%)
Brain stem (N = 54)	22 (41%)	28 (52%)	11 (22%)	26 (48%)	32 (59%)	26 (48%)
Cerebellar (N = 22)	13 (59%)	13 (59%)	6 (29%)	13 (59%)	18 (82%)	10 (46%)

Abbreviations
CPM = chronic progressive myelopathy
MRI SS = strongly suggestive of multiple sclerosis (MS)
MRI AA = any MS-like abnormality (one or more MS-like lesions)
NNE = normal neurologic evaluation
OB = oligoclonal banding
ON = optic neuritis
SEP = somatosensory-evoked potentials
VEP = visual-evoked potentials

TABLE 5
Frequency of Other Paraclinical Abnormalities in Various Categories of MRI Diagnosis

MRI Diagnosis	VEP	SEP	CT	OB
Strongly suggestive of MS (N = 98)	65 (66%)	64 (65%)	36 (37%)	66 (67%)
Suggestive of MS (N = 9)	4 (44%)	2 (22%)	1 (11%)	4 (44%)
Possible MS (N = 8)	3 (37%)	3 (37%)	1 (13%)	5 (63%)
One lesion (N = 9)	3 (33%)	6 (67%)	4 (50%)	7 (78%)
Normal (N = 69)	16 (23%)	18 (26%)	6 (9%)	11 (16%)
Non-MS finding (N = 7)	1 (14%)	5 (71%)	2 (29%)	0

Abbreviations
OB = oligoclonal banding
SEP = somatosensory-evoked potentials
VEP = visual-evoked potentials

dysmyelinated areas in the majority of MRI abnormalities in MS patients. In systematic serial studies (Ref 8), new lesions that are entirely asymptomatic may appear and disappear. The occasional lesion that disappears indicates that it has resolved to a state below the detection threshold of the technique of the particular machine used. Nevertheless, they are impressed by the lack of specificity of MRI for MS. The present study used patients in whom MS was clinically suspected by MS-knowledgeable neurologists. They found that a "MRI strongly suggestive" pattern can be produced by other disease states. One particular problem will always be that of acute disseminated encephalomyelitis (ADEM), which can produce both disseminated clinical CT- and MRI-detected lesions and OB.

This prospective study of paraclinical tests in diagnosis of MS has shown that the MRI is the most sensitive way of demonstrating dissemination in space. MRI not only had the most frequent overall abnormality rate (62%), but, in analysis of ON and CPM patients, it identified all patients that could be diagnosed as having LSDMS in 18/19 (95%) who later developed diagnostically significant clinical events. OB was the next most sensitive predictor of CDMS, at 75%. Evoked potentials and CT each had a 50% prediction rate.

CT was not diagnostically helpful and, based upon these data, they feel that when MRI is available, CT is not necessary for establishing dissemination in space.

MRI is not only the procedure of choice for demonstration of dissemination in space, but it will allow prospective evaluation of the evolution of the disease process.

MRI: Sensitive and Safe in Diagnosing MS
Author: D.H. Miller (Ref 18)

Brain MRI Sensitivity
Magnetic Resonance Imaging (MRI) is very sensitive in detecting the brain lesions of MS. They are best seen on moderately T2-weighted sequences. Miller analyzed 200 consecutive patients who had clinically definite MS according to the Poser criteria.

The characteristic MRI pattern, based on this study is one of multifocal white-matter lesions, particularly appearing in the periventricular location and most often involving the body of the lateral ventricle. Postmortem studies have confirmed that such MRI lesions indeed correspond to MS plaques.

Multifocal white-matter lesions, indistinguishable from those of MS, are also seen in patients with cerebrovascular (CV) disease. Furthermore, 5% to 30% of normal individuals 50 years of age or older have white-matter lesions, which are seen more frequently in those with risk factors for CV disease (including hypertension), and with increasing age. It seems most likely that the lesions are due to asymptomatic CV disease.

In summary, MRI is highly suggestive in detecting the characteristic brain lesions of MS, but the MRI pattern is not specific for these lesions.

Brain MRI: Age and Activity of MS Plaques
Simple inspection of the MRI scan does not differentiate new, active lesions from old, inactive ones. Relaxation-time measurements are also ineffective in distinguishing the age of lesions. However, recent experience with serial MRI, using the contrast marker gadopentetate dimeglumine, has shown that it is a useful marker of new and biologically active lesions. Enhancement is a consistent feature of new MS plaque while it appears only infrequently in older ones. These observations also suggest that blood-brain barrier (BBB) impairment may be of importance in the pathogenesis of MS lesions.

Silent Brain Lesions in Patients with Isolated Optic Neuronitis — A Clinical and MRI Study
Authors: L. Jacobs et al

Lawrence Jacobs, et al. stated that MRI has proved to be much more sensitive than CT for identifying brain lesions in patients with MS. It has also proved to be more sensitive than CSF and evoked potentials studies for making the initial diagnosis of MS. In this study, Jacobs et al. used the MRI to image the brains of 16 patients with isolated ON. All had normal findings on CT examination. All patients had definite isolated idiopathic ON by accepted clinical diagnostic criteria. There were 11 female and 5 male patients, aged 12 to 62 years. The ON was unilateral in 15 patients and bilateral in one patient.

Results
CT findings were normal in all patients, but the MRI scan was abnormal in 8 patients. The MRI identified multiple lesions (2 to 7 lesions) in 6 patients, in 2 patients, only one lesion was identified.

The only CSF abnormality in any of the patients was the presence of oligoclonal bands (identified in 5 patients). There was no consistent relationship between the MRI and CSF findings. Three patients with abnormal MRI examinations had normal CSF study results. One patient, with a normal MRI refused lumbar puncture.

The follow-up of these patients since the time of their MRI examinations had been 2.01 to 14.4 months for a total follow-up since onset of idiopathic ON symptoms of 2 months to 7.2 years. None of the patients has had a new episode of ON or developed symptoms or signs of disseminated lesions of the CNS. All of the patients have remained neurologically normal except for symptoms and signs related to their previous episode of idiopathic ON.

Comment
Their findings demonstrated that half of the patients who experience an episode of idiopathic ON may harbor one or more lesions of the brain that are clinically silent. It is likely that these lesions are MS plaques because the pattern, location, and extent of the MRI abnormality observed is similar to that seen in patients with proved MS. By recently published criteria (Ref 26), the four patients with abnormalities of both MRI and CSF have definite MS, the other four with abnormalities by MRI but normal CSF have probable MS.

