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TASK 3: Review of Historical Aviation Constructs

USAF Strategic Personnel Research Program

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14. ABSTRACT

At the end of World War II, the Army Air Forces Aviation Psychology Program produced a 19-volume series documenting their efforts in aircrew selection, training, the design of aircraft displays and controls, and the reassignment of aircrew returning from combat duty. Damos Aviation Services, Inc. (DAS) was tasked with digitizing the 19 volumes and developing a new index for reference and technical analysis. Eighteen volumes were digitized with their indices. Volume 7 was digitized but contains no index.

The new index developed by DAS addresses four problems with the existing indices. The first concerned terminology. The 18 indices use terminology from the 1940's. The new index includes updated terminology for dated entries. Second, some of the 18 indices are very detailed; others, very superficial. The new index contains additional entries for volumes with less detailed indices. Third, DAS created entries for Volume 7 and included them in the new index. Fourth, the 18 indices typically do not cross reference information in other volumes. This could force investigators to search multiple volumes to find needed information. DAS combined the 18 original indices and the new index into a 20th volume, which is completely searchable, to facilitate locating information across multiple volumes.

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Review of Historical Aviation Constructs

OVERVIEW

Advanced Computer Learning Company (ACLC) contracted Damos Aviation Services, Inc. (DAS) to provide support for ACLC on Task 3 of the Strategic Personnel Research Program for the United States Air Force (USAF) *[Task Order # 47QFAA18F0043 under HCaTS Contract # GS02Q17DCR0008, ITSS #: ID10180037].* As part of this task, DAS was required to digitize and index the 19 volumes of the *Army Air Forces Aviation Psychology Program Research Reports.* This series is frequently known as the "Blue Books." Access to this series was not an issue because DAS owns the complete Blue Book series. The 19 volumes comprise over 7500 pages.

DIGITIZING

Digitizing this series presented several challenges. The first was the age of the books. Because the books are over 70 years old, they are somewhat brittle, a few pages are torn, some are annotated, and many of the pages have yellowed substantially. A second challenge concerned the size of the books. One of the books is more than 1000 pages and another is more than 900 pages. Using a flatbed scanner to copy the larger volumes was impractical because pressure had to be exerted on the books to obtain a clear copy of the pages. This risked cracking the spines. Another challenge involved the paper. The Blue Books are printed on several different types of paper, ranging from matte to semi-gloss with varying opacities. In a few cases, the type of paper used for the text pages changed part way through the volume.

Additionally, the Blue Books have many fold-out pages that are neither letter nor legal size. In a few cases, they are double or triple the width and double the height of a standard letter-sized page. The fold-out pages are also printed on a variety of papers with different opacities and thicknesses. Some of these fold-out pages presented DAS with additional challenges related to their binding. Particularly in Report #1, *The Aviation Psychology Program in the Army Air Forces*, multiple successive fold-out pages were attached to each other and then to a single text page that was bound into the spine. These pages were bound more tightly at the bottom than at the top. A standard flat-bed scanner produced fan-shaped images of these types of pages.

All of these challenges were addressed by using a new overhead optical scanner. The scanner allowed the book to be placed text up on a flat surface. The scanner was placed several inches above the surface of the book. The optical character recognition (OCR) software automatically flattened the curved pages. If the book had to be held down to obtain a clear image, the OCR software automatically recognized and cropped the operator's fingers from the image. When text pages with low opacity were scanned, print from the reverse side of the page did bleed through occasionally. DAS personnel could not eliminate this problem entirely.

The Blue Books contain a variety of types of images. Wiring-diagrams and large tables were often printed on fold-out pages. Other diagrams and photographs were usually on letter-size pages. DAS personnel experimented with the OCR settings for all of the different types of images.

After testing all OCR settings, DAS personnel found that the grayscale and black-and-white settings provided the best results. Photographs were scanned using grayscale. Text pages, diagrams, and tables were scanned in black and white. The black-and-white setting eliminated any page yellowing. Occasionally, a diagram had large blackened areas. In these cases, the best results were obtained by using grayscale. Fold-out pages that were printed on low opacity paper were scanned with a piece of plain white paper behind the page. This ensured that print from the following page did not show through the page being copied.

