DEPARTMENT OF DEFENSE IN-HOUSE RDT&E ACTIVITIES REPORT

for

Fiscal Year 1998

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The DOD In-House RDT&E Activities Report and Database Project is the DDR&E's central source of information on laboratory status, and serves four essential purposes: (1) Since inception, it has been the only compilation of statistics organized by location on DoD RDT&E activities; (2) It provides the basis for prompt responses to many general queries about DoD RDT&E activities without recourse to special surveys, etc.; (3) It provides a historical database which can be used for tracing consolidations and organizational changes, and for special analyses and trend studies; and, (4) It provides insight into the technical and organizational environment of the DoD laboratories and the financial manpower and facility investments made in them.

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FOREWORD

Introduction

The DoD In-House Research, Development, Test & Evaluation (RDT&E) Activities Report was started in the mid-1960s by the Office of Laboratory Management within the Office of the Secretary of Defense, at the request of the then Director of Defense Research and Engineering (DDR&E), Dr. John Foster. The annual report has been produced in official form since 1966.

The DoD In-House RDT&E Activities Report and database project is the DDR&E's central source of information on laboratory status, and serves four essential purposes:

(1) since inception, it has been the only compilation of statistics organized by location on DoD RDT&E Activities;
(2) it provides the basis for prompt responses to many general queries about DoD RDT&E Activities, without recourse to special surveys, etc.;
(3) it provides a historical database which can be utilized for tracing consolidations and organizational changes, and for special analyses and trend studies; and
(4) it provides insight into the technical and organizational environment of the DoD Laboratories and the financial manpower and facility investments made in them.

The Office of the Deputy Director of Defense Research and Engineering for Laboratory Management and Technology Transition leads a Steering Group which is responsible for the preparation and oversight of the report and its underlying database. The Steering Group is composed of representatives from the offices of the Director of Defense Research and Engineering, the Director, Test Systems Engineering & Evaluation, the Deputy Assistant Secretary of the Army for Research and Technology, the Chief of Naval Research, the Deputy Assistant Secretary of the Air Force (Science, Technology and Engineering), and the Director of the Armed Forces Radiobiology Research Institute of the Uniformed Services University of the Health Sciences (USUHS).

A DoD organizational entity is considered to be a "DoD RDT&E Activity" when it is owned and operated by the Government, and a minimum of 25% of its total effort is devoted to research, advanced technology development, engineering and manufacturing development, demonstration/validation, systems or operational support, or some combination thereof. Examples are a research laboratory; a research, development and engineering center (RDEC), a test center or proving ground, and a multi-functional entity such as a "warfare center." An "In-House" RDT&E Activity is an organization where a minimum of 25% of the in-house manpower and/or 25% of the obligational authority used is devoted to research, exploratory or advanced development, engineering development, etc., conducted in-house.

Structure of Report

Selected data for the In-House RDT&E Activities of the Army, Navy, Air Force and the USUHS are summarized in tables in the first section of the report. Following the tables are individual sections which cover the In-House RDT&E Activities of the three Military Services and USUHS. Each Activity is described in a standard multi-page format.

Activities are listed alphabetically within their respective military departments. A partial organization chart, entitled "Abbreviated Functional Chart - Technical Organizations", appears for each Activity to provide an overview of its technical operations.

Funding data are broken down into the standard RDT&E sub-categories:

6.1 - Research
6.2 - Applied Research
6.3 - Advanced Technology Development
6.4 - Demonstration & Validation
6.5 - Engineering and Manufacturing Development
6.6 - RDT&E Management Support
6.7 - Operational Systems Development
Non-DoD

All zero-filled report data fields reflect a zero amount reported.

Organizational changes for FY98 appear in Appendix A. Appendix B contains definitions of the data elements displayed in this report. Appendix C defines selected abbreviations and acronyms.

Every effort has been made to provide accurate information. Each submission was reviewed and approved by the head of the reporting Activity. All numbers and statements submitted by each Activity were then thoroughly examined by the members and staff of the Steering Group. Please note, though, that this report does not represent the total DoD RDT&E program. It is also not an accounting or financial management document, but rather a "snapshot" of the operation of the individual Activities contained in the report. All funding data reflect total obligational authority received in FY98. The data in this report should not be summarized or used for detailed comparative analyses, because the Service labs/centers use a number of different business accounting systems to satisfy their special needs. See Appendix B for further explanations.

The report is used by numerous DoD organizations, as well as various committees of Congress, the Library of Congress and the General Accounting Office. The report provides easily accessible comprehensive and accurate information without frequent querying of field Activities.

Significant Changes for FY98

Air Force Research Laboratory

The Air Force Research Laboratory (AFRL), which was established in 1997, has been re-organized, consolidating the four existing AF laboratories and the AF Office of Scientific Research (AFOSR). This re-structuring has led to the addition of 11 new Activities for publication in the FY98 report.

Navy RDT&E Reporting

The four Naval warfare centers provide full spectrum research, development, test and evaluation, engineering, and fleet support services and perform a substantial amount of non-RDT&E work (e.g., FY98 workload was 30% RDT&E and 70% non-RDT&E). In previous years' reports, the Navy has been reporting each warfare center in its entirety, even though a considerable amount of the reported end strengths, funding, and other resources are devoted to other than RDT&E programs. For purposes of more accurately reflecting RDT&E In-House resources for the FY98 report, the Navy has applied the established RDT&E In-House criteria (i.e., a minimum of 25% of total funds is RDT&E and a minimum of 25% of in-house effort is devoted to RDT&E) at the division or major site level rather than reporting all warfare center sites, regardless of their level of RDT&E work. As a result, some warfare center entities have been eliminated from the FY98 report because they are below the 25% RDT&E threshold for inclusion in this report. Sites affected by this process are identified at the beginning of each Activity section in the report, and in Appendix A.

DMDC Personnel Data

Personnel data for the FY98 report has been extracted, where possible, from 30 September 1998 data provided to the Defense Manpower Data Center (DMDC), by the Services. The DMDC Personnel Data Importation process has been significantly modified, based on lessons learned from FY97, to include more detailed Validation/Reconciliation procedures.

In-House Report Web Site

This report can be found in the **DOCUMENTS** section on the DDR&E/LM&TT Web Site at *www.dtic.mil/labman,* for on-line browsing or downloading as a Word document or an Adobe Acrobat PDF document.

Distribution

This publication should be given widespread distribution in the DoD Laboratories, both as an internal resources reference document at the Director and Commanding Officer level, and as a catalog of general activity at the bench level. It provides laboratory staff an opportunity to familiarize themselves with the functional capabilities of other DoD Laboratories, thereby encouraging scientists and engineers to communicate with their counterparts at other labs on problems of common interest.

In addition, this publication has proven helpful to those in the private sector interested in exploring the potential for technology cooperation/transfer with DoD Laboratories (for example, Cooperative Research and Development Agreements - CRADAs).

Hans Mark

Hans Mark
Director, Defense Research and Engineering

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NOTE: *The "Location" column heading in the Service "RDT&E Activities, Facility Data" tables, has been changed to "Headquarters Location" for FY98. Many Activities in the report have facilities and personnel dispersed throughout the world. As a result, all of the data presented for a particular Activity, may not be at the same geographical location as the Activity Headquarters.*

TABLE 1. ARMY RDT&E ACTIVITIES, PROGRAM AND PERSONNEL DATA, FY 1998

INSTALLATION	FUNDING DATA (MILLIONS $)				PERSONNEL DATA					
	TOTAL	TOTALS IN-HOUSE	TOTALS RDT&E	IN-HOUSE RDT&E	TOTAL MIL	TOTAL CIV	DOC MIL	DOC CIV	S&E MIL	S&E CIV
Aberdeen Test Center	110.086	55.587	69.200	31.600	37	853	0	5	1	242
Aeromedical Research Laboratory	6.767	6.740	5.017	4.990	38	40	8	5	16	8
Armament RDEC	520.117	260.949	283.239	134.202	32	3,144	0	63	17	1,613
Army Materiel Systems Analysis Activity	37.493	25.239	12.082	11.768	11	276	0	7	0	196
Army Research Institute	26.588	11.404	23.539	9.331	5	115	1	48	4	28
Army Research Institute of Environ. Medicine	12.353	8.507	10.194	7.119	68	79	22	22	33	32
Army Research Laboratory	404.799	185.278	323.916	165.103	60	2,155	6	304	38	939
Aviation RDEC	130.784	41.089	101.558	26.365	15	517	0	17	14	279
Aviation Technical Test Center	11.575	11.575	9.639	9.639	26	96	0	1	0	35
CECOM RDEC	472.276	108.576	296.981	74.185	33	1,983	0	73	7	1,243
Cold Regions Research & Engineering Lab	36.964	25.319	20.668	15.979	5	297	0	52	0	81
Construction Engineering Research Labs	62.640	30.690	46.396	20.218	1	305	0	34	1	120
Dugway Proving Ground	46.440	21.052	39.825	20.328	7	437	0	19	0	66
Edgewood RDEC	394.360	135.695	143.954	51.981	42	833	2	22	13	338
Institute of Surgical Research	7.013	7.013	6.816	6.816	176	51	18	4	42	18
Medical Research Institute of Chemical Defense	27.185	21.429	25.638	19.252	57	148	19	27	5	31
Medical Research Institute of Infectious Diseases	33.991	33.881	28.814	28.704	225	197	41	41	6	41
Missile RDEC	501.193	132.060	296.924	48.431	8	1,737	0	40	5	1,173
Natick RDEC	141.811	41.023	89.073	24.546	28	451	0	13	0	151
Operational Test and Evaluation Command	189.238	185.555	126.554	123.057	573	871	0	20	28	247
Redstone Technical Test Center	62.657	62.657	29.124	29.124	0	145	0	0	0	95
Tank-Automotive RDEC	209.418	80.234	141.845	29.337	11	1,097	0	27	4	637
Topographic Engineering Center	50.045	26.553	35.645	11.127	10	345	0	10	4	182
Walter Reed Army Institute of Research	77.178	77.178	64.305	64.305	384	399	84	82	69	97
Waterways Experiment Station	273.223	158.951	237.384	146.495	8	1,223	0	178	7	468
White Sands Missile Range	351.151	190.673	319.887	166.143	322	1,855	2	12	21	518
Yuma Proving Ground	127.948	21.674	115.426	15.120	57	666	0	0	0	113

TABLE 2. ARMY RDT&E ACTIVITIES, FACILITY DATA, FY 1998

INSTALLATION	HEADQUARTERS LOCATION	SPACE AND PROPERTY						
			SPACE (THOUSANDS OF SQ FT)				COST (MILLIONS $)	
		ACRES	LAB	ADMIN	OTHER	TOTAL	REAL PROPERTY	EQUIPMENT
Aberdeen Test Center	Aberdeen Prov. Gnd, MD	56,707	119.200	138.700	981.100	1,239.000	580.700	0.218
Aeromedical Research Laboratory	Fort Rucker, AL	4	69.000	22.000	37.000	128.000	12.021	47.152
Armament RDEC	Picatinny Arsenal, NJ	6,493	325.098	865.120	2,816.244	4,006.462	194.505	179.788
Army Materiel Systems Analysis Activity	Aberdeen Prov. Gnd, MD	4	0.000	104.700	17.100	121.800	3.600	5.336
Army Research Institute	Alexandria, VA	0	12.325	60.100	3.425	78.850	13.200	10.100
Army Research Institute of Environ. Medicine	Natick, MA	1	42.581	21.483	43.732	107.796	9.168	30.909
Army Research Laboratory	Adelphi, MD	5,335	1,250.000	864.000	673.000	2,787.000	697.000	569.666
Aviation RDEC	Redstone Arsenal, AL	5	62.436	76.405	42.631	181.472	6.652	28.643
Aviation Technical Test Center	Fort Rucker, AL	11,005	0.000	85.633	125.004	210.637	3.300	108.546
CECOM RDEC	Ft. Monmouth, NJ	1,122	325.200	384.600	106.500	816.300	80.000	290.000
Cold Regions Research & Engineering Lab	Hanover, NH	31	242.200	48.400	20.400	311.000	0.000	0.000
Construction Engineering Research Labs	Champaign, IL	30	108.400	49.800	38.900	197.100	0.000	14.600
Dugway Proving Ground	Dugway, UT	799	154.417	171.387	1,935.475	2,261.279	179.385	99.000
Edgewood RDEC	Aberdeen Prov. Gnd, MD	0	856.000	338.000	459.000	1,653.000	94.000	115.113
Institute of Surgical Research	Fort Sam Houston, TX	1	73.850	11.000	50.300	135.150	17.191	15.075
Medical Research Institute of Chemical Defense	Natick, MA	30	37.419	38.433	125.024	200.876	23.400	32.000
Medical Research Institute of Infectious Diseases	Fort Detrick, MD	150	121.000	78.000	148.000	347.000	24.892	41.551
Missile RDEC	Redstone Arsenal, AL	4,000	974.866	236.162	143.587	1,354.615	227.797	347.853
Natick RDEC	Natick, MA	58	368.747	32.336	23.786	424.869	43.100	2.354
Operational Test and Evaluation Command	Alexandria, VA	23	0.000	498.000	214.000	712.000	38.100	1.500
Redstone Technical Test Center	Redstone Arsenal, AL	14,000	580.000	62.000	168.000	810.000	320.000	0.000
Tank-Automotive RDEC	Warren, MI	95	513.949	174.870	22.202	711.021	128.486	245.275
Topographic Engineering Center	Alexandria, VA	0	88.776	35.081	53.134	176.991	22.400	20.820
Walter Reed Army Institute of Research	Washington, DC	0	403.544	178.372	151.472	733.388	12.882	64.690
Waterways Experiment Station	Vicksburg, MS	2,680	2,213.413	297.071	214.324	2,724.808	501.622	567.676
White Sands Missile Range	White Sands Missile, NM	2,281,659	1,605.675	979.265	2,951.585	5,536.525	481.946	485.638
Yuma Proving Ground	Yuma, AZ	1,008,904	22.030	145.888	2,077.112	2,245.030	166.537	190.573

TABLE 3. NAVY RDT&E ACTIVITIES, PROGRAM AND PERSONNEL DATA, FY 1998

INSTALLATION	FUNDING DATA (MILLIONS $) TOTAL	TOTALS IN-HOUSE	TOTALS RDT&E	IN-HOUSE RDT&E	PERSONNEL DATA TOTAL MIL	TOTAL CIV	DOC MIL	DOC CIV	S&E MIL	S&E CIV
Naval Aerospace Medical Research Lab	3.067	2.672	2.413	2.113	24	25	8	3	1	8
Naval Air Warfare Center*	2,739.174	1,634.034	1,055.597	634.029	2,307	10,275	8	211	194	4,015
Navy Clothing & Textile Research Facility	4.467	3.720	1.696	1.474	0	36	0	1	0	24
Naval Dental Research Institute	1.758	1.758	1.758	1.758	21	11	4	3	7	3
Naval Facilities Engineering Service Center	147.666	91.317	31.144	21.037	11	534	1	21	10	316
Naval Health Research Center	17.221	5.997	14.732	4.739	16	60	6	15	3	21
Naval Medical Research Institute	31.232	20.824	16.475	12.353	165	145	0	16	0	21
Naval Medical Research Unit # 2	4.651	4.468	3.622	3.439	19	93	6	1	8	52
Naval Medical Research Unit # 3	8.850	8.850	6.374	6.374	37	162	8	20	11	17
Navy Personnel Rsrch & Development Center	17.556	9.607	8.350	4.676	10	79	0	13	0	30
Naval Research Laboratory	722.268	346.504	604.643	303.742	184	3,009	0	839	0	868
Naval Submarine Medical Research Lab	5.134	3.506	3.838	2.719	19	26	6	6	0	7
Naval Surface Warfare Center*	2,066.000	1,129.000	834.000	472.000	306	10,190	1	384	29	5,072
Naval Undersea Warfare Center*	594.967	340.640	249.508	168.561	61	2,901	0	140	0	1,774
Space & Naval Warfare Systems Centers*	1,207.802	438.303	523.627	160.932	75	3,478	0	188	9	1,616

***Change for FY98 Report**: The four Naval warfare centers provide full spectrum research, development, test and evaluation, engineering, and fleet support services and perform a substantial amount of non-RDT&E work (e.g., FY98 workload was 30% RDT&E and 70% non-RDTE). In previous years' reports, the Navy has been reporting each warfare center in its entirety, even though a considerable amount of the reported end strengths, funding, and other resources are devoted to other than RDT&E programs. For purposes of more accurately reflecting RDT&E In-House resources for the FY98 report, the Navy has applied the established RDT&E In-House criteria (i.e., a minimum of 25% of total funds is RDT&E and a minimum of 25% of in-house effort is devoted to RDT&E) at the division or major site level rather than reporting all warfare center sites, regardless of their level of RDT&E work. As a result, some warfare center entities have been eliminated from the FY98 report because they are below the 25% RDT&E threshold for inclusion in this report.*

TABLE 4. NAVY RDT&E ACTIVITIES, FACILITY DATA, FY 1998

INSTALLATION	HEADQUARTERS LOCATION	SPACE AND PROPERTY						
			SPACE (THOUSANDS OF SQUARE FEET)				COST (MILLIONS $)	
		ACRES	LAB	ADMIN	OTHER	TOTAL	REAL PROPERTY	EQUIPMENT
Naval Aerospace Medical Research Lab	Pensacola, FL	3	100.400	6.700	10.200	117.300	13.100	5.578
Naval Air Warfare Center*	Patuxent, MD	1,145,491	7,782.410	1,241.885	10,409.500	19,433.795	1,441.500	557.808
Navy Clothing & Textile Research Facility	Natick, MA	0	12.667	16.000	0.000	28.667	4.300	2.805
Naval Dental Research Institute	Great Lakes, IL	0	19.212	5.137	11.676	36.025	13.300	2.097
Naval Facilities Engineering Service Center	Port Hueneme, CA	10	68.000	84.000	35.000	187.000	30.000	8.700
Naval Health Research Center	San Diego, CA	0	49.246	10.342	2.200	61.788	0.000	0.462
Naval Medical Research Institute	Bethesda, MD	8	215.000	70.000	0.000	285.000	0.237	9.982
Naval Medical Research Unit # 2	Jakarta, Indonesia	0	18.014	11.816	33.583	63.413	2.524	3.543
Naval Medical Research Unit # 3	Cairo, Egypt	3	57.279	21.980	40.380	119.639	9.920	5.000
Navy Personnel Rsrch & Development Center	San Diego, CA	3	37.500	16.400	4.500	58.400	1.126	4.430
Naval Research Laboratory	Washington, DC	532	3,188.283	227.533	399.043	3,814.859	197.043	490.193
Naval Submarine Medical Research Lab	Groton, CT	0	46.190	15.798	0.000	61.988	8.223	3.816
Naval Surface Warfare Center*	Arlington, VA	8,813	5,260.700	1,470.900	6,079.800	13,171.400	807.700	470.000
Naval Undersea Warfare Center*	Newport, RI	797	1,696.000	187.000	732.000	2,615.000	189.000	432.000
Space & Naval Warfare Systems Centers*	San Diego, CA	1,238	1,416.000	802.000	1,204.000	3,422.000	185.702	204.765

***Change for FY98 Report:** The four Naval warfare centers provide full spectrum research, development, test and evaluation, engineering, and fleet support services and perform a substantial amount of non-RDT&E work (e.g., FY98 workload was 30% RDT&E and 70% non-RDTE). In previous years' reports, the Navy has been reporting each warfare center in its entirety, even though a considerable amount of the reported end strengths, funding, and other resources are devoted to other than RDT&E programs. For purposes of more accurately reflecting RDT&E In-House resources for the FY98 report, the Navy has applied the established RDT&E In-House criteria (i.e., a minimum of 25% of total funds is RDT&E and a minimum of 25% of in-house effort is devoted to RDT&E) at the division or major site level rather than reporting all warfare center sites, regardless of their level of RDT&E work. As a result, some warfare center entities have been eliminated from the FY98 report because they are below the 25% RDT&E threshold for inclusion in this report.*

TABLE 5. AIR FORCE RDT&E ACTIVITIES, PROGRAM AND PERSONNEL DATA, FY 1998

INSTALLATION	FUNDING DATA (MILLIONS $)				PERSONNEL DATA					
	TOTAL	TOTALS IN-HOUSE	TOTALS RDT&E	IN-HOUSE RDT&E	TOTAL MIL	TOTAL CIV	DOC MIL	DOC CIV	S&E MIL	S&E CIV
Arnold Engineering Development Center	307.514	276.719	291.927	267.138	105	204	0	2	39	71
Development Test Center	601.378	296.151	536.279	260.140	4,097	2,555	1	8	97	543
Flight Test Center	632.123	294.136	550.641	266.120	3,911	3,011	2	7	120	557
HQ (AFRL)/Research Sites	21.238	0.000	21.238	0.000	134	208	8	13	57	83
AF Office of Scientific Research	231.110	0.000	231.110	0.000	25	99	17	30	0	7
Air Vehicles Directorate	122.261	76.278	90.392	44.409	38	382	6	46	14	96
Directed Energy Directorate	167.951	15.825	99.148	9.828	211	400	30	83	80	92
Human Effectiveness Directorate	181.881	40.812	153.975	38.167	291	401	16	106	84	106
Information Directorate	524.098	85.772	413.624	66.997	87	759	3	31	46	350
Materials & Manufacturing Directorate	207.489	207.489	101.527	101.527	53	466	4	94	34	240
Munitions Directorate	74.823	14.101	74.823	14.101	75	246	9	31	46	138
Propulsion Directorate	243.908	53.116	243.852	53.116	87	492	0	73	0	240
Sensors Directorate	148.389	42.281	148.389	42.281	66	556	19	72	36	343
Space Vehicles Directorate	241.790	24.362	158.377	17.638	139	501	9	101	49	134

TABLE 6. AIR FORCE RDT&E ACTIVITIES, FACILITY DATA, FY 1998

INSTALLATION	HEADQUARTERS LOCATION	SPACE AND PROPERTY						
		SPACE (THOUSANDS OF SQUARE FEET)					COST (MILLIONS $)	
		ACRES	LAB	ADMIN	OTHER	TOTAL	REAL PROPERTY	EQUIPMENT
Arnold Engineering Development Center	Arnold AFB, TN	39,081	230.549	505.891	2,091.002	2,827.442	1,353.859	241.037
Development Test Center	Eglin AFB, FL	463,546	2,335.171	1,102.009	9,010.841	12,448.021	949.275	753.975
Flight Test Center	Edwards AFB, CA	297,771	332.522	257.448	9,181.952	9,771.922	864.273	69.919
HQ (AFRL)/Research Sites	WPAFB, OH	1	0.000	49.000	0.000	49.000	1.840	1.241
AF Office of Scientific Research	Arlington, VA	0	0.000	25.250	0.000	25.250	0.000	0.000
Air Vehicles Directorate	WPAFB, OH	25	923.600	52.300	217.800	1,193.700	242.356	1,107.415
Directed Energy Directorate	Kirtland AFB, NM	4,325	503.000	108.000	46.000	657.000	65.000	30.269
Human Effectiveness Directorate	WPAFB, OH	18	559.200	340.400	70.900	970.500	84.971	83.880
Information Directorate	Rome, NY	84	1,067.400	89.200	220.600	1,377.200	54.700	148.447
Materials & Manufacturing Directorate	WPAFB, OH	25	296.300	216.200	87.700	600.200	96.000	52.000
Munitions Directorate	Eglin AFB, FL	1,000	272.100	0.000	23.300	295.400	27.363	28.974
Propulsion Directorate	WPAFB, OH	41,642	1,413.000	16.000	130.000	1,559.000	118.000	2.500
Sensors Directorate	WPAFB, OH	100	306.790	127.276	64.650	498.716	182.164	43.500
Space Vehicles Directorate	Kirtland AFB, NM	5,787	483.000	114.000	58.000	655.000	53.000	339.000

TABLE 7. USUHS RDT&E ACTIVITIES, PROGRAM AND PERSONNEL DATA, FY 1998

INSTALLATION	FUNDING DATA (MILLIONS $)				PERSONNEL DATA					
	TOTAL	TOTALS IN-HOUSE	TOTALS RDT&E	IN-HOUSE RDT&E	TOTAL MIL	TOTAL CIV	DOC MIL	DOC CIV	S&E MIL	S&E CIV
Armed Forces Radiobiology Research Institute	12.472	12.472	11.407	11.407	63	101	0	39	0	27

TABLE 8. USUHS RDT&E ACTIVITIES, FACILITY DATA, FY 1998

INSTALLATION	HEADQUARTERS LOCATION	SPACE AND PROPERTY						
			SPACE (THOUSANDS OF SQUARE FEET)				COST (MILLIONS $)	
		ACRES	LAB	ADMIN	OTHER	TOTAL	REAL PROPERTY	EQUIPMENT
Armed Forces Radiobiology Rsrch Inst.	Bethesda, MD	10	61.750	34.257	23.908	119.915	18.610	11.921

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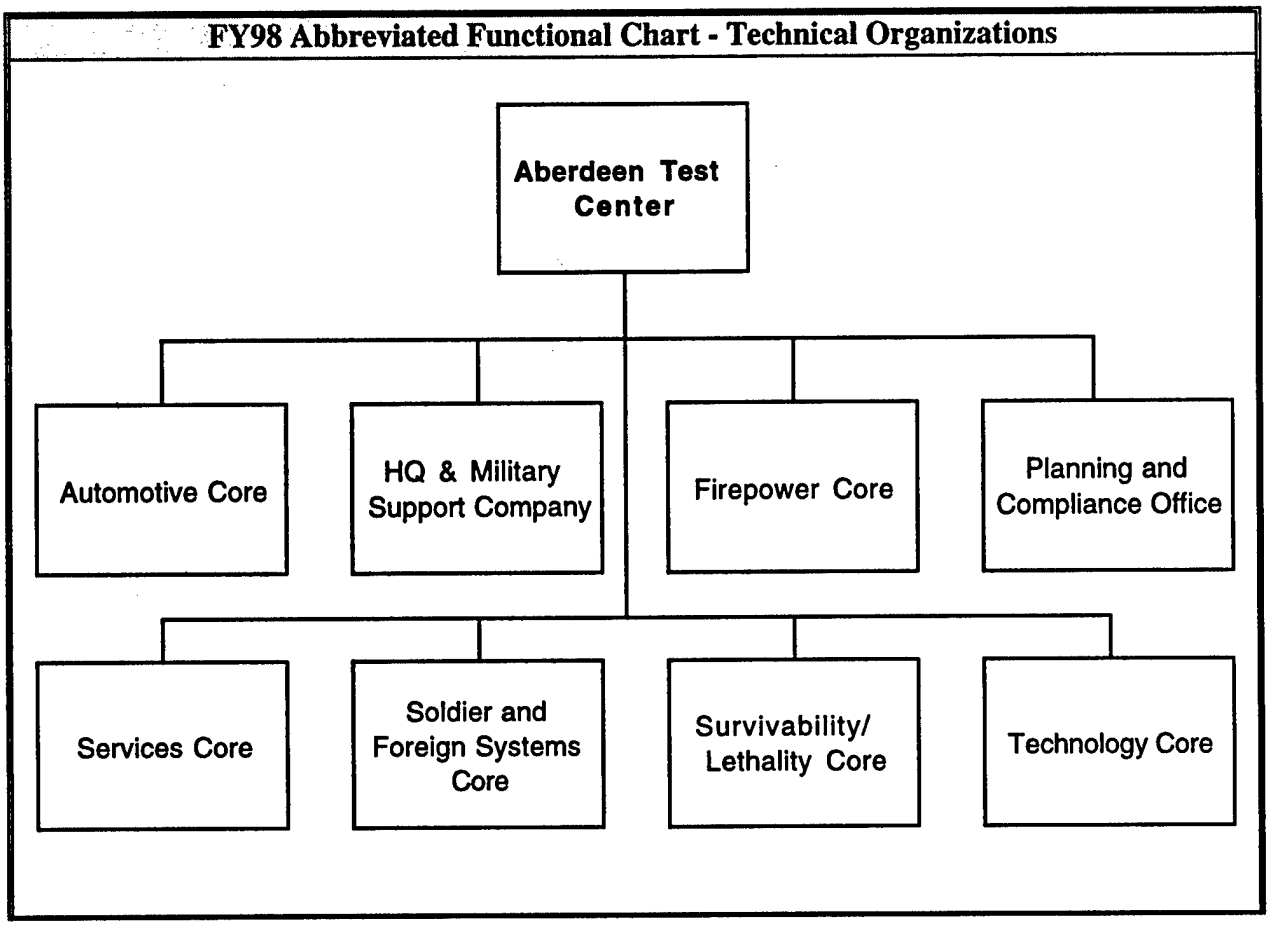
DEPARTMENT OF THE ARMY

DEPARTMENT OF THE ARMY

The Army's twenty-seven (27) In-House RDT&E Activities are:

Aberdeen Test Center



Aberdeen Test Center
Aberdeen Proving Ground, MD 21005-5059
(410) 278-4405

Commander: Andrew G. Ellis, COL, FA
Technical Director: James W. Fasig

MISSION

Aberdeen Test Center (ATC) is the most diverse test facility within DoD, testing a broad spectrum of military weapons systems and equipment including armored vehicles, guns, ammunition, trucks, bridges, generators, night vision devices, individual equipment (boots, uniforms, helmets, etc.), and surface and underwater marine systems. As a multi-purpose proving ground, with a temperate climate, our primary mission is to plan, conduct, analyze and report on projects supporting research, development, test and evaluation (RDTE), design, engineering, production, surveillance and operational tests for DoD and other government agencies, contractors, foreign government, and private industry. In this single location, ATC can subject an item to a full range of tests from automotive endurance and full weapons performance with environmental extremes, to full-scale live fire vulnerability/survivability/lethality testing utilizing an extensive array of test ranges/facilities, simulators and models. In addition to testing domestic systems, we exploit foreign systems to assess the enemy threat. We also develop state-of-the-art test procedures (DoD, International), methodologies and instrumentation in order to meet the test requirements of advancing military technologies. ATC is partnered with CINCLANTFLT forming the Chesapeake Regional Range Complex which provides air, land and sea test and training support to the joint warfighter.

CURRENT IMPORTANT PROGRAMS

Medium Tactical Truck Remanufactured (MTTR) for MTT 5-Ton Truck (Army Version)
Development Test of Armor Tiles
Medium Tactical Truck Remanufactured (MTTR) for MTT 5-Ton Truck (Marine Version)
A/B-1 Shock Qualification Test Series
BFVS A-3 Automotive System Performance, Transportability and RAM Testing
M1A2 Abrams Tank Follow-On Production Test
Halon Alternatives for Ground Vehicle Crew Compartment
Mobile Resource Center Support to Naval Supply Systems Command
M865E3 Cartridge, 120MM, TPFSDS-T, TPR
M1A2 System Enhancement Program (SEP), Temperate Zone Phase

Technology Transfer Efforts:

Federal Highways Administration/MD State Highway Administration/MD State Police/ATC - ATC successfully developed and fielded an Aggressive Driver Imaging System prototype. The System integrates MD State Police LIDAR with ATC developed advanced imaging technologies consisting of computer driven digital imaging video instrumentation and components. Currently, ATC is performing enhancements to the prototype in an effort to turn it into a final product.

AV Technologies/ATC - Under a cooperative agreement ATC and AV successfully completed the first phase supporting the test and training initiative for the PANDUR commercialization program. This is the first combined test and training initiative between the private sector and this DoD facility. The PANDUR program will continue through FY00.

CURRENT IMPORTANT PROGRAMS (continued)

Drexel University/Patuxent River Naval Air Warfare Center/ATC - A project proposal was developed to create a large scale model of the U.S. Electric Power Grid. This project will link a computer - hardware - based and digital control system with an interchangeable set of standard power system components to produce a very flexible model at a fraction of the cost of current models. Furthermore, the proposed model will provide analytical data 12 times faster than current models. Federal agencies concerned with power and vulnerabilities will be able to get good information without relying on vested interests of the power industry. A training tool of unparalleled importance will be available to the nation.

HP White Laboratories/ATC - The parties continue to cooperatively perform efforts focused in the research and development of intermediate level fire test technologies and methodologies, hardware testing and fire hazard compliance issues. Currently, the partners are working to determine the capability of new fire extinguishing agents in Class B hand-held fire extinguishers and their effectiveness on fuel fire in accordance with UL 711 (Fire Extinguishers, Rating and Fire Testing). Methodologies include continued development of laser diode, in-situ chemical instrumentation measurement devices in conjunction with the Army Research Laboratory and acid gas scavenging determination for a private industry customer.

EQUIPMENT/FACILITIES

World-renowned automotive test/obstacle courses.

Numerous interior and exterior firing ranges.

Environmental simulation capabilities including rough-handling and vibration, electromagnetic interference and environmental conditioning capabilities.

Full transportability test capability to include rail, roadability, MIL-STD 209 pull and tie-down, internal and external air transport.

Underwater Explosion test ponds and Depleted Uranium Containment Fixture (Superbox) for live fire vulnerability and lethality testing.

Sophisticated non-destructive test facilities.

Robotics test facilities.

Pulse radiation facility.

Firing Impulse Simulator.

State of the art industrial complex which includes maintenance and experimental fabrication capabilities.

Secure airfield.

Aberdeen Test Center
Aberdeen Proving Ground, MD 21005-5059
(410) 278-4405

Commander: Andrew G. Ellis, COL, FA
Technical Director: James W. Fasig

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	IN-HOUSE	IN-HOUSE MANAGEMENT	OUT-OF-HOUSE	TOTAL
RDT&E:				
6.1 ILIR	0.000	N/A	N/A	0.000
6.1 Other	0.154	0.002	0.117	0.273
6.2	2.132	0.022	2.855	5.009
6.3	0.684	0.007	0.916	1.607
Subtotal (S&T)	**2.970**	**0.031**	**3.888**	**6.889**
6.4	1.452	0.015	1.945	3.412
6.5	5.963	0.060	7.985	14.008
6.6	21.215	0.214	23.462	44.891
6.7	0.000	0.000	0.000	0.000
Non-DOD	0.000	0.000	0.000	0.000
TOTAL RDT&E	**31.600**	**0.320**	**37.280**	**69.200**
Procurement	13.593	N/A	8.799	22.392
Operations & Maintenance	3.699	N/A	3.050	6.749
Other	6.695	N/A	5.050	11.745
TOTAL FUNDING	**55.587**	**0.320**	**54.179**	**110.086**

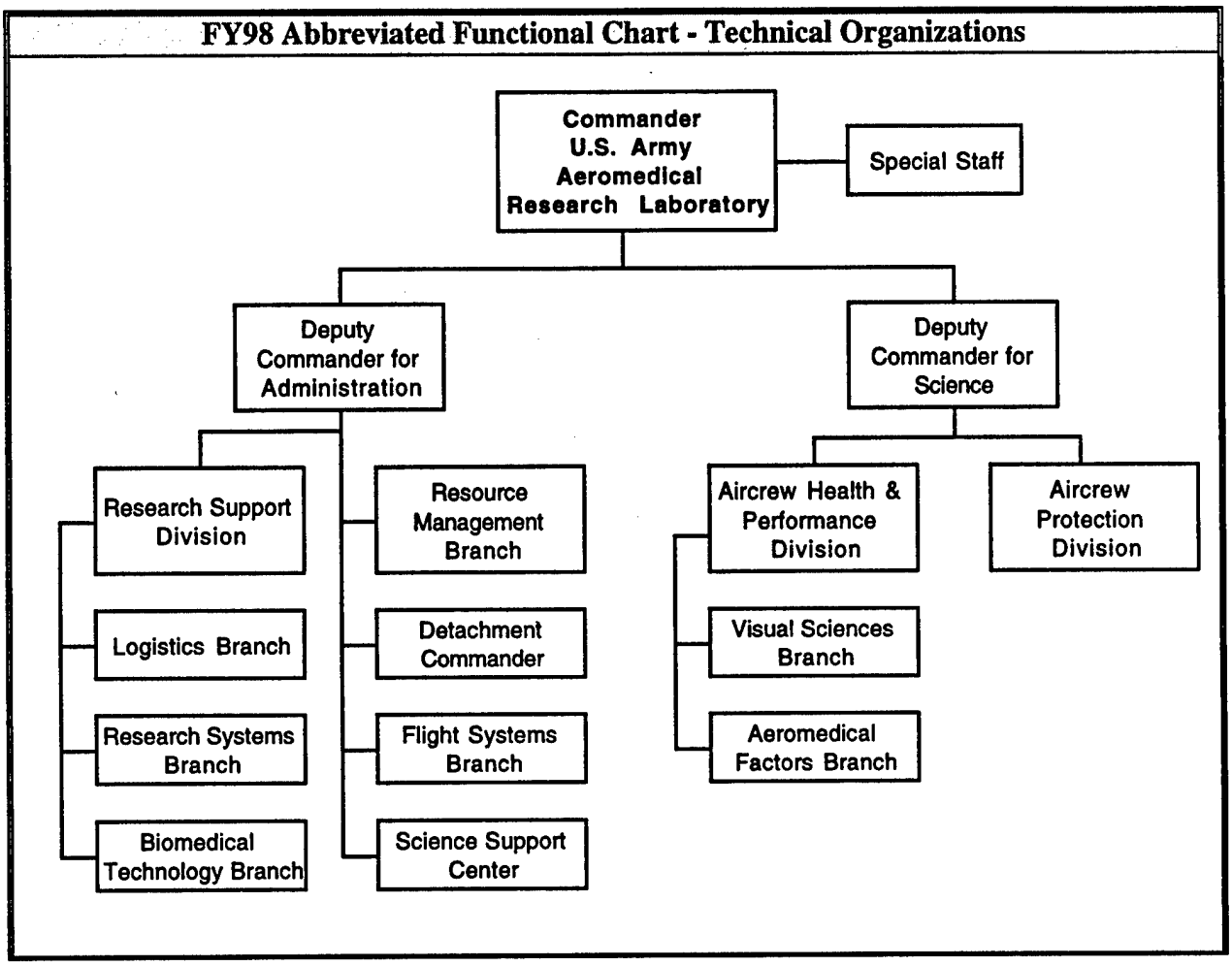
MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		TECHNICAL SUPPORT & OTHER PERSONNEL	END STRENGTH
TYPE	DOCTORATES	OTHER		
MILITARY	0	1	36	37
CIVILIAN	5	242	606	853
TOTAL	**5**	**243**	**642**	**890**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		PROPERTY ACQUISITION COST (MILLIONS $)	
LAB	119.200	**REAL PROPERTY**	580.700
ADMIN	138.700	* NEW CAPITAL EQUIPMENT	0.000
OTHER	981.100	**EQUIPMENT**	0.218
TOTAL	1,239.000	* NEW SCIENTIFIC & ENG. EQUIP.	0.022
ACRES	**56,707**	* Subset of previous category.	

N/A - Not Applicable

Aeromedical Research Laboratory



Aeromedical Research Laboratory
Fort Rucker, AL 36362-0577
(334) 255-6917

Commander: COL Cherry L. Gaffney
Deputy Commander for Science: COL Clyde D. Byrne

MISSION

Conducts medical research related to the effects of military aviation, combat vehicles, and other weapons systems on soldier health and performance. Additionally, performs research on the impact of continuous operations on crew performance, on health hazards of emerging military materiel systems, develops training and operational strategies to cope with those detractors, and develops design criteria for aviator protective equipment and visual systems.

CURRENT IMPORTANT PROGRAMS

Aviator Helmet Protective Capability and Tolerance to Head Supported Mass (In Support of Land Warrior, Air Warrior, and Comanche Programs).

Crew Coordination Analysis System Development.

Investigation of Spatial Disorientation in the Rotary-Wing Environment and Counter Measures.

Airworthiness Certification Evaluations of Medical Devices Intended for Use Aboard U.S. Army Rotary-Wing Aircraft During Medical Evacuations.

Aviator Performance Effects of Sustained Operations, Sleep Cycle Disruption and Coping Mechanisms.

Aviation Life Support Equipment Retrieval Program.

Visual Performance Comparison of Flat Panel and Analog Display Technologies.

Soldier Tolerance to Biomechanical Impact and Prevention of Impact Injury.

COOPERATIVE RESEARCH AND DEVELOPMENT AGREEMENTS (CRDA)

Advanced Active Noise Reduction, Active Noise Cancellation (ANR/ANC) for Aviation Headsets and Microphones.

Research and Development on Advanced Aircrew Protection Systems (Simula).

Research and Development of Advanced Restraint Systems (H. Koch and Sons).

Research, Development, Test and Evaluation of Aeromedical Evacuation Equipment Gulf Coast Alliance for Technology Transfer (GCATT).

Research Agreements with the University of Houston and the University of Alabama at Birmingham.

EQUIPMENT/FACILITIES

Multi-Axis Ride Simulation System.

Helmet Drop Test Tower and Impact Facility.

Variable Center of Gravity Helmet Device.

Head and Neck Inertial Loading Sled.

Mass Properties (Center of Mass Location & Mass Moments of Inertia) Measurement System.

Biochemistry Lab.

UH-60 Visual Flight Simulator for Aeromedical Research.

Helicopter Inflight Monitoring System.

Modified Aircraft for Inflight Medical Research (JUH-1 Huey; JUH-60 Blackhawk).

Data Acquisition and Telemetry Systems for use in either JUH-1 or JUH-60.

Sleep Study Center.

Spatial Disorientation Laboratory.

Crew Coordination Analysis Center.

High Intensity Impulse Noise Generator (Shock Tube).

Mobile Acoustics Lab.

Anechoic and Reverberation Chambers.

Scanning Laser Ophthalmoscope.

Ophthalmic Telemedicine System.

Corneal Physiology and Topography Center.

Optical Testing Lab.

Optical Fabrication Facility.

Electro-Optical Testing Lab.

Visual Displays Analysis Center.

Scientific and Medical Research Information Center.

MEDEVAC Equipment Testing Facility.

Aeromedical Research Laboratory
Fort Rucker, AL 36362-0577
(334) 255-6917

Commander: COL Cherry L. Gaffney
Deputy Commander for Science: COL Clyde D. Byrne

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	0.009	N/A	N/A	0.009
6.1 Other	0.672	0.000	0.000	0.672
6.2	3.893	0.027	0.000	3.920
6.3	0.322	0.000	0.000	0.322
Subtotal (S&T)	**4.896**	**0.027**	**0.000**	**4.923**
6.4	0.028	0.000	0.000	0.028
6.5	0.061	0.000	0.000	0.061
6.6	0.004	0.000	0.000	0.004
6.7	0.000	0.000	0.000	0.000
Non-DOD	0.001	0.000	0.000	0.001
TOTAL RDT&E	**4.990**	**0.027**	**0.000**	**5.017**
Procurement	0.005	N/A	0.000	0.005
Operations & Maintenance	0.023	N/A	0.000	0.023
Other	1.722	N/A	0.000	1.722
TOTAL FUNDING	**6.740**	**0.027**	**0.000**	**6.767**

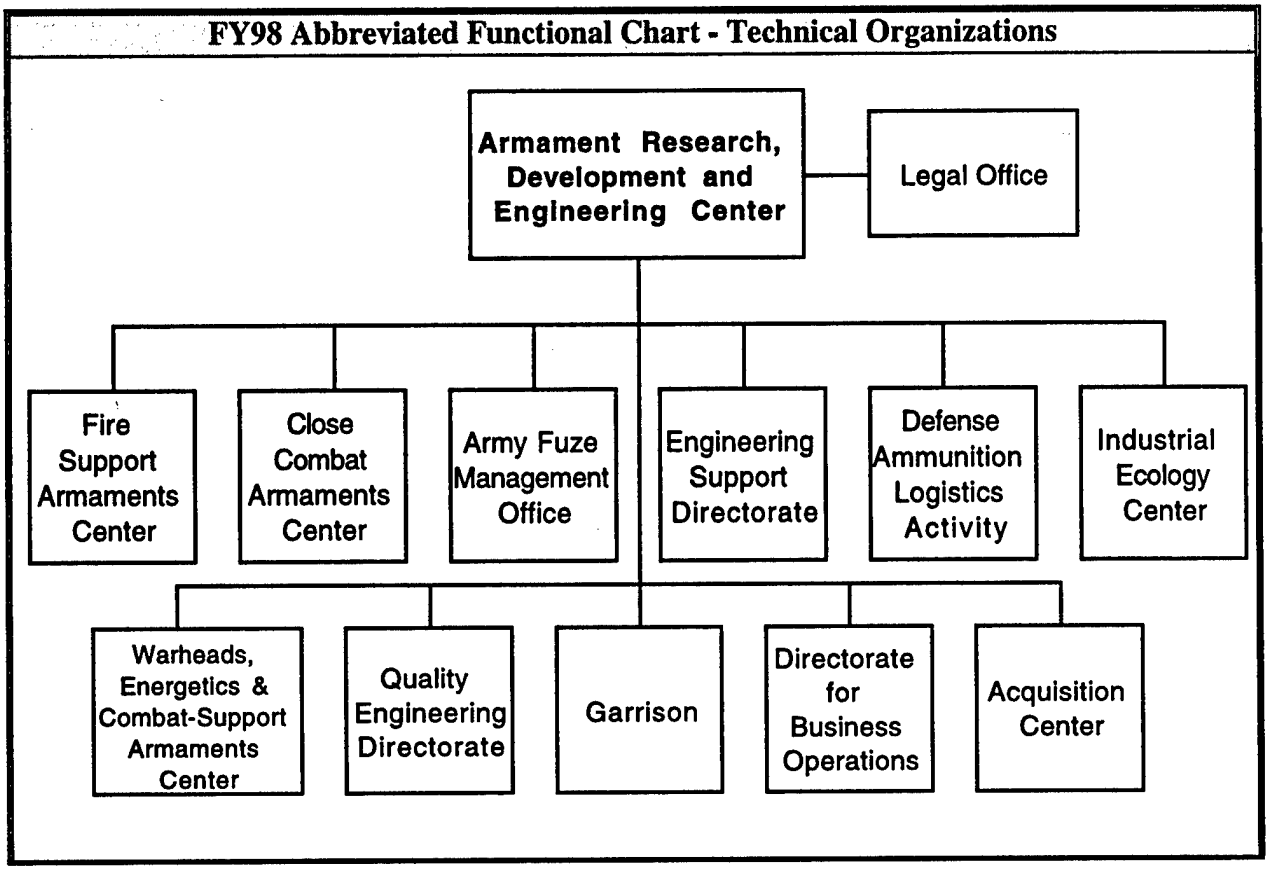
MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	**END STRENGTH**
TYPE	**DOCTORATES**	**OTHER**		
MILITARY	8	16	14	38
CIVILIAN	5	8	27	40
TOTAL	**13**	**24**	**41**	**78**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	69.000	**REAL PROPERTY**	12.021
ADMIN	22.000	* NEW CAPITAL EQUIPMENT	0.000
OTHER	37.000	**EQUIPMENT**	47.152
TOTAL	**128.000**	* NEW SCIENTIFIC & ENG. EQUIP.	0.274
ACRES	**4**	* Subset of previous category.	

N/A - Not Applicable

Armament Research, Development and Engineering Center



Armament Research, Development and Engineering Center
Picatinny Arsenal, NJ 07806-5000
(973) 724-6000

Commander: BG John P. Geis
Technical Director: Mr. Michael F. Fisette

MISSION

TACOM-ARDEC is a business center of the Tank-Automotive and Armaments Command (TACOM), a major subordinate command of the US Army Materiel Command (AMC). TACOM-ARDEC provides the United States military with the firepower to achieve decisive battlefield victory. Our mission is to conduct or manage research, development and life cycle engineering, including quality engineering for ammunition, weapons, fire control and associated items. This includes engineering support for production and integrated logistics support. We provide procurement and management of initial production quantities and technical support to soldiers and equipment in the field throughout their entire life cycle. TACOM-ARDEC is also the Army executive agent for research and development for pollution prevention.

The primary function of TACOM-ARDEC is to be the smart buyer for armaments and the integrator of complex technologies into armament systems. TACOM-ARDEC currently retains the technical knowledge and expertise for current, historical and future experimental and developmental ammunition and weapon systems, many of which have no counterpart in industry. In order to develop and maintain this knowledge base, TACOM-ARDEC is active in all phases of the life cycle process. We maintain a technology base to assure that technologies transition to weapon systems developments which currently account for over 90% of the Army's lethality. TACOM-ARDEC performs system analyses that consider a diverse number of systems and technologies, both in-house and contractor developed, resulting in the best technical approach and best buy decisions. TACOM-ARDEC also performs technical assessments of the current state-of-the-art in ammunition and weapon systems that points the way to future developmental programs and technology transfer to industry.

CURRENT IMPORTANT PROGRAMS

Our core business areas and corresponding technical initiatives are:

SMART MUNITIONS: To develop self-contained munitions for all mission areas with the ability to autonomously sense, engage, and kill their intended targets.

INDIRECT FIRE: To maximize defeat of enemy personnel and vehicular targets by developing advanced artillery and mortars with extended range and accuracy. We will achieve autonomous operations, increase range, increase rate of fire, and reduce manpower requirements over current fielded systems.

DIRECT FIRE: To develop weapons and munitions which will defeat the most advanced enemy armor through increased frontal penetration, higher hit probabilities, and enhanced top attack capabilities, while reducing crew size and stress.

SOLDIER WEAPONS: To upgrade armaments for light infantry and special operation forces (SOF), and to develop advanced small caliber weapons that will significantly increase kill capability, enhance survivability and improve the capability to destroy hard targets, and to develop non-lethal weapons for low intensity/peacekeeping missions.

MINES & DEMOLITIONS: To defeat and deter advanced helicopters, vehicles & personnel with highly intelligent minefields, with features such as wide area denial, complete user control, and Identification Friend or Foe (IFF) capability.

CURRENT IMPORTANT PROGRAMS (continued)

FUZING & LETHAL MECHANISMS: To greatly increase the lethality of armament materiel by focusing on advanced chemical energy warheads (shaped charge and explosively formed penetrators), kinetic energy (KE) penetrators, associated warhead materials, and low collateral damage munitions. Also, to create fuzes with integrated sensors, signal processing, and guidance and control; capable of performing target/clutter discrimination and having multi-option capability for compatibility with autoloaders, and containing electronic safe and arm (S&A) functions.

FIRE CONTROL: To provide life cycle engineering and management of fire control subsystems, software, command, control, and communications; test, measurement and diagnostic equipment and training devices utilizing an integration of sensors, computers, advanced controls and artificial intelligence aids for a rapid response to command orders of engagement.

MUNITIONS SURVIVABILITY: Insure the survivability of the critical warfighting assets through Munitions Logistics, Munitions Survivability. The program provides "built in" survivability improvements that will help preclude destructive reactions within logistics nodes, transportation assets and combat vehicles using proven/available technologies.

TACOM-ARDEC is the Army agent for pollution prevention R&D, providing the Army with technical management for pollution prevention R&D, integration of pollution prevention concerns into the weapons system R&D process, and technical assistance and integration expertise to the Army, other government agencies, and industry. Specifically, some of our key strategic system initiatives are:

Precision Guided Mortar Munition (PGMM). PGMM is a 120mm Global Positioning System (GPS) / laser guided mortar munition with an extened range guide capability. PGMM is envisioned as the maneuver task force commander's "hip pocket" precision indirect fire weapon capable of providing responsive standoff defeat of threats behind protective cover. The target set includes crew served weapons, command posts, observers, etc. employed in fortified positions such as bunkers and buildings.

Advanced Kinetic Energy (KE) Cartridge for Tanks. Advanced KE cartridge designs integrating the following technologies: novel penetrators effective against explosive reactive armor protected targets, lightweight sabot technology for 120mm, advanced propellant formulations, and axial or radial thruster technology enhancing system to increase accuracy up to 70% at extended ranges.

Tank Extended Range Munition (TERM). Advanced munitions technologies which provide tanks with a long range, line-of-sight, and non-line-of-sight anti-armor capability against high value threats, targets to include battle command vehicles, recon vehicles, and armored vehicles equipped with explosive reactive armor and/or active protection systems.

Light Weight 155 mm Howitzer. The Light Weight 155mm Howitzer will be a lighter towed howitzer with digital fire control and advanced navigation systems. It will replace our current light division general support artillery system - the M198. The system provides improvements in lethality, survivability and responsiveness.

Battlefield Acoustic Sensors. Acoustic sensor technology will be enhanced to provide passive, non-line-of-sight target detection, classification and tracking of military targets including artillery, ground combat vehicles and aircraft.

Objective Individual Combat Weapon (OICW). OICW will be a lightweight weapon capable of firing kinetic energy projectiles and an air-bursting fragmentation munition. It will allow soldiers to effectively attack targets at greater ranges, and to attack targets in defilade. It combines leading edge technologies in miniaturized fuzing; integrated fire control; lightweight, high strength materials; and munitions effects. OICW will increase the lethality and survivability of the individual soldier. It is the sole lethality component of the Dismounted Battle Lab's 21st Century Land Warrior (21 CLW) Top Level Demonstration.

CURRENT IMPORTANT PROGRAMS (continued)

Objective Crew Served Weapon (OCSW). The OCSW will be a lightweight, 2-man portable, crew-served weapon system providing the dismounted soldier with overwhelming lethality resulting in increased survivability through long range defeat of defilade protected personnel targets. It will be a more effective replacement for selected medium and heavy machine guns.

Nonlethal Defeat Mechanisms. TACOM-ARDEC has taken a leading role in the development of Nonlethal Technologies. With increasing emphasis on peacekeeping, low-intensity conflict and humanitarian missions, it becomes important to devise weapons which restrain or immobilize. To this end, TACOM-ARDEC is developing weapons such as: sponge grenades (co-developed with ARL), which are designed to incapacitate without imparting serious injury; acoustic weapons, which project sound waves, causing nausea and disorientation; sting nets, which envelop a foe and deliver a nonlethal electrical shock to discourage struggle; laser and other directed energy munitions, which are designed to degrade vehicle sensors; and radio frequency and electromagnetic pulse weapons, which could be utilized against enemy equipment in order to disrupt their electronics. Many of these technologies serve as dual-use applications for use in riot-control and civil disturbance situations.

TACOM-ARDEC has over 49 active CRADAs. Some of these are:

- **Picatinny Innovation Center (PIC)** - County College Morris.
- **Air rifle terminal ballistics** - Forensic Pathology Associates.
- **Material compatibility analyses with liquid propellant** - General Dynamics.
- **Proximity fuze sensors for munitions** - KDI Precision Products.
- **Epileptic sensor** - New York State Center for the Disabled.
- **Recuperator designs and virtual reality modeling** - NIKE.
- **Advanced materials for imaging applications** - Rennsselear Polytechnic Institute.
- **Environmentally friendly technologies for lead-based paint removal** - Rutgers University.
- **Improved shaped charge** - Western Atlas, International.
- **Pharmaceutical applications of cubane derivatives** - Yeshiva University.
- **Ammonium Dinitramide Propellants** - Atlantic Research.
- **High Performance Computing** - HTPI.
- **Improved Accuracy of Stabilized Systems** - Kollmorgen Electro Optical.
- **Viability of Sonic Denial Systems** - Performance Sounds.
- **Fuel Cells - Materials Technology** - Plug Power.

EQUIPMENT/FACILITIES

TACOM-ARDEC's **Stereolithography Lab** provides rapid prototyping for form, fit and function trials and produces masters for soft modeling and investment castings. The lab's capabilities range from the design and fabrication of a sheet "brass catcher" for the Squad Automatic Weapon to the modeling of complete scaled versions of the Crusader and Paladin recoil system prototypes. This service, available to TACOM-ARDEC engineers, academia and industry, reduces the developmental time and associated manufacturing and procurement costs by up to 75%.

The **Automated Inspection Device for Explosive Charge in Shell (AIDECS)** replaces visual x-ray film inspection of loaded artillery projectiles. The AIDECS pilot system at TACOM-ARDEC is the only operational unit of its kind, providing the capability to automatically examine 155mm rounds and smaller shells. Base separations, cracks, cavities and other critical defects in the explosive filler are detected by scanning the shell with x-rays. Radiation scattered from within the shell is electrically detected, and a computer analysis identifies and classifies each defect in the explosive. The computer makes an accept/reject decision for each shell and prints an inspection report. Benefits of the AIDECS system include improved reliability for detecting base separations and other critical defects accomplished in a totally automated manner, and cost savings due to elimination of x-ray film.

TACOM-ARDEC's **Distributed Interactive Simulation (DIS) Facility** supports a full spectrum of battlefield simulation activities to determine how technology, weapons and weapon mixes can be used to maximize the effectiveness of the soldier. DIS analyses of weapons in combined arms scenarios can influence designs long before any metal has been "bent", thereby minimizing cost and development time. Linkage to other sites and real systems allow real-time interaction on a hybrid battlefield.

The **Department of Defense's Center for X-Ray Diffraction** at TACOM-ARDEC is well recognized for its complete line of sophisticated X-Ray equipment, including two of the latest diffractometers and spectrometers, as well as for the comprehensive knowledge and experience of its personnel. The facility is used to enhance ballistic performance by determining the optimal crystal orientation of warhead and penetrator materials.

Benet Labs represents the Army's capability for large caliber cannon research, design and development, prototype production and engineering support. Benet works closely with the Watervliet Arsenal's cannon production facility to provide rapid prototyping services in support of new and improved weapon systems. Some of Benet's facilities are:

FATIGUE EXPERIMENTATION FACILITY: Capability of duplicating firing pressures in its breech mechanism facility and tube facility. This allows the rapid evaluation of new concepts of materials, and the establishment of safe firing parameters for these components in the laboratory rather than the much more expensive experimental firing previously necessary. These combined facilities provide Benet with a capability not available elsewhere.

GAS DYNAMICS LABORATORY: The Gas Dynamics Laboratory is a new research multi-task facility which includes two firing bays, a high bay area and a laboratory. The high bay area is used for experiments for heavy weapons and weapon components. Instrumentation includes 12 channels of digital data capture and display in 3 synchronized nicolet oscilloscopes with 4K points per channel. There is also a data acquisition system with 10 channels at 256K points per channel.

INTEGRATED CAE/CAD/CAM FACILITY: Benet Labs has a Computer Aided Design system, integrated with Watervliet Arsenal's Computer Aided Manufacturing system. This allows the ready interactive transmission of technical data electronically. Thus, the stress analysts' calculations can be integrated into the engineers' designs for final implementation on the manufacturing floor.

EQUIPMENT/FACILITIES (continued)

TURRET LABORATORY: Benet Labs provides engineering support for Turret hardware (less fire control systems) for Tracked Combat Vehicles, including the M551 Light Weight Air Transportable Assault Vehicle, and M60A3 and M1A1 Main Battle Tanks. The Turret Laboratory currently houses all of these vehicles and the tools and equipment necessary for investigation of problems relating to field, depot and spare parts procurement activities.

TERRAIN SUSPENSION/TURRET ENVIRONMENT SIMULATOR: This motion system consists of a large platform (18 ft x 10 ft) mounted on six large hydraulic cylinders, a hydraulic power supply unit and an electronic control cabinet. The simulator is a six-degree-of freedom system capable of providing all six motions simultaneously. The maximum payload that can be carried by the simulator is 18,000 lbs. This, it is capable of evaluating a full size tank turret.

FULL SCALE INVESTMENT CASTING FOUNDRY: Benet's investment casting foundry provides the necessary base from which technical support is provided to the Laboratory in the form of the development of new castings and providing prototype castings, to Watervliet Arsenal in the form of production castings to meet initial deliveries until a contractor can start full deliveries, and to Outside Contractors in the form of technical assistance to overcome problems encountered in meeting the requirements of castings for production.

VESSEL ELECTROPLATING FACILITY: A full-scale pilot production facility, built and operated by Benet Laboratories in a joint venture with the Watervliet Arsenal, provides a new process technology and the capability for plating an improved form of chromium (LC chrome) on any size cannon tube up to and including the 30-foot long 155-mm "Extended Range Cannon".

The **Armament Technology Facility (ATF)** is a 52,000 square foot, secure and environmentally safe integrated small and cannon-caliber design and test facility. The ATF co-locates simulation modeling, design, validation, and diagnostic engineering with the capability to immediately conduct confirmation experimental firings of interior and exterior ballistics. This concurrent engineering facility will support multi-service infantry, air defense, aircraft and combat vehicle armament systems and is available to government as well as private industry. It has four weapon validation bays with an environmental chamber capable of weather conditions between -65F to +165F; two indoor ranges - the first 100 meters in length and the second 300 meters. The latter can accept a Bradley Fighting Vehicle System firing its primary armament; or an Abrams-series tank firing secondary armament. The 300-meter range also has a -65F to +165F environmental chamber.

The **Keith L. Ware Simulation Center** is a research facility specializing in the analysis of helicopter armaments and small arms. The Ware Center is composed of two 100 meter indoor firing ranges and two 1000 inch indoor firing ranges. Small arms can be fired from any number of ground and vehicle mounts as well as several weapon mount simulators located at the center. Helicopter armaments are fired from the 6-Degree-of-Freedom simulator which is capable of mounting a helicopter fuselage and inputting vibration and other motions into it. This allows armaments to be investigated in realistic conditions at a great cost savings over field trials. A large environmental room is available connected to one of the 1000 inch firing ranges. This room can subject items to extreme temperatures from -65 degrees F to +160 degrees F as well as other environmental conditions such as humidity, salt fog, salt immersion, sand and dust. The Ware Simulation Center has extensive instrumentation capabilities to measure characteristic data and performance of weapon systems such as: accuracy, dispersion, rate of fire, round velocity, blast pressure, recoil force, temperature, strain, acceleration, linear and angular displacement, voltage and current. High speed video and regular speed video are also available.

The **Instrumentation and Measurements Lab** includes cutting-edge capabilities in the art of data reduction, signal processing, shock resistant telemetry design and radar analysis. One of its facilities consists of a radio frequency anechoic chamber equipped with a radar cross-section (RCS) measurement system utilizing a supercomputer. RCS measurements of various systems, including projectiles, identify radar reflectivity patterns. This technology is used for artillery experiments to evaluate and improve

EQUIPMENT/FACILITIES (continued)

projectile performance parameters such as range, yawing motion, spin and position. Some services and capabilities include: Development of telemetry concepts and systems Telemetry component technology; In-bore and in-flight telemetry techniques Secure telemetry systems; Qualification, compatibility and RFI Coordination of telemetry operations with test ranges; Collection and reduction of telemetered firing test data; Printed Circuit Board design, fabrication and assembly; Measurement System Design and Implementation Acoustic and Magnetic Signature Analysis Image Analysis/ Processing; Industrial Control, Design and Implementation RF Anechoic Studies.

The **Advanced Warhead Testing Facility** provides a 40 foot diameter reinforced concrete dome, lined with armor plate, that will be attached to a 35 foot long tunnel. This allows for extended target standoff experiments for explosively formed penetrators, shaped charges and other experimental warheads. Traditional and heavy metal liners such as tantalum and tungsten will be accommodated. Instrumentation includes flash radiography, streak cameras and electronic streak array.

Our **subsonic, transonic and supersonic wind tunnels** provide excellent opportunities to apply research to time and cost savings. The facility is used to design, develop and conduct experiments on tactical and training rounds for the Army. The facility has been awarded twelve U.S. patents in the last five years. One of the patents was for a stabilizer for the M831A1 TP-T tank training ammunition, developed using wind tunnel data. Optimization resulting from the experiments saved an estimated $40 million in annual production costs.

Electromagnetic Environmental Effects (E3) facilities perform assessments on weapon systems to determine their compliance against numerous electromagnetic environments such as Personnel Electrostatic Discharge (PESD), Helicopter Electrostatic Discharge (HESD), Hazards of Electromagnetic Radiation to Ordnance (HERO), Electromagnetic Vulnerability (EMV), and Electromagnetic Interference (EMI). High explosives are also assessed at our facilities.

ENVIRONMENTAL EXPERIMENTATION FACILITIES

- Air Guns for linear acceleration experiments: to 200,000 g with soft recovery.
- Rotary acceleration centrifuges: to 1300 g. have slip rings permitting measurement of arming time of fuzes and safing and arming devices.
- Altitude and climatic walk-in and bench chambers for the simulation of any world-wide temperature and humidity conditions.
- Drop facilities up to 110 ft.
- Jolt, Jumble, Leak, Load, Loose Cargo, Pressure, Rough Handling, Salt, and Fog experiments all with on-line data acquisition and analysis.
- Mechanical Shock experiments up to 30,000 g.
- Water Immersion, Solar Radiation, Spin, Stacking, Thermal Shock, Vacuum-Steam-Pressure, and Vibration: Random, sine, and gunfire, simulating transportation and tactical vibration at extreme temperatures.

Ranges for large caliber ballistic weapons firings for Ammunition/Component experiments:

- Assembly, disassembly, and modification of ammunition.
- Foreign ammunition exploitation.
- Fragmentation studies of ammunition.
- Hazard classification experiments.
- Malfunction investigation.
- Propellant/weapons evaluation.
- Surveillance of fielded ammunition.
- 155MM Ballistic Rail Gun- Soft Recovery of Projectiles/Components.

EQUIPMENT/FACILITIES (continued)

NON DESTRUCTIVE EVALUATION FACILITIES

- 25 Million Electron Volt Betatron.
- 1 Million Electron Volt X-Ray Machine.
- 200, 250, 300 Thousand Electron Volt X-Ray Machines.
- 150 Thousand Electron Volt Faxitron Fluoroscope.
- Neutron Radiography with Californium Source.
- Automatic Scanning Densitometer.
- X-omat Automatic Film Processor.
- Conventional Ultrasonics.
- Eddy Current Inspection.
- Magnetic Particle Inspection.
- Computer Aided Ultrasonic Inspection.
- Holographic Interferometry.
- Impactoscope.
- Magnetic Flux Leakage Inspection.

PROPELLANT SURVEILLANCE FACILITY: This unique facility is equipped with chambers heated to elevated temperatures in which large quantities of propellants undergo aging tests to determine safe lifetimes. This multi-service facility identifies propellant lots close to their maximum lifetime for destruction before a catastrophic accident occurs. Samples of propellants from field storage are also testing to ensure different environmental conditions don't degrade the propellant at a faster rate.

Armament Research, Development and Engineering Center
Picatinny Arsenal, NJ 07806-5000
(973) 724-6000

Commander: BG John P. Geis
Technical Director: Mr. Michael F. Fisette

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	1.940	N/A	N/A	1.940
6.1 Other	0.730	0.232	2.343	3.305
6.2	18.012	4.475	45.199	67.686
6.3	4.270	2.185	22.066	28.521
Subtotal (S&T)	**24.952**	**6.892**	**69.608**	**101.452**
6.4	48.506	0.862	8.709	58.077
6.5	13.815	0.246	2.481	16.542
6.6	41.688	3.931	39.704	85.323
6.7	4.168	1.477	14.916	20.561
Non-DOD	1.073	0.018	0.193	1.284
TOTAL RDT&E	**134.202**	**13.426**	**135.611**	**283.239**
Procurement	67.560	N/A	89.623	157.183
Operations & Maintenance	52.432	N/A	15.709	68.141
Other	6.755	N/A	4.799	11.554
TOTAL FUNDING	**260.949**	**13.426**	**245.742**	**520.117**

MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	7.300

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	
TYPE	**DOCTORATES**	**OTHER**		**END STRENGTH**
MILITARY	0	17	15	32
CIVILIAN	63	1,613	1,468	3,144
TOTAL	**63**	**1,630**	**1,483**	**3,176**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	325.098	**REAL PROPERTY**	194.505
ADMIN	865.120	* NEW CAPITAL EQUIPMENT	0.000
OTHER	2,816.244	**EQUIPMENT**	179.788
TOTAL	**4,006.462**	* NEW SCIENTIFIC & ENG. EQUIP.	1.487
ACRES	**6,493**	* Subset of previous category.	

N/A - Not Applicable

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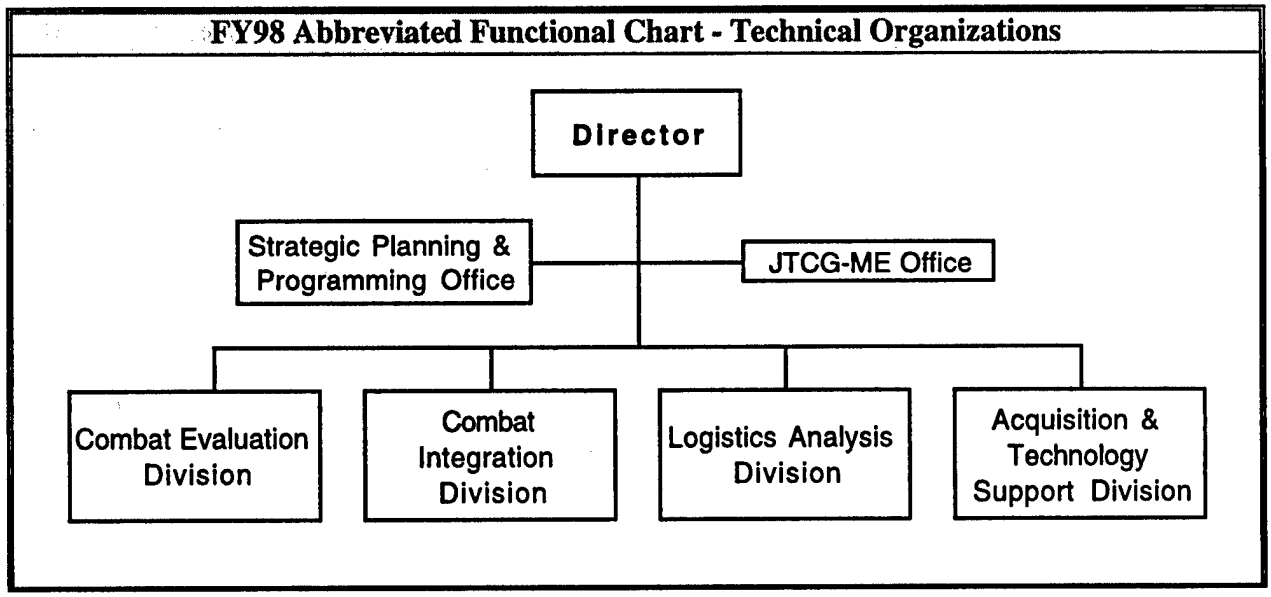
Army Materiel Systems Analysis Activity



Army Materiel Systems Analysis Activity
Aberdeen Proving Ground, MD 21005-5071
(410) 278-6614

Director: Mr. David J. Shaffer
Military Deputy: COL Pete Bucha

MISSION

Provide analysis of Army materiel and logistics systems to support decision making for equipping and sustaining the Army.

CURRENT IMPORTANT PROGRAMS

The U.S. Army Materiel Systems Analysis Activity (AMSAA) has focused its analytical capabilities into six core business areas: item and system level performance; modeling and simulation (M&S); investment strategies; acquisition and technology support; logistics analysis; and business and resource analysis. These interdependent core competencies combine to provide the Army with analytical capabilities that are unique in both breadth and depth across the life cycle of Army materiel. Below are several paragraphs that summarize the capabilities and responsibilities in the Research, Development, Test, and Evaluation (RDT&E) and Operations and Maintenance, Army (OMA) areas.

Primarily funded by RDT&E:

AMSAA is the Army's center for item and system level performance analysis and certified data. AMSAA utilizes automated databases and models to characterize the functionality of Army materiel systems. Unique models and methodologies have been developed to accurately predict critical performance variables, such as, weapon accuracy, target acquisition, rate of fire, the probability of inflicting catastrophic damage, and system reliability. AMSAA is responsible for the generation of these effectiveness measures and for ensuring their standard use across Army and Joint studies. Item and system performance analyses are initiated in the technology base and evolve with the system through the entire acquisition cycle. AMSAA is actively involved in the Army Science and Technology Objective and Advanced Technology Demonstration processes by examining how emerging technologies can potentially satisfy future Army requirements. AMSAA performs verification, validation, and certification of performance data, provides an analytical basis for the formulation of exit criteria, conducts performance analyses, and verifies, validates, and accredits (VV&A) required models and simulations. These capabilities support the timely transition of warfighting technologies from the tech base to materiel and system specific applications. AMSAA's linkage with the Integrated Concept Team (ICT) process creates an opportunity for the Army to take advantage of systems analysis even earlier in the process. AMSAA is positioned to support ICTs through early requirements trade-off analyses before specific solutions are identified. The integration of cost as an independent variable, as part of this process will help ensure the development of cost-effective systems that will provide critical war fighting capabilities to the Army After Next. As the Executive Agent for the Department of Defense (DoD) for the tri-service Joint Technical Coordinating Group/Munitions Effectiveness program, AMSAA applies its item and system level performance expertise to manage the program and to ensure standardized weapons effectiveness assessments are used across the services. The publication of Joint Munitions Effectiveness Manuals provides single source documents for modelers, materiel developers, and strategic and operational planners.

AMSAA's M&S capabilities support the development, linkage, and accreditation of live, virtual, and constructive simulations, and provide unique tools that support systems analysis of both individual systems and combined arms environments. This M&S expertise is utilized both to strengthen the organization's internal capabilities and to provide critical capabilities to external customers. Internally, AMSAA has resident and maintains a significant number of models and simulations, most of which were developed in-house to address specific analytical voids. This M&S infrastructure provides a

CURRENT IMPORTANT PROGRAMS (continued)

hierarchical modeling process that is unique to AMSAA and allows for a comprehensive performance prediction capability that can be utilized to make trade-off and investment decisions prior to extensive and expensive hardware testing. Externally, AMSAA applies its M&S capabilities to a wide variety of Army programs and activities. In Army Regulation (AR) 70-1, AMSAA is identified as the Army's Executive Agent for VV&A of item level performance models. In this role, AMSAA assists model developers with the development and execution of V&V plans to ensure new models and simulations faithfully represent actual systems. Additionally, AMSAA is extensively involved in M&S accreditation across the Army. Above the item level, AMSAA has gained extensive experience in the planning, execution and analysis of distributed interactive simulation exercises, and in the V&V of computer generated forces and system simulators.

Shrinking modernization budgets have forced the Army to increasingly focus its research and development efforts toward fewer critical systems and capabilities that will equip the force with the most "bang for the buck." Investment decisions across weapon systems and technologies are being forced earlier in the process, with cost effectiveness playing an increasingly dominant role in these decisions. AMSAA has developed and implemented new methodologies capable of examining decision alternatives in terms of value-added, cost benefit, and total risk. Potential exists to conduct analyses within battlefield capabilities, such as, anti-armor, sensors, and command and control as well as to examine relative contributions across capabilities.

Primarily funded by OMA

AMSAA's logistics analysis expertise covers the full range of Army logistics needs, from the development and refinement of new logistics models to the analysis of innovative or modified logistics concepts. AMSAA's studies have led to recommendations for major changes to the Army logistics system resulting in significant improvements in the supply, maintenance, and transportation processes, such as, increased flexibility, responsiveness to the customer, reduction in the generation of excess, and providing the best mix of supplies in a timely manner. AMSAA supports the logistics part of the acquisition process with level of repair and initial provisioning analyses for materiel development programs. AMSAA works with the program manager to ensure initial provisioning stocks and maintenance concepts provide adequate logistics support and best value to the Army once systems are fielded. AMSAA is heavily engaged in analysis to support the Army planning process for sustaining our forces during operations other than war, contingency operations, and in war. AMSAA develops Supply Class IX spare part contingency support packages for the Area Support Group, Core Support Group, Direct Support Group, and/or Organizational levels during wartime contingency planning. These support packages have been instrumental in planning logistics support and have served to assist in Bosnia, Somalia, Rwanda, and numerous other Army operations.

AMSAA is the Army's executive agent for Sample Data Collection (SDC) and as part of this executes the Field Exercise Data Collection (FEDC) program providing quantitative and qualitative operational maintenance, manpower, reliability, and logistical support data for fielded materiel systems. Critical information is provided to warfighting units and this same information is used in analyses being conducted for senior Army leadership.

AMSAA has been instrumental in the development, application, refinement, and investigation of models to support both wholesale and retail Army logistics operations and analysis. A library of models is maintained and new ones are regularly developed, as needed, either to support concept analysis or to improve a current methodology. AMSAA developed a methodology based on the Readiness Based Sparing approach to generate stockage lists for each supply echelon. The methodology includes techniques to estimate requirements for both combat damage and reliability failures and can optimize on several variables.

AMSAA serves as the Army executive agent for reliability and maintainability standardization improvement by developing and implementing reliability and maintainability acquisition reform initiatives. AMSAA develops and applies reliability engineering approaches that assess the reliability of Army materiel, and recommend ways to reduce life cycle costs and create more robust designs. The

CURRENT IMPORTANT PROGRAMS (continued)

Physics of Failure (PoF) program pioneered development of design and analysis tools to predict reliability and minimize potential redesign at the component level. PoF is based on the fundamental principle that it is not only important to understand how things work, but equally important to understand how things can fail under the intended operational environments.

AMSAA supports a broad range of efforts to improve the acquisition process and to apply new technology to the development and production of Army materiel. For example, continuous evaluations of military specifications and standards to include support in converting to commercial item descriptions and the preparation of performance specifications are conducted. To ensure new materiel can be produced and existing materiel can have significant modifications, production engineering and readiness reviews are conducted.

AMSAA's overall RDT&E and OMA program provides the Army with the critical information and analysis needed to facilitate the complex decisions required to move the Army into the next century. As resources become increasingly constrained, it is critical the Army leadership continue to have access to timely, reliable, and high quality analysis on which they can base the decisions required to shape the future Army. AMSAA has developed an integrated set of skills and tools focused on its core competencies to be responsive to the breadth and depth of systems analysis requirements for the Army now and into the next century. A few examples of major systems for which AMSAA provided critical analysis were: Future Scout and Cavalry System (FSCS), Future Combat System (FCS), Comanche, PATRIOT, MLRS, and Land Warrior.

EQUIPMENT/FACILITIES

Simulation facility for processing classified material and used for development and verification, validation, and accreditation of models and simulations. AMSAA also has additional facilities and equipment for use in the conduct of systems analysis.

Army Materiel Systems Analysis Activity
Aberdeen Proving Ground, MD 21005-5071
(410) 278-6614

Director: Mr. David J. Shaffer
Military Deputy: COL Pete Bucha

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	0.000	N/A	N/A	0.000
6.1 Other	0.000	0.000	0.000	0.000
6.2	0.000	0.000	0.000	0.000
6.3	0.000	0.000	0.000	0.000
Subtotal (S&T)	**0.000**	**0.000**	**0.000**	**0.000**
6.4	0.000	0.000	0.000	0.000
6.5	0.000	0.000	0.000	0.000
6.6	11.768	0.000	0.314	12.082
6.7	0.000	0.000	0.000	0.000
Non-DOD	0.000	0.000	0.000	0.000
TOTAL RDT&E	**11.768**	**0.000**	**0.314**	**12.082**
Procurement	0.248	N/A	0.000	0.248
Operations & Maintenance	9.231	N/A	4.584	13.815
Other	3.992	N/A	7.356	11.348
TOTAL FUNDING	**25.239**	**0.000**	**12.254**	**37.493**

MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	
TYPE	**DOCTORATES**	**OTHER**		**END STRENGTH**
MILITARY	0	0	11	11
CIVILIAN	7	196	73	276
TOTAL	**7**	**196**	**84**	**287**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	0.000	**REAL PROPERTY**	3.600
ADMIN	104.700	* NEW CAPITAL EQUIPMENT	0.000
OTHER	17.100	**EQUIPMENT**	5.336
TOTAL	**121.800**	* NEW SCIENTIFIC & ENG. EQUIP.	0.500
ACRES	**4**	* Subset of previous category.	

N/A - Not Applicable

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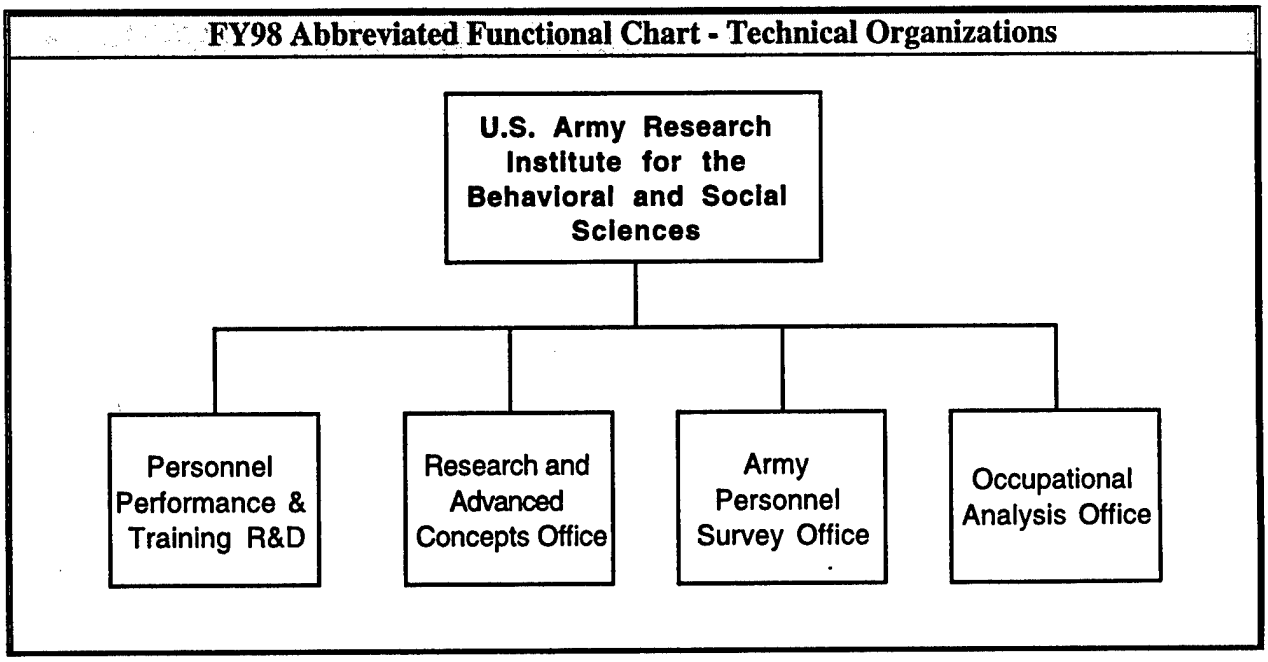
Army Research Institute for the Behavioral & Social Sciences



Army Research Institute for the Behavioral & Social Sciences
Alexandria, VA 22333
(703) 617-8636

Director: Dr. Edgar M. Johnson
Technical Director: Dr. Zita M. Simutis

MISSION

Maximize individual and unit performance and readiness to meet the full range of worldwide Army missions through advances in the behavioral and social sciences. ARI achieves its mission through research units located at headquarters in Alexandria, VA.; and tenant locations as follows: Simulator Systems Research Unit (Orlando, FL); Armored Forces Research Unit (Ft. Knox, KY); Infantry Forces Research Unit (Ft. Benning, GA); Reserve Component Training Research Unit (Boise, ID); Rotary-Wing Aviation Research Unit (Ft. Rucker, AL); Ft. Leavenworth Research Unit (Ft. Leavenworth, KS). Scientific Coordination Offices: Ft. Bragg (Ft. Bragg, NC); Ft. Hood (Ft. Hood, TX); USAREUR SCO (Heidelberg, GE); and TRADOC SCO (Ft. Monroe, VA).

CURRENT IMPORTANT PROGRAMS

1. Complete development of operational Enlisted Personnel Allocation System for IOT&E.
2. Implement and evaluate model Initial Entry Rotary Wing simulator-based training program.
3. Develop model of PERSTEMPO impacts on human resource outcomes.
4. Prepare a comprehensive research plan addressing digital skill training and retention issues.
5. Develop and evaluate prototype training and performance assessment methods for Force XXI.

EQUIPMENT/FACILITIES

In-house experimental facilities include laboratory and computer facilities for real-time, man-in-the-loop experimentation. Unique assets include: combat arms simulators; Virtual Reality test bed; a modular, reconfigurable flight simulator for helicopter pilot research; simulators for UH-1Fs, AH-74A and UH-60A helicopters; research access to SIMNET; and Battle Command Experimentation Center.

Army Research Institute for the Behavioral & Social Sciences
Alexandria, VA 22333
(703) 617-8636

Director: Dr. Edgar M. Johnson
Technical Director: Dr. Zita M. Simutis

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	0.000	N/A	N/A	0.000
6.1 Other	0.021	0.398	2.078	2.497
6.2	5.777	0.650	5.525	11.952
6.3	2.790	0.351	1.362	4.503
Subtotal (S&T)	**8.588**	**1.399**	**8.965**	**18.952**
6.4	0.000	0.000	0.000	0.000
6.5	0.000	0.000	0.000	0.000
6.6	0.743	0.313	3.531	4.587
6.7	0.000	0.000	0.000	0.000
Non-DOD	0.000	0.000	0.000	0.000
TOTAL RDT&E	**9.331**	**1.712**	**12.496**	**23.539**
Procurement	0.000	N/A	0.000	0.000
Operations & Maintenance	1.440	N/A	0.976	2.416
Other	0.633	N/A	0.000	0.633
TOTAL FUNDING	**11.404**	**1.712**	**13.472**	**26.588**

MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	
TYPE	**DOCTORATES**	**OTHER**		**END STRENGTH**
MILITARY	1	4	0	5
CIVILIAN	48	28	39	115
TOTAL	**49**	**32**	**39**	**120**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	12.325	**REAL PROPERTY**	13.200
ADMIN	60.100	* NEW CAPITAL EQUIPMENT	0.000
OTHER	3.425	**EQUIPMENT**	10.100
TOTAL	**75.850**	* NEW SCIENTIFIC & ENG. EQUIP.	0.127
ACRES	**0**	* Subset of previous category.	

N/A - Not Applicable

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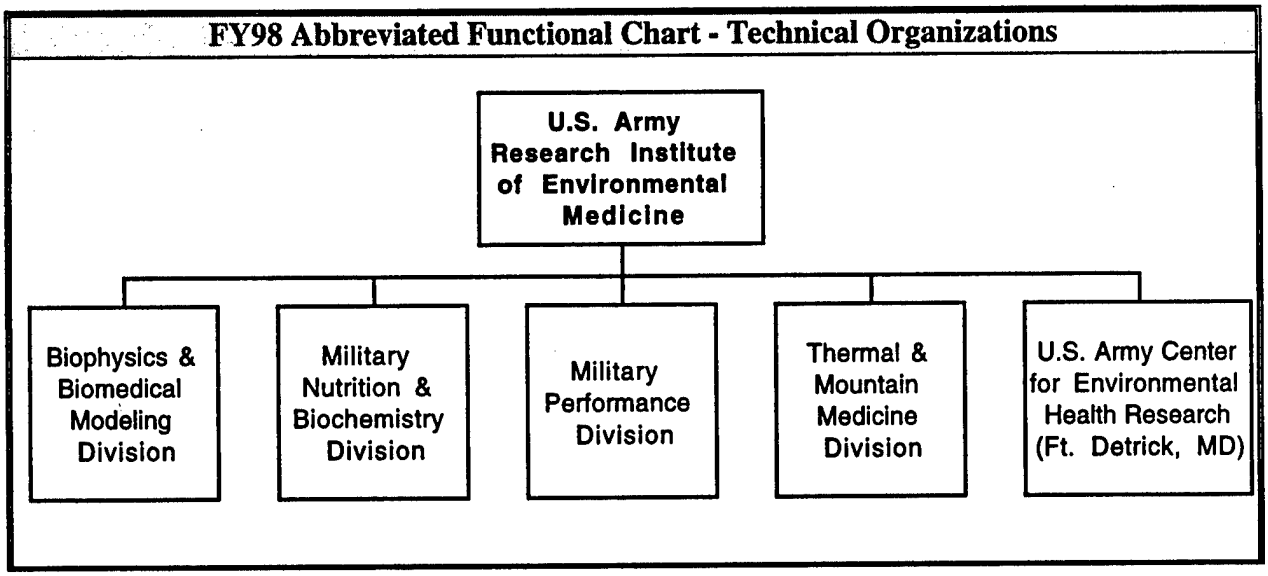
Army Research Institute of Environmental Medicine



Army Research Institute of Environmental Medicine
Natick, MA 01760-5007
(508) 233-4811

Commander: COL David M. Penetar
Deputy Commander: LTC John P. Obusek

MISSION

Conduct basic and applied research to determine how exposure to extreme heat, severe cold, high terrestrial altitude, occupational tasks, physical training, deployment operations and nutritional factors affect the health and performance of military personnel. Conduct research, development, testing, and validation of new methods and products for measuring chemical contaminants and their impact on the health and performance of US forces in garrison and during deployment.

CURRENT IMPORTANT PROGRAMS

Environmental Injury: Demonstrate the efficacy of strategies to predict, prevent and treat environmental illnesses, injuries and performance decrements.

Performance Limits: Develop and validate models to predict the effects of heat, cold, high altitude, hydration, nutritional status, and clothing and equipment on performance.

Nutritional Strategies: Identify and demonstrate nutritional strategies to maintain health and enhance soldier performance, to include maintaining immune system competency.

Musculoskeletal Injuries and Physical Performance: Demonstrate the efficacy of methods to reduce the incidents of musculoskeletal injuries and optimize performance during military training and operations. Special emphasis is being placed on the application of Biomechanics to the optimization of individual equipment and task design.

Warfighter Physiological Status Monitor: Develop ambulatory monitoring instruments that provide real-time assessment of an individual warfighter's physiological status in an operational environment.

Medical Chemical Defense: Investigate and define mechanisms of vesicant injury.

Deployment Toxicology: Develop new assays, methods and products for measuring chemical contaminants and their impact on the health and performance of U.S. forces in garrison and during deployment.

USARIEM's Technology Transfer Program included six new and fully negotiated Cooperative Research & Development Agreements during FY 98, bringing the total number of agreements to 23. The new agreements are:

- **MediVance, Inc.** - Develop products for the therapeutic application of hypothermia in the areas of heat trauma and stroke.
- **Nike, Inc.** - Evaluate the effects of compression shorts on human physiology.
- **DCV Biologics, Inc.** - Develop nutritional products that sustain or enhance warfighter performance in stressful environments.
- **Diagnostic Products Corporation** - Investigate the use of a urinary assay in the prevention and treatment of bone stress injuries in young people.
- **Wellesley College** - Investigate the relationship between female reproductive hormone and temperature regulation.
- **A/F Protein** - Investigate the use of anti-freeze proteins to protect cells against cold injury.

EQUIPMENT/FACILITIES

Unique facilities include: altitude chambers, animal care facility accredited by AAALAC (Association for the Advancement and Accreditation of Laboratory Animal Care, International), biophysical evaluation chambers, biomechanics laboratory, electron microscopy laboratory, environmental chambers, human/animal physiology laboratories, physical performance laboratory, high-altitude performance physiology laboratory on Pikes Peak, psychology laboratory, water immersion laboratory, access and primary user of the Doriot Climatic Chambers (a co-located facility assigned to Soldier Systems Center). Facilities located at the U.S. Army Center for Environmental Health Research (Fort Detrick, MD) include: aquaculture and aquatic toxicology laboratories, immunotoxicology laboratory, and mobile analytical chemistry laboratories and lab facilities at Colorado State University.

Army Research Institute of Environmental Medicine
Natick, MA 01760-5007
(508) 233-4811

Commander: COL David M. Penetar
Deputy Commander: LTC John P. Obusek

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	0.039	N/A	N/A	0.039
6.1 Other	2.254	0.036	0.852	3.142
6.2	4.528	0.084	1.755	6.367
6.3	0.076	0.001	0.057	0.134
Subtotal (S&T)	**6.897**	**0.121**	**2.664**	**9.682**
6.4	0.000	0.000	0.000	0.000
6.5	0.000	0.000	0.000	0.000
6.6	0.000	0.000	0.000	0.000
6.7	0.000	0.000	0.000	0.000
Non-DOD	0.222	0.000	0.290	0.512
TOTAL RDT&E	**7.119**	**0.121**	**2.954**	**10.194**
Procurement	0.000	N/A	0.000	0.000
Operations & Maintenance	0.000	N/A	0.000	0.000
Other	1.388	N/A	0.771	2.159
TOTAL FUNDING	**8.507**	**0.121**	**3.725**	**12.353**

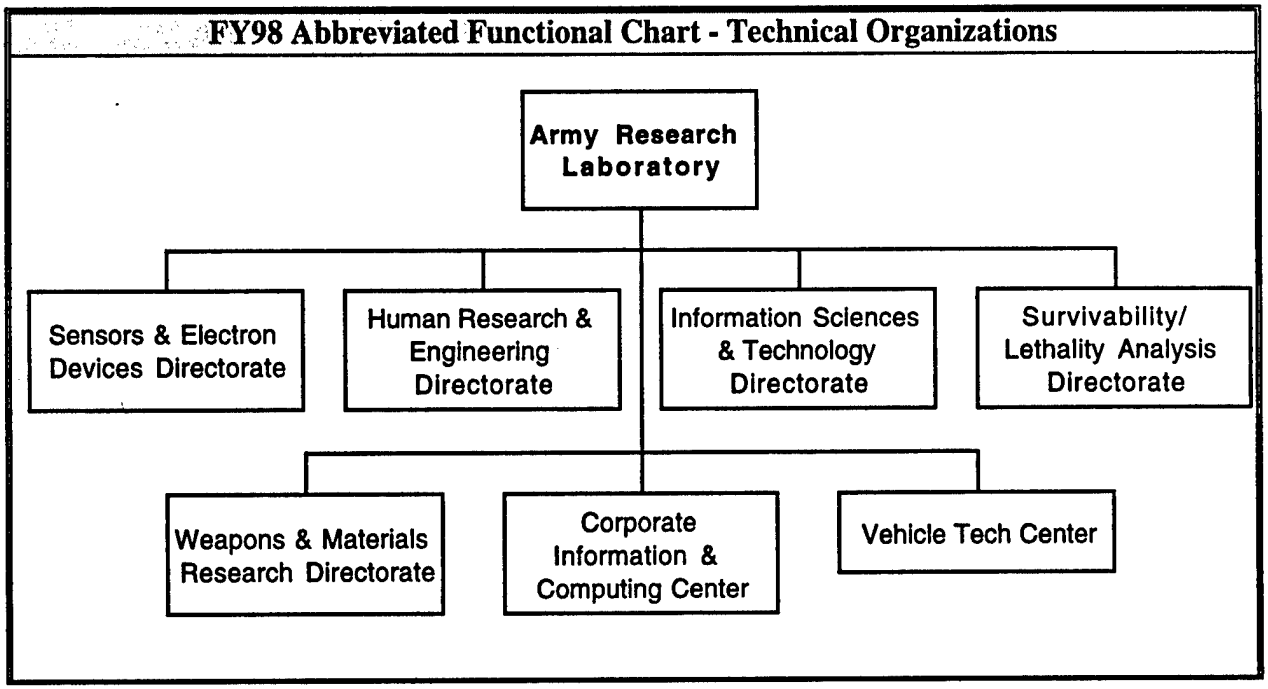
MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	**END STRENGTH**
TYPE	**DOCTORATES**	**OTHER**		
MILITARY	22	33	13	68
CIVILIAN	22	32	25	79
TOTAL	**44**	**65**	**38**	**147**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	42.581	**REAL PROPERTY**	9.168
ADMIN	21.483	* NEW CAPITAL EQUIPMENT	0.000
OTHER	43.732	**EQUIPMENT**	30.909
TOTAL	**107.796**	* NEW SCIENTIFIC & ENG. EQUIP.	0.830
ACRES	1	* Subset of previous category.	

N/A - Not Applicable

Army Research Laboratory



Army Research Laboratory
Adelphi, MD 20783-1197
(301) 394-1067

Director: Dr. John W. Lyons
Associate Director PPB: Mr. Bruce M. Fonoroff

MISSION

The mission of ARL is to execute fundamental and applied research to provide the Army with the key technologies and analytical support necessary to assure supremacy in future land warfare.

ARL's vision:

- A laboratory preeminent in key research areas of science, engineering and analysis relevant to land warfare.
- A staff widely recognized as outstanding.
- A laboratory seen by Army users as essential to their missions.
- An intellectual crossroads for the technical community.

CURRENT IMPORTANT PROGRAMS

ARL's Technology Goals - Grand Challenges

- Focus on critical AAN technologies that provide warfighters significantly improved capabilities.
- Provide leap-ahead technologies for more lethal and more survivable future combat systems.
- Provide lighter, faster, more fuel-efficient mobile platform technologies to enhance deployability and reduce logistics tail.
- Provide commanders the technology to achieve unprecedented real-time situation awareness of the battlefield.
- Significantly improve the battlefield soldier's ability to absorb information and make decisions.
- Solve the defense information warfare problem.

Technology Transfer

- New Cooperative R&D Agreements (CRDAs) = 13
- New Patent License Agreements (PLAs) = 3
- New Education Partnership Agreements (EPAs) = 4
- New International Agreements = 12
- Small Business Innovation Research (SBIR) awards of $14 Million (consisting of 30 Phase I and 31 Phase II awards)
- Initiated major effort to perform technology assessments on ARL's sensor technologies; targeted marketing of identified technologies will follow
- Initiated training program for S&E employees at the Adelphi Laboratory Center on patenting and licensing processes for software

CURRENT IMPORTANT PROGRAMS (continued)

Technology Transfer Web Pages

- Being updated to allow easier location of technologies available for licensing.
- Will provide links to additional information on these technologies (e.g. reports, patent info, journal articles, etc.).
- Will also contain links to patent license application and CRDA boilerplate information.

ARL Personnel Exchanges

- Guest researchers sent out = 107
- Guest researchers in = 188
- Minimum stay is two weeks

EQUIPMENT/FACILITIES

Flame Research Facility
This facility enables us to conduct sophisticated studies in flame chemistry in support of propellant combustion simulation, so that advances can be made in gun propulsion. A wide variety of state-of-the-art spectroscopic and mass spectrometric diagnostic tools are used for experimental flame measurements. These measurements can be coupled with sophisticated flame computer models to support not only gun propulsion research but other flame research of military interest, such as fire suppression/extinction, hazardous waste incineration, and soot abatement.

Aerodynamics Experimental Facility
This facility is used to measure the actual flight motion of projectiles up to 37-mm caliber under realistic pressures, densities, and velocities. It is the only experimental facility in the U.S. capable of obtaining the accurate data on small and medium-caliber projectiles needed for the preparation of precise aiming data and firing tables.

Transonic Experimental Facility
This facility measures the actual flight motion of large-caliber projectiles (up to 8-in. diameter) under realistic pressures, densities, and velocities. It is the only range in the free world capable of obtaining accurate data on large caliber projectiles needed for input to artillery fire-control computers and firing tables. This facility also conducts full interior ballistic testing and evaluation, from the ignition and combustion of propelling charges, through projectile in-bore travel, to muzzle exit. The facility tests and evaluates advanced conventional gun propulsion technologies, electrical propulsion concepts, and innovative propulsion schemes, such as in-bore ram acceleration.

Tungsten Alloy Experimental Facility
This Experimental Facility routinely conducts full-scale terminal-ballistic experiments with both kinetic-energy penetrators and shaped-charge warheads. It is able to fully instrument the terminal-ballistic tests of all advanced armors, including reactive armor.

Cannon-Caliber Electromagnetic Launcher Experimental Facility
This installation measures the launch and flight performance of electromagnetic cannons up to 30-mm caliber. Equipped with a nearly 2.0-MJ power supply and a range of 250m, it performs diagnostics on electrical, mechanical, and aerodynamic qualities of electromagnetic gun systems.

EQUIPMENT/FACILITIES (continued)

Explosive Mechanics Facility
At this facility, two enclosed blast chambers can test up to 23-kg of explosive material. The chambers feature high-speed photography (2 million frames per second), flash x-ray devices, four-channel x-ray cineradiography, and high-speed recording equipment. Projectiles are fired into the chambers from an adjacent gun room. The chambers are currently being used to study thresholds in special explosives for reactive armor and fundamental initiation processes in solid explosives.

Blast Experimental Facility,
Three air-driven shock tubes, 0.6, 1.7, and 2.4-m in diameter, simulate air blast from nuclear and conventional weapons. The largest air-driven shock tubes in the U.S., they allow flat-topped and exponentially decaying blast waves to be produced. All three Services use the range for R&D blast loading and response investigations of full-size and scale-model materiel. (Note: A recently constructed Large Blast/Thermal Simulator, to be operated by the U.S. Army Test and Evaluation Command, features a nitrogen-driven shock tube with a 167-m^2 test section.)

Aircraft Vulnerability/Lethality Experimentation Facility (AVLEF)
This test facility gives ARL a modern, centralized complex to evaluate the effects of explosive blast and fragmentation warheads, armor-piercing incendiary and high-explosive incendiary projectile impacts, and experimental penetrators and weapons, as well as unconventional threats, on aircraft components, subsystems, and complete operating fixed and rotary-wing aircraft. This testing capability benefits our participation in the DoD Joint Live-Fire Army-Air Force Program, as well as future developmental, specification, and live-fire test and evaluation associated with major Army aviation and anti-aircraft systems. In addition to Army test requirements, AVLEF supports Air Force and Navy-sponsored anti-aircraft warhead lethality evaluations and Aircraft Battle Damage Repair techniques. Specialized test resources and facilities at AVLEF include a blast pad for the evaluation of the effects of large blast/fragment warheads (of up to 100-lb of high explosives) on operating helicopters or fixed-wing aircraft, a covered full-scale dynamic turbine engine and helicopter drive train test pad, indoor and outdoor small-to-medium-caliber ballistic ranges for component and subsystem testing, EPA-approved fuel systems test capability, helicopter rotor-blade static loading fixture, remotely operated helicopter ground test tie-down, mobile airflow generator capable of 500 knots of airflow directed at targets, and a centralized test preparation and control/instrumentation building. A dedicated full-scale dynamic structural test building with ballistic capability was also constructed within AVLEF.

Out-of-Laboratory Facility (OLF)
The OLF supports survivability analyses of developmental weapon systems and assists materiel developers in hardening systems to withstand the effects of electromagnetic pulse (EMP) and other electromagnetic environments. The facility obtains electromagnetic coupling and response measurements through two experimental techniques, radiated continuous-wave and current injection. The Continuous-Wave Instrumentation System (CWIS) radiates sinusoidal electromagnetic fields at selected frequencies between 10-kHz and 1-GHz using two antenna systems, a 1000-ft horizontal dipole and a log-periodic antenna with a large clear 2500-m^2 test volume. The OLF also features current injection devices capable of producing a broad range of double-exponential and dampened sinusoidal waveforms, including sources that meet MIL-STD-188-125 requirements. Data measured by both techniques are transmitted, via fiber-optic link and network analyzers, to the facility's instrumentation trailer. These, computational resources determine the time-domain response to transient electromagnetic radiation, including the EMP threat, and duplicate threat-level system response to EMP or other transient electromagnetic coupling.

Computerized Mobility/Portability Course
This calibrated obstacle course has become an Army standard for measuring the effects of soldier load on mobility and physiological functions. It consists of hard surfaces and wooded areas, along with obstacles that require the encumbered soldier to run, jump, crawl, climb, and maneuver on foot. The facility is computerized, with the capability for real-time data collection and management. A special feature is the biophysical telemetry system, which monitors the soldier's heart rate, skin and core temperatures, sweat rate, and "G" loading.

EQUIPMENT/FACILITIES (continued)

Computerized 600-m Small Arms Experimental Facility
The Small Arms Experimental Facility is a state-of-the-art facility for examining soldier weapon performance. It consists of multiple stationary and moving targets, controlled from a computer-equipped command and control center. This experimental facility permits the engagement of targets at a wide variety of distances, target exposure times, and angles. It features four firing lanes with target exposures from 10 to 550-m; these firing lanes can be operated simultaneously with different target scenarios. Each lane has five targets at 10 and 25-m for firing personal defense weapons and three targets each at 50, 75, 100, 150, 200, 250, 300, 400, 500, and 550-m for rifle firing. In addition to the fixed targets, each lane has three moving targets at 80, 130, and 180-m, which travel a distance of 15-ft at 90° to the shooter. Special in-house-designed targets and pneumatically operated target mechanisms are also featured. The computerized command and control center can present programmed arrays of targets at any distance, time interval, and sequence. The computer system has a software package that records and reduces range events, such as targets presented, target time, target hits, shots fired, and time of shot. The computer system also features an acoustic measurement system that provides horizontal and vertical coordinates of a hit or a near miss on a target.

Indoor/Outdoor Robotics and Automation Research and Test Facility
Application of robotics technology and automated systems to military operations can enhance weapon system effectiveness, create new capabilities, and reduce risks to soldiers. This facility allows the development of robotics and related technologies. It includes an outdoor 14-acre test area that features a 25-mph sustained-speed test track, a standardized obstacle course, and an explosive-ordnance-disposal robot court, along with perimeter safety barricades and a Global Positioning System (GPS) position-location system. The indoor section contains a 35,000-ft^2 test area with an RF position-location system, central data-acquisition equipment, and a computing facility.

