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THE TECHNICAL LABORATORY FCRC (APL/JHU) AND THE NAVY WSAM PROGR--ETC(U)
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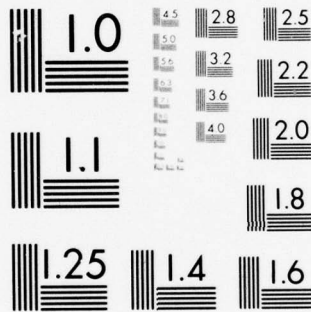
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THE TECHNICAL LABORATORY FORC (APL/JHU)

AND THE NAVY WSMX PROGRAM OFFICE

STUDY PROJECT REPORT
PHC 76-2

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DEFENSE SYSTEMS MANAGEMENT COLLEGE

STUDY TITLE:

The Technical Laboratory FORC (APL/JHU)
and the Navy WSAM Program Office

STUDY PROJECT GOALS:

To gain a thorough understanding of the services provided by the APL/JHU to the Navy WSAM Program Office and to determine: (1) if the services provided are unique and (2) if any advantages and/or disadvantages exist in this relationship between the two organizations.

STUDY REPORT ABSTRACT: The APL/JHU has been studied in depth in order to gain a more thorough understanding of the services provided by this institution to the Navy Program Office. Specific attention has been focused on determining if any unique services are provided and if any discrete advantages and/or disadvantages exist in this relationship between the two organizations. Research conducted included: (1) reviewing literature concerning FORCs and in particular that literature concerning the APL/JHU and (2) interviewing personnel from the APL/JHU and various Navy Program Offices.

The conclusions reached were that some services provided by the APL/JHU to the Navy Program Office are unique. Additionally, the advantages accrued in this relationship far outweigh the disadvantages.

A recommendation is made to revise the Congressional fiscal ceiling that has been placed on the APL/JHU, so that the Navy can more effectively utilize this organization as it endeavors to upgrade the readiness of its Fleet. The epilogue of this report indicates that Congress, at the request of DOD, is considering a course of action that will remove the APL/JHU from an FORC status, thereby allowing the Navy and other service components to increase their participation with this outstanding national asset.

Because the APL/JHU is similar in many ways to other FORCs and non-profit organizations, the advantages/disadvantages and conclusions written in this report may be applicable to other services in their relationships with these type organizations.

SUBJECT DESCRIPTORS: NAVY PROGRAMS
RESEARCH LABORATORIES
FORC (APL/JHU)

NAME, RANK, SERVICE

G.R. Waterman, LCDR., USN

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1 November 1976

THE TECHNICAL LABORATORY FCRC (APL/JHU)
AND THE NAVY WSAM PROGRAM OFFICE

STUDY PROJECT REPORT
INDIVIDUAL STUDY PROGRAM

DEFENSE SYSTEMS MANAGEMENT COLLEGE
PROGRAM MANAGEMENT COURSE
CLASS 76-2

BY

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STUDY PROJECT ADVISOR

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1 NOVEMBER 1976

This study project report represents the views, conclusions and recommendations of the author and does not necessarily reflect the official opinion of the Defense Systems Management College or the Department of Defense.

EXECUTIVE SUMMARY

→ The study examines the technical laboratory Federal Contract Research Center (FCRC), Applied Physics Laboratory, John Hopkins University (APL/JHU), in order to gain a thorough understanding of the service(s) provided by this institution ^{it provides} to the Navy Weapons System Acquisition Program Office. Specific attention ^{was} has been focused on determining if any unique service(s) are provided and if any discrete advantages and/or disadvantages exist in this relationship between the two organizations. Research conducted in preparation for writing this paper consisted of: (1) reviewing literature concerning FCRCs, in particular those concentrating on the APL/JHU and (2) interviewing personnel from the APL/JHU and various Navy Weapons System Acquisition Program Offices.

→ The writer The study concludes that some services provided by the APL/JHU to the Navy Program Office are unique and that advantages and disadvantages exist in this relationship. The advantages accrued in this relationship far outweigh the disadvantages.

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SECTION I

INTRODUCTION

PURPOSE OF THE STUDY PROJECT

The author reported to Commander, Naval Sea Systems Command in September 1974 from an operational billet at sea, having no prior experience in the Weapons System Acquisition arena. Assignment to PMS 395 (Deep Submergence Systems Project) afforded the author the opportunity to work closely with personnel associated with the Applied Physics Laboratory, John Hopkins University (APL/JHU). Dealing with a highly sophisticated and technically oriented program (at or pushing the state of the art), required the assistance of an organization of the APL/JHU's caliber. The APL/JHU's contributions to the Deep Submergence Systems Project Office (PMS 395) have been substantial and impressive.

