

**Advanced Technologies and Oceanic Procedures (ATOP) Results
Report: Airways Facilities (AF) Job Task Analysis (J/TA)
Report for New York, Anchorage, and Oakland Air Route Traffic
Control Centers (ARTCCs)**



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1 EXECUTIVE SUMMARY

This report describes and documents the effort undertaken to develop an Airways Facilities (AF) Job/Task Analysis for three Oceanic sites (New York (ZNY), Anchorage (ZAN), and Oakland (ZOA)) and the William J. Hughes Technical Center (WJHTC). In the absence of previous oceanic task data on which to base this analysis, subject matter experts (SMEs) at the aforementioned four sites were interviewed to create the baseline data. “Strawman” tasks were developed primarily from available literature sources to solicit data from the SMEs. These SMEs categorized and described those tasks employing a set of previously developed evaluation parameters.

Prior to compiling and analyzing the J/TA results, the task descriptions were updated to reflect recommended SME changes. Tasks were added, deleted, and changed as necessary. The tasks were then compiled, analyzed, and categorized in terms of whether they were considered **Primary**, **Principal**, or **Other** based on SME provided parameter ratings. Those tasks given the most extreme rating on at least four out of five of the task assessment factors (Difficulty, Criticality, and Frequency of Performance, Mental/Physical Demands, and Task Manpower) were categorized as **Primary**. On the other hand, those tasks rated as most extreme by the SME on any three of these assessment factors were assigned to the **Principal** priority category. All other tasks not falling into these two categories were placed in the priority category defined simply as **Other**.

The draft task lists were submitted to AUA-600 for review and comment, and subsequently delivered to the site SMEs for their review and comment. The draft task lists were then updated to reflect the SMEs comments and suggested changes. The results of the analyses show that the majority of tasks fell into the **Other** priority category, with the **Primary** category showing the lowest number of tasks. There were a total of ninety-four tasks assigned to the **Primary** priority category, one hundred thirty eight in the **Principal** category, and three hundred ninety five in the **Other** priority category. The only site that showed zero tasks as **Principal** was the WJHTC.

This report provides an AF task baseline for comparing performance of AF tasks associated with ATOP.

2 INTRODUCTION

This document is intended to present and discuss the results of an effort undertaken to gather data and develop a set of baseline job task analyses (J/TA) for six AF oceanic site job categories and the AOS Second Level Engineering job category. These data reflect current AF Oceanic activities and tasks as performed at the FAA's three Oceanic Air Traffic Control Centers (ARTCCs) - Anchorage (ZAN), New York (ZNY), and Oakland (ZOA) and the William J. Hughes Technical Center (WJHTC). The data provide a baseline description of current AF activities and tasks for use in conjunction with the Advanced Technologies and Oceanic Procedures (ATOP) program.

2.1 BACKGROUND

The ATOP program is the means by which the FAA plans to acquire modernized oceanic automation to support the established mission need for Oceanic Air Traffic Control (ATC) operations and Airways Facilities (AF) support at the ZNY, ZAN, and ZOA ARTCCs and the WJHTC.

Traditionally, human factors research has not focused on the operations and personnel involved in AF maintenance. However, recent and proposed new system deployments within the FAA environment necessitate addressing the human factors issues, including how AF jobs are being affected by the introduction of these new systems.

In 1993, CTA, Incorporated (a private contractor), conducted a limited job task analysis for the FAA. It covered only two AF job categories, ARTCC System Engineer (SE), and ARTCC NAS Operations Manager. While the J/TA did provide an in-depth characterization of the tasks performed at these two positions, it did not address the oceanic area in any amount of detail. The JT/A discussed in this report expands the previous JT/A by specifically focusing on the oceanic positions.

2.2 PURPOSE

The purpose of this AF J/TA effort is to document activities and tasks presently being accomplished in the current oceanic environment by the following identified oceanic job categories:

- NAS Operations Manager (NOM)
- NAS Area Specialist (NAS)
- Computer Specialist
- AF System Performance Specialist (SPS)
- AF Transportation System Specialist (ATSS)
- AOS Engineering (at WJHTC)
- AOS Adaptation (Field Sites)

The task information collected for the above job categories will be used by AUA-600 and the AF Site Product Teams (SPTs) to aid in the evaluation of the competing vendor's systems. Additionally, it establishes a baseline or "strawman" for comparing AF tasking within ATOP.

