



Human Factors And Medicine: Clearing Up Some Confusion

The author, a recognized authority in the area of human factors, aims to clarify the confusion that exists because all too often human factors is incorrectly perceived as a branch of medicine. He believes it to be a serious issue that has impeded progress of human factors in some countries.

by

Capt. Frank H. Hawkins, MPhil, FRAeS

Human Performance and Behavior

The human component is the most flexible, adaptable and valuable element in the flying system, yet it is also the most vulnerable to factors that can adversely affect its performance. This has been illustrated by the fact that for half a century about three out of four accidents resulted from less than optimum human performance of one kind or another. This has generally been classified simply as "pilot error."

This classification has not been helpful in the task of improving flight safety because although it indicated *where* in the system the breakdown finally occurred, it provided no guidance as to *why* it occurred. The accident findings were recorded, damage claims resolved and the case duly filed. We all then waited for the human performance cards to be reshuffled and dealt out again in a somewhat different pattern for the next accident. Yet errors attributed to humans could have been design-induced or stimulated by inadequate training, badly designed procedures or the poor concept or layout of checklists or manuals, all requiring attention beyond that of the flight crew.

But human factors awareness has been spreading in recent years and the public, as well as many involved in flying, are looking for more convincing and educated answers to the questions raised by aircraft accidents. They are being supported by the litigation industry and perhaps before long by

aviation insurance brokers. The cost in human and financial terms of a breakdown in human performance has now reached such a level that superficial responses are no longer enough. The days of blissful ignorance are over.

Understanding the normal, predictable capabilities and limitations of man and application of this understanding are the primary concerns of human factors. This multi-disciplinary technology has been progressively developed, refined and institutionalized since the end of the last century. It is backed by a vast store of knowledge.

Widespread Confusion

One of the factors which has retarded progress has been the widespread confusion between this and another activity based on the life sciences, medicine. The title of this Flight Safety Foundation bulletin makes it clear that these are two distinct activities involving different expertise, but the myth that human factors is somehow a branch of medicine dies hard in many countries, for various reasons. In the United Kingdom, for example, confusion still prevails and as a result of the different background qualifications required for the two activities, progress has been retarded.

In the United States, on the other hand, the distinction has been more clearly recognized and as a result, progress has been more dynamic. In the Human Factors Society, with members

in 38 countries, less than four percent of the membership have medical qualifications. A similar percentage is reflected in the composition of U.S. National Aeronautics and Space Administration's (NASA) Aerospace Human Factors Research Division. The Human Factors Committee of the National Research Council which advises the U.S. government in Washington, has no member with a background in medicine. In the U.S., too, there are some 50 universities offering programs leading to graduate degree specialization in human factors; none of these resides in a medical school. This level of understanding is also present in Australia, but elsewhere misconceptions are often to be found and progress suffers as a result.

Human Factors

This technology, like medicine, is concerned with people, but in quite a different way. It is principally concerned with healthy people and their normal performance and behavior, and with factors which influence them. It aims to understand these human characteristics so that equipment, working arrangements, procedures and environmental control can be matched to them and thus enhance the overall effectiveness of the system and the well-being of the individuals concerned.

It is a multi-disciplinary technology. For example, information is drawn from psychology to understand how people process information and make decisions. From psychology and physiology comes an understanding of vision and hearing as a means of detecting and transmitting information. The measures and movements of the body — essential in optimizing the design and layout of controls, and other workplace characteristics of the flight deck and the cabin — calls upon anthropometry and biomechanics. Biology and its increasingly important sub-discipline chronobiology, are needed to understand the nature of the body's rhythms and

sleep, for instance, and the effect on performance when disturbing it through night flying and time zone changes. And finally, no proper analysis or presentation of data from surveys or studies is possible without some basic understanding of statistics.

While utilizing these sources, human factors is concerned with solving practical problems in the real world. The relationship of human factors to the human sciences is similar to that of engineering to the physical sciences.

Many early concerns about man in flying were related to the physiological effects of noise, vibration, heat, cold and acceleration forces. Usually, the person nearest at hand with a knowledge of physiology was a physician. But increasingly, optimizing the role of man has come to involve much more than physiology. It has come to be concerned with all aspects of human performance and behavior: decision-making and other cognitive processes; design of displays and controls; cockpit and cabin layout; communication; software aspects of computers, maps and charts; and the very important field of operating manuals, checklists and other documentation. It is also involved with staff selection, training and accident investigation. A shift has clearly taken place towards psychological aspects of human activity.

It is said, in defense of inaction in the aviation human factors field, that human factors is complex, diverse and everyone has a different opinion about its meaning and scope. Regrettably, this is simply the result of ignorance. Those professionally engaged in teaching, research and application of human factors know what it is all about and any diversity in approach is no different than in any other dynamic technology. This excuse for inactivity should not be tolerated.



Fig. 1 Flight deck design is just one concern of human factors (cartoon: J. H. Band).*

If we wished to make a formal definition of this technology we can do no better than to use that created by Professor Elwyn Edwards, a British specialist in aviation human factors. He declared that “human factors is concerned to optimise the relationship between people and their activities, by the systematic application of the human sciences, integrated within the framework of systems engineering.”

