Conformal Flight Path Symbology For Head Up Displays

Precision navigation, display, and avionics technologies have progressed to the point that a head-up primary flight display incorporating synthetic elements such as terrain and commanded flight path is a possibility in the near future. The goal of such a display is to increase situation awareness and reduce aircrew reliance on warning systems or automation to prevent controlled flight into terrain (CFIT) mishaps. The primary flight display- and primary focus of attention - in modern fighter aircraft is a head-up display (HUD). This is becoming true also for newer transports in the U.S. Air Force inventory. Some human factors issues associated with synthetic vision in a head-down display are different from those associated with a head-up synthetic vision display, especially when the displays are used as primary flight references. Among these issues are the use of color, ability to see through the display, symbology clutter, compatibility between head-up and head-down displays, and attentional factors. This paper reports the results of a study in which HUD-experienced pilots flew simulated complex precision approaches to landing in three visibility conditions, with and without synthetic terrain, using either pathway-in the- sky symbology or more traditional military standard HUD symbology. Workload and situation awareness measures were collected to determine the relative workload associated with these conditions and if, as has been proposed elsewhere, flying a pathway-in-the-sky display is associated with "cognitive capture", or a decrease in situation awareness concerning things other than the pathway. It was hypothesized that including pathway and synthetic terrain in a head-up primary flight display would result in a conformal symbology set that naturally draws pilots' attention to external

events.

Over the past decade, Cognitive Work Analysis (CWA) has been one of the popular human factors approaches for complex systems evaluation and design applications. This is reflected by a diverse range of applications across safety critical domains. The book brings together a series of CWA applications and discussions from world-leading human factors researchers and practitioners. It begins with an overview of the CWA framework, including its theoretical underpinnings, the methodological approaches involved (including practical guidance on each phase), and previous applications of the framework. The core of the book is a series of CWA applications, undertaken in a wide range of safety critical domains for a range of purposes. These serve to demonstrate the contribution that CWA can make to real-world projects and provide readers with inspiration for how such analyses can be practically carried out. Following this, a series of applications in which new approaches or adaptations have been added to the framework are presented. These show how practical applications feedback into the theories/approaches underpinning CWA. The closing chapter then speculates on future applications of the framework and on a series of new research directions required in order to enhance its utility. In emphasising the practical realities of performing CWA, and the real-world impacts it can provide, the book tackles several common misconceptions in a constructive and persuasive way. It provides a welcome demonstration of how CWA can be a powerful ally in tackling complexity-related problems that afflict systems in all areas.

This is a thorough description of this increasingly important technology, starting from the development of head-up displays (HUDs), particularly specifications and standards and operational problems associated with HUD use. HUD involvement in spatial disorientation and

its use in recognizing and recovering from unusual attitudes is discussed. The book summarizes the design criteria including hardware, software, interface and display criteria. It goes on to outline flight tasks to be used for evaluating HUDs and discusses the impact of HUDs on flight training. Recent work indicates that a HUD may allow a significant reduction in the time required to train a pilot on a particular aircraft, even considering non-HUD-related tasks. The author concludes with a review of unresolved HUD issues and recommendations for further research and provides an impressive bibliography, glossary and index. Within the military aviation sector the book will be of use to industry, research agencies, test pilot schools and air force training establishments. In the civil area regulatory authorities, airlines and industry will also have an increasing interest.

Thirty-two pilots flew instrument approaches in a high-fidelity simulator. Location of flight symbology was manipulated head-up vs. head-down while controlling for optical distance and symbology format. Pilots were assigned to one of two symbology sets, conformal or non-conformal. Each pilot flew half of the trials with the symbology presented in a head-up location and half with the symbology located head-down. An unexpected far domain event was presented on one trial per pilot. The results revealed that, for flight path control, there was generally a cost associated with head-down location. The magnitude of this cost was larger for conformal than for non-conformal symbology. Head-up presentation resulted in faster transition from instrument to visual flight reference, but slower response to the far domain unexpected event and greater error tracking digital airspeed. The results are interpreted with the theoretical framework of object-based and space-based theories of visual attention.