Potential benefits gained as result of this analysis include:

- Assisting in the evaluation of vendors-proposed systems, by providing a baseline for comparing the difficulty of task performance associated with the ATOP system.
- Helping to ensure that activities essential to mission accomplishment are not neglected with the introduction of the new ATOP technology (i.e., basic and critical capabilities of the baseline system are retained by the vendors as part of the new system).
- Using the resulting task list to prioritize AF issues based upon all critical tasks impacted by the vendor-proposed system.
- Defining the new AF work environment introduced by ATOP by establishing a baseline for comparing the performance of new AF tasks with those performed in the current system. This will provide a basis for eliminating tasks no longer needed, adding new tasks, altering existing tasks to meet new performance needs, and/or re-distributing personnel tasks, roles, and responsibilities.
- Assisting in the definition and development of new support training needs by ensuring that tasking is covered in training, and addressing how AF tasking changes with the introduction of the new ATOP system.

Note: The task data will also provide essential source information for the conduct of the Training Needs Analysis and Task and Skill Analysis (TASA).

3 METHODOLOGY

Because no AF Oceanic J/TA baseline existed prior to this effort, the current AF J/TA had to be created. The basic steps involved in accomplishing this work were performed in four study phases as outlined below:

Phase 1 - Preparation Phase

- Performing a literature search and a review of existing oceanic documentation sources including specifications, software manuals, operator handbooks, training manuals, etc.
- Preparation of "strawman" J/TA worksheets.
- AUA-600 transmittal of letter requesting PASS National approval to conduct the J/TA at oceanic sites; PASS approval received--MOU effective 26 July 2000.
- Establishment of schedules and points of contact for site visits.
- Delivery of "strawman" J/TA worksheets to the three oceanic sites for review and familiarization in advance of site visits.

Phase 2 – Data Collection Phase

- Interviewing subject matter experts (SME) representing the AOS Second Level Engineering job category at the WJHTC, Atlantic City, New Jersey. Updating task information, compiling data, and entering it into draft task work sheets.
- Interviewing SMEs representing all six job categories at ZNY, ZAN, and ZOA respectively. Another interview was held with a SME representing AOS Second Level Engineering at the WJHTC. Data results were gathered, compiled, and entered into a draft task work sheet.

Note: In conjunction with the interviews and data collection, “in-briefs” and/or “out-briefs” were presented to both PASS and FAA management personnel per the MOU. These briefings were conducted at the discretion of the individual sites.

Phase 3 – Data Compilation, Analysis and Reporting Phase

- Updating “strawman” task descriptions and modifying evaluation parameters based upon SMEs input.
- Analyzing and categorizing tasks into one of three categories, (**Primary, Principal and Other**) based on SME provided parameter ratings.
- Preparation of the draft J/TA report for submission to the three oceanic sites and the WJHTC for SME review and updating.

Phase 4 – Task Comparison Phase

- Using SMEs, compare baseline task lists to the vendor proposed modified tasks.
- Interview SMEs to determine adequacy and completeness of new system tasks, and their impact on baseline maintenance operations.
- Evaluate SME data, prepare, and deliver draft report containing task list comparisons and operational impact to AUA-600 for review and comment.
- Deliver final report to AUA-600.

3.1 COMPOSITION OF THE FACILITY J/TA STUDY TEAMS

The oceanic AF personnel who were interviewed at the three sites were capable and experienced representatives of both the Oceanic ATC management and the bargaining unit (PASS) working within a given facility. Thus, the SMEs were completely knowledgeable about facility oceanic AF operations, and the purpose and goals of the ATOP program.

At each of the oceanic facilities the on-site ATOP SPT Manager selected at least one volunteer AF person to serve as an SME for each of the job categories.

The ATOP human factors engineering (HFE) support contractor provided two HFE analysts to conduct the interviews. The two analysts were supported by a member of the AUA-600 staff who participated in the site briefings and interviews.

3.2 SCHEDULE FOR SITE VISITS AND INTERVIEWS

<u>Location</u>	<u>Dates/Times</u>
ZNY	September 6 to 7, 2000
ZAN	September 11 to 12, 2000
ZOA	September 14 to 15, 2000

3.3 INTERVIEW PROCEDURE

The interviews were conducted in a structured, yet informal, open manner. Each SME was provided with a brief explanation of the assessment parameters and protocol for the interviews. They were asked to look at each task to determine whether it constituted a “valid” task that they would perform as part of their overall job function.

