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Technology Research Corporation

PROGRAM DOCUMENTATION FOR THE LIGHTWEIGHT WATER PURIFIER (LWP)

Final Report

15 March 1996

Prepared for Tank-Automotive Research, Development and Engineering Center, Mobility Technology Center-Belvoir, AMSTA-RBWE under contract number DAAK70-92-D-0003, DO 0039

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PROGRAM DOCUMENTATION
FOR THE
LIGHTWEIGHT WATER PURIFIER
(LWP)

1.0 INTRODUCTION

1.1 Scope

This Final Scientific and Technical Report was prepared by BRTRC Technology Research Corporation under Belvoir Research, Development, and Engineering Center Contract DAAK70-92-D-003, Task Order No. 39. The report covers all documents prepared under the task order in order to support a Milestone Decision Review I/II. All acquisition documents were prepared in accordance with formats provided in Department of Defense Manual 5000.2-M. Department of the Army Pamphlet 70-3 was used as a guide for the format for the System MANPRINT Management Plan.

Initial draft documentation was provided in the initial draft report dated 31 August 1994. The task order was subsequently modified to include the preparation of a draft Purchase Description / Performance Specification, System MANPRINT Management Plan (SMMP), and the Manpower, Personnel, and Training Assessment (MPTA). Original draft documentation has been revised several times to agree with the program and is currently updated herein to reflect the 7 April 1995 Coordinating Draft Operational Requirement Document (ORD).

1.2 Background

The Mission Need Statement (MNS) for the Lightweight Water Purifier (LWP) was approved on 6 October 1993 (CARDS Reference Number 22-93). To provide assistance in this program, BRTRC Incorporated was commissioned on 27 May 1994 to support development of program documentation for a Milestone I/II Decision Review, which was originally scheduled for March 1995. Because of delays in obtaining approval of the Operational Requirements Documents, the Milestone I/II Decision Review was postponed and is now scheduled for Second or Third Quarter FY96. Documentation prepared under this contract has been revised as the program has changed and is currently in review and staffing.

1.3 Program Documents

This report provides copies of the latest revisions of program documents prepared to support the Lightweight Water Purifier (LWP) program. Documents included here are:

- Integrated Program Summary (IPS)
- IPS, Annex A: Program Structure
- IPS, Annex B: Program Life Cycle Cost Summary
- IPS, Annex C: Acquisition Strategy Report (ASR)
- IPS, Annex D: Risk Assessment

- IPS, Annex E: Environmental Assessment
- IPS, Annex F: Affordability Assessment
- Acquisition Program Baseline (APB)
- Test and Evaluation Master Plan (TEMP)
- System MANPRINT Management Plan (SMMP)
- Manpower, Personnel, and Training Assessment (MPTA)
- Performance Specification

Additional documents prepared under this task order but delivered separately to the project engineer and cognizant offices were:

- Cost and Operational Effectiveness Analysis (COEA) Coord Final Report
- Validated and Revised Program Life Cycle Cost Estimates (LCCE)
- Decision Cost Estimates (DCE) for alternatives examined in the COEA

2.0 TECHNICAL OBJECTIVE AND APPROACH

2.1 Technical Objective

The principal technical objective for this task was to prepare documentation to support the Milestone I/II Decision process for the LWP. Sub-objectives required the preparation of a variety of acquisition documents to support the program. During the course of the task, changes in the operational requirements and the numbers of units required made necessary numerous revisions related to performance, quantities, cost, and schedule information contained in the documentation.

2.2 Technical Approach

This was a program management sciences effort rather than a technical support task. Techniques employed were based on experience with Defense Acquisition policy, procedures, and program management requirements, DoD costing procedures, Cost and Operational Analysis methods, as well as, knowledge and familiarity with water purification and water supply operations.

3.0 SUMMARY

This document, with its attachments, constitutes the final Scientific and Technical Report, Data Item 004, required under Task Order No. 39.

Fifteen (15) Enclosures

Encl 1	Integrated Program Summary (IPS), 15 March 1996
Encl 2	Annex A Program Structure
Encl 3	Annex B Program Life Cycle Cost Summary, 4 October 1996
Encl 4	Annex C Acquisition Strategy Report, 31 March 1995
Encl 5	Annex D Risk Assessment, 15 March 1996
Encl 6	Annex E Environmental Assessment, 26 December 1995
Encl 7	Annex F Affordability Assessment, 15 March 1996
Encl 8	Acquisition Program Baseline (APB), 31 January 1996
Encl 9	Test and Evaluation Master Plan (TEMP), 11 August 1995
Encl 10	System MANPRINT Management Plan (SMMP), 14 July 1995
Encl 11	Extract of Cost and Operational Effectiveness Analysis (COEA), Coordinating Final Report, 11 March 1996
Encl 12	Manpower, Personnel, and Training Assessment (MPTA), 25 July 1995
Encl 13	Performance Specification, 31 October 1995
Encl 14	Revised Program Life Cycle Cost Estimate (LCCE) (Summary Pages only), 4 October 1995
Encl 15	Decision Cost Estimates (DCE) for alternatives examined in the COEA (Summary Pages only), 11 July 1995

NOTE: These documents have all been revised -- many of them several times. Consequently only the latest version of each is enclosed.

INTEGRATED PROGRAM SUMMARY (IPS)

FOR THE

LIGHTWEIGHT WATER PURIFIER

(LWP)

15 March 1996

Bob Shalewitz (703) 704-3358
TARDEC Mobility Technology Center - Belvoir
Fuel and Water Supply Division
Fort Belvoir, Virginia 22060

MILESTONE I/II
LIGHTWEIGHT WATER PURIFIER
(LWP)

CONCURRENCE SHEET

Approve transition of the Lightweight Water Purifier (LWP) to Acquisition Phase II, Engineering and Manufacturing Development (EMD).

TARDEC MTC-Belvoir ATTN: AMSTA-RBWE Fort Belvoir, VA 22060-5843 MATERIEL DEVELOPER	CONCUR/NONCONCUR	DATE
TECOM ATTN: AMSTE-TA-G APG, MD 21005-5005 DEVELOPMENT ASSESSOR	CONCUR/NONCONCUR	DATE
OEC ATTN: CSTE-ECS Park Center IV, 4501 Ford Ave. Alexandria, VA 22302-1458 OPERATIONAL EVALUATOR	CONCUR/NONCONCUR	DATE
AMSAA ATTN: AMXSY-LX APG, MD 21005-5071 LOGISTICIAN	CONCUR/NONCONCUR	DATE
TRADOC ATTN: ATCD-SL Ft Monroe, VA 23651-5194 TRADOC REPRESENTATIVE	CONCUR/NONCONCUR	DATE

INTEGRATED PROGRAM SUMMARY

FOR THE

LIGHTWEIGHT WATER PURIFIER (LWP)

COVER SHEET

1. Decision Requested. It is requested that the Milestone Decision Authority approved transition of the Lightweight Water Purifier (LWP) to Acquisition Phase II, Engineering and Manufacturing Development (EMD).

2. Program Description. This Integrated Program Summary (IPS) supports a combined Milestone I/II Decision Review (MDR I/II). The Lightweight Water Purifier (LWP) program is based on a streamlined Non-Developmental Acquisition Strategy. Commercially available water purifiers using "state of the art" technology and lightweight and more efficient components or a combination of available systems can be integrated to meet the requirement. The LWP will support units that operate independently for extended periods or at remote sites outside the established water distribution network. The present requirement is for approximately 50 Army systems for special operation and medical units. The Lightweight Water Purifier (LWP) is a compact and mobile purification system which can be transported in the back of a High Mobility Multi-Purpose Wheeled Vehicle (HMMWV) or other 1¼ ton vehicle. The system can also be transported by UH-60 helicopter. The LWP is quick and easy to set up and is operated part-time by non-dedicated individuals. The proposed system produces at least 75 gallons of potable water per hour from salt water sources and up to 200 gallons per hour from fresh water sources. The LWP is expected to operate from 6 to 10 hours per day. The LWP must be emplaced and recovered from operational sites by four personnel.

Acquisition Category IV   Program Element 64804   Project Number XXXX

PREPARED BY

_______________________________ Date _______________

CONCURRENCE

_______________________________ Date _______________

APPROVAL

_______________________________ Date _______________

INTEGRATED PROGRAM SUMMARY

FOR THE

Lightweight Water Purifier (LWP)

EXECUTIVE SUMMARY

1. Program Execution Status.

a. Background.

(1) The U.S. Army has a need to provide a safe, potable water supply for small units and detachments, to include Special Operations Forces (SOF), engaged in early entry, long range surveillance, and contingency missions. Missions during Other Military Operations (formerly called Operations other than War - OOTW) may also include nation building, civil affairs assistance, and disaster relief. These units may operate independently for extended periods or at remote sites and at distances inconsistent with the established water distribution network. The need has been further documented in the Mission Need Statement (MNS) for the Lightweight Water Purifier (LWP) approved by Headquarters, Department of the Army (HQDA) on 6 October 1993 and in the 7 April 1995 coordinating draft Operational Requirements Document (ORD) for the Lightweight Water Purifier (LWP).

(2) The Lightweight Water Purifier (LWP) is a compact and mobile purification system which can be transported in the back of a High Mobility Multi-Purpose Wheeled Vehicle (HMMWV) or other 1¼ ton vehicle. The system can also be transported by UH-60 helicopter. The LWP is quick and easy to set up and is operated part-time by non-dedicated individuals. The proposed system produces at least 75 gallons of potable water per hour from salt water sources (45,000 mg/l total dissolved solids (TDS)) and up to 200 gallons per hour from fresh water sources (1,000 mg/l TDS). According to the Operational Mode Summary/Mission Profile (OMS/MP), Annex B to the ORD, the LWP is expected to operate from 6 to 10 hours per day to produce these quantities of potable water. The LWP must be emplaced and recovered from operational sites by four personnel. Single modules must not weigh more than 328 pounds. Emplacement and recovery by two individuals is desired. A total of 50 systems are projected for use by Special Operations Forces and selected medical units.

b. Program Progress.

(1) Milestone 0 Exit Criteria. A Mission Need Statement (MNS) was approved on 6 October 1993. A Milestone 0 decision to initiate a study effort to explore alternative concepts using commercially available components or improvements to existing systems is planned for ________. No exit criteria have been established.

(2) Additional Guidance. There has been no subsequent guidance, decisions, or Congressional actions since the MNS (and Milestone 0) approval.

(3) Current Program and Contract Status.

(a) The Cost Estimate at Completion is summarized by Fiscal Year at Annex B in Constant and Current Year dollars. Figures below are FY96 Constant $:

RDT&E:	$	2.43 Million
Procurement:	$	2.83 Million
Mil Con:	$	0.00 Million
Mil Per:	$	3.33 Million
O&M:	$	4.88 Million
Life Cycle:	$	13.47 Million

(b) The program currently awaits approval of the ORD and is behind schedule relative to Annex A, Program Structure according to the following milestones:

MS I/II:	2nd or 3QFY96
MS III:	1QFY98
FAT/PQT:	2QFY99

(c) Achieved Performance: A market survey of information on foreign and domestic purifiers obtained during the December 1992 - June 1993 period by the study sponsor. This survey canvassed thirty-seven (37) potential suppliers and obtained positive responses from sixteen (16) sources. Based on the results of the market survey and test data to date, several of these commercial water purifiers or components of existing purifiers can be configured to meet the need for a 75-200 GPH system within the approximate weight and cube limitations of the M1097A HMMWV cargo area. An Abbreviated Operational Assessment (AOA) was completed by the US Army Operational Evaluation Command (USAOEC) on __________. An Abbreviated Independent Assessment Report (AIAR) was completed by the US Army Test and Evaluation Command (TECOM) on __________.

(4) Trade-Offs. There are no known specific cost-performance-schedule trade-offs identified at this time. Obviously, there may be trade-offs associated with the size and weight, power requirements, and water production rates of the final system. These interrelation of these elements will be further explored during Phase II.

(5) Program Funding Status Relative to:

(a) Prior Years: Program Funding in prior years was used to carry out Technical Feasibility Testing of small commercial purifiers and individual components, conduct a Market Investigation of commercially available systems, and to evaluate the performance characteristics of available filtration, pre-treatment, and high pressure systems.

(b) Current Budget: The comparison chart below shows the status of near term funding. A potential surplus of $ 182,000 (Current Year $) is based on the 4 October 1995 revised Program Life Cycle Cost Estimate. Breakout by fiscal year is as follows:

	FY96	FY97	FY98	FY99	FY00	FY01	TOTAL
Reqd RDT&E	626	929	251	-	-	-	1806
Funded	805	633	550	-	-	-	1988
Surplus	179	-296	299	-	-	-	182

(c) Out-Year Funding: Out-Year Procurement funding currently falls about $ 1.31 Million below the estimated amounts for 50 systems. The Program Life Cycle Cost Estimate (LCCE) was based on a buyout out of all 50 Army systems over a three year period starting in FY99. The current programming in the POM reflects the purchase of only 20 systems over two years. Procurement of the additional 30 systems requires adjustments to the current POM as shown below in Current Year $K Dollars. The unfunded requirement (UFR) for $ 1.31 Million is noted. Funding options related to program acceleration are addressed in Annex F.

	FY99	FY00	FY01	FY02	FY03	FY04	FY05	TOTAL
REQD	997	2066	250	-	-	-	-	3313
POM	1000	1000	-	-	-	-	-	2000
UFR	-3	1066	250	-	-	-	-	1313

(6) Obligation Status: Not Applicable

2. Threat Highlights and System Shortfalls.

a. Threat Environment. The Lightweight Water Purifier (LWP) ... "does not counter a specific threat. An LWP capability and its associated personnel are vulnerable to the spectrum of threat destruction and/or disruption capabilities at all levels of conflict along the operational continuum. Though unlikely, the LWP capability also may be attacked as a target of opportunity. Destructive capabilities such as direct and indirect fires, small arms fire and sabotage can harm the system and associated personnel. This capability is will also be susceptible to contamination. The NBC operations and weapons effects may render the system temporarily unusable or may destroy it." (MNS, paragraph 2.b). The reliance on host nation or suspect sources of water poses a threat to the health and safety of soldiers operating outside normal water supply channels. Since water is an essential commodity, the LWP is intended to eliminate the health threat by providing an organic means to produce potable water within the unit. The LWP will be used by units involved in low intensity conflict (LIC) environments, contingency operations, special operations and other scenarios where the distribution of bulk water is not feasible or practical. During peacetime, Army SOF units may perform missions relating to foreign internal defense efforts, special reconnaissance, counterterrorism and counterdrug operations, humanitarian and civic assistance, and demonstrations of US presence.

b. System Threat Assessment Report. The System Threat Assessment Report (STAR) for Land Warrior has been approved for use as the baseline threat for the Lightweight Water Purifier (LWP).

c. Hostile Intelligence Threat. Not Applicable.

d. Inadequacies of Existing Capabilities or Systems. While the individual methods of water purification using iodine tablets, hypochlorite ampules, or boiling are appropriate to provide for the needs of the soldier or small groups in an emergency situation, they are not intended to meet the sustained requirements for small units. These methods are not effective for treating brackish or sea water. Therefore, none of the individual methods is considered a viable alternative to produce sustained quantities of 75 to 200 gallons of potable water per hour. Existing 600 and 3000 GPH ROWPUs are assigned primarily to division, corps, and echelon above corps quartermaster supply and service units which operate water points in the Division Support Area (DSA), Brigade Support Area (BSA), Corps Rear, and Communication Zone (COMMZ). Neither the 600 nor the 3000 GPH system is compatible with the missions and types of vehicles available to units requiring a Lightweight Water Purification capability. Except in cases where limited distribution is provided, units are required to travel to the water point for resupply. Remote units operating outside these areas are therefore isolated from normal resupply. For SOF missions, the 528th Support Battalion uses 600 GPH ROWPUs to produce water for air delivery to remote teams. Resupply by air is not always possible due to operational or weather limitations. In addition, delivery of water by air is expensive (see Annex F and the Cost and Operational Effectiveness Analysis (COEA)).

In summary, the deficiencies of current water purification methods can be characterized by:

- Inability of individual methods to treat brackish or sea water.
- Insufficient flow rates or excess water production capacity.
- Potential adverse mobility impact on non-Quartermaster using units.

e. Program Protection and System Security. The LWP is based on commercially available technology. There are no sensitive technologies or unique system features that necessitate special program protection or security measures.

3. Alternatives Assessed and Results.

a. Alternatives Considered

The March 1995 Cost and Operational Effectiveness Analysis (COEA) considered the following four alternatives:

- Base Case, Shipping Water in by Helicopter or Fixed Wing Aircraft
- Rebuy - Water Purification Unit, Reverse Osmosis, 600 GPH w/o Trailer, Flatbed Cargo, 5 Ton, 4 Wheel Tandem (REBUY 600 GPH)
- Rebuild - Water Purification Unit, Reverse Osmosis, 600 GPH w/o Trailer, Flatbed Cargo, 5 Ton, 4 Wheel Tandem (REBUILD 600 GPH)
- Lightweight Water Purifier (LWP)

b. Description of Alternatives

(1) Base Case: Shipping Water in by Helicopter or Fixed Wing Aircraft

The current system represents the base case. Small detachments and teams performing long range reconnaissance and covert operations rely primarily on emergency or survival water procedures. When demand for water exceeds the capability of these individual purification methods, however, bulk water production support is provided to the user from a secure base area and airdropped or airlifted by helicopter to the operating area. Thus support for semi-stationary missions involving 100 to 125 personnel will normally depend on air resupply. The 528th Special Operations Support Battalion (Airborne) performs such water supply missions for elements of the Special Operations Command (SOCOM).

This unit has four 600 GPH Reverse Osmosis Water Purification Units (ROWPUs). The water section normally sets up a consolidated water point at a convenientlocation in a secure base area. Purified water for the isolated detachment is pumped into 250-gallon drums at this water point. Rigging teams then configure the drums for air movement. In this configuration, the drums can be air delivered by C-130 or C-141 fixed wing aircraft to a forward support site and then further lifted using UH-60 Blackhawk or larger rotary wing aircraft into the actual area of operations. For costing purposes, the COEA assumed movement by helicopter out to a range of about 100 miles (1 hour flight time). To meet the requirements specified in the Operational Requirements Document (ORD), daily resupply is required.

(2) 600 GPH ROWPU - Rebuy of Marine Corps Version

This alternative consists of using the 600 GPH ROWPU to support Special Operations Forces (SOF) as an alternative to developing and acquiring the Lightweight Water Purifier (LWP). For this alternative, the US Marine Corps version of the 600 GPH ROWPU is used. This unit differs from the Army version in that it is skid mounted, and the 5-ton, 4-wheel tandem trailer is not included. A separate 30 kw generator is required. The unit is capable of producing drinking water from polluted fresh water, brackish water, and sea water. It is also capable of removing chemical and radiological contaminants from the water.

The Marine Corps version of the 600 GPH ROWPU is lighter than the Army version. It weighs only 7,300 pounds, plus approximately 2850 pounds for the generator. Hence the Marine Corps version is more suitable than the Army version for SOF missions. The unit and its generator could be transported to the SOF operating area by a UH-60 or CH-47D helicopter -- in both cases as external loads. Alternatively, the ROWPU and the generator could be airdropped into the operating area by a C-130 or larger aircraft.

To support SOF units, this ROWPU could produce up to 3,600 gallons of potable water per day (900 GPH) from a fresh water or brackish water source and up to an estimated 2,400 gallons daily (600 GPH) from a sea water source. Daily production in a SOF environment is based on a maximum of 4 hours of operation per day. Using the maximum demand of 800 GPD, this unit could meet the daily consumption needs with only 54 to 80 minutes of operation. Treated water is pumped to a potable water distribution system consisting of two 3000-gallon collapsible storage tanks and a dispensing pump. Brine waste water is collected in a third collapsible tank if required. The product water from the system meets quality standards for soldiers in the field.

(3) 600 GPH ROWPU - Rebuilding Existing Units

With the drawdown of force levels, it is possible that the 50 units required can be found from Army or Marine Corps holdings. This alternative involves acquiring and rebuilding the 600 GPH ROWPUs from service excesses.

The rebuilt ROWPU 600 obviously has identical operational and performance characteristics as the basic 600 GPH ROWPU discussed above. The rebuild option affects only the cost of the program. Since the ROWPUs and generators are already in the field, both RDT&E Costs and Procurement Costs for this alternative are Sunk Costs and hence are excluded from the Decision Cost Estimate. However, it is assumed that the units would need to be rebuilt or overhauled before issue, as they have been in the field for 10-15 years. The overhaul is estimated to cost 50% of the procurement costs for new units. Except for the overhaul costs and the costs of transporting the units to the depot for overhaul and from the depot to the SOF units, the O&M Costs would be the same as for the rebuy alternative above.

(4) <u>Lightweight water purifier (LWP)</u>

The LWP is a US Army effort to meet the need for water purification to support small units and detachments in areas that are remote from normal support assets. The LWP is intended to support the basic water needs of task forces ranging up to 125 personnel with a peak demand of 750 to 800 gallons per day. The system does not replace existing capabilities, but rather supplements the existing water purification and supply systems. The design objectives of the system are outlined in the coordinating draft ORD dated 7 April 1995.

An abbreviated development program using commercially available water purifiers and/or components is envisioned. Production quantities are estimated at 50 systems to support special operations forces and selected medical units. A specific Basis of Issue (BOI) has not yet been determined by the proponent(s). Production approval and Type Classification (TC) - Standard is planned for FY 1999 with deliveries occurring in FY 2000.

The Lightweight Water Purifier (LWP) will probably consist of several small modules or components to provide potable water from fresh, brackish, saline, or NBC-contaminated water sources. These components may include a pre-treatment stage or subsystem in the form of cartridge filters, screens, or membranes to reduce suspended solids in the feed water. A second bank of smaller mesh filtration may also be included to further improve water quality prior to entry into stage two. This second or desalinization stage will probably consist of a reverse osmosis unit with multiple elements and will eliminate dissolved solids from the source water. By-pass of this stage may be possible, depending on the initial level of dissolved solids in the source and the quality of the water exiting the pre-treatment stage. Following the desalinization stage, a post treatment stage will probably include a chlorinator to provide for residual protection against recontamination and filters to remove nuclear and chemical contamination. Water quality from this process is expected to exceed Environmental Protection Agency (EPA) standards, since most commercial purifiers are intended to service the general populace.

The LWP will be capable of providing a minimum of 75 gallons per hour using feed water with a salinity of 45,000 parts per million and a water temperature of 77° F. Commercial equipment with capacities of 250 GPH using a seawater source is available. Consequently, LWP projected outputs of 100-125 GPH (Seawater) and 185-200 GPH (Fresh water) are considered reasonably achievable. The LWP will incorporate storage drums, bladders, or tanks and a dispensing capability sufficient to store and issue at least 800 gallons per day (GPD). To produce this quantity of water, the LWP will operate no more than 4 hours per day.

The LWP will be capable of being transported by a C-130 or larger aircraft and by a UH-1 or larger helicopter.

c. Summary of Draft Cost and Operational Effectiveness Analysis.

A draft Cost and Operational Effectiveness Analysis (COEA) was prepared in August 1994 for the LWP. An updated COEA was provided in March 1996. This section summarizes the conclusions of the draft COEA.

For the Cost analysis, detailed Decision Cost Estimates were prepared for the alternatives; trade-off, sensitivity, and uncertainty analyses were conducted; and the Decision Cost Estimates were validated by the Belvoir Cost Analysis Office in October 1994. These estimates have been revised to reflect the current 7 April 1995 ORD and a quantity of 50 systems.

No combat or battlefield simulation models were used in the COEA. However, a decision analysis support software package, Expert Choice™ Version 9.0 for Windows, was used in the operational requirement analysis and comparison of each of the alternatives. The relative performance of each of the alternatives against the 7 April 1995 coordinating draft Operational Requirements Document (ORD) requirements formed the basis of the operational effectiveness analysis.

4. Most Promising Alternative and Rationale.

a. Comparison.

The primary function of a Lightweight Water Purifier (LWP) is to provide water support to special forces detachments and selected medical units during contingency operations and during operations other than war. Conduct of operations at remote sites and often in hostile/non-permissive environments are the key elements of the concept. Water production, ease of operations, mobility, transportability, and performance are major considerations. Figure 1 on the following page compares selected values for some of the chief Measures of Effectiveness (MOE).

Figure 1, which is reproduced from the March 1996 COEA, compares the Ratio Scale values for overall capability, principal operational criteria, subordinate performance criteria, and Total Decision Costs in both Constant FY 1996 and Current dollars. The preferred value for each of the criteria has been underlined for ease of identification. All decision costs were based on the procurement of 50 LWP systems.

CRITERIA	BASE CASE SHIP BY AIR	600 GPH ROWPU REBUY	600 GPH ROWPU REBUILD	LWP
OVERALL	.287	.171	.171	.371
PERFORMANCE	.264	.182	.182	.373
LOG/READI	.331	.124	.124	.422
CRIT SYST CHARACT'CS	.417	.178	.178	.226
MOBILITY	.150	.153	.153	.545
WATER OPNS	.155	.299	.299	.247
TIME/EFFORT	.322	.112	.112	.454
DURABILITY	.625	.125	.125	.125
TRANSPORT	.215	.118	.118	.549
TOTAL DCE (CONSTANT $)	$112.40 Million	$11.78 Million	$8.19 Million	$9.59 Million
TOTAL DCE (CURRENT $)	$184.50 Million	$16.33 Million	$11.90 Million	$12.94 Million

Figure 1. Comparison of Decision Costs and Operational Effectiveness

b. Decision Criteria

- Cost: If cost were the only criterion, a Rebuild of the existing 600 GPH ROWPU is clearly the cheapest of the four approaches in terms of Constant FY96 dollars. The rebuild option is $ 1.4 million less than the LWP and $ 3.6 million lower than a rebuy of the 600 GPH. Of particular interest is that the Base Case of Shipping Water by Air is, by more than an order of magnitude, the most expensive option. When viewed from the perspective of the base case, all the other alternatives are essentially equivalent in terms of cost.

- Operational Effectiveness: However, if operational effectiveness in terms of overall capability were the only gauge, the LWP is clearly superior to the other alternatives. The LWP outperforms the alternative systems in many areas. The only area that the 600 GPH alternatives excel is in water production where their ability exceeds the need. Durability (ruggedness, corrosion resistance, protection) is the major advantage of the base case.

- Cost and Operational Effectiveness: In most real-world decisions, both cost and operational effectiveness must be considered. Figure 2 provides a graphic comparison of decision cost and operational performance. This diagram sharply reveals the cost-effective advantages of the Lightweight Water Purifier (LWP). The LWP offers the opportunity to significantly improve on the Base Case and the 600 GPH ROWPU options at a cost nearly equal to the least expensive alternative.

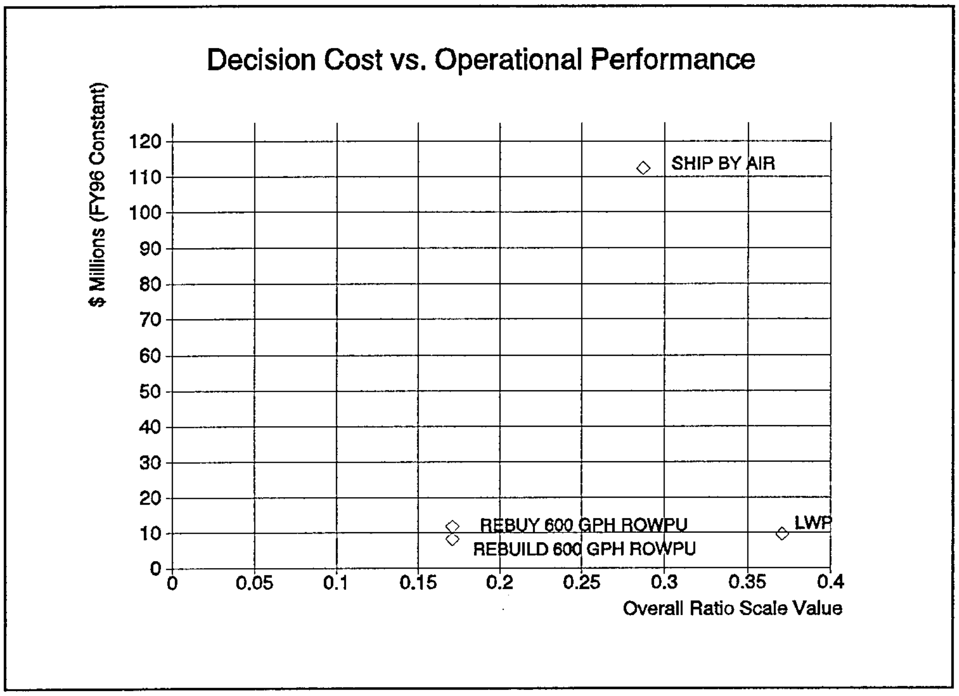

Figure 2. Cost and Operational Effectiveness Comparison

c. Preferred Alternative.

Based on a composite evaluation of system cost, schedule, and performance, the COEA concludes that the LWP is the recommended alternative to satisfy the requirement defined in the Mission Needs Statement and the Operational Requirements Document. Costs for the LWP are substantially lower than the current base case and are roughly equivalent to the other options. However, for essentially the same decision cost as the 600 GPH alternatives, the LWP offers a marked improvement in performance.

5. Acquisition Strategy.

a. The LWP program is based on a streamlined acquisition process intended to reduce overall program costs and development time. A market investigation indicates commercially available water purifiers and/or a combination of available purifiers with relatively minor modifications will provide feasible alternatives to satisfy this need. Several sources are capable of supplying the LWP and are expected to compete for its development and production. Accordingly, an abbreviated development effort is planned to select a commercial purifier or combination of purifiers and identify necessary modifications. Milestone I/II is scheduled for Second or Third Quarter FY96.

b. Water purifiers from several different sources will be procured for government in-house experiments and early test/evaluation. The resulting performance specification will be used to support a Third Quarter FY96 award of the Engineering Manufacturing Development (EMD) contract. Three operational prototypes, purchased from a single manufacturer, will support Production Qualification Test and Initial Operational Test scheduled to begin Fourth Quarter FY97.

c. Milestone III and Type Classification Standard of the LWP is projected for First Quarter FY98. Materiel Release based on FAT/PQT is projected for Second Quarter FY99. Spare parts and components for operator and direct support maintenance will be procured under the production contract according to a Level of Repair Analysis. Contractor logistics support will be used for higher echelons of maintenance and supply. Commercial operator and maintenance publications will be procured.

6. Cost Drivers and Major Trade-Offs. There are no known cost driver issues or tradeoffs to be addressed at Milestone I/II.

7. Risk Assessment and Plans to Reduce Risk.

a. A detailed risk assessment is attached at Annex D.

b. The Safety and Health Function is assessed as Low/Moderate Risk. Noise levels for reverse osmosis water purification equipment have frequently required post-development abatement efforts; for example, the 600 GPH and the 3000 GPH systems. The required level of 83 dB (A) or less is achievable if stressed during engineering. Plans to reduce risk include establishing noise levels $\leq$ 83 dB (A) as critical performance standards and establish procedures to insure compliance.

c. The Manpower, Personnel, and Training (MANPRINT) Interface Function has been rated as moderate risk primarily because of human factors issues and component weight constraints. Commercial candidates investigated thus far vary in weight from 315 to 750 pounds. Power for the system may require at least a 3 KW generator which adds approximately 370 pounds for a maximum total system weight of 1120 pounds. Although this weight is well within the rated payload capacity of the M1097A HMMWV, individual modules must be portable by 2-4 soldiers. The current 3 KW military standard generator exceeds both the 2 and 4 man lift limitations. Other modules may present similar lift problems. Plans to reduce risk include developing a weight budget and constantly monitoring the size and weights of individual components against the human factors lift limitations. The lightest military standard generator set capable of meeting power and other requirements will be considered. If it is still too heavy, commercial generators, which are often lighter than military ones, power sources may offer a means to solve this problem.

d. The Cost and Funding Function also represents a moderate degree of risk. The current funding stream does not appear to reflect the proper balance of RDT&E and Procurement funds necessary to execute the program. RDT&E funds appear too high, and Procurement funds seem too low, although the shortage of procurement funds may well be a result of the frequent changes in the quantity to be procured as the ORD has gone through several revisions. Current RDT&E funds total $ 1.988 Million for FY96-98. The revised decision cost estimates prepared in support of the program indicate that a total of $ 1.806 Million in RDT&E may be required or an apparent $ 0.182 Million surplus. On the other hand, Procurement funding for FY99-00 totals only $ 2.00 Million, for 20 systems. Estimates of Procurement funds required for 50 systems range from $ 2.381 to $4.416 Million (Current Dollars).[1] Clearly additional procurement funds will be needed if the requirement remains 50 systems. Under the most optimistic assumptions, however, a realignment of RDT&E and Procurement appropriations might solve the problem. Plans to minimize risk include seeking early approval of the Operational Requirement Document (ORD) to stabilize both crucial technical requirements and the quantities to be procured. Conduct a comprehensive review of programmed, available and estimated funding to detect shortfalls or excesses. As early as possible request realignment of funding or additional funds from proper authority as required.

e. The Environmental Assessment at Annex E concluded that the LWP was the environmentally preferred alternative. The potential environmental effects produced by the four alternatives during development, production, operation, and disposal are relatively minor. Differences between the environmental effects of the four systems are slight and mostly concentrated in the operations phase. The analysis above makes clear, however, that the Lightweight Water Purifier (LWP) produces the least harmful environmental effects. The Base Case, shipping the water to the operating area by air, is the most harmful. The ranking on the basis of environmental factors is as follows:

- Lightweight Water Purifier (LWP) - Environmentally preferred alternative.
- Rebuild Water Purification Unit, Reverse Osmosis (ROWPU), 600 GPH, w/o Trailer (Marine Corps version).

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[1]. For the development of these high and low estimates, see the Cost and Operational Effectiveness Analysis for the Lightweight Water Purifier (Enclosure 11), Section 3.4.2.5, p. 3-26.

- Rebuy of Water Purification Unit, Reverse Osmosis (ROWPU), 600 GPH, w/o Trailer (Marine Corps version).

- Base Case: Haul Water by Aircraft - Least desirable alternative.

8. Affordability of Selected Alternative.

a. A detailed affordability assessment is attached at Annex F.

b. The proposed Lightweight Water Purifier (LWP) can be accommodated fairly easily within the available top line funding for Water and Petroleum equipment. Attachment 1 shows that peak funding for the system never exceeds about 8 percent of projected available funding. Average funding over the years FY94-00 represents only about 3 percent of the total expected to be available.

(1) Comparison of the current and proposed system costs in Constant FY96 Dollars reveals that the LWP potentially produces a life cycle savings to the Army of $102.8 Million by reducing flying hours dedicated to water supply. (It is likely, however, that these hours/savings will be applied elsewhere to meet air mission requirements. In other words, these savings may actually represent increased aircraft availability for other operations.) The net RDT&E and Procurement investment of $ 5.3 Million produces savings of $108.0 Million in Operations and Maintenance. The average annual O&M savings of about $ 5.4 Million <u>each year</u> are almost the same as the <u>total</u> initial investment.

(2) Comparison of the current and proposed system costs in Current Dollars shows that the LWP produces a savings of $ 106.1 Million over the life of the system. The net RDT&E and Procurement investment of $ 5.8 Million produces savings of $ 117.4 Million in Operations and Maintenance. The average annual O&M savings of about $ 8.87 Million <u>each year</u> are greater than the <u>total</u> initial investment.

c. The Army could elect to keep the program "as is" and buy only 20 systems (or as many as the current funding will permit. This requires no action and no adjustments to the POM. The current unfunded requirement to purchase the remaining systems is only $ 1.31 Million. Based on the information above and in Annex F, savings in the first year of operation will more than offset the investment.

d. Bottom Line.

The proposed Lightweight Water Purifier (LWP) program is affordable and produces significant savings in operating costs (or increased aircraft availability for other missions) to the Army over its life span.

9. Recommendation. It is recommended that the Milestone Decision Authority (MDA) approve the Integrated Program Summary and transition of the Lightweight Water Purifier (LWP) to Acquisition Phase II, Engineering and Manufacturing Development.

Fourteen (14) Enclosures

Encl 1	Annex A Program Structure
Encl 2	Annex B Program Life Cycle Cost Summary
Encl 3	Annex C Acquisition Strategy Report
Encl 4	Annex D Risk Assessment
Encl 5	Annex E Environmental Assessment
Encl 6	Annex F Affordability Assessment
Encl 7	Acquisition Program Baseline (APB)
Encl 8	Extract of Cost and Operational Effectiveness Analysis (COEA)
Encl 9	Test and Evaluation Master Plan (TEMP)
Encl 10	Manpower, Personnel, and Training Assesment (MPTA)
Encl 11	System ManPrint Management Plan (SMMP)
Encl 12	Performance Specification
Encl 13	Mission Needs Statement (MNS)
Encl 14	Operational Requirement Document (ORD)

ANNEX A

LIGHTWEIGHT WATER PURIFIER (LWP) PROGRAM STRUCTURE AND SCHEDULE

FISCAL YEAR	1994	1995	1996	1997	1998	1999	2000
MILESTONES			Δ I/II		Δ III	Δ Mat Rel	
SOLICITATION RELEASE		Δ EMD			Δ PROD		
CONTRACT AWARD			Δ EMD			Δ PROD	
DELIVERIES			Prototype (3)			Production (50)	
DEVELOPMENTAL TEST & EVALUATION		MIT		PQT		FAT	
OPERATIONAL TEST & EVALUATION		EUP		IOT			

KEY TO ABBREVIATIONS

EMD	Engineering and Manufacturing Development	Mat Rel	Materiel Release
EUP	Early User Participation	MIT	Market Investigation Tests
FAT	First Article Test	Prod	Production
IOT	Initial Operational Test	PQT	Production Qualification Test

ANNEX B - LIGHTWEIGHT WATER PURIFIER (LWP) PROGRAM LIFE-CYCLE COST ESTIMATE SUMMARY ($K)

SECTION 1 - THOUSANDS OF FY 1996 CONSTANT DOLLARS

As of Date: 4 October 1995	FY94	FY95	FY96	FY97	FY98	FY99	FY00	TOTAL
ACQUISITION QUANTITIES								
Development Quantity: Funded	1	3		3				7
Delivered	1	3		3				7
Production Quantity:								
Low Rate Initial Prod: Funded								
Delivered								
Full Rate Production: Funded						10	40	50
Delivered						10	40	50
DEVELOPMENT PHASE REQUIREMENTS								
RDT&E (All 6.4)								
Combined DEMVAL/EMD								
Development Engineering	103	198	398	298	103			1,101
Prototype Manufacturing	31	125		117				273
Test and Evaluation			74	295				369
Total RDT&E	262	451	610	879	231			2,433
PRODUCTION PHASE REQUIREMENTS								
PROCUREMENT								
Manufacturing Cost						370	1,479	1,849
Initial Spares							185 (FY01)	185
Total Production Phase						869	1,748	2,836
TOTAL 20-YEAR LIFE CYCLE REQUIREMENTS	262	451	610	879	231	869	1,748	—

NOTE: Costs are extracted from the Revised Program Life Cycle Cost Estimate for the Lightweight Water Purifier (LWP). Because all cost elements and all years are not included, the figures will not add to the totals shown.

	FY01	FY02	FY03	FY04	FY05	FY06	TOTAL through 2021
OPERATIONS AND SUPPORT PHASE REQUIREMENTS							
MILITARY PERSONNEL		166	166	166	166	166	3,328
O&M		244	244	244	244	244	4,877
TOTAL 20-YEAR LIFE-CYCLE REQUIREMENTS	206	411	411	411	411	411	**13,473**

SECTION 2 - THOUSANDS OF **CURRENT** DOLLARS

As of Date: 4 October 1995	FY94	FY95	FY96	FY97	FY98	FY99	FY00	TOTAL
ACQUISITION QUANTITIES								
Development Quantity: Funded Delivered	1 1	3 3		3 3				7 7
Production Quantity:								
Low Rate Initial Prod: Funded Delivered								
Full Rate Production: Funded Delivered						10 10	40 40	50 50
DEVELOPMENT PHASE REQUIREMENTS								
RDT&E (All 6.4)								
Combined DEMVAL/EMD								
Development Engineering	100	198	409	315	112			1,134
Prototype Manufacturing	30	124		123				278
Test and Evaluation			76	312				388
Total RDT&E	253	450	626	929	251			2,509
PRODUCTION PHASE REQUIREMENTS								
PROCUREMENT								
Manufacturing Cost						424	1748	2,172
Initial Spares							225 (FY01)	225
Total Production Phase						997	2,066	3,335
TOTAL 20-YEAR LIFE CYCLE REQUIREMENTS	253	449	626	929	251	997	2,066	—

NOTE: Costs are extracted from the Revised Program Life Cycle Cost Estimate for the LWP. Because all Cost Elements and all years are not included, the figures will not add to the totals shown.

	FY01	FY02	FY03	FY04	FY05	FY06	TOTAL through 2021
OPERATIONS AND SUPPORT PHASE REQUIREMENTS							
MILITARY PERSONNEL		195	200	204	209	213	4,860
O&M		298	307	316	325	335	8,004
TOTAL 20-YEAR LIFE-CYCLE REQUIREMENTS	250	494	507	521	535	549	**18,708**

INTEGRATED PROGRAM SUMMARY (IPS)

ANNEX C

ACQUISITION STRATEGY REPORT

for the

LIGHTWEIGHT WATER PURIFIER

(LWP)

15 March 1996

ACQUISITION STRATEGY

LIGHTWEIGHT WATER PURIFIER (LWP)

1. Program Summary

a. The LWP is a US Army effort to meet the need for a water purification unit to support small units and detachments engaged in low intensity and disaster relief operations in areas remote from normal support assets. Local water supplies are often unacceptable in these contingencies and resupply of water is normally not practical. A Mission Needs Statement was approved 6 Oct 93.

b. Existing and projected military water purifiers require heavy vehicles and material handling equipment not available to these elements. They also greatly exceed available power and expendable resupply capabilities of isolated units in these contingencies.