In the majority of their patients, the idiopathic ON seemed to be the only clinical manifestation of a disease process that was already disseminated in the CNS. However, none of the patients has gone on to develop overt MS during the period of follow-up. While our mean follow-up period for the entire group is relatively short, one patient with an abnormal MRI scan has been followed up for over seven years and another for over four years without developing clinical signs of dissemination. It has been stated that, if a patient with idiopathic ON is going to develop MS, he/she will usually do so within four to five years (Refs 1, 2, 16, 17). However, there have been many recorded exceptions, and MS has evolved

from a background of ON occurring as long as 33 years to 56 years previously

MRI of the Brain in Isolated Optic Neuritis
Authors K Johns, et al (Ref 12)

Karla Johns et al (Ref.12), in their article used the MRI of the brain in isolated ON to look for evidence of subclinical disseminated intracranial demyelination

Patients and Methods
They selected 10 patients (age range 15 to 45 years) with isolated ON for the study Each had a rapid onset of decreased vision, achieving a maximum deficit within 7 days There were no retinal, vascular, or neoplastic lesions to account for the symptoms Results of a neurological exam by a neurologist were otherwise normal

From all patients, they obtained a complete blood count (CBC), anti-nuclear antibody test results, an ESR, a chest roentgenogram, and a complete physical examination results, to exclude collagen vascular disease, sarcoid, and other systematic diseases

Results
Ten patients with isolated ON were studied, seven had abnormal intracranial lesions in the periventricular white matter similar to that previously described in MS These lesions were asymptomatic The follow-up time of these patients ranged from two months to two years, with a mean of 13 6 months A summary of the findings and clinical courses in these ten patients is listed in Table 6

Comment
In one clinical study of 42 patients with clinically definite MS all had abnormal MRIs, but only 45% had abnormal CT scans The sharp margins of these lesions and their periventricular and brain stem distribution are similar to the configuration and distribution of dysmyelinating plaques seen in autopsy studies of patients with MS

Using MRI they found that 70% of patients with ON did, in fact, have asymptomatic disseminated lesions Thus, with MRI much more widespread involvement of the CNS is demonstrated than is clinically suspected Two recent studies have demonstrated subclinical MRI findings in 50% and 61% of patients with ON (Ref 20) However, in this study, the interval between the onset of symptoms and MRI scanning was short (mean 45 1 days), compared with means of 1.5 years and 6 3 days, respectively, in the above studies In addition, Jacobs 't al criteria were more stringent Thus, findings may represent the incidence of subclinical dissemination early in the course of isolated ON with greater accuracy

Impact of MRI on the Assessment of Multiple Sclerosis Patients
Authors L Jacobs et al (Ref 11)

Lawrence Jacobs et al noted that CT examinations of MS patients were usually normal The last few years' experience with MRI in the clinical environment seems to demonstrate its superiority over CT for assessing the brain in MS

They studied 147 patients with definite or probable MS Each of the patients had simultaneous or near simultaneous CT studies and the two examinations were compared

Clinical Correlation
Patients' clinical profiles were categorized by functional groups and disability status according to a modified Kurtzke scale before or shortly after scanning Patients were clinically reassessed and rescored at time of repeat scanning. In 27 of the patients, the lesions identified by MRI were compared with the patient's clinical status and correlated as

(1) definite, lesion definitely caused clinical symptoms or signs,

(2) possible lesion may have caused symptoms or signs, or

(3) none, lesions definitely did not caused symptoms or signs (clinicaliy silent)

Results
CT was abnormal in 56 (38%) and MRI in 98 (67%) of the patients The most common CT abnormality was one or more areas of decreased density of white matter (42 patients), which were diffuse and ill-defined Brain stem-cerebellar lesions were not identified by CT

MRI identified all of the lesions that had been demonstrated by CT It also revealed one to several more lesions than were

TABLE 6
Findings and Clinical Courses in 10 Patients

Patient #/ sex/age (yrs)	Intracranial MRI findings	CT findings	Follow-up months	Clinical course
1/F/44	periventricular lesion	normal	17	no recurrence
2/M/36	normal	not obtained	17	no recurrence
3/F/32	periventricular lesion	normal	19	developed MS
4/F/30	normal	not obtained	15	no recurrence
5/F/35	periventricular lesion	normal	12	no recurrence
6/M/29	multiperiventricular lesions	normal	10	no recurrence
7/M/42	normal	not obtained	12	no recurrence
8/F/21	periventricular lesion	not obtained	2	no recurrence
9/F/45	periventricular lesion	not obtained	8	no recurrence
10/F/45	periventricular lesion	not obtained	8	no recurrence

shown by CT. Moreover, MRI revealed one to several more lesions in 42 patients whose CT examinations had been normal. In 14 patients, the MRI identified lesions of the posterior fossa that were missed by CT.

Serial Studies

Parenchymal enhancing lesions were observed to disappear in 4/6 patients who were studied with serial CTs. In 2 patients, one or more nonenhancing areas of decreased density were also observed to disappear. However, MRI lesions corresponding to the CT lesions (nonenhancing, enhancing) persisted unchanged after they had disappeared on CT.

Comments

Their experience with 147 MS patients indicates that this technique has had a major impact on the assessment of these patients. MRI usually showed more lesions and extensive involvement than the CT. Even more striking was the observation that MRI revealed obvious lesions that were often extensive in 91 patients who had completely normal CT scans. MRI revealed posterior fossa lesions that were completely missed by CT in 14 patients. The explanation for this increased sensitivity of MRI for identifying posterior fossa lesions is that MRI images are not affected by artifact from adjacent bone, as are those of CT.

MRI identified all of the parenchymal abnormalities (nonenhancing, enhancing) shown by CT. It also continued to show the lesions (unchanged in appearance) after they had stopped enhancing. Thus, some lesions will be visualized only temporarily by CT (when they show contrast enhancement), but this is not the case with MRI. In their experience with 147 patients, once an MS lesion is seen by MRI, it does not disappear during serial examination.

Detailed clinical correlations of the lesions identified by MRI have been conducted on 27 of their patients to date and reported elsewhere. These correlations have shown that 75% of the lesions were clinically silent. A similar poor correlation between lesion site and clinical signs was found in another recent study. Some combination of physiologic activity and anatomic location probably determines whether or not an MS lesion will become symptomatic. Anatomic location may be most important, since the only lesions that had definite clinical correlations were located in the posterior fossa, whether the patients were in exacerbation or remission.

Serial Gadolinium-Enhanced MRI in MS

Authors: D.H. Miller, et al. (Ref 19)

Introduction

D.H. Miller et al. stated that MRI is highly sensitive for demonstrating brain lesions in patients with MS. Abnormalities are reported in 85% to 100% of patients with clinically definite MS, and the MRI lesions have been correlated with plaques on postmortem. The characteristic pattern is one of multifocal white-matter lesions, many of which are adjacent to the lateral ventricles.

