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**A FUNCTION LEVEL COMMONALITY ANALYSIS OF THE
F-4/F-14 NFO POSITIONS**

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NAVAL AEROSPACE-MEDICAL RESEARCH LABORATORY
PENSACOLA FLORIDA

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SUMMARY PAGE

THE PROBLEM

The introduction of the F-14, the Navy's newest fighter, into the fleet creates an additional demand on the fighter Naval Flight Officer (NFO) training pipeline. In an attempt to define the nature of this demand, the present study compared the F-14 with the F-4 in terms of the operational functions required of the NFO in each aircraft. Using NFO advisors, and F-14 and F-4 publications, a Function Description Inventory (FDI) was created. The FDI consisted of the various tasks, duties, and roles comprising the operational functions of the NFO on either or both aircraft. NFOs familiar with both aircraft rated the tasks on three dimensions: Proportion of Time and Effort (P), Importance (I), and Complexity (C). These ratings were then used as a basis for discussion of the differences in NFO operational functions between the two aircraft.

FINDINGS

A majority of the tasks were rated the same for both the F-4 and F-14 on the P and I dimensions. Important exceptions to this trend are found in the roles of Sensor Manager and Tactician. Eighteen per cent of the total tasks were rated as unique to the F-14, with a majority of these tasks being found in the roles of Sensor Manager and Weapons Manager. In terms of the C dimension, 26 per cent of the tasks were rated as increasing in difficulty in the F-14, 44 per cent were rated similar and 13 per cent were rated as decreasing.

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GLOSSARY OF ACRONYMS AND ABBREVIATIONS

ACM	Air Combat Maneuvering
AEW	Airborne Early Warning
ASM	Air-to-Surface Missile
ATDS	Airborne Tactical Data System
AWG-9	F-14 Automated Weapon System
C	Complexity (see Procedures)
CAP	Computer Address Panel
CRT	Cathode Ray Tube Display
DDD	Detailed Data Display
DL	Data Link
ECCM	Electronic Counter-counter Measure
ECM	Electronic Counter Measures
FAS	Fleet Air Superiority
I	Importance (see Procedures)
IFF	Identify Friend or Foe
INS	Inertial Navigation System
IR	Infrared
NFO	Naval Flight Officer
NTDS	Naval Tactical Data System
P	Proportion of Time and Effort (see Procedures)
PD	Pulse Doppler
FDI	Function Description Inventory (see Procedures)
RAG	Readiness Air Group
TID	Tactical Information Display

INTRODUCTION

The scheduled 1973 introduction into the fleet of the Navy's new fighter aircraft, the F-14A, creates an unprecedented training problem for the Naval Flight Officer (NFO) community. There is concern about the effect of this new weapons platform on the fighter NFO training pipeline, previously designed to accommodate only one aircraft, the F-4. In his review of this problem, the Chief of Naval Operations has requested a comparison of the operational functions performed by the NFOs in the two aircraft. In response to this request, this report is designed to present and compare general descriptions of the operational functions of the NFO in both the F-4 and F-14 and to provide a framework for discussion of factors which influence the performance of these NFO functions.

There are certain continually evolving factors which are responsible for differences in NFO functions between the aircraft and/or which influence performance within each of the aircraft. For example, modifications of system capability and alterations in the tactical utilization of both aircraft are obviously responsible for differences in NFO functions between the F-4 and F-14, and they also influence future variations in functions within each aircraft. Within any given aircraft and mission, the nature of the aircrew, their personalities, and their relative rank and expertise modulate the functions performed by the NFO and pilot. The remaining portion of this introduction is intended to provide an insight into the reasons underlying differences in NFO functions in the F-4 and F-14 and to also supply a framework for interpreting the results and discussion. However, it is beyond the scope of this report to provide a detailed system description of either aircraft, an exhaustive discussion of tactical usage, or a study of aircrew interaction. There are better sources for this information available (see references), and they need not be reproduced here.

The factors influencing fighter NFO functions have been grouped under three categories: tactical utilization, system capabilities, and nature of aircrew.

TACTICAL UTILIZATION

The F-14, like the F-4, will be called upon to fulfill many tactical roles. It is the balance or mixture of these tactical missions, operational or training, (plus nontactical use such as cross-country flights) that will determine the overall amount of time and effort the NFO devotes to any particular task, duty, or role. For example, if mission A calls for performance of task X, and mission B does not, then the overall amount of time and effort devoted to task X depends on the ratio of mission A to mission B on a particular deployment. Similarly, criticality, or the importance of a particular task, duty, or role to the mission also depends on the mission. Since NFO performance depends on the type of mission, a brief description of the present/proposed tactical utilization of the F-4/F-14 would be appropriate here. Obviously this report does not attempt to say how the F-14 should be used, but rather briefly presents the projected use at present.

Fleet Air Superiority (FAS)

The long-range, multi-target (multi-shot) intercept capability, unique to the F-14's AWG-9 and Phoenix missile, is designed primarily for interception of enemy airborne missile-firing platforms. These aircraft will, if the threat scenario is actualized, attack the fleet task force in multi-aircraft formation launching their air-to-surface missiles (ASM) at some distance from the carrier. It will be the prime mission of the F-14 to protect the fleet by destroying these aircraft before their missiles are launched, or, if possible, destroy the ASMS. Although this sort of all-out coordinated attack has a low probability of occurrence, a large portion of the F-14 NFO's operational function will be devoted to the long-range intercept of a non-maneuvering multi-target airborne threat. At present, the F-4 is tasked with Fleet Air Defense (FAD) (note change in terminology, the mission is essentially the same), but due to the lack of FAS capabilities, and to operational demands induced by the Vietnam War, the F-4 NFO does not devote a high proportion of his time to FAD. This change in primary mission will significantly influence performance of duties and tasks such as Sensor Manager (long-range, multi-target, radar/IR detection, acquisition and track), Weapons Manager and Tactician (evaluating a more complex tactical picture), and Communicator (the increased uses of Data Link (DL) from Navy tactical data systems.)

Air Combat Maneuvering (ACM)

On any mission within range of enemy fighters (Escort, Interdiction, Combat Air Patrols), it is possible for close-quarter, visual-contact, air-to-air combat to occur. The F-4 has been utilized heavily as a dog fighter due to South-east Asian demands for a "MIG-chaser". Obviously the F-14 will also meet this demand, but as mentioned before, it will receive proportionally less emphasis in NFO training in the RAG and fleet. Due to the higher probability of actual ACM, both in limited warfare and cold war incidences (like in the mid-east), this mission obviously retains high importance for both aircraft. As compared to FAS, ACM places different performance requirements on the NFOs in both the F-4 and F-14. Therefore, NFO performance will differ between the aircraft because of the difference in mission emphasis.

Interdiction

As in the past with the F-4, the F-14 will likely be called upon to supplement attack aircraft by striking a ground target. Their "self-escort" capability adds value to their air-to-ground capability. As compared to the F-4, the F-14 will probably be called on a lesser percentage of the time to perform interdiction missions. Factors influencing the F-14's decreased emphasis on interdiction include the large cost of the aircraft and associated political variables. Another is the primacy of FAS. Again, this difference in relative time spent on interdiction mission and its associated NFO training (both in RAG and in Fleet) will result in diverse ratings on tasks between the two aircraft.

SYSTEM CAPABILITY

The following discussion is a guide or outline which might be useful in conceptualizing how system capabilities and effectiveness can influence fighter NFO performance. It obviously is not an exhaustive review of changes between the F-4 and F-14 but hopefully will serve to orient the reader to more specific changes discussed in the comparison section. It is recommended that the reader familiarize himself with system descriptions available for the F-4 (NATOPS) and F-14 (AWG-9) publications) so that he can better interpret the comparison section.

The F-14 has a much greater capability and capacity for gathering and storing information than the F-4. The AWG-9 radar has many new modes of operation, larger surveillance volume, greater detection range, and greater capability of detection. This presents the F-14 with a wider area of operation, more accurate information, and previously undetectable targets. Coupled with this increased radar capability is the addition of passive detection capability in the form of either infrared (IR) or electro-optical (TV) capability and (proposed) new modifications of ECM equipment. Table I (All tables are presented at the end of this report) lists the F-14 AWG-9 operational modes as compared with the AWG-10 of the F-4. The additional modes allow the aircrew to optimize the system capability for the tactical situation. For example, the rapid acquisition modes, such as MRL and VSL allow the NFO to rapidly acquire a visual target in an ACM situation. The TWS mode allows for several (up to 24) targets to be automatically acquired and tracked simultaneously. The expansion of fleet data link capability (ATDS, NTDS) will provide a new source of target information to both aircraft, but will probably have a greater effect on the F-14 due to the FAS emphasis and to the F-14's two-way DL (F-4 has only one-way DL). DL, Automated IFF, and possibly TV will supply longer range identification to the F-14 crew. This additional sensor information puts new loads on the F-14 NFO as Sensor Manager and as Tactician.

Corresponding to the increase in sensor subsystem is an increase in weapons capability and range. The F-14 will carry a greater assortment of weapons giving the F-14 greater operational flexibility which again enlarges the tactical picture which the NFO must assess. Newer long-range missiles such as the Phoenix will require heavy participation on the NFO in their employment, thus changing the nature of Weapons Manager role. The added ability given to the F-14 by the wing sweep configuration will allow the F-14 to be more aggressive in ACM situations and will again add to the tactical picture. The addition of the INS to the F-14 will decrease the performance of the NFO on many of the duties previously assigned to him as navigator in the F-4.

As compared to the older analog techniques on the F-4, the digital techniques of preparing information for use on the F-14 allows several sources of information to be integrated automatically for different purposes, and also allows for automation of complicated logical operations, thus replacing some mental work of the NFO, and also providing him with information of a type and accuracy never

before available. Table II presents examples of computer program functions that the computer performs for AWG-9 subsystems.

The F-14 controls and displays subsystem is more complex due to the new computer driven cathode ray tube (CRT) displays and to the NFO/computer interface. The largest change comes from the addition of the Tactical Information Display (TID), a CRT display which is particularly useful for multiple target intercepts. The TID has the capability for four graphic display modes of operation: ground stabilized tactical display, aircraft stabilized tactical display, attack display superimposed on an aircraft stabilized tactical display and TV image display. The ground stabilized tactical display presents computer-stored information on north-oriented range versus azimuth (PPI) coordinates stabilized about any fixed point designated by the NFO. The aircraft stabilized tactical display presents computer stored information in heading-oriented range versus azimuth (PPI) coordinates stabilized about the aircraft. The attack display provides attack steering symbology superimposed on an aircraft stabilized tactical display (1).

The ground and aircraft stabilized PPI displays (similar to displays available in the AEW aircraft) are completely unique to the F-14 in the fighter community. The display should aid the NFO in his analysis of the tactical situation. Another display available in the F-14 is the detailed data display (DDD) which provides raw or processed radar, video, IFF video or IR video, and other sensor derived information. The DDD radar information is similar in nature to that available in the F-4. One large difference concerning this information is that the F-14 pilot, as opposed to the pilot in the F-4, no longer has access to the raw radar (B-scope) information. He only receives a repeat of TID. Another new display mode of the IR is presented on the DDD in terms of elevation and azimuth coordinates (C-scope), a display unique to the F-14.

Thus, the F-14 NFO can not only receive more information in more ways about more aircraft, but he also has available new integrated symbolic displays which represent the world in a different way from the displays available in the F-4 (which the F-14 also has). Obviously his task as Sensor Manager, Tactician, and Weapons Manager will change. Due to the complexity of the system, his task as System Assessor will also change. Corresponding to this increase in display capability is the need for the NFO to interface, usually through the computer address panel (CAPS) or hand control unit, with the computer--calling up needed information out of storage, inserting new data, and initiating sub-routines. The F-14 NFO will have to know what is available for readout, where it will be displayed, and how to call it up. He will also be faced with a new psychomotor task of punching in information to the computer on the CAP. This change of interface between the NFO and his system will thus influence the performance of many tasks when they are compared between the F-4 and F-14.

NATURE OF AIRCREW

In both the F-4 and F-14, either the pilot or the NFO may perform some of the tasks listed for the NFO in this report. Who performs a task, particularly those involved with decision-making, is determined by many factors such as relative rank, experience, or expertise of the aircrew, official Navy or squadron policy, relative workload at a given time, informal division of the tasks by the aircrew, and the personalities of the aircrew and how they interact. These differences will be reflected in the fleet rating of the FDI (see Procedures) on other aircraft. In this report, information from advisors' comments on this subject has been included in the discussion section.

The ability and personality of the NFO will also determine how he interfaces with his equipment. On a computerized aircraft like the F-14, the NFO is faced with new psychological loads. Unless he is aggressive in his demands of the equipment, the computer might "run the show" at the cost of mission effectiveness. A psychological concept, time-sharing, is useful in interpreting some of the expanded or new abilities demanded of the F-14 NFO. Time-sharing is defined as the ability to assimilate information from several simultaneous sources, to make decisions based on that information, to decide priorities of action, and to make appropriate responses while maintaining awareness of incoming information. A quote from a Naval Human Factors study sums up the problem--"one of the biggest human factors problems is how to cope with increasing data rate demands which result from faster aircraft. . . . The problem here is to find more effective ways to couple the large band width information system (sensors and computers) into the narrow bandpass human nervous system" (2).