Being impressed with the contributions provided by the APL/JHU to one Navy Program Office, has stimulated the author to gain a more in-depth knowledge of the APL/JHU for subsequent application in the Weapons System Acquisition arena. Specific attention has been focused on the general history of the APL/JHU and the services provided by this organization to other Navy Program Offices. In particular, a concentrated effort has been made to determine: (1) if the services provided by the APL/JHU to the Navy Program Office are unique and (2) if advantages and/or disadvantages exist in this relationship.

SCOPE AND LIMITATIONS

The scope of this report is limited to an in-depth study of the APL/JHU and its interaction with the Navy Program Office. The original scope of this paper was to include all technical FCRCs and their association with the Navy Program Office. However, due to the length of time available to the author in preparation of this report, the APL/JHU was selected because (1) the author was somewhat familiar with that organization and (2) the APL/JHU provided the majority of the laboratory FCRC effort to the Navy Program Office.

In order to validate the interview process, a conscientious attempt has been made to insure a good cross section of Navy Program Offices were selected. The following criteria were utilized during the selection process: (1) vary the length of association time between the two organizations (ranges from 3 - 22 years) and (2) select a variety of weapon systems being developed by Navy Program Offices in various stages of development, thereby insuring not only a good cross section on the Navy side of the house, but also a maximum dispersion on the APL/JHU side as well.

SECTION II

SITUATION

THE APL/JHU-UNIVERSITY-NAVY RELATIONSHIP

The APL/JHU is an independent, permanent division of the John Hopkins University, operating in parallel with the academic divisions. The Director of the Applied Physics Laboratory, currently Dr. A. Kossiakoff, has full responsibility and authority for the operation of the laboratory and reports directly to the President of John Hopkins University.

The APL/JHU has an Advisory Board that consists of the Director, the Assistant Director, the Chairman of the Research Center, six members of the APL/JHU Principal staff, and two members of the University faculty. The Advisory Board meets periodically with the President of the University to consider matters relating to University-APL relationships.

From its inception in 1942, a standing committee of the University of John Hopkins Board of Trustees, called the Trustees Committee on the Applied Physics Laboratory, has overseen the laboratory's operation and administration. The Chairman of the Board of Trustees and the President of the University are ex officio members. The Trustees Committee meets twice a year with the management (more often if required), to receive progress reports on laboratory programs, consider any major new work to be undertaken, and review APL's management and operations.

The Trustees Committee meetings customarily include by

invitation the Assistant Secretary of the Navy (Research and Development), the Chief of Naval Material, the Commander Naval Sea Systems Command, and other Navy officials directly concerned with APL programs. These meetings provide opportunities for exchange of views on policy, plans and current activities. (21:NA)¹

FCRC - WHAT DOES IT MEAN?

The APL/JHU, the first of the current Federal Contract Research Centers, was organized in 1942. There are nine such organizations considered by the Department of Defense and Congress to make up the present family of DOD FCRCs: Aerospace Corporation, El Segundo, California; Analytic Services, Inc. (ANSER), Falls Church, Virginia; APL/JHU, Silver Spring, Maryland; Center for Naval Analysis (CNA), University of Rochester, Alexandria, Virginia; Institute for Defense Analysis (IDA), Arlington, Virginia; Lincoln Laboratory, MIT, Lexington, Massachusetts; MITRE Corporation, Bedford, Massachusetts; ARL/PSU, State College, Pennsylvania; and Rand Corporation, Santa Monica, California. (16:10)

The term Federal Contract Research Center (FCRC) did not appear until 1962 when the National Science Foundation identified sixty-six (66) such organizations and defined FCRC

¹This notation will be used throughout the report for sources of quotations and major references. The first number is the source listed in the bibliography. The second number is the page in the reference. In the case of an interview, or in this particular case where the statement page was not numbered in the report to Congress, the second number is not applicable and NA is utilized.

as follows:

Federal Contract Research Centers are research and development undertakings exclusively funded by the government, which in most instances were originally established to meet a research and development need of the Federal Government, and which are administered by a private corporation through a contractual agreement. It may be administered by a profit organization, an educational organization or another non-profit organization. (2:6)