At present, it is not possible to determine the age or state of biological activity of a plaque seen at a single MRI examination. It would be of value to establish the lesions' ages in two groups of patients with (1) a single clinical episode of typical demyelinating disease (e.g., acute optic neuritis) and MRI evidence of asymptomatic multifocal brain lesions. Evidence of lesions of different ages in such patients would suggest a multiphasic disease (i.e., MS), if all lesions were the same age, the monophasic disease (i.e., acute disseminated encephalomyelitis) would be more likely. (2) MS patients participating in therapeutic trial, where the appearance of new and active lesions would provide evidence of continuing disease progression.

While serial CT studies show that the blood brain barrier (BBB) abnormalities correlate with clinical disease activity, they do not establish the age of the lesions. Because unenhanced CT has a low sensitivity for detecting plaques, it is not possible to state whether a new enhancing lesion represents reactivation of an old plaque or the development of a new one.

MRI, with its high sensitivity in detecting plaques, is well suited to a serial study of BBB abnormalities in MS. Contrast agents are required to demonstrate BBB impairment with the MRI. The most useful to date is gadolinium DTPA (Gd-DTPA), a paramagnetic agent which strongly enhances the relaxation of water protons.

Miller et al. performed a serial study with Gd-DTPA-enhanced MRI in MS to establish (1) the duration of enhancement of MS plaques and (2) the relationship of enhancement to the age of the lesion.

In view of a previous report that acute lesions have longer relaxation time than chronic ones (Ref 20), they also recorded these times in enhancing and nonenhancing lesions.

Methods

Ten patients aged 28 to 47 years with clinically definite MS (Ref 2,3) were studied. 8 were in acute clinical relapse at the time of the first scan. 1 had a relapse 3 months before the first scan; another had had gradual deterioration over several months. Follow-up scans were performed approximately 1 month and 6 months after the first scan. Eight patients completed 3 scans.

Results

First Scan

In all 10 patients, enhanced MRI demonstrated multifocal, mainly white-matter brain lesions typical of MS. In total, 76 of the lesions showed contrast enhancement. Enhancing lesions were seen in 8 patients, the 2 with no enhancing lesions were not in an acute relapse at the time of scanning. Enhancing lesions in a site compatible with the acute clinical relapse were seen in 6/8 patients. Most enhancing lesions were asymptomatic. Enhancement most often involved the whole lesion, but occasionally there was peripheral ring enhancement only.

Second Scan

This was performed in 9 patients 3 to 5 weeks after the first scan. Of the total of 54 enhancing lesions seen in these patients on the first scan, 42 were no longer enhancing, while 12 showed persisting but sometimes diminished enhancement.

Twelve new lesion areas (8 new lesions and 4 definite areas of extension of old lesions) were identified on the unenhanced scan, and all displayed enhancement. Enhancement was also seen in 2 older lesions which on the first scan were nonenhancing.

Third Scan

Eight patients were rescanned 6 months after the first scan.

A total of 15 new lesion areas were seen in the unenhanced scan, of which 8 displayed enhancement. Enhancement was also seen in 2 older lesions which had been nonenhancing on earlier scans. No enhancement was seen in any of the lesions which had enhanced on earlier scans.

Lesions Seen Only with Gd-DTPA Enhancement
Over the course of the study, a total of 10 small enhancing areas were seen which were not visible on the unenhanced study. In each case, they were seen in the cortex or subcortical white matter, and were no longer visible on follow-up scan.

Tolerance to Gd-DTPA
No side effects were noted in association with Gd-DTPA administration. The relapses which occurred in 1 patient within several weeks of the scan were probably coincidental.

A transient elevation of serum iron level was seen in 8/27 examinations 4 to 24 h after injection, and returned to normal in all cases within 48 h.

Comments
The study confirms that Gd-DTPA-enhanced MRI frequently demonstrates enhancing lesions in patients with clinically active MS. The majority of enhancing lesions are asymptomatic. Most lesions enhanced for less than 1 month, and none longer than 6 months. Enhancement was seen in every new lesion which appeared in a period of approximately 1 month (between the first and second scans), and in many but not all lesions that appeared in a period of 5 months (between the second and third scans).

The study also showed that the BBB impairment develops occasionally in older, previously nonenhancing plaques without evidence of increased size.

It is not surprising then that the enhanced MRI demonstrated a number of small cortical or subcortical lesions that were otherwise invisible.

The main conclusion from this study is that Gd-DTPA is a sensitive marker of the BBB impairment which occurs consistently in new plaques. It should prove useful in monitoring therapeutic trials in MS.

Comments
There is no doubt that a certain percentage of idiopathic ON patients will develop MS. In a civilian setting, it's not cost effective to evaluate each patient with ON as an MS suspect. In the aeromedical community, where the diagnosis of MS can lead to a loss of a trained aircrew member and expose the service to costly long-term care, the evaluation for potential MS may become cost beneficial. To improve on the predictive value of the standard MS battery, our review of literature gives us several suggestions. First, there may be a subpopulation of patients with idiopathic ON who are at high risk for developing MS. Second, this subpopulation may be identified by MRI scans, specifically, those patients who have MRI findings consistent with typical plaques by description and location for MS. The final stage of this research has to be the longitudinal follow-up of this subpopulation. Preliminary data by the six articles used reveal that the MRI may be predictive in 37% to 50% of these patients. If this predictive rate is substantiated by other studies, this would lead the aeromedical community to a specific policy as regards ON patients.

Given the information gained so far, only the following conclusions can be made:

(1) ON is a first symptom of MS in a significant percentage of patients.

(2) The specific risk factors such as age, sex, age at the initial event of ON, recurrent or bilateral ON, either individually or grouped are not good predictors of developing MS.

(3) The MRI divides the idiopathic ON patients into two groups, those with normal MRI and those with MRIs consistent with MS.

(4) Longitudinal studies thus far show a higher rate of MS among the abnormal MRI group.

(5) If this finding holds true in large long-term studies, it suggests that the MRI may be a cost-effective tool to select out candidates for aircrew prior to the cost of training. It will also allow us to identify a rated crewmember who has an increased risk for special sense loss after recovery from idiopathic ON.

(6) The United States Air Force has evaluated 63 aircrew members with ON at USAFSAM. Applying the MRI criteria, these cases can be divided into two groups and followed longitudinally. This would help answer these questions raised by this review. This effort could be furthered in a longitudinal study by serial MRIs.

(7) D.H. Miller et al. suggest that the use of gadolinium contrast with the MRI may allow dating of the different plaques, which would show ongoing disease and make the diagnosis of MS more secure.

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Headache

by

Marc S. Katchen, M.D
USAF School of Aerospace Medicine
United States

Headaches of some type have been reported to occur in up to 70% of the population of the United States at some point in their lifetime. Vascular headaches are reported in up to 20% of this population. Our task is to properly classify the headache, discover any triggers or unique circumstances of the headache and decide if it is aeromedically significant.