With the rapid influx of information previously described, the F-14 NFO is faced with a much greater time-sharing problem than the F-4 NFO. For example, the F-14 NFO must not only scan more displays to gain tactical information, he also has to decide what kind of information should be displayed (such as IR or radar information on the DOD) in a given situation. He has to budget time for the operation of the CAP as well as the hand control unit. Preliminary advisor experience in the F-14 NFO trainer indicates that the time-sharing load is much greater than anticipated and may well be underestimated in some of the ratings for tasks reported here. Further experience with the F-14 will reveal the extent of this problem.

Although there is a "learning to timeshare" factor present in certain learning situations, there is also a significant difference in the timesharing ability that an individual brings into the situation (3). This time-sharing dimension then affects the complexity of a task.

PROCEDURE

CONSTRUCTION AND REVIEW OF FUNCTION DESCRIPTION INVENTORIES (FDI)

Although this study was conducted as part of the Naval Aerospace Medical Research Laboratory's (NAMRL) NFO Function Analysis Project, the methodology and thus analysis and discussion of information differs from that of the main study due to the development nature of the F-14. Methodology for the NAMRL NFO Function Analysis Project was as follows:

1. Acquisition of source material to provide guidelines for the selection and wording of duties and tasks.
2. Local technical advisors (NFOs experienced in the particular aircraft under study) reviewed pools of duty and task items for applicability and developed additional items.
3. A preliminary FDI was developed based on reviewer comments, recommendations, and additions to the duty/task list.
4. A review of the preliminary inventory by selected NFOs (usually members of Replacement Training Squadrons for the subject aircraft).
5. On the basis of this review a final FDI was developed and mailed to all the operational squadrons in the fleet.

While the F-14's basic design is set, the results of flight tests and weapon system evaluations continue to rapidly modify the aircraft. As compared to the relatively long history and well-developed tactics of the F-4 aircraft, the F-14 is still in an exploratory stage. Although there are no NFOs who have actual F-14 operational experience at the time of this report, there are some NFOs available who have operational experience in the F-4, and who also have knowledge of the F-14. Such F-14 knowledge was obtained by participation in projects involving evaluation of the F-14 weapon system, the Missile Control Officer Trainer (MCOT), or preparation of the F-14 Readiness Air Group (RAG), VF-124. These NFOs served as advisors who participated in the construction, and review of the Function Description Inventories (FDI) for both the F-4 and F-14. Fighter NFOs from both the east (VF-101) and west coast (VF-121) F-4 RAGs also reviewed the construction of the F-4 FDI. Printed sources of information for the FDIs included F-4 NATOPS (4, 5, 6), various F-14 and AWG-9 contractor publications (1, 7, 8, 9), and a description of the fighter NFO's skills and knowledge requirements developed by the F-14 Aircrew Training Team, COMFAIRMIRAMAR. Three officers from VF-124/F-14 Aircrew Training Team, COMFAIRMIRAMAR, rated the F-14 FDI (see Appendix A for rating instructions). One officer from this group was interviewed concerning the differences between the F-4 and F-14. One officer from F-14 Weapons Test, Naval Missile Center, Point Mugu, rated the F-4 and

F-14 FDI and was also interviewed concerning the differences between the two aircraft. Nine West Coast F-4 RAG instructors rated the F-4 only.

The F-14 is described with reference to "advertised" capabilities (as long as tests have not disproven them) and projected balance of tactical utilization. The F-4 is described in relation to the F-4 (mostly F-4J) operational experience of the NFO advisors and to its present mixture of tactical utilization. The F-4 ratings are oriented to the F-4J, although some equipment (for example, certain DL capabilities) may not be on all F-4J aircraft. The F-4B is covered in that the F-4J FDI includes all of the tasks for the F-4B with the addition of tasks unique to the F-4J such as those concerned with pulse doppler radar operation. It is important to note here that the advisor's ratings on the tasks are based on preliminary knowledge of the F-14 and that further Navy F-14 experience could modify the results. Advisor's comments are included on certain areas (such as IR, INS, maintenance, NFO time-sharing abilities) where future F-14 experience could result in altered ratings.

RATING SCALES OF THE FDI AND THEIR ANALYSIS

There are three dimensions used in this report to describe the nature of the performance of the task in the F-14 and F-4: Proportion of Time and Effort (P), Importance (I), and Complexity (C). The P dimension represents the proportion of time and effort required to execute a particular task in relation to each of the other tasks performed as a fighter NFO. The I dimension represents the extent to which failure to perform a task affects the likelihood of mission completion. Although numerical ratings were given by advisors on these dimensions, it was decided, due to the low number of F-14 advisors, that interviews be used to supplement these ratings. Using the numerical ratings and the comments made by the advisors during interviews, the tasks were classified for P and I dimensions on the following basis: Low (L), Low ranging to Medium (L-M), Medium (M), Medium ranging to High (M-H), and Not Available (N.A.). An additional rating, designated by D, was used to signify tasks that had diverse numerical ratings on the I or P scales. These individual differences are attributable in part to equipment differences within the F-4 models and blocks, to individual preferences or attitudes, and to rank or experience differences. The introduction provides a discussion of some of the factors responsible for the individual differences. These classifications of tasks (L, L-M, M, M-H, H, and D) were then reviewed by advisors.

The C dimension was a synthesis of comments and rating discussions which occurred during the interviews. It represents the psychological complexity that is involved with performance of a task. Certain increases or decreases in difficulty are caused by modification of the decision-making, perceptual-motor, procedure-following, or monitoring requirements of a task due to differences in system-design or mission demands. The following symbols are used to represent classifications of tasks on this dimension: (+) increase in complexity from F-4 to

F-14, (=) approximately the same for both aircraft, and (*) unique to F-14. Table III lists these ratings for P, I, and C dimensions, and their abbreviations, and can be used for interpreting later tables.

In certain instances, new F-14 subsystems are compared to homologous F-4 subsystems in order to compare tasks performed on the different systems. For instance, tasks concerning the inertial navigational system (INS) are compared with tasks concerning the DR Navigational Computer, although the two systems are substantially different. Therefore, some of the tasks concerning the INS are not classified as unique to the F-14 although obviously the equipment itself is.

This report does not involve information from the fleet review of the F-4 FDI as these results have not been analyzed at the time of the present report. There are certain methodological differences, differences in instructions, rating procedures, and task wordings, which may make it difficult to quantitatively interpret those results in relation to the ones presented here for the F-4. The low number of rather select F-4 NFO advisors used for this report and the weighted emphasis given to the advisors' ratings who rated both aircraft could result in differences between these ratings and those from the fleet. However, it will be possible to interpret certain trends between the fleet ratings of the F-4 and the classification of the F-4 and F-14 tasks presented here. The fleet trends might represent practical requirements which could modify the proposed use of the F-14.

RESULTS AND DISCUSSION

The following discussions are based on the I, P, and C classifications of tasks which are listed in the tables following the text. The reader is advised to detach the tables and use them as references while reading this section. Tasks, duties, and roles are referenced using the following numbering system: Roman numerals I through VI for roles; capitalized letters for duties; numbers for tasks. For example, Task I.A.1 is the first task in Duty A, of Role I, Sensor Manager. This section is intended to discuss possible operational functions of the NFO in fighter aircraft, not the skills or knowledge needed to perform these functions. This is beyond the scope of the present report.

ROLE I. SENSOR MANAGER

Duty I.A. Coordinate Sensors

Tasks I.A.1 and I.A.2, listed in Table IV, were designed to evaluate those activities in which the NFO serves to integrate the duties within his role as Sensor Manager. As indicated by the P and I ratings, task I.A.1 summarizes as a major concern of the fighter NFO, regardless of aircraft. Task I.A.2 represents his ability to oversee the sensor activities controlled through his integrated weapon system (AWG-9 or AWG-10). It, too, is rated highly on P and I for both the aircraft, as it also summarizes a major portion of the Sensor Manager role.

Almost every factor listed in the introduction could be given as a reason for the increment in "complexity" for both tasks. The emphasis on long-range intercept of multiple airborne targets, the increase in sensor capability and radar modes, and the addition of new sensors increase not only the judgemental aspects involved (I.A.1) but also the overall difficulty of running a sensor system (I.A.2). Added to this problem in the F-14 is the additional chore of interfacing with the digital computer. Elements of these two tasks appear as tasks in other duties, but they are summarized here to emphasize the increased "timesharing" problem facing the F-14 NFO. In task I.A.2, corresponding to the new, possibly "better" display designs (such as the TID displays) which could serve to decrease the timesharing problem, is the increment in sheer number of switches, displays, and sensors, increased sensor effectiveness, etc. For example, the F-14 NFO has to scan more displays to gather radar information than an F-4 NFO performing the same activity. In task I.A.1, the NFO is faced with more options, requiring that he not only think more about what he is doing, but also more about what he could or should be doing instead.

Duty I.B. Manage Radar

In addition to the straight forward operation of the radar, in both the F-4 and F-14, there is the requirement that the NFO maintain an overall awareness of potential operations; i.e., capabilities and modes of operation that might be utilized to better optimize the radar's use in a given situation. This awareness, along with the determinations and evaluations which are used to assess the situation, calls for the inclusion of a duty covering the overall tasks of managing the radar system. These tasks are listed in Table V.

Tasks I.B.1, I.B.2, I.B.3, and I.B.4 are concerned with the evaluation of environmental effects on the effectiveness of the radar systems. On both aircraft these tasks were rated mostly low to medium on P and medium on I. They were also rated approximately the same on C. In short, they appear to be similar tasks on both aircraft. However, it is possible that future experience with the F-14 might result in an increase in P and C ratings due to the increased area of surveillance possible and utilized in the FAS mission.

The P and I ratings on task I.B.5 indicate a possible change in the importance of electronic counter-countermeasures (ECCM) which will affect the F-14, and also possibly the future use of the F-4. Rapid advances in ECM technology are being continually incorporated by both the U. S. and its potential adversaries. It is possible that the difference in F-4 NFO past experience with enemy ECM and ECCM is represented by the D rating for both P and I. The F-14 has a greater probability of encountering more frequent and sophisticated enemy ECM due to the nature of its mission and enemy tactics encountered in FAS. For example, the F-14 NFO can expect the use of drones to disguise the size of the attacking force or the employment of sophisticated deception repeaters. He will need to recognize different types of enemy ECM from his radar displays and quickly determine pro-

cedures to counter them. This need is reflected in the M-H ratings on both I and P for the F-14, and also in the increased C ratings. The F-14 NFO will have better indicators of enemy ECM, better computer assistance, IR or TV, and greater radar system capability (more power for quicker burnthrough, greater resolution). Although these advantages will serve to aid the F-14 NFO, they will also serve to increase the overall complexity of task I.B.5.

Due to the complexity of both radar systems, the performance of task I.B.6 will be of medium to high importance and will require a medium to high proportion of time and effort on both aircraft. The F-14 is a more complex system, with greater system testing capability (see Role V) and more radar modes. Thus, it is rated an increase on the C scale.

Tasks I.B.7 and I.B.8 deal with determinations of parameters of radar employment. Although rated the same on P and I, the increase in computer assistance and the existence of more modes allowing greater flexibility, could cause these determinations to decrease on the C ratings.

Duty I.C. Operate Radar: Air-to-Air

Using the radar system to search, acquire, and track airborne targets is probably the largest duty of the fighter NFO's role as Sensor Manager. The tasks in this duty are listed in Table VI. Tasks I.C.1, I.C.2 and I.C.3 are all concerned with the chore of detecting (or searching for) airborne targets. Task I.C.1, representing the earliest possible detection capability, has increased in P due to both an increase in PD capabilities and emphasis on long-range detection. Since the F-14 pilot only has a TID repeat radar presentation and not the "raw" radar (B-scope) presentation as does the pilot, it is possible that the F-14 NFO will spend more time monitoring the DDD. Task I.C.2 has an increase in C over I.C.1 because, as one advisor put it, the F-14 pulse mode is "not as clean". For a given target, task I.C.2 will possibly be more difficult for the F-14 NFO, while task I.C.1 will possibly be a little easier because of the increase in PD capability (power, resolution)--thus a decrease in C. Task I.C.3 reflects a new capability designed primarily for the F-14's FAS mission. It ranks as an important addition to the F-14 NFO's tasks. "Pause-to-Range" PD search could be classified as a simpler F-4 counterpart to RWS, but it is included here in the I.C.1 ratings. Task I.C.3 also introduces the use of the PPI displays on the TID.