High-Performance Computing Resources
As part of the DoD High-Performance Computing Modernization Program (HPCMP), ARL is one of four DoD Major Shared Resource Centers (MSRC) for High Performance Computing (HPC). The ARL HPC facility, located at Aberdeen MD, hosts state-of-the-art scalable parallel architectures, workstation clusters, and large vector-parallel systems supporting both classified and unclassified missions throughout the DoD Research Development and Test and Evaluation (RDT&E) community. The ARL MSRC provides DoD leadership in the design, development and implementation of innovative high speed networking technologies through the Defense Research and Engineering Network (DREN) initiative. In addition to the MSRC, the ARL HPC Center provides management oversight of the Army High Performance Computing Research Center (AHPCRC), located at the University of Minnesota. The AHPCRC focuses efforts toward novel HPC research areas and the development and application of advanced HPC technologies to relevant Army technology needs.

Composites Processing Research Facilities
Advanced low-cost, reliable processing techniques are essential to the future application of structural polymer matrix composites to Army ground vehicles, aircraft, and other materiel. ARL's state-of-the-art composites processing research facilities, such as the fully automated high-temperature (800° F) and pressure (450-psi) autoclaves, provide the necessary research tools to address scientific and engineering problems in process optimization and automated process control.

Materials Characterization Facility
This unique facility enables ARL's scientists and engineers to conduct highly detailed measurements of the properties of ceramics, polymers, glasses, and composites. It includes extensive state-of-the-art instrumentation for analyzing the chemical properties of materials at a wide range of temperatures, as well as a full complement of optical and electron microscopy and other electron probe instruments for microstructural analysis, x-ray residual stress analysis, and electrical, magnetic, and thermal property characterization. It also features a unique combination of surface analysis equipment.

EQUIPMENT/FACILITIES (continued)

Ion Implantation Facility
At this facility, employees develop and demonstrate novel ion surface treatments and coating techniques for Army materiel, such as machine tools and parts subject to corrosive or high-wear environments. This technology is demonstrating significant improvements in the quality of protective coating techniques, such as cadmium and chromium plating. In addition, the ion-implantation process has proven to be environmentally acceptable as an alternative to cadmium, chromium, and other heavy-metal plating processes which, collectively, account for 90 percent of the hazardous wastes generated by all electroplating processes within DoD. A cooperative effort with the Corpus Christi Army Depot is demonstrating the effectiveness and cost benefits of ion-implanted machine tools such as taps, drills, and end-mills.

Special Meteorological Equipment
We have developed a variety of special meteorological equipment to meet unique Army and other customer requirements that cannot be satisfied with standard laboratory instrumentation. Some examples include specialized visible and infrared transmissometers used to evaluate Army electro-optical weapon systems operating in degraded and battlefield-obscured atmospheres, and an atmospheric profiler facility used to measure vertical profiles of wind speed, wind direction, and small-scale turbulence at altitudes up to 2-km in support of ballistic correction requirements. Most of this instrumentation falls within a 40-by-140-mile division-sized area of operations at White Sands Missile Range. We have a variety of automated and manned data-collection points throughout this area, including 20 automated surface observation stations, a meteorological rocket launch complex, and two 500-ft instrumented meteorological towers.

Mobile Acoustic Source (MOAS)
The MOAS is a pneumatic loudspeaker system that allows scientists to verify acoustic models with atmospheric effects. The system is a true exponential horn, 56-ft long, with full fidelity from 10 to 500-Hz; it will generate sound sufficient for testing acoustic propagation of sources up to 15-km away. Other features include the following: (1) it is transportable, mounted on an expandable flatbed trailer, (2) it can develop 20,000 acoustic watts of power, or over 160-dB, and (3) it may be controlled via radio-frequency link and fail-safe software to ensure safe operation. The MOAS can reproduce realistic signals simulating any sound at various ranges and under controlled conditions, and it can broadcast single tones, multiple tones, or tape playbacks. No other system with comparable features exists in the world today.

Electromagnetics Research Laboratory (EMRL)
This facility conducts full-scale investigations of the vulnerability of weapon systems to electronic warfare, including radio frequency countermeasures (RFCM), millimeter-wave countermeasures, and high-power microwaves (HPM). Electromagnetic susceptibility experiments use three anechoic chambers: the primary investigation anechoic chamber, a 94-ft long, 32-ft wide, and 25-ft high chamber; and two smaller chambers, one used for RFCM and one for millimeter-wave CM. Featuring externally modulated high-power amplifiers, the EMAF offers the capability to continuously sweep from 100-MHz to 18-GHz and to generate pulsed RF of up to 1-MHz and pulsed waves from 50-ns to continuous-wave. The facility can also generate AM, FM, and noise-modulated RF environments to expose the system under investigation to a comprehensive set of conditions that may be encountered in a battlefield. Resident state-of-the-art computational resources are available to provide equipment automation and real-time data analysis and storage. Also featured is a computer-controlled RF-threat emulator that provides complex high-fidelity single RF-threat radar waveforms for the RFCM investigations.

Electro-Optical Countermeasures Missile Flight Simulation Facility
This hardware-in-the-loop missile flight simulator evaluates the effectiveness of EO air defense missile systems in CM environments. The simulator includes major portions of actual missile-guidance and control hardware with software embedded in the simulation loop. Real-time representations are solved, using both digital and analog computers, for missile dynamics in six degrees of freedom and target motion in three degrees of freedom. A multiprocessor digital computer solves the missile aerodynamics and propulsion and the relative target-missile geometry. The analog computer models subsystems with bandwidths too high to allow real-time digital solution, such as the wing servo or gyro transfer function. A second digital computer functions as the simulation controller and supervises the real-time trajectory

EQUIPMENT/FACILITIES (continued)

and field-of-view displays hosted on two PCs. The primary output from the simulation is miss distance at the point of closest approach to the target, a criterion from which the overall effectiveness of a CM technique may be assessed. Further processing of the miss distance into a digital end-game model can yield probability of hit (i.e., missile lethality) against specific threat aircraft.

Electro-Optical Data Acquisition System (EODATS)
The EODATS provides a unique capability of dynamically tracking and measuring target signatures during EW missile firing experiments. It consists of a 35-ft instrumentation van integrated with an automated tracking pedestal capable of controlling the operation of six electro-optical missile seekers in a captive track arrangement. Data collected from the captive seekers can be recorded for post-mission analysis. Video documentation of seeker responses to the EOCM environments aids quick-look analysis. The EODATS is equipped with infrared through ultraviolet spectrometers, radiometers, and imagers to obtain signatures of targets, countermeasures, and backgrounds. Automatic target tracking is achieved with a highly modified Chaparral AN/DAW-1B missile seeker or digital/analog outputs from the control computer. Manual target tracking is also available via a joy stick that operates the track mount (either remotely or directly by telescope optics). The motion of the track mount during a data run can be recorded to a computer file, which can be played back through the track mount to collect background signature data across the same path. The signature measurements of the background can then be subtracted from the target-plus-background data file to achieve target-only measurements.

Acoustic/Seismic Countermeasure Vehicle
ARL operates a modified 5-ton stake-bed truck that can evaluate acoustic and seismic countermeasures by functioning as an acoustic/seismic decoy and an acoustic jammer. The vehicle houses an acoustic loudspeaker system, consisting of a 12-kW power generator, subwoofer cabinets, and power amplifiers, that can reproduce any signal within a frequency range of 40 to 200-Hz. The vehicle also tows a 750-lb tank sprocket used to generate seismic energy that produces spectral lines similar to those of ground combat vehicles but at a smaller magnitude. To simulate a moving ground vehicle target, the vehicle radiates a pre-recorded target signature as it travels along the ground. To simulate an acoustic jammer, it radiates broad-band noise designed to protect accompanying target vehicles by masking their acoustic signatures. The vehicle is currently being used to examine the effects of decoying and jamming on the Wide-Area Mine System - a system that relies on the acoustic and seismic energies emanating from a ground combat vehicle to engage it as a target.

Air Defense Electronic Warfare Facility
This laboratory provides ARL with a quick-reaction capability for the implementation of EW techniques to ensure that all elements of the EW threat required for the vulnerability assessment process are addressed. Specialized hardware is developed and fabricated at this facility for the field experiments associated with surveillance, tracking, and guidance functions of Army systems. The facility supports a wide variety of special-purpose equipment, including airborne and ground-based RF jammers, EOCM equipment, passive RFCM equipment, and state-of-the-art field measurement systems. Although primarily developed to support EW vulnerability analyses, these resources have wide application and are routinely used by the other services as well as the international community.

Ultra Wideband (UWB) Synthetic-Aperture Radar (SAR) Testbed
A mobile UWB SAR testbed, featuring a 150-ft measurement system, is used to support vehicle-mounted ground-penetrating radar developments, including mine detection systems. The UWB radar on a 150-ft boom lift allows for collection of two-dimensional apertures to support three-dimensional image formation for improved target detection and identification.

Advanced Microanalysis Facility
This center provides the Army and DOD with a fully integrated capability for chemical and structural analysis of electronic materials and devices. Characterization measurements reach resolution on the atomic scale and elemental detection sensitivities to parts per billion levels. The center contains surface and bulk characterization instrumentation including, secondary ion mass spectrometry (SIMS), Auger electron spectrometry (AES), X-ray photoelectron spectrometry (XRS), scanning electron microscopy (SEM) with associated techniques (EDX), powder and crystal X-ray diffractometers, transmission

EQUIPMENT/FACILITIES (continued)

electron microscopy (TEM), atomic force microscopy (AFM), inductively coupled plasma mass spectrometer (ICP-MS), glow discharge mass spectrometer (GDMS), thermal desorption mass spectrometer (TDMS), surface profilometers and a host of state -of-the-art optical device characterization instruments. An added benefit of this center to the Army and DOD is the use of these capabilities on failure analysis on failed critical military devices or systems.

Relativistic Electron Beam Linear Accelerator Facility
The Sensors and Electron Devices Directorate operates a variable energy, variable pulse rate relativistic electron beam accelerator that is employed in pulsed radiolysis research dedicated to the non-thermal destruction of chemical and biological agents. It is also useful in research dedicated to the detection of narcotics, unexploded ordinance and landmines. This capability in force protection or decontamination is expected to facilitate the US response to chemical/biological attack and to reduce the cost and time for consequence management.

Power Conditioning Research Center
This facility is the laboratory setting for development and component testing for high average power and high peak power defense systems requiring advanced power conditioning components to provide an efficient, compact, and protected interface between the prime power and the power electronics load. Within the facility are a unique collection of power supplies in the megawatt average power class, offering variable voltages up to 250 kV and direct current outputs up to 1200 amperes. A variety of modulators, capacitor banks, and power supplies are available that use high capability solid state (GTO and thyristor), thyratron, ignitron and spark gap switching. The test beds are configured for testing high average power components, power conditioning, loads such as directed energy devices, high average power devices, and also diagnostics and sensors. The extensive inventory of high voltage components permits other configurations to be arranged to satisfy the specialized requirements of facility users.

Millimeter-Wave Instrumentation Test Facility
Here, specialists conduct basic research in propagation phenomena, remote sensing, and target signatures over the frequency range from 8 to 300-GHz. The facility is unparalleled in the breadth and depth of its instrumentation and analysis capability. Components and test equipment are available that can be readily configured for conducting feasibility studies of sensor concepts. Supporting tools include high-speed data acquisition and analysis systems, visualization tools, and model generation for performance evaluation. Through a synergistic relationship with the U.S. Army Combat Systems Test Activity (CSTA), ARL can conduct range testing using this facility with a minimum of in-house resources.

Acousto-Fluidic Test Facility
At this location, a full acoustic anechoic chamber allows the study of fluidic sensors, fluidic signal processors, and other microphone systems. Fluidic microphones, with a flat bandwidth down to a true zero hertz (DC), can be configured to be more sensitive than any commercially available microphone. In addition to the research being conducted on these fluidic microphones, they can also be used as a research tool for other programs requiring increased sensitivity and nonelectronic acoustic sensing.

Display Materials Research Facility
This facility is for the research and development of the materials, structures, and devices which will be the basis for the displays and display systems which the Army will need for our soldiers to effectively display and assimilate data on the digital battlefield. Some capabilities for luminescent research include: facilities for low and high voltage electron beam cathode luminescence (CL), electroluminescence, photoluminescence [Vacuum Ultraviolet-Near Infra-red (VUV-NIR), Raman, Raman imaging, Near Field imaging, reflectance/transmittance], Fourier transform spectrometer, and photometry. For device structures fabrication, there is an Atomic Layer Epitaxy Chemical Vapor Deposition (ALE CVD) reactor, a Radio Frequency sputtering system for electrodes, Rapid Thermal Annealing, sol-gel processing, and a multi-source system with laser ablation, sputtering, and thermal cells.

Army Research Laboratory
Adelphi, MD 20783-1197
(301) 394-1067

Director: Dr. John W. Lyons
Associate Director PPB: Mr. Bruce M. Fonoroff

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	0.000	N/A	N/A	0.000
6.1 Other	29.392	0.128	41.997	71.517
6.2	82.151	0.169	55.638	137.958
6.3	5.764	0.038	12.664	18.466
Subtotal (S&T)	**117.307**	**0.335**	**110.299**	**227.941**
6.4	1.808	0.010	3.395	5.213
6.5	1.103	0.007	2.424	3.534
6.6	44.387	4.779	36.962	86.128
6.7	0.498	0.002	0.600	1.100
Non-DOD	0.000	0.000	0.000	0.000
TOTAL RDT&E	**165.103**	**5.133**	**153.680**	**323.916**
Procurement	1.090	N/A	2.379	3.469
Operations & Maintenance	5.993	N/A	13.722	19.715
Other	13.092	N/A	44.607	57.699
TOTAL FUNDING	**185.278**	**5.133**	**214.388**	**404.799**

MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	21.278

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	
TYPE	**DOCTORATES**	**OTHER**		**END STRENGTH**
MILITARY	6	38	16	60
CIVILIAN	304	939	912	2,155
TOTAL	**310**	**977**	**928**	**2,215**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	1,250.000	**REAL PROPERTY**	697.000
ADMIN	864.000	* NEW CAPITAL EQUIPMENT	0.000
OTHER	673.000	**EQUIPMENT**	569.666
TOTAL	**2,787.000**	* NEW SCIENTIFIC & ENG. EQUIP.	8.079
ACRES	**5,335**	* Subset of previous category.	

N/A - Not Applicable

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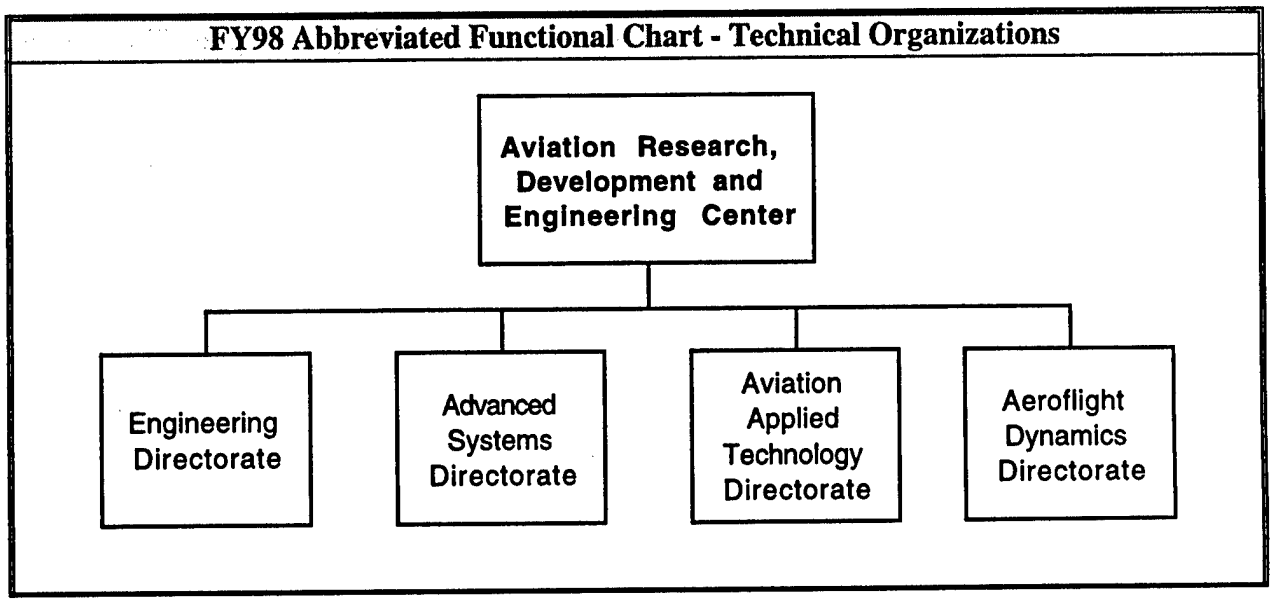
Aviation Research, Development and Engineering Center



Aviation Research, Development and Engineering Center
Redstone Arsenal, AL 35898-5241
(256) 842-9641

Director: Thomas L. House
Associate Director: Robert V. Kennedy

MISSION

Execute the DoD Rotorcraft Science and Technology program and provide 'one-stop' engineering support to all life cycle phases as required to achieve technologically superior, safe, and supportable Army aviation systems and equipment. The AVRDEC has the responsibility to plan and, in most cases, execute the fundamental basic research, exploratory development, and advanced development programs supporting DoD rotorcraft needs in the areas of aeromechanics, propulsion, structures, reliability and maintainability, survivability, weaponization, avionics mission equipment, and systems integration/simulation.

CURRENT IMPORTANT PROGRAMS

Rotorcraft Pilot's Associate; Joint Turbine Advanced Gas Generator and Integrated High Performance Turbine Engine Technology; Advanced Rotorcraft Transmission; Air-to-Air Starstreak Integrated Advanced Boresight Equipment; Integrated Fire and Flight Control; Helicopter Active Controls Technology; Advance Rotorcraft Aeromechanics Technology; Man/Machine Integration Design and Analysis; Control Designers Unified Interface; Advanced Cargo Handling System; Airborne Manned/Unmanned Systems Technology; Unit Maintenance Aerial Recovery Kit; Advanced Composite Structural Field Repair NDI/NDT; Rotary Wing Structures Technology, Light Weight, High Temperature Uncooled Turbine; Visual Electro-Optical Signature.

Cooperative Research and Development Agreements (CRDAs):

COMPANY: McDonnell Douglas Helicopter
SUBJECT: Flight Demonstration of a Helicopter Advanced Digital Flight Control System.

COMPANY: Advanced Technologies, Inc.
SUBJECT: Materials Characteristics of Composite Rotor Blades.

COMPANY: Kowen-Hoven and Hoskins (KHH)
SUBJECT: Peregrin Moving Map Display Demonstration.

COMPANY: Sikorsky Aircraft
SUBJECT: Development of Enhancement of Radar Detection Analysis Program.

COMPANY: Sikorsky Aircraft
SUBJECT: T-700 Engine Advanced HIRSS Technology Program.

COMPANY: Sikorsky Aircraft
SUBJECT: UH-60 Helicopter Fire Hawk System Demonstration.

COMPANY: Robertson Aviation
SUBJECT: Design and Fabrication of Tactical, Crashworthy, Self Sealing External Fuel Tanks.

COMPANY: Sikorsky Aircraft
SUBJECT: Aviation Manned/Unmanned Systems Technology Requirements Definition.

CURRENT IMPORTANT PROGRAMS (continued)

COMPANY: Boeing-Mesa
SUBJECT: Thermoplastic Longbow Electronic Forward Avionics Based Systems Door Application.

COMPANY: Sikorsky Aircraft
SUBJECT: Associate Cockpit Technology.

COMPANY: Boeing Defense and Space Group
SUBJECT: Application of Human Factor Research to Short Haul Civil Tiltrotor.

COMPANY: McDonnell Douglas Helicopter
SUBJECT: Aero and Structural Computer Models for AH-64D Helicopter.

COMPANY: Bell Helicopter
SUBJECT: Application of CONDUIT Control to Optimize Tilt Rotor Handling Qualities.

COMPANY: Lockheed Martin
SUBJECT: Application of CONDUIT Control to Optimize Tilt Rotor Handling Qualities.

COMPANY: Kaman Aerospace
SUBJECT: Application of CONDUIT Control Systems Design to Optimize the SH-2G AFCS.

COMPANY: Boeing Philadelphia
SUBJECT: Use of CONDUIT in Support of Boeing Digital SCAS Development.

COMPANY: MDC-Long Beach
SUBJECT: Use of CONDUIT in Support of Flying Qualities Research.

COMPANY: Sikorsky Aircraft
SUBJECT: Incompressible Navier-Stokes CFD Analysis to Predict Fuselage Drag.

COMPANY: Aerobotics Corporation
SUBJECT: AI Technology and Sensors to Army Air and Ground Vehicles.

COMPANY: Kaman Aerospace and Carnegie Melton Robotics Institute
SUBJECT: Comprehensive Identification from Frequency Response (CIFER).

EQUIPMENT/FACILITIES

Crew Station Research and Development Facility: Three blue/red team stations; fiberoptic helmets; one or two seat standard cockpit; Mission Equipment Simulation Evaluation Facility (MESEF) Cockpit; technical center can simulate 11 other aircraft, 99 threats, 20 moving targets, and C3. Flying Laboratory for Integrated T&E (FLITE): modified AH-1S aircraft; Apache PNVS; reconfigurable voice I/O system; flight symbology; fully integrated instrumentation.

NASA-Ames Vertical Motion Simulator: Four interchangeable cabins with virtual TV display; six DOF motion, acceleration, and velocities; sound generation system; pilot and co-pilot positions.

NASA-Ames Helicopter Human Factors Research Facility: Four part-task simulators to investigate; geographic orientation, visual cues simulator, voice actuated controls, and pilot decision-making.

EQUIPMENT/FACILITIES (continued)

NASA-Langley 14x22 Wind Tunnel: VSTOL/200 knots/variable test section; flow visualization and diagnostics; acoustics capability.

Countermeasures Test Facility: IR suppression fabrication shop; engine and test stand with indoor and outdoor test ranges; Sun workstation and software for: test data recording and analysis, and design and simulation of IR suppressors.

Ballistic Test Range: Two outdoor and one indoor test range: fully instrumented for data collection and analysis; fuel recovery system; API and HEI up to 30mm in caliber. Experimental fabrication facility. Full-scale aircraft and component structural test facility.

Structural Test Facility: Full-Scale rotor blade test fixture, full-scale rotor blade root end test fixture, torsional fatigue test facility, full-scale aircraft test facility, MTS and Instrom load frames, environmental test chamber.

Research Support Area: Model Shop, Machine shop with NC control machines.

NASA-Ames 40x80x120 Wind Tunnel: NASA-Ames 7x10 Wind Tunnel; NASA-Ames Automation Sciences Research Facility; NASA-Ames Numerical Aerodynamics Simulator; NASA-Ames Fluid Mechanics Laboratory; NASA-Ames Hover Anechoic Chamber.

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FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	1.228	N/A	N/A	1.228
6.1 Other	1.487	0.023	1.824	3.334
6.2	10.508	0.490	8.527	19.525
6.3	4.024	0.206	42.579	46.809
Subtotal (S&T)	**17.247**	**0.719**	**52.930**	**70.896**
6.4	2.059	0.108	4.905	7.072
6.5	1.981	0.104	0.898	2.983
6.6	4.309	0.167	8.576	13.052
6.7	0.769	0.036	6.750	7.555
Non-DOD	0.000	0.000	0.000	0.000
TOTAL RDT&E	**26.365**	**1.134**	**74.059**	**101.558**
Procurement	5.342	N/A	6.527	11.869
Operations & Maintenance	3.295	N/A	1.494	4.789
Other	6.087	N/A	6.481	12.568
TOTAL FUNDING	**41.089**	**1.134**	**88.561**	**130.784**

MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	
TYPE	**DOCTORATES**	**OTHER**		**END STRENGTH**
MILITARY	0	14	1	15
CIVILIAN	17	279	221	517
TOTAL	**17**	**293**	**222**	**532**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	62.436	**REAL PROPERTY**	6.652
ADMIN	76.405	* NEW CAPITAL EQUIPMENT	0.000
OTHER	42.631	**EQUIPMENT**	28.643
TOTAL	**181.472**	* NEW SCIENTIFIC & ENG. EQUIP.	0.030
ACRES	**5**	* Subset of previous category.	

N/A - Not Applicable

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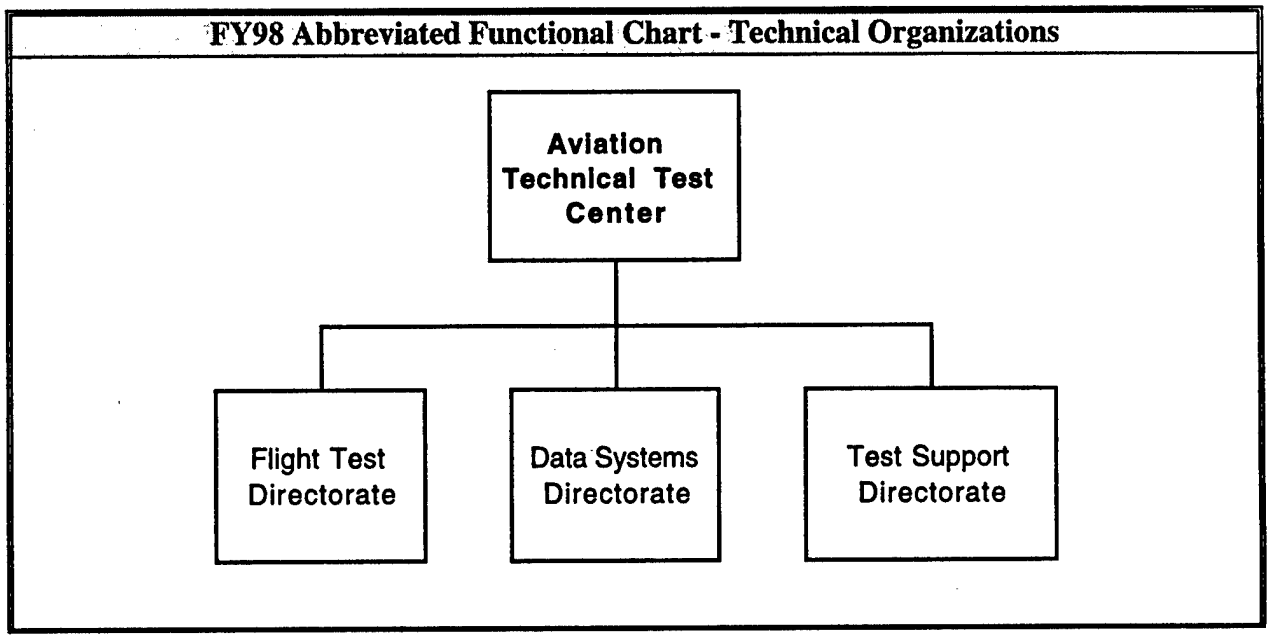
Aviation Technical Test Center



Aviation Technical Test Center
Fort Rucker, AL 36362-5276
(334) 255-8000

Commander: COL Austin R. Omlie
Technical Director: Larry E. Eagerton

MISSION

Plan, conduct, analyze, and report the results of developmental tests and studies to include airworthiness flight testing of Army aviation systems and associated materiel/systems. To provide test, test support, development support, and evaluations of aviation materiel/systems; and provide other aviation support for authorized customers as directed by the U.S. Army Test and Evaluation Command.

CURRENT IMPORTANT PROGRAMS

AH-64D Longbow.

RAH-66 Comanche.

OH-58D Kiowa Warrior.

T801 Engine Conversion for National Guard.

CH-47D Vibration Reduction Test Aircraft.

EQUIPMENT/FACILITIES

Twenty-one rotary and fixed-wing aircraft are currently assigned (4 AH-64A, 5 CH-47D, 1 C-23A, 2 OH-58D, 2 UH-1H, 4 UH-60A, 1 UH-60L, 1 U-21H, 1 EH-60A, as test beds. Helicopter Icing Spray System (HISS): a CH-47D with an integrated 1,800-gallon water tank and spray apparatus combined with a highly instrumented U-21A to provide cloud physics documentation, conducts in-flight icing evaluations under both artificial and natural conditions. Full flight test instrumentation capability exists. Analog and digital aircraft data can be recorded and/or telemetered to the ground. On-site data processing and display exist--real time and postmission. Capability to collect and process video, still, and high-speed pictures exists. C-23A aircraft provides multi-sensor test bed to test sensors or compare them in a side-by-side testing.

Aviation Technical Test Center
Fort Rucker, AL 36362-5276
(334) 255-8000

Commander: COL Austin R. Omlie
Technical Director: Larry E. Eagerton

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	0.000	N/A	N/A	0.000
6.1 Other	0.000	0.000	0.000	0.000
6.2	0.000	0.000	0.000	0.000
6.3	0.000	0.000	0.000	0.000
Subtotal (S&T)	**0.000**	**0.000**	**0.000**	**0.000**
6.4	0.000	0.000	0.000	0.000
6.5	0.000	0.000	0.000	0.000
6.6	9.639	0.000	0.000	9.639
6.7	0.000	0.000	0.000	0.000
Non-DOD	0.000	0.000	0.000	0.000
TOTAL RDT&E	**9.639**	**0.000**	**0.000**	**9.639**
Procurement	0.635	N/A	0.000	0.635
Operations & Maintenance	0.003	N/A	0.000	0.003
Other	1.298	N/A	0.000	1.298
TOTAL FUNDING	**11.575**	**0.000**	**0.000**	**11.575**

MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	
TYPE	**DOCTORATES**	**OTHER**		**END STRENGTH**
MILITARY	0	0	26	26
CIVILIAN	1	35	60	96
TOTAL	**1**	**35**	**86**	**122**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	0.000	**REAL PROPERTY**	3.300
ADMIN	85.633	* NEW CAPITAL EQUIPMENT	0.000
OTHER	125.004	**EQUIPMENT**	108.546
TOTAL	**210.637**	* NEW SCIENTIFIC & ENG. EQUIP.	0.414
ACRES	**11,005**	* Subset of previous category.	

N/A - Not Applicable

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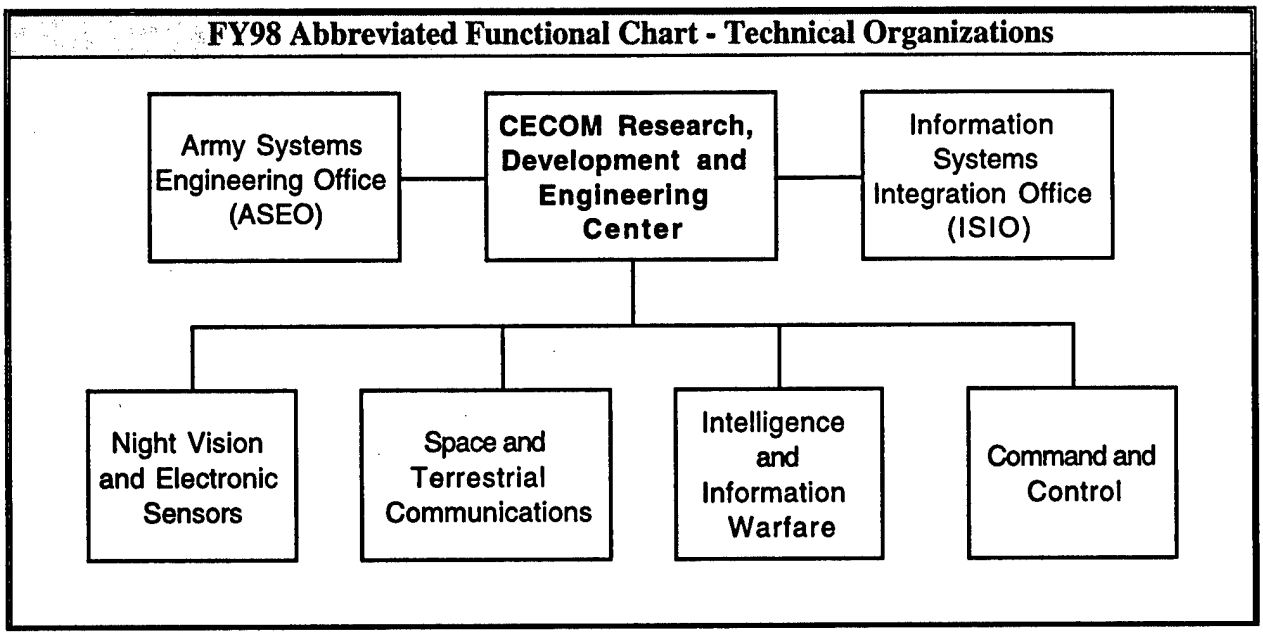
CECOM Research, Development & Engineering Center



CECOM Research, Development & Engineering Center
Ft. Monmouth, NJ 07703-5209
(732) 427-2686

Director: Dr. Louis C. Marquet
Military Deputy: COL Robert Fasulo

MISSION

To provide America's Warfighter with superior information technologies and integrated systems enabling battlespace dominance by identifying, developing, evaluating and tailoring emerging information technologies; by facilitating the transition of selected technologies into operational systems; and by performing and promoting System of Systems integration.

Vision: To be the universally recognized leader in providing information dominance capabilities to America's warfighters, "...so overwhelming that decisive victory is achieved."

CURRENT IMPORTANT PROGRAMS

Night Vision and Electronic Sensors:

Vehicle Mounted Mine Detector ATD completed in FY98 and demonstrated down and forward looking sensor technologies including ground penetrating radar and infrared mounted on a vehicle to detect metallic and non-metallic anti-tank mines. Five prototypes were built and tested in both temperate and arid climates with varying soils. These prototypes used sensor fusion (radar, IR, electro-magnetic induction, thermal neutron analysis) and were capable of electronically marking mines, tele-operation, and were equipped with GPS. This program has been selected by the PM Mines, Countermines, and Demolition for funding through production.

The Target Acquisition ATD completed in FY98, demonstrating an extended range target acquisition suite consisting of the MTI ground radar, second generation thermal sight and multifunction laser. These enhanced target acquisition capabilities were coupled with target identification technologies to improve lethality and survivability. Both the radar and laser were tested successfully and all modules were combined to an integrated system. The Multifunction Staring Sensor Suite ATD will leverage the Target Acquisition ATR. The Target Acquisition ATD can also provide HTI B-Kit upgrades for automation, technology and performance baseline for the Future Scout and Cavalry System, and provide technologies for the M1A2 SEP P3I.

The Advanced Focal Plane Array program is a Science and Technology Objective (STO) with the purpose of developing an advanced generation of IR imaging sensors with large staring focal plane arrays which allow smart temporal and multispectral processing. This STO is closely linked with activities under the 3rd Generation STO which is joint with ARL and closely linked with activities under the Overhead Sensor Technology STO which is joint with SMDC.

Command and Control:

Battlefield Command and Control (BC2) ATD will apply technologies for common view of the battlefield to develop prototype software battlefield visualization capabilities and architectures supporting the Army digital battle staff requirements for merging situational awareness and battle command with mission planning/rehearsal.

Battlefield Visualization will demonstrate a system that integrates emerging technologies with existing DOD systems to enhance battlespace awareness and facilitate total assessment, forecasting, information visualization, course of action analysis and other critical C2 functions.

CURRENT IMPORTANT PROGRAMS (continued)

Soldier Individual power will complete development of a standard family of lithium manganese dioxide batteries as a more cost-effective alternative to present non-rechargeable lithium sulfur dioxide system for combat missions.

Space and Terrestrial Communications:

Digital Battlefield Communications (DBC) ATD. This demonstration exploits emerging commercial communications technologies to support multimedia communication in a highly mobile, dynamic battlefield environment. It demonstrates capabilities that can supplement "legacy" military communications systems which are unable to keep pace with the rapidly increasing demand for communications bandwidths and global coverage in support of Digitized Battlefield and split-based operations.

Wideband Radio Networking (WRN). The primary objective of this effort is to develop the candidate Wideband Waveform for the Joint Tactical Radio System (JTRS). A secondary objective is to establish a joint testbed facility for evaluating the JTRS family of radios and emerging DARPA (GloMo) radio network protocols.

Tactical C2 Protect ATD. This effort will demonstrate the ability to protect the Army's tactical information systems, components and data from modern network attacks. The protect portion will include an integrated security architecture that provides advanced network access control, intrusion detection, and response within tactical communications networks.

Intelligence and Information Warfare:

ORION focuses on the use of an Unmanned Aerial Vehicle to extend the range of the Intelligence and Electronic Warfare (IEW) Common Sensors systems so as to intercept communications and non-communications signals located deep within enemy territory and beyond safe operational range of manned systems.

The Data Fusion Process program will enhance battlefield EW processing capabilities thereby supporting Joint Vision 2010 via software products to integrate diverse IEW source inputs at a single point to provide the commander a timely, fully fused portrayal of the battlefield situation and enemy intentions.

Modern Communications Attack program will establish vulnerabilities of various modern communications systems. Additional information is classified.

The Non-Communications/Electronic Support program's primary technical focus is on exploring/developing/demonstrating the technology needed to address modern radars that use low probability of intercept (LPI) techniques.

IEW Simulation and Modeling program develops the capability for evaluation of operations and interoperability of IEW systems through simulation.

The TROJAN program provides the intelligence collector the capability of accessing hostile forces communications from almost everywhere in the world; deployed ground forces intelligence processing capabilities and a communications backbone from the division to national level intelligence producers; the means to facilitate flexible, real-time information exchange through the TROJAN family of systems; fly-away satellite communications for enhanced voice and data connectivity between maneuver battalion or the brigade tactical analysis center to the division analysis and control element; a deployable switching capability to the TROJAN network for limited theater level contingency operations.

CURRENT IMPORTANT PROGRAMS (continued)

Technology Transfer:

SBIR - As part of President Clinton's Educational Technology Initiative, Farance/Edutool demonstrated its CECOM SBIR supported learning technology infrastructure software at the White House in April 1998.

As part of CECOM's Phase II SBIR program, Amain Electronics Company received an Army SBIR Phase II Quality Award for their work in LWIR focal plane arrays to provide image at extended ranges for both commercial and military applications.

Dual Use Science and Technology:

CECOM aggressively sought to maximize its scarce resources by leveraging $3.4M into dual use projects worth $19M for its FY98 Dual Use S&T program.

In August 1998, CECOM hosted various representatives from the Federal Government, industry and academia to announce $20M in projects to support the FY99 Dual Use S&T efforts.

CECOM's IR&D program was again quite successful in FY98, having hosted 5 Technical Interchange Meetings to brief some 30 projects of interest to the Team C4IEWS community.

EQUIPMENT/FACILITIES

The CERDEC boasts many world-unique and U.S. Government-unique facilities supporting a broad range of technical areas. A sampling of our state-of-the-art equipment and facilities follows.

Intelligence and Information (I2) Warfare Facility. Completed in 1997, this 89,000 square foot facility houses the I2 Simulation Lab, an Anechoic Chamber and the High Bay System Integration Lab. The facility has limited access and Sensitive Compartmented Information Facility (SCIF) areas. It has enabled CERDEC to expand our world-class R&D capabilities in the areas of signal intelligence, intelligence collection, intelligence data fusion and electronic countermeasures.

The Digital Integrated Laboratory (DIL) is a dynamic world-class distributed integration facility that electronically links distributed CERDEC labs, industry facilities, Battle Labs, field sites, as well as joint and allied activities. The DIL can be rapidly reconfigured to replicate diverse existing and evolving tactical C4I/I2W battlefield environments for systems engineering, development, integration, and evaluation of the digital battlefield. The DIL played a major role in the testing of systems for TFXXI and the Division AWE. It is expected to play a similar role in the evaluation of interoperability of systems prior to fielding as part of the First Digitized Division Army Digitization, as well as the first digitized corps and the continued digitization of the Army.

Classified Perception Lab. Experiments can be done at high levels of classification with military users. It will be completed with 10 400MHz computers and facilities for performing experiments with subjects seated at a measured distance from the screen.

Upgraded Eyetracking Equipment. Now has two eyetrackers with resolution at about .2 degrees resolution at 60Hz. These are used to track the position of the military observers' eyes during search of field of view of regard imagery.

Molecular Beam Epitaxy. An excimer laser and a chemical vapor deposition chamber were coupled to the microfactory to allow patterns to be etched into mercury cadmium telluride detector layers to form staring focal plane arrays.

EQUIPMENT/FACILITIES (continued)

Virtual Prototyping Facility. State-of-the-art computer graphics, image processing, networking, and system platform simulators to provide the capability for end-to-end designing and testing of advanced sensors.

Applied Communications-Electronics Lab. This facility supports new methods and concepts associated with the design, test and assessment/analysis of state-of-the-art, advanced electronic hardware and software. Special emphasis is on frequency control, microelectromechanics, electromagnetics, collaborative integrated electronic design, embedded processing, visualization and high performance computing. The lab has special facilities and expertise in the development and evaluation of ultraprecision low noise oscillators and clocks with special equipment for life testing, shock and vibration analysis, and RF/microwave network/spectrum and noise analysis. Software facilities include high-speed ATM/DS3 network access and resources for innovative scalable/parallel computing.

Power Sources Battery Test Facility. This facility performs safety, performance, quality and reliability tests on state-of-the-art power sources for the Army. Everything from developmental prototypes to high volume production samples can be tested to include all types of primary and rechargeable batteries, hybrid power sources, fuel cells and thermophotovoltaic devices.

Navigation Laboratory. This lab provides the capability to evaluate a wide number of navigation sensors and system integrations. It includes a GPS Satellite Signal Simulator, Doppler Navigation System Fault and Aircraft Simulator, as well as the Precision Navigation System. The GPS simulator provides the full Precise Positioning Service signal to a GPS receiver, injects jamming signals, and models dynamic platform trajectories and aiding sensor inputs (Doppler, Inertial and Altimeter). The Navigation Mobile Van is a 36-foot vehicle configured to provide a mobile laboratory environment for field testing of navigation technology.

Communications System Design Center (CSDC). This laboratory is for evaluating and experimenting with fielded voice and data communications systems. This center includes the following: MSE Support Facility (circuit and packet network systems); Development Engineering Facility (in-house design/development/product improvements/unique devices); System of Systems Central Patching; Army Integration Network (AIN) Terminal (communications with sites worldwide); Advanced Network Technology Facility (ATM Switching); Networks Management Facility (ATM switching systems) and Classified Data Processing Center.

Satellite Communications (SATCOM) Engineering Laboratories (SEL). The SEL supports research development, performance evaluation, system certification testing and anomaly resolution of space dependent and space based communications systems and equipment in the UHF, SHF, and EHF frequency bands. The SEL has four functional areas: Strategic Sys Lab, Control Systems Lab, Tactical Sys Lab, and Broadcast Management Center. All of the labs are interconnected with each other as well as to the CECOM Software Engineering Center and other CERDEC Digital Integrated Labs. This allows full connectivity to DISA for AIN, SIPRNET, NIPRNET, JWICS, etc. access and permits joint testing with the other services, battle labs, academia and industry. There are several unique assets in the labs, such as AN/GSC-39 SATCOM Terminals, DSCS III Satellite Simulator, Digital Communication Satellite Subsystem, Standardized Tactical Entry Point, UHF SATCOM Manpack Terminals, 5KHZ and 25KHZ DAMA UHF Satellite Test Emulators, and prototype SATCOM on-the-move antennas.

Signal Analysis Laboratory. This lab supports research and development for technology to collect, analyze, and exploit communications signals of interest. Signals can be collected and analyzed allowing the U.S. to respond rapidly to emerging threats. The central facility combines hardware and software capabilities for signals analysis and waveform measurement. This lab includes unique equipment and capabilities unavailable in other government or industrial labs.

EQUIPMENT/FACILITIES (continued)

The Information Systems Installation and Test Facility is a new facility that is simultaneously under development while being utilized for actual integration and testing of C4I systems and equipment. There are two large test and integration bays, which can accommodate several vehicles and shelters at the same time. Aircraft, up to and including the Blackhawk Helicopter, can be accommodated in the test bays. In addition, the test bays are equipped with 20 ton capacity travelling cranes which can be utilized for a number of purposes, including elevating vehicles or aircraft for EMI/RFI testing. The test bays are fully shielded for EMI/RFI testing. There is fiber optic as well as copper connectivity to the Digital Integrated Laboratory (DIL). By utilizing the outdoor areas, the test bays, connectivity to the DIL, UAVs, and satellites, actual field scenarios can be run, as well as training, before going to the field. This allows testing/swapping of hardware and software to determine interoperability and operational characteristics; and correction of any problems before joining in exercises or demonstrations. This facility is unique because real situations, not simulations, can be produced, which is important in the development of battlefield digitization equipment and systems.

CECOM Research, Development & Engineering Center
Ft. Monmouth, NJ 07703-5209
(732) 427-2686

Director: Dr. Louis C. Marquet
Military Deputy: COL Robert Fasulo

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	1.405	N/A	N/A	1.405
6.1 Other	0.849	0.179	0.348	1.376
6.2	22.744	4.499	47.762	75.005
6.3	22.035	4.505	106.863	133.403
Subtotal (S&T)	**47.033**	**9.183**	**154.973**	**211.189**
6.4	11.075	7.431	9.035	27.541
6.5	3.188	2.293	5.782	11.263
6.6	10.303	1.092	20.779	32.174
6.7	2.586	0.847	11.381	14.814
Non-DOD	0.000	0.000	0.000	0.000
TOTAL RDT&E	**74.185**	**20.846**	**201.950**	**296.981**
Procurement	22.099	N/A	48.840	70.939
Operations & Maintenance	8.725	N/A	22.295	31.020
Other	3.567	N/A	69.769	73.336
TOTAL FUNDING	**108.576**	**20.846**	**342.854**	**472.276**

MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	
TYPE	**DOCTORATES**	**OTHER**		**END STRENGTH**
MILITARY	0	7	26	33
CIVILIAN	73	1,243	667	1,983
TOTAL	**73**	**1,250**	**693**	**2,016**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	325.200	**REAL PROPERTY**	80.000
ADMIN	384.600	* NEW CAPITAL EQUIPMENT	0.000
OTHER	106.500	**EQUIPMENT**	290.000
TOTAL	**816.300**	* NEW SCIENTIFIC & ENG. EQUIP.	10.000
ACRES	**1,122**	* Subset of previous category.	

N/A - Not Applicable

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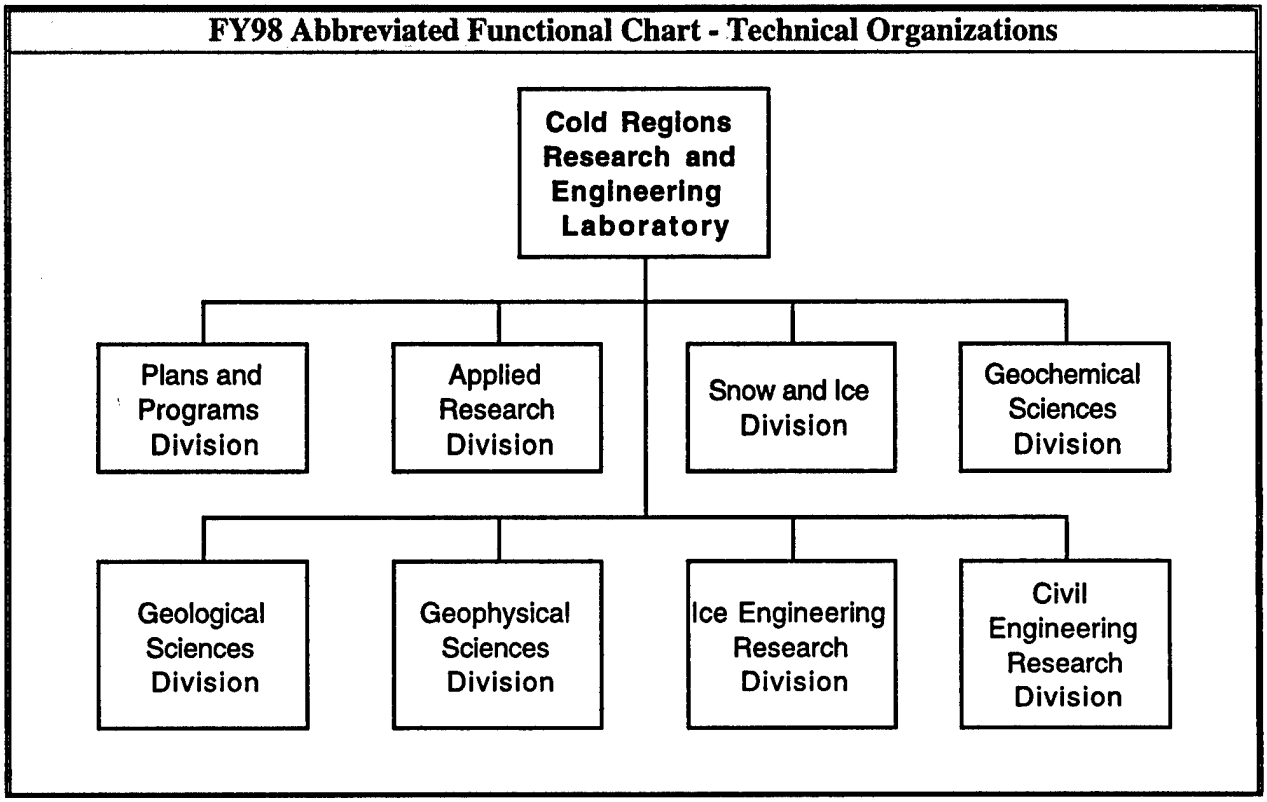
Cold Regions Research & Engineering Laboratory



Cold Regions Research & Engineering Laboratory
Hanover, NH 03755-1290
(603) 646-4100

Director: Dr. Barbara Sotirin
Chief, P&P Division: LTC William Loven

MISSION

Advancing knowledge of the cold regions through scientific and engineering research and putting that knowledge to work for the Army, Department of Defense and the Nation is the mission of the U.S. Army Cold Regions Research and Engineering Laboratory (USACRREL). Operating in cold regions requires appropriate equipment, training and doctrine, often very different from those used in more temperate conditions. These special requirements cover a broad range of military activities and can incur significant cost or capability penalties. Special challenges of cold regions exist on the more than 30% of the earth's surface that is covered by ice or underlain with permafrost. In addition, persistent and severe winter conditions occur in 50% of the earth's surface, including areas of Europe, Asia and North and South America. Bosnia/Herzegovina and North and South Korea are areas of interest today that experience severe winter conditions that are significantly impacting military operations.

USACRREL provides the technology to allow the Army to operate effectively in cold regions environments to maintain national security and foster peace. USACRREL research and development (R&D) focuses on all aspects of the cold/winter environment and its implications for military activities in garrison or on the battlefield; the singular exception being individual soldier clothing and equipment. CRREL also addresses the nation's winter water resources issues through the Civil Works program of the Corps of Engineers.

USACRREL is a single-focused R&D organization that is the primary source of cold regions expertise for the Department of Defense and both serves and leverages resources and efforts of other federal, state, and local agencies and the private sector.

CURRENT IMPORTANT PROGRAMS

USACRREL's current military programs are concentrated in four major research and development areas: Military Engineering, Battlespace Environments, Civil Engineering, and Environmental Quality.

The **Military Engineering** research provides innovative solutions to the difficult engineering problems that soldiers face in winter within the confines of existing and emerging equipment and manpower resources. This work is accomplished in conjunction with the primary materiel developer or with troop units to assist in focusing the research and provide direct transition and feedback. Focus areas are winter combat engineering, mobility, and operability. This research serves the cold regions requirements of all the military services and is directly relevant to current Army activities in Korea and Bosnia.

The **Battlespace Environments** research supports the design, test and evaluation of new systems through characterization, modeling and simulation of the highly varied world environmental conditions and their impact on systems (fielded or notional) performance. Winter and cold regions conditions are particularly difficult constraints for systems development and operation. Examples of direct support include icing problems for aircraft, modeling and simulation of the background environment and its impact on smart weapons systems, mine/countermine systems, and the ability to project environmental conditions in denied areas.

The **Civil Engineering** research generates technology for cost reductions in designing, building, operating, and maintaining military facilities in areas that experience harsh winter and severe cold weather; where infrastructure life-cycle costs and energy costs are high. USACRREL's efforts help solve critical Department of Defense civil engineering problems related to training, mobilizing, deploying, sustaining, protecting, and employing U.S. Forces in the cold environment.

CURRENT IMPORTANT PROGRAMS (continued)

The **Environmental Quality** research supports the test and evaluation of materiel systems through maintenance of training and test ranges, allowing their continued use while conserving the integrity of the environment. This is an especially difficult problem for ground vehicles and weapons systems that can have dramatic impacts on the flora and fauna of military ranges. The environmental quality area also has close ties to the Battlespace Environments area because of their common need for characterization and quantification of the geophysical processes that govern both the impact of the operating environment on military operations and systems, and the impact of activities on the quality of the natural environment. USACRREL research supports restoration and conservation goals focusing on special constraints imposed by winter conditions and cold climates.

USACRREL's current Civil Works programs are concentrated in three major research and development areas: **Remote Sensing (RS), Geographic Information Systems (GIS), and Cold Regions Engineering.**

The **RS** and **GIS** research programs support the development of oil spill and flood mapping. Support is also provided by conducting large area environmental assessments critical to emergency response efforts.

The **Cold Regions Engineering** research program addresses inland navigation, flood damage reduction, and water resource problems in cold regions. This program provides knowledge and mitigating solutions in the areas of ice on inland navigation, operation and maintenance of structures, river ice jams and related floods, ice hydraulics, ice damage to shorelines and shore structures, and hydrology and water resources of cold regions.

EQUIPMENT/FACILITIES

USACRREL has a complex of low temperature laboratories and experimental research facilities not found anywhere else in the world. The main laboratory consists of 24 low temperature research laboratories with a temperature range down to -50 degrees F. The 73,000 square feet Ice Engineering Facility houses three special-purpose research areas; a large low-temperature towing tank, a 100-foot long refrigerated flume for modeling rivers, and a large hydraulic-model room for studying ice impacts on civil works facilities, primarily locks and dams. The 29,000 square feet Frost Effects Research Facility (FERF) supports full-scale research on the impact of freeze-thaw cycles on pavements, foundations, and utility systems. The nationally unique FERF facility provides the capability to simulate natural 3-D freeze-thaw cycles to support research on the impact of these cycles on pavements, foundations, and utility systems. The unique 9000 square feet Low Temperature Materiel Test Facility provides additional capability to investigate composite materials performance subject to low-temperature and thermal cycling for potential use for future Army armor vehicles. USACRREL also has access to two permafrost research sites in Alaska.

In addition, USACRREL houses the 16,400 square foot Corps of Engineers' Civil Works Remote Sensing/Geographic Information System Center, and a state-of-the-art Department of Defense Cold Regions Technical Information Analysis Center (CRSTIAC). The 24,000 square foot CRSTIAC facility is home to the most comprehensive collection of cold regions science and engineering data in the world.

Cold Regions Research & Engineering Laboratory
Hanover, NH 03755-1290
(603) 646-4100

Director: Dr. Barbara Sotirin
Chief, P&P Division: LTC William Loven

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	0.459	N/A	N/A	0.459
6.1 Other	1.863	0.038	0.336	2.237
6.2	7.801	0.159	2.053	10.013
6.3	0.000	0.000	0.000	0.000
Subtotal (S&T)	**10.123**	**0.197**	**2.389**	**12.709**
6.4	0.000	0.000	0.000	0.000
6.5	0.000	0.000	0.000	0.000
6.6	5.856	0.120	1.983	7.959
6.7	0.000	0.000	0.000	0.000
Non-DOD	0.000	0.000	0.000	0.000
TOTAL RDT&E	**15.979**	**0.317**	**4.372**	**20.668**
Procurement	0.000	N/A	0.000	0.000
Operations & Maintenance	4.150	N/A	3.384	7.534
Other	5.190	N/A	3.572	8.762
TOTAL FUNDING	**25.319**	**0.317**	**11.328**	**36.964**

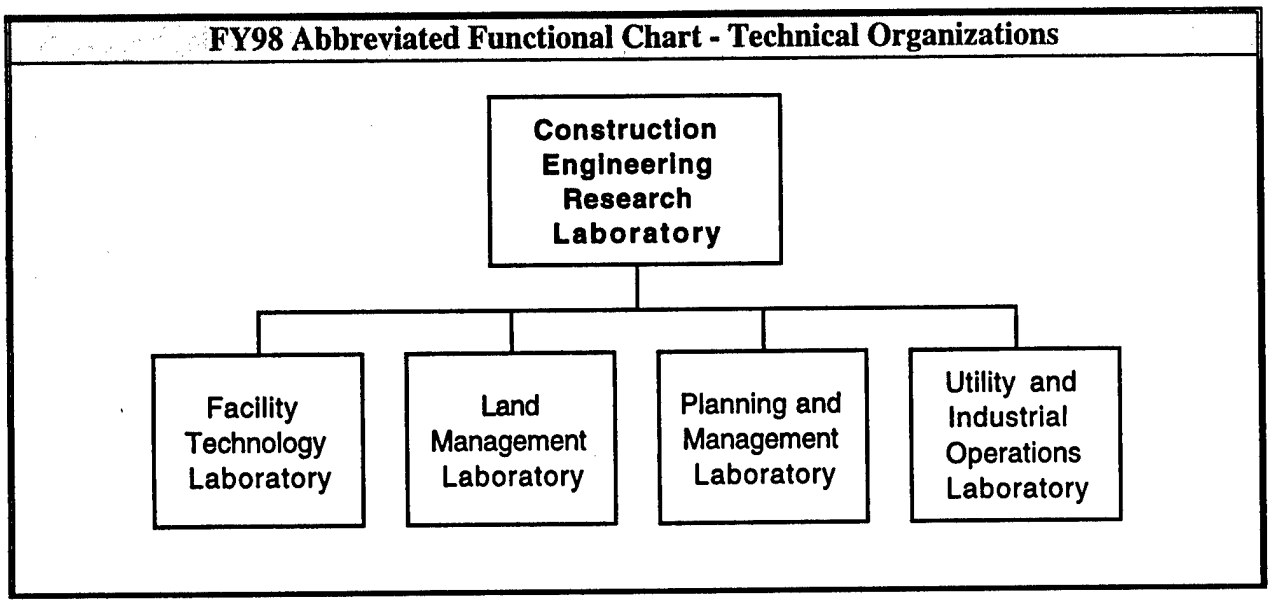
MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	**END STRENGTH**
TYPE	**DOCTORATES**	**OTHER**		
MILITARY	0	0	5	5
CIVILIAN	52	81	164	297
TOTAL	**52**	**81**	**169**	**302**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	242.200	**REAL PROPERTY**	0.000
ADMIN	48.400	* NEW CAPITAL EQUIPMENT	0.000
OTHER	20.400	**EQUIPMENT**	0.000
TOTAL	**311.000**	* NEW SCIENTIFIC & ENG. EQUIP.	0.000
ACRES	31	* Subset of previous category.	

N/A - Not Applicable

Construction Engineering Research Laboratories



Construction Engineering Research Laboratories
Champaign, IL 61826-9005
(217) 373-6714

Director: Dr. Michael J. O'Connor
Commander: COL James A. Walter

MISSION

OCE General Orders 17, 9 Sep 68, established USACERL as a Separate Field Operating Agency (SFOA) under the Chief of Engineers. By OCE General Orders 16, 20 May 74, USACERL was placed under the staff supervision of the USACE Research and Development Directorate. ER 10-1-26 assigns USACERL the mission of performing infrastructure and environmental sustainment research, development, studies and technical assistance to maintain a quality trained and ready Army; to set the standard in preserving and protecting its land, water and natural and cultural resources; and to repair, maintain and rehabilitate Civil Works facilities. It performs research and development for enhancing engineer capability to deploy rapidly and to sustain a full range of military operations. It executes the mission through various functional elements.

CURRENT IMPORTANT PROGRAMS

Munitions Production Compliance Technologies.

Sustainable Military Land Use and Stewardship of Army Lands (Military Land Management - LMS).

Defense Environmental Security Corporate Information Management (DESCIM).

Facility Seismic Risk Mitigation.

Facility Delivery Process Improvement.

Smart Structural Systems.

Integrated Installation Management.

Utilities Modernization and Optimization for Military Installations.

Training Land Carrying Capacity.

Protocols for Military Training to Reduce Impact on Threatened and Endangered Species.

EQUIPMENT/FACILITIES

Triaxial Earthquake and Shock Simulator (TESS): The United States' first large triaxial shaking table is a unique dual-mode shock and vibration test facility. The TESS, in its biaxial mode, simulates a wide range of transient shock vibrations typical of military applications requiring large accelerations over a wide frequency range with moderately heavy test specimens. In the triaxial mode, it can simulate a variety of vibration environments including earthquakes and random vibrations, as well as log-sweep and resonant searches. The TESS is one of the premier seismic experimental test facilities in this country, supporting experimental research that cannot be performed by any other U.S. organization.

EQUIPMENT/FACILITIES (continued)

Ion Plating Systems: Custom-designed to meet highly specialized research specifications to do small scale prototype thin film coating experiments; only facility of this kind (plasma-assisted physical vapor disposition) in the Army.

Heating, Ventilation and Air Conditioning Test Facility: A large 'mini-facility' with four rooms (zones) that can be thermally controlled separately to replicate a variety of HVAC systems and conditions, including dual or single duct and variable or constant air volume conditions; includes ventilation system, hot water supply loops, chilled water supply loops, HVAC systems configuration, facility controls, and data acquisition system; used to validate the energy thermodynamics analysis program and to analyze performance of proposed standard digital control panels; unique within DoD.

Acoustics Lab: The Impulse Noise Technology Center is a state-of-the-art lab facility for the quantification and reduction of impulse noise from cannon, helicopters, blast and small caliber weapons firing. Contains a variety of sophisticated noise monitoring, recording, and analysis instrumentation for research on impact assessment and mitigation of impulse noise related to human annoyance and animal disturbance. Also includes a one-of-a-kind noise impedance tube for the test of noise energy absorption along surfaces.

Paint Laboratory: Specialized equipment necessary to perform Qualified Product List testing on paints used by the Army (an 'honest broker' function); capability to manufacture lab size batches of experimental coatings and perform both real-time and accelerated performance testing of coatings; capability to perform forensic analysis of paint samples.

Equipment and facilities co-located at the University of Illinois:

Urbana-Champaign: In 1966, the U.S. Army Corps of Engineers proposed a new laboratory for engineering research to support military construction. In national competition in 1967, the University of Illinois at Urbana-Champaign was selected for co-locating USACERL. This unique relationship between USACERL and the University of Illinois, annually cited as one of the top three engineering schools in the nation, has been noted by HQ USACE as a prime example of 'reinventing Government.' Of approximately 420 personnel working at USACERL, over 70 are University of Illinois faculty, staff or students. Designated as an allied agency of the University of Illinois, $250-500 million of University of Illinois research laboratory equipment is accessible.

Controlled Archeological Test Site (CATS): The CATS facility has been constructed with funding provided by the National Center for Preservation Technology and Training and will be utilized for research and training with geophysical applications in archaeology. The CATS facility replicates a range of archeological features commonly encountered in North American archaeological sites and offers a controlled environment for the application of non-destructive investigative techniques. The CATS facility will be available for research in a broad range of problems associated with archaeogeophysics such as, the effects of environmental conditions on geophysical expression, sensor type and configuration, spatial resolution, image processing and pattern recognition, operator variation, and feature variability. This research will contribute to our ability to interpret geophysical data and refine field methods for application in archeological investigations.

Construction Engineering Research Laboratories
Champaign, IL 61826-9005
(217) 373-6714

Director: Dr. Michael J. O'Connor
Commander: COL James A. Walter

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	0.032	N/A	N/A	0.032
6.1 Other	1.529	0.276	1.325	3.130
6.2	11.707	1.673	20.113	33.493
6.3	0.000	0.000	0.000	0.000
Subtotal (S&T)	**13.268**	**1.949**	**21.438**	**36.655**
6.4	0.000	0.000	0.000	0.000
6.5	0.000	0.000	0.000	0.000
6.6	4.101	0.033	1.730	5.864
6.7	0.000	0.000	0.000	0.000
Non-DOD	2.849	0.503	0.525	3.877
TOTAL RDT&E	**20.218**	**2.485**	**23.693**	**46.396**
Procurement	0.000	N/A	0.000	0.000
Operations & Maintenance	10.472	N/A	5.772	16.244
Other	0.000	N/A	0.000	0.000
TOTAL FUNDING	**30.690**	**2.485**	**29.465**	**62.640**

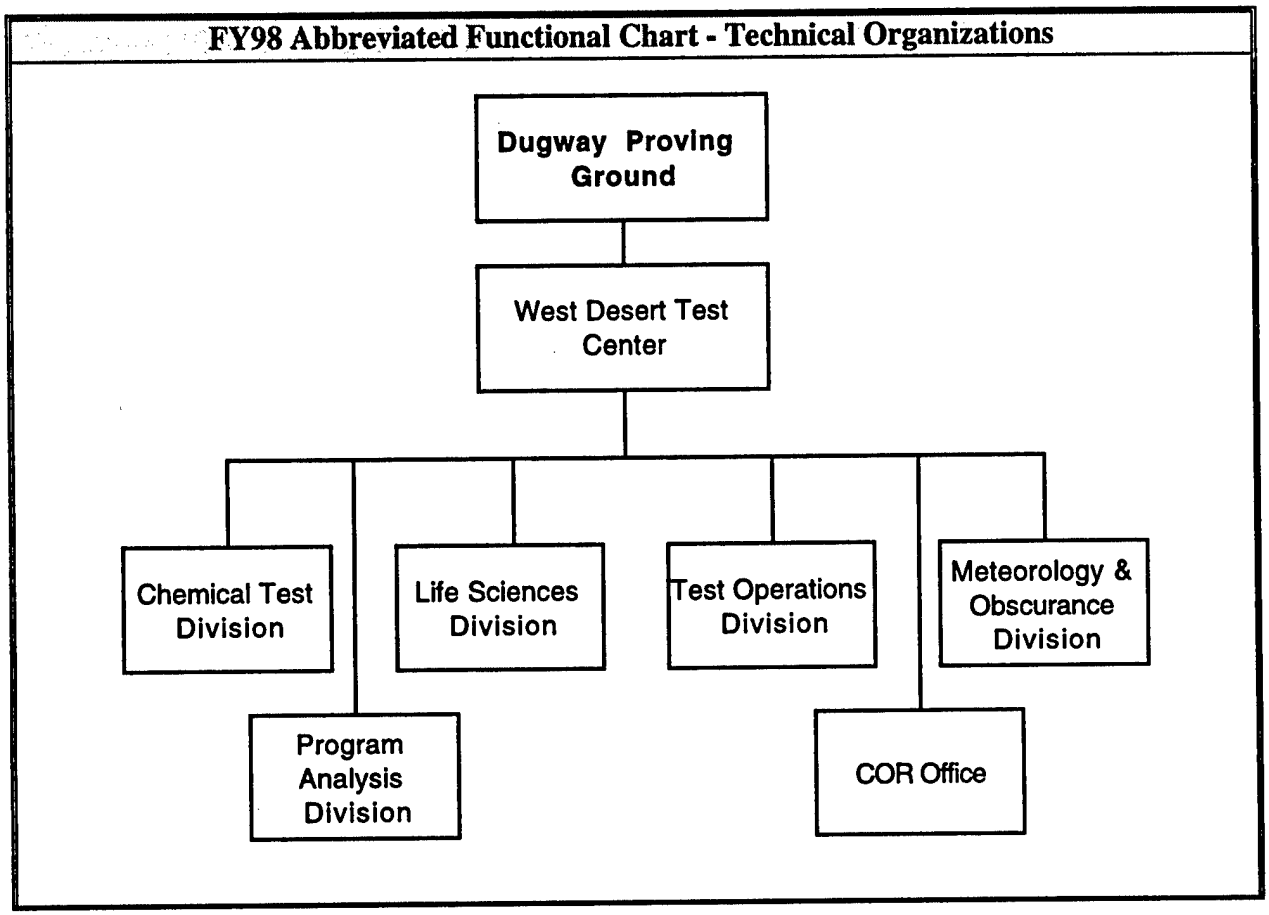
MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	**END STRENGTH**
TYPE	**DOCTORATES**	**OTHER**		
MILITARY	0	1	0	1
CIVILIAN	34	120	151	305
TOTAL	**34**	**121**	**151**	**306**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	108.400	**REAL PROPERTY**	0.000
ADMIN	49.800	* NEW CAPITAL EQUIPMENT	0.000
OTHER	38.900	**EQUIPMENT**	14.600
TOTAL	**197.100**	* NEW SCIENTIFIC & ENG. EQUIP.	0.000
ACRES	**30**	* Subset of previous category.	

N/A - Not Applicable

Dugway Proving Ground



Dugway Proving Ground
Dugway, UT 84022
(435) 831-3701

Commander: COL John A. Como
Chief Scientist: Dr. John Middlebrook

MISSION

To test U.S. and Allied chemical and biological defense systems. Perform NBC survivability testing of defense material. Test environmental characterization and remediation technology. Act as the DoD joint chem/bio defense contact point in support of warfighting CINCs. Provide support to chemical and biological weapons conventions. Safeguard the environment. Operate and maintain an installation to support the test mission.

CURRENT IMPORTANT PROGRAMS

Research, development and laboratory investigations. Joint-operations chemical and biological defense tests and studies for CINCS and Services. Munitions development/acceptance and production testing. Environmental studies to support DPG and Army programs.

FY98 Important Programs include:

- Advanced Integrated Collective Protection System (AICPS).
- Aircraft Cargo Contamination Control Field Test.
- Assembled Chemical Weapons Alternative (ACWS) Demilitarization Technology Testing.
- Assembled Chemical Weapons Assessment (ACWA) Program Support.
- Biological Integrated Detection system (BIDS).
- Cargo Aircraft Contamination Control (CACC) Test.
- Chamber Scale Panel Test.
- Chamber Scale Panel Test of the BX24 Decontamination System.
- Chemical Agent Resistant Coating (CARC) Specification Testing.
- Chemical Biological Mass Spectrometer (CBMS).
- Chemical Treaty Verification.
- Critical Reagents Program (CRP).
- Critical Area Decontamination.
- Defense Special Weapons Agency (DSWA), High Temperature Incendiary Device (HTI) Test.
- Demolition Charaterization Test of the 122MM Chemical-Fill Rocket.
- BioDetector (BD).
- Bio/Chem Decontaminability Testing of the Single Channel, Anti-Jam Manportable (SCAMP) Transit Case.
- Emission Characterization (BANGBOX).
- Four Dimensional Weather (4DWX) VV&A Field Study.
- Four Dimensional Weather system (4DWX) Demonstration at Virtual Proving Ground (VPG) Early User Utility (EUU).
- Improved Chemical Agent Monitor (ICAM).
- Joint Biological Remote Early Warning System (JBREWS) Advanced Concept Technology Demonstration (ACTD).
- Joint Chemical Agent Detector (JCAD) Test Methodology.
- Joint Field Trials (JFT) 4 Standoff Field Trial.
- Joint Field Trials 5 (JFT 5).
- Joint Services Lightweight Integrated Suit Technology (JSLIST) Pre Planned Product Improvement (P3I) Screening Test.
- Joint Service Lightweight Standoff Chemical Agent Detector (JSLSCAD) Test Methodology.
- Land Mine Cryofracture Demilitarization Test.

CURRENT IMPORTANT PROGRAMS (continued)

- Lightweight Standoff Chemical Agent Detector (LSCAD) M721 60MM Illuminating Cartridge, Lot Acceptance Test.
- M825A1 WP Smoke Projectiles.
- Mobile Munitions Device (MMD-1).
- Munitions Management Device (MMD-1).
- Navy Countermeasures (Lot Acceptance Test).
- P3I BIDS Component Test.
- P3I Biological Integrated Detector System (BIDS) Limited User Test (LUT).
- P3I Swatch Testing (Aerosol Vapor Liquid Assessment Group (AVLAG)).
- Patriot Missile Storage Test.
- Portal Shield Advanced Concept Technology Demonstration (ACTD).
- Reaerosolization Demonstration.
- Restoration of Operations (RESTOPS).
- Reverse Osmosis Water Purification Unit (ROWPU).
- Surface Sampler Methodology.
- Tactical Aircraft Interior Decontamination Study.
- Trilateral Field Trials of Advanced Mitigation Techniques.
- XI97E1 66 MM Cinamic Acid Training Grenade Production Qualification Test.
- XM767 60MM Infrared Illumination Cartridge Candle Confirmation Test.
- VX Study.

DPG supports a variety of combat training activities, e.g.,

ARMY = 941 Soldiers

1-1st Special Forces Group
1/3rd Special Forces Group
19th Special Forces
1/75th Ranger Battalion
116th EN
135th FA Battalion
142nd MI Bde
1st Battalion, 145th Field Artillery, Utah Army National Guard
1st Battalion, 211th Aviation Regiment, Utah Army National Guard
2/1st Special Forces
2/222nd FA Battalion
2/360th Inf Reg (UT USAR)
2-5th Special Forces Group (Ft. Campbell)
300th MI Bde
45th FA Battalion
5th Special Forces Group
Company A, 2nd Battalion, 5th Special Forces Group (ABN)
Co C, 5th SFG
D Co, 1/189th Avn
Golden Cargo
GLOBAL PATRIOT 98
HQ, 140th RTI
I Corps FAH
Stark Ut State Lands

CURRENT IMPORTANT PROGRAMS (continued)

AIR FORCE = 738 Airmen

174th FW
118th APS
123rd APS
118th AW
122nd ACOS
123rd AW
152nd ACG
205th CBCS
214th EIS
216th EIS
245th ATCS
272nd CBCS
731st Airlift Squadron (CO Air Guard)
Utah Air Guard HQ's
Air Force Research Lab
200rd Redhorse

MARINE CORPS = 25 Marines

CBIRF (Active Marines)

EQUIPMENT/FACILITIES

Instrumented grids for chemical, biological and smoke/obscurant systems. Artillery range for conventional and chemical metal parts. Ballistics and dissemination tests with field sample, sample mass analysis, meteorological (auto data acquisition and MESOMET network) system. Physical and environmental test facility (MIL SPEC 810) chambers for total agent containment. Operations supported by meteorological research on behavior of clouds. Chemical, life science technology, ecological survival of DPS. Capability for planning analysis, evaluation of tests and operations research. Labs equipped for wide range of chemical, microbiological, toxicological, immunological and pollution studies. Technical and mass array of fluorescent air tracers. External-communication and range safety system. Outstanding features are: large land area, restricted air space, long and flat artillery ranges, projectile recovery, sonic and electromagnetic sterility and diverse technical and scientific skills.

Dugway Proving Ground
Dugway, UT 84022
(435) 831-3701

Commander: COL John A. Como
Chief Scientist: Dr. John Middlebrook

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	0.000	N/A	N/A	0.000
6.1 Other	0.000	0.000	0.000	0.000
6.2	0.000	0.000	0.000	0.000
6.3	0.000	0.000	0.000	0.000
Subtotal (S&T)	**0.000**	**0.000**	**0.000**	**0.000**
6.4	0.000	0.000	0.000	0.000
6.5	0.000	0.000	0.000	0.000
6.6	20.328	0.000	19.497	39.825
6.7	0.000	0.000	0.000	0.000
Non-DOD	0.000	0.000	0.000	0.000
TOTAL RDT&E	**20.328**	**0.000**	**19.497**	**39.825**
Procurement	0.000	N/A	0.230	0.230
Operations & Maintenance	0.319	N/A	3.260	3.579
Other	0.405	N/A	2.401	2.806
TOTAL FUNDING	**21.052**	**0.000**	**25.388**	**46.440**

MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	
TYPE	**DOCTORATES**	**OTHER**		**END STRENGTH**
MILITARY	0	0	7	7
CIVILIAN	19	66	352	437
TOTAL	**19**	**66**	**359**	**444**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	154.417	**REAL PROPERTY**	179.385
ADMIN	171.387	* NEW CAPITAL EQUIPMENT	0.000
OTHER	1,935.475	**EQUIPMENT**	99.000
TOTAL	**2,261.279**	* NEW SCIENTIFIC & ENG. EQUIP.	4.000
ACRES	**799**	* Subset of previous category.	

N/A - Not Applicable

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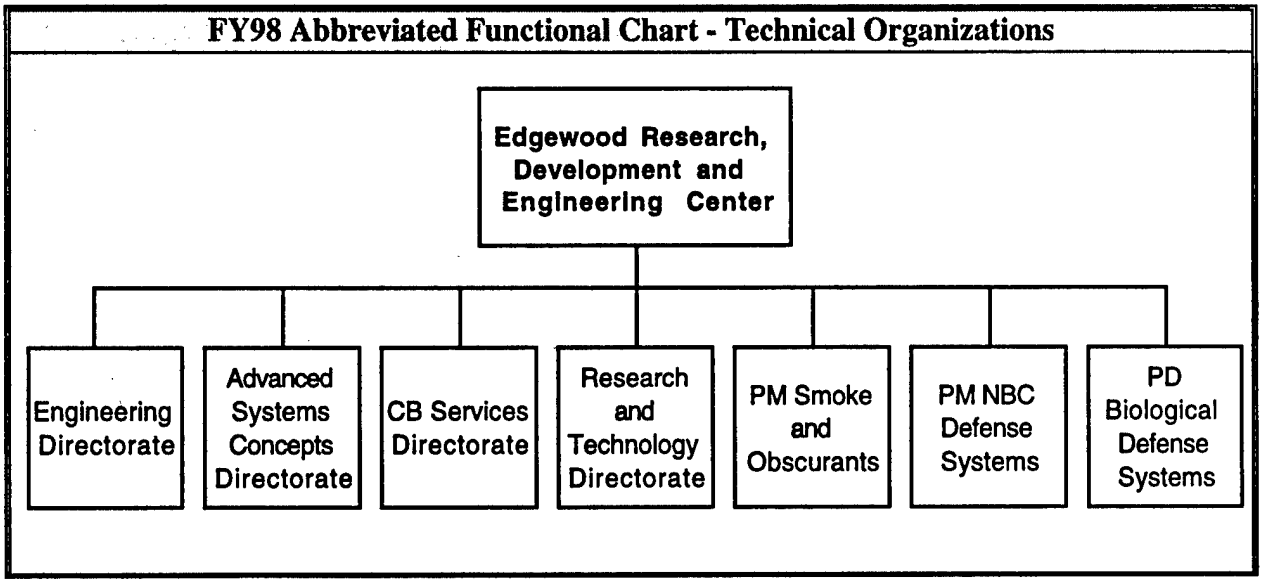
Edgewood Research, Development and Engineering Center



Edgewood Research, Development and Engineering Center
Aberdeen Proving Ground, MD 21010-5423
(410) 436-2621

Technical Director: Mr. Jim Zarzycki

MISSION

A research, development and engineering center for executing the chemical and biological defense programs for the Army and the Joint Services (JS). Provide research, development and acquisition as well as life cycle engineering support for chemical/biological defense and smoke/obscurant equipment under DODD 5160.5. Act as DoD lead lab for the JS chemical/biological/smoke technology base. The Edgewood RDEC technical director is also the manager of the Edgewood NBC RDA Enterprise which includes PM NBC Defense Systems, PM Smoke/Obscurants, Program Director of Biological Defense Systems, and the Edgewood RDEC. Responsible for the Domestic Preparedness Program, preparing the United States for the possibility of a terrorist attack involving nuclear, biological or chemical weapons.

CURRENT IMPORTANT PROGRAMS

Nuclear, Biological and Chemical (NBC) Reconnaissance, Detection and Identification.

Individual and Collective Protection.

NBC Decontamination.

Smoke and Obscurants and Target Defeating Materials.

Chemical Treaty Verification.

Chemical and Biological Remediation.

CB counterterrorism.

Domestic Preparedness.

EQUIPMENT/FACILITIES

Major equipment is contained in a complex of R&D engineering/laboratory areas and includes:

- Process engineering facility.
- Production and facility design chamber for studies of respiratory protection design drivers.
- Simulant agent challenge test chamber.
- Rubber/elastomer mold facility.
- Specialized chemical agent labs.
- Pyrotechnic mixing, loading, handling facility.
- Subsonic, supersonic, transonic wind tunnel.
- Complete analytical chemistry (trace analysis/tandem mass spectrometry).
- Obscurant test chambers for transmission measurements.
- Laser spectroscopy lab.
- Robotic toxic agent lab.
- CAD/CAE/CAM network.
- Super toxic facility.
- Design Evaluation Chemical Surety Lab.

EQUIPMENT/FACILITIES (continued)

- Decontamination/Detoxification Facility.
- Explosive test chamber.
- Toxic Dissemination Test Chamber.
- Inhalation Toxicology Laboratories.
- Molecular Modeling Facility.
- Microland Laboratory with electron microscopy and surface spectropy.
- Experimental Fabrication Facility.
- Nephelometry laboratory/Single Particle Laboratory.
- Smoke Breeze Tunnel.
- Controlled Environment.
- Soil-Core Microism Unit Chambers.
- Decontamination Test Facility.
- World Certified Treaty Laboratory.

Edgewood Research, Development and Engineering Center
Aberdeen Proving Ground, MD 21010-5423
(410) 436-2621

Technical Director: Mr. Jim Zarzycki

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	1.441	N/A	N/A	1.441
6.1 Other	1.297	0.024	1.214	2.535
6.2	20.960	0.383	19.134	40.477
6.3	2.531	0.147	7.346	10.024
Subtotal (S&T)	**26.229**	**0.554**	**27.694**	**54.477**
6.4	10.074	0.379	18.970	29.423
6.5	9.028	0.717	39.583	49.328
6.6	4.668	0.074	3.698	8.440
6.7	0.716	0.002	0.099	0.817
Non-DOD	1.266	0.004	0.199	1.469
TOTAL RDT&E	**51.981**	**1.730**	**90.243**	**143.954**
Procurement	24.319	N/A	124.536	148.855
Operations & Maintenance	37.757	N/A	39.742	77.499
Other	21.638	N/A	2.414	24.052
TOTAL FUNDING	**135.695**	**1.730**	**256.935**	**394.360**

MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

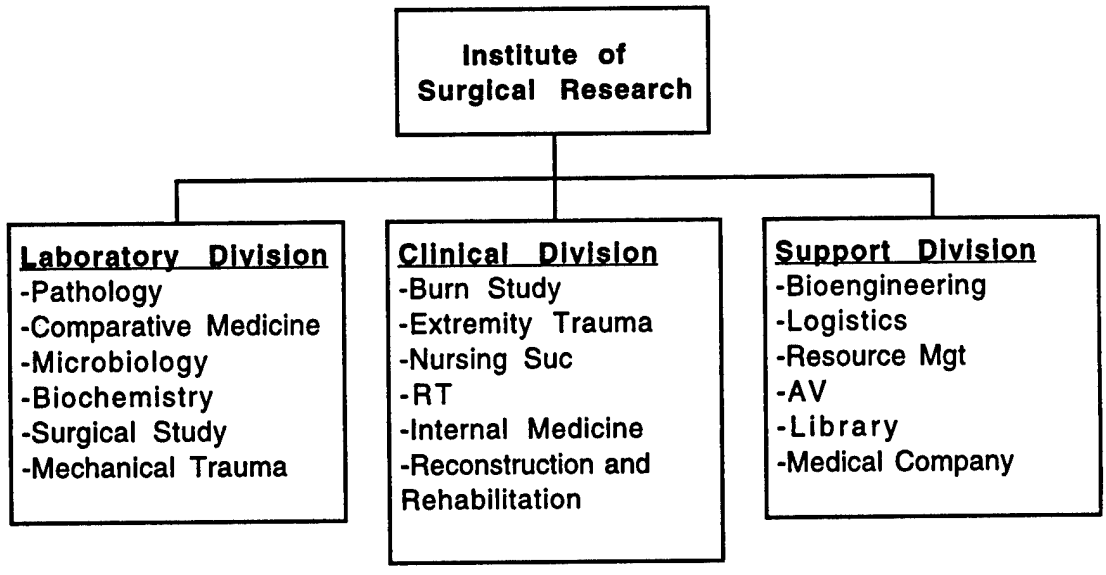
PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	
TYPE	**DOCTORATES**	**OTHER**		**END STRENGTH**
MILITARY	2	13	27	42
CIVILIAN	22	338	473	833
TOTAL	**24**	**351**	**500**	**875**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	856.000	**REAL PROPERTY**	94.000
ADMIN	338.000	* NEW CAPITAL EQUIPMENT	0.000
OTHER	459.000	**EQUIPMENT**	115.113
TOTAL	**1,653.000**	* NEW SCIENTIFIC & ENG. EQUIP.	14.584
ACRES	**0**	* Subset of previous category.	

N/A - Not Applicable

Institute of Surgical Research

FY98 Abbreviated Functional Chart - Technical Organizations



Institute of Surgical Research
Fort Sam Houston, TX 78234-6315
(210) 916-2720

Commander & Director: COL Cleon Goodwin
Deputy Commander: COL David Zolock

MISSION

Provide Combat Casualty Care medical solutions and products for injured soldiers by integrating laboratory and clinical research.

CURRENT IMPORTANT PROGRAMS

USAISR's research is focused on Combat Casualty Care and providing the injured soldier a winning edge on the battlefield. The primary research thrust areas are: minimizing blood loss and optimizing fluid resuscitation; treatments to prevent secondary damage after hemorrhage or major injuries; and other battle and non-battle injuries.

Current major research projects are:

- Develop a hemostatic dressing to stop/reduce uncontrolled compressible hemorrhage (extremity) from becoming life threatening. Uncontrolled hemorrhage is the greatest cause of death in injured soldiers.
- Develop a hemostatic foam to stop/reduce uncontrolled non-compressible hemorrhage (abdominal) from becoming life threatening.
- Develop improved resuscitative strategies prior to definitive treatment for injured soldiers before and during evacuation to minimize bleeding and optimize tissue perfusion. Hemorrhagic shock remains the major cause of death on the battlefield.
- Develop an external fixator pin that stabilizes open fractures and resists infection and promotes healing. Extremity trauma is the most common (70%) trauma on the battlefield and pin tract infections affects definitive treatment and frequently leads to prolonged morbidity and amputation.
- Identify technologies to determine severity of inhalation injuries as early as possible and develop appropriate treatments.
- Identify technologies to monitor regional organ blood flow and function in the treatment of shock to ensure resuscitation strategies restore adequate blood flow to critical organs.
- Determine the protective capability of new antimine footwear by evaluating the forces and injury patterns and developing a mathematical medical model for analysis of redesigns of the footwear.

EQUIPMENT/FACILITIES

The USAISR's equipment inventory of basic and clinical research equipment valued at over $15,075,000. The Institute consists of a 40 bed inpatient research unit of 50,300 square feet on the 4th floor of Brooke Army Medical center and the laboratory located in an adjacent 84,000 square foot research facility dedicated in FY96. Capabilities include: integrated clinical and laboratory research facilities and injured soldier test platforms; mass casualty burn care; aeromedical transport teams for multiple trauma victims with burn injuries; instruction in resuscitation and long term burn care; a computerized database of over 40 years of data on injury specific research subjects; a nutrition and metabolic study program; comprehensive orthopedic surgery and extremity research staff and research program; ballistics research; state-of-the-art animal operating suites; an image analysis facility; biocontainment suite for studying the effects of hazardous materials; materials testing apparatus and tissue engineering capabilities; and the only research clinical evaluation/management facility for injured soldiers in the U.S. military.

Institute of Surgical Research
Fort Sam Houston, TX 78234-6315
(210) 916-2720

Commander & Director: COL Cleon Goodwin
Deputy Commander: COL David Zolock

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	0.086	N/A	N/A	0.086
6.1 Other	0.503	0.000	0.000	0.503
6.2	5.258	0.000	0.000	5.258
6.3	0.958	0.000	0.000	0.958
Subtotal (S&T)	**6.805**	**0.000**	**0.000**	**6.805**
6.4	0.011	0.000	0.000	0.011
6.5	0.000	0.000	0.000	0.000
6.6	0.000	0.000	0.000	0.000
6.7	0.000	0.000	0.000	0.000
Non-DOD	0.000	0.000	0.000	0.000
TOTAL RDT&E	**6.816**	**0.000**	**0.000**	**6.816**
Procurement	0.000	N/A	0.000	0.000
Operations & Maintenance	0.001	N/A	0.000	0.001
Other	0.196	N/A	0.000	0.196
TOTAL FUNDING	**7.013**	**0.000**	**0.000**	**7.013**

MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	
TYPE	**DOCTORATES**	**OTHER**		**END STRENGTH**
MILITARY	18	42	116	176
CIVILIAN	4	18	29	51
TOTAL	**22**	**60**	**145**	**227**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	73.850	**REAL PROPERTY**	17.191
ADMIN	11.000	* NEW CAPITAL EQUIPMENT	0.000
OTHER	50.300	**EQUIPMENT**	15.075
TOTAL	**135.150**	* NEW SCIENTIFIC & ENG. EQUIP.	0.571
ACRES	**1**	* Subset of previous category.	

N/A - Not Applicable

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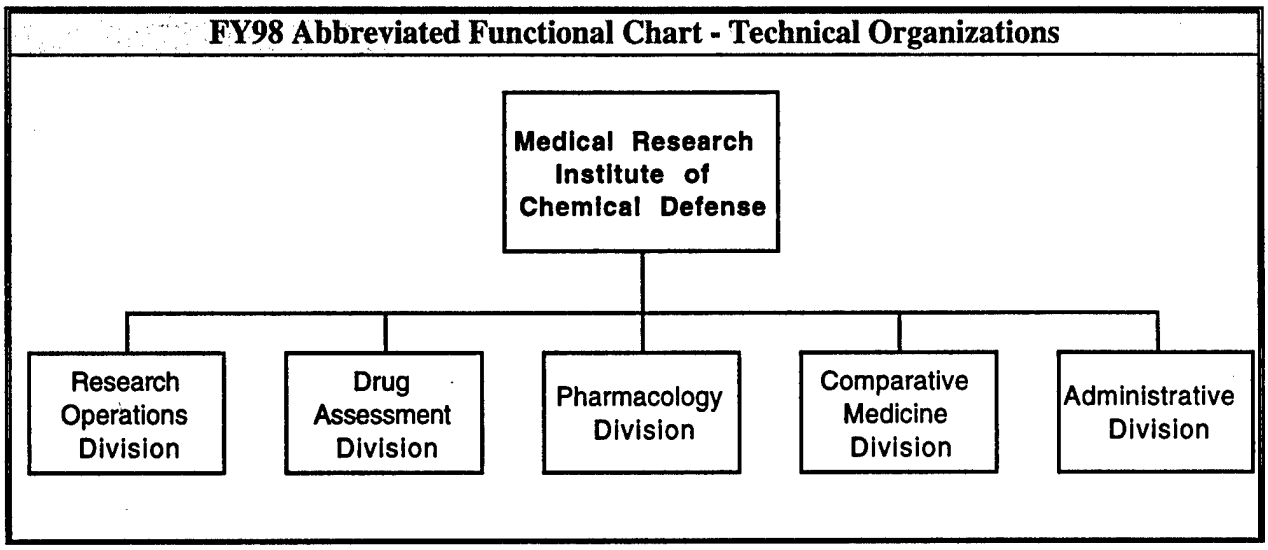
Medical Research Institute of Chemical Defense



Medical Research Institute of Chemical Defense
Aberdeen Proving Ground, MD 21010-5400
(410) 436-3276

Commander: COL James S. Little
Deputy Commander: COL James A. Romano Jr.

MISSION

The U.S. Army Medical Research Institute of Chemical Defense is the Department of Defense's lead laboratory for development of medical countermeasures against chemical warfare (CW) agents and for training personnel in the medical management of chemical casualties. In order to establish a scientific and technical base from which to plan and formulate enhanced medical countermeasures to CW threats and develop improved prevention and treatment modalities for CW casualties, this missions includes: fundamental and applied research on mechanisms of action of CW threat agents, candidate pretreatment, treatment, and personal or skin decontamination compounds; test and evaluation of drugs, decontaminants, and medical equipment for the prevention, resuscitation, treatment, and management of chemical casualties. The Institute provides assistance in the integration of concepts and products from research development, test and evaluation mission activities into logistical, doctrine and organizational development and training systems as well as training of medical and non-medical personnel in the prevention and management of chemical casualties. The Institute also conducts research on medical defense against agents (neurotoxins) of biological origin.

CURRENT IMPORTANT PROGRAMS

The goal of research programs at the Institute is to ensure preservation of combat effectiveness by timely provision of medical countermeasures to chemical warfare (CW) agents. These programs enable DA and DOD to maintain the technologic capability necessary to meet present requirements and counter future CW and neurotoxin threats, provide individual-level prevention and protection against these threats, and enhance the medical management of CW and neurotoxin casualties, thereby maximizing survival and expediting return to duty.

The Institute conducts basic research, exploratory development, non-system development, and on a reimbursable basis, advanced development of medical countermeasures for CW and neurotoxin agents. Biomedical effects of CW agents, neurotoxins, and candidate medical countermeasures to these threats are studied as, are safety and efficacy of candidate pretreatment and prophylactic countermeasures. The Institute develops analytical technologies for medical countermeasures, and performs advanced research into CW and neurotoxin casualty care technology. The Institute research program is organized by scientific technical objectives (STOs). In STO M, the Chemical Casualty Management effort identifies and utilizes new technologies to improve decontamination, clinical diagnosis, prognosis and management of chemical agent casualties. Physiological buffers and anti-inflammatory compounds have demonstrated significant efficacy in enhancing survival following phosgene poisoning. Post-exposure ventilation therapy to control pulmonary edema in the porcine model currently is under evaluation. A protein/anti-inflammatory mixture has significant efficacy when used as both a pre- and post-treatment in reducing corneal opacity following HD exposure in a rodent model. FDA approved antibiotic/steroidal and antibiotic/nonsteriodal anti-inflammatory compounds show benefit when used for post exposure treatment of HD exposure in the rabbit model. Polyurethane sponges impregnated with cholinesterases and oximes are able to detoxify organophosphorous threat agents and can be used to decontaminate wounds containing chemical agents.

We have developed mutant human butyrylcholinesterase and human carboxylestease capable of hydrolyzing all or some of the current threat nerve agents. These advances, along with the identification of a human paraoxonase and new data on stoichiometric scavengers such as native human butyrylcholinesterase have put us on target to meet the STO D FY99 milestone for a transition package.

CURRENT IMPORTANT PROGRAMS (continued)

The reactive topical skin protectant/ decontaminant research plan (STO E) is on target to demonstrate safety and efficacy sufficient for a milestone 0 transition of a reactive component for a TSP that will provide protection against agent penetration and will detoxify both vesicant and nerve threat agents. The vesicant research program (STO A) has met all milestones to date, and is now moving to determine the efficacy of multiple-compound therapy and extended time post-exposure treatments. This program is completely on track to accomplish STO timelines and the DTO metric to demonstrate a 50% reduction of HD-induced edema or histopathology. In STO C, advanced anticonvulsant drugs to treat nerve agent seizures were transitioned to milestone 0 in FY97. The effectiveness of two of the advanced anticonvulsant candidates against six threat nerve agents indicates that these anticonvulsants have a broad range of therapeutic applicability. Clinically used benzodiazepine drugs that act more rapidly than diazepam and are more potent in stopping nerve agent seizures have been identified. A nonhuman primate test model using telemetry monitored electroencephalography to evaluate candidate advanced anticonvulsants against the current standard and to determine the necessary blood levels of drug needed to achieve a therapeutic effect against nerve agent seizures has been developed. In addition a neuroprotectant compound that reduces seizure-induced brain lesion volume by 85% when administered as late as 40 minutes after onset of seizures has been identified.

In FY 98 two new STOs were established. Research conducted under STO P will evaluate standardized tests for assessing effectiveness of medical countermeasure against novel threat agents, establish criteria for effective medical countermeasures and identify new research needed to fill data gaps for this class of threat agents. A new objective, STO N examining on Effects of Chronic, Low Dose CW Agent Exposure, was also established. The goals of STO N are to develop model systems for studies of chronic, low-dose CW agent exposure and to develop coherent methodologies to permit integration of research with other DOD or VA programs related to STO N.

During FY98 25 courses on the Medical Management of Chemical Casualties, 8 Field Management Courses (FCBS) and 5 Train-the-Trainer courses were conducted. The total number of students trained in FY98 was 2,482.

The Institute maintained one full Cooperative Research and Development Agreement (CRDA) and 34 Material Transfer Agreements (MTA) during FY98.

EQUIPMENT/FACILITIES

The Institute's facilities support chemical casualty care training, physiology, drug assessment, pathophysiology, pharmacology, analytical chemistry, neurotoxicology, veterinary surgery, chemical safety/surety, medical maintenance, information and resource management, supply and quality assurance. A technical library with 6,000 books, 1,000 journal titles, and access to many databases is an integral part of our Institute. Video facility, computer facility and 7,000 SF animal facility also supports our researchers. Radioisotope chemical antidote and biochemical analysis, histochemistry, behavioral testing, drug screening, pharmacokinetics, molecular modeling, liquid, gas, column and affinity chromatography, quantitative image enhancement/analysis, electrophoresis, spectroscopy, fluorometry and spectropolarimetry, GC mass spectrometry, electron spin resonance and peptide synthesis/sequencing, amino acid analysis, monoclonal haptenantibodies; electron, scanning and X-ray microscopy, cell cloning, and receptor analysis are also supported.

Major Facilities and Equipment:

Building E-3100: Main Medical Chemical Defense Research Laboratory and Administrative Building.

Building E-3081: Unique to DOD. Contains a Chemical Surety Materiel Laboratory for Medical Chemical Defense Research.

EQUIPMENT/FACILITIES (continued)

Building E-3156: Large Animal Holding/Chemical Research Facility.

Building E-3244: Biotoxin Research Facility.

Building E-3103/E-3106: Chemical Casualty Care Training Facility.

Building E-3103/Classroom: Chemical portion of the Management of Chemical and Biological Casualties Course (6H-F26) is conducted here.

Building E-3101: Administrative Facility: Surety, Safety, Environment, and Contract Management.

Hazardous Materiel Storage and 90-Day Hazardous Waste Sites: These sites meet stringent specifications which conform to the environmental requirements for the storage and disposition of chemicals and hazardous materials.

Building E-3105: Information Management Support Facility.

Building E-3107: Equipment Turn-in Facility.

Building E-3104: Environmentally Controlled Building for Electronic Equipment.

Building E-2180: Equipment Storage and Turn-in Facility.

Building E-3083: Equipment storage for Medical Chemical and Biological Casualties course.

Building E-5826: Animal Care Equipment Storage Facility.

Building E-3221: Hazardous Waste Storage Facility.

Direct Digital Control HVAC System: System provides constant control and 24-hour remote monitoring of chemical fume hoods in the Surety Area of building E-3081, controls HVAC throughout remainder of laboratories and administrative areas, and controls and remotely monitors all animal rooms in buildings E-3081, E-3100, E-3156, and E-3244.

Walk-in Coolers in Building E-3081, E-3100: Storage of chemicals used for research.

Chillers, Building E-3081: Installed in 1994 to meet EPA requirements. Each unit produces 350 tons of cooling using 123 refrigerant.

Chillers, Building E-3100: Installed in 1994 to meet EPA requirements. Each unit produces 350 tons of cooling using 123 refrigerant.

Medical Waste Incinerator: Required to burn animal bedding, carcasses, and medical waste generated by the Institute

Air Compressor: Required to supply laboratories with bench air for research.

Chemical/Biological/Radiological (CBR) Filter Trains: Provided for all 77 chemical/biological hoods located in buildings E-3100, E-3081, and E-3244. Each CBR filter train consists of a housing unit containing prefilter, as well as the appropriate number and size of High Efficiency Particulate (HEPA) and High-Efficiency Gas-Phase Absorber (HEGA) filters. All filter trains are in support of the Chemical/Biological Defense Program and are in compliance with Environmental Protection Agency, State, and Federal Standards.

EQUIPMENT/FACILITIES (continued)

Exterior Walk-in (adjacent Bldg E-3100): Storage of animal carcasses prior to incineration.

Auxiliary Chillers (E-3100): Provides renovated laboratories with additional cooling to support electronic equipment.

Decontamination Showers Required to conduct research in accordance with regulations.

Building E-3156/Associated Animal Pens and rooms: Quarantine area for newly arrived large animal species. Required for the care of animals used in research.

House Water Distillation System (Bldgs E-3100, E3081, E-3244): This central system feeds water to satellite polishing systems in the individual laboratories. Pure laboratory water is needed in virtually all segments of laboratory research. High-purity water is used for reagent buffers and sensitive instrumental analyses (such as High Pressure Liquid Chromatograph, Gas Chromatograph/Mass Spectrometer, as well as inwashing and/or preparing biological solutions such as media for tissue culture.

Hazardous Materiel and 90-Day Hazardous Waste Sites: These sites meet stringent specifications which conform to the environmental requirements for the storage and disposition of chemicals and hazardous materials.

Emergency Generator (Bldg E-3100): Provides emergency power for lighting, freezers, incubators, and other specialized equipment which must remain operational.

Administrative and Laboratory Emergency Generator (Bldg E-3081): Provides emergency power for lighting, freezers, incubators, and other equipment which must remain operational.

Surety Area Back-up Generator (Bldg E-3081): Supplies emergency power to the entire chemical surety wing to include all fume hoods, heating, ventilation and air conditioning systems, and electrical systems.

Uninterruptable Power System (UPS) (Bldg E-3081): System supplies immediate power to the fume hood exhaust blowers in the chemical surety area until the emergency generator starts and transfers power.

Surety Area Holding Tanks (Bldg E-3081): Consists of two 10,000 gallon tanks which hold all waste water generated in the surety wing. This ensures that chemical spills will not escape into the sanitary sewer.

Medical Research Institute of Chemical Defense
Aberdeen Proving Ground, MD 21010-5400
(410) 436-3276

Commander: COL James S. Little
Deputy Commander: COL James A. Romano Jr.

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	0.041	N/A	N/A	0.041
6.1 Other	4.136	0.000	3.061	7.197
6.2	11.582	0.000	0.279	11.861
6.3	3.262	0.000	3.046	6.308
Subtotal (S&T)	**19.021**	**0.000**	**6.386**	**25.407**
6.4	0.049	0.000	0.000	0.049
6.5	0.182	0.000	0.000	0.182
6.6	0.000	0.000	0.000	0.000
6.7	0.000	0.000	0.000	0.000
Non-DOD	0.000	0.000	0.000	0.000
TOTAL RDT&E	**19.252**	**0.000**	**6.386**	**25.638**
Procurement	0.000	N/A	0.000	0.000
Operations & Maintenance	1.815	N/A	0.000	1.815
Other	0.362	N/A	0.000	0.362
TOTAL FUNDING	**21.429**	**0.000**	**6.386**	**27.815**

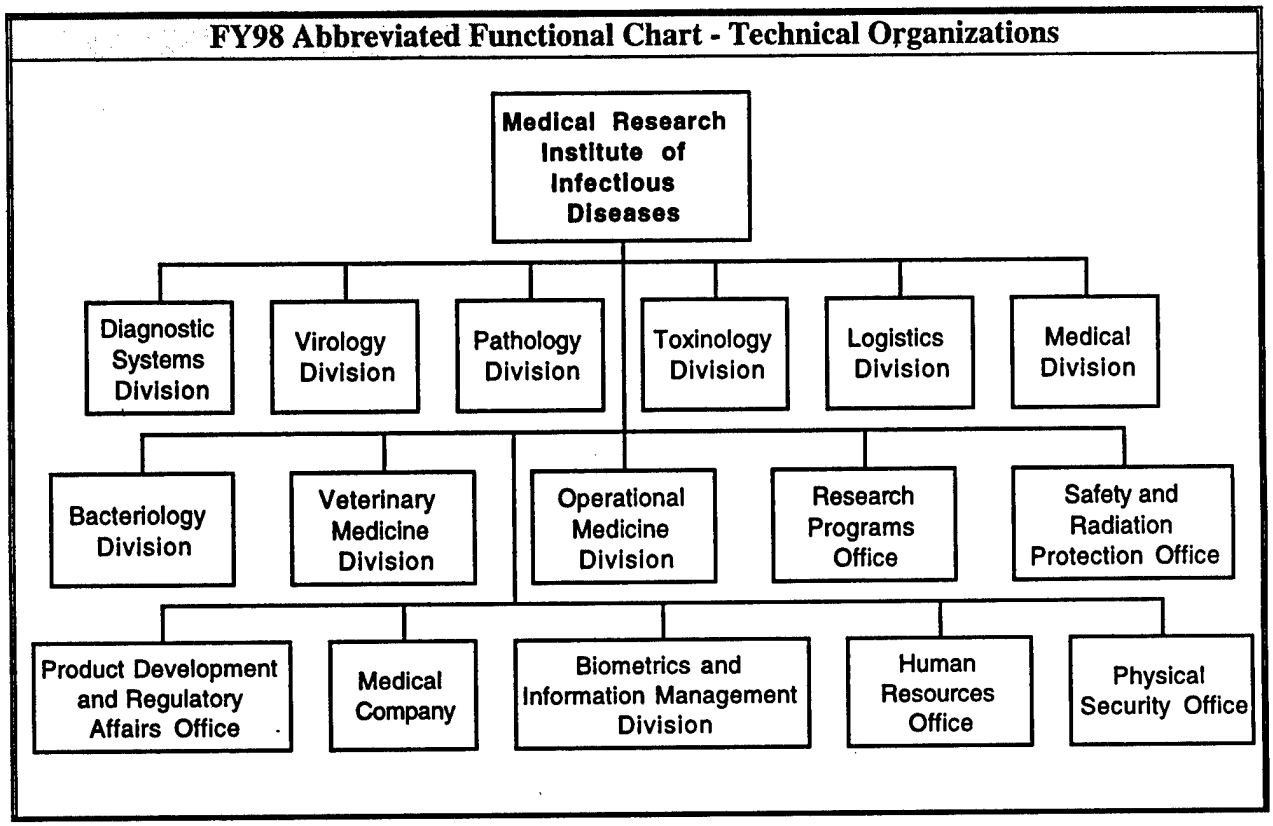
MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	
TYPE	**DOCTORATES**	**OTHER**		**END STRENGTH**
MILITARY	19	5	33	57
CIVILIAN	27	31	90	148
TOTAL	**46**	**36**	**123**	**205**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	37.419	**REAL PROPERTY**	23.400
ADMIN	38.433	* NEW CAPITAL EQUIPMENT	0.000
OTHER	125.024	**EQUIPMENT**	32.000
TOTAL	**200.876**	* NEW SCIENTIFIC & ENG. EQUIP.	2.246
ACRES	**30**	* Subset of previous category.	