The classification of headaches and facial pain has undergone it's first revision since 1962 and was published in Cephalgia 1988, 8 1–72. The title of this special supplement was Classification and Diagnostic Criteria for Headache Disorders, Cranial Neuralgias and Facial Pain. This divides the many types of headaches by description and specific criteria much like the DSM III. This manual will help the flight surgeon understand the complexity of headache description and may save valuable reso s.

The main issue is when does a headache become aeromedically significant. The answer seems to differ from service to service and country to country. I prefer to use the rules of thumb which measure the headaches and their accompanying symptoms against their effect on flight safety and effectiveness. Headaches, specifically vascular headaches, such as classic migraines are not innocuous problems. Loss of a visual field which can occur before a headache or an aphasia can be a serious safety hazard. There are documented class A (loss of life or aircraft) accidents directly related to this problem. Our rule has been that headaches that cause incapacitating pain or loss of a special sense constitutes an aeromedically significant disease. Making that distinction and making sure of your diagnosis is the crucial issue. We will review several examples that have been seen in the last 3 years. These cases raise the areas of controversy often accompanying a headache evaluation.

1. How can one make the diagnosis of a recurring illness eg migrain s after just one episode
2. When can incapacitating headaches be waiverable
3. How can we more effectively deal with these problems

Case 1. 30 year old pilot with sudden right homonymous hemianopsia and headache.

This pilot realized he had a problem when he could not see his wingman. The headache was very mild. He was originally told that since his headache was not incapacitating he could continue to fly. The pilot felt this was unsafe and requested a full evaluation. Appropriately he needed a CT scan to rule out a mass lesion. This was normal. The pilot recognized that loss of this special sense which could occur unpredictably was incapatible with flying safely and he remained grounded even though he had only one event.

Case 2. A student pilot with the worst headache of his life during intercourse. He had been a weapons officer in the F-4 for 5 years previously.

This student had clearly what he described as an incapacitating headache, but there was a specific and unique trigger. This was a classic coital migraine of the explosive type (see above reference) which was not transferable to similar M-1 or L-1 anti-G straining maneuvers proven by his past history in the F-4. Because of this he was able to continue his flying career.

Case 3. A 35 year old pilot complained of similar coital migraines but also developed paroxysmal incapacitating headaches on anti-G straining. His coital migraine overlapped into a type of exertional headache and he could only be allowed to fly in non-high performance aircraft, but he was retained as a valuable resource and kept his flying career.

The point of these cases is that there are many shades of headaches and many causes. A careful history is the most important part of the evaluation including dietary history, sleep patterns, drinking etc. Certainly any patient with neurologic deficits or impaired consciousness requires neuro-imaging. Patients with the worst headache of their lives also deserve lumbar punctures.

To help guide your exam and history, I have enclosed a check-list of questions concerning the entire headache episode. This list is currently being used in a retrospective study of patients seen at USAFSAM and hopefully will begin being used for a prospective study in the near future. As you can see from this list of questions the headache is divided into signs, symptoms and onset of symptoms. There is a section on testing but this does not imply every test listed needs to be performed on every patient. If there is any focal deficit with the headache a type of neuro-imaging should be performed. You are welcome to use these sheets for your own purposes.

At present there are no anti-migraine medications waivered to allow for prophylactic or on an as-needed basis so the diagnosis is important to your flyer's career and every effort should be expended to make the best diagnosis.

HEADACHE STUDY

Event (Circle Number)

A. Occurred Prior to Event (Within Days)
   1. Viral-Type Symptoms (malaise, muscle aches, nausea, GI distress)
   2. Febrile Illness
   3. Sleep Deprivation
   4. Sleep Cycle Alteration
   5. Altered Diet (introduction of new food or food source)
   6. Atypical Alcohol Consumption
   7. Photophobia
   8. Neck Pain or Stiffness
   9. Stressors (death/divorce/family relationship/work change)

10 New Diet or Weight Reduction Scheme — describe
11 Over-the-Counter or Other Medications
12 Head Trauma
13. Travel

B Occurred Just Prior to Event (Seconds to Minutes)
1 Emotional Shock (describe)
2 Head Injury
3 Valsalva
4 Exertion (aerobic)
5 Exertion (anaerobic, e g , weight lifting)
6 Bowel Movement
7. Intercourse
8. Coughing
9 Sleeping
10 Just Awoke from Sleep
11 Eating (specify food — ice cream, etc)
12 Studying
13. Hyperventilation
14 Facial Pain or Abnormal Sensation

C Symptoms Just prior to Event (Hours)
1 Uneasy Feeling
2 Nausea
3 Vomiting
4 Neck Pain/Tightness
5 Facial Pain/Dysesthesia
6 Scotoma (scintillating or other)
7 Field Cut
8 Paresis
9 Dysesthesias (face/arm/leg on one side)
10 Malaise
11. GI Distress (gas, diarrhea)
12 Chest Pain
13 Photophobia
14 Loss of Appetite
15 Increased Appetite
16 Chills
17 Decreased Level of Consciousness
18 Loss of Consciousness
19. Increased Irritability
20 Abdominal Pain
21 Other Visual Disturbance — describe
22 Other — describe

D Occurred Just Prior to Event (Seconds to Minutes)
1 Nausea
2 Vomiting
3 Neck Pain/Tightness
4 Facial Pain/Dysesthesia
5 Scotoma — (scintillating or other)
6 Field Cut
7 Paresis
8 Dysesthesias (hemisensory)
9 GI Distress
10 Chest Pain
11 Abdominal Pain
12 Photophobia
13 Other Visual Disturbance — describe
14. Chills
15 Decreased Level of Consciousness
16. Increased Irritability
17 Decreased Concentration Ability
18 Uneasy Feeling
19 Other — describe

E Headache Quality (Can be More than One)
1 Tightness around Head (band-like)
2 Aching
3 Pulsating (pounding/throbbing)

F Location of Headache(s) (Can be More than One)
1 Hemicranial
2 Whole Head
3. Migrating
4 Facial Only
5 No Headache Noted
6 Occipital
7 Neck
8 Jaw

G Headache Pain (At Its Worse)
1 Incapacitating
2. Not Incapacitating
3 Able to Work through It
4 Able to Work after Awhile
5 Greater than 7 on a 1—10 scale

H Headache Pain (If incapacitating — Time of Incapacitation)
1 1—5 Minutes
2 5—15 Minutes
3 15 Minutes — 1 Hour
4 Greater than 1 Hour

I Duration of Headache (Total Headache)
1 Less than 1 minute
2 Less than 5 minutes
3 Less than 15 minutes
4 Less than 1 hour
5 Less than 4 hours
6 Less than 12 hours
7 Less than 24 hours
8 Greater than 24 hours

