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REPORT

OF THE

AIR-TO-AIR MISSILE SYSTEM

CAPABILITY REVIEW (U)

JULY–NOVEMBER 1968

APPENDIX V

NAVAL AIR SYSTEMS COMMAND

UNCLASSIFIED

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APPENDIX V

REPORT OF TASK TEAM FIVE

Chairman: Mr. O. C. Robbins, Naval Air Systems Command Representative Pacific

"Is the Air-to-Air Missile System Repair and Rework Program Returning a Quality Product to the Fleet?"

INTRODUCTION

A. The mission of TASK Team Five was to determine whether or not the NARF's (Naval Air Rework Facilities) are returning a quality product to the Fleet. In examining this question, the Team visited NARF Norfolk, Cherry Point, North Island, and Alameda. In addition, the Team consulted with contractor representatives from McDonnell, Raytheon, and Westinghouse. Every level of management associated with the pertinent functions of concern to this Team was consulted during the visits to these activities.

B. In answer to the above question, the NARF's, in general, provide a product that compares favorably with the new product from industry, but the evidence indicates that both must be improved. The Team Five Report discusses 23 specific areas which will effect drastic improvements in not only the rework process, but all aspects of developing, purchasing, using, and maintaining a weapon system.

C. Team Five unanimously feels that considerable improvements can be achieved in the rework area if the management structure now available were more effectively employed. In general, it is felt that the Naval Air Systems Command Headquarters should retain the over-all policy direction, funding, and the exercise of any necessary management controls. Specifically, the Team proposes that management and procedures be improved by:

1. Using the Program Managers' charters to exercise firm control over all elements of the system.

2. Delegating In-Service Engineering responsibilities to competent field activities for all engineering elements of the air-to-air missile systems.

3. Placing in the formal rework cycle all special support equipment and ground support equipment used to support the air-to-air missile systems.

4. Establishing a rework plan, validating this plan using a joint Navy-Industry Team, and later following up this validation by periodic audits of the rework process.

5. Instituting an evaluation program for the reworked missile and missile system components that would routinely and regularly measure the quality of the rework.

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INDEX (Cont.)

I MANAGEMENT AND SUPERVISION

A. Program Management

Conclusion

It is the unanimous view of Team Five that the majority of improvements necessary in the rework area can be achieved by more effective use of the management tools now available.

Recommendation

Without changing the present functional NAVAIRSYSCOM (Naval Air Systems Command) organization, provide the Program Managers the staff to fulfill managerial functions. Provide them sufficient control over the appropriate desks. Have them designate In-Service Engineering activities as well as cognizant and participating field activities for all the air-to-air missile systems' components. Insist that the Program Managers manage the air-to-air missile programs.

B. Management Techniques and Maintenance Policy

Conclusion

Air-launched weapons as well as all other aeronautical material should be maintained using the same management techniques. NAVAIRINST 4700.2, "Naval Aircraft Maintenance Program," should be revised to reflect this philosophy. Appropriate sections should include airborne weapons. The instruction should also be directed to all users of the weapon system, Marine Corps as well as Navy.

Recommendation

Revise NAVAIRINST 4700.2 as an instruction entitled "Aeronautical Material Maintenance Manual." Reissuance as an OPNAV Instruction should be considered.

C. IN-SERVICE ENGINEERING

Conclusion

There is a definite lack of external engineering control over the work performed in the NARF's (Naval Air Rework Facilities). Too many activities are involved in decisions and changes in the area of engineering control. Assignment of responsibilities is not clear. There is no single engineering activity to which the NARF, other Field Activities, or the Fleet may turn for quick, responsive, and continuing assistance in solving engineering problems or in securing technical direction.

Recommendation

Delegate In-Service Engineering authority and responsibility, not Basic Engineering, to activities as determined by NAVAIRSYSCOM. The delegations to the most logical activities would include (not necessarily assigned to one activity) the In-Service Engineering authority and responsibility for all the various components of the air-to-air missile systems. See NAVAIRINST 5400.14 of 27 May 1967, which covers the policy and procedures for delegating authority and responsibility.

D. PROFICIENCY INSPECTIONS

Conclusion

A considerable difference exists in the rework process at different NARF's for the same product. There is a definite lack of test specifications, procedures, equipment, and qualified personnel to assure a high quality product is being delivered to the Fleet.

Recommendation

NAVAIRSYSCOM direct NAVAIRSYSCOMREPLANT/PAC to issue, prior to 1 January 1969, a joint instruction initiating an air-to-air weapon system proficiency inspection to be conducted annually or at such other intervals as may be deemed necessary, to insure quality products are being delivered to the Fleet. The instruction should be coordinated with appropriate NAVORD activities and initiate a similar inspection at appropriate NWS (Naval Weapon Station), (Air-Launched Missile Divisions) by NAVAIRSYSCOMREP Teams. Cognizant field activities (NAVMISCEN) (Naval Missile Center), NAVWEPCEN (Naval WEAPONS Center), QEL (Quality Evaluation Laboratory), FMSAEG (Fleet Missile Systems Analysis Evaluation Group), etc.) and contractor personnel will be requested to assist.

E. TECHNICALLY ORIENTED MANAGEMENT

Conclusion

Team Five found that NARF managements have not been able to efficiently staff themselves to effectively adjust to the changing workload which continues to become more technically oriented, with an ever increasing emphasis on sophisticated electronics.

Recommendation

NARF's re-examine their management needs, particularly as related to the effective administration of the increasingly complex technological workload. Structure, staffing, and emphasis are the prime areas of concern.

F. STOCKPILE TO TARGET SEQUENCES

Conclusion

If the STS (Stockpile to Target Sequence) procedures (Navy SWOP 50-20) are followed from the initial design through to production contracts, and anticipate the future operational use of a weapon, many Fleet problems should never occur.

Recommendation

That the concept of the Navy SWOP 50-20 (applicable to nuclear WEAPONS) be incorporated in all non-nuclear WEAPONS planning and contractural phases, envisioning, insofar as the planners can foresee, all the environmental factors that will face the WEAPON in service use.

II REWORK PROGRAM

A. REWORK PLAN

Conclusion

There is no comprehensive Rework Plan for the NARF's to use when reworking any of the in-service air-to-air missile system components, including AMCS, missiles, SSE, launchers, and aircraft.

Recommendation

NAVAIRSYSCOM direct an appropriate activity to develop comprehensive and standard rework plans. The team would be chaired as designated by NAVAIRSYSCOM. Team members would be furnished by the appropriate NARF's, appropriate contractors, and area representatives as directed by NAVAIRSYSCOM. When designated, the in-service engineering activity would also participate as directed by NAVAIRSYSCOM.

NAVAIRSYSCOM initially direct the formulation of rework plans for the AIM-7E-2 and AWG-10. Follow this initial step with teams for other air-to-air missile system constituents. The importance of such a "working plan" cannot be over emphasized.

B. REWORK VALIDATION PLAN

Conclusion

The NARF's do not have a validation plan for the rework of the AIM-7E-2 or the AWG-10 missile control system.

Recommendation

Set up a selected Navy/Industry small group to review the requirements for, and produce a validation plan that will include all the processes, plans, tests and inspections to insure that the NARF's will deliver a completely acceptable product to the Fleet. An activity outside the NARF's should represent NAVAIRSYSCOM; NARF's, however, should participate.

C. REWORK SCOPE

Conclusion

Team Five cannot confirm whether NAVAIRSYSCOM plans to continue rework of AERO-1A AMCS equipment concurrent with F4B PAR after the first year, second year, or throughout the active service life of the F4B/SPARROW III WEAPON system. (Refer NAVAIRSYSCOM letter 411211/42:JHK of 22 April 1968). Additionally, it should be noted that available test equipment is not adequate.

Recommendation

Team Five is unanimous in endorsement of a PAR policy for continued rework of the AERO-1A/F4B throughout the active service life of the system. Additionally, the PAR concept should be expanded to all air-to-air weapon system components.

D. DATA PACKAGE

Conclusion

Serious deficiencies generally exist in the control documentation received by the Navy when new material is introduced into the Fleet. This usually results from contractual weaknesses and creates a serious gap for the NARF's and other activities.

Recommendation

It is recommended that future contracts clearly state that the documentation must be in accordance with the requirements of MIL-D-8684(AER) and that contractual approval of documentation must be included through the use of a validation process made by an in-house technically competent team. To up-date present data packages, new contracts should be made to the manufacturers in accordance with the above philosophy. It is further recommended that a team of cognizant field personnel, NAVAIRSYSCOMREP's, In-Service Engineering, and NARF's, confer prior to final contract approval to discuss and approve contents of any addendum to MIL-D-8684(AER).

E. PARTS SUPPORT

Conclusion

There exists a critical shortage of specific parts within the NARF to support rework and modification programs. The quality of parts received from the supply system or on open-purchase and used by the NARF is questionable, even though the final product may pass all established test requirements.

Recommendations

The following recommendations will alleviate many of the parts problems:

(a) Adopt 3M reporting technique (see TAB W).

(b) Develop a meaningful ILSP (Integrated Logistics Support Plan).

(c) Maintain an updated QVL (Qualified Vendors' List).

(d) Procure stabilized components for critical circuit application.

(e) COMNAVAIRLANT (Commander, Naval Air Forces, Atlantic) and COMNAVAIRPAC (Commander, Naval Air Forces, Pacific) direct organizational and intermediate activities to deliver a complete assembly to the NARF's for rework if at all possible.

F. TECHNICAL DATA INTERCHANGE

Conclusion

Exchange of information between the NARF's involved in the air-to-air missile systems rework area varies from good to almost non-existent.

Recommendation

Interchange of common interest information be initiated or improved at all functional levels with an emphasis on small groups working to specific problems as they arise.

G. CONFIGURATION CONTROL

Conclusion

Air-to-air missile systems have a wide variation of configurations; this is especially so in the F-4 aircraft series. In many instances this has caused one or more of the systems to be degraded from "Mission Ready" to partially "Mission Capable."

Recommendation

It is recommended that all air-to-air missiles systems equipment be updated to some specific configuration and a better method of kit and configuration control be established.

