Aviation: History, Definition, Uses & Development

History

During World War I, the need to engage recently invented aircraft in combat demanded that new methods be utilised to select and train individuals to become qualified pilots. This encouraged the development of aviation psychology and the start of aeromedical research. This was then followed by the interwar period during which further studies were conducted and advancements were achieved. These included determining the traits of successful pilots, studying how flight performance is affected by environmental stressors in addition to incorporating the basics of anthropometry into aircraft design.

The discipline of Human Factors and Ergonomics, as known today, is thought to have originated during World War II. The outbreak of the second war was a catalytic factor for the development of the discipline. The advancements in human factors and ergonomics were borne out of military necessity. This was as a result of a number of war requirements that had to be met. Prior to WWII, the focus was on “designing the human to fit the machine”. The need to recruit large numbers of men and women made it difficult to select individuals for specific roles, the focus, therefore, shifted to designing the machine/equipment to fit human capabilities while trying to minimize the negative consequences of human body limitations. The need to incorporate human factors and ergonomics was also as a result of technological advancements outpacing the ability of individuals to compensate for poor design of the equipment. An evident example of this, is highly trained pilots crashing due to problems with the control configurations and instrument displays within the aircraft. These issues were studied by experimental psychologists who then adapted laboratory techniques to find solutions.

Driven by the Cold War, military-sponsored research continued after WWII. The military labs were expanded and additional ones were developed by the Army, Air Force and the Navy. Government funding assisted universities to also establish laboratories for the same purpose. The public sector also saw a development of human factors and ergonomics groups especially in aviation companies (Boeing, McDonnell Douglass and Grumman Corporation).

http://www.ericshaver.com/human-factors-a-brief-history/

Definition

Human factors is an interdisciplinary area of psychology that focuses on a range of different topics including: ergonomics, human error and human-machine interaction. It examines the relationship between human beings and systems with which they interact. It works by applying the principles of psychology to designing systems and equipment in addition to creating a suitable work environment that enhances productivity and ensures safety.

The International Ergonomics Association defines human factors as “the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and other methods to design in order to optimise human well-being and overly system performance”.

Uses & Development

There are countless applications and uses for human factors. Technologies that have an “interface” to facilitate interaction and control by humans require the incorporation of human factors for it to be suitable for use. As technologies have become more complex, the user interface has also become more difficult to understand and evaluate. Human factors is especially important in industries that are considered of high risk where safety-critical technology systems are utilized. These include nuclear power plants, chemical processing, weaponry, aviation and transport in addition to others.

One of the very first industries to incorporate human factors issues into design considerations and safety reviews, is the nuclear power industry. In the late 1970s, the Nuclear Regulatory Commission (NRC) started studying factors that affect human performance in addition to focusing on providing adequate training for operators to perform their assigned tasks. A human factors approach was applied for the evaluation and redesign of human-system interfaces of a nuclear power plant simulator. It is ultimately in the operators’ hands to make decisions regarding process changes, it is therefore crucial to ensure proper design of control operator interfaces. A cognitive task analysis approach (CTA) was used to observe as the operators carried out their assigned tasks in the control room, several opportunities for improvement were noted in the human/system interface which were implemented by redesigning the graphical layout of the system information which provided for better integration of the process steps.

Another notable industry in which human factors are intensively studied and applied, is the aviation industry. The aircraft itself- considered mechanically unsafe compared to aircrafts of today- was responsible for the majority of aviation accidents in the early years of the industry. However, even with the significant technological advancements in the modern era, accidents continued to occur. It is actually estimated that around 70-80% of all aviation accidents can, in fact, be attributed to human error.

There has been a significant decline in aviation accidents over the last 50 years or so. Reductions in human-error-related accidents have not been declining as fast as the decline in mechanical/environmental-related accidents. In fact, as aircraft equipment has become increasingly reliable, humans have played in a notable role in the causation of military and civil aviation accidents. The graph below illustrates an analysis of the rate of Naval aviation accidents from 1977 to 1992. As shown, the number of aviation accidents solely attributed to mechanical/environmental factors was equal to those attributed to human errors in 1977. By 1992, the number of mechanical/environmental-related accidents had almost been eliminated whilst human error-related ones were reduced by approximately only 50%. The decline in human error-related mishap was not as a result of improvements aimed at the aircrew, but rather as a direct result of aircrafts becoming more reliable and mechanically sound.

Following any accident, an investigation typically ensues. From an engineering perspective; investigations involved a team of air-safety investigators and technical support personnel tasked with examining the wreckage to determine the accident’s causes. Mechanical failures that resulted in accidents were often revealed pretty quickly due to the availability of sophisticated technology and analytical techniques to facilitate the investigation. Data collected from engineering investigations have therefore resulted in design changes that contributed notable to the evolution of today’s modern aircraft. This has helped dramatically reduce the rate of

mechanical-related accidents.

From a human factors perspective; the investigation typically involved one individual who may or may have not had any training in human factors. The evidence and causes of human errors are qualitative and elusive, which made it difficult to investigate. The investigation therefore focused on what caused the accident rather than why- statements like “pilot failed to maintain adequate clearance from the terrain” were included in reports with no mention of why the pilot failed to do so. Intervention strategies were introduced that were only marginally effective at reducing the occurrence of human error-related accidents as a result of the lack of proper and adequate human factors accident data. This consequently led to the overall rate of human-error-related accidents remaining constantly high over the years.

It was then realised that a thorough understanding of human factors in aviation accidents is required to enhance aviation safety. Over the years, a comprehensive analysis of existing accident databases was carried out which has led to the development of a number of theories/frameworks aimed at systematically examining and identifying human factors.