For each task that was determined to be valid, each SME evaluated the task based upon a set of parameters pre-selected by the HFE interviewers. This would allow an assessment of the particular importance of that task to the ATOP program and its contribution to the overall success / effectiveness of Oceanic AF operations. These parameters are described below:

For each task determined to be valid:

1. What media interface is used in performing this task (**D=Display, P=Printer, I=Internet, IC=Intercom, T=Telephone, F=Face-to-Face Communication, M=Computer Modem**)?
2. What support tools, if any, are needed to perform this task (**D=Documentation, E=Special Equipment, S=Special Software, T=Test Tools**)?
3. How complex or difficult is this task to perform (**E=Easy, S=Somewhat Difficult, D=Difficult/Complex**)?
4. How important or critical is this task in the performance of the job (**N=Not Critical, M=Moderately Critical** (must be acted upon within 24 hours), **C=Critical** (requires immediate response))?
5. How often or frequent must this task be performed (**D=Daily Activity, W=Weekly Activity, M=Monthly Activity, B= Bi-Monthly Activity, Q=Quarterly Activity, S=Semi-Annual Activity, Y=Annual or Yearly Activity, A=As Required Activity**)?
6. What mental/physical demands are imposed by this task defined by the stress level normally experienced in performing this task (**H=High, M=Moderate, L=Low**)?

7. What task manpower is required to perform this task defined by how many persons would normally be needed to perform this task (**O= One person, M=More than one person**)?
8. What is the functional allocation of the task defined as performed either manually or by automated means (**M=Manually, A=Automated**)?

For analysis purposes, another task category, Task Priority, was added to the assessment factors subsequent to completion of the site interviews. Accordingly, tasks were categorized into one the following three categories: **Primary, Principal, and Other**. Five assessment factors (out of the eight previously indicated) were used to determine the particular priority category a given task would fit into. These categories were: Difficulty, Criticality, Frequency, Mental/Physical Demands, and Task Manpower.

In the case of assessment factors 1, 2, 5, 7 and 8 above, the SME often responded that more than one of the items or levels applied. These were duly noted by the HFE analyst on the task worksheet.

After reviewing all of the tasks in the pre-prepared worksheet, the SMEs added tasks that were not covered, and modified the wording of some tasks. Tasks not considered to be valid were deleted from the worksheet.

3.4 TASK ASSESSMENT FACTORS

Based upon how the individual SME responded on each of the above assessment factors, the task was categorized as **Primary, Principal** or **Other**. More specifically, those tasks given the most extreme rating on *at least four* out of five of the task assessment factors (**Difficulty, Criticality, and Frequency of Performance, Mental/Physical Demands and Task Manpower**) were categorized as **Primary**. A rating of **Primary** means these tasks are considered to be **Critical** to the performance of the particular job being analyzed.

On the other hand, those tasks rated as most extreme by the SME on *any three* of the aforementioned assessment factors were assigned to the **Principal** priority category. A rating of **Principal** means these tasks are considered to be **Mostly critical** to the performance of the job.

All other tasks not falling into these two categories were placed in the priority category defined as **Other**.

4 RESULTS

The J/TA analysis results are provided in separate appendixes to this report. Appendix A contains the ZNY analysis results, Appendix B contains the ZAN analysis results, Appendix C contains the ZOA analysis results, and Appendix D contains the WJHTC

AOS Second Level Engineering results. Below is a summarization of these results for each of the four sites. As indicated, the tasks are prioritized for each of the six job categories for the three sites (ZNY, ZAN and ZOA), and the one job category for the WJHTC.

Table 4.1, Task Priority by Job Category--ZNY

Job Category/Task Priority	Primary	Principal	Other	Total
NOM	19	12	15	46
NAS	19	8	9	36
Computer Specialist	5	2	24	31
AF SPS	7	28	13	48
AF ATSS	1	25	12	38
AOS Adaptation	1	1	16	18
Total	52	76	89	217

Table 4.2, Task Priority by Job Category--ZAN

Job Category/Task Priority	Primary	Principal	Other	Total
NOM	3	4	19	26
NAS	2	6	24	32
Computer Specialist	1	1	8	10
AF SPS	3	5	35	43
AF ATSS	0	2	44	46
AOS Adaptation	1	1	17	19
Total	10	19	147	176

Table 4.3 Task Priority by Job Category--ZOA

Job Category/Task Priority	Primary	Principal	Other	Total
NOM	3	9	29	41
NAS	2	6	24	32
Computer Specialist	5	5	26	36
AF SPS	11	13	19	43
AF ATSS	7	8	23	38
AOS Adaptation	2	2	15	19
Total	30	43	136	209

Table 4.4 Task Priority by Job Category--WJHTC

Job Category/Task Priority	Primary	Principal	Other	Total
AOS Eng.—WJHTC	2	0	23	25
Total	2	0	23	25

Tables 4.5, 4.6 and 4.7 list the **Primary** tasks for each of the six job categories at each of the three sites (i.e., ZNY, ZAN, and ZOA) respectively. The WJHTC site is not included as it has only one job category, AOS Second Level Engineering, with only two **Primary** tasks (Provide emergency NAS restoration, and Perform hardware/software modifications).