J Accompanying Symptoms
1. Neck Tightness
2 Jaw Pain
3 Nausea
4 Vomiting
5 Scotomas
6 Field Cut
7 Other Visual Disturbance — describe
8 GI Distress
9. Photophobia
10 Dysesthesia (hemisensory)
11 Confusion
12. Irritability (increased)
13 Decreased Level of Consciousness
14 Chills
15. Other — describe

K Accompanying Signs
1 Rhinorrhea
2. Conjunctival Injection
3 Tearing
4 Ptosis
5 Dysarthria
6 Aphasia
7 Paresis
8 Persistent Deficit — Stroke
9. Cranial Nerve Deficit — describe
10. Other — describe

L Family History
- 1 Positive for Migraines
- 2 Positive for Headaches or Other Pain Conditions
- 3 No History of Above

M Personal History
- 1 History of Motion Sickness
- 2 History of Head Trauma
- 3 History of Mitral Valve Prolapse
- 4 History of Syncope
- 5 History of Labile Hypertension

N Work-Up
- 1 Neurological Exam (If Abnormal, Describe)
- 2 CT Scan (If Abnormal, Describe)
- 3 EEG (If Abnormal, Describe)
- 4 Echocardiogram (If Abnormal, Describe)
- 5 MRI Scan (If Abnormal, Describe)
- 6 Lumbar Puncture (If Abnormal, Describe)
- 7 Angiogram — Cerebral (If Abnormal, Describe)
- 8 Other Related Tests (If Abnormal, Describe)

O Diagnosis
- 1 Vascular Headache — Common Migraine
- 2 Vascular Headache — Classic Migraine
- 3 Vascular Headache — Complicated Migraine
- 4 Acephalgic Migraine
- 5 Cluster Headache
- 6 Tension Headache

Mishap Aftercare

by

John C. Patterson, Ph.D

Chief, Aerospace Clinical Psychology Function
USAF School of Aerospace Medicine
United States

This paper is the result of a panel discussion which was held during the AGARD course on neuropsychiatry and aerospace medicine. Of primary concern after a mishap are physical and somatic matters which are covered well in other places. Secondly, however, evidence is mounting that emotional and psychological adjustments to a mishap can be very important to various categories of victims who may be involved in a mishap. Relatively simple and straightforward psychological mishap aftercare principles are available and have been tested in a variety of disaster scenarios. Victim identification and intervention strategies are key concepts in mishap psychological aftercare.

A first step in psychological aftercare is identification of victims affected by a mishap. There are the obvious victims who experience a mishap directly. For the purposes of this paper, these are the surviving aviators who were flying the mishap airplane. Naturally there can be other passengers aboard airplanes and people on the ground who may be victims. Other less obvious victims, however, may be professional disaster workers such as body handlers, medical personnel, police and firemen whose jobs and occupational responsibilities bring them in contact with the mishap. Also, there are the family members of the aircrew victims and members of entire flying organizations such as squadrons and pilots based together who may become the secondary victims as their friends die in or suffer through the mishap. Thus, victims can be categorized in the following way: primary victims are those who have received direct exposure and survived the mishap. Secondary victims are the family and friends of those involved in the mishap, both survivors and those who were killed. Tertiary victims are the rescue workers. The fourth level victim is the community from which the primary victims have come and also those supervisors, managers and leaders who might be seen as responsible or might feel responsible for the mishap. The fifth level victim includes people who are emotionally unstable and may overidentify with the mishap and finally the sixth level victims are those who barely missed being primary victims.

Particular attention should be paid to the third level victim, the professional rescue worker, as they are often not considered victims and, no doubt, have many defenses against accepting help. Research suggests that 35% of rescue workers may be at high risk for any one particular mishap to stress the worker's ability to balance between the demands of their job and their ability to cope. Professional rescue workers are likely to have a great deal of experience with disaster and thus often have built protection strategies against the negative impact of their work. However, they suffer a variety of unusual stresses to include body handling, exhaustive work schedules, and they often feel responsible for life and death decisions and outcomes even though there may be very little they can realistically do. A cumulative effect may partially explain why a rescue worker will go for years without a negative emotional reaction to a mishap and then on one particular mishap, have a stress reaction. Further, there may be something very specific about a trauma scene that is particularly gruesome or has a personal connection to the rescue worker that may bring about a reaction. Thus, as with other classes of victims, the aftercare plan should be offered using techniques of education and ventilation as noted below.

Providing services to these various classes of victims can be important to the future stability and productivity of the victim. Many victims will not experience significant emotional reactions in response to exposure to trauma or disaster scenes. Those victims who experience emotional reactions will present with fatigue, and sleep, appetite or gastrointestinal disturbances and increased alcohol use or abuse. Other signs of emotional reaction include social withdrawal, depression and emotional liability, memory and cognition difficulties, as well as intrusive thoughts. Thus, the goal of the evaluation and intervention associated with the stress of the mishap is to limit symptoms and return these individuals to normality as soon as possible by attending to these acute emotional reactions.

The specific interventions for victims after a mishap tend to be relatively simple but are also quite specific in terms of effectiveness. Individuals associated with a mishap are likely to need to express their feelings and observations. Many will fully respond to active interest and concern while others may deny problems and reject any form of help. On occasion those who strongly reject interest and concern or help are those who may later show significant emotional reactions. Much of the psychological intervention can be accomplished in a group setting so that one or two care providers can help a large number of victims simultaneously. It is best to keep different classes of victims separate, their needs will be different and, indeed, their training and experience with mishaps will be different.

The first level of intervention is education. It is important that victims understand that humans have natural emotional reactions to physically and emotionally traumatic experiences. Victims should know that the range of reactions includes the symptoms noted above of somatization, social withdrawal, mild depression, emotional lability, and disturbances of sleep, appetite, and digestion. They should further be warned about increasing drug and alcohol use, memory and cognitive disturbance and the possibility of intrusive thoughts. In the second phase of intervention, victims are encouraged to ventilate or describe their experience. Depending on the reaction of a particular victim, some may actually relive the experience but most will describe what they saw, heard, and felt. This "telling the story" seems to be very important and only requires a listening ear and an occasional open-ended question that encourages the person to go on with their story. As noted

above most victims will respond well to education and brief ventilation with no need for further care Some however will obviously not be doing well and can be identified during the education and ventilation portions of the meeting The third phase of intervention is applied to the few individuals who need further consultation These individuals are approached separately and offered more specific care with scheduled followup If these victims need individual care, specific referral can be made to a mental health care provider with phone followup in a few days to ensure that the person has been seen and that their needs are being cared for

This model of intervention is relatively simple but it provides understanding to the victims that they may have a normal reaction which may be somatic, emotional, or both Victims should be reassured that if they experience this reaction, it will resolve with time and that specific help can be sought to help deal with these feelings Further, ventilation seems to help relieve the emotional tension caused by the mishap and the idea of care and concern may be extremely efficacious in returning the victims to normal functioning rapidly