Annotation This text presents the principles of dynamics and control for vertical,

short take-off landing (V/STOL) aircraft. It is the first book of its kind. It is intended for graduate students and professionals in aeronautics who have knowledge of linear systems analysis, aircraft static, dynamic stability, and control. The text begins with a discussion of V/STOL aircraft operations. Control strategies, equations of motion, longitudinal and lateral-directional flying qualities in both hover and forward flight, wind and turbulence responses, and control augmentation and cockpit displays are covered. Specific examples of the YAV-8B Harrier and XV-15 Tilt Rotor aircraft are used to illustrate actual V/STOL dynamic and control characteristics.

The helmet-mounted display (HMD) presents flight, sensor, and weapon information in the pilot's line of sight. The HMD was developed to allow the pilot to retain aircraft and weapon information and to view sensor images while looking off boresight.

This book discusses the latest advances in the research and development, design, operation, and analysis of transportation systems and their corresponding infrastructures. It presents both theories and case studies on road and rail, aviation, and maritime transportation. Further, it covers a wealth of topics, from accident analysis, intelligent vehicle control, and human-error and safety issues to next-generation transportation systems, model-based design methods,

simulation and training techniques, and many more. Special emphasis is placed on smart technologies and automation in transport, as well as the user-centered, ergonomic, and sustainable design of transportation systems. The book, which is based on the AHFE 2020 Virtual Conference on Human Aspects of Transportation, held on July 16–20, 2020, mainly addresses the needs of transportation system designers, industrial designers, human–computer interaction researchers, civil and control engineers, as well as vehicle system engineers. Moreover, it represents a timely source of information for transportation policy-makers and social scientists whose work involves traffic safety, management, and sustainability issues in transport.

Display systems are the vital indicators that monitor the various avionics, environmental, and electronic systems that keep aircraft in the air. "Aircraft Display Systems" introduces the reader to the means by which information is presented to the crew, enabling them to carry out their tasks safely and successfully. "Aircraft Display Systems" provides an assessment of the current and potential future information needs in civil and military flight decks. It also offers the reader an appreciation of the technologies available to the display engineer in order to provide solutions that meet those needs. This volume will be an invaluable source of information to all those involved in aircraft design, build,

testing, and investigation. Copublished with Professional Engineering Publishing. For orders from Europe and the Middle East, please contact 44 (0) 1243 843294 or cs-books@wiley.co.uk

This book covers the foundations and successes of Neuroergonomics, combining neuroscience and ergonomics to enhance efficiency and safety. An overview of the essential areas within the field is given including chapters on brain networks, perception, attention, and performance.

A moving-base simulation has been conducted on the Vertical Motion Simulator at Ames Research Center using a model of an advanced, short takeoff and vertical landing (STOVL) lift fan fighter aircraft. This experiment expanded on investigations during previous simulations with this STOVL configuration with the objective of evaluating (1) control law modifications over the low speed flight envelope, (2) integration of the throttle inceptor with flight control laws that provide direct thrust command for conventional flight, vertical and short takeoff, and flightpath or vertical velocity command for transition, hover, and vertical landing, (3) control mode blending for pitch, roll, yaw, and flightpath control during transition from wing-borne to jet-borne flight, and (4) effects of conformal versus nonconformal presentation of flightpath and pursuit guidance symbology on the out-the-window display for low speed STOVL operations. Assessments were made for takeoff, transition, hover, and landing, including precision hover and landing aboard an LPH-type amphibious assault ship in

the presence of winds and rough seas. Results yielded Level 1 pilot ratings for the flightpath and vertical velocity command modes for a range of land-based and shipboard operation and were consistent with previous experience with earlier control laws and displays for this STOVL concept. Control mode blending was performed over speed ranges in accord with the pilot's tasks and with the change of the basic aircraft's characteristics between wing-borne and hover flight. Blending of yaw control from heading command in hover to sideslip command in wing-borne flight performed over a broad speed range helped reduce yaw transients during acceleration through the low speed regime. Although the pilots appreciated conformality of flightpath and guidance symbols with the external scene during the approach, increased sensitivity of the symbols for lateral path tracking elevated the pilots' control activity in...