Table 4.5 Summary of “Primary” Tasks by All Job Categories-ZNY

NOM	NAS	COMP. SPEC.	AF SPS	AF ATSS	AOS ADAP.
1.1 Monitor/ evaluate LRUs, external/ internal interfaces and software components	1.1 Monitor/ evaluate LRUs, external/ internal interfaces and software components	1.1 Start-up and shut-down computer system	1.8 Execute system restoration procedures	1.8 Execute system restoration procedures	2.3 Perform 1 st level support/ adaptation
1.3 Perform system start-up, shut-down, recovery, and special commands/ procedures	1.3 Perform system start-up, shut-down, recovery, and special commands/ procedures	1.8 Initialize system software (operational and redundant)	3.3 Install system hardware/ software modifications		
1.4 Perform system switch-overs, start-overs, program aborts, recovery, PSW re-start, element and unit replacements (REPLs)	1.4 Perform system switch-overs, start-overs, program aborts, recovery, PSW re-start, element and unit replacements (REPLs)	3.1 Power-on/start-up system	6.3 Provide OJT for diagnostic procedures		
1.5 Perform system re-configuration and verification	1.5 Perform system re-configuration/ verification	3.2 Power-off/shut-down system/ recover system data	7.3 Analyze certification results		
1.7 Review and analyze failures, degraded conditions, and system/sub-system performance and recovery operations	1.7 Review and analyze failures, degraded conditions, and system/sub-system performance and recovery operations	4.1 Coordinate and report system failures/ incidents	8.1 Add new radars to HOST and DARC systems		

1.8 Execute on-line and off-line diagnostics/isolate faults/initiate recovery on system, sub-systems, elements, and units	1.8 Execute on-line and off-line diagnostics/isolate faults/initiate recovery on system, sub-systems, elements, and units		8.2 Test/integrate new radars		
1.9 Identify problems and solutions, perform failure recovery actions, and execute preventive measures	1.9 Identify problems and solutions, perform failure recovery actions, and execute preventive measures		8.3 Provide quality control of radar information (e.g., QARS, ERIT)		
1.13 Analyze sys./sub-sys./equipment histories to identify outage trends and resolution	1.13 Analyze system/sub-system/equipment histories to identify outage trends and resolution				
1.14 Ensure task reliability/availability of system, subsystems, equipment, and remote facilities associated with the geographical area of radars, RCAGs, NAVAIDs, and weather facilities	1.14 Ensure task reliability/availability of system, subsystems, equipment, and remote facilities associated with the geographical area of radars, RCAGs, NAVAIDs, and weather facilities				

2.2 Analyze/ respond to catastrophic communication line-failures	2.2 Analyze/ respond to catastrophic communication line-failures				
2.4 Analyze/ respond to system/ subsystems/ equipment outages and degradation	2.4 Analyze/ respond to system/ subsystems/ equipment outages and degradation				
2.5 Analyze/ respond to external/ internal interface alarms/alerts	2.5 Analyze/ respond to external/ internal interface alarms/alerts				
2.6 Analyze/ resolve problems with remote monitoring of system, sub- systems, and outlying facilities	2.6 Analyze/ resolve problems with remote monitoring of system, sub- systems, and outlying facilities				
2.7 Analyze/ resolve software problems/ failures/ anomalies/ performance	2.7 Analyze/ resolve software problems/ failures/ anomalies/ performance				
4.2 Analyze performance of services/ verify system integrity during assigned shift	4.2 Analyze performance of services/verify system integrity during assigned shift				
4.4 Perform service level certification	4.4 Perform service level certification				
4.5 Analyze/ respond to internal/ external system failures/ incidents	4.5 Analyze/ respond to internal/external system failures/ incidents				

6.1 Respond to various emergencies, disasters, and security situations	5.1 Respond to various emergencies, disasters, and security situations				
6.9 Coordinate the conduct of joint baseline tests for major system software deliveries. Test new or modified sys. changes/ identify needed improvements	5.5 Coordinate the conduct of joint baseline tests for major system software deliveries. Test new or modified system changes/identify needed improvements				