In May of 1963, Dr. Harold Brown, then Director of Defense Research and Engineering (DDR&E), in testimony before the subcommittee on Appropriations of the House of Representatives, referred to a specific group of organizations providing services to the Department of Defense and identified 39 such organizations. He said ... "we would like to call Federal Contract Research Centers so as to avoid the question of profit, non-profit, universities or others." (18:4)

In further clarification of this new term, FCRC, during hearings before a subcommittee of the committee on Appropriations, House of Representatives, 88th Congress, second session, Mr. Mahon, the subcommittee chairman, referred to these organizations as various "captive companies", which have been used by the Defense Department, and defined them as follows:

Federal Contract Research Centers are research organizations which are exclusively financed by the Federal Government and which, in most instances were originally established to meet a research and development need of the government. These organizations have a quasi-government status even though they are private organizations, and their relations with the government are defined under various contracts. (11:1)

In the hearing that followed, Dr. Brown (DDR&E) submitted a list of 21 such organizations and defined FCRC as follows:

Federal Contract Research Centers as utilized by the Department of Defense refers only to those centers which provide assistance in planning, developing, and executing of RDT&E programs, but excludes research organizations performing research and development tasks and those engaged in operating technical facilities. (2:7)

Between 1964 and 1971 nine more organizations were removed from the list of FCRCs since they did not meet the general definition of an FCRC.

In 1971, the National Science Foundation, due to obvious changes initiated by Congress and the Defense Department to the term FCRC, revised their definition and developed a similar but new term, Federally Funded Research and Development Centers:

Federally Funded Research and Development Centers (FFRDCs) are R&D performing or managing organizations exclusively or substantially financed by one or more Federal agencies. They share the unique advantage of gathering in one location a nucleus of scientists, engineers, and technicians who represent a wide range of disciplines and talents. These specialists work on complex problems in an atmosphere that permits unusual freedom of exchange. The non-profit character of FFRDCs make for objectivity of judgment. (2:8)

In June of this year (1976) with the number of FCRCs totaling nine, Dr. M. Currie, the Director of Defense Research and Engineering (DDR&E), in a report concerning the management of FCRCs, further described the DOD FCRCs as follows:

The Federal Contract Research Centers (FCRCs)

were conceived to provide the Department of Defense (DOD) with a small number of organizations that could provide high quality technical work and policy advice, both solicited and independently offered. To fill these needs organizations were required that possessed a depth and breadth of familiarity with Service needs, problems and programs like that of the DOD in-house laboratories but with a quality and vitality second to none.

The resulting organizations were established (1) as non-profit to assure freedom from profit motive biases, (2) outside the Services' Command structure to assure freedom from chain of command biases, and (3) outside the government to permit the management flexibility necessary to attract and retain the best people. Each DOD FCRC is distinctive and each performs different functions. They fall into three groupings: (1) Laboratory FCRCs, (2) System Engineering and Technical Direction FCRCs and (3) Studies and Analyses FCRCs. (17:1)

BRIEF HISTORY OF THE APL/JHU

In order to gain a perspective of what the APL/JHU does today for the Navy Program Office and to determine if the services provided are unique, a quick look at the history of this organization is required.

The evolution of the APL/JHU's technical programs can be viewed as being divided into four eras: the World War II era (1940 - 1944); the guided missile technology era (1944-1956); the systems engineering era (1956 -); and the space technology era (1957 -).

The APL/JHU was organized during World War II (1942) under the sponsorship of the Office of Scientific Research and Development to develop and produce radio proximity fuzes to meet urgent operational needs of fleet air defense. Within

an incredibly short period of time, these radio proximity fuzes were developed and produced by the APL/JHU and subsequently supplied to the Navy, Army and our Allies in 1944. Gun directors for shipboard anti-aircraft batteries were also developed by the APL/JHU and made operational in 1944. (23:317)

In 1944, the APL/JHU's sponsorship shifted from the Office of Scientific Research and Development to the Navy's Bureau of Ordnance and the guided missile technology era (1944 - 1956) evolved. The Bureau of Ordnance, in order to provide a better air defense for the fleet, tasked the APL/JHU to conduct research and development in the guided missile technology field and to develop a family of shipborne surface to air missiles. There were no guided missiles at that time and, indeed, most of the elements of missile technology were completely missing. This development was designated by the code name "Bumblebee". Upon termination of World War II in 1945, John Hopkins University, with strong urging from the Secretary of Defense, agreed to keep the Applied Physics Laboratory in operation and continue the "Bumblebee" program. The "Bumblebee" program led to a family of three anti-aircraft guided missiles (TALOS, TERRIER, and TARTAR) which have been utilized extensively in the U.S. Fleet and integrated into the fleets of seven of our Allies. Mainly because of this successful relationship between the U.S. Navy and the APL/JHU in the "Bumblebee" program, the idea of utilizing prime research and development organizations, tailored to serve as an agent of

the Department of Defense in areas where DOD lacked sufficient internal technological and technical management capabilities, was germinated. (18:204)

