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Historical Scientific Analysis of Aviator Selection



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TABLE OF CONTENTS

ACKNOWLEDGEMENT	iii
ABSTRACT	v
HISTORICAL SCIENTIFIC ANALYSIS OF AVIATOR SELECTION.....	1
INTRODUCTION.....	1
TECHNICAL DISCUSSION.....	1
CONCLUSION.....	3
REFERENCES.....	4

ABSTRACT

The purpose of this effort was to conduct a scientific analysis of aviator selection research. The report summarizes our efforts to 1) describe the development of pilot selection systems, 2) develop a searchable database of pilot selection references, and 3) identify the Knowledge, Skill, Ability, and Other (KSAO) characteristics that are critical to success as a pilot and success as an unmanned aerial system operator.

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HISTORICAL SCIENTIFIC ANALYSIS OF AVIATOR SELECTION

Introduction

This is the final report for Delivery Order 0762, Contract No. W911NF-07-D-0001. The goals of this Delivery Order were to: 1) describe the development of pilot selection systems, 2) develop a searchable database of references pertaining to pilot selection, and 3) identify the Knowledge, Skill, Ability, and Other (KSAO) characteristics that are critical to success as a pilot and success as an unmanned aerial system operator.

Pursuit of these goals has lead to the development of six research products. These are:

1. A report documenting the KSAOs for military pilot selection
2. A report describing the reference database
3. The reference database, Part A
4. The reference database, Part B
5. A report documenting the KSAOs for unmanned aerial system operators
6. A report describing the history of pilot selection.

Technical Discussion

The first product is titled “KSAOs for Military Pilot Selection: A Review of the Literature” (Damos, 2011). This report reviews nine studies concerned with identifying the knowledge, skills, abilities, and other characteristics (KSAOs) that are required for success as a military pilot. The report begins with a review of taxonomies used to identify the required KSAOs and notes issues associated with their use. Definitional problems of three attributes commonly associated with success as a pilot—Mechanical Aptitude, Timesharing, and Situational Awareness—are discussed. Next, the studies that identified the required KSAOs are reviewed. Limited conclusions can be drawn about the required KSAOs from the studies reviewed. Few investigators examined categories of knowledge as indicators of success. Similarly, the skills required for success were rarely identified because investigators assumed they would be trained. Problems with definitions of abilities and other methodological issues limited the identification of required abilities and restricted cross-study comparisons. Nevertheless, several abilities, particularly Perceptual Speed and Spatial Orientation, were closely associated with success as a military pilot. Identification of other traits required for success was hampered by the lack of strong theories of personality to guide investigators. The report concludes with recommendations for the development of a new taxonomy and for research focused on several attributes that may be critical for success as a military pilot.

The second product is titled “A Bibliographic Database for the History of Pilot Training Selection” (Howse & Damos, 2011a). This lengthy report documents the development and accumulation of a set of reference materials covering the history of U.S. aviator selection from the inception of military flight to the present day. It presents the materials so that they may be applied as a reference database or as a complete digital library for use by researchers in the field. The report contains an explanation of relevant copyright limitation. In addition it present user and installation instructions for alternative methods of utilization.

The third and fourth products are titled “Digital Library of the History of Pilot Selection Training” and were delivered as a set of two digital versatile disks (DVD; Howse & Damos, 2011b; Howse & Damos, 2011c). These disks contain the complete database and related files. On Disk A of this set an EndNote database is contained in the file *Aviator Selection.enl*. A co-located folder, *Aviator Selection.Data*, contains a subfolder, *PDF*. The subfolder *PDF* contains subfolders that themselves contain the file attachments associated with entries in the database. The EndNote application packages file attachments in a separate folder for each database entry. In some cases there are multiple files within a subfolder. Disk A also contains the file *Aviator Selection.htm*, which is a hypertext markup language (HTML) listing of the complete entries in the database. This file can be read by standard internet browsers. Finally, Disk A contains a Standard Form 298 for the digital library (*sf298.doc*). The size of the complete library exceeds the capacity of a single DVD. Therefore the balance of file attachments are on Disk B of the set, in *Aviator Selection.Data\PDF*. Disk B contains two other folders. The folder *Trash* is intended as a temporary location for deleted entries and is empty. The folder *rdb* contains 22 files that are used by the file management software. These are not intended to be manipulated by users.