Table 4.6 Summary of “Primary” Tasks by All Job Categories-ZAN

NOM	NAS	COMP. SPEC.	AF SPS	AF ATSS	AOS ADAP.
1.1 Monitor/ evaluate LRUs, external/ internal interfaces and software components	1.1 Monitor/ evaluate LRUs, external/ internal interfaces and software components	1.9 Restore main processor to service	3.3 Install system software/ hardware modifications		2.3 Perform 1 st level support/ adaptation
1.2 Manipulate display screen data/examine and enter parameters/print and analyze system messages	1.2 Manipulate display screen data/examine and enter parameters/print and analyze system messages		4.9 Execute SAR data and other system programs (e.g., equipment failures, status reports, hardware/ software test schedules, trend analysis reports, etc)		
1.3 Perform system start-up, shut-down, recovery, and special commands/ procedures			8.1 Perform in-depth analysis of radar information (e.g., QARS, ERIT)		

Table 4.7 Summary of “Primary” Tasks by All Job Categories-ZOA

NOM	NAS	COMP. SPEC.	AF SPS	AF ATSS	AOS ADAP.
1.1 Monitor/ evaluate LRUs, external/ internal interfaces and software components	1.1 Monitor/ evaluate LRUs, external/ internal interfaces and software components	1.14 Perform system switch-overs	2.2 Run diagnostics (including LAN) and execute troubleshooting procedures	2.2 Run diagnostics (including LAN) and execute troubleshooting procedures	2.2 Develop software/ hardware work-arounds
2.7 Analyze/ resolve software problems/failures/ anomalies/ performance	1.2 Manipulate display screen data/examine and enter parameters/ print and analyze system messages	1.15 Detect/ Acknowledge system alarms	2.3 Switch to alternate/back-up system	2.3 Switch to alternate/back-up system	2.4 Perform 1 st level support/ adaptation
6.1 Respond to various emergencies, disasters and security situations		1.16 Restore main processor to service	2.4 Shut-down/ recover/start-up system	2.4 Shutdown/ recover/start-up system	
		1.19 Perform event analysis after interruptions	2.5 Remove/ replace failed/faulty LRUs	2.5 Remove/ replace failed/faulty LRUs	
		3.5 Perform scheduled system outages/ interruptions	2.6 Execute system configuration/re-configuration procedures	2.6 Execute system configuration/ re-configuration procedures	
			2.7 Perform system restoration	2.7 Perform system restoration	
			3.1 Power-off and shut-down system (as required)	3.1 Power-off and shut-down system (as required)	

			6.4 Analyze diagnostic results (high level), and proposed upgrades to diagnostic tools		
			7.1 Build/maintain on-line certification tools		
			7.2 Provide/maintain on-line certification procedures		
			7.3 Analyze certification results information (e.g., QARS, ERIT)		

Table 4.8 Summary of “Primary” Tasks by All Job Categories-WJHTC

NOM	NAS	COMP. SPEC.	AF SPS	AF ATSS	AOS Engineering
N/A	N/A	N/A	N/A	N/A	1.1 Provide emergency NAS restoration
					2.3 Perform hardware/software modification

5 DISCUSSION

In the process of conducting the various interviews with SMEs at the ZNY, ZAN, ZOA, and WJHTC facilities, several distinctions were made concerning the differences in the way AF tasks are performed at each of these four sites. These are addressed in the following paragraphs:

5.1 General

Both ZNY and ZOA should have sufficient staff on-hand to maintain the new Oceanic System (ATOP) when it becomes operational, as this new system will completely replace the Oceanic Display and Processing System (ODAPS), Offshore Computer System (OCS), Offshore Data Link (ODL), and Interim Situation Display (ISD). However, in the case of ZAN, (Sectors 4, 10, 11 and 12), where the current staff supports the OCS and

Micro-EARTs, and DSR hardware, none of these systems will be replaced. The addition of the new ATOP system at ZAN may, in fact, require an augmentation in staffing to handle the additional workload.

Only tasks falling into the **Primary** and **Principal** task priority categories will be compared with tasks being performed in the new ATOP system. These two task priority categories are considered **Critical** to maintaining at least the same level of capability currently available at the three oceanic sites.

In many cases the SME was unable to decide whether a particular task should be rated easy or difficult as it depended upon the situation at hand. For example, using DSR, a specific task could be considered easy to perform, but while using ODAPS and ODL it would be considered difficult. Accordingly, the HFE analysts assigned a “Somewhat Difficult” rating to the task. A comment was then made to the effect that difficulty was dependent upon the situation, project, system or set of events that surrounded the performance of that particular task. Other assessment factors including “Criticality,” “Frequency,” “M/P Demands,” “Task Manpower,” and “Task Allocation” were treated in a similar manner.