The era of systems engineering evolved at the APL/JHU with their participation in integrating the recently developed guided missile system with the fleet's newly commissioned guided missile cruisers. Participation in the early shipboard use of the "Bumblebee" missiles gave the laboratory an intimate knowledge of the behavior of shipboard missile systems and of the problems arising in the use of these newly deployed missiles. As more guided missile ships came into commission the APL/JHU's involvement with these systems increased. Its responsibilities were enlarged to include not only the missiles but also the associated fire-control systems.

Late in 1956, due in main part to the specialized knowledge they had acquired in the "Bumblebee" program and the subsequent successful marriage of the "Bumblebee" missiles with afloat platforms, the APL/JHU was tasked by the U.S. Navy to apply this unique expertise to the Fleet Ballistic Missile (FBM) system. This subsequently led to the APL/JHU developing instruments and evaluation procedures for quantitative testing of Polaris components and of the complete system's performance and effectiveness. The APL/JHU continues to perform this most important task for the U.S. Navy today. (3:NA)

With the launching of SPUTNIK I by the USSR in October 1957, the APL/JHU embarked on perhaps the most far reaching

phase of its technical development, that being space technology. With their development of the so called "doppler shift" (the apparent change in the carrier frequency of a signal received from a satellite by a geographically fixed station on earth), a complete description of the satellite's orbit could be obtained. Simultaneously, while conducting research and development in the space arena and achieving a breakthrough in satellite orbit description, the APL/JHU was working on the acute Navy requirement for accurate navigation for Polaris submarines. Utilizing their knowledge gained in the space technology arena, the APL/JHU applied the "doppler shift" concept in developing the Navy Navigational Satellite System (TRANSIT), a system which provides extremely accurate navigation to Polaris submarines (ie, knowing the exact orbit of a satellite, the doppler shift concept was utilized to pinpoint the location of the earth bound receiver - Polaris submarine). (12:NA) Without the unique combination of objectives, capabilities and organization that existed at the APL/JHU, it is unlikely that a navigational system similar to TRANSIT would have been conceived, successfully developed, and put into operation. Additionally, the APL/JHU designed and developed the BRN-3 and SRN-9 Navigation receivers, which are utilized in conjunction with the TRANSIT Satellite System to provide precision position information to the fleet's submarines and surface elements respectively. (18:212)

THE APL/JHU TODAY

The APL/JHU is involved in a wide variety of research and development efforts in such fields as missile and space systems, electronic warfare and ballistic missiles. Their primary dedication is to the Navy Department, and a very large part of its workload is represented by Navy-assigned tasks. Its current programs may be grouped into ten (10) approximately equal areas of activity as delineated in the Naval Material Command Publication, Overview of the Federal Contract Research Centers, prepared by John Kaminski. (11:55) Several visits to the APL/JHU have been made by the author in an attempt to group and define the programs that exist at that institution within those activities listed by John Kaminski. The author found the activities to be valid, but extremely difficult to quantify by placing specific technical groups within the APL/JHU under those activities. Several of the technical work groups at the APL/JHU are broad in nature and their charter crosses activity boundaries. The description of each activity as contained below may not be all inclusive, but should give the reader, as it did the author, an excellent overview of the depth and breadth of the APL/JHU as it functions today.

1. Advanced Guided Missile Technology - Designs, develops and evaluates missile guidance systems, microwave devices, antennas, and specialized electronic circuits including T.V. instrumentation

for captive flight seeker analysis. Is developing a multi-mode, short range missile for ship self-defense against various air threats. Is investigating the applicability of various recent developments in filtering and control theory to tactical missile guidance and control.