H. QUALITY ASSURANCE PLAN

Conclusion

The NARF's do not have a standardized, effective Quality Assurance Program or a Quality Assurance Plan for the rework performed on air-to-air missile system components.

Recommendation

NAVAIRSYSCOM task a Government team to develop an overall Quality Assurance Program (objectives) and a general Quality Assurance Plan for air-to-air missile system rework.

NAVAIRSYSCOM task a Government/Industry team to develop detailed Quality Assurance Plans for the specific items of the air-to-air missile system components, and to develop quality workmanship standards for these components.

I. EXPANDED PERFORMANCE EVALUATION PROGRAM

Conclusion

The NAVAIRSYSCOM PEP (Performance Evaluation Program) for SPARROW is adequately performing its purpose within its current restraints. The program requires expansion in order to more adequately measure rework quality of all air-to-air missile systems.

Recommendation

Expand the PEP to develop a periodic test program to evaluate the air-to-air missile systems from cockpit to target. Adequately telemeter and monitor the program so as to pinpoint deficiencies or problem areas. Provide feedback to the NARF's and to the in-service engineering activity with specific recommendations for improvement.

J. EARLY NARF PARTICIPATION

Conclusion

The NARFs' talent and experience are not being properly utilized in the development stages of new programs and modifications to existing programs simply because they are not brought into the rework picture soon enough.

Recommendation

NAVAIRSYSCOM Program Managers initiate positive action to assure appropriate NARF participation early enough in planned programs that will eventually effect rework assignments. Early participation would assure the consideration of NARF requirements and experience prior to decisions being made that would effect the rework and maintenance processes. Specified participation should be identified in the WEAPON Planning Document, NAVAIR Notice 013010.

K. NARF/CONTRACTOR COST COMPARISONS

Conclusion

At the present time, there is no method by which NAVAIR routinely reviews and compares its in-house repair and rework costs with that of commercial facilities.

Recommendation

NAVAIR set up a plan by which periodic direct cost comparisons of like work on like items are made between in-house and commercial facilities.

L. AERO-7A/AMCS TEST FACILITY

Conclusion

There is no way for the NARF's to check either the operating sequence or the timing of the various relays in the SPARROW III firing circuits of the F-4 aircraft.

Recommendation

Procure a dynamic AERO-7A launcher ejector test facility for each NARF (North Island and Cherry Point). Use instrumentation similar to that presently in use at MAS Miramar or new instrumentation currently in prototype stage at the NAVMISCEN. This facility should be made available to all F-4 aircraft commands ashore.

III SURVEILLANCE

A. SURVEILLANCE PLAN

Conclusion

Surveillance/Quality Evaluation of some air-to-air WEAPON system components has contributed greatly both to the rework process and in general to improved missile reliability. However, surveillance of some components

(especially the AMCS and SPARROW) has not been implemented. This latter condition has allowed some deficiencies and aging problems to go undetected. There is a requirement to define the maximum number of captive flights allowable before the missile is reworked.

Recommendation

It is recommended that surveillance be given higher priority, additional funding, billeting and direction to expand existing quality evaluation programs and implement programs for AMCS and missile items which have demonstrated a history of unsatisfactory performance.

IV ENVIRONMENTAL TESTS

A. MARGINAL COMPONENT DETECTION

Conclusion

The application of relatively low level vibration to the SPARROW missile has indicated a strong possibility that marginal components may be induced to early failure without harming satisfactory items. Further tests are planned by NWS Concord to confirm the non-destructive nature of the technique. Temperature (particularly low) also shows promise in this application. Both approaches may be satisfactorily economical for 100% use by the NARF's if the required environmental parameters can de defined, and carefully selected engineering techniques are applied.

Recommendation

Pursue the planned NWS Concord investigation into the non-destructiveness of the present vibration technique. If satisfactory, endeavor to develop an economical means of mechanization and carefully define techniques to be used at the NARF's. Procure equipment and implement on a 100% basis. Investigate temperature as a possibly better and more economical means of obtaining marginal component failure.

V REPORTING

A. STANDARDIZED REPORTING PLAN

Conclusion

Numerous reports have repeatedly indicated various required corrective actions with little action resulting. These primarily consist of the non-standard analytical and engineering type reports. These reports with their lengthy distribution lists end up in various NAVAIRSYSCOM Codes which have neither an interest nor need for the information. The quantity creates a bottleneck and retards actions.

Recommendation

It is recommended that the In-Service Engineering activities be established and tasked to develop reporting plans with the single purpose of providing NAVAIRSYSCOM with the required information to make managerial decisions and to reduce the report traffic into NAVAIRSYSCOM to the essential.

It is further recommended that an Air Weapon ZIP Code be established giving adequate identification to steer reports to the action code(s).

B. 3M PLAN FOR REWORK FACILITIES

Conclusion

There is a definite need for the NARF's to join in early, full participation in the 3M (Navy Maintenance and Material Management) Reporting System.

Recommendation

NAVAIRSYSCOM task an appropriate field activity with developing a plan for the NARFs' full, early participation in the 3M Reporting System.

VI PUBLICATIONS

Conclusion

Publications have long been a problem and are usable only to a degree after being employed several years.

Recommendation

That the latest manual Military Specification (no number), titled "Manuals, Technical, Airborne Missiles" and the minutes of the SPARROW Technical Manual Management Team chaired by NAVAIR-4036 be distributed to all concerned for review and comment on a priority basis.

COST ESTIMATES

		FY'69	FY'70	FY'71	FY'72	FY'73
I	A. Program Managers	None required within NAVAIRSYSCOM other than to cover expansion of Headquarters Staff.				
	B. Rewrite NAVAIRINST 4700.2	(Within present funding limitations)				
	C. In-Service Engineering (Add 150K/ yr for Raytheon Assistance)	Obtain from field activities in their proposed transfer agreements.				
		SPARROW	500K	500K	400K	400K
		SIDEWINDER	300K	300K	300K	300K
	D. Air Launched Proficiency Inspections	10K	10K	10K	10K	
	E. Encouragement of Technically Oriented Management	Minimal, if any.				
	F. Stockpile to Target Sequence	(None required)				
II	A. Rework Plan	Indeterminate due to the wide variation of present situations on the various programs. The expenditure can normally be expected to be ammortized through resulting efficiencies on any continuing program. Top specification correction and fault isolation technique generation are particularly susceptible to wide variations in cost. Raytheon 230K for AERO 1A and ATM 7E, plans and documentation. Westinghouse estimate for rework plan is 150K. Fault isolation roughly estimated for AWG10 as 500K.				
	B. Rework Validation Plan	Obtain quotes from Industry. In-house participation estimated to cost 50K in FY'70. Westinghouse 40K, Raytheon 20K.				

TAB V-A

COST ESTIMATES
(Cont.)

		FY'69	FY'70	FY'71	FY'72	FY'73
C.	Expand Rework Scope of Missile Systems. Improved parts to update AERO 1A:2,815K. Additional SSE:456K (Westinghouse)	3.5K** Rework AIM7E-2 3K/ Missile, Update each missile 3K each	3.5K**	About 1000 mhr/sys as experience is gained (F4). About 300 mhr/ sys for A4		
D.	Data Package	500K	300K	200K(Figures include 225K for Raytheon)		
E.	Parts Support	100K	100K	100K(Includes 40K for QVL on SPARROW)		
F.	Technical Data Interchange Between NARF's	$40K per year over present expenditures, primarily for travel.				
G.	Configuration Control	500K	--	--		
H.	Quality Assurance Plan General Objectives and QA Plans (10 people - 5 teams, travel-per diem- -2 week's each)	25K	(within existing resources)			
	Detailed QA Plan (10 people - 5 teams, travel-per diem--2 Week's each)	25K	(within existing resources)			
	Quality Workmanship Document	Raytheon 30K, Westinghouse 185K, McDonnell Douglas participation 20K (All 3 phases)				

** Already in process so presumably is already funded. Other system components, including wiring, launchers and both "E" and "F" level checkout carts require estimates from NARF's.

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COST ESTIMATES
(Cont.)

		FY'69	FY'70	FY'71	FY'72	FY'73
I.	Expanded Performance Evaluation Program (Improved PEP)	100K (This includes 2/missile or 80K/yr for flight analysis)	200K	180K	150K	120K
J.	Early NARF Participation	40K per year for travel purposes.				
K.	NARF/Contractor Cost Comparisons	NARF-none; for industry, request a quotation.				
L.	AERO-7A/AMCS Test Facility Old Installation (Pit)	78K	4K	4K		
	New Installation ("Catcher's Mitt")	46 *	2K	2K		
III A.	Surveillance Plan Additional over present	50K	400K	400K	500K	500K

* Includes 20K for development of data package.

COST ESTIMATES
(Cont.)

			FY'69	FY'70	FY'71	FY'72	FY'73
IV	A.	Environmental Program for Detecting Marginal Components					
		NORFOLK					
		Equipment	5K	--	--	--	
		Maintenance	5K	5K	5K	5K	
		Test Personnel	54K	54K	54K	54K	
		ALAMEDA					
		Equipment	58K	--	--	--	
		Maintenance	5K	5K	5K	5K	
		Test Personnel	54K	54K	54K	54K	
		TOTAL	181K	118K	118K	118K	
			(This estimate presumes the application of a promising but unconfirmed vibration technique. Further investigation could easily disclose a much higher initial implementation figure.)				
V	A.	Standardized Reporting Plan	10K	10K	7K	3K	
	B.	3M Plan for Rework Facilities	100K	400K	300K	200K	
VI	A.	Publications	Funding requirements can be obtained from NAVAIRSYSCOMHQ Code				

PROGRAM MANAGERS

Detailed Conclusions and Recommendations

It was the unanimous view of Team Five that the majority of improvements necessary in the rework area can be achieved by more effective use of the management tools now available.