Overall, ZNY (refer to Tables 4.1 through 4.4) showed the highest number of tasks (i.e., two hundred-seventeen) encompassing all job and priority categories followed by ZOA and ZAN with two hundred nine and one hundred seventy six respectively. ZNY also had the most tasks rated as **Primary** (fifty-two), as compared to ZOA and ZAN with thirty and ten respectively for all job categories. The WJHTC showed only two tasks falling into the **Primary** priority category and no tasks that could be rated as **Principal** for AOS Engineering. The remainder of tasks (twenty-three) for the AOS Engineering job category fell into the **Other** priority category. Considering all tasks for all three sites including the WJHTC, there were a total of ninety-four tasks, which fell into the **Primary** priority category, one hundred thirty eight in the **Principal** category, and three hundred ninety five in the **Other** priority category.

In conducting the interviews for the various job categories at each of the sites, a majority of the SMEs reported that most of the tasks comprising their jobs were extremely important, and could even be considered **Critical**. A plausible reason for this is that each of the SMEs felt that if any of these tasks were to be omitted, or improperly performed, their entire job performance would be at risk. In fact, overall system performance could even be compromised. Another plausible explanation might be that the tasks are addressed at a fairly high level. Consequently, the SMEs, for fear of leaving out a piece of their job which might turn out to be critical, simply made a “blanket” assessment of the individual task’s criticality. Further detailing of the tasks might determine if, in fact, a particular task was really **Critical** to the overall performance of a particular aspect of the job.

5.2 Site Specific

Because the tasks performed by the NOM and NAS are basically the same with only minor differences, they have been combined into a single job category for purposes of discussion in the paragraphs below. This consolidation also applies with respect to the AF SPS and AF ATSS job categories.

ZNY

At ZNY, the NOM and NAS vary somewhat in their roles and responsibilities. Both the NOM and NAS can, and do perform many of the same tasks and thus, have overlapping roles and responsibilities. However, the NOM still retains overall management and control of the activity. Only NOMs can make final decisions and direct how the overall technical tasks are to be performed. These differences in responsibility may be largely due to the fact that in ZNY there will always be at least two NOMs assigned to each and every shift.

The results, Table 4.1, also indicate that while the NOM and NAS are both involved in the activity “Manage position resources,” the NAS performs at least two additional tasks not performed by the NOM. These tasks are “Coordinate facility housekeeping duties and responsibilities,” and, “Coordinate the conduct of joint baseline tests of major software deliveries and test new or modified systems to identify needed improvements.” From an inspection of the data in Table 4.1, the NOM and NAS show the largest number of **Primary** tasks (nineteen), while the AF ATSS and AOS/Adaptation job categories show the lowest number (one). Considering all job categories, the largest number of tasks falling into the **Principal** and **Other** task priority categories with seventy-six and eighty nine respectively.

When compared with ZAN and ZOA, ZNY data show that the most tasks (128) were rated in the **Primary** and **Principal** task priority categories. Analysis of both the NOM and NAS at ZNY disclosed that thirty-eight out of a total of fifty-two tasks were rated **Primary** and twenty tasks out of a total of seventy-six were rated **Principal**. The reason for this may be due to the fact that the specific NOM and NAS individuals being interviewed expressed an overall high regard for the “criticality” or importance of their jobs. On the other hand, it could be that NOM and NAS at ZOA and ZNY were more experienced, treated the jobs as more routine, and therefore, were more confident and secure in their work environment

NOM/NAS Tasks

Both the NOM and NAS SMEs indicated that tasks involving local and remote monitoring and evaluating system interfaces, performing system start-up, shut-down, switch-over, and re-configuration were all very critical aspects of their job. The data also indicated that the following were equally **Critical** aspects of their jobs:

- Analyzing failures and histories
- Executing diagnostics

- Identifying problems and solutions
- Ensuring system availability and reliability
- Analyzing and responding to catastrophic events (line failures, incidents, alerts, and anomalies)

These tasks were more often difficult, frequently performed, imposed high mental or physical demands, and were performed manually, usually by more than one person.

AF ATSS/SPS Tasks

The AF ATSS and SPS analysis data indicate that the most critical part of their jobs was executing system restoration procedures. The AF SPS data also show that, in addition to executing system restorations, the other tasks considered **Most critical** to their job performance were:

- Installing system hardware modifications
- Providing on-the-job training in diagnostic procedures
- Performing on-line certification functions including analyzing certification results
- Adding, analyzing and testing new radars
- Providing quality control of radar information

Most of these ATSS and SPS tasks were reported by the SMEs to be difficult, complex, frequently performed, imposing moderate to high mental and physical demands, and requiring manual performance, usually involving more than one person.

Computer Specialist Tasks

Analysis data for the Computer Specialist position disclosed the following tasks to be the most crucial aspects of the job.