2. Fleet Defense Missile Development - Is investigating the applicability of various electro/optical developments to the performance objectives of long-term fleet defense. Is utilizing its experience and capability in analysis, development and testing of radars, electronic warfare systems, command and control systems, and missile systems in supporting Navy efforts to engage an enemy armed with anti-ship missiles such as the Russian STYX and SHADDOCK. Is conducting effectiveness analysis in support of the Ship-Anti-Missile Integrated Defense/Anti-Ship-Missile Defense (SAMID/ASMD) program.
3. Ship System Integration - Coordinates the interfaces between weapons and new guided missile ships. Assists NAVSEASYSCOM in introducing advanced weapon systems into the fleet. Is conducting studies to determine location of radars and ordnance equipment in the interest of the optimum fire-power effectiveness of new weapons. This includes compatibility of missiles and launching systems, as well as rockets and handling systems from the depot through the supply system to

the tactical fighting ship. The APL/JHU has been a key member of the AEGIS development and integration team from the initial studies to the contract definition phases and has functioned as technical advisor to the Navy since 1969 in the areas of integration, evaluation and design.

4. Operational Tactics - Designs and executes experiments to evaluate system effectiveness (eg, vulnerability of aircraft to enemy missiles and anti-aircraft weapons systems). Analyzes friendly and unfriendly weapons capabilities. Participates in ships' missile firings by providing test plan, data analysis and final reports. Conducts battle simulations and analyzes data there from to determine weaknesses and evolve corrective measures to improve operator (man-machine) function in an operational environment. Provides back up analysis to fleet system project officers so that they have a rational background for making program decisions.
5. Polaris System Evaluation - Analyzes and evaluates the accuracy, reliability and maintainability of the fire control subsystems of the Fleet Ballistic Missile Weapon Systems. Analyzes and evaluates the launcher and ship subsystems of the Polaris, Poseidon and follow on strategic ballistic missile weapon systems. Assesses the reliability and accuracy of the

navigation subsystem in support of the Polaris/ Poseidon Weapon System on deployed FBM submarines. This section is addressed in more detail later in this report when an evaluation of unique services is made.

6. Submarine Defense - Provides technological assessment of potential threats to the deterrent effectiveness of the FBM force. Performs threat analysis; monitors and evaluates intelligence information. Assesses SSBN operations for specific vulnerabilities. Is developing advanced signal processing methods for analyzing signals with particular reference to sonar. Is investigating quieting techniques and automatic acoustic detection means. Is identifying potential weaknesses in security of SSBNs attributable to operating tactics or equipment deficiencies and is determining methods and techniques to improve the security of the FBM force.
7. Navy Satellite Systems - Supports and advises the Navy in all aspects of satellite doppler navigation. Provides system engineering, circuit design, power system design and thermal design for the TIP II advanced Navy navigational satellite.
8. Navigational Satellite Application - Operates the satellite doppler tracking station located at the APL/JHU. Serves as a technical advisor to the Defense

Mapping Agency for satellite doppler tracking and surveying operations. Assists and advises the satellite doppler tracking technical activities of various universities and governmental agencies and acts as a coordinator of these activities.

9. NASA Research Satellites - Is developing life expectancy tests and performing evaluations of NASA built satellite tape recorders for the Small Astronomy Satellites (SAS). Provides systems engineering, circuit design, power system design and thermal design for the Small Astronomy Satellites (SAS) for NASA-GODDARD and the Geodesy Radar Altimeter Satellite (GEOS) for NASA Wallops.
10. Research and Special Investigations - The APL/JHU continues to conduct research into the unknown. This advanced research will not be discussed here because of the sensitive and/or classified nature of that work.

The ten (10) areas of activity at the APL/JHU and the grouping of programs that exists at that institution within these activities, as determined by the author during his research, is shown on the following page.