N/A - Not Applicable

Medical Research Institute of Infectious Diseases



Medical Research Institute of Infectious Diseases
Fort Detrick, MD 21702-5011
(301) 619-2833

Commander: COL Gerald W. Parker
Deputy Commander: LTC Gerald B. Jennings

MISSION

USAMRIID's mission is to conduct research to develop strategies, products, information and training for medical defense against biological warfare threats and against naturally occurring infectious agents of military importance that require special containment. Medical countermeasures developed to protect military personnel against biological attack include vaccines, therapeutic drugs, diagnostic capabilities, and various medical management procedures. These products are intended to eliminate or minimize the effects of disease and preserve fighting strength. The Institute is the lead research laboratory in the Medical Biological Defense Research Program and participates in crucial aspects of the Infectious Disease Research Program. The Institute serves a key role in national defense and in infectious disease research as the only biological containment laboratory in the Department of Defense for the study of hazardous diseases. In addition, USAMRIID provides critical and timely training in medical management of biological casualties to both military and civilian health care providers. As a world-renowned resource, USAMRIID serves not only as the DoD reference laboratory for identification of biological agents and diagnosis of diseases caused by them, but as a reference center for the U.S. Centers for Disease Control and Prevention and the World Health Organization.

CURRENT IMPORTANT PROGRAMS

Development of medical countermeasures for biological warfare threats continues to be the highest mission priority. New vaccine candidates based on naked DNA or constructed using a benign virus vector have been generated using genetic engineering approaches and are in various stages of advanced preclinical testing. Pilot lots of candidate vaccines for Venezuelan equine encephalitis, botulinum toxins A and B, and staphylococcal enterotoxin B were produced using facilities and procedures that follow current Good Manufacturing Practices as specified by the Food and Drug Administration. These vaccine candidates are being evaluated for transition to advanced development. USAMRIID researchers created the first successful vaccine candidate for Marburg virus as demonstrated by the ability of the genetically engineered vaccine to protect non-human primates from this viral hemorrhagic fever. Monoclonal antibodies that protected animals against exposure to botulinum toxins and staphylococcal enterotoxins were developed successfully for the first time. Promising results in identification of antiviral drugs for treatment of orthopox viruses and filoviruses provided the basis for more advanced studies to eventually develop the most promising drugs for treating humans. Continued interactions with the pharmaceutical industry through Cooperative Research and Development Agreements allow researchers access to drugs that are in clinical development for commercial purposes so that they can be tested against the agents of military interest, to include viruses, bacteria and toxins, at USAMRIID.

Diagnostic tests developed at USAMRIID are fielded with the 520th Theater Army Medical Laboratory to provide the capability for that laboratory to diagnose and identify the classical biological warfare agents as well as important endemic infectious diseases. Immunochromatographic assays for approximately twenty biological agents are undergoing evaluation for transition to advanced development. Gene-based technologies for rapid and specific identification of biological agents were successfully demonstrated for thirteen important biological threat agents, and multiplexed devices were developed for simultaneous analysis of multiple agents. In collaboration with industry partners and other federal laboratories, equipment prototypes for automated sample handling, processing and analysis of biological agents were developed and provided to USAMRIID for assessment.

CURRENT IMPORTANT PROGRAMS (continued)

The reference laboratory capabilities for identification of biological threat agents was expanded to include additional technologies and diagnostic materials. New research efforts in the areas of multiagent vaccines and emerging threats were established. Several molecular technologies are being explored for creation of effective multiagent vaccines, and interdisciplinary groups of researchers have been formed to identify creative approaches for vaccines, therapeutics and diagnostics for genetically engineered or novel biological threat agents.

Data from the clinical study to assess the possibility of reducing the dosage schedule for anthrax vaccine were analyzed and prepared for presentation to the Food and Drug Administration. The interactive distance learning program designed to increase our capability to train military health-care providers in the Medical Management of Biological Casualties was expanded to reach civilian health care providers in partnership with the Centers for Disease Control and Prevention, and broadcast in September 1998 to hundreds of sites, reaching approximately eighteen thousand enrolled students. USAMRIID also is recognized as an important national resource for support in countering biological terrorism. The formal response team established to assist other responsible agencies in this arena participated in numerous exercises, presentations, and training sessions, providing technical expertise and laboratory capabilities to address this problem.

EQUIPMENT/FACILITIES

Three buildings provide 347,000 square feet with approximately 15% of the laboratory space capable of operations at biosafety level 3 and approximately 3% capable of operations at biosafety level 4 (maximum containment). These containment laboratories are a unique international resource for the safe study of high hazard disease agents, and are the only such laboratories within the DOD. Other unique facilities include: a 16-bed clinical research ward; high containment patient care facility (the only such facility in the U.S.) and support functions; contained dynamic aerosol laboratory exposure systems; cell culture and hybridoma laboratory; and electron microscopy equipment. The laboratory facilities also include a farm for the care and housing of large animals used in research. The laboratory animal facilities are accredited by the Association for the Assessment and Accreditation of Laboratory Animal Care, International.

The laboratories contain state of the art equipment to support studies in molecular biology, protein chemistry, gene sequencing and analysis, microbiology, virology, and biochemistry. In addition, USAMRIID has special mobile patient containment equipment designed to allow for the safe transport and medical care of a patient with a highly hazardous disease.

Medical Research Institute of Infectious Diseases
Fort Detrick, MD 21702-5011
(301) 619-2833

Commander: COL Gerald W. Parker
Deputy Commander: LTC Gerald B. Jennings

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	IN-HOUSE	IN-HOUSE MANAGEMENT	OUT-OF-HOUSE	TOTAL
RDT&E:				
6.1 ILIR	1.350	N/A	N/A	1.350
6.1 Other	9.467	0.050	0.000	9.517
6.2	8.347	0.010	0.000	8.357
6.3	9.540	0.050	0.000	9.590
Subtotal (S&T)	**28.704**	**0.110**	**0.000**	**28.814**
6.4	0.000	0.000	0.000	0.000
6.5	0.000	0.000	0.000	0.000
6.6	0.000	0.000	0.000	0.000
6.7	0.000	0.000	0.000	0.000
Non-DOD	0.000	0.000	0.000	0.000
TOTAL RDT&E	**28.704**	**0.110**	**0.000**	**28.814**
Procurement	0.000	N/A	0.000	0.000
Operations & Maintenance	1.592	N/A	0.000	1.592
Other	3.585	N/A	0.000	3.585
TOTAL FUNDING	**33.881**	**0.110**	**0.000**	**33.991**

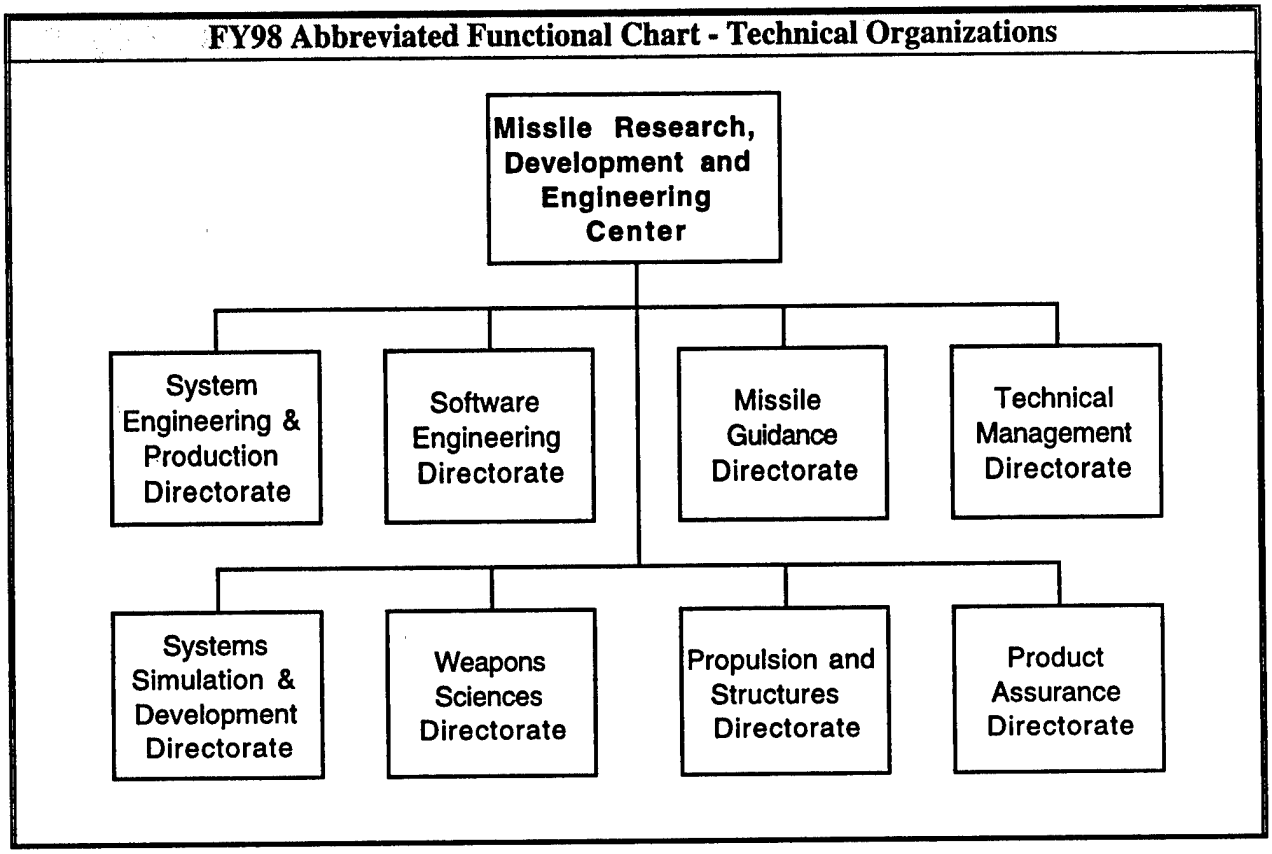
MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		TECHNICAL SUPPORT & OTHER PERSONNEL	
TYPE	DOCTORATES	OTHER		END STRENGTH
MILITARY	41	6	178	225
CIVILIAN	41	41	115	197
TOTAL	**82**	**47**	**293**	**422**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		PROPERTY ACQUISITION COST (MILLIONS $)	
LAB	121.000	**REAL PROPERTY**	24.892
ADMIN	78.000	* NEW CAPITAL EQUIPMENT	0.000
OTHER	148.000	**EQUIPMENT**	41.551
TOTAL	**347.000**	* NEW SCIENTIFIC & ENG. EQUIP.	2.458
ACRES	**150**	* Subset of previous category.	

N/A - Not Applicable

Missile Research, Development & Engineering Center



Missile Research, Development & Engineering Center
Redstone Arsenal, AL 35898-5241
(256) 955-6805

Technical Director: Dr. William C. McCorkle
Associate Director: Dr. Larry O. Daniel

MISSION

To plan, manage and conduct research, exploratory and advanced development for guided missile and rocket weapon systems and related components; to provide scientific, engineering, and technical support for weapon system programs over the complete life cycle; and to manage computer resources embedded in battlefield automated systems. MRDEC provides the technical expertise to enable the services to be smart buyers and users of missiles, rockets, unmanned vehicles and their unique command and control systems, directed energy, non-lethal technology, computer resources embedded in battlefield automated systems, and related models and simulation and, as such, is an essential part of the acquisition process.

MRDEC's science and technology base mission includes planning, managing, and conducting research, advanced development, and exploratory investigation in response to Army system needs. MRDEC's national defense mission includes mutually beneficial relationships with the private sector for those areas where parallel paths should be and can be reduced by cooperation. MRDEC's life cycle systems engineering mission includes planning, establishing, and managing the Missile Command programs to develop new weapon systems, evaluate system and subsystem performance, and maintain high readiness status, assure effectiveness of fielded systems, and control both acquisition and O&S costs. Selective research and component development is conducted to generate new manufacturable technology, reduce development lead time and system cost, and improve reliability.

MRDEC is the Army's lead organization for technologies in missile propulsion, guidance and control/terminal homing, high energy lasers, missile systems simulation, and unmanned vehicles. MRDEC is the System Integrator for the Joint Program Office for Unmanned Aerial Vehicles. MRDEC has the DoD Lead in the Rapid Force Projection Initiative (RFPI), a major Advanced Concept and Technology Demonstration (ACTD) that includes AMC-wide simulation/demonstration/residual support. In addition, MRDEC manages both AVRDEC and MRDEC common process-driven areas as follows: management of operations and business; systems engineering and production; product assurance; battlefield automation; test and evaluation management.

VISION: Weapon System Technology for Swift Decisive Victory without Casualties.

STRATEGIC GOALS:

1. Demonstrate feasibility of new systems concepts that significantly enhance warfighting capabilities by integration of enabling technology into demonstration efforts.
2. Focus the science and technology base on the new realities.
3. Increase market share: broaden the marketplace.
4. Improve the responsiveness, affordability, and quality of MRDEC products and engineering services.

ENABLING STRATEGIES:

1. Keep workforce fully engaged in state-of-the-art technology work to preserve capability as smart buyer.
2. Develop a superior workforce and a quality environment.

CURRENT IMPORTANT PROGRAMS

Ducted Rocket Engine (DRE) - This effort is a joint research and development program with Japan to develop and demonstrate a ducted rocket engine for medium surface-to-air missile to significantly increase the intercept envelope against aircraft, cruise missiles, and tactical ballistic missiles when compared to surface-to-air missiles using current solid rocket propulsion technology. This program completed in FY98.

Multimode Airframe Technology (MAT) (formerly known as Long Range Fiber Optic Guided Missile (LONGFOG)) - This program will provide a 40 km day/night, multiple and high value time sensitive point target strike capability while inflicting minimum collateral damage. The LONGFOG system will provide the capability to select priority targets after launch, conduct limited man-in-the-loop BDA, and provide target area reconnaissance in addition to target attack by means of variable cruise velocity over areas of interest.

Future Missile Technology Integration (FMTI) (formerly known as The Army Combined Arms Weapon Systems (TACAWS)) - This project provides for the demonstration of advanced tactical missile technologies including seekers, propulsion, airframes, warheads, and guidance and control. The project will demonstrate lightweight multi-role missile technology in support of ground-to- ground, ground-to-air, air-to-air, and air-to-ground missions. Combined, flexible capability allows one system or variants of one system to replace many, realizing potential extensive savings in development costs, logistics, training, etc. The FMTI demonstration program is transitioning technology to the Joint Advanced Weapons System (JAWS), an Army/Marine Corps multi-purpose, multi-platform missile.

Guided MLRS ATD - This program will demonstrate a low cost guidance and a control package for the MLRS rocket. At extended ranges, large quantities of baseline rockets are required to defeat the target. With the addition of a guidance system, an improved delivered accuracy will be achieved. The number of rockets required to defeat the target will be reduced to one-sixth the current quantity at maximum ranges. This program successfully demonstrated the guidance in flight tests.

Rapid Force Projection Demonstration - The integrated system of systems concept of the ACTD provides lightweight, responsive precision fires to destroy threat armor forces during day, night, and adverse weather. This ACTD will evaluate the value added by the insertion of these new technologies into the force structure of an existing light unit in a lift constrained environment. The inserted systems will consist of forward sensors (hunters), advanced C2, and a suite of standoff killers. This program has successfully demonstrated the concept in a major field experiment.

Compact Kinetic Energy Missile (CKEM) Technology - This project demonstrates the compact kinetic energy missile technology necessary for a LOSAT P3I. The LOSAT P3I will match the lethality of the LOSAT while reducing the LOSAT take off weight by 40-50%, missile diameter by 20%, minimum range to peak velocity by 40-50%, and provide the maneuver capability required to destroy attacking fixed and rotary wing aircraft. This concept is being designed to be compatible with the LOSAT target acquisition and tracking system and could be compatible with the fire control system for close combat and short range air defense missions.

Low Cost Precision Kill (LCPK) 2.75" Guided Rocket - This project provides for demonstration of a low cost, accurate (1-m CEP) guidance and control retrofit package for the 2.75" Hydra-70 rocket that provides a stand-off range for a high single shot probability of hit (Ph > or = 0.7) against the long range target, exceeding the current unguided 2.75" rocket baseline by 1 or 2 orders of magnitude and thereby providing a 4 to 1 increase in stowed kills at 1/3 the cost per kill compared to current guided missiles. The increased accuracy will minimize collateral damage, reduce risk of fratricide, and will reduce mission times and sorties resulting in increased system survivability. A retrofit guidance package approach based on a solid state (strapdown) mechanization of semi-active laser (SAL) guidance, will be developed and tested, with user participation, to assure the most cost effective transition to EMD.

CURRENT IMPORTANT PROGRAMS (continued)

Counter Active Protection Systems (CAPS) - This project develops and demonstrates technologies which can be applied to Anti Tank Guided Weapons (ATGW) for improving their effectiveness against threat armor equipped with Active Protection Systems (APS). Current technology development is concentrated in the following areas: Radio Frequency (RF) Counter-measure (RFCM) technology for jamming or deceiving APS sensors used for detection, acquisition, and tracking; warhead integration and ballistic hardening of ATGW to reduce vulnerability to fragment impact.

Cooperative Research and Development Agreements (CRDAs):

COMPANY: Sy Technologies, Inc.
DURATION: 5/94 through 1/99
SUBJECT: Development and analysis of designs, and fabrication and test of these designs of binary optic elements for use in unique state-of-the-art optical systems.
PAYOFF: Reduction in costs, increase in reliability and performance of optical elements used in Army missile and optics systems.

COMPANY: Rockwell International Corp
DURATION: 7/94 through 1/97
SUBJECT: Development and verification of advanced analytical design methodology and design tool that optimizes the structural performance of components made of composite materials by tying material properties directly to the manufacturing process.
PAYOFF: Acceleration of the use of lightweight, high strength structures in the development of advanced Army missile systems and aircraft.

COMPANY: Signature Products
DURATION: 7/94 through 1/97
SUBJECT: Increasing the production rate and improving the C(60) reactor process for Radar Absorbing Materials (RAM).
PAYOFF: Increasing efficiency (higher impulse) in missile propulsion systems.

COMPANY: Optical Processing Technology Systems
DURATION: 4/95 through 9/97
SUBJECT: Development of components and algorithms required for demonstration of a diverse pattern recognition system using optical processors.
PAYOFF: High throughput, smaller size, decreases power consumption, and lower costing processors.

COMPANY: Hughes Missile Systems
DURATION: 5/95 through 12/96
SUBJECT: Development of a comprehensive Tolerance Optimization and Variability Reduction (TOVAR) process and methodology model which can be integrated into both product development and production processes.
PAYOFF: Increased production yields, lower production costs, and increased product reliability and robustness.

COMPANY: Optical Corp of America
DURATION: 5/96 through 9/97
SUBJECT: Optical Processing Architectures and Algorithms for Automatic Target Recognition - This research, development, and demonstration of revolutionary optical processing architectures and algorithms for automatic target recognition for military and commercial applications.
PAYOFF: Reduction in the production cost of military systems.

COMPANY: Rochester Photonics Inc.
DURATION: 9/96 through 5/99
SUBJECT: E-Beam Fabrication Technology - This research will evaluate the technique of direct E-Beam fabrication for diffractive optical components and performance of replication studies.
PAYOFF: Lower cost of optical components.

CURRENT IMPORTANT PROGRAMS (continued)

COMPANY: Georgia Tech Research Corporation
DURATION: 11/92 through 1/99
SUBJECT: Development of advanced manufacturing processes and equipment in the areas of microelectronics and photonics.
PAYOFF: Reduction in the production costs of military systems.

COMPANY: Optelecom
DURATION: 8/97 through 9/99
SUBJECT: Navigation Grade Interferometric Fiber Optic Gyroscope (IFOG) coils. This project is to qualify new coil winding patterns and mounting designs to achieve navigation grade performance IFOGs of substantially reduced volume. This research will have direct commercial applications such as aircraft navigation; ships, mining, and surveyors.
PAYOFF: Low cost miniaturized gyroscopes for navigational operations.

COMPANY: Hughes Missile Systems
DURATION: 7/97 through 6/99
SUBJECT: Computer Aided Modeling Design and Analysis (CAMDA) - This research will be used as a tool to investigate advanced missile concepts and have direct commercial applications in computer modeling and simulation.
PAYOFF: Enhanced computer-aided modeling with commercial and military applications.

COMPANY: Northrop Grumman Corp
DURATION: 6/97 through 1/99
SUBJECT: Adaptive Rocket Payload Configuration (ARPC) - This research will have direct commercial applications in the area of foreign military sales for multiple payload configurations and missile technology using large nose cone missiles launched from existing small launch tubes.
PAYOFF: Reduction in the production cost of military systems.

COMPANY: Honeywell, Lucent Technologies & Northrop Grumman
DURATION: 12/96 through 12/00
SUBJECT: Plastic Encapsulated Microcircuits in Severe Storage Environments -This effort involves cooperative research and development to determine the risk in using plastic encapsulated microcircuits in severe storage environments.
PAYOFF: Low cost hardened electrical circuits.

COMPANY: Nichols Research Corp
DURATION: 12/96 through 10/01
SUBJECT: Adaptive Radio Interface Device - The radio infrastructure developed under this effort will be designed with the intent of supporting multiple communications protocols, multiple physical radio implementations, and multiple form factors.
PAYOFF: Multiple protocols for military communications.

COMPANY: Northrop Grumman Corporation
DURATION: 12/09/97 through 3/31/98
SUBJECT: Elliptical Rocket Payload Section (ERPS). This research will have direct commercial applications to foreign military sales of multiple payload configurations and missile technology using large nose cone missiles launched from existing small launch tubes.
PAYOFF: Cost-effective, readily fieldable, delivery system for several types of precision strike submunitions.

COMPANY: Vision Partners, L.P.
DURATION: 12/18/97 through 12/31/99
SUBJECT: Ocular Refractive Error/Disease Detection System (OREDDS). This research will have direct commercial applications such as mass screening preschool/kindergarten age children for ocular defects such as myopia, hyperopia, amblyopia, astigmatism, strabismus, and cataracts.
PAYOFF: Mass screening of adolescent children and learning impaired adults for vision abnormalities. Utilized by Armed forces for initial screening of Recruits.

CURRENT IMPORTANT PROGRAMS (continued)

COMPANY: Thiokol Corporation
DURATION: 12/31/97 through 12/31/98 (Amendment Pending)
SUBJECT: Propulsion for the Stinger Block II (SBII). The objective of this CRDA is to develop a preliminary propulsion design of the next-generation STINGER missile.
PAYOFF: Provide technical design evaluations and next-generation STINGER missiles.

COMPANY: Hughes Missile System
DURATION: 2/28/98 through 12/31/00
SUBJECT: Automatic Target Recognition (ATR). This involves evaluation of automatic target recognition technology for tactical weapons systems.
PAYOFF: Accelerate the development of next-generation Automatic Target Recognition. It will also provide for automatic car tag character decoding, text/symbolic character recognition.

COMPANY: University of Rochester
DURATION: 3/31/98 through 4/30/99
SUBJECT: Semi-Conductor Laser Dynamic Research (SLDR). This joint research will explore novel approaches to the fundamental formulation and understanding of the interactions and couplings of semiconductor materials with laser fields.
PAYOFF: This research will enhance telephone communications, optical communications, fiber optics, optical integrated elements, data processing, communications, stabilization of lasers in integrated optical systems, CD applications, and semiconductor phased arrays (for advanced infrared (IR) applications.

COMPANY: Oklahoma State University
DURATION: 3/31/98 through 4/30/99
SUBJECT: Semi-Conductor Laser Dynamic Research (SLDR). This joint research will explore novel approaches to the fundamental formulation and understanding of the interactions and couplings of semiconductor materials with laser fields.
PAYOFF: This research will enhance telephone communications, optical communications, fiber optics, optical integrated elements, data processing, communications, stabilization of lasers in integrated optical systems, CD applications, and semiconductor phased arrays (for advanced infrared (IR) applications.

COMPANY: University of Alabama in Huntsville (UAH)
DURATION: 3/31/98 through 4/30/99
SUBJECT: Semi-Conductor Laser Dynamic Research (SLDR). This joint research will explore novel approaches to the fundamental formulation and understanding of the interactions and couplings of semiconductor materials with laser fields.
PAYOFF: This research will enhance telephone communications, optical communications, fiber optics, optical integrated elements, data processing, communications, stabilization of lasers in integrated optical systems, CD applications, and semiconductor phased arrays (for advanced infrared (IR) applications.

COMPANY: Raytheon Missile Systems
DURATION: 3/31/98 through 4/30/99
SUBJECT: Long Range Fire Support Missile (LRFSM). This research will have direct commercial applications such as remote unmanned surveillance, uncooled Imaging InfraRed (IIR), and multi-mission payloads.
PAYOFF: The development of a modular missile/launcher system.

COMPANY: Aegis
DURATION: 5/31/98 through 3/31/00
SUBJECT: Photonic Sensor Components. This research will have direct commercial applications such as telecommunications, commercial-grade guidance and control systems, chemical and biological sensors, high-speed interconnects, and parallel optical processors.
PAYOFF: Development of low cost electro-optic sensors.

CURRENT IMPORTANT PROGRAMS (continued)

COMPANY: Northrop Grumman Corporation
DURATION: 7/7/98 through 1/31/02
SUBJECT: Adaptive Rocket Payload Configuration (ARPC). This research will have direct commercial applications in the area of foreign military sales of multiple payload configurations and missile technology using large nose cone missiles launched from existing small launch tubes.
PAYOFF: Reduction in the production cost of military systems.

COMPANY: OPTS, Inc.
DURATION: 8/19/98 THROUGH 7/30/00
SUBJECT: Microelectromechanical Support Element (MEMS). This research will have direct commercial applications such as optical communications links, miniature actuators, optical switching, and sensors.
PAYOFF: Reduction in cost of microelectronic devices (sensors, temperature, humidity, load sensors).

TECHNOLOGY TRANSFER HIGHLIGHTS:

Eleven new Cooperative Research and Development Agreements (CRDAs) were approved during FY98, and one existing CRDA was amended and extended through FY02. CRDAs were signed with the following companies: OPTS, Hughes Missile Systems, Northrop Grumman, Aegis, Raytheon Missile Systems, Thiokol Corporation, Vision Partners, L.P., Universities of Alabama in Huntsville, Oklahoma State, and Rochester; with technologies ranging from optics & lasers/optical detection, optoelectronic devices & systems, pattern recognition & images interfaces, payload configuration and semiconductor devices.

The MRDEC Director presented nineteen (19) Domestic Technology Transfer Awards. These awards were given to each outstanding contributor for their effort to bring MRDEC technologies to the commercial market place.

EQUIPMENT/FACILITIES

Propellant Aging and Mechanical Properties Facility - This is the most modern facility in the world dedicated to solid rocket motor structural integrity and service life extension investigation. Completed in 1988, it meets DoD's latest safety requirements for handling hazardous propulsion materials.

Gel Propellant Rheology Facility - This facility is used to determine rheological properties of gelled propellants over the full range of the Army operational temperature limits and for shear rates equivalent to those imposed on the gels by engine injectors. This information is required to minimize the volume and weight of gel propulsion systems.

Ducted Rocket Test Facility - This is the most modern, economical, sub-scale direct connect air facility in the world and is used for testing ducted rockets and ramjets. Completed in 1995, it utilizes state of the art computer control to deliver a wide range of air flow rates and temperatures during a single test run, in effect 'flying' a mission while on the test stand.

Signature Characterization Facility (SCF) - This facility is used to characterize the exhaust plumes of rocket motors. The facility consists of a static test stand mounted inside an environmental chamber. Small test motors can be fired under any atmospheric condition of temperature and humidity, and evaluated as to their exhaust characteristics. These include visible and infrared flash, visible and infrared smoke attenuation, toxicity, particle analysis, and mm wave radar absorption.

EQUIPMENT/FACILITIES (continued)

Target and Seeker Measurement Facility (TSMF) - Used by the Army and Air Force for sensor/seeker design measurements, this facility includes a 300 foot tower and elevator combination allowing an operator access to equipment at any elevation up to the maximum. It also includes a 70 ton capacity target turntable with multiple degrees of freedom.

Advanced Simulation Facility - This center is unequalled in the free world providing hardware-in-the-loop-simulation capability. Consisting of 10 hardware-in-the-loop simulation facilities, the Center provides unique capabilities for closed guidance loop system performance evaluation in a laboratory environment of missiles and submunitions guided and/or fuzed by: microwave and millimeterwave radar; scanning and staring infrared sensors; other electro-optical signals; and by inertially sensed motion. Its international reputation is demonstrated by previous and on-going international programs and consultations with the representatives of Australia, Belgium, France, Germany, Israel, Korea, and the United Kingdom.

The AMCOM Distributed Simulation (DS) Center - This facility provides the central node at AMCOM for distributed simulation. This facility contains ten interconnected application rooms for the development and operation of virtual prototype simulators, multiple local area networks, and supporting hardware and software essential to the conduct of DS exercises. It houses the node, or gateway, to the Defense Simulation Internet which facilitates simultaneous distributed experiments at multiple facilities throughout the U.S., and an extensive WAN which includes HWIL simulations, weapons system hardware, and virtual prototypes of systems and facilitates simultaneous distributed experiments at multiple facilities throughout the AMCOM.

The Advanced Protyping, Engineering and Experimentation (APEX) Laboratory - This facility is a research and development facility whose mission is to address the existing gap between warfighter simulation and engineering level simulation capabilities through the application of Distributed Interactive Simulation (DIS) and the emerging DOD High Level Architecture (HLA) technologies. It provides the infrastructure necessary to link live, virtual and constructive elements in common synthetic environments. This involves integrating the dynamics of doctrine, tactics, mobility, logistic support, Command, Control, and Communications (C3) decision making, and human reaction in a synthetic battlefield driven by both tactical and technical constraints. The APEX Lab provides a full spectrum systems engineering approach for evaluating emerging systems and concepts in a virtual prototyping environment.

Guidance and Control Analysis Facility - An all digital facility for check out of flight systems, this capability is unprecedented in its system bandwidth. It is currently used for real time check out of extremely high bandwidth ADKEM guidance and control components.

Anechoic RF Test Chamber - This facility is world renowned for its wide anechoic bandwidth and physical size. A specially designed floor provides realistic simulation of surface wave propagation - a unique capability.

Fire Support System Integration Lab - Designed for end-to-end weapon system hardware check out, this facility contains distributed, netted communication nodes which can perform high and low level system tests. The facility is currently uniquely configured to check out the MLRS family of munitions.

Army Missile Optical Range - A one of a kind, very large aperture (2m) compact laser range capable of illuminating large targets, under simulated far field conditions, at short range. This facility is used extensively for measurement of Strategic Defense Targets.

UAV System Integration Laboratory - A world class facility unique in its ability to integrate multiple UAV systems and test common subsystem integration interfaces.

Weapon System Interoperability Test Facility - Designed for weapon system software and communication testing, this is the only facility in the U.S. Government having, in residence, Army deployed tactical air defense systems, Unmanned Aerial Vehicle C3 assets, and other ground and fire

EQUIPMENT/FACILITIES (continued)

support weapon and C3 systems. It is regularly used for joint interoperability certification testing, AWE and field demonstration preparation, and soldier training.

Composites Manufacturing Facility - Wholly Government owned and operated, the Composites Manufacturing Facility provides MRDEC engineers with a 'hands on' capability in missile composites manufacturing from project concept, through fabrication, and testing. This facility is the Government's principal repository of technical expertise in this area.

Automated Manufacturing Cells - Contains a uniquely automated, fiberoptic winding capability and a cell for automated inspection of printed circuit boards down to 1-2 mils line width.

Laser Induced Chemistry Facility - Unique facility which includes lasers covering ultraviolet to infrared and analytical instrumentation to identify compounds resulting from laser induced reactions.

Laser Range - The Physical Sciences Building was designed for high energy laser operation. A laser range was built behind the building which allows the operation and use of the range from inside the building either by the hi-bay or directly from the lab. The range is approximately 1720 ft long with four islands each with a large mirror mount and electricity. A concrete bridge designed to support an M1 tank connects the islands with the hi-bay area. Chain link fence and interlocks on the interior doors restrict access to the range. Warning lights are positioned down the centerline of the range and on the access doors and gates.

Automated Laser Seeker Performance Evaluation System (ALSPES) - This $2M, one-of-a-kind facility provides complete open-loop test capability for semi-active laser (SAL) seekers/sensors operating at 1.064 microns. ALSPES provides characterizations on prototype/R&D hardware including specification compliance requirements, functional performance, and active electro-optical countermeasures (EOCM) susceptibility, and it has taken a commanding lead in EOCM susceptibility analysis. The facility has been used to test/characterize both foreign and domestic hardware, such as Copperhead, HELLFIRE, HELLFIRE II, Krasnopol, Vehicle defensive-aid suites, and 2.75" laser guided rockets. The modular equipment/software interface allows numerous systems to be tested with minimal changeover downtime.

The Laser Guidance Analysis Facility - This facility, which provides for real time, closed loop evaluation of semi-active laser guidance hardware, has and continues to be instrumental in the development and life cycle support of such systems as HELLFIRE and Copperhead. It is currently being utilized in the development and demonstration of new laser guidance concepts for the LCPK 2.75 Inch Guided Rocket program.

The Longbow/HELLFIRE and STINGER Systems Integration Facility - This facility is used to evaluate the interfaces and integration of the aircraft platforms, launchers, laser and Longbow HELLFIRE missiles, and Stinger missile. It provides the capability to assess hardware and software designs for entire weapon systems and supporting equipment such as test sets and training missiles.

Actuation Systems Test Facility - This facility provides the capability for testing pneumatic, hydraulic, electro-mechanical, and cold gas jet reaction control systems. It contains equipment for hydrostatic testing pressure vessels to 40 kpsi and pressurizing pressure vessels to 15 kpsi. The facility contains a six-component test stand with instrumentation for testing the forces and moments generated by a cold gas jet reaction system.

Guidance and Control Analysis Facility - An all digital facility for check out of flight systems, this capability is unprecedented in its system bandwidth. It is currently being used for real time check out of high bandwidth GMLRS guidance and control components and will be utilized in the near future in support of the CKEM and LCPK technology programs.

Inertial Guidance Management and Technology Center - The Center was established by the Army and funded in FY65 to provide central army monitorship of all R&D in inertial system/components

EQUIPMENT/FACILITIES (continued)

navigation for missiles, aircraft and drones, land navigation; and other applications such as inertial land surveying and inertial fuzing. Full Inertial Test facilities and instrumentation to carry out that function is available.

Global Positioning System (GPS) Test Facility - The GPS Test Facility has the capability to provide inexpensive GPS hardware testing in a dynamic environment through the use of the two GPS Satellite Simulators (Tester)-GPST. The GPST is used to determine overall system performance including total system navigation accuracy, initial acquisition time-to-first-fix (TTF), geometrical effects (GDOP) satellite management, effects of vehicle dynamics, selective availability/anti-spoofing (SA/A-S) operation, inertial navigation system (INS) aided and unaided performance, antenna gain pattern modeling, jamming susceptibility, and space and control segment errors.

Control Actuation System (CAS) - MRDEC spun off in-house development of a Control Actuation System (CAS) to the prime contractor of the guided MLRS EMD program (Lockheed Martin Vought Systems). Successful development and demonstration of a CAS by MRDEC during the Guided MLRS ATD program has reduced the risk and cost of the GMLRS EMD program. Development and demonstration of a CAS significantly reduced risk areas such as thermal environment, aerodynamic loads, and canard flutter. Cost information gained from development of the ATD CAS was used to negotiate a realistic price with the prime contractor. MRDEC spun off in-house design of a three-axis Control Actuation System (CAS) for the Stinger Block II program. In support of the Low Cost Precision Kill ATD program MRDEC designed a three-axis CAS that meets the package and performance requirements of Stinger block II.

Air Defense Radar Facility - This facility consists of laboratories, experimental test equipment, including a state of art test bed radar, and test ranges. This facility is now being used to support PATRIOT and SENTINEL product improvement programs, the MEADS development program, and air defense technology projects.

Compact Range Facilities - This facility provides the capability of precisely measuring amplitude and phase transmission characteristics of MMW antennas, radomes, and other devices. These compact ranges have been utilized to characterize threat radar antennas, BAT-P3I Seeker antennas, and multi-spectral materials. Most recently, one of these Compact Ranges has been extensively utilized in the support of PATRIOT's PAC-3 Seeker Development.

Army Air and Missile Defense Network Design Facility (AAMDNDF) - This facility provides JTIDS network designs and platform initialization load files for all Joint and Army-only tests, exercises, operations, and contingency events in which Army JTIDS-equipment units participate. The AAMDNDF is the Army's only JTIDS network design facility. Additionally, the NDF supports Army platform specific communications subsystem design, analysis, and testing for intra-Army, Joint, and Allied interoperability on this Joint mandated link. While routinely providing on-call technical support, the NDF is frequently called on to provide on-location support for tactical units deployed to field locations for exercises and contingency missions.

Computer/Software Development (Debug and Modeling) Environment - This one-of-a-kind environment provides full visibility into the operation of code on embedded systems operating with many microprocessors. This environment is microprocessor and microprocessor mount (processor in a socket or permanently attached) independent. This environment allows full visibility into the firmware's operation by stopping the code via breakpoints; display and/or alter the CPU's and code's resources (data structures, registers and the like); and trace the code flow in real time. Using the modeling capabilities within the environment, analysis based on the actual timing and data flow is used to construct a software architecture (repartitioned across the multiple processors). This integrated environment is based on a modular hardware/software architecture and can be easily reconfigured to interface with numerous systems with minimal downtime.

EQUIPMENT/FACILITIES (continued)

Applied Imagery Lab (AIL) - The AIL is a center of excellence for integrating COTS imagery into tactical applications, particularly trainers and system-in-the-loop stimulators for weapon systems. Lab focuses on providing low-cost, supportable, high-end PC-based technologies to solve real-time simulation problems. The AIL leverages these PC products with in-house expertise to provide prototyping, development, integration, demo, and test capabilities for tactical system-compatible products requiring real-time operator interactions with visible targets in a virtual environment. Actual tactical system sensors are stimulated with these virtual views to provide a realistic operational environment viewpoint to the weapon system operator. Facility is used by a number of program management offices and user organizations to reduce program risk, improve product quality of system trainers, and improve integration capabilities.

Life Cycle Software Engineering Center (Annex) - In September 1998 construction started on a 182,300 square foot facility that will expand the Software Engineering Directorate's (SED) capability to support Aviation and Missile Systems. This facility will provide a unique platform to enhance the SED mission of performing Interoperability Weapon System Development, Verification/Validation and Testing. The facility will consist of laboratories, a highbay, and engineering work space to support 661 personnel.

Missile Research, Development & Engineering Center
Redstone Arsenal, AL 35898-5241
(256) 955-6805

Technical Director: Dr. William C. McCorkle
Associate Director: Dr. Larry O. Daniel

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	1.238	N/A	N/A	1.238
6.1 Other	0.000	0.000	0.004	0.004
6.2	11.598	1.009	21.645	34.252
6.3	11.899	4.330	108.417	124.646
Subtotal (S&T)	**24.735**	**5.339**	**130.066**	**160.140**
6.4	6.521	7.639	17.689	31.849
6.5	9.065	7.031	13.132	29.228
6.6	4.702	1.567	54.555	60.824
6.7	3.408	1.659	9.816	14.883
Non-DOD	0.000	0.000	0.000	0.000
TOTAL RDT&E	**48.431**	**23.235**	**225.258**	**296.924**
Procurement	46.078	N/A	40.486	86.564
Operations & Maintenance	15.084	N/A	24.906	39.990
Other	22.467	N/A	55.248	77.715
TOTAL FUNDING	**132.060**	**23.235**	**345.898**	**501.193**

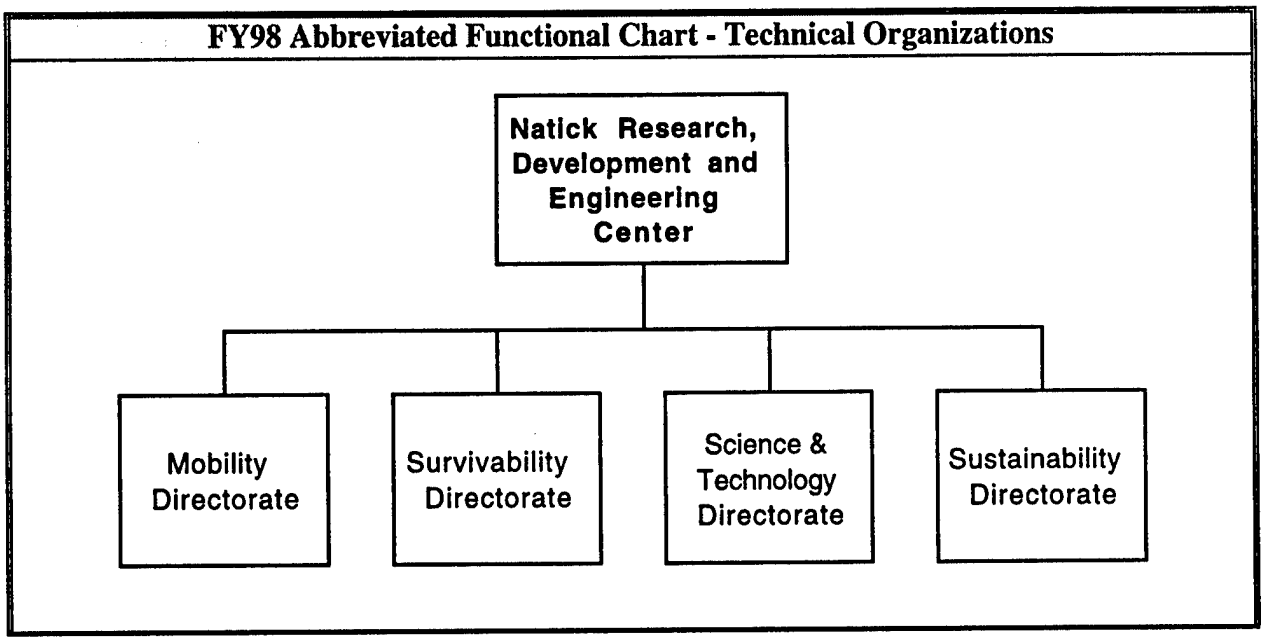
MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	**END STRENGTH**
TYPE	**DOCTORATES**	**OTHER**		
MILITARY	0	5	3	8
CIVILIAN	40	1,173	524	1,737
TOTAL	**40**	**1,178**	**527**	**1,745**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	974.866	**REAL PROPERTY**	227.797
ADMIN	236.162	* NEW CAPITAL EQUIPMENT	0.000
OTHER	143.587	**EQUIPMENT**	347.853
TOTAL	**1,354.615**	* NEW SCIENTIFIC & ENG. EQUIP.	0.763
ACRES	**4,000**	* Subset of previous category.	

N/A - Not Applicable

Natick Research, Development & Engineering Center



Natick Research, Development & Engineering Center
Natick, MA 01760
(508) 233-4300

Director: Mr. Philip Brandler

MISSION

NRDEC's mission is to research, develop, engineer, test, evaluate, and integrate the best technologies for warrior systems that enhance individual combat effectiveness and quality of life. Our core products include food, shelters, airdrop, individual protection, field service and other warrior-related technologies and systems. Key services include integration of all individual warrior-related technologies and systems for everything the warrior wears, carries, "jumps" and consumes, and related support equipment.

NRDEC is the executive agent for the Department of Defense's (DOD) Food and Nutrition Research, Development, Testing, and Engineering Program as well as a DOD Center of Excellence for Clothing & Textiles. Additionally, NRDEC is the DOD agency for Helicopter Sling Loading and the Army agent for Internal Air Transport Certification.

CURRENT IMPORTANT PROGRAMS

1. Develop technologies for insertion into 21st century integrated, modular, individual fighting systems that link the soldier to the digitized command and control network on the battlefield of the future. The Force XXI Land Warrior (LW) S&T program efforts focus on technology insertions to the architectural backbone of the system to achieve lightweight, miniaturized components to decrease soldier load while enhancing combat performance. The Military Operations in Urban Terrain (MOUT) program encompasses a breadth of technologies including advanced individual precision weapons, combat identification, counter-sniper technologies, nonlethal weapons, and advanced sensors, situational awareness and personal protection. The operational capability realized will be a series of advanced systems or components forming a MOUT "System of Systems" to ensure effective interoperability and functionality.

2. Maximize the warrior's survivability through development of integrated, modular system components that provide individual protection from ballistic, percutaneous chemical and biological, environmental, flame, surveillance, and directed energy threats.

   One Cooperative Research and Development Agreement (CRDA) supports ballistic protective fibers produced through genetic engineering techniques for ballistic impact applications. Four other CRDAs are in place to support the RDT&E of new materials and configurations for protective clothing and individual equipment systems. A new CRDA supports research into the development of synthetic fibers from recycled polyester (PET) bottles.

3. Provide soldiers with systems that enhance combat readiness and quality of life in the field through the development, integration, and fielding of advanced field services equipment and base camp systems in all environments and field conditions.

CURRENT IMPORTANT PROGRAMS (continued)

4. Develop a family of performance-enhancing combat rations (special-purpose and standard individual/group) and modularized, rapidly deployable field feeding equipment/systems (kitchens, burners, sanitation) for all the services to support the full spectrum of tactical scenarios.

   12 CRDAs support combat rations and field feeding R&D with innovative methods to provide microwave processed meals in retort pouches; irradiation, radio frequency, and non-thermal processes for the preservation of foods; improved capability for preparing special microencapsulated performance-enhancing nutrients; shelf-stable, eat-out-of-hand ration components; candidate replacements for the hydrogen producing Flameless Ration Heater (FRH); and research for the production of fresh-like fruit and vegetables with reduced weight and volume. One new CRDA supports interactive food packaging, and another CRDA in effect supports the development of biodegradable plastics from milk fat.

5. Enhance the mobility of the combatant with the following systems: terrain traversal, personnel augmentation equipment, personnel airdrop, and cargo airdrop.

   One CRDA supports airdrop R&D in the area of cushioning airdrop payloads by using gas-injected airbag technology. Another CRDA is using a phased approach to explore the flight control characteristics of high glide, semi-rigid wings, and to assess the feasibility of increasing range by use of a glide augmentation system.

6. Develop advanced shelters and shelter systems that provide new capabilities or enhancements, such as high-pressure, airbeam-supported maintenance shelters (lighter weight, less cube, quicker erection); command posts; and collective protection medical treatment facilities and hospital complexes.

7. Two new master CRDAs have been signed with major commercial R&D companies during FY98 covering a wide range of commodity areas.

   One CRDA supports advanced protective clothing, food formulations/services, collective protective technologies, and organizational equipment.

   The other CRDA supports ballistics protection, CB protection and associated equipment, and environmentally protective clothing and equipment.

EQUIPMENT/FACILITIES

Unique facilities at Natick include: man-rated climatic chambers capable of simulating world-wide environmental conditions; the Defense Simulation Internet (DSI) Facility which connects to the worldwide DSI for inserting fully outfitted dismounted infantrymen into the world of distributed interactive simulation; the aircraft and airdrop load roller conveyor, static, and drop test facilities; a parachute prototype facility; the soft shelters prototype fabrication facility which has many unique state of the art tentage fabrication machines and tools, including radio frequency fabric welders, hot wedge and hot air seam sealers, and is collocated with the rain test tower; food packaging facilities capable of prototype plant scale operations and simulation of rough handling; food processing pilot plant facilities; the food service equipment, engineering and evaluation lab including hooded work areas for chemical and combustion testing, a machine shop, an energy utilization panel, portable diagnostic and gas measurement instruments, and sound levels equipment; a complete laser laboratory with an alexandrite (variable frequency) laser; a fiber spinning and recycling facility; a dyeing, printing, and finishing fabrics pilot plant; a seams lab; a microbiology lab with a molecular modeling graphics workstation;

EQUIPMENT/FACILITIES (continued)

a biotechnology lab with automated respirator; fermentation facility; a microscopy lab with optical, electron, and atomic force microscopes; a taste test lab; and a camouflage evaluation facility/terrain analysis system.

Other equipment at Natick includes spectrophotometers, a CCD camera imaging system, robotic chemical agent stimulant materials test apparatus, oligonucleotide & peptide synthesizers, peptide sequencers, thermal analysis equipment, chambers for simulating artificial light, multi-layer film extrusion system, ballistics high speed impact test equipment, a materials testing machine, a computer video-analysis system, three-dimensional head and full body scanners, instrumented manikins, a small flight test/ultralight aircraft, a computerized pattern generating and grading system, a computerized rapid prototype machine, a twin screw extruder, and chromatographs with capabilities including GC, GC/MS, GDC, and HPLC.

BIOMECHANICS LABORATORY. This unique lab was established jointly by Natick and the U.S. Army Research Institute of Environmental Medicine (USARIEM). This Center for Military Biomechanical Research, the only facility of its kind within DOD, is designed for the study of ergonomic aspects of clothing and individual equipment, occupational medicine, and physical performance.

Natick Research, Development & Engineering Center
Natick, MA 01760
(508) 233-4300

Director: Mr. Philip Brandler

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	0.352	N/A	N/A	0.352
6.1 Other	1.394	0.044	0.419	1.857
6.2	7.556	0.725	16.429	24.710
6.3	4.381	0.622	31.994	36.997
Subtotal (S&T)	**13.683**	**1.391**	**48.842**	**63.916**
6.4	3.439	0.146	1.264	4.849
6.5	5.893	0.522	9.067	15.482
6.6	1.478	0.115	3.108	4.701
6.7	0.053	0.009	0.063	0.125
Non-DOD	0.000	0.000	0.000	0.000
TOTAL RDT&E	**24.546**	**2.183**	**62.344**	**89.073**
Procurement	0.000	N/A	0.000	0.000
Operations & Maintenance	15.213	N/A	1.674	16.887
Other	1.264	N/A	34.587	35.851
TOTAL FUNDING	**41.023**	**2.183**	**98.605**	**141.811**

MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	
TYPE	**DOCTORATES**	**OTHER**		**END STRENGTH**
MILITARY	0	0	28	28
CIVILIAN	13	151	287	451
TOTAL	**13**	**151**	**315**	**479**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	368.747	**REAL PROPERTY**	43.100
ADMIN	32.336	* NEW CAPITAL EQUIPMENT	0.000
OTHER	23.786	**EQUIPMENT**	2.354
TOTAL	**424.869**	* NEW SCIENTIFIC & ENG. EQUIP.	0.520
ACRES	**58**	* Subset of previous category.	

N/A - Not Applicable

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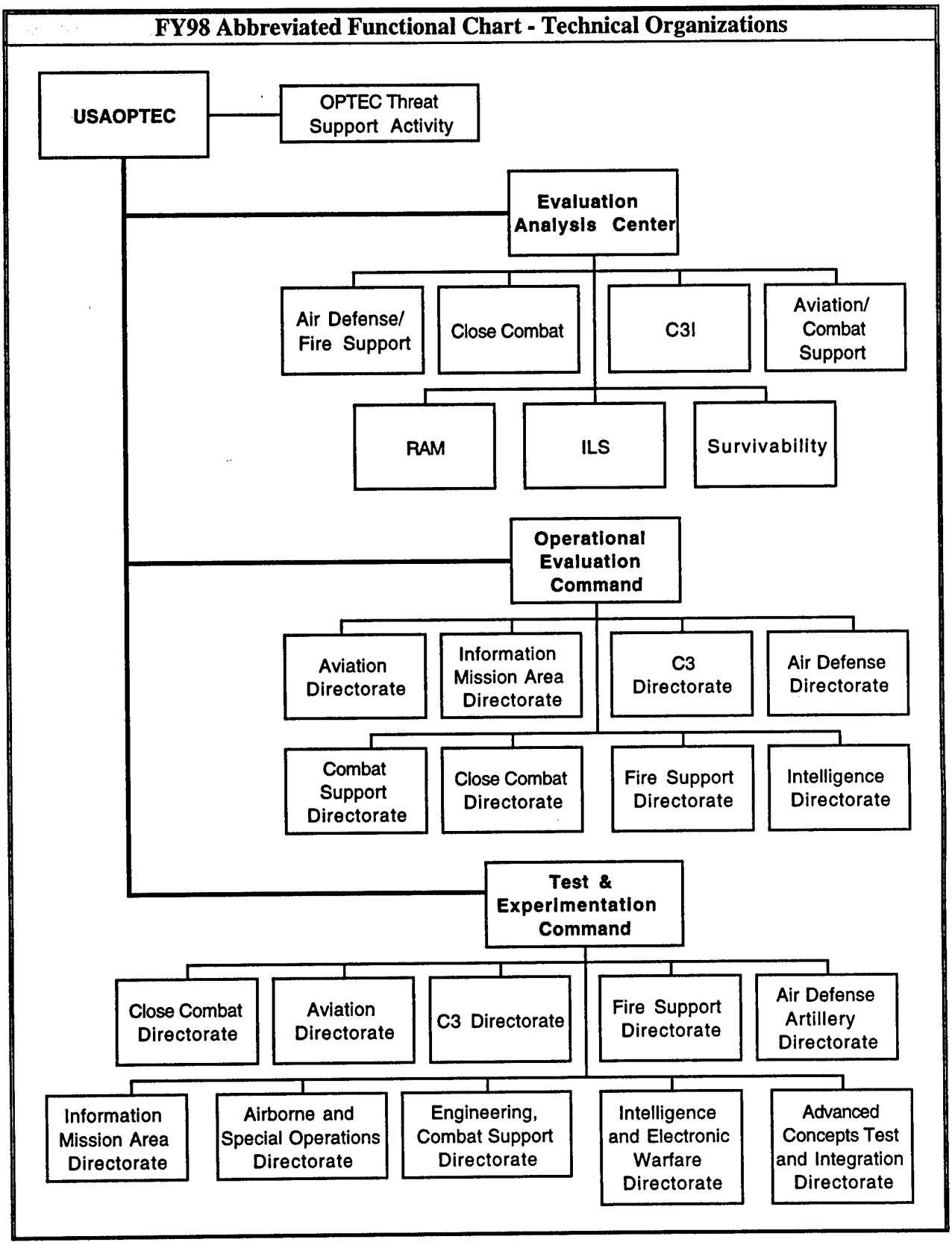
Operational Test and Evaluation Command



Operational Test and Evaluation Command
Alexandria, VA 22302-1458
(703) 681-9365

Commander: MG A. J. Madora
Technical Director: H. C. Dubin

MISSION

The mission of the United States Army Operational Test and Evaluation Command (OPTEC) is to support the soldier and the Army's fighting forces by planning and conducting Joint and Multiservice operational tests; Reporting on system operational effectiveness suitability and survivability; Planning and conducting force development tests and experiments, and managing the Army's Continuous Evaluation Program.

CURRENT IMPORTANT PROGRAMS

ASAS	All Source Analysis System.
ASV	Armored Security Vehicle.
ATACMS	Army Tactical Missile System.
BFVS A3	Bradley Fighting Vehicle System.
BIDS P3I	Biological Integrated Detection System.
C2V	Command and Control Vehicle.
CBPS	Chemically and Biologically Protected Shelter.
CCTT	Close Combat Tactical Trainer.
Comanche/RAH-66	Comanche Helicopter.
CRUSADER	Crusader.
FBCB2	Force XXI Battle Command Brigade and Below.
FMTV	Family Medium Tactical Vehicles.
ICH	Improved Cargo Helicopter.
ISYSCON	Integrated System Control.
JSTARS	Joint Stars.
LFT&E	Live Fire Test & Evaluation.
LW	Land Warrior.
M1A2 Sep	M1A2 Abrams Sep.
MCS	Maneuver Control System.
NBCRS	Nuclear, Biological and Chemical Reconnaissance System.
PAC3	Patriot Advanced Capabilities, Configuration 3.
SADARM	Sense and Destroy Armor.
SMART-T	Secure, Mobile, Anti-Jam, Reliable, Tactical Terminal.
THAAD	Theater High Altitude Area Defense.
UH-60Q	Utility Helicopter 60Q.

EQUIPMENT/FACILITIES

Position location, high angle modular integrated target, video, data acquisition and reduction, thermal imaging, fiber optics and video multiplexer/demultiplexer, range timing, microwave, environmental measurement and survey.

Point to Point Video Tele Conferencing (VTC) with direct link capability, desk top VTC's, CISCO Router direct linked, color copiers, Prioris dual processor server, and cabletron hubs.

Threat support hardware that includes EW, RADAR, AND C3 SYSTEMS.

Operational Test and Evaluation Command
Alexandria, VA 22302-1458
(703) 681-9365

Commander: MG A. J. Madora
Technical Director: H. C. Dubin

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	0.000	N/A	N/A	0.000
6.1 Other	0.000	0.000	0.000	0.000
6.2	0.000	0.000	0.000	0.000
6.3	0.000	0.000	0.000	0.000
Subtotal (S&T)	**0.000**	**0.000**	**0.000**	**0.000**
6.4	0.463	0.000	0.000	0.463
6.5	0.699	0.000	1.270	1.969
6.6	121.895	0.000	2.227	124.122
6.7	0.000	0.000	0.000	0.000
Non-DOD	0.000	0.000	0.000	0.000
TOTAL RDT&E	**123.057**	**0.000**	**3.497**	**126.554**
Procurement	1.700	N/A	0.000	1.700
Operations & Maintenance	60.798	N/A	0.186	60.984
Other	0.000	N/A	0.000	0.000
TOTAL FUNDING	**185.555**	**0.000**	**3.683**	**189.238**

MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	
TYPE	**DOCTORATES**	**OTHER**		**END STRENGTH**
MILITARY	0	28	545	573
CIVILIAN	20	247	604	871
TOTAL	**20**	**275**	**1,149**	**1,444**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	0.000	**REAL PROPERTY**	38.100
ADMIN	498.000	* NEW CAPITAL EQUIPMENT	3.500
OTHER	214.000	**EQUIPMENT**	1.500
TOTAL	**712.000**	* NEW SCIENTIFIC & ENG. EQUIP.	0.000
ACRES	**23**	* Subset of previous category.	

N/A - Not Applicable

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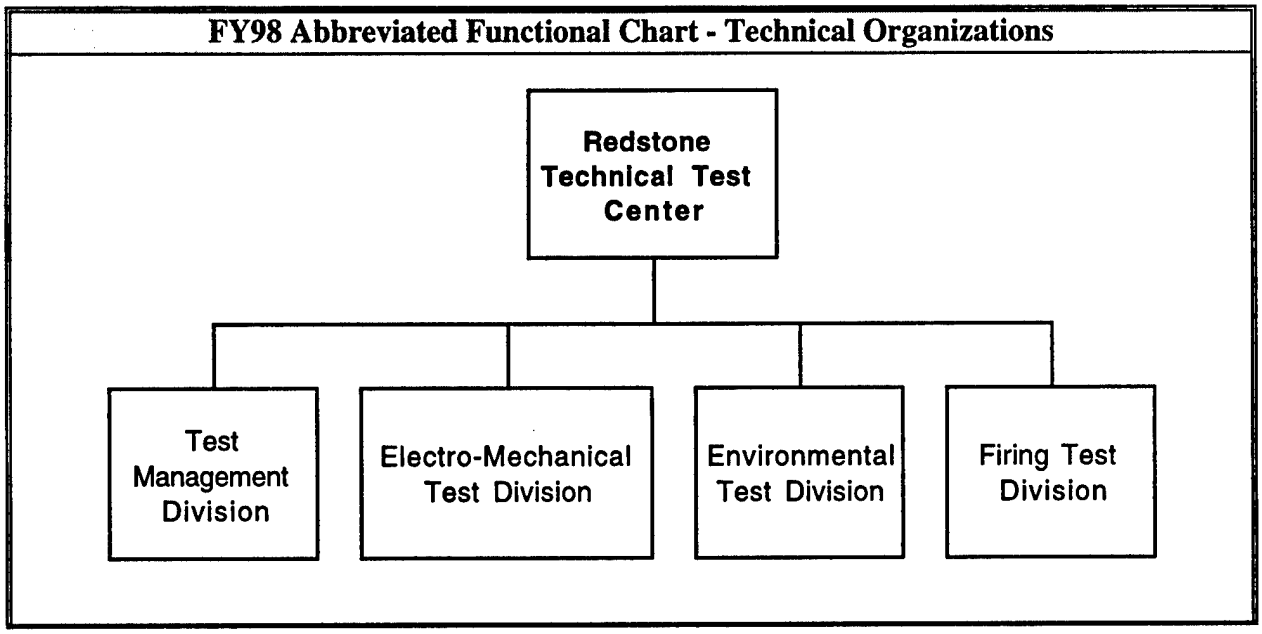
Redstone Technical Test Center



Redstone Technical Test Center
Redstone Arsenal, AL 35898-8052
(256) 876-3552

Director: Carl E. Roberts
Technical Director: Terry B. Farris

MISSION

The mission of Redstone Technical Test Center (RTTC) is to plan, conduct, analyze and report the results of technical tests of subsystems and components of major weapon systems and associated systems and materials; conduct life cycle technical testing of small rockets and guided missiles, and serve as the DOD Lightning Test Facility for hazardous items.

RTTC provides testing and test support for rockets and missile research, development, test and evaluation and other missions of authorized customers within the Department of Defense and outside DoD, to include government and non-government organizations, domestic and foreign.

CURRENT IMPORTANT PROGRAMS

Air-To-Ground Missile System (HELLFIRE).
Air-To-Ground Missile System (LONGBOW).
TOW Missile System.
Improved Target Acquisition System (ITAS).
Improved Bradley Acquisition Subsystem (IBAS).
Javelin Missile System.
Multiple Launch Rocket System (MLRS).
ATACMS/BAT.
MIPM/SRAW.
AMCOM Missile Repair Parts Program.
AMCOM Missile Shelf Life/Surveillance Program.
Enhanced Fiber Optic Guided Missile (EFOG-M).
M72.
Bunker Defeat Munition (BDM).
FOTT.
Super Dragon.
Avenger.
Rapid Force Projection Initiative (RFPI).
Hydra 70.
Stockpile Reliability Programs (SRP).

EQUIPMENT/FACILITIES

Redstone Technical Test Center has extensive equipment/instrumentation for performing complete functional tests in the laboratory and field of weapon system subsystems and components including IR, millimeter wave, and laser seekers and guidance sections, IR and visual target acquisition systems, antennas, fire control systems, gyroscopes, batteries, electronic and mechanical safe and arm devices, passive components, circuit cards, integrated circuits and other electronic, mechanical, optical, and RF devices.

EQUIPMENT/FACILITIES (continued)

Testing can be accomplished at environmental extremes and test methodology is rapidly expanding to incorporate hardware-in-the-loop (HIL) and state-of-art modeling and simulation (M&S) techniques to project subsystem/component test data to system level performance. Specialized and automated test instrumentation is available or can be developed for a particular weapon system application in either a laboratory or remote site environment.

Flight test ranges up to 8km are fully equipped with video and film fixed and tracking cameras, Doppler radars, GPS, telemetry and hard-line instrumentation, and tactical and simulated air and ground targets. A simulation/Test Acceptance facility provides a unique, non-destructive HIL test capability for acceptance testing of all-up-round (AUR) MMW-guided missiles. A 2000 acre, 5km, laser/optical range for designator/sensor testing has an elevated mound, a 75 ft tower with enclosed 2-story cab, and equipment/instrumentation/aircraft for captive carry and dirty battlefield scenarios. State-of-art instrumentation is available to accurately determine aircraft/target/sensor positions, provide atmospheric transmission measurements, determine target-to-background contact measurements, and provide target thermal signatures. Development of high resolution, three dimensional, interactive, validated terrain models of RTTC ranges in the visual, infrared, and MMW bandwidths is in progress.

Facilities for static and dynamic warhead testing are fully equipped with speed cameras and flash radiography. Full range of equipment/chambers is available for nondestructive and climatic testing. Static test facilities can accommodate static and liquid rocket motors up to 150K pounds vertical thrust and 10M pounds horizontal thrust. Rocket motor dissection capability exists and a thermal ablative/ducted rocket engine test facility is nearing completion. Dynamic test capabilities include vibration, shock, drop, centrifuge, and rail impact testing.

E3 facilities conduct EMRH/EMRO, EMI, antenna and RCS measurements. A radar Environment Emulation system housed in a broadband, 100 DB shielded, anechoic chamber provides capability to test weapon systems to high power, pulse modulated EMR environments.

Redstone Technical Test Center
Redstone Arsenal, AL 35898-8052
(256) 876-3552

Director: Carl E. Roberts
Technical Director: Terry B. Farris

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	0.000	N/A	N/A	0.000
6.1 Other	0.000	0.000	0.000	0.000
6.2	0.000	0.000	0.000	0.000
6.3	0.000	0.000	0.000	0.000
Subtotal (S&T)	**0.000**	**0.000**	**0.000**	**0.000**
6.4	0.000	0.000	0.000	0.000
6.5	0.000	0.000	0.000	0.000
6.6	29.124	0.000	0.000	29.124
6.7	0.000	0.000	0.000	0.000
Non-DOD	0.000	0.000	0.000	0.000
TOTAL RDT&E	**29.124**	**0.000**	**0.000**	**29.124**
Procurement	16.647	N/A	0.000	16.647
Operations & Maintenance	3.167	N/A	0.000	3.167
Other	13.719	N/A	0.000	13.719
TOTAL FUNDING	**62.657**	**0.000**	**0.000**	**62.657**

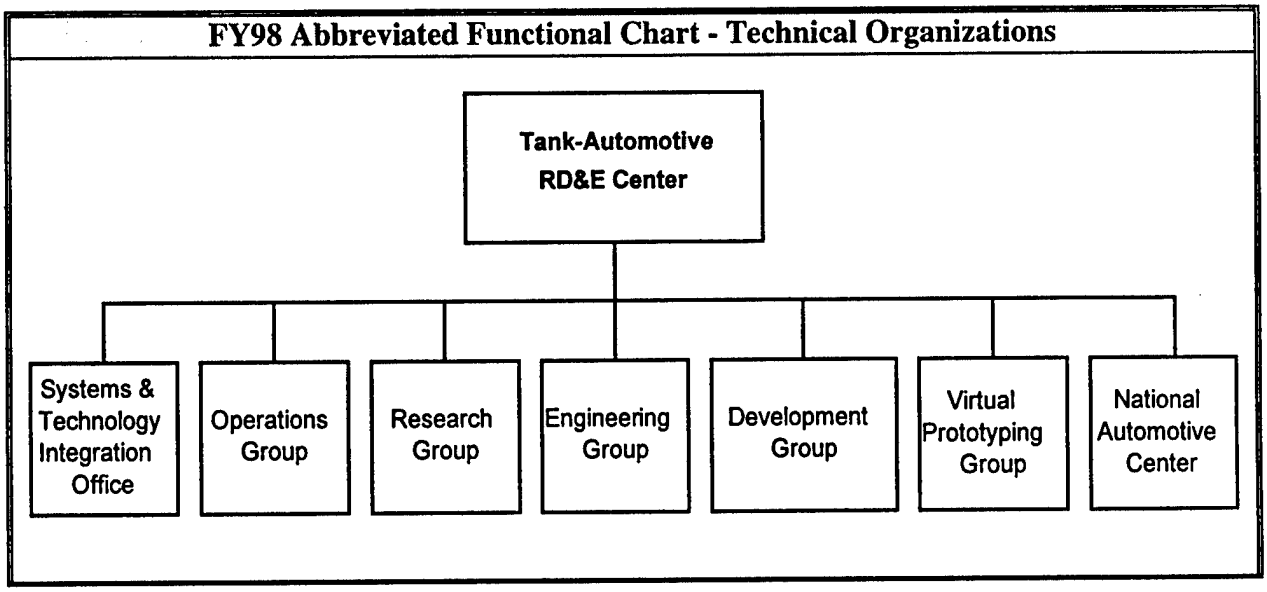
MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	
TYPE	**DOCTORATES**	**OTHER**		**END STRENGTH**
MILITARY	0	0	0	0
CIVILIAN	0	95	50	145
TOTAL	**0**	**95**	**50**	**145**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	580.000	**REAL PROPERTY**	320.000
ADMIN	62.000	* NEW CAPITAL EQUIPMENT	0.000
OTHER	168.000	**EQUIPMENT**	0.000
TOTAL	**810.000**	* NEW SCIENTIFIC & ENG. EQUIP.	0.000
ACRES	**14,000**	* Subset of previous category.	

N/A - Not Applicable

Tank-Automotive Research, Development & Engineering Center



Tank-Automotive Research, Development & Engineering Center
Warren, MI 48397-5000
(810) 574-6144

Commander: MG Roy Beauchamp
Director: Jerry L. Chapin

MISSION

Conduct research, development, and engineering and leverage advanced automotive technology to provide our soldiers with the world's technologically superior ground vehicle systems and logistics support equipment.

Provide the life-cycle management, engineering, and technical support necessary to guarantee continuous system readiness.

Serve as the Army's focal point for all ground system integration of all supporting technologies and subsystems as well as the development of dual-use automotive technologies and their application to military ground vehicles.

Respond to our customer and the broad concerns of the public while providing a safe working environment for our associates.

Conduct our operations prudently and provide quality products and services which meet our customers' expectations.

CURRENT IMPORTANT PROGRAMS

In FY98, TACOM-TARDEC was responsible for six Defense Technology Objectives (DTOs) as well as 8% of the Army's 200 Science Technology Objectives (STOs) which include two Advanced Technology Demonstrations (ATDs). Our six of the eight DTOs for ground vehicles are: Future Scout and Cavalry System, Future Combat Vehicles, Ground Vehicle Electronic Systems, Advanced Ground Vehicle Mobility Systems, Ground Vehicle Chassis and Turret Technologies, and Integrated Hit/Kill Avoidance Optimization. The other two DTOs are the Reconnaissance, Surveillance, and Targeting Vehicle; and Tactical Mobile Robotics which are the responsibility of the US Marine Corps and DARPA, respectively. The two ATDs are the Composite Armored Vehicle (CAV) ATD and Future Scout and Cavalry System (FSCS) ATD.

ADVANCED TECHNOLOGY DEMONSTRATIONS (ATDs) focus TARDEC's Science and Technology (S&T) programs on current and future customer requirements while showcasing technological opportunities for advanced ground vehicle warfighting capabilities.

Future Scout and Cavalry System (FSCS): In FY98, the US and UK signed a Memorandum of Understanding (MOU) establishing the cooperative FSCS/Tactical Reconnaissance Armored Combat Equipment Requirement (TRACER) Program. The Joint Project Office (JPO) described in the MOU is now formally established. An Invitation to Tender (ITT)(UK term for Request For Proposal) for the ATD phase of this program was released to Industry on 9 Jul 98, with the Source Selection commencing in October 98. The acquisition strategy for this ATD is for both countries to fund equal shares and to award ATD contracts to two competitive US/UK consortia. This will enable work to be shared equitably between the industries of both nations. Benefits of this cooperative program include affordable competition, greater program stability, broader technology options, and cost savings. Cost tradeoffs and initial designs will be accomplished in FY99.

Composite Armored Vehicle (CAV): The CAV ATD demonstrator, in FY98, completed 3000 miles of durability testing following the new benchmark achievement in FY97 with a measured 35% structural weight savings over an equivalent all metallic structure with armor. This ATD has demonstrated the

CURRENT IMPORTANT PROGRAMS (continued)

capability to use composites for structural components for vehicles with light and medium threat protection requirements to reduce their Gross Vehicle Weight (GVW) by 10 to 18%. The significance of reduction in GVW will be evident in the resulting improved deployability, increased payloads, survivability enhancement, reduced logistics burden and increased potential for system growth. In FY98, CAV ATD exceeded all its technology goals. The demonstrator's technology has been integrated into future Crusader demonstration/validation designs. Components using the CAV composite technology are being produced for the Crusader test vehicles. Advances in technology completed by the CAV ATD made the design and manufacture of large, integrated composite structural components affordable, producible and supportable for future ground vehicles. Composite technology transfer has occurred with the incorporation of CAV technology into the current Crusader howitzer turret design. Other technology transition opportunities included the Future Scout Cavalry System (FSCS) and the medium class of future ground combat platforms. This ATD was completed in FY98.

TECHNOLOGY DEMONSTRATIONS include TARDEC's non-ATD S&T programs and are formulated by Army agencies as a Science and Technology Objective (STO. Individually approved by the warfighting customer, each STO delivers a measurable new warfighting capability or a cost saving method to streamline ground vehicle acquisition and support investments. Four new STO's awaiting final approval include Full Spectrum Active Protection, Integrated Armor Structure for Light Weight Vehicles, Unified Commander Driver Technology Demonstration and Combat Hybrid Power System. The two STOs completed in FY98 were Improved Water Purification and Composite Armored Vehicle ATD. Other non-STO efforts included robotics and Halon replacement in addition to a significant increase in both collaborative technology with industry and classified efforts. The robotics effort was greatly increased from the FY97 level of effort to continue to develop and demonstrate semi-autonomous and autonomous navigation of vehicle platforms on off-road terrain. The development and demonstration effort continues for a non-ozone depleting substance suitable for a crew compartment explosion and fire suppression agent replacement of Halon 1301.

TECHNOLOGY DEVELOPMENT: The Ground Vehicles subarea of the 1998 DoD Ground and Sea Vehicles Defense Technology Area Plan (DTAP) identifies unique technology efforts, called Defense Technology Objectives (DTOs), critical to the fielding of technologically superior warfighting systems. In FY98, one additional DTO was added, one completed and one terminated. The Combat Hybrid Power Systems (CHPS) was added; Ground Vehicle Chassis and Turret Technologies was completed, and Future Combat Vehicle was terminated. The seven current Ground Vehicle DTOs include Future Scout and Cavalry System (FSCS); Ground vehicle Electronic Systems; Advanced Ground Vehicle Mobility; Integrated Hit/Kill Avoidance Optimization; Tactical Mobile Robotics; Reconnaissance, Surveillance and Targeting Vehicle; and the new addition, the Combat Hybrid Power Systems. The ground vehicle S&T investments were again consolidated in the DTAP.

VEHICLE PERFORMANCE SIMULATION/VIRTUAL PROTOTYPING efforts are centered on exploiting advances in High Performance Computing and Simulation software to analyze and assess wheel and track ground vehicle performance over the entire life cycle of the vehicle system, from concept design through fielded system support. Our expertise in multi-body/flexible body analysis as well as finite element/structural analysis is used to analyze engineering issues as finite as individual component performance, on up to whole vehicle system performance. Our expertise is used extensively to provide new vehicle system Source Selection Authorities additional insight into how proposed vehicle designs will perform while carrying out their directed missions. We are also called in to support Weapon System Managers, Program Managers and other decision makers to provide engineering solutions to problems in the field which preclude their system from meeting its mission requirement. Many of the state-of-the-art simulation tools we have at our disposal have been developed by TARDEC's Virtual Prototyping Group's researchers as part of our ongoing research program that keeps the Army's Simulation capabilities on the cutting edge of the technology. This technology allows TARDEC to provide vehicle system decision makers with timely, accurate answers to their real world engineering questions, thereby keeping the Army's vehicle fleet the safest and most effective in the world.

CURRENT IMPORTANT PROGRAMS (continued)

EMERGING SYSTEMS are based on recommendations of warfighter-lead Integrated Concept Teams (ICTs) sponsored by the US Army Training & Doctrine Command (TRADOC). ICTs this year focused on future systems include: Future Combat System (FCS), Future Scout & Cavalry System (FSCS), and Future Infantry Vehicle (FIV). An ICT also proposed upgrades to the M1 Abrams Main Battle Tank. In addition to ICT recommendations, a Petroleum Quality Analysis system is an emerging logistic system initiated with strong backing from the Combat Service Support warfighter organizations.

- Provided concept and manufacturing drawings, and built prototype combat identification panels for tracked vehicles, and for the HMMWV; designed, produced and fielded combat identification panels to U.S. Army Europe units.
- Provided mine resistant components and panels to the soldiers in Bosnia and other locations. These vehicles provided greater survivability in areas with high concentrations of land mines as experienced in Bosnia and other overseas locations.

SUPPORT TO PEO's included M1A2 System Enhancement Package (SEP), Bradley M2A3, Digitization of the Battlefield, Heavy Dry Support Bridge, Tactical Vehicle Mine Protection. Additional Support to PEOs included:

- Development of a 5000 mile track system specification for Abrams.
- Bradley track pad QPL program.
- M88 T-107 production track investigation.
- Abrams track pad QPL program.
- Abrams quiet sprocket program.
- Electronics architecture and/or embedded mapping consultation to PMs for Abrams, Bradley and CMS.
- Digital map editing station to provide usable, integratable DMA-based maps for embedded vehicle use by PM Abrams and Bradley during M1A2 SEP and M2A3 test and evaluation.
- PLS-based DEMO III truck full-scale hardware development and integration effort was completed including UP horsepower, new transmission, independent suspension, disc brakes and weight reduction concepts.

WEAPON SYSTEM MANAGEMENT and CONFIGURATION CONTROL for 19 systems in development, 34 systems in production/deployment and 2801 systems in sustainment (vehicles and end items). This encompasses over 850,000 military ground vehicles, 300,000 unique spare parts equating to 2.5 billion components (average of 3,000 parts per vehicle). Configuration control was maintained via 934,000 drawings. System support includes: materiel & combat development integration, acquisition, concurrent engineering, manufacturing & producibility engineering, product assurance, engineering data management, validation of technical data, field technical assistance, specifications and standards, tech adaptation/development/integration/transition and test management.

TECHNOLOGY TRANSFER EFFORTS: The Army chartered the National Automotive Center (NAC), a business group of the TARDEC, in 1993 to be the Army's focal point for automotive technology transfer efforts, collaborative research and development with industry, academia and other government agencies. The NAC matches the needs and capabilities of government with the capabilities and needs of industry. The NAC is the Army's principal catalyst for the execution of collaborative research and development in dual-use automotive S&T programs. The NAC's technology transfer strategy is embodied in five major technology programs: Improved Fuel Efficiency; Automotive Vehicle Modernization; Automotive Occupant Safety; Automotive Maintenance and Logistics; and Automotive Manufacturing Innovation. The following projects highlight some relevant initiatives the NAC has undertaken in implementing its technology transfer initiatives:

- Established a cooperative agreement with two major U.S. automobile manufacturers for a joint military/commercial light truck demonstrator program, using advanced commercial technologies.
- Demonstrated technology in thermal imaging in evaluating the performance and condition of tactical vehicle tires, brakes and wheel bearings.

CURRENT IMPORTANT PROGRAMS (continued)

- Continued collaboration with the Automotive Research Center, composed of eight universities, and a U.S. Army center of excellence in modeling and simulation of ground vehicles.
- Hosted an on-site demonstration of the Smart DART, an Army application of voice activated, multimedia Integrated Electronic Technical Manual (IETM) technology under development and evaluation by a major vehicle manufacturer under a dual-use S&T agreement.
- Continued development, demonstration and deployment of the Automotive Product Development Framework (APDF), a comprehensive, integrated virtual prototyping system for ground vehicles with advanced capabilities to automatically integrate and operate existing, dissimilar software products in a unified operating environment.
- Established a cooperative agreement to streamline and re-engineer the Army weapons system and spare part acquisition processes. This initiative was recognized with the Federal Government's "Hammer Award" citing reinvention initiatives.
- Demonstrated military ground vehicle and missile applications of selectively reinforced, silicon carbide whisker-aluminum metal matrix composite (AL-MMC) materials.
- Continued joint TARDEC/industry projects to prolong lead-acid battery life and to reduce their use, through ultracapacitor starting aids, smart electronic battery management, and modeling tools which improve vehicle electrical system behavior.
- Continued research in several areas of diesel engine technology including the evaluation of the High Output Diesel Engine and the insertion of advanced automotive technologies into the Army vehicle fleet to reduce operation and support costs.
- Initiated development of an environmentally-friendly, low-cost waste oil disposal system with recovery of residual waste oil energy for vehicle use.

EQUIPMENT/FACILITIES

TARDEC is the only Army/DOD Tank-Automotive Research, Development and Engineering Center committed to overall ground vehicle technology and integration.

NATIONAL AUTOMOTIVE CENTER, a joint venture with the American automotive industry and TARDEC is leading the way in 'dual use' of critical technologies.

PROPULSION LABORATORY: Provides a centralized physical test support capability for engineering experiments, test programs, and evaluation services in support of the Army's Research, Development, and Engineering programs associated with tracked and wheeled ground vehicle propulsion systems. Comprised of six computer controlled engine, transmission, and driveline dynamometer equipped test chambers, an Air Flow Lab dedicated to air cleaner, heat exchanger, and ballistic grille evaluations, and three dynamometer equipped test chambers dedicated to wheeled and tracked vehicle evaluations. This laboratory features a unique environmentally controlled tracked vehicle dynamometer equipped test chamber with wind, ambient temperature, and solar radiation simulation capabilities. Complete propulsion systems and components testing capabilities are available to address customer requirements during all engineering design phases.

TIRE LABORATORY: Provides full range of tire and roadwheel performance, endurance, and shock testing capability.

EQUIPMENT/FACILITIES (continued)

TRACK and SUSPENSION LABORATORY is used to conduct testing and evaluation of current and prototype combat vehicle components. Specific test systems include a track pad test machine, 1/4 HMMWV suspension test platform, three degree of freedom track loading, torsion bar test and linear shock absorber test. Generic capabilities are available for high static loading and endurance/fatigue test scenarios. Available linear and rotary hydraulic components and instrumentation allow for flexible test design and configuration.

ARMOR INTEGRATION LAB performs armor system fabrication and ballistic testing.

VISUAL PERCEPTION LABORATORY augments available field test data by providing a controlled environment to measure the detectability of signature management systems using trained military observers.

LASER PROTECTION LABORATORY develops and evaluates materials and techniques to harden combat vehicle surveillance vision optics against multiple laser hazards and threats.

ENVIRONMENTAL TEST CELL performs high-temperature performance tests on vehicles.

VEHICLE ELECTRONICS (VETRONICS) LABORATORIES include: Combat Vehicle Systems Integration Lab composed of ADA based vehicle-ready electronics, computer systems, and crew stations for proof-of-principle demonstrations of advanced and open electronic architecture approaches; Crew Station Simulator Lab composed of the following DIS compatible man-in-the-loop virtual simulators and support environments: 2/3 Man Tank, M2A3 HMMWV, MODSAF, ITEMS and virtual world/terrain modeling; Drivers Automation Lab composed of several tactical wheeled and combat vehicle systems with a variety of autonomous and semi-autonomous driving aids and sensors (e.g. collision avoidance system) and a base station for tele-operated field demonstrations.

COMBAT VEHICLE COMMAND AND CONTROL FACILITY provides an automated command and control system for armor/infantry vehicles, a tactical situation display in all vehicles, and supports the Army Horizontal Technology Insertion Program.

TACOM GROUND VEHICLE SYSTEMS SIMULATION LABORATORY houses national resources for full-scale motion based vehicle simulation. The laboratory consists of a variety of simulators to perform man-in-the-loop crew stations turret motion base simulator CS/TMBS is the center piece of this laboratory. This unique 6 degree of freedom simulator is used to reproduce dynamic conditions encountered by combat vehicle crew stations and turret systems (up to 25 tons) and traverses a variety of terrain environments. In addition to the CS/TMBS, a ride motion simulator (installed in FY98), a single crew person, six DOF high fidelity simulator, offers the capability of recreating the ride motion of any land based military vehicle system. In order to perform durability schedules, reconfigurable "poster" simulators are used to provide dynamic load inputs to ground vehicle systems and/or subsystems (tanks/trucks, hulls, frames, etc). In order to better test trailer systems, the laboratory has yet another unique one-of-a-kind capability: the Pintle Motion Base Simulator (PMBS). The PMBS is capable of providing both terrain disturbance inputs and dynamic pintle loads due to truck/trailer interaction.

LIGHTWEIGHT STRUCTURES LABORATORY performs materials test, characterization and assessment of advanced composite materials using state-of-the-art ultrasonic test equipment, Dynatup impact tester and MTS high-capacity load cells using automated advanced data acquisition. Additionally, the laboratory has the capability to prototype and analyze innovative lightweight vehicular structural specimens.

JANUS SIMULATION LAB is used for the evaluation of Advanced Vehicle Technologies in operational scenarios. The lab consists of one server and two player stations allowing up to three players to simultaneously evaluate new system concepts/technologies in force-on-force scenarios.

EQUIPMENT/FACILITIES (continued)

The HIGH PERFORMANCE COMPUTING CENTER (HPC) operates a 64-processor Power Challenge Array (PCA) Parallel Processor computer and is collocated in this facility. It is one of only eleven DoD national shared-resource high-performance computer centers. In addition, this center provides computational capability for real-time inputs needed by the Ground Vehicle System Simulation Laboratory.

VIRTUAL PROTOTYPING LABORATORY is capable of displaying interactive computer-aided design solid model virtual mock-up of present and future ground vehicle systems. A wide range of state-of-the art 3-D stereo display devices (helmet, boom, projection, and holographic) are used for interactive virtual mock-up of vehicle systems and manufacturing facilities. In addition state-of-the art CAD work stations directly networked to the HPC PCA will allow real-time interactive immersive environments for virtual mock-up of vehicle systems.

BRIDGE TEST FACILITY used in testing static or dynamic cyclic loads on various bridge designs.

WATER QUALITY AND WATER TEST CELL LABORATORIES used for the testing of various water filter elements, water filter systems, and providing chemical analytical support to water purification engineer functions.

FUEL EQUIPMENT TEST LABORATORY used for testing and evaluating fuel pumps, fuel filter elements, fuel filter separators, fuel nozzles and engine fuel filter elements.

GREASE AND FLUID LABORATORY performs development, evaluation, and environmental compliance assessments of hydraulic fluids, semi-solid lubricants, solid lubricants, antifreeze, and solvents to enable introduction of new technologies and development of new performance standards.

FUELS AND POWERTRAIN LUBRICANTS LABORATORY performs development, evaluation, and environmental compliance assessments of fuels, alternative fuels, and powertrain lubricants (i.e., engine oils, gear lubricants, and transmission fluids) to enable introduction of new technologies and development of new performance standards.

FUELS AND LUBRICANTS RESEARCH FACILITY (SwRI) a Government-owned, contractor operated facility at the Southwest Research Institute in Texas, is a one-of-a-kind resource where integrated fuels-lubricants-engine systems research and development programs involving combustion, performance characterization, engine cleanliness, vulnerability assessments, and tribology can be performed.

OTHER facilities and equipment include: software engineering, signature, dynamic motion simulator (seat simulator), fabrication, computer-aided design, Laminate Object Manufacturing (LOM) rapid prototyping system, packaging engineering, model shop, metallurgical, mechanical test, animation capabilities used in support of virtual prototyping, rapid prototyping, visualization capabilities, sheet/metal welding, machine shop, assembly shop, electrical, battery test, instrumentation, IR imaging, thermal wave microscopy, applied engineering, scanning electronic microscope, and material spectrum analyzer.

Tank-Automotive Research, Development & Engineering Center
Warren, MI 48397-5000
(810) 574-6144

Commander: MG Roy Beauchamp
Director: Jerry L. Chapin

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	1.052	N/A	N/A	1.052
6.1 Other	1.236	0.000	1.917	3.153
6.2	17.446	8.215	48.264	73.925
6.3	1.191	10.014	29.407	40.612
Subtotal (S&T)	**20.925**	**18.229**	**79.588**	**118.742**
6.4	1.979	1.032	2.052	5.063
6.5	2.577	0.007	1.396	3.980
6.6	2.745	0.000	9.495	12.240
6.7	1.111	0.000	0.709	1.820
Non-DOD	0.000	0.000	0.000	0.000
TOTAL RDT&E	**29.337**	**19.268**	**93.240**	**141.845**
Procurement	17.193	N/A	1.731	18.924
Operations & Maintenance	20.051	N/A	8.518	28.569
Other	13.653	N/A	6.427	20.080
TOTAL FUNDING	**80.234**	**19.268**	**109.916**	**209.418**

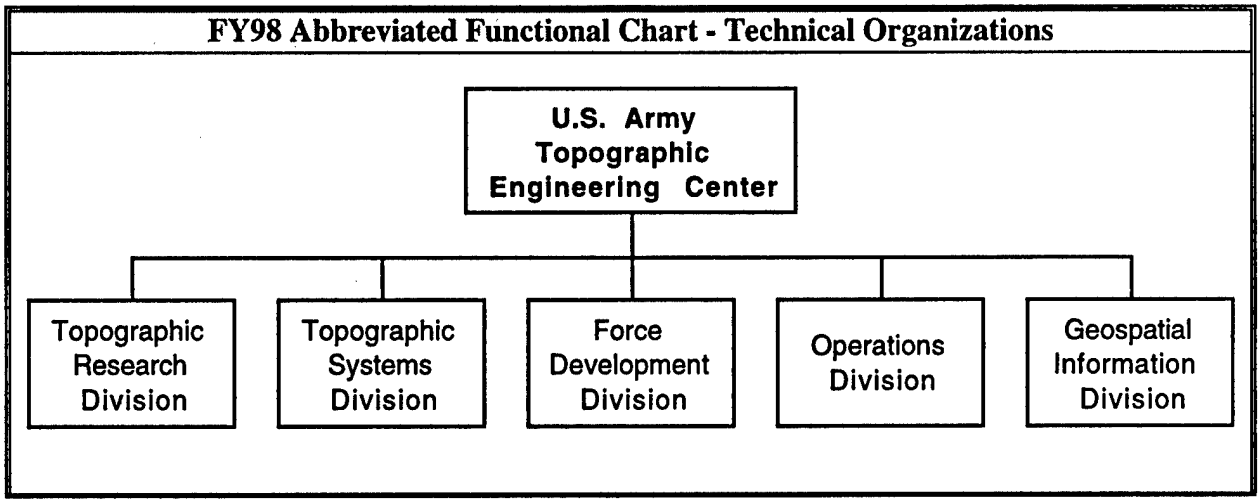
MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	**END STRENGTH**
TYPE	**DOCTORATES**	**OTHER**		
MILITARY	0	4	7	11
CIVILIAN	27	637	433	1,097
TOTAL	**27**	**641**	**440**	**1,108**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	513.949	**REAL PROPERTY**	128.486
ADMIN	174.870	* NEW CAPITAL EQUIPMENT	0.250
OTHER	22.202	**EQUIPMENT**	245.275
TOTAL	**711.021**	* NEW SCIENTIFIC & ENG. EQUIP.	8.650
ACRES	**95**	* Subset of previous category.	

N/A - Not Applicable

Topographic Engineering Center



Topographic Engineering Center
Alexandria, VA 22315-3864
(703) 428-6654

Director: William E. Roper
Commander: COL Gary Thomas

MISSION

The U.S. Army Topographic Engineering Center (TEC) is a field operating activity under the command of the U.S. Army Corps of Engineers (USACE). TEC's mission is to provide America's soldiers and their commanders with superior knowledge of the battlefield and other fields of operation, and to support the nation's civil and environmental initiatives through research, development and the application of expertise in topographic and related sciences. The mission involves research and development (R&D), system acquisition, operations and maintenance (OMA), and civil works programs. Military and civil R&D programs are guided by the USACE Director of Research and Development. System development programs are directed by the Program Executive Officer Command Control Communications Systems (PEO C3S), Program Executive Officer Intelligence and Electronic Warfare (PEO IEW), Deputy Chief of Staff, Operations (DCSOPS), and other agencies. Operations and Maintenance, Army (OMA) programs are under the guidance of the Deputy Chief of Staff for Intelligence (DCSINT) and the Office of the Chief of Engineers - Pentagon.

Vision: The preferred provider of quality geospatial research, development, products, and services.

CURRENT IMPORTANT PROGRAMS

The primary focus of TEC's Military programs is to enhance Army information systems used for Intelligence Preparation of the Battlefield (IPB) through research and development of terrain and terrain-related technologies. Military and civil R&D efforts make extensive use of remote sensing technologies and geospatial data generation and portrayal. Research and development is focused on creating the fastest, most accurate, efficient, and direct acquisition and transfer of information possible - from its source to the user in the field. These R&D areas include: rapid generation of accurate geospatial data; high-accuracy elevation data acquisition; terrain analysis and characterization; passive and active spectral signature identification; photogrammetry; terrain visualization; battlefield and terrain related simulation and modeling; precision surveying and mapping; image analysis; data management; geographic information systems; and data/image fusion. As USACE's Center of Expertise in surveying and mapping, TEC provides support to Corps of Engineer headquarters, divisions, and districts, as well as other civil agencies, to develop and test new technology and systems, to ensure consistency of surveying and mapping products, to maintain the capability to manage complex, nation-wide survey systems, and to allow for the expert data analysis. TEC also has skills in systems engineering, acquisition management, sustainment, and support. TEC provides developmental and demonstration support to PM, Joint Precision Strike, developmental support to the Army Space Program Office and PEOC3S for the Combat Terrain Information Systems.

Operationally TEC serves as the Army's primary agent for terrain analysis and the Department of Defense's (DoD) primary agent for water detection. Support for contingency plans, military operations, and Stability and Support Operations is provided to terrain teams, DoD, DA staff, MACOMs, and joint commands. TEC serves as the Army's technical expert to combat and materiel developers and field topographic units and other users of geospatial information for both training and military operations, and for Operations Other than War. TEC provides technical leadership for the orderly, cost effective integration of digital terrain data into Army systems and activities, and advises the Department of the Army Headquarters on all technical aspects of geospatial information requirements and standards.

CURRENT IMPORTANT PROGRAMS (continued)

TEC Technology Transfer in FY98: The Office of Research and Technology Applications within the Technical Plans & Programs Office has the responsibility for managing Technology Transfer (T2). Executed three new Cooperative Research and Development Agreements (CRADAs) with: EarthWatch, Inc. - purpose was for TEC personnel to evaluate samples of commercial satellite imagery and provide feedback regarding image product characteristics for rapid use by military users; Virginia Institute of Marine Science - purpose was to further develop remote sensing techniques to detect and analyze specific terrain conditions; and EarthData Technologies, LLC - purpose was to establish calibration procedures and techniques for digital photogrammetric cameras. Prepared and presented TEC's 2d annual in-house T2 training for engineers and scientists. Topic areas included terminology, concepts, responsibilities, statutory and regulatory basis, process, intellectual property, and current TEC T2 agreements. Training included presentations by the Humphreys Engineer Center Support Activity Office of Counsel and the Corps of Engineers Intellectual Property Counsel. Developed and coordinated TEC Domestic T2 Policy. Provided the Deputy Regional Coordinator to the Federal Laboratory Consortium (FLC) Mid-Atlantic Region and the FLC Training Committee chair. The Training Committee chair serves on the FLC Executive Board in a voting capacity. Served in a membership status on Training Committee of the DoD T2 Integrated Planning Team. Nominated TEC Director, Dr. William E. Roper, to serve on the FLC National Advisory Group (NAG) whose purpose is to provide leadership in technology transfer activities and be spokesperson for T2 at the national level. Participated in an Office of Personnel Management seminar on advanced T2 strategies.

EQUIPMENT/FACILITIES

TEC's facilities include data communications/networking, home page services, Intelink services, spectral research laboratory, Global Positioning System (GPS) equipment, the Terrain Information Extration System (TIES), the Collection Management Office (CMO), the Integration and Evaluation Center (IEC), and state-of-the-art capabilities for communications and imagery examination, exploitation, and dissemination. TEC has very high speed, high throughput internal and external connectivity to satisfy unclassified data communication requirements, accomplished by the Asynchronous Transmission Mode (ATM) Local Area Network. The ATM LAN consists of a high-band width fiber optic backbone extending throughout the TEC facility, fiber optic cabling throughout the annex (to meet accreditation requirements) and Category V twisted-pair cabling to the desktop in the collateral area. TEC's Home Page provides access to a wide range of information on geospatial information, commercial imagery, geographic data and imagery collection services, geographic freeware distribution, 3-D model library, DrawLand software, and the Survey of Terrain Visualization Software report. TEC has presence on the Intelink, a classified information service modeled after the World Wide Web and sponsored by the intelligence and military communities. Services offered by TEC on the Intelink include military geographic intelligence, terrain analysis and water resources products, special crisis management products, national and commercial imagery collection services, and the Multispectral Imagery Desert Guide. TEC's spectral research facility contains a Digital Multi-Spectral Video camera, and multiple spectral radiometers and fluorometers used in studying both passive and active phenomena in the visible, near infrared, and thermal electromagnetic regions. TEC has eight (8) geodetic-quality GPS receivers, permanent differential GPS reference stations with broadcast capabilities, and conventional survey equipment. The TIES provides a capability for extracting up-to-date terrain data from remotely sensed images. The Collection Management Office (CMO) provides TEC the capability to rapidly query status and order National Imagery in hardcopy or softcopy formats. The IEC complex is an accredited processing facility that provides extensive computational resources to support technology development, integration, demonstration, and evaluation. It currently hosts the RTB-ACTD Testbed, the TPSO-ACTD Testbed and the STOW-ACTD SEEDS. It uses commercial wideband and tactical communications links (e.g. T-1 lines, DISN, VAST, FAST, and Trojan Spirit) to provide connectivity with live exercise activity and distributed simulation networks that support Army and exercise control, data collection and analysis,

EQUIPMENT/FACILITIES (continued)

environmental/system simulation, and presentation/visualization for the Joint exercises and acts as the central hub of the demonstration network. The network includes links to several DoD and service facilities (e.g. D&SABL, WAIC, USACOM, AF and Navy). Through the Imagery and Geospatial Data Exploitation Testbed (IGDED), the warfighter will be provided with the technologies needed to achieve superior knowledge of the battlefield through more timely collection, exploitation, and dissemination of imagery and geospatial data and products. Within the IGDED new imagery evaluation and examination tools have been installed and integrated, and imagery received, and national tasking capabilities have been added. TEC's computer inventory includes many powerful independent work stations as well as personal computers for the majority of the workforce.

Topographic Engineering Center
Alexandria, VA 22315-3864
(703) 428-6654

Director: William E. Roper
Commander: COL Gary Thomas

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	0.169	N/A	N/A	0.169
6.1 Other	1.362	0.028	0.636	2.026
6.2	5.908	0.806	4.855	11.569
6.3	0.565	1.790	12.210	14.565
Subtotal (S&T)	**8.004**	**2.624**	**17.701**	**28.329**
6.4	0.302	0.034	0.994	1.330
6.5	0.076	0.093	0.095	0.264
6.6	1.993	0.000	2.962	4.955
6.7	0.752	0.015	0.000	0.767
Non-DOD	0.000	0.000	0.000	0.000
TOTAL RDT&E	**11.127**	**2.766**	**21.752**	**35.645**
Procurement	1.670	N/A	0.029	1.699
Operations & Maintenance	11.187	N/A	2.696	13.883
Other	2.569	N/A	0.249	2.818
TOTAL FUNDING	**26.553**	**2.766**	**24.726**	**54.045**

MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.192

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	
TYPE	**DOCTORATES**	**OTHER**		**END STRENGTH**
MILITARY	0	4	6	10
CIVILIAN	10	182	153	345
TOTAL	**10**	**186**	**159**	**355**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	88.776	**REAL PROPERTY**	22.400
ADMIN	35.081	* NEW CAPITAL EQUIPMENT	0.000
OTHER	53.134	**EQUIPMENT**	20.820
TOTAL	**176.991**	* NEW SCIENTIFIC & ENG. EQUIP.	1.821
ACRES	**0**	* Subset of previous category.	

N/A - Not Applicable

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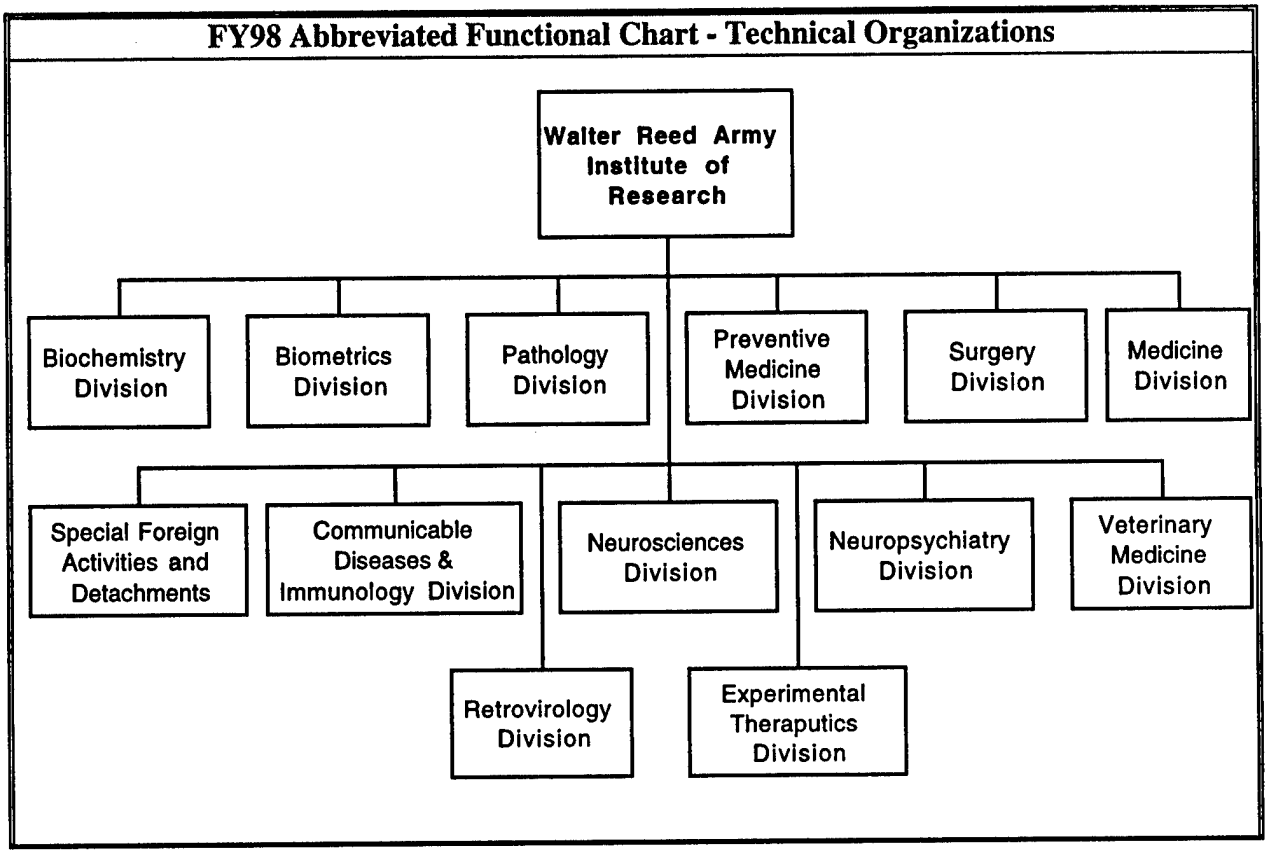
Walter Reed Army Institute of Research



Walter Reed Army Institute of Research
Washington, DC 20307-5100
(202) 782-3551

Director: COL Martin H. Crumrine
Deputy Director: COL Daniel L. Jarboe

MISSION

The Walter Reed Army Institute of Research (WRAIR) has one primary mission: biomedical research focused on soldier health and readiness. Whether in full-scale war or in other operations, the WRAIR provides America's fighting men and women with the tools and knowledge to survive in hostile, disease-ridden, and health-threatening environments. The Institute fulfills its mission by conducting innovative research in naturally occurring infectious diseases, combat casualty care, operational health hazards, and medical defense against chemical and biological weapons.