2. Program Structure. A graphic portrayal of program structure is at page 3.

a. A market investigation indicates commercially available water purifiers and/or a combination of available purifiers with relatively minor modifications will provide feasible alternatives to satisfy this need. Several sources are capable of supplying the LWP and are expected to compete for its development and production. Accordingly, an abbreviated development effort is planned to select a commercial purifier or combination of purifiers and identify necessary modifications. Milestone I/II is scheduled for Second or Third Quarter FY96.

b. Water purifiers from several different sources will be procured for government in-house experiments and early test/evaluation. The resulting performance specification will be used to support a Third Quarter FY96 award of the Engineering Manufacturing Development (EMD) contract. Three operational prototypes, purchased from a single manufacturer, will support Production Qualification Test and Initial Operational Test scheduled to begin Fourth Quarter FY97.

c. Milestone III and Type Classification Standard of the LWP is projected for First Quarter FY98. Materiel Release based on FAT/PQT is projected for Second Quarter FY99. Spare parts and components for operator and direct support maintenance will be procured under the production contract according to a Level of Repair Analysis. Contractor logistics support will be used for higher echelons of maintenance and supply. Commercial operator and maintenance publications will be procured.

3. **Contracting Strategy.** Full and open competition will be used for this procurement. Effective technical and price competition is expected to keep cost risk low. Overall technical risk is also estimated to be low because of the variety of water purification units available commercially which potentially meet LWP requirements .

a. The EMD contract will be competitively awarded on a best value basis. Technical approach, cost, logistical supportability and past performance will be the principal areas evaluated. A commercial product description will be a deliverable.

b. The production contract will be awarded on a sole source basis to the winner of the EMD contract, provided that PQT/IOT is successfully passed.

c. Production will be funded during FY99 and FY00. Ten items will be delivered in the first year and the remaining forty in the following year. An updated product description in commercial format will be delivered to provide a basis for possible procurement of additional LWPs and/or spare parts.

4. **Program Streamlining.** The LWP program is based on a tailored non development item acquisition process to reduce overall costs and time to field.

a. The strategy to produce the LWP by modifying commercially available purifiers is preferable to a product improvement approach using existing military water purification systems. Improving existing systems to meet user requirements would involve substantial redesign making them essentially new items. It would offer no cost advantage over the preferred approach.

b. The use of commercially available items and a best value approach for selecting a source are the major technical and cost risk reduction factors for this compressed effort. A logistics support analysis effort will begin in the EMD phase to ensure equipment publications and spare parts are available at the time LWP is fielded.

5. **Short Term Issues and Major Tradeoffs.** There are no known issues or tradeoffs to be addressed at Milestone I/II.

LIGHTWEIGHT WATER PURIFIER (LWP) PROGRAM STRUCTURE AND SCHEDULE

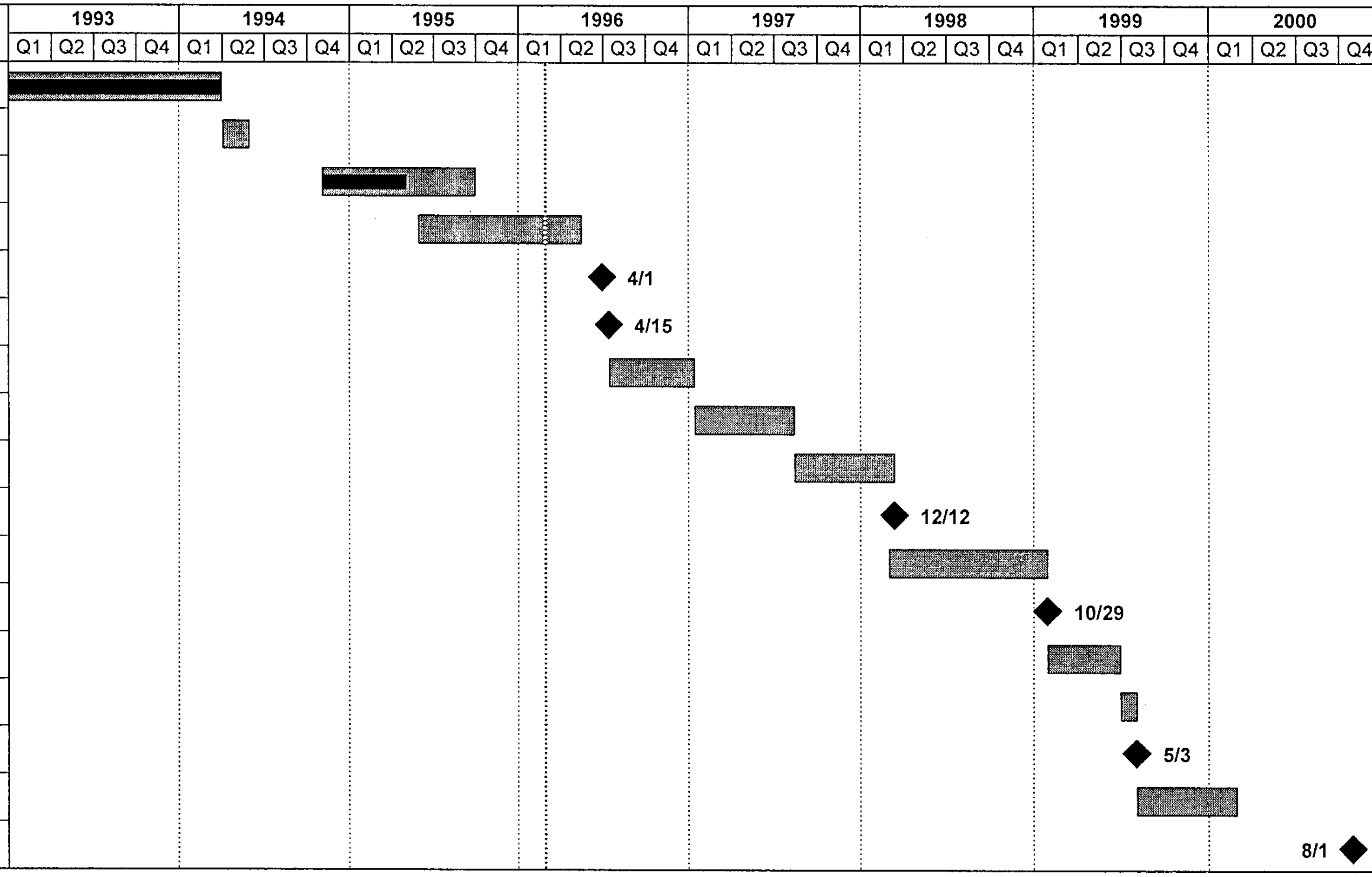
FISCAL YEAR	1994	1995	1996	1997	1998	1999	2000
MILESTONES			Δ I/II		Δ III	Δ Mat Rel	
SOLICITATION RELEASE		Δ EMD			Δ PROD		
CONTRACT AWARD			Δ EMD			Δ PROD	
DELIVERIES			Prototype (3)			Production (50)	
DEVELOPMENTAL TEST & EVALUATION		MIT		PQT		FAT	
OPERATIONAL TEST & EVALUATION		EUP		IOT			

KEY TO ABBREVIATIONS

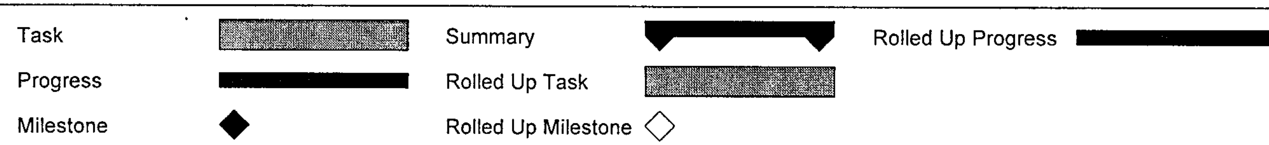
EMD	Engineering and Manufacturing Development	Mat Rel	Materiel Release
EUP	Early User Participation	MIT	Market Investigation Tests
FAT	First Article Test	Prod	Production
IOT	Initial Operational Test	PQT	Production Qualification Test

LIGHTWEIGHT WATER PURIFIER

ID	Task Name
1	Perform Market Investigation
2	Select Units for Evaluation
3	MTCB Testing
4	EMD Contract PALT
5	MS I/II IPR
6	Award EMD Contract (3 Units)
7	Fabricate EMD Prototypes
8	PPQT/IOT
9	Prep Test Rprts & IPR Package
10	MS III IPR
11	Production Contract PALT
12	Award Production Contract
13	Production of FAT Units
14	FAT
15	Complete FAT
16	Production Completed
17	FUE



Project: Lightweight Water Purifier
Date: 11/27/95



INTEGRATED PROGRAM SUMMARY (IPS)

ANNEX D

RISK ASSESSMENT

FOR THE

LIGHTWEIGHT WATER PURIFIER

(LWP)

15 March 1996

INTEGRATED PROGRAM SUMMARY
ANNEX D
RISK ASSESSMENT
FOR THE
LIGHTWEIGHT WATER PURIFIER (LWP)

1.0 RISK ASSESSMENT.

The Lightweight Water Purifier (LWP) is a compact and mobile purification system which can be transported in the back of a High Mobility Multi-Purpose Wheeled Vehicle (HMMWV) or other 1¼ ton vehicle. The system can also be transported by UH-60 helicopter. The LWP is quick and easy to set up and is operated part-time by non-dedicated individuals. The proposed system produces at least 75 gallons of potable water per hour from salt water sources (45,000 mg/l total dissolved solids (TDS)) and up to 200 gallons per hour from fresh water sources (1,000 mg/l TDS). According to the Operational Mode Summary/Mission Profile (OMS/MP), Annex B to the ORD, the LWP is expected to operate from 6 to 10 hours per day to produce these quantities of potable water. The LWP must be emplaced and recovered from operational sites by four personnel. Single modules must not weigh more than 328 pounds. Emplacement and recovery by two individuals is desired. A total of 50 systems are projected for use by Special Operations Forces and selected medical units.

The Lightweight Water Purifier (LWP) program planning is based on a streamlined Non-Developmental Item acquisition strategy. The results of a market investigation indicate that commercially available water purifiers or a combination of available components can be adapted or modified to meet the stated requirement.

An abbreviated development effort is planned to identify the best available water purifier or components and any necessary equipment modifications. A combined Milestone Decision Review (MDR) I/II is planned for 2Q or 3Q FY96. The accelerated Demonstration and Validation phase will consist of the procurement and evaluation of water purifiers and components from several commercial sources. The resulting performance specification will support an FY96 award of an Engineering and Manufacturing Development contract, which will include a production option for up to 50 systems.

Prototypes from the EMD phase will undergo Production Qualification Tests (PQT) and Initial Operational Testing (IOT). Following these tests, a 1Q FY 98 Milestone III and Type Classification - Generic decision will be conducted and the production option exercised shortly thereafter. The decision to Type Classify - Standard will be made after First Article Tests (FAT) by 2Q FY99. The First Unit Equipped (FUE) is expected in 2Q FY99.

The use of a combined developmental/production contract is considered appropriate and in the best interest of the government because of the small number of systems required. Full and open competition will be used for the contract.

Shown below are the known or estimated risks by functional area for the Lightweight Water Purifier (LWP). When the risk assessment for a functional area is rated moderate or higher, the critical subsystem or component is indicated in the table and discussed in detail in section 2.0.

FUNCTIONAL AREA	RISK ASSESSMENT	CRITICAL RISK SUBSYSTEM/COMPONENT
Threat	Low	
Technology	Low	
Design and Engineering	Low	
Hardware	Low	
Software	N/A	
Manufacturing	Low	
Support	Moderate	
Supply and Maintenance	Low	
Safety and Health	Low/Mod	Noise levels $\geq$ 83 dB (A).
MANPRINT	Moderate	Two/four soldier individual module lift requirement may be difficult to meet within current human factors guidelines and using existing commercial components and military standard generators.
Cost	Moderate	
Funding	Moderate	Mix of RDT&E and Procurement Funding may require review and adjustment. Delays in approving Operational Requirements Document (ORD) have complicated funding.

Schedule	Moderate	
Milestones	Moderate	Repeated delays in obtaining approval of the ORD may cause MS I/II and later milestones to be delayed.
Concurrency	Low	

2.0 RISK ASSESSMENT SUPPORT.

The functional areas with critical risk are those with a risk rating of moderate or higher. Each rating must be supported by critical subsystem/component risk assessments. These critical risk assessments should be traceable to design reviews, test results, or other specific analyses. Testing thus far on the LWP program has been limited to available water purifiers and market analyses. Therefore, only limited data is available.

The Safety and Health Function is assessed as Low/Moderate Risk. Noise levels for reverse osmosis water purification equipment have frequently required post-development abatement efforts; for example, the 600 GPH and the 3000 GPH systems. The required level of 83 dB (A) or less is achievable if stressed during engineering.

The Manpower, Personnel, and Training (MANPRINT) Interface Function has been rated as moderate risk primarily because of human factors issues and component weight constraints. Commercial candidates investigated thus far vary in weight from 315 to 750 pounds. Power for the system may require at least a 3 KW generator which adds approximately 370 pounds for a maximum total system weight of 1120 pounds. Although this weight is well within the rated payload capacity of the M1097A HMMWV, individual modules must be portable by 2-4 soldiers. The current 3 KW military standard generator exceeds both the 2 and 4 man lift limitations. Other modules may present similar lift problems.

The Cost and Funding Function also represents a moderate degree of risk. The current funding stream does not appear to reflect the proper balance of RDT&E and Procurement funds necessary to execute the program. RDT&E funds appear too high, and Procurement funds seem too low, although the shortage of procurement funds may well be a result of the frequent changes in the quantity to be procured as the ORD has gone through several revisions. Current RDT&E funds total $ 1.988 Million for FY96-98. The revised decision cost estimates prepared in support of the program indicate that a total of $ 1.806 Million in RDT&E may be required or an apparent $ 0.182 Million surplus. On the other hand, Procurement funding for FY99-00 totals only $ 2.00 Million, for 20 systems. Estimates of Procurement funds required for 50 systems range from $ 2.381 to $4.416 Million (Current Dollars).[1] Clearly additional procurement funds will be needed if the requirement remains 50 systems. Under the most optimistic assumptions, however, a realignment of RDT&E and Procurement appropriations might solve the problem.

3.0 PLANS TO REDUCE RISK.

Planned risk reduction efforts for functions with critical risk are summarized below.

POTENTIAL RISK AREA	COMPONENT/ SUBSYSTEM DIRECTLY AFFECTED	RISK REDUCTION ACTIONS
SUPPORT	SAFETY /HEALTH	Establish noise levels ≤ 83 dB (A) as critical performance standards and establish procedures to insure compliance.
	MANPRINT	Develop a Weight Budget and constantly monitor the size and weights of individual components against the human factors lift limitations. The lightest military standard generator set capable of meeting power and other requirements will be considered. If it is still too heavy, commercial generators, which are often lighter than military ones, power sources may offer a means to solve this problem.
COST	FUNDING	Seek early approval of the Operational Requirement Document (ORD) to stabilize both crucial technical requirements and the quantities to be procured. Conduct a comprehensive review of programmed, available and estimated funding to detect shortfalls or excesses. As early as possible request realignment of funding or additional funds from proper authority as required.

1. For the development of these high and low estimates, see the Cost and Operational Effectiveness Analysis for the Lightweight Water Purifier (Enclosure 11), Section 3.4.2.5, p. 3-26.

SCHEDULE	SCHEDULE	Expedite approval of ORD to permit program to proceed on schedule.

INTEGRATED PROGRAM SUMMARY (IPS)

ANNEX E

ENVIRONMENTAL ANALYSIS

FOR THE

LIGHTWEIGHT WATER PURIFIER

(LWP)

15 March 1996

INTEGRATED PROGRAM SUMMARY

ANNEX E

ENVIRONMENTAL ANALYSIS

FOR THE

LIGHTWEIGHT WATER PURIFIER (LWP)

1.0 ALTERNATIVES CONSIDERED

1.1 LISTING

The Cost and Operational Effectiveness Analysis (COEA) for the Lightweight Water Purifier (LWP) considered the following four alternatives:

- Base Case: Shipping Water in by Helicopter or Fixed Wing Aircraft
- Rebuy of Water Purification Unit, Reverse Osmosis (ROWPU), 600 GPH w/o Trailer (Marine Corps version)
- Rebuild Water Purification Unit, Reverse Osmosis (ROWPU), 600 GPH w/o Trailer (Marine Corps version)
- Lightweight Water Purifier (LWP)

1.2 Description

1.2.1 Base Case: Shipping Water in by Helicopter or Fixed Wing Aircraft

The current system represents the base case. Small detachments and teams performing long range reconnaissance and covert operations rely primarily on emergency or survival water procedures. When demand for water exceeds the capability of these individual purification methods, however, bulk water production support is provided to the user from a secure base area and airdropped or airlifted by helicopter to the operating area. Thus support for semi-stationary missions involving 100 to 125 personnel will normally depend on air resupply. The 528th Special Operations Support Battalion (Airborne) performs such water supply missions for elements of the Special Operations Command (SOCOM).

This unit has four 600 GPH Reverse Osmosis Water Purification Units (ROWPUs). The water section normally sets up a consolidated water point at a convenient location in a secure base area. Purified water for the isolated detachment is pumped into 250-gallon drums at this water point. Rigging teams then configure the drums for air movement. In this configuration, the drums can be air delivered by C-130 or C-141 fixed wing aircraft to a forward support site and then further lifted using UH-60 Blackhawk or larger rotary wing aircraft into the actual area of operations. For costing purposes, the COEA assumed movement by helicopter out to a range of about 100 miles (1 hour flight time). To meet the requirements specified in the Operational Requirements Document (ORD), daily resupply is required.

1.2.2 600 GPH ROWPU - Rebuy of Marine Corps Version

This alternative consists of using the 600 GPH ROWPU to support Special Operations Forces (SOF) as an alternative to developing and acquiring the Lightweight Water Purifier (LWP). For this alternative, the US Marine Corps version of the 600 GPH ROWPU is used. This unit differs from the Army version in that it is skid mounted, and the 5-ton, 4-wheel tandem trailer is not included. A separate 30 kw generator is required. The unit is capable of producing drinking water from polluted fresh water, brackish water, and sea water. It is also capable of removing chemical and radiological contaminants from the water.

The Marine Corps version of the 600 GPH ROWPU is lighter than the Army version. It weighs only 7,300 pounds, plus approximately 2850 pounds for the generator. Hence the Marine Corps version is more suitable than the Army version for SOF missions. The unit and its generator could be transported to the SOF operating area by a UH-60 or CH-47D helicopter -- in both cases as external loads. Alternatively, the ROWPU and the generator could be airdropped into the operating area by a C-130 or larger aircraft.

To support SOF units, this ROWPU could produce up to 3,600 gallons of potable water per day (900 GPH) from a fresh water or brackish water source and up to an estimated 2,400 gallons daily (600 GPH) from a sea water source. Daily production in a SOF environment is based on a maximum of 4 hours of operation per day. Using the maximum demand of 800 GPD, this unit could meet the daily consumption needs with only 54 to 80 minutes of operation. Treated water is pumped to a potable water distribution system consisting of two 3000-gallon collapsible storage tanks and a dispensing pump. Brine waste water is collected in a third collapsible tank if required. The product water from the system meets quality standards for soldiers in the field.

1.2.3 600 GPH ROWPU - Rebuilding Existing Units

With the drawdown of force levels, it is possible that the 50 units required can be found from Army or Marine Corps holdings. This alternative involves acquiring and rebuilding the 600 GPH ROWPUs from service excesses.

The rebuilt ROWPU 600 obviously has identical operational and performance characteristics as the basic 600 GPH ROWPU discussed above. The rebuild option affects only the cost of the program. Since the ROWPUs and generators are already in the field, both RDT&E Costs and Procurement Costs for this alternative are Sunk Costs and hence are excluded from the Decision Cost Estimate. However, it is assumed that the units would need to be rebuilt or overhauled before issue, as they have been in the field for 10-15 years. The overhaul is estimated to cost 50% of the procurement costs for new units. Except for the overhaul costs and the costs of transporting the units to the depot for overhaul and from the depot to the SOF units, the O&M Costs would be the same as for the rebuy alternative above.

1.2.4 Lightweight water purifier (LWP)

The LWP is a US Army effort to meet the need for water purification to support small units and detachments in areas that are remote from normal support assets. The LWP is intended to support the basic water needs of task forces ranging up to 125 personnel with a peak demand of 750 to 800 gallons per day. The system does not replace existing capabilities, but rather supplements the existing water purification and supply systems. The design objectives of the system are outlined in the coordinating draft ORD dated 7 April 1995.

An abbreviated development program using commercially available water purifiers and/or components is envisioned. Production quantities are estimated at 50 systems to support special operations forces and selected medical units. A specific Basis of Issue (BOI) has not yet been determined by the proponent(s). Production approval and Type Classification (TC) - Standard is planned for FY 1999 with deliveries occurring in FY 2000.

The Lightweight Water Purifier (LWP) will probably consist of several small modules or components to provide potable water from fresh, brackish, saline, or NBC-contaminated water sources. These components may include a pre-treatment stage or subsystem in the form of cartridge filters, screens, or membranes to reduce suspended solids in the feed water. A second bank of smaller mesh filtration may also be included to further improve water quality prior to entry into stage two. This second or desalinization stage will probably consist of a reverse osmosis unit with multiple elements and will eliminate dissolved solids from the source water. By-pass of this stage may be possible, depending on the initial level of dissolved solids in the source and the quality of the water exiting the pre-treatment stage. Following the desalinization stage, a post treatment stage will probably include a chlorinator to provide for residual protection against recontamination and filters to remove nuclear and chemical contamination. Water quality from this process is expected to exceed Environmental Protection Agency (EPA) standards, since most commercial purifiers are intended to service the general populace.

The LWP will be capable of providing a minimum of 75 gallons per hour using feed water with a salinity of 45,000 parts per million and a water temperature of 77° F. Commercial equipment with capacities of 250 GPH using a seawater source is available. Consequently, LWP projected outputs of 100-125 GPH (Seawater) and 185-200 GPH (Fresh water) are considered reasonably achievable. The LWP will incorporate storage drums, bladders, or tanks and a dispensing capability sufficient to store and issue at least 800 gallons per day (GPD). To produce this quantity of water, the LWP will operate no more than 4 hours per day.

The LWP will be capable of being transported by a C-130 or larger aircraft and by a UH-1 or larger helicopter.

1.3 Most Promising Alternative

Based on a thorough analysis and comparison of the costs and operational effectiveness of the four alternatives, the detailed Cost and Operational Effectiveness Analysis (COEA) recommends the Lightweight Water Purifier (LWP) as the most promising alternative.

2.0 POTENTIAL ENVIRONMENTAL EFFECTS

2.1 General

This section examines the potential effects of the LWP and the other alternatives on the land, water, and air environment. The examination and discussion are conducted for each phase of the program: development, production, operation, and disposal.

2.2 Development

Of the four alternatives considered, only the Lightweight Water Purifier (LWP) requires a development phase. During this phase the Acquisition Strategy calls for a number of commercially available water purification units and separate components to be tested. Based on the results of these tests, one of these units or a combination of components from several units will be selected for procurement. The commercially available water purification units do not produce any environmentally harmful materials, and all tests will be conducted using naturally occurring surface or subsurface water sources. The quantity of water treatment and purification chemicals used by the water purifiers and the exhaust fumes produced by the generator during these tests will both be quite small. Consequently, they will not significantly harm the air, water, or soil of the test sites.

2.3 Production

Two of the alternatives considered involve production: the rebuy of the Marine Corps 600 GPH ROWPU and the Lightweight Water Purifier. In addition, the rebuild alternative involves a major overhaul of the 600 GPH ROWPUs before reissue.

The 600 GPH ROWPU has been produced since 1981. No potentially dangerous manufacturing processes or materials have been identified for this system during this time. In addition, this rebuy involves only 50 units, a very small quantity when compared with previous acquisitions of about 1200.

The Lightweight Water Purifier (LWP) will use a more modern version of the same technology as the 600 GPH ROWPU. Moreover, the units being considered are all commercially available. No new or potentially dangerous manufacturing processes or materials are known to be involved in their production, and only 50 units will be acquired. Consequently no significant adverse environmental effects are expected from this very limited production.

2.4 Operations

In peacetime these water purification units will be used for training, field exercises, and humanitarian missions. The Cost and Operational Effectiveness Analysis (COEA) assumed two fifteen-day exercises per year, and some commentators thought this was too high. It is clear, therefore, that in peacetime the units will spend most of their time in storage and relatively little time actually purifying water. None of the systems contain explosive materials, radioactive substances, or chemicals that would be dangerous in storage. Provided proper handling procedures are observed, therefore, none of them will have significant undesirable environmental effects during the time they are in storage.

In operation all four alternative use essentially the same process, and three of them use the same equipment, the 600 GPH ROWPU. The requirement is to purify, store, and distribute up to 800 gallons per day during exercises or actual operations. Using fresh water, the 600 GPH ROWPU could satisfy this requirement in less than an hour, and using sea water, it would need about 75 minutes. The LWP is a much smaller unit and is expected to operate up to 4 hours a day to produce the required quantity of purified water.

The 600 GPH ROWPU uses a four-stage purification process, and the LWP will probably do so as well. In the first stage, the larger suspended solids are removed by a multimedia filter. Then a final "polishing filter" removes finer suspended solids. In the third stage, the dissolved solids are removed by the reverse osmosis process. Finally, chlorine is added to kill any remaining organisms and to keep the water safe during distribution and use.

Although the purification process is a physical one, several chemicals are used to assist in the process. A cationic water-soluble polyelectrolyte, such as the proprietary "Catafloc T," is added during the first stage as a coagulant aid to assist in removing the suspended solids during the filtering stage. Depending on the content of the raw water, varying amounts of sodium hexametaphosphate, an anti-scaling compound, are added to prevent scaling (accumulation of calcium and magnesium deposits) on the RO elements, housings, and pipes. Diluted citric acid is added to the filtered water to maintain the optimal pH for the reverse osmosis process and is also used in the membrane cleaning process. A detergent, such as Triton X-100 Surfactant (Octylphenoxypolyethoxyethanol), is also used in cleaning the RO membranes. Calcium hypochlorite is used to kill any remaining pathogens and provide a residual chlorine level of at least two parts per million (ppm) in the product water. Sodium bisulfite is used to neutralize any excess residual chlorine. Sodium chloride is used to prepare a 20% to 30% brine solution for feed stock to the electrolytic chlorinators. Finally, diethyl-p-phenylene diamine sulfate (DPD), a chemical dye, is used in extremely small quantities for the photometric and colormetric determination of free and total chlorine in the product water. Copies of the Material Safety Data Sheets (MSDS) on these chemicals are attached. Figure E-1 indicates typical quantities of each of these chemicals used daily and the principal hazards of each. Several of these chemicals can present hazards to human beings under certain conditions. Nevertheless, use of these chemicals is not expected to result in adverse environmental impacts, since the quantity of each is very small and the chemicals will be diluted in large volumes of water.

CHEMICAL	TYPICAL QUANTITY PER DAY	PRINCIPAL HAZARDS
Cationic Polyelectrolyte	160 ml	None
Sodium Hexametaphosphate	45 g.	Eye, skin irritation.
Citric Acid	360 g.	Eye, skin, respiratory tract irritation.
Calcium Hypochlorite	60 g. for 3000 gal. output	Eye, skin, respiratory tract irritation; may be fatal if swallowed. Strong oxidizer, flammable.
Sodium Bisulfite	60 g.	Eye, skin, respiratory tract irritation.
Sodium Chloride	300 g.	None
Triton X-100 Surfactant (Octylphenoxypolyetho-xyethanol)	360 g.	Eye, skin irritation.
Diethyl-p-phenylene Diamine Sulfate (DPD)	10 g.	None

Figure E-1 Chemicals Used in Reverse Osmosis Water Purification

The reverse osmosis water purification process used by all the alternatives produces four kinds of waste products. The first of these is brine. The reverse osmosis membrane separates the inflow water into two streams: purified water and a brine solution containing the dissolved impurities, mainly salt. Secondly, the first and second stage filters must be backwashed at regular intervals. This backwash stream contains in a more concentrated form the suspended solids present in the original raw water source plus the coagulant aid. Depending on the content of the raw water, this backwash water can exceed the levels permitted by the National Pollutant Discharge Elimination System (NPDES) and Wasserwirtshaftamt (WWA) standards. Similarly, detergent and citric acid are used to clean the reverse osmosis membrane and must be discharged into the stream or otherwise disposed of. The fourth waste product is heat generated by the pumping process -- the temperature of the outlet water is higher than that of the source or raw water. For the relatively small quantities of water processed for Special Operations Forces (SOF) use in this situation, this heat can be neglected.

Since all four alternatives use the same basic process to produce the same required quantity of purified water, the volume of waste products is essentially the same for all. However, the site location and duration of production are different.

For the Base Case, the 600 GPH water purification unit is located, probably with other similar units, in a consolidated water point in a rear area. Thus a large quantity of brine waste and backwash water is concentrated at one location. (It should be noted, however, that only a small portion of this waste -- less than 3% -- should be attributed to production of water for SOF use.) If a sewage treatment plant or intake sewer happens to be nearby, this would be an advantage in disposing of the waste water. The discharge of backwash water to a sewage treatment plant in the U.S. does not normally require any permit, but the characteristics of the waste water should be reported to the responsible local treatment authority. In the more likely case when no sewage treatment plant is available, however, disposing of the large volume of brine waste and backwash water could present a problem.

For the other three alternatives, the water purification unit is located in an isolated area with the supported unit. Here it would be highly unlikely to find a sewage treatment unit. Lifting the waste water out by helicopter, while theoretically possible, does not appear to be a practicable alternative. Consequently the most feasible solution appears to be return the brine and backwash water to the stream, downstream from the water intake. This actually amounts to returning the original pollutants to an already polluted stream. The disposal of the brine and backwash water would be influenced by current, wind direction, and tidal effects; but generally the concentration would be much greater near the outflow line. This effect will be much greater for the alternatives using the 600 GPH ROWPU, since it would discharge a relatively high brine flow for a short time. The LWP, on the other hand, would have a lower outflow rate over a longer time. Assuming an identical volume of brine, this would be better from an environmental point of view. This difference is, however, relatively small. In general, these microscale impacts of concentration will not result in adverse effects on the water and biological environment, since peacetime use of the water purification units will be so limited in quantity and duration.

All of the alternatives require electric power, which is normally provided by a diesel electric generator set. During operation these generator sets produce exhaust emissions and noise pollution typical of diesel generator sets. This is most serious for the Base Case, since several water purification units and their generators are grouped in a consolidated water point. In addition, the Base Case involves transporting the water to the operating area by helicopter, which produces a much higher amount of exhaust emissions and noise. In the other alternatives a water purification unit is located with the supported unit in the operating area. The LWP requires a smaller generator than the 600 GPH ROWPU. Thus this alterative will produce lower emissions and less noise -- though over a longer period each day, up to four hours compared with about one hour per day for the larger capacity units.

2.5 Disposal

The water purification units in each of the alternatives is expected to have a useful life of 20 years. After this time, the equipment will be released for disposal. None of the systems contains chemicals, explosive materials, or radioactive substances which would be dangerous during disposal. Consequently none of them will have undesirable environmental effects during the disposal phase.

2.5 Summary of Potential Environmental Effects

The potential environmental effects produced by the four alternatives during development, production, operation, and disposal are relatively minor. Differences between the environmental effects of the four systems are slight and mostly concentrated in the operations phase. The analysis above makes clear, however, that the Lightweight Water Purifier (LWP) produces the least harmful environmental effects. The Base Case, shipping the water to the operating area by air, is the most harmful. The ranking on the basis of environmental factors is as follows:

- Lightweight Water Purifier (LWP) - Environmentally preferred alternative.
- Rebuild Water Purification Unit, Reverse Osmosis (ROWPU), 600 GPH, w/o Trailer (Marine Corps version).
- Rebuy of Water Purification Unit, Reverse Osmosis (ROWPU), 600 GPH, w/o Trailer (Marine Corps version).
- Base Case: Haul Water by Aircraft - Least desirable alternative.

3.0 RATIONALE FOR CONCEPT/DESIGN ALTERNATIVE CHOSEN

3.1 Introduction

A detailed Cost and Operational Effectiveness Analysis (COEA) was prepared for the Lightweight Water Purifier (LWP) to aid decision makers at the Milestone Decision Review (MDR) in selecting from the alternatives those which offer the highest potential to best meet the stated operational requirement. This section summarizes the conclusions of the COEA and integrates them with the environmental analysis discussed in Section 2.

For the Cost analysis, detailed Decision Cost Estimates were prepared for the alternatives; trade-off, sensitivity, and uncertainty analyses were conducted; and the Decision Cost Estimates were validated by the Belvoir Cost Analysis Office.

No combat or battlefield simulation models were used in the COEA. However, a decision analysis support software package, Expert Choice™ Version 8.0, was used in the operational requirement analysis and comparison of each of the alternatives. The relative performance of each of the alternatives against the original draft Operational Requirements Document (ORD) requirements formed the basis of the operational effectiveness analysis.

3.2 Comparison of Alternatives

Figure E-2, which is reproduced from the COEA, compares the Ratio Scale values for the overall capability, principal operational criteria, several of the subordinate performance criteria, and the total Decision Costs in both Constant FY 1996 and Current Year dollars. The preferred value for each of the criteria has been underlined for ease of identification.

CRITERIA	BASE CASE SHIP BY AIR	600 GPH ROWPU REBUY	600 GPH ROWPU REBUILD	LWP
OVERALL	.287	.171	.171	.371
PERFORMANCE	.264	.182	.182	.373
LOGISTICS/ READINESS	.331	.124	.124	.422
CRITICAL SYSTEM CHARACTERISTICS	.417	.178	.178	.226
MOBILITY	.150	.153	.153	.545
WATER OPERATIONS	.155	.299	.299	.247
TIME/EFFORT	.322	.112	.112	.454
DURABILITY	.625	.125	.125	.125
TRANSPORT	.215	.118	.118	.549
TOTAL DCE (CONSTANT 1996$)	$112.40 Million	$11.78 Million	$8.19 Million	$9.59 Million
TOTAL DCE (CURRENT $)	$184.50 Million	$16.33 Million	$11.90 Million	$12.94 Million

Figure E-2 Comparison of Decision Costs and Operational Effectiveness

3.3 Decision Criteria

- Cost: If cost were the only criterion, the decision would be simple -- the Rebuild of the Existing 600 GPH ROWPU is clearly the cheapest of the four approaches, both in terms of Constant FY 1996 dollars and in Current Year (i.e. actual budgeted) dollars. In FY 1996 Constant dollars, the rebuild option is $ 1.4 million less than the LWP and $ 3.6 million lower than a rebuy of the 600 GPH. Of particular interest is the fact that the Base Case of Shipping Water by Air is, by far, the most expensive option. Compared to the base case, all the other alternatives are very close in terms of cost.

- Operational Effectiveness: If operational effectiveness in terms of overall capability were the only gauge, the LWP would clearly be superior to the other alternatives.

- Environmental Considerations: As the discussion in Section 2 indicated, the LWP is superior to the other alternatives on environmental grounds, although the differences are relatively slight.

- Cost and Operational Effectiveness: In most real-world situations, both cost and operational effectiveness must be considered. Figure E-3 provides a graphic comparison of decision cost and operational performance. This diagram clearly indicates the cost and operational effectiveness advantages of the Lightweight Water Purifier (LWP). The LWP offers the opportunity to improve significantly on the Base Case at a much reduced decision cost.

3.4 Summary

Based on system cost, schedule, and performance, the COEA concludes that the Lightweight Water Purifier (LWP) is the recommended alternative to satisfy the requirement defined in the Mission Needs Statement and the draft Operational Requirements Document. The LWP is also the recommended alternative to minimize any adverse environmental effects.

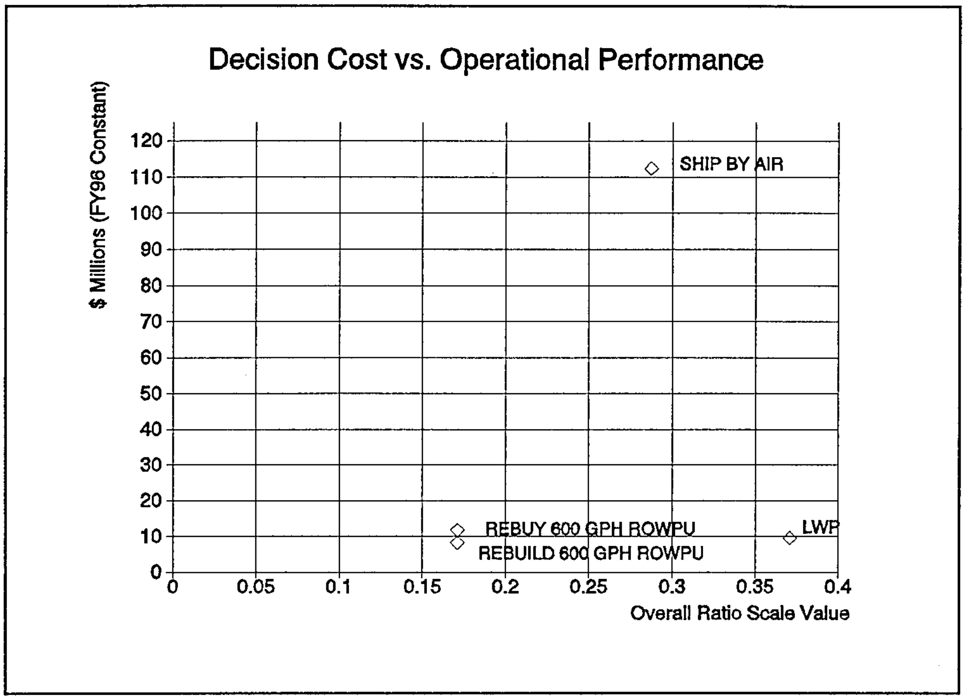


Figure E-3 Cost and Operational Effectiveness Comparison

4.0 MITIGATION MEASURES

Since the recommended alternative, the LWP, will produce only very minor environmental effects, no substantial mitigating design, support, basing and operating measures are proposed.

Only relatively minor operating measures are proposed. When the LWP is required to discharge brine solution and backwash water into the stream used as the raw water source, the release should be done gradually over a long period of time to maximize mixing and minimize biological impact on the stream. In addition, the generator should be located to reduce noise hazards, unless Tactical Quiet Generators (TQG) are used. These operating measures will have no impact on the cost and schedule for the LWP.

5.0 CONCLUSIONS

5.1 Type of Analysis Conducted

An informal environmental analysis was conducted and is summarized in Section 2 above. This analysis indicated that no significant environmental impact is likely. Consequently no formal Environmental Impact Statement (EIS) or Environmental Assessment (EA) has been prepared.

5.2 Environmentally Preferred Alternative

The environmentally preferred alternative, the Lightweight Water Purifier (LWP), is the alternative recommended by the Cost and Operational Effectiveness Analysis (COEA).

ATTACHMENT
TO
ANNEX E:

MATERIAL SAFETY DATA SHEETS
(MSDS)
FOR CHEMICALS
USED IN REVERSE OSMOSIS

INTEGRATED PROGRAM SUMMARY (IPS)

ANNEX E

ENVIRONMENTAL ANALYSIS

FOR THE

LIGHTWEIGHT WATER PURIFIER

(LWP)

15 March 1996

INTEGRATED PROGRAM SUMMARY

ANNEX E

ENVIRONMENTAL ANALYSIS

FOR THE

LIGHTWEIGHT WATER PURIFIER (LWP)

1.0 ALTERNATIVES CONSIDERED

1.1 LISTING

The Cost and Operational Effectiveness Analysis (COEA) for the Lightweight Water Purifier (LWP) considered the following four alternatives:

- Base Case: Shipping Water in by Helicopter or Fixed Wing Aircraft
- Rebuy of Water Purification Unit, Reverse Osmosis (ROWPU), 600 GPH w/o Trailer (Marine Corps version)
- Rebuild Water Purification Unit, Reverse Osmosis (ROWPU), 600 GPH w/o Trailer (Marine Corps version)
- Lightweight Water Purifier (LWP)

1.2 Description

1.2.1 Base Case: Shipping Water in by Helicopter or Fixed Wing Aircraft

The current system represents the base case. Small detachments and teams performing long range reconnaissance and covert operations rely primarily on emergency or survival water procedures. When demand for water exceeds the capability of these individual purification methods, however, bulk water production support is provided to the user from a secure base area and airdropped or airlifted by helicopter to the operating area. Thus support for semi-stationary missions involving 100 to 125 personnel will normally depend on air resupply. The 528th Special Operations Support Battalion (Airborne) performs such water supply missions for elements of the Special Operations Command (SOCOM).

This unit has four 600 GPH Reverse Osmosis Water Purification Units (ROWPUs). The water section normally sets up a consolidated water point at a convenient location in a secure base area. Purified water for the isolated detachment is pumped into 250-gallon drums at this water point. Rigging teams then configure the drums for air movement. In this configuration, the drums can be air delivered by C-130 or C-141 fixed wing aircraft to a forward support site and then further lifted using UH-60 Blackhawk or larger rotary wing aircraft into the actual area of operations. For costing purposes, the COEA assumed movement by helicopter out to a range of about 100 miles (1 hour flight time). To meet the requirements specified in the Operational Requirements Document (ORD), daily resupply is required.

1.2.2 600 GPH ROWPU - Rebuy of Marine Corps Version

This alternative consists of using the 600 GPH ROWPU to support Special Operations Forces (SOF) as an alternative to developing and acquiring the Lightweight Water Purifier (LWP). For this alternative, the US Marine Corps version of the 600 GPH ROWPU is used. This unit differs from the Army version in that it is skid mounted, and the 5-ton, 4-wheel tandem trailer is not included. A separate 30 kw generator is required. The unit is capable of producing drinking water from polluted fresh water, brackish water, and sea water. It is also capable of removing chemical and radiological contaminants from the water.

The Marine Corps version of the 600 GPH ROWPU is lighter than the Army version. It weighs only 7,300 pounds, plus approximately 2850 pounds for the generator. Hence the Marine Corps version is more suitable than the Army version for SOF missions. The unit and its generator could be transported to the SOF operating area by a UH-60 or CH-47D helicopter -- in both cases as external loads. Alternatively, the ROWPU and the generator could be airdropped into the operating area by a C-130 or larger aircraft.