1	2	3	4	5
ADV. GUIDED MISSILE TECH.	FLEET DEFENSE MISSILE DEV.	SHIP SYSTEM INTEGRATION	OPERATIONAL TACTICS	POLARIS SYS. EVALUATION
MULTI-MODE MISSILE	ANTI-SHIP MISSILE DEF.	AEGIS SYSTEM INTEGRATION	FLEET EXERCISE ANALYSIS AND TRAINING	SYS. QUALIFICATION PERFORMANCE MEASUREMENT
ADV. MISSILE PROPULSION	AUTOMATED SURVEILLANCE	3T SYSTEM INTEGRATION	AIR TACTICS EVALUATION	PATROL ANALYSIS
HARPOON GUIDANCE	SHIP-ANTI-MISSILE INTEGRATED DEFENSE	DIGITAL WEAPON CONTROL	SPECIAL WEAPON STUDIES	COMMUNICATIONS PROGRAMS
ADV. CRUISE MISSILE			AIR COMBAT TEST RANGES	PERSHING EVALUATION
6	7	8	9	10
SUBMARINE DEFENSE	NAVY SATELLITE SYSTEMS	NAV. SATELLITE APPLICATION	NASA RESEARCH SATELLITES	RESEARCH AND SPECIAL INVEST.
ACOUSTICS CONTAMINANTS	TRANSIT SATELLITES	GEODETTIC TRACKING NETWORK	GEODETTIC SATELLITES	OPS. ANALYSIS
DIRECT OBSERVABLES	TRIAD	GEOCENTER	IONOSPHERIC MEASUREMENTS	ADV. COMPONENT TECHNOLOGY
HYDRODYNAMICS	IMPROVED TRANSIT	NAV. RECEIVERS	HIGH ENERGY PARTICLES	ADV. RESEARCH PROJECTS
MAGNETICS	SATRACK	A/C NAVIGATION	SMALL ASTRONOMY SATELLITES	TRANSPORTATION SYS. EVALUATION
		DOPPLER BEACONS		AIR TRAFFIC CONTROL

SECTION III

ANALYSIS OF THE DATA

THE APL/JHU - UNIQUE?

Unique is defined in Webster's dictionary as "being without a like or equal". Its status as a technical Department of Defense Federal Contract Research Center makes the APL/JHU unique. As stated earlier there are only nine DOD FCRCs and of these nine, three are structured as technical laboratories. The most similar type of organization in attempting to strike a comparison with that of an FCRC, is the non-profit institution. Dr. John S. Foster, former Director, Defense Research and Engineering (DDR&E), in testifying before the Senate Armed Services Committee in April of 1972 stated that while there was no clearly defined distinction between FCRCs and other non-profit institutions, FCRCs tended to have the following unique characteristics:

They exist primarily to perform work for the Department of Defense.

They have no commercial affiliations and undertake little or no work for private industry.

They are usually funded by sole source, annual, level of effort contracts which implies a DOD attitude of responsibility for their continuance and stability.

They have continuous privileged access to data of the government and industry in their field work.

They represent, in some cases, an alternative way of carrying out activities which are sometimes done in house. (11:1)

In its field as a technical laboratory interacting with

the Navy Program Office, the APL/JHU does provide unique services; services that are required in order for the sponsor to successfully perform his mission. The February 1976 report of the Defense Science Board Task Force to the Secretary of Defense concerning Federal Contract Research Center utilization states:

In no case did we find any suggestion that, in the short term, the mission of the sponsor could be performed without the service the FCRCs are now providing. On the other hand, almost universally, statements were made to the effect that the mission could, in time, be performed by alternative methods. Since we have ample evidence that this later case is, in fact, true, one then must make value judgments as to the relative merits for the longer term solution in various forms In the case of the product related FCRCs - APL/JHU, ARL (PSU) and Lincoln Laboratory/MIT, the need issue is more broadly related to their total environment. The academic and research orientation of these institutions, their special facilities and people, and their divorce from proprietary-product interest in manufacturing is attractive to their service sponsorship because of the creative totality the institution itself represents. (16:14)

The role filled by the APL/JHU in support of the Navy's sea based strategic deterrence system is only one of several major contributions provided by this institution to the Navy Program Office. The APL/JHU is responsible to the Navy's Strategic Systems Project Office (SSPO), a large program management office located within the Naval Material Command structure, for defining, instrumenting, testing and analyzing the results of demonstration and shakedown operations in which every FBM submarine must successfully participate prior to being certified for operations in support of the nation's

deterrent posture. The APL/JHU also assists the SSPO in the submarine security program which encompasses the analysis and testing of all unusual, abnormal or exceptional occurrences that might compromise the security of the submarine fleet. Utilizing data obtained from operational patrols, the APL/JHU does post-deployment analysis of all subsystems in the operational environment in a continuing program to upgrade the operational capability of the FBM fleet. (3:NA)

During interviews with personnel from the Navy's Strategic Systems Project Office, it was concluded that there is no other organization in existence which has the APL/JHU's broad background of experience in FBM weapon system analysis and evaluation. The unique qualifications which the APL/JHU has brought to the FBM systems evaluation are: long experience in all aspects of guided missile technology from research to production and test; special skills in system test and evaluation; a staff combining specialists in all relevant branches of science and engineering; and long acquaintance with Navy operational environment problems.