CURRENT IMPORTANT PROGRAMS

Conduct research and develop drugs and vaccines to protect against infectious diseases to deployed soldiers.

Conduct research and develop means to prevent operational stress in the combat environment.

Conduct research and develop technologies for far forward combat casualty care and evacuation.

Conduct research and develop strategies and technologies to prevent injuries from blast and directed energy sources and prevent progressive damage following traumatic wounds.

Conduct research to develop medical strategies for the protection of soldiers from chemical and biological warfare threats.

Evaluation of military health hazards of Army weapon systems and manpower programs, in coordination with AMC, TRADOC, and ODSCPER.

Transfer military medical science and technology into commercially viable products through cooperative research and development agreements, (CRADAS) outreach programs, and patent licensing, such as CRADAS with commercial companies on the development of drugs and vaccines to prevent malaria.

There are approximately 21 persons assigned to WRAIR under CRADAs.

EQUIPMENT/FACILITIES

Complete analytical chemistry capability to include gas chromatography and mass spectrometry; drug development from computer-aided drug design and synthesis to field testing for efficacy and safety; vaccine development from basic research and computer assisted recognition of relevant vaccine candidates to biological model development and production, testing and production, testing and licensing; complete infectious disease diagnosis to include isolation and culture of causative agents and physiological, serological and genetic diagnosis; perform comprehensive human behavioral research studies both in the laboratory setting and in the field; evaluate health hazards from blast, toxic, gas, and laser energy as well as materiel, and approaches to combat casualties from these same sources; perform complete epidemiology on military medical threats and accidents from infectious diseases and toxins; through pathological evaluation to include histophathological diagnosis and transmission and scanning electron microscopy studies; basic research studies into the pathophysiology of disease utilizing modern cell physiology and hematological techniques; testing of drugs, vaccines and medical doctrine in overseas locations in Brazil, Germany, Thailand and Kenya.

EQUIPMENT/FACILITIES (continued)

Facility Locations:

A. WRAMC AND FOREST GLEN

Headquarters and site of main research programs. The full spectrum of biomedical research is conducted to include: infectious disease and vaccine development research, HIV research, operational medicine, combat casualty care, and medical and chemical biological defense research.

B. CONUS DETACHMENTS

- Wright Patterson Air Force Base - Occupational toxicology research.
- Brooks Air Force Base - Medical effect of laser and microwave irradiation.
- Blood Storage Preservation Research - located in leased space in Rockville.
- Dental Research Detachment - Great Lakes, IL (Naval Base).

C. OCONUS DETACHMENTS

- US Army Medical Research Unit (USAMRU) - Germany - Operational Stress and Human Dimensions Research related to Operational Medicine.
- USAMRU - Kenya - Infectious diseases endemic to Sub-Saharan Africa.
- USAMRU - Brazil - Infectious diseases endemic to South America including malaria, leishmaniasis, dengue, shigella, and enteric diseases.
- Armed Forces Research Institute of Medical Sciences (AFRIMS) - Bangkok Thailand - Infectious diseases and vaccine development for those diseases endemic to Southeast Asia to include malaria and HIV.

Walter Reed Army Institute of Research
Washington, DC 20307-5100
(202) 782-3551

Director: COL Martin H. Crumrine
Deputy Director: COL Daniel L. Jarboe

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	2.221	N/A	N/A	2.221
6.1 Other	10.118	0.000	0.000	10.118
6.2	40.564	0.000	0.000	40.564
6.3	10.330	0.000	0.000	10.330
Subtotal (S&T)	**63.233**	**0.000**	**0.000**	**63.233**
6.4	1.006	0.000	0.000	1.006
6.5	0.066	0.000	0.000	0.066
6.6	0.000	0.000	0.000	0.000
6.7	0.000	0.000	0.000	0.000
Non-DOD	0.000	0.000	0.000	0.000
TOTAL RDT&E	**64.305**	**0.000**	**0.000**	**64.305**
Procurement	0.000	N/A	0.000	0.000
Operations & Maintenance	0.000	N/A	0.000	0.000
Other	12.873	N/A	0.000	12.873
TOTAL FUNDING	**77.178**	**0.000**	**0.000**	**77.178**

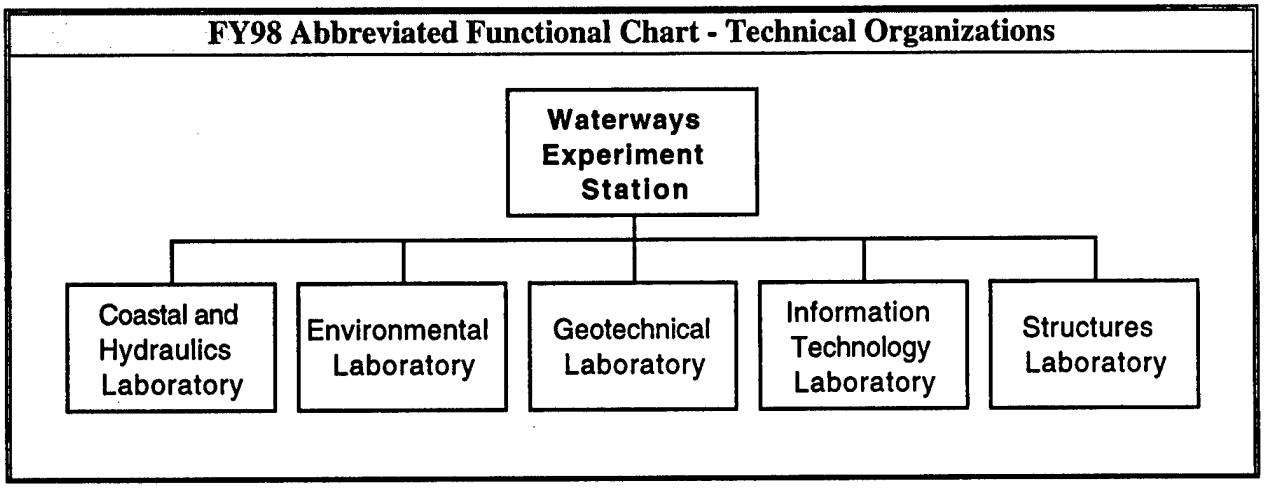
MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	**END STRENGTH**
TYPE	**DOCTORATES**	**OTHER**		
MILITARY	84	69	231	384
CIVILIAN	82	97	220	399
TOTAL	**166**	**166**	**451**	**783**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	403.544	**REAL PROPERTY**	12.882
ADMIN	178.372	* NEW CAPITAL EQUIPMENT	0.000
OTHER	151.472	**EQUIPMENT**	64.690
TOTAL	**733.388**	* NEW SCIENTIFIC & ENG. EQUIP.	0.379
ACRES	**0**	* Subset of previous category.	

N/A - Not Applicable

Waterways Experiment Station



Waterways Experiment Station
Vicksburg, MS 39180-6199
(601) 634-2504

Director: Dr. Robert W. Whalin
Commander & Deputy Director: COL Robin R. Cababa

MISSION

The US Army Engineer Waterways Experiment Station (WES) is the largest Civil Engineering/Environmental Quality R&D complex in the Nation and is the DoD Category 3 Reliance lead Laboratory in the Civil Engineering Areas of Airfields and Pavements, Survivability and Protective Structures, and Sustainment Engineering. WES is the DoD Reliance lead Laboratory in the Environmental Quality subarea for Installation Restoration. WES operates and maintains the first DoD High Performance Computing Major Shared Resource Center for the Director, Defense Research and Engineering. The Tri-Service Computer Aided Design Drafting and Geographic Information System Technology Center is managed, operated and maintained by WES. The Corps of Engineers Central Processing Center is operated and maintained for the purpose of processing management information systems information for about 60% of Corps offices worldwide. WES manages 7 DoD Information Analysis Centers (IAC): Airfields, Pavements, and Mobility (IAC); Coastal Engineering (IAC); Concrete Technology (IAC); Hydraulic Engineering (IAC); Soil Mechanics (IAC); Environmental (IAC); and the Shock and Vibration (IAC). The US Army Centrifuge Research Center is managed, operated, and maintained by WES. WES manages and executes 85% of the Army Corps of Engineers Civil Works Research and Development Program in the areas of hydraulic, coastal, geotechnical, structural, and environmental engineering, and information technology. Primary research and development missions encompass weapons effects; fighting positions; terrorist threat protection; structural hardening; fixed facility camouflage, concealment, and deception; bridge assessment and repair; vehicle/terrain interaction; military hydrology; lines of communications, construction, and repair; airfields and pavements; coastal engineering; coastal oceanography; littoral processes; hydraulic engineering; flood control and navigation; dynamic modeling and simulation; environmental impact; environmental restoration, aquatic plant control, zebra mussels, recreation, dredging and contaminated sediments; groundwater modeling; engineering geology; wetlands processes; environmental and geotechnical site characterization; ecosystem processes; reservoir, riverine, estuarine, and coastal water quality; mobility analyses; seismic response of structures; earthquake engineering; dredging and dredged material disposal; natural resources management; concrete technology; structural dynamics; and geotechnical engineering.

CURRENT IMPORTANT PROGRAMS

Unparalleled synergism exists between the $106M US Army Civil Works R&D Programs (listed as Non-DoD under FUNDING DATA) and the other DoD RDTE. Construction materials and methods for rapid establishment of in-theater transportation network required for force protection; designs, materials, and construction practices for force protection (on the battlefield, from terrorist threats, and against advanced conventional weapons); engineer operations planning software for inclusion in the Army Tactical Command and Control System; accurate and reliable PC-based mobility models for command and control systems, combat models and simulations, and virtual prototyping; methodologies to predict coastal effects on Logistics-Over-The-Shore operations; Airfields and Pavements research for durable and cost-effective pavements for roads, airfields, and other operating surfaces including the development of design criteria for semi-prepared operating surfaces for the C-17 aircraft; effective remediation of sites contaminated with explosives, organics, and heavy metals; methods for investigation, characterization, and monitoring of potential hazardous waste sites; prediction of subsurface transport of contaminants in subsurface groundwater; effective chemical analysis techniques for accurate identification of suspected contaminants at DoD sites; Materials/Structural Engineering; Innovative Design and Construction; National Wetlands Characterization and Restoration; Zebra Mussel research; Repair, Evaluation, Maintenance, and Rehabilitation; Aquatic Plant Control research; Earthquake Engineering research, tunnel and under-ground facility detection research; and the Dredging Operations

CURRENT IMPORTANT PROGRAMS (continued)

and Environmental Research Program. Technology Transfer Activities include: seventeen Cooperative Research and Development Agreements approved in FY98 (four are awaiting approval and 31 are others are active). Four new Patent License Agreements were approved, and three additional Patent License agreements were in negotiations.

EQUIPMENT/FACILITIES

The US Army Engineer Waterways Experiment Station (WES) has an unmatched combination of experimental and computational facilities for research in hydraulic, geotechnical, structural, environmental, and coastal engineering, and information technology. Some of the more significant facilities are:

Hazardous and Toxic Waste Research Center (HTWRC) (17,000 sq ft): This is the only DoD-permitted (RCRA) facility to conduct large volume HTW research, development, test, and evaluation. EPA recognizes the HTWRC as the Nation's premier facility. An 8,000 sq ft addition to this facility will be completed in FY99.

Environmental Chemistry Laboratory: a new 22,000 sq ft analytical chemistry research and testing facility was constructed in Vicksburg, MS in FY98. The new facility houses state-of-the-art equipment to address DoD research, analytical, and quality assurance requirements for environmental quality, contaminated sediments, and environmental restoration facilities. This laboratory meets the demands for high hazard research (i.e. dioxins and dibensofurans) and at detection levels that meet requirements of health and regulatory risk-based hazardous risk assessments. The Corp's Chemistry Quality Assurance facility, with 20,000 sq feet of chemistry laboratories, located in Omaha, NE, was realigned with WES in March 1998. Together, these chemistry laboratories provide one-stop-services for all environmental design and construction quality assurance during the engineering design and construction or environmental projects within the DoD.

Fate and Effects R&D Center (30,000 sq ft): Complete experimental radioisotope, microbiology, toxicity, and instrumentation laboratories for investigations of contaminant fate and effects on ecosystems.

DoD High Performance Computing Major Shared Resource Center (55,000 sq ft): Includes multiple, state-of-the-art High Performance Computing systems which provide the most powerful scientific and engineering capability in DoD with 47000+ Megabytes of memory, 6,700 Gigabytes of high-speed disk, and 500 Terabytes of high-speed robotic archival storage. Includes a $4.1M Scientific Visualization Center to identify and develop innovative methods of interpreting large data sets from modelings/simulation, field data collection, and Computer Aided Design and Drafting (CADD) applications.

Airfields & Pavements Research Center (25,000 sq ft): State-of-the-art facility contains the DoD unique Joint Sealant Laboratory and an Automated Data Acquisition System for acquiring rheological data on creep, strength, resilient moduli, and fatigue of a variety of paving materials.

Soils Research Center (10,000 sq ft): The largest soil mechanics research facility in DoD, it has a loading capability of 250,000-lb on triaxial specimens up to 15 inches in diameter. Also included are direct shear devices for 3 to 24 inch specimens, automated consolidometers and rock-testing capabilities including anchor pullout tests.

Mass Construction Materials Laboratory (20,000 sq ft): A concrete research and development laboratory for determining physical, chemical, and mineralogical properties of concrete and other construction materials as well as the structural response of subscale models.

EQUIPMENT/FACILITIES (continued)

Full-Scale Aircraft Loading Facility: Simulates aircraft loading with different wheel loads and gear geometry applied to full scale constructed test pavements; response and performance data for development of new design and behavior theories; current fighter and transport aircraft simulators.

Heavy Vehicle Simulator-Aircraft: The largest portable automated trafficking device in the world capable of replicating multiple or single aircraft or vehicle traffic. This device can apply over 1 million passes on a pavement section in 5 months to provide valuable data for predicting long-term pavement life.

Projectile Penetration Facility: Unique to DoD, this facility enables investigation of anti-penetration shielding technology techniques employing geologic and manmade structural materials against a wide variety of threats. An 83-mm diameter gas gun has the capability of launching projectiles with masses up to 6.2 lbs at velocities in excess of 6562 ft/sec and launching projectiles with masses of 26.5 lbs at velocities of 3280 ft/sec.

Coastal Facilities: Approximately 400,000 sq ft under roof for 3-D high-precision coastal experiments. Contains over 850-ft of spectral wave generators (including a 90-ft long Directional Spectral Wave Generator) designed to reproduce waves of 2-ft in height.

Field Research Facility, Duck, NC (175 acres): Recognized worldwide for cooperative multi-national and multi-agency high precision field experiments in coastal and nearshore processes; 1970-ft concrete and steel pier, 1 mile of beachfront, full suite of installed coastal processes instrumentation, special purpose beach and amphibious vehicles, etc.

RipRap Experimental Facility: The largest curved channel experimental facility in the world, used for study of effects of channel bendways on flow fields, specifically aimed at developing design criteria for riprap protection of bendways.

Hydraulic Engineering Experimental Facilities: Approximately 2,500,000 sq ft under roof for high-precision experiments relating to rivers, estuaries, hydraulic structures, and navigation.

Mobility Instrumentation Facility: 30,000 sq ft complex for conducting research and development investigations of cross-country mobility, trafficability, and terrain data acquisition. This research requires complex design and fabrication of real-time data collection and analysis hardware unique to quantifying the performance of all types of wheeled, tracked, and amphibious military vehicles. A 14,000 sq ft annex is optimally structured to support modeling and simulation in distributive interactive simulations and virtual prototyping in support of battlefield automation.

Aquatic and Wetlands Ecosystem Research Center: 10,000 sq ft research center provides the capability to evaluate the impact of DoD activities on aquatic and wetland ecosystems, including impacts on threatened and endangered species, and wetland identification, delineation, and evaluation.

Geosciences Research, Applications, and Test Facility: The most extensive near-surface geophysics equipment and applications capability in DoD. Specializing in engineering, environmental, archeological, and groundwater geophysics, and geology, the facilities support the DoD requirements for foundation investigations, installation restoration, cultural resource assessments, military groundwater supply, tunnel detection, and environmental site characterization. In addition, a 15,000 sq ft Engineering Geophysics Training Facility consisting of metallic and non-metallic targets buried at various depths and orientations, is used for evaluating geophysical instruments and providing hands-on training with the equipment.

US Army Centrifuge Research Center: Uniquely large and powerful, the research centrifuge weighs 85 tons and has a 21-ft radius; it can apply a maximum g-force of 1256 g-tons operating at 350g's for a 2.2 ton payload and at 143g's for an 8.8 ton payload (1g = normal gravity). A 27.5-year event can be replicated in one day operating at 350g's. Research applications include all areas of civil and

EQUIPMENT/FACILITIES (continued)

environmental engineering with particular focus on earthquake engineering, coastal engineering, structural engineering, blast phenomena, and groundwater behavior.

Mobile Ballistic Research System: provides the DoD with the capability to conduct projectile penetration field experiments at geologic sites of interest. The truck-mounted, breach-loaded ballistic gun can launch large-scale (up to 155-mm) projectiles at velocities as high as 3280 ft/sec. Associated diagnostic instrumentation and analysis hardware are contained within a support trailer.

Geodynamics Research Facility: unique to DoD, this facility houses a wide variety of high-pressure dynamic devices that simulate explosive loadings under controlled stress states on geologic and man-made construction materials. The characterization of their material behavior is required for weapons effects assessment against military fixed assets.

TeleEngineering Operations Center: Unique to DoD, this facility can provide the warfighter with solutions to complex, real-world engineering problems using the entire Corps of Engineers knowledge base capabilities through classified and unclassified computer networks and high performance computing assets. Rapid response problems beyond in-theater expertise will be provided using existing C2 architecture.

Waterways Experiment Station
Vicksburg, MS 39180-6199
(601) 634-2504

Director: Dr. Robert W. Whalin
Commander & Deputy Director: COL Robin R. Cababa

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	0.227	N/A	N/A	0.227
6.1 Other	2.553	0.042	1.687	4.282
6.2	42.878	0.527	41.981	85.386
6.3	13.788	0.221	21.964	35.973
Subtotal (S&T)	**59.446**	**0.790**	**65.632**	**125.868**
6.4	0.000	0.000	0.000	0.000
6.5	0.000	0.000	0.000	0.000
6.6	4.879	0.000	0.378	5.257
6.7	0.000	0.000	0.000	0.000
Non-DOD	82.170	1.141	22.948	106.259
TOTAL RDT&E	**146.495**	**1.931**	**88.958**	**237.384**
Procurement	0.000	N/A	14.563	14.563
Operations & Maintenance	12.173	N/A	8.498	20.671
Other	0.283	N/A	0.322	0.605
TOTAL FUNDING	**158.951**	**1.931**	**112.341**	**273.223**

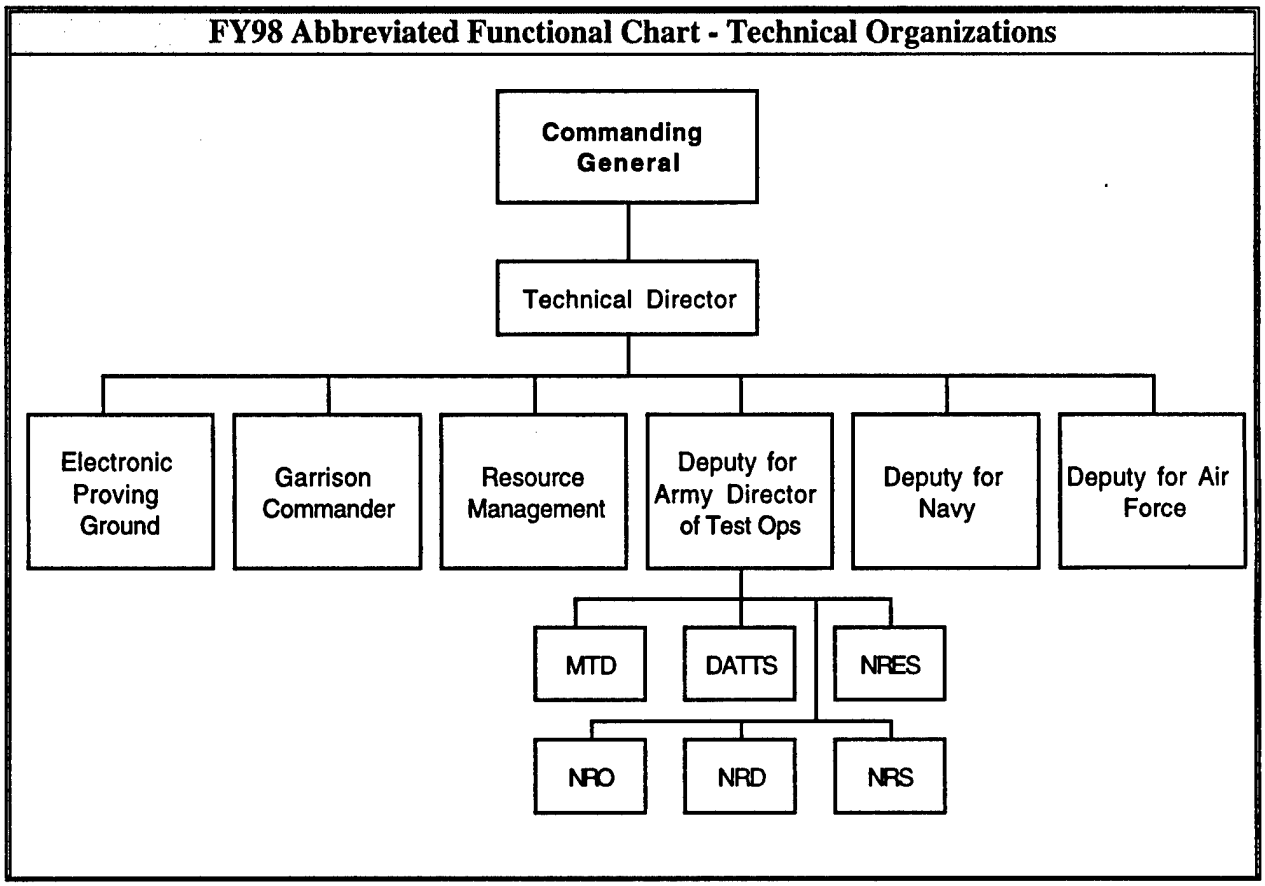
MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.588

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	**END STRENGTH**
TYPE	**DOCTORATES**	**OTHER**		
MILITARY	0	7	1	8
CIVILIAN	178	468	577	1,223
TOTAL	**178**	**475**	**578**	**1,231**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	2,213.413	**REAL PROPERTY**	501.622
ADMIN	297.071	* NEW CAPITAL EQUIPMENT	1.855
OTHER	214.324	**EQUIPMENT**	567.676
TOTAL	**2,724.808**	* NEW SCIENTIFIC & ENG. EQUIP.	2.634
ACRES	**2,680**	* Subset of previous category.	

N/A - Not Applicable

White Sands Missile Range



White Sands Missile Range
White Sands, NM 88002-5000
(505) 678-7900

Commander: BG Harry D. Gatanas
Technical Director.: George A. Orlicki

MISSION

The U.S. Army White Sands Missile Range provides quality test and evaluation, research, and other technical services to the Army and Department of Defense (DOD) acquisition programs.

The White Sands Missile Range, a unique and strategic national asset, is "America's Range" for the 21st Century. We will ensure our war fighters have the best military equipment possible by providing the highest quality and most cost effective test, evaluation, research, and technical services. We will continue to emphasize customer focus, sound resource management, innovative use of technology, modernized infrastucture, stewardship of our land, and superior quality of life.

CURRENT IMPORTANT PROGRAMS

Army-Patriot.
Army Tactical Missile System (ATACMS).
Theater High Altitude Area Defense (THAAD).
Advanced Medium Range Air-to-Air Missile (AMRAAM).
Standard Missile (SM).
Multiple Launch Rocket System (MLRS).
Theater Missile Defense Programs (TMDP).
Research Rockets.
Advanced Short Range Air-to-Air Missile (ASRAAM).
Extended Sea Sparrow Missile (ESSM).
Space Shuttle and Tactical Training Program.
Unmanned Aerial Vehicle.
Army Tactical Command and Control System.
Enhanced Position Location Reporting Systems.
Global Positioning System.
All Source Analysis System.
Single Channel Ground and Airborne Radio Systems.
Intel and Electronic Warfare.
Counter Technology Assessment Center Support to Office of National Drug Control Policy (Cactus Wren).
Advanced Warfighting Experiments.
Satellite Test Bed.
Digitization of the Army.

EQUIPMENT/FACILITIES

White Sands Missile Range, including the Electronic Proving Ground, Fort Huachuca, Az., has a variety of equipment, facilities and features that make it a premier test range. These features include: the largest overland test range, WSMR managed restricted airspace and varied terrain features. The White Sands Missile Range also has range instrumentation which includes instrumentation and airspace surveillance radar, fixed and mobile telemetry instrumentation, remote-controlled optical tracking mounts, modeling and simulation development facilities, and range and target control instrumentation. The White Sands Missile Range also has a complete environmental and scientific laboratory suite (including a Microbiological Test Chamber, Large Environmental Test Chamber, Chemistry Lab, Metallurgy Lab, and Dynamics Lab)and the Directorate of Applied Technology, Test and Simulation (DATTS)has testing facilities such as the Solar Furnace, Electromagnetic Pulse, Linear Electron Accelerator, Electromagnetic Radiation Effects transmitters and the Large Blast Thermal Simulator. Big Crow is an airborne electronic warfare asset that includes and aircraft and helicopters. WSMR is also the site of the Aerial Cable Range, a three mile cable suspended from two mountain peaks. The Smart Munitions Test Suite allows us to track submunitions.

At our Electronic Proving Ground site we conduct comprehensive testing of C4I equipment and systems. We use a combination of field testing bench-type testing and modeling & simulation to test the large distributed digital systems being proposed for and fielded with the Army digital divisions of the future. We also test unattended Arial vehicles, GPS receivers, emergency beacon systems, individual radios, intelligence systems, and the functioning of various navigation systems. Facilities available include a state-of-the-art antenna facility, an EMI/EMC/Tempest test facility, a computer modeling and simulation capability, a communications test bed, and an instrumented test range. EPG is also the site of a 12,000 foot paved runway, a number of short UAV runways and the US beacon testing facility for the verification of commercial emergency rescue beacons.

White Sands Missile Range
White Sands, NM 88002-5000
(505) 678-7900

Commander: BG Harry D. Gatanas
Technical Director: George A. Orlicki

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	0.000	N/A	N/A	0.000
6.1 Other	0.000	0.000	0.000	0.000
6.2	0.806	0.000	0.267	1.073
6.3	4.323	0.000	2.876	7.199
Subtotal (S&T)	**5.129**	**0.000**	**3.143**	**8.272**
6.4	5.666	0.000	4.929	10.595
6.5	142.043	0.000	74.761	216.804
6.6	0.000	0.000	0.000	0.000
6.7	0.000	0.000	0.000	0.000
Non-DOD	13.305	0.000	70.911	84.216
TOTAL RDT&E	**166.143**	**0.000**	**153.744**	**319.887**
Procurement	15.582	N/A	3.069	18.651
Operations & Maintenance	5.749	N/A	3.343	9.092
Other	3.199	N/A	0.322	3.521
TOTAL FUNDING	**190.673**	**0.000**	**160.478**	**351.151**

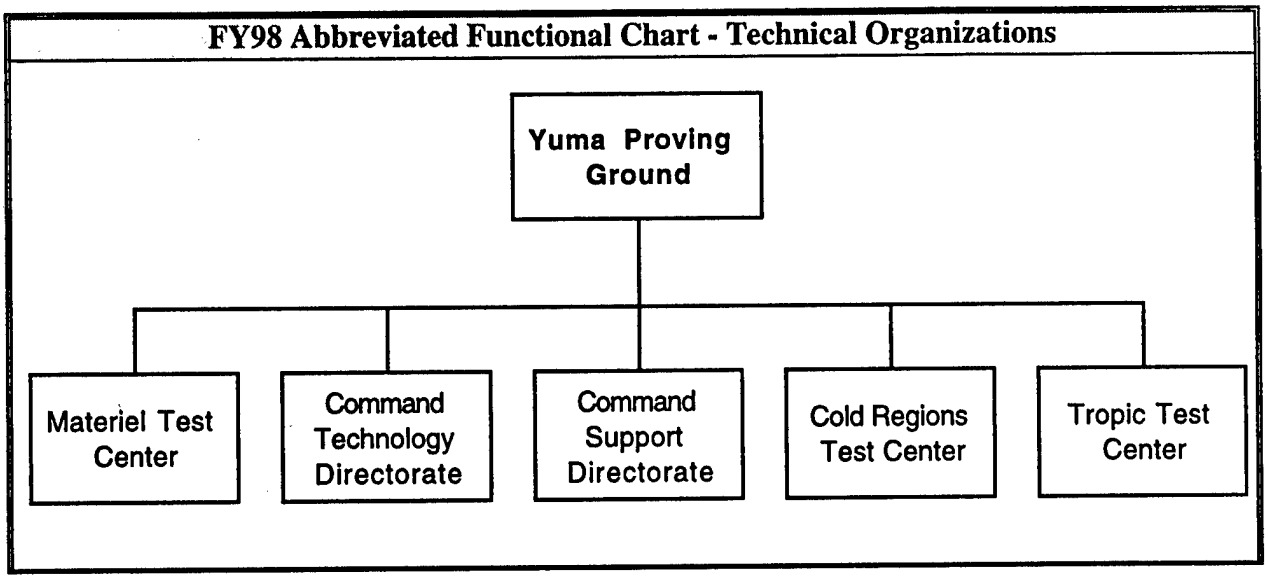
MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	
TYPE	**DOCTORATES**	**OTHER**		**END STRENGTH**
MILITARY	2	21	299	322
CIVILIAN	12	518	1,325	1,855
TOTAL	**14**	**539**	**1,624**	**2,177**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	1,605.675	**REAL PROPERTY**	481.946
ADMIN	979.265	* NEW CAPITAL EQUIPMENT	21.002
OTHER	2,951.585	**EQUIPMENT**	485.638
TOTAL	**5,536.525**	* NEW SCIENTIFIC & ENG. EQUIP.	0.997
ACRES	**2,281,659**	* Subset of previous category.	

N/A - Not Applicable

Yuma Proving Ground



Yuma Proving Ground
Yuma, AZ 85365-9101
(520) 328-2163

Commander: COL Robert C. Filbey
Technical Director: James L. Wymer

MISSION

Our focus is on the planning, execution, and reporting of development and production testing of artillery, direct fire, automotive, aviation systems, mines and countermines, UXO systems, air delivery and soldier equipment. We do this in diverse world-wide operating environments (desert, tropic and cold regions) through application of our experience throughout a system's life-cycle.

CURRENT IMPORTANT PROGRAMS

M1-A1 Abrams Tank.
M-2 Bradley IFV.
Palletized Load System (PLS).
Search and Destroy Armor (SADARM).
Tank Main Armament System (TMAS).
C-17 Cargo Aircraft.
Low Altitude Retrorocket Recovery System (LARRS).
OH-58D Kiowa Warrior.
Unmanned Aerial Vehicle Close Range (UAV-CR).
RAH-66 Comanche Target Acquisition Systems.
AH-64D Apache Longbow.
Wide Area Mine (WAM).
Safeair.
Cold Weather Clothing and Equipment.
Foreign Military Testing (SPH, SP2000, 2WH, 120MM MORTAR, Shielder).
Navy's Extended Range Guided Munitions, ICM Projectiles and MARK 399.
Munitions and Weapons Testing (M913 and M915 Cartridge; GPS-Projectile; XM982 155MM; FMU 153B Artillery Fuze Bunker Function; M782 Multi-Option Fuze Artillery; M732 ET Fuzes - Point Detonating; M4AZ - Propellent Charges).
Antipersonnel Landmine Alternative Program (ALAP).
Crusader.

EQUIPMENT/FACILITIES

WEAPONS FIRING CHAMBER: Capable of testing full-sized combat/tactical vehicles and helicopters, artillery and direct fire systems from -65F to 160F with humidity from 5% to 95%.

WEAPONS ACCURACY RANGE: The artillery range is sufficiently large to fire all artillery to maximum range and is fully instrumented with radar, multi-camera tracking mounts, telemetry and microwave systems, specially developed instrumented impact fields and communications systems. The aircraft weapons range is specially developed for helicopter armament and instrumented with multiple laser trackers, radars, telemetry video, multi-camera tracking mounts, remote control moving targets, GPS-based moving target tracking system and integrated real-time mission control and data processing center. The aircraft range includes specialty sites for ground mounted tests of aircraft weapons. All range areas are under restricted airspace to a minimum of 80,000 ft.

EQUIPMENT/FACILITIES (continued)

AUTOMOTIVE TEST COURSE: Paved, unpaved, hilly, Middle East, gravel, dust, fording basin, vehicle swimming, dynamometer capability for all Army systems. Complete shop and overhaul capability for Army vehicles and weapons systems.

AIR CARGO TEST FACILITY: Army airfield, two (2) runways to 6,000 ft., two (2) hangers, Air Cargo Complex for tests of airdrop systems and airdrop qualification of military systems and ammunition.

TEST ENVIRONMENT: Complete environment test capability including 30,000 lb. vibration tables, rain, humidity, dust and other chambers. Laboratory facilities including X-ray, chemical and materials lab.

NATURAL ENVIRONMENT: Cold weather, tropic and desert testing.

LARGE MULTI-PURPOSE ENVIRONMENTAL CHAMBER: Complete conditioning chamber for a variety of weapons and munitions testing.

Yuma Proving Ground
Yuma, AZ 85365-9101
(520) 328-2163

Commander: COL Robert C. Filbey
Technical Director: James L. Wymer

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	0.000	N/A	N/A	0.000
6.1 Other	0.000	0.000	0.000	0.000
6.2	0.000	0.000	0.000	0.000
6.3	0.000	0.000	0.000	0.000
Subtotal (S&T)	**0.000**	**0.000**	**0.000**	**0.000**
6.4	0.000	0.000	0.000	0.000
6.5	0.000	0.000	0.000	0.000
6.6	15.120	0.416	99.890	115.426
6.7	0.000	0.000	0.000	0.000
Non-DOD	0.000	0.000	0.000	0.000
TOTAL RDT&E	**15.120**	**0.416**	**99.890**	**115.426**
Procurement	0.688	N/A	2.851	3.539
Operations & Maintenance	3.717	N/A	3.117	6.834
Other	2.149	N/A	0.000	2.149
TOTAL FUNDING	**21.674**	**0.416**	**105.858**	**127.948**

MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	7.400

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	**END STRENGTH**
TYPE	**DOCTORATES**	**OTHER**		
MILITARY	0	0	57	57
CIVILIAN	0	113	553	666
TOTAL	**0**	**113**	**610**	**723**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	22.030	**REAL PROPERTY**	166.537
ADMIN	145.888	* NEW CAPITAL EQUIPMENT	0.837
OTHER	2,077.112	**EQUIPMENT**	190.573
TOTAL	**2,245.030**	* NEW SCIENTIFIC & ENG. EQUIP.	0.824
ACRES	**1,008,904**	* Subset of previous category.	

N/A - Not Applicable

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DEPARTMENT OF THE NAVY

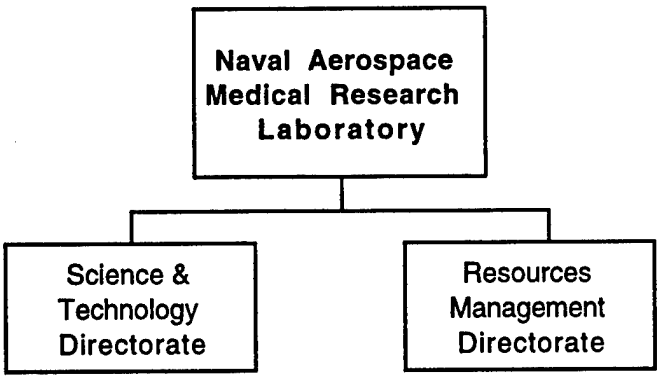
DEPARTMENT OF THE NAVY

The Navy's fifteen (15) In-House RDT&E Activities are:

***Change for FY98 Report**: The four Naval warfare centers provide full spectrum research, development, test and evaluation, engineering, and fleet support services and perform a substantial amount of non-RDT&E work (e.g., FY98 workload was 30% RDT&E and 70% non-RDTE). In previous years' reports, the Navy has been reporting each warfare center in its entirety, even though a considerable amount of the reported end strengths, funding, and other resources are devoted to other than RDT&E programs. For purposes of more accurately reflecting RDT&E In-House resources for the FY98 report, the Navy has applied the established RDT&E In-House criteria (i.e., a minimum of 25% of total funds is RDT&E and a minimum of 25% of in-house effort is devoted to RDT&E) at the division or major site level rather than reporting all warfare center sites, regardless of their level of RDT&E work. As a result, some warfare center entities have been eliminated from the FY98 report because they are below the 25% RDT&E threshold for inclusion in this report.*

Naval Aerospace Medical Research Laboratory

FY98 Abbreviated Functional Chart - Technical Organizations



Naval Aerospace Medical Research Laboratory
Pensacola, FL 32508-1046
(850) 452-3286
Commanding Officer: Captain C. G. Armstrong, MSC, USN
Technical Director: Dr. Robert Stanny

MISSION

The laboratory's mission is to conduct research and development in aviation medicine and allied sciences to enhance the health, safety, and readiness of Navy and Marine Corps personnel.

CURRENT IMPORTANT PROGRAMS

ENHANCED HEARING PROTECTION FOR HIGH-NOISE ENVIRONMENTS: Current hearing protection devices can be inadequate in high-noise operational environments. We have developed and patented a new sound-attenuating technology that significantly improves hearing protection devices and sound attenuation in general. We are determining optimal engineering parameters for the new technology, applying them to hearing protectors and sound-attenuating materials, providing prototype models for formal test and evaluation, and developing design specifications for eventual manufacture.

NAVAL AVIATION PILOT PREDICTION SYSTEM: This project is:

(1) centralizing existing training and mishap data for naval aviators from accession through winging and beyond;
(2) determining the feasibility of using training and fleet-performance criteria to identify marginal performers;
(3) developing predictive models for selection, classification, and review/mishap board analysis; and
(4) developing a networked system for accessing the database and associated predictive models.

SPATIAL AWARENESS IN NAVAL AVIATION: We are developing tactile navigation and orientation displays that enhance spatial awareness and reduce operator workload. We have developed displays that pilots and special forces personnel can use to navigate and maintain situational and spatial awareness in the absence of visual information.

NAVAL AVIATION SELECTION TOOLS DEVELOPMENT: We have developed an Internet version of the Aviation Selection Test Battery (ASTB) that will improve the Navy/Marine Corps aviator selection process by reducing test administration and maintenance costs, enhancing test security, and providing new opportunities to develop and validate better test items. The paper-and-pencil ASTB is taken by approximately 10,000 examinees annually at over 200 remote sites around the world. This volume of remote testing makes the ASTB an ideal candidate for implementing in a client/server format.

LANDING CRAFT AIR CUSHION (LCAC) VEHICLE NAVIGATOR SELECTION SYSTEM: In the late 1980s, LCAC operators and engineers had training attrition rates as high as 40-60%. Consequently, the Naval Safety Center asked us to develop a selection system to reduce this rate. With funding from the Naval Air Systems Command, the revised LCAC selection system was delivered in 1992, and attrition rates dropped to 10-20%. Similar attrition problems among LCAC navigators led to an additional tasking to develop a selection system for this position. A task analysis was completed, and a selection system was developed and validated. Preliminary screening began in May 1996. The final system is in development; a full product will be delivered in October 1998.

ATTENTION-DIRECTING FLIGHT INSTRUMENT DISPLAY: All current flight instrument displays require pilots to scan instruments, one after another, and mentally integrate the data to produce flightpath information. We have developed a new technique that integrates flight information in a single display, thus permitting pilots to understand their positions in flight at a glance. The new display reduces time spent on instruments to approximately 15% of that required with traditional displays and almost eliminates routine scanning.

CURRENT IMPORTANT PROGRAMS (continued)

UNMANNED AERIAL VEHICLE (UAV) HUMAN FACTORS: The objective of this project is to characterize the cognitive skills needed to pilot UAVs, and to evaluate human-factors design and interface issues in UAV control systems, panels, and displays.

VISUAL SCANNING AS AN INDEX OF PILOT SKILL DEVELOPMENT: The objective of this project is to develop teaching aids that facilitate the acquisition of instrument-scan patterns by student pilots.

NIGHT VISION FOR SPECIAL WARFARE: We are developing a field-worthy, operationally relevant night vision test that (1) has known and definable relations to tests in the optometric literature and (2) is predictive of operational performance under a variety of nighttime conditions.

VIRTUAL DISPLAYS IN ACCELERATION ENVIRONMENTS: This basic-research project is characterizing the effects of actual motion on spatial perception and the motor responses of human operators in virtual environments.

VESTIBULAR TEST DEVELOPMENT: The objective of this project is to improve aviation selection and training by developing tests that detect vestibular and other disorders of spatial orientation incompatible with military aviation.

SPATIAL ORIENTATION DESIGN AND TRAINING ISSUES: This project is aimed at improving cockpit design standards by defining relations between control compatibility, pilot spatial awareness, and pilot performance, as well as enhancing pilot performance by developing training programs that incorporate accurate models of sensory-spatial awareness.

APPROACHES TO SPATIAL DISORIENTATION: Our task is to develop basic knowledge and models of systems involved in the control of whole-body motion relative to the earth. Current models are insufficient to predict the perceptual and sensorimotor reactions that occur in complex motion conditions. The ultimate objective is to develop mathematical models that will predict spatial orientation dynamics in complex environments of flight simulators and real flight.

SOPITE SYNDROME: The term Sopite Syndrome was coined to describe the extreme fatigue and drowsiness that can occur in motion and virtual environments. The project entails characterizing basic neurophysiological and behavioral effects of the syndrome, developing fleet recommendations and guidelines, and relating the syndrome to similar maladies, such as Simulator Sickness and Space Adaptation Syndrome.

MARINE CORPS FIELD CASUALTY MONITORING/TRACKING SUPPORT: We are developing a flexible, user-friendly, information-management system for real-time correlation of tactical operations, patients, and echelons 1 through 4 evacuation and treatment resources. The system should improve medical regulating significantly on battlefields of the future.

HEALTH RISK APPRAISAL OF NAVAL SPECIAL FORCES PERSONNEL: The Department of the Navy lacks baseline epidemiological and health data needed to adequately assess and track the health status of naval Special Operations Forces (SOF) personnel. In this project, we are gathering baseline health and health risk factor data on active duty, reserve, and retired naval SOF personnel.

PERFORMANCE-BASED OCCUPATIONAL STRENGTH TESTING FOR CANDIDATE NAVY PILOTS/NAVAL FLIGHT OFFICERS: Goals of this project are threefold:

(1) to identify selected strength-critical tasks in the Joint Primary Aircraft Trainer System (JPATS),
(2) to replicate those tasks on a strength-screening device, and
(3) to develop strength-enhancement programs that will enable individuals to meet or exceed the strength standards (control force requirements) specified in the JPATS MIL-SPECs.

EQUIPMENT/FACILITIES

The **VISION LABORATORY** includes a mobile night vision device (NVD) training facility ('NITE Lab') that can be used to train NVD users in the field. The 'NITE Lab' is equipped with numerous NVD demonstrations and training aids as well as optical testing and vision equipment. The laboratory has facilities for recording, digitizing, and mathematically filtering and enhancing visual images. In cooperation with the helicopter training facility at Whiting Field (TRAWING FIVE), the laboratory is able to noninvasively record the instrument scan patterns of pilots flying the motion based, full-scale helicopter instrument trainer.

The **SPATIAL DISORIENTATION LABORATORY** capability is a unique national asset consisting of many one-of-a-kind research devices, as described below:

The **CORIOLIS ACCELERATION PLATFORM (CAP)** is the only device worldwide capable of applying combined linear and angular acceleration to the human subject. It is also the only device in the DOD inventory available to study chronic exposure to altered G environments. It uses two, independently controlled power servomechanism drive systems to generate acceleration stimuli caused by rotation about an Earth-vertical axis and/or rectilinear translation along an Earth-horizontal axis. This device has enabled scientists to make accurate simulations of many bizarre combinations of force stimuli and their effects on aerospace crewmen under carefully controlled conditions. Data gathered in various studies using the CAP continue to contribute significantly to the success of the space program and to the safety and well being of astronauts.

The **HUMAN DISORIENTATION DEVICE (HDD)** can accelerate an instrumented human subject about two head-centered axes simultaneously. It is used to help differentiate the relative roles played by the various sensory systems involved in the production of disorientation, as well as to examine the contribution of each system and subsystem to motion sickness. The HDD is also employed to study the effects of disorientation caused by rotation and tumbling. The HDD differs substantially from the Pate device in that the axes of rotation can be made to pass through the intersection of the interaural and naso-occipital lines. This permits isolating the function and stimulation of specific portions of the organs of balance in the inner ear. The device has provided direct support for many basic and applied research projects sponsored by both the Navy and NASA.

The **LINEAR ANGULAR ROTATOR (LAR)** is a new, short-arm (6-foot), human centrifuge capable of high rotation speeds (to 80 rpm) and precise, simultaneous, linear movement of the human along the arm. It is located in a large, cylindrical chamber upon which visual stimuli can be projected. The LAR and chamber combination will permit displaying visual stimuli at various distances from the center of rotation, to about 25 feet from the subject. Due to its ability to produce accurate linear and rotational stimuli, the LAR will afford precise measurements of unilateral labyrinthine function, which should lead to improved clinical tests for detecting vestibular abnormalities. Because the device will afford linear and rotational stimuli coupled with near and distant visual stimuli, it will enable studies of visual suppression of vestibulo-ocular reflexes, and of visual information processing under conditions in which target and background stimuli vary in distance and move at different speeds.

The **VESTIBULAR VISUAL SPHERE DEVICE (VVSD)** is a new device for studying visual-vestibular interactions. The VVSD is a 12-foot sphere that can be rotated about two axes to approximately 29 RPM. A subject seated in the center of the sphere can rotate about two axes to approximately 57 RPM. Visual stimuli displayed on the interior of the sphere yield compelling, visually induced motion illusions. The VVSD permits displaying real, moving stimuli to stationary or moving subjects. Measurements of three-dimensional, visual-vestibular responses should provide gold-standard data for evaluating virtual-reality displays, and for evaluating the effects of these displays on stationary and moving observers. The device will also permit exploring conditions in which the visual suppression of vestibulo-ocular reflexes (hence the ability to track visual targets) is enhanced relative to normal. Findings from these studies should lead to techniques for optimizing information delivery through head-mounted displays.

EQUIPMENT/FACILITIES (continued)

The **PENDULAR INERTIAL GRAVITATIONAL (PIG)** devices (PIG 1A and PIG 1B) are fixed on the CAP linear track and are used to position a human subject at various angles off vertical axis while the CAP room is rotated. The PIGs can be oriented in four different directions.

The **EQUITEST SYSTEM** employs computerized dynamic posturography to systematically examine the effectiveness of visual, vestibular, and somatosensory inputs to balance and the timing, strength, and coordination of postural movements. This permits evaluating visual, vestibular, and somatosensory contributions to equilibrium.

The **PATE DEVICE** resembles a patient litter and is capable of rotating a subject about the longitudinal body axis and/or the horizontal axis through the pelvis. This apparatus has slip rings, which permit physiological monitoring, and is currently being used to study eye movements in response to rotation or perceived motion generated by moving patterns projected on a hemispheric screen in front of the subject.

The **OCULAR COUNTERROLL DEVICE** is used to measure ocular counterroll in response to total body tilting movement and provide information on possible changes related to aging.

The **OFF-VERTICAL-ROTATOR (OVR)** is used to gain measures of semicircular canal and otolith function and related spatial orientation performance.

The **PERIODIC ANGULAR ROTATOR (PAR)** is a novel servorotator designed for studies of the dynamic response of the vestibulo-ocular system. The PAR is a high-performance motion-inducing instrument that rotates a seated subject about the Earth-vertical axis in a wide variety of stimulus waveforms.

The **PSYCHOACOUSTICS LABORATORY** includes acoustical test chambers, an ANSI standards compliant Real-Ear Attenuation Test Facility, a semireverberant test chamber for simulating various Navy operational environments, and a high-level noise test chamber. In addition, equipment is available to support analog and digital signal processing, speech analysis, spectral analysis, and radio voice communications monitoring. The psychacoustics laboratory also houses unique equipment for the design, fabrication, and testing of innovative hearing protection devices and sound-attenuating materials.

We have three **ENVIRONMENTAL CHAMBERS**, two of which are in adjacent rooms. One is 8 x 8 ft; the other is 10 x 16 ft. The smaller chamber, used primarily for cold exposure, has active temperature control from -5 to 25 degrees C. The larger room has active temperature control from 0 to 50 degrees C. The third environmental chamber is a free-standing room 8 x 10 ft with precise temperature (0-60 degrees C) and humidity (20-80%) control.

This command has also developed and equipped several **MOBILE FIELD LABORATORIES** to study the visual, vestibular, and auditory sensory systems. These tests, by virtue of the trailers' mobility, permit our researchers to collect data at training sites, in Navy and Marine Corps operational settings, and on board ships.

Naval Aerospace Medical Research Laboratory
Pensacola, FL 32508-1046
(850) 452-3286
Commanding Officer: Captain C. G. Armstrong, MSC, USN
Technical Director: Dr. Robert Stanny

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	IN-HOUSE	IN-HOUSE MANAGEMENT	OUT-OF-HOUSE	TOTAL
RDT&E:				
6.1 ILIR	0.000	N/A	0.000	0.000
6.1 Other	0.481	N/A	0.079	0.560
6.2	0.424	N/A	0.071	0.495
6.3	0.476	N/A	0.079	0.555
Subtotal (S&T)	**1.381**	**N/A**	**0.229**	**1.610**
6.4	0.359	N/A	0.059	0.418
6.5	0.000	N/A	0.000	0.000
6.6	0.315	N/A	0.000	0.315
6.7	0.000	N/A	0.000	0.000
Non-DOD	0.058	N/A	0.012	0.070
TOTAL RDT&E	**2.113**	**N/A**	**0.300**	**2.413**
Procurement	0.000	N/A	0.000	0.000
Operations & Maintenance	0.000	N/A	0.000	0.000
Other	0.559	N/A	0.095	0.654
TOTAL FUNDING	**2.672**	**N/A**	**0.395**	**3.067**

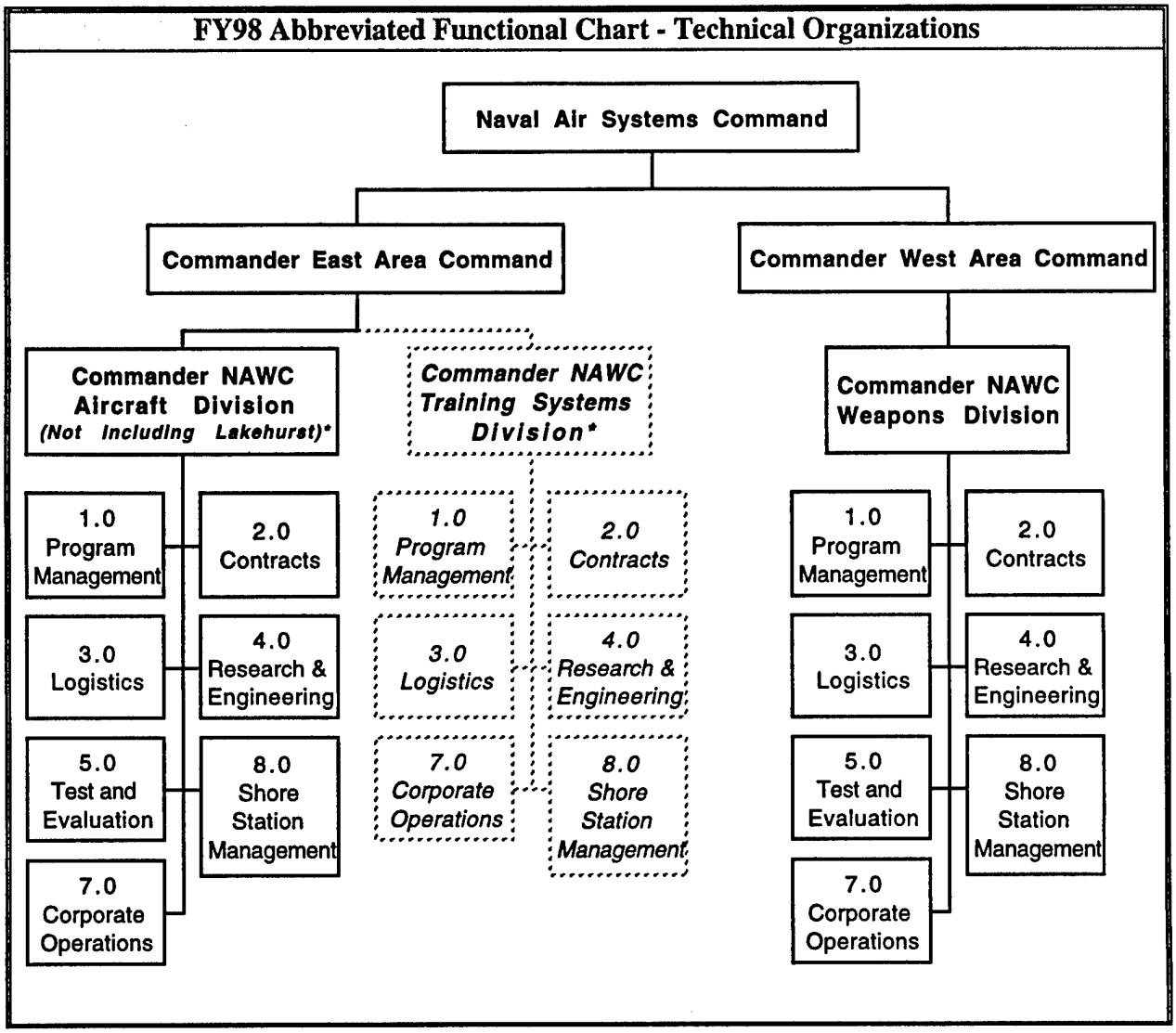
MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		TECHNICAL SUPPORT & OTHER PERSONNEL	END STRENGTH
TYPE	DOCTORATES	OTHER		
MILITARY	8	1	15	24
CIVILIAN	3	8	14	25
TOTAL	**11**	**9**	**29**	**49**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		PROPERTY ACQUISITION COST (MILLIONS $)	
LAB	100.400	**REAL PROPERTY**	13.100
ADMIN	6.700	* NEW CAPITAL EQUIPMENT	0.000
OTHER	10.200	**EQUIPMENT**	5.578
TOTAL	**117.300**	* NEW SCIENTIFIC & ENG. EQUIP.	0.241
ACRES	**3**	* Subset of previous category.	

N/A - Not Applicable

Naval Air Warfare Center



**As a result of applying the In-House RDT&E Activity criteria at the division or major site level (see NOTE on page 3-1), NAWC Training Systems Division and NAWC Aircraft Division Lakehurst Activity data is not included in the FY98 report. These two activities contribute an additional $1.5B to the total NAWC business base.*

Naval Air Warfare Center
Patuxent River, MD 20670-1547
(301) 757-7692

Commander NAVAIR: VADM John A. Lockard
Deputy Commander NAVAIR: Dr. Alan Somoroff

MISSION

Our mission is to be the Navy's full spectrum research, development, test and evaluation, engineering, and fleet support center for air platforms, autonomous air vehicles, missiles, weapons and sensors used to conduct air warfare; and to be the principal Navy center for acquisition and product support of training systems.

The Naval Air Warfare Center is composed of three Divisions: The Aircraft, Weapons, and Training Systems Divisions. The Commander of the Training Systems Division reports to the Commander, Aircraft Division who is also designated as the Commander, East Area Command. The Commanders of the Aircraft and Weapons Divisions report directly to the Commander of the Naval Air Systems Command who holds responsibility for the Naval Air Warfare Center activity.

CURRENT IMPORTANT PROGRAMS

AIRCRAFT DIVISION

EA-6B - The DSDC-4 successfully completed a backwards compatibility ground check in SD 535.

F-14 Trainer - The second trainer device, 2F95A, developed by Manned Flight Simulator (MFS)/Air Combat Environment Test and Evaluation facility (ACETEF), has been accepted by the Fleet for "Independent mode" training.

Carrier Suitability testing was completed for the Joint Air-to-Surface Standoff Missile (JASSM). Carrier Suitability Test Facilities include: Landing Systems Test Facility, Takeoff Assist Ramp, Aircraft Catapult launch and Arrested Landing Test Facility.

Aircraft Launch testing complete for symmetric and asymmetric loadings (up to 22kftolb lateral weight asym).

The **V-22 Troop Seat** fabric changes were made to bring the fit in accordance with the Berry Amendment. These changes necessitated requalification of the HA. Tests were performed with positive results which are being compiled and forwarded to the contractor for processing through the V-22 team.

V-22 Osprey Program - During 1998 four MV-22 EMD aircraft were in flight test at NAS Patuxent River, MD. Test activities included: formation flying, austere area landings, carrying external loads up to 10,000 lbs., simulated/field carrier landings, aerial refueling (dry plugs), expendable deployment, fast roping, SPIE rig work, and soft duck (boat and swimmers off ramp into water).

F-14 - The FLE flight test effort was completed at the TC-7 site. The final data points were gathered with 4 cat shots.

F/A-18A/B - Flight test of the 10A+ OFP version for GPWS is basically completed. The team desires to perform a second simulated CFIT flight to obtain more statistical data on warning protection/save rates in the limited envelope for comparison to C/D baseline results.

CURRENT IMPORTANT PROGRAMS (continued)

F/A-18C/D - Completed extensive 2-year flight test program for Switzerland (Pax and China Lake).

F/A-18E/F - Aircraft E1 has completed ground vibration tests of several stores loadings and completion of flutter tests with stores loading #14.

Aircraft E3 continued the flight loads survey with stores. Two weapons configurations were completed during week of 21 August 1998.

Aircraft E4 conducted the fourth phase of high angle of attack tests with wing stores.

Aircraft F1 completed the 2-seat high-angle-of-attack and ACM evaluation in preparation for OT testing and also, conducted ground and flight tests of the fuel thermal management system.

Completing **noise and vibration data collection** to resolve watch item issues discovered during F/A-18E/F EMD testing related to MK-83, MK-84, AIM-9M and LAU-127.

Successfully completing **weapon separation testing** during F/A-18E/F EMD for the following stores: CBU-99/100, GBU-10. AMRAAM (fuselage), HARM, Maverick, 480 Fuel Tanks, and AIM-9M (Wingtip).

Successfully completed **Carrier suitability testing (CATS and TRAPS) program** with a JASSM IMV on the F/A-18 aircraft.

Completed **F/A-18E/F Spin Program.**

Completed **flight flutter program** clearing the F/A-18E/F to full envelope with and without stores.

Wrap up of third year of **F/A-18E/F developmental testing.**

Established **T-10 Test Cell Capability** at Pax River.

Further defined efforts to conduct **air worthiness certification** during FOT&E 1 & 2 Of JSOW, JDAM, SLAM-ER, GBU-24 and expanded envelope for AMRAAM, LGTR, MK-83/BSU-85 HD.

U.S. Naval Test Pilot School - ASTARS, the highly modified P-3 with training avionics suite, completed post SDLM FCF.

Minesweeper Lightning Test - Dockside testing of two USN minesweeping ships began on 27 July. Tests were completed 7 August 1998.

HH-60 - The HH-60H Armed Helicopter test team successfully completed six test firings of the Hellfire System.

A fully successful system sled test of the **4th Generation Escape System Program** was conducted at Holloman AFB, NM. This test demonstrated the ability of the controllable propulsion system to stabilize the escape system during a high-speed ejection.

Completed on-site assistance for the installation of **C-10316/F Control-Interface units** onboard ENS MURBARAK in Alexandria, Egypt, as part of the FFG-25 and FFG-26 Foreign Military Sales (FMS) Transfer Support Program.

New Modulation Doubles Spectrum Capacity: The tri-service Advanced Range Telemetry (ARTM) project has acquired a new modulation technique which may double the amount of data available through limited and shrinking spectral resources.

CURRENT IMPORTANT PROGRAMS (continued)

The **High Performance Computing (HPC)** system is presently being utilized by Manned Flight Simulator. Software is being used to drive visuals in the dome. This software will be employed by HPC enabling the retirement of the old and hard to maintain Compu-Scene IVA image generator. FY98

AIRCRAFT SYSTEM AND TACTIAL AIRCRAFT SYSTEMS: C-3 Technology, E-2 squadrons, F/A-18E/F, V-22, JAST, T800 (LNX) Engine Qualification Program, Unmanned Air Vehicle, Aircraft Materials, Air Crew Systems Development, Airborne ASW Surveillance, Aviation Survivability, Carrier Systems Development, IFF Systems Development, Aircraft Technology, RDT&E Ship Support, Aviation Improvements.

ELECTRONIC WARFARE: TACAIR EQ Electro-Optics and Infrared R&D, Electronic Research, EW Development.

ANTI-SURFACE WARFARE: Undersea Warfare Advance Technology, ASW System Development.

TECHNOLOGY BASE: Sensors/seekers (AIR, EO, RF) Propulsion, Materials Technology, IHPTET Program Management, Weapons and Aircraft Modeling and Analysis, Mission Support Technology, Air Systems and Weapon Advanced Technology, Shipboard Aviation Systems, Acoustic Search Sensors, Target Systems Development, Standards Development, Navy Strategic communications, Advance Technology Transition T&E Support, Major T&E Investment, NAVSTAR GPS Equipment, In-House Independent Laboratory Research Materials-Electronics and Computer Technology Readiness Training Environmental Quality Technology, Fleet Technology Support.

TRAINER PROGRAMS: Research and Technology Development in Instructional Technology, Simulator Networking, Tactical Decision making Under Stress, Embedded Training Technology, Deployable Training, Virtual Environmental Training, Sensor Simulation, Weapons Teams Simulation, Scenario Development, Simulator Sickness, Aircrew Coordination and Software Technology for Adaptable Reliable Systems, Consolidated Training Systems Development Fleet Air Training.

WEAPONS DIVISION

Weapons System Integration:
We provide weapons systems/software support throughout the life-cycle, including system engineering, system integration, software development, system software verification and validation, configuration management, technology development assessment and application, fleet support, T&E support, product line coordination, design/development agent for out-of-production aircraft, and foreign military sales system/software support for the following aircraft:

UH-1Y, AH-1Z, AV-8B, F/A-18, F-14, EA-6B.

Weapons Systems and Targets RDT&E:
We provide technical agent assistance to the weapons systems and targets acquisition program managers and in-service support for the following weapons and targets:

Aerial Targets, airborne threat simulators, AMRAAM, Evolved Sea Sparrow, Gator, HARM, HARPOON, Hellfire, JDAM, JSOW, JSSAM, Maverick, Penguin, Phoenix, QF-4 targets, Surface Targets, Rolling Airframe Missile, Sidewinder, SLAM, SLAM ER, Sparrow, Standard Missile, surface targets, Tomahawk, TOW, Vandal.

Electronic Warfare and Information Warfare Systems:
We provide technical agent assistance to the electronic warfare systems acquisition program managers for the following systems:

AN/AAR-47 Warning System, AN/ALE-29, -39, -47, and -50 countermeasures systems, AN/ALR-66 and -67 warning systems, weapons support systems, IRCM systems, and the Integrated Defense Electronic Countermeasures system.

CURRENT IMPORTANT PROGRAMS (continued)

Test and Evaluation:
We provide instrumented open air land, air and sea test ranges for development and operational test of integrated aircraft/weapons systems and electronic warfare systems, as well as many laboratory and test facilities for warheads, propulsion, and other weapons system components and all-up weapons for both inert and live-fire tests.

Other RDT&E:
Crew systems; weapons support equipment; parachutes; materials research; propulsion/materials exploratory and advanced development product support; targets and simulators for air, land, and sea-launched weapons systems; threat simulator development; warheads; fuzes; insensitive munitions; mission planning systems (e.g., TAMPS); aircraft survivability and vulnerability live-fire testing; sensor systems; laser/optical systems; nuclear weapons safety; guidance and control systems; foreign military sales support; operation of land and sea ranges for fleet training.

EQUIPMENT/FACILITIES

AIRCRAFT DIVISION

Patuxent River Station, MD: Facilities include: Air Combat Environment Test and Evaluation Facility (ACETEF), Air Vehicle, Aircraft Modification and Instrumentation, Aircrew Systems, Test Range Facilities, Avionics, Mission System, Propulsion Systems, Ship and Shore Facilities.

Air Combat Environment Test and Evaluation Facility (ACETEF) - A fully integrated ground RDT&E facility - full spectrum evaluation of highly integrated aircraft and systems.

Aerodrome - RDT&E aircraft, hangar facilities, maintenance, runways and airfield services.

Air Vehicle RDT&E Facilities - Provides RDT&E for air platforms with armament and stores; component systems and hardware support systems.

Aircraft Modification & Instrumentation Facility - Provides aircraft instrumentation, modification, and prototyping for RDT&E flight programs.

Aircrew Systems RDT&E Facilities - Provides RDT&E of aircrew human factors and life support systems.

Atlantic Ranges - Chesapeake and Mid-Atlantic test ranges supporting full spectrum RDT&E.

Avionics RDT&E Facilities - Provides RDT&E for the full spectrum of avionics systems.

Mission System RDT&E Facilities - Provides RDT&E capabilities for C41, ASW, ASUW, AEW, Tactical, VP, VS and Vertical Flight Mission Areas.

Propulsion Systems RDT&E Facilities - RDT&E of small scale engines, engine accessories, fuels and lubrication systems.

Ship and Shore Electronic Systems RDT&E Facilities - Provides RDT&E for ATC systems, ID systems, SPECWAR, communication, shipboard data link, & systems external communications.

EQUIPMENT/FACILITIES (continued)

WEAPONS DIVISION

INTEGRATED MODELING AND SIMULATION. NAWCWD can support large-scale battlespace engineering and aircraft/weapons systems integration with a combination of inter-linked R&D laboratories and instrumented test ranges. We are developing and exploiting advanced concepts and technologies such as high-bandwidth data links, joint mission planning, and real-time targeting. We can link geographically separated and disparate facilities such as our Integrated Battlespace Simulation Arena (SIMLAB), GPS Lab, the F/A-18 Advanced Weapons Lab, the Battle Management Interoperability Center (BMIC) (see below) at Point Mugu, and the ACETEF at Patuxent River into a total "virtual" battlespace.

BATTLE MANAGEMENT INTEROPERABILITY CENTER (BMIC). The BMIC links command, control, communications, computers, and intelligence (C4I) systems during live-fire test events in a controlled, closely monitored range environment. The BMIC creates theater-level environments and dynamics by linking synthetic applications (live, constructive, and virtual) on the Defense Simulation Internet. As well as receiving simulated threats from other facilities, the BMIC supplies other facilities with live simulations from the Sea Range. By bringing together test-and-evaluation assets with live-exercise assets, the BMIC provides a meeting place for the laboratory and shipboard environments and allows a flexible mix of laboratory control and operational dynamics. The BMIC consists of a fixed-site facility at Point Mugu as well as local and remote electronic and communications systems used to coordinate complex operations.

COMBINED SIMULATION FACILITIES. Four simulation facilities aid in weapons development and testing: the Virtual Prototyping Facility (VPF), the Precision Imaging Strike Technology Integration Laboratory (PISTIL), the Missile Simulation Laboratory (SIMLAB), and the Missile System Evaluation Laboratory (MSEL). Progressively, the four laboratories provide additional realism leading up to an actual live-firing test event. The VPF is an all-digital, easily configurable cockpit environment in which entire weapon and aircraft platform systems can be simulated and evaluated for various scenarios. As the U.S. Navy's first cockpit simulation to include communications to and from the simulated aircraft to the weapons, the VPF offers one-on-one and one-on-many aircraft engagement and strike weapon capabilities for manned or unmanned aircraft. The PISTIL is a signal-processor-in-the-loop facility where every aspect of a missile's signal-processing environment can be modeled and tested using the actual hardware. Combining three-dimensional target images, missile hardware-in-the-loop (HWIL), and on-site tactical aircraft, PISTIL supports evaluation of a variety of seekers, including imaging infrared (IR), millimeter wave, laser detection and ranging (LADAR), and television. The SIMLAB and the MSEL are fully-equipped, state-of-the-art missile HWIL simulation laboratories that provide the last test check before actual flight testing. HWIL testing is used to test actual missile hardware (seekers, guidance sections, inertial units, etc.) in a test environment that simulates missile flight. SIMLAB and MSEL are used to demonstrate new missile technology, evaluate new or existing designs, and integrate new hardware or software. Each of the SIMLAB's five laboratories and the MSEL's three laboratories are equipped with a flight motion simulator table and real-time computers with input/output, targeting system, and peripheral equipment. The laboratories include five anechoic chambers and three IR facilities for testing RF, IR, multimode, and inertially-guided systems. These laboratories are equipped with targeting systems capable of generating both simple and complex target signatures and countermeasures for a wide range of missiles. The newest of the SIMLAB IR laboratories contains a five-axis flight motion simulator table capable of angular extent up to 130 degrees off boresight. This flight simulator allows for simultaneous missile and target movement and provides dynamic IR scene generation and projection to the unit under test. SIMLAB links with other laboratories to run simultaneous, real-time operations involving launch aircraft, weapons, and targets, allowing a systems-level approach to the issues.

MISSILE ENGAGEMENT SIMULATION ARENA (MESA): MESA is an indoor facility in which full- or subscale hardware models or modified real-world sensors, fuzes, and targets are used to evaluate the highly sophisticated interactions between air vehicles and missile sensors. The only facility of its kind

EQUIPMENT/FACILITIES (continued)

in the world, MESA was designed for precision analyses of missile lethality, air-vehicle survivability, and endgame properties of both sensor and vehicle. Able to run simulations around the clock and in all weather, MESA provides a cost-effective alternative to field testing. Targets weighing up to 11.3 metric tons (25,000 pounds) are suspended in MESA's high bay, which is 46 meters wide, 123 meters long, and 27 meters high (150 by 405 by 90 feet). The targets can be suspended mid- or downrange and positioned within 0.32-centimeter (1/8-inch) accuracy either vertically or horizontally in a wide variety of yaw, pitch, and roll angles. Sensors weighing up to 91 kilograms (200 pounds) are mounted on a three-axis positioner, which is accurate to within 0.1 degree. The sensors are transported past the target at speeds from 3.05 centimeters to 3.05 meters (0.1 to 10 feet) per second along the relative velocity vector. Trajectory control and a stable instrumentation radar provide repeatable testing and precise data. Processed data are provided to the customer immediately after a test; analyzed data provide information about sensor performance and missile effectiveness. Typically, thousands of intercepts are simulated during a system evaluation, providing more precise data than obtained from a missile firing.

MISSILE AND AIRCRAFT WEAPON SOFTWARE SUPPORT ACTIVITIES (WSSA): As the U.S. Navy's lead activity for fighter-attack aircraft system development and weapons integration, the Naval Air Warfare Center Weapons Division is home to five WSSAs: F/A-18 Hornet, F-14 Tomcat, EA-6B Prowler, AV-8B Harrier, and AH-1W Cobra. The WSSAs are the tools used to provide development testing; verification and validation; safety-of-flight testing; quick-response investigations of problems reported by the U.S. Naval Fleet; corrections of errors and deficiencies; investigation of changes; life-cycle weapon-system support; and integration and testing of new technology, mission systems, and weapons. Some WSSAs perform software design, coding, and development. WSSAs are the focal points for quickly deploying enhancements to existing weapon systems and for integrating new weapons and mission capabilities in response to changing battlefield requirements. The WSSAs' collocation with the Land, Sea, and Air Test Ranges provides nearly unlimited space in which to perform weapon and system integration testing. The WSSAs have met the challenge of integrating yesterday's weapons on the new generation of digital aircraft as well as developing and integrating a new generation of advanced mission systems and weaponry.

ENERGETIC MATERIALS LABORATORIES: A complex of laboratories provides facilities for energetic materials research in the fundamentals of propellant and explosives technology. Outdoor warhead test arenas are capable of testing up to 500,000 pounds of explosives.

The China Lake Ordnance And Propulsion Pilot Plant's mission is to advance ordnance-related technology (i.e., energetic materials, propulsion, warheads, bombs, and fuzing), and to design and develop weapons and weapon components that contain energetic materials. At the 56-building facility, designed exclusively for proper handing of energetic materials, the process begins with synthesis of new energetic materials and new formulations and extends from hand mixes to large-scale processing of propellants and explosives. Processing equipment includes high-shear mixers from 0.14 (1/4 pint) to 661 liters (150 gallons) in size for mixing propellants and explosives; up to 176-liter (40-gallon) slurry kettles for mixing melt cast and other explosives; pellet presses; 18.1, 45.4, and 272-metric ton (20, 50, and 300-short-ton) explosive presses; complete raw material preparation in hammer mill; Sweco grinders and fluid energy mills; injection loaders for explosives; casting facilities; ovens for curing explosives and propellants; and complete machining capability for rocket motors, warheads, bombs, explosives, and propellants.

The Detonation Physics Laboratory has highly instrumented firing bays where up to 6.8 kilograms (15 pounds) of explosive can be detonated. This laboratory has ultra-high-speed framing and streak cameras as well as electronic instrumentation to fully characterize detonation reactions. The thermal research area provides complete thermal characterization of explosives and propellants. The Pilot Plant also features a quality-assurance laboratory for determining physical properties and performing safety tests on energetic materials as well as analysis of raw materials. Explosive and propellant scrap and other excess ordnance components are disposed of on site, and a regulatory-approved explosive hazardous-waste-treatment system allows for effluent collection, treatment, and disposal.

EQUIPMENT/FACILITIES (continued)

The Air-breathing Propulsion Facility static-fires and tests air-breathing engines such as ramjets, scramjets, pulse detonation engines, divert bi-propellant propulsion, and expendable turbine systems as well as engine components such as fuels, inlets, insulators, combustors, and fuel-management systems. Instrumented rocket motors and pyrotechnic devices are also static fired. Multiple test bays are available for cold flow and hot firings of liquid and solid-fuel systems. Liquid fuels formulation, development, and evaluation capabilities are available on-site, and the remote location provides unparalleled safety and security.

The Skytop Propulsion Complex is used for static testing of solid-fuel rocket motors, from small motors and gas generators to rocket motors with 680 metric tons (a million and a half pounds) of thrust. The isolated test areas and facility designs enable testing of large, high-energy, high-risk systems with complete protection for personnel and minimum equipment exposure. Even in the event of catastrophic motor failure, data can be acquired and protected. Skytop has two control rooms and seven separate test bays, equipped with state-of-the-art data-acquisition and -processing systems, for testing a variety of systems and components. Equipment includes flash x-ray and optical instrumentation, including metric video and high-speed motion picture cameras (up to 3048 meters (10,000 feet) per second), as well as instrumentation for recording pressure, force, strain, temperature, position, shock, and vibration. Each test bay provides thrust-vector-control hydraulic power and has a remotely controlled water quench system. Unique capabilities include real-time radiography to record internal motor ballistics during static firing, spin testing of small motors (up to 20.32 centimeters (8 inches) in diameter) in either vertical or horizontal attitude, and thrust-vector-control evaluation of motors.

The Plume Measurement Facility gathers rocket motor performance measurements and signature-characterization data for rocket plumes, providing information to designers of weapons and countermeasures. Rocket motor test stands up to 6.1 meters (20 feet) high accommodate motors up to 76 centimeters (30 inches) in diameter and 4.3 meters (14 feet) long and with thrusts to 36,000 kilograms (80,000 pounds). The stands can restrain the rocket motor at any pitch from horizontal to a completely vertical (nozzle-up) position, and at a yaw angle fixed between zero and 180 degrees. A six-degree-of-freedom force-measurement system located between the test stand and the pad determines the motor's thrust performance. The placement and elevation of the test motor stand allows a clear line of sight to the test motor with blue-sky background from most of the surrounding 19 instrumentation sites, minimizing background clutter. Instrumentation to measure ultraviolet (UV), visible, and infrared (IR) signature data includes a 484 by 800-element UV-intensified silicon CCD camera with spectral filter and UV camera lenses; a 180-element dual-band IR mercury cadmium telluride scanning imager; a 256 by 256-element indium antimonide focal plane array camera; a 500 by 800-element platinum silicide focal plane array camera; three grating spectrometers with 256 by 1024-element UV-enhanced silicon detector arrays including one with intensifier; a Fourier-transform infrared spectrometer; and three filter radiometers with cesium telluride photomultiplier tube detectors, silicon detector radiometers, and liquid-nitrogen-cooled indium antimonide detector radiometers with telescope optics. For measuring plume RF signature data, the facility has two radars with complementary capabilities: one high-power, long-range pulsed Doppler system, and one low-power, high-resolution, frequency-modulated system. The facility performs data reduction and generates test reports.

The Non-Destructive Ordnance Test Facility uses a large, high-energy computed tomography system; two-dimensional digital video data; and conventional film x-rays to inspect tactical missile systems for non-destructive testing, lot acceptance, quality assurance, environmental qualification, safety testing, and explosives and propellant research, development, test, and evaluation. Inspection and testing is performed on items ranging from small ordnance to strategic rocket motors weighing up to 59 metric tons (130,000 pounds). Warheads, fuzes, safe-arm devices, and associated subsystems can also be inspected and tested. The facility can test strategic rocket motors up to 7.3 meters (24 feet) long and 2.3 meters (92 inches) in diameter. Longer motors can be inspected with two upending evolutions. The facility also conducts helium leak testing and boroscopic

COMPOSITES AND PLASTICS LABORATORY: The Composites and Plastics Laboratory provides advanced composite development, from design and analysis methodology, materials development and characterization, and fabrication methods, through testing for tactical missile airframes

EQUIPMENT/FACILITIES (continued)

and propulsion systems. The plastic and composite (fiber-reinforced) parts developed here include bulkheads, complete airframes and nozzles, liners and insulators, and rocket-motor cases. Unique design, analysis, fabrication, and test equipment are integrated for quick-turnaround projects and special one-of-a-kind solutions to customer needs. Lay-up tables, presses up to 290 metric tons (320 short tons), autoclaves (172 x 105 N/m^2 (250 psi) and temperatures up to 399°C (750°F)), and curing ovens afford a self-contained capability to meet all manner of nonmetallic-parts fabrication requirements. The composite winding equipment can fabricate solid rocket-motor cases and complete airframes for tactical missiles up to 1.2 meters (48 inches) in diameter and 4.9 meters (16 feet) long.

AEROHEAT TEST FACILITY. This facility (T-Range) is a high-pressure air blow-down facility capable of simulating variable Mach number and altitude flight conditions for materials characterization and testing of tactical-sized missile components and air-breathing propulsion systems. Infrared imaging cameras are available to estimate the surface temperature on items being tested. The facility is supported by experts in computational fluid dynamics and thermal and structural analysis.

RADAR REFLECTIVITY LABORATORIES: The **Monostatic** and **Bistatic Radar Reflectivity Laboratories** are used to conduct analyses, experiments and measurements in radar reflectivity, materials, and RF signatures.

The **Monostatic Radar Reflectivity Laboratory** consists of two instrumented anechoic chambers. The larger chamber, 30.5 meters long by 12 meters wide by 12 meters high (100 by 40 by 40 feet), is equipped for performing electromagnetic scattering and radiation measurements to determine radar signatures of air vehicles as large as 4.9 meters (16 feet) and weighing up to 0.9 metric ton (2000 pounds). The chamber is polarization diverse and can measure S, C, X, Ku, Ka, V, and W bands (2 to 100 gigahertz). The second chamber, 22.8 meters long by 8.2 meters wide by 4.5 meters high (75 by 27 by 15 feet), is used primarily for development and testing of antennas and target-augmentation devices. This smaller chamber can provide monostatic near-field measurement data over the 2 to 95 gigahertz frequency range.

The **Bistatic Radar Reflectivity Laboratory** is a one-of-a-kind facility that consists of a large instrumented anechoic chamber for performing bistatic electromagnetic scattering and radiation measurements to determine radar signatures of air vehicles as large as 9 meters (30 feet) and weighing up to 2.7 metric tons (6000 pounds). The bistatic anechoic chamber, which measures 46 by 46 by 18 meters (150 by 150 by 60 feet), is a unique facility that provides free space, far-field or near-field conditions in a secure indoor environment. The facility is polarization diverse and is instrumented to measure VHF, UHF, L, S, C, X, Ku, Ka, V, and W bands (0.1 to 100 gigahertz). Bistatic angular coverage is provided from 0 to 180 degrees (horizontal) and 0 to 90 degrees (vertical). Both laboratories provide free space, far-field, or near-field conditions in a secure indoor environment. A collimator is used to provide far-field monostatic or bistatic signature measurements. Both laboratories provide versatile target supports, radar measurements, and data-processing capabilities.

WEAPONS SURVIVABILITY LABORATORY: The WSL conducts survivability testing to provide empirical data on the vulnerability of aircraft to actual threats. Survivability tests at the WSL are conducted on hardware ranging from full-scale aircraft and subsystems to smaller-scale developmental hardware, simulators, replicas, components, and materials. In-flight airflow conditions from 74 to 1111 kilometers per hour (40 to 600 knots) are simulated with the High Velocity Airflow System (HIVAS) and the portable HIVAS. These systems allow tests that would otherwise be difficult or impossible to perform. Ballistics testing at the WSL involves nearly all calibers as well as explosively projected and gun-fired (sabot-launched) fragments at speeds of 305 meters to 2.2 kilometers (1000 to 7200 feet) per second. The WSL's 15.2-centimeter (6-inch) diameter air gun can launch 8-kilogram (18-pound) warheads and projectiles at speeds up to 457 meters (1500 feet) per second. WSL test instrumentation is comprehensive, and a variety of data products are offered. All support services are available on site, including a complete machine shop and mechanical, aerospace, and electronic engineering support.

AERIAL AND SURFACE TARGETS COMPLEX. The Aerial and Surface Targets Complex provides full life-cycle support services for aerial and surface targets. Services include target

EQUIPMENT/FACILITIES (continued)

development, modification, test and evaluation, operations, maintenance, and the associated systems and in-service engineering functions. These services support full-scale targets, subscale targets, missile targets, surface targets and target augmentation/ auxiliary systems. Full-scale targets include the QF-4N and QF-4S Phantom II aircraft, capable of speeds to Mach 2 and altitudes of 17 kilometers (57,000 feet). Subscale targets include the BQM-74, BQM-34, and Ballistic Aerial Target. Missile targets include the MQM-8 series Vandal targets (capable of Mach 2.1 at 3.6-meter (12-foot) altitude with terminal weave/jink end-game maneuver, and a total range of 74 kilometers (40 nautical miles)), the AQM-37 C and D targets, which can reach Mach 4.5 at 33,500 meters (110,000 feet) when air launched from the QF-4 (manned or unmanned) or the F-16 (manned only) platforms, and the MA-31 which is currently undergoing a Foreign Comparative Test program and is expected to become operational within the next year. Surface targets include Seaborne Powered Targets (SEPTARS, both 5.5-meter (18-foot) and 17-meter (56-foot) classes), target ships (powered and unpowered), and towed targets. The 80-meter (262-foot) Mobile Ship Target (MST) is highly survivable, environmentally clean, and capable of speeds in excess of 22 kilometers per hour (12 knots). Seaborne target harbor facilities at Port Hueneme provide ready access to the Sea Range and open ocean. Target augmentation/auxiliary systems, which are available for all aerial and surface target types, include command-and-control, flight termination, radar and infrared signature enhancement, threat seeker and threat countermeasure simulators, and scoring systems. The Complex has a DC-130 aircraft for aerial target launches as well as the Aerial Target Launch Ship. These allow the target capability for airborne or seaborne launches to be deployed in operations throughout the world.

OPTICS AND LASER RESEARCH FACILITY: The Optics and Laser Research Facility conducts research, development, test, and evaluation on optical materials, components, systems, and subsystems. Laboratories and equipment in this facility provide the capability for design, fabrication, characterization, evaluation, and research of new optical materials; and fabrication and characterization techniques and instrumentation. Specific areas of research include laser devices, laser interaction with matter, and protection against laser radiation. Capabilities include optical design and fabrication, diamond turning, optical thin films, optical characterization, laser devices and effects, laser spectroscopy, and large optics. The integrated capabilities that exist in this facility allow, for example, the combination of surface finishing by diamond-single-point machining, reactive-sputtering coating, and precision measurement of surface finish and optical performance all in a single location.

RADAR CROSS-SECTION, HIGH POWER MICROWAVE MEASUREMENT, and GPS JAMMING FACILITIES: Junction Ranch is an outdoor research facility for radar-cross-section (RCS) testing, high-power microwave (HPM) measurements, and Global Positioning System (GPS) jamming tests. The 168-square-kilometer (65-square-mile) facility offers excellent air and ground security because of its isolated location, rugged terrain, restricted airspace, and controlled borders and ground space. Precision RCS measurements are performed at two adjacent facilities: the Bounce Strip Range and the Look-Down Range. The Bounce Strip Range operates in the HF, VHF, UHF, L, S, C, X, W, Ku, and Ka bands. The range features a 12-meter (40-foot), low-backscatter stationary pylon that can hold targets weighing up to 2.7 metric tons (6,000 pounds). The pylon can be located at the 213-meter (700-foot) pit for low-frequency tests, the 1,219-meter (4,000-foot) pit for high-frequency tests, or the 610-meter (2,000-foot) pit for a combination of both tests. At the Look-Down Range, the radar looks down on the target from a range of 5181 meters (17,000 feet) and an angle of 10 degrees. Two special-purpose target test beds make this facility unique. The wet site, a 24 by 30-meter (78 by 100-foot) pond, creates a simulated sea environment used to investigate background clutter and target-to-surface interactions. The tilt deck is a 24 by 43-meter (80 by 140-foot) hydraulically-controlled platform enabling target presentations of 5 to 32 degrees in elevation. Each site has a 9-meter-diameter (30-foot-diameter) turntable capable of holding targets up to 4.5 metric tons (10,000 pounds) and rotating targets 360 degrees to expose all aspects to the radar. Junction Ranch was selected for HPM and GPS testing because of its remote, shielded location, superb technical capability, and low RF/EMI background. The facility provides the instrumentation suite, test coordination, targets, facilities, and support functions ranging from frequency allocations to construction of low observable support structures capable of handling full-scale aircraft or ground vehicles. Frequency range coverage is 30 Mhz to 18 Ghz with a spot frequency at 34 Mhz to 36 Mhz.

EQUIPMENT/FACILITIES (continued)

INFORMATION & ELECTRONIC WARFARE (I&EW) SYSTEMS LABORATORIES: The various NAWCWPNS I&EW systems laboratories provide life-cycle support for airborne EW systems, including warning receiver, jammer, EO/IR, missile-warning, countermeasures, and support systems; software support for the EA-6B aircraft as well as for prime multi-platform EW systems; and system engineering support, including system design and integration, development of information systems, and fleet system software upgrades for warning, jamming, and decoy systems.

The **Electronic Combat Simulation and Evaluation Laboratory (ECSEL)** is the Navy's principal laboratory complex for research, development, and in-service engineering of naval airborne electronic-warfare (EW) equipment. This modern, secure facility develops, operates, and maintains simulations that replicate the functional characteristics and performance of threat weapon systems. The ECSEL's Advanced Multiple Environment Simulator family of open-loop simulations provides a dense electromagnetic environment of land-based, naval, and airborne threat weapon systems. Frequency coverage is from 100 kHz to 96 GHz. Specific closed-loop simulators include a current threat surface-to-air missile system, the Radar Equipment Simulator, the Semiactive Test System, and the Early Warning/Acquisition system. EW systems workstations provide prime power, avionics, computer, and simulator interfaces for naval aircraft radar-warning receivers and jammers. Research and development testing of developmental EW equipment, software support for currently fielded systems, integration support, and techniques development and optimization are routinely performed in the ECSEL.

The **Electronic Warfare Integration Laboratory (EWIL)** provides complete end-to-end test and integration of avionics, weapons, and electronic-warfare (EW) suites aboard tactical aircraft. The facility employs the Multiple Agile Radar Threat Simulator (MARTS) and the Modular Advanced Radar Simulator (MARS) workstations, and consists of several EW laboratories integrated in one building. The Multiple Target RF Environment covers the range from 600 MHz to 18 GHz with up to 112 simultaneous emitters and 14 pulse Doppler radar simulators in a single anechoic chamber. The EW Suite Integration Laboratory contains powered, spread benches for radar warning receivers, self-protection jammers, antiradiation missile (ARM) seekers (and their associated command-launch computer), and simulated aircraft mission computers.

The **Antiradiation Seeker Development Laboratory** utilizes both the Multiple Target RF Environment and the ARM system development environment. The Radar Warning Receiver Development Laboratory utilizes the Multiple Target RF Environment and the radar warning receiver system development environment. Remote terminals attached to the EW and avionics MUX bus can be fully monitored for operational flight program (OFP) development, integration, and test. The laboratory includes a data-reduction facility for flight-test data as well as data-analysis workstations. Data-reduction packages include cockpit video, digital display reproduction, and digital flight and engineering data (provided on a compact disk or other media). Software verification and validation for OFPs under development are performed on a DEC Alpha VAX system in Ada.

ELECTRONIC COMBAT RANGE CAPABILTIES: The ECR is a free-space (open-air) test range for aircraft and airborne systems and techniques designed to sense, counter, or penetrate threat air-defense systems. This is the only U.S. Department of Defense electronic-combat range with the ability to test against naval air-defense systems and combinations of land and naval systems (the littoral threat) either individually or as part of an integrated air-defense system. Operating on 2978 square kilometers (1150 square miles) of U.S. Navy land under 3108 square kilometers (1200 square miles) of unlimited-altitude restricted airspace, the ECR is a dedicated electronic-combat range. The Range is located in a region selected for its remoteness and relative absence of population and offers high security with minimum electromagnetic interference. The ECR provides for unlimited use of expendables and decoys.

MISSILE & AIRCRAFT SOFTWARE VALIDATION & TESTING LABORATORIES: Laboratories are available to support independent software verification, validation and performance testing.

WEAPON SYSTEM INSTRUMENTATION & DATA ANALYSIS: These facilities support instrumentation requirements related to tactical missile, aircraft, and other product testing areas. The data

EQUIPMENT/FACILITIES (continued)

analysis laboratories provide near-real-time data extraction and valuation for timely assessment of aircraft/weapon integration and missile system performance.

AIRFIELDS: Airfields at China Lake, Point Mugu, and San Nicolas Island provide comprehensive flight services for NAWCWPNS customers. These airfields can support all types of tactical and logistical aircraft (including C-5s and 747s) and offer a full range of airfield operational capabilities and related facilities for support of research, development, test, and evaluation projects. Operational capabilities include Tactical Air Navigation (TACAN), instrument landing system (ILS) navigational aids (Point Mugu only), approach control (Point Mugu only) and control tower operations, 24-hour crash crew response, and emergency aircraft arresting gear (E-28) on all runways. Aircraft support includes aircraft intermediate maintenance facilities (China Lake and Point Mugu only), aviation supply facilities (China Lake and Point Mugu only), aviation ready fuel storage, and ground support equipment. Customs and agriculture inspections for aircraft arriving from overseas are available at China Lake and Point Mugu with prior coordination. At China Lake and Point Mugu, spaces for operating detachments are available (limited spaces for operating detachments are available at San Nicolas Island) as are first-class galleys. Limited transient quarters are available at all three airfields.

LAND RANGES: The Land Ranges are composed of multiple air and ground test ranges, specialized test areas, ordnance test facilities, and control and support facilities. The Land Ranges support test and evaluation for air and ground conventional weapons, aircraft systems, air-to-air and air-to-surface missiles, rockets, bombs, cluster munitions, cruise missiles, unmanned air vehicles, guns and artillery, fuzes and sensors, mass detonation, training and tactics development, and parachute systems. Instrumentation includes photo-optic systems; telemetry receiving and display; radar, video, laser, and global positioning tracking; meteorological data; and communications systems. A Range Control Center provides consolidated command, control, and coordination of test operations. Targets from simple billboards to full-scale aerial targets are available, including the largest array in the U.S. of "shootable" targets for antiradiation missile testing. Land within an 80-kilometer (50-mile) radius is in the public domain, and airspace over the ranges is restricted from surface to infinity, providing safe and secure air and ground range operational areas. A comprehensive land-use management plan will enable customers performing routine testing on the Land Ranges to use the existing base-wide environmental impact statement as a basis for meeting environmental analysis and documentation requirements, thereby saving the customer time and money. Two specialized range areas are the Coso Military Target Range and the Superior Valley Tactical Training Range. Coso Range covers 181 square kilometers (70 square miles) of rough, mountainous terrain that represents a typical wilderness combat environment and presents pilots with unexpected, realistic conditions that are not duplicated at other aircraft test ranges. Coso Range is ideal for aircrew training, weapons delivery techniques and tactics, and detecting and acquiring partly hidden or camouflaged military targets. Targets at Coso Range include a railroad, bridges, radars, tunnels, truck convoys, tanks, and a revetted surface-to-air missile site. Superior Valley is a 91-square-kilometer (35-square-mile) remote area used for aerial delivery of both conventional and nuclear training ordnance, test and evaluation of new and experimental systems, search-and-rescue training, helicopter mobile assaults, and insertion, fire fights, and extraction. Targets at Superior Valley include two bombing circles for light inert nuclear and conventional deliveries and high-angle strafe, two triangular targets for low-angle strafe, a simulated vehicle convoy, a simulated airfield complex with antiaircraft artillery and surface-to-air missile sites, and a 2438-meter (8000-foot) simulated runway, taxiway, and ramp with numerous aircraft targets.

SEA RANGE AND SAN NICOLAS ISLAND: The Sea Range off the coast of Point Mugu, California, is the United States' largest and most heavily instrumented sea/air range, encompassing more than 323,700 square kilometers (125,000 square miles) of instrumented test space and more than 123,000 square kilometers (36,000 square nautical miles) of controlled airspace. With the cooperation of other U.S. Government agencies, available test space can be expanded to more than 507,000 square kilometers (196,000 square miles). Instrumentation includes radar; photo-optics; video; surveillance; telemetry; communications; command, control, and destruct; and data processing and display. Meteorological and oceanographic data are also provided. Ground-based coverage is augmented by airborne instrumentation, including multibeam telemetry; multilateration tracking; surveillance; command, control, and destruct; range safety; long-range optics; and communications. Surface craft are provided for placing and

EQUIPMENT/FACILITIES (continued)

recovering surface targets. The coastal region and offshore islands support true at-sea and littoral scenarios. San Nicolas Island (SNI), located 97 kilometers (60 miles) southwest of Point Mugu, is instrumented with metric tracking, telemetry, and communications equipment and has a 3048-meter (10,000-foot) runway; with its isolated environment and shoreline characteristics, SNI is ideal for providing littoral warfare training, including theater warfare exercises. SNI has the capability to launch subscale and unmanned full-scale targets, has launch sites for surface-launched weapons, and also has an impact area for weapons launched from aircraft or ships. An extensive array of aerial and surface targets are available at the Sea Range, including full-scale unmanned aircraft. Up to 20 targets can be engaged simultaneously, with associated metric track, telemetry, and precision scoring. Electronic warfare environments are provided by manned aircraft, unmanned aerial targets, and surface (land and sea) assets including simulations of surface and airborne electronic countermeasures threats, surveillance and targeting radars, and antiship missile seekers. Cruise missiles can be launched from the Sea Range and flown via the military instrument route known as IR-200 to ranges in California, Nevada, or Utah, more than 1600 kilometers (1000 miles) away. Some of the testing capabilities unique to the Sea Range are complex, multiparticipant, multiple-warfare-area, multinational operations; coordinated air, surface, and submarine operations; submarine-, surface-, and air-launched cruise weapons testing; long-range, large-hazard-pattern weapons testing; simulated regional conflict operations; multiple-participant live-fire exercises; and support for ballistic missile and polar satellite launches from Vandenberg Air Force Base in California. Multiple theater missile defense scenarios can be supported by the Sea Range.

NATIONAL PARACHUTE TEST RANGE: The National Parachute Test Range provides a broad spectrum of resources and capabilities for parachute testing. These include parachute fabrication, airborne and ground-based instrumentation, sled track operations, aircraft, live jumpers, water test areas, explosive operations, and paraloft facilities. Projects that have been tested at the National Parachute Test Range include the U.S. Naval Aircrew Common Ejection Seat (NACES), Thin Pack bailout parachute, egress system for the U.S. Space Shuttle, and components of the Mars Pathfinder.

NAVAL TEST WING PACIFIC (NTWP): The NTWP provides aircraft, project flight-test aircrews, flight-test planning, and flight-clearance management for aircraft modification to support weapons and weapon-systems development, test and evaluation, and training missions. These services can be deployed worldwide. Two Weapons Test Squadrons make up the NTWP, one at Point Mugu and one at China Lake. Both squadrons can modify test aircraft to meet project requirements and thus can accommodate a wide variety of weapons and weapon systems in the test and training environments. Aircraft assets include the AH-1W Cobra attack helicopter (2), AV-8B and TAV-8B Harrier (6), F-14 Tomcat (7), F/A-18 Hornet (16), HH-1N Iroquois helicopter (3), NP-3D Orion (5), QF-4N/S Phantom II (12), SA-227 Metroliner (4), T-39 Sabreliner (1), DC-130 target launch aircraft (3), and a variety of contract aircraft for logistic-support services.

OTHER SPECIAL CAPABILITIES: Specialized facilities are used for electronics research leading to complete life-cycle support of fire-control systems, guidance-and-control systems for missile weaponry, sensors, and fuzes. In addition, NAWCWPNS has unique capabilities provided by its EO/IR laboratories, RF anechoic chambers, strategic-systems propulsion test facilities, complete photographic laboratory, and a large industrial machine shop used for weapons system engineering prototyping.

Naval Air Warfare Center
Patuxent River, MD 20670-1547
(301) 757-7692

Commander NAVAIR: VADM John A. Lockard
Deputy Commander NAVAIR: Dr. Alan Somoroff

FY98 FUNDING DATA (MILLIONS $) [1]				
APPROPRIATION	IN-HOUSE	IN-HOUSE MANAGEMENT	OUT-OF-HOUSE	TOTAL
RDT&E:				
6.1 ILIR	2.825	N/A	0.000	2.825
6.1 Other	1.779	N/A	0.711	2.490
6.2	31.582	N/A	23.751	55.333
6.3	23.687	N/A	28.942	52.629
Subtotal (S&T)	**59.873**	**N/A**	**53.404**	**113.277**
6.4	80.928	N/A	50.057	130.985
6.5	119.529	N/A	133.703	253.232
6.6	247.748	N/A	117.944	365.692
6.7	125.951	N/A	66.460	192.411
Non-DOD	0.000	N/A	0.000	0.000
TOTAL RDT&E	**634.029**	**N/A**	**421.568**	**1,055.597**
Procurement	387.250	N/A	328.088	715.338
Operations & Maintenance	333.059	N/A	200.017	533.076
Other	279.696	N/A	155.467	453.163
TOTAL FUNDING	**1,634.034**	**N/A**	**1,105.140**	**2,739.174**

MILITARY CONSTRUCTION (MILLIONS $) [1]	
Military Construction (MILCON)	13.819

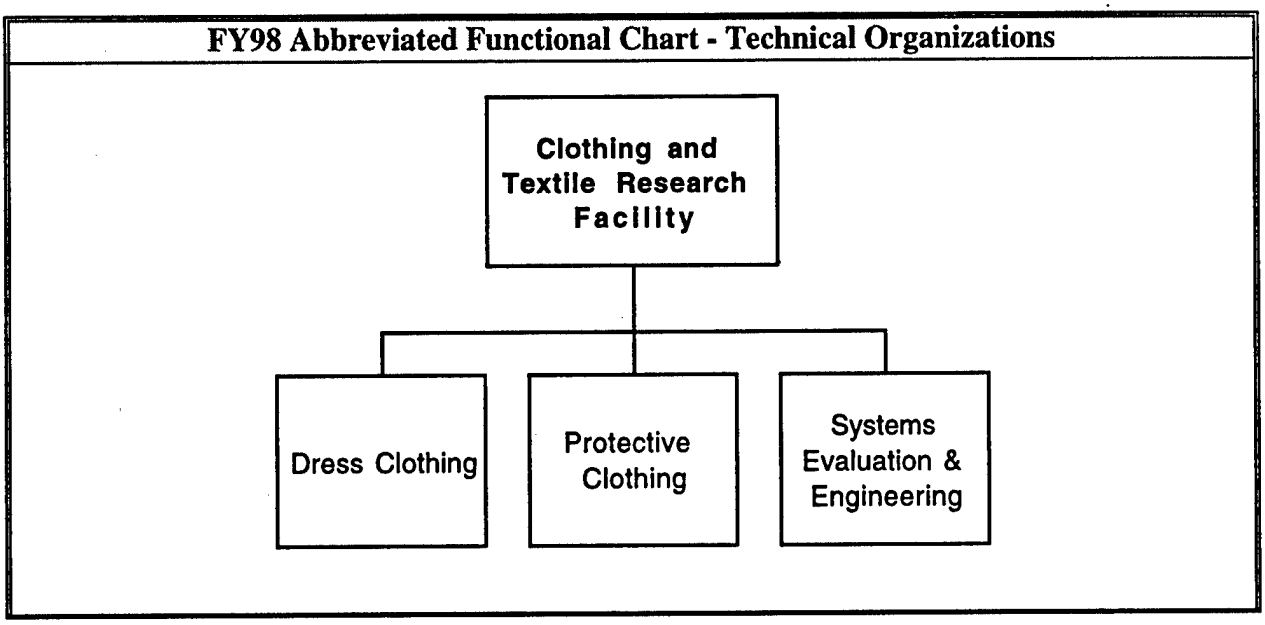
PERSONNEL DATA (END OF FISCAL YEAR 1998) [1]				
TYPE	SCIENTISTS & ENGINEERS		TECHNICAL SUPPORT & OTHER PERSONNEL	END STRENGTH
	DOCTORATES	OTHER		
MILITARY	8	194	2,105	2,307
CIVILIAN	211	4,015	6,049	10,275
TOTAL	**219**	**4,209**	**8,154**	**12,582**

SPACE AND PROPERTY [1]			
BUILDING SPACE (THOUSANDS OF SQ FT)		PROPERTY ACQUISITION COST (MILLIONS $)	
LAB	7,782.410	**REAL PROPERTY**	1,441.500
ADMIN	1,241.885	* NEW CAPITAL EQUIPMENT	112.974
OTHER	10,409.500	**EQUIPMENT**	557.808
TOTAL	**19,433.795**	* NEW SCIENTIFIC & ENG. EQUIP.	20.371
ACRES	**1,145,491**	* Subset of previous category.	

N/A - Not Applicable

[1] As a result of applying the In-House RDT&E Activity criteria at the division or major site level (see NOTE on page 3-1), NAWC Training Systems Division and NAWC Aircraft Division Lakehurst Activity data is not included in the FY98 report. These two activities contribute an additional $1.5B to the total NAWC business base.

Navy Clothing and Textile Research Facility



Navy Clothing and Textile Research Facility
Natick, MA 01760
(508) 233-4172

Director: Barbara A. Avellini, Ph.D.