Tasks I.C.4 through I.C.16 represent different target-acquisition methods which involve various levels of NFO and computer activity, and combinations of search and track modes (both radar and IR/TV). Tasks I.C.4, I.C.5, I.C.7, and I.C.8 represent NFO participation in target selection using the hand control unit, and their C classifications reflect the relative merits of F-4 and F-14 pulse and PD modes as discussed above. Included in tasks I.C.7 and I.C.8 are additional computer assisted methods of transitioning to pulse track from other search forms. Note the individual differences asterisked in task I.C.5 (see

discussion of ECM conditions for task I.B.5). Task I.C.6 is rated higher on P and C due to new modes of computer assisted PD acquisition and increased computer interface. The D rating on Role I for the F-4 could possibly reflect mixed attitudes toward automatic acquisition mode--a combination search, acquisition, and track mode. Tasks I.C.9 through I.C.14 represent the additional ability of the F-14 radar to be slaved to the track of a target maintained by the new independent sensors. Performance of tasks I.C.15 and I.C.16 requires the fighter NFO to switch rapidly from the three dimensional visual tracking world to his two dimensional symbolic cockpit representations under periodic high "g" forces and other stress factors. Since these tasks occur frequently in ACM, they are rated medium to high on P and I. The possibility of frequent use of the rapid acquisition modes in the F-14 will necessitate an accurate spatial orientation. That is, the NFO will have to know where a target is in relation to his own aircraft and how this will appear on a display.

Tasks I.C.17 through I.C.22 refer to the tracking of single or multiple targets. It is through the information gathered here that the fighter NFO analyzes an intercept and proceeds with some of the tasks listed in Weapons Manager (II), Tactician (VI), and Communication (III). The introduction of the TID could ease this activity by reducing display interpretation difficulties such as relative motion problems inherent in the B-scope display. Tasks I.C.17 and I.C.18 again reflect the differences in the relative capabilities of the F-4 and F-14 pulse and PD radar modes. Task I.C.19 reflects the difference in attitudes toward the pulse manual-track system which, although easier in a perceptual-motor dimension in the F-14, increases in C due to the F-14's pulse radar characteristics. Tasks I.C.20 and I.C.21 represent ECCM modes available in both aircraft. The F-14 decreases in C for a given target because of increased computer assistance and radar capability in ECM conditions. Again note the difference in ratings represented by D (see discussion of ECM conditions in I.B.5). Task I.C.22 is a new multiple target tracking mode designed primarily for Fleet Air Superiority (FAS). It makes full use of the TID display, computer assistance, and computer-generated decision aids. The assignment of firing priorities by the computer aids the F-14 NFO, but it also requires him to monitor those priorities to see if they are realistic. The simultaneous monitoring of multiple targets and the assessment of priorities places another new "timesharing" burden on the F-14 NFO.

Duty I.D. Operate IR: Air-to-Air

The addition of IR (see Table VII) as an on-board sensor gives the F-14 NFO additional information gathering capabilities. It is independent of radar search thus allowing surveillance separate from radar scan. It is also impervious to most ECM now employed against radar. Its higher resolution capability allows threat assessment not available by radar alone (I.D.4). Its range is sometimes greater than radar, although it is highly dependent on the strength of the target. Thus it will provide additional information (I.D.1, I.D.2, I.D.3) for the NFO. Coupled with these advantages are some disadvantages which also increase the load (or possibly decrease the use of IR) on the NFO. It could be difficult to inter-

pret due to problems with setting signal-over-threshold levels. It is presented on a new type display, C-scope (aximuth versus elevation) which is not used in the F-4 and possibly offers conceptual difficulties for some NFOs. It might be monitored using audio signals mostly because its video display shares the DDD with radar (which most NFOs prefer). It is not known how effective it will be (what range possible) against typical FAS targets--Bears and Badgers in a front hemisphere intercept--although it might provide detection of ASM missiles at longer range than radar. In short, tactical utilization of IR has not been fully worked out at present and thus the moderate to low ratings (both I and P scales) for the tasks could possibly be changed given future F-14 experience.

Duty I.E. Operate T.V.

A proposed alternate to IR is the addition of an electro-optical device which would be a stabilized on-board TV camera capable of detecting (task I.E.1. in Table VIII) and tracking air and ground targets beyond visual distance. The TV display would be presented on the TID allowing identification of targets beyond visual range (tasks I.E.2 and I.E.3). This identification would be particularly useful in a visual-identification (VID) environment typical of limited wars or cold war incidents. It makes available to the NFO some of the same advantages of IR; i.e., surveillance which is independent of radar and can be used in ECM conditions. This duty would obviously increase the amount of information impinging on the NFO and would also increase the tactical flexibility of his aircraft. Again, since tactical utilization of T.V. has not been fully worked out, the low to moderate ratings could possibly be modified given further F-14 experience.

Duty I.F. Visual Scan

Always of considerable importance in any fighter, the maintenance of visual scan (Table IX) is made easier in the F-14 due to better canopy design which allows increased aircrew visibility. Through the use of mirrors, and by turning in his seat, the F-14 NFO has considerably better visibility to the rear, an important factor in ACM. As indicated by the C rating in tasks I.F.1 through I.F.7, this increase in visibility will ease the NFO's tasks concerning monitoring for airborne targets on missiles, and it could possibly ease his visual monitoring tasks that are oriented to the ground (although the increased visibility is best realized in the ACM environment). The increase in visibility and use of electro-optical devices (see duty I.E.) might enhance the need of the F-14 NFO to receive training in rapid identification of aircraft, spatial orientation, and interpretation of target aircraft maneuvers. The total amount of time and effort devoted to these tasks depends on the individual aircrew's division of responsibility or the flight/wingman division of visual search responsibilities. Tasks I.F.6 and I.F.7 have differences in ratings by advisors. Task I.F.6 is said by some to be mainly a pilot's task. The decrease in the P rating of tasks I.F.3 and I.F.5 for the F-14 could be indicative of the decrease in the proportion of interdiction missions for the F-14.

Duty I.G. Operate Counter Measures

Corresponding to the increased fighter NFO concern with ECCM is the duty of operating his own ECM gear. Experience of individual F-4 NFOs in this area has been varied, as possibly indicated by the number of D ratings in this duty (see Table X). Due to the growth in Soviet air defenses, this duty is becoming very important (as it is at present in Southeast Asia).

Tasks I.G.1 and I.G.4 are important for the NFO to perform over hostile territory. He needs to know what the most effective tactics are and how and when to apply them in a given situation. Tasks I.G.2 and I.G.3 are also important defensive tasks requiring both monitoring and interpretation. On the basis of the strobe display of the AN/APR-25 the NFO can give descriptive and directive commentary to the pilot in relation to the enemy threat. It is possible that a newer modification, the ALR-45, which is digital, thus faster and able to sense more threats, will be incorporated into the F-14 possibly increasing the complexity of this task. Operation of the AN/APX-76A interrogation equipment (I.G.5) is important on both aircraft due to the need for identification of unknown contacts. A new display of IFF information (TID) will be available in the F-14.

ROLE II. WEAPONS MANAGER

Duty II.A Manage Air-to-Air Weapons

These tasks, listed in Table XI, are concerned with the evaluations, determinations, coordination, and procedures involved with weapon selection, maneuvering to launch envelope, and weapon release. Task II.A.1 ratings increased in both P and C for the F-14 due to a combination of factors. The F-14 FAS emphasis, additional weapon system (AWG-9) capabilities, the AIM-54 missile, the M-61 guns, and possibly newer modifications of the sidewinder and sparrow missiles all serve to complicate the choice. Tasks II.A.2 and II.A.4, while remaining the same in I and P, increase in C due to having more weapons, thus more characteristics to consider. There is also an increase in the complexity of the F-14 flight characteristics due to wing sweep configuration. In addition to the above, the F-14 NFO will also be more concerned with planning for the next shot due to the FAS emphasis. This might cause an increase in the complexity of coordination with the Pilot. Task II.A.3 decreases in P and C due to increased computer assistance, new displays, and better firing equations allowing a larger launch envelope. Being new, Task II.A.5 requires additional perceptual-motor ability on the part of the F-14 NFO. Task II.A.6 is dependent on a particular aircrew's division of responsibilities, but the combat-ready NFO should be able to provide the appropriate inputs to the personnel making the decision.

Duty II.B Operate AIM 7F/7E

This duty was designed to evaluate the F-14 NFO's new tasks (Table XII) concerning the operation of the AIM 7F/7E missiles. Although rated low in P, they are more highly rated in I. Note the inclusion of the capability to trigger the missile, previously available only to the pilot. For some fighter NFOs, however, this change is not too different, as they had directed the intercept and verbally commanded the launch of missiles in the F-4.

Duty II.C Operate the AIM 54

Again this duty (Table XIII) is included to evaluate the participation of the NFO in the operations concerning the AIM 54. The two tasks are considered rather low in P and low, or low to medium, in I.

Duty II.D Manage Air-to-Ground Weapons

This duty (Table XIV) is concerned with the evaluations, determinations, coordinations, and procedures involved with weapon selection, maneuvering to a ground release point and weapon release. The D rating for P and I on Task II.D.1 indicates, perhaps, a difference in F-4 NFO's orientation toward interdiction. This could be due to deployment experience or a function of rank and experience. As mentioned previously, the F-14 will probably be utilized proportionately less in the interdiction mission as possibly reflected by the P rating decrease in Tasks II.D.2, II.D.4, and II.D.5. The F-14 has a new computer determined ground release mode for the NFO to monitor (II.D.3) and new equipment operation (II.D.7) for which he shares responsibility.

ROLE III. COMMUNICATOR/COORDINATOR

Duty III.A Coordinate Using UHF Communications

The tasks in this duty (Table XV) cover information exchanged between the NFO and the tactical or navigational facilities. There was almost no change in the P, I, or C ratings for tasks in this duty. One point might be considered interesting: the individual differences (represented by D) in the ratings of importance for the operation of the KY-28, Task III.A.10. This could be indicative of attitude, experience, or squadron maintenance differences.

Duty III.B Coordinate Using Visual Communication

This duty (Table XVI) includes tasks that cover visual exchange (via hand signal, lights, etc.) of information in the air or on the deck. Again, there was almost no change in the P, I, or C ratings from F-4 to F-14.

Duty III.C Coordinate Using Data Link (DL)

These tasks (Table XVII) evaluate the NFO's participation in the exchange of digital data information for navigational or tactical purposes. The data is exchanged via the F-4/F-14 UHF DL and the: Navy Tactical Data System (NTDS), Airborne Tactical Data System (ATDS), Marine Tactical Data System (MTDS) or, possibly, other aircraft.

The F-14 DL has increased capabilities which allow transmission as well as reception (only reception is possible in F-4) and an increased capability for what can be exchanged via DL. This increase is reflected in the increased C classifications for all of the tasks in the duty plus the addition of the possibility of fighter-to-fighter DL (see Task II.C.5). As the capability of the ATDS, NTDS, and MTDS improve, the use of DL might increase for both F-4 and F-14.

Duty III.D Coordinate Using ICS Communication

These tasks (Table XVIII) evaluate the important area of crew coordination via verbal exchange of information using the ICS. Tasks III.D.1, III.D.2, III.D.3, III.D.5, and III.D.8 are all concerned with the directive and descriptive commentary used by the NFO to transmit information concerning airborne targets, to make recommendations for maneuvering the aircraft, and to report weapon system status during air-to-air engagements. The new pilot's displays (in particular the Heads-Up Display, HUD) will present the F-14 pilot with computer-generated steering commands and other intercept or weapon system information. This reduces the C rating for Tasks III.D.1, III.D.5, and III.D.8. In close combat, ACM, the pilot and NFO rely on quick information exchange that usually concerns target information gathered by visual tracking. Since the F-14 NFO has better visibility than the F-4 NFO (especially the rear hemisphere), he might have an increased responsibility for visually tracking targets. The Tasks III.D.2 and III.D.3 could become more complex.

Tasks III.D.4, III.D.6 and III.D.7 all represent consultation between the NFO and pilot regarding the choices in a given tactical situation. There are more choices in the F-14 due to increased system capability, and multiple target (FAS) emphasis. Thus, Tasks III.D.6 and III.D.7 increase in C classifications.

Task III.D.10 is concerned with the NFO's participation during air-to-ground deliveries. Due to a possible decrease in the proportion of interdiction missions, and to the increase in weapon system capability and pilot's display, the P and C ratings were lower for the F-14.

As discussed above, changes which influence other roles, modify the nature of ICS communication. Because of the increased complexity of the F-14, the C rating on tasks III.D.12 and III.D.19 increased. See Role V, Assessor of Systems, for a further discussion of information related to these tasks. Due to the

increased frequency and sophistication of ECM expected to be encountered by the F-14, III.D.13 also rated an increase in C. The addition of the INS navigational mode is reflected in the increased C rating on Task III.D.15. Increased visibility for the pilot and NFO results in a decrease in C for Task III.D.18.