To support SOF units, this ROWPU could produce up to 3,600 gallons of potable water per day (900 GPH) from a fresh water or brackish water source and up to an estimated 2,400 gallons daily (600 GPH) from a sea water source. Daily production in a SOF environment is based on a maximum of 4 hours of operation per day. Using the maximum demand of 800 GPD, this unit could meet the daily consumption needs with only 54 to 80 minutes of operation. Treated water is pumped to a potable water distribution system consisting of two 3000-gallon collapsible storage tanks and a dispensing pump. Brine waste water is collected in a third collapsible tank if required. The product water from the system meets quality standards for soldiers in the field.

1.2.3 600 GPH ROWPU - Rebuilding Existing Units

With the drawdown of force levels, it is possible that the 50 units required can be found from Army or Marine Corps holdings. This alternative involves acquiring and rebuilding the 600 GPH ROWPUs from service excesses.

The rebuilt ROWPU 600 obviously has identical operational and performance characteristics as the basic 600 GPH ROWPU discussed above. The rebuild option affects only the cost of the program. Since the ROWPUs and generators are already in the field, both RDT&E Costs and Procurement Costs for this alternative are Sunk Costs and hence are excluded from the Decision Cost Estimate. However, it is assumed that the units would need to be rebuilt or overhauled before issue, as they have been in the field for 10-15 years. The overhaul is estimated to cost 50% of the procurement costs for new units. Except for the overhaul costs and the costs of transporting the units to the depot for overhaul and from the depot to the SOF units, the O&M Costs would be the same as for the rebuy alternative above.

1.2.4 Lightweight water purifier (LWP)

The LWP is a US Army effort to meet the need for water purification to support small units and detachments in areas that are remote from normal support assets. The LWP is intended to support the basic water needs of task forces ranging up to 125 personnel with a peak demand of 750 to 800 gallons per day. The system does not replace existing capabilities, but rather supplements the existing water purification and supply systems. The design objectives of the system are outlined in the coordinating draft ORD dated 7 April 1995.

An abbreviated development program using commercially available water purifiers and/or components is envisioned. Production quantities are estimated at 50 systems to support special operations forces and selected medical units. A specific Basis of Issue (BOI) has not yet been determined by the proponent(s). Production approval and Type Classification (TC) - Standard is planned for FY 1999 with deliveries occurring in FY 2000.

The Lightweight Water Purifier (LWP) will probably consist of several small modules or components to provide potable water from fresh, brackish, saline, or NBC-contaminated water sources. These components may include a pre-treatment stage or subsystem in the form of cartridge filters, screens, or membranes to reduce suspended solids in the feed water. A second bank of smaller mesh filtration may also be included to further improve water quality prior to entry into stage two. This second or desalinization stage will probably consist of a reverse osmosis unit with multiple elements and will eliminate dissolved solids from the source water. By-pass of this stage may be possible, depending on the initial level of dissolved solids in the source and the quality of the water exiting the pre-treatment stage. Following the desalinization stage, a post treatment stage will probably include a chlorinator to provide for residual protection against recontamination and filters to remove nuclear and chemical contamination. Water quality from this process is expected to exceed Environmental Protection Agency (EPA) standards, since most commercial purifiers are intended to service the general populace.

The LWP will be capable of providing a minimum of 75 gallons per hour using feed water with a salinity of 45,000 parts per million and a water temperature of 77° F. Commercial equipment with capacities of 250 GPH using a seawater source is available. Consequently, LWP projected outputs of 100-125 GPH (Seawater) and 185-200 GPH (Fresh water) are considered reasonably achievable. The LWP will incorporate storage drums, bladders, or tanks and a dispensing capability sufficient to store and issue at least 800 gallons per day (GPD). To produce this quantity of water, the LWP will operate no more than 4 hours per day.

The LWP will be capable of being transported by a C-130 or larger aircraft and by a UH-1 or larger helicopter.

1.3 Most Promising Alternative

Based on a thorough analysis and comparison of the costs and operational effectiveness of the four alternatives, the detailed Cost and Operational Effectiveness Analysis (COEA) recommends the Lightweight Water Purifier (LWP) as the most promising alternative.

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Although the purification process is a physical one, several chemicals are used to assist in the process. A cationic water-soluble polyelectrolyte, such as the proprietary "Catafloc T," is added during the first stage as a coagulant aid to assist in removing the suspended solids during the filtering stage. Depending on the content of the raw water, varying amounts of sodium hexametaphosphate, an anti-scaling compound, are added to prevent scaling (accumulation of calcium and magnesium deposits) on the RO elements, housings, and pipes. Diluted citric acid is added to the filtered water to maintain the optimal pH for the reverse osmosis process and is also used in the membrane cleaning process. A detergent, such as Triton X-100 Surfactant (Octylphenoxypolyethoxyethanol), is also used in cleaning the RO membranes. Calcium hypochlorite is used to kill any remaining pathogens and provide a residual chlorine level of at least two parts per million (ppm) in the product water. Sodium bisulfite is used to neutralize any excess residual chlorine. Sodium chloride is used to prepare a 20% to 30% brine solution for feed stock to the electrolytic chlorinators. Finally, diethyl-p-phenylene diamine sulfate (DPD), a chemical dye, is used in extremely small quantities for the photometric and colormetric determination of free and total chlorine in the product water. Copies of the Material Safety Data Sheets (MSDS) on these chemicals are attached. Figure E-1 indicates typical quantities of each of these chemicals used daily and the principal hazards of each. Several of these chemicals can present hazards to human beings under certain conditions. Nevertheless, use of these chemicals is not expected to result in adverse environmental impacts, since the quantity of each is very small and the chemicals will be diluted in large volumes of water.

CHEMICAL	TYPICAL QUANTITY PER DAY	PRINCIPAL HAZARDS
Cationic Polyelectrolyte	160 ml	None
Sodium Hexametaphosphate	45 g.	Eye, skin irritation.
Citric Acid	360 g.	Eye, skin, respiratory tract irritation.
Calcium Hypochlorite	60 g. for 3000 gal. output	Eye, skin, respiratory tract irritation; may be fatal if swallowed. Strong oxidizer, flammable.
Sodium Bisulfite	60 g.	Eye, skin, respiratory tract irritation.
Sodium Chloride	300 g.	None
Triton X-100 Surfactant (Octylphenoxypolyethoxyethanol)	360 g.	Eye, skin irritation.
Diethyl-p-phenylene Diamine Sulfate (DPD)	10 g.	None

Figure E-1 Chemicals Used in Reverse Osmosis Water Purification

The reverse osmosis water purification process used by all the alternatives produces four kinds of waste products. The first of these is brine. The reverse osmosis membrane separates the inflow water into two streams: purified water and a brine solution containing the dissolved impurities, mainly salt. Secondly, the first and second stage filters must be backwashed at regular intervals. This backwash stream contains in a more concentrated form the suspended solids present in the original raw water source plus the coagulant aid. Depending on the content of the raw water, this backwash water can exceed the levels permitted by the National Pollutant Discharge Elimination System (NPDES) and Wasserwirtshaftamt (WWA) standards. Similarly, detergent and citric acid are used to clean the reverse osmosis membrane and must be discharged into the stream or otherwise disposed of. The fourth waste product is heat generated by the pumping process -- the temperature of the outlet water is higher than that of the source or raw water. For the relatively small quantities of water processed for Special Operations Forces (SOF) use in this situation, this heat can be neglected.

Since all four alternatives use the same basic process to produce the same required quantity of purified water, the volume of waste products is essentially the same for all. However, the site location and duration of production are different.

For the Base Case, the 600 GPH water purification unit is located, probably with other similar units, in a consolidated water point in a rear area. Thus a large quantity of brine waste and backwash water is concentrated at one location. (It should be noted, however, that only a small portion of this waste -- less than 3% -- should be attributed to production of water for SOF use.) If a sewage treatment plant or intake sewer happens to be nearby, this would be an advantage in disposing of the waste water. The discharge of backwash water to a sewage treatment plant in the U.S. does not normally require any permit, but the characteristics of the waste water should be reported to the responsible local treatment authority. In the more likely case when no sewage treatment plant is available, however, disposing of the large volume of brine waste and backwash water could present a problem.

For the other three alternatives, the water purification unit is located in an isolated area with the supported unit. Here it would be highly unlikely to find a sewage treatment unit. Lifting the waste water out by helicopter, while theoretically possible, does not appear to be a practicable alternative. Consequently the most feasible solution appears to be return the brine and backwash water to the stream, downstream from the water intake. This actually amounts to returning the original pollutants to an already polluted stream. The disposal of the brine and backwash water would be influenced by current, wind direction, and tidal effects; but generally the concentration would be much greater near the outflow line. This effect will be much greater for the alternatives using the 600 GPH ROWPU, since it would discharge a relatively high brine flow for a short time. The LWP, on the other hand, would have a lower outflow rate over a longer time. Assuming an identical volume of brine, this would be better from an environmental point of view. This difference is, however, relatively small. In general, these microscale impacts of concentration will not result in adverse effects on the water and biological environment, since peacetime use of the water purification units will be so limited in quantity and duration.

All of the alternatives require electric power, which is normally provided by a diesel electric generator set. During operation these generator sets produce exhaust emissions and noise pollution typical of diesel generator sets. This is most serious for the Base Case, since several water purification units and their generators are grouped in a consolidated water point. In addition, the Base Case involves transporting the water to the operating area by helicopter, which produces a much higher amount of exhaust emissions and noise. In the other alternatives a water purification unit is located with the supported unit in the operating area. The LWP requires a smaller generator than the 600 GPH ROWPU. Thus this alterative will produce lower emissions and less noise -- though over a longer period each day, up to four hours compared with about one hour per day for the larger capacity units.

2.5 Disposal

The water purification units in each of the alternatives is expected to have a useful life of 20 years. After this time, the equipment will be released for disposal. None of the systems contains chemicals, explosive materials, or radioactive substances which would be dangerous during disposal. Consequently none of them will have undesirable environmental effects during the disposal phase.

2.5 Summary of Potential Environmental Effects

The potential environmental effects produced by the four alternatives during development, production, operation, and disposal are relatively minor. Differences between the environmental effects of the four systems are slight and mostly concentrated in the operations phase. The analysis above makes clear, however, that the Lightweight Water Purifier (LWP) produces the least harmful environmental effects. The Base Case, shipping the water to the operating area by air, is the most harmful. The ranking on the basis of environmental factors is as follows:

- Lightweight Water Purifier (LWP) - Environmentally preferred alternative.

- Rebuild Water Purification Unit, Reverse Osmosis (ROWPU), 600 GPH, w/o Trailer (Marine Corps version).

- Rebuy of Water Purification Unit, Reverse Osmosis (ROWPU), 600 GPH, w/o Trailer (Marine Corps version).

- Base Case: Haul Water by Aircraft - Least desirable alternative.

3.0 RATIONALE FOR CONCEPT/DESIGN ALTERNATIVE CHOSEN

3.1 Introduction

A detailed Cost and Operational Effectiveness Analysis (COEA) was prepared for the Lightweight Water Purifier (LWP) to aid decision makers at the Milestone Decision Review (MDR) in selecting from the alternatives those which offer the highest potential to best meet the stated operational requirement. This section summarizes the conclusions of the COEA and integrates them with the environmental analysis discussed in Section 2.

For the Cost analysis, detailed Decision Cost Estimates were prepared for the alternatives; trade-off, sensitivity, and uncertainty analyses were conducted; and the Decision Cost Estimates were validated by the Belvoir Cost Analysis Office.

No combat or battlefield simulation models were used in the COEA. However, a decision analysis support software package, Expert Choice™ Version 8.0, was used in the operational requirement analysis and comparison of each of the alternatives. The relative performance of each of the alternatives against the original draft Operational Requirements Document (ORD) requirements formed the basis of the operational effectiveness analysis.

3.2 Comparison of Alternatives

Figure E-2, which is reproduced from the COEA, compares the Ratio Scale values for the overall capability, principal operational criteria, several of the subordinate performance criteria, and the total Decision Costs in both Constant FY 1996 and Current Year dollars. The preferred value for each of the criteria has been underlined for ease of identification.

CRITERIA	BASE CASE SHIP BY AIR	600 GPH ROWPU REBUY	600 GPH ROWPU REBUILD	LWP
OVERALL	.287	.171	.171	.371
PERFORMANCE	.264	.182	.182	.373
LOGISTICS/ READINESS	.331	.124	.124	.422
CRITICAL SYSTEM CHARACTERISTICS	.417	.178	.178	.226
MOBILITY	.150	.153	.153	.545
WATER OPERATIONS	.155	.299	.299	.247
TIME/EFFORT	.322	.112	.112	.454
DURABILITY	.625	.125	.125	.125
TRANSPORT	.215	.118	.118	.549
TOTAL DCE (CONSTANT 1996$)	$112.40 Million	$11.78 Million	$8.19 Million	$9.59 Million
TOTAL DCE (CURRENT $)	$184.50 Million	$16.33 Million	$11.90 Million	$12.94 Million

Figure E-2 Comparison of Decision Costs and Operational Effectiveness

3.3 Decision Criteria

- Cost: If cost were the only criterion, the decision would be simple -- the Rebuild of the Existing 600 GPH ROWPU is clearly the cheapest of the four approaches, both in terms of Constant FY 1996 dollars and in Current Year (i.e. actual budgeted) dollars. In FY 1996 Constant dollars, the rebuild option is $ 1.4 million less than the LWP and $ 3.6 million lower than a rebuy of the 600 GPH. Of particular interest is the fact that the Base Case of Shipping Water by Air is, by far, the most expensive option. Compared to the base case, all the other alternatives are very close in terms of cost.

- Operational Effectiveness: If operational effectiveness in terms of overall capability were the only gauge, the LWP would clearly be superior to the other alternatives.

- Environmental Considerations: As the discussion in Section 2 indicated, the LWP is superior to the other alternatives on environmental grounds, although the differences are relatively slight.

- Cost and Operational Effectiveness: In most real-world situations, both cost and operational effectiveness must be considered. Figure E-3 provides a graphic comparison of decision cost and operational performance. This diagram clearly indicates the cost and operational effectiveness advantages of the Lightweight Water Purifier (LWP). The LWP offers the opportunity to improve significantly on the Base Case at a much reduced decision cost.

3.4 Summary

Based on system cost, schedule, and performance, the COEA concludes that the Lightweight Water Purifier (LWP) is the recommended alternative to satisfy the requirement defined in the Mission Needs Statement and the draft Operational Requirements Document. The LWP is also the recommended alternative to minimize any adverse environmental effects.

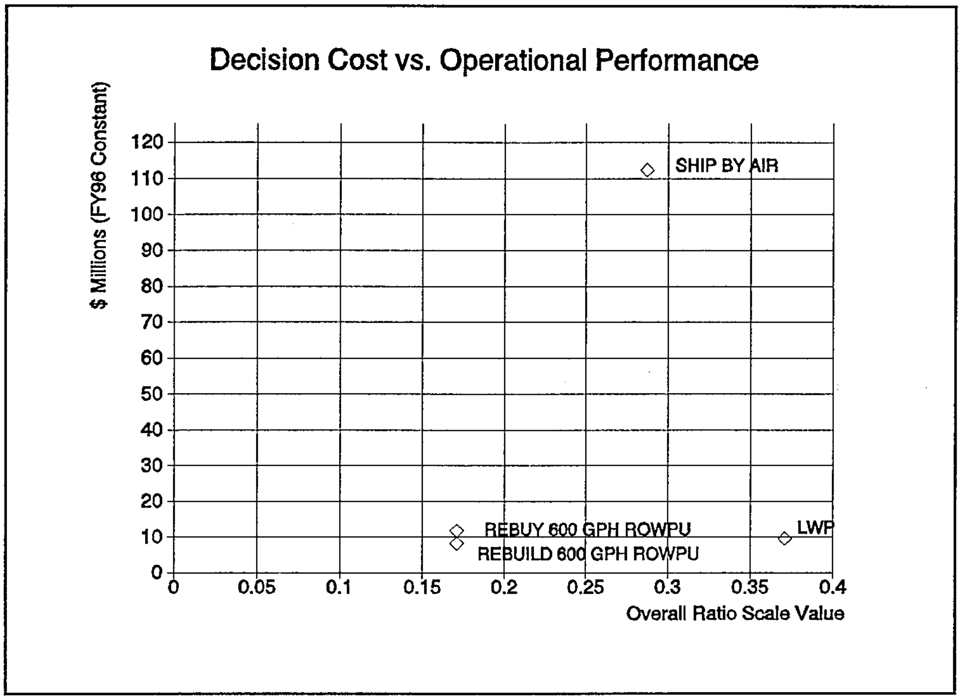

Figure E-3 Cost and Operational Effectiveness Comparison

4.0 MITIGATION MEASURES

Since the recommended alternative, the LWP, will produce only very minor environmental effects, no substantial mitigating design, support, basing and operating measures are proposed.

Only relatively minor operating measures are proposed. When the LWP is required to discharge brine solution and backwash water into the stream used as the raw water source, the release should be done gradually over a long period of time to maximize mixing and minimize biological impact on the stream. In addition, the generator should be located to reduce noise hazards, unless Tactical Quiet Generators (TQG) are used. These operating measures will have no impact on the cost and schedule for the LWP.

5.0 CONCLUSIONS

5.1 Type of Analysis Conducted

An informal environmental analysis was conducted and is summarized in Section 2 above. This analysis indicated that no significant environmental impact is likely. Consequently no formal Environmental Impact Statement (EIS) or Environmental Assessment (EA) has been prepared.

5.2 Environmentally Preferred Alternative

The environmentally preferred alternative, the Lightweight Water Purifier (LWP), is the alternative recommended by the Cost and Operational Effectiveness Analysis (COEA).

ATTACHMENT
TO
ANNEX E:

MATERIAL SAFETY DATA SHEETS (MSDS) FOR CHEMICALS USED IN REVERSE OSMOSIS

INTEGRATED PROGRAM SUMMARY (IPS)

ANNEX F

AFFORDABILITY ASSESSMENT

FOR THE

LIGHTWEIGHT WATER PURIFIER

(LWP)

15 March 1996

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ANNEX F
AFFORDABILITY ASSESSMENT
OF THE
LIGHTWEIGHT WATER PURIFIER (LWP)

1. DATA DEVELOPMENT

A. Introduction.

(1) Data Source. The cost data presented in this Affordability Assessment were extracted from the validated Program Life Cycle Cost Estimate (LCCE) and Decision Cost Estimates (DCE) developed in support of the Lightweight Water Purifier (LWP) program, revised to reflect the changed quantity of 50 systems. A detailed discussion and comparison of the various cost elements is presented in Section 3.3 of the Cost and Operational Effectiveness Analysis (COEA) for the LWP.

(2) Description of Current System. Special Operations Forces (SOF) detachments and selected other small units which are isolated from traditional water support must rely on emergency/survival water purification methods. When water demand exceeds this capability, water must be delivered by airlift or airdrop. The base case assumes one UH-60 helicopter flight per day for potable water resupply (maximum 750 gallons per day).

(3) Description of Proposed System. The Lightweight Water Purifier (LWP) is a compact and mobile purification system which can be transported in the back of a High Mobility Multi-Purpose Wheeled Vehicle (HMMWV) or other 1¼ ton vehicle. The LWP is easy to set up and is operated part-time by non-dedicated individuals. The proposed system produces at least 75 gallons of potable water per hour from salt water sources and 125 gallons per hour from fresh water sources. Based on the Operational Mode Summary/Mission Profile, it is assumed that each unit will operate an average of 120 days per year: 5% at 10 hours per day and 95% at 6 hours per day. A total of 50 systems is projected for SOF and medical units.

B. Ongoing and New Start Programs.

The Lightweight Water Purifier (LWP) program costs are based on a streamlined Non-Developmental Acquisition Strategy. The results of a market investigation indicate that commercially available water purifiers or a combination of available components can be adapted to meet the requirement. A combined Milestone Decision Review (MDR) I/II is planned for the 2nd or 3d Quarter FY96. An accelerated Demonstration and Validation phase will consist of obtaining and testing of water purifiers and components from commercial sources. Information from this effort will aid in the development of a purchase specification to support an FY96 award of an EMD contract with a limited production option. The MDR III (Type Classification-Standard) is tentatively scheduled for 1st Quarter FY98. Initial deliveries to the field are anticipated during early FY99. Summaries of RDT&E and Procurement for the proposed program are presented in Figures 1 (Constant FY96 Dollars) and Figure 2 (Current Dollars):

	FY94	FY95	FY96	FY97	FY98	FY99	FY00	TOTAL
RDT&E	262	451	610	879	231			2433
PROC						869	1748	2836
TOTAL	262	451	610	879	231	869	1748	5269

Figure 1 Lightweight Water Purifier (LWP) Program (Thousands of Constant FY96 Dollars)

	FY94	FY95	FY96	FY97	FY98	FY99	FY00	TOTAL
RDT&E	253	450	626	929	251			2509
PROC						997	2066	3335
TOTAL	253	450	626	929	251	997	2066	5844

Figure 2 Lightweight Water Purifier (LWP) Program (Thousands of Current Dollars)

The combined total estimated RDT&E and Procurement for the Lightweight Water Purifier is approximately \$ 5.27 Million (Constant FY96) or \$ 5.84 Million (Current). A maximum budget demand of about \$ 2.066 Million (Current) occurs during the last year of production (FY 2000). The average funding over the entire development and production period is just under \$835,000 (Current) per year.

Water purification equipment is traditionally funded under the Other Procurement, Army (OPA) Appropriation. Specifically, it is assumed that the proposed system would be budgeted under the OPA3 (Other Support Equipment - Water Equipment and Petroleum Equipment) account. During FY91, Petroleum and Water Equipment was funded at a level of about \$ 89.0 Million. As a result of the force build-down and completion of the 3000 GPH Reverse Osmosis Water Purification Unit (ROWPU) procurement, current actual levels have dipped to about \$ 30.0 Million. Based on existing POM projections, funding over the FY95-10 period can be expected at about an average level of \$ 25.5 million for combined Water and Petroleum Equipment (Water Equip averages \$ 14.3 M per year & Petroleum Equip is roughly \$ 11.2 M). A comparison of required and available funding is provided at Attachment 1.

C. Current System Support.

Operations and Support costs for the current system include those directly associated with the dedicated daily delivery of water to remote units. These costs include petroleum, oil, and lubricants (POL) and repair parts (both consumables and depot level reparables) for the UH-60 helicopter. Annual operating hours were based on a peacetime estimate of two 15 day exercises per year and an average one-hour flight each way from the airfield to the water point to the operating area; that is, 60 flight hours per year for each of the 50 systems.

Total operating costs for 20 years are estimated at $ 112.41 Million (Constant FY96) or $ 184.50 Million (Current Dollars). Depot Level Reparables and Consumables account for about 95 percent of these costs, with POL representing the remaining 5 percent. Average annual operating costs for the current base case of hauling water by helicopter are estimated at $ 5.6 Million per year (Constant Dollars) or $ 9.23 Million (Current Dollars). The charts at Attachments 2 and 3 provide a profile of operating costs for the present system in Constant FY96 and Current Year dollars.

D. Proposed System Support.

Operations and support cost elements for the Lightweight Water Purifier (LWP) are based on operation of the purifier. Costs include POL, Consumable Repair Parts, and Depot Level Reparables for the LWP unit over its planned 20 year life.

Total operating costs based on 50 systems are estimated at $4.34 Million (Constant FY96) or $7.12 Million (Current Dollars). In this case, Depot Level Reparables and Consumables account for 77 percent of these O&M costs. POL represents about 8 percent of the total. Average annual operating costs for the proposed LWP are roughly $ 217,000 per year (Constant Dollars) or $ 356,000 (Current Dollars). The charts at Attachments 4 and 5 provide a profile of operating costs for the LWP in constant and then year dollars.

2. AFFORDABILITY ASSESSMENT

The proposed Lightweight Water Purifier (LWP) can be accommodated fairly easily within the available top line funding for Water and Petroleum equipment. Attachment 1 shows that peak funding for the system never exceeds about 8 percent of projected available funding. Average funding over the years FY94-00 represents only about 3 percent of the total expected to be available.

Attachments 2 and 4 provide a direct comparison of the current and proposed system costs in Constant FY96 Dollars. Both figures are scaled identically to facilitate the analysis. The LWP potentially produces a life cycle savings to the Army of $102.8 Million by reducing flying hours dedicated to water supply. (It is likely, however, that these hours/savings will be applied elsewhere to meet air mission requirements. In other words, these savings may actually represent increased aircraft availability for other operations.) The net RDT&E and Procurement investment of $ 5.3 Million produces savings of $108.0 Million in Operations and Maintenance.

The average annual O&M savings of about $ 5.4 Million each year are almost the same as the total initial investment.

Attachments 3 and 5 provide a direct comparison of the current and proposed system costs in Current Dollars. Again, both figures are scaled identically to facilitate the analysis. Here, the LWP produces a savings of $ 106.1 Million over the life of the system. The net RDT&E and Procurement investment of $ 5.8 Million produces savings of $ 117.4 Million in Operations and Maintenance. The average annual O&M savings of about $ 8.87 Million each year are greater than the total initial investment.

3. RECOMMENDATION

A. Alternative Strategy - One.

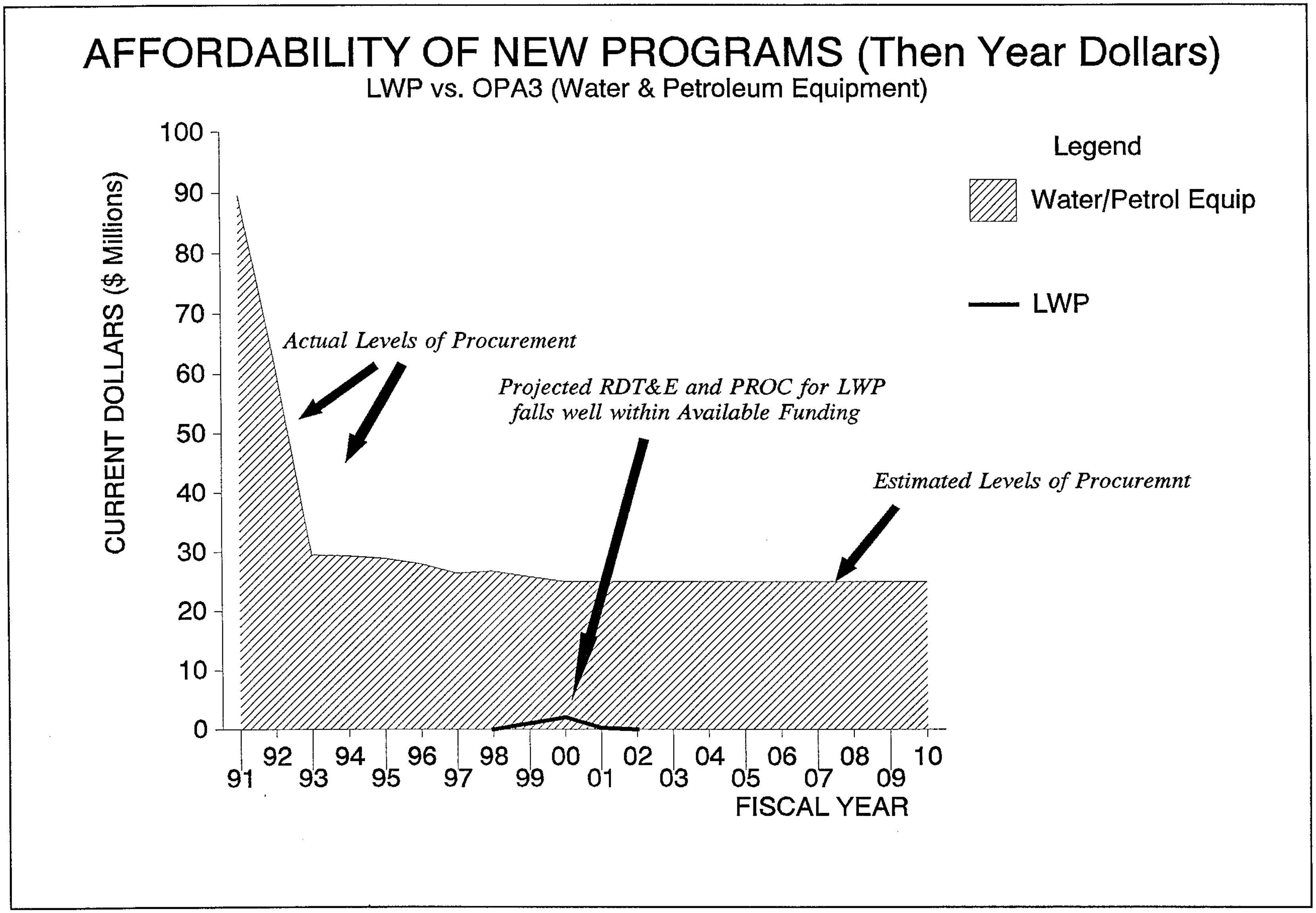
The procurement of all 50 required units could be bought out in one year. This strategy might result in some minor savings attributed to inflation. However, the single year procurement demand would jump to about $ 3.0 Million (Current). This level of funding should be able to be absorbed within the available top line funding. The decision on the length of procurement timing will probably be determined by the surge capacity of the manufacturer finally selected. There is no major advantage in decreasing procurement time.

B. Alternative Strategy - Two.

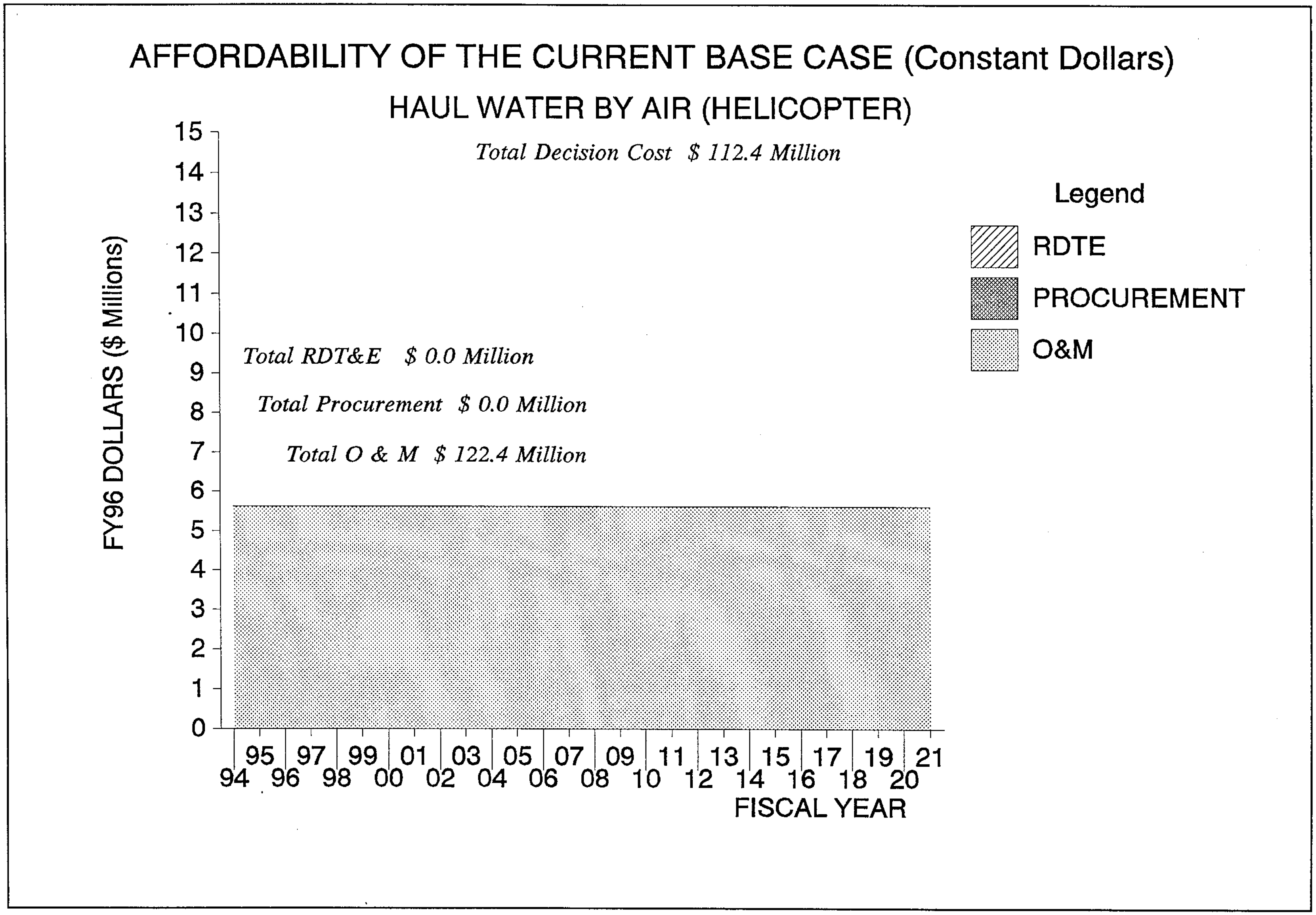
The development duration for the LWP could feasibly be shortened by about one year. However, such a strategy would probably increase risk to the program with little or no actual savings in development costs. Artificially accelerating development might even result in somewhat increased RDT&E costs with no real overall benefit.

C. Bottom Line.

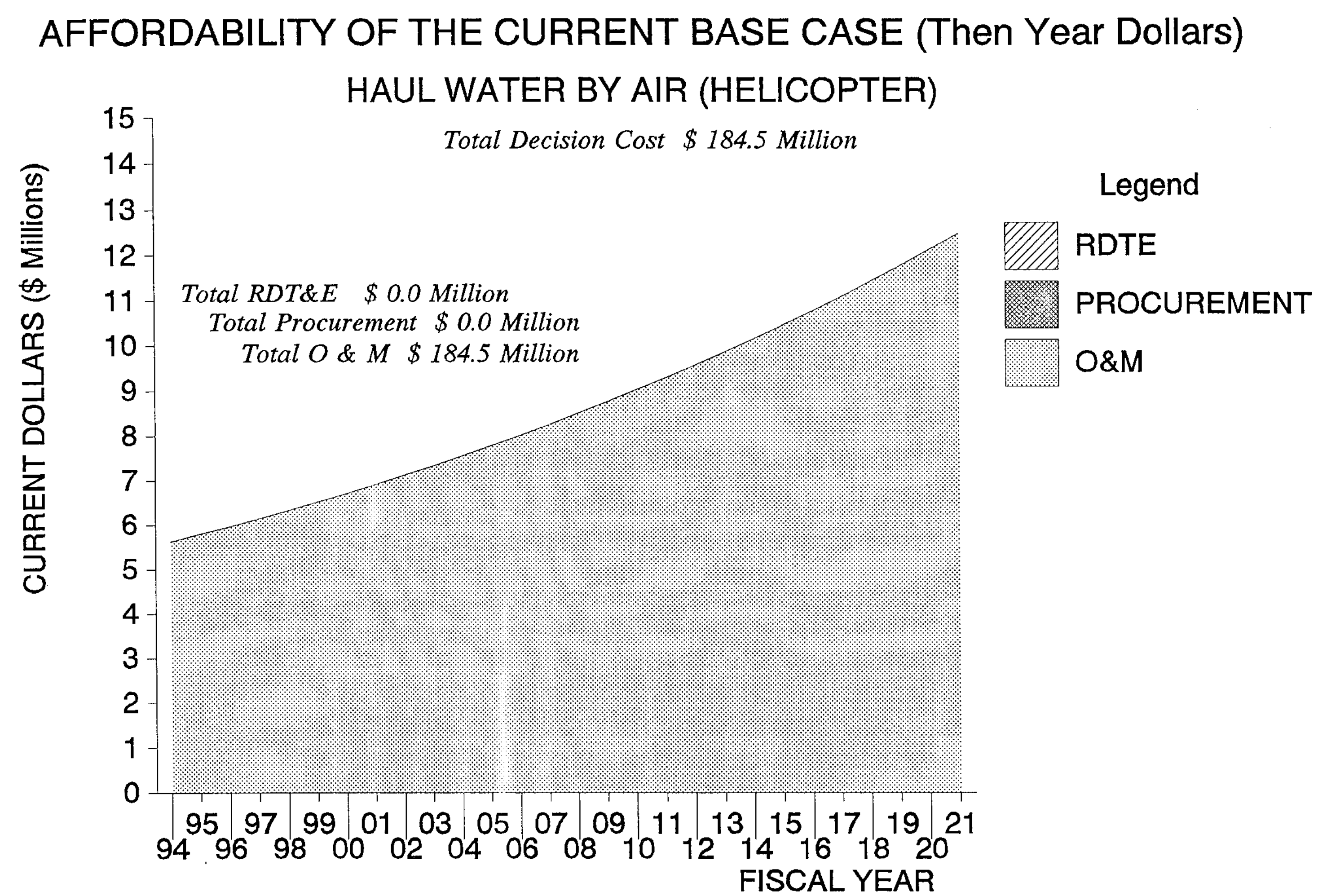
The proposed Lightweight Water Purifier (LWP) program is affordable and produces significant savings in operating costs (or increased aircraft availability for other missions) to the Army over its life span.



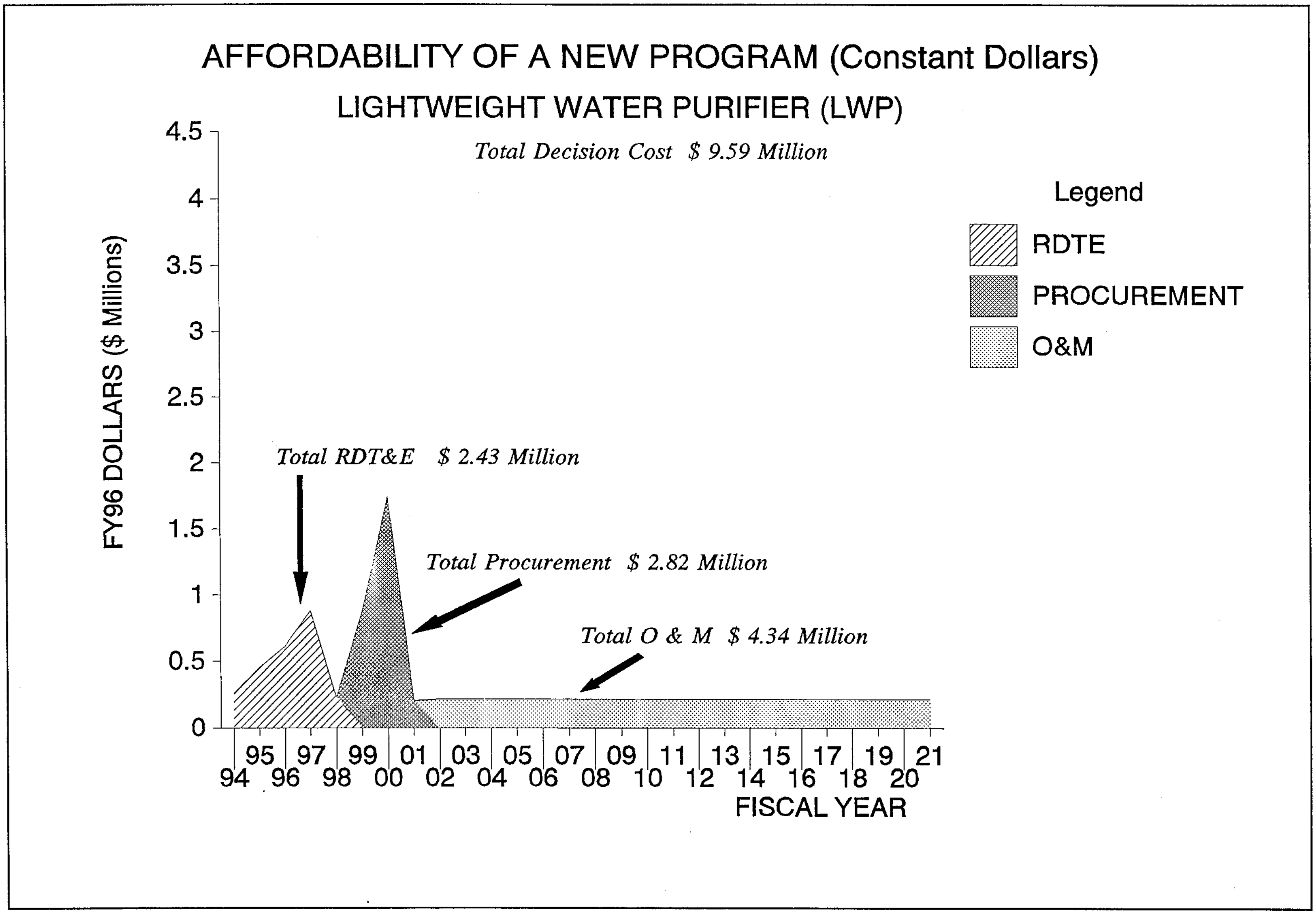
Attachment-1

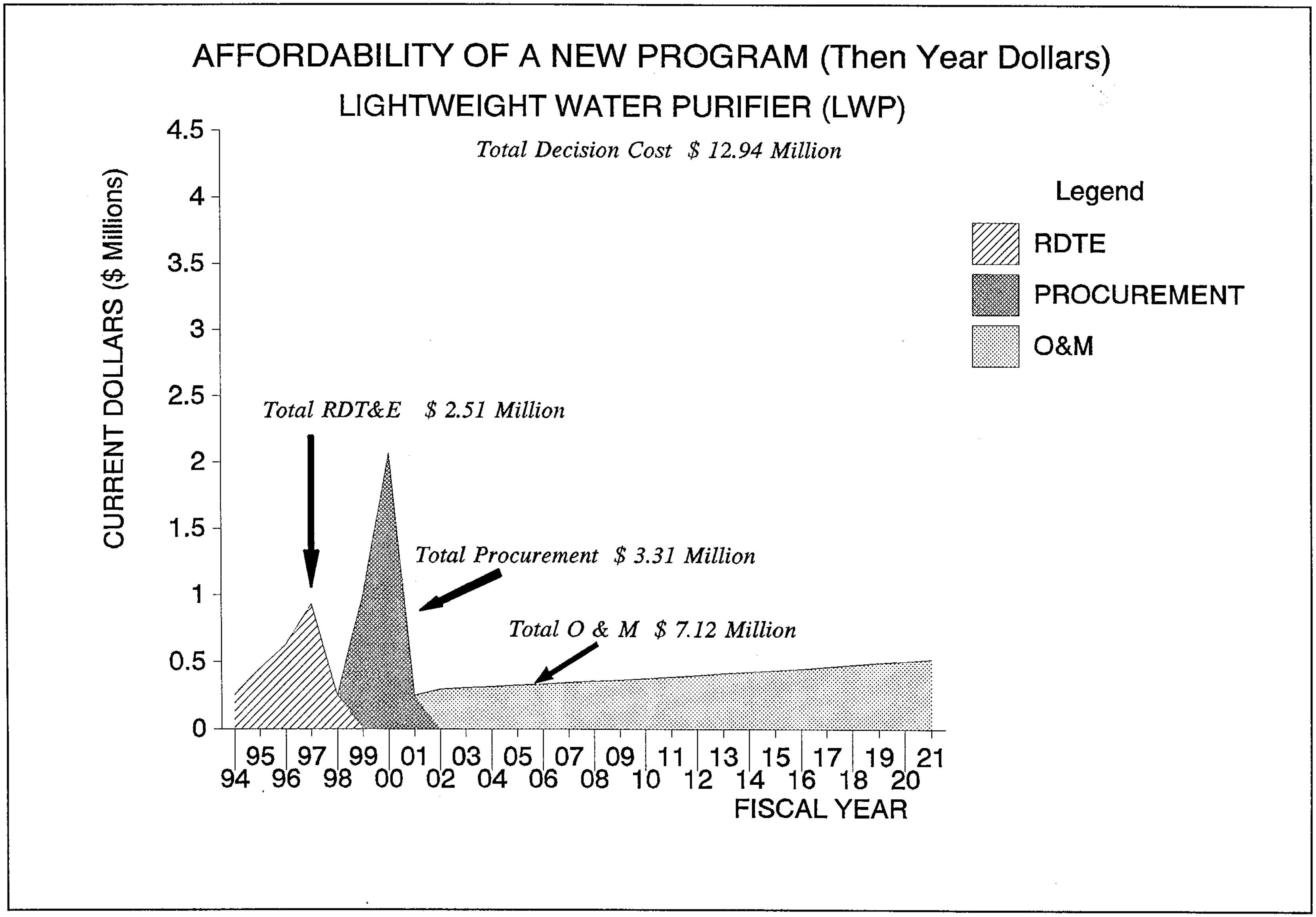


AFFORDABILITY OF THE CURRENT BASE CASE (Constant Dollars)
HAUL WATER BY AIR (HELICOPTER)
Total Decision Cost $ 112.4 Million
Total RDT&E $ 0.0 Million
Total Procurement $ 0.0 Million
Total O & M $ 122.4 Million
FY96 DOLLARS ($ Millions)
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
94 95 96 97 98 99 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21
FISCAL YEAR
Legend
RDTE
PROCUREMENT
O&M



AFFORDABILITY OF THE CURRENT BASE CASE (Then Year Dollars)
HAUL WATER BY AIR (HELICOPTER)
Total Decision Cost $ 184.5 Million
Total RDT&E $ 0.0 Million
Total Procurement $ 0.0 Million
Total O & M $ 184.5 Million
CURRENT DOLLARS ($ Millions)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
94 95 96 97 98 99 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21
FISCAL YEAR
Legend
RDTE
PROCUREMENT
O&M


AFFORDABILITY OF A NEW PROGRAM (Constant Dollars)
LIGHTWEIGHT WATER PURIFIER (LWP)
Total Decision Cost $ 9.59 Million
Legend
RDTE
PROCUREMENT
O&M
FY96 DOLLARS ($ Millions)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Total RDT&E $ 2.43 Million
Total Procurement $ 2.82 Million
Total O & M $ 4.34 Million
94 95 96 97 98 99 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21
FISCAL YEAR



AFFORDABILITY OF A NEW PROGRAM (Then Year Dollars)
LIGHTWEIGHT WATER PURIFIER (LWP)
Total Decision Cost $ 12.94 Million
Legend
RDTE
PROCUREMENT
O&M
Total RDT&E $ 2.51 Million
Total Procurement $ 3.31 Million
Total O & M $ 7.12 Million
CURRENT DOLLARS ($ Millions)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
94 95 96 97 98 99 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21
FISCAL YEAR

ACQUISITION PROGRAM BASELINE

(APB)

FOR THE

LIGHTWEIGHT WATER PURIFIER

(LWP)

31 January 1996

ACQUISITION PROGRAM BASELINE AGREEMENT
FOR THE
LIGHTWEIGHT WATER PURIFIER (LWP)

With the objective of enhancing program stability and controlling cost growth, we, the undersigned, approve this baseline document. Our intent is that the program be managed within the programmatic, schedule, and financial constraints identified. We agree to support the required funding in the Planning, Programming, and Budgeting System (PPBS).