MISSION

Conduct research, development, test and evaluation and provide engineering support in clothing, textiles, and related fields associated with service clothing and environmental protective clothing. Our core technologies revolve around individual protection against environmental threats such as, heat, cold, accidental water immersion, fire, steam, biological-chemical exposure, hazardous chemicals, etc. The Natick site which houses both NCTRF and the U.S. Army Natick Research, Development and Engineering Center has been designated the DoD Center of Excellence for Clothing and Textiles.

CURRENT IMPORTANT PROGRAMS

Joint Services Lightweight Integrated Suit Technology Pre-Planned Product Improvement - Joint service program to upgrade garments which will be protective in chemical-biological contaminated environments and can be used in one form or another by all services.

Shipboard Protective Clothing Program - Provide state-of-the-art, commercially available, firefighter's protective clothing, flame resistant utility uniforms, anti-exposure suits, cold and wet weather ensembles and life-support systems and equipment for Navy personnel which meet appropriate performance requirements for the shipboard environment. Performance requirements/testing procedures are developed at NCTRF to enable commercial products to be qualified through NCTRF laboratory testing and Fleet evaluation. Testing includes conformance to standards and Navy unique requirements designed to analyze the protective capabilities of materials and clothing.

AIR WARRIOR - Support of army program to develop improved integrated aircrew ensemble for rotary wing aircraft.

Joint Protective Aircrew Ensemble (JPACE) - Joint service program to develop next generation chemical-biological protective garments for aircrew of all services.

Phase Change Materials - New technology which will be used to extend the range of comfort for individuals exposed to warm and cold environments, as well as to enhance the performance of protective clothing. This technology can also be useful to the private sector.

A CRADA has been established between NCTRF and Battelle, Natick Operations for the purpose of furthering technologies of mutual interest for utilization in protective clothing and equipment. We have also teamed with the Center of Technology Transfer and the U.S. Felt Manufacturing Company of Maine to develop new cold weather footwear for dual-use applications in the civilian and military markets.

EQUIPMENT/FACILITIES

Major equipment and facility capabilities include:

Two thermal manikin systems used to measure insulation values of protective clothing systems. One system employs cutting edge heat pipe technology to obtain measurements in an air environment; this manikin is the only known in existence utilizing this technology. The second manikin has the capability to evaluate items in both an air and water immersion environment. This is one of only four known manikins worldwide capable of being used in both water and air; the thermal hand and thermal foot are used to measure insulation values of handwear and footwear, respectively. The environmental test chambers reproduce extremes from 0°F to 130°F at 5% to 95% relative humidity, with wind speeds up to .5 to 15 mph. The hydro-environmental simulator is the only known chamber within the Navy that is able to independently control both air and water temperatures simultaneously, and thus simulate any air/water interface. A Gerber Micromark/Silhouette computer-aided design system to grade, alter, and trace patterns, and to cut hard patterns; a shipboard laundry laboratory; a thermal flammability laboratory includes instrumentation to evaluate conductive, radiative, and convective heat; physiological test and evaluation equipment. Instron testers, weatherometers, fadeometers, launderometer, tear tester, etc., used to determine the physical characteristics of clothing and textiles. A traversing thermocouple instrumented manikin, used to evaluate fire resistant protective clothing at variable heat flux levels and exposure times, when exposed to a propane-fueled fire in an enclosed area.

Navy Clothing and Textile Research Facility
Natick, MA 01760
(508) 233-4172
Director: Barbara A. Avellini, Ph.D.

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	IN-HOUSE	IN-HOUSE MANAGEMENT	OUT-OF-HOUSE	TOTAL
RDT&E:				
6.1 ILIR	0.000	N/A	0.000	0.000
6.1 Other	0.000	N/A	0.000	0.000
6.2	0.372	N/A	0.058	0.430
6.3	0.074	N/A	0.000	0.074
Subtotal (S&T)	**0.446**	**N/A**	**0.058**	**0.504**
6.4	0.688	N/A	0.066	0.754
6.5	0.271	N/A	0.003	0.274
6.6	0.001	N/A	0.000	0.001
6.7	0.000	N/A	0.000	0.000
Non-DOD	0.068	N/A	0.095	0.163
TOTAL RDT&E	**1.474**	**N/A**	**0.222**	**1.696**
Procurement	0.229	N/A	0.002	0.231
Operations & Maintenance	1.838	N/A	0.236	2.074
Other	0.179	N/A	0.287	0.466
TOTAL FUNDING	**3.720**	**N/A**	**0.747**	**4.467**

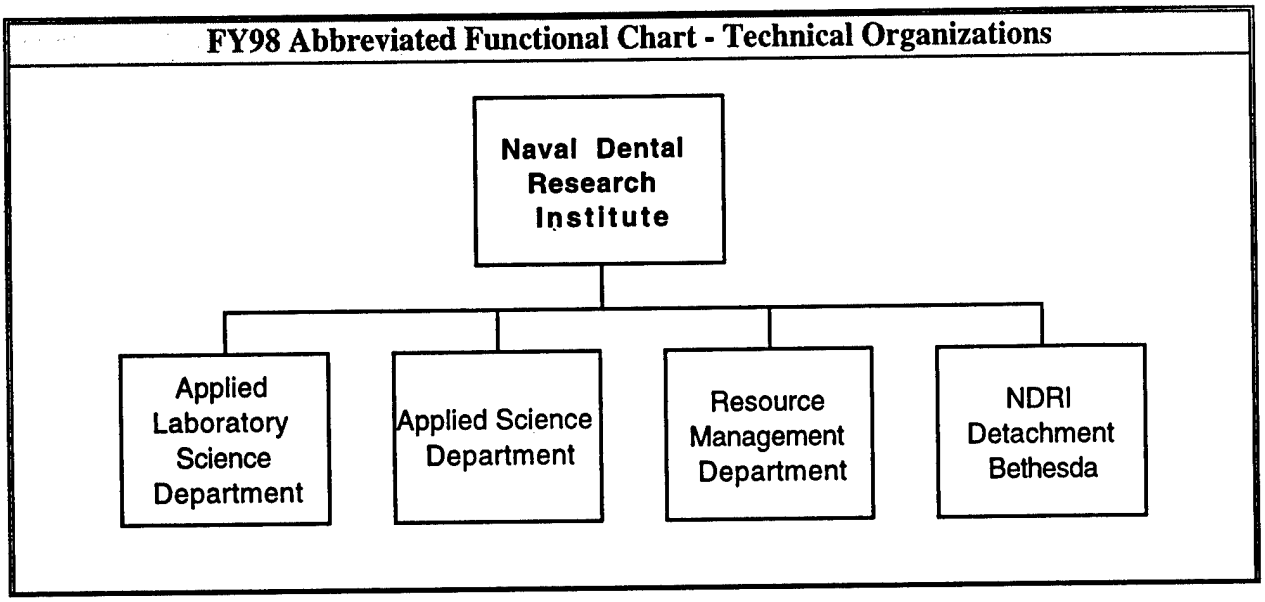
MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		TECHNICAL SUPPORT & OTHER PERSONNEL	END STRENGTH
TYPE	DOCTORATES	OTHER		
MILITARY	0	0	0	0
CIVILIAN	1	24	11	36
TOTAL	**1**	**24**	**11**	**36**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		PROPERTY ACQUISITION COST (MILLIONS $)	
LAB	12.667	**REAL PROPERTY**	4.300
ADMIN	16.000	* NEW CAPITAL EQUIPMENT	0.000
OTHER	0.000	**EQUIPMENT**	2.805
TOTAL	**28.667**	* NEW SCIENTIFIC & ENG. EQUIP.	0.002
ACRES	**0**	* Subset of previous category.	

N/A - Not Applicable

Naval Dental Research Institute



Naval Dental Research Institute
Great Lakes, IL 60088-5259
(847) 688-5647

Commanding Officer: CAPT Gordon K. Jones, DC
Chief Scientist: Dr. Lloyd G. Simonson

MISSION

To research, develop, test, and evaluate new methods and materials that limit oral disease, reduce dental emergencies, maximize operational readiness, and promote dental wellness for Navy and Marine Corps personnel.

CURRENT IMPORTANT PROGRAMS

1. Continue advanced development of rapid chairside risk assessment tests for dental caries, advanced prototypes completed. Patents awarded, License pending.
2. Continue advanced development of fluorescence polarization as technique for rapid diagnosis. Patent awarded. License pending.
3. Develop rapid non-invasive salivary assays for presence of antibodies to tuberculosis and other infectious diseases.
4. Develop tests for genetic biomarkers for periodontal disease.
5. Develop protein pattern recognition technology for periodontal disease.

CHEMICAL AND BIOLOGICAL CONTAMINANTS IN DENTISTRY

1. Develop systems and apparatus to remove mercury from dental waste water. Patents awarded. Industrial mercury recovery compound adapted for dental use with Nalco, Inc. Continue transition of this technology to war zone/afloat system applications.
2. Develop biochemical techniques to test salivary levels of bis-phenol A associated with oral resin systems in collaboration with National Institute of Dental Research (NIDR) and ADA.

DENTAL CARE DELIVERY TECHNOLOGIES

1. Develop bioactive materials to promote and accelerate wound healing and implant incorporation.
2. Develop interim dental restorative materials for use by the IDC in the War-zone that will result in dental casualty return to operational assignments within 30 minutes.
3. Develop clinical protocols to minimize post-surgical complications in women.
4. Study the effectiveness of dental sealants in young adults.
5. Develop new periodontic and endodontic treatment techniques, equipment, and materials.
6. Develop improved patient tracking/data collection with SMART Card and optical mark recognition technology.
7. Continue evaluation of the Navy-Wide Managed Dental Care delivery system.

CURRENT IMPORTANT PROGRAMS (continued)

8. Deploy multimedia dental diagnostic and treatment system for war zone/remote site use by IDCs. Transition software to the HTML format.

DENTAL HEALTH RELATED STUDIES

1. Develop and evaluate improved Tobacco Cessation Programs.
2. Investigate relationships between Oral and Systemic Diseases.
3. Develop techniques for dental materials fracture analysis/prediction with National Institute of Standards and Technology (NIST).
4. Collect and analyze dental epidemiologic data as requested by higher authority.
5. Collect and analyze operational dental emergency data.

EQUIPMENT/FACILITIES

13,000 square feet AAALAC-accredited animal colony.

A comprehensive dental research library, numerous volumes and journals with direct online access to a variety of literature search services.

Extensive computer and data processing facilities.

Direct access to large military populations and the Navy's only Recruit Training Center.

Direct access to the American Dental Association, three university dental schools, two large VA hospitals, a large Naval Hospital, a major Naval Dental Center, and the headquarters of nearly 50 leading dental organizations.

A gas chromatography microbial identification system.

Atomic Absorption Spectrometer.

Numerous other pieces of state-of-the-art equipment.

Direct access to the National Institute of Dental Research, National Library of Medicine, the National Institute of Standards and Technology, and National Institutes of Health (NDRI Bethesda Detachment).

Illinois EPA Certified Waste Water Testing Facility for mercury.

Co-located with U.S. Army Dental Research Detachment.

Total facility capacity = 75,000 sq. ft.

Naval Dental Research Institute
Great Lakes, IL 60088-5259
(847) 688-5647

Commanding Officer: CAPT Gordon K. Jones, DC
Chief Scientist: Dr. Lloyd G. Simonson

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	0.072	N/A	0.000	0.072
6.1 Other	0.128	N/A	0.000	0.128
6.2	0.000	N/A	0.000	0.000
6.3	1.310	N/A	0.000	1.310
Subtotal (S&T)	**1.510**	**N/A**	**0.000**	**1.510**
6.4	0.000	N/A	0.000	0.000
6.5	0.000	N/A	0.000	0.000
6.6	0.248	N/A	0.000	0.248
6.7	0.000	N/A	0.000	0.000
Non-DOD	0.000	N/A	0.000	0.000
TOTAL RDT&E	**1.758**	**N/A**	**0.000**	**1.758**
Procurement	0.000	N/A	0.000	0.000
Operations & Maintenance	0.000	N/A	0.000	0.000
Other	0.000	N/A	0.000	0.000
TOTAL FUNDING	**1.758**	**N/A**	**0.000**	**1.758**

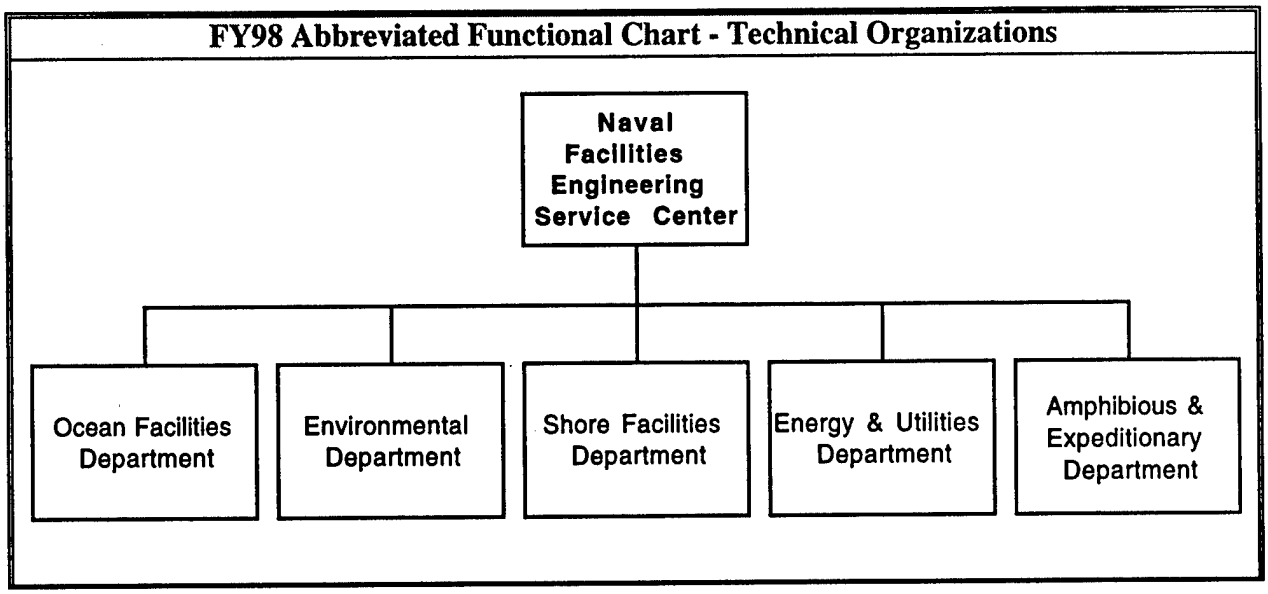
MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	**END STRENGTH**
TYPE	**DOCTORATES**	**OTHER**		
MILITARY	4	7	10	21
CIVILIAN	3	3	5	11
TOTAL	**7**	**10**	**15**	**32**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	19.212	**REAL PROPERTY**	13.300
ADMIN	5.137	* NEW CAPITAL EQUIPMENT	0.000
OTHER	11.676	**EQUIPMENT**	2.097
TOTAL	**36.025**	* NEW SCIENTIFIC & ENG. EQUIP.	0.045
ACRES	**0**	* Subset of previous category.	

N/A - Not Applicable

Naval Facilities Engineering Service Center



Naval Facilities Engineering Service Center
Port Hueneme, CA 93043-4328
(805) 982-1393

Commanding Officer: CAPT Donald G. Morris

MISSION

Delivers specialized facilities engineering and technology products and services in Shore, Ocean and Waterfront Facilities, Environment, Amphibious and Expeditionary Operations, Energy and Utilities. Provides solutions to problems through engineering, design, construction, consultation, test and evaluation, technology implementation, and management support.

CURRENT IMPORTANT PROGRAMS

Defense Environmental Restoration Program.
Pollution Prevention Equipment Program.
Navy Shore Facilities Improvement.
Advanced Fendering Program.
Deep Ocean Technology in support of ASW. Marine Corps Amphibious Logistics.
Mobile Offshore Basing (MOBS).
Ocean Test Ranges.
Shallow Water Test Ranges.
Ocean Moorings for Acoustic Surveillance (Std Eiger II Program).
Marine Handling Systems for Low Frequency Active Acoustic Surveillance Systems.
Undersea Cable Burial and Survivability.
Explosives Safety.
Physical Security Systems.
DoD LOCKS Program.

EQUIPMENT/FACILITIES

Deep Ocean Simulation Laboratory. Shallow Water Dive Tank. Motor Vessel Independence. Advanced Waterfront Technology Test Site. Water Purification Laboratory. Electromagnetic Pulse Test Facility. Physical Security Test Facility. High temperature pavements stand.

Deep Ocean Simulation Laboratory - This is the largest facility of its kind on the West Coast. It contains 12 pressure vessels capable of simulating the deep ocean environment under controlled conditions. It is used for certifying fleet hardware and support technology validation and testing.

Shallow Water Dive Tank - A 30-ft diameter, 65,000 gallon seawater tank for testing oceanographic equipment, diver construction techniques, diver tools and underwater non-destructive technical (NDT) equipment.

Motor Vessel Independence - A 200-ft vessel with state-of-the-art GPS capability, outfitted to support ocean engineering research and undersea equipment validation testing. The Independence has an A-Frame well and crane system for installation and retrieval of underwater systems.

Research Support Vessel (RSV) - A 50-foot nearshore vessel outfitted to support diving operations and oceanographic equipment testing and operations.

EQUIPMENT/FACILITIES (continued)

Remotely Operated Underwater Vehicle (ROV) - A 2000 foot ROV system which includes a PHANTOM vehicle, control van, handling system and experienced operating crew. For heavier applications the 4000 foot MAX ROVER can incorporate a wide range of components at greater depth. May be deployed from shore or onboard surface vessels.

Advanced Waterfront Technology Test Site (AWTTS) - A half-scale 160í foot test pier with removable deck sections for testing constructability and durability (under constant stress) of waterfront construction and repair materials and systems in a corrosive marine environment. Decks can be statically loaded up to 300,000 lbs. Embedded instrumentation facilitates monitoring performance of structural components. Supports testing programs for the USA CERL, USA WES, Composites Institute and the CERF.

Linear Cable Engine (LCE) - Cable deployment system for 8000 lbs. line pull at a maximum line speed of 500 ft/min.

High Temperature Pavements Test Facility - Controlled high temperature blast facility, which simulates the jet blast of an aircraft auxiliary power unit. Used to test concrete mixtures from the effects of blasts from F-18s, B-1s and AV-8Bs.

Cable Survivability Test Flume - 100-ft by 50-ft by 3-ft deep salt water tank provides survivability testing of full-sized seafloor cabling in a flowing water environment.

Seawater Test Facility - Test site for development, test and evaluation of seawater desalination equipment and expeditionary water treatment devices for production of potable water.

Battery Laboratory - This facility supports testing and evaluation of batteries for Deep Submergence Rescue Vehicles under simulated ocean conditions in conjunction with the pressure vessels of the Deep Ocean Simulation Laboratory. Large battery chargers, load banks, cell monitoring voltage scanners and electrolyte handling equipment are used to conduct tests on silver-zinc batteries for the Navy.

Flexor Test Stand - Computer controlled test rig capable of applying cyclical test loads of up to 300,000 lbs. for dynamic barge loading tests of Flexor Pontoon connectors.

Fiber Optics Laboratory - A 2000 sq. ft facility with temperature controlled cleanrooms for preparing glass optical fibers for precision optical measurements.

Geotechnical Modeling Test Facility - The only Navy facility for controlled testing involving dragging of implements through soils at metered rates for monitoring soil behavior. The facility is used for testing model anchors, site assessment tools, cable plows, and other implements for penetrating the seafloor.

Naval Facilities Engineering Service Center
Port Hueneme, CA 93043-4328
(805) 982-1393
Commanding Officer: CAPT Donald G. Morris

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	IN-HOUSE	IN-HOUSE MANAGEMENT	OUT-OF-HOUSE	TOTAL
RDT&E:				
6.1 ILIR	0.000	N/A	0.000	0.000
6.1 Other	0.000	N/A	0.000	0.000
6.2	2.825	N/A	1.455	4.280
6.3	2.496	N/A	2.931	5.427
Subtotal (S&T)	**5.321**	**N/A**	**4.386**	**9.707**
6.4	14.453	N/A	5.714	20.167
6.5	0.052	N/A	0.000	0.052
6.6	1.116	N/A	0.002	1.118
6.7	0.095	N/A	0.005	0.100
Non-DOD	0.000	N/A	0.000	0.000
TOTAL RDT&E	**21.037**	**N/A**	**10.107**	**31.144**
Procurement	3.787	N/A	5.499	9.286
Operations & Maintenance	61.219	N/A	33.675	94.894
Other	5.274	N/A	7.068	12.342
TOTAL FUNDING	**91.317**	**N/A**	**56.349**	**147.666**

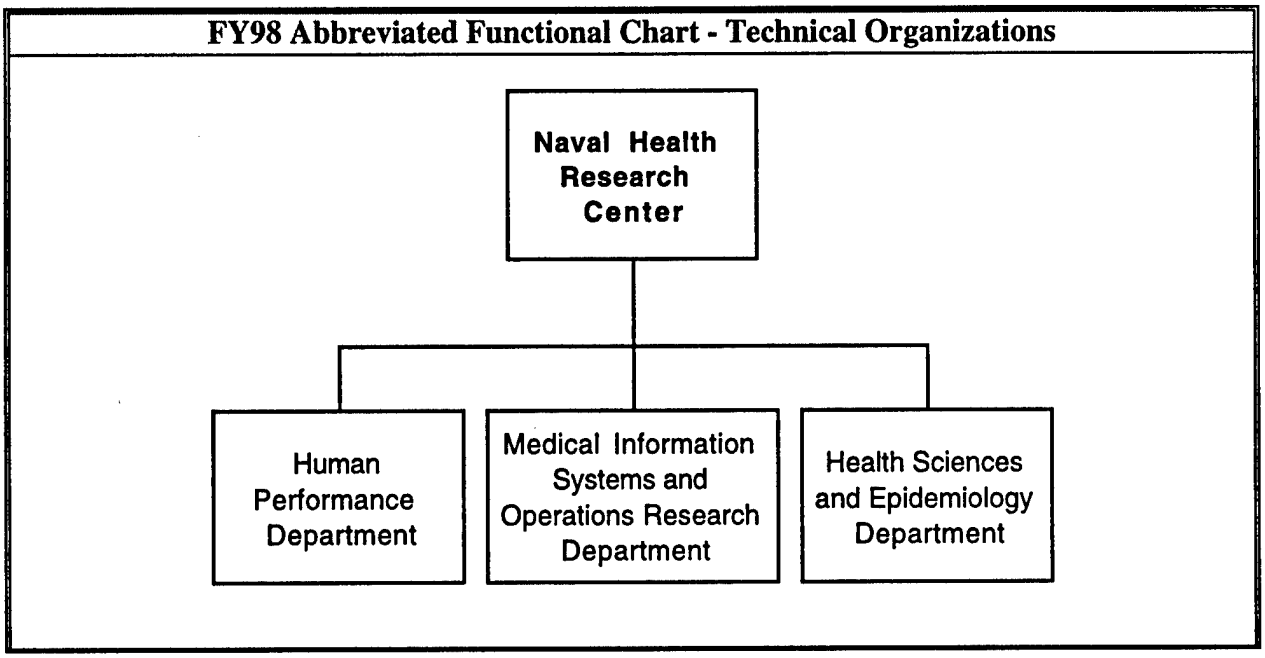
MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		TECHNICAL SUPPORT & OTHER PERSONNEL	END STRENGTH
TYPE	DOCTORATES	OTHER		
MILITARY	1	10	0	11
CIVILIAN	21	316	197	534
TOTAL	**22**	**326**	**197**	**545**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		PROPERTY ACQUISITION COST (MILLIONS $)	
LAB	68.000	**REAL PROPERTY**	30.000
ADMIN	84.000	* NEW CAPITAL EQUIPMENT	0.000
OTHER	35.000	**EQUIPMENT**	8.700
TOTAL	**187.000**	* NEW SCIENTIFIC & ENG. EQUIP.	0.200
ACRES	**10**	* Subset of previous category.	

N/A - Not Applicable

Naval Health Research Center



Naval Health Research Center
San Diego, CA 92186-5122
(619) 553-8400

Commanding Officer: CAPT L. H. Frank
Scientific Director: Dr. Don Stephen Nice

MISSION

To support fleet operational readiness through research, development, test, and evaluation on the biomedical and psychological aspect of Navy and Marine Corps personnel health and performance; and to perform such other functions or tasks as may be directed by higher authority.

CURRENT IMPORTANT PROGRAMS

The R&D mission at Naval Health Research Center addresses three programmatic areas. For updated information on all NHRC programs, please visit the Programs/Publications section of our Homepage at: http://www.nhrc.navy.mil/.

1. Human Performance Department:

The smaller force structure, coupled with constantly evolving mission and tactical requirements, makes it imperative that each warfighter be at peak operational readiness. This program focuses on optimizing Navy and Marine Corps operational performance through assessment of personnel performance and quantification of mission stressors that negatively influence mission success. The research includes controlled laboratory studies and studies in which researchers deploy to training locations. These research teams are widely recognized for excellence in conducting research meeting critical Fleet and Marine Corps requirements and insuring rapid technology transfer.

Environmental Extremes - With a worldwide theater of operations, Navy and Marine Corps personnel operate in environments that can substantially degrade performance. This research quantifies the effects of exposure to environmental stressors (e.g., heat, cold, g-forces) and identifies, develops, and evaluates countermeasures to performance degradation. Marine Corps and Naval Special Warfare (SEAL) cold weather operations are a core area of research.

Special Operations - Recognizing the unique requirements of Naval Special Warfare and Marine Corps Special Operations Capable personnel, this program focuses on effectively enhancing mission performance under the most arduous of operational conditions. The program is strongly user oriented, with special operations personnel involved extensively in all steps of the research process.

Protective Equipment Evaluation - Protective equipment designed to safeguard personnel in hazardous environments often places substantial physiological strain on the individual. Understanding the complex interaction of protection from the environment and the resulting impact on physiology and performance is critical to developing interventions that enhance personnel safety and operational capability.

Physical Readiness Standards - This program established the Navy's physical readiness and body fat standards. While work has continued in this area, it has expanded to encompass occupation specific, gender neutral standards that focus on enhanced operational readiness for Navy and Marine Corps personnel.

Occupational and Exercise-related Injuries - These injuries have a substantial negative impact on manpower availability, cost, and combat readiness. The research focuses on identifying prevalent risk factors for musculoskeletal injury, evaluating the efficacy of rehabilitation modalities, and injury prevention. A new area of investigation incorporates cutting-edge technologies using tissue metabolism markers to predict those at increased risk of injury, thus enhancing personnel safety and reducing the burden on the medical care system.

CURRENT IMPORTANT PROGRAMS (continued)

2. Medical Information Systems & Operations Research Department:

Medical Decision Support - Systems are developed that integrate information from multiple sources to generate indices and displays for reducing information overload and facilitating rapid responses during crises.

Occupational Health Management - Methods are developed to provide occupational safety and health managers improved capability to plan and execute environmental inspections, better identify high risk conditions, and project the cost of occupational illness and injury.

Theater Medical Information - Systems are designed to capture medical information in an operational theater, compile the information needed to support the continuity of care, project the impact on medical resources, and improve medical situational awareness.

Telemedicine - Information is gathered and analyzed to assess the impact of telecommunication technology on clinical care and medical readiness in remote operational environments.

Medical Readiness Modeling and Simulation - Models and simulations are developed to project patient load in deployed operational environments, to manage the handling of casualties, and to estimate the impact on medical resources.

Operator State Modeling - Psychophysiological (e.g., electroencephalographic, eye tracking) and behavioral data are used to model states of drowsiness and cognitive overload in order to develop real-time cognitive monitoring technologies. These technologies are central to human performance optimization.

Interpersonal Violence - Data related to victimization and perpetration of aggression are collected to develop treatment, prevention, and intervention programs associated with health-care utilization.

3. Health Sciences & Epidemiology Department:

Shipboard Health Studies - Survey data are provided by men and women serving aboard ship. Shipboard Medical Departments provided information regarding sick call visits, availability of supplies, pregnancy rates; reproductive health; stress; lifestyle factors; self-reported occupational exposures; and self-reported health conditions. These programs provide decision support for shipboard health care policy.

Persian Gulf War Unexplained Illness - Currently, 7 research studies of Gulf War veterans and their families are being conducted in the areas of hospitalizations, symptoms, exposures, physical performance, infertility, and pregnancy outcomes.

Global Surveillance for Emerging Illnesses - As the U.S. Navy Node of the DoD Global Surveillance and Response Program for Emerging Illnesses, NHRC is conducting epidemiologic studies of a number of pathogens which cause emerging illnesses. Active surveillance currently includes studies of the epidemiology of Streptococcus pyogenes, Streptococcus pneumoniae, Mycoplasma pneumoniae, Chlamydia pneumoniae, Bordella pertussis, adenovirus, and Ureaplasma urealyticum.

Respiratory Disease Epidemiology - This research area focuses on the epidemiology of respiratory disease in military populations, particularly in populations of trainees with a high aggregation of susceptible individuals.

Health Promotion - Addresses the Navy's need to reduce health risks and associated health care costs. Current work focuses on the effectiveness of interventions for weight management, smoking cessation, and alcohol abuse rehabilitation.

CURRENT IMPORTANT PROGRAMS (continued)

Suicide and Mental Illness - NHRC maintains a casualty record database for Navy and Marine Corps suicides since 1983. The primary objective of this research area is to provide epidemiologic information relevant to prevention programs that are targeted to military populations. Efforts are currently focused on evaluating alternative methods to document suicide information.

Musculoskeletal Overuse Injury Prevention Research - Goals: 1) determination of the operational, fiscal, and personal impact of musculoskeletal injury in training and operational forces; 2) development of predictive profiles for injury susceptibility; and 3) development, implementation and evaluation of interventions to reduce the incidence and negative impact of these injuries.

Alcohol Misuse Prevention Research - Goals: 1) develop a cognitive-behavioral intervention program to reduce heavy drinking among junior Marine Corps personnel and promote responsible attitudes toward alcohol use, with a particular emphasis on behavior during deployments; 2) develop complementary training programs for senior enlisted and officers aimed at deglamourizing alcohol use; and 3) measure the effectiveness of intervention programs using hard outcome measures, as well attitudes and behavioral intentions.

Sexually Transmitted Disease and Unplanned Pregnancy Prevention Research - Develop cognitive skills building interventions to reduce the high-risk behaviors associated with STD acquisition and unplanned pregnancy in operational military populations. This research area includes a program in HIV which is defining the epidemiology of HIV in military populations and includes molecular subtyping of HIV strains to pinpoint likely locations of acquisition of HIV infection.

HIV Central Registry - NHRC maintains the Navy HIV Central Registry, a computerized database devoted to the study of the acquisition of, and clinical course of HIV infection. The HIV Central Registry contains extensive demographic and career history information for all active-duty Navy and Marine Corps personnel tested for HIV.

Epidemiologic Research Database Development - The primary resource for hospitalization studies is the Career History Archival Medical and Personnel System (CHAMPS) Research Database which is a computerized medical (inpatient events) and career history database that provides extensive information for Naval epidemiologic occupational health research. This longitudinal database includes information for Navy enlisted personnel dating back to 1973 and is currently being expanded to include Navy officer and Marine Corps personnel.

EQUIPMENT/FACILITIES

Occupational and Environmental Physiology Laboratory:

This 8,000 square foot facility, built in 1997, provides a unique ability to address operational issues rapidly and, when required, under operational conditions. The state-of-the-art equipment in the laboratory was selected to ensure high mobility and multifunction capability. Enhanced mobility allows researchers to set up temporary, yet fully operational, laboratories on site at Fleet and Marine Corps facilities, both in CONUS and OCONUS. The laboratory's proximity to the West Coast Fleet maximizes technology transfer to the Fleet and Marine Corps operational forces. A satellite laboratory for cold-weather and altitude studies is maintained at the Marine Corps Mountain Warfare Training Center, Bridgeport, CA.

EQUIPMENT/FACILITIES (continued)

Equipment:

- Thermal physiology: two environmental chambers with temperature ranges of -20° to 180° F; humidity 20-85%, each capable of holding three treadmills for exercise studies; immersion tank allowing whole-body exposure to water between 45° and 110° F.
- Swim flume: one of the worlds largest swim flumes allows studies of immersion in static water or swimming in moving water (up to 4 knots) at temperatures between 45° and 90° F. The proximity of the flume to the environmental chambers allows research on serial wet-dry exposures such as those encountered during special operations or littoral warfare.
- Biomechanics: force plates for motion and ground reaction forces, electromyography, kinesthesiology, electrogoniometry, accelerometry, 3-D motion analysis system.
- Biochemistry laboratory: basic clinical and hormonal chemistries, tissue sample preparation and analyses.
- Body composition: anthropometry, bone densities (dual energy x-ray absorptometry [DEXA]), bioimpedence, hydrodensitometry allow determination of body composition using the four-compartment model.
- Ergometry: treadmills (2 with eccentric [downhill] capability), mechanically and electrically-braked bicycle ergometers; 7 automated and semiautomated metabolic measurement systems; incremental lifting machine; equilibrium testing; pulmonary function testing; Cybex, Kincom, and Ariel computerized muscle function testing systems.
- Thermal imaging: infrared camera for dynamic measurement of weighted and gradient skin surface temperatures.
- Whole body calorimetry: fluid-based tube suit for measuring heat flux from six body regions to protective ensembles or the environment.

Medical Information Systems & Operations Research Specific Equipment:

- Several Concurrent and Silicon Graphics computer systems form the backbone of the electroencephalographic and electro-oculographic laboratory, currently used for Operator-State Assessment projects. The systems enable multi-channel real-time signal acquisition and subsequent analysis of psychophysiological and behavioral data.
- Two ASL 4000 series video-based eye tracking systems (one remote, one head mounted optics) and an electromagnetic head tracking system.

Health Sciences & Epidemiology Equipment Wet Laboratory capabilities:

- Primary focus on specimen preparation, cold storage, packaging, and some limited in-house laboratory analyses. Current laboratory analytic capabilities include: viral culture, with a current focus on identification and typing of adenovirus and influenza A; culture and performance of antibiotic resistance testing on a variety of bacterial pathogens, including Streptococcus pyogenes and Streptococcus pneumoniae; serological and PCR assays for various pathogens are also performed.
- Future laboratory analytic capabilities include DNA fingerprinting of clinical respiratory isolates.

Naval Health Research Center
San Diego, CA 92186-5122
(619) 553-8400

Commanding Officer: CAPT L. H. Frank
Scientific Director: Dr. Don Stephen Nice

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	0.000	N/A	0.000	0.000
6.1 Other	0.052	N/A	0.020	0.072
6.2	0.262	N/A	0.163	0.425
6.3	3.897	N/A	5.182	9.079
Subtotal (S&T)	**4.211**	**N/A**	**5.365**	**9.576**
6.4	0.122	N/A	4.407	4.529
6.5	0.066	N/A	0.024	0.090
6.6	0.005	N/A	0.089	0.094
6.7	0.132	N/A	0.050	0.182
Non-DOD	0.203	N/A	0.058	0.261
TOTAL RDT&E	**4.739**	**N/A**	**9.993**	**14.732**
Procurement	0.000	N/A	0.000	0.000
Operations & Maintenance	1.258	N/A	1.231	2.489
Other	0.000	N/A	0.000	0.000
TOTAL FUNDING	**5.997**	**N/A**	**11.224**	**17.221**

MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

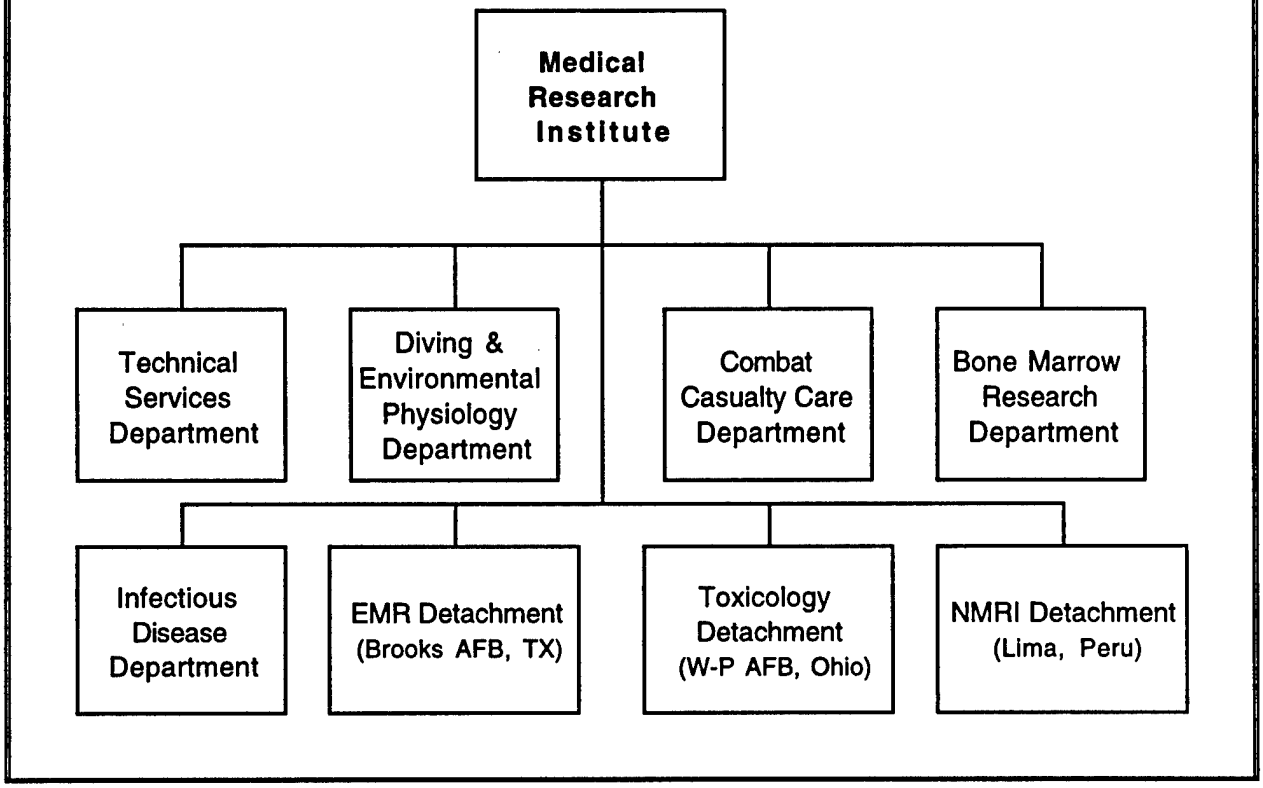
PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	
TYPE	**DOCTORATES**	**OTHER**		**END STRENGTH**
MILITARY	6	3	7	16
CIVILIAN	15	21	24	60
TOTAL	**21**	**24**	**31**	**76**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	49.246	**REAL PROPERTY**	0.000
ADMIN	10.342	* NEW CAPITAL EQUIPMENT	0.000
OTHER	2.200	**EQUIPMENT**	0.462
TOTAL	**61.788**	* NEW SCIENTIFIC & ENG. EQUIP.	0.121
ACRES	**0**	* Subset of previous category.	

N/A - Not Applicable

Naval Medical Research Institute

FY98 Abbreviated Functional Chart - Technical Organizations



Naval Medical Research Institute
Bethesda, MD 20889-5607
(301) 295-0007

Commander: CAPT Thomas J. Contreras, Jr.
Executive Officer: CAPT Richard Oberst

MISSION

To conduct research, development, tests and evaluations to enhance the health, safety, and readiness of Navy and Marine Corps personnel in the effective performance of peacetime and contingency missions, and to perform such other functions or tasks as may be directed by higher authority.

The specific functions to be accomplished are:

(1) Provide basic and applied research on infectious diseases, tissue transplantation, diving and hyperbaric medicine, casualty care, and environmental medicine and human factors which are directly related to military requirements and operational needs.
(2) Maintain a program of basic biomedical research in areas of military importance to develop knowledge in anticipation of future problems.
(3) Provide the scientific potential for the application of new biomedical knowledge to operational problems.
(4) Provide biomedical research capabilities to support field laboratories, hospitals and other naval activities in problems beyond their scope.
(5) Provide a source of scientific advisors and consultants readily available to operational commands.

CURRENT IMPORTANT PROGRAMS

BONE MARROW RESEARCH DEPARTMENT:

A research leader in the Department of Defense Marrow Donor Program (C. W. Bill Young Marrow Donor Recruitment and Research Program), the Bone Marrow Research Department provides military contingency support for casualties with marrow toxic injury due to radiation or chemical warfare agents. The department performs laboratory research which supports technology innovations to make highly reliable and cost effective DNA-based typing for marrow transplants.

COMBAT CASUALTY CARE DEPARTMENT:

Immune Cell Biology Program: The Immune Cell Biology centers its research efforts upon three basic scientific and clinical applications of immunology, namely:

(1) the development of novel, safe and effective methods to suppress undesired immune responses in organ transplantation, autoimmune disease, and superantigen toxin exposure;
(2) the development of strategies to enhance immune responses so as to improve defenses against a variety of infectious processes, including HIV; and,
(3) the development of methodologies that will allow for the ex vivo expansion of bone marrow for use in transplantation of patients with seriously injured marrow. In addition, this last research thrust area focuses upon strategies to generate specific types of blood cells of therapeutic interest.

CURRENT IMPORTANT PROGRAMS (continued)

Transfusion and Cryopreservation Research Program: The Transfusion and Cryopreservation Research Program centers its research efforts upon four scientific research and clinical applications of Cryobiology, namely:

(1) the development of safe and effective methods of extending the refrigerated storage of red cells, the post-thaw shelf-life of frozen red cells and optimization of a transfusable polymer cryoprotectant;
(2) the examination of the radical discovery that proteins unfolded in cold do not necessarily reverse to the native state and to assess this effect on function;
(3) the prevention of phagocytosis of red cells following transfusion which may result from the rapid degeneration of leukocytes following blood collection, the release of cytokines and the development of apoptotic cells which can absorb on red cells and stimulate phagocytosis; and
(4) the utilization of vitrification instead of freezing for the cryopreservation of tissues as a means of long term storage to achieve surgical reconstruction of traumatic tissue loss.

Resuscitative Medicine Research Program: The Resuscitative Medicine Research Program is focused upon the investigation of mechanisms responsible for cell death during hemorrhage and upon various approaches for pharmacological intervention to improve the survival of personnel who have sustained combat casualties. Program efforts are centered upon four specific research methodological targets:

(1) the development of treatment regimens for the depression of metabolic rate in both cell cultures and animal models of hemorrhage and ischemia;
(2) the examination of the involvement of both the vascular endothelium and circulating blood cells in acute inflammatory responses and subsequent cellular injury observed during severe trauma, hemorrhagic shock and ischemia;
(3) the identification of methods to modulate leukocyte-induced tissue damage triggered by hypoxia/hemorrhage; and,
(4) the characterization of mechanisms such as hypothermia and hibernation to identify key mechanisms to create low metabolic states to induce resistance to damage and to study mechanisms of natural tolerance to hypoxia.

DIVING AND ENVIRONMENTAL PHYSIOLOGY DEPARTMENT:

Thermal Stress Research Program: The primary objective of the Thermal Stress Program is to develop effective interventions, both physiological and pharmacological, and provide guidelines to minimize the impact of diving and extreme temperature. Recommendations are provided to the operational community to improve both physical and cognitive performance in harsh environments. These recommendations may take the form of pharmacological, nutritive or training interventions.

Decompression Research Program: The primary objective of the Decompression Research Program is to perform basic and applied research that is aimed at finding new ways to accelerate decompression safely after long deep dives, as well as prevent and treat decompression sickness (DCS) in deep sea divers and crewmembers of disabled submarines. The program includes research procedures in decompression, DCS epidemiology and risk prediction, development of gas exchange kinetics and bubble dynamics models, biochemical decompression, DCS pathophysiology, and control of contaminants in confined atmospheres. Direct taskings involve research for the Explosive Ordnance Disposal, Naval Special Warfare, and Fleet Submarine and Diving communities.

Oxygen Toxicity Research Program: The primary objective of the Oxygen Toxicity Research Program targets the etiology of neurological toxicity, resulting in convulsive seizures, by the breathing of pure oxygen under pressure. The Oxygen Toxicity Program seeks to understand the mechanism underlying this toxicity, and thereby to identify methods for prevention of oxygen-induced seizures. The program addresses the problem at various levels, from biochemical to cellular to animal models.

CURRENT IMPORTANT PROGRAMS (continued)

INFECTIOUS DISEASES DEPARTMENT:

Malaria Research Program: The primary objective of the Malaria Program is to develop vaccines that prevent malaria in military personnel. The Malaria Program is part of the Department of Defense Malaria Vaccine Program, along with the Division of Communicable Diseases and Immunology, Walter Reed Army Institute of Research, and Navy and Army overseas laboratories in Indonesia, Thailand, Kenya, Brazil, and Peru.

Enteric Diseases Research Program: Globally, diarrheal diseases are a major cause of morbidity and mortality. The Enteric Diseases Research Program is composed of 8 distinct and separately funded research projects. However, the program may be viewed as functionally consisting of two principal thrust areas. These areas are:

(1) development of a Campylobacter vaccine, and
(2) basic research and epidemiology of emerging disease threats (which is currently focused on newly discovered toxic phenotypes of E. coli).

Viral and Rickettsial Diseases Research Program: This program focuses primarily on two major diseases of military importance: Dengue Fever and Scrub Typhus. Dengue fever is an important acute viral disease that is widely distributed throughout the tropical and sub-tropical areas of the world. Research efforts concerned with the development of an efficacious vaccine against dengue fever have employed molecular genetic approaches to define the genetic sequences of the virus that are actually responsible for human virulence and to develop "naked" DNA vaccine by expressing subunits of the dengue virus RNA genome as copy DNA for direct inoculation into laboratory animal models. The Scrub Typhus Program is focused on the development of improved diagnostic assays and the characterization of antibiotic resistance.

Infectious Disease Threat Assessment Research Program: The purpose of this program is to systematically acquire and assess infectious disease risk data from research projects and from collaborations with Navy CONUS and OCONUS medical treatment and research facilities for use in operational planning and research prioritization, and to develop prevention and control, diagnostic, and treatment strategies for infectious disease threats worldwide.

Biological Defense Research Program: The objective of the Biologic Defense Research Program is to improve diagnostic assays for the detection of biological and chemical agents during peacetime and wartime. This program has recently designed, developed, and tested a new prototype immuno-chromatographic assay device which enables multiple assays to be performed simultaneously.

NMRI EMR DETACHMENT, BROOKS AFB, TX: This NMRI detachment is located at Brooks Air Force Base in San Antonio, Texas. Their focus is upon research, development, testing and evaluation of the biomedical effects of electromagnetic radiation (EMR) to enhance the health, safety and readiness of Navy and Marine Corps personnel. A variety of EMR research efforts are conducted within the detachment's Bioengineering, Microwave, and Laser Departments.

NMRI TOXICOLOGY DETACHMENT, W.P. AFB, OH: This NMRI detachment is the Navy's sole toxicology research laboratory and is a part of the Triservice Toxicology Consortium located at Wright-Patterson Air Force Base near Dayton, Ohio. Current programs focus on the toxicity of materials encountered by sailors and marines in their operational environments and how conditions in those environments modify the expression of toxicity.

NMRI DETACHMENT, LIMA, PERU: This NMRI detachment operates two laboratories located at Peruvian Naval Hospital facilities in Lima and Iquitos, Peru. They conduct infectious disease research programs focused upon various viral, bacterial, or parasitic diseases known or suspected to be present in the region.

CURRENT IMPORTANT PROGRAMS (continued)

COOPERATIVE RESEARCH AND DEVELOPMENT AGREEMENTS:

The Institute for Genomic Research - The broad intent of the work performed under the auspices of this agreement is to obtain the entire DNA sequence of at least two species of malaria parasites, of the genius Plasmodium. The DNA sequences will provide the foundation for the discovery of new antimalarial drugs, vaccines, and diagnostics, and for greater elucidation of the biology of malaria parasites.

Indx - Serological testing on Dengue patients.

MicroCarb, Inc. (Antex) - Large-scale production of a safe a effective vaccine for the prevention of diarrhea caused by the enteropathogenic Campylobacter in humans.

SmithKline Beecham Corp. - Research, development and commercialization of a genetically engineered bacterial toxin, LT-R192G, for use as a safe and efficacious mucosal adjuvant (immune enhancer) to be administered with oral vaccines.

SmithKline Beecham Corp. - Development of chimeric and humanized anti-bodies useful for the prevention of malaria.

Cel-Sci Corporation - The Naval Medical Research Institute and Cel-Sci Corporation are sharing equipment and facilities to facilitate collaborative research partnerships and enhance the research capabilities of each organization. The broad intent of the work performed under the auspices of this Agreement is to develop and test heteroconjugate peptide-based Plasmodium vaccines which contain B or T cell epitopes of the Plasmodium yoelii circumsporozoite protein (CSP) or sporozoite surface protein 2 (SSP2) and T cell binding ligands. These vaccines will be tested for their efficacy in the prevention of sporozoite induced malaria. The active collaboration of staff from both organizations will allow for accelerated development and execution of various Research Projects. Utilizing this model of collaboration and cooperation, research efforts at both organizations will be less costly resulting in increased productivity with less fiscal support.

The University of Illinois - The purpose of this agreement is to investigate the interactions of human and nonhuman primate hematopoietic stem cells (HSC) with porcine brain microvascular endothelial cells (PMVECs). The proposed studies will evaluate the expansion and self-renewal potential of hematopoietic stem cells from normal and diseased subjects with the ultimate goal of fundamentally improving gene marking and gene therapy protocols. In addition, the PMVEC hematopoietic supportive micoenvironment will be characterized in regard to adhesion and/or contact-mediated interactions.

Chembio Diagnostic Systems, Inc - Scrub typhus is an acute, febrile disease caused by infection with Orientia (formerly Rickettsia) tsutsugamush. It accounts for up to 23% of all fever in endemic regions of Asia-Pacific. NMRI is involved in the technology development on the diagnosis, threat assessment and treatment of rickettsial diseases. CHEMBIO has developed the capability to produce simple, rapid, highly sensitive and specific diagnostic tests using a variety of antigens. Working together this CRADA hopes to develop rapid serological diagnostic tests including detection of specific IgM antibody and total immunoglobulin against rickettsiae.

Biogen - Both partners wish to develop therapies to specifically prevent the rejection of organs or tissues transplanted from one individual to another. The partners agree that the ideal therapy should be safe, durable, and specific (that is, immune responses other than those directed against the transplant should be left intact). For the joint effort, the ICBP brings experience and scientific expertise in molecular and cellular immunology, and in animal models including primate transplant models. BIOGEN's participation is to provide sufficient quantities of an agent that modulates the function of the cell surface receptor pair called CD40: CD40L, and to provide partial financial support for the primate transplant studies planned. BIOGEN also contributes manufacturing capability to produce drug of the highest (known as good manufacturing practice or GMP) quality, and expertise in both the conduct of human clinical trials and in marketing.

CURRENT IMPORTANT PROGRAMS (continued)

CpG Immunopharmaceuticals Incorporated - The intent of this cooperative agreement is to develop and test the clinical application of oligonucleotide sequences for enhancement of immunogenicity and efficacy of anti-malarial vaccines for the prevention of malaria. Proprietary oligonucleotides that have been identified, engineered and developed as potent pharmacological immune modulators by CpG Inc. will be provided to the Malaria Program at the Naval Medical Research Institute for use in malaria vaccine development. The joint cooperative effort between CpG Inc. and the Naval Medical Research Institute constitutes a major commitment by both parties to advance anti-malarial vaccines for human use by combining CpG oligonucleotide based immune modulation and advanced DNA and/or protein based vaccinology.

Biosource Technologies - NMRI/ICPB has developed a novel patented porcine microvascular endothelial cell line growth medium to expand human stem cells. Biosources Technologies, Inc. will utilize its capabilities to work with NMRI/ICPB isolating and identifying the specific peptide(s) responsible for the unique growth factor properties of the growth medium.

Corixa - The Parties intend to collaborate in the evaluation of LeIF, a novel adjuvant from Corixa Corporation, for potential efficacy as a component of malaria vaccines. Malaria vaccines will include synthetic peptide vaccines; recombinant protein vaccines; and DNA vaccines. In joint studies the NMRI Malaria Program and Corixa Corporation will utilize purified LeIF recombinant protein formulations as well as LeIF encoding DNA together with Plasmodium yoelii antigens or antigen encoding genes (DNA vaccines) to immunize various strains of mice. Specific cellular and humoral immunological responses will be evaluated and the animals will be challenged with parasites to determine protective efficacy. If shown to be efficacious as an adjuvant of P. yoelii vaccines in mice, LeIF will be further assessed as an adjuvant for Plasmodium vaccines in nonhuman primates. Various routes of immunization, immunization schedules and mixtures of antigens will be studied to optimize protective immunity with LeIF as a adjuvant. If successful these preclinical experiments will lead to collaborative efforts by the Parties to prepare and test candidate vaccines with LeIF adjuvant in human subjects, eventually leading to the submission of appropriate documentation to the FDA seeking approval to market such a malaria vaccine.

Nextran - Both partners wish to develop therapies to specifically prevent the rejection of organs or tissues transplanted from pigs into man. The partners agree that the ideal therapy should be safe, durable, and specific (that is, immune responses other than those directed against the transplant should be left intact) and that donor organs should be manipulated when possible to avoid immune attack by the recipient. For the joint effort, the ICBP brings access to several agents which modulate the function of cell surface receptor pairs called CD28: B7 (B7 has two discrete members called CD80 and CD86), and CTLA4 (or CD152): B7. In addition access to hu-5C8, a monoclonal antibody directed toward CD40 ligand (CD154) will be provided. This is provided through a separate CRADA between the NMRI and the BIOGEN Corporation, the sole owner of hu-5C8, specifically allowing the ICBP to participate in pre-clinical trials in xenotransplantation. The ICBP also brings experience and scientific expertise in molecular and cellular immunology, and in animal models including porcine to primate transplant models. Further the ICBP brings experience and expertise in clinical organ transplantation. NEXTRAN's participation is to provide sufficient access to pigs genetically engineered to express one or more human transgenes felt to be important in protecting the organ against hyperacute discordant xenograft rejection. These animals are to serve as donors for transplantation and transplant related studies. NEXTRAN also brings expertise in histological evaluation of transgene expression and evaluation of xeno-specific immune responses. NEXTRAN will also provide partial financial support for the expensive primate transplant studies planned.

University of Kentucky Research Foundation - Acute lung injury (ALI) and its most severe progressive form Acute Respiratory Distress Syndrome (ARDS - collectively ALI/ARDS) often results from the inhalation of smoke and combustion byproducts. Since it's initial recognition as a distinctive lung disease in 1967 important discoveries have been made about the causes and development of ALI/ARDS; however, a great deal of additional research is still necessary to determine risk factors and to develop improved methods to assess novel treatment regimens for this continuum of lung diseases. NMRI/TD and UKRF each have specialized research capabilities which when combined could make significant strides toward satisfying some of these research requirements.

CURRENT IMPORTANT PROGRAMS (continued)

Dyad Pharmaceuticals - It is the goal of this CRADA to design and investigate the protective effects of antisense molecules against the inflammation associated with septic shock and inflammatory diseases in animals, cell cultures, and human subjects with the results and processes made available for public use.

OraVax, Inc. - Research and development of a native labile toxin and a mutant recombinant toxin as adjuvants for a H. pylori vaccine in humans.

Integrated Diagnostics Inc. - Serological test for pathogens of Dengue.

Vical, Inc. - Evaluation of novel vaccine approaches for prevention of malaria using genetic material encoding malarial protein antigens.

Entremed - Development and testing of DNA-based Plasmodium vaccines.

Organ, Inc. - Cryopreservation.

EQUIPMENT/FACILITIES

The main NMRI complex consists of 7 buildings (1 off site) containing approximately 160,000 square feet of laboratories. The NMRI Detachment, Lima, Peru is in 2 buildings with approximately 33,000 square feet total. The EMR Detachment is housed in two primary buildings with a total square footage of about 17,000 square feet. NMRI's Toxicology Detachment is in a single building with roughly 11,000 square feet.

These laboratories include the following specialized facilities or equipment:

- **Man-rated, Deep-dive Hyperbaric Research Chamber Complex:** A DOD unique diving medical research chamber capable of reaching simulated depths of 300 meters, with full research quality level support systems, and composed of 5 separate, interconnected chambers, one with wet-pot capability.
- **Large Animal Hydrogen Diving Chamber:** A DOD unique chamber capable of accommodating large animals and using Hydrogen/Oxygen gas mixtures. Designed for use in the study of novel enzymatic decompression techniques.
- **Emergency Hyperbaric Treatment Chamber:** Special chamber designed for treatment of hyperbaric injuries or other clinical hyperbaric treatments.
- **Scanning Transmission Electron Microscope:** Standard research quality instrument approximately 10 years old.
- **Fluorescence Cytometers:** Three fully capable instruments, two with double laser capability, one with triple beam capability.
- **Digital Imaging System.**
- **An exterior flight deck simulation** complete with an F-18 fuselage for various shipboard EMR simulations.

Naval Medical Research Institute
Bethesda, MD 20889-5607
(301) 295-0007

Commander: CAPT Thomas J. Contreras, Jr.
Executive Officer: CAPT Richard Oberst

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	0.644	N/A	0.000	0.644
6.1 Other	1.053	N/A	0.654	1.707
6.2	1.026	N/A	1.116	2.142
6.3	6.676	N/A	1.774	8.450
Subtotal (S&T)	**9.399**	**N/A**	**3.544**	**12.943**
6.4	0.563	N/A	0.098	0.661
6.5	0.000	N/A	0.000	0.000
6.6	1.817	N/A	0.000	1.817
6.7	0.000	N/A	0.000	0.000
Non-DOD	0.574	N/A	0.480	1.054
TOTAL RDT&E	**12.353**	**N/A**	**4.122**	**16.475**
Procurement	0.000	N/A	0.000	0.000
Operations & Maintenance	0.000	N/A	0.000	0.000
Other	8.471	N/A	6.286	14.757
TOTAL FUNDING	**20.824**	**N/A**	**10.408**	**31.232**

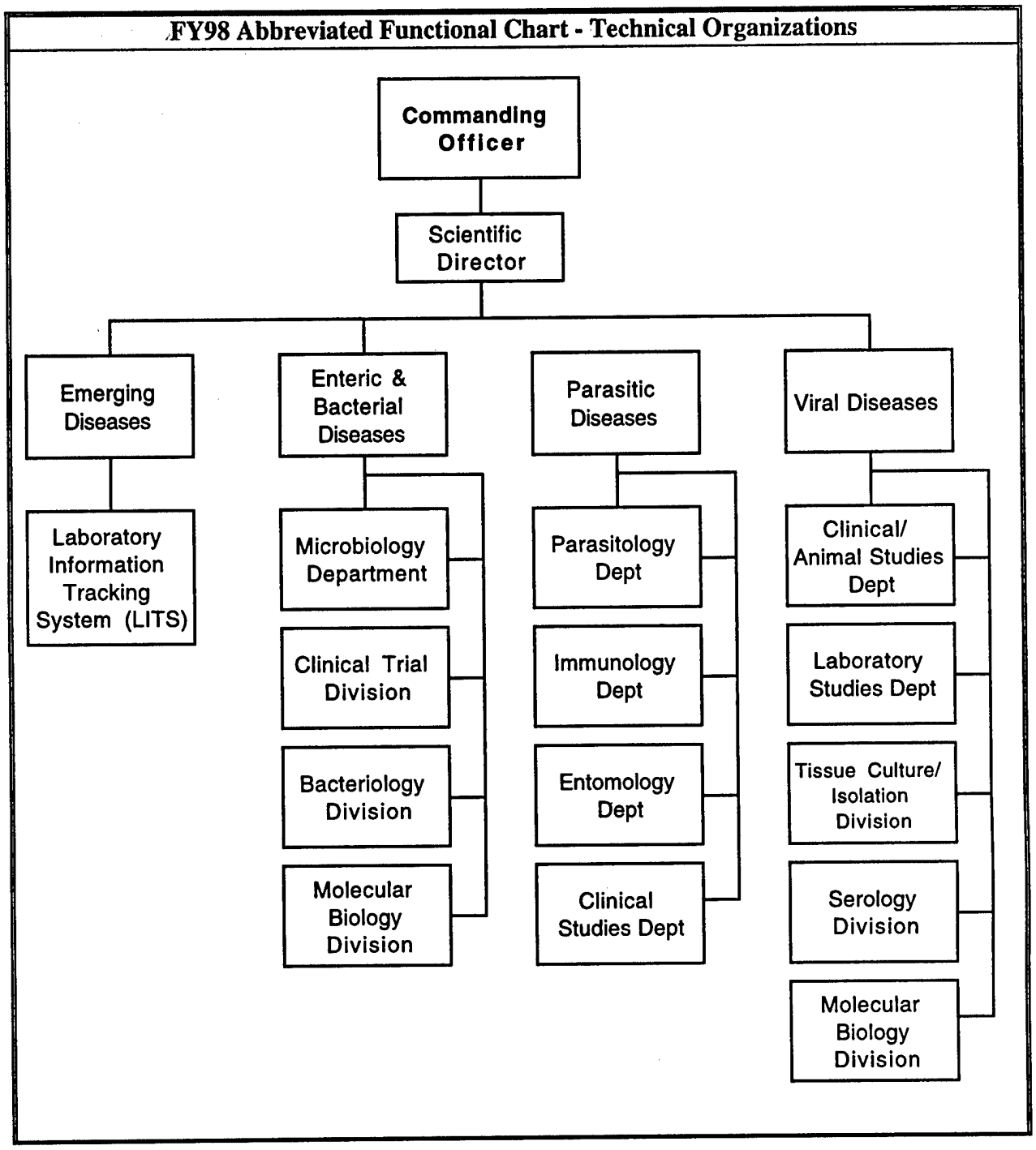
MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
TYPE	**SCIENTISTS & ENGINEERS**		**TECHNICAL SUPPORT & OTHER PERSONNEL**	**END STRENGTH**
	DOCTORATES	**OTHER**		
MILITARY	0	0	165	165
CIVILIAN	16	21	108	145
TOTAL	**16**	**21**	**273**	**310**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	215.000	**REAL PROPERTY**	0.237
ADMIN	70.000	* NEW CAPITAL EQUIPMENT	0.237
OTHER	0.000	**EQUIPMENT**	9.982
TOTAL	**285.000**	* NEW SCIENTIFIC & ENG. EQUIP.	8.526
ACRES	**8**	* Subset of previous category.	

N/A - Not Applicable

Naval Medical Research Unit #2



Naval Medical Research Unit #2
Jakarta, Indonesia, APO AP 96520
(62) 421-4452

Commanding Officer: CAPT H.V. Peterson, MSC
Executive Officer: CDR J.P. Burans, MSC

MISSION

The U.S. Naval Medical Research Unit No.2 (NAMRU-2) is a Department of Defense infectious Diseases laboratory located on the grounds of the Indonesian National Institutes of Health Research and Development in downtown Jakarta. Its Mission is to study infectious diseases of mission aborting potential in Southeast Asia and to assist host government health agencies with infectious diseases problems of mutual interest. NAMRU-2 is also part of the Department of Defense (DOD) Global Surveillance Program and has recently been designated the Southeast Asia Regional Collaborating Center for Emerging Diseases by the World Health Organization (WHO). The Unit has been in Asia since 1942 having moved from Guam to Taiwan and subsequently to the Philippines and Indonesia where it has operated since 1970. NAMRU-2 serves the United States military by providing an environment for the study of tropical diseases of importance to both military and civilian populations. Of particular emphasis, both historically and currently, are studies of malaria, cholera, typhoid fever, dengue fever, severe diarrhea, viral hepatitis, HIV and Japanese encephalitis. Noteworthy contributions include the pioneering work for development of oral rehydration therapy that prevents death due to water loss in severe diarrheal diseases like cholera, the identification and characterization of hepatitis B in Asia and the demonstration by NAMRU-2 scientists and their Indonesian colleagues of the efficacy of the current oral typhoid vaccine. NAMRU-2 has also been in the forefront of the discovery and surveillance of the spread of drug resistant malaria parasites and emerging diseases. CAPT Henrik V. Petersen, MSC, USN is the current Commanding Officer of the Unit which is staffed by 13 military officers, six enlisted members, one civilian Scientific Director, two civilian investigators, and 90 Foreign Service National (FSN) staff.

CURRENT IMPORTANT PROGRAMS

The research institute is composed of scientific research programs which include the; Emerging Diseases Program, Viral Diseases Program, Parasitic Diseases Program, Bacterial and Enterics Disease Program and Administrative and Logistical Support. These scientific programs have state of the art equipment to support the numerous ongoing infectious disease research projects at NAMRU-2.

The **Emerging Diseases Program** conducts field studies throughout the Indonesian archipelago and other countries in Southeast Asia such as Vietnam, Laos and Cambodia. The efforts of this program are primarily focused on surveillance for new, emerging and re-emerging infectious diseases using NAMRU-2's extensive infectious disease diagnostic and epidemiological capabilities.

The **Parasitic Diseases Program** is primarily focused on basic and applied research on malaria. Research efforts include: evaluation of new diagnostic assays, evaluation of new prophylactic and therapeutic drugs, characterization of the immune response to malaria infections to facilitate the development of potential vaccines for malaria and development and characterization of field sites for new malaria vaccine evaluations. This program utilizes sophisticated equipment such as a flow cytometer, DNA sequencer and DNA thermocyclers to conduct basic immunology and molecular biology studies of malaria. The program also has an extensive entomology capability which includes the in house breeding of mosquitoes.

The **Bacterial and Enteric Diseases Programs** conducts research to; determine the causes of acute diarrheal disease in Southeast Asia, evaluate vaccines for cholera and to support emerging disease surveillance with a comprehensive diagnostic medical microbiology capability which includes sophisticated equipment and reagents necessary for the biomolecular identification and characterization of microbial pathogens.

CURRENT IMPORTANT PROGRAMS (continued)

The **Viral Diseases Program** conducts research on the molecular biology and epidemiology of HIV and several viral diseases such as Dengue. The program supports NAMRU-2's emerging disease surveillance efforts with extensive diagnostic capabilities for the isolation and identification of human viral pathogens. The Viral Diseases Program also includes a modular Biosafety Level 3 Containment Laboratory which when fully operational will exceed all current requirements for work with Biosafety Level 3 pathogens. This laboratory is the only one of its kind in Southeast Asia and will allow NAMRU-2 personnel and Indonesian collaborators to work safely with samples potentially containing BSL-3 agents.

EQUIPMENT/FACILITIES

Background: Naval Medical Research Unit No 2 (NAMRU-2) and its satellite lab component in Jayapura, Irian Jaya has conducted infectious disease research throughout the Indonesian archipelago and in other areas of Southeast Asia for over 30 years. NAMRU-2 is located in Jakarta, Indonesia on the compound of the National Institutes of Health (LITBANGKES), Indonesian Ministry of Health. The research unit has a staff of 19 military, 3 civilian and 90 Foreign Service National (FSN) scientific, technical and support staff. Research laboratories, administrative offices and logistical support spaces are integrated into buildings owned by the Indonesian Ministry of Health. NAMRU-2 currently has 18.1 k sq ft of laboratories, 11.8 k sq ft of administrative offices and 33.6 k sq ft of logistical support spaces.

The administrative and logistical support components provide: administrative oversight and personnel support, contracting, disbursing, purchasing, warehousing, transportation, facilities maintenance, medical repair, veterinary services, automated data processing, publication services, library services and American staff housing support. In order to provide these administrative and logistical support services NAMRU-2 has and maintains an animal facility, BL-3 Laboratory, scientific library, computer network, in house maintenance facility, motorpool (includes vehicles for home to work transportation and logistical support) and facility electrical backup (5 diesel generators with total of 1,170 KW)

NAMRU-2's field laboratory in Jayapura, Irian Jaya, which is 4,500 Km from Jakarta, is used to support malaria and other important infectious diseases studies being conducted in more remote areas of Irian Jaya. The Jayapura laboratory has 4.5 k sq ft of lab space, a guest house, electrical generator backup and a vehicles use for transportation to remote field sites. related laboratory assays and also to process research specimens for shipment to the Jakarta lab.

Naval Medical Research Unit #2
Jakarta, Indonesia, APO AP 96520
(62) 421-4452

Commanding Officer: CAPT H.V. Peterson, MSC
Executive Officer: CDR J.P. Burans, MSC

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	0.086	N/A	0.000	0.086
6.1 Other	0.246	N/A	0.057	0.303
6.2	0.553	N/A	0.007	0.560
6.3	0.323	N/A	0.069	0.392
Subtotal (S&T)	**1.208**	**N/A**	**0.133**	**1.341**
6.4	0.000	N/A	0.000	0.000
6.5	0.000	N/A	0.000	0.000
6.6	1.750	N/A	0.000	1.750
6.7	0.000	N/A	0.000	0.000
Non-DOD	0.481	N/A	0.050	0.531
TOTAL RDT&E	**3.439**	**N/A**	**0.183**	**3.622**
Procurement	0.000	N/A	0.000	0.000
Operations & Maintenance	0.000	N/A	0.000	0.000
Other	1.029	N/A	0.000	1.029
TOTAL FUNDING	**4.468**	**N/A**	**0.183**	**4.651**

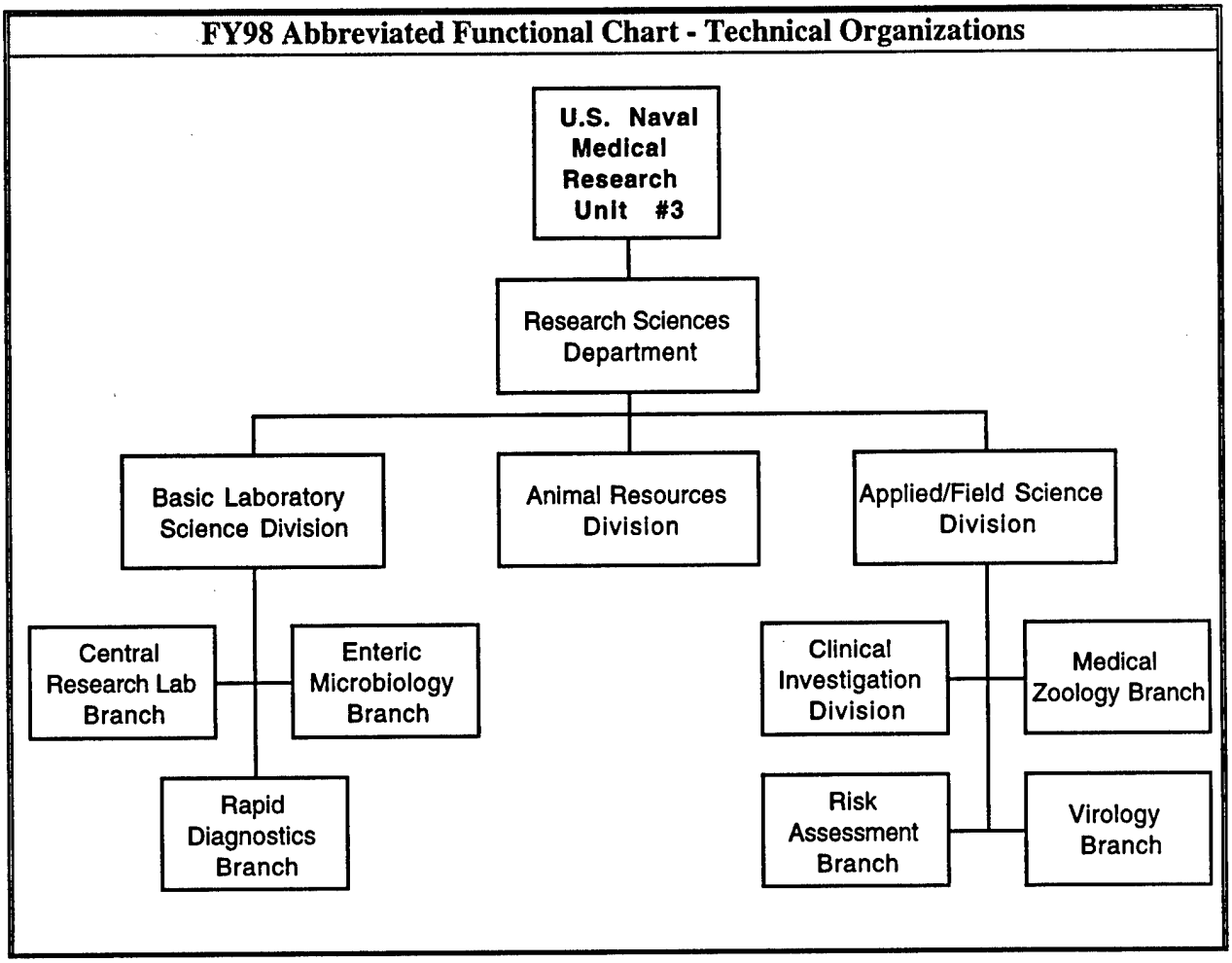
MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	**END STRENGTH**
TYPE	**DOCTORATES**	**OTHER**		
MILITARY	6	8	5	19
CIVILIAN	1	52	40	93
TOTAL	**7**	**60**	**45**	**112**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	18.014	**REAL PROPERTY**	2.524
ADMIN	11.816	* NEW CAPITAL EQUIPMENT	0.000
OTHER	33.583	**EQUIPMENT**	3.543
TOTAL	**63.413**	* NEW SCIENTIFIC & ENG. EQUIP.	0.581
ACRES	**0**	* Subset of previous category.	

N/A - Not Applicable

Naval Medical Research Unit #3



Naval Medical Research Unit #3
Cairo, Egypt, FPO AE 09835-0007
(202) 284-1381

Commander: CAPT L. Edward Antosek
Head, RSD: CDR Eileen D. Villasante

MISSION

To conduct:

(1) infectious disease research, including evaluation of vaccines, therapeutic agents, diagnostic assays, and vector control measures, and
(2) infectious disease surveillance and response activities to enhance the health, safety and readiness of DoD personnel assigned to Africa, the Middle East and Southwest Asia in the performance of peacetime and contingency missions.

CURRENT IMPORTANT PROGRAMS

Enterics Program

The mission of this program is to describe the epidemiology of enteric pathogens in the region and evaluate vaccines, therapeutic agents and diagnostic assays.

- A 3-year pediatric cohort study on surveillance for diarrhea in a rural area in Egypt (Abu Homos) was completed in February 1998. The study yielded comprehensive data on the age and pathogen specific incidence of diarrhea, relative pathogenicity of bacterial agents and measures of natural immunity, and built the infrastructure to support future vaccine trials. A birth cohort study of the epidemiology of Helicobacter pylori infections in Abu Homos, which was started in February 1998, is providing an active surveillance for major diarrheal pathogens and will allow for further studies on naturally-acquired immunity against them.
- Over the past 3 years four Phase 2 trials of a killed, oral vaccine against enterotoxigenic E. coli (ETEC) were done. A Phase 3 ETEC vaccine trial was started in October 1998 in Abu Homos.

Malaria Program

The mission of this program is to develop and maintain a field site in a malaria endemic area to evaluate vaccines, and chemoprophylactic and therapeutic agents. This research is in support of the larger objective to reduce the risk of malaria disease to non-immune troops in the face of a world-wide resurgence of multi-drug resistant parasites and mosquito resistance to insecticides.

- A 2-year detailed study of the malaria attack rate in three cohorts in a malaria endemic area in northern Ghana (Navrongo) was completed in November 1997. The study provided basic malariometric databases needed for designing and conducting chemoprophylactic, therapeutic and vaccine trials in this population.
- A dose-ranging study of the efficacy of Etaquine for the chemoprophylaxis of Plasmodium falciparum in adults living in Navrongo was started in August 1998.

CURRENT IMPORTANT PROGRAMS (continued)

Virology Program

The mission of this program is to describe the epidemiology of viral pathogens, and to genetically and antigenically characterize virus isolates, and evaluate vaccines and diagnostic assays.

- Blood and peripheral blood mononuclear cell samples are being collected for an HIV-1 genotype characterization study from high risk groups in several countries in Sub-Saharan Africa, the Middle East and Eastern Europe. This is providing information on the HIV-1 subtypes present in regions where military personnel may be deployed or are presently assigned and will help in designing an HIV-1 vaccine.
- Data on the epidemiology of arboviruses that may be a threat to deployed forces in the region are being obtained in order to determine the prevalence of infection and risk factors associated with infection, as well as to define the spectrum of clinical disease, identify the disease burden and characterize virus isolates.

Global Emerging Infections Surveillance Program

The mission of this program is to identify, characterize and evaluate risk factors for the most important infectious disease threats in the region.

- A surveillance project for bacterial and viral meningitis was started in 6 fever hospitals in Egypt in June 1998.
- A plan to enhance the surveillance of emerging infectious diseases in Egypt has been drafted to establish a sentinel surveillance network of 12 hospitals for priority diseases and prospective community-based surveillance for selected diseases.

Entomology Program

The mission of this program is to identify arthropod vectors, detect pathogens in vectors, evaluate control measures for vectors and assess vector-borne disease risks in the region.

- Laboratory colonies of sand flies, mosquitoes and ticks are used to evaluate repellents and insecticides.
- Four field sites in Egypt have been characterized and prepared for repellent testing.
- Seasonal trends on mosquito vector populations and associated disease risk from arboviruses in Egypt are being determined.

Clinical Investigations Program

The mission of this program is to evaluate diagnostic assays and therapeutic measures for infectious diseases that may affect DoD personnel assigned to this region. Current studies include:

- a comparison of Azithromycin and Ceftriaxone in the treatment of uncomplicated typhoid fever in children,
- a comparative study of Alatrofloxicin and Ceftriaxone with optional Vancomycin in the treatment of bacterial meningitis in children,
- a comparison of 6 vs 12-month therapy for the treatment of tuberculous meningitis, and
- an evaluation of a new rapid serological test for tuberculosis.

EQUIPMENT/FACILITIES

The equipment and resources at NAMRU-3 make it competitive with any major research laboratory in the United States.

BIOMEDICAL RESEARCH SCIENCE BUILDING: Six-story state-of-the-art building completed in 1983. Clinical and Applied Research Laboratory. 2,750 sq ft Biosafety Level-3 Laboratory. Backup emergency generators and modern ventilation and waste disposal design.

LIBRARY: Heavily used by local scientists/physicians as well as NAMRU-3 staff. Subscriptions to over 75 scientific journals. Houses over 7,000 books.

INSECTARY: Supports colonies of disease vectors such as ticks, mosquitoes and sand flies.

ANIMAL FACILITY: Directed by U.S. Army Veterinarian and enlisted (91T) Veterinary Technician. AAALAC-International accredited state-of-the-art animal facility houses rodents, sheep, rabbits and pigeons; it has a barrier facility for breeding inbred mouse strains.

PUBLIC WORKS FACILITY: Directed by U.S. Navy Civil Engineering Corps Officer. Responsible for engineering, maintenance, construction, design, transportation. Shops: automotive, electrical, mechanical, sheet metal, carpentry, paint and plumbing.

OTHER SUPPORT FACILITIES: Administration, Finance, Supply, Medical Equipment Repair, Safety, Occupational Health, Management Information and Post Office.

ACCESS TO ABBASSIA FEVER HOSPITAL: The largest Ministry of Health infectious disease hospital in Egypt with 1,500 beds is adjacent to NAMRU-3. NAMRU-3 conducts clinical studies in the Meningitis and Fever of Unknown Origin (FUO) wards.

FIELD SITES: The field sites for the Enterics Program are located in Abu Homos and Benha, Egypt. Malaria field studies are being conducted in Navrongo, Ghana.

Naval Medical Research Unit #3
Cairo, Egypt, FPO AE 09835-0007
(202) 284-1381

Commander: CAPT L. Edward Antosek
Head, RSD: CDR Eileen D. Villasante

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	0.341	N/A	0.000	0.341
6.1 Other	0.177	N/A	0.000	0.177
6.2	0.510	N/A	0.000	0.510
6.3	0.616	N/A	0.000	0.616
Subtotal (S&T)	**1.644**	**N/A**	**0.000**	**1.644**
6.4	0.393	N/A	0.000	0.393
6.5	0.000	N/A	0.000	0.000
6.6	3.497	N/A	0.000	3.497
6.7	0.000	N/A	0.000	0.000
Non-DOD	0.840	N/A	0.000	0.840
TOTAL RDT&E	**6.374**	**N/A**	**0.000**	**6.374**
Procurement	0.000	N/A	0.000	0.000
Operations & Maintenance	1.479	N/A	0.000	1.479
Other	0.997	N/A	0.000	0.997
TOTAL FUNDING	**8.850**	**N/A**	**0.000**	**8.850**

MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	
TYPE	**DOCTORATES**	**OTHER**		**END STRENGTH**
MILITARY	8	11	18	37
CIVILIAN	20	17	125	162
TOTAL	**28**	**28**	**143**	**199**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	57.279	**REAL PROPERTY**	9.920
ADMIN	21.980	* NEW CAPITAL EQUIPMENT	0.000
OTHER	40.380	**EQUIPMENT**	5.000
TOTAL	**119.639**	* NEW SCIENTIFIC & ENG. EQUIP.	0.000
ACRES	**3**	* Subset of previous category.	

N/A - Not Applicable

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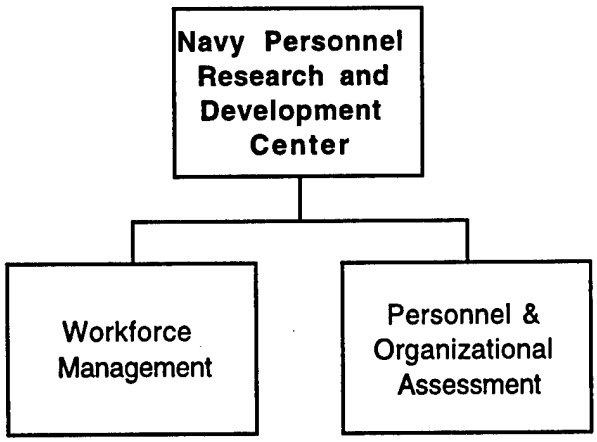
Navy Personnel Research and Development Center

FY98 Abbreviated Functional Chart - Technical Organizations



Navy Personnel Research and Development Center
San Diego, CA 92152-7250
(619) 553-7812

CO: CDR William M. Keeney
Technical Director: Mr. Murray W. Rowe

MISSION

NPRDC serves as the Navy's principal research laboratory for developing Manpower and Personnel technologies. We maintain and enhance fleet readiness by developing state-of-the-art technology solutions to significant operational problems in Workforce Management, and Personnel and Organizational Assessment.

The Center's R&D program encompasses Recruiting, Selection and Classification; Personnel Planning and Policy Analysis; Distribution and Assignment; Knowledge Management Systems; and Personnel Surveys and Program Evaluation. We also maintain corporate expertise in personnel surveys, multicultural and gender research, quality of life issues, productivity enhancement, and drug abuse research.

CURRENT IMPORTANT PROGRAMS

WORKFORCE MANAGEMENT - A comprehensive program to improve the Navy's management of its personnel resources. Products include suites of integrated, computer-based models, databases and systems which enable: Rapidly collecting and displaying information on personnel force characteristics in easily understood graphic and tabular forms; Testing the effects of alternative policies on the workforce by mathematically simulating force dynamics under varying test policies; Developing and updating manning plans to reflect budgetary and end-strength constraints, and statistically forecasting losses and gains at several levels of detail within the enlisted and officer workforce. Major projects include the Enlisted Strength Planning System, which enables monitoring all personnel force transactions on a daily basis; the Navy Training Reservation System (NTRS), designed to improve the way students are scheduled for Navy schools, while cutting times lost while students transition to and from schools; a Job Advertisement and Selection System (JASS), an on line information and decision system for both sailors and detailers; and Computer-Based Technology for Detailers, which:

(1) optimally matches rotating sailors to available jobs while considering moving costs,
(2) meets sailors' location preferences, and
(3) enables maximum use and reuse of individual skills. The department also provides R&D support for the Navy Drug and Alcohol Prevention Program, with tasks addressing detection, prevention, education and substance abuse modeling.

PERSONNEL AND ORGANIZATIONAL ASSESSMENT - The goal of the overall research program is to enhance both personnel and organizational readiness. Efforts in Personnel Assessment address enlisted and officer selection, personnel testing, job classification, and performance measurement. The Center has a strong program to improve the sensitivity and effectiveness of computer adaptive testing in general. Innovative measurement technologies, including computer-based dynamic measures, are also being explored for their usefulness in personnel assessment. Organizational Assessment investigates and develops organizational solutions to meet Navy goals. Research projects focus on organizational and workgroup behavior. Major projects involve personnel surveys and attitude assessment, multicultural and gender integration, the role of quality of life factors in relation to readiness, and technical innovations to enhance workgroup productivity.

BRAC REALIGNMENT - Per BRAC 95, NPRDC's Classroom and Afloat Training research program was transferred to the Naval Air Warfare Center, Training Systems Division on 1 February 1998. NPRDC's Workforce Management and Personnel and Organizational Assessment research programs will realign into the Navy Personnel Command, Memphis in November 1999 becoming the Navy Personnel Research, Studies and Technology Department. Upon completion of the Memphis transfer, NPRDC will be disestablished.

EQUIPMENT/FACILITIES

The Center occupies approximately 58,400 square feet of space in converted World War II barracks buildings. Much of this is configured to accommodate the social science and mathematical analysis tasks performed on microcomputers and minicomputers. The facilities include upgraded electrical capability and air conditioning of the most equipment-intensive rooms. In addition, there are two facilities which contain computer rooms with raised flooring, central air conditioning, and upgraded electrical power, both components of the Center Research Computing Facility (RCF):

One installation occupies 2000 square feet and houses an IBM 4381 mainframe computer facility. It is used to develop, process, and maintain statistical and forecasting systems; very large complex personnel and training databases, and large software system applications.

A separate Sun Systems facility, operating under the UNIX operating system occupies 1600 square feet. It provides network (internal and external) services, data analysis software, text processing support, graphics/video image processing software, and electronic mail/news services. The data analysis, text processing, and graphics/video image processing software is specialized and, in some cases, custom written for NPRDC applications. Some of the RCF services required modifications to the UNIX operating system kernel, necessitating an NPRDC source license for the UNIX operating system.

Navy Personnel Research and Development Center
San Diego, CA 92152-7250
(619) 553-7812

CO: CDR William M. Keeney
Technical Director: Mr. Murray W. Rowe

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	IN-HOUSE	IN-HOUSE MANAGEMENT	OUT-OF-HOUSE	TOTAL
RDT&E:				
6.1 ILIR	0.169	N/A	0.000	0.169
6.1 Other	0.000	N/A	0.014	0.014
6.2	1.650	N/A	0.917	2.567
6.3	1.957	N/A	1.277	3.234
Subtotal (S&T)	**3.776**	**N/A**	**2.208**	**5.984**
6.4	0.000	N/A	0.000	0.000
6.5	0.445	N/A	0.689	1.134
6.6	0.469	N/A	0.763	1.232
6.7	0.000	N/A	0.000	0.000
Non-DOD	0.000	N/A	0.000	0.000
TOTAL RDT&E	**4.690**	**N/A**	**3.660**	**8.350**
Procurement	0.000	N/A	0.000	0.000
Operations & Maintenance	4.699	N/A	4.143	8.842
Other	0.232	N/A	0.132	0.364
TOTAL FUNDING	**9.621**	**N/A**	**7.935**	**17.556**

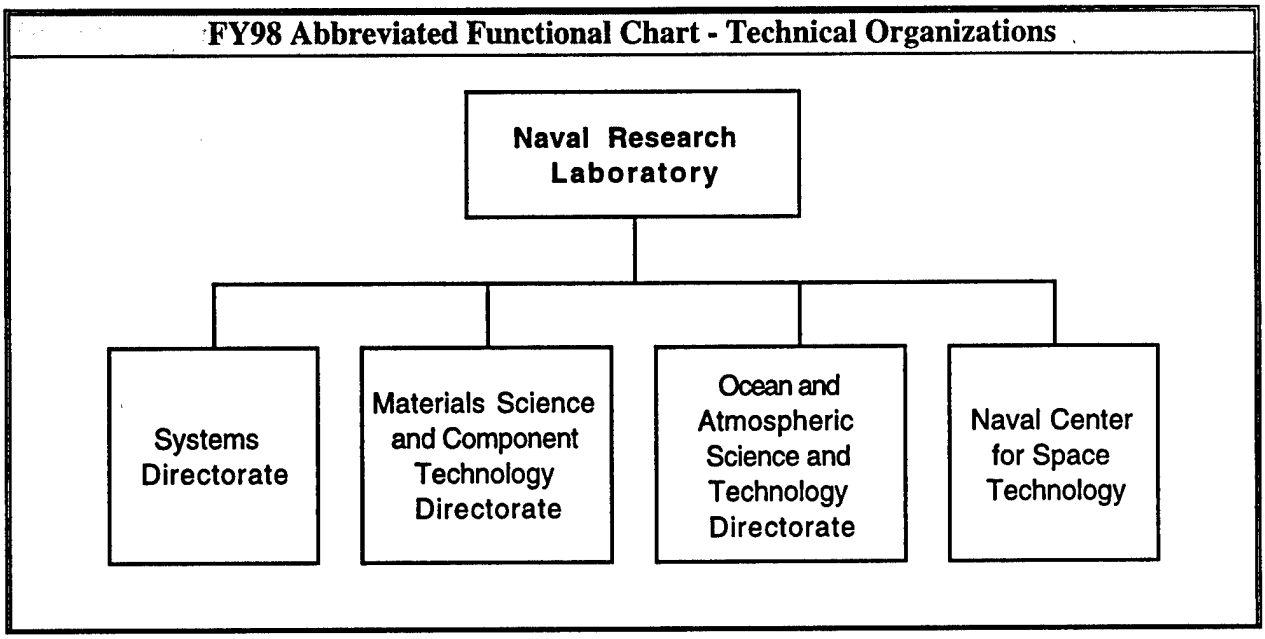
MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		TECHNICAL SUPPORT & OTHER PERSONNEL	END STRENGTH
TYPE	DOCTORATES	OTHER		
MILITARY	0	0	10	10
CIVILIAN	13	30	36	79
TOTAL	**13**	**30**	**46**	**89**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		PROPERTY ACQUISITION COST (MILLIONS $)	
LAB	37.500	**REAL PROPERTY**	1.126
ADMIN	16.400	* NEW CAPITAL EQUIPMENT	0.000
OTHER	4.500	**EQUIPMENT**	4.430
TOTAL	**58.400**	* NEW SCIENTIFIC & ENG. EQUIP.	0.246
ACRES	**3**	* Subset of previous category.	

N/A - Not Applicable

Naval Research Laboratory



Naval Research Laboratory
Washington, D.C. 20375-5320
(202) 767-2541

Commanding Officer: CAPT Bruce W. Buckley
Director of Research: Dr. Timothy P. Coffey

MISSION

Operate as the Navy's full spectrum corporate laboratory. To conduct a broadly based multidisciplinary program of scientific research and advanced technological development directed toward maritime applications of new and improved materials, techniques, equipment, systems and ocean, atmospheric, and space sciences and related technologies. In fulfillment of this mission, the Naval Research Laboratory:

(1) Initiates and conducts broad scientific research of a basic and long-range nature in scientific areas of interest to the Navy.

(2) Conducts exploratory and advanced technological development deriving from or appropriate to the scientific program areas.

(3) Within areas of technological expertise, develops prototype systems applicable to specific projects.

(4) Assumes responsibility as the Navy's principal R&D activity in areas of unique professional competence upon designation from appropriate Navy or DoD authority.

(5) Performs scientific research and development for other Navy activities and, where specifically qualified, for other agencies of the Department of Defense and, in defense-related efforts, for other Government agencies.

(6) Serves as the lead Navy activity for space technology and space systems development and support.

(7) Serves as the lead Navy activity for mapping, charting, and geodesy (MC&G) research and development for the National Imagery and Mapping Agency.

LEADERSHIP AREAS: NRL, the Navy's single, integrated corporate laboratory, provides the Navy with a broad foundation of in-house expertise from scientific through advanced development activity. Specific leadership responsibilities and expertise are maintained in the following areas:

(1) Primary in-house research for the physical, engineering, space, and environmental sciences.

(2) Broadly based exploratory and advanced development program in response to identified and anticipated Navy needs.

(3) Broad multidisciplinary support to the Naval Warfare Centers.

(4) Space and space systems technology, development, and support.

CURRENT IMPORTANT PROGRAMS

ECM Transmitter ATD; Signature Technology Program; Advanced multifunction RF system (AMRFS); For enabling new military capabilities, the fabrication, characterization and manipulation of nanometer sized structures is pursued for electronic, electrooptic, magnetic, and biological detection applications; Wide bandgap semiconductor programs are conducted to provide RF power and Power Electronics components to Naval platforms; Biomaterials-Programs focuses on the discovery and development of functional materials using biology as both a resource to develop advanced ultrasensitive detection systems. Multistatic Active Sonar Technologies (MAST); Environmentally Adaptive Sonar Technologies (EAST); Satellite METOC Sensors; Polar Ozone and Aerosol Monitor; Nesting Satellite Optical Products at Large and Fine Scales; LINKS, Dynamical Linkage of the Asian Marginal Seas; Littoral Morphodynamics Programs; Geospatial Information Database (GIDB); Targeted Observation Studies for Improving Atmospheric Predictability; Development and Transition of Meteorological Satellite Applications; Upper Atmospheric Program provides basic theory of space weather; Solar Studies Program providing operational space-weather information; Hyperspectral Remote Sensing Technology (HRST) demonstration and a passive microwave ocean WIND SATellite (WINDSAT); Interim Control Module (ICM) to provide interim attitude control and reboost functions for the International Space Station.

CRADAs ACTIVE DURING FY98

Title: Electronic Support Systems Technology
CRADA Between NRL and AIL Systems, Inc.
The objective of this Agreement is to conduct basic advanced receiver research and evaluate innovative concepts.

Title: Quantitative Mobility Spectrum Analysis for Hall Evaluation Software Package
CRADA Between NRL and Lake Shore Cryotronics, Inc.
The objective of this Agreement is to develop and make available to the semiconductor community a software package based on the Quantitative Mobility Spectrum Analysis (QMSA) algorithm for evaluating magnetic-field-dependent Hall and resistivity measurements. The package may be used either as a built-in component of Lake Shore Hall instrumentation or in conjunction with data acquired by any other Hall system. By providing a more accurate and computer-automated analysis algorithm than has been available previously, this CRADA will lead to significantly enhanced capabilities for routinely characterizing multiple electron and hole densities and mobilities in semiconductor samples, including bulk, thin film, and quantum well materials and devices. Suitable for use by both experts and non-experts, the product will benefit Navy, other DoD, industrial, and university laboratories and production facilities involved in the development and characterization of semiconductor materials and devices.

Title: Naval Environmental Operational Nowcasting System
CRADA Between NRL and Empress Software, Inc.
The objective of this CRADA is to integrate the Naval Environmental Operational Nowcasting System software (a generic, machine independent database management interface software package which handles most of the meteorological and oceanographic data types over both UNIX and PC Systems) with the Empress relational database management system software, and create a user interface for easy access.

Title: Research on DNA Sequencing Using an Atomic Force Microscope
CRADA Between NRL and Stratagene
The objective of this CRADA is to carry out cooperative research and development relating to the measurement of forces resulting from breaking individual DNA base-pairs in a peeling configuration and to use such forces to directly sequence nucleic acids.

Title: Radiation Hardness in Thin Simox
CRADA Between NRL and Ibis Technology Corporation
The objective of this CRADA is to determine optimal processes parameters to maximize radiation hardness of thin box SIMOX.

CURRENT IMPORTANT PROGRAMS (continued)

Title: Proof-of-Principle Experiment of the Vacuum Beat Wave Accelerator
CRADA between NRL and Omega-P, Inc.
The objective of this CRADA is to conduct research on the Vacuum Beat Wave Accelerator (VBWA) is an efficient scheme of charged particle acceleration that can produce high energy particle beams in significantly shorter interaction distances. The utilization of processes that can accelerate particles in vacuum eliminates many difficulties encountered when an accelerating medium is used. Development of intense lasers and the study of their interaction with plasmas and electron beams are advanced technologies with many potential Navy and/or DoD applications. In addition to advancing the forefront of scientific research in the interaction of lasers with matter, this work could also lead to new technologies in areas such as material processing, manufacturing, and characterization. The VBWA proof-of-principle experiment integrates with other on-going programs at NRL that utilize intense lasers and the RF electron gun facility.

Title: Fiber Bragg Grating Sensors Development
CRADA between NRL and Astro Technology, Inc.
The objective of this CRADA is to examine the use of fiber Bragg grating sensors in various applications where the use of electrically passive sensors is extremely important. These include strain monitoring in liquefied gas fuel composite tanks and strain monitoring of rocket motor casings and nozzles in long term storage, and static motor testing. The CRADA will result in field testing of instrumentation in these application areas, which will enhance the understanding and knowledge of distributed strain sensor systems for other closely related Navy and DoD applications.

Title: Private Communications Using Chaotic Dynamical Systems
CRADA Between NRL and Dynetics, Inc.
The objective of this CRADA is to develop a prototype device and/or a market product that uses chaotic dynamics in electronics circuits to achieve a functional private or secure communications system. Research and development will focus on more secure approaches to encoding or masking information with chaotic waveforms than the simple approaches that have been tried thus far in the field.

Title: Fiber Optic Sensor Techniques for Blood Glucose Measuring Instruments
CRADA between NRL and Sunshine Medical Instruments, Inc.
The objective of this CRADA is to investigate modulation methods and devices for use with polarized light to improve the performance of Sunshine's prototype blood glucose measuring instruments.

Title: Ion Implantation Technology for GaN and Related Alloys
CRADA Between NRL and Implant Sciences Corporation
The objective of this CRADA is to develop and implement for device and IC fabrication an implantation technology for GaN and its related alloys

Title: Digital Library Research
CRADA Between NRL and Visual History Foundation
The objective of this CRADA is to conduct basic Digital Library Research and evaluate innovative concepts.

Title: Liquid Crystal Material Research
CRADA Between NRL and Spatialight, Inc.
The objective of this CRADA is to couple NRL's electroclinic liquid crystal materials with the monocrystalline silicon active matrix substrates developed by Spatialight, Inc., and thereby develop and test high performance spatial light modulators for both military and commercial applications.

Title: High Power Fiber Amplifiers
CRADA Between NRL and Clark-MXR, Inc.
The objective of this CRADA is to test the suitability of a broad stripe diode pumped fiber amplifier to replace the Master Oscillator Power Amplifier (MOPA) pumped amplifier currently used in the Clark-

CURRENT IMPORTANT PROGRAMS (continued)

MXR Erf stretched pulsed modelocked fiber laser. In the course of this work the characteristics of the amplifier will be modified to attain suitability. A further objective is to maintain a low-cost robust design of the laser amplifier. It is expected that with minor (if any) modifications the fiber amplifier developed at NRL will provide a substitute for the MOPA pumped amplifier at a substantially reduced cost.

Title: Diamond Based Materials Research
CRADA Between NRL and Diamond Microelectronics Corporation
The objective of this CRADA is to develop cost-effective diamond-based, high power/high frequency switches and assorted vacuum electronics.

Title: Athermal Annealing of Semiconductor Wafers and Devices
CRADA Between NRL and Prime Capital Group, Inc.
The objective of this CRADA will be to elucidate the physics of athermal annealing and to determine whether the technology can have a significant impact on the civilian semiconductor industry. Specific goals include the production of reproducible, uniform activation on 2-8 inch diameter n- and p- type Si wafers doped to 1015-1020 cm-3, as well as actual Si devices; demonstration of reduced dopant diffusion relative to thermally-annealed wafers; and identification of the athermal annealing mechanism.

Title: Development of Bi-Stable, High Resolution Reflective Display as a Memory Device
CRADA Between NRL and Opticom ASA
The objective of this CRADA is to develop and build a bi-stable, high resolution reflective display using conducting polymer based plastic substrates and further, to explore technical issues involved with a high definition electrical read and write memory device using a bi-stable cholesteric display and conducting polymer substrates.

Title: Conversational Case-Based Reasoning Research
CRADA Between NRL and Inference Corporation
The objective of this CRADA is to evaluate possible extensions to IC's product line of CBR tools based on automated case authoring and case retrieval models. Specific goals are

(1) to simplify the case authoring process so that users can more easily design and maintain high performance case libraries in diverse domains; and
(2) to allow users to interact with probabilistic modeling tools so that they can improve the performance of case retrieval.

Title: Advanced Radar Modeling and Simulation Tool for Electronic Warfare Research
CRADA Between NRL and Photon Research Associates
The objective of this CRADA is to develop a modular, reconfigurable, distributed, interactive radar simulation (RADSIM) that can be seamlessly integrated into the NRL ENEWS M&S framework.

Title: X-Ray Absorption Analysis and Experiments
CRADA between NRL and PPG Industries, Inc.
The objective of this CRADA is to develop X-ray absorption spectroscopies (primarily XANES -- X-ray Absorption Near-Edge Spectroscopy and EXAFS --Extended X-ray Absorption Fine Structure) as tools suitable for studying low concentrations of key elements in glass and fiber glass, as well as coatings (such as automotive coatings) and other organic materials. Such information is intended to be used for analysis, quality control, and forensic science. A further objective is to explore the use of XANES and EXAFS as evidentiary tools in litigation.

Title: Anti-Ship Cruise Missile (ASCM) Tactical Analysis Workstation Development
CRADA Between NRL and Sippican, Inc., Hycor Group
The objectives of this CRADA are: (1) To expand on HYCOR's tactical analysis workstation model to enable modeling of both RF and IR missile engagements; (2) To develop a graphical user interface that can be shared by both the RF and IR missiles; and (3) To perform initial verification and validation efforts on the PC-based workstation model.

CURRENT IMPORTANT PROGRAMS (continued)

Title: High Data Rate SATCOM Networks for Disadvantaged Users
CRADA Between NRL and Orion Network Services, Inc.
The objective of this CRADA is to develop HDR SATCOM technology using VSAT to support network connectivity to small platforms (ships, aircraft, forward-deployed forces) and commercial installations where antenna size is a limiting factor. Additionally, bandwidth efficient modulations and efficient networking schemes will be developed to support efficient use of the satellite transponder asset.

Title: Fast Recovery Time Nuclear Quadrupole Resonance (NQR) Detection
CRADA Between NRL and Quantum Magnetics
The objective of this CRADA is to incorporate fast recovery time electronics into the NRL NQR system, evaluate the potential for improvements over current methods of contraband chemical compound detection, then incorporate the improvements into QM NQR system.

Title: Quantification of Elastomeric Ozone Detector Performance
CRADA between NRL and Environics, Inc.
The objective of this CRADA is to develop NRL's patented Elastomeric Ozone Detector into a commercial product, the accuracy and reproducibility of the method need to be addressed. The purpose of the cooperative research is to use Environics hardware in order to calibrate NRL's ozone chamber, whereby the performance of the Elastomeric Ozone Detector can be objectively assessed. Thus, quantitative determinations will be obtained of both accuracy and reproducibility.

Title: Meteorological Satellite Application System
CRADA between NRL and Seaspace Corporation
The objective of this CRADA is to permit the efficient and timely integration of state-of-the-art satellite meteorological application software from NRL-MRY's research and development laboratory environment to Navy operations via SeaSpace's TeraScan software package.

Title: Embedded Sensors for Space Applications
CRADA Between NRL and Cytec Fiberite, Inc.
The objective of this CRADA is to evaluate new composite materials and fabrication techniques for spacecraft components. In particular, the goals of the program are
(1) to apply techniques developed at NRL for embedding fiber optic sensors to a commercial fabrication method for composite parts;
(2) to produce and develop prototype spacecraft components with embedded sensors; and
(3) to develop the tooling and techniques required for commercial fabrication of spacecraft components with embedded sensors.

Title: Germanium Strip Detector System for X-Ray and Gamma-Ray Spectrometry and Imaging
CRADA Between NRL and Physical Sciences, Inc.
The objectives of this CRADA are:
(1) Develop a 16 channel ASIC with multiplexed output and improved features from current NRL 2-channel chip set;
(2) Demonstrate low noise, multi-channel readout of GSD using the new ASIC;
(3) Develop new contact technology to replace Li diffused contacts on germanium strip detectors;
(4) Demonstrate 0.5 mm pitch germanium strip detector;
(5) Integrate germanium strip detector and new electronics into a demonstration system; and
(6) Conduct an assortment of tests to prove the utility of this technology to NASA and potential future sponsors and customers.