Additionally, the following is a series of quotations made by representatives from industry who assisted Team Five. It indicates how the NARF (Naval Air Rework Facility) management system appeared to them:

> "The chain of command which the NARF's must go through to be responsive is too cumbersome to expect any clear-cut direction in a timely manner or to enhance or motivate the NARF's to react effectively.
>
> "The most needed reform is to establish a weapons system project management team with broad enough powers to satisfy the needs of all participating activities of the Navy. Included within this management team should be members of the supporting NARF's to assist in the development of SSE, special purpose tooling for manufacturing and calibration, and technical data required to meet the needs and skills at a given NARF. ASO should also be an active member to see that adequate bits and pieces are procured to maintain the radar. ASO must consider transitional training and normal maintenance actions required to keep the radar operational, rather than wait for a demand usage to be developed.
>
> "Currently there are too many channels, which the NARF's must follow on every item thinkable.
>
> "Should the NARF's receive a defined effort and be permitted to be an active participant in early system development, a more concerned attitude would be apparent."

Without changing the present functional NAVAIRSYSCOM (Naval Air Systems Command) organization, COMNAVAIRSYSCOM should provide the Program Manager the staff to fulfill his managerial functions, provide him sufficient control over the appropriate desks, initiate immediate action

to assign In-Service Engineering Activities, CFA's and PFA's in the air-to-air missile systems, and insist that the Program Managers manage the programs.

The draft copy of the F-4/RF-4/SPARROW III Weapon Systems Project Manager Charter now signed by RADM Townsend, but not yet signed (as of 23 September 1968) by his Air Force counterpart, would give the Program Manager ample authority to exercise firm direction of the SPARROW - F-4 - AMCS project and to correct all its present lack of cohesion. Similar broad charters should be provided to other Project Managers.

TAB D to this report discusses the assignment of In-Service Engineering to appropriate field activities. For example, In-Service Engineering activities should be able to boil down reliability information and furnish this to Program Managers. Examining the relevant reliability figures so obtained then becomes a routine task of the Program Managers' Office. He can then focus corrective effort on the low reliability items. A comparison of reliability figures of all elements of the system (guidance, AMCS, fuzing, aircrew training, launcher and aircraft circuitry) would clearly indicate wherein refocus on rework or on initial design is required. The comparatively low reliability of the AMCS in Fleet shoots should have a bearing on whether the rework is to continue beyond the presently planned rework update program. Fuzing failures should have instituted redesign several years ago.

TAB K of this report discusses some of the areas of Data Package deficiencies that should be corrected. The Program Manager should also insure close liaison between the In-Service Engineering Activity, NATSF, and the Supply Control Point, together with the cognizant desks in NAVAIRSYSCOM to insure that the Data Package is updated and latest configurations are incorporated in rework.

TAB G briefly discusses the Stockpile to Target Sequence. The Program Manager should also insure that new contracts and developments take under consideration environmental conditions that could be encountered. In retrospect, had it been envisioned that the SPARROW would be used as it is now employed and had these requirements been written into the contract, some problems would have been avoided. For example, the SPARROW G&C contract did not provide for radiation protection of the SRS.* The limitations of captive flights are not yet fully known. However, the point is that the Program Manager should insure that the most rigorous demands feasible and foreseen are written into new development contracts.

*Side Receiving System

The Program Manager should insure that the Long Range Development Plans are promulgated as early as possible so that the Area Representatives may sufficiently involve the NARF in its initial development of a rework line and in contracting for long lead-time facilities and equipment. This is in accordance with the Area Representatives Mission and Task Statement.

The preceding are only a few examples of areas in which the Program Manager should act to effectively manage. In summary, the Program Managers should retain over-all policy direction, control funding allocations, and exercise or direct any necessary management tools. Within all of this, only one type weapons management technique should be used - that used for all other aeronautical material. With only one type of aeronautical management tool, COMNAVAIRSYSCOM can more effectively control all his material.

MANAGEMENT TECHNIQUES AND MAINTENANCE POLICY

Detailed Conclusions and Recommendations

The Fleet has access to many documents, some cancelled, that provide conflicting maintenance instructions, the most recent being NAVORDINST 8025.1 which cancelled BUWEPSINST 8020.6B and is not in consonance with NAVAIRINST 4700.2. Since many activities are still reporting under these various instructions, delays up to 12 months have been encountered in the receipt of material involved in hazards directly affecting safety. (e.g. misfired BULLPUP missiles.)

In addition, since Marines as well as the Navy are users of aeronautical material for which OP-05 and the COMNAVAIRSYSCOM are responsible, it would appear appropriate that NAVAIRINST 4700.2 "Naval Aircraft Maintenance Program" could be rewritten as a CNO instruction. When rewritten it should include all aeronautical material -- aircraft as well as air-launched weapons. If the above action is taken and the title of the instruction changed to "Aeronautical Material Maintenance Manual" it would be applicable to all users of aeronautical material. Specific recommendations to include airborne weapons in the aeronautical maintenance management system are included in NAVAIRSYSCOMREPAC letter 3341/OCR:drs serial 99% 16 February 1968 and concurred with by NAVAIRSYSCOMREPLANT. Implementation of these recommendations would materially expedite logistics support of the Fleet.

In addition, the rewrite of 4700.2 should spell out specifically the three levels of maintenance for each element of the Missile System, including, specifically, the limiting number of captive flights per missile prior rework. See also TAB J.

IN-SERVICE ENGINEERING

Detailed Conclusions and Recommendations

It is the unanimous opinion of the activities visited and Team Five members that there is an urgent requirement for the delegation of In-Service Engineering functions to field activities in accordance with the policy contained in paragraph 3 of the NAVAIRINST 5400.14 of 27 May 1967. Basically this feeling was generated by the lack of responsiveness of the present system.

Tremendous Navy talent is being wasted. This is evidenced by the numerous investigations and data analyses presented with good, sound conclusions and recommendations (including proposed changes), which have had little or no consideration or follow-up action. In short, the field and Fleet activities have had no overall effective engineering guidance.

Activities concerned with the SIDEWINDER missile need direction regarding rework specifications, test equipment, field specifications, manual up-dating, etc. At present there is no field activity with overall In-Service Engineering cognizance. NAVWEPCEN China Lake has assumed these responsibilities in lieu of being given this authority, primarily because no one else has, and also because China Lake designed the weapon and has the engineering experience necessary to perform this task. This unofficial responsibility, however, has built-in problems.

Activities concerned with the rework of the SPARROW III need faster resolution of their problems. For example, NARF Alameda letter NARF-324-CAH ser 2131 of 13 August 1968 presents two engineering investigation reports No. AL-13 and No. AL-14. AL-13 discusses the measurements conducted on the 10:1 probe used at Target Seeker Station No. 5 on the PLM line and recommends a required change. AL-14 discussed the frequency versus amplitude characteristics on the AC/DC converters used on the PLM facility and recommends a fix. Both of these reports illustrate PLM deficiencies which effect the missiles processed and should have been acted upon by this time.

The LAU-7A Pylon Launcher does not have the proper documentation for rework and test. An In-Service Engineering facility would be able to investigate and initiate the proper documentation action in a timely manner for this most important item in the air-to-air missile system.

Lack of effective engineering management has probably been the greatest obstacle in the F-4/SPARROW III Program. This has been the primary cause of inaction to improve the quality and reliability of the F-4/SPARROW III

System. It is firmly believed that designating appropriate In-Service Engineering field activities would speed the solving of problems encountered in the field. Figure 1 is a schematic depicting the flow of functions, authority, and responsibility through a Cognizant Field Activity (CFA) performing In-Service Engineering tasks.

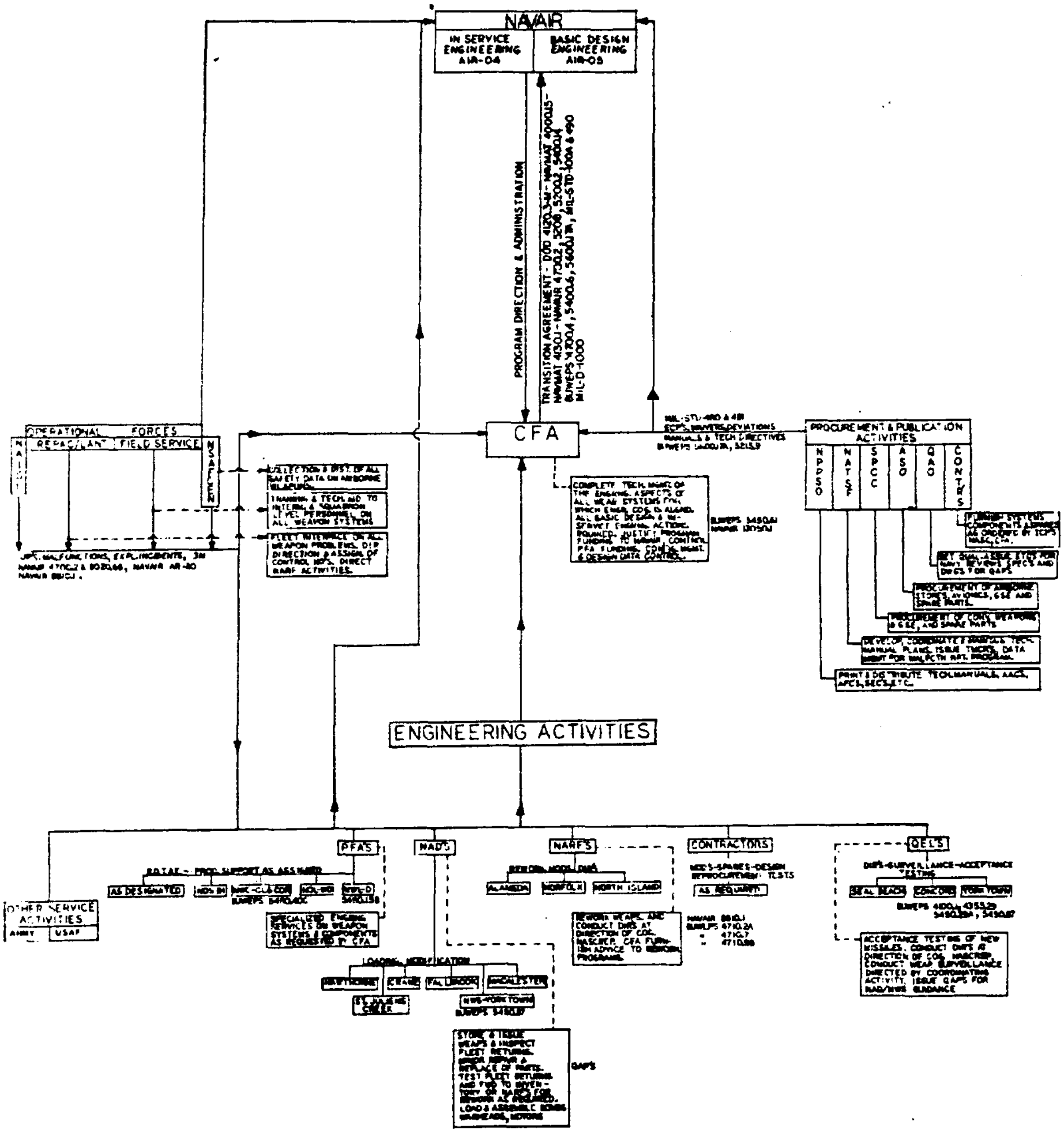
NAVAIR
IN SERVICE ENGINEERING AIR-04
BASIC DESIGN ENGINEERING AIR-05
PROGRAM DIRECTION & ADMINISTRATION
CFA
OPERATIONAL FORCES
PROCUREMENT & PUBLICATION ACTIVITIES
ENGINEERING ACTIVITIES
PFAS
NAD'S
NARF'S
CONTRACTORS
QEL'S
OTHER SERVICE ACTIVITIES
ARMY
USAF
ALAMEDA
NORFOLK
NORTH ISLAND
SEAL BEACH
CONCORD
YORKTOWN