This baseline document is a summary and does not provide detailed program requirements or content. It does, however, contain key performance, schedule, and cost parameters that are the basis for satisfying an identified mission need. As long as the program is being managed within the framework established by this baseline, in-phase reviews will not be held between the regularly scheduled In Process Reviews (IPR).

____

Program Manager
Date:

____

Program Executive Officer
Date:

____

Army Acquisition Executive
Date:

LIGHTWEIGHT WATER PURIFIER (LWP)
ACQUISITION PROGRAM BASELINE

REFERENCE: Coordination Draft Operational Requirements Document (ORD) for the Lightweight Water Purifier dated 7 April 1995.

SECTION A: PERFORMANCE

	DEVELOPMENT BASELINE MS I/II Approval Date:__________ Objective/Threshold	REVISED BASELINE/ PROGRAM REVIEW Date:________	CONTRACT SPECIFICATION For Information Purposes Only
Potable Water Quality (ORD 4a(2))	TB Med 577 & Tri-Service Quality Standards		
Water Production Rate @ 77°F and 45,000 ppm TDS (ORD 4a(1))	75 GPH, (125 GPH from fresh water)		
Storage Capacity (ORD 4a(9))	Two 400 gal closed storage bags or tanks for source water and product water		
Distribute Potable Water (ORD 4a(6))	Distribute potable water from storage bags or tanks ≥ 10 GPM		
Highway Transportability (ORD 6b)	Meet US and NATO countries highway legal limits when carried in HMMWV		

	DEVELOPMENT BASELINE MS I/II Approval Date:__________ Objective/Threshold	REVISED BASELINE/ PROGRAM REVIEW Date:________	CONTRACT SPECIFICATION For Information Purposes Only
Air Transportability (ORD 6b)	Transportable internally in UH-60 in one lift. Air droppable from C-130 or C-141 using current airdrop container systems.		
Emplace and Recover Crew (ORD 4b(1))	4 Soldiers (2 desired)		
Set-Up Time by 1 Soldier (ORD 4b(2))	Initial: within 45 min after emplacement. Daily: within 15 min. Prep for Move: within 45 min.		
Operating Crew (ORD 4b(6)	One soldier (SOF, CMF 18 and Medical, MOS 91B)		
Specialized Operator or Maintainer Training (ORD 5c(2))	None/Minimal		
Fuel and Power (ORD 6c)	Electric Power compatible with std military gen sets. Engines compatible with standard fuels and lubricants.		
Add disinfectant and maintain residual (ORD 4a(8), TM 10-52-1, p. C-13, and DA Msg 291451Z Mar 1996)	Add disinfectant and maintain chlorine residual ≥ 2 ppm during storage and distribution.		

	DEVELOPMENT BASELINE MS I/II Approval Date:___________ Objective/Threshold	REVISED BASELINE/ PROGRAM REVIEW Date:_________	CONTRACT SPECIFICATION For Information Purposes Only
Weight (ORD 4a(7))	Complete system must not exceed 1,000 lbs; single modules $\leq$ 328 pounds.		
Dimensions (ORD 4a(7))	System, including power source, BII, and 150 hours of supply, must fit in cargo compartment of M1097A and UH-60.		
Operational Environment & Conditions (ORD 4c(2))	Capable of being operated in Basic and Hot and stored in Basic climatic conditions.		
Maintainability (ORD 4b(3))	MTTR $\leq$ 1 hr for all unscheduled maintenance and MaxTTR $\leq$ 2 hrs for 90% of all unscheduled maintenance. PMCS $\leq$ 30 min for each 4 hrs operation.		
Integrated Logistics Supportability (ORD 4b(7) and 5a)	Supported by standard supply and logistical systems. GS and Depot by contract.		

	DEVELOPMENT BASELINE MS I/II **Approval Date:__________** **Objective/Threshold**	**REVISED BASELINE/ PROGRAM REVIEW** **Date:________**	**CONTRACT SPECIFICATION** **For Information Purposes Only**
Self-sustained Operation (ORD 4b(5))	At least 150 operating hours, excluding Class III requirements.		
Safety (ORD 4c(7) and 5c(3))	Must meet specific Army safety and quantified noise requirements (e.g. 83 dB for $\leq$ 12 hrs exposure or 85 dB for $\leq$ 8 hrs exposure).		

LIGHTWEIGHT WATER PURIFIER (LWP)
ACQUISITION PROGRAM BASELINE

SECTION B: SCHEDULE

	DEVELOPMENT BASELINE MS I/II Approval Date:______ Objective/Threshold	**REVISED BASELINE/ PROGRAM REVIEW Date:______ Objective/Threshold**	**CONTRACT SPECIFICATION For Information Purposes Only**
MNS Approval (CARDS 22-93)			6 Oct 93
Milestone 0			(6 Oct 93)
ORD Approval	Feb 96/May 96		
Milestone I/II	Mar 96/Jun 96		
Release RFP/Solicitation	Feb 96/May 96		
Development Contract Award	Mar 96/Jun 96		
Prototype Delivery	Jun 96/Sep 96		
Production Qualification Tests (PQT) & Initial Operational Tests (IOT)	Sep 96/Dec 96 to Sep 97/Dec 97		
Release Production RFP	Oct 97/Jan 98		
Milestone III (TC Standard)	Oct 97/Jan 98		
Production Contract Award	Oct 98/Jan 99		

	DEVELOPMENT BASELINE MS I/II Approval Date:___________ Objective/Threshold	REVISED BASELINE/ PROGRAM REVIEW Date:___________ Objective/Threshold	CONTRACT SPECIFICATION For Information Purposes Only
First Article Test (FAT)	Jan 99/Apr 99		
First Unit Equipped (FUE)	May 99/Aug 99		
Initial Operational Capab (IOC)	Jul 99/Oct 99		
Full Operational Capab (FOC)	Jan 00/Apr 00		

LIGHTWEIGHT WATER PURIFIER (LWP)
ACQUISITION PROGRAM BASELINE

SECTION C: COST

	DEVELOPMENT BASELINE MS I/II Approval Date:_______ Objective/Threshold	REVISED BASELINE/ PROGRAM REVIEW Date:_______ Objective/Threshold	CONTRACT SPECIFICATION For Information Purposes Only
CURRENT (Then Year) DOLLARS			
Total RDTE	$ 2.509 M		
Total Procurement Cost	$ 3.335 M		
Total MILCON	$ 0.0 M		
FY96 CONSTANT DOLLARS			
Total RDTE	$ 2.158/7.267 M		
Total Procurement Cost	$ 2.025/3.755 M		
Total MILCON	$ 0.0 M		
Average Unit Manufacturing Cost (FY96 Constant $)	$ 21.0/55.6 K		
Total Procurement Quantities	50		

LIST OF ABBREVIATIONS

GPH	gallons per hour
GPD	gallons per day
EMD	Engineering and Manufacturing Development
EUP	Early User Participation
FAT	First Article Test
IOT	Initial Operational Test
MIT	Market Investigation Tests
Mat Rel	Materiel Release
ppm	parts per million
PQT	Production Qualification Test
Std	standard

TEST AND EVALUATION MASTER PLAN (TEMP)

for the

LIGHTWEIGHT WATER PURIFIER (LWP)

August 11, 1995

SUBMITTED BY:

Program Manager	Date

APPROVED BY:

EDWARD L. ANDREWS BG, USA Commander, USA TACOM Milestone Decision Authority	Date

Bob Shalewitz (703) 704-3358
TARDEC Mobility Technology Center Belvoir
Fuel and Water Supply Division
Fort Belvoir, VA 22060

TIWG COORDINATION SHEET
FOR
LIGHTWEIGHT WATER PURIFIER (LWP)

Signature	Date
Program Manager ____________________ (TIWG Chair)	CONCUR/NONCONCUR___________
Combat Developer ____________________ (CASCOM)	CONCUR/NONCONCUR___________
Developmental Tester__________________ (TECOM)	CONCUR/NONCONCUR__________
Developmental Assessor________________ (TECOM)	CONCUR/NONCONCUR___________
Operational Tester_____________________ (TEXCOM)	CONCUR/NONCONCUR___________
Operational Evaluator__________________ (OEC)	CONCUR/NONCONCUR___________
Logistician___________________________ (AMSAA)	CONCUR/NONCONCUR___________
USMC ______________________________ (MCCDC)	CONCUR/NONCONCUR___________
Special Operations ____________________ (USASOC)	CONCUR/NONCONCUR___________
Medical Service ______________________ U. S. Army Medical Command	CONCUR/NONCONCUR___________

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1. PART I - SYSTEM INTRODUCTION

a. Mission Description.

(1). The Mission Needs Statement for the Lightweight Water Purifier (LWP) was approved 6 October 1993 (CARDS Reference Number 22-93). It established a requirement to provide a purified water production capability for small units and detachments, including special operations forces (SOF), conducting military missions and operations other than war in areas remote from external support. The Marine Corps has recommended the Joint Potential Designator of this program to be "Joint Interest."

(2). The need is for a highly transportable water purification unit which can be emplaced, operated, and maintained at unit level as an additional duty by personnel without special training. Under normal conditions the water purifier must produce potable water at a rate sufficient to meet consumption and personal hygiene needs of the supported unit with intermittent operation over short periods of time. It is intended for employment in low intensity conflict, peacekeeping, and disaster relief operations, when it is not practical to depend on normal sources of water support. Other operations such as early entry, long-range surveillance, nation building, foreign internal defense, humanitarian assistance, and civil affairs are also included.

(3). At present there is no water purification equipment which satisfies this need. Small units and detachments operating in remote areas must rely on individual water purification methods, carry all required water with them, or have it shipped in to them by air. Existing and projected water purifiers are not designed for use by small units or detachments with limited potable water requirements and limited supplies. Both the 600 and 3000 GPH Reverse Osmosis Water Purification Units (ROWPUs) require heavy vehicles, material handling equipment, large generators for power supply, and dedicated operators. Thus these systems are not practical for supporting isolated units in such contingencies.

b. System Threat Assessment.

(1). The Lightweight Water Purifier (LWP) does not counter a specific threat capability. U. S. forces deploying worldwide in support of U. S. interests are always subject to a range of health and environmental hazards. These hazards can have a significant impact on soldier performance and overall combat effectiveness. U. S. forces deploying worldwide are especially at risk from both intentionally placed and natural contaminants in water sources. These contaminants include industrial chemical contaminants, natural biological contaminants, organic and inorganic substances, and possibly nuclear, biological, and chemical contaminants.

(2). The LWP will encounter the same battlefield threats as those facing employing Special Operating Forces (SOF) units and teams. This could include small arms, artillery, and aircraft, as well as NBC munitions. In addition, the LWP will produce potable water in environments subject to chemical and waterborne pathogens resulting from natural disasters.

(3). The System Threat Assessment Report (STAR) for Land Warrior has been approved for use as the baseline threat assessment for the LWP.

c. Minimum Acceptable Operational Performance Requirements. A Cost and Operational Effectiveness Analysis (COEA) has been prepared for the LWP. The Analytical Hierarchy Process (AHP) was used for the Operational Requirements Analysis in this COEA. The Measures of Effectiveness (MOE) ("criteria" in the AHP terminology) used in this analysis were derived directly from paragraphs 4, 5, and 6 of the Operational Requirements Document (ORD) and hence are very closely related to the Operational Performance Parameters discussed below.

The Coordinating Draft ORD for the Lightweight Water Purifier (LWP) dated 7 April 1995, established the following minimum acceptable operational performance parameters. The LWP will:

(1). Produce potable water that meets the field drinking water standards identified in TB MED 577, STANAG 2136, QSTAG 245, and the proposed Tri-Service Field Water Quality Standards from all surface and ground water sources of fresh brackish, and sea water, including NBC-contaminated water. Be capable of adding disinfectant and maintaining a disinfectant residual.

(2). Produce at least 75 gallons per hour (GPH), normalized to 77°F, of potable water meeting the standards described in paragraph 1.c.(1) from water sources with a total dissolved solids (TDS) level of 45,000 milligrams per liter (mg/l) and water sources contaminated with NBC agents; and 125 GPH, normalized to 77°F, of potable water meeting the same standards from sources with a TDS level less than 1000 mg/l. These are the required performance standards. The desired performance objective is 75 GPH from water with a TDS level of 60,000 mg/l.

(3). Weigh not more than 1,000 pounds. This weight limit includes the power source, Basic Issue Items and 150 hours of supplies. The desired total weight is 750 pounds. Single modules must not weigh more than 328 pounds.

(4). Entire LWP system, including power source, BII, and 150 hours of supply, must fit in the rear compartment of a M1097A truck (HMMWV) and be air transportable inside the UH-60 in one lift.

(5). Operate using multi-purpose fuel (e.g., JP-8). Direct drive pumps, electrical motor powered pumps driven by a generator set, or a combination of both types is acceptable.

(6). Contain two 400 gallon storage bags or containers closed to the atmosphere to be used as holding tanks for source water and product water.

(7). Contain interchangeable raw water and product water distribution pumps.

(8). Draw water from any type of water sources a distance of 50 horizontal feet and 10 vertical feet and pump the water a distance of 100 horizontal feet and 25 vertical feet.

(9). Be capable of identifying defective Reverse Osmosis (RO) membranes during operations.

(10). Distribute potable water from storage bags or tanks at a flow rate of at least 10 gallons per minute.

(11). Incorporate in-line water quality monitoring technology for system performance parameters such as turbidity, total dissolved solids (TDS), temperature, pH, and total water production.

(12). Be emplaced and recovered from operational sites by four individuals. Emplacement and recovery by two individuals is desired.

(13). Following emplacement, be initially put into operation by one individual without specialized training within 45 minutes. Daily operational set up and shutdown time will be 15 minutes or less. No more than 45 minutes will be required for one individual to prepare the LWP for movement to another site.

(14). Must have a Mean Time Between Essential Function Failure of 280 hours, a Mean Time to Repair no greater than 1 hour, and a Maximum Time to Repair no greater than 2 hours for 90% of all Essential Unscheduled Maintenance Demands. Preventive Maintenance Checks and Services (PMCS) must not require more than 30 minutes for each 4 hours of operation and must be accomplished by individuals without specialized training.

(15). Be capable of self-sustained operation, excluding Class III requirements, for a minimum of 150 hours.

d. System Description.

(1). The LWP will be a skid mounted system capable of being lifted and handled by two to four individuals. It may consist of separate elements, but all components, along with 150 hours of expendable supplies and repair parts, must fit within the space and load capacity of a M1097A truck (HMMWV) or a UH-60 Helicopter. Ease of operation and maintenance by personnel without special training is a prime consideration. A variety of technologies now in commercial use are being considered to meet performance requirements. The following basic functions are common to all approaches:

(a). A raw water system will provide pumps and hoses needed to draw water from surface sources.

(b). A pretreatment system consisting of filters, chemical treatment containers, or a combination of the two will remove most suspended, colloidal, and biological solids present in the raw water.

(c). A reverse osmosis system will remove dissolved solids. It will consist of filter/membrane elements, pressure vessels and a high pressure pump.

(d). A post treatment system will remove NBC contamination and will provide disinfection for the final purification of the water.

(e). A storage/distribution system will provide storage bags or other containers, pumps, and hoses for dispensing product water and provide for inactivation of microbiological organisms by disinfection.

(f). A power system will provide the necessary mechanical or electrical energy to operate all components of the LWP.

(g). Process control will provide the necessary switches, valves, controls, and instruments for operation and quality control.

(2). The LWP will not replace any existing equipment. At present these small units and detachments have no bulk water purification equipment and are limited to individual water purification methods such as iodine tablets. The current means of providing water is to conduct frequent, and costly, aerial resupply with bottled or bulk water.

(3) The LWP will be operated and maintained in accordance with the standard Army supply and maintenance systems. Operator, organizational, and direct support (DS) maintenance will be provided by military personnel. General support (GS) and depot maintenance will performed by a contractor and will consist of repair of assemblies replaces at lower maintenance levels. Full organic support will be provided at initial operational capability (IOC), with no interim contractor support.

(4). Critical system characteristics. The LWP has no critical characteristics as defined by Section 4-C of DoD Instruction 5000.2 which would require special test and analysis requirements. In particular, the LWP is not required to be NBC survivable.

(5). Initial Operational Capability (IOC) for the LWP will be attained when: the first unit equipped has received its authorized LWP equipment and all primary and supporting equipment; repair parts, expendable items, and field and technical manuals are available; and instructor and key personnel training has been completed. Full Operational

Capability (FOC) is attained when all authorized units have received their LWP equipment and all the other standards listed for IOC have been completed for all units.

e. Critical Technical Parameters. Critical technical parameters for the LWP are summarized in Table 1. These technical parameters are based directly on the system performance requirements, logistics and readiness requirements, and critical system characteristics specified in paragraphs 4, 5, and 6 of the 7 April 1995 Draft Operational Requirements Document.

Table 1. Critical Test Parameters for the LWP

Critical Test Parameters	Total Events	Technical Objective for Each Test Event	Location	Schedule	Decision Supported	Demonstrated Value
Potable Water Production Rate (ORD 4a(1))	Market Investigation Tests (MIT)	Minimum flow $\geq$ 75 GPH from source water with salinity of 45,000 mg/l and 125 GPH from source water with 1000 mg/l (both flow rates normalized to 77° F).	Ft Belvoir	4Q94-3Q95	MS I/II	Must be demonstrated
	PPQT	Same	USACSTA	4Q96-4Q97	MS III (TC Generic)	Must be demonstrated
	FAT/PQT	Same	Contractor	3Q99	MS III (TC Std and Mat Rel	Must be demonstrated
Produce Potable Water from All Types of water sources (ORD 4a(2))	MIT	Produce potable water that meets Tri-Service Field Water Quality Standards from water sources above, including when NBC contaminated.	Ft Belvoir	4Q94-3Q95	MS I/II	Must be demonstrated
	PPQT	Same	USACSTA	4Q96-4Q97	MS III	Must be demonstrated
	FAT/PQT	Same	Contractor	3Q99	Mat Rel	Must be demonstrated

Critical Test Parameters	Total Events	Technical Objective for Each Test Event	Location	Schedule	Decision Supported	Demonstrated Value
Add disinfectant and maintain residual (ORD 4a(8), TM 10-52-1, p. C-13, and DA Msg 291451Z Mar 1996)	MIT	Add disinfectant and maintain chlorine residual ≥ 2 ppm during storage and distribution.	Ft Belvoir	4Q94-3Q95	MS I/II	Must be demonstrated
	PPQT	Same	USACSTA	4Q96-4Q97	MS III	Must be demonstrated
	FAT/PQT	Same	Contractor	3Q99	Mat Rel	Must be demonstrated
Water draw and pumping distance (ORD 4a(5))	PPQT	<u>Draw</u> water from any source a distance of 50 horizontal feet and 10 vertical feet. <u>Pump</u> the water a distance of 100 horizontal feet and 25 vertical feet.	USACSTA	4Q96-4Q97	MS III	Must be demonstrated
	FAT/PQT	Same	Contractor	3Q99	Mat Rel	Must be demonstrated
Water storage (ORD 4a(9)	PPQT	Include two 400 gal closed storage bags or tanks for source water and product water.	USACSTA	4Q96-4Q97	MS III	Must be demonstrated
	FAT/PQT	Same	Contractor	3Q99	Mat Rel	Must be demonstrated

Critical Test Parameters	Total Events	Technical Objective for Each Test Event	Location	Schedule	Decision Supported	Demonstrated Value
Distribution of potable water (ORD 4a(6))	PPQT	Distribute potable water from storage bags or tanks $\geq$ 10 GPM	USACSTA	4Q96-4Q97	MS III	Must be demonstrated
	FAT/PQT	Same	Contractor	3Q99	Mat Rel	Must be demonstrated
Weight (ORD 4a(7))	PPQT	Complete system must not exceed 1,000 lbs; single modules $\leq$ 328 pounds.	USACSTA	4Q96-4Q97	MS III	Must be demonstrated
	FAT/PQT	Same	Contractor	3Q99	Mat Rel	Must be demonstrated
Dimensions (ORD 4a(7))	PPQT	System, including power source, BII, and 150 hours of supply, must fit in cargo compartment of M1097A and UH-60.	USACSTA	4Q96-4Q97	MS III	Must be demonstrated
	FAT/PQT	Same	Contractor	3Q99	Mat Rel	Must be demonstrated
Instrumentation (ORD 4a(11))	PPQT	Incorporate in-line water monitoring technology for system performance parameters and flow totalizing and recording devices.	USACSTA	4Q96-4Q97	MS III	Must be demonstrated
	FAT/PQT	Same	Contractor	3Q99	Mat Rel	Must be demonstrated

Critical Test Parameters	Total Events	Technical Objective for Each Test Event	Location	Schedule	Decision Supported	Demonstrated Value
Environmental Conditions (ORD 4c(2) and AR 70-38)	PPQT	Capable of being operated in Basic and Hot and stored in Basic climatic conditions.	USACSTA	4Q96-4Q97	MS III	Must be demonstrated
	FAT/PQT	Same	Contractor	3Q99	Mat Rel	Must be demonstrated
Personnel Requirements (ORD 4b(6) and 5c(4))	PPQT	Operated by SOF (CMF 18) and medical (MOS 91B) soldiers as an additional duty and maintained by MOS 63J with or without MOPP4 gear. No new MOS.	USACSTA	4Q96-4Q97	MS III	Must be demonstrated
	FAT/PQT	Same	Contractor	3Q99	Mat Rel	Must be demonstrated
Emplaced and recovered by 4 soldiers (ORD 4b(1))	PPQT	SOF and medical personnel.	USACSTA	4Q96-4Q97	MS III	Must be demonstrated
	FAT/PQT	Same	Contractor	3Q99	Mat Rel	Must be demonstrated
Setup and teardown by 1 soldier (ORD 4b(2))	PPQT	Initial: within 45 min after emplacement. Daily: within 15 min. Prep for Move: within 45 min.	USACSTA	4Q96-4Q97	MS III	Must be demonstrated
	FAT/PQT	Same	Contractor	3Q99	Mat Rel	Must be demonstrated

Critical Test Parameters	Total Events	Technical Objective for Each Test Event	Location	Schedule	Decision Supported	Demonstrated Value
Air Transportability and Droppability (ORD 6b)	PPQT	Transportable internally in UH-60 in one lift. Air droppable from C-130 or C-141 using current airdrop container systems.	USACSTA	4Q96-4Q97	MS III	Must be demonstrated
	FAT/PQT	Same	Contractor	3Q99	Mat Rel	Must be demonstrated
Rail Transportability (ORD 6b)	PPQT	Meet GIC equipment rail outline diagram when carried in HMMWV, have military standard lifting and tiedown provisions, and pass rail impact test.	USACSTA	4Q96-4Q97	MS III	Must be demonstrated
Highway Transportability (ORD 6b)	PPQT	Meet US and NATO countries highway legal limits when carried in HMMWV.	USACSTA	4Q96-4Q97	MS III	Must be demonstrated
	FAT/PQT	Same	Contractor	3Q99	Mat Rel	Must be demonstrated
Reliability (ORD 4b(3))	PPQT	MTBEFF $\geq$ 280 hours.	USACSTA	4Q96-4Q97	MS III	Must be demonstrated
	FAT/PQT	Same	Contractor	3Q99	Mat Rel	Must be demonstrated

Critical Test Parameters	Total Events	Technical Objective for Each Test Event	Location	Schedule	Decision Supported	Demonstrated Value
Maintainability (ORD 4b(3))	PPQT	MTTR $\leq$ 1 hr for all unscheduled maintenance and MaxTTR $\leq$ 2 hrs for 90% of all unscheduled maintenance. PMCS $\leq$ 30 min for each 4 hrs operation.	USACSTA	4Q96-4Q97	MS III	Must be demonstrated
	FAT/PQT	Same	Contractor	3Q99	Mat Rel	Must be demonstrated
Integrated Logistics Supportability (ORD 4b(7) and 5a)	PPQT	Supported by standard supply and logistical systems. GS and Depot by contract.	USACSTA	4Q96-4Q97	MS III	Must be demonstrated
	FAT/PQT	Same	Contractor	3Q99	Mat Rel	Must be demonstrated
Self-sustained Operation (ORD 4b(5))	PPQT	At least 150 operating hours, excluding Class III requirements.	USACSTA	4Q96-4Q97	MS III	Must be demonstrated
	FAT/PQT	Same	Contractor	3Q99	Mat Rel	Must be demonstrated
NBC Contamination Removal (ORD 4a(2) and 4c(1))	PPQT	Remove NBC contamination from water	Dugway Proving Ground (DPG)	4Q96-4Q97	MS III	Must be demonstrated

Critical Test Parameters	Total Events	Technical Objective for Each Test Event	Location	Schedule	Decision Supported	Demonstrated Value
Safety (ORD 4c(7) and 5c(3))	PPQT	Must meet specific Army safety and quantified noise requirements (e.g. 83 dB for $\leq$ 12 hrs exposure or 85 dB for $\leq$ 8 hrs exposure).	USACSTA	4Q96-4Q97	MS III	Must be demonstrated
	FAT/PQT	Same	Contractor	3Q99	Mat Rel	Must be demonstrated

2. PART II - INTEGRATED TEST PROGRAM SUMMARY.

a. Integrated Test Program Schedule

The integrated test program schedule is shown in Table 2. Developmental Test and Evaluation is discussed in Part III. Operational Test and Evaluation is discussed in Part IV.

b. Management.

(1). Responsibilities

(a). Materiel Developer. Mobility Technology Center-Belvoir performs the following functions:

1. Chairs TIWG meetings and prepares the TEMP in coordination with TIWG members.

2. Prepares the market investigation report.

3. Budgets for testing and provides funds to testing agencies. Manages procurement and delivery of test materiel including the system support package and New Equipment Training Support Package.

4. Provides technical expertise at test sites. Monitors testing to insure compliance with test plans. Maintains a test and RAM database.

5. Chairs developmental test scoring conferences and provides a voting member to all scoring conferences. Chairs the Corrective Action Review Team (CART) and the Supportability T&E Working Group (STEWG). Co-chairs the RAM Working Group (RAMWG).

6. Provides the Materiel Developer's Operational Test Readiness Statement.

(b). Combat Developer. The Combined Arms Support Command (CASCOM) performs the following functions:

1. Prepares/updates the Operational Requirements Document (ORD) and the Critical Operational Issues and Criteria (COIC). Provides the doctrinal and organizational test support package.

2. Provides a TIWG member. Co-chairs the RAMWG. Provides a member to the CART and a voting member to all scoring conferences.

Table 2 Lightweight Water Purifier (LWP) Integrated Test Program Schedule

FISCAL YEAR	1994	1995	1996	1997	1998	1999	2000
MILESTONES			Δ I/II		Δ III	Δ Mat Rel	
SOLICITATION RELEASE		Δ EMD			Δ PROD		
CONTRACT AWARD			Δ EMD			Δ PROD	
DELIVERIES			Prototype (3)			Production (50)	
DEVELOPMENTAL TEST & EVALUATION		MIT		PPQT		FAT	
OPERATIONAL TEST & EVALUATION		EUP		IOT			
FUNDING (In millions of Current Dollars, based on Program Life Cycle Cost Estimate)							
RDT&E	0.253	0.449	0.626	0.929	0.251	0.0	0.0
PROCUREMENT	0.0	0.0	0.0	0.0	0.0	0.997	2.066
TOTAL	0.253	0.449	0.626	0.929	0.251	0.997	2.066

3. Provides the Operational Test and Readiness Statement (OTRS) and Training Test Support Package (TTSP).

(c). Developmental Tester. The US Army Test and Evaluation Command, Aberdeen Proving Ground, MD performs the following functions:

1. Provides a TIWG member and develops input to assigned sections of the TEMP.

2. Plans, provides resources for, and conducts the developmental portion of the combined development and operational tests.

3. Provides a member to the CART and participates in all scoring conferences.

(d). Developmental Assessor. The US Army Test and Evaluation Command is also the Independent Developmental Assessor and performs the following functions:

1. Provides a TIWG member and prepares input to assigned sections of the TEMP.

2. Prepares the Independent Assessment Plan (IAP) and provides Independent Assessment Reports (IAR).

3. Provides a member to the CART, RAMWG, STEWG and a voting member to all scoring conferences.

(e). Operational Tester. The US Army Test and Experimentation Command (TEXCOM) performs the following functions:

1. Provides a member to the TIWG and prepares input to assigned sections of the TEMP.

2. Plans and conducts the operational portion of the combined development and operational tests.

3. Coordinates test resource requirements through the Test Schedule and Review Committee (TSARC).

4. Provides a member to the CART and participates in all scoring conferences.

5. Prepares the Test Evaluation Plan (TEP) and Test Evaluation Report (TER).

(f). Operational Evaluator. The US Army Operational Evaluation Command (OEC) performs the following functions:

1. Provides a member to the TIWG and prepares input to assigned sections of the TEMP.

2. Provides Abbreviated Operational Assessments (AOA).

3. Provides a member to the CART, RAMWG, and STEWG. Chairs scoring conferences for operational tests and provides a voting member to all scoring conferences.

4. Reviews and comments on all user test and evaluation documentation and program documentation.

(g). Logistician. The US Army Material Systems Analysis Activity (AMSAA) performs the following functions:

1. Provides a member to the TIWG.

2. Provides guidance and evaluation of logistics supportability issues.

3. Participates as an observer in all scoring conferences.

(h). Transportability Evaluator. The Military Traffic Management Command Transportation Engineering Agency (MTMCTEA), Newport News, VA, performs the following functions:

1. Participates in the TIWG process.

2. Reviews and analyzes the transportability engineering aspects of test-related documents.

3. Ensures the required transportability testing is planned, conducted, and reported by the program manager.

4. Provides technical expertise at the test site for transportability testing.

(i). <u>Special Operations Forces User.</u> The U. S. Army Special Operations Command (USASOC), Fort Bragg, NC, the principal user of the LWP, performs the following functions:

<u>1.</u> Provides a member of the TIWG and participated in the TIWG process.

<u>2.</u> Reviews and analyzes the operational aspects of test-related documents.

<u>3.</u> Provides operational expertise at the test site for operational testing.

(j). <u>Medical Service Users.</u> The U. S. Army Medical Command, Fort Sam Houston, Texas, performs the following functions:

<u>1.</u> Invited to participate as non-voting member of the TIWG.

<u>2.</u> Provides operational expertise with regard to issues concerning medical personnel.

(2). <u>Production Decision.</u> Milestone III and Type Classification Standard is planned for 1QFY98. Production is expected to begin in 1QFY99. Materiel Release based on FAT or PQT is projected for 2QFY99.

(3). <u>Unresolved Operational Issues and Live Fire Testing</u>

All operational issues will be resolved prior to Milestone III. There will be no live fire testing of the Lightweight Water Purifier (LWP).

3. PART III - DEVELOPMENTAL TEST AND EVALUATION OUTLINE

a. Developmental test and Evaluation Overview. The LWP program is based on a streamlined and tailored Non-Development Item (NDI) acquisition process to reduce the overall costs and time to field the system. The use of commercial practice and non-government performance specifications in accordance with Acquisition Reform guidelines will be integrated into the program to the maximum extent. The materiel developer's market investigation report and reports on testing of commercially available water purifiers will be the primary source of test data to support Milestone I/II. A combined PPQT/IOT is scheduled to support Milestone III and Type Classification Generic. A first article test (FAT) and, if necessary, a production qualification test (PQT) are planned to support Type Classification Standard and Material Release. The schedule for these tests is shown in Table 2.

b. Developmental Test and Evaluation to Date.

(1). Concept Exploration and Demonstration and Validation Phase.

A market investigation was completed in early FY 1994. It indicated that commercially available water purifiers or a combination of available purifiers with relatively minor modifications will provide feasible alternatives to satisfy this need. Several sources are capable of supplying the LWP and are expected to compete for its development and production. Accordingly, a series of Market Investigation Tests (MIT) is planned to select a commercial purifier or combination of purifiers and identify any modifications necessary.

Based on the results of the market survey, several commercial water purification units and components drawing on a variety of technologies have been procured or leased. The material developer is performing Market Investigation Tests (MIT) on these units and components to evaluate their performance and determine whether they can meet the production and water quality standards required by the ORD. Table 1 indicates the technical objectives required for this testing. Collection of data for independent assessment and Abbreviated Operational Assessment of the LWP are being included as required for Milestone I/II. Test and Evaluation reports prepared to date are included as references in Appendix A.

The results of these Market Investigation Tests (MIT) are being used to prepare a performance specification for a solicitation, source selection, and planned Second Quarter FY96 award of a Engineering Manufacturing Development (EMD) contract.

c. Future Developmental Test and Evaluation.

(1). Engineering and Manufacturing Development Phase (EMD).

(a). Configuration Description. The EMD contract will include a performance specification for three operational prototypes purchased from a single manufacturer. These prototypes will not be especially fabricated units but standard, off-the-shelf water purification units with only minor modifications. These prototypes will support the Pre-Production Qualification Test (PPQT) and Initial Operational Test and Evaluation (IOT&E) scheduled to begin First Quarter FY97. Unless deficiencies are detected during PPQT/IOT which require modification to the performance specification, these prototypes should perform the same as production models.

(b). PPQT/IOT Objectives. The general objectives of PPQT/IOT are to validate that non-developmental Lightweight Water Purifiers built in accordance with the performance specification in accordance with the Acquisition Reform initiatives will meet user requirements. Specific technical objectives, developed from the ORD, are listed in Table 1.

(c). PPQT/IOT Events. Three test phases are planned which may overlap in time. A common goal is to collect 500 hours of operating data from each of the three LWP prototypes. The time is to be distributed approximately 75% operating from fresh water sources at Aberdeen Proving Ground, MD and 25% from salt water sources at Fort Story, VA. A logistics demonstration (LD), including manual verification, will be integrated into this program. The LD will take place at Aberdeen Proving Ground before the actual water production testing begins.

1. Phase one will be conducted under TECOM lead and will consist of operating the LWP for sustained periods of time at static locations. The purpose is to demonstrate that the LWP is safe and ready for further testing, to measure individual component as well as total system performance and to collect RAM data for sustained operations.

2. Phase two will be conducted under TECOM lead and will consist of operating the LWP for intermittent periods of time at static locations. The purpose is to verify that commercial manuals are adequate for further test, to determine whether human factors engineering is adequate, and to collect RAM data for these operating conditions.

3. Phase three will be with the assistance of TEXCOM and will involve representative user operators in ten cycles of transport, emplacement, intermittent operation, and recovery/preparation for transport of the LWP. The purpose is to complete collection of information necessary to address critical operational issues not already available and to collect RAM data under these operating conditions.

(d). Limitations. None expected.

(3). Production.

(a). First Article Test. Type Classification Standard and Material Release will be based on the contractor's certificate of conformance to the performance specification or purchase description (PD) and a contractor-conducted first article test (FAT) to demonstrate that quality assurance provisions of the contract have been met. Material Release is projected for Third Quarter FY99.

(b). <u>Production Qualification Test.</u> A production qualification test (PQT) will be conducted by TECOM only in the event that a manufacturer other than the EMD contractor is selected for production or that the performance specification has to be significantly modified as a result of PPQT/IOT. If a PQT is required, it will consist of operating the LWP at static locations for at least 200 hours over a period of thirty days. The operating time will be apportioned 75% to fresh source water and 25% to salt water. The purpose will be to verify that the LWP meets requirements of the performance specification.

d. <u>Live Fire Test and Evaluation</u>

No live fire test and evaluation will be conducted for the LWP. The system is a water purification system and has no live fire capability or ballistic protection systems.

4. PART IV - OPERATIONAL TEST AND EVALUATION OUTLINE

a. Operational Test and Evaluation Overview. Limited Early User Participation (EUP), involving the MOS who will operate and maintain the LWP, will be conducted in conjunction with the Market Investigation Tests. The purpose of this effort will be to provide data for early operational assessment to support Milestone I/II. During the Engineering and Manufacturing Development Phase (EMD), there will not be a separate operational test. Instead, operational test and evaluation requirements will be integrated into a combined PPQT/IOT.

b. Critical Operational Issues

(1). Issue. Does the LWP, when combined with its support equipment, meet mission operational requirements?

(a). Scope. This issue addresses the capability of the LWP with its storage tanks, expendable supplies, and other authorized support equipment to produce, store and dispense potable water at acceptable rates under conditions compatible with the Operational Mode Summary/Mission Profile (OMS/MP) of the ORD. The LWP will be operated by military personnel in accordance with approved doctrine, tactics, techniques and procedures. It will be examined for compatibility between water purification components, power unit and storage/dispensing elements during day and night operations under all required climatic and source water conditions. Faults or deficiencies found will be recorded and assigned to specific major components or to the overall combination. This evaluation will concentrate on the ability of SOF military personnel (CMF 18) and medical personnel (MOS 91B) with minimum additional training to set up and produce a suitable quantity of potable water.

(b). Criteria.

1. The LWP will be emplaced by two to four individuals.

2. After emplacement, the LWP will initially be put into operation within 45 minutes and prepared for a move within 45 minutes, both by one individual.

3. The LWP will be put into operation daily within 15 minutes and shut down within 15 minutes by one individual.

4. The LWP will produce potable water at the desired rate of 75 gallons per hour from salt water and 125 gallons per hour from fresh water (normalized to 77° F).

5. The LWP will store 800 gallons of source water and product water and dispense potable water to five gallon cans, 1 or 2 quart canteens or other containers at a rate of at least 10 GPM.

6. The LWP will draw water from any source at a distance of 50 horizontal feet and 10 vertical feet. It will be able to pump the water 100 horizontal feet and 25 vertical feet.

(c). Rationale. The LWP is needed to provide units with water purification capability consistent with mission profiles and conditions estimated for the full range of likely contingencies.

(2). Issue. Can the LWP with its programmed logistics support satisfactorily sustain operations in accordance with the wartime OMS/MP?

(a). Scope. This issue examines the ability of the LWP and its system support package (SSP) to sustain OMS/MP water purification operations. The SSP will be examined for consistency with the Standard Army Maintenance System (SAMS) as well as for completeness and functionality of its technical publications, special tools and common tools when used by the operators. During the test period operators and maintainers will perform their functions while wearing individual equipment, NBC protective equipment and weather protection clothing under anticipated operational conditions.