ROLE IV. NAVIGATOR

Duty IV.A Manage Navigation

Task IV.A.1 (Table XIX) represents not only the overall equipment interface in the selection of a navigation mode, but the decision-making and evaluation which lie behind the action. In the F-4, selection of navigation modes consists of operating various independent subsystems. The F-14 NFO must not only perform most of these tasks but has to interface with the digital computer in order to align, update and otherwise manipulate information concerned with the INS and its associated back-ups. This addition also increases the decision-making that lies behind selection. Although the INS is controlled mostly by the NFO, the Pilot can operate other modes (TACAN, ADF, etc.). One advisor stated that the F-14 pilot might have to take over some of the navigational tasks that were previously performed by the F-4 NFO due to overloads on the F-14 NFO at some points in the mission.

Task IV.A.2 increases in C due to the addition of the INS and its associated backup modes. A 40 degree lock-off error on TACAN, and inaccurate read-outs on the DR Nav Computer, are examples of problems which confront the F-4 NFO. The F-14 still has TACAN, plus degraded modes of the INS.

Duty IV.B Navigate Using TACAN

There was little change in ratings for P, I, and C for tasks (Table XX) in this duty. When ground facilities are available, TACAN is the most frequently used mode of navigation in the F-4. Since TACAN facilities are relatively abundant, even being installed in areas of limited warfare such as Laos, TACAN is of prime importance in the F-4. The F-4 NFO enters into most phases of TACAN navigation: flight planning, equipment operation, and interpretation of TACAN information. The above hold true for the F-14, except that the presence of the Inertial Navigation System might change the usage of the TACAN system. Future favorable experience with the INS in the F-14 might eventually decrease ratings on some more tasks in this section.

Duty IV.C Navigate Using Visual Scan

Again, most tasks (Table XXI) do not change in rating in this duty. Two points of interest might be noted in the ratings which correspond in part to smaller trends in the TACAN ratings (not discussed). On task IV.C.7 (and IV.B.7) there was disagreement, indicated by D, in the use and importance of the DR Navi-

gation Computer (F-4). There are certain design and maintenance problems that affect the accuracy of the DR Nav Computer, and thus individual NFOs differ in their attitudes toward it. Updating the INS system will involve computer interfacing which might prove more complex for the NFO.

The other point of interest is manifested in the D classification given to some tasks concerning visual monitoring (or monitoring of Nav aids) and advising the pilot, especially in terminal areas. Individual NFOs vary in their attitude toward these tasks.

In areas where no TACAN exists, or is unusable, F-4 crews often employ low-level visual navigation. Some missions, particularly interdiction missions, are run using specified landmarks from pre-mission briefs, or from ground controllers. On most interdiction missions it is necessary, after navigation to the general area of the target using other modes, to pick out landmarks to pinpoint the target. The NFO participates in most phases of visual navigation; planning, reading charts and photographs, relating their appearance to how they will appear in the air, determination of aircraft position and monitoring approaches and departures to terminals or carriers. The F-14 NFO will share in this duty, although future experience with INS might again serve to decrease ratings for some of these tasks.

Duty IV.D Navigation Using UHF/ADF

There are no significant changes in ratings on I, P, or C for tasks in this duty (Table XXII). The ADF serves as a back-up for other modes (in both the F-4 and the F-14) in two senses. One, it is a navigational aid which can be keyed to any UHF transmitter. Thus it has value in emergencies when other navigation systems are not available. It is hindered in this chore because it provides only limited information. The other use of UHF/ADF is for emergency communication when the primary UHF radio is down. It will serve these back-up functions in approximately the same manner for both the F-4 and the F-14.

Duty IV.E Navigation Using Inertial Navigational System (INS/DR Navigational Computer)

As previously discussed in duty IV.C, the DR Nav Computer has maintenance and design problems which have resulted in varying NFO attitudes toward it. It is usually turned on and set up, thus it serves as an additional source of navigational information or an independent (not dependent on ground facilities) mode of navigation when it is needed. The INS should be more reliable and give much more accurate information. By interfacing with the computer, the F-14 NFO can gain information that he previously would have calculated in his head. The ratings D (Table XXIII) reflect the mixed attitude toward the DR Nav Computer and, in task IV.E.1, toward the INS, as it is new to the fighter community. The similarity of the C rating for tasks IV.E.1 and IV.E.2 could possibly be due to different

reasons. The DR Nav computer and INS are difficult to operate and interpret (judge accuracy) in their own way. Task IV.E.3 increases in C due to the increased number of way points possible on the INS. A large portion of the NFO's concern with the INS will take place on the deck where he will align and center data into the system. The value of the INS is increased by the addition of associate back-up modes (Tasks IV.E.4 and IV.E.5) which can be used when components in the INS malfunction.

Duty IV.F. Navigate Using Radar

Since the radar systems aboard the F-4 and the F-14 are designed primarily for airborne target detection and tracking, they both have some limitations when used for land-mapping. The F-14 pulse mode is similar to that in the F-4, but its smaller display (DDD) and a less clear presentation of the information could increase interpretation problems in the F-14, tasks IV.F.1, 2, 3 and 6 (Table XXIV). The increase in difficulty, combined with the addition of the Inertial Navigation System, and the decrease in interdiction mission (the mission that normally require the most radar navigation), could reduce the use of the F-14's radar for navigational purposes. Assessment of the possible reduction can be made after more experience is gained with the F-14.

Duty IV.G Navigation Using Flight Instruments/DR

Tasks in this duty (Table XXV) are rated approximately the same for both aircraft. It is possible that future experience with the F-14's Inertial Navigational System might reduce the need for mental calculations, such as found in task IV.G.1. Tasks IV.G.3, IV.G.4, IV.G.5, and IV.G.6 represent some of the pilot back-up functions that the fighter NFO performs. These tasks, and some of the tasks located in other duties and roles, are performed for the safety and efficiency of flight and are considered by some advisors to be very important activities for the NFOs in both the F-4 and the F-14.

ROLE V. ASSESSOR OF SYSTEMS

Duty V.A Preparation and Inspection of Systems

Obviously, preflight checks are more important to a mission than post-flight checks, but since they involve similar activities, the preflight and postflight checks were grouped together. There is one significant change between aircraft in this duty (Table XXVI). Task V.A.2 increased in C due to increased system complexity. Most of the tasks remain the same on the dimensions rated, although the equipment inspected might differ.

Duty V.B Assess System Status

Task ratings in this duty (Table XXVII) reflect the increased self-test complexity of the AWG-9 system. Task V.B.1 decreases in C because the AWG-9 self-test programs, and their readouts, are better, while tasks V.B.3 increases in C due to the increased complexity of the radar system and its displays. Tasks V.B.6, V.B.8, V.B.9, and V.B.17 all increase in C due to the addition of new equipment and new modes of operations. There are new self-test capabilities and equipment; i.e., tasks V.B.11, V.B.12, V.B.15, and V.B.16, which place an additional responsibility on the NFO. The F-14 system-maintenance philosophy is designed to emphasize "all up" systems before launch to prevent continued degradation of malfunctioning systems. This change and other changes in maintenance philosophy puts an even greater responsibility on the F-14 NFO for activities like those in Task V.B.8.

ROLE VI. TACTICIAN

Duty VI.A Coordinate Combat-Air Patrols and Escort Missions

The tasks within the role of Tactician, as opposed to other roles, are not related to any specific aircraft system or subsystem. They are combinations of activities which form tasks in other roles. The role is designed to evaluate the overall tactical decision-making functions which the NFO performs.

Duty VI.A. (Table XXVIII) presents evaluations, planning, recommendations, and, in some instances, commands concerned with tactical employment of a fighter. Tasks VI.A.1, VI.A.2, and VI.A.6 received diverse (D) ratings from advisors due mainly to their differences in rank and experience. Tasks such as these usually accrue to the NFO (or pilot) with rank and experience. The increase in complexity of the tactical picture for the F-14 NFO is reflected in the increase of classifications in the C dimension for Tasks VI.A.4, VI.A.5, VI.A.6 and the addition of Task VI.A.7. As tactics are not yet fully determined for the F-14, the load upon the NFO may be greater in the future.

Duty VI.B Coordinate Aerial-Combat Maneuvers

Once the fighter has engaged the enemy, the aircrew must make certain evaluations and determinations to optimize their ACM capabilities, and to maximize their probability of kill. Ratings on these tasks (Table XXIX) reflect the division of responsibilities between the pilot and NFO. There is not as great a difference in the ratings as is displayed in duty VI.A. Task VI.B.1 increases in C due to the increase in capabilities of the F-14. While F-4 tactics and past performance against enemy fighters are relatively well determined, the F-14 NFO will be exploring partially unknown areas. This also adds to the C rating on Task VI.B.1. Task

VI.B.2 increases in C because the F-14 NFO has more weapons to consider and more capabilities to assess concerning his own aircraft. Tasks VI.B.3, VI.B.4, VI.B.5, and VI.B.6 represent evaluations involved in directing the aircraft to the launch envelope for a selected weapon. The various C classifications represent trade-offs between relative F-14/F-4 system capabilities and complexities. The F-14 has larger launch envelopes, better maneuverability, better computer assistance (firing equations, etc.) and more easily interpretable displays. However, it also has more weapons (thus more parameters to consider), multiple displays to scan, and possibly, a more complicated tactical situation. Task VI.B.7 is classified as a decrease in C because of computer assistance and better computerized calculations. Task VI.B.8 could increase in C due to the F-14 wing sweep configuration. Duty VI.B, similar to duty VI.A, includes tasks which concern presently unknown activities. Testing of both the weapon system and aircraft was underway at the time this report was written. It is only when the capabilities are fully known that F-14 tactics can be developed and an accurate assessment of the NFO's role as Tactician be made.

Duty VI.C Coordinate Intelligence Collection and Dissemination

Only two tasks in this duty (Table XXX) were classified as changing between the F-4 and F-14. Tasks VI.C.2, and VI.C.5 increase due to the rise in complexity of the F-14 tactical picture. The F-14 NFO has more threats to assess and an additional method of recording information via the mission recorder.

ROLE SUMMARIES

Sensor Manager

Table XXXI summarizes the I and P classifications of tasks in the role of Sensor Manager. For example, 38% of the tasks did not change in rating from F-4 to F-14 on the P dimension. These tasks were from duties I.A., I.B., I.C., I.F., and I.G. They had a median rating of M-H. By interpreting Table XXXI, it is possible to summarize some of the general trends in the Sensor Manager I and P ratings. Every duty except I.D. and I.E., the new sensors, had tasks that were similarly rated in the F-4 and F-14. Only a small portion of the tasks increased or decreased. These were mostly due to changes in mission balance, the increased F-14 emphasis on FAS or decreased proportion of Interdiction missions. The tasks classified as D were mainly those that included ECM conditions in duties I.C., I.B., and I.G. The F-4 tended to have more D ratings than the F-14, reflecting perhaps the difference in ECM experience for the F-4 and the expected frequency of ECM in the F-14. Those tasks that were classified as unique to the F-14 were mainly those concerned with new radar modes (I.D.) and the new sensors (I.D., I.E.).

Table XXXII presents an overview of the C ratings for the role of Sensor Manager and its duties. Tasks in duties I.B. and I.G. were the only ones rated similar. While I.G. was 100% in this category, some tasks in I.B. were also rated to increase and decrease in the F-4, depending on complexity of the radar system or its increased capabilities. All tasks in I.B. were common to both aircraft. In I.C., there was a large percentage of new tasks because of the new radar modes available. The remaining tasks in duty I.C. increased due to the F-14 pulse mode or decreased due to increased PD mode and other system capabilities. Naturally, I.D. and I.E. were composed of all new tasks. Reflecting the increase in visibility, all the tasks in I.F. were rated to decrease. To sum up the role of sensor manager, in terms of ratings in C, some tasks remain the same, and a few more tasks decrease than increase. This decrement, however, is considerably offset by the addition of new tasks.

Weapon Manager

As in Sensor Manager, Table XXXIII is presented to summarize the information available from the P and I F-14 and F-4 ratings. As compared to Sensor Manager, a lower percentage of tasks had ratings which did not change from F-4 to F-14. The importance of the tasks, however, remained relatively constant between aircraft, as indicated by the large percentage of tasks unique to the F-14 which is offset by the low P ratings received by these tasks.

Table XXXIV presents an overview of the C ratings for tasks within the Weapons Manager role. In duty II.A. a large portion of the tasks increased in rating due to increased complexity of the F-14 system. There was also a decrease due to increased system capability. Naturally, tasks in duties II.B and II.C are unique to the F-14. Tasks in II.D, if performed, remain approximately the same except for the addition of two new tasks representing in part an increase in the AWG-9 system's air-to-ground capability.

Communicator/Coordinator

As before, Table XXXV summarizes the information available from the F-4 and F-14 cross-ratings on the P and I scale. The majority of the Tasks did not change from F-4 to F-14 on either I or P. Table XXXVI presents the summary of the C ratings for the role and its duties. Again, a majority of the tasks were rated as approximately the same for both aircraft. Duty III.C has one task unique to the F-14, and the rest of the tasks were rated as increased for the F-14. This was due to the expanded capabilities of the F-14 DL system. Reflecting the changes covered in other roles, duty III.D has the biggest change in complexity ratings. A few more tasks increased than decreased, which could be interpreted as being indicative of the increased responsibilities and activities of the F-14 NFO.