Although there have been some differences in emphasis between European “ergonomics” and the U.S. “human factors,” the two terms are generally regarded as being synonymous. The Human Factors Society, is, together with many other ergonomics associations, a member of the International Ergonomics Society.

Aviation Medicine

Medicine is primarily concerned with the prevention, diagnosis and cure of disease and injury. Aviation medicine is particularly concerned with the impact of flying on the health of those involved, both crew and passengers.

The physician is responsible for the detection of physical conditions which would make it unsafe for a crew member to fly — unsafe for his passengers as well as himself. For the passenger, the aviation physician must be able to determine whether any pathological condition would be aggravated by flight and this particularly relates to changes in cabin pressure. He is responsible for advising the operator on the handling of sicknesses and disorders that occur during flight, though this question is currently open to wide debate and is not yet resolved.

In the field of preventive medicine, the flight surgeon should be able to provide guidance for flying staff on long-term

measures to preserve their health. This aims to ensure a full flying career with the minimum risk of loss of license on medical grounds. Several Flight Safety Foundation bulletins authored by Dr. Stanley Mohler, professor of aerospace medicine from Wright State University, have had precisely this objective.

One area of aviation physician specialization is that of pharmacology — medication and drugs — and the suitability of these for those who fly. With crew members, the particular concerns are performance effects, accumulation of the drug in the body and addiction. A safe drug for use on the ground is not necessarily safe for those who fly. Perhaps the most common problem here relates to drugs — usually from the benzodiazepine group — which are used to induce sleep, often referred to as tranquilizers or hypnotics. But others, such as antihistamines, which are commonly used for colds and allergies, often induce drowsiness and can influence performance.

Areas of Joint Interest

While the tasks of the human factors practitioner and the aviation physician appear different in most respects, there are times when the two specialists should talk to each other. For example, seat design is basically a task for the ergonomist or human factors expert. Yet it is possible that the medical officer will learn of a design deficiency through complaints of back pain before it comes to the notice of the human factors consultant. The effects of smoking on board can certainly be pathological in the long term and so of interest to the physician. But smoking can also involve behavior and performance on board; arguments, and even fist fights, related to smoking have occurred. This is of concern to the human factors specialist and the safety officer.



Fig. 2 Smoking on board presents a pathological problem for medicine but a behavioral one for human factors (cartoon: J. H. Band).*

Another area of mutual interest is in the disturbance of biological rhythms and sleep as a result of irregular working hours and time zone changes. This affects performance and behavior and may result in the victim seeking help through sleep-inducing medication.

Human Factors Expertise

To be clear on the distinction between these two areas of specialization so that appropriate expertise can be brought to bear on the related problems is very important; confusion can lead to a lack of the required activity and may prejudice safety.

**Human Factors in Flight*, published by Gower Technical Press, Croft Road, Hampshire GU11 3HR, England. ♦

About The Author

Capt. Frank H. Hawkins developed and applied his interest in human factors during 30 years as a line captain and research/

development pilot for KLM airline. He participated in the design of flight decks for all KLM aircraft from the Viscount to the Boeing 747.

Hawkins perceived a lack of knowledge in the human factors area that often led to tragedy. His interest in this area led to the development of courses in human factors, including the KLM Human Factors Awareness Course.

He is a member of the Human Factors Society and a Liveryman of the Guild of Air Pilots.

His book, "Human Factors in Flight," published in 1987, explores the area of human factors in an easy-to-read style and is aimed at pilots, operators, regulators and designers of aircraft. While aimed at flight decks and operational aspects, the cabin and passenger well-being is also addressed.

34th Annual Corporate Aviation Safety Seminar

Dearborn, Michigan

April 18-21, 1989

"Safety Through Quality: Meeting The Challenge"

For more information contact
Bob Cooke, FSF

HUMAN FACTORS & AVIATION MEDICINE

Copyright © 1989 FLIGHT SAFETY FOUNDATION, INC. ISSN 0898-5723

Articles in this bulletin may be reprinted in whole or in part, but credit must be given to Flight Safety Foundation and *Human Factors & Aviation Medicine*. Please send two copies of reprinted material to the editor. • The suggestions and opinions expressed in this bulletin are those of the author(s); Flight Safety Foundation does not necessarily endorse or agree with the author(s). Bulletin content is not intended to take the place of information in company policy handbooks and equipment manuals, or to supercede government regulations. • Unsolicited manuscripts must be accompanied by stamped and addressed return envelopes if authors want material returned. Reasonable care will be taken in handling manuscripts, but the Flight Safety Foundation assumes no responsibility for material submitted. • Subscriptions: \$50 U.S. (U.S., Canada, Mexico), \$55 U.S. Air Mail (all other countries), six issues yearly • Staff: Alisa Joaquin, editorial assistant; Jacqueline Edwards, word processor. • Request address changes by mail and include old and new addresses. • Roger Rozelle, Editor, Flight Safety Foundation, 2200 Wilson Boulevard, Suite 500, Arlington, VA 22201-3306 U.S. • Telephone: 703-522-8300 • Telex: 901176 FSF INC AGTN • Fax: 703-525-6047