- Powering-on, starting-up, powering-off, and shutting down the system
- Initializing system software
- Performing system recovery
- Responding to system failures and incidents

These tasks were considered difficult to perform, and were performed more frequently than other tasks. Additionally, they imposed high physical or mental demands, were performed manually, and required more than one person to perform.

AOS Adaptation Tasks

Performing first level maintenance support and adaptation, and developing software and hardware work-arounds were found to be the **Most critical** tasks to be performed by the AOS Adaptation position. These tasks were not only difficult and frequently performed, but imposed certain mental or physical demands, often required more than one person to perform, and were normally performed manually.

ZAN

At Anchorage Center, some of the computer operator's tasks and responsibilities are shared between the Air Transportation System Specialist (ATSS) and System Performance Specialist (SPS) job categories. This may explain why, comparatively speaking, the ZAN Computer Specialist has fewer tasks to perform than the ZNY and ZOA Computer Specialists.

The results, Table 4.2, show the NOM and AF SPS to have the largest number of tasks (3) categorized as **Primary**, followed by the NAS with two, and Computer Specialist and AOS Adaptation job categories with one each. There were no **Primary** tasks indicated for the AF ATSS job category. The number of tasks falling into the **Principal** task priority category for the NAS was six, followed by the AF SPS with five, the NOM with four, and the AF ATSS with two. The Computer Specialist and AOS Adaptation job categories only had one task rated in the **Principal** priority category. The majority of tasks fell under the task priority category, **Other** (147).

For Anchorage Center, some tasks were considered valid by the NOM and NAS SMEs, yet no assessment factors were provided. The apparent reason for this is that the SME reported that these particular tasks would not be impacted by the future ATOP system. Hence, it would be of no value to apply any of the assessment factors.

NOM/NAS Tasks

Looking at the analysis results, those tasks involving facility monitoring, resolving system alarms and service problems, and performing other special actions such as serving as the lead for special projects and managing and participating in special assignments were shown to be **Critical** or **Mostly critical** in performing the NOM/NAS function.

Tasks falling under these activities were reported as difficult to perform, performed on a frequent basis, imposing high mental and physical demands on AF personnel, and were accomplished manually, usually by more than one person.

AF ATSS/SPS Tasks

From an inspection of the task assessment data, tasks determined to be **Critical** involve installing system software and hardware modification, executing SAR data and other system programs, and performing in-depth analysis of radar modifications. Other tasks determined to be **Mostly critical** entail powering-on and starting-up the system, switching to an alternate or back-up system, and removing and replacing a failed or faulty LRU.

Critical or **Mostly critical** ATSS/SPS tasks were most often reported by the SMEs as difficult to perform, performed on a frequent basis, imposing moderate to high mental or physical demands, and performed manually by more than one person.

Computer Specialist Tasks

The data for the Computer Specialist position at ZAN show two tasks to be **Critical** to their job performance. These tasks involve restoring the main processor to service, and entering data and maintaining operational databases. Both of these tasks were reported as difficult to perform, more often frequently performed, imposing moderate to high workload demands, and requiring manual performance by more than one person.

AOS Adaptation Tasks

The same tasks reported as **Critical** by the AOS Adaptation SME in ZNY, were considered **Critical** by ZAN AOS Adaptation personnel as well.

ZOA

Table 4.3 shows the AF SPS and ATSS categories as having the highest number of tasks, (eleven and seven respectively) rated in the **Primary** category. The highest number of the tasks rated in the **Principal** priority category were divided between the SPS, NOM, ATSS, and NAS job categories with, thirteen, nine, eight, and six respectively. The Computer Specialist and AOS Adaptation job categories had five and two tasks respectively falling into the **Principal** priority category. Again, the majority of tasks (136), however, were in the **Other** priority task category.

NOM/NAS Tasks

No clear distinction exists between NOM and NAS roles and responsibilities at ZOA. Both the NOM and NAS can perform all of the same functions, and the former can make all critical decisions necessary on his or her shift. In the absence of a NOM on a given shift, the NAS can provide the same management and control over the activity for which only a NOM would normally be responsible. This may be because a NOM may not be available for each and every shift, and the NAS, in this case, must exercise the same management and control that the NOM would normally do.

Tasks disclosed as being **Critical** or **Mostly critical** in the analysis results included:

- Monitoring and evaluating LRUs, external and internal interfaces, and software components.
- Performing remote status monitoring of radars, navigational aids, communications, and weather equipment.
- Directing system start-up, shut-down, and recovery operations.
- Issuing special commands and procedures.
- Directing switch-overs, start-overs, program aborts, element and unit replacements (REPLs).

- Directing system re-configuration and verification.
- Reviewing and analyzing failures, degraded conditions, and system/subsystem performance degradation and outages.