Navigator

Table XXXVII summarizes the I and P ratings for the role of navigator. A majority of the tasks did not change in I or P ratings from the F-4 to the F-14. The relatively large percentage of D classified tasks on the P scale was possibly due to individual differences in attitude towards the use of certain navigational modes (especially the DR Navigational Computer) to perform certain functions. Table XXXVIII presents an overview of the C ratings. Again, a majority of the ratings did not change for the tasks in this role. The two tasks in duty IV.A were rated as an increase due to the addition of the F-14 INS, which gives the F-14 NFO more responsibilities. This addition is also represented in duty IV.E. The only other major change was in duty IV.F. As discussed previously, this change is due to an increase in interpretation problems for the NFO monitoring the F-14 pulse radar display for land-mapping purposes.

Assessor of Systems

Table XXXIX presents an overview of the I and P ratings. As with most roles, I changed less than P. Most of the change was due to the addition of new tasks to the F-14 in duty V.B. Again, this is indicative of the new systems that have to be assessed and the new self-test capabilities present in the F-14.

Table XL summarizes the C ratings. For duty V.A., it can be seen that, as in the I and P ratings, there was not much change. However, duty V.B. does have a significant number of new and increased tasks. Overall, about half the tasks in the role do not change within the dimensions used. The change seems to be relatively divided between new and increased tasks for the F-14.

Tactician

As mentioned previously, the full assessment of the F-14 NFO's tactical role must wait until tactics, and thus crew responsibilities are further developed. Educated guesses made by the advisors indicate that the role will increase for a given rank and experience level due to the design of the F-14 weapon system and to FAS emphasis. Table XLI summarizes the I and P ratings for tasks within role VI. Most tasks did not change on these dimensions. This is probably due in part to a lack of tactical experience with the F-14 and also to the insensitivity of the ratings to changes in this particular role. Hopefully, the introduction can provide additional useful information concerning this role. Table XLII does indicate an increase in the overall complexity of the Tactician's role for the F-14 NFO. A large portion of common tasks, found mostly in duties VI.A and VI.B, increase in C. The majority of tasks in duty VI.C do not change.

POSITION COMPARISON

Table XLIII presents an overview of the P and I ratings for all the roles. As can be seen, a majority of the tasks were rated the same for both the F-4 and F-14 on both the P and I dimensions. The commonality on these dimensions is due in part to the relative similarity of the equipment and missions of the two fighters as compared to other aircraft such as patrol aircraft. The contingencies of the NFO's actions are similar in both fighters. Tasks classified as unique to the F-14 are, for the most part, rated low on the P dimension and medium on the I dimension. Important exceptions to this trend are tasks found in Sensor Manager and Tactician. Refer to the discussions of these two roles for an explanation of these differences. Table XLIV presents a summary of the roles according to the C dimension. Role I, Sensor Manager, accounts for much of the change between the two aircraft. The tasks in Sensor Manager account for 26% of the total tasks, but tasks within this role make up 46% of the tasks unique to the F-14. Furthermore, 62% of the total tasks that decreased are found within the role of Sensor Manager. Tasks in Weapons Manager account for 26% of the tasks unique to the F-14, while the total number of tasks in this role make up only 9% of the total tasks. The AWG-9 weapon system decreases some of the previous load of the F-4 NFO through better displays and capabilities, but it also drastically increases the F-14 NFO's chores by providing new radar modes, new displays, new sensors, etc. While the F-14 NFO has few new tasks in his role as Tactician, he does have a large portion of tasks that have been classified as an increase in C due to the rise in complexity of the overall tactical picture. A large portion of the tasks within Communicator/Coordinator, Navigator, and Assessor of Systems remain the same within the C dimension.

Before ending this comparison of overall positions, it would perhaps be best to discuss the integrated manner in which the NFO performs his roles. These roles are not performed in a vacuum, and thus the "time-sharing" factor mentioned previously must be extended to include this overall coordination of activities. Stated simply, because there is more for an NFO to do on an F-14, his task of coordinating the various roles becomes more complex. It is important to realize that the tasks, duties, and roles presented here are in reality a highly integrated activity and, because of the learning-to-timeshare factor mentioned previously, training for both the F-4 and F-14 must emphasize this integration. Because the F-14 is more complex, this is especially important for the F-14 NFO. It is due to this factor that some advisors have mentioned the possibility of using only experienced (second tour) personnel for the F-14.

Table 1

A Comparison of the Operational Modes of the AWG-9 (F-14)* and AWG-10 (F-4)

AWG-9 Operational Modes	AWG-10 Operational Modes
AIR-TO-AIR	AIR-TO-AIR
SEARCH	SEARCH
Air-to-Air Pulse Search (PULSE SEARCH) Range-While-Search (RWS) Pulse Doppler Search (PD SEARCH) IR/TV Search	Air-to-Air Pulse (P) Search Pulse Doppler (PD) Search
MULTIPLE TARGET TRACK	SINGLE TARGET ACQUISITION
Track-While-Scan Automatic (TWS AUTO) Manual (TWS MAN)	PD Acquisition from Velocity Search Automatic PD Acquisition PD Manual Track Acquisition (very rarely used) Pulse Acquisition Pulse Manual Track Acquisition Pilot Lock-On Modification (PLM)
SINGLE TARGET ACQUISITION	SINGLE TARGET TRACK
MCO Rapid Lock-On (MRL) Vertical Scan Lock-On (VSL) Pilot Lock-On (PLM) Optical Acquisition Manual Pulse Lock-On Computer Assisted TWS-Pulse Lock-On Computer Assisted Pulse Doppler Track-Pulse Lock-On IR/TV Assisted Pulse Lock-On Manual Pulse Doppler Lock-On Computer Assisted TWS-Pulse Doppler Lock-On Computer Assisted Pulse Track-Pulse Doppler Lock-On IR/TV Assisted Pulse Doppler Lock-On IR/TV Lock-On	PD Automatic Track P Automatic Track PD Manual Track P Manual Track PD Jam-Angle Track (AOJ/HOJ) P Jam Angle Track (AOJ/HOJ) PD J Track
SINGLE TARGET TRACK	AIR-TO-GROUND
Pulse Single Target Track (PULSE STT) Range Track Jam-Angle-Track (JAT) Pulse Doppler Single Target Track (PD STT) Velocity Track Jam-Angle-Track (JAT) Optical Track IR/TV Track	SEARCH
AIR-TO-GROUND	Air-to-Ground Pulse Search
SEARCH	
Air-to-Ground Pulse Search (PULSE SEARCH)	
WEAPON DELIVERY	
Air-to-Ground Weapon Delivery (A/G)	
SUPPLEMENTARY MODES	
Raid Size Estimation Target Identification	

*Reprinted from reference 1.

Table II

Examples of AWG-9 Computer Program Functions.*

-
- . Radar. Perform clutter rejection computations.
 - . Transmitter pulsewidth, pulse length, PRF selection.
 - . Antenna control.
 - . Speed tracker acquisition commands.
 - . Controls and displays. Accept data inserted by the operator and format the synthetic video display.
 - . Missile preparation and attack. Determine optimum attack priority, pilot steering for maximum kills, and time to fire each missile and generate message sent to missile during flight.
 - . ECM functions. Radar and infrared angle ranging. Track extrapolation. Observation processing according to ECM environment.
 - . Data Link. Associate data link targets with radar targets and generate reply to NTDS.
 - . Automatic built-in-test. In-flight test of AWG-9, AIM-54 and other avionics.
 - . Navigation. Navigation computations simultaneous with tactical and BIT modes.
 - . ACM. Short range attack mode computations for missile launch and gun control.
 - . Air-to-ground. Release and steering data for pilot and control signals to integrated armament control system.
 - . Single target track. Computer track files for both pulse and pulse doppler. Assists radar in automatic track transfer.
 - . Multiple target track. Track-while-scan computations.
-

* Reprinted from Reference 7.

Table III

Ratings Used for the P, I, C Dimensions and Their Abbreviations

Proportion of Time and Effort and Importance Classification Codes

H	-	High
M-H	-	Medium Ranging to High
M	-	Medium
L-M	-	Low Ranging to Medium
L	-	Low
D	-	Diverse Ratings

Complexity Classification Codes

+	Increase F-4 to F-14
=	Approximately the same
-	Decrease F-4 to F-14
*	Unique to F-14

For an explanation of Proportion of Time and Effort, Importance and Complexity classifications, see the Procedure section.

Table IV

Duty I.A. Coordinate Sensors

Task Code	Task Statement	Rating Classifications				
		<u>F-4</u>		<u>F-14</u>		C
		P	I	P	I	
I.A.1	Evaluate threat information from all sources in order to select the optimum sensor/sensor mode for threat detection, utilizing each sensor independently or simultaneously to maximize that detection capability.	H	H	H	H	+
I.A.2	Coordinate sensor activity using the AWG-9/AWG-10 systems.	M-H	M-H	M-H	M-H	+

Table V

Duty I.B. Manage Radar

Task Code	Task Statement	Rating Classifications					C
		F-4		F-14		C	
		P	I	P	I		
I.B.1	Evaluate effects of own altitude, air-speed, weather, and surface conditions in order to determine system effectiveness in given situation.	L-M	M	L-M	M	=	
I.B.2	Evaluate effects of airborne target size, and altitude in order to determine system effectiveness.	L-M	M	L-M	M	=	
I.B.3	Evaluate effects of surface target size in order to determine system effectiveness.	L-M	M	L-M	M	=	
I.B.4	Determine the presence of and evaluate the effects of ducting on sensor effectiveness.	L	L-M	L	L-M	=	
I.B.5	Evaluate the effects of enemy ECM on radar in order to employ tactics to counter the ECM.	D	D	M-H	M-H	+	
I.B.6	Select alternate radar modes in order to optimize system effect in the event of a system malfunction.	M-H	M-H	M-H	M-H	+	
I.B.7	Determine/control elevation search angle and altitude differential to set up scan and plan intercept.	M-H	M-H	M-H	M-H	-	
I.B.8	Determine airspeed, altitude, and search pattern in order to optimize radar capabilities in a given situation.	M	M-H	M	M-H	-	

Table VI

Duty I.C. Operate Radar: Air-to-Air

Task Code	Task Statement	Rating Classifications					C	
		P	F-4		P	F-14		
			I			I		
I.C.1	Search using PD search.	M-H	M-H	H	M-H	-		
I.C.2	Search using pulse search.	M-H	M-H	M-H	M-H	+		
I.C.3	Search using Range-While-Scan (RWS).	N.A.	N.A.	M	M-H	*		
I.C.4	Acquire target in PD track from velocity search in non-ECM conditions.	M-H	M-H	M-H	M-H	-		
I.C.5	Acquire the target in PD track from velocity search in ECM conditions.	D	M-H	M-H	M-H	-		
I.C.6	Select proper configuration of system in order to acquire single target in PD track automatically.	L-M	D	M	M-H	+		
I.C.7	Acquire the target in pulse track from pulse search in non-ECM conditions.	M-H	M-H	M-H	M-H	+		
I.C.8	Acquire the target in pulse track from pulse search in ECM conditions.	M-H	M-H	M-H	M	+		
I.C.9	Acquire the target using IR assisted PD Lock-On in ECM conditions.	N.A.	N.A.	M	M	*		
I.C.10	Acquire the target using IR assisted PD Lock-On in non-ECM environment.	N.A.	N.A.	L-M	L-M	*		
I.C.11	Acquire the target using IR assisted Pulse Lock-On in ECM conditions.	N.A.	N.A.	M	M	*		
I.C.12	Acquire the target using IR assisted Pulse Lock-On in non-ECM conditions.	N.A.	N.A.	L-M	L-M	*		
I.C.13	Acquire the target using TV assisted PD Lock-On.	N.A.	N.A.	L-M	M	*		

Table VI (Continued)

Duty I.C. Operate Radar: Air-to-Air

Task Code	Task Statement	Rating Classifications					C
		F-4 P	I	P	F-14 I		
I.C.14	Acquire the target using TV assisted Pulse Lock-On.	N.A.	N.A.	M	M	*	
I.C.15	Acquire the target using MCO Rapid Lock-On (MRL).	N.A.	N.A.	M-H	H	*	
I.C.16	Acquire the target using Vertical Scan Lock-On (VSL)	N.A.	N.A.	M-H	H	*	
I.C.17	Monitor track of target using PD automatic track.	M-H	M-H	M-H	M-H	-	
I.C.18	Monitor track of target using Pulse automatic track.	M-H	M-H	M-H	M-H	+	
I.C.19	Track the target using Pulse manual track.	D	D	D	M	+	
I.C.20	Monitor track of target using PD AOJ/HOJ (jam angle track).	D	M	M	M-H	-	
I.C.21	Monitor track of target using Pulse AOJ/HOJ (jam angle track).	D	M	D	M-H	-	
I.C.22	Monitor track of multiple targets in TWS mode.	N.A.	N.A.	M-H	M-H	*	