(b). Criteria.

1. The LWP must have a operational threshold reliability of 280 hours Mean Time Between Essential Function Failure (MTBEFF). The Mean Time to Repair (MTTR) must be no greater than 1 hour, with a Maximum Time to Repair (MaxTTR) of 2 hours for 90 percent of all essential unscheduled maintenance demands. Preventive Maintenance Checks and Services (PMCS) must require no more than 30 minutes for each 4 hours of operation.

2. The LWP System Support Package (SSP) will be compatible with the Standard Army Maintenance System (SAMS) and be functionally ready for fielding at the same time as the LWP.

3. The LWP will be capable of self-sustained operations for at least 150 operating hours, excluding Class III requirements.

4. The LWP will operated by SOF and medical personnel without specialized training during daylight and darkness by soldiers wearing full Mission-Oriented Protective Posture IV (MOPP4) equipment.

5. The LWP will operate using standard fuels and lubricants.

6. The LWP will be maintained with standard tools and basic issue items to the maximum extent possible.

7. The LWP will control to an acceptable risk level all unique health/safety hazards introduced by unit for operators and maintenance personnel with minimum additional training. Health Hazard Assessments will be completed in accordance with guidelines provided by the Army Surgeon General. An initial assessment was prepared by the U. S. Army Environmental Hygiene Agency in July 1994 and updated on 4 October 1994.

(c). Rationale. These requirements ensure that the LWP will be capable of safely accomplishing the required missions and be repaired in time to complete subsequent missions and that potential occupational/environmental health effects are appropriately minimized.

(3) Issue. Does the LWP meet transportability requirements?

(a). Scope. This issue addresses the capability of the LWP to be transported both strategically and tactically. Strategically it will be transported by aircraft, rail and ships. Tactically it will be transported by a M1097A (HMMWV) or larger military vehicle and internally by a UH-60 helicopter in one lift. It must be air droppable from C-130 or C-141 using current airdrop container systems.

(b). Criteria.

1. The LWP must meet US and NATO air, rail and sea transportation requirements without waiver.

2. The LWP must be transportable in the rear cargo compartment of a M1097A (HMMWV) military vehicle.

3. The LWP must be transportable internally by a UH-60 helicopter in one lift.

4. The LWP must be air droppable from C-130 or C-141 aircraft using current air delivery container systems.

(c). Rationale. The LWP must be capable of being transported strategically to the theater of operations and within the theater to the SOF operating areas using transportation means normally available to SOF forces.

c. Operational Test and Evaluation to Date. None.

d. Future Operational Test and Evaluation.

(1). Concept Exploration Phase

(a). Configuration Description. Based a market survey, several commercial water purification units and components have been procured or leased. The material developer is performing Market Investigation Tests (MIT) on these units and components. These units will also support limited Early User Participation (EUP).

(b). EUP Objectives.

The objectives of EUP are to involve the Quartermaster Center and School and the Army Special Operations Command (SOC), the user, at a relatively early stage in the testing process. To accomplish this, representative MOS 18C, 18D, and 63J military personnel will determine whether they, with minimum additional training, can operate and repair a commercially available LWP or what technical modifications will be necessary to make this possible.

(c). Events and Scope

The EUP will be integrated with MIT and conducted at Ft. Belvoir, VA. The EUP will use the Critical Operational Issues and procedures developed for the Initial Operational Test (IOT), modified to reflect the fact that the MIT prototypes are less mature, commercial systems.

(d). Limitations

Logistics and readiness requirements and transportability will not be tested during EUP.

(2). Engineering and Manufacturing Development (EMD)

During the Engineering and Manufacturing Development Phase (EMD), there will not be a separate operational test. Instead, data requirements for operational test and evaluation will be integrated into a combined PPQT/IOT. Phase three of the combined PPQT/IOT, conducted with the assistance of TEXCOM, will emphasize operational factors and provide opportunity for collecting unique information not already provided by other tests. The Configuration Description, Objectives, Events, and Limitations for this combined PPQT/IOT are described in Section III c (1) above.

5. PART V - TEST AND EVALUATION RESOURCE SUMMARY.

a. Test Articles. Based on the results of a market survey, several commercial systems and components have been procured or leased during Concept Exploration (Phase 0). The material developer is performing Market Investigation Tests with Early User Participation (EUP) on these systems and components. Three operational prototype LWPs complete with accessories, spare parts, expendable supplies, and operator/maintenance manuals in commercial format will be required for the combined PPQT/IOT. If a PQT is necessary, three complete production model LWPs will be required. Requirements for the contractor conducted FAT will be specified in the contract.

b. Test Sites and Instrumentation. Commercial systems and components are being tested at Ft. Belvoir, VA. The combination PPQT/IOT will be conducted primarily at Aberdeen Proving Ground, MD. Sustained access to a suitable fresh water source is necessary. Capability to test operations in temperatures down to -25 degrees F is required. Sea water testing will be conducted at Fort Story, VA. Sustained access to a suitable salt water source is necessary at that location.

c. Test Support Equipment. To be determined.

d. Threat Systems/Simulators. None required.

e. Test Targets and Expendables. None required.

f. Operational Force Test Support. None required.

g. Simulation, Models and Testbeds. None required.

h. Special Requirements. None.

i. Test and Evaluation Funding Requirements.

	FY96	**FY97**	**FY98**	**FY99**	**FY00**
RDT&E	75.76	312.12	0	0	0
Procurement	0	0	0	264.11	0

NOTE: Estimates are based on the Revised Program Life-Cycle Cost Estimate (LCCE) for the Lightweight Water Purifier (LWP) dated 20 July 1995.

j. Manpower/Personnel Training. The Market Investigation Tests (MIT) with Early User Participation (EUP) are being conducted in-house. No training classes will be conducted for personnel for these tests. Initial Key Personnel Training (IKPT) will be conducted for the combined Pre-Production Qualification Test and Initial Operational Test (PPQT/IOT). One 40-hour course will be conducted for operators and one for maintenance personnel. Both courses will be conducted by contractors, and the costs estimated in the LCCE are included in the table in Section i.

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APPENDIX B - ACRONYMS

AHP	Analytic Hierarchy Process
AMSAA	U. S. Army Materiel Systems Analysis Activity
ANSI	American National Standards Institute
AOA	Abbreviated Operational Assessment
APG	Aberdeen Proving Ground
BII	Basic Issue Items
CARDS	Catalog of Approved Requirements Documents
CART	Corrective Action Review Team
CASCOM	Combined Arms Support Command
CDR	Critical Design Review
CMF	Career Management Field
COEA	Cost and Operational Effectiveness Analysis
COIC	Critical Operational Issues and Criteria
CRAF	Civil Reserve Air Fleet
DEMVAL	Demonstration and Validation Phase
DPG	Dugway Proving Ground
DS	Direct Support
DSN	Defense Switched Network
EDT	Engineering Development Test
EMD	Engineering and Manufacturing Development
EUP	Early User Participation

FAT	First Article Test
FOC	Full Operational Capability
GIC	Gabarit International de Chargement (Rail Clearance Diagram)
GPH	Gallons per Hour
GPM	Gallons per Minute
GS	General Support
HMMWV	High Mobility Multipurpose Wheeled Vehicle
IAP	Independent Assessment Plan
IAR	Individual Assessment Report
IKPT	Initial Key Personnel Training
ISO	International Standards Organization
IOC	Initial Operational Capability
IOT	Initial Operational Test
LCCE	Life Cycle Cost Estimate
LRIP	Low Rate Initial Production
MaxTTR	Maximum Time to Repair
MCCDC	Marine Corps Combat Development Command
mg/l	Milligrams per liter
MHE	Material Handling Equipment
MIT	Market Investigation Tests
MOE	Measures of Effectiveness
MOPP4	Mission Oriented Protective Posture IV

MOS	Military Occupational Specialty
MR	Material Release
MS I	Milestone I In Process Review
MS II	Milestone II In Process Review
MTBEFF	Mean Time Between Essential Function Failure
MTMCTEA	Military Traffic Management Command Transportation Engineering Agency
MTTR	Mean Time to Repair
NBC	Nuclear, Biological, and Chemical
NDI	Non-Developmental Item
OEC	Operational Evaluation Command
OMS/MP	Operational Mode Summary/Mission Profile
ORD	Operational Requirements Document
OTRS	Operational Test and Readiness Statement
pH	A measure of the acidity or alkalinity of a solution, numerically equal to 7 for neutral solutions.
PMCS	Preventive Maintenance Checks and Services
ppm	parts per million
PPQT	Pre-Production Qualification Test
PQT	Production Qualification Test
QSTAG	Quadripartite Standardization Agreements
RAM	Reliability, Availability, and Maintainability
RAMWG	Reliability, Availability, and Maintainability Working Group

RO	Reverse Osmosis
ROWPU	Reverse Osmosis Water Purification Unit
SAMS	Standard Army Maintenance System
SOF	Special Operations Forces
SOC	Special Operations Command
STANAG	(NATO) Standardization Agreements
STEWG	Supportability Test and Evaluation Working Group
SSP	System Support Package
TARDEC	Tank-Automotive Research, Development, and Engineering Center
TC Generic	Type Classification Generic
TC STD	Type Classification Standard
TDS	Total Dissolved Solids
TECOM	Test and Evaluation Command
TEXCOM	Test and Experimentation Command
TEMP	Test and Evaluation Master Plan
TEP	Test Evaluation Plan
TER	Test Evaluation Report
TFT	Technical Feasibility Test
TIWG	Test Integration Working Group
TRADOC	Training and Doctrine Command
TSARC	Test Schedule and Review Committee
TTSP	Training Test Support Package

USACSTA	U. S. Army Combat Systems Test Activity
USASOC	U. S. Army Special Operations Command
USSOUTHCOM	U. S. Southern Command

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APPENDIX D

REQUIREMENTS/TEST ANNEX CROSSWALK MATRIX FOR LWP

COIs	COEA	MAOPRs	CTPs	ORD	TFT/EUT	PPQT\IOT	FAT
Does the LWP meet mission operational requirements?	Move by hand	Emplaced & recovered by 2-4 soldiers	SOF and Medical Personnel	4b(1)		X	X
	Setup and teardown	Setup and teardown by 1 soldier	Initially within 45 minutes. Daily within 15 minutes.	4b(2)		X	X
	Water production	Produce 75 GPH from salt water and 125 GPH from fresh water.	Minimum flow ≥ 75 GPH from source water with salinity of 45,000 mg/l and 125 GPH from source water with 1000 mg/l, both normalized to 77° F.	4a(1)	X	X	X
	Store and dispense water	Store 800 gal of water and dispense potable water at 10 GPM.	Include two 400 gal closed bags and dispense potable water ≥ 10 GPM.	4a(6) and 4a(9)		X	X

COIs	COEA	MAOPRs	CTPs	ORD	TFT/EUT	PPQT\IOT	FAT
	Draw and Pump water	Draw water from any source and pump it at least 100 feet.	<u>Draw</u> water from any source a distance of 50 horizontal feet and 10 vertical feet. <u>Pump</u> the water a distance of 100 horizontal feet and 25 vertical feet.	4a(5)		X	X
Can the LWP satisfactorily sustain operations in accordance with OMS/MP?	Reliability and maintainability	Have high reliability and low maintenance.	MTBEFF $\geq$ 280 hours. MTTR $\leq$ 1 hr for all unscheduled maintenance and MaxTTR $\leq$ 2 hrs for 90% of all unscheduled maintenance. PMCS $\leq$ 30 min for each 4 hrs operation.	4b(3)		X	X
	Standard maintenance	Supported by standard supply and maintenance systems. GS and Depot by contract.	SSP will be compatible with SAMS.	5a and 4b(7)		X	X

COIs	COEA	MAOPRs	CTPs	ORD	TFT/EUT	PPQT\IOT	FAT
	Self-sustained operations	Capable of self-sustained operations.	At least 150 operating hours, excluding Class III	4b(5)		X	X
	Operated by SOF and medical personnel as additional duty. No new MOS.	Operated by CMF 18 and MOS 91B. Maintained by 63J.	Operated and maintained in daylight and darkness, with or without MOPP4 gear.	4b(6) and 5c(4)		X	X
	Supply.	Use standard fuels and lubricants.	Use standard fuels and lubricants.	6c	X	X	X
	Maintenance	Use standard tools to maximum extent.	Use standard tools to maximum extent.	6c	X	X	X
	Human Factors: Safety and noise.	Minimize health and safety hazards, including noise levels.	Minimize health and safety hazards. Noise levels ≤ 83 dB for up to 12 hours exposure.	4c(7) and 5c(3)		X	X

COIs	COEA	MAOPRs	CTPs	ORD	TFT\EUT	PQT\IOT	PVT
Does the LWP meet transportability requirements?	US and NATO Requirements	Meet US and NATO requirements for air, rail, and sea requirements.	Meet US and NATO highway limits when in HMMWV. Meet GIC rail diagram. Have military standard lifting and tiedown provisions.	6b		X	X
	Ground: Transported in M1097A (HMMWV).	Must be transportable in rear cargo compartment of M1097A (HMMWV).	System, including power source, BII, and 150 hours of supply, must fit in rear compartment of M1097A (HMMWV)	4a(7) and 6b		X	X
	Helicopter: Transported by UH-60	Must be transportable internally by UH-60 helicopter in one lift.	Must be transportable internally by UH-60 helicopter in one lift.	6b		X	X
	Air droppable	Must be air droppable from C-130 or C-141 using current container systems.	Must be air droppable from C-130 or C-141 using current container systems.	6b		X	X

REQUIREMENTS

COIs	Critical Operational Issues
COEA	Cost and Operational Effectiveness Analysis
MAOPRs	Minimum Acceptable Operational Performance Requirements
CTPs	Critical Technical Parameters
ORD	Operational Requirements Document

TESTS

TFT	Technical Feasibility Tests
EDT	Engineering Development Tests
EUT	Early User Tests
PQT	Production Qualification Tests
IOT	Initial Operational Tests
PVT	Production Verification Tests

******************* TITLE/APPROVAL PAGE *******************

Draft 14 July 1995

SYSTEM MANPRINT MANAGEMENT PLAN (SMMP)

FOR

LIGHTWEIGHT WATER PURIFIER (LWP)

IN SUPPORT OF MILESTONE I/II

DEVELOPMENTAL APPROVAL

SUBJECT: Approval of the System MANPRINT Management Plan (SMMP) for the Lightweight Water Purifier (LWP).

1. We, the undersigned, jointly approve the attached SMMP for the LWP.

2. Reference. Draft System MANPRINT Management Plan (SMMP) for Lightweight Water Purifier (LWP) prepared by the Directorate of Combat Developments, U.S. Army Quartermaster Center and School, Fort Lee, VA, dated July 1994.

3. This SMMP reflects revisions to referenced draft, SMMP required by Department of Defense (DoD) Instruction 5000.2, part 7, section B, "Human Systems Integration" and DA Pamphlet 70-3, Part 7, Section B, "MANPRINT". All questions regarding this SMMP should be addressed to Commander, U.S. Army Combined Arms Support Command and Fort Lee, Attention: ATCL-MES (CPT Scott Wright), Fort Lee, Virginia, 23801-6000. Phone contact numbers are DSN 687-0496 or Commercial (804) 734-0496.

THOMAS C. HILL, III Colonel, QM Deputy Assistant Commandant Modernization/Integrated for Future Developments	RANDOLPH A. MATHEWS Lieutenant Colonel, QM Product Manager-Petroleum and Water Logistics Systems USA Aviation Troop Command
Date	Date

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2. ABBREVIATED TOTAL SYSTEM DESCRIPTION

(a) System Description.

(i) The Lightweight Water Purifier (LWP) is a modular, lightweight, highly mobile, and rapidly emplaced water purification system intended to provide potable water support for small units or detachments operating in remote or isolated areas. The LWP is a Combat Service Support (CSS) item of equipment which is set up and operated by selected CMF 18 Special Forces or CMF 91 Medical soldiers in tactical and training environments. The system can be operated by soldiers without complicated or lengthy training. It will be operated part-time by one soldier to meet the daily water consumption and personal hygiene requirements of the organization. The LWP can produce up to 125 gallons of potable water per hour depending on the quality and character of the raw water source. The LWP also provides an organic storage and dispensing capability for up to 800 gallons of potable water. The system is transportable in a High Mobility Multi-Purpose Wheeled Vehicle (HMMWV) or by UH-60 helicopter and can be emplaced by no more than four soldiers.

(ii) Significant operational and performance characteristics of the new system in relative order of priority are:

(1) Produces a minimum of 75 gallons of potable water per hour (GPH) from source water with a salinity of 45,000 mg/liter Total Dissolved Solids (TDS). Produces at least 125 gallons per hour from fresh water source with a salinity of 1,000 mg/liter TDS. A performance objective of 75 GPH @ 60,000 mg/liter TDS is desired. All flow rates are normalized to 77 degrees Fahrenheit.

(2) Produces, stores, and distributes potable water meeting the field drinking water quality standards of Technical Bulletin (TB) Med 577, Proposed Tri-Service Field Water Quality Standards, STANAG 2136, and QSTAG 245.

(3) Purifies water from fresh, brackish, sea water, and NBC-contaminated water sources.

(4) The raw source water pumps and product water dispensing pumps are interchangeable.

(5) Uses pumps (or a combination of pumps) powered by direct drive and/or 208V, 3-phase or 120V, 1-phase electric generators using multi-purpose fuel (e.g. JP-8).

(6) Has raw water pump(s) capable of drawing source water a distance of 50 horizontal and 10 vertical feet. The raw water pump is also capable of pumping water a distance of 100 horizontal and 50 vertical feet.

(7) Dispenses product water at a minimum rate of 10 GPM.

(8) Weighs less than 1,000 pounds (750 pounds is desired), including power source, basic issue items (BII), and sufficient operating supplies (except for POL) for 150 hours of operation. The complete LWP fits in the rear cargo area of a M1097 High Mobility Multi-Purpose Wheeled Vehicle. A complete LWP fits internally in a UH-60 helicopter for transport in one lift.

(9) Adds disinfectant and maintains a residual disinfectant level as prescribed by the Surgeon General in the product water to prevent reinfection.

(10) Stores 800 gallons of product or source water in two containers (tanks, bags, bladders, etc.) which are closed to the atmosphere.

(11) Identifies individual or groups of defective reverse osmosis (RO) membranes during operations to facilitate changing of elements.

(12) Incorporates in-line water quality monitoring for turbidity, total dissolved solids, Ph, and temperature. Displays and records flow rates and quantities.

(iii) The LWP fills the requirement for a safe and reliable 75-125 GPH water purification system which can be emplaced and recovered by four soldiers (two desired) and operated part-time by one person. Individual modules weigh less than 328 pounds. Initial operational checks, services, and connections for the LWP are performed within 45 minutes by one soldier without specialized training. Shut-down and preparation for movement is also accomplished in no more than 45 minutes by one soldier. The LWP is durable, rugged, and suitable for use and transport in tactical or field environments. It withstands exposure to varied environmental factors, climate conditions, and extreme temperature ranges. The system is supported through Direct Support level by the standard Army supply and maintenance systems. General Support (GS) and Depot level maintenance are contractor supported.

(b) <u>Target Audience Description (TAD). See Appendix A.</u>

(i) Army Regulation 611-201 gives threshold mental and physical aptitude skills for all affected enlisted Military Occupational Specialties (MOS).

(ii) Operator and Unit Trainer (CMF 18 and 91). The LWP will be fielded primarily (42 systems) to Special Forces organizations. In addition, eight systems will be issued to medical or health care detachments. The LWP will be operated and maintained in the unit by Career Management Field (CMF) 18 soldiers in special forces units and CMF 91 in medical or health care units. Military Occupational Specialty (MOS) 18C, Special Forces Engineer Sergeant; 18D, Special Forces Medical Sergeant; and 91B, Medical Specialist are assumed to be the principal operators and unit level trainers for the system.

In special forces units, the LWP will be operated by CMF 18 soldiers at skill level 30 and 40. In medical units, operators may be assigned at skill levels 10 through 40. The system may also be occasionally operated by other CMF 18 personnel (the basic qualifications are the same within CMF 18). MOSs 18C/D and 91B have different physical and mental aptitude prerequisites. Of significance is that the SOF career field is closed to women and is the most physically demanding specialty. Physical requirements for CMF 18 include lift and carry requirements. SOF soldiers occasionally lift and carry a 160 pound person on their back and frequently perform all other tasks while carrying a 65 pound load evenly distributed over the entire body. They are able to walk, crawl, run, and climb over varied terrain for distances of 25 miles. The PULHES profile for CMF 18 is 111221 (Medically, PULHES signifies P-Pulmonary system, U-Upper Body, L-Lower Body, H-hearing, E-eyesight, and S-Psychology). This means that minor limiting conditions are allowable only for hearing and eyesight.

The physical demands for the 91B medical specialist are classed as moderately heavy with physical requirements limited to normal color vision and finger dexterity in both hands. Lifting and load carrying requirements are the same as those expected of the average male or female soldier (as described in MIL-STD-1472D). The physical profile for the 91B is 222221 (i.e. minor limiting conditions are permissible in all areas except S-psychological).

Basic mental qualifications for CMF 18 include a General Technical (GT) aptitude score of 110 and 100 in the Combat (CO) aptitude area. The medical MOS requires a Skill Technical (ST) score of 95.

(iii) Maintainer CMF 63 (MOS 63J, Quartermaster and Chemical Equipment Repairer) is the principal maintainer personnel required to support the LWP at levels above the organization. The 63J physical aptitude is classified as very heavy with a PULHES profile of 222222 (i.e. limiting conditions are permissible in all areas). The 63J occasionally lifts 100 pounds to a height of 4 feet and carries a distance of 50 feet. This is frequently done with 70 pound loads. As part of a 2-person team, the 63J occasionally lifts and lowers equipment weighing 220 pounds (110 pounds each person). The 63J requires a Mechanical Maintenance (MM) aptitude of 90.

(iv) Eighty-four percent (42 of 50) of all planned LWPs will be operated by special forces personnel with high physical and mental aptitudes. Personnel to operate the LWP in SF units are also of a higher skill level (i.e 30/40) than will be normally tasked to operate the LWP in medical units (i.e. 10/20). Human engineering system characteristics must take these differences, between the various operating personnel, into account during system design.

3. ACQUISITION STRATEGY.

(a) <u>Acquisition Category.</u> The LWP is a Non-Major Defense Acquisition Category (ACAT) IV program. Based on the June 1995 estimate, the total Program Life Cycle Cost (PLCCE) is estimated at $ 13.4 million with total eventual RDT&E expenditures of $ 2.3 million and $ 2.8 million ultimate procurement (FY96 Constant Dollars).

(b) Acquisition Strategy. The LWP program is based on a streamlined and tailored Non-Development Item (NDI) acquisition process to reduce overall costs and time to field. Use of commercial practice and non-government performance specifications in accordance with Acquisition Reform guidelines has been integrated into the program to the maximum extent.

(i) A market investigation completed in early FY94 indicated commercially available water purifiers or a combination of available purifiers with relatively minor modifications will provide feasible alternatives to satisfy this need. Several sources are capable of supplying the LWP and are expected to compete for its development and production. Accordingly, an abbreviated development effort is planned to select a commercial purifier or combination of purifiers and identify any modifications necessary to the basic item. A combined Milestone I/II is planned for First Quarter FY96.

(ii) Prior to MS I/II, water purifiers from several different sources were procured for government in-house experiments and early test and evaluation. The resulting performance specification forms the basis for a solicitation, source selection, and planned Second Quarter FY96 award of a Engineering Manufacturing Development (EMD) contract. During EMD, three operational prototypes purchased from a single manufacturer will support Pre-Production Qualification Test (PPQT) and Initial Operational Test and Evaluation (IOT&E) scheduled to begin First Quarter FY97.

(iii) Milestone III and Type Classification Standard of the LWP is projected for First Quarter FY98. Award of a production contract will be made soon thereafter depending on the availability of funding. Materiel Release based on First Article Test (FAT)/Production Qualification Tests (PQT) is projected for Third Quarter FY99. Spare parts and replaceable modules or components for operator and direct support maintenance will be procured under the production contract according to a Level of Repair Analysis (LORA). Contractor logistics support will be used for General Support and depot level maintenance which will consist of repair of assemblies replaced at lower levels. Military technical manuals conforming to current policy or commercially available operator and maintenance publications will be procured. The use of Commercial Off-the-Shelf (COTS) manuals may require a policy waiver and addenda for unique military procedures (e.g. maintenance allocation or decontamination).

4. DEFICIENCIES AND/OR LESSONS LEARNED OF THE PREDECESSOR OR SIMILAR SYSTEMS.

(a) General. There is no current means of on-site bulk water production at remote locations. Current methods of individual water purification using iodine tablets or hypochlorite ampules are suitable only for short term emergency treatment of small quantities of drinking water. These methods generally affect the taste of the water and do not reduce turbidity or TDS. Furthermore, these treatments are inadequate to eliminate certain types of biologic organisms such as spores or cysts (e.g. Cryptosporidium and Giardia lamblia). Therefore, water purified in this manner is not suited for sustained consumption. Boiling water also provides for initial disinfection but does not provide any residual protection against reinfection.

(b) Similar Systems. There is no current system that performs the water supply function in support of small, isolated units or detachments. These units rely on local raw water sources of uncertain quality by applying individual field treatment methods. Alternative procedures for long term water requirements use long distance resupply from water points equipped with 600 GPH or 3000 GPH Reverse Osmosis Water Purification Units (ROWPU). However, such resupply may not always be practical or possible. These large quantity systems require heavy vehicle transport for towing ROWPU trailers and trained 77W Water Treatment Specialist operators. Even the smallest, the 600 GPH ROWPU, requires two soldiers. The 528th Special Operations Support Battalion (Airborne) is equipped with four 600 GPH ROWPUs. This unit provides water support for SOF units and can rig water drums or pallets for airdrop or air delivery by helicopter. Nevertheless, routine daily ground or air resupply of water using collapsible drums or bottled water is not cost-effective for extended periods of time. Because of the weight of water (about 3.3 tons for 800 gallons) and diversion of required manpower and transportation assets from other missions, the cost of such resupply operations can be substantial. In addition, many remote areas are not easily accessible for resupply and may entail transit through hostile areas or endanger low visibility or covert operations.

(c) Deficiencies by Domain.

(i) Manpower.

(1) Wartime Requirements. At the small unit level there is no manpower specifically dedicated to the production of water. The water supply manpower structure is normally found in the brigade, division, or corps support organizations. Units arrayed on the battlefield typically return to rear area water points to replenish their supplies of water and other classes of supply. Small water points (600 GPH) are usually manned by two specially trained 77W soldiers who produce and dispense the product to multiple users within the brigade or division area. Using units normally provide the manpower and vehicle haul assets for transporting the potable water. Delivery of packaged water or drums by air is costly in terms of manpower, aircrew and aircraft usage. Units or small detachments which are committed to operate outside the bounds of traditional water support structure for extended periods must rely on local water sources or individual treatment methods.

(2) Deployment Considerations. Current bulk water purification systems are too large and cumbersome to support the consumption demands of small isolated units. The 600 GPH purification system is mounted on a 5 ton, 4 wheel tandem trailer and towed by a 5 ton cargo truck. These vehicles are not authorized in special operations teams and detachments. Although the 600 GPH is airdrop capable, it requires materiel handling equipment and transportation for uploading and movement to the production site.

(3) Manning Concepts. Set up and operation of the LWP is intended to impose only minor additional requirements on the using unit. There will be no dedicated manpower to operate the system. It will be operated part time as an additional duty by soldiers with minimal water purification training.

(ii) Personnel.

(1) Personnel Classification and Selection. CMF 18 is a non-entry level accession specialty. Soldiers typically enter the Army in combat or combat support MOSs and volunteer or are subsequently selected for the SOF career path. All special forces soldiers must complete the Special Forces Qualification Course (SFQC). The majority of 91B medical soldiers are accessed as entry level trainees and attend 91B10 Medical Specialist Course qualification. Some medical soldiers may enter service in other specialties and be subsequently reclassified upon request or upon direction.

(2) Demographics. No deviation from existing CMF 18 or 91 demographics is expected. Current entry skill requirements will remain unchanged.

(3) Accession, attrition, and retention rates. The addition of water purification duties as a part time mission is not expected to influence any of these rates.

(4) Promotion Flow. The existing promotion opportunities within the CMF 18 and CMF 91 fields will not be affected by this requirement.

(iii) Training.

(1) Training Concepts and Strategy. Fielded water purification systems are operated by specially trained 77W Water Treatment Specialists. The 600 and 3000 GPH ROWPU systems are complex and require multiple connections of hoses, fittings, pumps, and filters. Operation requires frequent water quality monitoring, mixing and adding chemicals in the proper proportions, and observing the status of various subsystems for pressure, temperature, and flow. Operators must calibrate systems based on source water conditions. They routinely inspect and change filters and elements as necessary and periodically backwash the system to prevent clogging of filters. Throughout this process, product water must meet stringent health and quality standards. Required tasks for the LWP will probably be similar to those for the 600 GPH ROWPU. However, operators will receive only initial new equipment and familiarization training. Therefore, simplification of tasks for set-up and operation of the LWP should require the minimum amount of time and effort necessary to insure proper operation.

(2) Media and Equipment. System operational and maintenance training will be conducted using an operational LWP and the operator's technical manual.

(3) Simulation. No training simulation systems are planned.

(4) Operational Tempo. Existing ROWPUs are designed to operate a minimum of twenty hours per day in two shifts. Four hours per day are allowed for maintenance. Based on the mission profile for the LWP, the system is expected to operate no more than 6 hours per day from a fresh water site. Use of sea water may increase the required time to 10 hours. Daily maintenance and backwashing require up to 1.5 hours per day.

(iv) Human Factors Engineering.

(1) Physical and Mental Capabilities and Limitations. Current water purification equipment is operated by 77W soldiers specifically selected according to the physical and mental requirements of the position. However, the LWP will be integrated into existing SOF units and medical detachments. Therefore, the LWP must be adaptable to and compatible with the skills already found within those units. Typical soldiers within the special forces career field are noted for both their physical and mental strengths. Their qualifications are among the most stringent in the military and entry is limited to male soldiers only. Set-up and operation of the LWP is not expected to present any unique challenges to special forces regardless of the specific operator selected for the water purification duty. Integration of the LWP into medical detachments may define the limiting physical and mental skills for the system despite its low density (8 of 50 systems) within the Army. Typical 91B soldiers have a minimum Skill Technical (ST) aptitude of 95 and physical strengths of the average male or female soldier.

(2) Anthropometric and Biomedical Criteria. Operation and routine unit maintenance on the LWP will be performed primarily by male (based on system densities) and less frequently by female soldiers with minor limiting physical capabilities as defined by PULHES profile 222221. Typical body characteristics for the 5th through 95th percentile male as derived from Section 5.6, MIL-STD-1472D are: Height 64.1 to 73.9 inches, Weight 122.4 to 211.6 pounds, and Functional Reach of 28.6 to 35.8 inches. Similar dimensions for female soldiers are: Height 60.0 to 68.5 inches, Weight 102.3 to 164.3 pounds, and Functional Reach of 25.2 to 31.7 inches. The most limiting value for each of these parameters is defined by the 5th percentile female and are shown with double underlining.

(3) Man-Machine Interface. The LWP will have simpler man-machine interfaces than current purification systems. The following sections address the human factors of the 600 GPH ROWPU for comparison. Current water purification systems require operators to lift individual skid-mounted modules and make a number of mechanical and electrical connections. These systems consist of an assortment of pumps, hoses of different types, fittings, valves, and electrical leads which must be assembled correctly. During initial set-up, four different commercial chemicals are measured and mixed by hand and added to the chemical feed system. Initial specific concentrations are subsequently calibrated and adjusted to insure optimal quality and production. During production the system operator must monitor dials and gauges for water quality, flow, and pressure. Periodically various vent valves must be opened or closed to vent pressure or divert water flows to backwash the filters. The system also has six drain valves. Pressure relief valves and backup systems automatically release excess pressure or shut down subsystems to prevent system damage. The LWP configuration should seek to reduce the number and type of manual connections consistent with the modular design which must be made by the operator. Pressure vents and high pressure connections should be away from the operator console. The 600 GPH ROWPU requires the operator to stand between two sets of three low pressure connections. Indicator lamps should use standard color coding to indicate normal "in tolerance" (GREEN) conditions, caution "alert operator" (YELLOW) conditions, and error "malfunction" (RED) conditions according to MIL-STD-1472D paragraph 5.2.2.1.18. The 600

GPH manual notes two *blue* lights to indicate high or low pressures outside normal tolerances which should have shut down the high pressure pumps. Such a condition requires immediate operator action and should be coded as an "emergency" condition requiring a red or flashing red lamp. Flow gauges should accurately display current flow rates and maximum allowable values. The product water flow gauge on the 600 GPH ROWPU uses a float and tube device to determine flow rates. The current shape and marking of the float unit may result in reading errors of 2 to 3 GPM (120 to 180 GPH) and has the capability to display flow rates of 50 percent above the maximum permissible reading for fresh or brackish source water. Meters of this type should incorporate a "orange zone" such as that on a tachometer to readily show that the system is operating above normal tolerance levels. A similar situation exists for the product water pressure gauge that reads 75 psi beyond rupture failure of the system. The gauge should unambiguously show where high pressure readings cause the needle to go into the "red zone".

(v) System Safety Hazards. The Safety and Health Data Sheet for the LWP identifies eight potentially significant safety hazards associated with the operation and maintenance of a water purification system.

(1) High Pressure Leaks, Whipping Hoses, and Lines. The specific configuration and operating pressures within the LWP are not known at this time. The following information applies to operating conditions for the 600 GPH ROWPU. Some similarities can be expected for the LWP. Typical maximum operating pressures occur within the high pressure reverse osmosis module of the 600 GPH ROWPU and can reach 500 psi (using fresh water source) and 960 psi (using a sea water source). Backup safety features include a high pressure relief valve (activates at 1100 psi), high pressure switch with warning lamp and pump cutoff (activates at 1250 psi), and a rupture disc assembly (activates at 1425 psi). All of the high pressure components including the pump, pressure vessels, and internal lines are fixed within the frame of the ROWPU. Therefore, the operator is not exposed directly to hoses or lines whipping under high pressure. Placing high pressure relief vents and release safety features away from the operator console and directing pressurized water up and away from personnel can enhance safety. Raw water and backwash hoses external to the 600 GPH unit itself may reach pressures of 20-75 psi. Most of the hoses and lines lead away from personnel. However, the current 600 GPH has six hose connections at the panel and the operator must stand between them to perform operations at the console. Rerouting hose connections away from the operator's panel reduces operator exposure to any potential leaks and tripping hazards.

(2) Hot Components. Pumps, pump motors, and electrical generators produce heat which can cause burn injuries due to accidental contact or during maintenance and servicing. These components normally will not cause a safety issue. During routine operations, the operator does not come into contact with these components. Prior to performing maintenance on the system, an allowance for a cool down period should be incorporated into procedures prior to servicing the item. Exposed surfaces that present a possible burn hazard should be provided with adequate shielding against inadvertent contact and cautionary procedures should be included in operating and maintenance procedures to prevent injuries due to burns during operation, servicing and maintenance.

(3) High Voltage and Currents. As with all electrical equipment, there is some danger from electrocution, electric shock, burns, and fire hazards. Appropriate warnings are included in the technical manuals. Additional specific emphasis may be required in the case of water purification equipment due to the nature of operations and the proximity of water and electricity. Selection of a site with proper drainage can minimize ponding around externally placed components. The existing 600 GPH ROWPU is powered by a single 30 KW diesel generator. Power requirements for the 600 GPH system are: 22 KW; 120 VAC, 1 phase; 208-230/460 VAC, 3 phase; and 104 amps maximum. The specific power requirement for the LWP is not known but is expected to be substantially less. The current system is equipped with a grounding rod and strap. External electrical connections from the junction box run separate power cables to the raw water pumps, backwash pump, and distribution pump. Water hoses are also connected to these modules. Prior to maintenance, power to the system should be disconnected. Incorporation of a fault interrupter circuit such as those required in building codes can provide an additional measure of electrical safety.

(4) Rotating and Moving Parts. For the current system, the rotating and moving parts are contained within the housings of the pumps, pump motors, and generator. External exposed parts are typically shielded to prevent injury. This is not expected to present a problem for the LWP.

(5) Diesel Fuel Fire Hazard. Use and handling of diesel fuel for vehicles and generators within the military has become standard practice. Diesel fuel is much safer to use and transport than gasoline. Observing proper established procedures during refueling and storage will minimize any potential fire hazard.

(6) Heavy Lifts. Soldiers engaged in the loading and offloading of water purification modules are susceptible to back strains and back injuries, as well as, crush injuries to the extremities of the hands and feet (with potential traumatic amputation of fingers or toes). Typical items are generally suited for a two man lift. However, the manual cautions operators to get help before lifting the backwash pump. Weight and size of the separate components of the LWP should not exceed 287 pounds for a male only four-person carry of 10 meters (or a maximum of 164 pounds is permissible for a male only two-person carry of 10 meters). According to MIL-STD-1472D, paragraph 5.9.11.3, the 82 pound per person allowance is reduced by 25 percent for the 3rd and 4th person (i.e. 82 pounds * .75 or 61.5 pounds). The respective limits of 84 pounds (2-person) and 147 pounds (4-person) for a combined male or female lift may overly restrict design or tradeoff options.

(7) Mismatching of Hoses, Plugs, and Component Parts. Technical Manual 5-4610-215-10 contains highly detailed instructions and sequencing for making all of the hose and electrical connections for the 600 GPH ROWPU. Connections at the operator console are clearly labelled. Due to the large number of hoses, valves, adapters, and components which are affected, it is extremely important to adhere to the specific guidelines and diagrams in the manual. While the high number of individual connections and components may affect set-up, proper site organization and layout can aid in reducing the possibility of crossovers and

mismatching of hoses and connections. Operator attention to detail can be supplemented by a double check by an assistant.

(8) Inadequate Access for Maintenance. Many of the components of the 600 GPH ROWPU are stand alone skid mounted systems such as the pumps, motors, and generator. Access for these components and the external hoses or connections does not pose a problem. Many of the modules fixed within the system frame itself can be accessed from outside the frame with minimal effort or from areas required for storage of all of the external components. This should not present a problem for the LWP since maintenance activity at the organization will be primarily restricted to routine checks, services, and filter replacement.

(vi) Soldier Survivability. The LWP is a soldier survivability enhancement for the Army. Upon introduction to the force, it will provide quality safe drinking water in sufficient quantities to sustain small unit operations. The LWP will reduce the incidence of water borne disease and resultant illnesses among the soldiers of using units. Physical size and shape characteristics of the LWP alone should not draw undue attention to the unit. Distinctive signature suppression and reduction measures do not normally apply to water purification systems since they are normally located with other support vehicles and equipment in rear areas. Use of the LWP in special operations may require additional emphasis regarding:

(1) Visual Signature. Current ROWPUs are relatively large and bulky items requiring their own trailer for transport. The LWP is planned as a lightweight, compact system small enough to be placed in the rear of a High Mobility Multi-Purpose Wheeled Vehicle (HMMWV) or airlifted by helicopter. When employed in routine operations, individual skid mounted components (e.g. pumps) are dispersed and may be positioned to reduce their visual signature. Concealment of small modules can be accomplished easily.

(2) Audible Signature. Aside from posing a health hazard, noise from the system's generators and pumps also create an acoustic signature. Reduction of noise to safe levels for operators will also limit the detection of sound to the area immediately around the equipment itself. Standard practice of sandbagging or placing noisy items in a pit or depression will further limit distances at which the LWP can be detected. Use of tactical quiet generators is also an option to minimize the audible signature of the system.

(3) Infrared (IR) Signature. The primary heat sources in water purification equipment are the generators, motors, and pumps. Individual components are usually dispersed; therefore a number of small IR signatures may be evident. The single largest IR signature will depend on the size and type of power source eventually selected to drive the system. Current ROWPUs require 30 to 60 KW diesel generators. The LWP should not require more than 3 to 5 KW. Heat shielding and dissipation may also be appropriate.

(vii) Health Hazards. The Safety and Health Data Sheet for the LWP identifies seven potentially significant health hazards associated with the operation and maintenance of the system.

(1) Exposure to Commercial Chemicals. Operators of the 600 GPH ROWPU are routinely required to measure, mix and handle commercial chemicals used in water purification such as calcium hypochlorite, polymer, sodium hexametaphosphate, and citric acid. These chemicals are added manually to chemical feed system at the beginning of operations and as necessary. A surfactant known as Triton X-100 is used to clean RO elements and the solvent P-D-680 is used to wipe down the high pressure pump. These chemicals alone or in combination represent a serious hazard to health and life especially the solvents. Breathing chemicals used in the ROWPU system can cause severe headaches, dizziness, loss of muscular control, sleepiness, and coma. Brain damage, eye injury, severe skin damage, or death can result from heavy exposure. The technical manual stresses the use of protective clothing and use in a well ventilated area. It is likely that any purification system will use the same or similar chemicals. Procedures for minimizing contact and exposure are required. However, the 600 GPH system does not provide protective clothing with the Basic Issue Items (BII).

(2) Exposure to Water Borne Disease. One of the hazards of water purification is that water borne pathogens present in the source water may become concentrated in the strainers, filters, RO elements and backwash or waste water stream. In the process of handling discarded filters or changing cartridges and RO elements, operators may come into contact with these waste products. Current technical manual procedures do not caution operators about this potential hazard nor require the use of or provide for protective clothing during maintenance of these items. Reducing hazard exposures when handling filters and RO elements recommends the operators to wear shoulder length butyl rubber gloves, rubber aprons, and rubber boots. Washing with anti-bacterial soap is also recommended. Face shields and dust masks are recommended when there is a possible aerosol exposure. Future manuals should stress this exposure hazard and recommended ways to minimize the problem.

(3) Exposure to NBC Contaminants. The 600 GPH ROWPU has separate posttreatment cartridges for the removal of nuclear or chemical contaminants. The primary exposure hazard occurs when the cartridges are changed after each 100 hours of operation. Instructions in the technical manual recognize the hazard and recommends extreme care and safe disposal. No further guidance is included. These contaminants may also become trapped in earlier stages of treatment so caution must also be exercised when handling any of the waste products in an NBC contaminated environment.