Figure 1

AIR-LAUNCHED PROFICIENCY INSPECTIONS

Detailed Conclusions and Recommendations

The requirement for an annual detailed, comprehensive review of the NARF's is evident from the information contained in this report on visits to the NARF's; such as, "The NARF's cannot guarantee or predict uniform quality and performance since there are no detailed specifications, plans and procedures applicable to all NARF's assigned identical tasks: they depend almost entirely on handbooks which are not always up-to-date, very general and contain limited quality assurance." . . . "The poor performance of the SPARROW missile must be improved. It has not been determined, however, that the poor performance results from work performed by the NARF's; data suggests the real problem may be poor reliability inherent in the missile. Regardless of where the problem originates, the NARF's must be provided the capability to detect and correct such problems." The team's general conclusion was that AMCS being reworked in PAR were in satisfactory condition, although not of the same configuration due to lack of kits. The team was concerned, however, that adequate procedures, support equipment, parts, quality assurance/rework plans were not available to the NARF's that would continue this satisfactory level without the present complement of limited, highly qualified personnel involved in the process.

It is believed that a team composed of competent personnel reviewing the following areas annually would be able to greatly assist in improving the NARF rework: Areas of review--quality assurance, engineering, rework processes and procedures, facilities, data package, and logistics.

It is recommended that NAVAIRSYSCOM direct NAVAIRSYSCOMREPLANT/PAC to issue prior to 1 January 1969, a joint instruction initiating an air-to-air weapon system proficiency inspection to be conducted annually or at such other intervals as may be deemed necessary, to insure quality products are being delivered to the Fleet. The instruction should be coordinated with appropriate NAVORD activities and initiate a similar inspection at appropriate NWS, (Air-Launched Missile Divisions) by NAVAIRSYSCOMREP Teams. Cognizant field activities NAVMISCEN, NWC, QEL, FMSAEG and contractor personnel will be requested to assist.

ENCOURAGEMENT OF TECHNICALLY ORIENTED MANAGEMENT

Detailed Conclusions and Recommendations

The NARF workload has evolved from basically overhaul and repair of aeronautical structures and engines to very complex weapon systems. NARF managements have not fully evolved along a parallel line. Additionally, quality relative to production must carry a much higher priority since field repair on many weapon system components has become impractical.

Two of the observations relevant to this condition and noted during the Team visits were:

a. Engineering support was not sufficient at all of the NARF's. For example, North Island reportedly had a professional engineering staff of 22 men to support 7,200 employees. Greater emphasis on the use of professional technical staff is believed to be required.

b. Very few electronics oriented personnel are included in the overall production management structure. Those with the necessary management skills, should be encouraged to enter management and advance to any level where their individual abilities allow them to function as competent managers with technical appreciation.

Finally, NAVAIRSYSCOM should assist the NARF's in upgrading their professional engineering billets.

STOCKPILE TO TARGET SEQUENCE

Detailed Conclusions and Recommendations

A brief summary of the contents of SWOP TP50-20, "Procedures for Preparation of Stockpile to Target Sequences (STS's) for Nuclear Weapons" (For Official Use Only):

A STS will be presented in a three-part format consisting of introduction, operational concepts and environment requirements.

a. INTRODUCTION - The introduction will identify the weapon system for which it has been prepared. It must include the means of revision appropriate for this particular application. A brief description of the purpose and scope of the STS and a description of the weapon system will be included.

b. OPERATIONAL CONCEPTS - This part of the STS will include a relative description of the logistics plan for the weapon and a description of the intended employment of the weapon as part of a weapon system. The employment concept will cover the configuration and geographical areas in which the weapon is expected to be operational. Targeting information, flight sequence or launch and trajectory sequence, mode of delivery, command and control, and types of firing shall be included as appropriate.

c. ENVIRONMENTAL REQUIREMENTS - This portion of the STS will include sections on general environmental requirements, logistics, delivery to the targets and supplemental data. Sections which do not apply for a particular section need not be included. Natural and intended environments will be included where applicable. Environmental levels presented are the extremes which the weapon is expected to experience. Environmental conditions which are imposed concurrently during the expected use of the weapon will be specified; that is, the temperature spectrum for simultaneous vibration or shock. Significant contractual and maintenance and events are depicted along with a description of these procedures and events; vulnerability and design criteria will be included. The application, configuration and the location of the environmental requirements will be specified. Supplemental data can consist of related information from other parts of the weapon system which may be of reference value to the designer.

It is recommended that NAVAIRSYSCOM prepare a NAVAIR Instruction requiring its Program Managers to incorporate the concepts of Navy SWOP TP50-20 in project development.

REWORK PLAN

Detailed Conclusions and Recommendations

It was very apparent to the members of Team Five and contractor representatives that the four NARF's visited lacked a plan that specifies the rework to be accomplished. Such a plan would attempt to provide a standard configuration, where all approved Class 1 and 2 changes could be conveniently installed, thus upgrading the system by removing chronic failure parts and replacing with more reliable components.

A typical Air to Air Missile Rework Plan would cover the following areas as a minimum:

Master Flow and Schedule. This document is essentially the overall plan for a given system or component. It defines, in flow chart format, what should be done and where, with the processes called out and explained. All of this then is referenced against a time frame with appropriate sub-plans from Quality Assurance, Facilities Planning, and others. Also this plan will normally introduce the areas where change control and action must be injected into the NARF's effort along with reliability improvement through parts replacement, etc.

Top Specification. This document is mandatory, for many other facets of the plan hinge on it. It must be based on a reasonable allocation of system parameters with particular emphasis on field and other associated test set parameter relativity (i.e., the parameter allocation "wedge"). Presently, this document is minimal or non-existent in the air-to-air rework area. It must be developed.

Test Procedure. These are presently in the form of Handbook of Overhaul Instructions or in-house generated documents. Serious problems exist in keeping these current. This problem should be resolved by generating either corrected manuals or, more appropriately, specific, controlled procedures for each program. This should be done by an in-service engineering activity.

Shop Practices and Workmanship Documentation. In general, no such formal guidelines exist, except in the area of solderfication. This tends to not be the most recent data.

Rework Test Plan. This document generally does not exist today and where it does, it is not generally available at working levels. It should, as a minimum, call out all test equipments (military, special, and commercial), procedures, tools and fixtures, and miscellaneous processes, in a flow chart format.

[redacted]

Test Equipment Validation and Calibration Plan. This plan almost always exists at the NARF's, although the formalization and mechanization varies widely. It should include an original checkout and validation procedure for each piece of test equipment, a means of insuring calibration accuracy (normally through a recall system), and a feedback system to refine the plan.

Fault Isolation Techniques. This area is presently entirely in the hands of the troubleshooter who uses deductive reasoning, some handbook information, and experience to define and correct malfunctions. As systems become more complex this approach will become even less desirable. There are several reasonably good manual fault isolation techniques being pursued by both private industry and military activities. Westinghouse and Raytheon are both contributors to this art.

Test Equipment Maintenance. This effort is usually left to the judgement and talent of superior mechanics and technicians. This, in general, is a sound approach when viewed from an economic and effectiveness point of view. However, the inclusion of a routine preventive maintenance program, where indicated, and overall guidelines, tend to improve the situation.

Training Plan. The NARF's are, in general, holding their own, or slowly loosing ground, in their efforts to hire and retain qualified line workers. Apprentice and on-the-job training is the mainstay of the present efforts, though their application varies widely from NARF to NARF. Level, depth and type of training must be injected into the rework plan to carry out the objectives of the basic rework philosophy with the least expenditure of manhours and money.

Overall Feedback. As an outcome of all the foregoing, a feedback system must be tailored into the above plans. In general, this will vary from job to job, but is paramount in the effort to obtain the greatest effectiveness of the planning process. This feedback is particularly associated with equipment preventative maintenance, reliability improvement, and detailed scheduling and flow.

In order for any rework plan to become effective within a NARF, NAVAIRSYSCOM must:

a. Establish a prime designated overhaul point for each air to air missile system component.

b. Establish an in-service engineering activity for each air to air missile system component that will be responsive to NARF rework technical needs, in a timely manner.

[redacted]

TAB V-1

REWORK VALIDATION PLAN

Detailed Conclusions and Recommendations

The NARF's require a validation plan that includes all the requirements for reworking a unit or system in such a manner that assures the return to the Fleet of a fully acceptable, reliable product.

