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## **Project Plan for the Baseline Measurement of Checkpoint Effectiveness and Efficiency**

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| 16. Abstract - A project plan for obtaining baseline measurements of operational effectiveness and <b>efficiency</b> of the Northwestern checkpoint at Detroit Wayne Metropolitan Airport is described. The project will consist of carefully structured observations of checkpoint tasks under operational conditions. The baseline report will provide information that can be used to evaluate changes in checkpoint design. |  |                                                             |                                                                                                                                                               |                                                         |  |
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## LIST OF ACRONYMS

|           |                                    |
|-----------|------------------------------------|
| DTW       | Detroit Wayne Metropolitan Airport |
| MOE       | Measure of Effectiveness           |
| MOP       | Measure of Performance             |
| <b>QA</b> | Quality Assurance                  |
| TEP       | Test and Evaluation Plan           |

## **1. INTRODUCTION**

### **1.1 Background**

The effectiveness of the national civil aviation security system is highly dependent upon people, especially those employed as checkpoint screeners. Therefore, the **FAA** is very interested in enhancing screener training, performance, and further improving their readiness for the job.

The Aviation Security Improvement Act, Public Law 101-604, mandates the Federal Aviation Administration (FAA) to enhance and improve X-ray baggage screener selection, training, and performance. The Aviation Security Human Factors Program (AAR-5 10) of the Aviation Security Research and Development Division, is the FAA unit tasked with this responsibility.

### **1.2 Problem Statement**

Passenger and carry-on baggage throughput at Detroit Wayne Metropolitan Airport (**DTW**) is considered slow, causing considerable lines at the checkpoint. By performing a human factors evaluation of the checkpoint, including screener performance, problems can be identified and improvements in throughput and security can be accomplished. This includes redesigning the checkpoint, deploying advanced technological systems, and improving screener performance.

## **2. PROJECT GOALS**

The objective of this project is to collect, analyze, and report baseline data on passenger flow restrictions and threat detection. These data can then be used to evaluate future states of the checkpoint and screener performance.

## **3. MAJOR PROGRAM ACTIVITIES**

### **3.1 Project Management**

Quality Assurance (QA) is the overall process of evaluations, inspections, and audits conducted during the project's development process and its products to ensure that: (1) the process and products **conform** to their established plans and standards; (2) the final product(s) completely and accurately implement(s) the system's functional, performance, and operational requirements; and (3) the system is built to the highest quality attributes possible (reliability, maintainability, supportability, robustness, extensibility, etc.). The QA is conducted internally by the contractor's QA organization, managerially independent from the performing organization. The QA will include overall project-level QA consisting of formal and informal reviews, inspections, walkthroughs, measurements, and quality audits.

The QA activities envisioned for this project include the following:

1. Formal/Informal Reviews-formal and informal reviews will include the following:
  - Formal reviews will be conducted at the conclusion of each phase of the project and completion of a major task or step in a phase. They are the decision milestones for internal or government approval to proceed from one development phase to the next.
  - Informal reviews will be conducted by QA personnel between formal reviews to evaluate progress towards phase completion and/or assess readiness for the formal reviews.
2. Evaluation/Inspections-evaluation and inspections will be conducted periodically by QA to assess conformance to the project plan, engineering and software development processes, and contract requirements.
3. **Quality Assurance Reporting**-monthly status reports will include QA activities performed for the reporting period; results of these activities; problems identified and corrected or action items assigned; status of previous action items; and plans for the next reporting period.
4. Final Delivery Certification-functional and physical configuration audits will ensure that the product meets its original requirements and that all changes made through the development process have been properly integrated.

### **3.2 Technical Approach**

This effort will focus on two main problem areas: passenger flow and threat detection. This section identifies the four phases of the project and the critical issues associated with the problem areas.

#### **3.2.1 Phase 1 - Test and Evaluation Plan**

Before drafting a Test and Evaluation Plan (TEP), two human factors engineers will travel to DTW to speak with the Federal Security Manager and other security personnel. The purpose of the trip will be to acquire **information** regarding test variables (i.e., what information can be captured) and data collection (i.e., the use, control, and location of video cameras, archived tapes, and incident reports). In addition, they will elicit information regarding perceived problems, **staffing** requirements, and security procedures. Finally, they will visit the checkpoint to get a better sense of its layout and equipment,

Following the visit to DTW, a TEP based in part on information gathered during the trip will be constructed. The TEP will focus on four critical issues: flow, threat detection, training, and screener communication. It will include Measures of Performance (MOPs) and Measures of Effectiveness (**MOEs**) required to accurately baseline the current checkpoint operation. Furthermore, the TEP will outline an approach to evaluating the **MOPs** and **MOEs** and collecting, reducing, and analyzing the data.