Table VII

Duty I.D. Operate IR: Air-to-Air

Task Code	Task Statement	Rating Classifications					C
		F-4		F-14			
		P	I	P	I		
I.D.1	Search using IR.	N.A.	N.A.	M	M	*	
I.D.2	Acquire the target using IR Lock-On.	N.A.	N.A.	L-M	M	*	
I.D.3	Monitor automatic IR track of target.	N.A.	N.A.	L-M	M	*	
I.D.4	Slave IR scan to radar.	N.A.	N.A.	L	L-M	*	

Table VIII

Duty I.E. Operate TV

Task Code	Task Statement	Rating Classifications					C
		F-4		F-14			
		P	I	P	I		
I.E.1	Search using TV.	N.A.	N.A.	M	M	*	
I.E.2	Slave TV scan to radar.	N.A.	N.A.	L	M	*	
I.E.3	Identify target using TV.	N.A.	N.A.	M	M	*	

Table IX

Duty I.F. Visual Scan

Task Code	Task Statement	Rating Classifications				C
		F-4		F-14		
		P	I	P	I	
I.F.1	Search for airborne targets using visual scan.	M-H	H	M-H	H	-
I.F.2	Track airborne target visually.	M	H	M	H	-
I.F.3	Monitor ground and search/acquire controller or ground target.	M-H	M-H	M	M-H	-
I.F.4	Monitor ground and sky for position of enemy AAA fire.	M-H	H	M-H	H	-
I.F.5	Monitor ground for terrain avoidance.	M-H	M-H	M	M-H	-
I.F.6	Transition from radar contact to visual track of airborne target.	M-H	M-H	D	D	-
I.F.7	Transition from ECM contact to visual track of airborne target/weapon.	D	D	D	M-H	-

Table X

Duty I.G. Operate Counter Measures

Task Code	Task Statement	Rating Classifications					C
		F-4		F-14			
		P	I	P	I		
I.G.1	Operate AN/ALQ 51A/100 for DECM purposes.	D	M-H	M	M-H	=	
I.G.2	Monitor AN/ALR 27 for missile alert.	D	D	D	M-H	=	
I.G.3	Monitor AN/APR-25 for enemy radar alert and evaluate implications of strobe display.	D	D	D	D	=	
I.G.4	Operate AN/ALE-29A Chaff dispenser to disrupt enemy radar.	D	M-H	L-M	M-H	=	
I.G.5	Operate/monitor AN/APX-76A interrogation equipment to identify unknown aircraft.	M	M	M	M	=	

Table XI

Duty II.A Manage Air-to-Air Weapons (nuclear weapons, missiles, conventional gunnery, rockets).

Task Code	Task Statement	Rating Classifications					C
		F-4		F-14			
		P	I	P	I		
II.A.1	Evaluate the effects of number of targets, type of threat, and other aspects of the tactical situation in order to select which weapon to employ to best counter threat.	M	M-H	M-H	M-H	+	
II.A.2	Evaluate aircraft and missile characteristics in order to direct aircraft/flight to launch envelope for selected weapon.	M-H	M-H	M-H	M-H	+	
II.A.3	Evaluate target aspect and lateral separation in order to determine optimum firing position.	H	M-H	M-H	M-H	-	
II.A.4	Coordinate with pilot concerning missile firing parameters.	M-H	H	M-H	H	+	
II.A.5	Track and illuminate target for air-to-air missiles/Aim-9, Aim-7, and Aim-54.	N.A.	N.A.	M-H	H	*	
II.A.6	Determine optimum moment when to commit weapon.	M-H	H	M-H	H	=	

Table XII

Duty II.B. Operate Aim 7F/7E

Task Code	Task Statement	Rating Classifications				
		F-4		F-14		C
		P	I	P	I	
II.B.1	Prepare Missiles.	N.A.	N.A.	L	M	*
II.B.2	Provide speedgate position when otherwise not available.	N.A.	N.A.	L	M-H	*
II.B.3	Trigger missiles.	N.A.	N.A.	L	M-H	*
II.B.4	Safe missiles.	N.A.	N.A.	L	L-M	*

Table XIII

Duty II.C. Operate Aim 54A

Task Code	Task Statement	Rating Classifications				
		F-4		F-14		C
		P	I	P	I	
II.C.1	Prepare missiles.	N.A.	N.A.	L	L-M	*
II.C.2	Safe missiles.	N.A.	N.A.	L	L	*

Table XIV

Duty II.D Manage Air-to-Ground Weapons (bombs, missiles, nuclear weapons, conventional gunnery, incendiaries).

Task Code	Task Statement	Rating Classifications				
		F-4		F-14		C
		P	I	P	I	
II.D.1	Evaluate the effects of number of targets, type of targets, terrain, and target size in order to select which weapon to employ to best achieve mission success.	D	D	L	M	=
II.D.2	Evaluate manual air-to-ground release parameters of dive angle, airspeed, and release altitude.	M	M	L-M	L-M	=
II.D.3	Evaluate automatic air-to-ground release parameters of dive angle, airspeed, and release altitude.	N.A.	N.A.	L	L-M	*
II.D.4	Coordinate with pilot concerning air-to-ground release parameters.	M	M	L-M	M	=
II.D.5	Determine optimum moment when to commit weapon.	M-H	M-H	M	M-H	=
II.D.6	Assess battle damage to own aircraft and target.	M	M	M	M	=
II.D.7	Select A/G mode.	N.A.	N.A.	L	M-H	*

Table XV

Duty III.A Coordinate Using UHF Communications

Task Code	Task Statement	Rating Classifications					C
		F-4		F-14			
		P	I	P	I		
III.A.1	Communicate with tactical controlling (such as picket ship, VAW aircraft, VA aircraft, other fighter aircraft, carrier and ground control) concerning position, mission, and tactical information.	M-H	M-H	M-H	M-H	=	
III.A.2	Communicate with tactical controlling agencies concerning own weapon system status and aircraft system failures.	M-H	M	M-H	M	=	
III.A.3	Communicate with tactical controlling agencies concerning the threat environment and mission success.	D	M	L	D	=	
III.A.4	Communicate with the carrier in its control zone under VFR day conditions (including check-in, checkout, tower, ground control LSO, approach, and departure).	L-M	M	L-M	M	=	
III.A.5	Communicate with the carrier in its control zone under IFR and night conditions (including approach, departure, CCA (ACL), Marshal, LSO).	M-H	M	M-H	M	=	
III.A.6	Communicate with an airport in its control zone under VFR conditions including ground control and tower.	D	M	L-M	M	=	
III.A.7	Communicate with an airport in its control zone under IFR conditions including approach, departure, and GCA.	M-H	M	M-H	M	=	

Table XV (Continued)

Duty III.A Coordinate Using UHF Communications

Task Code	Task Statement	Rating Classifications					C
		F-4		F-14			
		P	I	P	I		
III.A.8	Communicate and receive enroute information from air traffic control, GCI, metro, FSS, approach, and departure.	M-H	M	M-H	M	=	
III.A.9	Communicate in emergency situations, including own aircraft emergency, other aircraft emergency, SAR and lost aircraft.	L-M	M-H	L-M	M-H	=	
III.A.10	Operate the KY-28 in order to have secure UHF communications.	L	D	L	D	=	

Table XVI

Duty III.B Coordinate Using Visual Communications

Task Ccde	Task Statement	Rating Classifications				
		F-4		F-14		C
		P	I	P	I	
III.B.1	Communicate with other aircraft via visual head, hand, or light signals.	M	M	M	M	=
III.B.2	Communicate with air station ground crew or tower via visual head, hand, or light signals.	L	L	L	L	=
III.B.3	Communicate with carrier flight deck personnel or tower via visual, head, hand, or light signals.	L	M	L	M	=
III.B.4	Back-up pilot on LSO visual hand or light signals while on glide slope.	D	D	M	M	=

Table XVII

Duty III.C Coordinate Using Data Link Communication

Task Code	Task Statement	Rating Classifications					C
		F-4		F-14			
		P	I	P	I		
III.C.1	Interpret (and transmit) tactical information to/from ATDS.	L-M	M	L-M	M	+	
III.C.2	Interpret (and transmit) tactical information to/from NTDS.	L-M	M	L-M	M	+	
III.C.3	Operate DL with respect to automatic carrier landings.	L-M	M	L-M	M	+	
III.C.4	Interpret (and transmit) tactical information to/from MTDS.	D	M	L	M	+	
III.C.5	Interpret (and transmit) tactical information to/from other fighters (if capability becomes available).	N.A.	N.A.	L-M	M	*	

Table XVIII

Duty III.D Coordinate Using ICS Communications

Task Code	Task Statement	Rating Classifications				C
		F-4		F-14		
		P	I	P	I	
III.D.1	Communicate directive and descriptive commentary to the pilot/flight during the air-to-air intercept.	H	H	H	H	-
III.D.2	Communicate directive and descriptive commentary to the pilot/flight during ACM.	H	H	H	H	+
III.D.3	Direct pilot to visual acquisition of friendly/unfriendly aircraft.	M-H	H	M-H	H	+
III.D.4	Confer with pilot on decision to engage.	M-H	M-H	M-H	M-H	=
III.D.5	Advise pilot concerning flight parameters of fuel state, target energy level, closure rate, target altitude, number of targets, type of threat, and target size in a tactical situation.	M-H	M-H	M-H	M-H	-
III.D.6	Confer with pilot concerning target priority.	M-H	M	M-H	M	+
III.D.7	Confer with pilot on type weapon to be used.	M-H	M-H	M-H	M-H	+
III.D.8	Advise pilot of weapon expenditure and effectiveness.	D	D	D	D	-
III.D.9	Advise pilot of own aircraft damage.	D	D	L	M-H	=
III.D.10	Communicate descriptive and directive commentary to the pilot during air-to-ground weapons delivery including altitude, airspeed, glide angle, and flak.	H	M-H	M-H	M-H	-

Table XVIII (Continued)

Duty III.D Coordinate Using ICS Communications

Task Code	Task Statement	Rating Classifications					C
		F-4		F-14			
		P	I	P	I		
III.D.11	Provide pilot with rendezvous information of altitude, speed, heading, closure rate, and relative position.	M	M	M	M	=	
III.D.12	Advise pilot of aircraft status, system effectiveness and aircraft failure.	M	M-H	M	M-H	+	
III.D.13	Advise pilot of ECM encounter.	M-H	M-H	M-H	M-H	+	
III.D.14	Advise pilot of fuel and heading for egress.	M	M-H	M	M-H	=	
III.D.15	Advise pilot concerning navigation information.	M-H	M-H	M-H	M-H	+	
III.D.16	Advise pilot of surface threats and pertinent surface contacts.	L-M	M	L-M	M	=	
III.D.17	Advise pilot of wingman's position in all tactical situations.	M-H	M-H	M-H	M-H	=	
III.D.18	Advise pilot during air refueling concerning relative position of In-flight Refueling (IFR) probe and drogue.	M-H	M	M-H	M	-	
III.D.19	Assist the pilot through a system of challenge and reply statements on checklists (such as start, taxi, takeoff, landing, weapon arm/dearm, shutdown, etc.).	L-M	M	L-M	M	+	

Table XIX

Duty IV.A Manage Navigation

Task Code	Task Statement	Rating Classifications					C
		<u>F-4</u>	<u>F-14</u>				
		P	I	P	I		
IV.A.1	Selection navigation mode.	L	L-M	L-M	L-M	+	
IV.A.2	In degraded mode, evaluate information from various inputs to determine effectiveness of navigation modes.	L-M	M-H	L-M	M-H	+	

Table XX

Duty IV.B Navigate Using TACAN

Task Code	Task Statement	Rating Classifications					C
		F-4		F-14			
		P	I	P	I		
IV.B.1	Perform airways navigation using TACAN.	L-M	L-M	L-M	L-M	=	
IV.B.2	Compute GS using TACAN.	L-M	L-M	L	L-M	=	
IV.B.3	Using TACAN, navigate from own position to another TACAN position not overhead the station.	M	M	M	M	=	
IV.B.4	Using air-to-air TACAN (and ADF information) acquire relative position information needed to effect rendezvous.	L	M	M	M	=	
IV.B.5	Navigate during ASR/TACAN approach.	D	M	M	M	=	
IV.B.6	Plot own position using TACAN information.	M-H	M	M	M	=	
IV.B.7	Using TACAN fix, update INS (F-14)/DR NAV Computer (F-4).	D	M	L-M	M	+	
IV.B.8	Monitor TACAN and advise pilot during takeoff.	D	M	L	M	=	
IV.B.9	Monitor TACAN and advise pilot during approaches.	M-H	M	M-H	M	=	
IV.B.10	Monitor TACAN and advise pilot during departures.	M-H	M	M	M	=	
IV.B.11	Monitor TACAN and advise pilot while holding.	M	M	M	M	=	