The fifth product, titled “KSAOs for Unmanned Aircraft Operators” (Howse, 2011) presents the results from a review of a literature base of more than 200 publications in which eight were found to contain lists of KSAOs for unmanned aerial system crew positions, either for the purpose of system design specification or for personnel selection. The report compares KSO lists across these studies and presents a cross reference table for them. The report also surveys past efforts to establish KSAOs in anticipation of related developments and discusses the major likely sources and nature of future changes in KSAO demand for unmanned aerial system operators.

The sixth product, titled “A summary of the technical pilot selection literature” (Damos, 2011) presents a history of military pilot selection in the United States beginning with the inception of formal efforts to systematically select pilots just prior to World War I, through World War II and into the modern era. Below are a few highlights of that effort.

Before the start of World War I candidate selection was based on medical examinations. An intelligence test was added to the selection battery in 1918. The war ended before tests of simple reaction and vestibular function were implemented. Tests of spatial ability and multi-limb coordination were in development when the war ended. Some preliminary attempts at track selection began but were not given serious consideration. Useful selection instruments and promising lines of research identified in World War I were abandoned shortly after the Armistice. Consequently, the period between the wars was marked by extremely poor pilot selection systems for both the Army and the Navy as evidenced by extraordinarily high failure rates in training. The small amount of military research conducted between the wars appears focused on psychiatric and personality issues.

In 1939, the Committee on Selection and Training of Aircraft Pilots of the National Research Council (CSTAP) was created and tasked with developing selection and training methods for private and commercial pilots. The CSTAP performed a job/task analysis for private flying,

developed rating scales for check rides, standardized maneuvers for use in check rides, and identified tests with predictive validity for student pilots. Many of the early changes to the military selection systems were the result of research by the CSTAP and not outgrowths of recommendations by prominent military investigators.

During World War II, the Army and the Navy adopted different approaches to research on pilot selection and developed different types of selection batteries. The Army employed a two-phase selection process consisting of a basic physical examination and one written test. If the applicant passed the first phase, he became an aviation cadet. The second phase consisted of a flight physical examination and the Aircrew Classification Battery. If the candidate passed the physical examination, he was placed into one of three aircrew specialties: pilot, navigator, or bombardier based on his scores on the Aircrew Classification Battery and his preference. If he failed the physical examination, he was assigned to a ground crew specialty. Much of the effort described in the *19 Army Air Forces Aviation Psychology Program Research Reports* was devoted to classification, not selection. The AAFQE was revised several times. Individual selection instruments were frequently revised to increase their predictive validity.

The Navy, also worked with CSTAP, but unlike the Army, the Navy appears to have relied on the CSTAP throughout much of the war for selection research. The few articles that could be located describing the Navy's pilot selection effort show fewer uniformed psychologists than the Army. The non-medical portion of the Navy pilot selection battery consisted of three tests: General intelligence, mechanical aptitude, and a biographical inventory. A striking difference between Army and the Navy selection and classification batteries concerned apparatus tests. The Army had at least five apparatus tests; the Navy had none.

By the end of World War II, pilot selection had been placed on a strong scientific foundation. In contrast to the research conducted in World War I, that conducted in World War II used more modern experimental and statistical methods. Perhaps the greatest contribution of the pilot selection effort was to the professional development of numerous psychologists who made subsequent major contributions to the areas of intelligence, statistical methods, and human factors.

Conclusion

The Statement of Work for Delivery Order 0762 was analyzed by Damos Aviation Services, Inc. and divided into specific tasks that could be addressed in a logical and systematic manner. The products delivered are the results of the efforts expended to complete those tasks. These products should provide the services with useful resources for future research and development in aviation personnel selection and other technical areas that employ KSAOs.

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