Title: Multi-Channel Integrated Optic Phase Modulators
CRADA Between NRL and Dylor Corporation
The objective of this CRADA is to build an integrated optic device with multiple phase modulation channels, capable of independent broadband operation to ~20 GHz. In particular, the goal is fabrication of an 8-channel modulator where operation of all 8 channels (4 on each side of the chip) can be demonstrated. The prototype device demonstration will be considered a success if functional operation of 4 channels whose electrodes all terminate on one side of the chip can be demonstrated. This successful

CURRENT IMPORTANT PROGRAMS (continued)

demonstration will likely lead to subsequent collaboration. A further objective is for NRL to transfer to Dylor the technology and information necessary for them to produce such devices commercially.

Title: Mechanisms of Insulation Failure
CRADA Between NRL and Lectromechanical Design Company
The objective of this CRADA is to analyze electrical insulation that has failed in field use in order to derive a better understanding of the failure modes of the insulation and identify possible means to improve the lifetime of electrical insulation.

Title: Development of Commercial Towed-Array System Including a Man-Portable Multisensor Towed Array System (MTADS) Adjunct for Survey of Hazardous Metallic Material
CRADA Between NRL and Geometrics, Inc.
The objectives of this CRADA are:

(1) The transfer of NRL's MTADS technology to GEO to allow manufacture and full implementation of one unit of a commercial towed array system for location and identification of buried metallic hazardous material such as unexploded ordnance. Such a system is in high demand by the Department of Defense for survey and characterization of current and former military ranges; and
(2) The joint development and building by NRL and GEO of one unit of a man-portable adjunct to MTADS. This system will allow GEO to provide commercial services in areas where the vehicular MTADS cannot perform normally.

Title: Boundary Element and Finite Element Models for the Application of Nearfield Acoustic Holography
CRADA Between NRL and Automated Analysis Corporation
The objective of this CRADA is to develop and validate a robust algorithm to identify a noise source based on sound pressure measurements on a surface with an arbitrary shape.

Title: Development of Metal-Insulator-Metal Ensemble Materials for Chemical Sensing
CRADA Between NRL and Microsensor Systems, Inc.
The objective of this CRADA is to explore organic ligand stabilized metal clusters as the critical absorbent and transducer element in a new class of solid-state vapor sensors.

Title: Fiber Optic Sensors for Oil Exploration
CRADA Between NRL and Schlumberger Technology Corporation
The objective of this CRADA is to develop high performance fiber Bragg grating sensor systems for oil exploration and production for land and offshore applications. STC has also licensed the Navy's high performance fiber Bragg grating interferometric receiver system and desires to develop state of the art sensor systems using this license rapidly.

Title: Investigation of Geobat Concept for Naval Applications
CRADA Between NRL and Geobat-FS Aviation, Inc.
The objectives of this CRADA are:

(1) To obtain a greater understanding of the fluid flow and the aerodynamic characteristics of the Geobat concept via wind-tunnel testing;
(2) To understand the effects of scaling the concept, thereby obtaining an understanding of the suitability of the concept for Naval/DOD/military applications;
(3) To obtain an improved, more efficient aircraft design using the Geobat concept; and
(4) To verify the improved design through limited radiocontrolled flight tests.

Title: Industrial Applications of Mie Scattering
CRADA Between NRL and Rohm & Haas, Inc.
The objective of this CRADA is to adapt NRL-developed wave propagation and scattering algorithms and computer programs to compute the field of light scattered by irregularly-shaped colloidal particles whose size is comparable to the wavelength of the light (Mie scattering).

CURRENT IMPORTANT PROGRAMS (continued)

Title: X-Ray Fluorescence Analysis of Cobalt Fluorides
CRADA Between NRL and Mine Safety Appliances Company
The objective of this CRADA is to develop optimal sample preparation and data analysis methods for determining the fluorine content of colbalt fluorides using XRF.

Title: Development of the MAPLE Direct-Write Approach to Circuit and Sensor Element Fabrication
CRADA Between NRL and Potomac Photonics, Inc.
The objective of this CRADA is to carry out the cooperative research necessary to develop the matrix assisted pulsed laser deposition (MAPLE) laser-writer approach to direct-writing of circuit and sensor elements into a system which will meet the specifications of the DARPA MICE program.

Title: Structural Acoustics of Aircraft Interiors
CRADA Between NRL and Cessna Aircraft Company
The objective of this CRADA is to carry out research toward the development of a structural acoustic model of aircraft interior acoustics with the ultimate goal of creating design guidance and tools for a quieter business jet.

Title: Development of High-Power, Long-Pulse, Large-Diameter, Annular Electron Beam Diodes for Microwave Generation
CRADA Between NRL and Mission Research Corporation The primary objective of this CRADA is to conduct research to develop practical, reliable electron beam diodes that can power gigawatt-class relativistic kystrons for pulse durations of at least a microsecond. Secondary objectives are to develop a better understanding of the physical processes responsible for limiting pulse duration in high-power electron beam diodes and to demonstrate approaches to overcome these problems.

Title: Measurement and Analysis of the Radiation Response of InGaP/InGaAs Solar Cells in Terms of Displacement Damage Dose
CRADA Between NRL and Essential Research, Inc.
The objective of this CRADA is to study the radiation response of ERI's innovative solar cell technology consisting of InGaP/InGaAs dual-junction semiconductor layers with bandgaps tailored to match the solar spectrum. In particular, the bottom InGaAs cell of the dual-junction technology will be investigated in-depth. The specific goal of this collaboration is to gain an understanding of the basic radiation response mechanisms for this new cell technology. The ultimate goal of the research is to develop high efficiency, radiation-hard solar cells that may be used in space-based systems such as those used in communications, navigation, environmental monitoring (oceanography, weather, topography), surveillance for over-the-horizon targeting support, tactical warning, and situational awareness/monitoring.

Title: Evaluation of the Sweat Patch Substance of Abuse Detector for Alcohol Detection
CRADA Between NRL and Pro Tech Monitoring, Inc.
The objective of this CRADA is to transfer the Sweat Patch Substance of Abuse Detector technology to the marketplace. Specific goals include modification of the frequency of the Sweat Patch Substance of Abuse Detector transmitter, evaluation of the ability of the detector to detect alcohol and identification of the level of effort required to optimize detection of cocaine, opiates, and amphetamines.

Title: Leo One Advanced Satellite System Development
CRADA Between NRL and Leo One USA, Inc.
The objective of this CRADA is to apply NRL's expertise and technologies such as gravity-gradient stabilization employing active magnetic control, tethered wire de-orbit techniques, and multi-satellite constellation phasing and maintenance techniques to the Leo One low earth orbiting satellite constellation for non-voice messaging and paging services.

CURRENT IMPORTANT PROGRAMS (continued)

Title: Commercial Radiation-Tolerant Deep Submicron CMOS Microelectronics
CRADA Between NRL and Mission Research Corporation
The objectives of this CRADA are:
(1) To implement and optimize minimally invasive process and design methodologies to improve the radiation tolerance of commercial deep submicron CMOS microelectronics, including the preparation of test samples using these techniques;
(2) To assess the scaleability of these approaches to evolving CMOS technologies; and
(3) To perform total dose radiation effects testing on test structures, including capacitors, transistors, and circuits.

Title: New Paint Formulations for Fluorinated Polyurethane Resins
CRADA between NRL and 21st Century Coating, Inc.
The objective of this CRADA is to produce and test new paint formulations of the NRL fluorinated polyurethane resins manufactured under license by 21st Century Coatings, Inc. The current fuel tank coating systems utilizing the NRL resins does not meet the EPA VOC and heavy metal standards for several states. NRL and 21st Century Coatings will work together to develop new formulations and systems that meet or exceed the current standards announced for future implementation.

Title: Molecular Dynamic Study of Acoustic Damping
CRADA between NRL and IBM Almaden Research Center
The objective of this CRADA is to use parallel-computer molecular dynamics codes using atomistic descriptions of matter to study mesoscopic systems.

Title: Laser-Heated Thermoluminescent Glass
CRADA between NRL and Keithley Instruments, Inc.
The objective of this CRADA is to conduct research towards improving the performance of the laser-heated thermoluminescent glass by modifying the composition of the material by changing concentrations of ions and semiconductor nanocrystalites. It is anticipated that this will lead to a significant cost reduction for the laser-heated thermoluminescence reader.

Title: Magnicon Development at ll.4GHz
CRADA Between NRL and Omega-P, Inc.
The objective of this CRADA is to conduct research on a high power, high gain, high efficiency X-band thermionic magnicon amplifier tube. The magnicon is an advanced scanning-beam microwave tube that was originally invented at the Institute for Nuclear Physics in the former Soviet Union. Specifically, the objective of this research is to develop a magnicon tube with a gain greater than 50 dB, a peak power of 50 MW at 11.4 GHz, a pulse length of 1 μsec, and an efficiency of greater than 50%. This technology would have a variety of potential Navy and/or DoD applications as a high efficiency replacement for klystron amplifiers in the frequency range of 0.5 to 12 GHz. The development of magnicon amplifier tubes integrates with other programs to develop advanced microwave sources for radars, remote sensing, and other applications. In addition, the advanced electron gun that will be developed as part of the program is an enabling technology for high power microwave tube development, and supports the development of klystrons, ubitrons, and linear beam devices, in addition to magnicons.

Title: Liquid Crystal Alignment Layer Program
CRADA Between NRL and Shipley Company
The objective of this CRADA is to provide an optical alignment layer capable of uniform alignment of nematic liquid crystals with a contrast ratio greater than 10. The CRADA will demonstrate a pre-tilt angle in the range of 2° to 5° (suitable for both passive and active matrix TN displays) on one set of substrate surfaces and for one liquid crystal sample material. The CRADA will also demonstrate the robustness of the alignment layer by showing switching for a period of three (3) months or more of a prototype TN cell fabricated using the various surfaces.

Title: Patterned Bimolecular Surfaces for High Throughput Biological and Chemical Diagnostics
CRADA Between NRL and Biological Detection, Inc.
The objective of this CRADA is to determine the efficacies of NRL's technology for fabricating two and

CURRENT IMPORTANT PROGRAMS (continued)

three-dimensionally patterned bimolecular surfaces for use with BioDx's fluorescence-based micro-imaging technology, and to evaluate the different patterning techniques with regard to potential commercial viability. It is envisioned that the results of this effort will lead to the development and production of prototype diagnostic devices in a subsequent NRL-BioDx collaborative program.

Title: Improved Methods for Generating Target Motion for Closed Loop Simulation Facilities
CRADA Between NRL and CARCO Electronics
The objective of this CRADA is to conduct joint research to gain a better understanding of CARCO's technology through participation in the testing and validation of the Dual Target Motion System at NASA's Ames Research Center. CARCO will conduct an extensive series of experiments/trials in Hanger 2 at the Ames Research Center to support the quantification, development, and verification of the Dual Target Motion System's performance. Data collected from these trials will be forwarded to NRL for analysis as to the credibility of the system for use in the conduct of advanced countermeasures research. NRL will review the data with special emphasis placed on the fidelity of target motion with respect to positioning accuracy and accelerations achieved. The results of this research activity will yield a fundamental understanding of the performance boundaries for such systems and the range of research topics to which low cost electromechanical systems could be applied as compared to higher cost of electronic systems.

Title: Wide Bandgap Semiconductor Research
CRADA Between NRL and CREE Research, Inc.
The objective of this CRADA is to conduct basic research on the properties of wide bandgap semiconductor and their possible impact on civilian and military applications. The role of intrinsic defects and impurities in materials and device performance will be studied by spectroscopic techniques and correlations with materials processing parameters will be investigated.

Title: Development of Bi-Stable, High Resolution Reflective Display as a Memory Device
CRADA Between NRL and Opticom-ASA
The objective of this CRADA is to develop and build a bi-stable, high resolution reflective display using conducting polymer based plastic substrates and further, to explore technical issues involved with a high definition electrical read and write memory device using a bi-stable cholesteric display and conducting polymer substrates.

Title: Fiber Optic Seismic Systems
CRADA Between NRL and Optical Products, Inc.
The objective of this CRADA is to conduct basic studies and evaluate innovative concepts for fiber optic sensor systems for the marine exploration of oil and gas reserves. In particular, NRL has developed optical fiber technology for Navy towed array applications.
The objective of this cooperative research is to develop and refine these fiber optic technologies for seismic applications.

Title: Multi-Quantum Well Solar Cell Radiation Testing
CRADA Between NRL and University of Houston Space Vacuum Epitaxy Center
The objective of this CRADA is to study a new and very promising space cell technology, MultiQuantum Well (MQW) solar cells. These cells are currently being produced by the University of Houston, and NRL will take several cells, expose them to particle irradiation, and measure the radiation-induced degradation.

Title: On-Line Fiber Bragg Grating Implementation
CRADA Between NRL and Spectran Specialty Optics Company
The objective of this CRADA is to implement NRL's patented technology for producing fiber Bragg gratings in-line on the fiber draw tower in SSOC's Avon, CT facility. Under license from NRL, SSOC will manufacture and sell fiber Bragg grating arrays using NRL's patented technology.

CURRENT IMPORTANT PROGRAMS (continued)

Title: Commercial Development of Halloysite Controlled Release System
CRADA Between NRL and New Zealand China Clays, Ltd.
The objectives of this CRADA are:

(1) To characterize the physical properties of existing feed stocks of NZCC materials to establish the fraction suitable for use at the least cost in a controlled delivery system;
(2) To produce release rate data for both lipophilic and hydrophilic materials from selected feed stocks sufficient to provide NZCC with marketing materials and technical evaluation data for NZCC target customers;
(3) To perform a market analysis for selection of initial target market;
(4) To develop a best-practice paradigm for optimum production of halloysite tubules at the highest entrapment rate achievable with the production sample chosen; and
(5) To develop engineering parameters for pilot plant production of commercial evaluation samples.

Title: Analysis of Rugate Coatings
CRADA Between NRL and Raytheon Optical Systems
The objective of this CRADA is for ROS and NRL together to determine the optimum coating design and fabrication procedure for LEP filters. NRL will analyze coating properties of samples supplied by ROS.

Title: Suppressing Diode Collapse in High Power Electron Beam Diodes
CRADA Between Nrl and Berkeley Research Associates
The objective of this CRADA is to conduct research on radiative heating techniques to suppress diode collapse in high pulsed power density diodes and related phenomena in devices such as plasma opening switches.

Title: Virtual Enterprise Endeavor
CRADA Between NRL and Husky Labs
The objective of this CRADA is to provide a simple, easily enhanced medium which will allow NRL to acquire certain expertise in the development of the Virtual Enterprise capability for Navy programs. Utilizing NRL's experience with Navy requirements for Virtual Enterprise applications, and Husky Labs' experience with the Chakra product development, a customizable interface will be developed that is expected to ease information flow and decision-making in the coming century.

Title: Optical Marking
CRADA Between NRL and Biocode Corporation
The objective of this CRADA is the development of a class of covert inks that can be applied to both porous and non-porous surfaces using conventional printing technologies. The inks will be invisible to the naked eye but will be visualized in a discrete manner using an inexpensive, handheld infrared viewer. Several wavelength bands in the infrared will be used by selecting chemicals that have distinct absorption properties. Absorption of light at each distinct band will be detected using appropriate optical bandpass filters. This frequency agility will provide an acceptable level of security for a wide range of commercial products.

Title: Deep-Towed Acoustic/Geophysical System
CRADA between NRL and Seafloor International, Inc.
The objective of this CRADA is to improve the State of the Art of DTAGS and the SSI developed Integrated Short Base Line (ISBL) navigation systems through research. Joint research between the parties will determine whether coupling the DTAGS with the ISBL would improve the geographical accuracy of NRL's seismic seafloor data interpretation. The joint research would also evaluate whether the ISBL is suitable for deep ocean applications. A second objective of the research is to publish peer-reviewed articles related to basic research and exploratory development achieved cooperatively by the parties. The goal of the research is to improve the knowledge of seafloor environmental features for Naval operations.

EQUIPMENT/FACILITIES

Digital Electro-Optic Infrared Reconnaissance Cameras: NRL has a unique national resource for testing cameras for airborne manned reconnaissance which provide day and night capability and can data link targeting quality images in real time for use in precision strike weapons, high data rate cameras using compression techniques and image formats conforming to national standards.

Flying Lab: NRL has specially configured NP-3D aircraft which provides a one-of-a-kind national resource for testing up to 8 missile simulator systems and associated control and data collection instrumentation for use in providing realistic EW effectiveness assessment against a large cross section of modern ASCM missile threats. The aircraft also is equipped with AN/APS-145 AEW radar and cooperative engagement capability.

Ultra-Near Field Measurement Facility: NRL has a world class facility for making precision microwave (2-18 GHz) measurements of metal and metal coated objects to within one wavelength of the surface and to process massive data sets for conversion to frequency-wave vector (w,k) space. This data gives unique insights into physical mechanisms producing the scattering and measures evanescent energy that doesn't propagate to the far-field.

Structural Acoustic Pool Facilities: Steel cylindrical tank (55 ft diameter, 50 ft deep, 8,000,000 gal deionized water with in-water robotic scanners generating nearfield acoustic holography and 3-D laser vibrometry radiation and scattering databases for studying submarine and mine structural acoustics phenomena.

High Frequency Acoustics At-Sea Measurement Systems: High-speed tow body system instrumented with 2 high-frequency side looking steerable sonar arrays operating over the frequency range of 75 to 450kHz. The system also has internal motion sensing (IMU) systems and a 1.2Mhz downward looking ADCP.

Navy Prototype Optical Interferometer (NPOI): Located near Flagstone, AZ, the world's first and only fully coherent and operational imaging optical interferometer capable of high precision astrometric measurements as well as stellar imaging.

Sealab: An advanced processing facility for national systems imagery entirely devoted to S&T and development of new environmental measurement applications. It is capable of processing all current systems data and is also used for testing new systems' concepts and data types.

Ocean Color Lab: Has the ability to receive line of site data from NOAA (AVHRR) and NASA SeaWiFS satellites. Only Navy facility to directly receive SeaWifs. Provides real-time visible (including color) and thermal infrared to investigators studying physical, optical and biological processes in coastal and open ocean areas of the globe.

Slope-Tilt Wave Measurement System: Used to address research issues about the linkages of remote radar images of an ocean surface to the wave processes that create the images. These measurements are required for accurately specifying the principal parameters required for the models that attempt to link radar signal distributions to processes going on in the water.

Acoustic Seafloor Classification System (ASCS): A narrow beam echo sounder with software for real-time processing of the reflected signal to predict sediment physical and geotechnical properties. The technology is adapted to mine burial prediction and, through a CRADA with C&C Technologies of Lafayette, Louisiana, to cable and pipeline route surveys.

EQUIPMENT/FACILITIES (continued)

Transmission Electron Microscope (TEM) Laboratory: The new JEOL 300 KeV TEM magnifies specimens up to 1.5 million times yielding resolutions of up to 1.7 angstroms. The TEM lab includes an Environmental Cell for real-time observation, a Scanning Image Observation device, an Electron Dispersive Spectroscope, and an Electron Energy Loss Spectrometer.

Tactical Atmospheric Modeling System/Real Time (TAMS/RT): Deployable atmospheric prediction system which consists of 3 computers:

(1) SGI Origin 2000 computational server which runs the prediction system;
(2) HP C200 database server which runs the NRL Tactical Environmental Data Server (TEDS);
(3) SGI 02 graphics console which runs the graphical user interface, web server, and visualization software.

Bergen Data Center: A distributed data backup, archiving, hierarchical storage management (HSM) system for large meteorological observational and model data sets. Veritas Inc, High-Availability, NetBackup, and HSM software is used in coordination with the Andrew file System (AFS) to manage the system.

Large Angle Spectrometric Coronagraph (LASCO) and the Extreme Ultraviolet Imaging Telescope (EIT): These facilities on board the Solar and Helisopheric Observatory Spacecraft located in solar orbit between the Earth and the Sun continually monitor solar activity providing an early warning of pending disruptive solar phenomena.

Advanced Materials Facility for chemical vapor deposition and plasma processing with in situ laser diagnostics and process control.

For **Safety and Survivability** studies, the ex-SHADWELL (LSD-15) is a unique, full-scale fire and damage control test bed located in Mobile Bay, AL.

An unique **Trace Element Accelerator Mass Spectrometer Facility** includes a Finnigan TSQ-70 triple quadrupole mass spectrometer with particle bombardment, electrospray, atmospheric pressure chemical ionization, thermal desorption, and electron ionization.

Thin-film deposition systems are dedicated to magnetic and superconducting materials fabrication and processing. These systems are fully instrumented with in situ diagnostic tools to grow films--atomic layer by atomic layer--and to observe their growth pattern.

Space Physics Simulations Chamber - A 1.7 m diameter by 5 m Ultra High Vacuum chamber is available for ionospheric and near earth space experiments and spacecraft component testing.

A completely instrumented **EPI Center** provides molecular beam epitaxial (MBE) film growth and in situ characterization of Group II-VI and Group III-V semiconductors.

Naval Research Laboratory
Washington, D.C. 20375-5320
(202) 767-2541

Commanding Officer: CAPT Bruce W. Buckley
Director of Research: Dr. Timothy P. Coffey

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	0.000	N/A	0.000	0.000
6.1 Other	78.715	N/A	12.856	91.571
6.2	79.202	N/A	67.882	147.084
6.3	77.789	N/A	92.257	170.046
Subtotal (S&T)	**235.706**	**N/A**	**172.995**	**408.701**
6.4	14.066	N/A	30.903	44.969
6.5	15.701	N/A	40.403	56.104
6.6	1.725	N/A	3.134	4.859
6.7	11.673	N/A	17.636	29.309
Non-DOD	24.871	N/A	35.830	60.701
TOTAL RDT&E	**303.742**	**N/A**	**300.901**	**604.643**
Procurement	20.675	N/A	42.498	63.173
Operations & Maintenance	13.770	N/A	20.232	34.002
Other	8.317	N/A	12.133	20.450
TOTAL FUNDING	**346.504**	**N/A**	**375.764**	**722.268**

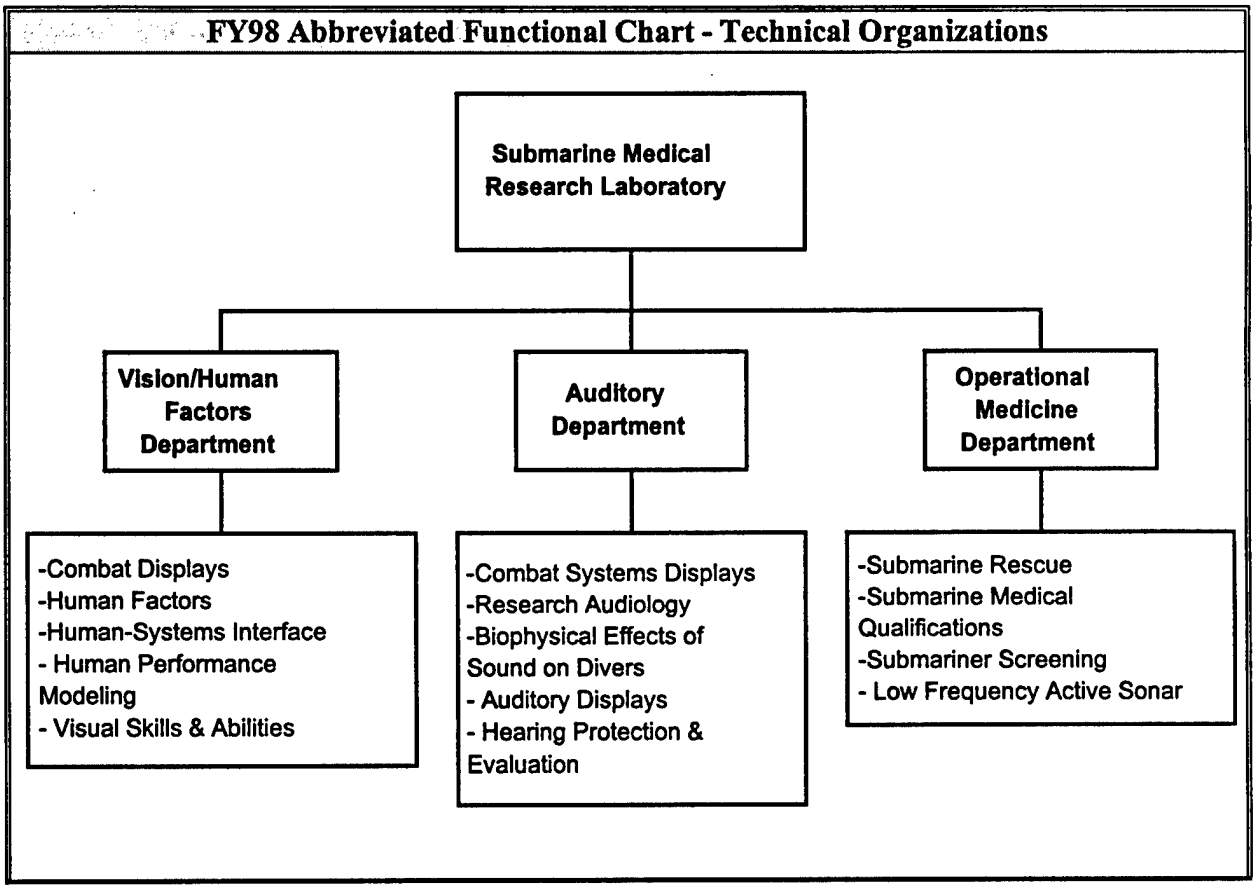
MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.445

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
TYPE	**SCIENTISTS & ENGINEERS**		**TECHNICAL SUPPORT & OTHER PERSONNEL**	**END STRENGTH**
	DOCTORATES	**OTHER**		
MILITARY	0	0	184	184
CIVILIAN	839	868	1,302	3,009
TOTAL	**839**	**868**	**1,486**	**3,193**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	3,188.283	**REAL PROPERTY**	197.043
ADMIN	227.533	* NEW CAPITAL EQUIPMENT	0.242
OTHER	399.043	**EQUIPMENT**	490.193
TOTAL	**3,814.859**	* NEW SCIENTIFIC & ENG. EQUIP.	26.031
ACRES	**532**	* Subset of previous category.	

N/A - Not Applicable

Naval Submarine Medical Research Laboratory



Naval Submarine Medical Research Laboratory
Groton, CT 06349-5900
(860) 649-3263

CO: CAPT Mark T. Wooster, MSC
DFA: LCDR Steven L. Keener, MSC

MISSION

Provide timely, high quality R&D to the submarine and fleet force to enhance auditory and visual operator performance, health and physical standards, closed environment atmospheric monitoring, escape and rescue, and hearing conservation both in air and under the sea.

CURRENT IMPORTANT PROGRAMS

Submarine Escape and Rescue: This project is focused on optimizing the survival of the crew that may be trapped in a damaged submarine that is unable to surface. The areas being addressed include active and passive carbon dioxide scrubbing, decision aids to assist the senior survivor to manage his men and materiel and the biomedical aspects of the introduction of new escape equipment into the submarine fleet.

Low Frequency Active Sonar: Tactical use of low frequency active sonar (LFA) may result in unintentional exposure (ensonification) of recreational divers. This study assesses diver aversion and panic reaction to elements of the LFA signal in order to create exposure guidance and an environmental impact statement.

Submarine Atmospheres Health Assessment Program (SAHAP): The health and performance of submarine crews can be adversely affected by contamination with chemicals and respirable suspended particles (RSP). The goal of this project is to determine the effectiveness of contaminant control procedures by measuring concentrations of volatile organic compounds, oxygenated compounds, ozone and RSP.

Environmental Adaptablility Screening for Submarine Service (SUBSCREEN): NSMRL developed and implements psychological and motivational screening for prospective Navy Submarine School students. Research related to this project includes reliability, validity of the screening, and outcome measures. One current project is determining the predictive capability of both SUBSCREEN and a clinical inventory to identify individuals who will later be disqualified from the submarine force for a personality disorder. The goal is to provide the recruiters with additional aids to evaluate prospective recruits.

Mortality of US Navy Nuclear Submariners Serving from 1969-1982: Mortality causes and rates were studied in a cohort of over 76,000 submariners who served on nuclear submarines between 1969 and 1982. In the first phase of the study, ending in the 1980's, mortality was very low compared to the general male population and the cohort was still quite young. As 15 years have now passed, the same cohort is being studied once again to determine if mortality rates for specific causes are affected by prior exposure to the submarine environment.

Active Noise Reduction Stethoscope: This project is evaluating commercial off the shelf compact noise-reducing/canceling stethoscopes for field, aeromedical and shipboard use in noise environments.

Predicting the Detectability of Auditory Signals: This project will help the Navy estimate detection ranges for sounds emitted from submarines by modeling the human auditory capability for detecting simple and complex transient signals under conditions of low and high uncertainty. An automated algorithm that uses available data to better predict the probability of detection due to combined visual and aural monitoring would highlight the self-generated noises that pose the greatest threat of counterdetection.

CURRENT IMPORTANT PROGRAMS (continued)

Evoked Otoacoustic Emissions (EOAEs) & Inner-Ear Damage from Navy Occupational Noise Exposure: This project is to determine what role EOAEs should play in hearing conservation programs. The project will determine whether EOAEs can be a more sensitive measure of noise-induced auditory damage than pure-tone audiograms and to what extent EOAEs can be used to predict and prevent pure-tone audiometric changes.

Spatialized Audio as a Human-System Interface: This project is for the development and evaluation of efficient adaptive signal processing techniques to customize auditory displays for use in combat and training systems. It will assess the benefits of spatialized auditory displays for enhancing the detection and identification of acoustic signals (i.e., targets & communications).

Development of General Hearing Conservation Standard for Diving Operations: This project is focused on permissible underwater sound exposure guidances for Navy diving environments and the design and development of portable underwater sound measurement instruments for Navy diving environments suitable for assessing noise exposure.

Vibration Bioeffects of Low Frequence Sound on Divers: This project investigates the bioeffects of low frequency sound on divers. In presence of low frequency underwater sound - determine the vibration response of the skull, measure the vibration in body structures and measure the psychological impact and effects on diver performance.

Human Performance Modeling: Current human performance modeling technology for sensory-motor, perceptual, and cognitive behavior is evaluated in the context of Navy military and medical system needs. Modeling tools are applied to demonstration problems in the design of the Human-System Interface as well as its operational and training requirements.

Detection and Recognition Trade-offs in Chromatic and Monochromatic Images: Specific colorization techniques are examined, and their effect on signal detection and recognition is quantitatively measured. In particular, certain colorization schemes may lead to improved detection at the expense of recognition.

Improved Alerting and Attention Management Methods: The overall objective of this research is to design an attention allocation system that provides necessary prompting cues when critical information changes occur in a display.

Information Requirements in Submarine Combat Systems: Although computers can handle vast amounts of information, they may not prioritize information effectively in a particular real world situation or keep pace with changes in the situation. The information that submarine conning officers consider to be the most important for decision making is being studied to improve the design and usability of software and displays used aboard submarines.

Spatial Thinking Ability for Submarine Personnel: Improvements in visual displays have partially relieved the cognitive demand of the submariner in maintaining a mental representation of the world outside his own ship; however, the ability for an individual to create and maintain a mental representation of the surrounding world is still vital in the submarine environment. This program attempts to identify specific mental abilities involved in faster, more accurate decisions in submarine operations and explores methods to train these basic mental abilities.

EQUIPMENT/FACILITIES

Fully equipped auditory, visual, and physiological laboratories, two man-rated hyperbaric chambers, large anechoic chamber, medical research library, and graphic arts capabilities.

Naval Submarine Medical Research Laboratory
Groton, CT 06349-5900
(860) 649-3263

CO: CAPT Mark T. Wooster, MSC
DFA: LCDR Steven L. Keener, MSC

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	IN-HOUSE	IN-HOUSE MANAGEMENT	OUT-OF-HOUSE	TOTAL
RDT&E:				
6.1 ILIR	0.120	N/A	0.000	0.120
6.1 Other	0.315	N/A	0.100	0.415
6.2	0.320	N/A	0.030	0.350
6.3	1.422	N/A	0.914	2.336
Subtotal (S&T)	**2.177**	**N/A**	**1.044**	**3.221**
6.4	0.375	N/A	0.043	0.418
6.5	0.000	N/A	0.000	0.000
6.6	0.058	N/A	0.032	0.090
6.7	0.000	N/A	0.000	0.000
Non-DOD	0.109	N/A	0.000	0.109
TOTAL RDT&E	**2.719**	**N/A**	**1.119**	**3.838**
Procurement	0.000	N/A	0.000	0.000
Operations & Maintenance	0.624	N/A	0.416	1.040
Other	0.163	N/A	0.093	0.256
TOTAL FUNDING	**3.506**	**N/A**	**1.628**	**5.134**

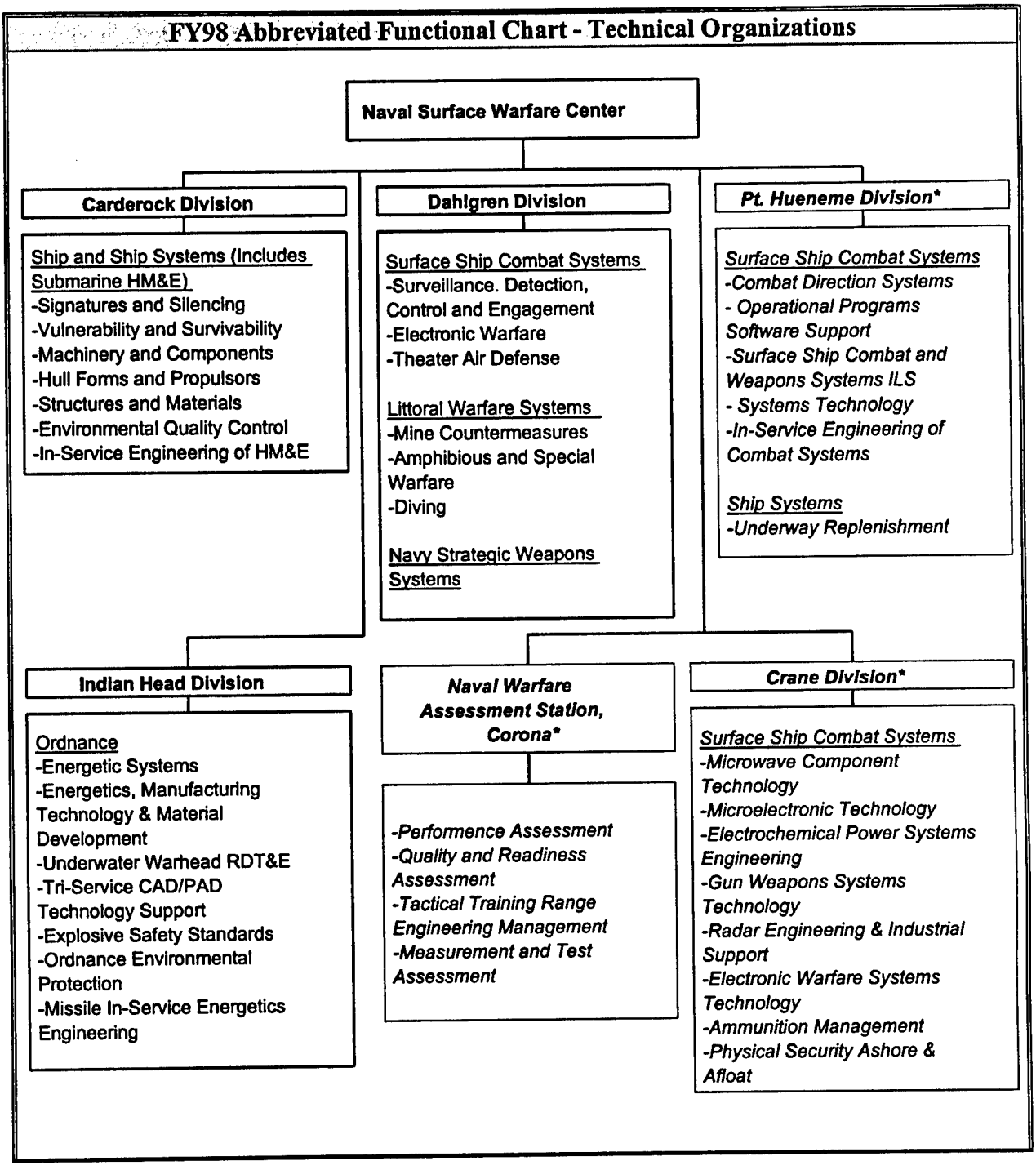
MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
TYPE	SCIENTISTS & ENGINEERS		TECHNICAL SUPPORT & OTHER PERSONNEL	END STRENGTH
	DOCTORATES	OTHER		
MILITARY	6	0	13	19
CIVILIAN	6	7	13	26
TOTAL	**12**	**7**	**26**	**45**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		PROPERTY ACQUISITION COST (MILLIONS $)	
LAB	46.190	REAL PROPERTY	8.223
ADMIN	15.798	* NEW CAPITAL EQUIPMENT	0.000
OTHER	0.000	EQUIPMENT	3.816
TOTAL	**61.988**	* NEW SCIENTIFIC & ENG. EQUIP.	0.175
ACRES	0	* Subset of previous category.	

N/A - Not Applicable

Naval Surface Warfare Center



**As a result of applying the In-House RDT&E Activity criteria at the division or major site level (see NOTE on page 3-1), NSWC Port Hueneme Division, Crane Division, and NWAS Corona data is not included in the FY98 report. NWAS was realigned from the Naval Ordnance Center (NOC) to the Naval Surface Warfare Center in March 1998; their financial data continued with the NOC through 30 September 1998.*

Naval Surface Warfare Center
Arlington, VA 22242-5160
(703) 602-0632

Acting Commander : Dr. Ira Blatstein

MISSION

Operate the Navy's full spectrum RDT&E, engineering and fleet support center for ship hull, mechanical and electrical systems, surface ship combat systems, coastal warfare systems, and other offensive and defensive systems associated with surface warfare.

CURRENT IMPORTANT PROGRAMS

Carderock Division:

NSSN
Provide design support and technology assessment for the new attack submarine program. Includes all hull, mechanical & electrical (HM&E) technology areas, platform related combat & weapon subsystems, as well as cost and military effectiveness analysis. Work categories include: auxiliary systems, CAD/CAM, cost effectiveness, electrical systems, EM silencing, fairwater, hydrodynamics, propulsor development, ship control, stealth-target strength, stealth-machinery, stealth-self/radiated noise, structures/materials, survivability, management systems and program support.

SSN-21 Seawolf Submarine
To participate in the design, construction, testing and operation of the SSN-21 Seawolf Submarine Class.

Environmental Quality Pollution Abatement
Provide continued in-service engineering (ISE) support to NAVSEA and fleet customers in order to effectively maintain, operate and support this equipment to provide the fleet with maximum operational capabilities while operating in restricted waters. The pollution abatement systems include sanitary waste collection and treatment, oily waste management and processing, solid waste management, incineration, compaction, shredding, pulping and hazardous materials/waste management and control.

Electric Drive System
Develop affordable electric propulsion and auxiliary equipment, which maintains or improves platform capabilities and reduces acoustic noise from electrical equipment.

Acoustic Submarine Trials
Provide subsurface acoustical data on the Navy's fleet and private companies.

Smart Base
Models that apply technology and/or management methods to increase shore installations efficiency and reduce the cost of infrastructure; to demonstrate that initiatives can be implemented through the application of commercially available technology, policy changes, and/or partnerships with the local community.

Electric Power Distribution System
To develop advanced electrical distribution system concepts meeting mission requirements at reduced costs.

CURRENT IMPORTANT PROGRAMS (continued)

Composite Structures
Develop and demonstrate advanced composites for application to surface ship and submarine structural systems/components and related non-marine dual-use applications.

Computational Mechanics
To perform research, development, and advanced application of computational methods and tools in the fields of structural mechanics, fluid dynamics, acoustics, and electromagnetics for solving engineering problems related to vehicle signatures, performance, and affordability. Also included are the enabling technologies of geometric and numerical modeling, optimization, visualization, and massively parallel processing.

Surface Vehicle Electromagnetic Signal Silencing
To develop and demonstrate technology in order to reduce surface ship underwater Electromagnetic (EM) Signature (0-1khz) and reduce vulnerability to magnetic mine threat for MCM and steel hull surface ships.

Dahlgren Division:

Battlegroup/Battleforce Interoperability – NSWCDD Dahlgren Site formed an alliance that will allow approximatley 14 Naval Labs and Research Centers to address this problem. That linkage is called the Distributed Engineering Plant. The alliance was formed in FY98 and will continue to work toward solving the interoperability problem for the fleet, services and eventually the allies

Portal Shield – Provides a previously unavailable capability for biological detection in OCONUS Airbase and Port facilities. NSWCDD DL Site provided quick response capability for Operation Desert Thunder in the Persian Gulf.

CSS participated in MARCOT – "Unified Spirit '98" Exercise off the coast of Newfoundland, Canada with five significant and successful technology systems demonstrations:

(1) **ALISS** – the next generation acoustic and magnetic influence mine countermeasures
(2) **EN** – a long stand-off, precision-placed, rocket-launched explosive mine and obstacle neutralization system
(3) **COBRA** – the first stand-off minefield reconnaissance capability from the surf zone to inland
(4) **ML(A)** – a high speed, wide swath LIDAR system for the detection and classification of surface and near-surface mines
(5) **Advanced Sensors** – the next generation mine countermeasures sonar and electro-optic sensors.

Wavenet Video Compression Testbed Hardware Configuration – This new video compression brass board technology has been demonstrated which combines Wavelet transform technology and perceptional neural Net processing, called WaveNet. This new compression technology has been demonstrated to transmit 30Hz color TV video through a 16 kbps Army SINCGARS radio channel.

The CSS Diving and Life Support Division and HardSuits, Inc., of Vancouver, BC, Canada teamed together to develop the One Atmosphere Diving Suit. This follows the successful redesign, adaptation, and certification of commercial technology for Navy use.

AEGIS CCL Integration Testing – NSWCDD DL Site Provided the risk mitigation of interfacing the existing AEGIS WCS with a launch control system that utilizes an open electronic architecture, a local area network (LAN), and COTS Hardware. This will reduce the chance of future interoperability issues between AEGIS and any similar launcher architecture

CURRENT IMPORTANT PROGRAMS (continued)

Remote Minehunting System – CSS completed successful development and testing of over-the-horizon communications and control for remotely operated systems, offering significant increases in effective range of operations.

DD21 Program – NSWCDD DL Site was an integral part of the DD21 Program Offices's (PMS-500) accomplishments in FY98 including establishing the Collaborative Engineering Data Center (CEDC) and the DD21 government team's Integrated Data Environment, and leading PMS500's government engineering and technical support team, TT21.

Unmanned Maritime Vehicle (UMV) – CSS successfully demonstrated command and control of the first unmanned surface vehicle by the Fleet Tactical Control System (TCS). The UMV-TCS demonstration paves the way for the Navy to integrate UMVs with significant cost savings over current approaches.

Hiper-D/Ad-Con-21 Quorum – The FY98 demonstration was the most ambitious to date for the NSWCDD DL site team. The Hiper-D AAW path was completely fault tolerant from end to end with the addition of a replicated track correlation and filtering function along with the fault tolerant engagement server.

A major breakthrough in underwater communications was realized with the **Head Contact Microphone** designed and developed by CSS for the U.S. Navy SEALs. This technology has received wide interest in other life support roles such as firefighting.

Indian Head Division:

MCM/DET: RDT&E for Navy and Marine Corps Mine Countermeasures (MCM) - including: distributed explosives technology (DET), demonstrative/advanced countermeasure, surf zone MCM, and shallow water MCM.

NSFS: R&D of new propellants for propulsion and projectiles for the Navy's extended range guided munitions in support of Naval Surface Fire Support systems (NSFS)

IMAD-HE: Insensitive munitions advanced development for high explosives for all Navy weapons

MEMS (Microelectromechanical Systems): RDT&E efforts in support of Navy fuze/safe & arm devices for future underwater weapons.

SERDP (Strategic Environmental R&D Program): Leading the R&D of environmentally benign synthesis, processing, and manufacturing technologies for "green" energetic materials.

Reactive Materials: Synthesis of new materials for undersea and mine warfare warhead applications

GEM (Green Energetics Materials): R&D of new energetic materials and manufacturing processes that are environmentally cleaner. GEM program is focused on the use of TPE (thermoplastic elastomers) for gun propelling charges, rocket motors, and pressed explosives.

CAD/PAD: Tri-Service RDT&E support for cartridges, cartridge and propellant actuated devices, and aircrew escape propulsion systems.

ENATD (Explosive Neutralization Advanced Technology Development): Development of improved explosive nets for the neutralization of mines in the surf zone.

VULCAN Fire: R&D in use of reactive materials for neutralization of chemical/biological stores.

CURRENT IMPORTANT PROGRAMS (continued)

NSWC
ACTIVE COOPERATIVE RESEARCH AND DEVELOPMENT AGREEMENTS (FY98)

Carderock Division:

Double Hull and Composite Material/Structure Technologies. Ingalls and CDNSWC will perform a cooperative research and development effort to develop composite material/structures and double hull structures and associated subelements and technology for surface ships. It is anticipated that the work conducted will result in designs that can be realized in advanced surface combatants, retrofit activities to same, and commercial applications alike. The goals for these new designs will be tailored for each application and will include, as appropriate, reduced weight, enhanced survivability, reduced maintenance, and comparable cost, or lower. Ingalls, upon successful completion of development, intends to carry out a plan for marketing the technologies for a variety of naval and commercial applications.

Shipboard Power Systems Improvement Program. To evaluate specific applications of WI&CSD developed power and control system designs and concepts to Navy and commercial ships. Successfully proven applications may later be shared with other Westinghouse Departments to improve commercial product lines.

Study of Reduced Fire Hazard Silicone Materials For Navy Applications. To develop, document and evaluate silicone-based or silicone modified advanced fire resistant materials. Also, reformulate and optimize processing characteristics of the above polymeric materials to conform to Navy selected fabrication techniques. Facilitate successful fire resistant materials for use in commercial applications. Organize technical workshops involving Navy and Dow Corning personnel to further understand the needs and capabilities of the partners.

Modular Utility Core. The objective of this partnership is to jointly develop a modular utility core for low/moderate income housing. This core will be a prototype modular unit containing the mechanical, electrical and energy management systems for residential housing. The prototype modular utility core is intended to be fabricated at Naval Surface Warfare Center, Carderock Division --Philadelphia, PA, transported to a residential site and installed into an existing house being rehabilitated.

Intelligent Shock Mitigation & Isolation System through Applied RSPM Technology. To first perform the remaining development work to refine and upgrade RSPM control algorithms for Naval applications to meet a compelling need for Naval isolation technology; and secondly to scale up and test the fully integrated systems in mock-ups and simulators to verify the technology. The objective of the overall RSPM program is to create a commercially available family of ISMIS products through applied RSPM that will both meet the compelling need for Naval isolation technology and satisfy the uses of ISMIS in seismic protection of structures.

Light Scattering Measurement Techniques and Practices. To develop standard materials for verifying polarized BRDF measurements in the visible and infrared spectral region. Currently there are no accepted standard materials for verifying Mueller matrix BRDF measurements in general, or for unpolarized scattering measurements in the infrared. Work performed will produce well a characterized sample of materials that can be theoretically analyzed to predict the polarized BRDF which can be used to verify the experimental measurements.

Technical Assistance to CIT. The objective of this Agreement is to transfer technology from CDNSWC to those companies in the Commonwealth of Virginia that, through CIT, have requested technology assistance. It is expected that technology in the fields of acoustics, advanced materials, environmental technology, hydromechanics, machinery and ship technology will be of the most interest for Cooperative Research.

CURRENT IMPORTANT PROGRAMS (continued)

Centrifugal Casting Technology. The objectives of this agreement are to:

(1) Develop techniques for synthesis of remeltable TiC/bronze and/or WC/bronze or both, metal matriz composite ingots.
(2) Develop centrifugal casting procedures.
(3) Scale up ingot size from laboratory to production size, including centrifugal casting procedures from bench scale to large size castings respectively.
(4) Produce wear resistant full size components such as cylinder liners, bearing races, gears, flywheels and others as need arises.
(5) Commercialize the technology and the product for U.S. markets beyond Navy (and DoD) components and applications.

Resonance Apparatus. The objective of this Agreement is to obtain resonance apparatus evaluation of twelve samples covering a wide range of frequencies by the use of time-temperature superposition of data obtained in the kilohertze region as a function of temperature. These results will be analyzed for the insight possible into the molecular mechanisms responsible for the dynamic behavior. Of particular interest is to compare the data obtained with the resonance apparatus to the data obtained from commercial equipment for the same purpose. It is hoped that the potential advantages of using the resonance apparatus will be demonstrated by these measurements.

Technical Assistance to the University of Maryland Technology Extension Service. The objective of this Agreement is to transfer technology from CDNSWC to those companies in the State of Maryland that, through UMCP, have requested technology assistance. It is expected that technology in the fields of chemical processing, testing, manufacturing technology, safety, electronics and environmental technology will be of the most interest for Cooperative Research.

Discriminate Reduction Data Processing. Objective of this Agreement is to further develop the art of Discriminate Reduction Data Processing by developing and providing software which will approximately evaluate the speed dependence of computer generated error-affected data.

Ben Franklin Technology Center (BFTC). The objective of this Agreement is to transfer technology from CDNSWC to those companies in the Philadelphia metropolitan region that through the BFTC have requested such technology. It is expected that technology in the fields of Acoustics, Advanced Materials and Structures, Environmental, Machinery Systems, and Ship Technology will be of the most interest for Cooperative Research.

Design and Analysis of Antenna Systems. The objective of this Agreement is to cooperatively perform RDT&E in the fields of sensors and C4I systems, particularly antenna systems and low observable technology.

Tech Assistance To AAI/Manufacturing Services Division. CDNSWC will review the corrosion plan for AAI/Manufacturing Services Division, which is building electric transportation buses.

Dahlgren Division:

Dahlgren Site

Development of New Software Products Based on NSWCDD Supersonic Airflow Programs. (NCRADA-NSWCDDWO-90-002) The objective of this task is to develop new software products embodying:

(1) previously developed original work of NSWCDD on supersonic airflow programs embodied in the software package identified as 'ZEUS'
(2) the derivative work embodying trade secret data received from Nielson Engineering & Research, Inc. (NEAR) making the software products more suitable for commercialization by NEAR.

CURRENT IMPORTANT PROGRAMS (continued)

Development of a New and Improved Launcher for the Shoulder-Launched Multi-Purpose Assault Weapon (SMAW). (NCRADA-NSWCDD-95-008) The objectives of this task with CMS, Inc. are:

(1) to develop and transition to production the SMAW lightweight launcher,
(2) to develop and transition to production a new SMAW spotter round with acceptable ballistics and lower production cost,
(3) the successful transfer of the current SMAW technical data package,
(4) to investigate and incorporate other system improvements, as appropriate.

Research and Development Contributing to the Understanding of High-Voltage Connector Technology in Low-Inductance Environments. (NCRADA-NSWCDD-95-009) The objective of this task is the research and development contributing to the understanding of high-voltage connector technology in low-inductance environments along with multiple usage scenarios. NSWCDD and Raymond Engineering (RE) will evaluate and characterize the performance of the RE-developed removable Exploding Foil Initiator (EFI) and connector.

R&D Into Epitaxial Material Processing Based Technologies. (NCRADA-NSWCDD-95-010) The overall objective of the CRADA with the Emcore Corporation is to develop an enabling technology that can resolve the problems in epitaxial material deposition and accelerate the implementation of III-nitride based technologies in practical applications. The technical objectives and proposed effort will be divided into Three Phases: PHASE I will focus on the feasibility study using the compliance layer materials that have previously been successfully employed for the epitaxial growth of II-VI and IV-VI semi conductors. The scheduled period for PHASE I is nine months.

PCR Destruction of Volatile Organic Compounds. (NCRADA-NSWCDD-95-011) The objective of this CRADA with Physics International is to perform a parametric study of the NSWCDD PCR in search of the least power deposited into the corona discharge per unit air flow that still destroys more than 98% of a 500 ppm toluene impurity in an atmospheric pressure air flow. Parameters involved in this investigation include (but are not limited to) voltage rise time, applied voltage pulse width, amplitude and rep-rate, and air flow through the PCR and humidity.

Compliant Barium-Compound Substrate Technology for Chemically Deposited PbS and PbSe Monolithic Focal Plan Arrays. (NCRADA-NSWCDD-95-012) The objective of this CRADA with Sensarray Corporation is to develop an enabling technology that would allow the integration of infrared optical detector arrays and silicon electronic circuitry onto a single substrate. It should also have the capability of on-chip signal processing. The output of the sensors must be directly applicable to electronic decision-making and be commensurate with more complicated electronic processing for target detection and pattern recognition.

Technical Assistance to CIT. (NCRADA-NSWCDD-96-014) The objective of this agreement with Virginia Center for Innovative Technology is to transfer technology from NSWCDD to those companies in the Commonwealth of Virginia that through the CIT have requested such technology. It is expected that technology is the fields of Devices and Sensors, Information and Systems Sciences, Advanced Data Processing Methods, Pulsed Power Technology, Simulation and Modeling, and Electromagnetic Environmental Effects will be of the most interest for Cooperative Research.

Technical Assistance to the University of Maryland's Technology Extension Service. (NCRADA-NSWCDD-97-015) To transfer technology from NSWCDD to those companies in the State of Maryland that through the University of Maryland (College Park) have requested such technology. It is expected that technology in the fields of Devices and Sensors, Information and Systems Sciences, Advanced Data Processing Methods, Pulsed Power Systems Sciences, Simulation and Modeling, and Electromagnetic Environmental Effects will be of the most interest for Cooperative Research.

Effort to Develop an Advanced Launching System. (Raytheon Missile Systems Company). (NCRADA-NSWCDD-97-016) Design, fabricate and demonstrate the feasibility of an advanced launching system prototype. Prepare a development test plan which identifies all testing, procedures,

CURRENT IMPORTANT PROGRAMS (continued)

pass/fail criteria, test sites, and number and configuration of the units to be tested. Prepare a system safety program that identifies the system safety organization; hazard identification, risk assessment process, tracking process, and resolution process; safety analysis requirements; safety testing requirements and establishes Weapons Systems Explosive Safety Review Board (WSESRB) reviews at appropriate milestones.

Land Attack Standard Missile Program. (Alliant Techsystems, Inc.) (NCRADA-NSWCDD-97-016) Demonstrate the feasibility of using composites in structural missile applications by designing, fabricating, and testing payload bodies for the Land Attack STANDARD Missile.

Development of Multi-Point Initiators for Voltage Threshold Testing. (KDI Precision Products, Inc.) (NCRADA-NSWCDD-97-018) Demonstrate the feasibility of using chip bridge detonators in multi-point initiator applications, resulting in a significant reduction in the threshold voltage requirements for future weapon systems. Develop, integrate, demonstrate, and evaluate chip bridge detonators in multi-point initiator applications. The participants will provide personnel knowledgeable in the development of low voltage threshold detonators for warhead initiation, and use the design and fabrication facilities at KDI Precision Products, Inc. and the testing facility/equipment at NSWCDD.

The Development of Low Threshold Multi-Point Initiators. (Electronics Development Corporation (EDC)) (NCRADA-NSWCDD-97-019) Demonstrate the feasibility of using chip bridge detonators in multi-point initiator applications, resulting in a significant reduction in the threshold voltage requirements for future weapon systems. Develop, integrate, demonstrate, and evaluate multi-point initiated, low threshold Exploding Foil Initiators. The participants will provide personnel knowledgeable in the development of low threshold detonators and attachment techniques for Exploding Foil Initiators, using the NSWCDD test facility and test equipment.

The Development of Multi-Point Initiators for Voltage Threshold Testing. (EG&G Optoelectronics Division) (NCRADA-NSWCDD-97-020) Demonstrate the feasibility of using chip bridge detonators in multi-point initiator applications, resulting in a significant reduction in the threshold voltage requirements for future weapons systems. Develop, integrate, demonstrate, and evaluate chip bridge detonators in a multi-point application. The participants will provide personnel knowledgeable in the development of low voltage threshold detonators for warhead initiation, and use the design and fabrication facilities at EG&G and the testing facility/equipment at NSWCDD.

Reverberation Chamber Program (Lindgren RF Enclosures, Inc.). (NCRADA-NSWCDD-97-021) Design, fabricate, and test a compact reverberation chamber and demonstrate the feasibility of using it operate down to the lower frequency limit of 80MHz as specified in International Electrotechnical Commission (IEC) specification 1000-4-3.

Improved Naval Gun Technology. (United Defense LP Armament Systems Division) (NCRADA-NSWCDD-97-022) The partners will:

(1) Model advanced gun systems concepts such as utilizing composite gun barrel materials, improving propellant charge technologies and advanced munition handling systems, and integrating of advanced future gun systems work;
(2) Provide cost modeling, production planning (process/methods) and pre-production plans for advanced gun systems; and
(3) Provide "lessons learned" information with respect to R&D gun system efforts.

Advanced Launching System Technology. (United Defense LP Armament Systems Division) (NCRADA-NSWCDD-98-025) The objective is to support the development of advanced launching systems via computer modeling and simulation, system conceptual design studies, safety evaluations, the building of mockup designs, and the use of test facilities.

CURRENT IMPORTANT PROGRAMS (continued)

Investigative Collaboration to Develop GUIScript Toolkit. (Apogee Software, Inc.) (NCRADA-NSWCDD-98-026) The objective is to create a commercial extension to the Universal Client and GUIScript that provides a toolkit for Web developers.

White Oak Lab RDT&E. (White Oak History Corporation) (NCRADA-NSWCDD-98-027) The objective is investigative research that will support the development of a technical anthology detailing significant accomplishments of a major Navy RDT&E site over a 50-year period.

Coastal Systems Station Panama City Site

SDV-X Test and Evaluation. (30 Sep 96 - 30 Sep 99) Columbia Research Corporation (CRC) has preliminary design concepts for a Swimmer Delivery Vehicle of interest to a foreign government. Under this CRADA the feasibility of the design will be confirmed through test and evaluation. CSS will collaborate with CRC on engineering oversight, guidance, and participate in the test and evaluation of the initial prototype unit.

Development of Hybrid Dive/Gas Mask. (Navy Experimental Diving Unit and Diving Systems International) The NEDU and DSI entered into this agreement in order to design, construct, and perform engineering analysis of a prototype Hybrid Dive/Gas Mask. DSI intends to manufacture and market this device if it proves successful. In addition to the commercial application of this concept to the private sector, unique applications to the SEAL community have been identified.

Submersible Boat Development and Commercialization. (CSS and Stidd Systems Inc.) The objective of this CRADA is design, fabricate, develop, integrate new componentry, improve, and test a second generation SEAL Submersible Boat for commercial development and marketing purposes. Two previously issued patents (numbers 5,377,613 and 5,632,659) are licensed in support of this CRADA.

Development of a Cold Water Regulator. (Navy Experimental Dive Unit and Scuba Technology Unit and Scuba Technology, Inc.) The objective of this CRADA is to develop an open circuit dive regulator which meets or exceeds the Navy requirements for cold water diving.

Explosives Testing. (HITECH, Inc.) This CRADA will explore technologies available for the mine/counter mine obstacle clearance mission. The intent is to identify a system which is significantly more effective against these targets as compared with the MK 138 demolition kits. HITECH will provide explosive devices to NSWCCSS and NSWCCSS will test and evaluate them against targets.

Hazmat Protection Ensemble. (Unconventional Concepts, Inc.) The purpose of this CRADA is to design, develop, and manufacture a hazardous material protection ensemble designed to provide constant and continuous situational awareness and battle space management capabilities. The focus will not be on protective capabilities, per se, but on the integration of communications and information management/display capabilities into existing equipment.

Integrated Diver Display. (American Underwater Products, Inc.) The objective is to develop a prototype diver's integrated display mask. The display mask will incorporate RF technology, pressure transducers, miniature liquid crystal displays, and custom optical lenses to present a magnified image of the diver's depth, dive time, and tank pressure.

Indian Head Division

Applied Research into Instructional and Information Exchange Technologies. The objective of the CRADA is to develop, demonstrate, introduce and transfer new and evolving information technologies relating to training and instructional approaches. The technology will be transferred from the innovator (US Navy) to the user (Charles County Community College, Maryland) and further developed to meet mutual needs.

CURRENT IMPORTANT PROGRAMS (continued)

Testing of Commercial Electrical Generator Before and After Subjection to KMA Process. The objective of the CRADA is to demonstrate the "proof of concept" of an invention provided by a private small business concern, AEG, California, to alter and increase the energy output of various electrical devices. AEG's invention (i.e. The KMA Technology) is a "process" in which an electronic device (e.g., generators, battery power packs, etc.) can be subjected to and subsequently perform at a much higher level of output. If the AEG process proves out, then commercialization will be highly desirable for AEG and the use of the KMA Technology "process" by the Navy and the Department of Defense may be of high critical value to saving energy consumption.

Research and Development of Extruded Composite Propellant Grains Incorporating Motor Case Venting Technology. The objective of this CRADA is for IHDIV and CMS, Inc., Florida, to jointly conduct research in order to develop an extruded propellant grain with motor case venting technology, then test and demonstrate the use of these technologies in the venting technology on the 2.75 Inch Rocket Motor in the 2.75 Inch Rocket System.

Application of Navy-developed Extrudable Composite Propellant to Low Cost Rocket Motors. The objective of this CRADA is for IHDIV, CMS, Inc., and Alliant Techsystems to further develop and characterize extrudable composite propellant formulations and to apply and evaluate this propellant technology in small diameter (<100mm) rocket/missile applications.

Advanced Modular Arm-Fire Device for Multiple Applications. The objectives of this CRADA include IHDIV and EG&G, Inc., to integrate advanced technology, such as found in EFI detonators, "smart electronics" and miniaturized sensors, for the purpose of demonstrating and evaluating low cost, advanced explosive initiation technology.

Research and Development of Flashless MK66 Rocket Motor System. The objective of this CRADA is for IHDIV and General Dynamics Ordnance Systems, Inc., to jointly conduct research in order to develop flashless rocket motor plume and igniter flash suppression technology, then test and demonstrate the use of the flashless technology in the MK66 Rocket Motor.

Technical Assistance to the University of Maryland's Technology Extension Service. The objective of this CRADA is to transfer technology from IHDIV to those companies in the State of Maryland that, through the University of Maryland at College Park, have requested technology assistance. It is expected that technology, safety, electronics and environmental technology will be of the most interest for cooperative research.

Applied Research into Transportable Plasma Arc Technology. The objective of this CRADA is for IHDIV and MSE-Technology Applications, Inc., Montana, to provide testing, modification, development, and employment of a prototype transportable plasma arc technology to resolve environmental problems within DoD and for other government and commercial clients. The prototype transportable plasma arc technology will be operated by MSE Technology Applications with engineering and facility support provided by IHDIV.

Applied Research into Composite Air Bag Propellants. The objective of the CRADA is to utilize IHDIV manufacturing technology to develop processes originating with OEA, Inc., Colorado. The ultimate goal would be controlled release of a gas producing energetic material.

Applied Research in the Alkaline Hydrolysis of Energetic Waste. The technical objective of this CRADA is for IHDIV and the Regents of the University of California at Los Angeles to jointly provide testing, modification, development, and employment of alkaline hydrolysis technology to completely destroy RDX, HMX, and TNT-containing solid wastes and treatment of waste waters produced by this technology. The expected result of this technology is the assurance that the final products are free of all energetic materials and suitable for disposal in ordinary treatment facilities such as conventional wastewater treatment plant and non-hazardous landfills, governed by state and local regulations.

CURRENT IMPORTANT PROGRAMS (continued)

Research into the Disposal of Solid Hazardous Waste by Molten Salt Oxidation Process. The objective of this CRADA is IHDIV and Virginia Polytechnic Institute to facilitate the advancement of technical and economic feasibility of the molten salt oxidation process, including conducting research leading to the advancement of the molten salt oxidation process technology for treatment of hazardous wastes.

EQUIPMENT/FACILITIES

Carderock Division:

Carderock Bethesda Site: Simulation, Planning and Analysis Research Center. Explosives Test Pond. Data and Image Processing Systems. David Taylor Model Basin Complex. Maneuvering and Seakeeping Basin. Rotating Arm Basin. Radio-controlled Model Facility. Circulating Water Channel. 24-inch and 36-inch Cavitation Channels. Dynamic Control System Simulator. 140-foot Towing Basin. Hydrodynamic/Hydroacoustic Technical Center. Deep Submergence Pressure Tanks. Structural Evaluation Lab. Wind Tunnels. Low Observable Materials Lab. Marine Composites Lab. Marine Coatings and Corrosion Control Facility. Shipboard Environmental Protection Facility.

Carderock Philadelphia Site: Full-scale Improved Performance Machinery Program (IPMP) (SSN-21) Steam Propulsion Land Based Test Site. Full-scale LSD-41 Diesel Propulsion land Based Test Site. Full-scale DDG-51 Gas Turbine Land Based Test Site. Full-scale Electric Drive/Machinery Module Land Based Test Site. Full-scale Gear Meteorology and Calibration Lab. Full-scale Air Compressor Test Site. Full-scale Submarine Life Support Test Site. Full-scale Submarine Generator Test Site. Full-scale Submarine Ship Service Generator Test Site. Fire, Pollution, Marine Equipment Lab. Full-scale Conveyor and Elevator Test Complex. Full-scale Submarine Mast Bending Test Facility. Full-scale Submarine periscope/Antenna Test Sites. Full-scale Submarine Buoy Communication Test Site. Chemistry and Metallurgy Lab. Full-scale Gravimetric Flow Calibration Lab. Test Operations. Analysis and Control Center. Full-scale Stem Propulsion Testing Complex. Marine Tribology Lab.

Carderock Annapolis Site: Fire Research and Air Contamination Facility. Machinery Systems Silencing Lab. Acoustics Materials Lab. Magnetic Fields Lab. Advanced Electrical Machining. Technology and Development Facility. Submarine Fluid Dynamics Facility. Electric Power Tech Lab. Metallic Materials and Processing Facility. Deep Ocean Pressure Simulation Facility.

Carderock Division - Bayview, ID: Acoustic Research Detachment.

Carderock Division - Memphis, TN: Large Cavitation Channel (LCC).

Carderock Division - Norfolk, VA: Combatant Craft Engineering Detachment.

Carderock Division - Portsmouth, VA: Shock Trials Instrumentation.

Carderock Division - Cape Canaveral, FL: Research Vessel Hayes.

Carderock Division - Fort Lauderdale, FL: South Florida Test Facility.

Carderock Division - Panama City, FL: Lauren & Athena Research Vessels/Ship Systems.

Carderock Division - Bremerton, WA: Carr Inlet Test Facility.

Carderock Division - Ketchikan, AK: Southeast Alaska Facility.

EQUIPMENT/FACILITIES (continued)

Dahlgren Division:

Dahlgren Site

Chem-Bio Sciences Complex - This complex is used for basic research in the particular field of biological science that supports molecular computing and research into the effects of chemicals on various materials. This complex includes the following state-of-the-art science labs: Molecular and Cellular Biology Lab, Molecular Computing Spectroscopy and photonics lab, Chem-Bio Instrumentation and Thermal Analysis Labs, and general chemistry labs.

SLBM Weapons Control Facility - used for the development and testing of SLBM weapons control software, fleet problem investigation, fleet procedure development, technology and obsolescence studies and for the production and quality control of fleet media (i.e. magnetic media containing weapons control software and data and strategic targeting data0.

Scientific and Engineering Computing Complex - Provides high performance computing to the scientific and engineering personnel of the laboratory. The equipment available includes a CRAY Y-MP2E supercomputer (up to the secret level), and a CRAY EL98 entry level computer (unclassified only).

Aegis computing Center - This is the designated computer program Lifetime Support Engineering (LSE) facility for supporting CG-47 and DDG-51 class ships. This facility is used to support ships during construction, operation, and modernization phases by providing the tactical computer programs, and training exercises needed to make AEGIS ships and sites operational.

Search and Track Sensor Test Site (STSTS) - the STSTS allows over water testing of individual Radio Frequency (RF) and Electro-Optical sensors or complex sensor systems during and/or at the completion of their development cycle. This facility is used in conjunction with the Potomac River Test Range (PRTR) and provides an 80,000-yard over the water, littoral, laser certified, instrumented range.

Potomac River Test Range (PRTR) - The PRTR is a complex of land and water ranges used for the test and evaluation of live or inert ordnance, weapon systems, and weapon systems components. The water ranges is approximately 3 nautical miles wide and sixteen nautical miles long.

Panama City Site

Mine Warfare (MIW) Research and Engineering Complex - This is a special facility that includes the Airborne Mine Countermeasures Facility, The Mine Exploration Facility, the Countermeasures Evaluator, the Computation and Analysis Lab (CSEL), and the MIW Fleet Support module, the Sensor Development Complex. This facility is used to perform almost all US Navy Research and Development (R&D), Test and Evaluation (T&E), acquisition support and in-service engineering (ISE) of mine warfare systems, including mines and mine countermeasures.

Airborne Mine Countermeasures Complex (AMCM) - This special facility is required to conduct research and development, test and evaluation, and in-service engineering activities for the AMCM systems. This complex supports the aircraft and AMCM systems required to conduct full scale testing of AMCM systems for quick response to operational airborne MCM squads.

Mine Exploitation Complex - This facility is used to perform R&D, T&E, acquisition support, and ISE of Mine Warfare Systems. The complex is an integrated combination of special facilities designed for testing and analyzing the vulnerability of Air and Surface Mines Warfare platforms and systems, Amphibious Warfare systems, and Special Warfare systems to foreign and U.S. mines.

EQUIPMENT/FACILITIES (continued)

Amphibious Warfare Engineering and Test complex - This complex consists of five permanent buildings and thirteen temporary structures. The complex is used to conduct the majority of R&D, T&E, acquisition support, and ISE for Amphibious Warfare systems. The major buildings are the LCAC Hanger/Ramp Facility, the Amphibious Warfare Building, and three engineering support buildings.

Mine Warfare Test and Training Range - This ranges is located along the Gulf of Mexico and supports the training, test and evaluation (T&E) of those systems and technologies utilized primarily mine countermeasures (MCM), amphibious, and special warfare operations. Essential this consists of tracking, positioning and signature measurements including acoustic, magnetic, and pressure.

Indian Head Division:

Explosive Test Chambers - highly instrumented facilities capable of testing up to 50 lbs of high explosive in a very controlled environment. These facilities are used to conduct research into detonation science and for development of advanced materials and warheads.

Energetics Formulation and Development - includes a variety of facilities capable of processing all classes of energetic materials in quantities from a few grams up to thousands of pounds. Additionally, design, modeling, and simulation capabilities are available to develop advanced warhead, rocket motor and gun propulsion concepts and designs that can be made in the extensive processing facilities. The Continuous Processing development facility is a state of the art facility to develop advanced processing technology for energetic materials using a twin screw mixer/extruder. This facility can process most solid energetic materials at rates up to approximately 100 lbs/hr. The flexibility to handle multiple material feeds and materials with a very wide range of rheologies, coupled with extensive instrumentation makes this facility unique in the ability to develop future generations of energetic materials and components, affordably.

Energetic Chemicals Synthesis and Scale-up - a collection of laboratories and pilot scale chemical processing facilities that are used to develop next generation energetic molecules. Batch and continuous chemical reactors, distillation, extraction, and other chemical operations are easily reconfigureable to scale-up new energetic chemicals. Extensive laboratory synthesis and analytical equipment complements the scale-up capability in a way that a new chemical can be taken from the gram scale through to a scale of hundreds of pounds quickly and efficiently.

Rocket Motor Testing - facilities are capable of evaluating many aspects of rocket motor performance. Static testing and environmental test chambers are routinely used to provide data on motors in development as well as to verify performance of fleet assets. A unique capability to conduct a functional ground test of the Tomahawk missile allows the performance of a missile to be monitored throughout its entire flight cycle without the missile ever leaving the ground.

Chemical and Physical Analysis - laboratories are used extensively to support the research and development of new energetics. Extensive state-of-the-art instrumentation and techniques are used to evaluate parameters such as purity, composition, structural properties, and safety, as well as to evaluate aging and service life of fielded systems. Environmental analysis is also a key component of this capability.

Naval Surface Warfare Center
Arlington, VA 22242-5160
(703) 602-0632

Acting Commander : Dr. Ira Blatstein

FY98 FUNDING DATA (MILLIONS $) [1]				
APPROPRIATION	IN-HOUSE	IN-HOUSE MANAGEMENT	OUT-OF-HOUSE	TOTAL
RDT&E:				
6.1 ILIR	5.000	N/A	0.000	5.000
6.1 Other	3.000	N/A	1.000	4.000
6.2	61.000	N/A	42.000	103.000
6.3	52.000	N/A	61.000	113.000
Subtotal (S&T)	**121.000**	**N/A**	**104.000**	**225.000**
6.4	207.000	N/A	129.000	336.000
6.5	93.000	N/A	77.000	170.000
6.6	15.000	N/A	19.000	34.000
6.7	36.000	N/A	33.000	69.000
Non-DOD	0.000	N/A	0.000	0.000
TOTAL RDT&E	**472.000**	**N/A**	**362.000**	**834.000**
Procurement	220.000	N/A	283.000	503.000
Operations & Maintenance	253.000	N/A	217.000	470.000
Other	184.000	N/A	75.000	259.000
TOTAL FUNDING	1,129.000	N/A	937.000	2,066.000

MILITARY CONSTRUCTION (MILLIONS $) [1]	
Military Construction (MILCON)	43.800

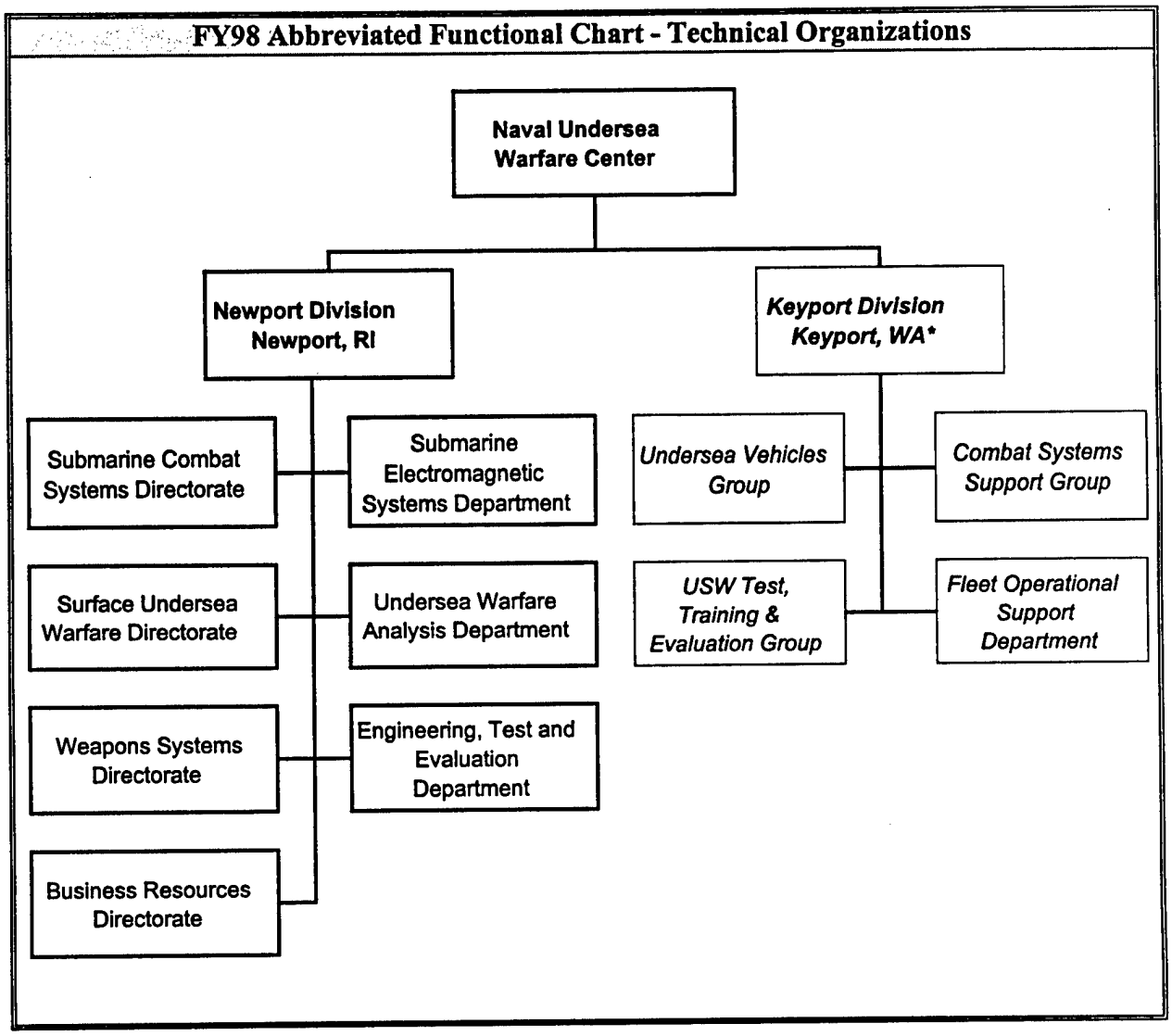
PERSONNEL DATA (END OF FISCAL YEAR 1998) [1]				
	SCIENTISTS & ENGINEERS		TECHNICAL SUPPORT & OTHER PERSONNEL	END STRENGTH
TYPE	DOCTORATES	OTHER		
MILITARY	1	29	276	306
CIVILIAN	384	5,072	4,734	10,190
TOTAL	385	5,101	5,010	10,496

SPACE AND PROPERTY [1]			
BUILDING SPACE (THOUSANDS OF SQ FT)		PROPERTY ACQUISITION COST (MILLIONS $)	
LAB	5,620.700	REAL PROPERTY	807.700
ADMIN	1,470.900	* NEW CAPITAL EQUIPMENT	25.800
OTHER	6,079.800	EQUIPMENT	470.000
TOTAL	13,171.400	* NEW SCIENTIFIC & ENG. EQUIP.	23.600
ACRES	8,813	* Subset of previous category.	

N/A - Not Applicable

[1] As a result of applying the In-House RDT&E Activity criteria at the division or major site level (see NOTE on page 3-1), NSWC Port Hueneme Division, Crane Division, and NWAS Corona data is not included in the FY98 report. NWAS was realigned from the Naval Ordnance Center (NOC) to the Naval Surface Warfare Center in March 1998; their financial data continued with the NOC through 30 September 1998.

Naval Undersea Warfare Center



**As a result of applying the In-House RDT&E Activity criteria at the division level (see NOTE on page 3-1), NUWC Keyport Division data is not included in the FY98 report.*

Naval Undersea Warfare Center
Newport, RI 02841-1708
(401) 832-6761

Commander: RADM Charles B. Young
Technical Director: Dr. John E. Sirmalis

MISSION

The Naval Undersea Warfare Center (NUWC) Mission promulgated by OPNAVNOTE 5450 Ser 09B22/1U510577 dtd 23 Dec 91 is as follows:

'Operate the Navy's full spectrum research, development, test and evaluation, engineering, and fleet support center for submarines, autonomous underwater systems, and offensive and defensive weapon systems associated with undersea warfare.'

CURRENT IMPORTANT PROGRAMS

SCIENCE AND TECHNOLOGY

NUWC conducts a comprehensive Science and Technology program in support of its mission that spans In-House Laboratory Independent Research (ILIR), Basic Research, Applied Research and participation in Advanced Technology Demonstrations. Current emphasis areas include:

- **Submarine Combat Control** - contact management, weapon targeting, engagement planning and advanced information management concepts, training automation.
- **Submarine/Surface Ship Sonar** - shallow water active classification, high gain systems, active surveillance systems, full signature processing, deployable surveillance systems.
- **Torpedoes** - propulsion and control systems, hydrodynamics/drag reduction, supercavitating technology noise reduction/acoustics, countermeasure technologies, UUV's, launchers; and advanced concepts.
- **Submarine Communications** - communication at speed and depth, mast antenna technology.

SUBMARINE SONAR

- AN/BQQ-5.
- AN/BQG-5 Wide Aperture Array.
- TB-16F, -23 and -29 Submarine Towed Arrays.
- Submarine Sonar Advanced Development.
- AN/WLY-1 AN/WLR-9.
- New SSN Sonar Subsystem.
- AFTAS.
- RATTRAP.
- Acoustic Rapid COTS Insertion.
- Sonar Advanced Development.
- Transducer Tech Direction/Support Program.
- AN/BSY-1 Acoustics.
- Submarine Ancillary Sonar Systems.
- Affordable Array Technology (ATD).
- Ultra Thin Line Array.
- Thin Optical Towed Array.
- Acoustic Comms (ATD).
- Submarine Safety (SUBSAFE) Program.
- Multi-Chip Module Laboratory.
- Towed Systems ISEA.
- Macintosh-Based Digital Signal Processor (MACDSP).

CURRENT IMPORTANT PROGRAMS (continued)

- Multi-line Towed Array (MLTA).
- Conformal Acoustic VElocity Sensors (CAVES).
- High Frequency Active (HFA).
- Advanced Processor Build Program.
- Multi-purpose Acoustic New Technology Insertion System (MANTIS).

SURFACE SHIP SONAR AND ASW SYSTEMS

- AN/SQQ-89 ASW Combat System.
- Multistatic Sonar.
- Surface Ship Torpedo Defense.
- AN/SQR-19 Tow Array Sonar.
- AN/SQS-53 A,B,C,D Active Hull Sonar.
- AN/SQQ-28 Sonobuoy Processor.
- KINGFISHER.
- Echo Target Classifier.
- Shallow Water Active Detection Classification.
- Surface Combatant 21st Century.
- DD-21.
- Lightweight Broadband Variable Depth Sonar.
- Towed Active Receiving System (TARS).
- Sonar Insitu Mode Assessment System (SIMAS).
- Weapon System Accuracy Trails (WSAT) Program.
- ASW Systems Consolidated Operability Test (SCOT) Program.
- AN/SQQ-89 Support Team.

SUBMARINE COMMUNICATIONS, ELECTRONIC WARFARE SUPPORT MEASURES (ESM), ELECTRO-OPTICS SYSTEMS/PERISCOPES

- Submarine Connectivity.
- On-Hull Extremely Low Frequency (ELF) Antenna.
- SHF High Data Rate (HDR) Phased Array Antenna Advanced Technology Demonstration.
- Submarine High Data Rate (HDR) Antenna System.
- Large Aperture Multifunction C4ISR Mast.
- OE-538 Multifunction Mast Antenna.
- Submarine Integrated Antenna System (SIAS).
- Extremely Low Frequency (ELF) Communications.
- Navy Extremely High Frequency (EHF) Satellite Communication Program (NESP).
- Submarine Communication Support System (SCSS).
- Integrated Electronic Support Measures (ESM) Mast (IEM).
- An/BLQ-10 Submarine Electronic Warfare Support System.
- AN/WLR-8 High Probability of Intercept (HPI) Receiver.
- AN/BVS-1 Photonics Mast.
- Electro-Optic Sensor Development and Acquisition.
- Submarine Periscopes Program.
- Submarine Shipboard Electromagnetic Compatibility Improvement Program (SEMCIP).
- EMC Advisory Boards (EMCAB).

VIRGINIA, SEAWOLF, LOS ANGELES AND TRIDENT CLASS SUBMARINE COMBAT, AND COMBAT CONTROL SYSTEMS

- VIRGINIA.
- AN/BSY-2, AN/BQG-5 Submarine Combat System.
- Combat Control Systems MK 2.
- Seawolf Non-Propulsion Electronics.
- Trident Command and Control System.

CURRENT IMPORTANT PROGRAMS (continued)

- Missiles: Combat Control.
- Module Test and Repair Program.
- Trainers.
- Sensor Performance Computer Based Tactical Aids.
- CCS Mk1 C4.2V2A.
- Advanced Tomahawk Weapon Control System.
- Submarine Fleet Mission Program Library.
- Tactical Control Program.

UNDERSEA WARFARE MODELING AND ANALYSIS

- Analysis of Undersea Warfare (USW) Contributions to Joint Vision 2010.
- USW Technical Support to Fleet Battle Experiments (FBEs).
- Development of Future USW Concepts of Operation.
- New USW Program Capability Assessment.
- USW Investment Strategy Options Development.
- Intelligence Data Assessment.
- USW Requirements Analysis.
- Derivation of USW Technology Goals.
- Coordinated ASW Force Assessments.
- Submarine and USW Synthetic Environments.
- Battle Group Net Based USW.
- Submarine System Engineering and Analysis.
- SSN Tactical Development Support.
- SSN End-to-End Assessment.
- Analysis of Site-Specific ASW Performance with Selected Environmental Models.
- Test and Training Enabling Architecture.
- Achieving High Level Architecture (HLA) Compliance for USW Simulations & Simulators.

DEVELOPMENT OF TRAINING, T&E, AND LOGICAL RANGES

- AUTEC Hydrophone Replacement Program.
- Tri-Service Signature Measurement and Database System.
- Pinger Program.
- Undersea Battlespace.
- East Coast Shallow-Water Training Range.
- Pacific Missile Range Facility Shallow-Water Training Range.
- Hawaii Shallow-Water Training Range.
- Atlantic Fleet Weapons Test Facility Hydrophone Replacement.
- Test and Training Enabling Architecture.
- Synthetic Environment Tactical Integration.

SUBMARINE, SURFACE SHIP AND AIR LAUNCHED TORPEDOES, TORPEDO/SONAR COUNTERMEASURES, UUVS, ASSOCIATED LAUNCHER SYSTEMS AND MISSILES

- Torpedo Mk 48/Mk 48 ADCAP Program.
- Torpedo Mk 50 Program.
- Torpedo Mk 46 Program.
- Torpedo Mk 54 (Lightweight Hybrid Torpedo) Program.
- Torpedo Mk 46/Mk 48 FMS Program.
- Torpedo Alternate Fuels Program.
- CBASS Program.
- ISLMM Program.
- Torpedo Test Equipment Programs.
- Mk 30 ASW Target Program.
- Near Term Mine Reconnaissance System Program.

CURRENT IMPORTANT PROGRAMS (continued)

- Long Term Mine Reconnaissance System Program.
- ONR UUV Program.
- ADC Mk 2/3/4 Countermeasure Program.
- Affordable Common Countermeasure Program.
- Tomahawk Cruise Missile (Submarine-Launched).
- Encapsulated Harpoon Weapon System.
- Submarine Weapon Simulators and Test Vehicles.
- Integrated Diagnostic Support System.
- Submarine Torpedo Tubes.
- SSN-21 Launcher Systems.
- Turbine Pump Ejection Systems.
- Submarine Weapon Handling.
- SSN-688 Vertical Launch System.
- Surface Ship Torpedo Tubes.
- New SSN Launcher Systems.
- Submarine External Countermeasure Launchers.
- Submarine Internal Auxiliary Launchers.
- Elastomeric Ejection Systems.
- Submarine Advanced Launch Technology.
- Adaptable High Speed Undersea Munitions.

TECHNOLOGY TRANSFER:
NUWC conducts an extensive technology transfer program that is structured to make technology developed for defense purposes available to the academic and industrial communities through development of partnerships that benefit NUWC and the Navy. The main mechanics for technology transfer are:

Patent Program - NUWC operates a highly efficient patent program believed to be the most productive in U.S. government (patents per scientist/engineer). In FY98, 172 invention disclosures were recorded, 80 patent applications were filed, and 134 patents were issued or allowed (128 patents and 6 classified allowances (D-10)). Some significant examples are:

- Patent No. 5,632,218 - Debris Deflector.
- Patent No. 5,635,662 - Method and Apparatus for Avoiding Detection by a Threat Projectile.
- Patent No. 5,637,826 - Method and Apparatus for Optimal Guidance.
- Patent No. 5,654,937 - Acoustic Element Tester for an Array of Hydrophones.
- Patent No. 5,673,645 - Agile Water Vehicle.

COOPERATIVE RESEARCH AND DEVELOPMENT AGREEMENTS (CRADAs):

- Lockheed-Martin - Explore and exploit massively parallel processing as applicable to sonar processing.
- MedAcoustics, Inc. - Demonstrate signal-processing algorithms to process acoustic signals within the cardiac cycle.
- Precision Signal, Inc. - Develop state-of-the-art equipment to map deep- and shallow-water ocean floors.
- General Dynamics/Electric Boat Division - Further the development of Computational Fluid Dynamics to meet current and future Navy needs.
- Connecticut Municipal Electric Energy Cooperative - Investigate electric vehicle electromagnetic interference, measurement and mitigation.
- University of Maine - Develop a method of predicting the deformation of nets deployed in an ocean environment.
- Lucent Technologies - Develop ultra-thin array technology.
- Yale University School of Medicine - Bio-medical model development.
- Draper Laboratory - Co-development of unmanned underwater vehicle technology.

CURRENT IMPORTANT PROGRAMS (continued)

- Foster-Miller, Inc. - Demonstrate low-cost, expendable bottom-crawling vehicles for ocean-bottom explorations.
- Public Service Electric and Gas Co. - Material development, testing and evaluation for shielding capability in electromagnetic fields.
- Rhode Island Technology Transfer Center - Technical assistance to Rhode Island's technically-based companies.
- CytoTheraputics, Inc. - Prototype packaging for medical devices using stereolithography.
- Westfall Manufacturing Co. - Design verification and representation of a static fluid mixing device for water treatment processing.
- Niche Medical, Inc. - Assistance in the design of a surgical smoke plume collector.
- Deep Creek Technology, Inc. - Assistance with the integrated diagnostics support system.
- Michigan State University - Development and application of controllable fluids.
- Automata, Inc. - Assistance with the integrated diagnostics support system.
- Dr. Alan Semine - Medical image processing for breast cancer.
- Flight Safety Technologies, Inc. - Modeling and simulation of the acoustic signature of atmospheric disturbances.
- BENTHOS, Inc. - Transfer and commercialize the THAMES acoustic measurement system software.
- D. G. O'Brien - Underwater Test and Training Ranges - Development of a family of standard cable seals for use in terminating marine cables on the Navy's underwater test and training ranges.
- Madison Technology International - Development of a family of high performance preamplifier/signal conditioners.
- Yale Medical School - Bio-Medical Model Development - Develop constitutive formulation and mathematical representation for several cardiac tissues including anisotropic structures with time dependence.
- Loctite Corporation - Acoustic Material Measurements - Determine the acoustic impedance of various candidate materials as a function of frequency and adhesive related structural boundary conditions.

EDUCATION PARTNERSHIP AGREEMENTS (EPA's)

- Oceansciences, Inc. - to provide undersea science and technology educational guidance and assistance for an ocean sciences camp and museum to further math and science education.
- The University of Massachusetts/Dartmouth - to aid in the undersea science and technology education of students and faculty.
- Yale University - to aid in the fluid mechanics, acoustics, and mathematics education of students and faculty.
- The University of Rhode Island - to aid in the ocean science, engineering, technology, and policy applications of these disciplines to encourage student interest in these areas.
- The University of Massachusetts/Lowell, Institute for Plastics Innovation - to encourage students interest in the low-density extruded plastic materials applications of their individual disciplines.
- Rutgers, the State University of New Jersey - to aid in the ocean science, engineering, technology, and policy applications of these disciplines to encourage students interest in these areas.
- The University of Rhode Island - to aid in the education of students and faculty in computer science and engineering, mathematics, and statistics.
- Florida Atlantic University - to aid in the education of students and faculty in ocean and systems engineering.

EQUIPMENT/FACILITIES

The Naval Undersea Warfare Center maintains and continuously improves numerous facilities designed to support the Research, Development, Test, and Evaluation of Undersea Warfare (USW) systems. These facilities include:

SONAR COMPLEX. This complex is a unique set of 6 facilities that include platform independent and federated laboratories and robust simulation and stimulation used to explore the underlying science and technology common to submarine and surface ship sonars. These facilities encompass the research, development and test of acoustic sensors, transducers, and arrays for use in tactical, calibration and standards applications at sites ranging from laboratory test beds and large scale pressure vessels to inland lakes and ponds. This complex provides the Navy with the capability to explore the technologies and science associated with transduction materials, fiber optics, environmental acoustics, and measurement and analysis techniques, leading to development of hull mounted, towed, and expendable sensors and arrays. Sonar systems laboratories consist of specialized sites for the investigation of signal processing, operator displays, detection and classification algorithms, acoustic communication, acoustic intercept, system architecture, onboard trainers, and commercial off-the-shelf applications utilizing robust simulation/stimulation capabilities to perform system evaluation, performance analysis and life cycle support.

SUBMARINE ANTENNA TEST COMPLEX. This complex of four facilities permits full characterization of submarine exterior communications, electronic and imaging warfare systems and their related antennas/sensors by using unique laboratories and in-the-field test facilities. Stimulation/ simulation equipment that replicates advanced radio frequency (RF) emitters, specialized test equipment, and RF anechoic chambers provides highly accurate measurement of systems baseline performance, transmit and receive patterns, and radar cross section signatures. An Overwater Arch in Newport, RI, and a remote, electromagnetically quiet, test site on Fishers Island, NY, are used to measure systems performance with antennas/sensors operating in the sea water environment simulating actual submarine operations.

SUBMARINE LAUNCHER SYSTEM TEST AND EVALUATION COMPLEX. This complex is a unique array of 5 major facilities dedicated to full spectrum support to submarine launcher programs for weapons, vehicles, and countermeasures from submarines. The facilities provide the capabilities for evaluating new launcher developments and improvements, land-based acceptance testing, and troubleshooting Fleet problems. The Transient Flow, Impeller Test Facilities are the only known facilities in the world capable of conducting hydrodynamic and hydroacoustic tests of transient flows and torpedo ejection pumps. The Submerged Launcher Test Facility replicates full-scale launch systems on SSN-688 and SSBN-726 class submarines and is capable of firing dummy weapons at simulated depths from surface to submarine test depth. Dual ejection capability allows for concurrent, side-by-side firing comparisons of any two current or future candidate ejection systems. The Advanced Submarine Launcher Facility replicates the full-scale launch system on SSN-21 and is capable of launch system performance testing and measuring radiated sound pressure levels in a unique Ocean Simulation Tank.

SUBMARINE ANTENNA TEST COMPLEX. This complex of four facilities permits full characterization of submarine exterior communications, electronic and imaging warfare systems' related antennas/sensors by using unique laboratories and in-the-field test facilities. Stimulation/simulation equipment that replicates advanced radio frequency (RF) emitters, specialized test equipment, and RF anechoic chambers provides highly accurate measurement of systems baseline performance, transmit and receive patterns, and radar cross section signatures. An Overwater Antenna Test Facility in Newport, RI, and a remote, electromagnetically quiet, test sites both on Fishers Island, NY, and an open ocean site 900 feet offshore, are used to measure performance with antennas/sensors operating in the sea water environment simulating actual submarine operations.

ELECTRO-MAGNETIC SENSOR TEST COMPLEX. This complex is a unique combination of 8 facilities that provides full spectrum support for the development, test, evaluation, and in-service engineering for current and future submarine, periscopes and imaging systems. Facilities include the Trident Periscope Facility, Special Mission Electro-Optic Sensor Support Facility, National Periscope

EQUIPMENT/FACILITIES (continued)

Maintenance Facility, EHF Satellite Communication (SATCOM) Development Terminal, Electro-Magnetic System Operational Readiness Test (EMSORT) Development and Support Facility, Photonics Mast Land Based Test Site, Imagery Archive and Video Editing Facility, and Periscope Engineering RDT&E Facility.

UNDERSEA WARFARE ANALYSIS COMPLEX. This complex has developed and maintains a suite of USW models, databases and U.S. and foreign weapon system hardware-in-the-loop simulations. These are exercised in support of requirements analysis, tactical development, concept development and performance assessment from system level through force and theater levels. This complex comprises two components:

- The Undersea Warfare Analysis Laboratory (USWAL) component consists of distributed computer servers linked together via a high speed network and tied to a centralized file server. This architecture, combined with an intelligent queuing system provides the USWAL with a specialized simulation environment that outperforms the combined power of multiple supercomputers.
- The Weapons Analysis Facility (WAF) simulation component provides a massively parallel processing synthetic environment which integrates a variety of actual weapon hardware and software within its specialized architecture. Thus, real weapons are allowed to perform mission scenarios in the highest fidelity virtual environment the U.S. Navy has developed. The combined computing engines in this complex achieve a maximum throughput exceeding 40 GigaFlops.

ATLANTIC UNDERSEA TEST & EVALUATION CENTER (AUTEC). AUTEC is a comprehensive open ocean test and evaluation complex located in the ocean waters off Andros Island in the Bahamas. The AUTEC ranges allow testing of aircraft, surface ships, and submarines in an instrumented, calibrated 230-square-mile ocean area with precision tracking in three dimensions of all platforms. AUTEC also provides measurement systems for basic acoustic, environmental, and oceanographic research and test programs. As part of the AUTEC complex, there is a shallow-water OPAREA that consists of a minefield adjacent to a 90 square-mile ocean area with precision tracking in three dimensions of all platforms. The real-time positional information can be displayed on location or linked back to one of AUTEC's display centers at Andros or West Palm Beach. There is also a Portable Tracking System (50 nmi) that can be deployed in OPAREAs of opportunity and provides three dimensional precision tracking of all platforms. AUTEC's facilities are available for use by U.S. and allied foreign government organizations, private industry, and academic institutions.

LITTORAL UNDERSEA WARFARE COMPLEX. The complex is a unique combination of test and tracking facilities and test environments in the Northeast. These facilities and environments represent potential areas of regional conflict (Persian Gulf, Gulf of Oman, coast of Korea) and have been well characterized, contain baseline performance data on existing systems, and can be supported cost effectively by nearby shore activities. The unique Gould Island Elevator/Launch System, deep water piers, and test areas immediately adjacent to NUWCDIVNPT are especially effective for testing systems in shallow water in an effective and affordable manner. Also, the decommissioned diesel submarine USS SALMON provides sonar targets for development of new systems and acts as a training aid for submarines transiting the area aiding in detection and classification of bottom targets.

UNDERSEA RANGES. NATO FORACS AUTEC (NFA) NATO FORACS (Naval FORces Sensor and Weapons Accuracy Check Sites) is a multi-national NATO project with eight member nations: Canada, Denmark, Germany, Greece, Italy, Norway, the United Kingdom, and the United States of America. Its mission is to measure the bearing, range and heading errors of sensors on-board surface ships, submarines, and helicopters. These calibration measurements establish confidence among the member naval forces that target locations can be accurately passed from sensors to weapon systems and other NATO combatant units. The sensors that are tested include: active, passive, dipping and towed array sonars; fire control and search radars; ESM and RDF equipment; infrared, laser and TV sensors; optical sights and peloruses; periscopes, inertial navigation and positioning systems; GPS; and gyrocompasses. There are three NATO FORACS Ranges: Greece, Norway, and AUTEC. NFA is collocated within the AUTEC complex.

EQUIPMENT/FACILITIES (continued)

SHIPBOARD ELECTRONIC SYSTEMS EVALUATION FACILITY (SESEF). The SESEF program was developed to provide electromagnetic systems test and evaluation services to afloat and shore commands for the development of new and upgraded systems; to validate system performance following new construction and overhaul; and to provide real-time assessment of material readiness in an operational environment.

ACOUSTIC MEASUREMENT CALIBRATION TEST FACILITIES. The Seneca Lake and Dodge Pond acoustic calibration facilities are unique in that they provide full spectrum testing of all types of acoustic devices from small prototypes projectors to full scale arrays and systems. The facilities provide open water test and evaluation capabilities with depths ranging from 50 feet to 500 feet, test ranges to 8000 meters and lifting capacities up to 220 tons. Open year around, the facilities are accessible within close proximity of the Northeast industrial area either by highway or in the case of Seneca Lake, access from the Atlantic Ocean is possible through the New York canal system.

UNDERSEA WARFARE EXERCISE COMMUNICATIONS CENTER. The facility provides the ability for real-time and post-exercise monitoring and processing of instrumented underwater range date from the Atlantic Undersea Test and Evaluation Center (AUTEC) and the Atlantic Fleet Weapons Training Facility (AFWTF). This facility is unique in that it enables training, test and evaluation in synthetic environments. UWECC serves as the communications link between simulation and analysis laboratories, T&E and training ranges, and submarines and surface ships. Linkages between ranges, simulators and trainers, government and private laboratories (i.e. geographically separated test facilities) allows for more simulation, less live testing; virtual prototyping; integrated constructive and virtual simulation with live tests; and fully stressed threat environment in training exercises.

WEAPONS DEVELOPMENT FACILITY COMPLEX. This complex includes major facilities for design, development, test, and life cycle support of Navy torpedoes, countermeasures, unmanned undersea vehicles, and undersea targets. Torpedo and other vehicle system designs are developed and maintained in the complex. Its Propulsion Test Facility supports electric and thermal (open and closed cycle) propulsion system developments and includes the Deep Depth Propulsion Test Facility, the only land-based facility capable of testing entire torpedoes to maximum power and depth; a total containment High Energy Chamber, designed to contain the total energy content of advanced propulsion systems in an environmentally safe manner; and the Propulsion Noise Test Facility, the only land-based facility capable of measuring radiated noise of operational underwater vehicles on land. The complex also includes the world's quietest anechoic wind tunnel, a 64,000 cubic foot anechoic chamber, the largest Reverberant Acoustic Tank of its kind in the country, the Navy's only large scale sea-water tow tank (3000 feet long) and an advanced materials laboratory, all of which provide comprehensive hydrodynamic, structural and acoustic data on components, as well as on full systems. Development and evaluation of vehicle sonars, guidance and control systems and software are accomplished in the unique Torpedo Life Cycle Support Facility. It includes undersea vehicle testbeds, allowing the capability to integrate new software with vehicle guidance and control hardware and test it under simulated in-water operating conditions.