Table XXI

Duty IV.C Navigate Using Visual Scan

Task Code	Task Statement	Rating Classifications					C
		F-4		F-14			
		P	I	P	I		
IV.C.1	Plot own position using visual reference to ground.	M	M-H	M	M-H	=	
IV.C.2	Navigate point-to-point using visual navigation procedures.	M-H	M-H	D	M-H	=	
IV.C.3	Monitor visually to acquire relative position information needed to effect rendezvous.	M	M	M	M	=	
IV.C.4	Monitor visually and advise pilot during VFR take-off and departures.	D	D	D	D	=	
IV.C.5	Monitor visually and advise pilot during VFR landings and approaches.	D	D	M	M-H	-	
IV.C.6	Monitor visually and advise pilot while holding.	L-M	M	L-M	M	=	
IV.C.7	Use visual fix to update INS (F-14) /DR NAV Computer (F-4).	D	D	L-M	M	+	

Table XXII

Duty IV.D Navigate Using UHF-ADF

Task Code	Task Statement	Rating Classifications				C
		F-4		F-14		
		P	I	P	I	
IV.D.1	Navigate point-to-point using UHF-ADF.	L	L-M	L	L-M	=
IV.D.2	Perform radial tracking and interception using ADF information.	L	L-M	L	L-M	=
IV.D.3	Plot own position using ADF.	L	L-M	L	L-M	=
IV.D.4	Use ADF to determine azimuth during DF steer.	L	L	L	L	=
IV.D.5	Use ADF cuts to acquire lost wingman.	L-M	M-H	L	D	=
IV.D.6	Use ADF in case of lost communication (NORDO).	D	D	L	D	=
IV.D.7	Use ADF information to assist pilot during departures, approaches and while holding.	L	L	L	L	=
IV.D.8	Locate UHF voice jammers using ADF.	L	D	L	M	=

Table XXIII

Duty IV.E Navigate Using Inertial Navigational System (INS)/DR NAV Computer

Task Code	Task Statement	Rating Classifications					C
		F-4		F-14			
		P	I	P	I		
IV.E.1	Plot own position using INS/DR NAV Computer.	D	M	D	M-H	=	
IV.E.2	Navigate point-to-point using INS/DR NAV Computer.	D	M	M-H	M-H	=	
IV.E.3	Plot position of way points (ultimate destination) using INS/DR NAV computer.	D	M	L-M	M-H	+	
IV.E.4	Navigate point-to-point using inertial Measurement Unit (IMU) information if Digital Differential Analyzer (DDA) fails (degraded mode, INS).	N.A.	N.A.	L	M	*	
IV.E.5	Navigate point-to-point using information derived from the Attitude Heading Reference System, if IMU fails (degraded mode, INS).	N.A.	N.A.	L	M	*	

Table XXIV

Duty IV.F Navigate Using Radar

Task Code	Task Statement	Rating Classifications				C
		<u>F-4</u>	<u>F-14</u>	<u>F-4</u>	<u>F-14</u>	
		P	I	P	I	
IV.F.1	Perform coastal mapping using radar.	M-H	M-H	M-H	M-H	+
IV.F.2	Distinguish prominent inland features using radar.	D	M	D	M	+
IV.F.3	Plot own position using radar information.	M	M	M	M	+
IV.F.4	Using radar fix, update INS (F-14) DR NAV Computer (F-4).	M	M	M	M	+
IV.F.5	Calculate G.S. using radar.	L	L	L	L	=
IV.F.6	Navigate point-to-point using radar (combined with DR).	D	M	L-M	M	+
IV.F.7	Monitor radar for aircraft avoidance during approaches, departures, and while holding to assist pilot.	M	M	L-M	L-M	=

Table XXV

Duty IV.G Navigate Using Flight Instruments/DR.

Task Code	Task Statement	Rating Classifications					C
		F-4		F-14			
		P	I	P	I		
IV.G.1	Plot own position using TAS, winds, and heading.	M	M	M	M	=	
IV.G.2	Compute fuel flow and fuel required for bingo fuel figures.	M-H	M-H	M-H	M-H	=	
IV.G.3	Monitor flight instruments and advise pilot during rendezvous.	L-M	M	L-M	M	=	
IV.G.4	Monitor flight instruments and advise pilot during takeoff, landing, approaches, departures, and while holding.	M	M-H	M	M-H	=	
IV.G.5	Monitor flight instruments and advise pilot during unusual flight regimes and emergencies.	M	H	M	H	=	

Table XXVI

Duty V.A Preparation and Inspection of Systems

Task Code	Task Statement	Rating Classifications					C
		F-4		F-14			
		P	I	P	I		
V.A.1	Pre/post flight inspect aircraft to insure integrity of external airframe.	M	M-H	M	M-H	=	
V.A.2	Pre/post flight inspect aircraft to externally check major systems/subsystems.	M	M-H	M	M-H	+	
V.A.3	Pre/post flight inspect aircraft to check weapon loading/offload.	M	M-H	M	M-H	=	
V.A.4	Preflight inspect RIO cockpit to insure proper configuration.	M	M-H	M	M-H	=	
V.A.5	Pre/post flight inspect personnel egress system.	M	M H	M	M-H	=	
V.A.6	Assist and challenge pilot on cockpit checks on AA weapons and AG weapons to insure proper procedures carried out.	L-M	M	L-M	M	=	
V.A.7	Monitor personnel and equipment present at start/shutdown to insure proper support/safety.	D	D	L-M	M	=	

Table XXVII

Duty V.B Assess System Status

Task Code	Task Statement	Rating Classifications					C
		F-4		F-14			
		P	I	P	I		
V.B.1	Isolate and record faults using test program of AWG-9/AWG-10 System.	M	M-H	M	M-H	-	
V.B.2	Assess degraded capabilities of AWG-9/ AWG-10 System using test program.	M	M-H	M	M-H	-	
V.B.3	Assess degraded capabilities of radar using scope display (operational mode).	D	M-H	M	M-H	+	
V.B.4	Isolate and record faults of communication equipment.	L-M	M-H	L-M	M-H	=	
V.B.5	Isolate and record faults of flight instruments.	D	M-H	M	M-H	=	
V.B.6	Assess status of AA weapons.	L	M-H	L-M	M-H	+	
V.B.7	Assess status of ECM equipment and isolate and record faults.	M	M	M	M-H	=	
V.B.8	Report all faults to proper maintenance personnel.	M	M-H	M	M-H	+	
V.B.9	Determine which major systems are affected by subsystems/modes degrade/malfunction and employ secondary modes to circumvent malfunction.	M	M-H	M	M-H	+	
V.B.10	Assess feasibility of mission completion or the commencement of an alternate mission applying system degradation/malfunction.	L-M	M	M	M	=	
V.B.11	Conduct CM to assess, isolate, and record system malfunction and degradation.	N.A.	N.A.	L	M-H	*	

Table XXVII (Continued)

Duty V.B Assess System Status

Task Code	Task Statement	Rating Classifications				C
		F-4		F-14		
		P	I	P	I	
V.B.12	Conduct MOAT to assess, isolate, and record system malfunction and degradation.	N.A.	N.A.	M	M-H	*
V.B.13	Record all system malfunctions on MSN recorder.	N.A.	N.A.	L	M	*
V.B.14	Record all system malfunctions on knee board checklist/form.	L-M	M	L-M	M	=
V.B.15	Conduct inertial alignment checks.	N.A.	N.A.	M	M	*
V.B.16	Isolate and record faults in AWG 15.	N.A.	N.A.	L	M	*
V.B.17	Isolate and record faults in NAV instruments (CNO).	D	D	L-M	M-H	+

Table XXVIII

Duty VI.A Coordinate Combat Air Patrols and Escort Missions

Task Code	Task Statement	Rating Classifications				C
		F-4		F-14		
		P	I	P	I	
VI.A.1	Evaluate own aircraft's role in loose deuce tactics for BARCAP, TARCAP, RESCAP, and fighter sweep missions in order to make recommendations to maintain mutual support both in maintaining the offensive and encountering threats from a defensive position.	D	D	D	D	=
VI.A.2	Recommend lead and wingman support responsibilities in order to determine spatial positioning during BARCAP, TARCAP, RESCAP, and escort missions.	D	D	D	D	=
VI.A.3	Be aware of friendly flight composition, strike route, speed, and altitude, and of enemy defense posture, both in the air and on the ground, in order to recommend the proper escort tactics.	M	M	M	M	=
VI.A.4	Be aware of friendly force ship and aircraft dispositions, size, communications, sensors, and weapons in order to fully realize and understand the employment of the F-4/F-14 in the tactical picture.	M-H	M-H	M-H	M-H	+
VI.A.5	Evaluate the impact of various fighter altitudes, threat altitudes, relative overtake, and look-up/look-down in order to detect required threats.	M	M	M	M	+
VI.A.6	Plan flight composition for tactical mission.	D	D	D	D	+
VI.A.7	Coordinate through the AWG-9 (F-14) system the capability of handling simultaneously a multi-target situation.	N.A.	N.A.	M	M-H	*

Table XXIX

Duty VI.B Coordinate Aerial Combat Maneuvers

Task Code	Task Statement	Rating Classifications				C
		F-4		F-14		
		P	I	P	I	
VI.B.1	Evaluate the relative performance of the F-4/F-14 and the threat aircraft in order to maximize the F-14's performance characteristics in a given situation.	M	M	M	M	+
VI.B.2	Evaluate threat aircraft air-to-air-weapons capabilities and determine the optimum approach to maximize F-4/F-14 weapon effectiveness while minimizing exposure to threat weapon systems.	M	M	M	M	+
VI.B.3	Evaluate the effects of target maneuvering, target size, engagement altitude, closure rate, energy level, and angular drift in order to maneuver aircraft/flight effectively to the launch envelope for the selected weapon.	M	M	M	M	+
VI.B.4	Evaluate fuel consumption versus range/time completion and altitude differential in order to direct aircraft/flight to launch envelope for selected weapon.	M	M-H	M	M-H	-
VI.B.5	Evaluate the intercept triangle and its associated principles in various types of intercepts in order to direct the aircraft/flight to launch envelope for selected weapon.	M-H	M-H	M-H	M-H	+
VI.B.6	Detect significant changes in intercept parameters in order to direct the aircraft/flight to launch envelope for selected weapon.	M-H	M-H	M-H	M-H	-

Table XXIX (Continued)

Duty VI.B Coordinate Aerial Combat Maneuvers

Task Code	Task Statement	Rating Classifications				C
		F-4		F-14		
		P	I	P	I	
VI.B.7	Determine the basic air combat maneuver in order to attain the optimum launch position.	M	M	M	M	-
VI.B.8	Compute drag index/aircraft gross wt. for aircraft configuration and relate these figures to aerodynamic performance.	D	D	L	M	+
VI.B.9	Determine when an engagement has degenerated into a defensive situation in order to recommend prudent escape maneuvers to the pilot considering bingo direction, fuel, and defenses.	L-M	M-H	L-M	M-H	=

Table XXX

Duty VI.C Coordinate Intelligence Collection and Dissemination

Task Code	Task Statement	Rating Classifications				C
		F-4		F-14		
		P	I	P	I	
VI.C.1	Assess, record, and report mission effectiveness.	L-M	L-M	L-M	L-M	=
VI.C.2	Record intelligence data inflight.	L	L-M	L	L-M	+
VI.C.3	Record weather data inflight.	L	L-M	L	L-M	=
VI.C.4	Use hand-held camera inflight for photographic intelligence.	L	M	L	M	=
VI.C.5	Construct and conduct mission brief.	M	M	M	M	+
VI.C.6	Record unfriendly ECM contacts as to duration, strength, position, frequency/band and the affect on our ECM.	L	L-M	L	L-M	=

Table XXXI

Summary of Cross Ratings for the P and I Dimensions in the Role of Sensor Manager

	Percentage of Tasks	Included Tasks from Duties:	Median Ratings	
			F-14	F-4
PROPORTION OF TIME AND EFFORT				
Rating did not change F-4 to F-14	38	IA,IB,IC,IF,IG	M-H	M-H
Rating increased from F-4 to F-14	4	IC	M-H	M
Rating decreased from F-4 to F-14	4	IF	M	M-H
Tasks classified as D (F-4 D - 20%) (F-14 D - 12%)	22	IC,IB,IG	M	M-H
Tasks classified as unique to F-14	33	IC,ID,IE	M	
IMPORTANCE				
Rating did not change F-4 to F-14	47	IA,IB,IC,IF,IG	M-H	M-H
Rating increased from F-4 to F-14	4	IC	M-H	M
Rating decreased from F-4 to F-14	2	IC	M	M-H
Tasks classified as D (F-4 D - 12%) (F-14 D - 4%)	14	IB,IC,IF,IG	M-H	M-H
Tasks classified as unique to F-14	33	IC,ID,IE	M	

Table XXXII

A Comparison of the Role and Duties of Sensor Manager in the F-4 and F-14
on the Basis of the Percentage of Tasks Occurring in Selected
Categories of Comparative Complexity

		Complexity of the Task in the F-14 as Compare to its Counterpart (if available) in the F-4			Unique to	Total No. of Tasks
		Increase	Approx. Same	Decrease		
I.	Sensor Manager	20	17	31	33	51
I.A	Coordination of Sensors	100	0	10	---	2
I.B	Manage Radar	25	50	25	---	8
I.C	Operate Radar: Air-to-Air	27	---	27	45	22
I.D	Operate IR: Air-to-Air	---	---	---	100	4
I.E	Operate TV	---	---	---	100	3
I.F	Visual Scan	---	---	100	---	7
I.G	Operate Counter- Measures	---	100	---	---	5