The validation plan must look at the entire data package, the incoming inspection, examination and evaluation, change configuration, repair and test, rework plan, quality verification plan, reliability, availability of proper parts, proper test equipment, calibration, workmanship, formalized and on-the-job training requirements, availability of manpower, skills and resources. The plan must include management techniques and also provide for periodic audits by outside Naval activities (AIRSYSCOMREPAC/REPLANT). See TAB E.

The validation plan that is developed must take advantage of the experience gained by industry in the original manufacture and test of the units and/or systems, and also the experience and know-how of the NARF that has been directly concerned with the requirements of the Fleet, and is geared to handle their particular problem. The Navy/Industry team concept would be the most advantageous to the Navy since together they could make a very definite contribution.

REWORK SCOPE OF MISSILE SYSTEMS

Detailed Conclusions and Recommendations

AMCS performance can be and has been vastly improved by including it in the PAR program. This is decisively indicated by the following quotes from the Naval Missile Center:

> "Significant differences between performance reliability achieved in operational service and that observed in PMT at NAVMISCEN indicates that increase in reliability of AERO-1A is obtainable in rework.
>
> "Replaceable assemblies and qualified components and parts of APQ-109 and AWG-10, which have significantly higher reliability and are directly interchangeable in AERO-1A MCS should be procured as replacements, example is; Antenna Azimuth Actuator.
>
> "Replaceable assemblies should be requalified to factory acceptance criteria after rework and before integration into an AERO-1A MCS.
>
> "Incorporation of specific engineering changes to replaceable assemblies which are designed to increase reliability should be accomplished, example is; WECO ECP 126.
>
> "The hydraulic actuator on the APQ-120 and APQ-109 gives greater reliability than the actuators on the APQ-72. There are other parts which exist that could be interchanged during the rework cycle".

The demonstrated low fleet reliability of the AERO-1A and low probability of mission success dictates continued PAR for the AMCS.

The rework activity at Cherry Point does not have a depot level test capability for final check of the AERO-1A system. The final check of this system must be at a level above that of the IMA equipment ("E" level cart) that is used. At NARF, North Island, depot level test equipment for unit test, system integration test, and final check is lacking. Should the rework of AERO-1A during PAR continue, both NARF's should be provided with adequate and sufficient equipment for test and alignment.

Additionally, weapon suspension equipment (Racks and Launchers) associated with air-to-air missile systems should be reworked during the aircraft PAR cycle. Finally spare Weapon Replaceable Assemblies (WRA) should be

immediately reworked by NARF's in sufficient quantities to maintain AERO-1A system integrity.

Recommendations

Rework the entire AMCS, SPARROW and SIDEWINDER during each PAR cycle. At that time replace the less reliable parts with more reliable parts. Similarly update the SPARROW Missile during rework. Rework integral launchers at each PAR and other launchers by the NARFS on a routine calendar basis. Test aircraft missile wiring and replace any wiring showing evidence of deterioration. Check the entire SPARROW Missile System, after rework, with an instrumented ejection of dummy missiles. See TAB S.

NARFS should rework the special Support Equipment and ground Support Equipment on a calendar basis. Rework missiles after a specified number of captive flights. This number must be determined by NAVAIRSYSCOM.

AERO-1A

Replace unreliable AERO-1A parts with more reliable AWG-10/APQ 109/APQ 120 parts: (Quotes are sufficient to rework 500 systems).

ECP 126	400K	(1) Westinghouse
ECP 204	1,000K	(2) Westinghouse
ECP 206	150K	(2) Westinghouse
Az and El Actuators	1,115K	Westinghouse
Overload Switch	150K	

Notes:

(1) Approved by the Navy, but not funded.
(2) ECP is presently awaiting approval by USAF. The costs quoted assume that non-recurring costs will be funded by the USAF.

AWG-10

Both NARF'S reworking the AWG-10 expressed a need for the following additional SSE: (Quotes are sufficient to complete the outfitting requested).

2 Each	Indicator Test Sets	142K
2 Each	Scan Pattern Test Sets	87K
1 Each	1F Test Set	47K
2 Each	1871 Test Sets	64K

SPARROW

Raytheon will submit a list of specific reliability improvements to NAVAIR 5108 for approval. Meanwhile, the following specific improvements should be incorporated during NARF rework. A directive from NAVAIRSYSCOM is recommended:

1. ECO-H-9174 (Circuit Change). Add a resistor to protect 3CR103 and 3CR105 diodes from current surges. Production incorporated at Serial R-6601-6.

2. ECO-J-1027 (Component Change). Improved klystron tube coarse tuning mechanism. Production incorporated at Serial R-12136-6. (O&R retrofit program is firmly scheduled).

3. Improved quality of 5Y101 Crystal, effective at production Serial approximately R-500-6. Missiles prior to this Serial (R-500-6) should have 5Y101 crystal replaced.

4. Improved quality of electro-mechanical relays (Hi-G, Inc., and Couch Vendors) effective at production Serial approximately R-6000-6.

5. Erratic routing of wiring over module 7T105 frequently resulted in serious pinching. Production correction effective at approximately Serial R-5000-6. All missiles prior to this serial should be carefully inspected at this location, and leads replaced if necessary.

SPARROW REWORK LINE

Add a final System test at Station No. 14, Target Seeker Line, for Alameda and Norfolk lines similar to the one in use at Raytheon.

DATA PACKAGE

Detailed Conclusions and Recommendations

Serious deficiencies generally exist in the control documentation received by the Navy when new material is introduced into the Fleet. This usually results from contractual weaknesses and creates a serious gap for the NARF's and other activities.

These deficiencies create difficulties in failure analysis, fault isolation, calibration and about every area of the NARF effort. This results in "back engineering" which is wasteful and slows down the corrective effort of the NARF's and the QEL's.

The minimum data package requirements are represented by Military Specification "Data, Design, Contract Requirements for Guided Missile Systems (MIL-D-8684 (AER))." MIL-G-23986, the detail specification for the AIM-9D Guidance and Control Section, is an example of a document which meets the above requirement. This document provides a complete, detailed specification for the end item. In addition, it provides drawing lists, applicable military specifications, weapons requirements, ordnance documents, etc. It contains everything needed for a manufacturer who is interested to bid and produce the hardware.

The existing SPARROW documentation does not measure up to this standard. To update the SPARROW package would require considerable refinement and additions to the existing specifications and drawings. The Team feels that the updating requirements are so extensive with so many proprietory drawings and information that Raytheon would have to provide the service necessary to update the package; however, it is urged that a competent "in-house" field team review and validate the data package as well as the addendum to Mil-D-8684 (AER) as being acceptable.

PARTS SUPPORT

Detailed Conclusions and Recommendations

There is no ultimate solution to solve all existing and future problems regarding parts. However, if the recommendations detailed herein are adopted, the results should provide significant improvements within "real world" funding limitations.

a. Parts procurement is based on inventory withdrawal and not on 3M data which reflects actual usage. Base spare parts procurement on 3M data.

b. A need exists to define all elements of parts logistics required to support present and proposed work loads in the NARF's. Sufficient information must be collected from all facets of the programs and channeled to an ICP (Inventory Control Point) in order to have spare parts contracts negotiated and material available when needed. It is therefore recommended that a comprehensive ILSP (Integrated Logistics Support Plan) be developed for all air-to-air weapon systems and components. The plan must be supported with timely funding and must cover all phases of the effort. For example, spares requirements need to be integrated to cover not only SPARROW Navy rework, but Air Force, United Kingdom, and Iranian rework as well.

c. Parts for NARF rework programs are being purchased from vendors that have been removed from the original contractor's QVL (Qualified Vendor's List). ASO and SPCC have made efforts to adhere to the QVL but it is not updated on out-of-production equipment. It is therefore recommended that QVL's be provided to, and maintained for, the NAVY both on older air-to-air missile system components as well as new, by contractural agreement with the prime contractor. It is further recommended that QVL maintenance for components out-of-production be made an in-service engineering activity function when an activity is designated.

d. Aging of components to achieve circuit stability is a valid and economical method to obtain equipment reliability. It is, therefore, recommended that the prime contractors be required to develop identification of components as to type and circuit location that would be substantially improved through aging. When these improved components enter the supply system, particular care should be taken to identify them separately from their counterparts. Vacuum tubes will be especially involved in this effort but other component types should also be included.

e. Incomplete air-to-air missile system assemblies are being returned to the NARF's for rework. This results in parts shortages, delays in shipping and substantially increased rework costs. It is recommended that organizational and intermediate activities be directed to send complete assemblies

to the NARF whether or not some portions may be serviceable. Many unserviceable auxiliary items such as the SIDEWINDER umbilicals can be inexpensively repaired but are costly to reprocure.

f. There is at present no contract vehicle providing incentive for the vendors to produce a better product. If a vendor meets the QVL or is qualified to produce an end item his maximum profit is achieved if he barely meets these requirements. It is recommended that an incentive program be established so that it will motivate the vendor to produce a better, more reliable product on a continuing basis. In summary the rework parts effort offers a prime area for innovation and new looks at old problems. The criticalness and magnitude of the operation makes ample opportunity for large cost savings.

However, it should be noted that emphasis on savings, often at the expense of quality, can be more expensive in the long run. One such idea which shows potential to substantially improve equipment is the use of vendor incentives to upgrade the reliability and acceptance rates of components. This and other like items should be vigorously pursued by groups such as in-service engineering activities, the NARF's, QEL's, etc.

TECHNICAL DATA INTERCHANGE BETWEEN NARF'S

Detailed Conclusions and Recommendations

For several years, the SPARROW rework program has used the Engineering Symposium approach as a means of interchanging information between the "missile NARF's." However, the scope and attendance has grown from the first meetings which were directed to test equipment and standardization, to cover many other aspects of the program. Other exchanges, both formal and informal, have also been used.

The Missile Control Systems, Weapon Suspension Equipment, etc., have also experienced various degrees of interchange among the involved NARF's but no formal symposium approach has been used. Communication effectiveness appears to be substantially less in these areas.

It is, therefore, recommended that the required interchange be achieved through two basic means. Both should be conducted under the auspices of the NAVAIRSYSCOMREPS (NAVAIRINST 5451.60) with the cognizant in-service engineering activity chairing.