(4) Exposure to Other Hazardous Materials. Other materials concentrated in the filters, cartridges, and RO elements may include such elements as arsenic, cyanide, chloride, lindane, magnesium, and sulfates depending on the quality and content of the source water. Procedures for maintenance and replacement of filters should also cite proper safe handling procedures such as those mentioned above.

(5) Contaminated Product Water. Product water from the 600 GPH ROWPU is pumped to storage tanks and distributed from there. The chlorine metering pump is calibrated to provide a chlorine level of approximately 5 parts per million in the product to insure a residual disinfectant capability. Failure of the chemical feed pump causes the indicator

lamp on the operator panel to go out and alert the operator to the problem. As long as the situation is corrected within a reasonable period of time and the chlorine level is within tolerance, this should not be a major issue. Problems created by mismatched hoses, etc. should be readily detectable due to erroneous flow or pressure readings. As long as the system is operating as intended and has not been subjected to sabotage, product water contamination should not be a major concern.

(6) Hazardous Noise Levels. Prolonged exposure to noise caused by pumps and generators has been cited as a major concern in past assessments of water purification equipment. Prolonged unprotected exposure to hazardous noise levels will cause loss of hearing. The technical manual for the 600 GPH recommends the use of hearing protection as recommended by the medical officer. Prior to a noise abatement effort, the original noise levels for the 3000 GPH ROWPU were 102 Db(A). Primary noise sources were the high pressure pump, motor, piping, compressor, booster pump and motor. Components were mounted inside a reverberant container. Subsequent engineering efforts reduced the noise levels to below 82 dB(A). The Initial Health Hazard Assessment Report for the LWP dated July 1994 (with Change 1 dated 4 October 1994) recommends a steady state hazardous noise limit for personnel exposures of no more than 85 dB(A) for up to 8 hours, 84 dB(A) for up to 10 hours, 83 dB(A) for up to 12 hours, and 82 dB(A) for up to 16 hours. The mission profile for the LWP indicates that up to 7 hours production and backwash may be required using fresh water. The upper limit for seawater is 11 hours. Therefore, a LWP level of 83 dB(A) or less should suffice in the worst case situation. Since the 3000 GPH noise abatement effort was successful, it is reasonable to expect that noise levels for the LWP can be met provided that abatement efforts such as base isolation and acoustic insulation measures are included early in the development process.

(7) Exposure to Diesel Engine Exhaust. On the 600 GPH ROWPU power is provided by a 30 KW diesel generator placed immediately behind the ROWPU. Both the generator and ROWPU are mounted on a trailer. Combustion products from diesel engines include carbon monoxide (CO), oxides of nitrogen (NO_x), formaldehyde, acrolein, sulfur dioxide (SO_2), and polynuclear aromatic hydrocarbons (PAHs). The effects of these hazards are documented by the National Institute for Occupational Safety and Health (NIOSH). Exhaust fumes from the generator are vented to the atmosphere above and away from the normal operating position. The ROWPU is normally operated outside where a buildup of toxic vapors is rare. Appropriate caution must be exercised when operating or performing services on the system in an enclosed area such as a maintenance bay. Water purification equipment does not pose unique hazard conditions above that for other diesel engines.

(d) Application of Lessons Learned - Summary. The LWP Non-Developmental Item (NDI) Acquisition Strategy will rely heavily on the integration of commercially available components. Special emphasis will be placed on noise abatement and handling of hazardous materials in the addition of chemicals and replacement of filter cartridges. Where possible, manual handling procedures will be minimized or containerized (i.e. pre-measured or packaged). Protective clothing such as disposable dust masks, face shields, rubber gloves, aprons, and boots will be included with the basic issue or associated items list. Cautionary procedures on the handling and disposal of contaminated materiel will be included as an addendum to technical manuals. The weight of individual modules will be limited to a maximum of 287 pounds for a four-male soldier lift to reduce lifting and loading injuries. Adaptation of the LWP will emphasize system layout and the routing of hoses and lines away from the operator. Fault interrupter circuits will be used wherever possible to eliminate the electrical hazards. Pressure vents will also consider personnel safety in their physical location on the LWP. The number and type of individual connections will be reduced to the minimum number necessary to perform the function. Panel indicators and gauges will use standard approved color coding to indicate system status and flow indicators will be planned to reduce the potential for inaccuracies in the readings. These elements will be specifically integrated into the safety and health hazards portion of the LWP performance specification/purchase description and tested or verified during technical testing.

5. MANPRINT PARAMETERS

(a) Goals by Domain.

(i) Manpower Goals.

(1) The Lightweight Water Purifier (LWP) manpower goal is to ensure that no additional force structure space requirements are generated by the introduction of the system. Manpower resources for the operation and maintenance of the LWP will come from within the existing structure of special forces organization and selected medical detachment.

(2) Operation of the LWP will be addressed as an additional or part time duty within the available manpower of the detachment or unit.

(ii) Personnel Goals.

(1) Do not increase soldier related skill levels of the target population. High driver tasks will be identified during front end analysis, testing, and evaluation. Any recognized high driver tasks will be eliminated or simplified.

(2) Create no new Military Occupational Specialties (MOS).

(3) Impacted MOS are defined in the Target Audience Description (TAD) discussed previously. Principally affected specialties are: Enlisted Operator - 18C30-40, 18D30-40, and 91B10-40. Enlisted Repairer - 63J20-30.

(iii) Training Goals.

(1) The LWP will be integrated into units with minimal training requirements. The LWP and issue items will be designed so that institutional training will not be required. A New Equipment Training Package (NETP) will be available to support fielding.

(2) Ensure unit training requirements are not increased above present levels. Unit level training on critical operator and maintainer tasks will be conducted at the team or detachment level by supervisory personnel. Such training will be sufficiently comprehensive to assure that the LWP can be safely operated, maintained, and repaired in a field environment. Levels of training shall be adequate to ensure that operations and maintenance can be accomplished with less than five percent repeat error (errors of omission or commission). Exportable training packages, videotape lessons, and individual programmed texts for skill maintenance will be considered during system development. Individual and unit proficiency is maintained through the routine integration of realistic water purification missions into Field Training Exercises (FTX).

(3) The LWP will be supported by Electronic Training Manuals (ETM) unless a waiver is obtained to use commercial manuals. If a waiver is granted, ensure that Commercial-Off-The-Shelf (COTS) Technical Manuals (TMs) are supplemented as necessary to reflect military unique requirements and operation in various environments. Manuals must be complete, accurate, and easy to understand by members of the Target Audience.

(iv) Human Factors Engineering Goals.

(1) Ensure that the system configuration enables loading, unloading, set up, start up, operation, maintenance, repair, and shut down tasks by representative soldiers in daylight or darkness and while wearing protective clothing. Anthropometric data is provided for reference in paragraph 4(c)(iv)(2) of this SMMP.

(2) Configure the operator console or workstation so that the complexity of tasks does not exceed the physical or cognitive capabilities of the target audience.

(3) Ensure the all controls, buttons, valves, switches, handles, gauges, indicator lamps, etc. are visible, clearly indicate function or status, and can be reached and actuated from the normal operating position by the operator during purification operations. Provide reasonable access for maintainers to replaceable parts or modules.

(4) Simplify procedures for the replacement of filters, membranes, and elements. Reduce manual handling in the mixing and addition of any water purification chemicals.

(5) Reduce crew or maintainer mistakes when performing critical tasks to a level of 5 percent or less repeated errors of omission or commission.

(6) Ensure that all mission requirements can be carried out effectively in basic and hot climates, and various environments including daylight and darkness, rain, etc.

(7) Ensure that the operator and maintainer can effectively perform their tasks while wearing personal protective clothing and equipment.

(v) Safety Goals.

(1) Apply noise abatement measures to reduce noise levels at the operator's station to a level of 83 dB(A) or less.

(2) Eliminate or control system safety risks associated with the lifting, loading or unloading of components by minimizing module weight and size.

(3) Ensure that the system incorporates safety features to protect the operator, other personnel in close proximity, maintenance personnel, user personnel and vehicles, and facilities during operation and maintenance.

(4) Ensure that all safety hazard warnings or criteria are included and correctly referenced in the system's training publications along with procedures to control risks.

(5) Eliminate or reduce all potential heat, fire, or explosion hazards due to the use of water purification chemicals or fuels. Provide grounding systems and fault isolators to eliminate electrical hazards.

(6) Reduce exposure to hazards from pressurized systems, lines, and relief valves. Provide suitable shielding to protect operators or maintainers from rotating or moving parts and hot surfaces.

(vi) Soldier Survivability Goals.

(1) Ensure consistent and sustained water quality/quantity production.

(2) Minimize visual, acoustic, and infrared signatures.

(vii) Health Hazard Goals.

(1) Reduce handling and exposure to hazardous chemicals. Provide protective clothing and equipment as necessary with the Basic Issue Items (BII).

(2) Control or eliminate handling of waste products and concentrates from the purification process. Reduce exposure to concentrated water borne pathogens and NBC contaminants during the maintenance and inspection of filters, etc.

(3) Include procedures for the proper disposal of waste products, cartridges, and filters used or consumed in the process.

(4) Properly vent high pressure lines and diesel exhaust fumes away from operators and maintainers.

(b) Objectives/Concerns (by Domain).

(i) Manpower. Introduction of the LWP will not generate any requirement for additional manpower or personnel. Operation of the system shall be suitable for delegation as an additional duty with minimum interference with primary duties.

(ii) Personnel. Soldiers that will operate the LWP in special forces and select medical units do not possess the technical knowledge level and water purification experience of a trained 77W Water Treatment Specialist. Set-up and operation of the LWP shall be as simple as possible and not require constant observation, monitoring, or adjustment to assure water quality consistency. Ideally, the LWP will be suitable for 75% unattended operation.

(iii) Training.

(1) There is no institutional training planned for the LWP. Units will receive initial training at fielding and thereafter provide training as necessary to selected personnel using technical manuals and other training materials. Procedures shall be as user friendly and simple as possible to avoid lengthy initial or refresher training.

(2) Operator and maintenance training should be integrated as frequently as possible during field exercises and be conducted on actual equipment under typical or representative operating environmental conditions.

(3) Manuals shall be complete, accurate, easy to read, and easy to comprehend by the target audience.

(iv) Human Factors Engineering.

(1) Workspace layout (operator console/station) shall facilitate individual and crew performance for the 5th to 95th percentile 91B male or female soldier.

(2) System controls and gauges shall be unambiguous with regard to status, function, or value to reduce the possibility of design induced personnel errors (i.e. the system and its man-machine interfaces should be user friendly).

(3) All maintainable components, filters, elements, etc. should be designed and installed to facilitate easy access, identification, removal, replacement, or repair by the full range of operator, maintainer, repairer, and support personnel.

(v) Safety.

(1) All predecessor system (600 GPH ROWPU) safety hazards involving high pressure items, hot surfaces, high voltage or electric shock, and unshielded moving parts shall be reduced or eliminated.

(2) New technology features should be analyzed for potential injury causing conditions.

(3) Heavy lift requirements shall be reduced to levels appropriate for 2 or 4 male soldiers (i.e. 164 to 287 pound maximum single lifts).

(vi) Soldier Survivability. The LWP must enhance soldier survivability with regard to the availability and quality of potable water. Product water from the LWP shall instill confidence in soldiers regarding its quality and suitability for consumption.

(vii) Health Hazards.

(1) Noise levels shall be reduced to 83 dB(A) or less for sustained exposures of up to 11 hours daily (maximum period of operation expected using seawater).

(2) Exposure to chemicals or concentrated contaminants must be controlled or eliminated. Suitable protective clothing and equipment shall be provided with the LWP as Basic Issue Items (BII) or associated items.

(3) All critical systems should have manual or alternate back-ups where possible (i.e. electrical, hydraulic, or computer assisted functions).

(4) Health hazards associated with chemical handling or contact with concentrated contaminants in predecessor systems shall be reduced or eliminated.

(5) Procedures for the disposal of waste water and contaminants during peacetime shall address environmental issues related to water purification.

(6) New or innovative materials used in the manufacture of components shall pose no health risk to personnel from short or long term exposure.

6. MANPRINT ISSUES.

(a) Summary Listing of Issues and Status Indicators. The following is a summary listing of MANPRINT issues and status indicators. These issues reflect the comments received from the initial draft System MANPRINT Management Plan (SMMP). These issues will be updated as necessary by the MANPRINT Joint Working Group (MJWG).

ISSUE NUMBER	ISSUE DESCRIPTION	AGENCY	STATUS
1	Does the LWP change the Quantity and Quality of personnel required to operate and maintain the system?	USAQMCS & USACASCOM	Open July 1995
2	Are the training and training materials accurate, comprehensive, and effective?	USAQMCS & USACASCOM	Open July 1995
3	Does the LWP present any uncontrollable safety or health hazards to personnel?	OSG/AMCSG (AEHA) & CASCOM	Open July 1995
4	Does the LWP meet Human Factors Engineering and Noise Limitations?	ARL-HFED, OTSG & MTC-B	Open July 1995

(b) Issues. See Appendix B for Individual Issue Sheets.

(c) See Appendix C for Data Sources Matrix.

7. MANPRINT EXECUTION

(a) General. Human Systems Integration (HSI)/MANPRINT requirements in accordance with DoD Instruction 5000.2, part 7, section B and DA Pamphlet 70-3, Part 7, Section B will serve to establish the man-machine interface through analysis and design using the issues and criteria for Human Factors Engineering, Manpower, Personnel, Training, Soldier Survivability, and Safety and Health Hazards. HSI/MANPRINT criteria will be given consideration during all phases of systems development. Where possible, the HSI/MANPRINT effort will be conducted in conjunction with the Logistics Support Analysis (LSA) process. Data available from the LSA will be analyzed to prevent duplication of effort in the HSI/MANPRINT process.

(b) Major Objectives.

(1) Ensure sustained, high levels of soldier performance within the systems and total force contexts. Do not exceed maximum physical or cognitive workload levels.

(2) Minimize the complexity of operations and maintenance for operators, maintainers, repairers, and supporters.

(3) Optimize ease of operation, reliability, availability, supportability, responsiveness, safety and effectiveness of the system.

(c) Schedule of Major HSI/MANPRINT Events.

ACTIVITY DESCRIPTION	**SCHEDULED COMPLETION**
Early Component Testing & Technical Feasibility Testing	4QFY94-3QFY95
Original Draft Systems MANPRINT Management Plan (SMMP)	July 1994
Draft ORD/Final ORD	7 April 1995/31 July 1995
Draft Revised SMMP (DoD 5000.2 & DA Pam 70-3)	14 July 1995
Test & Evaluation Master Plan (TEMP)	August 1994/July 1995 Update
Milestone I/II	1QFY96 (Dec 1995)
PPQT/IOT	1QFY97-2QFY97
Milestone III	1QFY98
First Article Test	3QFY99

(d) Planned Level of HSI/MANPRINT Analysis Effort.

(i) Pre-Milestone I/II (Phase 0/I) HSI/MANPRINT actions include the development of information to support acquisition decisions. Actions include:

(1) Development and Update of the SMMP.

(2) Development of HSI/MANPRINT issues and questions.

(3) Initiation of research actions required to develop answers to HSI/MANPRINT questions.

(4) Inclusion of HSI/MANPRINT objectives, constraints, issues, and questions as appropriate in the Mission Needs Statement (MNS), Operational Requirements Document (ORD), and the Purchase Description and Request for Proposal (RFP).

(5) Input of HSI/MANPRINT considerations to the Test and Evaluation Master Plan (TEMP), Integrated Logistics Support Plan (ILSP), Cost and Operational Effectiveness Analysis (COEA), and other program management documents.

(ii) Post-Milestone I/II (Phase I/II) HSI/MANPRINT actions include the development of information and prototypes to support the next acquisition decision (Milestone III, Production Decision). The actions include:

(1) Ensuring all analyses required in para 7(e) below are accomplished.

(2) Redefining HSI/MANPRINT testing issues in updates to the TEMP.

(3) Reviewing prototype designs to assure adherence to HSI/MANPRINT goals, objectives, and constraints and documenting the results.

(4) Observing developmental and operational testing of HSI/MANPRINT issues and documenting the results.

(5) Ensuring the all HSI/MANPRINT issues are satisfactorily resolved prior to the initiation of Phase III (Production and Deployment).

(6) Ensure that suitable technical and user testing is conducted to validate crew and supporter performance with respect to HSI/MANPRINT goals.

(iii) Post-Milestone III (Phase III)

(1) Monitor results of post-production, PQT, and First Article Testing (FAT) for identification and resolution of outstanding HSI/MANPRINT issues.

(2) Work closely with the developer, project engineer, and product manager to incorporate change orders, if necessary, into on-going production to alleviate or correct HSI/MANPRINT deficiencies as they are identified.

(iv) Phase IV (Operations and Support)

(1) Monitor training and field experiences to capture lessons learned.

(2) Develop/continue current methods of sharing information on HSI/MANPRINT issues between the developer and the user or field community.

(3) Work with item manager/Major Subordinate Command (MSC) in the resolution of HSI/MANPRINT deficiencies.

(4) Coordinate with the materiel developer on potential Pre-Planned Product Improvements (P3I).

(e) The following major HSI/MANPRINT tasks/responsible agencies are planned:

(i) Task Analysis (to be considered as appropriate).

(ii) Workload Analysis (to be considered as appropriate).

(iii) Manpower, Personnel, and Training (MPTA) Assessment, CASCOM and Mobility Tech Center-Belvoir.

(iv) Logistics Support Analysis (LSA), Aviation-Troop Support Command.

(v) Human Factors Engineering Assessment (HFEA), ARL Human Engineering Laboratory.

(vi) Early Comparability Analysis (N/R-no existing comparable system).

(vii) Safety and Health Data Analysis, Tank Automotive and Armaments Command, Mobility Technology Center-Belvoir.

(viii) Health Hazards Assessment (HHA), US Army Center of Health Promotion and Preventive Medicine (USACHPPM) and Office of the Surgeon General.

(f) Critical questions to be answered during the Human Systems Integration (HSI)/MANPRINT process are reflected by domain in Appendix D.

APPENDIX A

TARGET AUDIENCE DESCRIPTION (TAD)

1. The Target Audience Description (TAD) delineates the number, characteristics, and potential performance of the soldiers who operate, maintain, repair, and support the Lightweight Water Purifier (LWP). The TAD also describes the range of individual qualifications of all relevant physical, mental, physiological, demographic, and motivational dimensions. A basic assumption of the TADs is that the soldier of FY99-FY02 timeframe will have many of the same characteristics as the current soldier.

2. The following Military Occupational Specialties (MOS) have been identified as being appropriate for the operation of the Lightweight Water Purifier (LWP): 18C30, 18C40, 18D30, 18D40, 91B10, 91B20, and 91B30. The principal repairer for the LWP and other quartermaster and chemical equipment is the 63J10, 63J20, and 63J30. Other MOS identified in the Qualitative and Quantitative Personnel Requirements Information (QQPRI) will be added as this SMMP is updated.

3. The TADs will be updated as new information is provided by the Manning Integration Directorate, Soldier Support Center-National Capitol Region (SSC-NCR). Current information for the TAD may be extracted from the following sources:

a.	AR 611-201	Enlisted Career Management Fields and Military Occupational Specialties
b.	MIL STD 1472D	Human Engineering Design Criteria for Military Systems, Equipment, and Facilities
c.	FC 21-451	I am the American Soldier

4. The following tasks are "high drivers" (i.e. costly in terms of manpower, personnel, and training resources) that were identified during a review of the procedures for the 600 GPH Reverse Osmosis Water Purification Unit contained in Technical Manual TM 5-4610-215-10. The LWP may have similar drivers. These tasks should be simplified or eliminated in the Lightweight Water Purifier (LWP).

a. Limit the number of before and after operations checks to those critical to safe operations which can be performed within the specified 15 minute timeframe.

b. Selecting a site and leveling of equipment.

c. Unpacking (repacking) of skid mounted components and supplies.

d. Unloading (reloading) and positioning numerous components.

e. Making many electrical and hose, pump, valve, and adapter connections. The 600 GPH system requires 39 hose and fitting connections alone (11 for raw water feed lines, 12 for backwash lines, and 16 for the product and storage lines.

f. Erecting and anchoring canvas water storage tanks.

g. Measuring, mixing, adding, and calibration of the chemical feed system.

h. Initial adjustments and checks of drain valves, vent valves, pump valves, switches, and backwash timers.

i. Performing manual water quality checks using the color comparator (pH levels and chlorine residual), TDS meter and calibration (total dissolved solids level), and turbidity tube (clarity of water).

j. Backwash of the media filters.

k. Cleaning of reverse osmosis elements.

l. Removal and replacement of elements, membranes, filters, etc. requires partial disassembly of vessels or filter tubes and handling of numerous connectors, spacers, O-rings, nuts, bolts, washers, clamps, etc.

m. Constant or near constant observation and monitoring or gauges, dials, meters for pressure, flow rates, and water quality indicators.

APPENDIX B - ISSUE SHEET #1

STATEMENT OF ISSUE	Does the Lightweight Water Purifier (LWP) change the quantity of quality of personnel required to operate or maintain the system?
IMPACT	The LWP is intended to be integrated into existing force structure within current manpower constraints. The system will be operated and maintained in the unit by assigned special forces or medical personnel on a part time basis. Design of the LWP beyond the parameters of the TAD will result in increased manpower or new MOSs or additional skill identifiers. Design of the LWP beyond the skill level parameters will result in the need for more complicated and technical training than originally planned.
AFFECTED DOMAINS	Manpower, Personnel, and Training.
RESPONSIBLE AGENCY	U.S. Army Quartermaster Center and School (USAQMCS), Proponency Office; Tank Automotive and Armaments Command, Mobility Technology Center - Belvoir (MTC-B); Combined Arms Support Command (CASCOM), Directorate of Modernization and Technology.
DATA SOURCE	Operational Requirements Document (ORD), Test and Evaluation Master Plan (TEMP), Critical Operational Issues and Criteria (COIC), MANPRINT Assessment (MPTA), Developmental Testing (DT), Operational Testing (OT)
PROJECTED AVAILABILITY	ORD, Draft 7 April 1995; TEMP, Draft August 1994; COIC, __________; MPTA, Draft July 1995; DT, 4QFY95 & 3QFY97; IOT, 3QFY97.
FINDINGS	Assessment is On-going. LWP is being developed to meet the minimum performance characteristics outlined in the ORD.
STATUS	Open, July 1995

APPENDIX B - ISSUE SHEET #2

STATEMENT OF ISSUE	Are training and training materials accurate, comprehensive, and effective?
IMPACT	The LWP will be operated and maintained by soldiers who have had no formal training on water purification and who have no prior experience on the 600 GPH or 3000 GPH ROWPU. Training materials must be adequate and understandable to allow soldiers in the target audience to effectively and efficiently conduct all required operations to provide water support using the LWP. Once trained, operators will be able to provide uninterrupted support with less than 5 percent repeat errors (omission or commission) in the performance of critical tasks. Reading level of manuals shall be appropriate for the target audience.
AFFECTED DOMAINS	Human Factors Engineering and Training.
RESPONSIBLE AGENCY	U.S. Army Quartermaster Center and School (USAQMCS), Proponency Office; Tank Automotive and Armaments Command, Mobility Technology Center - Belvoir (MTC-B); Combined Arms Support Command (CASCOM).
DATA SOURCE	Operational Requirements Document (ORD), Test and Evaluation Master Plan (TEMP), Critical Operational Issues and Criteria (COIC), Initial Operational Test and Evaluation (IOT&E); First Article Test (FAT); Test Questionnaires will be developed for evaluation of training materials and manuals during the test phase.
PROJECTED AVAILABILITY	ORD, Draft 7 April 1995; TEMP, Draft August 1994; COIC, __________; MPTA, Draft July 1995; DT, 4QFY95 & 3QFY97; IOT&E, 3QFY97.; FAT, May 1999.
FINDINGS	Assessment is On-going. LWP is being developed using Non-Developmental procedures and the integration of commercial components and available manuals.
STATUS	Open, July 1995

APPENDIX B - ISSUE SHEET #3

STATEMENT OF ISSUE	Does the LWP present any uncontrollable safety or health hazards to personnel?
IMPACT	The soldier must never, knowingly, be placed in an unsafe environment caused directly by use or operation of unit LWP equipment. Hazards classified with high Risk Assessment Codes (RAC) of 1 or 2 shall be eliminated. Hazards with a RAC of 3 shall be controllable to a lower level of risk (i.e. RAC 4 or greater). Specific attention to noise levels, heavy lift, handling of chemicals and contaminants, electrical, high pressure hoses, and heat/fire hazards is required.
AFFECTED DOMAINS	Human Factors Engineering, Safety, and Health Hazards.
RESPONSIBLE AGENCY	Tank Automotive Command, MTC-B, Safety Office; Test and Evaluation Command (TECOM); Army Research Laboratory-Human Engineering Laboratory (HEL); US Army Center for Health Promotion and Preventive Medicine (CHPPM); Office of the Surgeon General.
DATA SOURCE	Operational Requirements Document (ORD), Test and Evaluation Master Plan (TEMP), Critical Operational Issues and Criteria (COIC), Human Factors Engineering Assessment (HFEA), Safety and Health Data Sheet (SHDS), Health Hazard Assessment Report (HHAR), MPT Assessment (MPTA); Technical Testing (TT); Initial Operational Test and Evaluation (IOT&E)
PROJECTED AVAILABILITY	ORD, Draft 7 April 1995; TEMP, Draft August 1994; COIC, __________; HFEA, ________; SHDS, 16 March 1995; HHAR, 4 October 1994; MPTA, July 1995; TT, 4QFY95 & 3QFY97; IOT&E, 3QFY97.
FINDINGS	Assessment is On-going. The current assessment is based on experiences with other water purification equipment such as the 600 and 3000 GPH systems. The specific configuration of the LWP is not known; but is expected to contain some of the same processes.
STATUS	Open, July 1995

APPENDIX B - ISSUE SHEET #4

STATEMENT OF ISSUE	Does the LWP meet or fall within the human factors engineering or noise limitation requirements?
IMPACT	Noise abatement has been used on past water purification equipment with dangerous noise levels based on findings from initial testing of the 600 and 3000 GPH systems. Principal noise sources are power sources, pumps, and high pressure systems. The LWP maximum noise level is calculated at 83 dB(A) based on an 11 hour exposure using the worst case current Mission Profile. Human factors engineering should be based on the limiting operator characteristics of the 91B, 5th percentile female soldier anthropometric stature of 60", 102.3 pounds, 25.2" functional reach, and Skill Technical aptitude score of 95. Maximum 4 man lift for individual modules is 287 pounds. Controls and gauges will facilitate ease of understanding and operation. Access to replaceable filters will be simplified. The necessity for numerous separate connections will be reduced. And, protective clothing and equipment necessary for handling chemicals or contaminated waste shall be included in the BII for the system.
AFFECTED DOMAINS	Human Factors Engineering, Health Hazards, and Safety.
RESPONSIBLE AGENCY	USAQMCS, Proponency Office; CASCOM; TACOM, MTC-B; ARL-HEL; CHPPM.
DATA SOURCE	ORD, TEMP, COIC, HFEA, SHDS, HHAR, MPTA, TT, IOT&E
PROJECTED AVAILABILITY	ORD, Draft 7 April 1995; TEMP, Draft August 1994; COIC, __________; HFEA, ________; SHDS, 16 March 1995; HHAR, 4 October 1994; MPTA, July 1995; TT, 4QFY95 & 3QFY97; IOT&E, 3QFY97.
FINDINGS	Assessment is On-going. LWP is being developed using commercially available components and technology to meet the HFE, safety, and health hazards performance characteristics outlined in the ORD.
STATUS	Open, July 1995

APPENDIX C - DATA SOURCE MATRIX

DATA SOURCES	HFE	MAN-POWER	PERSON-NEL	TRAIN-ING	SAFE-TY	HEALTH HAZARD
ARTEP		X	X	X	X	
SQT	X	X	X	X	X	X
AR611-201			X	X		
MISHAP DATA BASE	X				X	X
SAFETY EXPERTS AT AMC,TRADOC, AND OTHERS	X			X	X	X
QM 77W WATER INSTRUCTORS	X	X	X	X	X	X
CONTRACTOR DATA	X	X		X	X	X
BOIP/ QQPRI		X	X			
HFEA	X				X	X
TECHNI-CAL MANUAL			X	X	X	X
TEST REPORTS	X	X	X	X	X	X
SHDS					X	X
HHAR					X	X

APPENDIX D - QUESTIONS TO BE ANSWERED

1. General.

a. Will sufficient space be available on the HMMWV transport vehicle to adequately carry the Lightweight Water Purifier (LWP) and each soldier's combat gear (TA-50, NBC Protective Clothing, Special Clothing and Tools, Weapons, and Ammunition), rations, Basic Issue Items (BII), and without restricting the soldiers or will some gear be stored in a trailer?

b. Is the LWP configured for ease of transport and handling?

c. Is the LWP complete with 5 days of supplies, power source, and BII?

2. Manpower.

a. Can the LWP be operated by one soldier on a part time additional duty basis?

b. What percent of the soldier's time is devoted to system checks and operation?

c. Can the LWP be emplaced by two to four male soldiers?

d. What additional manpower is required to rig and transport the LWP by helicopter?

3. Personnel.

a. Has a Target Audience Description (TAD) been established for the LWP?

b. Can the operator, taken from the CMF 18 or 91 target audience population, operate the system to standard under all environmental and specified climatic conditions?

c. Can the proposed maintainer, taken from the CMF 63 target audience population, maintain the system at the organization and direct support level under all conditions?

d. Have any new skill, training, or technical requirements been identified for members of the target audience? Is an Additional Skill Identifier (ASI) appropriate?

e. Is there a LWP performance aptitude difference between the target populations of special forces (CMF 18) and medical units (CMF 91)?

f. How does system design affect skill requirements?

g. Does the LWP system have any skill, technical, or mechanical aptitude sensitive critical tasks?

4. Training.

a. What are the critical tasks for operation and maintenance of the LWP system?

b. Can the LWP be safely operated without institutional training or dedicated operators?

c. Have performance criteria been developed for each task element?

d. Will sufficient test players be trained and participate in Early User Testing (EUT) and Initial Operational Tests (IOT)?

e. Which tasks can be classified or structured to generate groups of tasks having common elements in order to simplify skill assessment?

f. What is the workload for each defined job or separate task?

g. Are the technical manuals complete, comprehensive, and accurate?

h. What is the reading grade level assessed for the technical manuals?

i. Are training resources available to support the proposed training program?

5. Human Factors Engineering.

a. Have human factors engineering problems encountered in the development and fielding of similar systems been identified?

(1) Can the system be easily operated by the 5th percentile female?

(2) How many modules, electrical, and water connections are required? What is the average time to set up and check out the system? Is this considered excessive?

(3) Does the system require manual mixing and handling of chemicals?

(4) Is the start up process complex with numerous steps and sequences?

(5) Are dials, switches, meters, gauges, and indicators user friendly, accurate, and unambiguous? Do they clearly indicate range tolerances? Are they properly labeled by function and intent? Can they be seen and operated in hours of darkness?

(6) Are high pressure lines and electrical connections located away from the operator panel? Is pressure vented up and away from the operator console?

b. Will the anticipated working environment, including the physical aspects (weather, light, temperature, humidity, ventilation, noise, vibration, etc.) and the operational aspects (threat, operational communications, workloads, duty cycle, etc.) adversely affect operator, maintainer, or repairer performance?

c. Do the equipment characteristics demand operator performance which exceeds the capability of the target audience population or do performance requirements approach limitations which may significantly contribute to the occurrence of one or more of the following conditions?

(1) Jeopardize water quality or mission performance/completion?

(2) Delay operations beyond acceptable time limits?

(3) Cause or promote improper operation leading to system failure?

(4) Result in excessive maintenance workload or operational down time?

(5) Result in degradation below threshold reliability requirements?

(6) Cause or foster damage to equipment?

(7) Cause or facilitate injury to personnel?

d. What is the impact of the human operator on system operations in terms of workloads, duty cycles, stress, and extremes of environmental conditions?

e. Which system functions should be machine implemented and which should be assigned to the operator and/or maintainer?

f. Will the ancillary equipment interface with the system being deployed be tested for compatibility and accessibility of cables, controls, displays, power sources, and the effects of noise, light, vibration, motion, etc.?

g. Will easy accessibility to subsystems rated most likely to fail or require frequent replacement be designed into the system?

h. Which tasks are more likely to cause (or result in) crew error?

6. Systems Safety.

a. Have appropriate safety cautionary warnings been included in the technical manuals which accompany the system?

b. Are there any unique safety issues related to the LWP technology?

c. Have safety issues identified in predecessor water purification systems been addressed and risk reduction measures implemented?

(1) Does the system have back-up and redundant high pressure relief systems? Is this pressure released away from the operator? Are high pressure lines routed away from the operator to prevent exposure to leaks and minimize tripping hazards?

(2) Are hot exposed surfaces shielded to prevent burns from inadvertent contact? Are caution placards properly located and adequate to warn operators of hazards?

(3) Does the system have provisions for electrical grounding? Does the LWP incorporate fault interrupter circuitry? What measures have been taken to isolate water and electricity contact? Is site selection and proper drainage adequately stressed in manuals and warning placards? Do operations in rain or snow require special safety procedures?

(4) Are exposed moving or rotating parts shielded?

(5) Are there any particular fire or explosion hazards associated with refueling operations? Does refueling require the system to be shut down?

(6) What is the weight of the largest and heaviest single component? Does this exceed the 287 pound lift requirement? Does the supply package exceed the 74 pound single female lift requirement?

(7) Has a marking, numbering, or color coding system been used to prevent the mismatching of hoselines and electrical connections?

(8) Has adequate access been provided to component, filters, elements, and items requiring frequent replacement or maintenance?

c. Are emergency or warning signals (lamps, sounds, or markers) effective for alerting operators, maintainers, and supporters under all environmental and operational conditions?

d. Are the controls positioned and protected from inadvertent activation?

7. <u>Soldier Survivability.</u>

a. When compared to individual purification methods, does the quality and quantity of water from the LWP enhance operations and reduce exposure to water borne disease?

b. Does the LWP possess a visual, infrared, or acoustic signature that in itself endangers personnel or exposes them to increased threats.

c. At what specific distances can the system be heard or seen (unaided)?

8. Health Hazards.

a. What measures (if any) have been taken to reduce the manual handling of water purification chemicals and concentrated waste products?

b. What health hazard issues identified with predecessor systems have been addressed in the design of the LWP system?

(1) Has protective clothing (butyl rubber gloves, apron, eye , and face protection been included with the system Basic Issue Items (BII)?

(2) Are commercial chemicals used during the purification process? Is the operator required to manually handle or mix these chemicals? Are chemicals packaged to minimize direct handling (i.e. individual measured doses or bulk)? Are appropriate caution labels affixed to the packages and included in the manuals?

(3) Is the operator exposed to concentrated waste during the replacement of filters, cleaning of strainers, changing of elements?

(4) Does the LWP manual alert operators to the hazards of waste products with regard to water borne diseases and concentrated chemicals or toxic materials?

(5) What measures have been taken to minimize the possibility of recontamination of the product water? Are storage tanks or bladders opened or closed to the atmosphere?

(6) What is the steady state noise level at the normal operating station? At 5 meters? At 10 meters? Have noise abatement measures been applied to the system design? Is hearing protection required to reduce noise levels to below 83 dB(A)?

(6) What measures have been taken to reduce exposure to diesel exhaust? Have exhaust pipes been positioned to divert fumes up and away from the operator console? Have energy recovery techniques been used? Does this affect exhaust location content?

ANNEX A
COORDINATION

ORGANIZATION	LOCATION	CONCUR	NUMBER OF COMMENTS ACCEPTED/REJECTED
HQ, TRADOC	Fort Monroe, VA		
USACAC	Fort Leavenworth, KS		
CASCOM	Fort Lee, VA		
SSC-NCR	Alexandria, VA		
HEL	Fort Belvoir, VA		
MTC-B (RBWE)	Fort Belvoir, VA		
USAJFKSWC	Fort Bragg, NC		
USAMMED	Fort Sam Houston, TX		

ANNEX B
REFERENCES

1. Mission Need Statement (MNS) for the Lightweight Water Purifier (LWP), 6 October 1993.

2. Operational Requirement Document for the Lightweight Water Purifier (LWP), 7 April 1995 including Annex A Supporting Rationale and Annex B Operational Mode Summary/Mission Profile (OMS/MP).

3. Draft System MANPRINT Management Plan (SMMP) for Lightweight Water Purifier (LWP) in Support of Milestone I, July 1994.

4. Safety and Health Data Sheet (SHDS) for Lightweight Water Purifier (LWP) for Milestone I In-Process Review, Tank-Automotive and Armaments Command, Mobility Technology Center-Belvoir, AMSTA-RBEQ, 16 March 1995.

5. Initial Health Hazard Assessment Report (RCS MED 388) on the Lightweight Water Purifier (LWP) 69-37-X3JW-94, US Army Environmental Hygiene Agency, Health Hazard Assessment Office, July 1994 with endorsements and memo change to initial report, HQ AMC, AMCSG, 4 October 1994.

6. Manpower, Personnel, and Training Assessment (MPTA) for the Lightweight Water Purifier (LWP), Draft, 11 July 1995.

COST AND OPERATIONAL EFFECTIVENESS ANALYSIS (COEA) FOR THE LIGHTWEIGHT WATER PURIFIER (LWP)

Coordinating Final Report
11 March 1996

Prepared for US Army Tank-Automotive & Armaments Command, Mobility Technology Center-Belvoir under contract DAAK70-92-D-0003, DO 0039.

TABLE OF CONTENTS

INTRODUCTION

0.1 BACKGROUND

The US Army Quartermaster Center and School (USAQMC&S) has a requirement for a Cost and Operational Effectiveness Analysis (COEA) to determine the most effective and cost efficient alternative to meet the stated requirement for a Lightweight Water Purifier (LWP). Data and information from this COEA is intended to support a Milestone Decision Review (MDR I/II) planned for December 1995.

This COEA is based on the 6 October 1993 approved Mission Need Statement, CARDS No. 22-93 and the 7 April 1995 coordinating draft Operational Requirements Document (ORD). The approved MNS is attached at Appendix A. Also, a copy of the draft ORD is included as Appendix B to this report. The acquisition category (ACAT) for the system has not yet been determined. However, LWP is anticipated to be either ACAT III or IV, depending on the expected total value of the program in terms of procurement or Research, Development, Test, and Evaluation (RDT&E).

The purpose of this COEA is to assist the combat developer in refining the definition of the operational requirement and to aid decision makers at the Milestone Decision Review (MDR) with suitable information and analysis to enable them to:

(1) Select from among the designated Lightweight Water Purifier (LWP) alternatives and establish those which offer the highest potential to best meet the stated operational requirement; and

(2) Decide whether continuation of the LWP program is justified.

BRTRC, Incorporated was tasked to provide the required COEA under their existing operations research/systems analysis (ORSA) support contract with the US Army Belvoir Research, Development and Engineering Center (BRDEC), contract number DAAK70-92-D-0003, Delivery Order 0039. This COEA constitutes a portion of the Acquisition Management Document work performed under tasks 3.1 (draft report) and 3.2 (final report) of that Delivery Order.

0.2 FORMAT

This COEA uses the format prescribed for a Cost and Operational Analysis (COEA) by Department of Defense Manual DoD 5000.2-M, Defense Acquisition Management Documentation and Reports, dated February 1991, Part 8, Attachment 1.

0.3 GENERAL TECHNICAL APPROACH

The general technical approach employed during the preparation of this COEA is in accordance with the study process outlined in the US Army Training and Doctrine Command (TRADOC) Pamphlet 11-8 (Draft). In particular, the COEA utilizes the concept of Decision Cost developed in that TRADOC publication. The COEA was also conducted in accordance with the guidance set forth in the DoD 5000 series Directives and Instructions; relevant Army Regulations and Army Acquisition Executive, Department of the Army (DA), TRADOC, and Army Materiel Command (AMC) memoranda and guidance in effect on or before the information cutoff date for this study (31 October 1995). The COEA includes information derived from other current program management documents that apply to the Lightweight Water Purifier and references those documents.

0.4 NATURE OF THIS REVISION

This document represents the final version of the LWP Cost and Operational Effectiveness Analysis. The final report incorporates recommended changes and revisions requested as a result of the Government review of the draft report. A summary of the most significant modifications is presented here:

- Revisions to the ORD have not impacted the operational analysis parameters or basic performance characteristics of the alternatives.

- Costs have been updated to reflect a change in the quantity of Lightweight Water Purifiers (LWP) to 50 total systems.

- Due to the delay in the approval of the ORD and the resulting slippage of the Milestone Decision, the decision costs have been adjusted to reflect FY96 Constant dollars.

- Other changes reflect editorial adjustments in requirements to agree with the current version of the ORD or minor adjustments in costs as a result of the review process or the issuance of new guidance on cost factors since the publication of the draft report.

0.5 SUMMARY

Section 4 presents a summary of the results and is intended as an Executive Summary of this Cost and Operational Effectiveness Analysis (COEA).

SECTION 1

THE ACQUISITION ISSUE

1.1 NEED

1.1.1 General

The U.S. Army has a need to provide a safe, potable water supply for small units and detachments, to include Special Operations Forces (SOF), engaged in early entry, long range surveillance, and contingency missions. Missions during Operations other than War (OOTW) may also include nation building, civil affairs assistance, and disaster relief. These units may operate independently for extended periods or at remote sites and at distances inconsistent with the established water distribution network. This need is identified as priority number 43 of the US Army Training and Doctrine Command Battlefield Development Plan (BDP 94-08). The need has been further documented in the Mission Need Statement (MNS) for the Lightweight Water Purifier (LWP) approved by Headquarters, Department of the Army (HQDA) on 6 October 1993 (Appendix A) and in the 7 April 1995 coordinating draft Operational Requirements Document (ORD) for the Lightweight Water Purifier (LWP) (Appendix B).

The Lightweight Water Purifier (LWP) responding to this requirement shall be capable of producing potable water from fresh, brackish, and sea water sources or water sources tainted with nuclear, biological, or chemical contaminants. Water produced by the LWP must meet the US Army and Tri- Service field water quality standards contained in Technical Bulletin, Medical (TB MED 577). The LWP falls within the Combat Service Support (CSS) mission area and shall be suitable for use by organic unit personnel in selected units with minimal training.