All 19 volumes have blank pages at the front of the book. Some have blank pages immediately preceding the start of a new chapter. These blank pages were copied. A few fold-out diagrams were three-pages wide. For these diagrams, a fourth blank page was added after the third page. This ensured that, in a two-page viewing mode, the images accurately reflected the layout of the book.

UPDATING THE INDICES

Task 3 required "indexing for reference and technical review" with no further specifications. A preliminary examination of the Blue Book series revealed several shortcomings of the indices. Some of the indices were very detailed, and information could be located easily. Others were far less detailed. Investigators using these volumes could spend a substantial amount of time locating information. One of the volumes (Report #7, *Motion Picture Testing and Research*) did not have an index.

Because the Blue Books were the outgrowth of World War II research, the entries use 1940's terminology. For example, the term "crew assembly" is used to denote the more modern "crew formation." The terminology for spatial and memory tasks reflects the understanding of these areas in the early 1940's and is particularly dated.

DAS created a new index to supplement the existing indices to meet Task 3 requirements. For each volume, DAS went through the body of the report page by page identifying the important topics. The existing index then was checked to determine which terms were used for each topic. In a few cases, important topics had no entries in the existing index. Entries were created for such topics and added to the new index. In many cases, the entries used dated terminology that investigators would be unlikely to use. New entries using modern terminology were created and added to the new index for these cases. As noted earlier, Report #7, *Motion Picture Testing and Research*, had no index or glossary. Therefore, the only index terms for this volume are those provided by DAS. The entries for this report were added to the new index; a separate index for Volume 7 was not created.

One difference in terminology is important to note. In 1943 the Army Air Corps decided to admit a group of 1143 men to flight training who took the Army Air Forces Qualifying Examination but were not selected on the basis of their scores. These men were required to pass the flight physical but were otherwise unselected. This group was then tracked through flight training.

This unselected group is unique in the history of pilot selection and provides an important baseline for studying washout rates, accident rates, and test validity. The authors of the Blue Books refer to this group as the "experimental group." Modern investigators, however, may consider this to be a control group. DAS added the term "control group" to the new index with references to the volumes and pages describing this unselected group.

CONSOLIDATION OF INDICES

Although some of the Blue Book indices are very detailed, none of them cross-references information in other volumes. Consequently, digitizing each volume separately could cause an investigator to search multiple indices to find the information of interest. In consultation with the USAF, DAS constructed a 20th volume composed of all the existing Blue Book indices plus the new index.

By combining all of the indices into one searchable volume, an investigator only has to search one source to locate the relevant information. To ensure that an investigator can find the volume for an entry easily, each index is preceded by a copy of its title page, and a heading was added to each page with the volume number. The new index was placed at the end of the 20th volume.

SEARCH RESULTS

After each volume was digitized, it was searched using ten different terms. DAS personnel used a mixture of common words, e.g., "aviation", and words that were more specific to that volume. All of the volumes were found to be immediately searchable. DAS personnel also tested the OCR accuracy of various tables, diagrams, and pictures. Words that were part of diagrams or were in a figure or photograph caption were not always found. That is, none of the words on certain diagrams, tables, and photographs could be found, whereas words in other diagrams, tables, and photographs were found easily. DAS personnel believe that different methods may have been used to insert images into the text. At this time there is no method to determine which images are searchable and which are not.

After the 20th volume was completed, it was also tested to ensure that all of the volumes were searchable. It was searched using general terms, such as "job analysis" and "radar operator," and with more volume-specific terms such as "WASP" and "spot location." In all cases, the terms were found easily.

FINAL COMMENTS

Two additional comments are necessary concerning the indices. The first concerns the new index. Terms were included in the new index only when a topic did not have an entry in its index or when the entry used dated terminology. That is, entries in the new index do not duplicate entries in the existing indices. It should be mentioned that no entry in any of the original 18 indices was omitted or altered, and no new entries were added to the original indices.

The final comment concerns formatting. The 18 indices use both one- and two-column formats. DAS selected the two-column format, which is the most common, for the new index. DAS selected the simplest of the two-column formats and matched the layout and typeface of the original volumes as closely as possible. In the overwhelming majority of cases, the original indices only list the page on which a given topic begins. All entries in the new index have a beginning and an ending page as appropriate.