(1) The symposium approach should be instituted throughout the Air-to-Air Missile Systems Programs. However, several smaller symposiums should be conducted addressing more specific areas. For example, Test Equipment would include such subjects as calibration, test procedure adequacy and change, test set parts provisioning, special facilities requirements, etc. These symposiums should be SCHEDULED on a routine basis, at least annually.

(2) Specific meetings (not symposiums) should be called when problems arise that warrant immediate resolution through this means.

At the conclusion of these meetings the cognizant in-service engineering activity should assume responsibility for follow-up to assure that the action items were successfully resolved. Meetings can never replace good management follow-up and control.

The expanded use of the above scheduled and called meetings should not preclude the use of other means of information exchange, but should greatly lessen the requirement for them.

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CONFIGURATION CONTROL

Detailed Conclusions and Recommendations

Air-to-air missile systems have a wide variation as to specific configurations, especially in the F4 aircraft series. In many instances, this has degraded the systems from "Mission Ready" to partially "Mission Capable."

To alleviate existing configuration control problems all systems need to be updated to an approved configuration. To avoid future similar configuration control problems, BUWEPSINST 5200.20 (1) should be closely adhered to in identifying Class II type changes. Finally, a configuration document for each major assembly similar to Westinghouse Drawing 514R300 (Configuration Document) for the AWG-10 should be provided.

The inherent complexity and diversity of modern weapons demands timely and accurate configuration statistic accounting capability for management decisions, particularly in the area of support equipment, components, and air-borne weapons systems.

There is a pressing need to update all systems, sub-assemblies, and launchers to a specific configuration because a large number of both Class I and Class II changes have been introduced resulting in systems and sub-assemblies that are not identifiable (externally) as to their configuration. Often it is not possible to determine if a sub-assembly will function until it is installed in the aircraft and an operational check is attempted.

It is recommended that each system, sub-assembly and launcher be programmed through the NARF for updating. Additionally, in order to update the systems, sufficient quantities of parts and kits must be procured for each change. A major complaint has been that the NARF's are unable to obtain kits to meet configuration requirements. Single kits that have been reported issued to operating squadrons are unobtainable during the PAR cycle. It is mandatory that BUWEPSINST 13052.1A (2) and 5218.8 (3) (MIL-T-23336) (4) on kit control be complied with to prevent the above situations from occuring.

Many changes are incorporated into equipment introduced as Class II changes that are in reality Class I changes. Such changes do not have the logistic support required and they are not fully documented. In such cases the change is first apparent when an interface, a failure, or a test equipment incompatibility problem presents itself. Time consuming delays are incurred while the squadron, AMD or NARF personnel procure the necessary

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documentation and/or parts to support the unit containing such changes. An additional problem is introduced even when the Class II change is properly labeled. For example, the reasonably simple LAU-7A Launcher has over 400 Class II changes, none of which are available at the NARF, yet the combined changes preclude repeatable test results. To avoid future configuration control problems, BUWEPSINST 5200.20 (1) must be closely adhered to in identifying Class II type changes.

LES's normally fall well within the Class II change category; therefore, it is recommended that NAVAIRINST 5215.6A (5) be revised by the Program Managers to provide the NARF's with a format tailored to MIL-T-23336 and that a numbering system be established which can be better controlled and identified.

NAVAIR-4026 has under consideration a proposed NAVAIRINST "Configuration Status Accounting Systems" which should cover many of the above problems. It establishes a system utilizing configuration data from all pertinent sources as a management tool for control and analyses of weapons systems' requirements and capabilities. Consideration should be given to its early promulgation.

(1) BUWEPSINST 5200..20 of 29 April 1963, "Weapons Systems Configuration Control Manual"
(2) BUWEPSINST 13052.1A of 8 April 1964, "Aircraft and Their Related Equipment and Material; Procedures for Preparation, Distribution, Incorporation and Distribution of Changes To"
(3) BUWEPSINST 5215.8A of 30 January, "Letter Type Technical Directive System; Establishment of"
(4) MIL-T-23336(WEP) of 20 June 1962 "Technical Directive (Letter Type); Preparation of"
(5) NAVAIRINST 5215.6A of 27 November 1967, "Local Engineering Directives Prepared by Naval Air Rework Facilities"

QUALITY ASSURANCE PLAN

Detailed Conclusions and Recommendations

The NARF's visited by Team Five did not have effective Quality Assurance Programs or Plans developed specifically for the air to air missile system. In order to deliver good quality hardware, the NARF's Quality Assurance Organization must have overall management objectives (Quality Assurance Program) and a standardized method to implement these objectives (General and Detailed Quality Assurance Plans).

Recommend that NAVAIRSYSCOM task Government teams composed of NARF quality assurance and engineering representatives and chaired by NAVAIR-SYSCOM to meet at the NARF's presently reworking each weapon system component. These teams should formulate quality assurance objectives and general quality assurance plans for each item reworked (AWG-10, AERO-1A, SPARROW, SIDEWINDER, various launchers). NAVAIRSYSCOM should arbitrate all disagreement, make final approval on all planning produced at these meetings, and direct final implementation by the NARF's concerned. These teams should utilize the minimum requirements for quality assurance objectives and for a general quality assurance plan as shown in paragraphs three and four.

Minimum objectives for a specific air to air missile system Quality Assurance Program include:

a. The overall objective that only good hardware is delivered from the NARF's.

b. The associated objective to evaluate and assess production, inspection and testing procedures, techniques, process controls, and related documentation for adequacy and effectiveness.

c. The associated objective to assess product quality and reliability in quantitative terms.

d. The associated objective to advise in writing responsible authority of deficiencies uncovered.

e. The associated objective to prevent shipment of material to using activities that does not conform to established standards (NARF Rework Plan) of quality and reliability.

Minimum requirements for a General Quality Assurance Plan are as follows:

a. Statement of the purpose and scope of the plan, including nomenclature of the particular weapon system component involved.

b. Quality assurance organization involved for operating the plan. Include the required minimum quality assurance personnel required for specified amounts of hardware reworked to effectively do the quality assurance task.

c. Training. Include all on-the-job, Government sponsored, and factory training required for quality assurance and production personnel such as: soldering, welding, non-destructive testing, potting, special testing, management training, etc.

d. Product Verification. This includes physical inspection and witnessing inspection in the following areas:

(1) Incoming material inspection to the extent necessary. (Example: Qualified Vendor Lists.)

(2) Sampling inspection.

(3) Assembly inspection.

(4) Final acceptance/test inspection.

(5) Environmental testing.

(6) Preservation and packaging.

(7) Indication of inspection status.

e. Process Control. State the amount of quality assurance verification required to adequately control all processes.

f. Specifications. State the applicable quality standards involved, including all test specifications and specification changes.

g. Personnel Certification. State all the requirements for certification in special processes and non-destructive testing.

h. Material Review Board. State the Material Review Board authority proposed for use.

i. Documentation Control. State the review authority expected from quality assurance personnel regarding all product and procurement documentation and configuration control requirements.

j. Data Gathering and Analysis.

The reporting of suspected or discrepant materials in house must be required in order that failure modes, trends, and causes can be established. Cataloguing and correlating this data systematically will enhance problem identification and also aid in initiation of corrective action. In addition to NARF use, this information should be reported to the 3M system for developing usage and reliability data. The reduced data should be analyzed by the responsible in-service engineering activity of the prime designated overhaul point with assistance to be furnished as may be necessary from the contractor.

To properly identify the failure cause, and in-depth analysis of failed parts must be performed by the in-service engineering activity, QELS, prime designated overhaul point, or the contractor as necessary to provide accurate information for initiating effective corrective actions back to the NARF's.

k. Corrective Action. State the flow of the internal NARF corrective action cycle.

l. Quality Audits and Process Reviews. State the reason for performing audits and set up an audit schedule to be followed.

m. Controlled Storage. State controlled storage conditions and how non-conforming material is segregated, identified, and controlled.

n. Calibration Requirements. State how all test and measuring equipment and tools are controlled.

o. Reference Documents. Include all references that are pertinent to the Quality Assurance Plan.

Recommend that NAVAIRSYSCOM task Government/Industry teams composed of NAVAIRSYSCOM quality assurance management as chairman, NARF engineering, quality assurance representatives, in-service engineering activity representatives, and appropriate industry quality assurance engineering representatives. One team should meet for each basic hardware item reworked (e.g., AWG-10, AERO-1A, SPARROW, SIDEWINDER, launchers). The basic team objectives should be to develop a standard, pictorially highlighted, workmanship document for the specific hardware being reworked; and also to develop specific Detailed Quality Assurance Plans. The Detailed Quality Assurance Plan should consist of:

a. QCL's (Quality Characteristic Lists) of all portions of hardware being reworked or soon to be reworked at the NARF's involved.

b. Acceptance and rejection criteria for this hardware.

c. AQL's (Acceptable Quality Levels) expected of the reworked hardware. (Recommended sampling AQL for air to air missile system hardware is 95 percent for outgoing material, and 90 percent for reworked material at the receiving activities.) Sampling AQL must be defined for each type of component reworked.

The NAVAIRSYSCOM chairman should arbitrate all disputes during these meetings, and be authorized to negotiate for the industry input (contractor workmanship documentation and contractor established QCL's). He should be responsible for final review and acceptance of all teams' input to the NARF's. Finally the Detailed Quality Assurance Plans should be married with the General Quality Assurance Plans at the NARF's, and periodically updated, maintained, and used by the NARF's after receipt. The quality workmanship document should also be periodically updated by the contractors when major changes occur to them.

In the future, recommend that the quality assurance provisions for all air launched hardware be initially developed by the NAVAIRSYSCOM design engineering activity. Further recommend that these quality assurance provisions be maintained and updated by the NAVAIRSYSCOM in-service engineering activity.