1.1.2 Background

Army Field Manuals recognize the importance of an adequate water supply. "Water is essential to the army in the field. Safe water ranks in importance with ammunition and food ... and often has a bearing on the success of failure of a mission. When in the field, soldiers must be supplied with sufficient water to drink and to maintain personal hygiene. The water for these purposes must be safe for human consumption and should be reasonably free of objectionable tastes, odors, turbidity, and color" (para 2-6a, FM 21-10-1).

Soldiers are encouraged to drink sufficient quantities of water to reduce the risk of heat injuries and dehydration. Planning estimates can reach 4 gallons per soldier per day in hot, arid climates for drinking alone. The addition of water for personal hygiene and cooking can increase this factor to 6 gallons per day. Water from surface, ground, or other sources must be treated to prevent the spread of disease caused by waterborne organisms. The Lightweight Water Purifier (LWP) is intended to provide a water treatment capability for small units, SOF, and detachments operating without normal quartermaster water support.

1.1.3 Responsibilities

The unit commander is ultimately responsible for water supply and treatment within the unit. Other responsibilities involve the Army Medical Department (AMEDD), Corps of Engineers (COE), and the Quartermaster Corps (QM). The AMEDD establishes water quality standards, inspects water sources and supply points, performs tests, advises on treatment methods, and approves water for consumption. The COE selects and establishes water points by drilling wells if necessary. And, the QM sets up and operates bulk water treatment equipment and water supply points.

"Military units deployed in a contingency area must initially secure water for themselves or carry sufficient water with them until engineers, quartermaster water units, and supply and services elements can establish water operations" (FM 5-104). Water support is normally provided by the Division Support Command (DISCOM), Corps Support Command (COSCOM), or Theater Army Area Command (TAACOM) structure. This structure will not normally be in-place during the early phases of a deployment or may not be available at all to smaller battalion or company sized units operating independently or engaged in certain limited objective operations of short duration (e.g. less than 90 days). Larger organizations have organic support built into their structure. Some of those organizations are cited below.

In the light divisions, water is provided by the water supply section of the DISCOM Supply and Transport Battalion (S&T), Headquarters and Supply Company (SRC 42026L000). This company is organized for purification, storage (up to 27,000 gallons), issue (up to 72,000 gallons per day), and unit distribution of water to the light infantry battalion trains. The water section operates up to three water points in the Division Support Area (DSA) and the Brigade Support Areas (BSA).

In the airborne division, potable water is similarly provided by the water supply section of the DISCOM S&T Battalion, Headquarters and Supply Company (SRC 42056L000). This company is organized for purification, storage (up to 24,000 gallons), issue (up to 96,000 gallons per day), and limited unit distribution of water. The water section operates up to four water points in the DSA and BSAs.

Logistical support, including water purification, for components of the Army Special Operations Command (SOCOM) is provided by the 528th Special Operations Support Battalion (Airborne). The 528th is a one-of-a-kind unit responsible for air delivery of supplies to special operations troops. Fuel and water drums/bladders are rigged for airdrop and can be delivered by C-130 or slingloaded by the CH-47. The battalion has two water teams each equipped with two 600 GPH ROWPUs. These teams can operate up to four water points as required and are normally task organized to support specific missions. Although the water section can perform limited distribution, delivery and rigging; this is usually accomplished by other elements in the battalion organization.

1.1.4 Current Water Purification Capabilities

Current US Army capabilities to produce potable water for soldiers in the field range from individual measures to bulk purification methods. Individual measures may be classified as emergency procedures used when soldiers are on patrol or when the only source of water is raw or unapproved. They are not intended for large volumes for extended periods.

► Iodine Tablets. The most common of the individual measures is the use of iodine tablets. Typically, one iodine tablet is added to a 1-quart canteen of fresh water to disinfect the water. A minimum of thirty minutes contact time is required for disinfection. Two tablets are required for turbid or cold water at or below 40° F.

► Calcium Hypochlorite Ampules. Use of these ampules is generally a 2-step process. First, a concentrated solution is made by dissolving one ampule in one-half canteen cup of water (about 8 ounces). Then, one-half canteen capful of concentrated solution is added to each canteen of fresh water. As with iodine treatment, a minimum of thirty minutes contact time is required for disinfection. Larger batches of water may be purified using the 36 gallon Lyster bag or the 400 gallon water trailer if available according to the procedures in FM 21-10-1.

► Survival Straws. Emergency Drinking Straws, such as the Aquastraw 2 manufactured in the UK, allow individuals to drink directly from untreated sources and provide a reduction in biological organisms. The straws are light and discarded after 24 hours of use.

► Boiling. When disinfecting compounds are not available, water may be brought to a rolling boil for 5 to 10 minutes to kill most organisms. However, this method provides no residual protection against reinfection.

► Hand Operated Watermakers. Recovery Engineering Inc., Minneapolis, Minnesota manufactures a hand operated purifier known as the "Survivor". Jane's Military Vehicles and Logistics, 1991-1992, Twelfth edition indicates that this item is in service with the US Army, Navy, and Coast Guard. The system was designed for use as an emergency water supply for use on lifeboats or for units separated from central water supplies. Operation of the hand pump forces pressurized water through a reverse osmosis membrane producing pure drinking water from fresh, brackish, or saltwater. Three models of the "Survivor" are available as shown in Figure 1-1:

	Survivor 06	**Survivor 35**	**Survivor 35CS**
Production Rate	0.29 GPH	1.43 GPH	1.69 GPH
Weight	3.53 lbs	7.05 lbs	8.15 lbs

Figure 1-1 Hand Operated Water Purifiers

Current US Army bulk water production methods include:

- Reverse Osmosis Water Purification Unit (ROWPU), 600 GPH
- Reverse Osmosis Water Purification Unit (ROWPU), 3000 GPH

1.1.4 Deficiencies

While the individual methods of water purification described above are appropriate to provide for the needs of the soldier or small groups in an emergency situation, they are not intended to meet the sustained requirements for small units. For instance, in order to provide the estimated 6 gallons per day in the extreme case, the largest of the hand operated systems would require nearly 4 hours of constant pumping per soldier. Similarly, using tablets or ampules, a soldier would need to purify 24 full canteens over a period of six hours (assuming 2 canteens per soldier) to meet the maximum planning demand. Obviously, the considerable amount of time devoted to these efforts would impact on the primary mission. In addition, only the "Survivor" can use brackish or saltwater sources. Therefore, none of the individual methods is considered a viable alternative to meet the needs of the LWP and are disqualified from further consideration.

Existing 600 and 3000 GPH ROWPUs are assigned primarily to division, corps, and echelon above corps quartermaster supply and service units which operate water points in the DSA, BSAs, Corps Rear, and Communication Zone (COMMZ). Except in cases where limited distribution is provided, units are required to travel to the water point for resupply. For SOF missions, the 528th Support Battalion uses 600 GPH ROWPUs to produce water for air delivery to remote teams. These ROWPU units are sized and allocated to QM units meet the water point needs of brigade sized elements (approximately 3300 personnel with associated equipment) with large volumes of purified water. Flow rates produced by these systems require reasonably large sources and far exceed the requirements of small units, detachments, and SOF elements. In addition, these systems are skid-mounted or packaged in a special 8x8x20 foot ISO container and are normally transported on a 5 ton, 4 wheel tandem flatbed cargo trailer (600 GPH) or an M871A1 22.5 ton flatbed semi-trailer (3000 GPH) and represent a significant movement consideration for small or light units. The 600 GPH systems weighs about 3.7 tons skid mounted (USMC version) and about 8.5 tons with trailer (Army version). Figures for the 3000 GPH ROWPU are 7.6 tons (ISO van only) and 19.0 tons (mounted on trailer), respectively. Neither system is compatible with the missions and types of vehicles available to units requiring a Lightweight Water Purification capability.

In summary, the deficiencies of current water purification methods can be characterized by:

- Inability of all individual methods to treat brackish or sea water.
- Insufficient flow rates or excess water production capacity.

- Potential adverse mobility impact on non-Quartermaster using units. Sizes and weights of existing ROWPU equipment are not compatible with vehicles typically found in the target SOF or medical units.

1.1.5 Opportunities

The Lightweight Water Purifier (LWP) offers the possibility of overcoming these deficiencies in current water purification capabilities and presents the following opportunities:

- The opportunity to improve the responsiveness of water support to early entry, highly mobile forces throughout the spectrum of conflict.

- The opportunity to provide quality water support to small units and detachments during LIC or contingency operations where distribution of bulk water is not feasible or practical.

- The opportunity to provide such water support without committing outsized production assets or specially trained personnel from the division or corps support structure.

- The opportunity to tailor water production flow rates to the demands of independent Special Operations Forces, detachments, and other units typically engaged in remote site missions or in Operations other than War.

- The opportunity to use state-of-the-art technology in reducing the size, weight, and deployment features of existing water purification equipment.

- The opportunity to improve water production efficiency and flow rates from sources with high salt contents (e.g. > 45,000 milligrams per liter Total Dissolved Solids (TDS)).

- The opportunity to employ emerging water purification technology to improve quality of water regardless of source contamination.

- The opportunity to extend the lightweight water purification capability to other units with similar needs.

1.2 THREAT

1.2.1 Threat to be Encountered

The Lightweight Water Purifier (LWP) ... "does not counter a specific threat. An LWP capability and its associated personnel are vulnerable to the spectrum of threat destruction and/or disruption capabilities at all levels of conflict along the operational continuum. Though unlikely, the LWP capability also may be attacked as a target of opportunity. Destructive capabilities such as direct and indirect fires, small arms fire and sabotage can harm the system and associated personnel. This capability is will also be susceptible to contamination. The NBC operations and weapons effects may render the system temporarily unusable or may destroy it." (MNS, paragraph 2.b). The reliance on host nation or suspect sources of water poses a threat to the health and safety of soldiers operating outside normal water supply channels. Since water is an essential commodity, the LWP is intended to eliminate the health threat by providing an organic means to produce potable water within the unit.

1.2.2 Projected Threat Environment

The LWP will be used by units involved in low intensity conflict (LIC) environments, contingency operations, special operations and other scenarios where the distribution of bulk water is not feasible or practical. "Special operations occur frequently in hostile, denied, or politically sensitive areas across the full range of operations. ... Special operations during war and in other hostile environments usually occur deep in the enemy's rear area or in other areas void of conventional maneuver forces." (FM 100-5, page 2-20). During peacetime, Army SOF units may perform missions relating to foreign internal defense efforts, special reconnaissance, counterterrorism and counterdrug operations, humanitarian assistance, civic assistance, and demonstrations of US presence.

Regardless of the level of conflict, SOF forces are trained to operate independently with minimal external direction and support and are typically isolated from traditional forces and lines of communication. Their ability to operate in remote areas and hostile environments for protracted periods of time is one of their primary capabilities.

The threat environment in which SOF operates may be characterized by enemy rear area defense forces and local security teams organized to protect critical operational or command and control facilities. These defense forces may be part of a well-equipped and organized conventional army or regional police forces. They may also include lightly equipped local militia or insurgent elements configured for rear area security missions. These forces are generally equipped with small arms weapons and may possess a limited to moderate number of crew served weapons. Sabotage of equipment or supplies is also a potential threat when operating with indigenous personnel or local nationals. The threat from heavier weapons, artillery, or rocket fire is less of a consideration for these types of units due to the nature of the operations.

1.3 ENVIRONMENT

The LWP and the approaches evaluated as potential candidates must be capable of undegraded performance in a variety of environmental and climatic conditions. Specifically, the requirement includes the following environmental conditions as LWP system characteristics:

- The LWP must produce, store, and distribute potable water ... from all surface and ground water sources of fresh, brackish, and sea water, including NBC-contaminated water... (ORD, para 4.a.(2)).

- The LWP must also produce water ... while operating in an NBC environment and/or drawing water from NBC contaminated sources. Processed potable water shall be protected against NBC contamination/recontamination. (MNS, para 5).

- The LWP will be operated in basic and hot climate conditions as defined in Army Regulation 70-38, including NBC-contaminated environments when the systems is contained in an NBC-safe structure. (ORD, para 1.c.(1)).

- The LWP will not be NBC Survivable since it is not a mission essential item. (ORD, para 1.c.(1)).

- The LWP must be capable of storage and transportation in basic climates and be capable of operation in basic and hot climates (see AR 70-38). (ORD, paragraph 4.c.(2)).

- The LWP operation must operate with no observable deleterious effects due to blowing rain, blowing sand, or blowing soil. (ORD, paragraph 4.c.(1)).

1.4 CONSTRAINTS AND ASSUMPTIONS

1.4.1 Constraints

The Lightweight Water Purifier (LWP) must be capable of operating 24 hours per day in all geographic environments likely to be encountered during low intensity conflict, contingency or special operations during war or peacetime. This includes undegraded operation various weather and climates, day or night, and in the presence of natural or man-made battlefield obscurants.

The LWP must also be capable of undegraded operation in Nuclear, Biological, and Chemical (NBC) environments when housed in an NBC-safe structure and must be able to purify NBC-contaminated source water. In addition:

- The size and weight of the LWP must be such that it is readily transportable to the tactical area of operations (AO) by sea, rail, or air; and within the AO by ground transport modes available to the using units.

- The LWP must be tactically mobile and suitable for rapid deployment during early entry, contingency, and special operations.

- The LWP system must be transportable by an M1097A High Mobility Multi-Purpose Wheeled Vehicle (HMMWV). It must also be transportable inside an 8 foot x 8 foot x 20 foot ISO frame.

- The LWP system must be air transportable and air droppable by C-130 or C-141 medium lift aircraft using current air delivery containers. Additionally, the LWP must be capable of internal air transport by UH-60 Blackhawk aircraft.

- The LWP and associated equipment must not generate a requirement for additional manpower nor produce a need for additional military occupational specialties (MOS) or special skills.

- The LWP must be supportable by the standard supply and maintenance systems. Unit level and DS maintenance will be accomplished with common tools and/or those in the general automotive mechanics tool kit.

1.4.2 Assumptions

- The FY2001 force structure validated requirements are valid for the purposes of this Cost and Operational Effectiveness Analysis (COEA).

- Doctrine as outlined in FM 5-100, Operations, drives operational requirements and requires that all units (including LWP equipped units) be capable of operating in NBC contaminated environments.

- Operational and Support costs include maintenance and field support requirements and are identified by the decision cost element codes. The decision costs contained in this analysis do not contain "sunk costs" nor costs associated with military personnel per TRADOC Pamphlet 11-8.

- None of the alternatives examined in this COEA analysis will create (or generate) a requirement for any new military occupational specialties.

- Daily water production is based on 2-4 hours operation per day.

1.5 OPERATIONAL CONCEPT

Current water distribution capabilities are found within the support structure of the Division or Corps Support Commands (DISCOM or COSCOM). Quartermaster S&S or S&T companies establish and operate water distribution points to support units as far forward as the Brigade Support Area (BSA). Separate brigades or regiments have a similar capability in their organic service units. The 528th Special Operations Support Battalion provides water purification and other support to components of the Army's Special Operations Command on an as needed basis. Distribution of water and supplies to special operations, ranger, etc. units on the move is accomplished by air delivery at extended ranges.

This structure has proven satisfactory to support conventional deployments for brigade sized elements or larger. However, increasing emphasis on contingency operations, peacekeeping missions, humanitarian assistance and other special operations in remote and possibly hostile regions often requires flexibility in the tailoring of water support to smaller task forces or detachments with limited transportation assets. Such units must rely on local water support, individual low capacity purification methods, or the task organization of heavy, high capacity assets and personnel from the parent organization's support command.

The Lightweight Water Purifier (LWP) is not intended to replace the existing support structure; but rather to supplement it in situations where it is not feasible or practical to employ traditional water purification and distribution methods or equipment. Individual purification methods would presumably continue to be used during long range reconnaissance patrols (LRRP) and most covert operations of relatively short duration. However, the LWP will probably be used most frequently in situations where SOF elements are supporting missions involving organization, instruction, or training of popular guerilla type forces or local resistance units. Peacetime support may include training support to isolated units, humanitarian assistance, or disaster assistance where limited potable water supplies are available to support small portions (50-100 persons) of the local populace.

- The LWP shall be used by Special Operations Forces (SOF) down to detachment level and by selected medical units organized to, and engaged in, wartime and peacetime contingency operations or in Operations Other Than War (OOTW).

- The LWP may be issued to the support battalion or to the Service Company, SF Group on the Basis of three (3) per Special Forces Group. Each LWP will have adequate production capacity to support the consumption (drinking, cooking, and personal hygiene) demands of an estimated task force of about 100-125 persons. The Service Company will support deployments based on mission needs through attachment or task organization of LWP assets.

- Additional LWP systems will be allocated to selected medical units.

- The LWP shall be capable of producing potable water from fresh, brackish, and salt water sources and NBC contaminated sources at rates of 75 to 125 GPH (a maximum demand of 750 gallons per day in hot, arid climates is based on a population of 125 persons and 6 gallons of water per individual).

- The LWP will be airlanded in the area of operations by C-130 tactical or C-141 strategic airlift assets depending on distances and aircraft availability. Remote delivery will also be possible by Low Velocity AirDrop (LVAD) using air delivery containers. In theater movement on the ground will be accomplished by organic transportation assets. Short haul air movement in theater will be accomplished using CH-47 Chinook or UH-60 Blackhawk aircraft.

- The LWP shall be carried in or towed by vehicles organic to SOF or medical organizations. The target organic transport vehicle cited in the cooordinating draft ORD include the M1097A HMMWV. Supporting units may also use:

  - Heavy Expanded Mobility Tactical Trucks (HEMTT).
  - Truck, Cargo 5 Ton (M923-M928 series).
  - Trailer, Cargo 1½ Ton, 2 wheel (M104, M105 series).
  - Truck, Cargo 16½ ton, Palletized Load System flatrack.

- Upon arrival at the designated site, the LWP unit (or modules) are downloaded from the transport vehicle by a team of two to four soldiers (two desired). One soldier assembles the LWP and prepares it for operations in less than 45 minutes. Water production begins immediately upon completion of set-up and check-out. Purified water is pumped to storage tanks or bladders (maximum 800 gallon capacity) which serve to replenish unit and individual supplies.

- The LWP produces water in one shift up to 10 hours per day and allows 30 minutes/per four hours operation for periodic inspection, maintenance, cleaning, and filter replacement.

- The LWP shall be operated and maintained by unit personnel as an additional duty. The LWP requires minimal training and will not introduce a requirement for added personnel or for any new Career Management Field (CMF), Military Occupational Specialty (MOS), or Additional Skill Identifier (ASI).

- Upon completion of the water mission, the LWP is disassembled, cleaned, and prepared for redeployment or movement to an alternate site by one soldier in 45 minutes or less.

SECTION 2

ALTERNATIVES

2.1 CAPABILITY OBJECTIVES

The required *capability* objectives for the Lightweight Water Purifier (LWP) are defined in the Revised Draft Operational Requirements Document (ORD) for the LWP dated 7 April 1995, paragraph 4. They can be summarized as follows:

2.1.1 System Performance

2.1.1.1 The LWP will produce, store, and distribute potable water that meets TB Med 577 and Tri-Service field water quality standards.

2.1.1.2 The LWP will be transportable in commercial or standard military vehicles one and one-quarter ton size or larger and by UH-60 or larger helicopters as an internal, external or combined load. Thirty days of expendable supplies and repair parts will be included in the standard load.

2.1.1.3 The LWP will be emplaced and recovered from operational sites by two to four personnel. Emplacement and recovery by two individuals is desired.

2.1.1.4 The LWP will, after emplacement, be initially put into operation by one individual within 30 minutes without specialized training. On a daily basis, the LWP will not require more than 15 minutes preparation before producing potable water or require more than 15 minutes to shut down. No more than 30 minutes will be required by one individual to prepare the LWP for movement to a different site.

2.1.1.5 The LWP will, within size and weight limits, produce at least 75 gallons per hour (GPH) of potable water from source water with a salinity of 35,000 parts per million and temperature normalized to 77° F. A production rate of 200 GPH from fresh water is desired.

2.1.1.6 The LWP will store and distribute the equivalent of a one day potable water requirement for the supported unit or up to 800 gallons.

2.1.2 Logistics and Readiness

2.1.2.1 When operating or maintaining the LWP, any item requiring replacement or calibration by the operator must be replaced and/or calibrated within 15 minutes without special training or complex equipment.

2.1.2.2 Preventative maintenance checks and services for the LWP must not require more than 15 minutes for each four hours of operation and must be accomplished by individuals without specialized training.

2.1.3 Critical System Characteristics

2.1.3.1 The LWP will not require NBC contamination survivability.

2.1.3.2 The LWP will be capable of being operated and stored in basic climatic conditions as defined in AR 70-38. A winterization kit may be required in sub-freezing weather to enable the LWP to perform its mission.

2.1.3.3 LWP operation will not be adversely affected by exposure to rain, blowing dust, or blowing sand.

2.1.4 Integrated Logistics Support (ILS) Requirements

2.1.4.1 Maintenance Planning. The LWP will be maintained at unit level as an additional duty by individuals without special training. Maintenance at the direct support level will consist of test, calibration, and replacement of major components and sub-assemblies. Higher level maintenance requirements will be contractor supported.

2.1.4.2 Support Equipment. The LWP Basic Issue Items (BII) will include all tools, test, and calibration equipment required to operate and maintain the LWP at unit level. Direct support maintenance will be accomplished using standard tools and test equipment.

2.1.4.3 Human Systems Integration.

(1) Manpower. No additional manpower or increases to force structure will be required to operate or maintain the LWP.

(2) Personnel. The unit will be operated and maintained as an additional duty by current unit personnel. The LWP will be operable, transportable, and maintainable by soldiers from the 5th female through the 95th male percentile of individuals authorized for the gaining units.

(3) Training. The LWP and basic issue items will be designed so that institutional training or other special training for operator and maintenance personnel will not be required. Unit training will be the responsibility of receiving units.

(4) System Safety and Health Hazards. The LWP will not introduce unique health or safety hazards which cannot be controlled to a risk level acceptable for operation by personnel without special training.

2.2 DESCRIPTION OF ALTERNATIVES

2.2.1 Listing of Alternatives

In accordance with the Statement of Work (SOW) and in coordination with the study sponsor, this Cost and Operational Effectiveness Analysis (COEA) investigated the following alternatives:

- Base Case, Haul Water by Aircraft
- Rebuy - Water Purification Unit, Reverse Osmosis, 600 GPH w/o Trailer, Flatbed Cargo, 5 Ton, 4 Wheel Tandem (REBUY 600 GPH)
- Rebuild - Water Purification Unit, Reverse Osmosis, 600 GPH w/o Trailer, Flatbed Cargo, 5 Ton, 4 Wheel Tandem (REBUILD 600 GPH)
- Lightweight Water Purifier (LWP)

2.2.2 Base Case - Haul Water by Aircraft

When demand for water exceeds the capability of individual purification methods, bulk water production support can be provided to the user from a secure base area and airdropped or airlifted by helicopter. While detachments and teams performing long range reconnaissance and covert operations will presumably continue to rely on emergency or survival water procedures, support for semi-stationary missions involving 50 to 100 personnel will normally depend on air resupply. The 528th Special Operations Support Battalion (Airborne) performs such missions for elements of the Special Operations Command (SOCOM).

As outlined in Army FM 10-522, potable water may be rigged for airdrop/air transport in a variety of configurations. This manual describes the procedures for rigging water resupply ranging from 6 gallons (24 - one quart canteens) to 2160 gallons (5 - 250 gallon collapsible drums). These drums are not shipped at full capacity, hence the seeming discrepancy in total quantity. For these purposes, the 500 gallon drum is filled with 432 gallons of water and weighs approximately 3,599 pounds. A 250 gallon drum holds 240 gallons and weighs 2,150 pounds. The smaller drum measures 60 inches in length with a 40 inch diameter.

Peak demand, as defined in the ORD, is 800 gallons per day. For the purposes of this analysis, the smallest rigged single package that approaches this demand is comprised of three 250 gallon drums containing a total of 720 gallons of potable water. Air resupply using this package is thus defined as the base case.

Water teams of the support battalion produce potable water using their organic 600 GPH ROWPUs. This water is pumped into the collapsible drums at the designated water point. Rigging teams then configure the drums for air movement. Three drums are positioned on a Type II modular airdrop platform and lashed to the platform using 28 tiedown assemblies and honeycomb cushioning pads. Actual rigging is estimated at 30 to 45 minutes for two persons exclusive of relocation of the drums and any material handling support required. Once rigged, the platform is suitable for low velocity airdrop (LVAD) or slingload. The entire assembly measures 120 by 108 by 80 inches and weighs approximately 8,000 pounds. The weight of water alone is approximately 5,976 pounds.

In this configuration, the drums may be air delivered by C-130 or C-141 to a forward support site and then further lifted using UH-60 Blackhawk or larger rotary wing aircraft into the actual area of operations. The base case considers only helicopter movement out to a range of about 100 miles (1 hour flight time). To meet peak demand, daily resupply is required.

Theoretically, a single drum can be transported by HMMWV. However, lifting or material handling equipment would be required. Ground movement over short distances may be accomplished by dragging/towing a drum behind a HMMWV. The bulk and weight of each drum precludes movement by hand for all but the shortest of distance, i.e. repositioning.

2.2.3 Water Purification Unit, Reverse Osmosis, 600 GPH (ROWPU 600)

This alternative consists of the current 600 GPH ROWPU. This system is currently the standard water purification equipment available to U.S. Army and U.S. Marine Corps supply and service units at division or below. Additional units are located in the 528th Special Operations Support Battalion (Airborne) to support elements of the Army Special Operations Command (SOCOM).

The 600 GPH Reverse Osmosis Water Purification Unit provides fresh drinking water from fresh, saline, brackish water sources. The system comes overpacked with a post treatment cartridges for NBC contaminated sources. Separate cartridges are required for nuclear or chemical contamination which can remove hazardous concentrations of all known chemical and biological agents. The system was Type classified in 1979 and is now in service with the US Armed Forces. An estimated 583 are in use with the Army, 702 with the USMC, and an additional 105 with the Navy/Air Force.

Under the SOF concept, the water purification unit (WPU) can produce up to 3,840 gallons of potable water per day (960 GPH) from a fresh water or brackish water source and up to an estimated 2,400 gallons daily (600 GPH) from a sea water source. Hourly production rates are extracted from Appendix C, FM 10-52-1 and daily production in a SOF environment is based on a part time maximum of 4 hours of operation per day. Using the maximum demand of 800 GPD, this unit could meet the daily consumption needs in 50 to 80 minutes of operation. Production flows are less at temperatures below 77 ° F and at TDS concentrations exceeding 35,000 milligrams per liter. According to FM 10-52-1, water production at 50 ° F drops 69-74 percent. Treated water is pumped to a potable water distribution system consisting of two - 1500 gallon collapsible storage tanks and a dispensing pump. Brine waste water is collected in a third collapsible tank if required. The product water from the system meets quality standards for soldiers in the field.

The 600 GPH ROWPU was manufactured in two configurations to meet the needs of the principal using services. The US Army version includes a M105 trailer for transport. The USMC version without the trailer is lighter, more compact and is somewhat more compatible with the LWP requirement. This version of the 600 GPH ROWPU is most consistent with the SOF mission and consists of the water purification unit (WPU) housed in a 113 inch long by 68 inch high by 83 inch wide skid frame. The skid mounted ROWPU alone weighs 7,300 pounds (3.65 tons). A 30 KW diesel generator must be provided as a separate power source.

The 30 KW generator weighs approximately 2850 pounds (1.43 tons) and measures 79.75 inches long by 34 inches wide by 54.75 inches high. The complete system weight is about 10,150 pounds (5.08 tons). The weights of either component exceed the cargo capacity of the High Mobility Multi-Purpose Wheeled Vehicle. Therefore, if movement by road is required, a minimum M800 or M900 series 5 ton truck would be required to transport the WPU skid with generator. The combined system exceeds off-road design payload of the M923A2/M925A2 dropside 5 ton truck by about 150 pounds. A C-130 can carry three (3) skid mounted systems including the generator. A C-141 can transport six (6) skid mounted systems. Additional sorties are required for transport of the prime movers. The skid mounted version exceeds the maximum external lift capacity at sea level for the UH-1 (2,800 lbs); but is within the lift of the UH-60 (8,000 lbs) helicopters. A second UH-60 lift is necessary for the generator. External transport of the both skid and generator is possible by CH-47D rotary wing aircraft within its 22,800 maximum lift dependent on rigging limitations. The system was originally engineered to meet the needs of airborne units and can be rigged for Low Velocity Airdrop (LVAD).

The ROWPU 600 can be set up by two soldiers and operated by one soldier trained in water purification operations (MOS 77W). Operation is semi-automatic; however an operator must be present to mix and add chemicals, monitor gauges, and backwash the system. The WPU is equipped with a canvas cover to protect the unit from the effects of weather. The canvas cover is rolled up and stowed during normal operations.

According to the technical manual on the equipment, the ROWPU 600 can operate in temperatures between +32°F and +90°F. However, when the air temperature is below 32°F, adequate shelter and heating must be provided to protect equipment from the effects of freezing. Above 90°F special precautions must be taken to prevent pumps from overheating. The system must be operated on sites where the ground is as level as possible. The chemicals used in the purification process can be dangerous alone or in combination. Protective clothing and a well ventilated area is required when handling chemicals before, during, or after operations.

2.2.4 Rebuild - Water Purification Unit, Reverse Osmosis, 600 GPH (ROWPU 600)

The rebuilt ROWPU 600 has identical operational and performance characteristics as the basic 600 GPH ROWPU cited above. The rebuild option principally affects the cost of the program by using earlier or displaced versions of the item and repairing/rehabilitating the system as necessary. This alternative is defined more fully in section 3.3 on costs.

2.2.5 Lightweight Water Purifier (LWP)

The LWP is a US Army effort to meet the need for water purification to support small units and detachments in areas that are remote from normal support assets. The LWP is intended to support the basic water needs of task forces ranging up to a maximum of 125 personnel and a peak demand of 750-800 gallons per day. The system does not replace existing capabilities; but rather supplements existing water purification and supply systems. The design objectives of the system are outlined in the coordinating draft ORD.

An abbreviated development program using commercially available water purifiers and/or components is envisioned. Production quantities are estimated at 50 systems to support special operations forces and selected medical units. A specific Basis of Issue (BOI) has not yet been determined by the proponent(s). Production approval and Type Classification (TC) - Standard is planned for FY 1999 with deliveries occurring in FY2000.

A market survey of information on foreign and domestic purifiers obtained during the December 1992 - June 1993 period by the study sponsor. This survey canvassed thirty-seven (37) potential suppliers and obtained positive responses from sixteen (16) sources. Within size, weight, and production limitations - six (6) vendor options were determined to offer the most promise for further testing and evaluation. Specific LWP performance characteristics cited here represent a composite of the ORD requirements and market data on these items.

The Lightweight Water Purifier (LWP) will most likely consist of several small modules or components to provide potable water from fresh, brackish, saline, or NBC contaminated water sources. These components may include pre-treatment in the form of cartridge filters, screens, or membranes to reduce suspended solids in the feed water. A second bank of smaller mesh filtration may also be included to further improve water quality prior to entry into stage two. After removal of suspended solids, a desalinization module such as a reverse osmosis skid with multiple elements eliminates dissolved solids from the source water. By-pass of this stage may be possible depending on the initial level of dissolved solids in the source and quality of the water exiting the pre-treatment module(s). Post treatment will probably include filters to remove NBC contamination and a chlorinator to provide for residual protection against recontamination. Water quality is expected to exceed Environmental Protection Agency (EPA) standards since most commercial purifiers are intended to service the general populace.

The LWP will be capable of providing a minimum of 75 gallons per hour based on a feed water salinity of 45,000 milligrams per liter and a water temperature of 77 ° F.

Commercial equipment with capacities of 250 GPH using a seawater source are available. LWP projections of 75-125 GPH (Seawater) and 185-200 GPH (Fresh water) are considered reasonably achievable. The LWP will incorporate storage drums, bladders, or tanks and a dispensing capability to accommodate storage and issue of at least 800 gallons on a daily basis.

The LWP will consist of a purification skid or shelter housing and ideally will have a self-contained power source. The major limits on size and weight are derived from the smallest principal transporter, the M1097A HMMWV. Cargo dimensions are restricted to a length of 84.3 inches and a width of 52 inches (between the wheel wells). A maximum skid height of 69 inches above the bed floor is required so that the system can be driven onto the C-130 (i.e. 32.9" + 69" ≤ 102"). An optimal width of approximately 34 inches would permit the system to slide between the rear seats. An ideal design height of 39 inches would retain the system profile at or below the current 72 inches. Therefore, outside dimensions must not exceed 84" x 52" x 69" to 84" x 34" x 39" (all dimensions in inches).

The maximum single length, width, and height combination of any of the commercial systems considered is 84" x 36" x 60" and fits within the permissible envelope. This is therefore assumed to be the maximum possible size for the LWP. However, it is reasonable to expect that the actual system may be much smaller. Average dimensions of the commercial purifiers are roughly 60" x 36" x 40".

Gross payload of the HMMWV is estimated at 2,200 pounds (2,500 pounds minus a 300 pound allowance for the operator and equipment). Commercial candidates vary in weight from 315 to 750 pounds. Average system weight is 541 pounds. Power for the system may require a separate 3 KW generator estimated at 370 pounds. Weight of the total system is estimated at 911 pounds (0.46 tons) and is well within the cargo capacity of the HMMWV. The requirement for MHE (or expedient lifting devices) is dependent on the weight of individual modules. It should be noted that the standard generator alone exceeds the four man lift criteria.

The LWP can be unloaded and emplaced by 2-4 soldiers and can be set up or torn down within 45 minutes by one soldier. The LWP can be operated by one soldier with a minimum of training. Operation of the system will conducted on a part-time basis no more than 4 hours per day. Routine maintenance and Preventive Maintenance Checks and Services will require no more than 30 minutes for every 4 hours of operation.

A C-130 can carry four (4) HMMWV mounted systems and a C-141 can transport eight (8). The downloaded LWP is well within the external lift capacity at sea level for UH-1 (2,800 lbs), UH-60 (8,000 lbs), and CH-47D (22,800) rotary wing aircraft. Movement by road, rail, or sea will not pose any restrictions due to the small size and weight of the LWP.

The LWP can operate in basic and hot climatic conditions at temperatures of -25°F to +120°F. Special insulation or winterization kits are necessary to conduct operations in sub-freezing temperatures. The system must be operated on site where the ground is as level as possible.

	Base Case Haul by Aircraft	**600 GPH ROWPU Rebuy**	**600 GPH ROWPU Rebuild**	**LWP**
Quality	Meets TB Med 577	Meets TB Med 577	Meets TB Med 577	Meets EPA Standards
Fresh (4 hrs/day)	720 gpd (3 x 240 gal)	960 gph (3840 gpd)	960 gph (3840 gpd)	185-200gph (800 gpd)
Brackish (4 hrs/day)	720 gpd (3 x 240 gal)	960 gph (3840 gpd)	960 gph (3840 gpd)	185-200gph (800 gpd)
Sea Water (4 hrs/day)	720 gpd (3 x 240 gal)	600 gph (2400 gpd)	600 gph (2400 gpd)	75-125gph (500gpd)
Design TDS	35K mg/l	35K mg/l	35K mg/l	45K mg/l
Dimensions (inches)	120x60x40 (3 drums) 120x108x80 (rigged)	113x83x68	113x83x68	84x36x60 est maximum
Basic Weight Generator (if reqd) Total	6450 lbs (3-250 gallon drums @240 gal water) 8000 lbs (rigged)	7300 lbs 2850 lbs 10150 lbs	7300 lbs 2850 lbs 10150 lbs	est 541 lbs 370 lbs <911 lbs
Crew/MOS	2 (riggers)	2 (MOS 77W)	2 (MOS 77W)	1 (Non-Specific)
Operating Temp	+32 to +110° F	+32 to +90° F	+32 to +90° F	-25 to +120 ° F
Set-Up/Tear Down	2 soldiers-30 to 45 min	2 soldiers-4 hr	2 soldiers-4 hr	1 pers-45 min
# of slingloads	1 UH-60 minimum	2 UH-60 minimum	2 UH-60 minimum	1 UH-60 minimum
# per C-130	4 rigged platforms	4 skid mtd with generator set	4 skid mtd with generator set	4 HMMWV mtd/ 10-13 skid mtd
# per C-141	8 rigged platforms	6 skid mtd with generator set	6 skid mtd with generator set	8 HMMWV mtd/ 30-36 skid mtd

Figure 2-1 Comparison of Selected Performance Elements for Alternatives

SECTION 3

ANALYSIS OF ALTERNATIVES

3.1 MODELS

3.1.1 General

No combat or battlefield simulation models were used in this Cost and Operational Effectiveness Analysis (COEA). However, a decision analysis support software package entitled Expert Choice ™, Version 8.0 was employed in the operational analysis comparison of each of the alternative characteristics. Relative performance against original draft ORD requirements forms the basis for the Cost and Operational Effectiveness Analysis (COEA).

3.1.2 Analytical Hierarchy Process (AHP) and Expert Choice ™

The methodology used in the operational evaluation portion of this study effort was based on the Analytical Hierarchy Process (AHP). AHP is a decision theory that was developed at the Wharton School of Business by Dr. Thomas L. Saaty as a means to define, organize, and resolve complex questions involving multiple criteria of varying significance. It is a mathematical model which relies on the mechanics of pairwise comparisons, direct data input, and matrix algebra. The process permits a logical and systematic evaluation of each proposed alternative with respect to each other over the full range of criteria. Commercially available computerized AHP decision support software designed by Dr. Ernest H. Forman, specifically *Expert Choice*™, was used as a principal tool in conducting the COEA analysis.

3.2 OPERATIONAL REQUIREMENT ANALYSIS

3.2.1 General

A hierarchy or decision tree description of the Operational Requirement serves as the core of the evaluation process. The hierarchy for LWP was derived indirectly from the paragraphs of the requirement documents found in Appendix A and B. Major capabilities criteria include factors such as systems performance, critical characteristics, and integrated logistics support. Subcriteria under each major category reflect ORD subparagraphs and specific design limitations or operational specifications. The initial hierarchy was developed and presented to the proponent and study sponsor for review and comment. The final hierarchy structure was coordinated with the project sponsor and the U.S. Army Quartermaster Center and School (USAQMC&S), Combined Arms Support Command (CASCOM), and other proponent representatives.

Since the relative importance of each criteria is not equal, a series of pairwise comparisons were necessary to assess the relative significance of one criteria versus another. Through the software, all of the individual comparisons are synthesized into an overall evaluation of importance of those factors. Results of the synthesis are expressed as criteria weights. Strawman comparisons were developed by a team from BRTRC and were reviewed and adjusted by representatives of the USAQMC&S at the direction of the study sponsors. Inconsistencies in the pairwise comparison process reflected as an "inconsistency (IC) index" were resolved to insure that the IC was below the recommended level of 0.1. The resultant hierarchy is depicted in Figure 3-1 and in also Appendix B. Appendix C presents a detailed summary of the individual pairwise comparisons.

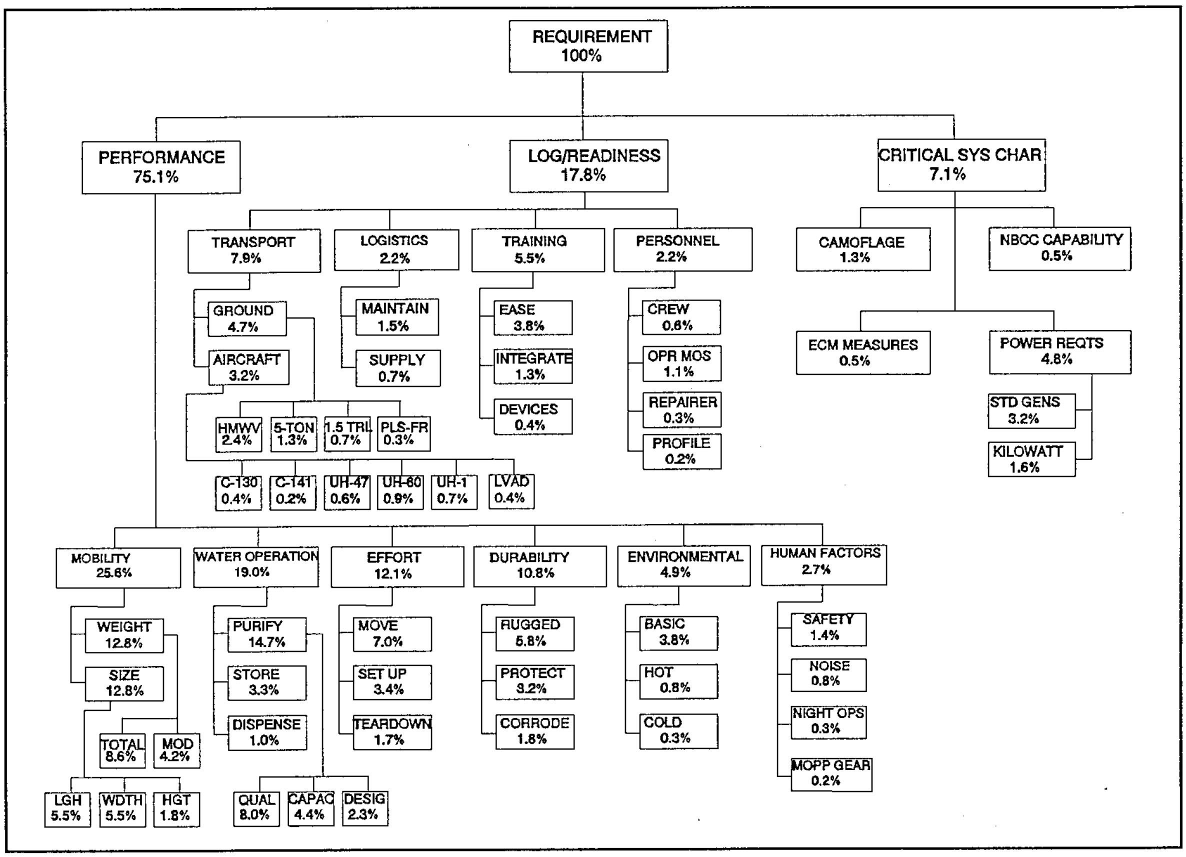

Figure 3-1 Lightweight Water Purifier (LWP)
Evaluation Hierarchy

3.2.2 Analysis of Alternatives versus Operational Hierarchy

Appendix D presents the results of the overall operational evaluation. Information is provided for each of the alternatives investigated in both verbal and numerical form for each subcriteria. Input data for these investigations was derived from technical manuals, field manuals, performance reports, and other sources. Where hard data was not available, engineering judgment was used to supplement information to fill voids. Principal selected performance features are displayed in Figure 2-1. Results are expressed in ratio scale for each of the major operational criteria and the composite overall evaluation. Figures 3-2 and 3-3 depict these results in both tabular and graphical form.