#### **Task-Based MOPs and MOEs**

Checkpoint operations can be subdivided into a set of discrete tasks performed by screeners and supervisors. Each screener task serves the overall mission of effectively (detering and detecting

threats) and efficiently (operating with minimum effects on throughput) processing passengers and their baggage. Before constructing task-based **MOPs** and **MOEs**, a review will be made of **previous** analyses of checkpoint operations and the knowledge, skills, and abilities involved in performing specific checkpoint tasks (Fobes & Neiderman, 1997; Monichetti, Fobes, & Neiderman, in press). Major checkpoint tasks to be included are walk-through and hand-held magnetometer, pat-down, hand search, X-ray, trace detector, exit land, and supervision. **MOPs** and **MOEs** will be constructed around all of the essential checkpoint tasks. They will be **designed** to answer questions like

- Are effective procedures followed?
- Are the security staff adequately trained to follow effective procedures?
- Do the security staff communicate effectively in performing tasks?
- How quickly are tasks accomplished?
- Are staffing levels and staff knowledge adequate to accomplish tasks quickly?

Potential **MOEs** are provided below.

#### **Passenger Flow Baseline**

- Throughput (passengers and bags)
  - Number of people processed using the X-ray machine
  - Average amount of time to process using the X-ray machine
  - Number of people processed using the **front** magnetometer
  - Average amount of time to process using the **front** magnetometer
  - Number of people processed using the back magnetometer
  - Average amount of time to process using the back magnetometer
  - Number of people processed using the hand wand
  - Average amount of time to process using the hand wand
  - Number of people processed using the Electronic Detection System (**EDS**)
  - Average amount of time to process using the EDS
- **Staffing** numbers (screeners, supervisors, duty managers)

#### **Threat Detection Baseline**

- TIP performance ( $P_d$ ,  $P_c$ ,  $P_{fa}$ ,  $c$ ,  $d'$ )
- CBT performance (initial and final Unit 7 and 8 scores)
- Training (initial, on-the-job, and recurrent)
- Previous threat detection studies by FAA testing organization(s)
- DTW incident reports
- Measures of compliance with effective threat detection procedures

#### **Integrating Tasks Into a Checkpoint Model**

The screening tasks are interrelated with the outcome of one task dictating performance of another. Other **MOPs** and **MOEs** will be constructed using a checkpoint model that specifies the relationships between tasks. These include the probabilities of moving between one task and another, as well as the integration of task performance times into global measures **like** the

average amount of time to pass through the checkpoint. Checkpoint operations and measures, considered as a whole, are likely to be influenced by variables such as passenger volume and staffing levels. The **MOPs** and **MOEs** will be constructed to specify these global variables and their influence upon checkpoint operations.

With a careful choice of measures, a plan for a baseline description of the checkpoint, which produces valid and useful information, will be constructed. This will include descriptions of **staffing** levels, traffic volume, and time and probability elements for each screener task (i.e., X-ray, magnetometer, hand wand, bag search, trace, and exit lane) as well as supervisory positions. Effectiveness and efficiency measures for each task will be described. Threat Image Projection performance and the frequencies of deviations from procedures will be part of the baseline description of effectiveness.

### **3.2.2 Phase 2 – Pilot Test**

After developing the TEP, a pilot study will be conducted to determine if one can accurately collect the necessary data. Any deficiencies in data collection procedures will be identified and any newly identified variables incorporated into the actual test. Any measures of effectiveness or efficiency associated with a particular position that cannot be accurately recorded, will be brought to the attention of AAR-5 10. These variables will then be revised or eliminated. Data received from the pilot study will be used to create a database from which data reduction tools can be developed. This will enable the data to be more quickly analyzed from the actual test.

### **3.2.3 Phase 3 – Measurement**

The results of the pilot test will be the basis for the actual collection of MOP data. At this point, useful and realistic **MOEs** and **MOPs** will be identified and tested, as will the effort required in the data collection process.

### **3.2.4 Final Report**

Upon completion of Phase 3, a final report will be composed describing the method, results, and lessons learned **from** the baseline study. To the extent possible, it will describe the effectiveness and efficiency for each screener task, as well as diagram the checkpoint and passenger flow through it. Finally, it will provide possible human factors solutions to alleviate problems associated with the issues of slow flow, threat detection, training deficiencies, and screener communication. Information from the final report can be given to subject matter experts so that a checkpoint model can be developed. This will allow what-if scenarios and capacity variations to be simulated.