Vision is the dominant sense used by pilots and visual misperception has been identified as the primary contributing factor in numerous aviation mishaps, resulting in hundreds of fatalities and major resource loss. Despite physiological limitations for sensing and perceiving their aviation environment, pilots can often make the required visual judgments with a high degree of accuracy and precision. At the same time, however, visual illusions and misjudgments have been cited as the probable cause of numerous aviation accidents, and in spite of technological and instructional efforts to remedy some of the problems associated with visual perception in aviation, mishaps of this type continue to occur. Clearly, understanding the role of visual perception in

aviation is key to improving pilot performance and reducing aviation mishaps. This book is the first dedicated to the role of visual perception in aviation, and it provides a comprehensive, single-source document encompassing all aspects of aviation visual perception. Thus, this book includes the foundations of visual and vestibular sensation and perception; how visual perceptual abilities are assessed in pilots; the pilot's perspective of visual flying; a summary of human factors research on the visual guidance of flying; examples of specific visual and vestibular illusions and misperceptions; mishap analyses from military, commercial and general aviation; and, finally, how this knowledge is being used to better understand visual perception in aviation's next generation. Aviation Visual Perception: Research, Misperception and Mishaps is intended to be used for instruction in academia, as a resource for human factors researchers, design engineers, and for instruction and training in the pilot community.

A perennial bestseller, the Digital Avionics Handbook offers a comprehensive view of avionics. Complete with case studies of avionics architectures as well as examples of modern systems flying on current military and civil aircraft, this Third Edition includes: Ten brand-new chapters covering new topics and emerging trends Significant restructuring to deliver a more coherent and cohesive story Updates to all existing chapters to reflect the latest software and technologies Featuring discussions of new data bus and display concepts involving retina scanning, speech interaction, and

synthetic vision, the Digital Avionics Handbook, Third Edition provides practicing and aspiring electrical, aerospace, avionics, and control systems engineers with a pragmatic look at the present state of the art of avionics.

This book describes some of the most recent advances and examines emerging problems in engineering psychology and cognitive ergonomics, bridging the gap between the academic theoreticians, who are developing models of human performance and practitioners in the industrial sector, responsible for the design, development and testing of new equipment and working practices.

Human error is now the main cause of aircraft accidents. However, in many cases the pilot simply falls into a trap that has been left for him/her by the poor design of the flight deck. This book addresses the human factors issues pertinent to the design of modern flight decks. Comprising of invited chapters from internationally recognised experts in human factors and flight deck design, contributions span the world of industry, government research establishments and academia. The book brings together the practical experience of professionals across the human factors and flight deck design disciplines to provide a single, all-encompassing volume. Divided into two main parts, part one of the book examines: the benefits of human engineering; flight deck design process; head down display design; head-up display design; auditory warning systems; flight control systems, control inceptors and aircraft handling qualities; flight deck automation; and human-computer interaction on the flight deck and anthropometrics for

flight deck design. Part two is concerned with flight deck evaluation - the human factors evaluation of flight decks; human factors in flight test and the regulatory viewpoint Of interest to all human factors professionals operating in high technology, high-risk dynamic industries as well as those engaged directly in aerospace activities, the book will also be of key importance to engineers with an interest in human factors for flight deck design, academics and third year and post-graduate human factors/ergonomics and psychology students.

This is the first of two edited volumes from an international group of researchers and specialists, which together comprise the edited proceedings of the First International Conference on Engineering Psychology and Cognitive Ergonomics, organized by Cranfield College of Aeronautics at Stratford-upon-Avon, England in October 1996. The applications areas include aerospace and other transportation, human-computer interaction, process control and training technology. Topics addressed include: the design of control and display systems; human perception, error, reliability, information processing, and human perception, error, reliability, information processing, and awareness, skill acquisition and retention; techniques for evaluating human-machine systems and the physiological correlates of performance. This volume covers Human Factors in transportation systems. Part One opens with a chapter by Chris Wickens on attentional issues in head-up displays; its concluding chapter by Peter Jorna, pulls together the Human Factors issues in air traffic management from both the pilot‘s and

the air traffic controller‘s perspectives. Part Two considers the ground-based aspects to air traffic control, while Part Three emphasizes the psychology of the individual. The opening chapter of Part Four uses lessons learned from aviation to avoid similar mistakes in road vehicles. The final part contains topics such as naval command and control, and automation in trains and armoured fighting vehicles.

Conformal Flight Path Symbology for Head-up DisplaysDefining the Distribution of Visual Attention in Three-dimensional SpaceHuman Factors for Civil Flight Deck DesignRoutledge