Mishap aftercare for various levels of victims is relatively simple and cost effective Where victims are given only physical examinations and treatment some may experience long periods of dysfunction, distress, and low productivity may occur Very few victims will experience crippling emotional reactions to mishaps but, as with other areas of aerospace medicine, preventing rare occurrences of severe problems with significant consequences is highly preferable to waiting for dysfunction to occur to attempt to restore the individual to full capability Mishap aftercare is an area where significant gains can be realized with a small expenditure of resources

Medical or Administrative? Personality Disorders and Maladaptive Personality Traits in Aerospace Medical Practice

by

David R. Jones M D , M PH , F A C PrM , F Aa M A , F A P A and **John C. Patterson** Ph D
Aeropsych Associates, San Antonio, Texas
United States

Corresponding author
David R Jones, M D
One Clermont Court, Oakwell Farms
San Antonio, TX 78218-1741
United States

Aeromedical/occupational decisions are hard enough to make when there is concrete evidence of disease, such as a malignancy or an abnormal coronary angiogram, and they are even more difficult when the evidence consists of abstract symptoms rather than physical signs, as in the case of most psychiatric disorders Yet most aeromedical practitioners can diagnose severe depression, or a functional psychosis or organic brain disease on the basis of the presentation of the patient in the examining room, recognizing the symptoms before their eyes But what does one do when confronted with a flier whose off-duty interpersonal relationships are so flawed that he (let us presume a male patient) is a constant source of irritation to those around him one who is chronically involved in disputes or whose personality simply rubs other people the wrong way What are the standards here? What degree of upsetting behavior should be tolerated before action is taken? How do we decide if this behavior represents a disease which infers a need for treatment, or a willful activity which infers the need for some sort of administrative intervention? And, more directly to the point, can such people fly safely?

CASE REPORT

Mr A, a 35-year-old flier, was referred for outside psychiatric and psychological evaluation when his organization was unable to decide how to deal with his situation Divorced because of his wife's infidelity after a 5 year marriage, he established a 6-year live-in relationship with a young lac who worked with him She had become depressed and bulemic during the latter 3 years, and was smoking and drinking excessively He suggested that they both enter counselling, and they did so for several dozen sessions However, she then entered a romance with a man who worked in the same company with the two of them This triangle led to a number of fights, some physical and the police arrested her for assault after one of them Word of the situation got back to the company, and the other man and the young lady resigned after some uproar, including physical threats between all three parties involved

Mr A took a prolonged leave of absence from his flying job in order to se'tle down a bit, during which time he was seen by a local psychiatrist His young lady joined him in this therapy, and they re-established their relationship However, there were misunderstandings between the psychiatrist and the aeromedical examiner as to therapeutic goals and follow-up, and Mr A was finally medically grounded with a diagnosis of an adult situational anxiety reaction with depressive and anxious features The dispute between the local medical authorities led to a joint decision to seek outside aeromedical mediation

At the time Mr A was seen, he was free of psychiatric symptoms, was doing well in a non-flying career field, and was planning to marry his young lady No overt psychopathology was noted during the psychiatric and psychological evaluations The parallels between the circumstances involved in the breakup of his marriage and in his later live-in relationship were noted His personality style was described as one "which some might find irritating", from which one might assume that the *psychiatrist* found it irritating He was bright and apparently functioned well under pressure, but his intense and dogmatic desire always to be in the right and in control, which served him well as an aviator, did little for his relationships with the women in his life He also had personality conflicts within his organization, a clear indication that his behavior was not that of the usual aviator His attitude toward flying was that it was mostly boring, and he looked upon it mainly as a diversion from his usual activities His on-the-job attitude of smug superiority antagonized the other fliers, who were generally more enthusiastic and goal-oriented.

During his evaluation, he presented as direct and blunt demonstrating some lack of social judgement by behaving antagonistically toward those who where evaluating him, even though he was seeking their approval to return to flying duties His psychological testing showed him to be self-centered, manipulative, and one who demanded attention He was oversensitive to criticism, and held rigidly to his ideas regardless of the other view He was intelligent, compulsive, over-reactive and narcissistic He enjoyed intricate abstract arguments and was hair-splittingly, irritatingly logical. He was quite aware of his pugnacity, and described it in rather prideful terms as a virtue These traits had clearly not been serving him well, but did not meet the rather specific formal criteria for a diagnosable personality disorder. Indeed, had his social problems not grown into such a source of distraction, his performance within the organization would likely never have brought him to medical attention and even then it did so only because he was a flier (Often, however, these individuals are marginal performers in their work as well, but managers and supervisors may be reluctant to confront them directly unless their behavior deteriorates to a completely unacceptable level)

The mental health consultants recommended that he be

medically cleared for flying duties, but they acknowledged that he would probably experience future interpersonal difficulties Since these had never resulted in a compromise of aviation safety, nor placed him at aeromedical risk, he was returned to fly The consultants specifically recommended to the company management that his supervisors judge his retention on the basis of his subsequent performance alone

DISCUSSION

American psychiatrists and psychologists use the revised third edition of the diagnostic system published by the American Psychiatric Association, the *Diagnostic and Statistical Manual of Mental Disorders*, known as DSM-III-R (Ref 1) In discussing the personality difficulties of aviators, let us presume no other category of psychopathology is present no *organic* disorders, *schizophrenia, delusional* or other *psychotic* disorders, disorders of *mood* or *anxiety, somatoform or dissociative* disorders The behavior which will be described concerns personality problems, whether present as traits or as overt disorders

Personality may be defined as the distinctive set of behavioral patterns and tendencies of a given individual, the characteristic way that the individual behaves in the environment It results from genetic, biological and physiological constituents, along with the influence of the environment on the individual as registered, interpreted, stored and integrated by the central nervous system (Ref 2) Through this combination of nature and nurture, of heredity and environment, of experience and adaptation, an individual develops the enduring, consistent, and somewhat predictable attitudes, basic beliefs, values, interpretations and patterns of adaptation to life which, taken together, make each of us a unique human being As we mature, we learn different ways to react to different situations To some extent, these reactions are flexible and adaptive If one response does not seem to satisfy our own and others' needs, we try another If that response works we remember it, and use it the next time a similar situation arises We learn what is appropriate in various social contexts — with peers, subordinates or superiors, with men, women or children, with strangers, friends or rivals, in our own culture, other cultures or ambiguous situations, and so on

One measure of the success of such a behavioral spectrum is pragmatic does it work? Do or can we adapt to novel situations to our own satisfaction, and to the satisfaction of the others involved, by whatever standards we choose to judge such encounters? Obviously, the standards we choose derive from matters of opinion, moral judgement, ethics, politics, religion, and other abstract ideas which may be much debated One key to a healthy personality, however, is *flexibility*, the ability of the individual to fit his behavior to various situations so that interpersonal relations run smoothly most of the time