In conclusion, Team Five feels that if these recommendations are undertaken, the quality of all reworked air to air missile hardware will be significantly improved.

b. Acceptance and rejection criteria for this hardware.

c. AQL's (Acceptable Quality Levels) expected of the reworked hardware. (Recommended sampling AQL for air to air missile system hardware is 95 percent for outgoing material, and 90 percent for reworked material at the receiving activities.) Sampling AQL must be defined for each type of component reworked.

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In conclusion, Team Five feels that if these recommendations are undertaken, the quality of all reworked air to air missile hardware will be significantly improved.

EXPANDED PERFORMANCE EVALUATION PROGRAM

Detailed Conclusions and Recommendations

The PEP should be expanded. The basic approaches of PMT are good, but the contractual requirements limit its effectiveness. Therefore, instead of PMT, Team Five proposes the following course of action:

a. The NARF's PEP should be continued at or above the present sampling rate.

b. Testing activity should submit one of the accepted missiles from the above sample to the QEL for environmental testing (vibration and temperature cycling), for detailed visual inspection and for complete testing of all circuits.

c. Testing activities should continue to send all failed missiles to QEL for analysis and feedback.

d. One missile per sampling lot should be fired at a realistic target within realistic parameters for better test results. It should be fired under full telemetry.

e. Insure NARF and in-service engineering activity take positive follow-up action and notify all concerned of their action.

In order to supplement the above changes in the present PEP program, it is recommended that NAVAIRSYSCOMHQ direct NAVAIRSYSCOMREPLANT/PAC to revise their current joint REPLANT/PAC PEP instruction using inputs from QEL's, NARF's, NAVMISCEN, FMSAEG and Raytheon.

EARLY NARF PARTICIPATION

Detailed Conclusions and Recommendations

Present NARF participation is basically limited to spare parts identification and procurement. This effort should be expanded to participation in the MEAR's (Maintenance Engineering Analysis Reviews) including selection of SSE, contractor support, training and publication procurement, as per the current Integrated Maintenance Management WR-30.

Early participation is particularly required in the areas of major facility changes, calibration of equipment considerations, general testing philosophy and mechanization. Modifications in many cases must be considered as new programs and they should be reviewed by the NARF's for the necessary interchange of information and coordination in the future rework process.

Most early information gained has been through informal contacts, but very little of this can be considered official; however, it is often the only information available to the NARF to determine whether or not an equipment or facility problem exists. Although the AWG-10, for example, has shown some improvements in this area, the trend should be strengthened. At the early stage in a project, the NARF can contribute many inputs to the contractor that may easily be incorporated, resulting in saving funds, manhours and elapsed time through the use of presently available experience, equipment, techniques and procedures. As an example, if special environmental controlled space is required, and assuming space is available within existing buildings, a minimum of one year would be required to obtain such a facility; if facility requirements fall into the Military Construction category (including additional utilities to existing buildings), one to three years would be required.

In the past emergency measures have had to be used to provide the required lighting, power, work spaces, space, etc., simply because the NARF was not aware of the size or requirements of the program. This could reduce the efficiency and adequacy of the facility and could effect the timeliness and/or quality of support.

The need for early participation is particularly important when two NARF's are to rework the same equipment. The test equipment, philosophies, and facility should be the same; but if some differences do exist, the reasons should be valid and clearly understood by all parties. It should be noted that the AWG-10 has several differences in test equipment, philosophy and mechanization in the NARF's with less than complete justification.

Several problems observed due to lack of early involvement were noted as follows:

a. The NARF did not receive the correct equipment causing in-house build-up or modification of existing equipments. This equipment is now a problem area in future modification efforts.

b. Major facilities such as radar ranges, environmental chambers, clean room facilities, etc., required long lead-time for completion.

c. Calibration equipment, specifications and instructions are areas that tend to be de-emphasized until the project starts in the NARF.

d. General purpose automated test equipment available to the NARF (or will be in the immediate future) is not adequately considered for use on new programs.

e. Failure to develop a comprehensive rework and quality control plan. This basic management tool to optimal processing is, in general, lacking in content or non-existent in the AMCS or missile rework efforts observed.

It should be noted when missiles are procured with WR-1, WR-2 and WR-5* as the contracting requirements, there are no provisions for NARF participation in determining the maintenance concept, technical data and support equipment requirements. An example of a smooth running program with a quality product is the SHRIKE program. NARF Alameda had a definite say in the type and depth of technical data and type of test equipment to be provided.

NARF engineering and production personnel should be permitted to be active team members of the IMM teams and MEAR's review teams in accordance with WR-30*. These team members would be able to make important contributions to depot level maintenance concepts, define depot level technical data requirements, and assure that the level of test equipment is adequate for depot level rework and can be integrated with existing facilities at the NARF.

If WR-30 logistic support elements are considered properly by NAVAIRSYSCOM during the development stages of an air-to-air program, the problems down stream would be taken care of.

*WR-1 "Supply Item Provisioning for Bureau of Naval Weapons Contracts"
WR-2 "Contract Support for Bureau of Naval Weapons Contracts"
WR-5 "Support Equipment Design, Approval Selection and Ordering for Bureau of Naval Weapons Contracts"
WR-30 "Integrated Maintenance Management for Aeronautical Weapons and Weapon System Related Equipment"

Who knows better than the NARF's, the depot maintenance problems, the type and depth of technical data required for depot support of the AMCS and missile, and the type of test equipment that will best integrate with existing NARF's?

NARF/CONTRACTOR COST COMPARISONS

Detailed Conclusions and Recommendations

The assignment of rework responsibilities for air-launched missiles and components to Navy in-house facilities is based primarily upon the strategic and operational aspects of logistic support of Mission Essential equipment. This is in line with DOD Instruction 4151.1 which states that each service will develop and maintain an organic (in-house) maintenance production function for mission essential equipment. The referenced DOD Instruction, however, does not preclude the use of contract support as an additional source. The determination of whether or not rework will be supported in-house is based upon a subjective reasoning process which includes measurable considerations along with risks and uncertainties.. Included in any such determination must be the responsiveness of each to rapidly changing Fleet demands, the technical capabilities of each, and of course, direct comparisons of costs. Technical know-how is centralized at the prime contractor's facility while the hardware is in production. The data package is kept current at the prime and configuration control can easily be maintained between new production and rework. On the other hand the in-house facilities can more readily adapt to changing workloads and changing priorities and in these respects are much more responsive to the Navy's needs, especially in a war or crisis situation. In other words, the Navy has direct control over the priorities it assigns to its in-house facilities, and can ask for and get immediate response to its changing demands.

With regard to cost, there has been, from time to time, comparison studies conducted by the Navy. One such study, the Navy Aeronautical Depot Maintenance Cost Comparison Study of 23 February 1965, evaluated a total of 39 components overhauled by both the Navy O&R and commercial facilities. It revealed that in 34 cases, the average cost to the Navy was lower in its in-house facility. These studies are performed infrequently, however, and at present there are no commercial contracts that would provide a basis for a direct cost comparison study. In the planning stage, however, is a requirement for the repair, rework, and installation of Engineering Change Proposal No. 54 in AIM-7E missiles. A contract (Air Force) has been let to the Raytheon Company for this work at a unit price of $3800. In the meantime, NARF, NORVA has priced out this work at $3064 each.

If it is determined that a private contractor should become involved in a rework effort, one approach toward leveling off the varying workload of repair units at the contractor's facility would be to contract for the rework in two stages. First, award incentive type continuing contracts for defect analysis and repair appraisal and second, after sufficient

units had accumulated, to award a fixed price contract for repair of a specific number of appraised units.

Another consideration that must be made in the Navy's determination of where repair is to take place is the problem that arises when the hardware to be repaired is no longer in production. It has often been the case that when the contractor completes production of an item, he rapidly loses interest in the rework function. If the Navy has large stores of this item and requires a continuing rework function, repair costs can rise significantly without an in-house repair capability.

By means of comparing contractor proposals to in-house costs, and weighing the above subjective factors, the Navy can measure the relative merits of contractor versus in-house repair and rework costs. It is recommended by this team that the Program Managers set up a plan by which such direct cost comparisons are made on a routine, peroidic basis as early in each program as feasible.

AERO-7A/AMCS TEST FACILITY

Detailed Conclusions and Recommendations

In the checkout of the firing functions of the F-4 aircraft, there is a weakness which reduces the reliability of the entire system, i.e., the inability of checkout personnel to test the sequence, timing, amplitude, and duration of events from trigger pull to missile separation. This is true at the NARF's as well as in the Fleet since the same test set and procedures are used by all. A dynamic type test (pit test) which overcomes the weakness of, and supplements, the static "E" level test was devised for use by Fleet units. The dynamic testing consists of actually ejecting a dummy missile from each launcher into an arresting device and recording the firing circuit sequences. By examining the recording, the technician can verify the serviceability of unit or problems in the firing circuits which otherwise would go undetected. In August of 1965 a program was established at NAS Miramar to dynamically check as many squadron aircraft as possible. The testing has produced significant results as documented by FMSAEG's Technical Memorandum E5-680 of August 1967 which reports the results of F/O 213 "SPARROW Shoot." Among other things, FMSAEG's data shows that those squadrons which did not have dynamic testing had a misfire rate of 14.9%, whereas those squadrons which did have dynamic testing had a misfire rate of 4.9%. FMSAEG concludes that these figures demonstrate "the importance of usefulness" of dynamic testing. Since the NARF's do not now have dynamic testing capability, it is logical to assume that some aircraft are "sold" with undetected discrepancies in the firing circuits which could preclude a successful SPARROW III launch.

In order that the NARF's might turn out a more "mission ready" aircraft, it is recommended that dynamic testing be done at the NARF's as part of the final checkout of the aircraft. Dynamic testing can be implemented in one of the following ways:

1. Procure instrumentation as currently installed at NAS Miramar, NAS Oceana, and NAS Cubi Point. This consists of a Honeywell Model 1108 Visicorder, a signal conditioning and timing unit, and instrumented dummy missiles. This type instrumentation can be built by the NAVMISCEN, Point Mugu, at a cost of $25K to $30K, depending on requirements of the particular installation. This requires a six-month lead time after maney is made available.