Naval Undersea Warfare Center
Newport, RI 02841-1708
(401) 832-6761

Commander: RADM Charles B. Young
Technical Director: Dr. John E. Sirmalis

FY98 FUNDING DATA (MILLIONS $) [1]				
APPROPRIATION	IN-HOUSE	IN-HOUSE MANAGEMENT	OUT-OF-HOUSE	TOTAL
RDT&E:				
6.1 ILIR	1.854	N/A	0.000	1.854
6.1 Other	2.054	N/A	0.228	2.282
6.2	17.732	N/A	5.971	23.703
6.3	10.008	N/A	7.111	17.119
Subtotal (S&T)	**31.648**	**N/A**	**13.310**	**44.958**
6.4	35.787	N/A	20.564	56.351
6.5	47.111	N/A	19.389	66.500
6.6	35.787	N/A	12.623	48.410
6.7	18.228	N/A	15.061	33.289
Non-DOD	0.000	N/A	0.000	0.000
TOTAL RDT&E	**168.561**	**N/A**	**80.947**	**249.508**
Procurement	101.828	N/A	105.059	206.887
Operations & Maintenance	46.615	N/A	55.904	102.519
Other	23.636	N/A	12.417	36.053
TOTAL FUNDING	**340.640**	**N/A**	**254.327**	**594.967**

MILITARY CONSTRUCTION (MILLIONS $) [1]	
Military Construction (MILCON)	0.000

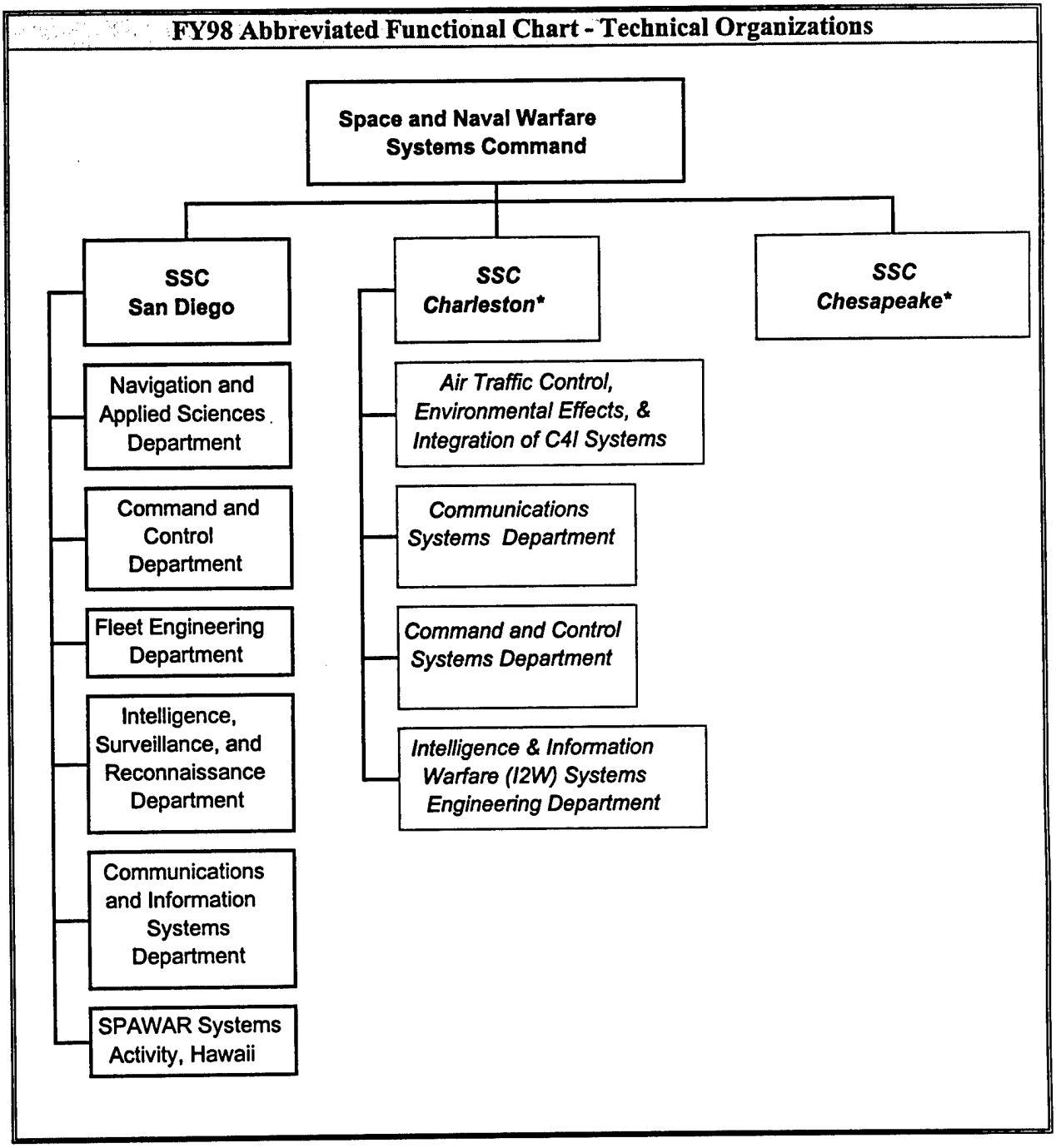
PERSONNEL DATA (END OF FISCAL YEAR 1998) [1]				
TYPE	SCIENTISTS & ENGINEERS		TECHNICAL SUPPORT & OTHER PERSONNEL	END STRENGTH
	DOCTORATES	OTHER		
MILITARY	0	0	61	61
CIVILIAN	140	1,774	987	2,901
TOTAL	**140**	**1,774**	**1,048**	**2,962**

SPACE AND PROPERTY [1]			
BUILDING SPACE (THOUSANDS OF SQ FT)		PROPERTY ACQUISITION COST (MILLIONS $)	
LAB	1,696.000	**REAL PROPERTY**	189.000
ADMIN	187.000	* NEW CAPITAL EQUIPMENT	0.800
OTHER	732.000	**EQUIPMENT**	432.000
TOTAL	**2,615.000**	* NEW SCIENTIFIC & ENG. EQUIP.	48.000
ACRES	**797**	* Subset of previous category.	

N/A - Not Applicable

[1] As a result of applying the In-House RDT&E Activity criteria at the division level (see NOTE on page 3-1), NUWC Keyport Division data is not included in the FY98 report.

Space and Naval Warfare Systems Centers



**As a result of applying the In-House RDT&E Activity criteria at the center level (see NOTE on page 3-1), SSC, Charleston and SSC, Chesapeake data is not included in the FY98 report.*

Space and Naval Warfare Systems Centers
San Diego, CA 92152-5101
(619) 553-2724

Commanding Officer: CAPT Harold A. Williams
Executive Director: Dr. Robert C. Kolb

MISSION

To be the Navy's full-spectrum research, development, test and evaluation, engineering and fleet support center for Command, Control and Communications Systems and Ocean Surveillance and the integration of those systems which overarch multiplatforms.

Leadership areas:

- Command, Control and Communication Systems
- Command, Control and Communication System Countermeasures
- Ocean Surveillance Systems
- Command, Control and Communication Modeling and Analysis
- Ocean Engineering
- Navigation Systems and Techniques
- Marine Mammals
- Integration of Space Communication and Surveillance Systems

CURRENT IMPORTANT PROGRAMS

Global Command and Control System.
Global Positioning System.
Joint Maritime Command Information System (JMCIS).
Joint Military Communication Implementation System.
Relocatable Over the Horizon Radar (ROTHER).
Advanced User Interface for Tactical Security Systems (AITS).
IT-21.
Joint Tactical Information Distribution System.
Defense Messaging System (DMS) Implementation.
Link 16/Link 11.
Navigation Sensor System Interference (NAVSSI).
Multifunction Information Distribution System.
Tactical Security Sensor Internetting and Integration (TSSII).
SHF/EHF/UHF Satellite Communications.
Navigation and Aircraft C3 Technology.
Submarine Communications.
Fleet Electronic Warfare.
Theater Missile Defense.
PLRS/EPLRS.
Hawaii Information Transfer System (HITs).
EODMU IV Initial Outfit.
Fixed Surveillance Systems.
Waterside Security Systems.
SUPRNET/NIPRNET Systems.
Advanced Marine Biological System.
Submarine Mast Detection.
Air Mobile Ground Security and Surveillance System.
Airborne Acoustic Detection Program.
Tactical Related Applications Program (TRAP).

CURRENT IMPORTANT PROGRAMS (continued)

Alternative Mine Detection (ALTER)
Marine Environmental Quality Assistance.
OSIS Evolutionary Development (OED).
Underwater Security Vehicle with Acoustic Guidance.
Unmanned Ground Vehicle.
Marine Corps Security and depot level repair and manufacture of C4I systems.
Intelligence and Information Warfare Systems.
INFOSEC Systems (EIP, AMODSM, SOVR, and Electronic Key Management Systems).

Technology Transfers:

Company	Title/Work Being Done
Marketpath Corporation	NCCOSC RDTE DEVIAHA Software Development
Proxima Corporation	UTSOS for Display Application
Conductus	Hybrid Thin Film CMOS/Superconducting Circuits
Loral Comm. Systems	HDR Ship to Ship & Ship to Shore Comm
Northrop Grumman Corp.	Naval Simulation Systems (NSS) Coop Dev
Hawaii Space Ctr., Inc.	Excimer Laser Materials Processing
Luminore, Inc.	Metal Composite Coating
Spectrogram Corporation	Oil Spill Alarm System
Optron Systems, Inc.	Head Mounted Liquid Crystal Displays
Bien Logic, Inc.	Planet Earth-Next Generation
Telesis Corporation	Drug Prevention/Career Education Library
San Diego City College	Technology Assistance/Access
RGB Technology, Inc.	Commercialization of 3-D Volumetric Display system
Sun Microsys.Federal Inc.	Dev. Mission Critical Systems Using Java Tech.
Spectra Diode Labs, Inc.	Wavelength Div Multiplex Tech-Fiber Optics
Pacific Marine Supply	Swath R&D/SSP Kaimalino
TriTeal Corporation	Universal JAVA Desktop for Networkcentric Architec
Beatty & Company	Utilization of ATM Technology in Large Enterprise
Oceaneering International Inc.	LBA-1 Acoustic Array System

EQUIPMENT/FACILITIES

In San Diego, our facilities occupy more than 580 acres. Facilities are concentrated in four major areas: Topside, Bayside, Seaside, and Old Town. Topside facilities, located on the ridge of Point Loma, include the principal administrative and support sections, as well as facilities for communications, environmental testing, electronic material, advanced electronics, laser technology, and ocean surveillance. Our Bayside facilities face San Diego Bay, which provides waterfront access and berthing capabilities vital to SSC San Diego activities in ocean surveillance, ocean engineering, navigation, and marine sciences. Seaside facilities are located on the west slope of Point Loma, which offers a protected, electromagnetically shielded site essential to RDT&E in C3I and ocean surveillance. The Old Town Campus houses work areas for the fabrication of electronic hardware supporting SSC San Diego's C4ISR programs. The Old Town Campus also became the headquarters of Space and Naval Warfare Systems Command on 1 October 1997.

Our Hawaii Activity and its two western facilities in Guam and Japan provide electronic systems engineering support to Navy and Marine Corps and joint service component forces in the Western Pacific and Indian Oceans.

EQUIPMENT/FACILITIES (continued)

Our communications connectivity allows most of the Navy's C4ISR systems to be interconnected to support developmental testing as well as to participate in live operations with U.S. Fleet units. SSC San Diego's total capability allows us to provide and manage rapid reconfiguration of our C4ISR capabilities and to provide national and international connectivity using commercial and military capabilities in support of primary mission areas.

EQUIPMENT AND FACILITIES:

C4ISR SYSTEMS INTEGRATION ENVIRONMENT (C4ISR SIE). The C4ISR Systems Integration Environment is the Navy's premier C4ISR integration and test facility. The C4ISR SIE exploits current technology to realize cost-effective and timely integrated systems development and implementation. A distributed environment consisting of existing laboratory facilities, systems, and core personnel, the C4ISR SIE support life-cycle acquisition, supports system integration and test, and assures cost-effective implementation of integrated, joint, and interoperable naval C4ISR systems.

Advanced Virtual Intelligence, Surveillance, and Reconnaissance Laboratory, (ADVISR) in development at SSC San Diego, is a distributed interactive simulation and future high-level-architecture compatible, physics-based simulator capable of modeling sensors, communications, and command and control systems.

Reconfigurable Land-Based Test Site, a versatile integration interoperability test center, takes advantage of the variety of systems available at SSC San Diego and provides connectivity to operational tactical networks as well as development laboratories to configure interoperability tests that accurately reflect real-world operations in a controlled environment.

Advanced Combat Direction System (ACDS) Laboratory provides the primary development and testing facilities for the ACDS Block 0 and Block 1 programs and the Command and Control Processor (C2P).

The ACDS Staging Facility is a joint Program Executive Office Theater Air Defense -- SSC San Diego project in support of the LHA-1 (general-purpose amphibious assault ship) class ACDS upgrade effort.

The Command and Control Advanced Research Network (CCARnet) is the backbone network service for classified and unclassified, high-bandwidth, high-speed, multimedia (voice, audio, digital data) internetworking between SSC San Diego Command and Control Department spaces located throughout the Point Loma campus.

The Combat Direction System (CDS) Development and Evaluation Site (CDES) is a multiconfigurable development center and provides the facilities, equipment, and system engineering capability for the development of new or upgraded ship combat direction systems.

The Distributed Command and Control Laboratory provides hardware, software, and communications connectivity to support the development and application of distributed processing technology to command and control systems.

The Distributed Simulation Internet (DSI) Advanced Simulation Laboratory (DASL) provides secure DSI integration hardware, software, simulations, and gateways to other simulations.

The Global Command and Control System–Maritime (GCCS-M) Ashore Integration and Test Facility provides hardware, software, and communications for application development integration, and compliance, functional, and interoperability testing in support of ashore command systems.

The GCCS-M Afloat Test Bed and Integration Facility provides mockups of the installations on aircraft carriers, command ships, and unit-level platforms to support application development, integration, and compliance, functional, and interoperability testing.

EQUIPMENT/FACILITIES (continued)

The Systems Integration Facility is used for testing and integrating Joint Tactical Information Distribution System terminals with aircraft data systems and shipboard combat direction systems, and for testing the interoperability of Link-16 systems.

The Joint Maritime Communications Strategy (JMCOMS) Simulation Facility provides an environment for evaluating software components being developed for communication control systems; analysis includes fleet protocol definition, operator interfaces, and system engineering.

High-Data-Rate Mobile Internet (MONET) is a test bed for high-data-rate tactical communication technologies.

The Modeling and Simulation (M&S) Operations Support Cell (MOSC) provides a single point of contact for information requests, analyses, and decision support for planners using C4I systems.

The SHF SATCOM Test Facility contains a complete super high frequency (SHF) satellite communications terminal and test equipment to support follow-on SHF equipment development.

The Ship Antenna Model Range allows simulation and modeling of ship communications, consisting of ground planes, model ships, track, towers, control systems, test equipment, data collection systems, data-reduction computers, and analysis software and components.

The Ship Antenna Simulation Facility operates with the Ship Antenna Model Range to provide software modeling and simulation of systems, confirmation of models, and extensions beyond the test capability of the model range.

The Acoustic Systems and Technology Analysis and Research Laboratory provides both in-house and at-sea multistatic active acoustic signal-processing capabilities via a network of workstations and associated programs.

The Cryptologic Systems Land-Based Test Facility supports prototyping, integration, validation, and testing of tactical cryptologic and information warfare exploitation systems.

The Intelligence System Advanced Development Laboratory offers radio frequency interference-shielded, vault-level security and capability to receive and process data from various sources through online communications.

The Microwave and Millimeter-Wave Antenna Range Complex supports development of surveillance antennas for numerous operational applications.

The Processing and Data Exploitation Center is an in-house laboratory facility to conduct data fusion and information processing research for the exploitation of national systems' products for national, unified, and specified command, and joint service and tactical applications.

The Real-Time Embedded High-Performance Computing Facility (RTEHPCF) provides high-performance, parallel computing and visualization resources in a secure environment, with connectivity to other secure locations throughout SSC San Diego and to external locations by use of end-to-end encryption.

HIGH-PERFORMANCE COMPUTING AND NETWORKING. SSC San Diego is a leader in Department of Defense (DoD) high-performance computing and networking (HPCN). The most recent addition to this capability is an upgrade to our high-bandwidth asynchronous transfer mode (ATM) campus network system linking SSC San Diego and other DoD scientists and engineers with our Intel Paragon and Hewlett-Packard/Convex Exemplar scalable, parallel computing systems. Fiber-optic links supporting fiber-optic distributed data interface/ATM/Synchronous Optical Network connections between command-wide facilities are provided to enhance and enable global connectivity for state-of-the-art advances in HPCN and information integration.

EQUIPMENT/FACILITIES (continued)

The Surveillance Test and Integration Center (STIC) is a radio frequency interference-shielded vault that can receive and process data from various sources through online communications.

The Surveillance Radar Development Facility provides a test bed for development of radar waveforms, techniques, and equipment to support inverse synthetic aperture radar, radar cross section measurements, and higher resolution radar developments.

The Signals Warfare Integration Facilities and Test Bed is a secure electromagnetic interference/electromagnetic frequency interference facility that supports the full spectrum of analysis, system development, test and evaluation, simulation, and integration in a multisystem environment supporting signals intelligence, countercommunications, signal security, information warfare, and related cryptologic systems.

The Transducer Analysis Computer Laboratory is a facility for evaluation and analysis of transducers, transducer arrays, and acoustic array system performance.

The Transducer Evaluation Center (TRANSDEC) is a controlled-environment low-ambient-noise, conveniently accessible transducer calibration and underwater acoustic test facility.

The Tactical Surveillance Laboratory (TSL) offers a centralized facility for multiservice and national organizations to display and analyze tactical data systems.

SSC San Diego's Dive Locker is responsible for all diving and diving-related operations in support of SSC San Diego projects. Examples of dive support include planning and conducting at-sea testing, organizing logistics for deployments or remote site testing, remotely operated vehicle operations, underwater facility inspection and repair, Arctic/Ice Camp planning and operations, outboard engine repair and operations, and shipboard interface and operations.

DISTRIBUTED TEST BEDS C4ISR systems must link U.S. ships, aircraft, submarines, and land sites, and theater, joint, allied, and coalition forces into an information network that supports warfighters in the execution of their assigned mission. The overarching nature of these systems requires test beds that support the integrated testing of multiple configurations involving components on a global scale. Connectivity for these distributed test beds in provided by integrated virtual networks using both military and commercial communications systems.

Test Facility at San Clemente Island. Located 80 miles off the coast from San Diego, San Clemente Island provides a physically remote multi-faceted ground, air, and sea test site suitable for a variety of projects. The most recent project was the UAV/SSN Interoperability Demonstration.

The USS Dolphin is the Navy's only operational diesel-electric, deep-diving research and development submarine. Dolphin provides a cost-effective platform for both scientific research and test and evaluation programs.

The Visualization Image Processing Virtual Environment (VIPER) Laboratory is a facility for research and development studies in scientific visualization, interactive image processing, and advanced virtual environments.

The Global Positioning System (GPS) Central Engineering Activity (CEA) was relocated to SSC San Diego in June 1997. The GPS User Equipment CEA has been the Navy's lead laboratory for developing GPS receivers.

The Navigation Sensor System Interface (NAVSSI) Development Laboratory provides a facility, replete with navigation sensors identical to those found on U.S. Navy ships, for the development and test of NAVSSI software before introduction to the Fleet.

EQUIPMENT/FACILITIES (continued)

The NAVSSI Hardware Development Laboratory provides an area in which new concepts for NAVSSI hardware can be tested and engineering development models can be built.

The Ocean Survey Program Survey System (OSPSS) System Integration Laboratory (SIL) contains an integrated navigation system, sonar sensor and processing systems, equipment prototypes, and simulators that replicate existing shipboard systems.

The AN/FRT In-Service Engineering Agent (ISEA) Laboratory supports AN/FRT Series communications transmitters and provides capabilities for development of engineering change proposals, investigation of transmitter design problems, and simulation of fleet transmitter problems.

The Caribbean Regional Operations Center (CARIBROC) Processing and Display System Laboratory provides testing, evaluation, life-cycle support capability, and integrated logistics support functions.

The Communications/TEMPEST (Transient Electromagnetic Pulse Emanations Standard) Laboratory provides a capability for instrumented and visual equipment survey, emanations analysis, and testing, evaluation, and pre-installation of communications equipment wiring.

The U.S. Navy's primary **Cryptographic Repair Facility** provides maintenance, repair, and modification of cryptographic and communications security equipment, and interfaces with Navy, Army, and Air Force in matters relating to cryptographic automatic test equipment.

The In-Service Engineering Agent and Pre-Installation Test and Check-Out facilities provide engineering and technical services for integration and installation of 2-kHz to 45-GHz radio frequency communications systems, including system design, material control, system integration/installation, and system modifications.

Joint Integrated Voice Communications Facility serves as an integration and test facility for legacy and emergent C4I in-service engineering agent maintained systems.

The Integrated Voice Communications System Life-Cycle Support Facility, initially installed in 1974 on board USS Tarawa (LHA 1), has since been expanded to cover a variety of shipboard integrated communications systems and equipment.

The Link-16 In-Service Engineering Agent (ISEA) Laboratory has a fully operational Link-16 system and extensive test equipment, providing total life-cycle support to the Link-16 program.

The Engineering Software Development Laboratory provides capabilities for Test Program Set development and maintenance to support organic depot repair capabilities for SPAWAR, Naval Inventory Control Point, and Naval Sea Systems Command, and includes state-of-the-art Consolidated Automated Support System, VAX, and LASAR systems.

The Intelligent Management Application System (IMAS) is an architecture that combines leading commercial software and innovative programming to perform any desired business application through the World Wide Web.

The RADIAC (Radioactivity Detection, Indication, and Computation) Calibration Laboratory provides capabilities for testing, calibration, and repair of distributed radiation detection equipment for the U.S. Navy.

Test Engineering and Restoration Depot offers a wide range of capabilities to support shipboard and land-based communication systems test, repair, and restoration.

EQUIPMENT/FACILITIES (continued)

Engineering Services Laboratory provides facilities to perform environmental testing under shipboard shock, vibration, and climatic conditions, and capabilities to perform structural materials testing, analysis, and corrosion engineering.

The Meteorological and Oceanographic (METOC) System Laboratory is a state-of-the-art systems integration laboratory for Navy and Marine Corps METOC equipment, including line data sources.

SURTASS Support SPAWAR Systems Activity Pacific provides technical and logistical support for the Surveillance Towed Array Sensor System (SURTASS) ships and facilities.

Tactical Systems Support Complex supports engineering and technical services, configuration management, software maintenance, and repair of electronic surveillance measures systems.

Ocean Sciences Laboratory provides special facilities for work in marine biology and toxicology, environmental chemistry research, analytical instrumentation development, marine environmental quality assessment and monitoring, environmental biotechnology, radiation sensor development, stochastic resonance, biomedical research, lasers, and microelectronics.

Bioscience Facility provides facilities for acoustical and physiological research, training, and handling of marine animals to perform naval tasks in the open ocean.

Integrated Circuit and Fabrication Facility SSC San Diego operates a state-of-the-art integrated circuit facility, generally regarded as a world leader in development of thin-film silicon-on-insulator technology (for radiation hardening).

Space and Naval Warfare Systems Centers
San Diego, CA 92152-5101
(619) 553-2724

Commanding Officer: CAPT Harold A. Williams
Executive Director: Dr. Robert C. Kolb

FY98 FUNDING DATA (MILLIONS $) [1]

APPROPRIATION	IN-HOUSE	IN-HOUSE MANAGEMENT	OUT-OF-HOUSE	TOTAL
RDT&E:				
6.1 ILIR	2.299	N/A	0.000	2.299
6.1 Other	1.542	N/A	3.093	4.635
6.2	33.458	N/A	108.373	141.831
6.3	23.292	N/A	80.714	104.006
Subtotal (S&T)	**60.591**	**N/A**	**192.180**	**252.771**
6.4	41.199	N/A	88.093	129.292
6.5	28.516	N/A	41.461	69.977
6.6	2.901	N/A	2.813	5.714
6.7	27.725	N/A	38.148	65.873
Non-DOD	0.000	N/A	0.000	0.000
TOTAL RDT&E	**160.932**	**N/A**	**362.695**	**523.627**
Procurement	114.080	N/A	246.429	360.509
Operations & Maintenance	122.107	N/A	95.360	217.467
Other	41.184	N/A	65.015	106.199
TOTAL FUNDING	438.303	N/A	769.499	1,207.802

MILITARY CONSTRUCTION (MILLIONS $) [1]

Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998) [1]

TYPE	SCIENTISTS & ENGINEERS		TECHNICAL SUPPORT & OTHER PERSONNEL	END STRENGTH
	DOCTORATES	OTHER		
MILITARY	0	9	66	75
CIVILIAN	188	1,616	1,674	3,478
TOTAL	188	1,625	1,740	3,553

SPACE AND PROPERTY [1]

BUILDING SPACE (THOUSANDS OF SQ FT)		PROPERTY ACQUISITION COST (MILLIONS $)	
LAB	1,416.000	REAL PROPERTY	185.702
ADMIN	802.000	* NEW CAPITAL EQUIPMENT	0.575
OTHER	1,204.000	EQUIPMENT	204.765
TOTAL	3,422.000	* NEW SCIENTIFIC & ENG. EQUIP.	0.000 [2]
ACRES	1,238	* Subset of previous category.	

N/A - Not Applicable

[1] As a result of applying the In-House RDT&E Activity criteria at the center level (see NOTE on page 3-1), SSC, Charleston and SSC, Chesapeake data is not included in the FY98 report.

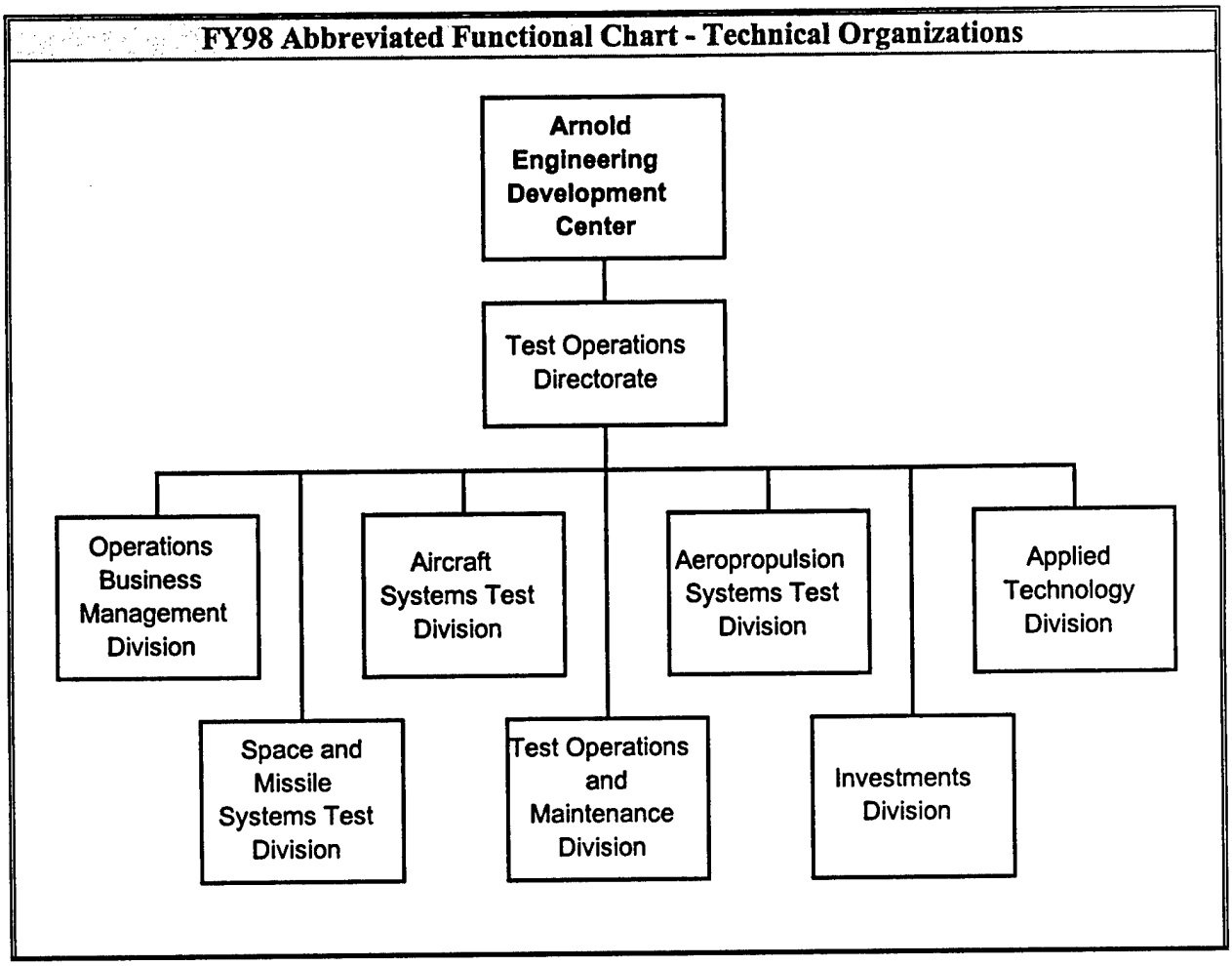
[2] Cost data for New Scientific and Engineering Equipment is not available at this time, due to a changeover to a new accounting system.

DEPARTMENT OF THE AIR FORCE

DEPARTMENT OF THE AIR FORCE

The Air Force's fourteen (14) In-House RDT&E Activities are:

Arnold Engineering Development Center



Arnold Engineering Development Center
Arnold AFB, TN 37389-5000
(615) 454-3000

Commander: Col Michael Heil
Executive Director: John M. Rampy

MISSION

The overall mission of Arnold Engineering Development Center (AEDC) is to support the development of aerospace systems by testing hardware in facilities that simulate flight conditions. AEDC is the Department of Defense's premier aerospace ground test and evaluation/simulation center specifically by performing tests, engineering analyses, and technical evaluations for research, system development, and operational programs of the Air Force and Department of Defense, other governmental agencies, and industry.

CURRENT IMPORTANT PROGRAMS

The following list contains some of the more important test programs at the Arnold Engineering Development Center:

F-22 Fighter: Wind tunnel testing and analysis accomplished supporting the engineering/manufacturing/development phase; majority focused on store separation testing.

F119 Engine for F-22: Significant testing completed on altitude development and ram accelerated mission test qualification supporting the initial service release milestone and flight clearance of flight test engines 6 and 7. Continued flight envelope expansion for the flight test program.

F-15 Fighter: Weapons separation test and analysis completed for a number of stores.

F-18 Fighter: Store separation testing conducted on the E/F versions of the aircraft.

Joint Strike Fighter (JSF): Testing accomplished for both competing contractors.

F119 Engine for JSF: Pre-test planning, coordination, and test cell modifications accomplished in preparation for the FY99 testing of the two competing propulsion system candidates.

JASSM: Wind tunnel testing conducted on both competing weapon versions in support of downselect.

JDAM: Testing in support of time critical weapon modifications.

AD3007 Engine for Global Hawk Aircraft: Pre-testing planning and coordination accomplished in preparation for the FY99 testing of the propulsion system.

F110 Engine Blisk Fan: Completed altitude development testing of an integral blade and disk (blisk) fan rotor for the F110-GE-129 Enhanced Fighter Engine (EFE).

PW4098 Engine for Boeing 777: Completed altitude certification testing of the 98,000 lb thrust PW4098 engine for the Boeing 777-300.

F414 for F/A-18E/F: Altitude test program completed in support of the full production qualification milestone.

Evolved Expendable Launch Vehicle: Provided simulated altitude test services for the RL-10B-2 upperstage engine to be used on the Boeing Delta III and Delta IV launch vehicles. Conducted wind tunnel testing for both competing contractors.

CURRENT IMPORTANT PROGRAMS (continued)

Peacekeeper Intercontinental Ballistic Missile (ICBM): Provided simulated altitude test services for both aging and surveillance of the second and third stage solid rocket motors.

Minuteman III ICBM: Provided simulated altitude test services for aging surveillance of the second and third stage solid rocket motors.

Minuteman III Propulsion Replacement Program: Provided simulated altitude test services for development of the replacement second and third stage solid rocket motors.

Ground Base Interceptor: Calibrated and tested the sensor and focal planes using target simulation packages traceable to national standards. Evaluated in a vacuum, cryogenic environment that closely simulated actual operating conditions.

Navy Standard Missile: Provided hypersonic flight test environments in support of Block IVa component upgrades.

Patriot Advanced Capability-3 (PAC-3) Program: Provided sub-scale hypervelocity lethality testing in support of Live Fire Test and Evaluation (LFT&E) during low rate initial production.

AIM-9X: Significant testing completed on F-15E and F-18 C/D to determine safe separation and store compatibility. Supported initial flight testing.

F-117: Store separation testing conducted to integrate 1,000 lb JDAM store.

EQUIPMENT/FACILITIES

AEDC represents a $6 billion investment in the most advanced and largest complex of flight simulation facilities in the world with test units having capabilities unmatched elsewhere. AEDC encompasses three main business areas: Aeropropulsion, Aerodynamics, and Space and Missiles.

The **Aeropropulsion Business Area** includes 15 turbine engine test cells supporting aircraft and missile system research and development simulating flight tests over a wide range of Mach numbers and altitudes to determine operational characteristics of air breathing propulsion systems. Test capabilities include engine performance and operability, engine/inlet integration, and environmental/climatic testing. Unique military requirements supported include afterburner use, high altitude flight, high speed low altitude flight, maneuverability, fighter/bomber engine/inlet integration, and environmental testing.

The **Aerodynamics Business Area** includes 7 wind tunnels (conventional, continuous-flow, and intermittent blowdown) supporting flight simulation, store separation simulations, computational fluid dynamics, and engineering approximations of relatively large-scale models of high speed aircraft, missiles, and spacecraft. Unique military requirements supported include high performance fighter flight simulations, full scale engine/inlet/exhaust testing, and store separation simulations.

The **Space and Missile Business Area** includes altitude rocket facilities, propulsion research test cells, aerospace chambers, hypervelocity wind tunnel, continuous flow arc-heated facilities, and free-flight ranges providing test capabilities for rockets, spacecraft, and hypersonic interceptors and re-entry systems. Unique military requirements supported include large solid and liquid rocket altitude tests, aero/thermal testing, high speed impact/counter fire, high speed large model launches, soft model recovery, digitally controlled scene generation, and multi-functional focal plane array.

Arnold Engineering Development Center
Arnold AFB, TN 37389-5000
(615) 454-3000

Commander: Col Michael Heil
Executive Director: John M. Rampy

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	0.000	N/A	N/A	0.000
6.1 Other	0.000	0.000	0.000	0.000
6.2	0.000	0.000	0.000	0.000
6.3	0.000	0.000	0.000	0.000
Subtotal (S&T)	**0.000**	**0.000**	**0.000**	**0.000**
6.4	0.000	0.000	0.000	0.000
6.5	0.000	0.000	0.000	0.000
6.6	267.138	1.180	23.609	291.927
6.7	0.000	0.000	0.000	0.000
Non-DOD	0.000	0.000	0.000	0.000
TOTAL RDT&E	**267.138**	**1.180**	**23.609**	**291.927**
Procurement	0.000	N/A	0.000	0.000
Operations & Maintenance	2.695	N/A	4.557	7.252
Other	6.886	N/A	1.449	8.335
TOTAL FUNDING	**276.719**	**1.180**	**29.615**	**307.514**

MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

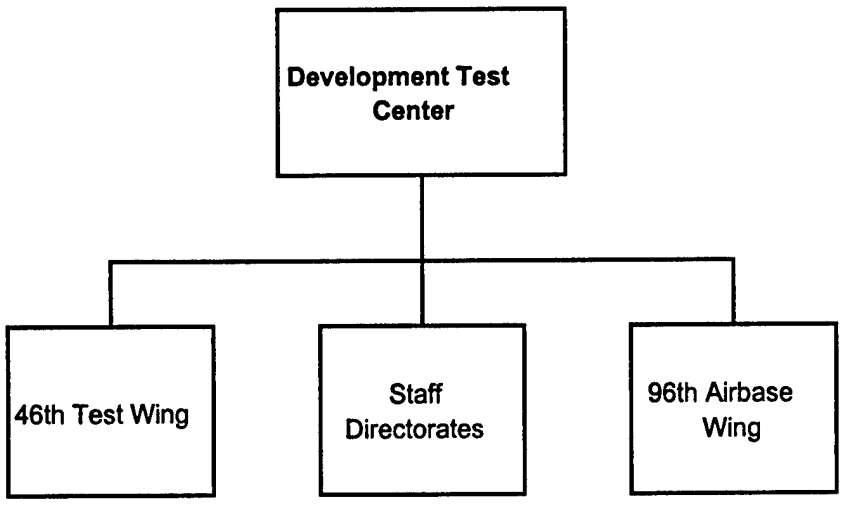
PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	**END STRENGTH**
TYPE	**DOCTORATES**	**OTHER**		
MILITARY	0	39	66	105
CIVILIAN	2	71	131	204
TOTAL	**2**	**110**	**197**	**309**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	230.549	**REAL PROPERTY**	1,353.859
ADMIN	505.891	* NEW CAPITAL EQUIPMENT	0.000
OTHER	2,091.002	**EQUIPMENT**	241.037
TOTAL	**2,827.442**	* NEW SCIENTIFIC & ENG. EQUIP.	13.502
ACRES	**39,081**	* Subset of previous category.	

N/A - Not Applicable

Development Test Center

FY98 Abbreviated Functional Chart - Technical Organizations



Development Test Center
Eglin AFB, FL 32542-5498
(850) 882-5422

Commander: MG Michael C. Kostelnik
Executive Director: Dr. J. Daniel Stewart

MISSION

The Air Force Development Test Center (AFDTC) plans, directs and conducts test and evaluation of US and allied non-nuclear munitions and navigation/guidance systems. AFDTC operates the largest air base in the free world, providing host support to 50 tenant units, and supports the largest single base mobility commitment in the Air Force. The Test Center accomplishes its mission through its two component wings - the 46th Test Wing and the 96th Air Base Wing.

CURRENT IMPORTANT PROGRAMS

Advanced Medium Range Air-to-Air Missile* - T&E includes flight test and hardware-in-the-loop testing at the Guided Weapons Evaluation Facility (GWEF) for an improved autopilot repackaged electronics, extended rocket motor, shortened control actuator, and improved electronic counter-counter measures (ECCM). Munitions lethality testing is conducted at Eglin, including Congressionally mandated LIVE FIRE T&E vs modern threat aircraft.

Hellfire - Production lot and pre-planned product improvement (P3I) testing of Hellfire and Longbow Apache Hellfire Modular Missile Systems.

CHICKEN LITTLE** - A joint Army-Air Force smart weapons test and evaluation organization hosted at Eglin. This organization conducts seeker/sensor and lethal mechanism T&E and system effectiveness evaluations.

Joint Stars - Tests are conducted on Eglin ranges to evaluate Joint Stars capability to detect and track multiple targets in various environments.

SEEK EAGLE - Air Force stores compatibility program hosted at Eglin AFB. Flight tests to verify weapon separation simulations as well as instrumented flight testing (flutter, loads, stability, and control) to define safe carriage and employment limits are conducted on Eglin ranges.

F-15E Tactical Electronic Warfare Systems (TEWS) - Electronic counter measures performance testing.

Sensor Fuzed Weapon - Production lot flight and P3I ground testing (including DT&E, IOT&E, and LIVE FIRE (LF)T&E) are currently being conducted at Eglin. P3I testing will begin 3Q FY99 and continue through 1Q FY00.

Joint Tactical Information Distribution System and Link 16 - Testing of information transfer among various types of Link 16 terminals is conducted on Eglin ranges.

Joint Direct Attack Munition* - JDAM is a joint Air Force-Navy program. Development, Test and Evaluation planning and flight testing are conducted.

Joint Stand Off Weapon* - JSOW is a joint Air Force-Navy program. Development, Test and Evaluation planning and flight testing and LFT&E are conducted.

AIM-9X (Air launch, Intercept Mission) - This program is a joint Air Force-Navy program led by the Navy. The 46th Test Wing is principal Air Force test office. Captive flight testing, separation testing, and live launches will be conducted during the next three years.

CURRENT IMPORTANT PROGRAMS (continued)

Advanced Short Range Air-to-Air Missile (British) and Various Allied Weapons - A component of allied munitions testing. The ASRAAM TRIALS (essentially Development, Test and Evaluation) are being conducted by a British Aerospace establishment team at Eglin. ASRAAM Service Evaluation Trial begins testing of launch profiles this year in preparation for launches next calendar year.

Wind Corrected Munition Dispenser - WCMD allows standard cluster bombs to become smart weapons. Development, Test and Evaluation planning and flight testing are being conducted.

Joint Air-to-Surface Standoff Missile* - JASSM is a joint Navy and Air Force program to acquire a next generation air launch, long range, precision guided standoff missile weapon system. Free flight testing is being conducted as the final PDRR Phase test events. Initial planning and testing for EMD Phase are ongoing. Captive flight testing, separation testing, and live launches will be conducted during next four years.

US Navy Aerial Targets - The F-16 has been selected as a launch platform for the AQM-37 and BQM-74 aerial targets. Flight testing planning and execution are being conducted to provide a limited flight clearance for the F-16 to launch the drones during US Navy operations.

A-10 Testing - Three major programs have been conducted to enhance the capability of the aircraft. The Low Altitude, Safety, and Targeting Enhancement (LASTE) program introduced new software capabilities. The Embedded Global Positioning System and Inertial Navigation System (EGI) Program increased the navigation accuracy of the aircraft. The 600-Gallon Fuel Tank program resolved stability and control questions necessary to increase loiter time by using external fuel tanks. We are currently testing Block Cycle Change BCC-01 and will begin planning efforts for BCC-02 in Jan 99.

Low Cost Autonomous Attack System - Testing of the unpowered LOCAAS is being conducted over Eglin land ranges to evaluate the systems ability to acquire, classify, and attack ground targets.

Anti-Jam GPS Technology Flight Test - The AGTFT, which is similar to a JDAM, is designed to resist GPS jamming and is currently being evaluated by the 46th Test Wing.

Air Force Mission Support System (AFMSS) - Testing of the core software and many of the 50 plus aircraft/weapon/electronic system software modules for mission planning.

TRIDENT - An instrumented pod developed to evaluate missile guidance software updates. The pod is flown on the F-15E aircraft.

AGM-130 - Improvements to this weapon system to include GPS guidance and the ability to track horizontal targets were evaluated.

BOL Chaff and Flare Dispenser - This foreign comparative test evaluated the operations of this new dispenser on the F-15E.

The following are **Technology Transfer Programs** providing unique T&E facilities/capabilities for commercial use. Capabilities are followed by actual commercial test efforts (if applicable).

Advanced Transportation and Automotive - Accomplish vehicle and automated highway systems tests in varying climatic conditions; test sensors under controlled electromagnetic environment; collision avoidance sensor tests.

Law Enforcement and Security - Intrusion, surveillance, access control, and weapons and ammunition testing.

Medical Equipment - Characterize electromagnetic emissions of equipment; test compatibility with helicopters, aircraft, or ambulances; test systems under controlled climatic conditions.

CURRENT IMPORTANT PROGRAMS (continued)

Communications Aviation - Test aircraft in climatic chamber; evaluate electromagnetic compatibility in large anechoic chamber; test on open air ranges. Interstate Electronics - advanced GPS navigation equipment.

Environmental - Use infrared and other technologies to test forest fire detection, and pollution detection. Apply expertise in environmental monitoring, restoration and field data collection. Accu-Weather - software evaluation for weather assessment.

Software/Modeling and Simulation - Access CRAY Supercomputer; use AFDTC developed software products.

At Holloman AFB, Hypersonic lethality testing for Threat Missile Defense (TMD), Crew Escape System Technology (CREST) tests, Global Positioning System (GPS) integration, field tests of the Federal Aviation Administration's (FAA) GPS navigational and landing aids, and electromagnetic testing including radar cross section and antenna pattern measurements of such advanced systems as the F-117, B-2, and other advanced technology.

*Navy and Air Force Joint Programs
**Army and Air Force Joint Programs

EQUIPMENT/FACILITIES

Capabilities and facilities include those for armament and C4I (Command, Control, Communication, Computer System, Intelligence) testing. The only DOD location with contiguous major land (724 sq. mi.) and water test ranges (125,000 sq. mi.), and the largest climatic test facility in the free world. Equipment and facilities include: a DoD High Performance Computing Center (real time and post mission support); airborne and ground based multispectral signature measurement; kinetic energy test facility (sled track); static warhead arenas; gun test facility; combined hardware and simulations testing (Guided Weapons Evaluation Facility - GWEF) and Preflight Integration of Munitions and Electronic Systems (PRIMES) facility; time-space-position information; telemetry systems facilities including airborne relay; airborne and surface targets; ground threat systems; base installation and security systems (BISS) test facility; photographic laboratory; and aircraft maintenance (test associated) facilities.

Also, at Holloman AFB are the:

- High Speed Test Track (HSTT): The world's longest sled track (50,788 ft), the Project Reliance lead for all DoD test tracks, and the Center of Excellence for ejection seat testing. The HSTT supports sled speeds exceeding Mach 8 and accelerations up to 200G for aerodynamic tests, impact tests, and missile simulations in various controlled environments of rain, particle, and blast/shock wave;
- Central Inertial Guidance Test Facility (CIGTF): America's most seismically stable (0.01 micro G isolated background level) test bed for truth reference validation of navigation systems. CIGTF has the largest collection of precision rate tables (10), multi-axis tables (12), and precision centrifuges (3) in DoD;
- Radar Target Scatter (RATSCAT) Mainsite and RATSCAT advanced measurement for full-scale and sub-scale systems--up to 100,000 lbs at Mainsite and 30,000 lbs at RATSCAT Advanced Measurement Site (RAMS). Both facilities have computer resources to support Radar Cross Section (RCS) target predictions, detection profiles, model validation, and real-time diagnostic imaging; and
- 586th Flight Test Squadron: Aircraft support for testing of air-to-air missiles, air-to-ground ordnance, photo/safety chase, inertial navigational systems, and Global Positioning Systems. The squadron operates two T-38's and a C-12, and uses F-15 and F-16 aircraft from Eglin AFB.

Development Test Center
Eglin AFB, FL 32542-5498
(850) 882-5422

Commander: MG Michael C. Kostelnik
Executive Director: Dr. J. Daniel Stewart

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	0.000	N/A	N/A	0.000
6.1 Other	0.000	0.000	0.000	0.000
6.2	0.000	0.000	0.000	0.000
6.3	0.000	0.000	0.000	0.000
Subtotal (S&T)	**0.000**	**0.000**	**0.000**	**0.000**
6.4	0.000	0.000	0.000	0.000
6.5	0.000	0.000	0.000	0.000
6.6	260.140	1.554	274.585	536.279
6.7	0.000	0.000	0.000	0.000
Non-DOD	0.000	0.000	0.000	0.000
TOTAL RDT&E	**260.140**	**1.554**	**274.585**	**536.279**
Procurement	0.220	N/A	0.000	0.220
Operations & Maintenance	9.548	N/A	12.981	22.529
Other	26.243	N/A	16.107	42.350
TOTAL FUNDING	**296.151**	**1.554**	**303.673**	**601.378**

MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	
TYPE	**DOCTORATES**	**OTHER**		**END STRENGTH**
MILITARY	1	97	3,999	4,097
CIVILIAN	8	543	2,004	2,555
TOTAL	**9**	**640**	**6,003**	**6,652**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	2,335.171	**REAL PROPERTY**	949.275
ADMIN	1,102.009	* NEW CAPITAL EQUIPMENT	0.000
OTHER	9,010.841	**EQUIPMENT**	753.975
TOTAL	**12,448.021**	* NEW SCIENTIFIC & ENG. EQUIP.	0.614
ACRES	**463,546**	* Subset of previous category.	

N/A - Not Applicable

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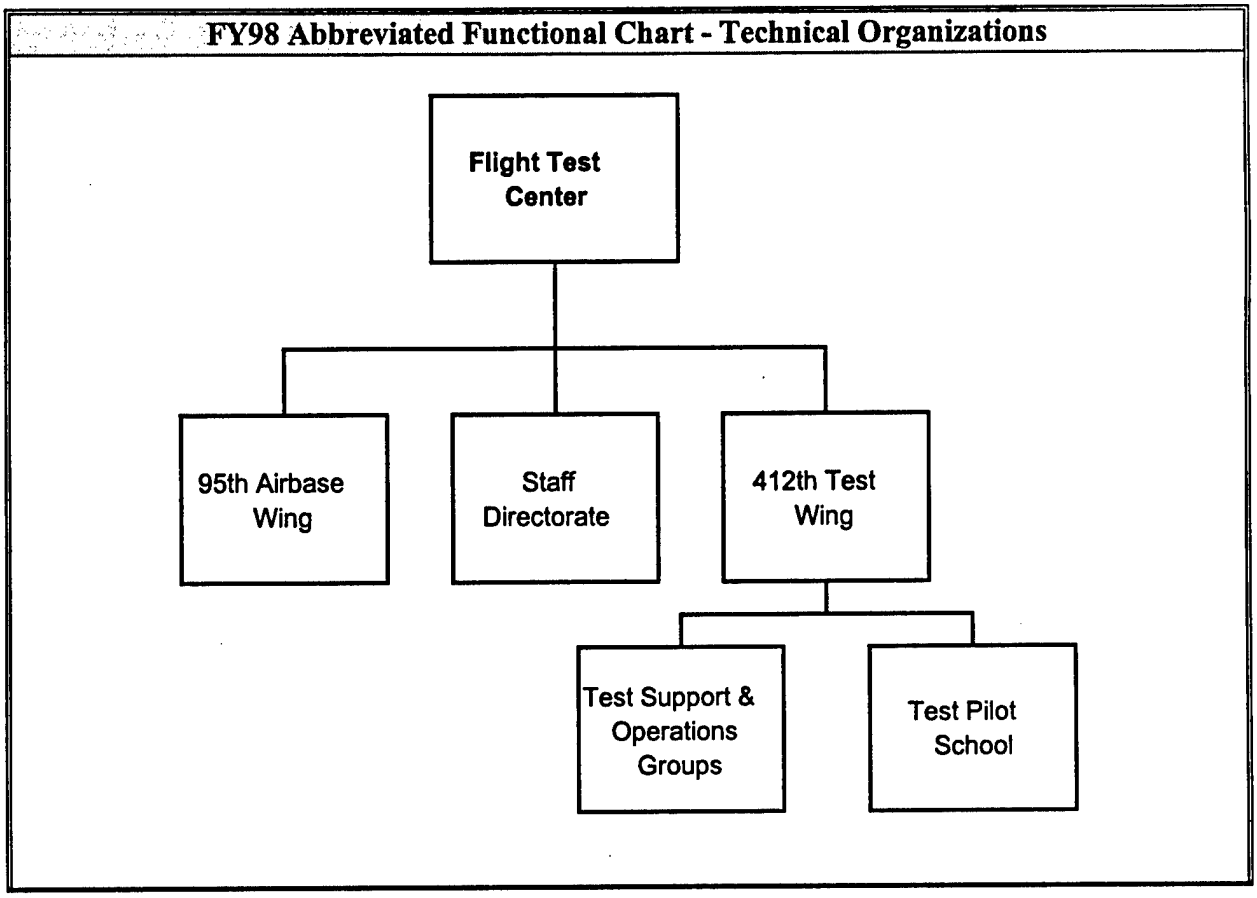
Flight Test Center



Flight Test Center
Edwards AFB, CA 93524-1000
(805) 277-2704

Commander: Brig Gen Richard Reynolds
Executive Director: James A. Papa

MISSION

The Air Force Flight Test Center (AFFTC) is charged with supporting the Air Force Material Command (AFMC) mission by conducting and supporting research, development, test and evaluation of manned and unmanned aerospace systems. This mission involves aspects of testing aerospace systems and subsystems, including development testing of aerodynamic decelerators; weapons systems; electronic warfare systems; recovery of research vehicles; operating the USAF Test Pilot School; developing, operating, and managing the Edwards Flight Test Range. The AFFTC conducts aerodynamic testing including performance and flying qualities evaluations; total weapons systems evaluations; and electronic warfare systems and subsystems evaluations. The AFFTC operates a fleet of test bed aircraft for early development and check out of new avionics and also operates a fleet of Advanced Range Instrumentation Aircraft (ARIA) for worldwide support to a variety of space and missile tests. The AFFTC supports and participates in research, development, test and evaluation programs for other USAF, Departments of Defense and government agencies, as well as for contractors and foreign governments.

CURRENT IMPORTANT PROGRAMS

B-1 BOMBER AVIONICS AND CONVENTIONAL WEAPONS UPGRADES
The B-1B is a flexible bomber with a large payload capability and a long range that makes it an ideal aircraft to support our deterrent posture across the full spectrum of conflict. The B-1B has been designated to form the core of future conventional bomber capability. The challenge of a conventional role requires the development of an extensive offensive and defensive capability without compromising current capability. The conventional mission upgrade program is planned to accomplish the changes required for the B-1B aircraft to become an effective conventional bomber.

B-2 BOMBER FOLLOW-ON PROGRAM
The B-2 Follow-on Flight Test Program is a Development Test and Evaluation program. The program is a continuance to test critical technical characteristics. The evaluation includes signature, composite structure, flight control system, air data system, and software integration. Testing will support activity in the following priority: safety of flight, initial system capability, and full capability. It must verify specification compliance for operational assessment.

B-52 BOMBER UPGRADES.
The advanced weapons integration program will span all smart weapon development/integration on the B-52 to include Joint Direct Attack Munitions (JDAM), Joint Stand-Off Weapons (JSOW), Joint Air-to-Surface Stand-Off Missile (JASSM), etc.

C-17 TRANSPORT FOLLOW-ON PROGRAM
The C-17 Follow-On Flight Test Program is a Development Test and Evaluation program. This program supports the fielded system which results from the C-17 Weapon System Production, Field Support or Flexible Sustainment contract and support enhancements to C-17 capabilities by supporting the authorized Producibility Enhancement/Performance Improvement Program. The program encompasses, but is not limited to, testing needed for engineering studies, preplanned product improvements, performance improvements, system upgrades, modifications of production equipment, field problem evaluations, production cut ins, and mission changes. The program will provide data for use in design studies, system development, field problem resolution specification compliance and performance characteristic evaluations.

CURRENT IMPORTANT PROGRAMS (continued)

C-130J TRANSPORT
The C-130J Test and Evaluation program is currently flight testing at Edwards AFB. The tests support the development and demonstration of the basic Lockheed C-130J aircraft and unique USAF C-130J systems. Other activities included takeoff and landing performance testing, enhanced cargo handling system development and demonstration evaluations, and auto thrust control testing. Additionally, air drop testing, which required chase/photo compatible aircraft, was accomplished.

F-15 FIGHTER
The F-15 Development Test and Evaluation (DT&E) program provides general avionics laboratory and overhead support for the F-15 System Program Office DT&E program requirements. Specific program objectives, descriptions and requirements are in support of radar, avionics operational flight program updates and the F-15E. The F-15 test aircraft at Edwards support a variety of non F-15 SPO programs such as B-1B Avionics Testing, Engine Testing, and F-15E/LANTIRN Integration DT&E.

F-16 FIGHTER
The F-16 Follow-on DT&E program is a continuing effort to add enhanced tactical capabilities and correct previously identified deficiencies. Testing centers around the development and integration of major production blocks 30B, 40, 50. A/B model testing will center on planned retrofit of selected capabilities. Testing will be conducted by a large test force and will involve virtually every technical discipline within the AFFTC mission. Additional test efforts will involve evaluations of the improved performance version of the Pratt and Whitney F100 and General Electric F110 engines.

F-117 FIGHTER
The F-117 test program provides for the continuous test of all systems as they are made available to the test team. As the aircraft systems mature, testing to include maintainability, reliability, survivability and effectiveness are evaluated. The goals of the test program are to ensure the F-117A stealth fighter can be deployed anywhere in the world at a moments notice and carry out it's intended mission: to employ stealth technology and precision weapon delivery on time and on target.

F-22 ADVANCED TACTICAL FIGHTER
The F-22 is being developed to meet air superiority requirements for the 1990's and beyond. This aircraft will incorporate state of the art materials, avionics, weapons and control systems. Testing facilities will be required on a very large scale. Some new facilities may be required. It is anticipated that the program will make extensive use of avionics ground test facilities at Edwards and several off-site locations. Provisions will be made for adequate Initial Operational Test and Evaluation (IOT&E) testing, climatic tests and technical order validation and verification. Testing is planned for airframe, engine, and envelope expansion test. Avionics will be installed and integrated incrementally.

JOINT STRIKE FIGHTER
The Joint Strike Fighter (JSF) Test and Evaluation (T&E) Support Office is responsible for all AFMC T&E support conducted in executing the JSF Concept Demonstration Phase (CDP) and planning for the Engineering and Manufacturing Development E&MD Phase. The JSF T&E Support Office provides a single point of contact for the member services, Office of the Secretary of Defense, AFMC and the Weapon Systems Contractors for AF Test and Evaluation (T&E) related matters. Specifically, the JSF T&E Support Office: coordinates AFMC test facilities and T&E resources; provides input to the Test and Evaluation Master Plan and the Flight Certification Plan; helps coordinate the combined DT and OT activities; serves as liaison between the Weapon Systems Contractors and government ground and flight test teams; helps coordinate the systems' safety requirements and helps develop and execute the Concept of Operations for the Concept Demonstration Aircraft. Personnel spread across the 412th Test Wing are currently accomplishing these actions. This proposed change would bring these people together and provide a single AFMC T&E team to support the customer needs.

LANTIRN
The test effort supports the continued development and refinement of the LANTIRN navigation and targeting pod. Efforts include continuing software development and area tracker testing.

CURRENT IMPORTANT PROGRAMS (continued)

BIG CROW
The overall mission of the Big Crow Program is to project an electronic warfare environment for electronic warfare vulnerability assessments. The system contains the capability to capture data required to accomplish vulnerability assessments for the Department of Defense C2I Weapon Systems. Follow-on modification assistance includes support of engineering design, engineering drawing and quality reviews.

ADVANCED RANGE INSTRUMENTATION AIRCRAFT (ARIA)
ARIA supports a variety of national and international spacelift customers, both military and commercial. The ARIA mission is to gather telemetry from booster and/or space launch payloads to verify correct orbital insertion and/or payload operations, and alerting the Space Control Network (SCN) of any problems. If a problem is detected, the SCN can then activate spacecraft solar panels before the launch vehicles on-board batteries die, correcting the orbit and saving the vehicle. ARIA data is sometimes the only data available, especially over large bodies of water where no ground telemetry sites exist. ARIA's mission is world-wide and they have recently supported from such places as Ascension Island, Guam, Hawaii, Australia, Reunion Island, French Guyana, New Caledonia, Tahiti, and others.

UNMANNED AERIAL VEHICLE (UAV)
The High Altitude Endurance (HAE) UAV Program is an advanced concept technology demonstration aimed at developing and demonstrating long dwell, high altitude tactical reconnaissance. Two HAE airborne components and a common ground segment are being developed under this program; a low observable HAE "Darkstar" and conventional design HAE "Global Hawk".

ACCESS TO SPACE PROGRAMS
AFFTC/RL will manage and act as the AFFTC focal point for the NASA X-33, X-34, X-37, X-37, X-38 and subsequent Reusable Launch Vehicle (RLV) programs. The AFFTC will provide a cadre of personnel with experience in the development and testing of these types of vehicles and other transatmospheric/orbital spacelift programs. Numerous commercial access to space, reusable launch vehicle, and spaceplane ventures are currently in various stages of development and desire unique AFFTC engineering expertise or facility/extended range use.

EQUIPMENT/FACILITIES

Major unique facilities and equipment include: Rogers Dry Lake, a natural landing field; ground-test capabilities, Integrated Facility for Avionics System Test (IFAST), Benefield Anechoic Facility (BAF), and Test & Evaluation Mission Simulator (TEMS) as part of the Electronic Combat Integrated Test (ECIT) complex; Edwards Flight Test Range (EFTR) which includes the real time mission control facilities, Precision Impact Range Area (PIRA) used for bombing/gunnery/infrared systems integration, personnel and cargo parachute drop zones, photo resolution range, and instrumented low level terrain following course; hydrant refueling system for heavy aircraft; aircraft weight and balance facility complex; photo/video lab for airborne and ground testing; intermediate aircraft maintenance support capability; Pacer Comet (jet engine test facility); horizontal aircraft thrust stand; and aircraft gun system harmonization range (GUNBUTT).

Flight Test Center
Edwards AFB, CA 93524-1000
(805) 277-2704

Commander: Brig Gen Richard Reynolds
Executive Director: James A. Papa

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	0.000	N/A	N/A	0.000
6.1 Other	0.000	0.000	0.000	0.000
6.2	0.000	0.000	0.000	0.000
6.3	0.000	0.000	0.000	0.000
Subtotal (S&T)	**0.000**	**0.000**	**0.000**	**0.000**
6.4	0.000	0.000	0.000	0.000
6.5	0.000	0.000	0.000	0.000
6.6	266.120	0.531	283.990	550.641
6.7	0.000	0.000	0.000	0.000
Non-DOD	0.000	0.000	0.000	0.000
TOTAL RDT&E	**266.120**	**0.531**	**283.990**	**550.641**
Procurement	0.000	N/A	0.000	0.000
Operations & Maintenance	21.117	N/A	34.560	55.677
Other	6.899	N/A	18.906	25.805
TOTAL FUNDING	**294.136**	**0.531**	**337.456**	**632.123**

MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	8.211

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	
TYPE	**DOCTORATES**	**OTHER**		**END STRENGTH**
MILITARY	2	120	3,789	3,911
CIVILIAN	7	557	2,447	3,011
TOTAL	**9**	**677**	**6,236**	**6,922**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	332.522	**REAL PROPERTY**	864.273
ADMIN	257.448	* NEW CAPITAL EQUIPMENT	0.000
OTHER	9,181.952	**EQUIPMENT**	61.919
TOTAL	**9,771.922**	* NEW SCIENTIFIC & ENG. EQUIP.	0.000
ACRES	**297,771**	* Subset of previous category.	

N/A - Not Applicable

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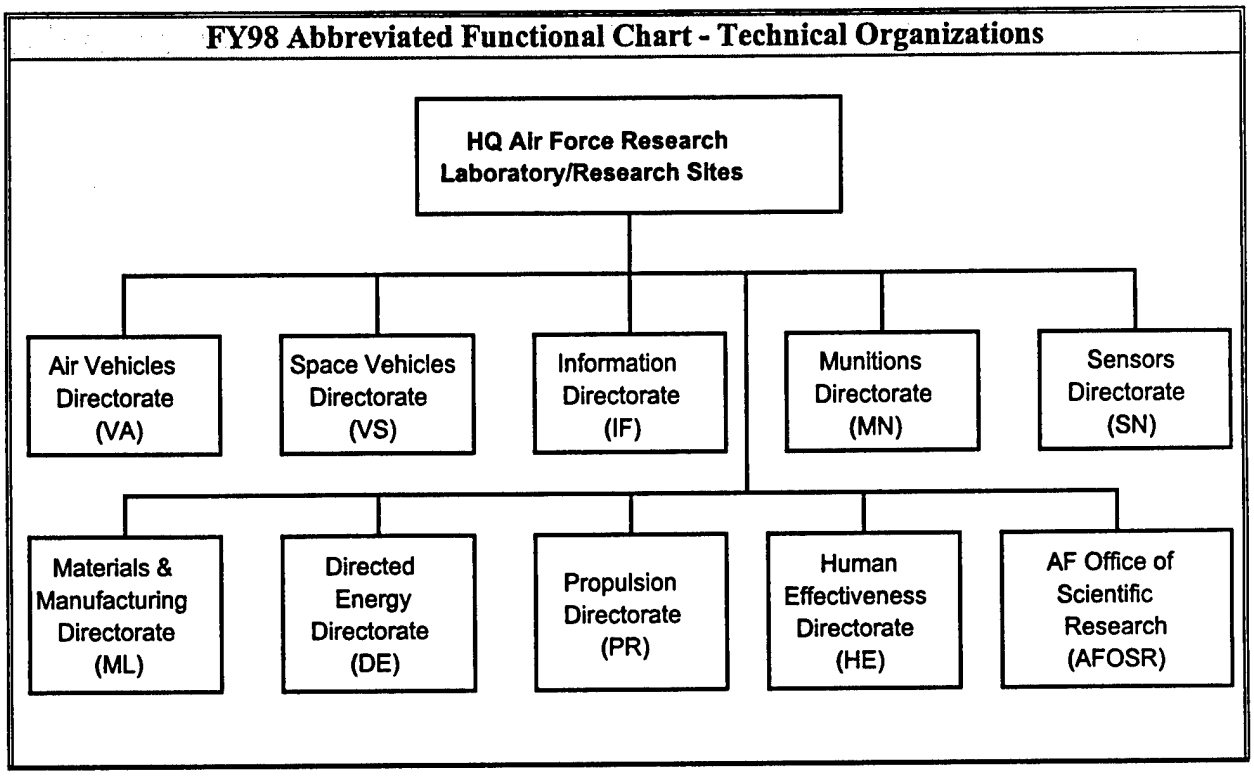
HQ Air Force Research Laboratory/Research Sites



HQ Air Force Research Laboratory/Research Sites
Wright-Patterson AFB, OH 45433-7131
(937) 904-9000

Commander: Major General Richard R. Paul
Executive Director: Dr. Donald C. Daniel

MISSION

To lead the discovery, development, and timely transition of affordable, integrated technologies that keep our Air Force the best in the world.

CURRENT IMPORTANT PROGRAMS

The Air Force Research Laboratory has taken a bold new step to respond to the needs of the Air Force and DoD by integrating its major technology programs across directorates, in the form of **Integrated Technology Thrusts (ITTs)**. The ITTs are groupings of related high visibility programs that provide a top-level means of characterizing the Air Force's portfolio of customer focused programs.

The goal of the **Aircraft Sustainment ITT** is to provide technologies to reduce aircraft sustainment costs, while increasing force readiness. Achieving this goal should free monies for badly needed force modernization.

The **Information Dominance ITT** will develop technologies to collect, control, exploit, and defend information while denying an adversary the ability to do the same.

The goal of the **Precision Strike ITT** is to develop and demonstrate the enabling technologies required for swiftly locating, striking and destroying targets throughout the globe. Each of the Precision Strike ITT programs address dramatic improvements in warfighting platforms in the areas of platform warfare, propulsion, information exploitation, survivability, precision targeting, and lethality.

The goal of the **Space Superiority ITT** is to advocate AFRL technologies supporting fielded and future system operations in or through the space environment. The ITT develops, advocates, documents and maintains a "Space systems technology portfolio" and investment strategy that is orchestrated across all AFRL technology directorates.

The **Agile Combat Support ITT** will provide improved capability to prepare and rapidly deploy responsive and tailored forces in support of multiple flexible deterrent options. The Expeditionary Air Force, (EAF) concept mandates a force that is "light, lean and lethal" (CSAF). Being lean means using Agile Combat Support to operate out of austere locations with minimal resupply.

The **Training for Warfighting ITT** will provide a capability to "Train the Way we Fight" through a distributed training and warfighting decision making environment. The primary long-term goal of the Training for Warfighting ITT is to provide warfighting decision-making training and operational decision-making support by merging operations and training into common, seamless, global aerospace power structure.

Technology Transfer: Located in the Air Force Research Laboratory, Wright-Patterson AFB, Ohio, the Air Force Technology Transfer Program was created to assure all Air Force science and engineering activities promote the transfer or exchange of technology with state and local government and the private sector. These activities enhance the economic competitiveness of industry and promote the productivity of state and local governments while leveraging the Department of Defense (DoD) research and development investment. The end result is a strong industrial base the Air Force and DoD can utilize to supply their needs.

HQ Air Force Research Laboratory/Research Sites
Wright-Patterson AFB, OH 45433-7131
(937) 904-9000

Commander: Major General Richard R. Paul
Executive Director: Dr. Donald C. Daniel

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	0.000	N/A	N/A	0.000
6.1 Other	0.000	2.815	0.000	2.815
6.2	0.000	12.278	0.000	12.278
6.3	0.000	6.145	0.000	6.145
Subtotal (S&T)	**0.000**	**21.238**	**0.000**	**21.238**
6.4	0.000	0.000	0.000	0.000
6.5	0.000	0.000	0.000	0.000
6.6	0.000	0.000	0.000	0.000
6.7	0.000	0.000	0.000	0.000
Non-DOD	0.000	0.000	0.000	0.000
TOTAL RDT&E	**0.000**	**21.238**	**0.000**	**21.238**
Procurement	0.000	N/A	0.000	0.000
Operations & Maintenance	0.000	N/A	0.000	0.000
Other	0.000	N/A	0.000	0.000
TOTAL FUNDING	**0.000**	**21.238**	**0.000**	**21.238**

MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	**END STRENGTH**
TYPE	**DOCTORATES**	**OTHER**		
MILITARY	8	57	69	134
CIVILIAN	13	83	112	208
TOTAL	**21**	**140**	**181**	**342**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	0.000	**REAL PROPERTY**	1.840
ADMIN	49.000	* NEW CAPITAL EQUIPMENT	0.000
OTHER	0.000	**EQUIPMENT**	1.241
TOTAL	**49.000**	* NEW SCIENTIFIC & ENG. EQUIP.	0.000
ACRES	1	* Subset of previous category.	

N/A - Not Applicable

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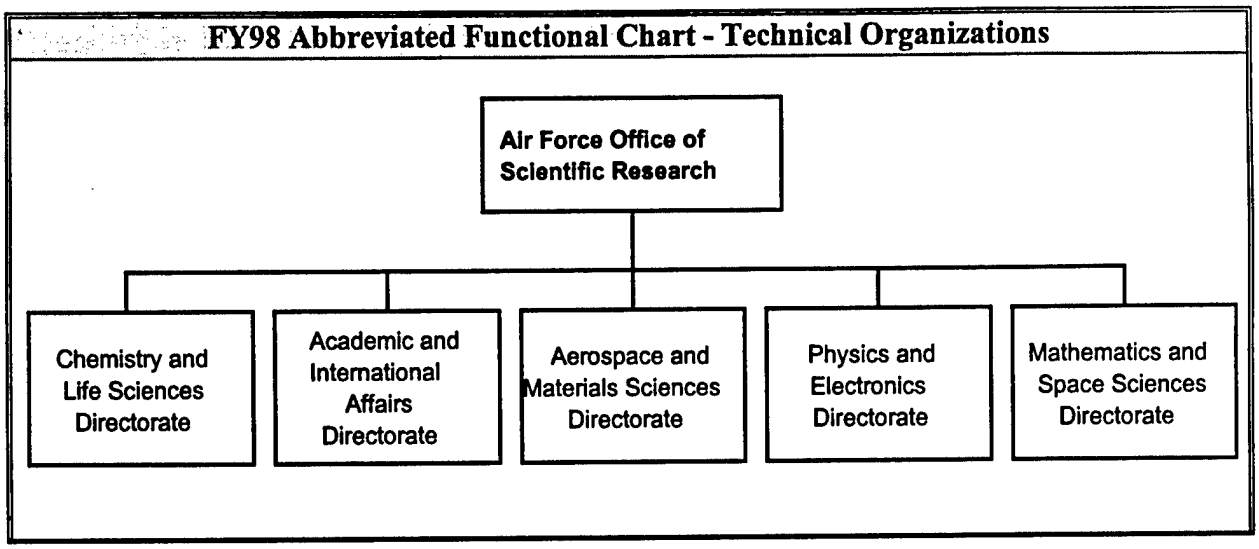
Air Force Office of Scientific Research



Air Force Office of Scientific Research
Arlington, VA 22203-1977
(703) 696-7796

Director: Dr. Joseph F. Janni
Commander: Col Robert L. Herklotz

MISSION

AFOSR manages all Air Force basic research. Plans, coordinates, and executes the Air Force Research Laboratory's (AFRL) basic research program in response to technical guidance from AFRL and requirements of Air Force. Fosters, supports, and conducts research within Air Force, university, and industry laboratories. Ensures transition of research results to support USAF needs.

CURRENT IMPORTANT PROGRAMS

The AFOSR research program is responsible for funding broad-based scientific and engineering basic research in technologies critical to the Air Force mission. These technologies include aerospace structures, aerodynamics, materials, propulsion, power, electronics, computer science, directed energy, conventional weapons, life sciences, and atmospheric and space sciences. All projects are coordinated through the Reliance process to harmonize efforts, eliminate duplication, and ensure the most effective use of funds. All technology areas are subject to long-range research planning and technical review by tri-Service scientific planning groups that interface and support the Defense Technology Area Planning process. The AFOSR basic research program is divided into the following twelve scientific projects and one educational project:

PROJECT	TITLE
2301	Physics
2302	Solid Mechanics and Structures
2303	Chemistry
2304	Mathematical and Computer Sciences
2305	Electronics
2306	Structural Materials
2307	Fluid Mechanics
2308	Propulsion
2310	Atmospheric Sciences
2311	Space Sciences
2312	Biological Sciences
2313	Human Performance
4113	Science and Engineering Education Program

2301 Physics: This project provides the fundamental knowledge required to conceptualize and develop new Air Force weapons and also establishes the basis for many technologies critical to the Air Force. Research in physics has an impact on electromagnetic countermeasures, nuclear weapons effects, communications, and non-destructive and non-intrusive testing and analysis, as well as new materials development. Other technologies affected include avionics, laser technology, and propulsion research. The primary areas of research supported by this project are Photonic Physics, Optics, Plasma Physics, and Atomic and Molecular Physics.

2302 Solid Mechanics and Structures: This project seeks to develop a fundamental understanding of the behavior of aerospace materials, structures, and supporting facilities, leading to cost-effective development and safe and reliable operation of superior weapons and defensive systems. Research includes such diverse topics as the micromechanical design of advanced materials, modeling and simulation of the dynamic behavior of aircraft, missiles, and large space structures, and technology

CURRENT IMPORTANT PROGRAMS (continued)

integration for the performance and survivability enhancement of these systems. This research will result in expanding the fundamental knowledge base to better understand the mechanics of deformation and damage of aerospace materials and structures. Also, this research will lead to an improved understanding of the aeroelastic and acoustic behavior of airframe and engine structures, and the dynamic behavior of launch vehicles and space structures.

2303 Chemistry: In the chemistry research program, knowledge and understanding is sought in chemical synthesis and reactivity, polymer chemistry, surface science, and molecular dynamics. The focus is on building the knowledge base required to develop new materials and to improve the synthesis of existing materials. Specific research focus areas include functional and structural materials, electronic and photonic materials, biomimetic materials, electromagnetic and conventional weaponry, propellants, and environmentally safer materials. This program conducts novel synthesis and characterization of higher performance and lower cost nonmetallic and biomimetic materials for application as infrared sensors, and safer, more efficient fire suppressants and deicer/anti-ice materials, and mechanistic studies of biological corrosion and semiconductor nanolithography. The chemistry program also investigates effects of chemical and morphological structures on functional and mechanical properties of polymeric materials. The program also explores atomic and molecular surface interactions that can limit performance of electronic devices, compact power sources, and lubricant materials, and investigates molecular energy release mechanisms and energy storage in metastable molecular systems to foster advances in laser weapons development and new chemical propellants.

2304 Mathematical and Computer Sciences: This research focuses on mathematical modeling, simulation, and control of complex systems and provides analytical and computational methods. Topics include: effective utilization of high-performance computers; control of aerospace systems; models and computational tools for the design of aircraft, missiles, or other weapons; efficient production of large-scale, well documented computer programs and software; communication and information theory; signal processing; artificial intelligence in surveillance systems or independent weapons; reliability and maintainability; and the allocation of resources in logistics or operational activities using ideas from optimization and linear programming theories.

2305 Electronics: Research in this project emphasizes electronic devices and systems that enable new Air Force capabilities such as battle information management systems, countermeasures, sensors, and the more electric aircraft concept. The goals are to increase the data and information processing speed of electronic systems, to firmly control their complexity and reliability, and to improve the security and reliability of information and data transmission. Research is conducted in electronic processes which will enable the engineer to model and predict performance of electronic materials, devices, and systems for high-speed digital and analog signal processing, microwave and millimeter wave signal and power generation, superconducting, optical signal processing, and radiation effects.

2306 Structural Materials: Research focuses on metallic, polymeric, ceramic, and nonmetallic structural materials. Materials research provides the knowledge for improving the performance, cost, and reliability of structural materials. Structural materials research studies a broad range of material properties such as strength, toughness, fatigue resistance, and corrosion resistance of airframe, turbine engine, and spacecraft materials. Emphasis is on refractory alloys, intermetallics, polymer composites, metal and ceramic matrix composites, and advanced ceramics, such as alumina, silicon carbide, silicon nitride, and carbon/carbon. Research in new processing methods complements research on materials properties. Direct goals of this program are to increase the operating temperature of engine materials which will further increase thrust-to-weight ratio of engines, develop improved aerospace vehicle structural materials, and control or eliminate advance material reliability issues related to high temperature strength, toughness, fatigue, and environmental conditions.

2307 Fluid Mechanics: Research involves turbulence prediction and control, unsteady and separated flows, hypersonics, and internal fluid dynamics. This research provides fundamental knowledge, tools, data, concepts, and methods for improving the efficiency, effectiveness, and reliability of aerospace vehicles. Research provides an understanding of key fluid flow phenomena, improves theoretical models for aerodynamic prediction and design, and originates flow control concepts and predictive methods to

CURRENT IMPORTANT PROGRAMS (continued)

expand current flight performance boundaries. Research includes the development of computational methods for complex flows, prediction of real gas effects in high-speed flight, control and prediction of turbulence in flight vehicles, propulsion systems, aero-optic applications, the dynamics of unsteady and separated flows, thrust vectoring and high lift concepts associated with enhanced performance and maneuverability, heat transfer and compressor instabilities in gas turbine engines, flow-structure interactions in both external and internal flows, and transport phenomena in structural materials processing.

2308 Propulsion: Efforts include space power and propulsion, airbreathing propulsion, and propulsion diagnostics. Research is focused on the efficient utilization of energy in airbreathing engines and chemical and non-chemical rockets. Research is organized into the areas of chemically reacting flow, non-chemical energetics. Chemically reacting flows involve complex coupling between energy release through chemical reaction and the flow processes which transport chemical reactants, products, and energy. Non-chemical energetic systems include plasma and beamed energy propulsion for orbit raising space missions and efficient ultra-high energy techniques for space-based energy utilization. Thermal management of space-based power and propulsion systems will be addressed.

2310 Atmospheric Sciences: Areas of emphasis include ionospheric research and meteorology. This research includes the physics, dynamics, and chemistry of processes that determine the structure and variability of the earth's atmosphere. Atmospheric properties such as wind, density, clouds and precipitation, ionization, and optical/infrared (IR) transmission/emissivity all affect the performance of Air Force systems. Research includes new measurement techniques and the development of models for specifying and predicting weather and other atmospheric conditions. Emphasis is placed on understanding fundamental atmospheric processes and their impacts on optical and IR weapon systems, and on understanding the dynamics and structure of the ionosphere that affect communications and surveillance systems. Major research efforts focus on ionospheric dynamics, mesoscale meteorology, triggered and natural lightning, cloud prediction, and models which define the optical structure of the atmosphere.

2311 Space Sciences: The objective of this project is to provide basic knowledge of the space environment and solar activity for the design and calibration of advanced Air Force systems relevant to operations in and through near-Earth space. The project also supports the Air Weather Service (AWS) by improving observing and forecasting techniques that support operational military systems in space environments. Theoretical and empirical descriptions and models of the physics of the sun and the earth's magnetosphere, which are critical elements of future AWS prediction models and radiation belt codes, are being investigated.

2312 Biological Sciences: This project consists of two research areas: biodegradation and the toxicology of biohazards; and chronobiology and neural adaptation. Understanding how microbes degrade Air Force chemicals will enable the development of efficient and cost-effective strategies for cleaning up Air Force bases and preventing exposure to hazards due to Air Force operations. Likewise, knowledge of the mechanisms by which Air Force chemical and physical (lasers and microwaves) agents produce toxic effects will enable the development of safety assessment strategies and technologies to ensure the hazard-free development and use of future aerospace materials and systems. Basic research in neuroscience and chronobiology will result in new strategies to prevent G-induced loss of consciousness in pilots, impaired performance due to jet-lag and shift-work, night operations, and the loss of life and aircraft due to stress, inattention, or lack of vigilance.

2313 Human Performance: This project provides fundamental knowledge of information processing in humans and other complex organisms needed to advance technologies for autonomous systems, command and control, human systems integration, and personnel selection and training. Research on sensory systems impacts technologies of computer image and speech processing, human interface, sensors, and sensor fusion. Research on cognitive and perceptual processes impacts technologies of selection, education and training, command and control, and adaptive autonomous systems. Supported areas of research include sensory systems, with emphasis on: vision and hearing; Cognition, Perception, and Intelligent Tutors; and Team Situational Awareness.

CURRENT IMPORTANT PROGRAMS (continued)

4113 Science and Engineering Education Program: This project stimulates scientific and engineering education and increases the interaction between the broader research community (including the international research community) and the Air Force laboratories. Emphasis is placed on increasing the number of U.S. citizens, especially women and minorities, with advanced degrees in science and engineering. These programs include: the Summer Faculty Research Program under which selected university faculty members conduct research at Air Force labs; the Graduate Student Research Program where graduate students in areas of interest to the Air Force perform research at Air Force labs; the University Resident Research Program where faculty members spend one year at an Air Force lab contributing to Air Force research needs and operations; the U.S. Air Force National Research Council (NRC) Resident Research Associateship Program which provides outstanding post-doctoral and senior scientists and engineers opportunities to research problems of their own choice that are compatible with the research interests of selected Air Force labs; the Laboratory Graduate Fellowship Program which is designed to stimulate doctoral candidate interest in Air Force labs and the research programs of those labs; and the National Defense Science and Engineering Graduate Fellowship Program which is jointly sponsored by the Army, Navy, Air Force, and the Defense Advanced Research Projects Agency for the purpose of increasing the number of U.S. citizens trained in science and engineering, and various international programs such as Windows on Science which provides insight and experience in international research.

EQUIPMENT/FACILITIES

Primary operating location is Arlington, VA. Overseas Detachments are maintained in London, UK, and Tokyo, Japan.

Air Force Office of Scientific Research
Arlington, VA 22203-1977
(703) 696-7796

Director: Dr. Joseph F. Janni
Commander: Col Robert L. Herklotz

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	0.000	N/A	N/A	0.000
6.1 Other	0.000	58.594	172.516	231.110
6.2	0.000	0.000	0.000	0.000
6.3	0.000	0.000	0.000	0.000
Subtotal (S&T)	**0.000**	**58.594**	**172.516**	**231.110**
6.4	0.000	0.000	0.000	0.000
6.5	0.000	0.000	0.000	0.000
6.6	0.000	0.000	0.000	0.000
6.7	0.000	0.000	0.000	0.000
Non-DOD	0.000	0.000	0.000	0.000
TOTAL RDT&E	**0.000**	**58.594**	**172.516**	**231.110**
Procurement	0.000	N/A	0.000	0.000
Operations & Maintenance	0.000	N/A	0.000	0.000
Other	0.000	N/A	0.000	0.000
TOTAL FUNDING	**0.000**	**58.594**	**172.516**	**231.110**

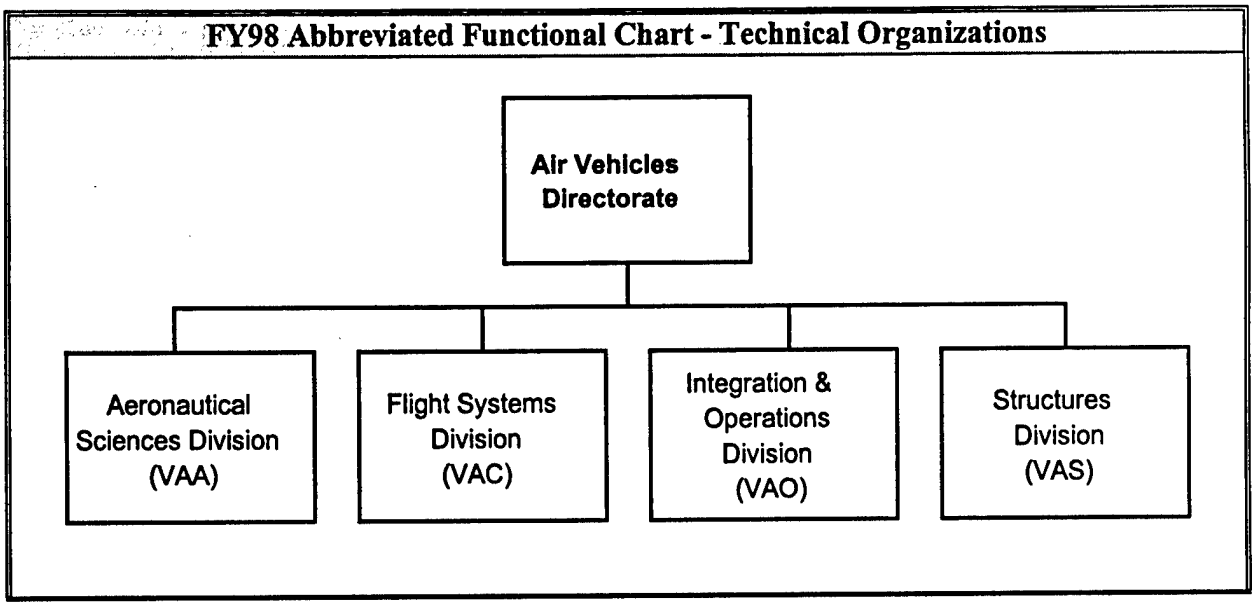
MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	**END STRENGTH**
TYPE	**DOCTORATES**	**OTHER**		
MILITARY	17	0	8	25
CIVILIAN	30	7	62	99
TOTAL	**47**	**7**	**70**	**124**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	0.000	**REAL PROPERTY**	0.000
ADMIN	25.250	* NEW CAPITAL EQUIPMENT	0.000
OTHER	0.000	**EQUIPMENT**	0.000
TOTAL	**25.250**	* NEW SCIENTIFIC & ENG. EQUIP.	0.000
ACRES	**0**	* Subset of previous category.	

N/A - Not Applicable

Air Vehicles Directorate



Air Vehicles Directorate
Wright-Patterson AFB, OH 45433-7542
(937) 255-4012

Director: Colonel Robert J. Wood
Deputy Director: Dr. William Borger

MISSION

As the Department of Defense leader in the development and integration of Fixed Wing Air Vehicle Technologies, the Air Vehicles Directorate understands the operational environment of warfighters and focuses resources to:

(a) Demonstrate affordable and supportable options to improve capabilities in current Fixed Wing Air Vehicles
(b) Deliver revolutionary Fixed Wing Air Vehicle Technologies for a new warfighting capability

AERONAUTICAL SCIENCE DIVISION
The mission of the Aeronautical Sciences Division is to advance the state-of-the-art for air vehicle technology from subsonic through hypersonic flight by developing and demonstrating new innovative aeromechanics technologies for original and derivative military aircraft.

FLIGHT SYSTEMS DIVISION
The mission of the Flight Systems Division is to develop and demonstrate advanced flight control concepts, and to advance technology for flight vehicle equipment and subsystems, which contribute to an affordable combat advance for 21st century operational Air Force vehicles.

INTEGRATION AND OPERATIONS
The mission of the Integration Division is to integrate multi-discipline functional areas, such as aeromechanics, structures, flight control, crew systems, subsystems, propulsion, avionics, and weapons to maximize the payoff of the technologies on overall system performance and affordability.

STRUCTURES
The mission for the Structures Division is to plan, manage, and conduct research and development programs to solve critical structural problems on fixed-winged aerospace vehicles.

SUPPORT DIVISIONS
This includes the Contracting Division, The Financial Management Division, the Corporate Information Office, and the Corporate Development Office.

CURRENT IMPORTANT PROGRAMS

NF-16D Variable Stability In-Flight Simulator Test Aircraft (VISTA), YF-15B Advanced Control Technology for Integrated Vehicles (ACTIVE), Inhabited Air Vehicle Technology (IAV), Unihabited Air Vehicle (UAV) Technology, DARPA/USAF Strike Unmanned Combat Air Vehicle (UCAV) Program, Auto Ground Collision Avoidance System (GCAS), Advanced Fighter Technology Integration (AFTI) NF-16.

3-D Design Optimization, Aerostructural CFD, Fludic Injection Nozzle Technology, Advanced Compact Inlets, Inlet Aerostructural Integration LO External Carriage, Weapons Bay Active Flow Control, High L/D Technology, Continuous Moldline Technology.

Aircraft Battle Damage Repair, Thermal Energy Management, On-Board Fire Suppression Technology, Next Generation Transparency, Ballistic Impact Damage Prediction, Precision Aerial Delivery.

CURRENT IMPORTANT PROGRAMS (continued)

Flight Control Integrity, Control Automation Task Allocation, Reconfigurable Control for Tailless Fighters, Advanced Vehicle Management Technology, Control Concepts for Global Range, Innovative Control Effectors, Optical Air Data System, Electrically Powered Actuation Demonstration.

Bonded Composite Repairs, Widespread Fatigue Damage, Affordable Exhaust-Washed Structures, Conformal Load Bearing Antenna, Composite Affordability Initiative (CAI), Weapon Bay Acoustic Suppression, Multidisciplinary Design and Analysis Methods.

EQUIPMENT/FACILITIES

F-16 Variable Stability In-Flight Simulator Test Aircraft (VISTA) and the **Total In-Flight Simulator (TIFS) Test Aircraft.**

LAMARS - Large Amplitude Multimode Aerospace Simulator, a one-of-a-kind 20' diameter motion base simulator dome providing large amplitude, high fidelity, five degree-of-freedom motion simulation.

Flight Control Actuation Systems Facility - Only US facility with test rig that can evaluate linear actuators under static and dynamic (high - bandwidth - up to 100 Hz) loads up to 100,000 pounds. Unmanned Research Vehicle Facility - Two unmanned research air vehicles (14' and 18' wingspan) with flexible control laws for flight control validation.

Landing Gear Development Facility - Advanced aircraft tire testing capability including realistic tread wear test, dynamic stability testing of integrated nose and main dear assemblies at representative takeoff and landing load/speed conditions.

Aircraft Survivability Research Facility - Supports the research and development of combat survivable systems. Used to study ballistic survivability/vulnerability on full-scale test program and large scale research programs for technology/development. Capable of airflow's up to 550 knots, threats up to 57mm, and structural loads up to 6 g's. Center of Expertise for congressionally mandated Live Fire Test (LFT).

Aircraft Engine Nacelle Test Facility - A ground test facility designed to simulate the fire hazards with exist in the compartment surrounding an aircraft engine. Research and development utilizes fueled and non-fueled test conditions for full-scale survivability/vulnerability analysis and technology development. Center of Expertise for the Halon 1301 Replacement Program for Aviation.

Munitions and Pyrotechnics Materials Fire Suppression Test Facility - World's only facility for testing fire suppression concepts for presenting conflagration of munitions and related energetic materials; this hardened facility contains high-speed video and data analysis capability.

Full-Scale Aircraft Fire Fighting Test Facility - One-of-a-kind facility used for agent and equipment testing under virtually all fire suppression and mitigation scenarios; fully instrumented, multiple variety wide-body aircraft model mockup in 100 diameter fire pit. Simulates dry tarmac fires.

EQUIPMENT/FACILITIES (continued)

Hydrogen Test Facility - Specifically designed to experimentally simulate the thermal environment of airframe and engine hydrogen actively cooled structures or small cryogenic tankage. Fluids available include both hydrogen and helium. Heat source provided by a plasma arc heater, which provides an impinged heat flux up to 2000 BTU/FT2/Sec.

Fatigue and Fracture Extreme Environment Facility - Provides combined thermal/mechanical fatigue testing under controlled temperatures from -200 to 2200F. Altitudes may be simulated from sea level to 150,000 ft with flexibility to simultaneously mix up to four separate gases. Specimens up to 4 inches wide including complex structural joints may be tested.

Combined Environment Acoustic Chamber - conducts high temperature acoustic response and fatigue testing of structural components. The facility can produce a heat flux of 50 BTU/Ft2/Sec in 170 dB overall sound pressure level creating temperatures as high as 2500F. Test specimen up to 4 x 10 feet may be accomplished.

Large Acoustic Test Facility - Used to conduct fatigue testing of aerospace structures and components. The test chamber is 20 x 56 ft and could be configured to test full-scale aerospace vehicles and components in a reverberate of anechoic mode.

Vertical Wind Tunnel (VWT) - features the capability, unique to US, of simultaneous acquisition of both rotary balance and forced oscillation wind tunnel data using the same model. This capability enables researchers to efficiently acquire both sets of dynamic data, crucial to the study of aircraft control under extreme maneuvering conditions, with one test entry. Current research is exploring the potential of combining the two motions to simulate more flight representative motions of highly agile aircraft.

Subsonic Aerodynamic Research Laboratory (SARL) - unique in the US for its (1) extremely low (<0.1%) test section turbulence levels achieved by a large, 36:1 contraction ratio coupled with a honey comb and six fine mesh screens, its (2) max viewing area (55% of test section walls are transparent) to enable unique non-intrusive advanced diagnostic flow visualization, its (3) high model attitude (-5/+45 degree angle of attack, -10/+10 degree angle of yaw, -185/+185 degree angle of roll) coupled with (4) high aerodynamic load capability (8000, 2200 and 1000 pound normal, axial and side force respectively).

Air Vehicles Directorate
Wright-Patterson AFB, OH 45433-7542
(937) 255-4012

Director: Colonel Robert J. Wood
Deputy Director: Dr. William Borger

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	0.069	N/A	N/A	0.069
6.1 Other	2.665	0.115	0.460	3.240
6.2	37.808	1.217	14.579	53.604
6.3	2.004	0.176	14.062	16.242
Subtotal (S&T)	**42.546**	**1.508**	**29.101**	**73.155**
6.4	0.767	0.010	4.833	5.610
6.5	1.096	0.052	10.479	11.627
6.6	0.000	0.000	0.000	0.000
6.7	0.000	0.000	0.000	0.000
Non-DOD	0.000	0.000	0.000	0.000
TOTAL RDT&E	**44.409**	**1.570**	**44.413**	**90.392**
Procurement	0.000	N/A	0.000	0.000
Operations & Maintenance	5.020	N/A	0.000	5.020
Other	26.849	N/A	0.000	26.849
TOTAL FUNDING	**76.278**	**1.570**	**44.413**	**122.261**

MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	**END STRENGTH**
TYPE	**DOCTORATES**	**OTHER**		
MILITARY	6	14	18	38
CIVILIAN	46	96	240	382
TOTAL	**52**	**110**	**258**	**420**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	923.600	**REAL PROPERTY**	242.356
ADMIN	52.300	* NEW CAPITAL EQUIPMENT	0.000
OTHER	217.800	**EQUIPMENT**	1,107.415
TOTAL	**1,193.700**	* NEW SCIENTIFIC & ENG. EQUIP.	0.000
ACRES	**25**	* Subset of previous category.	

N/A - Not Applicable

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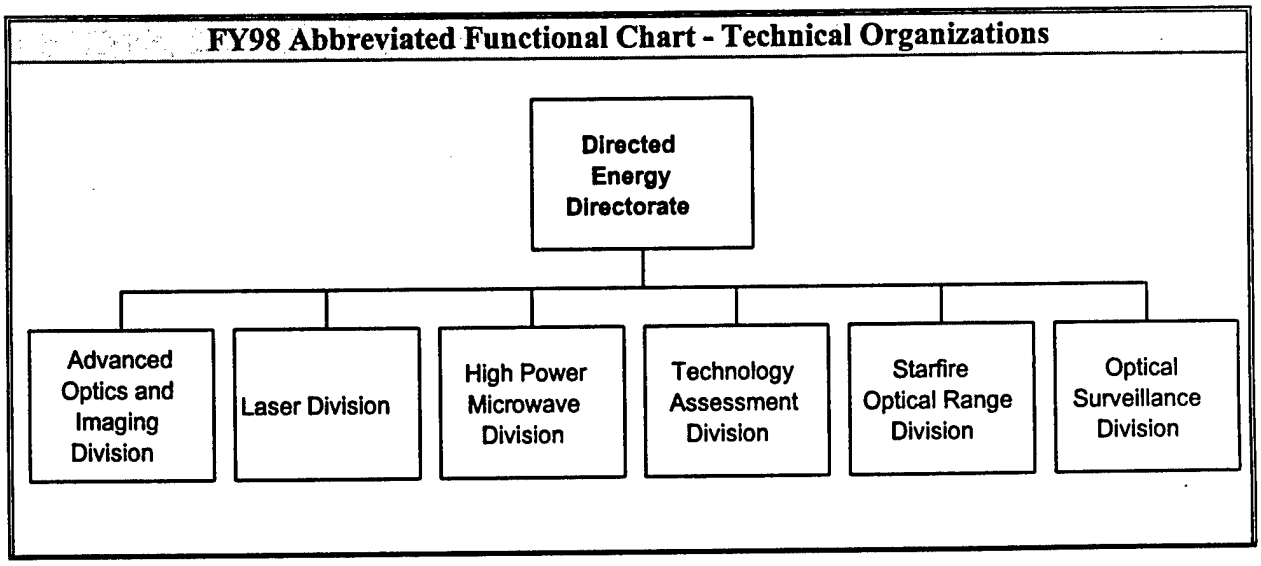
Directed Energy Directorate



Directed Energy Directorate
Kirtland AFB, NM 87117-5776
(505) 846-0241

Director: Dr. R. Earl Good
Deputy Director: Col. Douglas Beason

MISSION

The mission of the Directed Energy Directorate is to develop, integrate, and transition science and technology for Directed Energy to include high power microwaves, lasers, adaptive optics, imaging and effects to assure the preeminence of U.S. in air and space.

CURRENT IMPORTANT PROGRAMS

Laser Technology establishes the feasibility and payoff of lasers in advanced weapon, communication, illumination, and optical counter-measure applications. Development efforts continue to address the concerns of scaling to high power, good beam quality, and high efficiency, but have recently included increased emphasis on suitability for specific classes of applications and operational environments, with additional emphasis on operation in specific wavelength bands, packaging for minimum weight and volume and affordability and reliability in real weapon system applications.

Beam Control Technology involves the development and transition of advanced optical systems for laser propagation and high resolution imaging applications. This includes technologies for adaptive optics, highly-accurate target acquisition and tracking, precision beam pointing for aimpoint control, and high quality optical components.

Advanced Optics and Imaging Technology involves the development and transition of multi-spectral sensing and image processing technologies for high resolution imaging applications. This technology takes advantage of adaptive optics and target acquisition/tracking technologies developed under the Beam Control technology to produce a compensated, stabilized image which can then be further improved with advanced imaging sensors and post-processing of the image. Advanced concepts which can reconstruct images from interferometric or speckle data are also being pursued.

HPM RF Technology develops and demonstrates high-powered microwave (HPM) technology to disrupt, degrade, and destroy electronics in communication and information systems to support command and control information warfare missions. Adversaries will be denied use of electronic information processing and communications systems by using high-peak (damage) and high-average (disruption) power wideband sources packaged for an air-deliverable bomb, submunition, man-portable device or unmanned aerial vehicle (UAV). Nonlethal or lethal technology will initially concentrate on man-portable (short-range) or heavy transportable weapons and SEAD applications, followed by airborne weapons on UAVs or as submunitions, as prioritized by user needs and technical maturity.

Two major studies are helping to guide our future directions in applications and technology investments:

(1) **LASSOS** is comprised to identify, evaluate, and cost promising weapon and non-weapon mission applications for the warfighter that can best be accomplished using laser beams in, from, or through space.
(2) **DE ATAC** study objective is to identify, develop, and evaluate promising airborne tactical applications using directed energy technology that is prioritized, high payoff concepts and applications.

EQUIPMENT/FACILITIES

The primary operating location for the Directed Energy Directorate is at Kirtland AFB, NM. Unique facilities include the High Energy Research and Technology Facility, High Energy Microwave Laboratory, High Energy Plasma Laboratory, Starfire Optical Range, Chemical Laser Facility (COIL), and underground tunnels in the Manzano Weapons Storage Area.

Directed Energy Directorate
Kirtland AFB, NM 87117-5776
(505) 846-0241

Director: Dr. R. Earl Good
Deputy Director: Col. Douglas Beason

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	IN-HOUSE	IN-HOUSE MANAGEMENT	OUT-OF-HOUSE	TOTAL
RDT&E:				
6.1 ILIR	0.000	N/A	N/A	0.000
6.1 Other	2.106	0.122	2.360	4.588
6.2	3.740	7.906	16.390	28.036
6.3	3.718	1.658	44.865	50.241
Subtotal (S&T)	**9.564**	**9.686**	**63.615**	**82.865**
6.4	0.000	0.000	0.000	0.000
6.5	0.000	0.043	13.022	13.065
6.6	0.000	0.000	0.000	0.000
6.7	0.000	0.000	0.000	0.000
Non-DOD	0.264	0.106	2.848	3.218
TOTAL RDT&E	**9.828**	**9.835**	**79.485**	**99.148**
Procurement	0.000	N/A	0.000	0.000
Operations & Maintenance	1.080	N/A	0.000	1.080
Other	4.917	N/A	62.806	67.723
TOTAL FUNDING	**15.825**	**9.835**	**142.291**	**167.951**

MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		TECHNICAL SUPPORT & OTHER PERSONNEL	END STRENGTH
TYPE	DOCTORATES	OTHER		
MILITARY	30	80	101	211
CIVILIAN	83	92	225	400
TOTAL	**113**	**172**	**326**	**611**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		PROPERTY ACQUISITION COST (MILLIONS $)	
LAB	503.000	REAL PROPERTY	65.000
ADMIN	108.000	* NEW CAPITAL EQUIPMENT	0.000
OTHER	46.000	EQUIPMENT	30.269
TOTAL	**657.000**	* NEW SCIENTIFIC & ENG. EQUIP.	9.700
ACRES	**4,325**	* Subset of previous category.	

N/A - Not Applicable

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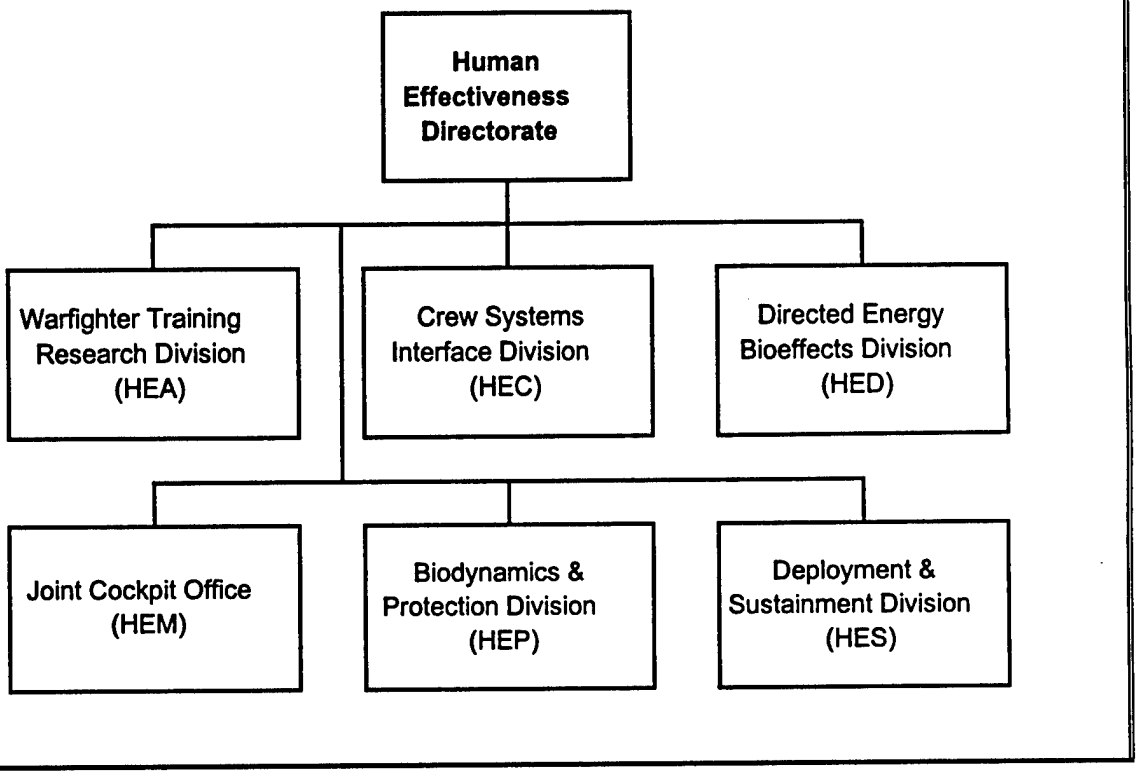
Human Effectiveness Directorate

FY98 Abbreviated Functional Chart - Technical Organizations



Human Effectiveness Directorate
Wright-Patterson AFB, OH 45433-7901
(937) 255-2683

Director: James W. Brinkley
Deputy Director: Lt Col Robin R. Taylor

MISSION

Develop, integrate, demonstrate, and transition affordable science and technology products for training personnel, protecting and sustaining the crew member, and improving human interfaces with weapon systems to assure the preeminence of US air and space forces.

CURRENT IMPORTANT PROGRAMS

Human Effectiveness Technology Area - The Human Effectiveness technology area is divided into four thrusts:

Crew System Interface Thrust: This thrust strives to improve effectiveness of crew systems by matching characteristics of information display and system control to the performance, capabilities, and limitations of the warfighter. The Crew System Interface thrust is presently investigating high risk, high payoff technologies that enhance system effectiveness, warfighter operability, and affordability; human performance models, metrics, design tools and simulation testbeds; and proof-of-concept solutions to warfighting deficiencies.

Warfighter Training Thrust: The Warfighter Training thrust researches, develops, demonstrates, evaluates, and transitions technologies and methods that train the warfighter. The best way to train is to "Train the way we intend to fight". By investigating warfighter training effectiveness, distributed mission training technologies, and night vision device training technologies, we will be able to create on demand, affordable, realistic training environments for the warfighter.

Bioeffects and Protection Thrust: This thrust predicts and mitigates bioeffects of directed energy on the warfighter and mission performance. It defines human responses to impact, sustained acceleration, vibration, altitude, and noise. Under the protection part of this thrust, it provides human systems criteria for emergency escape systems and crash protection. Current focus is on biophysics of directed energy, interaction with tissues and organisms, development, interpretation, and applications of directed energy guidelines, relationships of normal and altered mammalian functioning to mission performance, communicating operational impact of human performance to operators, planners and weapon system designers.

Deployment and Sustainment Thrust: The purpose of this thrust is to assure the effectiveness, and sustainability of personnel, systems, and information exposed to the forces and stressors of operational environments. This thrust is presently investigating human response to toxic compounds and materials in operational environments, tools to assess the chemical environment threat, and technologies for logistics readiness and sustainability.