The failure of this behavioral spectrum is another matter altogether, and may be identified by the reaction of other people to the individual, who may see himself as having no problem at all, blaming the turmoil on everyone else and feeling persecuted by his involvement. Generally the upsetting behavior falls into a pattern which can be identified, using a classification system such as the DSM-III-R A major part of the problem is the *lack* of flexibility of the individual, who continues the upsetting behavior but fails to get his needs met. At least part of the problem is that this is the only way he knows how to behave Such behavior is his nature, it is a natural part of him, so basic that he may never question its lack of effectiveness, regardless of how much he upsets others or gets into trouble because of it Surprisingly, these inefficiencies seem to meet just enough of the individual's basic emotional needs that the process of change may be seen as more distressing than the repeated negative outcomes of such behavior Thus, non-professional counselling on the need to change is either rejected outright, or is given just enough lip service to mollify the counsellor for the time being

Such problems usually arrive in the aeromedical examiner's office amidst a flurry of telephone calls and paperwork Everything seems unusually complicated Stories are told of upsetting incidents sometimes prefaced with "Don't quote me", or "I don't want to get him in trouble, but " The aviator may lack judgement and insight into the situation, not seeing what the problem is, citing personality conflicts or other perceived failings of those around him Lawsuits, formal complaints, union grievances, or other appeals to authority are mentioned, all aimed at getting *other* people to change And above it all loom two questions First, is this flier safe to fly? Second, is this flier ill in some way, and therefore in need of treatment, or may he be regarded as a misfit, an eccentric, or some other, ruder lay word implying a variant of normal, deserving disciplinary action, reprimand, or other administrative retribution? In other words, is this problem medical or administrative?

As with most aeromedical questions, there are also matters of degree to consider The problem may be mild, or manifest only under certain occasional conditions of stress These behaviors we define as *personality traits*, pervasive patterns of feeling, thinking and behaving which may be appropriate (i e , not distressing to self or others) under most conditions To quote DSM-III-R, "it is only when *personality traits* are inflexible and maladaptive and cause either significant functional impairment or subjective distress that they constitute *personality disorders*" (Ref 1) These disorders thus interfere with normal social functioning, and they certainly may interfere with the interpersonal aspects of normal cockpit functioning They are lifelong, one can recognize them (usually in retrospect) in adolescence, and they continue to affect people's behavior, although this effect may tend to diminish somewhat in the fifth or sixth decades Although their exact classification has been the subject of much debate among psychiatrists (Ref 3), and will undoubtedly change somewhat in future editions of DSM-III-R, the present nosology is useful in categorizing problems which may be seen in fliers, and we will consider four such disorders in detail. The description of some of these disorders will probably recall someone you have known, either professionally or socially Some of these characteristics apply to many of us at times, but not to the exclusion of other ways of dealing with life, and not so strongly that they keep us in friction when we desire harmony. All of the descriptions below have been derived from the DSM-III-R diagnostic criteria, to which the reader is referred for a more complete definition of the condition in question (Ref 1)

Paranoid personality disorder The essence of this condition is "a pervasive and unwarranted tendency, beginning by early adulthood and present in a variety of contexts, to interpret the actions of people as deliberately demeaning or threatening" These people question the motives of others, are jealous, expect the worst, read hidden meanings into innocent remarks or situations, are easily insulted and quick

to anger They are unforgiving grudge-bearers, avoid blame even when deserved, and are seen as secretive, guarded, and humorless Quick to criticize others, they react to criticism with angry counterattacks They are rigid, hostile, stubborn, and usually friendless They see no fault in themselves, and cannot "take a joke' They elicit anger from others with surprising speed. Every official office in the world has received inappropriate litigious mail from such individuals Under extreme stress, these people may undergo brief psychotic episodes, not of sufficient duration to warrant a more serious diagnosis

The diagnosis is indicated by at least four of the following

(1) expects, without sufficient basis, to be exploited or harmed by others

(2) questions, without justification, the loyalty or trustworthiness of friends or associates

(3) reads hidden demeaning or threatening meanings into benign remarks or events, e g , suspects that a neighbor put out trash early to annoy him

(4) bears grudges or is unforgiving of insults or slights

(5) is reluctant to confide in others because of unwarranted fear that the information may be used against him

(6) is easily slighted and quick to react with anger or to counterattack

(7) questions, without justification, fidelity of spouse or sexual partner

Here you may see the difficulty in medical judgement — how does one know whether the aviator's suspicions of an unfaithful spouse are justified? What degree of quickness to anger is pathological? How much can you attempt to investigate the situation before you, too, are seen as a threat and reacted to with anger? How much of this behavior can be tolerated in the cockpit of a commercial air transport? The level of judgement required in such instances emphasizes the need for the mental health consultants involved to be familiar with the particular requirements of aviation, especially commercial aviation

Antisocial personality disorder is characterized by irresponsible and antisocial behavior from late childhood on through adolescence and into adulthood They can be charming rogues at times, and have the classic "con man" personality. If they are intelligent, they may be very successful, though utterly amoral and without scruples or conscience They have no remorse about the effects their behaviors have on others, and may even feel justified After age thirty the more florid behavior may diminish, especially the promiscuity, fighting, and criminal behavior. One may see signs of personal distress sometimes to the point of diagnosable depression, but there still may be an inability to sustain close, warm, caring relationships with anyone Those who do achieve some success usually do not have the full clinical picture There is some familial predisposition to this disorder

The diagnosis requires three or more of the following behaviors before age 15

(1) was often truant
(2) ran away from home overnight at least twice
(3) often initiated physical fights
(4) used a weapon in more than one fight
(5) forced someone into sexual activity
(6) was physically cruel to animals
(7) was physically cruel to other people
(8) deliberately destroyed others' property
(9) deliberately engaged in fire-setting
(10) often lied (other than to avoid physical or sexual abuse)
(11) has stolen without confrontation (fraud, forgery)
(12) has stolen with confrontation (mugging, purse-snatching)

The diagnosis further requires at least four of the following since age 15

(1) unable to sustain consistent work behavior
(2) fails to conform to social norms by repeated antisocial or illegal acts
(3) is irritable and aggressive (repeated physical fights or assaults on spouse, child, or others)
(4) repeatedly fails to honor financial obligations
(5) fails to plan ahead, or is impulsive travels without a job or a clear goal or a clear date of termination, lacks a fixed address for over a month
(6) has no regard for the truth — lies, uses aliases, cheats
(7) is reckless regarding safety of self or others
(8) not a responsible parent — neglects or abuses child
(9) has never sustained a monogamous relationship more than one year
(10) lacks remorse (feels justified in having hurt, mistreated or stolen from another)