One additional NAS task determined to be **Critical** was the “manipulation of display screen data, the examination and entry of parameters, and the printing and analysis of display messages”.

All of the above tasks were found to be somewhat difficult-to difficult to perform, frequently performed, imposing medium to high mental or physical demands, and performed manually by more than one person.

AF ATSS and SPS Tasks

From an inspection of the analysis results, the SMEs representing the NOM and NAS positions were in agreement that those tasks considered to be the most crucial included:

- Running diagnostics and executing troubleshooting procedures
- Switching to alternate or back-up systems
- Powering – on and powering – off the system
- Starting-up and shutting-down the system
- Recovering the system after failure or interruption
- Performing system restorations
- Executing system configuration and re-configuration procedures
- Checking-out and testing replacement items
- Removing and replacing failed/faulty LRUs
- Installing hardware modifications
- Analyzing diagnostic test results
- Building and maintaining on-line certification tools
- Providing on-line certification procedures
- Analyzing certification results

There seemed to be consensus among the ATSS and SPS SMEs that there were many unexpected events or conditions that might occur affecting their ability to successfully complete a given task. Moreover, most of these variables were out of their immediate control. Still other tasks that were determined to be critical to fulfilling their roles and responsibilities included the following:

- Monitoring LRUs, external interfaces and software components
- Installing, checking-out, testing of system replacement items and modifications
- Executing and verifying unit certification procedures and parameters
- Providing and maintaining a diagnostic data base and procedures
- Administering on-the-job diagnostic training programs

All of the above tasks were reported to be difficult to perform, performed on a frequent basis, usually imposing medium to high mental or physical workload demands, and accomplished manually by more than one individual.

Computer Specialist Tasks

Computer Specialist tasks disclosed by the analysis as being **Critical** were associated with performing system switch-overs, detecting and acknowledging system alarms, restoring the main processor to service, and analyzing events after system interruptions. Other tasks indicated as **Mostly critical** to their job performance included performing software operations, changing operational modes, responding to unscheduled system outages, re-configuring hardware elements, and coordinating and reporting system failures and incidents.

Most of these tasks were reported as difficult to perform, were performed more frequently than other tasks, imposed some degree of mental or physical stress, were performed manually, and usually required more than one person to perform.

AOS Adaptation Tasks

For the AOS Adaptation function, it was determined that field support tasks involving software development and hardware work-arounds, and performing first level support and adaptation were **Critical** to overall job performance. Similarly, ensuring hardware and firmware availability and implementing quality performance criteria such as peer reviews were also considered to be **Critical** to effectively performing the AOS Adaptation job function.

Not unlike the other job categories described above, the AOS Adaptation tasks were found to be mostly difficult to perform, were performed more often than other tasks, imposed some amount of mental or physical workload, were performed without the aid of a machine, and required more than one person to perform.

WJHTC

The results presented in Table 4.4 for the AOS Engineering job category show only two tasks being rated in the **Primary** priority category. The remainder of the tasks (23) were rated in the **Other** priority category. No tasks were categorized in the **Principal** priority category for this position.

AOS Second Level Engineering Tasks

The analysis results for AOS Second Level Engineering function at the WJHTC showed only two tasks as being crucial to overall job performance. The tasks included providing emergency NAS restorations and performing hardware and software modifications. These same tasks were also determined to be somewhat difficult to difficult to perform, required frequent accomplishment, imposed moderate to high mental and physical demands, involved manual performance, and for the most part, required more than one person to perform the task.

The SME responses indicate that most of the tasks that critically impact AF job performance are tasks that involve decisive actions and impose a certain amount of risk (i.e., some propensity for human error) in accomplishing them.

6 CONCLUSIONS

The AF J/TA effort provides an important starting point and baseline for understanding the current roles and responsibilities of AF personnel at the three oceanic sites (ZNY, ZAN and ZOA). In comparing current AF tasks with those proposed in the new ATOP system, the data collected here will prove useful in ascertaining any changes in job performance. These analyses will also serve as a valuable aid in ensuring that **Critical** tasks have not been omitted in the new ATOP system.

Nevertheless, due to the small number of SMEs interviewed for the various job categories and the “subjectivness” of their responses it would be difficult to draw any significant conclusions about the results that were obtained. For example, the ZNY ratings for the **Primary** priority category, in particular, are much higher when compared to ZAN and ZOA.

This indicates the need for further data collection using additional SMEs representing the seven job categories. At the very least, further in-depth probing by the FAA to confirm these findings is recommended. A more detailed characterization of the tasks performed in each of these job categories may provide further insight into the criticality, frequency and difficulty of performing them.