Additionally, the shifting of the APL/JHU's effort and support in the strategic deterrence arena to another institution was discussed with personnel from the SSPO. If tasked to implement such a shift, it was estimated that it would take at least ten (10) years to accomplish with the attendant risk of degrading the Navy's sea based strategic

deterrence system. This conclusion tends to agree favorably with the 1971 Report of the Special Study Group on FCRCs, Office of the Director of Defense Research and Engineering:

If the APL/JHU was disestablished or its utilization otherwise denied to the Navy, it would be immediately necessary to reestablish a similar activity since no other facilities, in-house or contractor operated, are available. It has been conservatively estimated that it would require a minimum of ten years to recruit and train scientists and engineers into a responsive team competence that is now available. Further, it would require an estimated \$90-\$100 million to duplicate the current laboratory instrumentation and facilities based on a current audit expenditure of approximately \$65-70 million. The assumption of the effort of the FCRCs by industry is not a practical alternative. In the absence of a special exclusive long-term commitment from the Government, industrial contractors must concentrate their technical talents on areas where good markets exist. (18:213)

Another of the APL/JHU's major capabilities is in support of Surface Fleet defense, including the integration of the many systems that are required in defense of surface fleet forces, particularly against airborne or surface attack by anti-ship weapons. Interviews with personnel associated with this field from Navy Program Offices revealed that the depth of understanding, body of knowledge, experience, data and facilities found at the APL/JHU, accumulated through several decades of highly diversified technical work in this area, are not available in any other organization.

In summary, it is concluded that many of the services provided by the APL/JHU are unique. Over the more than thirty years that the APL/JHU has been in existence, it has developed

excellent facilities in support of Navy sponsored programs. These facilities are mainly in critical areas such as guided missile propulsion, countermeasures test, computer simulations, acoustics, radar and data processing. A sophisticated scientific computer is available on site for obtaining answers to complex scientific and engineering problems. Additionally, because of their long association with the Navy, the personnel at the APL/JHU have an understanding of the practical problems of the operating forces. Personnel from the APL/JHU are in the field and aboard ship throughout the year, maintaining continued close liaison with the U.S. Navy.

THE NAVY - APL/JHU RELATIONSHIP

ADVANTAGES/DISADVANTAGES

In the course of interviewing personnel from various Naval Program Offices and conducting informal discussions with contemporaries at the Defense Systems Management College on the topic of working with FCRCs and non-profit research and development organizations in general, and the APL/JHU in particular, it became apparent that significant advantages exist as a result of this relationship. Some disadvantages do exist, but appear insignificant when compared with the advantages.

The intent of this section of the report is to list those advantages and disadvantages identified by the author during the interview process. Substantiating each and every advantage and disadvantage is extremely subjective and does not fall

within the scope of this report.

ADVANTAGES

1. Extensive experience and excellent facilities exist at the APL/JHU in support of their acknowledged areas of expertise (surface fleet defense, fleet air defense, space technology, and sea based strategic deterrence). The memory of lessons learned relative to the above areas and stored within the bowels of the APL/JHU is priceless.
2. The excellent reputation and concurrent credibility that the APL/JHU has achieved by successfully performing high priority work over an extended period of time for the U.S. Navy and the Department of Defense is a tremendous asset to the Navy Program Office associated with the APL/JHU. Congress and others in the weapon system acquisition arena place high credence on decisions that are substantiated by studies and reports conducted by the APL/JHU. This adds to the credibility of that Navy Program Office.
3. The absense of proprietary manufacturing prejudices and attendant financial considerations; the absense of bureaucratic biases; and the university type environment which leads to freedom of thought, enables the APL/JHU to make decisions which stand on their technical merit alone.
4. Due to their decades of association with the U.S. Navy

and the concurrent development of unique capabilities in qualified personnel, experience and facilities, the APL/JHU is able to react quickly to newly assigned tasks.

5. Because of their status as an FCRC with sponsorship almost solely by the U.S. Navy, Navy Program Offices are able to provide to the APL/JHU privileged industrial and government information. This enables the Navy Program Office, early in program life when proper manning is critical, but difficult to achieve from in-house assets, to bring the APL/JHU on to their team with their attendant experience and knowledge.
6. The manner in which the APL/JHU approaches tasks often results in the identification of related tasks that must be addressed by the Navy Program Office prior to making decisions. The APL/JHU consistently approaches the problem from a systems standpoint, starting with the definition and understanding of the problem through analysis, design, production and eventual operational use.
7. The physical location of the APL/JHU in Maryland places it in close proximity to most Navy Program Offices. This enhances the face to face relationships between the two organizations which is so important in achieving continuity and eventual success in the complex undertaking of weapons system acquisition.