Table XXXIII

Summary of Cross-Ratings for the P and I Dimensions in the Role of Weapons Manager

	Percent- age of Tasks	Included Tasks from Duties	Median Ratings	
			F-14	F-4
PROPORTION OF TIME AND EFFORT				
Rating did not change F-4 to F-14	21	IIA, IID	M-H	M-H
Rating increased from F-4 to F-14	5	IIA	M-H	M
Rating decreased from F-4 to F-14	21	IIA, IID	L-M/M	M/M-H
Tasks classified as D (F-4 D - 5%) (F-14 D - 0%)	5	IID	L	-
Tasks classified as unique to F-14	47	IIA, IIB, IIC, IID	L	-
IMPORTANCE				
Rating did not change F-4 to F-14	43	IIA, IID	M-H	M-H
Rating increased from F-4 to F-14	--	-	-	-
Rating decreased from F-4 to F-14	5	IID	L-M	M
Tasks classified as D (F-4 D - 5%) (F-14 D - 0%)	5	IID	M	-
Tasks classified as unique to F-14	47	IIA, IIB, IIC, IID	M	

Table XXXIV

A Comparison of the Role and Duties of Weapons Manager in the F-4 and F-14
on the Basis of the Percentage of Tasks Occurring in Selected
Categories of Comparative Complexity

		Complexity of the Task in the F-14 as Compared to its Counterpart (if available) in the F-4			Total	
		Increase	Approx , Same	Decrease	No.	
					Unique to F-14 Tasks	
II.	Weapons Manager	16	32	5	47	19
II.A	Manage Air-to-Air Weapons	50	17	17	17	6
II.B	Operate Aim 7F/7E	--	--	--	100	4
II.C	Operate Aim 54A	--	--	--	100	2
II.D	Manage Air-to- Ground Weapons	--	71	--	29	7

Table XXXV

Summary of Cross-Ratings for the P and I Dimensions in the
Role of Communicator/Coordinator

	Percent- of Tasks	Included Tasks from Duties	Median Ratings	
			F-14	F-4
PROPORTION OF TIME AND EFFORT				
Rating did not change F-4 to F-14	79	IIA ,IIB ,IIC ,IID	M-H	M-H
Rating increased from F-4 to F-14	--	-	-	-
Rating decreased from F-4 to F-14	3	IIID	M-H	H
Tasks classified as D (F-4 D - 17%) (F-14 D - 3%)	17	IIA ,IIB ,IIC ,IID	L	D
Tasks classified as unique to F-14	3	IIIC	L-M	-
IMPORTANCE				
Rating did not change F-4 to F-14	85	IIIA ,IIIB ,IIIC ,IIID	M	M
Rating increased from F-4 to F-14	--	-	-	-
Rating decreased from F-4 to F-14	--	-	-	-
Tasks classified as D (F-4 D - 11%) (F-14 D - 5%)	11	IIIA ,IIIB ,IIID	M/M-H	M-H
Tasks classified as unique to F-14	3	IIIC	M	-

Table XXXVI

A Comparison of the Role and Duties of Communicator/Coordinator in the F-4 and F-14 on the Basis of the Percentage of Tasks Occurring in Selected Categories of Comparative Complexity

Complexity of the Task in the F-14 as Compared to its Counterpart (if available) in the F-4					
	Increase	Approx. Same	Decrease	Unique to F-14	Total No. of Tasks
III. Communicator Coordinator	32	53	13	3	38
III.A Coordinate using UHF Communications	--	100	--	-	10
III.B Visual Communications	--	100	--	-	4
III.C Coordinate using Data Link	80	--	--	20	5
III.D I.C.S. Communications	42	32	26	--	19

Table XXXVII

Summary of Cross-Ratings for the P and I Dimensions in the Role of Navigator

	Percentage of Tasks	Included Tasks from Duties	Median Ratings F-14	F-4
PROPORTION OF TIME AND EFFORT				
Rating did not change F-4 to F-14	54	IVA, IVB, IVC	L-M/M	L-M/M
Rating increased from F-4 to F-14	2	IVD, IVF, IVG	L-M	L
Rating decreased from F-4 to F-14	6	IVB, IVF	M	M-H
Tasks classified as D (F-4 D - 26%) (F-14 D - 9%)	28	IVB, IVC, IVD, IVE, IVF	L-M	M-H
Tasks classified as unique to F-14	4	IVE	L	
IMPORTANCE				
Rating did not change F-4 to F-14	73	IVA, IVB, IVC, IVD, IVF, IVG	M	M
Rating increased from F-4 to F-14	7	IVE	M-H	M
Rating decreased from F-4 to F-14	2	IVF	L-M	M
Tasks classified as D (F-4 D - 10%) (F-14 D - 6%)	12		M	M-H
Tasks classified as unique to F-14	4	IVE	M	

Table XXXVIII

A Comparison of the Role and Duties of Navigator in the F-4 and F-14
on the Basis of the Percentage of Tasks Occurring in Selected
Categories of Comparative Complexity

Complexity of the Task in the F-4 as Compared to its Counterpart (if available) in the F-14						
		Increase	Approx. Same	Decrease	Unique to F-14	Total Number of Tasks
IV.	Navigator	22	73	-	4	45
IV.A	Manage Navigation	100	--	-	-	2
IV.B	Navigate Using TACAN	9	91	-	-	11
IV.C	Navigate Using Visual Scan	14	86	-	-	7
IV.D	Navigate Using UHF-ADF	--	100	-	-	8
IV.E	Navigate Using Inertial System (INS)/DR Nav Computer	20	40	-	40	5
IV.F	Navigate Using Radar	71	29	-	-	7
IV.G	Navigate Using Flight Instru- ments	--	100	-	-	5

Table XXXIX

Summary of Cross-Ratings for the P and I Dimensions in the
Role of Assessor of Systems

	Percentage of Tasks	Included Tasks from Duties:	Median Ratings F-14	F-4
PROPORTION OF TIME AND EFFORT				
Rating did not change F-4 to F-14	54	VA,VB	M	M
Rating increased from F-4 to F-14	8	VB	L-M/M	L-M/L
Rating decreased from F-4 to F-14	-	-	-	-
Tasks classified as D (F-4 D - 16%) (F-14 D - -)	16	VA,VB	L-M/M	-
Tasks classified as unique to F-14	21	VB	L	-
IMPORTANCE				
Rating did not change F-4 to F-14	67	VA,VB	M-H	M-H
Rating increased from F-4 to F-14	4	VB	M-H	M
Rating decreased from F-4 to F-14	-	-	-	-
Tasks classified as D (F-4 D - 8%) (F-14 D - -)	8	VA,VB	M/M-H	-
Tasks classified as unique to F-14	21	VB	M	-

Table XL

A Comparison of the Role and Duties of Assessor of Systems in the F-4 and F-14
on the Basis of the Percentage of Tasks Occurring in Selected
Categories of Comparative Complexity

		Complexity of the Tasks in the F-14 as Compared to its Counterpart (if available) in the F-4			Unique to F-14	Total Number of Tasks
		Increase	Approx. Same	Decrease		
V.	Assessor of Sys- tems	25	50	4	21	24
V.A	Preparation and Inspection of Systems	14	86	-	-	7
V.B	Assess System Status	29	35	6	29	17

Table XLI

Summary of Cross-Ratings for the P and I Dimensions in the Role of Tactician

	Percentage of Tasks	Included Tasks from Duties:	Median F-14	Ratings F-4
PROPORTION OF TIME AND EFFORT				
Rating did not change F-4 to F-14	77	VIA , VIB , VIC	M	M
Rating increased from F-4 to F-14	-	-	-	-
Rating decreased from F-4 to F-14	-	-	-	-
Tasks classified as D (F-4 D - 19%) (F-14 D - 14%)	19	VIA , VIB	L	D
Tasks classified as unique to F-14	5	VIA	M	-
IMPORTANCE				
Rating did not change F-4 to F-14	77	VIA , VIB , VIC	M	M
Rating increased from F-4 to F-14	-	-	-	-
Rating decreased from F-4 to F-14	-	-	-	-
Tasks classified as D (F-4 D - 19%) (F-14 D - 14%)	19	VIA , VIB	M	D
Tasks classified as unique to F-14	5	VIA	M-H	-

Table XLII

A Comparison of the Role and Duties of Tactician in the F-4 and F-14
on the Basis of the Percentage of Tasks Occurring in Selected
Categories of Comparative Complexity

Complexity of the Task in the F-14 as Compared to its Counterpart (if available) in the F-4						
		Approx. Increase	Same	Decrease	Unique to F-14	Total No. of Tasks
VI.	Tactician	45	36	14	05	22
VI.A	Coordinate Combat Air Patrols & Escort Missions	43	43	-	14	7
VI.B	Coordinate Aerial Combat Maneuvers	56	11	33	-	9
VI.C	Coordinate Intelli- gence Collection and Dissemination	33	67	-	-	6

Table XLIII

A Comparison of Roles Using the Median Ratings on the I and P Dimensions

Role	No Change in Rating		Tasks Classified as Unique to F-14		Tasks Rated as Increasing F-4 to F-14		Tasks Rated as Decreasing F4/F-14	
	P	I	P	I	P	I	P	I
	I	M-H	M-H	M	M	M-H	M-H	M
II	M-H	M-H	L	M	M-H	-	L-M/M	L-M
III	M-H	M	L	M	-	-	M-H	-
IV	L-M/M	M	L	M	L-M	M-H	M	L-M
V	L-M/M	M-H	L	M	L-M/M	M-H	-	-
VI	M	M	M	M-H	-	-	-	-
Percent of Total Tasks	54	65	18	18	4	3	6	2

Table XLIV

Percentage of Total Tasks in a C Classification by Roles

Role	Increase	Approx. Same	Decrease	Unique to F-14	Percent of Total Tasks
I. Sensor Manager	12	10	62	46	26
II. Weapons Manager	6	7	4	26	9
III. Communicator/ Coordinator	24	23	19	2	19
IV. Navigator	20	38	-	4	23
V. Assessor of Systems	12	14	4	9	12
VI. Tactician	20	9	12	2	11
Percentage of Total Tasks	26	44	13	18	

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APPENDIX A

INSTRUCTIONS FOR COMPLETING THE NFO POSITION INVENTORY

INSTRUCTIONS FOR COMPLETING THE NFO POSITION INVENTORY

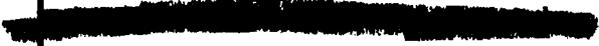
1. Fill in the Background Information page. Then turn to Duty A on page 1 of your booklet and read the entire inventory to see how well your position is covered. Be sure to read all the tasks under every duty. As you read, place a check mark in the check column beside each task you do.
2. In the blank spaces at the end of the lists of tasks under each duty, write in all the tasks you do in that duty that are not listed. If some tasks you perform do not fit under any of the duties in the booklet, write them on the blank page at the end of the booklet.
3. Turn back to Duty A on page 1 again. You are now to make "Part of Position" rating for all the tasks you have checked or added. Place one of the seven rating values (1, 2, 3, 4, 5, 6, or 7) that best indicates the proportion of time or effort required to execute each task relative to each of the other tasks you perform (overall mission) as an NFO. If you do not perform the task, do not place a rating for that task.
4. Turn back to Duty A on page 1 again. You are now to make "Criticality" ratings for all the tasks you have checked or added. Place one of the four rating values (1, 2, 3, or 4) that best indicates the extent to which failure to perform a task affects the likelihood of mission completion. If the task is performed as a dual function, inasmuch as both NFO and pilot coordinate in the carrying out of the task, then rate the criticality of the whole task to mission effectiveness.

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13. ABSTRACT The introduction of the F-14, the Navy's newest fighter, into the fleet creates an additional demand on the fighter Naval Flight Officer (NFO) training pipeline. In an attempt to define this demand, this study compares the F-14 with the F-4 in terms of the operational functions required of the NFO in each aircraft. Using NFO advisors, and F-14 and F-4 publications, a Function Description Inventory (FDI) was created. The FDI consisted of the various tasks, duties, and roles comprising the operational functions of the NFO on either or both aircraft. NFOs familiar with both aircraft rated the tasks on three dimensions: Proportion of Time and Effort (P), Importance (I), and Complexity (C). These ratings were then used as a basis for discussion of the differences in NFO operational functions between the two aircraft. A majority of the tasks were rated the same for both the F-4 and F-14 on the P and I dimensions. Important exceptions to this trend are found in the roles of Sensor Manager and Tactician. Eighteen per cent of the total tasks were rated as unique to the F-14, with a majority of these tasks being found in the roles of Sensor Manager and Weapons Manager. In terms of the C dimension, 26 per cent of the tasks were rated as increasing in difficulty in the F-14, 44 per cent were rated similar and 13 per cent were rated as decreasing.			

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