In addition to the instrumentation package, some sort of arresting device is required for retrieval of the ejected dummy missiles. NAS Miramar and Oceana use pits filled with straw; NAS Cubi Point uses portable "catcher's mitts" designed and built by the NAVMISCEN. These are no longer available from the NAVMISCEN, but a data package has been produced and

turned over to SPCC so that more may be obtained through normal supply channels. The cost of the "catcher's mitt" will probably be about $1500 each. Four are required to check all ejection launchers on an aircraft at one time.

A cleaning stand for the AERO 7A launcher is also required since the launcher ejection cartridges must be fired to fully accomplish the checkout. An EL-540A cleaning stand manufactured by Raytheon is recommended. This is the same stand which is being procured for Fleet use. The cost under the present contract is about $2500 each.

The total initial cost of the above test set-up will be about $38,500, or about the cost of ONE complete SPARROW III missile.

2. Procure the "next generation" instrumentation package which is in the prototype stage at the NAVMISCEN. This unit is a solid state test set in a suitcase which gives performance comparable to the Visicorder but which is easier to use and maintain. It is also much less costly, the prototype costing about $1000. The prototype is not built to Mil standards so the cost for a Mil standard version is expected to be in the range of $2000 to $3000 each. About six months lead time will be required after a data package is developed. The data package will cost approximately $20,000.

The arresting devices and cleaning stand are required with this instrumentation, as are the dummy missiles, which will bring the total cost of the package to about $13,000, plus $20,000 for the data package.

3. The NARF's will also need to program approximately 8 manhours, additional labor per aircraft to cover checkout, cleaning, and reinstallation of the launchers.

SURVEILLANCE PLAN

Detailed Conclusions and Recommendations

Surveillance of air-to-air weapon system components has not been totally effective. Surveillance has generally been limited to weapon components available at the NWS's. Existing programs have been developed on a low priority basis and in some cases test equipment and test samples have been difficult to get. Additionally environmental test requirements have not been well defined and this technique has been limited to special situations, primarily because of insufficient manpower and to some extent, equipment.

It is recommended that a relatively higher priority and more emphasis be given to surveillance of air-to-air missile system components, especially the AMCS and weapons suspension equipment which have demonstrated unsatisfactory performance. Additional funding, billets and direction should be made available to:

a. Accelerate those programs not yet functional.

b. Institute new programs and expand existing ones as deemed necessary.

c. Define sample requirements including environmental testing.

d. Make special malfunction investigations as the need arises.

e. Evaluate reasons for high failure and replacement rate components.

This program should include:

a. Periodic surveillance of the stockpile.

b. Fleet return surveillance.

c. Weapon system performance and captive flight data reporting.

d. Surveillance of test equipment calibration data.

e. NWS/Ammunition Depots/Naval Magazines test and inspection.

f. Shipboard tests and inspection data.

g. Rework data reports.

h. Flight tests of repaired items.

[redacted]

i. Review of failure report information.

This program is designed to define problem areas so that air-to-air weapons and weapon components may demonstrate acceptable quality and reliability. This program will further provide necessary data on which decisions will be made concerning maintenance, rework, corrective action, and final disposition action for air-to-air weapons material.

This program would also serve to define the number of captive flights allowable before rework.

[redacted]

ENVIRONMENTAL PROGRAM FOR DETECTING MARGINAL COMPONENTS

Detailed Conclusions and Recommendations

Several basic facts should be recognized concerning the concept of using environmental techniques to induce early marginal component failures:

a. The approach does not primarily detect workmanship faults. Care must be taken to assure that this technique does not become a "crutch" to the bench mechanic.

b. Additional in-process time will be required if vibration techniques are proven and then introduced. However, the reworked missiles will have a higher readiness availability in the Fleet

c. Although not a primary purpose of the effort, some design deficiencies will be uncovered through this technique. Programs such as the Design Margin Evaluation conducted by NAVMISCEN Point Mugu, provide the basic inputs in this area.

d. Improper application of the technique can cause serious damage to the missile.

e. The technique is not a screening device nor a "test."

Before any consideration can be given to NARF implementation of these techniques, the quite valid question of whether repeated vibration of a missile will result in a constant failure rate, must be answered. If the rate remains essentially constant, the technique is destructive and must be re-evaluated along one or more of the following lines:

(1) Correction of design deficiency.

(2) Consideration of application of a lower level stimuli.

(3) Further investigation of applying a low temperature environment to induce the desired faults.

If the rate decreases, then an engineering determination of what factors are significant and a means of economical NARF implementation should be determined. It is recommended that this determination be jointly performed by NWS, Concord; the NAVMISCEN, Point Mugu; with the NARF's. The prime factors to be determined are the applicability of sine wave in lieu of random excitation, spectrum, fixturing, monitoring points, stimuli control point, and the testing/vibration sequence. It should be remembered that NARF NORVA presently has only a sine wave capability (random scheduled

for delivery Spring of 1969) and that NARF Alameda has no vibration capability assignable to SPARROW along with a severe space problem.

The NAVMISCEN has proposed that in order to eliminate the requirement for a noise generator and a spectrum analyzer at the NARF's the random vibration input for the shaker could be provided by a prerecorded FM magnetic tape. The tape would be prepared by NAVMISCEN after determining the characteristics of the system to be used. For calibration of the system the shaker output would be recorded periodically and sent to NAVMISCEN for analysis. If the shaker output were discovered to be outside of the desired range, a new tape would be prepared for that system. Based on what is known today, the proposal has potential and should be investigated thoroughly.

If a low frequency, multiple unit, vibration mechanization could be developed, substantial first and continuing cost savings should result. However, it must be kept in mind that when using inexpensive environmental techniques, one must have an extremely well defined and controlled situation and goal. This information does not exist today.

It should be noted that the key to the direction of the entire effort hinges on the results of the NWS Concord Study to determine the non-destructive character of the present vibration parameters. This additional testing has not yet been initiated due to load out requirements. It is therefore recommended, that adequate priority be given the investigation.

The possibility of implementing environmental techniques on other air-to-air systems was pursued at the NARF's. Although there was some interest expressed, such an action appears to be contraindicated at this time.

STANDARDIZED REPORTING PLAN

Detailed Conclusions and Recommendations

The NAVAIRSYSCOM (as well as other activities) has been saturated with reports and other forms of communications much of which is not relevant to the requirements of NAVAIRSYSCOM. In general, these reports contain much detail and are often clear only to the originator or his technical equivalent. They generally do not contain the type of information nor the format which enables NAVAIRSYSCOM to make timely response. To get action, the originating activity often adds all codes associated in any way with the component involved thus frustrating the system and plugging the communication channels.

It is recommended that the In-Service Engineering activities be established and tasked to develop reporting plans to provide NAVAIRSYSCOM with the required information to make prompt decisions and to reduce the report traffic into NAVAIRSYSCOM to the essential. Some of the considerations for these plans are:

a. Provide a substantially single channel action communication system between NAVAIRSYSCOM and the In-Service Engineering activity, thereby reducing the number of activities the appropriate NAVAIRSYSCOM Code AIR-04 must deal with.

b. Establish the required NAVAIRSYSCOM information and format for various types of reports.

c. Take advantage of and complement the 3M/UR reporting system. That is, standardize and incorporate engineering and analytical reports into these systems where feasible.

d. Attempt to define reporting requirements of the various participating activities (NARF's, QEL's FMSAEG, Field Reps (Mugu, NARF, contractor), etc.) in terms of required content, format, timing and distribution. Perhaps most of the non-routine reports could be based on a task assignment system which pre-defines some of these requirements.

Additionally at a higher level, all the report plans for a given weapon system should be coordinated for simplicity and similarity.

Finally, an Air Weapons "ZIP Code" should be considered to provide sufficient identification to aid in communication routing and retrieval and especially to enable the reader to ascertain his interest. Such things to be included would be: component identification and breakdown, safety, funding, report type, activities affected, etc.

3M PLAN FOR REWORK FACILITIES

Detailed Conclusions and Recommendations

The activity tasked by NAVAIRSYSCOM for developing a plan for the NARF's full, early participation in the 3M Reporting System should evaluate and determine the possible inclusion of the following reporting formats already present in the Navy system:

Existing 3M Data
Failure/Malfunction Reports (UR, ADR)
Contractor reports
NAESU reports
NAVMISCEN Point Mugu reports
QEL reports
Participating Field Activity (Crane, Indian Head, etc.) reports
NARF Field Team reports

PUBLICATIONS

Detailed Conclusions and Recommendations

Publications have long been a problem in spite of the large expenditures for documentation.

Handbooks are changed so frequently that users do not have sufficient time to provide comments or changes within the existing manual before another is printed. Recent equipment changes are not documented in the manuals and in general, the manuals are usable only to a degree after being employed several years and are never considered adequate for a standard.

There have been numerous efforts to correct handbooks, but these have met with little success and this includes the use of the UR. As an example; NARF Alameda wrote a UR against the AN/DPN-14 SPARROW III missile test set manual over a year ago and as of this writing, it has just been received by Raytheon for possible adoption.

The SPARROW III missile and its rework have not changed appreciably over the last five years. The rework handbook has been revised every six months and even been reissued. It is still unsatisfactory for use as a standard or even as a good reference document.

It is recognized that the seven working groups of the "Ordnance/Armament Technical Manual" Ad Hoc Committee* discussed manual deficiencies and made specific recommendations for improvement of manuals and the manual updating methods. These recommendations have been only partly formalized. Criticism of publications is still directed toward those manuals presently in existence that have not incorporated the newly developed methods and format.

It is recommended that NAVAIRSYSCOM (AIR-4036) be directed to provide the NARF with the (proposed) Military Specification (no number) titled Manuals, Technical, Airborne Missile and the minutes of the SPARROW III Technical Manual Management Team (chaired by AIR-4036), and comments be solicited. It is recommended that manual contracts be written so that it will be the responsibility of the contractor to insure that the manual is free of errors, other than personal interpretations, after one year of use. After the first year any manual change other than changes resulting from equipment or specification changes, shall be initiated by a UR and should be accomplished at no cost to the Government.

*Meeting held on 4-6 September 1968 as directed by NATSF message 161322Z August, 1968.