EQUIPMENT/FACILITIES

The Air Force Research Laboratory Human Effectiveness Directorate conducts S&T at Wright-Patterson AFB OH, Brooks AFB TX, and Mesa AZ. Equipment and facilities include: Two human centrifuges, a high on-set rate centrifuge located at Brooks AFB and a multi-axis centrifuge located at Wright-Patterson AFB; hypobaric chambers with capability to simulate high altitude subzero conditions; anechoic chambers for study of human and noise interactions; "virtual worlds" for systems training research; inhalation toxicology chambers; directed energy laboratory to research bioeffects of lasers and RF radiation; human isolation facility for controlled study of group dynamics in simulated air operations; a TEMPEST secure facility with simulators for EW research and training; and a facility for testing subjects (mostly new recruits) in S&T of computer automated training and force management tools.

Human Effectiveness Directorate
Wright-Patterson AFB, OH 45433-7901
(937) 255-2683

Director: James W. Brinkley
Deputy Director: Lt Col Robin R. Taylor

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	0.000	N/A	N/A	0.000
6.1 Other	0.738	0.450	6.570	7.758
6.2	34.657	3.340	29.173	67.170
6.3	1.406	3.150	44.990	49.546
Subtotal (S&T)	**36.801**	**6.940**	**80.733**	**124.474**
6.4	0.004	0.030	6.096	6.130
6.5	0.090	0.040	20.930	21.060
6.6	0.000	0.000	0.000	0.000
6.7	0.000	0.000	0.000	0.000
Non-DOD	1.272	0.000	1.039	2.311
TOTAL RDT&E	**38.167**	**7.010**	**108.798**	**153.975**
Procurement	0.000	N/A	0.000	0.000
Operations & Maintenance	0.000	N/A	0.000	0.000
Other	2.645	N/A	25.261	27.906
TOTAL FUNDING	**40.812**	**7.010**	**134.059**	**181.881**

MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	
TYPE	**DOCTORATES**	**OTHER**		**END STRENGTH**
MILITARY	16	84	191	291
CIVILIAN	106	106	189	401
TOTAL	**122**	**190**	**380**	**692**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	559.200	**REAL PROPERTY**	84.971
ADMIN	340.400	* NEW CAPITAL EQUIPMENT	1.045
OTHER	70.900	**EQUIPMENT**	83.880
TOTAL	**970.500**	* NEW SCIENTIFIC & ENG. EQUIP.	2.286
ACRES	**18**	* Subset of previous category.	

N/A - Not Applicable

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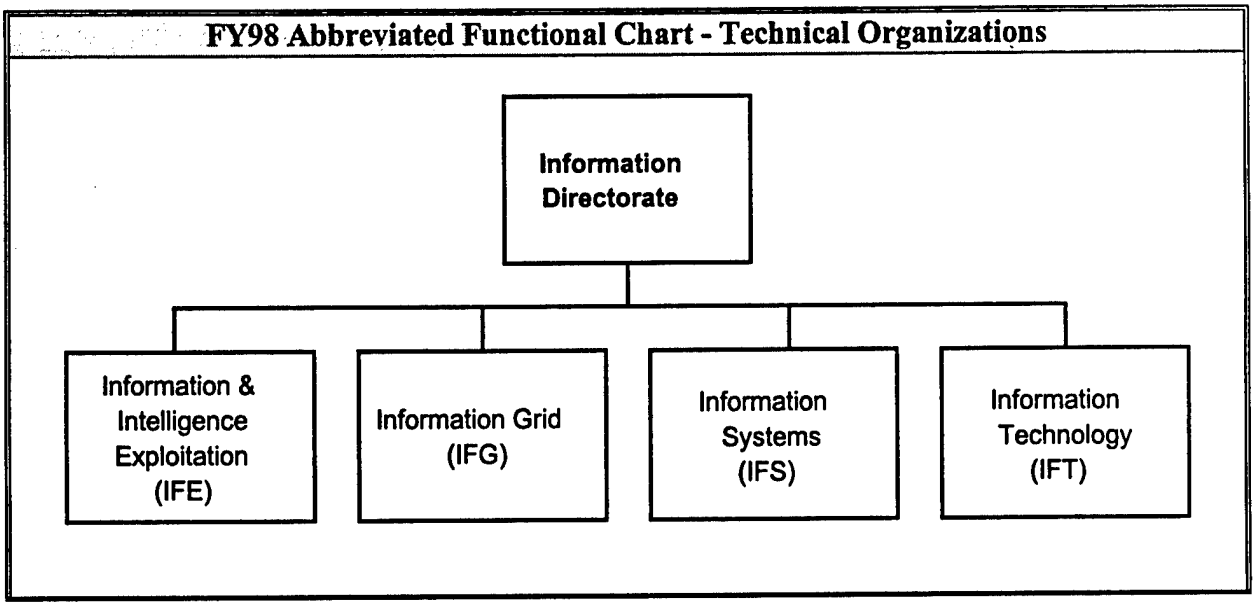
Information Directorate



Information Directorate
Rome, NY 13441-4514
(315) 330-7701

Director: Mr. Raymond Urtz
Deputy Director: Col John Bedford

MISSION

The mission of the Information Directorate is the advancement and application of information systems science and technology for Information Dominance and its transition to air, space and ground systems to meet customer needs. The Directorate's areas of investigation include a broad spectrum of information science and technology disciplines including fusion, communication, collaborative environments, design, modeling and simulation, defensive information warfare, and intelligent information systems architectures and technologies.

CURRENT IMPORTANT PROGRAMS

The following are some of the important programs on which the laboratory is working: Consistent Battlespace Picture; Dynamic Command and Control; Global Grid; Configurable Aerospace Command Center; Real Time Sensor-to-Shooter Operations; Defensive Information Warfare; Offboard Augmented Theater Surveillance and High Performance Computing for Joint STARS; Intelligence Data Handling; Information For The Warrior; Secure Survivable Communications; SPEAKeasy Program; Low Data Rate Reachback from Airborne Platforms; ARPA/Rome Lab Planning Initiative; Imagery Product Archive; Force Level Execution; Integrated Sensor System; VHDL Design Environment for Legacy Electronics; Signal Exploitation & Hostile Target Identification; Timeline Analysis System; Artificial Intelligence; Speech Processing; Storage & Retrieval; Concept Based Indexing & Retrieval; Imagery Exploitation; Situation Assessment & Target Analysis; Evolutionary Design of Complex Software; and Real-Time Signal Processor Enhancement.

The Technology Transfer Program includes: Utilizing Education Partnerships with 43 Universities for collaborative research under the Information Institute Program and the donation of surplus laboratory computers to school districts under the Computers for Schools Program; CRADAs between the laboratory and New York State Technology Enterprise Corporation (NYSTEC) were executed in the areas of Advanced Communications for the NY State Police and a statewide satellite and ground line telecommunications system design for all NY State Agencies use; the Laboratory's Partnership Intermediary Agreement with NYSTEC continued co-development of an In-Vehicle Voice Verification System for the Immigration and Naturalization Service to aid traffic flow at U.S. Border Crossings, The Laboratory's Patents database was increased to include new patents issued this year; Participated in the joint training exercise Global Patriot 98 using advanced communications technology to enhance the capabilities of the warfighter in the field.

EQUIPMENT/FACILITIES

Primary operating locations are: Griffiss Business & Technology Park, Rome NY and Wright Patterson Air Force Base, Dayton OH. Equipment and facilities include: Defensive Information Warfare R&D Facility; Network Management R&D Facility; Signal Processing R&D Facility; Embedded Systems Architecture Laboratory; Computer Science and Technology Laboratory; High Performance Computing; Micro Electro Mechanical Machine Systems Center; Joint Integrated Test Facility; Broadsword Facility; Fusion Facility; Audio/Speech Facility; Imagery Exploitation 2000 / Elint Facility; Network Design Facility; Distributed Systems Evaluation Environment Testbed; Artificial Intelligence Facility; Command & Control Technology Center; Highbay Anechoic Measurement Facility; and two antenna evaluation facilities (Newport and Stockbridge).

Information Directorate
Rome, NY 13441-4514
(315) 330-7701

Director: Mr. Raymond Urtz
Deputy Director: Col John Bedford

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	0.000	N/A	N/A	0.000
6.1 Other	3.455	2.051	7.010	12.516
6.2	52.289	3.843	136.557	192.689
6.3	6.597	3.917	141.986	152.500
Subtotal (S&T)	**62.341**	**9.811**	**285.553**	**357.705**
6.4	3.792	2.252	16.458	22.502
6.5	0.627	0.374	27.020	28.021
6.6	0.150	0.092	2.971	3.213
6.7	0.000	0.000	0.000	0.000
Non-DOD	0.087	0.051	2.045	2.183
TOTAL RDT&E	**66.997**	**12.580**	**334.047**	**413.624**
Procurement	0.896	N/A	7.133	8.029
Operations & Maintenance	12.326	N/A	84.566	96.892
Other	5.553	N/A	0.000	5.553
TOTAL FUNDING	**85.772**	**12.580**	**425.746**	**524.098**

MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	**END STRENGTH**
TYPE	**DOCTORATES**	**OTHER**		
MILITARY	3	46	38	87
CIVILIAN	31	350	378*	759
TOTAL	**34**	**396**	**416**	**846**

*Includes 14 temporary employees that do not continue into FY99.

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	1,067.400	**REAL PROPERTY**	54.700
ADMIN	89.200	* NEW CAPITAL EQUIPMENT	0.200
OTHER	220.600	**EQUIPMENT**	148.447
TOTAL	**1,377.200**	* NEW SCIENTIFIC & ENG. EQUIP.	13.491
ACRES	**84**	* Subset of previous category.	

N/A - Not Applicable

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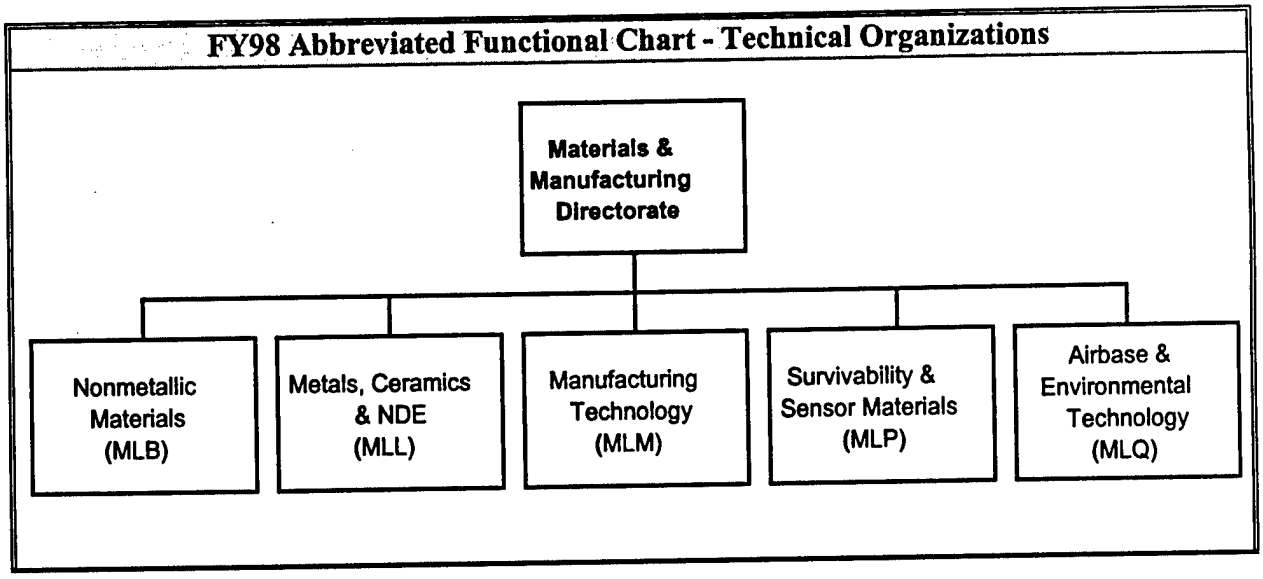
Materials and Manufacturing Directorate



Materials and Manufacturing Directorate
Wright-Patterson AFB, OH 45433-7739
(937) 255-4726

Director: Dr. Charles E. Browning
Deputy Director: Col Robert L. Tipton, Jr.

MISSION

Plan and execute the USAF program for materials and processes, manufacturing, and environmental technologies in the areas of basic research, exploratory development, advanced development and industrial preparedness. Provide systems support to Air Force product centers, logistics centers, and operating commands to solve system related problems and to transfer expertise.

CURRENT IMPORTANT PROGRAMS

I. Orthorhombic Titanium Composite Matrix Processing Optimization To develop the expertise to reliably produce consistently high quality matrix materials based on the orthorhombic phase of titanium for use in continuously reinforced composites up to 1400 degrees F.

II. Thermal-Structural Materials Solutions for Spacecraft - Lockheed To develop and demonstrate affordable lightweight polymeric composite materials that meet spacecraft structural and thermal requirements.

III. Research on Advanced Nondestructive Evaluation Methods for Aerospace Materials, Processes and Structures To identify and show preliminary feasibility of a wide variety of new nondestructive evaluation (NDE) techniques for hidden corrosion detection.

IV. Advanced Aircraft Corrosion Resistant Coating Systems To optimize, demonstrate, and transition environmentally compliant advanced aircraft coating systems. The coating materials and processes will satisfy the DoD requirements for a system that prevents pollution, reduces or eliminates hazardous waste treatment and disposal costs, and is safe to use.

V. Laser Hardened Concepts This program will invent and investigate advanced laser protection concepts and materials for high-speed, broadband response. The technology developed on this program will provide the basis for fabricating novel tunable filters and optical limiters for wavelength-independent protection of personnel and electro-optical sensor systems

VI. Joint Strike Fighter Technology Manufacturing Demonstrations To demonstrate lean processes, and integrated design and cost data to reduce Joint Strike Fighter manufacturing costs. This will be accomplished through work in four key areas: 1) define and document key lean practices/processes; 2) develop integrated design and cost data/tools; 3) demonstrate effectiveness of lean practices/processes and integrated design/cost data 4) transfer knowledge of practices, processes and data/tool integration approach to the JSF community.

VII. Lean Aerospace Initiative To develop a framework for implementation of a fundamentally different, provably better way of production, enterprise-wide, that would better support the defense aircraft needs over the next decades. Success of this endeavor is dependent upon the establishment of extraordinary cooperation between customers.

VIII. Improved Processing for Field Level Evaluated and developed technologies to improve the field level repair process of bonded composite patch repairs.

IX. Biological/Chemical/Physical Treatment Technology Biological remediation has proven to be a cost effective alternative to traditional technologies for remediation of several organic pollutants. This technical area intends to expand and extend the current biological treatment technologies to new pollutants and new environments. Reduction of pollutants by chemical and physical methods has

CURRENT IMPORTANT PROGRAMS (continued)

proven to be cost effective relative to the traditional dig and burn methods. These processes are particularly well suited to metals and non-organic pollutants. This technical area intends to identify additional technologies using chemical and physical methods for cost-effective remediation of metals, fuels, solvents, and non-organic pollutants.

X. Fire Extinguishment by Electro-Magnetic Fields The USAF is seeking to develop a fire suppression system based on the principles of interactions of electromagnetic fields with flames, which is safe, and practical to use in specific fire fighting environments. Applications are aimed at replacing existing total flood and streaming type agents. The overall objective is to design and fully test a device which could be utilized both in enclosed as well as open areas and serve as effective replacement to current fire suppressing chemicals.

XI. Composite Affordability Initiative (CAI) Develop the tools and technologies necessary to enable integrated product teams to confidently design, manufacture and integrate with aircraft subsystems an "all-composites" airframe utilizing revolutionary design techniques, innovative manufacturing concepts, materials, processes and advanced business practices, to enable breakthrough reductions in cost, schedule and weight. Initial CAI emphasis will be placed on Joint Strike Fighter (JSF) insertion opportunities.

XII. Military Products from Commercial Lines Apply lean principles to demonstrate the commercial manufacture of military electronics modules, and measure and transfer results. To establish a flexible manufacturing line for producing both military and commercial products. By using a flexible, lean approach, cost will be minimized since there is no dedicated line

EQUIPMENT/FACILITIES

Behavior and Life Prediction Laboratory - Extensive and unique capability for evaluation of properties of metals, alloys, and composites under a wide range of environmental conditions, including high cycle fatigue.

Laser Hardened Materials Evaluation Laboratory - Unique capability to evaluate laser/materials interactions and effects of lasers on advanced materials for aerospace applications. Includes a 15 KW, continuous wave, carbon dioxide laser with a well characterized flat-top beam and 1 to 11 cm spot sizes Special capabilities include three vacuum environment test chambers (1x10-6 Torr); 50 ksi tensile test machine; subsonic blow-down wind tunnel (Mach 0.1 to 0.9); supersonic blow-down wind tunnel (Mach 2); 7ft by 9 ft chamber (to lx10-6 Torr); cryogenic sample holders.

Electronic Properties of Semiconductors Laboratory - In this unique facility, one can measure the Hall Effect at ambient and elevated temperatures, the temperature-dependent Hall Effect, and the Shubnikov Effect. In addition, there is the capability for doing deep level transient spectroscopy and optical admittance spectroscopy.

Processing Laboratory - This is a unique facility for the process of a wide range of metals and alloys. It includes both commercial and one-of-a-kind apparatus for producing special samples by extrusion, forging, rolling, swaging, and heat-treating.

SCEPTRE Laboratory - The Space Coatings Environmental Test and Research Laboratory is a unique facility for testing thermal radiation and protective coatings under conditions of high vacuum, high electron or proton flux, and high intensity electromagnetic radiation

Computational Materials Science/Molecular Modeling Laboratory - A variety of workstations and software, plus a virtual reality facility with a force-feedback arm.

EQUIPMENT/FACILITIES (continued)

Chemical Analysis Laboratory - Includes capability for the wet chemical and instrumental analyses of a wide range of materials

NDE Laboratory - Facilities for the non-destructive evaluation of metallic and non-metallic materials

Failure Analysis Laboratory - Capability for the analysis of metal, electronic, and other samples for purposes of determining the causes of failure.

Corrosion Test Laboratory - Facilities comprise a variety of equipment for testing, and instruments for evaluating, corrosion.

Rain Erosion Facility - This unique facility permits the evaluation of rain erosion of a variety of materials under realistic use conditions.

Ultrasonic laboratory - Ultrahigh frequency laser-generated ultrasound system, acoustic microscopes and large and small precision ultrasonic imaging systems.

Computed Tomography (CT) Laboratory - Includes a laminography/dual energy CT system and a tomoscope CT system.

Polymer Physics Experimental Laboratory - Includes instrumentation necessary to measure thickness and the conductivity of polymer films.

Polymer Characterization Laboratory - This laboratory includes the capability for obtaining spectroscopic data, plus measuring the mechanical and thermal properties of polymers.

Fiber/Film Fabrication Laboratory - This laboratory provides the capability for producing fibers and films in controlled environments.

Polymer Synthesis Laboratory - A well-equipped facility for the synthesis and chromatographic characterization of polymers

Morphology Laboratory - An X-ray diffraction laboratory with multiple generators and cameras, plus optical and electron microscopes.

Analytical Spectroscopy Laboratory - This laboratory includes FTIR, Solid State NMR, and GC-MS, with all supporting equipment

Optical Microscopy Laboratory - In this laboratory there are a variety of light microscopes and an electron microscope.

Thermal Analysis Laboratory - This well-equipped laboratory is equipped to do DSC, PDSC, DTA, TGA and Dilatometry measurements.

Rheological Characterization Laboratory - This laboratory is centered around a Dynamic Mechanical Analyzer.

Mechanical Characterization Laboratory - This well-equipped laboratory features tensile and other mechanical tests for laboratory to extremely large scale samples.

Materials Processing Laboratory - In this facility, it is possible to go from the starting materials to finished product for a number of composite materials.

EQUIPMENT/FACILITIES (continued)

Optical Properties of Semiconductors Laboratory - A wide variety of measurements are possible in this laboratory, including infrared, photoluminescence, light scattering, reflectance, and magneto-optical semiconductor behavior.

Nonlinear Optical Materials Laboratory - In this laboratory, one can measure a variety of NLO properties on bulk and film samples.

Superconductor Materials Characterization Laboratory - This laboratory has the capability to measure transport properties and critical current densities along with AC magnetic susceptibility

Pulsed Laser Deposition Laboratory - The capability exists to prepare thin films for hard or lubricious coatings or for application in sensors

Molecular Beam Epitaxy Laboratory - This is a major facility for the preparation and characterization of a wide range of semiconductor materials and devices..

AC Hydraulic Pump Test Laboratory - This is a specialized facility for testing both components of aircraft hydraulic systems and hydraulic fluids.

Lubricant Traction Lab - This laboratory is a specialized facility for measuring the traction coefficients of liquid lubricants under controlled (high) temperature conditions.

Optical lab - Included in this laboratory is a variety of optical instrumentation including scatterometers, emissometers, imaging IR radiometers, UV-Vis-NIR and IR spectrophotometers, and optical microscopes.

Liquid Lubricants Lab - This laboratory includes a wide range of testing equipment such as viscosity baths and measuring devices and instruments such as gas chromatographs, a gas chromatograph-mass spectrometer, and an infrared spectrophotometer.

X-ray Photoelectron Spectroscopy Laboratory - In this laboratory there are two XPS instruments, one devoted to solid lubricants and a second with an in-situ tribometer for use with solid or liquid lubricants

Raman Analysis Laboratory - There are two Raman spectrometers in this lab, primarily used for the evaluation of solid lubricant coatings.

Mechanical Test Laboratory - This laboratory comprises a variety of instruments for determining friction and wear properties of lubricant, hard coatings, and other systems.

Ceramic Composites Research Laboratory - This laboratory has a wide variety of specialized equipment for fiber growth and coating, ceramic powder characterization and composite processing and testing.

Materials and Manufacturing Directorate
Wright-Patterson AFB, OH 45433-7739
(937) 255-4726

Director: Dr. Charles E. Browning
Deputy Director: Col Robert L. Tipton, Jr.

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	IN-HOUSE	IN-HOUSE MANAGEMENT	OUT-OF-HOUSE	TOTAL
RDT&E:				
6.1 ILIR	0.000	N/A	N/A	0.000
6.1 Other	11.628	0.000	0.000	11.628
6.2	62.718	0.000	0.000	62.718
6.3	25.496	0.000	0.000	25.496
Subtotal (S&T)	**99.842**	**0.000**	**0.000**	**99.842**
6.4	0.000	0.000	0.000	0.000
6.5	1.685	0.000	0.000	1.685
6.6	0.000	0.000	0.000	0.000
6.7	0.000	0.000	0.000	0.000
Non-DOD	0.000	0.000	0.000	0.000
TOTAL RDT&E	**101.527**	**0.000**	**0.000**	**101.527**
Procurement	3.146	N/A	0.000	3.146
Operations & Maintenance	0.811	N/A	0.000	0.811
Other	102.005	N/A	0.000	102.005
TOTAL FUNDING	**207.489**	**0.000**	**0.000**	**207.489**

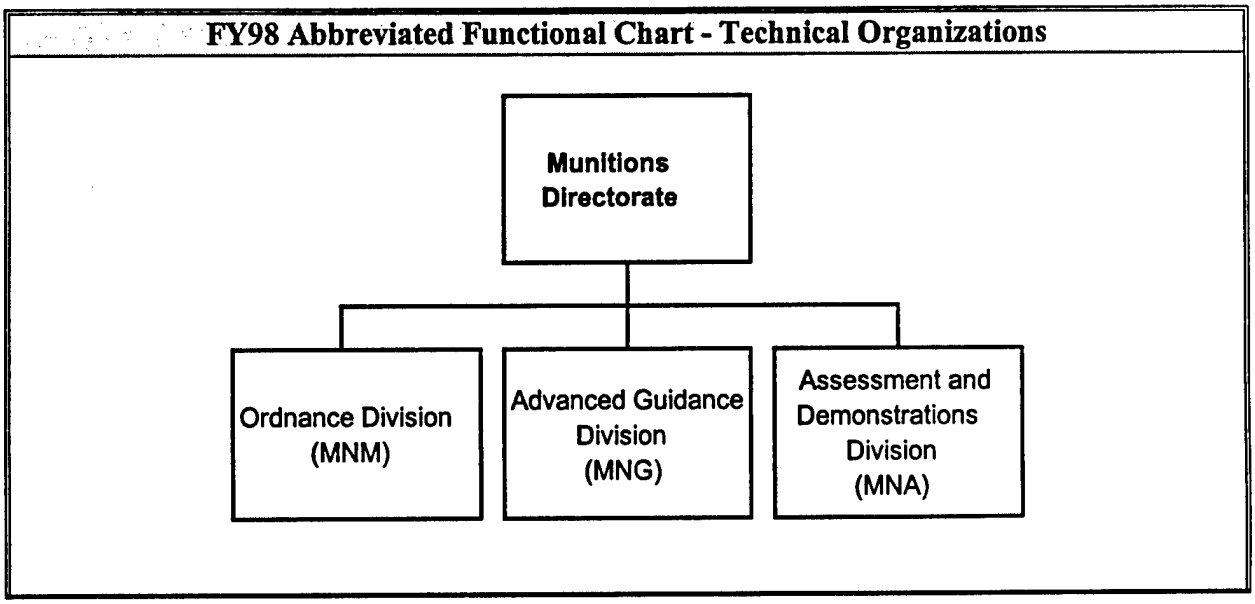
MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		TECHNICAL SUPPORT & OTHER PERSONNEL	END STRENGTH
TYPE	DOCTORATES	OTHER		
MILITARY	4	34	15	53
CIVILIAN	94	240	132	466
TOTAL	**98**	**274**	**147**	**519**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		PROPERTY ACQUISITION COST (MILLIONS $)	
LAB	296.300	**REAL PROPERTY**	96.000
ADMIN	216.200	* NEW CAPITAL EQUIPMENT	0.000
OTHER	87.700	**EQUIPMENT**	52.000
TOTAL	**600.200**	* NEW SCIENTIFIC & ENG. EQUIP.	8.000
ACRES	**25**	* Subset of previous category.	

N/A - Not Applicable

Munitions Directorate



Munitions Directorate
Eglin AFB, FL 32542-6810
(850) 882-3003

Director: Col H. V. Dutchyshyn
Deputy Director: Mr. S. C. Korn

MISSION

Develop, integrate, and transition science and technology for air-launched munitions for defeating ground fixed, mobile/re-locatable, air, and space targets to assure the preeminence of U.S. air and space forces.

CURRENT IMPORTANT PROGRAMS

MN's research and development planning process is structured around Integrating Concepts. The Integrating Concepts can be thought of as planning modules consisting of suites of technologies integrated into munition systems, time phased over a 25 year period into near, mid and far term concepts. Each of the Integrating Concepts has been built around satisfying particular warfighters' needs associated with engaging air and ground targets. The Integrating Concepts are implemented via Integrated Product Teams drawn from the Directorate's Core Competencies and from external organizations to develop the necessary technology roadmaps and concepts. An annual process is conducted to ensure the Integrating Concepts remain fully aligned with the users' operational needs and to capture new technology opportunities. The Directorate has currently identified four Integrating Concepts:

Small Smart Bomb (SSB) Integrating Concept: This Integrating Concept is developing a 250-lb class munition with a penetrating warhead and accurate guidance, compatible with very low cost standoff technologies. Enhanced energy/kill mechanism technologies are being emphasized. An all weather, precision terminal seeker compatible with the concept will be developed.

Hard Target Smart Munition (HTSM) Integrating Concept: This Integrating Concept is developing advanced penetrator warhead technologies for use against fixed and hardened targets. Fuzing technology to provide selectable burst point capability through void detection, layer counting, and penetration depth calculation is being developed. Affordable, all-weather precision seekers and sensor to provide target interrogation and selection of optimal burst point prior to target penetration are being pursued.

Antimateriel Munition (AMM) Integrating Concept: This Integrating Concept is developing the integration technology for the warhead, seeker, and airframe subsystems and demonstrating the performance and effectiveness of the munition concept against the full spectrum of ground mobile and relocatable targets. A key aspect is the development and demonstration of a low observable, low drag, standoff dispenser for the antimateriel submunition. Technologies for all-weather operation and enhanced effectiveness will be matured.

Air Superiority Missile Integrating Concept: This Integrating Concept is developing and demonstrating guidance and control technologies for enhancing the close-in combat capability of air-to-air missiles. It is also pursuing terminal seekers with extended acquisition range, and advanced propulsion for extended flyout ranges. Technologies for expanding the off-boresight launch angle capability are being emphasized. Ordnance technologies for increasing the probability of kill against such targets as cruise missiles and bombers are being identified and pursued.

CURRENT IMPORTANT PROGRAMS (continued)

The Munitions Directorate (MN) of the Air Force Research Laboratory has instituted a full spectrum technology transfer program consisting of outreach, education, patents and intellectual property management, marketing, and cooperative research efforts. At the present time, the Munitions Directorate has five active Cooperative Research and Development Agreements (CRADAs) encompassing research in electromagnetic phenomenon, engineered ceramics, modeling and simulation, and explosives. One example of this cooperative research is a CRADA with Halliburton, Inc. for commercializing an explosive pipe cutter technology. Royalties from licenses of MN technologies brings in over $100K per year.

Three University professors working in AFRL/MN under Intergovernmental Personnel Agreements (IPA).

EQUIPMENT/FACILITIES

Primary Operating location is Eglin AFB FL. Equipment and facilities include:

- **High Explosives Research & Development Facility (HERD)** provides high explosive formulation, processing, X-ray, quality control and loading support for Air Force nonnuclear weapons development programs and other agency requirements.
- **Advanced Warhead Experimentation Facility (AWEF)** provides state of the art capability to conduct research and development of advanced warhead technologies; including heavy metal, warheads, projectiles, penetrators, shaped charge liners, and various components and explosives.
- **Aeroballistics Research Facility (ARF)** advances basic aerodynamic knowledge and defines aerodynamic performance, stability and control parameters for hypervelocity missiles, advanced ammunition, high fineness ratio penetrators, and submunitions.
- **Ballistics Experimentation Facility (BEF)** conducts and supports custom ballistic munitions research, development, and evaluation on various munitions and projectiles ranging in size from .177 inches through 8.0 inches in diameter.
- **Fuzes Research and Development Facility** provides capability to develop and evaluate technologies for fuzes, sensors and signal processing circuitry components for conventional munitions.
- **Electromagnetic Munition Experimentation Facility** explores advanced munitions concepts which exploit the unique qualities of electromagnetics, develop advanced oxidation techniques to destroy hazardous compounds generated by munitions development/disposal, and study the gas dynamic principles governing shock-induced combustion/detonation.
- **Advanced Guidance Research Lab** provides multi-user, electro-optical (EO) and radio frequency (RF) computing facility for guided weapons seeker development.
- **LADAR Development and Evaluation Research Facility (LDERF)** develops, tests and evaluates active imaging direct detection laser radar (LADAR) sensors and seekers.
- **Radio Frequency/Millimeter Wave (RF/MMW) Lab** develops and evaluates sensors and seekers using radar guidance technology employing frequencies up to and including millimeter wave.
- **Kinetic Kill Vehicle Hardware-in-the-Loop Simulation Facility (KHILS)** provides an independent, government owned, national resource for nondestructive performance testing and technology integration of precision guided weapon systems.

EQUIPMENT/FACILITIES (continued)

- **Inertial Navigation Lab** researches and develops tactical weapons navigation and control technology.
- **Optical Correlation Research Lab** designs, develops and evaluates optical processors; combines lenses, mirrors and laser diodes to process data at light speed.
- **Environmental Sciences Lab** supports conventional munitions technology programs and environmental assessment requirements through chemical, radiochemical and microanalysis research.
- **Prototype Munitions Fabrication Facility** provides a wide range of rapid fabrication support in the areas of exploratory and advanced development of both experimental and prototype hardware designs.
- **Technical Library Facility** provides technical library support for Eglin AFB.

Munitions Directorate
Eglin AFB, FL 32542-6810
(850) 882-3003

Director: Col H. V. Dutchyshyn
Deputy Director: Mr. S. C. Korn

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	0.339	N/A	N/A	0.339
6.1 Other	0.200	0.000	0.000	0.200
6.2	13.562	8.863	13.584	36.009
6.3	0.000	2.293	19.852	22.145
Subtotal (S&T)	**14.101**	**11.156**	**33.436**	**58.693**
6.4	0.000	0.000	0.000	0.000
6.5	0.000	0.028	16.102	16.130
6.6	0.000	0.000	0.000	0.000
6.7	0.000	0.000	0.000	0.000
Non-DOD	0.000	0.000	0.000	0.000
TOTAL RDT&E	**14.101**	**11.184**	**49.538**	**74.823**
Procurement	0.000	N/A	0.000	0.000
Operations & Maintenance	0.000	N/A	0.000	0.000
Other	0.000	N/A	0.000	0.000
TOTAL FUNDING	**14.101**	**11.184**	**49.538**	**74.823**

MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	**END STRENGTH**
TYPE	**DOCTORATES**	**OTHER**		
MILITARY	9	46	20	75
CIVILIAN	31	138	77	246
TOTAL	**40**	**184**	**97**	**321**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	272.100	**REAL PROPERTY**	27.363
ADMIN	0.000	* NEW CAPITAL EQUIPMENT	0.000
OTHER	23.300	**EQUIPMENT**	28.974
TOTAL	**295.400**	* NEW SCIENTIFIC & ENG. EQUIP.	0.478
ACRES	**1,000**	* Subset of previous category.	

N/A - Not Applicable

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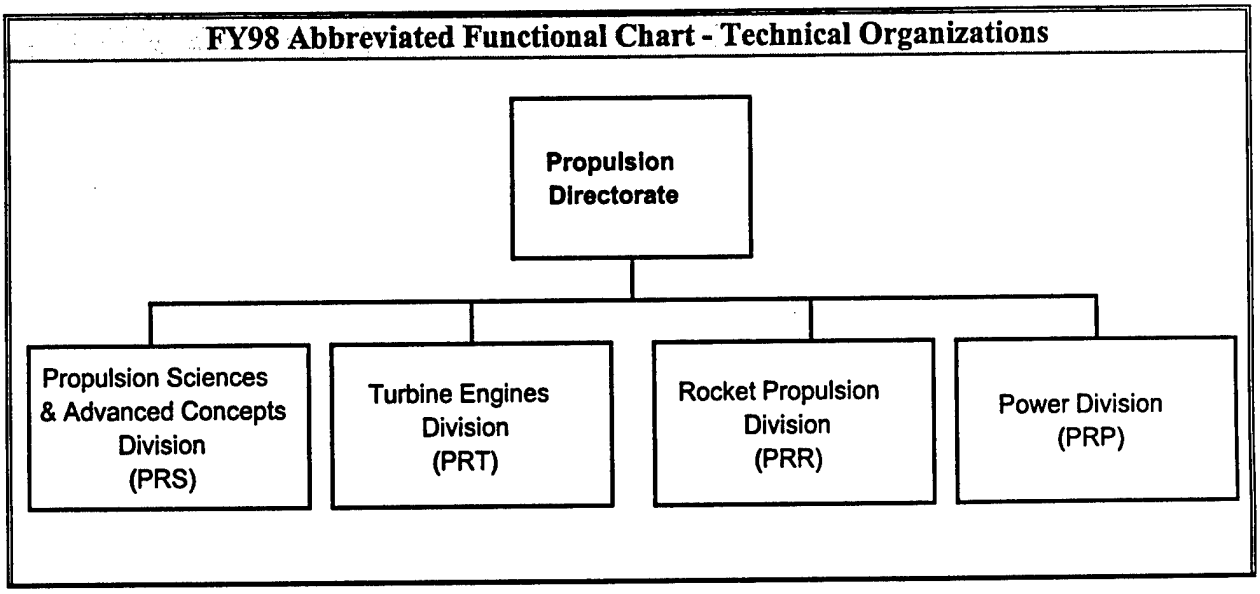
Propulsion Directorate



Propulsion Directorate
Wright-Patterson AFB, OH 45433-7251
(937) 255-2520

Director: Col John Rogacki
Deputy Director: Richard E. Quigley, Jr.

MISSION

AFRL/PR creates and transition propulsion and power technology for dominance of air and space.

CURRENT IMPORTANT PROGRAMS

Integrated High Performance Turbine Technology (IHPTET): Joint DoD/NASA/Industry time-phased program to demonstrate technologies to enable doubling turbine engine capability by 2003. IHPET includes three classes of engines: large turbofan/turbojet for fighters, bombers, and transports; smaller turboprop/turboshaft for rotorcraft, patrol, and trainers; and limited life for missiles and UAVs.

Integrated High Payoff Rocket Propulsion Technology (IHPRPT): Joint DoD/NASA/Industry program to demonstrate rocket propulsion technologies to improve performance of solid and liquid rockets. IHPRPT includes all classes of rockets including tactical, space launch, and orbit transfer.

More Electric Aircraft (MEA) Initiative: Joint program to demonstrate electric power technologies to improve reliability and maintainability of aircraft. MEA addresses power generation, distribution, and storage components and systems.

Hypersonic Technology for Missiles (HyTech): HyTech develops and demonstrates hypersonic technologies for advanced airbreathing propulsion systems. The current emphasis is on a Mach 8 hydrocarbon fueled scramjet for unmanned (missile) application.

JP8+100 fuel program: JP8+100 is an additive package added to JP8 fuel to increase the thermal stability of the fuel to withstand higher heat loads of future systems and to reduce maintenance required due to fuel coking in current systems.

TECHNOLOGY TRANSFER

The Propulsion Directorate has CRADAs to conduct impact and containment testing of GE90 (which is a commercial engine) turbine blade; to investigate carbon lithium-ion battery anodes; and to investigate the use of drag reducing agents in pipelines to increase throughput.

EQUIPMENT/FACILITIES

Turbine Research Laboratory to simulate all relevant engine conditions governing turbine operations.

Compressor Research Facility capable of testing full-scale, multi-stage and single shaft fans and compressor at speed/power of 3,000 to 16,000 rpm at 3,000 hp and 16,000 to 30,000 rpm at 15,000 hp.

Injector Spray Characteristics Chamber for unique capabilities include: Pc2 2,000 psi g, flow rates to 28 gal/minutes, fluid to 3,000 psi g, flow chamber optically accessible at 3,000 psi g.

Propulsion Directorate
Wright-Patterson AFB, OH 45433-7251
(937) 255-2520

Director: Col John Rogacki
Deputy Director: Richard E. Quigley, Jr.

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	0.079	N/A	N/A	0.079
6.1 Other	3.782	0.490	6.598	10.870
6.2	23.436	18.228	53.797	95.461
6.3	3.021	4.602	60.208	67.831
Subtotal (S&T)	**30.318**	**23.320**	**120.603**	**174.241**
6.4	0.000	0.000	0.000	0.000
6.5	0.010	0.000	17.797	17.807
6.6	0.000	0.000	0.000	0.000
6.7	0.000	0.000	0.000	0.000
Non-DOD	22.788	0.573	28.443	51.804
TOTAL RDT&E	**53.116**	**23.893**	**166.843**	**243.852**
Procurement	0.000	N/A	0.000	0.000
Operations & Maintenance	0.000	N/A	0.056	0.056
Other	0.000	N/A	0.000	0.000
TOTAL FUNDING	**53.116**	**23.893**	**166.899**	**243.908**

MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	**END STRENGTH**
TYPE	**DOCTORATES**	**OTHER**		
MILITARY	0	0	87	87
CIVILIAN	73	240	179	492
TOTAL	**73**	**240**	**266**	**579**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	1,413.000	**REAL PROPERTY**	118.000
ADMIN	16.000	* NEW CAPITAL EQUIPMENT	0.000
OTHER	130.000	**EQUIPMENT**	2.500
TOTAL	**1,559.000**	* NEW SCIENTIFIC & ENG. EQUIP.	0.200
ACRES	**41,642**	* Subset of previous category.	

N/A - Not Applicable

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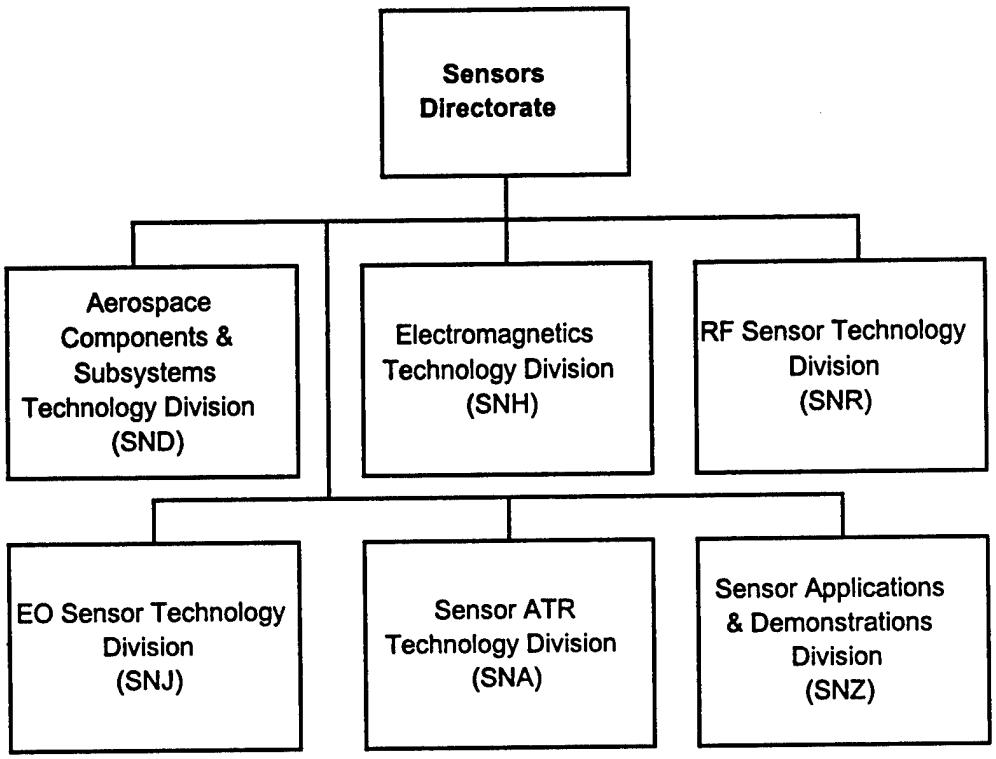
Sensors Directorate

FY98 Abbreviated Functional Chart - Technical Organizations



Sensors Directorate
Wright-Patterson AFB, OH 45433-7320
(937) 255-2620

Director: Mr. Les McFawn
Deputy Director: Lt Col Dick A. Trapp

MISSION

Ensures unequaled reconnaissance, surveillance, precision engagement and electronic warfare capabilities for America's air and space forces by conceiving, demonstrating and transitioning advanced sensors and sensor technologies in partnership with industry, universities and other DoD agencies, and providing knowledgeable support to the acquisition community and warfighters.

CURRENT IMPORTANT PROGRAMS

The following are just some of the current important programs/thrusts on which the Sensors Laboratory is working:

Large Aircraft Infrared Countermeasures (63270F): Threat-adaptable, laser based techniques to defend large signature aircraft from the growing infrared surface-to-air missile threat.

Advanced Tactical Targeting for Supression of Enemy Air Defenses (SEAD) (63270F): Affordable, passive SEAD techniques to allow multiple, non-dedicated platforms to cooperate in quickly deriving the precise location of a ground threat radar, even if it shuts down after emitting only briefly.

Command & Control Warfare (63270F): Advanced techniques to supress and counter adversary command and control networks.

Enhanced Recognition & Sensing Ladar (63203F): Laser radar (ladar) technologies for positive air-to-ground target identification (ID) at longer, safer standoff ranges.

Integrated Real-Time Information into the Cockpit (63203F): On-board mission management technologies to allow strike aircraft to use the latest intelligence information from off-board sources to improve re-routing capability, effectiveness, and survivability.

Space Based Radar (63203F): Radio frequency sensor components and techniques to enable advanced orbital radar systems.

Automatic Target Recognition (63203F): Technologies and techniques to help warfighters quickly pick out potential targets from an increasing flood of information and reliably identify those potential targets as friend or foe, even at long ranges.

EQUIPMENT/FACILITIES

WRIGHT-PATTERSON A.F.B. OHIO

Name of Facility: ELECTRONIC WARFARE ANECHOIC CHAMBER (EWAC)

Facility Type: Electronic Warfare.

Purpose: Develop and evaluate RF Electronic countermeasures techniques, devices and subsystems.

Primary Capabilities: 39Lx26Wx26H, electromagnetically shielded room lined with radio frequency (RF) energy absorbing material. Used for RF measurements, such as antenna polarization patterns, from 250MHz to 100MHz. Ability to test/evaluate most types of ECM hardware/techniques against hardware-in-the-loop simulations of seeker/target interactions.

Special/Unique Capabilities: Instrumentation systems for measuring and printing 3D plots of angle error voltage developed by a monopulse tracking radar in response to polarization jamming.

Instrumentation: Wide range of microwave instrumentation.

Name of Facility: RF RECEIVER/PROCESSOR LABORATORY

Facility Type: RF Receiver and Processor

Purpose: Evaluation and development of new RF receiver, processor, and software concepts.

Primary Capabilities: Evaluation, test, evaluate, and develop new RF receiver systems in frequency range 2 to 18GHz. Research, evaluate, develop new threat sorting and identification software techniques.

Special/Unique Capabilities: Classified facility and screen room, capability of both laboratory and field research, and capability to collect and analyze special signals of interest.

Instrumentation: Prototype receivers-superhet, instantaneous frequency measurement, microscan, channelized, optical various RF transmission and modulation technique available. Sorting and identification software prototype available.

Name of Facility: OPTO-ELECTRONIC RESEARCH FACILITY

Facility Type: Coherent and Non-Coherent Optical Device Research

Purpose: Exploratory development of lasers, optical processing and control devices, opto-electronic integrated circuits, detectors and detector arrays.

Primary Capabilities: Characterization and evaluation of laser and non-linear materials. Optical device evaluation, including surface metrology, optical waveguide elements, optical logic and active optical processing evaluation. Infrared and ultraviolet optical detector characterization, evaluation and optimization, including optical Fourier transform measurement facility.

Special/Unique Capabilities: Optical excitation spectroscopy, time-resolved, for laser materials from 4 degreesKelvin through elevated temperatures. Absorption, fluorescence and transmission spectroscopy from UV through long wave infrared. interferometric and scatterometric surface analysis together with topographical surface microscopy for both insulating and conducting/semiconducting samples.

EQUIPMENT/FACILITIES (continued)

Instrumentation: Multiple spectrometers and spectrophotometers; laser sources from visible through long wave infrared (10.6 micrometers). Bi-directional, reflectance distribution function measurement instrumentation for 4 inch surfaces at 3 visible wavelengths; Zygo surface interferometer.

Name of Facility: OPTICAL RESEARCH LABORATORY

Facility Type: Optical and Digital Seeker Processing

Purpose: Design, develop, and evaluate optical and digital processing technology; develop a standard math morphology for image processing; develop seeker algorithms.

Primary Capabilities: Main Lab:(1232sq ft) Vibration isolated benches and computer workstations, Laser Polarimeter. Make measurements of the Kerr and Farady constants of infrared materials.

Special/Unique Capabilities: Only known achromatic infrared laser Polarimeter; computer driven spatial light modular for evaluation binary-phase-only-spatial filters. Optical/digital integration for image processing capability.

Instrumentation: Photometers, laser beam cross section analyzer, high speed oscilloscopes, Co2, Co and solid state lasers, long and mid wavelength IR detectors. Spatial light modulators integrated wit high speed Sun workstation.

Name of Facility: MICROWAVE/MILLIMETER WAVE LABORATORY

Facility Type: Microwave/Millimeter Wave

Purpose: Design, simulate, fabricate and/or test microwave and millimeter wave electronic components and integrated circuits.

Primary Capabilities: Design, model and simulate solid state devices, integrated circuits and multi-chip assemblies operating in the 0.1 to 100GHz frequency range. MMIC and multi-chip assembly performance and fabrication parameter correlation and data analysis. Design, fabrication and testing of GaAs MIMMICs; testing of a wide range of microwave/millimeter wave components.

Special/Unique Capabilities: Radio Frequency (RF) on-wafer testing of MIMMICs using a Cascade automatic prober and a Hewlett-Packard (HP) vector network analyzer. Load pull testing of high power devices using semi-automatic system employing automatic tuners operating in the 0.1 to 26GHz frequency range. Overstress testing of microwave devices and MIMMICs.

Instrumentation: PMI scalar network analyzer (1-40GHz); HP8510 vector network analyzers (0.1 to 65GHz), On-wafer RF prober, Wiltron/HP load-pull measurement system; Ees of and Compact microwave computer-aided design software and workstations; and general purpose microwave/millimeter wave test equipment.

Name of Facility: MICROELECTRONICS COMPUTER AIDED DESIGN (CAD) & TEST FACILITY

Facility Type: Microelectronic

Purpose: Design and test microelectronic devices and integrated circuits. Maintain a state-of-the-art CAD facility.

Primary Capabilities: Very Large Scale Integrated Circuit (VHSIC) and analog circuit design.

EQUIPMENT/FACILITIES (continued)

Development of FaAs-based heterojunction field effect transistors, heterojunction bipolar transistors and resonant tunneling devices. High speed testing of devices, circuits, and analog-to-digital (A/D) converters.

Special/Unique Capabilities: Silicon compilation of integrated circuits. Automated wafer parametric testing; automate A/D converter testing. Research and development prototype design tools.

Instrumentation: Electroglass automatic prober, Tektronics login analyzer, Hewlett Packard: parameter analyzer, impedance analyzer, switching matrix, sweep oscillator, data generator, rate generator, oscilloscope, synthesized sign generator, LeCroy pulse generator, Fluke synthesized radio frequency signal generator, Stanford Research System amplifies, and general purpose test equipment.

Name of Facility: LASER RADAR RESEARCH LAB (LADAR)

Facility Type: Laser radar systems

Purpose: Research, test and develop high performance solid state laser radar and component technology.

Primary Capabilities: Development of new system integration technologies of laser radar systems. Can perform heterodyne detection and fiber optic mixing.

Special/Unique Capabilities: Uses non-mechanical beam agility device. Combines beam agility devices in the receiver portion of the laser radar system.

Instrumentation: Solid State 1.06um ND:YAG laser, consto-optic modulator, In GaAs detector, Faraday isolator, fiber couplers, digital oscilloscope. Two beam agility devices using liquid crystal phase grating concept using acoustic-optic defector modules.

Name of Facility: LASER COMMUNICATION LABORATORY

Facility Type: Laser Communications

Purpose: Research, development and research of ground, airborne, and space based laser communications systems.

Primary Capabilities: Atmospheric Turbulence, laser Characteristics, spectral Characterization of Transparent Materials and Systems Reliability research.

Special/Unique Capabilities: Real-time measurement of atmospheric conditions to include temperature, pressure, humidity, and diffraction-limited aperture of the atmosphere. Eight inch telescope interfaced with optical detection equipment and Micro VAX for use a generic optical antenna/receiver in lasercom link analysis system. Optical wavefront/coherence analysis system
interfaced with Micro VAX for laser beam wavefront characterization.

Instrumentation: EGG-55 Spectral radiometer capable of wavelength measurements (UV through IR), Phtodyne Radiometer, Optical wavefront/coherence analysis system. Eight inch telescope, Micro VAX workstation interfaced wit IEEE-488 Data Bus for use as data acquisition equipment. Software for design/analysis of optical systems; Evaluation laser hazards, evaluations/simulation of atmospheric equipment modeling.

EQUIPMENT/FACILITIES (continued)

Name of Facility: INTEGRATED DEFENSIVE AVIONICS LABORATORY (IDAL)

Facility Type: Hybrid/real-time digital simulation Laboratory

Purpose: To conduct integrated EW system/concept evaluate in support of Air Force Exploratory and Advanced Development programs.

Primary Capabilities: Real-time interactive, multispectral EW simulation to drive hardware system to digital emulation's.

Special/Unique Capabilities: Real-time interactive implementation of SUPPRESSOR command and control model, digital IR/EO scene generator, real-time digital RWR emulation. Interaction with DEES/CEE SIM RF environment generators, interaction with Integrated Test Bed Cockpit/Avionics simulator. Interaction with Electronic Defense Evaluator threat radar simulator.

Instrumentation: VAX 11/750, VAXstation 3, Sun 4, CCC3240, CCC3260 MPS.

Name of Facility: INTEGRATED AVIONICS LAB (IAL)

Facility Type: Avionics Research

Purpose: Conduct classified/unclassified, real-time/non-real-time, multispectral, multidisciplinary experiments, studies, research, simulations and analyses in the areas of integrated avionics, core processing architecture, information processing, communications, navigation, identification, software, life cycle support and machine intelligence.

Primary Capabilities: Real-time simulation of aircraft performing an operational mission allows evaluation of capabilities across entire spectrum of performance requirements. Provides a direct (non-extrapolated) view of real world problems and considerations. Validation of contract research products in a Systems context.

Special/Unique Capabilities: Real-time simulation/stimulation of avionics interface signals. Generalized Avionics and Simulation/Integration Systems (GENASIS) software configurable simulated aircraft workstations. Real-time interface to defensive and communication avionics test facilities.

Instrumentation: Avionics flight processors with Ada operational flight programs and the avionics multiplex and fiber data buses. Models set include multiple aircraft, sensors, weapons and external environment modules; VAX 11/785/non-real-time development environment. GENASIS modular cockpit with six-nine inch diagonal color displays couple with F-15 type stick and throttle, moving map display, fiber optics communications.

Name of Facility: ELECTRONIC COMBAT RESEARCH SIMULATION LAB (ESCRL)

Facility Type: Electronic Combat Simulation

Purpose: Develop requirements for electronic combat equipment; evaluate electronic combat equipment.

Primary Capabilities: Three levels of digital simulation; one-on-one, one of many, and, campaign level (many-on-many).

Special/Unique Capabilities: Classified TEMPEST Facility.

Instrumentation: Electronic and data processing hardware.

EQUIPMENT/FACILITIES (continued)

Name of Facility: ELECTRO-OPTICAL RECEIVER LABORATORY

Facility Type: E-O Devices

Purpose: Research and evaluate IR and laser warning receivers.

Primary Capabilities: Calibrate, test, and evaluate infrared laser sensors and warning receivers in Bands I, II and III.

Special/Unique Capabilities: Classified facility with additional capabilities for foreign equipment exploitation. Capability for both laboratory and field research. field research utilize outdoor WL turntable facility located on WPAFB, OH, Area C, flight line for rotation for full scale aircraft.

Instrumentation: Large array of optical, electrical, and data processing hardware in a facility comprising greater than 5,000 sq ft. Equipment account exceeds a value of $2m. Large optical collimator.

Name of Facility: DYNAMIC INFRARED MISSILE EVALUATOR (DIME)

Facility Type: Infrared Target Simulator and Multispectral Signature Generation.

Purpose: Research and develop infrared countermeasures (IRCM) techniques and assessment of multispectral signature control techniques for EOCM.

Primary Capabilities: Provides semi-physical simulation of the homing interception of a target by and IR guided missile. Optiscan instrumentiation for evaluating IRCM effects upon infrared missiles. Interactive image processing system that allows aircraft signature modifications to be designed, modified, and evaluated by use of and image array processor.

Special/Unique Capabilities: Use actual IR missile optics and guidance electronics along with computer simulated, aerodynamic characteristics and servo controlled sources. Can manipulate imagery representing both the aircraft signature and camouflage treatment of interest. Multi-spectral tool to be used for signature analysis into the year 2000 and beyond.

Instrumentation: Operational IR missile guidance and control units. Digital aerodynamic computational capability. Servo-controlled IR sources/optics. SPIRITS; generic sensor model.

Name of Facility: 100 INCH COLLIMATOR FACILITY

Facility Type: Electo-Optical Sensors

Purpose: Research, test and analysis of tactical and strategic electro-optical and laser radar systems under simulated environmental conditions.

Primary Capabilities: Profiling atmosphere to in excess of 100km. Sub-centimeter space debris experiment.

Special/Unique Capabilities: 100inch diameter optical collimating mirror housed in vacuum chamber which can be evacuated to simulate a 270,000 ft altitude.

Instrumentation: Seismometers, 32 channel data logger, 8 channel digital recorder. PC based computer system.

EQUIPMENT/FACILITIES (continued)

Name of Facility: DEVICE RESEARCH LABORATORY

Facility Type: Device and Semiconductor Research.

Purpose: Research on compound semiconductors and semiconductor structures, advanced microwave, high speed digital and novel electro-optic devices.

Primary Capabilities: Theoretical and experimental research on III-V semiconductor structures and devices; development of advanced electronic and electro-optical devices. Extensive theoretical and experimental growth and characterization of electronic and optical properties of III-V materials and devices.

Special/Unique Capabilities: Molecular beam epitaxy of components of gallium; indium, aluminum, arsenic, and antimony; ion implantation; metal and dielectric deposition. Reactive ion etching; nanometer lithograph; modeling of device physics. Conventional and rapid thermal annealing; scanning electron microcopy and electrical testing.

Instrumentation: JEOL 5 DIIU-A e-beam; Varian 360 and GEN II MBE; full complement of conventional semiconductor process equipment. Time resolved high resolution photoluminescence; photoreflectance; hall measurement apparatus; Fourier transform infrared spectroscopy.

HANSCOM A.F.B. MASS

FACILITY: Hyperspectral Imaging (HSI) Infrared imaging processing facility. Facility type: A real time high speed imaging processing network.

PURPOSE: To process consecutive frames of infrared data at 12 bits dynamic range up to 400 frames per second.

DESCRIPTION:, A high speed 100 megabit network connecting 30 computers to process field collected data.

UNIQUE FEATURES: Id of difficult targets using hyperspectral techniques.

INSTRUMENTATION: High speed midwave infrared cameras capable of processing up to 64 monochomatic images in near real time.

FACILITY: Bulk III-V Growth Facility

PURPOSE: To perform research and development on the crystal growth and preparation of III-V compounds with emphasis on producing bulk indium phosphide crystal substrates of high quality necessary for the next generation of photonic and electronic devices.

DESCRIPTION: The facility consists of a high pressure growth furnace of unique design and associated equipment for determining the quality of bulk material and substrate wafers. The furnace itself is inside a sixteen foot standing hood; disassembly is facilitated by a one ton crane on a monorail. In InP growth, the furnace maintains temperatures up to 1070 degrees Celsius at pressures exceeding 600 psi. An axial magnetic field can be applied during crystal growth. Associated equipment includes crystal cutting and wafer preparation stations. Hall effect measurements systems, and a photoluminescence system.

CAPABILITIES: III-V single crystals can be grown by a variety of high pressure techniques. These techniques include the liquid encapsulation Czochralski method of pulling from the melt, and the liquid encapsulation Kyropoulous technique of topseeded growth into a crucible, pioneered in this facility of

EQUIPMENT/FACILITIES (continued)

InP growth. A strong magnetic field may be applied during growth to suppress turbulent convection in the melt. Indium phosphide may be synthesized in situ prior to growth using a unique phosphorus injection method. The hot zone of the furnace is large enough to accommodate growth of crystals up to eight inches in diameter.

UNIQUE FEATURES: The crystal growth system was designed by Rome Laboratory personnel. It supports the capability for in situ synthesis of indium phosphide prior to growth. Magnetic fields up to four kilogauss may be applied during growth. Crystals of commercial dimensions may be grown to facilitate
technology transfer.

INSTRUMENTATION: Fifty kilowatt radio frequency power supply and thirty kilowatt DC resistance heating supply for crystal growth. Computer controlled motors for rotation and positioning of crystals and crucibles. Crystal cutting saws and polishing equipment. Photoluminescence and Hall effect equipment for characterization. Characterization advanced electromagnetic techniques. Preparation and characterization support such as clean rooms and deep level transient spectroscopy are available in other Rome Laboratory facilities.

LOCATION: Hanscom AFB MA, Bldg 1142

FACILITY: Superconductor Thin Film Fabrication/Characterization Facility

PURPOSE: To perform research and development on the fabrication of high temperature superconductor (HTS) films and structures for electromagnetic, devices, including microwave and millimeter wave devices.

DESCRIPTION: This facility supports research and development of the fabrication and patterning of large are HTS films, and of multilayer structures for circuit elements and superconductive tunneling devices.

CAPABILITIES: Film fabrication facilities included RF diode sputtering apparatus that has been modified for HTS deposition and a fully automated CVC SC-4000 three gun magnetron sputtering system. The CVC system, which was originally specified by Rome Lab, incorporates such features as a heated substrate holder and a fast oxygen source that are specially adapter to HTS film fabrication. A system for laser evaporative deposition is under construction. Equipment for sol-gel preparation of HTS films, e.g., high quality glove boxes and photo resist spinners, is available. The facility also includes an array of supporting fabrication and characterization equipment such as a SQUID
magnetometer, furnaces, equipment for fabricating sputter targets, equipment for photolithography and patterning, a differential scanning calorimeter, and a differential thermal analyzer.

UNIQUE FEATURES: The tow sputtering systems have been modified to meet the unique and fast-changing demands of HTS research and development. The laser evaporative deposition system has been designed in-house by Rome lab, and it will include, in addition to the deposition chamber, a chamber for Auger analysis of the deposited films.

INSTRUMENTATION: The sputtering and laser deposition units described above; a mask aligned and other equipment for patterning films; automated systems for measuring resistance and critical current as a function of temperature; a SQUID magnetometer for measuring dc magnetic susceptibility and apparatus for measuring the ac magnetic susceptibility. Scanning electron microscopy (including elemental analysis via EDS and WDS) and a variety of x-ray diffraction analysis techniques are provided through the Microcharacterization Facility. The Microwave characterization is provided by the Monolithic Microwave Integrated Circuit Facility.

LOCATION: Hanscom AFB MA Bldg 1141

EQUIPMENT/FACILITIES (continued)

FACILITY: PHOTONIC CRYSTAL/PHOTONIC GLASS FACILITY

PURPOSE: To perform research and development on linear and nonlinear optical (including photorefractive crystalline and glass materials for future Air Force applications that employ free-space signal, image processing and optical computing.

DESCRIPTION: The facility includes a variety of crystal growth and material processing systems. The Research Hydrothermal Growth System consists of 11 high temperature, high pressure autoclaves capable of growth from solution at temperatures up to 550 C and pressures up to 20,000psi. This system is completely computer controlled. Melt growth capabilities include a twenty atmosphere system and a variety of systems for growth in controlled atmospheres. A top seeded solution growth system designed in-house operates at temperatures above 1400 C. Glass forming and annealing furnaces are available for processing in air or controlled atmospheres. Optical characterization is also available in this facility.

CAPABILITIES: Crystals of photorefractive and other non linear optical materials may be grown by several techniques, to assist in determining basic physical mechanisms and to optimize properties. When possible the same crystals are grown by several methods. Complete glass synthesis capacity, including both glass melting and sol-gel preparation techniques, permits investigation of novel nonlinear optical glass compositions.

UNIQUE FEATURES: The Research Hydrothermal Growth System is completely computer controlled and supports the simultaneous operation of ten crystal growth autoclaves for growth runs in excess of 90 days. Multiple safety alarms and interlocks protect personnel. This the most extensive and comprehensive research Hydrothermal facility in the United States.

INSTRUMENTATION: Research Hydrothermal Growth System with local controls and computer. MP furnace capable of growth at 20atm. Controlled atmosphere growth system. High temperature to seeded solution growth (TSSG) furnaces. Spectrometers and apparatus for photoconductivity, optical absorption, and photoluminescence measurements. Fourier Transform Infrared Spectrometer, Additional x-ray characterization and analysis is available in the Microcharacterization Facility. Other sample evaluation techniques, e.g., differential scanning calorimetry and differential thermal analysis, are also available in Rome Laboratory facilities.

LOCATION: Hanscom AFB MA Bldgs 1142/1141

FACILITY: ELECTROMAGNETIC TECHNOLOGY RESEARCH FACILITY

PURPOSE: To investigate methods for design, construction, and testing of millimeterwave integrated circuit (MMIC) components; to research superconducting materials and their application to practical components; to conduct measurements of the radar cross-section of selected model targets; and to measure the properties of phased array antennas.

DESCRIPTION: 15,000 sq ft facility with a clean room; laboratories for MMIC magnetic and photonic research; ant tow anechoic chambers.

CAPABILITIES: See Purpose/Description

UNIQUE FEATURES: The facility is planned to have a near-field measurement range to characterize large phased array antennas in a controlled environment.

INSTRUMENTATION: No information available at this time.

LOCATION: Hanscom AFB MA, Bldg 1123

EQUIPMENT/FACILITIES (continued)

FACILITY: MONOLITHIC MICROWAVE AND MILLIMETERWAVE INTEGRATED CIRCUIT FACILITY

PURPOSE: To design, fabricate, and test monolithic microwave and millimeterwave integrated circuit (MMIC)

DESCRIPTION: A highly sophisticated mask layout program, a class 100 clean room, an ohmic contact annealing furnace, a vacuum station for electron beam metalization, a photo resist spinner, and ultraviolet exposure system, and several wire bonders all work together to give MMIC fabrication capability. Additionally, network analyzers are available to test MMIC components and upload experimental data in a format directly compatible with design software.

CAPABILITIES: In addition to the design and test of MMIC components, the facility permits the integration of superconducting electronics and photonic circuits with MMIC components to offer better performance and the opportunity for less expensive electronics through wafer scale integration.

UNIQUE FEATURES: All critical design and test functions are consolidated on a single computer to allow rapid turnaround of experimental components.

INSTRUMENTATION: See Description

LOCATION: Hanscom AFB MA, Bldg 11105B, 1123

FACILITY: MICROCHARACTERIZATION FACILITY

PURPOSE: To perform chemical, crystallographic, and microstructural characterization of electromagnetic and photonic materials in response to requirements of photonic/electromagnetic materials and device development programs.

DESCRIPTION: This facility consists of equipment that utilizes x-ray and electron beam technologies to measure, analyze, and characterize microstructural properties of materials. X-ray diffraction techniques are used to perform phase identification, measure lattice parameters, orient single crystals, evaluate crystal perfection, and determine lattice match of epitaxial layers. Electron microscopy techniques re used to evaluate surface microstructure; to perform qualitative and quantitative chemical analyses of major and impurity constituents of materials; and to measure crystallographic properties of selected portions of samples.

CAPABILITIES: Microstructural features can be imaged from 10X 300,000X with a resolution of 4nm (secondary image) and 10nm (backscattered image) on the scanning electron microscope (SEM). On the scanning transmission electron microscope (STEM), magnification ranges from 30X ñ 800,000X, with a resolution of 0.2 nm. Chemical analyses of elements having atomic numbers of 5 or greater can be performed routinely. X-ray techniques can measure lattice parameters with a precision of 0.00001 nm, and lattice match differences of epitaxial layers to 10ppm.

UNIQUE FEATURES: The SEM is equipped with a cold stage for examination of high temperature superconducting materials at temperatures as low as 80 degrees Kelvin.

INSTRUMENTATION: Scanning electron microscope equipped with both energy and wavelength dispersive spectrometers; scanning transmission electron microscope equipped with energy dispersive x-ray spectrometer and high resolution electron diffraction capability; automated x-ray power diffraction system; automated double crystal x-ray diffractometer; Lang topographic camera; Lauc and Debye-Scherrer cameras; x-ray generators; optical microscopes; micohardness tester, (Knoop and Vickers); and support equipment such as ion mill and evaporative coater.

LOCATION: Hanscom AFB MA, Bldg 1140

Sensors Directorate
Wright-Patterson AFB, OH 45433-7320
(937) 255-2620

Director: Mr. Les McFawn
Deputy Director: Lt Col Dick A. Trapp

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	IN-HOUSE	IN-HOUSE MANAGEMENT	OUT-OF-HOUSE	TOTAL
RDT&E:				
6.1 ILIR	1.700	N/A	N/A	1.700
6.1 Other	0.845	0.328	0.455	1.628
6.2	28.006	7.264	21.773	57.043
6.3	11.730	5.137	53.443	70.310
Subtotal (S&T)	**42.281**	**12.729**	**75.671**	**130.681**
6.4	0.000	0.000	0.000	0.000
6.5	0.000	0.000	17.708	17.708
6.6	0.000	0.000	0.000	0.000
6.7	0.000	0.000	0.000	0.000
Non-DOD	0.000	0.000	0.000	0.000
TOTAL RDT&E	**42.281**	**12.729**	**93.379**	**148.389**
Procurement	0.000	N/A	0.000	0.000
Operations & Maintenance	0.000	N/A	0.000	0.000
Other	0.000	N/A	0.000	0.000
TOTAL FUNDING	**42.281**	**12.729**	**93.379**	**148.389**

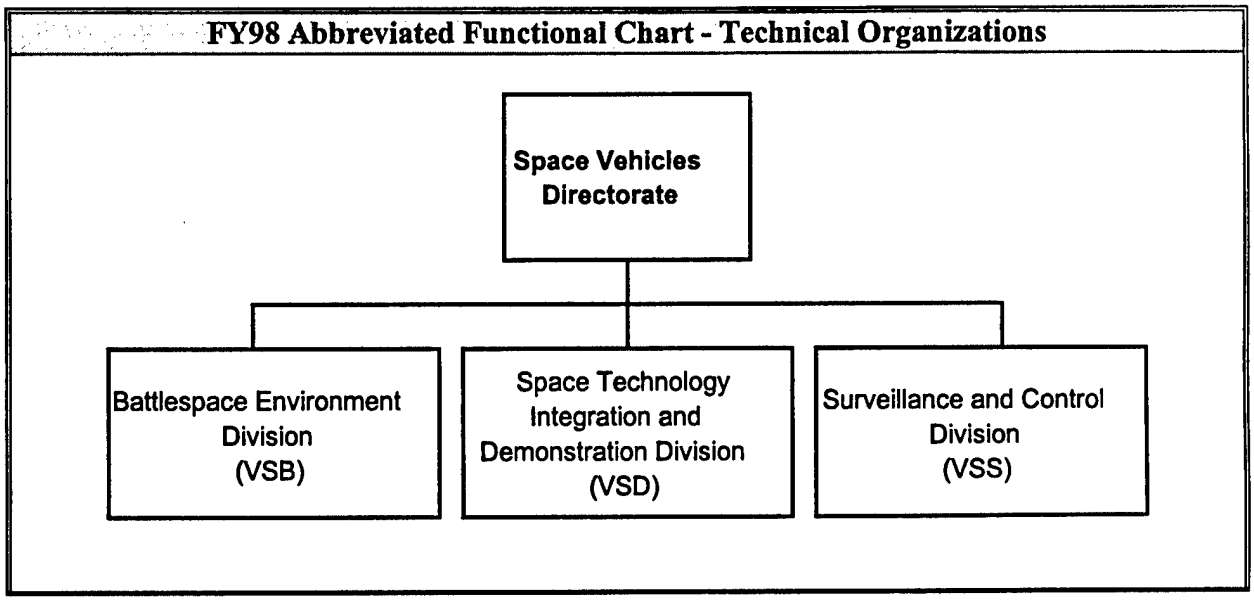
MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		TECHNICAL SUPPORT & OTHER PERSONNEL	END STRENGTH
TYPE	DOCTORATES	OTHER		
MILITARY	19	36	11	66
CIVILIAN	72	343	141	556
TOTAL	**91**	**379**	**152**	**622**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		PROPERTY ACQUISITION COST (MILLIONS $)	
LAB	306.790	**REAL PROPERTY**	182.164
ADMIN	127.276	* NEW CAPITAL EQUIPMENT	0.150
OTHER	64.650	**EQUIPMENT**	43.500
TOTAL	**498.716**	* NEW SCIENTIFIC & ENG. EQUIP.	0.000
ACRES	**100**	* Subset of previous category.	

N/A - Not Applicable

Space Vehicles Directorate



Space Vehicles Directorate
Kirtland AFB, NM 87117-5776
(505) 846-6243

Director: Christine M. Anderson
Deputy Director: Col Bruce A.Thieman

MISSION

The Space Vehicles Directorate mission is to:

Develop and transition high payoff space technologies supporting the warfighter while leveraging commercial, civil and other government space capabilities to ensure America's advantage.

CURRENT IMPORTANT PROGRAMS

The following are some of the current important programs (thrusts) on which the laboratory is working:

Space Based Surveillance: *"Sense anything, anywhere, anytime for perfect knowledge of the battlespace"*. Key programs in this area: Space Based Radar technologies, Space power, structures, electronics, Lightweight optics, Precision structures, autonomous systems, HSI/USI and multi-color sensors, and Background mitigation.

Space Capability Protection: *"Protect space systems from natural and man-made threats"*. Key programs in this area: Threat environment modeling, Environmental and hazard sensors, Ionosperic monitoring, On-orbit manueverability, Active threat control/negation, Radiation-Hardened electronics, Charge control monitoring, Debris modeling, and Contamination.

Technology Transfer Efforts: There are 26 active CRADAs. The following are some examples:

Development of microcontroller/applications with Management Sciences Inc; Test equipment in the balloon, sounding rockets and satellite arena with Jackson and Tull; Sine vibration testing of the LM 700B Structural Test Vehicle with Lockheed Martin Corporation; Taurus Payload Isolation System with Orbital Sciences Corp; Integrating DGPS/INS with Litton Guidance and Control Systems; Low-cost composite structure fabrication technology with Aerospace Consulting Corp; and NUMINT FORTRAN with Boeing Defense and Space Group

EQUIPMENT/FACILITIES

Primary operating locations are: Kirtland AFB NM, and Hanscom AFB MA. Secondary locations are at Edwards AFB CA, Holloman AFB NM, Sunspot NM and Gakona AK.

Unique facilities at Kirtland AFB NM include: the Space Structures/Composites Laboratory, the Aerospace Engineering Facility (AEF), the Space Assembly and Integration Facility (SAITF), Power and Thermal laboratory, Dynamitron facility, Cobalt 60 facility, and Nuclear Engineering evaluation facility.

Unique facilities at Hanscom AFB MA include: the High Resolution Spectroscopy facility, Cold Chemiexcited Infrared Simulation Experiment (COCHISE), Laboratory Cryogenic Electron Dependent Emissions (LABCEDE), Selected Ion Flow Drift Tube (SIFDT), Air Force Interactive Meterological System (AIMS), Electron/Ion and Thermal Calibration Facility (MUMBO and JUMBO), Mass Spectrometer Calibration System, and High Altitude Light Detection and Ranging (LIDAR) Sounder.

At Edwards AFB CA: the National Hover Test Facility (NHTF).
At Gakona AK: the High Frequency Active Auroral Research Program (HAARP) facility.
At Sunspot NM: shared use of the National Solar Observatory (owned by NSF).
At Holloman NM: the high altitude balloon launch facility.

Space Vehicles Directorate
Kirtland AFB, NM 87117-5776
(505) 846-6243

Director: Christine M. Anderson
Deputy Director: Col Bruce A.Thieman

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	0.000	N/A	N/A	0.000
6.1 Other	5.023	0.292	5.630	10.945
6.2	7.633	16.136	33.451	57.220
6.3	4.654	2.076	56.167	62.897
Subtotal (S&T)	**17.310**	**18.504**	**95.248**	**131.062**
6.4	0.000	0.000	0.000	0.000
6.5	0.000	0.077	23.233	23.310
6.6	0.000	0.000	0.000	0.000
6.7	0.000	0.000	0.000	0.000
Non-DOD	0.328	0.132	3.545	4.005
TOTAL RDT&E	**17.638**	**18.713**	**122.026**	**158.377**
Procurement	0.000	N/A	0.000	0.000
Operations & Maintenance	0.720	N/A	0.000	0.720
Other	6.004	N/A	76.689	82.693
TOTAL FUNDING	**24.362**	**18.713**	**198.715**	**241.790**

MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	**END STRENGTH**
TYPE	**DOCTORATES**	**OTHER**		
MILITARY	9	49	81	139
CIVILIAN	101	134	266	501
TOTAL	**110**	**183**	**347**	**640**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	483.000	**REAL PROPERTY**	53.000
ADMIN	114.000	* NEW CAPITAL EQUIPMENT	0.000
OTHER	58.000	**EQUIPMENT**	339.000
TOTAL	**655.000**	* NEW SCIENTIFIC & ENG. EQUIP.	0.000
ACRES	**5,787**	* Subset of previous category.	

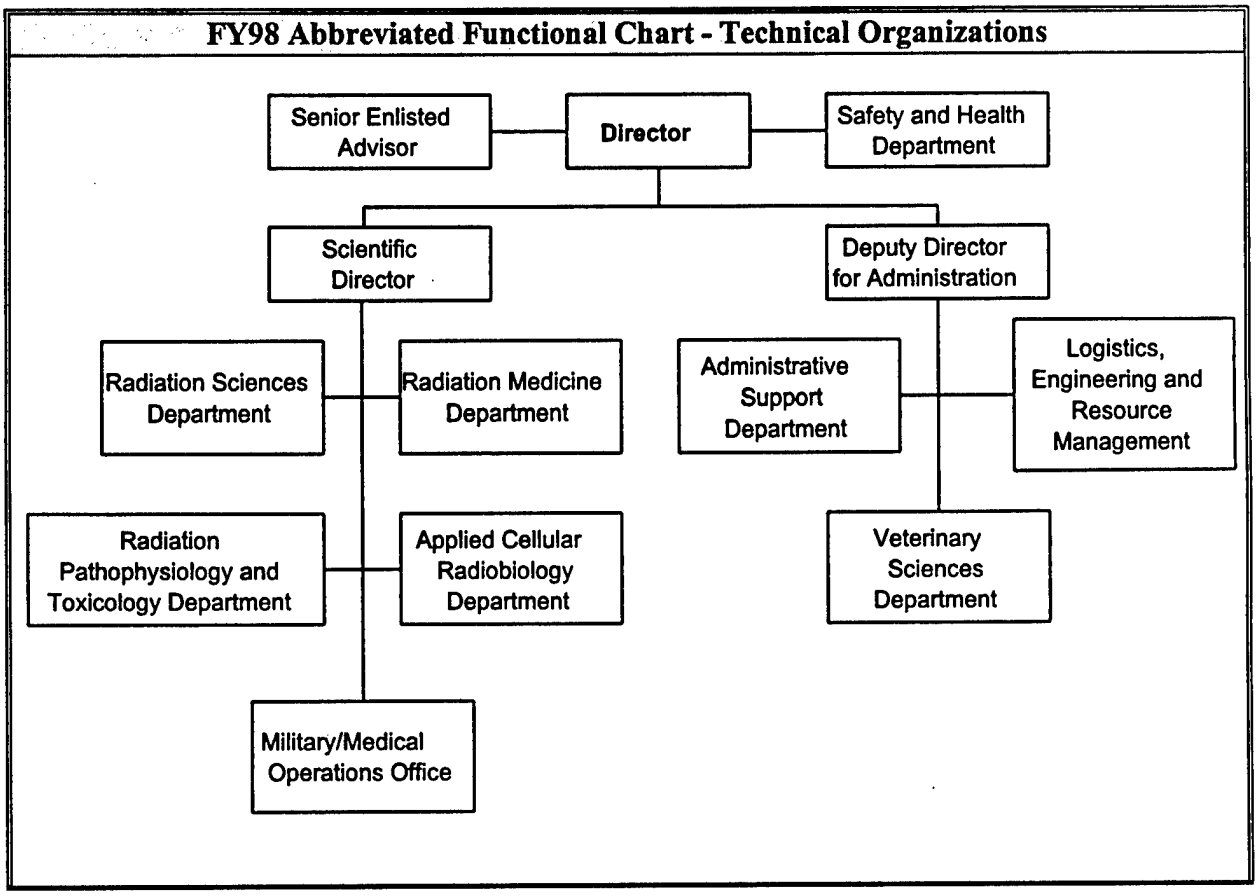
N/A - Not Applicable

UNIFORMED SERVICES UNIVERSITY OF THE HEALTH SCIENCES

UNIFORMED SERVICES UNIVERSITY of the HEALTH SCIENCES (USUHS)

The only In-House RDT&E Activity within USUHS is the Armed Forces Radiobiology Research Institute (AFRRI).

Armed Forces Radiobiology Research Institute



Armed Forces Radiobiology Research Institute
Bethesda, MD 20889-5603
(301) 295-1210

Director: COL Robert R. Eng, MS, USA
Deputy Director: COL Curtis Pearson, USAF, MSC

MISSION

The mission of Armed Forces Radiobiology Research Institute shall be to conduct research in the field of radiobiology and related matters essential to the operational and medical support of the Department of Defense and military services.

CURRENT IMPORTANT PROGRAMS

Develop medical countermeasures to treat radiation injuries.

Optimize combinations of protective agents to promote survival and combat effectiveness following irradiation at high or low dose rates.

Development of reliable biodosimetry assays/techniques.

Evaluation of early and late effects of radiation exposures at low dose rates.

Neutralization of BW/CW weapons of mass destruction.

Impact of imbedded depleted uranium shrapnel on biological systems.

Continue to support studies of residents of the former Soviet Union who were exposed to chronic radiation through environmental contamination.

EQUIPMENT/FACILITIES

Functions: operate facilities for conducting radiobiology research and disseminating results, conduct advanced training, provide analysis consultation on bioeffects of radiation, and perform such other research functions as required. Major equipment includes: pulse and steady state nuclear reactor, 100,000-Curie Cobalt-60 irradiator, electron linear accelerator, and steady state X-ray source. Support services include: measurement of radiation fields, provision and care of laboratory animals, equipment design and fabrication assistance, real-time data acquisition system, television and film documentation of experiments, personnel and environmental monitoring, editorial assistance in report preparation, and a large technical library.

Armed Forces Radiobiology Research Institute
Bethesda, MD 20889-5603
(301) 295-1210

Director: COL Robert R. Eng, MS, USA
Deputy Director: COL Curtis Pearson, USAF, MSC

FY98 FUNDING DATA (MILLIONS $)				
APPROPRIATION	**IN-HOUSE**	**IN-HOUSE MANAGEMENT**	**OUT-OF-HOUSE**	**TOTAL**
RDT&E:				
6.1 ILIR	0.000	N/A	N/A	0.000
6.1 Other	0.000	0.000	0.000	0.000
6.2	8.559	0.000	0.000	8.559
6.3	2.848	0.000	0.000	2.848
Subtotal (S&T)	**11.407**	**0.000**	**0.000**	**11.407**
6.4	0.000	0.000	0.000	0.000
6.5	0.000	0.000	0.000	0.000
6.6	0.000	0.000	0.000	0.000
6.7	0.000	0.000	0.000	0.000
Non-DOD	0.000	0.000	0.000	0.000
TOTAL RDT&E	**11.407**	**0.000**	**0.000**	**11.407**
Procurement	0.000	N/A	0.000	0.000
Operations & Maintenance	0.000	N/A	0.000	0.000
Other	1.065	N/A	0.000	1.065
TOTAL FUNDING	**12.472**	**0.000**	**0.000**	**12.472**

MILITARY CONSTRUCTION (MILLIONS $)	
Military Construction (MILCON)	0.000

PERSONNEL DATA (END OF FISCAL YEAR 1998)				
	SCIENTISTS & ENGINEERS		**TECHNICAL SUPPORT & OTHER PERSONNEL**	**END STRENGTH**
TYPE	**DOCTORATES**	**OTHER**		
MILITARY	0	0	63	63
CIVILIAN	39	27	35	101
TOTAL	**39**	**27**	**98**	**164**

SPACE AND PROPERTY			
BUILDING SPACE (THOUSANDS OF SQ FT)		**PROPERTY ACQUISITION COST (MILLIONS $)**	
LAB	61.750	**REAL PROPERTY**	18.610
ADMIN	34.257	* NEW CAPITAL EQUIPMENT	0.000
OTHER	23.908	**EQUIPMENT**	11.921
TOTAL	**119.915**	* NEW SCIENTIFIC & ENG. EQUIP.	0.025
ACRES	**10**	* Subset of previous category.	

N/A - Not Applicable

APPENDICES

APPENDIX A
DISESTABLISHMENT, ESTABLISHMENT, OR CHANGE IN ORGANIZATION NAME

APPENDIX A

DISESTABLISHMENT, ESTABLISHMENT, OR CHANGES IN ORGANIZATION NAME BETWEEN FY97 AND FY98

DEPARTMENT OF THE ARMY

The **Army Research Institute** is now referred to as the *Army Research Institute for Behavioral and Social Sciences.*

The **Medical Research Institute of Environmental Medicine** is now referred to as the *Army Research Institute of Environmental Medicine.*

Operational Test and Experimentation Command data is now reported as part of the *Operational Test and Evaluation Command.*

DEPARTMENT OF THE NAVY

The **Naval Command, Control, and Ocean Surveillance Center** (NCCOSC) has been disestablished effective 30 September 1997. Space and Naval Warfare Systems Command (SPAWAR) field activities formerly reporting to NCCOSC now report directly to SPAWAR. The SPAWAR activities have been renamed the Space and Naval Warfare Systems Centers (SSCs) and consist of SSC, San Diego (previously known as NCCOSC RDT&E Division), SSC, Charleston (previously known as NCCOSC ISE East Division), and SSC, Chesapeake (previously known as Navy Management Systems Support Office).

The Naval Warfare Assessment Station (NWAS), Corona was realigned from the Naval Ordnance Center (NOC) to the **Naval Surface Warfare Center** in March 1998: their financial data continued with the NOC through 30 September 1998.

The four Naval warfare centers provide full spectrum research, development, test and evaluation, engineering, and fleet support services and perform a substantial amount of non-RDT&E work (e.g., FY98 workload was 30% RDT&E and 70% non-RDT&E). In previous years' reports, the Navy has been reporting each warfare center in its entirety, even though a considerable amount of the reported end strengths, funding, and other resources are devoted to other than RDT&E programs. For purposes of more accurately reflecting RDT&E In-House resources for the FY98 report, the Navy has applied the established RDT&E In-House criteria (i.e., a minimum of 25% of total funds is RDT&E and a minimum of 25% of in-house effort is devoted to RDT&E) at the division or major site level rather than reporting all warfare center sites, regardless of their level of RDT&E work. As a result, some warfare center entities have been eliminated from the FY98 report because they are below the 25% RDT&E threshold for inclusion in this report:

The **Naval Air Warfare Center** does not include data from the Aircraft Division Lakehurst Activity and Training Systems Division which were reported as part of the center for FY97.

The **Naval Surface Warfare Center** does not include data from the Crane and Port Hueneme Divisions which were reported as part of the center for FY97. NWAS Corona data is not included in the FY98 DOD In-House RDT&E Activities Report.

The **Naval Undersea Warfare Center** does not include data from the Keyport Division which was reported as part of the center for FY97.

The **Space and Naval Warfare Systems Centers** do not include data from SSC, Charleston and SSC, Chesapeake which were reported as part of the center (then known as NCCOSC) for FY97.

APPENDIX A

DISESTABLISHMENT, ESTABLISHMENT, OR CHANGES IN ORGANIZATION NAME BETWEEN FY97 AND FY98

DEPARTMENT OF THE AIR FORCE

The Air Force Research Laboratory (AFRL) has been re-organized, consolidating the four existing AF laboratories, **Armstrong Laboratory, Phillips Laboratory, Rome Laboratory,** and **Wright Laboratory,** and the AF Office of Scientific Research (AFOSR). AFRL Activities reported for FY98 are:

Headquarters Air Force Research Laboratory (AFRL)/Research Sites
Air Force Office of Scientific Research (AFOSR)
Air Vehicles Directorate (VA)
Directed Energy Directorate (DE)
Human Effectiveness Directorate (HE)
Information Directorate (IF)
Materials and Manufacturing Directorate (ML)
Munitions Directorate (MN)
Propulsion Directorate (PR)
Sensors Directorate (SN)
Space Vehicles Directorate (VS)

DEPARTMENT OF DEFENSE AGENCIES

No changes.

Note: Activities in **bold typeface** were reported in the FY97 edition of this report as separate Activities.

Italicized Activities are new for FY98.

APPENDIX B
DEFINITIONS OF REPORT ELEMENTS

APPENDIX B

DEFINITIONS OF REPORT ELEMENTS

INTRODUCTORY PRECAUTIONARY NOTE

Data in this report should not be summarized or used for comparative analyses between Activities and/or across Services because labs/centers use different business systems to satisfy their special needs. Some organizations (e.g., Navy) operate on an industrial funding basis; that is, they charge their customers for all operating costs, including maintaining their physical plants and providing other necessary support services (e.g., human resources office, finance and accounting support). Other labs/centers (e.g., Air Force) are institutionally funded; that is, they receive most of their funding as direct appropriations from Congress and use these funds for operating support costs as well as for research. In addition, most institutionally funded labs/centers are tenants on larger military bases and receive their support services at reduced or no charge from their host. Even those that own their own facilities receive separate funding support services and do not charge their customers for these overhead costs. Efforts are underway to institute common business practices across the DOD RDT&E labs, but until that occurs comparisons may be misleading.

APPENDIX B

DEFINITIONS OF REPORT ELEMENTS

ABBREVIATED FUNCTIONAL CHART - TECHNICAL ORGANIZATIONS

This is a partial organization chart, provided by each Activity, to provide an overview of its technical operations. It does not depict the entire organizational structure and is abbreviated for purposes of this report.

NARRATIVES

Mission Statement
Stated is the mission of the laboratory or Activity.

Current Important Programs Narrative
Summarized are current important programs on which the laboratory or Activity is working. Any Technology Transition efforts like Cooperative Research and Development Agreements (CRADAs) are identified.

- **Technology Transfer**
  Data supplied are any major Technology Transfer efforts underway, including the number of scientists and engineers exchanged with industry or academia.

Equipment/Facilities Narrative
Summarized are the major equipment and facility capabilities of the laboratory or Activity including any unique equipment and facilities not available to the commercial or academic R&D community anywhere else.

APPENDIX B

DEFINITIONS OF REPORT ELEMENTS

FUNDING

RDT&E Budget Activities (BAs)

BA	BA Title	Applicable Research Categories
1	Basic Research	6.1
2	Applied Research	6.2
3	Advanced Technology Development	6.3
4	Demonstration and Validation (Dem/Val)	6.4
5	Engineering & Manufacturing Development (EMD)	6.5
6	RDT&E Management Support	6.6
7	Operational Systems Development (OSD)	6.7

In-House RDT&E Activities
These Activities are organizational entities which perform at least 25% of their work in any or all of the categories of research, development, test and evaluation (RDT&E). In addition, at least 25% of an Activity's In-House manpower and/or 25% of the obligation authority used In-House is devoted to one or more of the categories of RDT&E.

Current Year Obligation Authority
Authority for the financial resources available for obligation in the specific year being reported. This excludes unobligated authority carried forward from the prior year. The appropriation category refers to the original funding source, even if it may reimburse a different funding category.

In-House
The total amount for the fiscal year reporting period for mission-oriented work directly performed, or to be performed, by government personnel of the reporting organization.

- **Included**: funding regardless of source (i.e., own Service, sister Service, ARPA, OSD, etc.); costs of supplies and equipment essentially of an off-the-shelf nature, which are procured for use in-house; direct labor, direct material, direct travel, direct equipment, direct computer support, other direct support; and all overhead costs.
- **Excluded**: expenses for planning and administering contracts and grants for out-of-house work and expenses for activities performed by contractors of the reporting organization.

In-House Managing Out-of-House
The total amount of funds incurred in planning and administering out-of-house programs by personnel of the reporting organization. **(This data element is not applicable for the Navy. The Navy includes these funds in the In-House category).**

- **Included**: travel and other supporting services.

Out-of-House
The total amount for the fiscal year reporting period for direct mission-oriented work performed, or to be performed, by other than the government personnel *at* the reporting organization.

- **Included**: RDT&E work by other departmental or DoD organizations, industrial firms, educational institutions, not-for-profit institutions, and private individuals.
- **Excluded**: all overhead costs.

APPENDIX B

DEFINITIONS OF REPORT ELEMENTS

FUNDING (continued)

6.1 Basic Research

6.1 In-House Laboratory Independent Research (ILIR)
The total amount for research 6.1 In-House Laboratory Independent Research program elements.

6.1 Other In-House/Out-of-House
The total amount for Basic Research 6.1 program elements which are not ILIR but are conducted in-house/out-of-house.

6.1 In-House Effort Managing Out-of-House Contracts (In-House-Management)
The total amount for expenses incurred in planning and administering Basic Research 6.1 programs, by personnel of the organizational entity, which are conducted out-of-house.

6.2 Applied Research

6.2 In-House/Out-of-House
The total amount for Applied Research 6.2 program elements conducted in-house/out-of-house.

6.2 In-House Effort Managing Out-of-House Contracts (In-House-Management)
The total amount for expenses incurred in planning and administering Applied Research 6.2 programs, by personnel of the organizational entity, which are conducted out-of-house.

6.3 Advanced Technology Development

6.3 In-House/Out-of-House
The total amount for Advanced Technology Development 6.3 program elements conducted in-house/out-of-house.

6.3 In-House Effort Managing Out-of-House Contracts (In-House-Management)
The total amount for expenses incurred in planning and administering Advanced Development 6.3 programs, by personnel of the organizational entity, which are conducted out-of-house.

6.4 Demonstration and Validation (Dem/Val)

6.4 In-House/Out-of-House
The total amount for Dem/Val 6.4 program elements conducted in-house/out-of-house.

6.4 In-House Effort Managing Out-of-House Contracts (In-House-Management)
The total amount for expenses incurred in planning and administering Dem/Val 6.4 programs, by personnel of the organizational entity, which are conducted out-of-house.

APPENDIX B

DEFINITIONS OF REPORT ELEMENTS

FUNDING (continued)

6.5 Engineering and Manufacturing Development (EMD)

6.5 In-House/Out-of-House
The total amount for EMD 6.5 program elements conducted in-house/out-of-house.

6.5 In-House Effort Managing Out-of-House Contracts (In-House-Management)
The total amount for expenses incurred in planning and administering Engineering and Manufacturing Development 6.5 programs, by personnel of the organizational entity, which are conducted out-of-house.

6.6 RDT&E Management Support

6.6 In-House/Out-of-House
The total amount for RDT&E Management Support 6.6 program elements conducted in-house/out-of-house.

6.6 In-House Effort Managing Out-of-House Contracts (In-House-Management)
The total amount for expenses incurred in planning and administering Management Support 6.6 programs, by personnel of the organizational entity, which are conducted out-of-house.

6.7 Operational Systems Development (OSD)

6.7 In-House/Out-of-House
The total amount for all OSD 6.7 with RDT&E funds conducted in-house/out-of-house. This item is interpreted in its broadest sense to include operational developments outside the systems areas, and not included in any of the above categories.

6.7 In-House Effort Managing Out-of-House Contracts (In-House-Management)
The total amount for expenses incurred in planning and administering Operational Systems Development (OSD) 6.7 programs, by personnel of the organizational entity, which are conducted out-of-house.

Non-DoD

Non-DoD In-House/Out-of-House
The total amount for all In-House/Out-of-House RDT&E not included in 6.1-6.7 as defined above.

Non-DoD In-House Effort Managing Out-of-House Contracts (In-House-Management)
The total amount for expenses incurred in planning and administering RDT&E not included in 6.1-6.7 programs, by personnel of the organizational entity, which are conducted out-of-house

Procurement

Procurement In-House/Out-of-House
The total amount for procurement appropriations in-house/out-of-house regardless of source.

APPENDIX B

DEFINITIONS OF REPORT ELEMENTS

FUNDING (continued)

Operation and Maintenance (O&M)

O&M In-House/Out-of-House
The total amount for O&M appropriations in-house/out-of-house regardless of source.

Other

Other In-House/Out-of-House
The total amount for all other appropriations in-house/out-of-house regardless of source. Included are Military Pay and Allowances (MPA) if applicable.

Military Construction (MILCON)

MILCON
This is the total amount for Military Construction appropriations.

Totals

Total RDT&E
The sum of the total amount, regardless of source, for both In-House, In-House Managing Out-of-House, and Out-of-House funding for the following categories:

ILIR 6.1
Basic Research 6.1
Applied Research 6.2
Advanced Technology Development 6.3
Demonstration and Validation (Dem/Val) 6.4
Engineering and Manufacturing Development (EMD) 6.5
RDT&E Management Support 6.6
Operational Systems Development 6.7
Non-DOD

Total Funding
The sum of Total RDT&E, Procurement, Operations & Maintenance and Other.

APPENDIX B

DEFINITIONS OF REPORT ELEMENTS

PERSONNEL

Military

Military End Strength
Military end strength is the September 30 strength of Active duty military

- **Included**: Transients, trainees, holdees and students.
- **Excluded**: Cadets.

Military Scientist and Engineering Doctorates
The total number of military scientists and engineers (officer and enlisted) whose most advanced degree is a doctorate. Degrees must be earned from an accredited college or university. Honorary degrees are excluded.

- **Included**: Full-time military scientific, engineering, mathematical, and medical personnel actively engaged in RDT&E activities.
- **Excluded**: Lawyers, accountants, chaplains, social workers and educators.

Other Military Scientists and Engineers
The total number of military scientists and engineers (officer and enlisted) who do not hold a doctor's degree, but who are considered professionals.

- **Included**: Full-time military scientific and engineering personnel actively engaged in RDT&E activities.
- **Excluded**: Lawyers, accountants, chaplains, social workers and educators.

Military Technical Support and Other Personnel
The total number of Military Technical Support and Other Personnel. This includes all military personnel not listed in the above two categories.

Civilian

Civilian End Strength
Civilian end strength is the September 30 strength of DoD civilian direct hires in a paid, active duty status who are paid from appropriated funds (RDT&E and other appropriations).

- **Included**: Part time and temporary personnel.
- **Excluded**: Defense Intelligence Agency and National Security Agency personnel.

Civilian Scientist and Engineering Doctorates
The total number of civilian scientists and engineers whose most advanced degree is a doctorate. Degrees must be earned from an accredited college or university. Honorary degrees are excluded.

- **Included**: Full-time government scientific, engineering, mathematical, and medical personnel actively engaged in RDT&E activities.
- **Excluded**: Lawyers, accountants, chaplains, social workers and educators.

APPENDIX B

DEFINITIONS OF REPORT ELEMENTS

PERSONNEL (continued)

Other Civilian Scientists and Engineers
The total number of civilian scientists and engineers who do not hold a doctor's degree, but who are rated as professionals.

- **Included**: Full-time government scientific and engineering personnel actively engaged in RDT&E activities.
- **Excluded**: Lawyers, accountants, chaplains, social workers and educators.

Civilian Technical Support and Other Personnel
The total number of Civilian Technical Support and Other Personnel. This includes all civilian personnel not listed in the above two categories.

APPENDIX B

DEFINITIONS OF REPORT ELEMENTS

SPACE AND PROPERTY

Acreage
The total number of acres owned, combined with the total number of acres occupied, rounded to the nearest acre. In cases involving tenants who are also RDT&E Activities, the tenants report only the acreage occupied solely by them. The owning Activity reports the remainder including any acreage occupied by non-R&D tenants.

- **Included**: land which is public domain.
- **Excluded**: all easements and permits.

Laboratory Space
The total number of square feet (in thousands)* of permanent and semi-permanent (e.g., fixed-site trailers) building space that is laboratory space.

- **Included**: only walled and roofed building space; facilities assigned to, leased by, or occupied by the reporting organization.
- **Excluded**: parking lots; open storage areas; lean-tos.

Administrative Space
The total number of square feet (in thousands)* of building space that is administrative space (usually that portion occupied by the headquarters and support services staff, and excluding scientists' or engineers' offices in a laboratory which is reported as Laboratory space).

- **Included**: facilities assigned to, leased by, or occupied by the reporting organization.

Other Space
The total number of square feet (in thousands)* of all remaining building space (e.g., hangars, warehouses, garages, etc.).

- **Included**: facilities assigned to, leased by, or occupied by the reporting organization.

**Square feet is expressed in thousands. For example, 15,200 square feet is entered as 15.2.*

Acquisition Cost of Real Property
The total acquisition cost (in millions $)** of all land, buildings, and capital equipment and their improvements. An RDT&E owner does not report this information for the facilities assigned to, or occupied by its RDT&E tenants, as they report this information separately.

- **Included**: the cost of installed physical plant equipment, such as HVAC; facilities assigned to, leased by, or occupied by the reporting organization.
- **Excluded**: The cost of acreage or buildings rented from private owners.

Each reporting activity is responsible for determining and reporting the cost of real property. This includes the cost of installed equipment.. This figure represents the true total investment over the life of the activity for real property on hand as of the reporting date.

New Capital Equipment
The total acquisition cost (in millions $)** for new capital equipment (i.e., installed physical plant equipment such as HVAC) acquired during the fiscal year reporting period. This amount is also included in the entry for Acquisition Cost of Real Property.

APPENDIX B

DEFINITIONS OF REPORT ELEMENTS

SPACE AND PROPERTY (continued)

Acquisition Cost of Equipment
The total acquisition cost (in millions $)** of all "personal property" equipment. An RDT&E owner does not report this information for the facilities assigned to, or occupied by its RDT&E tenants, as they report this information separately.

- **Included**: The cost of installed equipment directly related to mission execution, such as lab test equipment; the cost of equipment in facilities assigned to, leased by, or occupied by the reporting organization.
- **Excluded**: The cost of physical plant equipment reported under Acquisition Cost of Real Property (explained previously).

Each reporting activity is responsible for determining and reporting the cost of personal property. This cost includes those costs incurred by the acquisition (including installation when applicable) of all property other than real property. It includes personal property such as machine tools, environmental test equipment, furniture, laboratory equipment, vehicles, etc. Items having a unit cost of less than $200 are excluded. The figure represents the cost of all personal property acquired throughout the life of the activity, to the reporting date, that is still on hand.

New Scientific & Engineering Equipment
The total acquisition cost (in millions $)** for new scientific & engineering equipment acquired during the fiscal year reporting period. This amount is also included in the entry for Acquisition Cost of Equipment.

- **Included**: The cost of installed equipment directly related to mission execution, such as lab test equipment.

*** Dollars are expressed in millions rounded to the nearest thousand. For example, $2,517,830 is entered as 2.518.*

APPENDIX C
SELECTED STANDARD ABBREVIATIONS AND ACRONYMS

APPENDIX C

SELECTED STANDARD ABBREVIATIONS AND ACRONYMS

ACTD	-	Advanced Concept and Technology Demonstration
ASW	-	Antisubmarine Warfare
ATD	-	Advanced Technology Demonstration
BRAC	-	Base Realignment and Closure
C2	-	Command and Control
C4I	-	Command, Control, Communications, Computers, and Intelligence
CAD	-	Computer Aided Design
CAE	-	Computer Aided Engineering
CAM	-	Computer Aided Manufacturing
CB	-	Chemical Biological
CBR	-	Chemical, Biological, Radiological
CM	-	Countermeasures
CONUS	-	Continental United States
COTS	-	Commercial off-the Shelf
CRADA	-	Cooperative Research and Development Agreement
CW	-	Chemical Warfare
DA	-	Department of the Army
DOD	-	Department of Defense
DREN	-	Defense Research and Engineering Network
DTAP	-	Defense Technology Area Plan
ECCM	-	Electronic Counter-Countermeasures
ECM	-	Electronic Countermeasures
EMI	-	Electromagnetic Interference
EMP	-	Electromagnetic Propagation
EMV	-	Electromagnetic Vulnerability
EPA	-	Environmental Protection Agency
EW	-	Electronic Warfare
FSN	-	Foreign Service National
GPS	-	Global Positioning System
HF	-	High-Frequency
HVAC	-	Heating, Ventilation, and Air Conditioning
IAC	-	Information Analysis Center
IEW	-	Intelligence and Electronic Warfare
IFF	-	Identification, Friend or Foe
ILIR	-	In-House Laboratory Independent Research
IR	-	Infrared
IR&D	-	Independent Research and Development
KE	-	Kinetic Energy
LAN	-	Local Area Network
M&S	-	Modeling and Simulation
MOU	-	Memorandum of Understanding

APPENDIX C

SELECTED STANDARD ABBREVIATIONS AND ACRONYMS

MSRC	-	Major Shared Resource Center
NBC	-	Nuclear, Biological and Chemical
NVD	-	Night Vision Devices
OCONUS	-	Outside the Continental United States
PEO	-	Program Executive Officer
PM	-	Program Manager
R&D	-	Research and Development
RDT&E	-	Research, Development, Test and Evaluation
RF	-	Radio Frequency
SOF	-	Special Operations Forces
S&T	-	Science and Technology
SBIR	-	Small Business Innovation Research
STO	-	Science and Technology Objective
T&E	-	Test and Evaluation
UAV	-	Unmanned Aerial Vehicle
USW	-	Undersea Warfare
UUV	-	Unmanned Undersea Vehicle
UV	-	Ultraviolet
WAN	-	Wide Area Network