Passive-aggressive personality disorder represents a lack of adaptation to usual occupational and social roles Anger and resistance are expressed indirectly in ways which they may then disavow or deny blaming others, or circumstance, or other matters "obviously" beyond their ability to control They will be late for their appointment with you, and have a very poor excuse

This diagnosis is indicated by at least five of the following

(1) procrastinates, puts things off, misses deadlines
(2) becomes sulky, irritable or argumentative when asked to do something he or she does not wish to do
(3) seems to work deliberately slowly, or to do a bad job, on tasks that he or she does not wish to do
(4) protests, without justification, that others make unreasonable demands
(5) avoids obligations by claiming to have "forgotten'
(6) believes that he or she is doing a much better job than others think
(7) resents useful suggestions about improved productivity
(8) obstructs efforts of others by failing to do own share of the work
(9) unreasonably criticizes or scorns people in authority

Obsessive-compulsive personality disorder represents a pervasive pattern of perfectionism and inflexibility, beginning by early adulthood and present in a variety of contexts Striving for perfection, their strict and unattainable standards defy common sense Things are never good enough. They are preoccupied with trivial details to the exclusion of the big picture. They allocate time poorly, resist authority from superiors, and misuse it upon subordinates Decisions are postponed because of the fear of mistakes, and there is never enough information anyway Form is more important than substance They are stiff, formal, hide feelings, are stingy, and rarely compliment, since things are never quite perfect enough. They have a strong need to control, and may be depressed

This disorder is indicated by at least five of the following

(1) perfectionism that interferes with task completion, e.g., inability to complete a task because own overly strict standards are not met
(2) preoccupation with details, rules, lists, order organization, or schedules to the extent that the major point of the activity is lost
(3) unreasonable insistence that others submit to exactly his or her way of doing things, OR unreasonable reluctance to allow others to do things because of the conviction that they will not do them correctly (can't delegate)
(4) excessive devotion to work and productivity to the exclusion of leisure activity or friendship (not economically necessary)
(5) indecisive avoids, prolongs or postpones decisions, e.g., does not do task because of ruminating about priorities
(6) overly conscientious, scrupulous, or inflexible about matters of morality, ethics or values, beyond usual cultural or religious identification
(7) restricted expression of affection
(8) lack of generosity in altruistic giving of time, money or gifts
(9) will not discard worn-out or worthless objects with no sentimental value

These full-scale personality disorders represent some of the more commonly seen, but less full-blown, patterns of personality inefficiencies among fliers. Other personality disorders include *dependent, histrionic, schizoid, schizotypal, borderline, narcissistic* and *avoidant*.

Decisions about such disorders are difficult. The diagnoses themselves are not easily made, since the consultant may see only brief bits of the problem when the aviator is definitely on his best behavior. Meaningful information may be available only from sources who may be unwilling to commit themselves because of possible legal, administrative or personal repercussions. Such diagnostic evidence is only second-hand at best, and may be colored by other issues. When it is one person's word against another's, the issue is often uncertain, and mental health consultants are not judges or detectives. Still, the diagnoses may be made with accurate information and skillful appraisal of the individual in the office setting, especially if, in addition to psychiatric consultation, psychological tests of personality structure are obtained. Although not infallible, these may suggest or reinforce the diagnosis. Obtaining such testing allows two independent consultants, the psychiatrist and the clinical psychologist, to work within their own areas of expertise toward a diagnostic formulation in these difficult situations. The consultations are of especial value if aviation-oriented mental health consultants work directly with the aeromedical examiner to give realistic and practical recommendations to the necessary agency.

Once a diagnosis of personality disorder is made, the consultant(s) and the aeromedical examiner must then decide what to do. If the diagnosis is disqualifying for flying duties, the aviator will likely be unhappy, if not openly antagonistic. This is especially true if the grounding is administrative, and therefore not compensable. Treatment of these conditions is very difficult, since the problem involves the very essence of the aviator's personality, the way he reacts to those around him. There are no short-cuts here, no trendy books or three-week therapies. However,

— if the disorder is mild, and
— if the aviator has a bit of insight into the fact that he brings most of his problems upon himself, and
— if he is willing at least to consider a need for change on his part, and
— if he has access to a knowledgeable psychiatrist or psychologist who is willing and able to undertake a lengthy therapeutic endeavor aimed at helping the aviator understand how he came to be the way he is, and to make life-changing decisions about the way he perceives and reacts to the people around him,
— then there is some chance for change.

Usually one or more of these conditions is not met, however, and it then remains for the consultant to articulate the problem clearly, and for the appropriate medical and administrative bodies concerned to decide whether the aviator can continue to fly, or, if not, whether the disorder should be compensable. Most flying organizations with which the authors are familiar have established these disorders as *not* medically disqualifying, and thus not compensable. These troublesome fliers then become the primary responsibility of their supervisors, and are subject to the organization's administrative regulations for job performance. Mental health consultants can be used to support management and supervisory handling of such cases, but often cannot provide the ultimate "fix" of medical grounding.

In the last analysis, the aeromedical disposition depends on the regulations under which you work, and the diagnostic categories which you use. In the United States, there are five sets of regulations which apply: Federal Aviation Agency (FAA), National Aeronautics and Space Agency (NASA), Army, Navy, and Air Force. In each of these, personality disorders may be considered disqualifying for initial selection. The armed forces thereafter consider the individual's behavior to be under his or her control, and therefore handle such problems administratively. Other agencies must decide on the criteria outlined above, usually on a case-by-case basis, and decide each on its merits. These cases are frequently disruptive and are never easy to deal with. Nevertheless, with informed consultants who understand the unique demands of aviation and informed aeromedical examiners who understand at least the general nature of personality disorders, fair and intelligent decisions may be made.

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14. Abstract

This three-day, 24 hour short course is an overview of the neurological, psychiatric, and psychological aspects of aerospace medicine. The purpose of the course is to further the knowledge of the flight surgeon and aeromedical examiner in the issues of neuropsychiatry. Secondly, the course will provide aeromedical information for the neuropsychiatric specialist.

The course describes the unique application of psychiatry, psychology, and neurology to the aviation environment. Topics such as motivation to fly, human performance, stress in aviation and the failing aviator will be discussed. Further psychiatric and neurologic disorders found among aviators will be presented. The unique aspects of assessment and decision making about flying status among neuropsychiatric cases will be presented.

This course provides a thorough overview in a difficult area. There is no doubt that the central nervous system plays an important part in the aeromedical aspects of aviation. However, the central nervous system is highly complex and is not as well understood as other human systems. However much has been learned over the years since neuropsychiatric specialists have been involved with aviation since the very beginning. This course summarizes the concepts and information currently available in aeromedical neuropsychiatry.

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