8. The APL/JHU has good work assignment policies which increase their efficiency and productivity, thereby providing to the Navy Program Office a good return on their investment.

DISADVANTAGES

1. The professional and technical personnel at the APL/JHU, in general, can be considered to be imaginative and curious. This, coupled with their systems approach to task accomplishment, is advantageous to the Navy Program Office as stated above. However, if the task is not thoroughly described or explained by the Navy Program Office and sufficient background material is not provided to the APL/JHU, a tangential path may be taken by the imaginative and curious worker, resulting in a loss of valuable time.
2. Being an FCRC restricts the amount of research and development work that can be accepted by the APL/JHU from the U.S. Navy and the Department of Defense. This is a Congressionally imposed fiscal ceiling which is intended to limit growth and size, cost of operation, and the degree of DOD dependence. Some Navy Program Offices are experiencing the effects of this restriction and have been forced to reduce the amount of work normally given to the APL/JHU and award it to in-house laboratories or industry.

SECTION IV

SUMMARY

CONCLUSIONS

The APL/JHU has essentially been a Navy in-house laboratory since its inception in 1942. Over the years of its existence it has developed and maintained a capability in personnel, experience and facilities that is unique in its field of expertise. The advantages accrued to the Navy Program Office by having the APL/JHU as a member of its team far outweigh any disadvantages.

The APL/JHU is considered by the author to be a critical asset to the U.S. Navy and the Department of Defense, for without their unique capabilities being applied to the fields of expertise that they have developed over the decades, Naval mission areas associated with these fields of endeavor would most certainly be downgraded.

RECOMMENDATIONS

With increased emphasis being placed on upgrading our Fleet to the highest readiness posture that the nation can afford, there is an urgent need to expand the effort that the APL/JHU is providing to the Navy and the Department of Defense. Only through technological improvements or breakthroughs can this nation realize a Fleet that is qualitatively superior yet quantitatively inferior to our potential enemies.

The Congressionally imposed fiscal ceiling on FCRCs is presently causing a decrease in effort by the APL/JHU to the

U.S. Navy, because the annual increases allowed have not kept pace with the inflationary trends. Congressional action to remove or adjust this fiscal ceiling imposed on the APL/JHU is recommended in order to reverse this trend of declining effort by the APL/JHU to the U.S. Navy.

EPILOGUE

In February of 1976, a Defense Science Board Task Force completed an indepth study for the Director of Defense Research and Engineering concerning FCRC utilization. The Task Force had been tasked by the Director of Defense Research and Engineering to:

..... assess the DOD - FCRC relationships and recommend steps that could be taken to improve the short and long term posture of DOD with respect to FCRC utilization. (16:ABSTRACT)

In June of 1976, Dr. M. Currie, Director of Defense Research and Engineering, in a DDR&E report titled Management of the Federal Contract Research Centers, recommended to Congress that two of the three technical FCRCs (the APL/JHU and the Applied Physics Laboratory at Pennsylvania State University) be removed from the FCRC list. The report states:

The Applied Physics Laboratory's and the Applied Research Laboratory's DOD-University relationships are similar to those of any other university with large in-house bench type activity and should be recognized as such.

In light of the normal Navy-University contractual relationships under which these two laboratories exist, the DOD should cease referring to or considering them FCRCs. Their business should continue to be awarded under ASPR procedures for universities. Any matters relating to the contracting, proprietary

information and privileged intelligence positions should be the responsibility of the activity awarding the contract. (17:5)

Congress presently has this recommendation under advisement and, to the author's knowledge, a final decision by Congress has not been made as of this date. The Committee on Appropriations, in their report on Authorizing Appropriations for Fiscal Year 1977, made reference to Dr. Currie's recommendation as follows:

The Committee concurs with certain recommendations made in the report. Congressional approval is dependent on similar concurrence from other interested committees.

The plan to drop three of the nine centers, Applied Physics Laboratory (John Hopkins University), Applied Research Laboratory (Pennsylvania State University), and ANSER, from FCRC status is in keeping with the common practice of Federal Contracting with universities, without necessarily having a special guaranteed relationship. (7:48)

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