## 4. SCHEDULE, DELIVERABLES, AND RESOURCES

### 4.1 Schedule

Figure 1 depicts the work breakdown structure of this project.

| ID | Task Name                        | WBS   | Quarter |     | 3rd Quarter |     |     | 4th Quarter |     |     | 1st Quarter |     |     | 2nd Quar |     |
|----|----------------------------------|-------|---------|-----|-------------|-----|-----|-------------|-----|-----|-------------|-----|-----|----------|-----|
|    |                                  |       | May     | Jun | Jul         | Aug | Sep | Oct         | Nov | Dec | Jan         | Feb | Mar | Apr      | May |
| 1  | HF008- Checkpoint Design Project | 1     |         |     |             |     |     |             |     |     |             |     |     |          |     |
| 2  | Project Planning                 | 1.1   |         |     |             |     |     |             |     |     |             |     |     |          |     |
| 3  | status review                    | 1.1.1 |         |     |             |     |     |             |     |     |             |     |     |          |     |
| 11 | Ongoing Planning                 | 1.1.2 |         |     |             |     |     |             |     |     |             |     |     |          |     |
| 12 | Project Plan                     | 1.1.3 |         |     |             |     |     |             |     |     |             |     |     |          |     |
| 13 | Test and Evaluation Plan         | 1.2   |         |     |             |     |     |             |     |     |             |     |     |          |     |
| 14 | Inspect site                     | 1.2.1 |         |     |             |     |     |             |     |     |             |     |     |          |     |
| 15 | Construct Measures               | 1.2.2 |         |     |             |     |     |             |     |     |             |     |     |          |     |
| 16 | Write Draft                      | 1.2.3 |         |     |             |     |     |             |     |     |             |     |     |          |     |
| 17 | OperationalTesting               | 1.3   |         |     |             |     |     |             |     |     |             |     |     |          |     |
| 18 | Data collection materials        | 1.3.1 |         |     |             |     |     |             |     |     |             |     |     |          |     |
| 19 | Data collection strategies       | 1.3.2 |         |     |             |     |     |             |     |     |             |     |     |          |     |
| 20 | Pilot testing                    | 1.3.3 |         |     |             |     |     |             |     |     |             |     |     |          |     |
| 21 | Analyze pilot                    | 1.3.4 |         |     |             |     |     |             |     |     |             |     |     |          |     |
| 22 | Revise plan and procedures       | 1.3.5 |         |     |             |     |     |             |     |     |             |     |     |          |     |
| 23 | Operationa Test site visit 1     | 1.3.6 |         |     |             |     |     |             |     |     |             |     |     |          |     |
| 24 | Data Analysis 1                  | 1.3.7 |         |     |             |     |     |             |     |     |             |     |     |          |     |
| 25 | Operational Test Site visit 2    | 1.3.8 |         |     |             |     |     |             |     |     |             |     |     |          |     |
| 26 | Complete Data Analysis           | 1.3.9 |         |     |             |     |     |             |     |     |             |     |     |          |     |
| 27 | Final Report                     | 1.4   |         |     |             |     |     |             |     |     |             |     |     |          |     |
| 28 | Review Findings                  | 1.4.1 |         |     |             |     |     |             |     |     |             |     |     |          |     |
| 29 | Prepare Data Presentation Forr   | 1.4.2 |         |     |             |     |     |             |     |     |             |     |     |          |     |
| 30 | Prepare Draft Report             | 1.4.3 |         |     |             |     |     |             |     |     |             |     |     |          |     |
| 31 | Revise Report                    | 1.4.4 |         |     |             |     |     |             |     |     |             |     |     |          |     |

Figure I. Work Breakdown Structure

## **4.2 Deliverables**

Table 1 contains all project deliverables and their due dates.

***Table 1. Deliverables***

| <b>Deliverables</b>      | <b>Due Dates</b>            |
|--------------------------|-----------------------------|
| Monthly Status Reports   | Monthly beginning June 1999 |
| Trip Reports             | Within 5 days of return     |
| Project Plan             | May 11, 1999                |
| Test and Evaluation Plan | May 27, 1999                |
| Final Report             | September 24, 1999          |

## **4.3 Resources**

Table 2 contains a list of project resources, hours, and key personnel required for this task.

***Table 2. Resources, Hours, and Personnel***

| <b>Resources</b>         | <b>Hours</b> | <b>Personnel</b>           |
|--------------------------|--------------|----------------------------|
| Program Manager          | 104          | Mr. Bischoff and Dr. Lyons |
| Senior HF Engineers      | 750          | Dr. Maguire and Mr. Snyder |
| HF Engineers             | 870          | Mr. Winters and Mr. Newman |
| Documentation Specialist | 120          | Ms. Militello              |
| Clerk                    | 30           | Ms. Deckard                |

## **5. REFERENCES**

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