	SYSTEM PERFORM-ANCE	LOG/READI -NESS CRITERIA	CRITICAL SYSTEMS CHARACT	OVERALL EVALUATION
LWP	.373 (1)	.422 (1)	.226 (2)	.371 (1)
SHIP BY AIR	.264 (2)	.331 (2)	.417 (1)	.287 (2)
600 REBUY	.182 (3)	.124 (3)	.178 (3)	.171 (3)
600 GPH REBUILD	.182 (3)	.124 (3)	.178 (3)	.171 (3)

Figure 3-2 Operational Criteria Evaluation Results

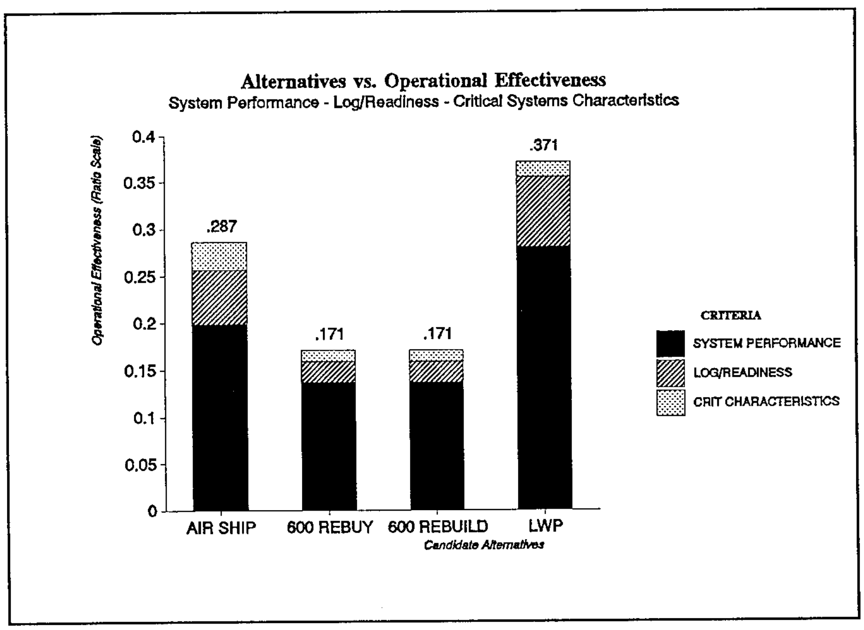

Figure 3-3 Graphical Results of Evaluation

The figures reveal that the LWP is the best overall alternative. Based on the hierarchy and relative importance of the criteria, LWP is rated as 29 percent more operationally effective than the Base Case of Shipping Water by helicopter. It is also 117 percent more effective overall than the 600 GPH REBUY or the 600 GPH REBUILD options. The LWP ranks as the number one choice in two of three major criteria. Details of these rankings will be explored further in the following paragraphs.

3.2.3 Major Elements of the LWP Hierarchy

In order to obtain a more exact representation regarding each of the alternatives, it is necessary to look at individual elements within the hierarchy. Five major subcriteria at the third level of the hierarchy comprise 75.4 percent of the total capability required. These are: mobility in terms of size and weight (25.6%), water operations including purification quality, capacity, storage, and dispensing capabilities (19.0%), effort to move, set-up, and tear down (12.1%), durability (10.8%), and transportability (7.9%). A closer inspection of these areas provides additional insight into the advantages and disadvantages of each of the alternatives.

3.2.3.1 Mobility. System mobility is driven not only by the size and dimensions of the system but also by the total system weight and individual weight of the largest module. The optimal system must be compatible with the forces to be supported and thus must be as small and mobile as possible. Figure 3-4 displays mobility characteristics of the alternatives.

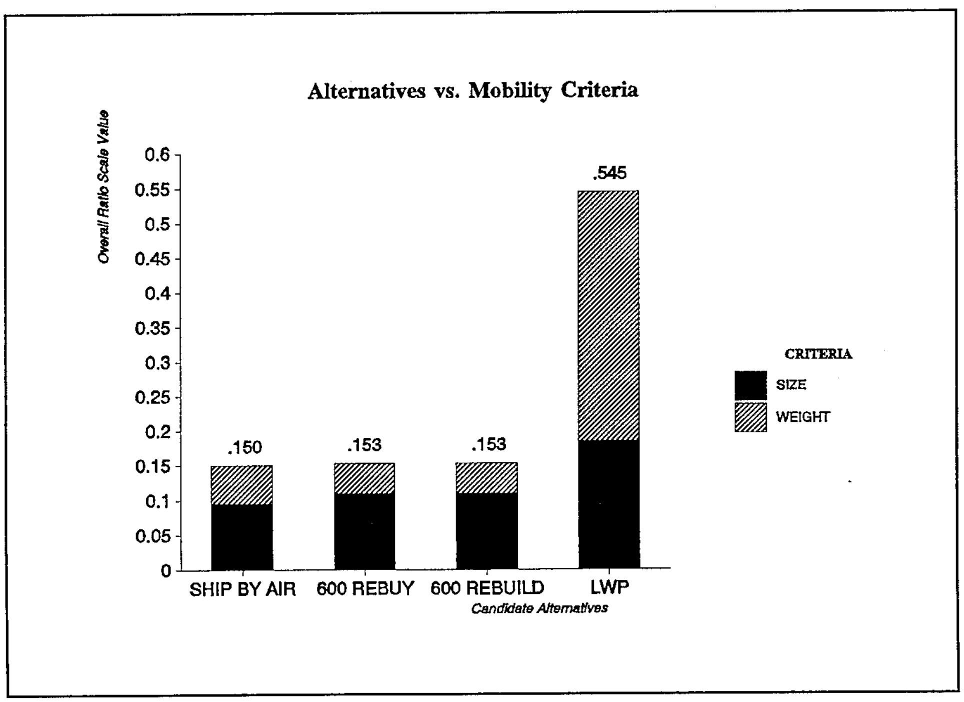

Figure 3-4 Comparison of Mobility Characteristics

Three of the alternatives are essentially equivalent with respect to mobility. Both of the 600 GPH ROWPU options display a slight edge over the Base Case Ship by Air with regard to size. The Base Case offsets this benefit with a lower total and module weight. However, the LWP demonstrates a significant advantage in both size and weight. The mobility advantage of the LWP is more than 2.5 times that of the other alternatives.

3.2.3.2 Water Purification Operations. Water Operations reflect the quality of the product water, as well as, the production-storage-dispensing capacities of the systems. Figure 3-5 displays relative ability of the alternatives to produce potable water based on these factors.

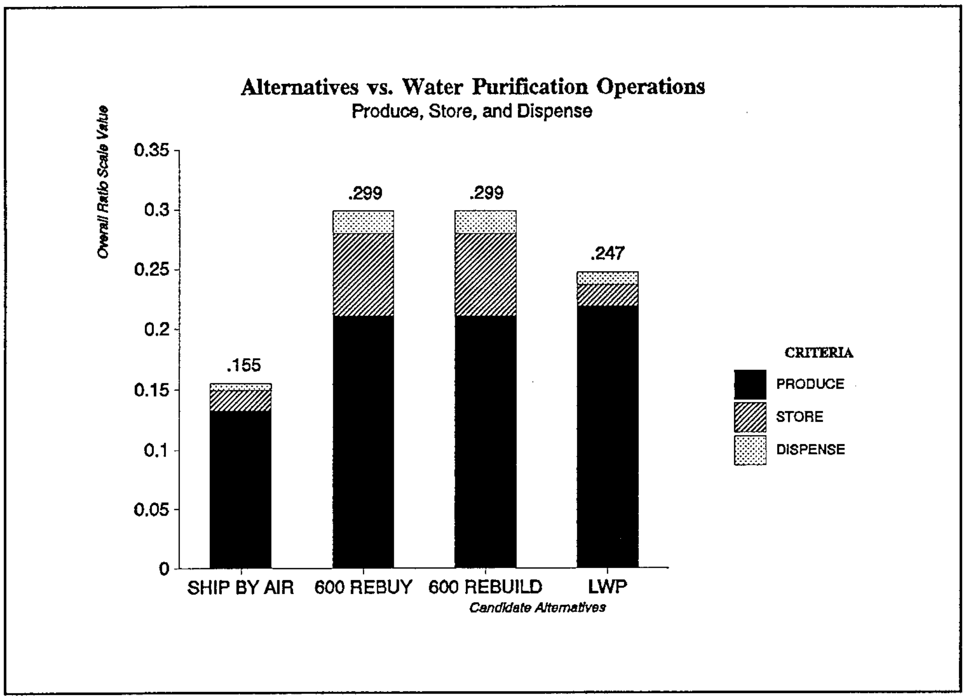

Figure 3-5 Comparison of Water Purification Operations

Both of the 600 GPH ROWPU options (Rebuy or Rebuild) show better performance in the area of water purification operations. These systems are 21 percent more effective than the LWP and 93 percent better than shipping the water by air. The 600 GPH systems reveal an excess production capacity which is more than four times the estimated peak demand. This advantage in capacity is balanced by the LWPs ability to produce water meeting the higher EPA standards of quality. Therefore, the 600 GPH systems and the LWP are about equal in purification capabilities. The Ship by Air alternative is the least flexible since production and storage is limited to the 720 gallon - 3 drum package. Increasing the size or number of drums to upgrade this characteristic would necessarily produce severe offsets in mobility and transportability criteria. The dispensing advantage goes to the 600 GPH systems.

3.2.3.3 Effort and Time Characteristics. These characteristics show the combined effects of the time and effort required to move the system, set it up for operations, and tear the system down for relocation or redeployment. Figure 3-6 displays relative system performance based on these factors.

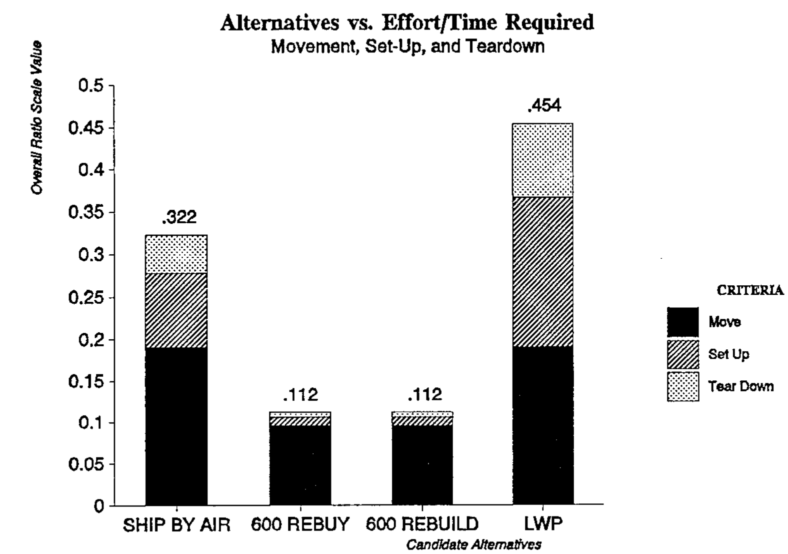

Figure 3-6 Comparison of Effort & Time Characteristics

Here, the LWP emerges as the preferred system. The LWP shows a 41 percent advantage over the Ship by Air alternative and a three-fold advantage over the 600 GPH ROWPUs. Initial movement of either of the 600 GPH systems requires substantially more effort due to the number of modules (i.e. pumps, filters, etc.) which must be downloaded from the transport vehicle. Material Handling Equipment must be made available in order to move the 30 KW generator power source. The LWP can be man-handled into position relatively easily by two persons. No more than four are expected for the heaviest of the LWP modules. Even the 250 gallon water drums can theoretically be rolled from the platform after derigging (or off the back of a HMMWV) to their final location fairly quickly by several (6-8) persons on generally flat terrain. As discussed earlier, gross bulk and weight of the individual drums have the most impact here. Actual set-up favors the LWP since it can be placed into full operation by one person in less than 45 minutes. The number of components and piping and electrical connections required for the 600 GPH systems is reflected in the higher overall set up and tear down effort required (estimated at 4 to 8 man-hours). Thus, the lower performance values in ratio scale.

3.2.3.4 Durability Characteristics. System durability characteristics reflect the ability of the alternatives to meet the demands of field handling under adverse conditions. Ruggedness of construction, resistance to corrosion, and protection afforded from the elements are the prime criteria. Figure 3-7 displays relative durability based on these factors.

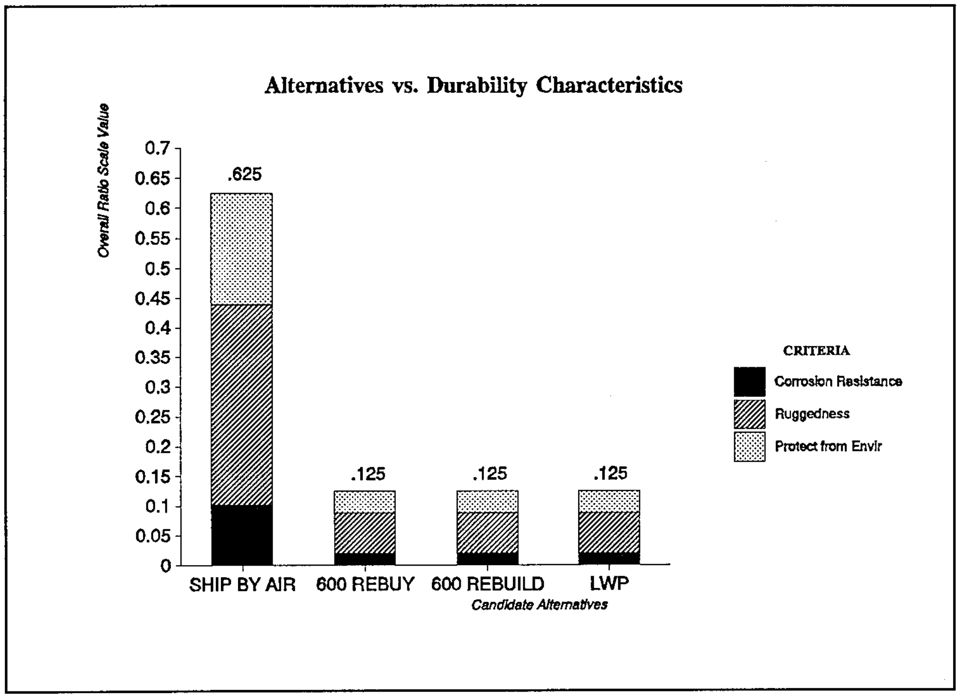

Figure 3-7 Comparison of Durability Characteristics

The Ship by Air option is favored by a wide margin in durability characteristics. Relatively speaking, using the collapsible water drums provides a solution that is about four times the durability of any of the other systems. The drums themselves are sufficiently rugged that they can be air dropped, rolled, and dragged with little difficulty. They are intended to withstand rough handling and reuse provided adequate care is taken to prevent accidental puncture. The materials used for the drums is designed to resist corrosion and the effects of wind, dust, dirt, and other environmental conditions. Both the 600 GPH and LWP contain modules that are exposed and susceptible to the environment and thus are shown here with about the same durability ratings.

3.2.3.5 Transportability. Transportability encompasses criteria related to both ground and air deployability by various vehicles available to units or support elements and aircraft normally used for tactical airlift. Figure 3-8 displays relative system transportability characteristics based on these factors.

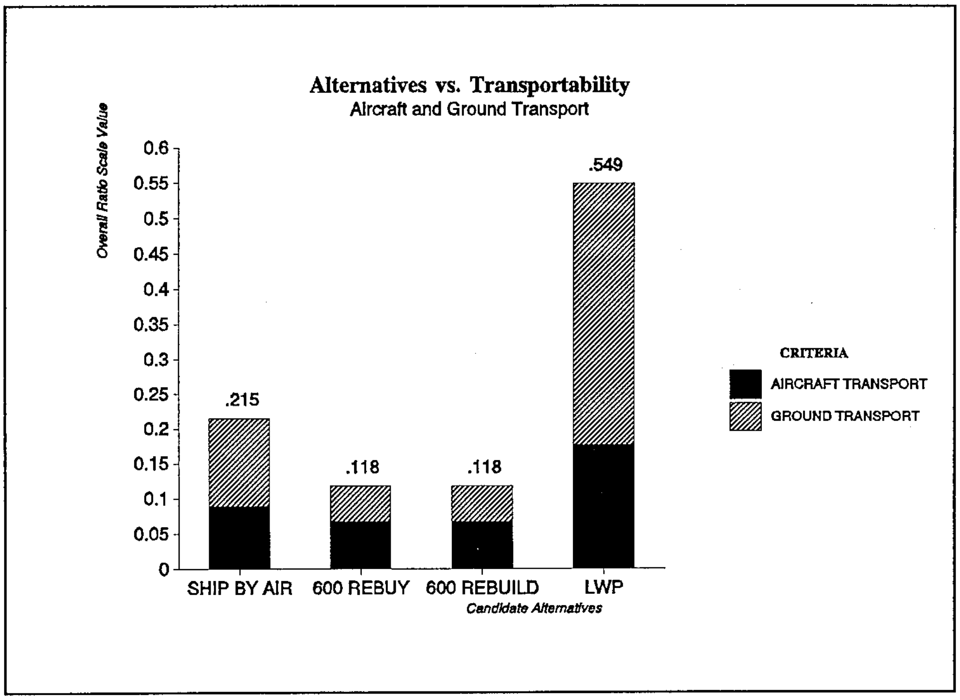

Figure 3-8 Comparison of Transportability Characteristics

From a total transportability point of view, the LWP is clearly the best option among the alternatives. It is almost twice as transportable as the Base Case of Shipping the water by Air and nearly five times better than the 600 GPH systems with respect to overall transportability. Only the LWP can be transported by the HMMWV in a single lift. A minimum of three HMMWVs are necessary to move the water drums (i.e. 1 per drum). The 600 GPH systems require a vehicle with at least a 5 ton capacity. Use of a 1.5 ton trailer is only compatible with the LWP. From an aircraft perspective, only the LWP can be inserted in a single lift by a UH-60 helicopter. A single UH-60 can also accommodate the Base Case Shipment of Water Drums. However, two lifts are required for the 600 GPH systems. External lift for any system is possible using the CH-47D. One C-130 sortie is required to transport four LWPs mounted on a HMMWV in a roll on/roll off configuration. As many as 10 to 13 LWP can be loaded onto a C-130 depending on the load orientation. Four skid mounted 600 GPH ROWPUs or four rigged Type II platforms can be transport in a single C-130. For transport in the C-141, eight LWPs mounted on HMMWVs or eight rigged platforms can be transported in a single sortie. Six 600 GPH ROWPUs can be transported by C-141. Low Velocity Airdrop is the only area where the 600 GPH ROWPU or Ship by Air option displays an advantage over the LWP. An airdrop capability for the LWP is required but may not be fully achievable using a commercial item and component strategy without added development costs. The capability was not credited to the LWP for this comparison.

3.2.4 Summary Results

The principal conclusion that can be derived from this analysis is that the LWP offers significant advantages in many of the major systems performance and logistics/readiness criteria. The LWP is the number one ranked candidate considering the composite overall criteria and the Systems Performance and Logistics and Readiness Criteria. Only in the realm of Critical Systems Characteristics (CSC) does the LWP place 2nd to the Base Case Ship by Air Option. For the five major subordinate criteria at the third level of the hierarchy, the LWP demonstrates clear advantage in 3 of 5 areas with respect to mobility, time and effort required, and transportability. With respect to water purification operations, the LWP rates about 21 percent below the combined purification, storage, and dispensing capability of the 600 GPH ROWPUs. This, however, represents the single most important advantage of the 600 GPH over the LWP and actually represents an excess capacity. Due to its size/weight and complexity, the 600 GPH systems are handicapped in many of the ORD criteria. The Base Case - Ship by Air alternative's prime major advantage is in the CSC and durability criteria.

3.2.5 Operational Sensitivity Analysis

Appendix D consists of a series of charts and graphs which capture the sensitivity of adjustments in the weights of the criteria of the LWP evaluation hierarchy. All comparisons are presented in ratio scale. The charts indicate that the selection of the LWP is not sensitive to variations in weightings two of the three the major level 2 criteria. Regardless of the specific weight placed on systems performance and Log/Readiness criteria, the LWP is always the preferred alternative. Selection of the LWP is somewhat sensitive, however, to the weighting of Critical Systems Characteristics if the base weighting of 7% is increased five-fold to above 35%. Such a weighting would indicate relative equality of the three chief factors and is presumed to be not very likely. Several of the individual level 3 criteria were determined slightly sensitive to the selection of the Base Case Ship by Air option. However, specific weightings must be increased (or decreased in some cases) by factors of 2 to 10 in order to make a difference in the overall selection. Decrease in emphasis on mobility (34 to 9%) or transportability (44 to 23%) leads to selection of the Base Case. Increases in the weightings of durability (14 to 30%), water operations (25 to 84%), logistics (12 to 41%), training (31 to 60%), or human factors (4 to 37%) have similar impacts on selection. All of the remaining level 3 criteria are insensitive to variations in weights. Based on the magnitude of change required, the choice of the LWP is not sensitive to moderate variations in the weightings of individual criteria. Further sensitivity analysis is included in the charts at Appendix D.

A series of four different types of charts or diagrams are included in this analysis. Each type requires a brief explanation:

- Barcharts. The barchart presents criteria weights on the left and resultant ratio scale values for each of the alternatives on the right. The first barchart shown within a series reflects the results at the initial criteria weightings. Subsequent charts examine the impact of varying individual criteria weights.

- Performance Illustrations. These illustrations depict criteria along the horizontal axis. The length of the vertical bar above a criteria indicates its weight which can be read from the left hand scale. Ratio scale values for each approach can be determined for each criteria from the right hand scale. The intersection of the criteria line with each of the approaches reveals their relative rankings for that measure of effectiveness. Combined or overall values for those criteria are shown in the far right column.

- 2-dimensional plots. These plots are used to compare two criteria simultaneously. Axes are labeled in ratio scale. In general, the more preferable characteristics would result in a plot in the upper right quadrant. Less preferable alternatives appear in the lower left quadrant. Tradeoffs are identified in the remaining sections.

- Gradient diagrams. These diagrams show the rankings of the approaches in ratio scale as the weighting or priority of a given criteria is altered. The vertical line indicates the baseline weight from Figure 3-1. The impact of varying the weight of the criteria can be deduced from the relative positions of the approach lines at the adjusted weight.

3.2.6 <u>Conclusions of the Operational Requirement Analysis</u>

The major conclusions of the Operational Requirement Analysis are summarized as follows:

- That the LWP exhibits the highest potential of the alternatives considered for meeting the capability requirements stated in the Operational Requirements Document (ORD).

- That the LWP offers best characteristics with regard to overall capability (29% better than the Base Case and 117% better than the 600 GPH ROWPU), systems performance (41% better than the Base Case and 105% better than the 600 GPH), and Log/Readiness criteria (27% better than the Base Case and 240% better than the 600 GPH).

- That the LWP offers a significantly greater potential with respect to mobility, transportability, and effort required to move, set up, and tear down the system. LWP is also significantly more smaller and lighter than the Base Case.

- That the 600 GPH ROWPU offers higher production and storage capacity; but is less mobile and transportable than the Base Case and significantly less mobile than the LWP. This excess capacity in the 600 GPH represents a tradeoff for size and weight.

- That the selection of LWP is not very sensitive to the exact weightings of major criteria at the 2nd and 3rd level of the evaluation hierarchy.

- That the Rebuilt 600 GPH system offers identical capabilities as a Rebuy of the 600 GPH ROWPU.

3.3 COSTS

3.3.1 General Methodology

The cost analysis for this Cost and Operational Effectiveness Analysis (COEA) was conducted in accordance with the guidance set forth in the DoD 5000 series Directives and Instructions, the Training and Doctrine Command (TRADOC) Pamphlet 11-8 (Draft), and other applicable references. In particular, the cost analysis utilized the concept of Decision Cost developed in that TRADOC publication. The general methodology consisted of the following steps:

(1) A determination was made of the decision costs associated with selection of each of the four approaches. Decision cost categories include both dollar costs and non-dollar costs.

(2) A comparison of the decision costs for each approach was performed.

(3) Trade-off, sensitivity, and uncertainty analyses were conducted.

(4) The Decision Cost Estimates were validated by the Belvoir Cost Analysis Office on October 25,1994.

(5) When the Operational Requirements Document (ORD) was changed to increase the Army requirement from 37 to 50 LWPs, the decision costs for each approach were revised.

(6) The Trade-off, sensitivity, and uncertainty analyses were revised to be consistent with the revised Decision Cost Estimates.

(7) The revised Decision Cost Estimates are being submitted for validation to the Cost Analysis Division, TACOM, since the Belvoir Cost Analysis Office has been disestablished and its functions transferred to TACOM.

3.3.2 Dollar Decision Costs

3.3.2.1 Development of Dollar Decision Costs

3.3.2.1.1 General

(1) All costs were estimated in thousands of FY 1996 Constant Dollars and converted into Current Dollars using Inflation Guidance from Memo, Headquarters, Army Materiel Command (AMCRM-CE), dated 1 February 1995.

(2) All costs through 1994 were considered Sunk Costs and excluded from the Decision Cost Estimates.

(3) In accordance with Draft TRADOC Pamphlet 11-8, Para 3-3.c.1 (page 25), Military Personnel Costs (Cost Category 4.0) were excluded from Decision Costs, although they are included in the Program Life Cycle Cost Estimate (LCCE) for the Lightweight Water Purifier (LWP). (Since the LWP requires no crew, Military Personnel Costs for this system are, in any case, only those for maintenance personnel.)

3.3.2.1.2 Base Case: Shipping Water in by Helicopter or Fixed Wing Aircraft

The current system represents the Base Case. The mission of supplying water and other supplies to SOF in operating areas is assigned to the 528th Special Operations Support Battalion (Airborne). This unit has four 600 GPH ROWPUs. The water section normally sets up a consolidated water point at a convenient location. The water is then delivered to the supported forces in the operating area by helicopters or airdropped from fixed wing aircraft. More detailed information is included in Section 2.2 above.

Since this alternative involves no RDT&E and no acquisition of new equipment, a detailed Decision Cost Estimate was not prepared. Instead the O&M costs of transporting the water over 20 years were estimated as follows:

- Assume 125 people to be supported with 6 gallons per day per person.
  Thus the requirement = 125 * 6 = 750 gallons per day.
  This equates to three 250-gal collapsible water drums per day.

- Assume two 15-day exercises per year supported by helicopters for a total of 30 days per year. This assumption is extremely conservative. It agrees with the Operational Mode Summary/Mission Profile (OMS/MP) for the LWP for peacetime training missions. For operations other than war, however, operations may last up to one year. Similarly, for wartime missions, the OMS/MP anticipates durations of three months to one year.

- Assume the UH-60A is used to transport the water. A UH-60A can transport 3 drums per mission as an external load. Thus one mission each day is required for water.

- Assume an average one-hour flight each way from airfield to water point to operating area * 30 days per year = 60 flight hours per year.

Then operating costs of UH-60 will be:

Depot level reparables: (FY96$)	\$1462.35/hour[1] * 60 hrs/year * 20 years * 50 systems =	\$87,741K
Consumables: (FY96$)	323.15/hour * 60 hrs/year * 20 years * 50 systems =	\$19,389K
POL: (FY96$)	88.05/hour * 60 hrs/year * 20 years * 50 systems =	\$ 5,283K
	Total operating costs for 20 years =	\$112,413K

(FY96$).

These costs are, of course dependent on the assumptions discussed above. The effect of changing these assumptions is investigated in the Trade-Off Analyses in Section 3.4 below.

For this alternative, the water is assumed to be available in the base area, either from Host Nation Support or from an operating rear area water supply point. **Therefore no costs are included for purifying the water.**

3.3.2.1.3 600 GPH ROWPU - Rebuy of Marine Corps Version

As Section 2.2.2 indicates, this alternative consists of using the 600 GPH ROWPU for Special Operations Forces (SOF) as an alternative to developing and acquiring the Lightweight Water Purifier (LWP).

For this alternative, the US Marine Corps version of the 600 GPH ROWPU is used. This unit differs from the Army version in that it is skid mounted, and the 5-ton, 4-wheel tandem trailer is not included. A separate 30 kw generator, such as LIN J36109, NSN 6115-00-1118-1240, is required. The unit is capable of producing drinking water from polluted fresh water, brackish water, and sea water. It is also capable of removing chemical and radiological contaminants from the water.

The Marine Corps version of the 600 GPH ROWPU is lighter than the Army version and weighs only 7,300 pounds. The generator, LIN J36109, weighs an additional 2,850 pounds. Since it is lighter than the trailer-mounted Army version, the Marine Corps version is more suitable than the Army version for SOF missions. The unit and its generator could be transported to the SOF operating area by a UH-60A or CH-47D

1. Cost per hour of Depot Level Reparables, Consumables, and POL for UH-60A from USA CEAC Memo: FY 96 President's Budget Materiel System Sustainment Cost Factors, 13 January 1995.

helicopter -- in both cases as external loads. Alternatively, the ROWPU and the generator could be airdropped into the operating area by a C-130 or larger aircraft.

Although it is possible that surplus units could be obtained from the Marine Corps and rebuilt, this Cost Estimate assumes a rebuy. (The costs of acquiring surplus units and rebuilding them are explored in Section 3.3.2.1.4 below.) Requirements are anticipated to be the same as for the Lightweight Water Purifier (LWP); that is, 8 ROWPUs for Medical units and 42 for Special Operations Forces for a total of 50 units. The system is estimated to have a useful life of 20 years.

A detailed summary of the Decision Cost Estimate for using the 600 GPH ROWPU for Special Operations Forces, showing the assumptions, all the Cost Elements, and the breakdown of costs over the years is shown in Appendix E.

3.3.2.1.4 600 GPH ROWPU - Rebuilding Existing Units

With the drawdown of force levels, it is possible that the 50 units required could be found from Army assets. This alternative estimates the cost of acquiring and rebuilding the 600 GPH ROWPUs from service excesses.

Since the ROWPUs and generators are already in the field, both RDT&E Costs and Procurement Costs for this alternative are Sunk Costs and hence are excluded from the Decision Cost Estimate. However, it is assumed that the units would need to be rebuilt or overhauled before issue, as they have been in the field for 10-15 years. The overhaul is estimated to cost 50% of the procurement costs for new units. Except for the overhaul costs and the costs of transporting the units to the depot and from the depot to the SOF units, the O&M Costs would be the same as for the rebuy alternative above.

A detailed Decision Cost Estimate was not prepared for this alternative. As indicated above, there are no RDT&E Costs and no Procurement Costs. The only additional Cost Elements needed for O&M Costs are Depot Overhaul Costs and Transportation Costs to and from the depot. These costs were estimated as follows:

Depot Rebuild or Overhaul Costs:

Estimated to be 50% of cost of ROWPU and generator = 0.5 * ($92.445K + 16.995K)(FY96$) = 0.5 * $109.440K * 50 units = $2,736.0 (FY96$) (Costs from December 1995 AMDF, using NSNs 4610-01-6287 and 6115-118-1240 and inflating to FY96$.)

Transportation to Depot and from Depot to SOF Units.

Weight ROWPU	=	7,300 pounds
Weight Generator	=	2,850 pounds
Total	=	10,150 pounds + 10% for packing/2000 = 5.58 ST

Shipping cost per ton = $121.41 (FY85$)/0.7121 = $0.17050K (FY96$)

Total transportation cost = 2 (round trip) * 5.58 ST * 0.17050$K per ST * 50 units = $95.139K (FY 96$)

3.3.2.1.5 Lightweight Water Purifier (LWP)

The Lightweight Water Purifier (LWP) is being developed to support small units and detachments, particularly Special Operations Forces (SOF) and small health care units, in low intensity conflict, nation building, civil affairs actions, peacekeeping, disaster relief operations, early entry, long range surveillance, and additional operations other than war (OOTW). It will be lightweight and highly mobile for deployment in areas where road nets and host nation water supply may be limited or unavailable. The LWP will purify salt, brackish, and fresh waters and water contaminated with nuclear, biological, and chemical (NBC) agents. A more detailed description and characteristics are included in Section 2.2.

Although the Mission Needs Statement for the Lightweight Water Purifier (LWP) was approved on 6 October 1993, the Operational Requirements Document (ORD) has not yet been approved. Present plans call for a Milestone I/II in the second or third quarter of FY 1996 and Milestone III in the first quarter of FY 1998. Requirements are anticipated to be 8 LWPs for Medical units and 42 for Special Forces for a total of 50 units. The system is estimated to have a useful life of 20 years.

Appendix F contains a detailed summary of the Program Life Cycle Estimate for the LWP, showing the assumptions, all the Cost Elements, and the breakdown of costs over the years. It should be noted that this is a **Program Life Cycle Estimate (PLCCE)**. To obtain the Decision Costs for the LWP, personnel related costs (Cost Category 4.0 and Cost Elements 2.11 and 5.11) must be subtracted in accordance with TRADOC guidance.

3.3.2.2 Comparison of Constant Dollar Decision Costs

Figure 3-9 presents a comparison of the Decision Costs of these alternatives in thousands of FY 1996 constant dollars. In order to simplify this presentation, only the most significant Cost Elements are listed in this figure. Listings of all the Cost Elements for each Decision Cost Element, as well as breakouts over the program years, are included in Appendices E and F. In developing the Decision Costs, the analyst carried calculations to eight significant figures for accuracy. In accordance with TRADOC guidance, however, the costs in this figure have been rounded to four significant figures. Because of this rounding, the numbers may not add to the totals shown.

	BASE CASE: SHIPPING WATER TO OPERATING AREA	600 GPH ROWPU FOR SOF: REBUY	600 GPH ROWPU FOR SOF: REBUILD	LWP
APPENDIX	N/A	E	N/A	F
1.0 RDT&E	**0.0**	**0.0**	**0.0**	**2,433.0**
1.01 Development Engineering	0.0	0.0	0.0	1,101.0
1.04 Prototype Manufacture	0.0	0.0	0.0	272.5
2.0 PRO-CUREMENT	**0.0**	**6,418.0**	**0.0**	**2,823.0**
2.021 Manufacturing	0.0	5,472.0	0.0	1,849.0
3.0 MIL CONSTRUCTION	0.0	0.0	0.0	0.0
4.0 MIL PERSONNEL	0.0	0.0	0.0	0.0
5.0 O&M (20 yrs)	**112,400.0**	**5,362.0**	**8,193.0**	**4,338.0**
5.03 Depot Level Reparables	87,740.0	2,311.0	2,311.0	973.3
5.04 Consumables	19,390.0	2,631.0	2,631.0	2,372.0
5.05 POL	5,283.0	320.0	320.0	357.1
5.06 Depot Overhaul	0.0	0.0	2,736.0	535.3
5.07 Transportation to and from Depot	0.0	0.0	95.1	0.0
TOTALS	**112,400.0**	**11,780.0**	**8,193.0**	**9,594.0**

Figure 3-9 Dollar Decision Costs in Thousands of FY 1996 CONSTANT Dollars

(Because all Cost Elements are not included, the figures will not add to the totals shown.)

3.3.2.3 Analysis of Constant Dollar Decision Costs

From Figure 3-9 it is clear that the Base Case -- purifying the water in a secure base area and shipping it by helicopter to the SOF operating areas -- is the most expensive of the four alternatives. Its total Decision Cost, about $112.4 million, is over $100 million higher than any other alternative. Even though this alternative requires no RDT&E or Procurement, the costs of shipping the water for 20 years by aircraft (assumed to be the UH-60A for cost purposes) are very high indeed.

The least expensive alternative is the 600 GPH ROWPU, provided that the equipment can be obtained from stocks and rebuilt or overhauled. As Section 3.3.2.1.3 indicates, the Marine Corps (skid mounted) version was used, since it appears to be less unsuitable for use by light forces than the heavier Army (trailer mounted) version. The RDT&E and Procurement Costs for this alternative are Sunk Costs and hence are excluded from the Decision Cost Estimate. However, the cost estimate assumes that rather extensive rebuild or overhaul would be required. Even with these overhaul costs, the total Decision Cost is less than $8.2 million.

A rebuy of the Marine Corps 600 GPH ROWPU would increase the Total Decision Costs about $3.5 million over the rebuild alternative. The total Decision Cost of this alternative, about $11.8 million, makes it more expensive than any of the other alternatives except for shipping the water to the operating area by aircraft.

The costs of the Lightweight Water Purifier (LWP) are between those for the 600 GPH rebuy and the rebuild alternatives. Even though it includes both RDT&E and Procurement, its total Decision Costs are only about $1.4 million **more** than those for the rebuild alternative and are about $2.2 million **less** than the rebuy of the 600 GPH ROWPU. The LWP is, of course, a smaller system than the 600 GPH ROWPU, and its procurement and operating costs are estimated to be much lower. These much smaller procurement and O&M costs offset the RDT&E costs required for the LWP but not for the other systems.

3.3.2.4 Current Dollar Decision Costs

Figure 3-10 presents a comparison of the Decision Costs of the three alternatives in thousands of CURRENT dollars. Because of inflation, the figures are naturally all considerably higher than those in constant dollars.

As both the figure and the discussion in Section 3.3.2.3 indicate, the costs for the different alternatives are distributed differently among the cost categories. Only the LWP incurs RDT&E Costs, and the Base Case and the Rebuild Alternative for the 600 GPH ROWPU have no Production Costs. These differences in distribution do not affect the total Decision Costs in Constant Dollars. In Current Dollar Costs, however, the effects of inflation on these different distributions make a substantial difference. RDT&E expenditures occur in the early years of the program and hence are not affected a great deal by inflation. The O&M Costs,

	BASE CASE: SHIPPING WATER TO OPERATING AREA	600 GPH ROWPU FOR SOF: REBUY	600 GPH ROWPU FOR SOF: REBUILD	LWP
APPENDIX	N/A	E	N/A	F
1.0 RDT&E	**0.0**	**0.0**	**0.0**	**2,509.0**
1.01 Development Engineering	0.0	0.0	0.0	1,134.0
1.04 Prototype Manufacture	0.0	0.0	0.0	277.6
2.0 PRO-CUREMENT	**0.0**	**7,527.0**	**0.0**	**3,313.0**
2.021 Manufacturing	0.0	6,428.0	0.0	2,172.0
3.0 MIL CONSTRUCTION	0.0	0.0	0.0	0.0
4.0 MIL PERSONNEL	0.0	0.0	0.0	0.0
5.0 O&M (20 yrs)	**184,500.0**	**8,800.0**	**11,900.0**	**7,119.0**
5.03 Depot Level Reparables	144,000.0	3,793.0	3,793.0	1,597.0
5.04 Consumables	31,820.0	4,318.0	4,318.0	3,893.0
5.05 POL	8,670.0	525.2	525.0	586.1
5.06 Depot Overhaul	0.0	0.0	2,990.0	878.6
5.07 Transportation to and from Depot	0.0	0.0	105.5	0.0
TOTALS	**184,500.0**	**16,330.0**	**11,900.0**	**12,940.0**

Figure 3-10 Dollar Decision Costs

(In Thousands of CURRENT Dollars)

on the other hand, are spread over the 20-year life of the equipment and thus are greatly affected by inflation. Therefore the alternatives with a large proportion of O&M Costs -- the Base Case, and the 600 GPH ROWPU -- are most heavily affected by inflation. Since the LWP has the lowest proportion of O&M Costs, its costs are much less affected.

The result in this case, as Figure 3-10 indicates, is that the costs in current dollars for the LWP are closer to those for the Rebuild Alternative for the 600 GPH ROWPU. The difference in current dollars is only $1.04 million -- about 8% of the total. This difference is about the same as the margin of error of the estimates. Consequently it would be accurate to say that these two alternatives **cost about the same in current or budget dollars**.

For the reasons discussed above, the differences in cost between these two systems and the more expensive alternatives are greater in current dollars than in constant dollars. A rebuy of the Marine Corps 600 GPH ROWPU would increase the Total Decision Costs about $4.4 million in current dollars over the rebuild alternative. Likewise, the Base Case -- purifying the water in a secure base area and shipping it by helicopter to the SOF operating areas -- is still the most expensive of the four alternatives. Its total Decision Cost, about $184.5 million in current dollars, is about $172 million more than the least expensive alternatives.

3.3.3 Non-Dollar Decision Costs

3.3.3.1 Comparison of Non-Decision Costs

Figure 3-11 presents a comparison of the Non-Dollar Decision Costs of the alternatives. Since the Non-Dollar Costs for the Rebuy and the Rebuild Alternatives are the same, they are combined in a single column.

3.3.3.2 Analysis of Non-Decision Costs

As the first row of Figure 3-11 indicates, the estimated deployment weights of the different systems vary considerably. The Base Case, shipping the water to the SOF operating area by aircraft, would require shipping three 250-gallon drums per day. The weight of three drums filled with 240 gallons of water each is about 3.3 Short Tons (ST) for delivery by helicopter. (Three drums on a platform and rigged for air drop weigh about 4 ST.) The Marine Corps version of the 600 GPH ROWPU and its generator weigh just over 5 ST. The LWP is much lighter, with an estimated weight of only about 0.5 ST. In addition, both of these systems would require only **one** deployment to and from the operational area, while shipping the water in by helicopter would require that the three drums of water be shipped in every day throughout the exercise.

	BASE CASE: SHIPPING WATER TO OPERATING AREA	600 GPH ROWPU FOR SOF: REBUY OR REBUILD	LWP
Estimated Deployment Weight (ST)	3 Drums = 3 * 1.1 = 3.3 ST per Day	ROWPU: 3.65 ST + Gen: 1.43 ST = 5.08 ST	Estimated 0.50 ST
Operating Time (800 gallons from Fresh Water)	Flight Time Estimated at 1 Hour Each Way + Production & Rigging Time	About 1 Hour	About 6 Hours (ORD: OMS/MP)
Fuel Consumption for 800 Gal per day	2 * 113.3 = 226.6 gal/day (UH-60 Helicopter)	2.13 gal/day (1 hour)	Est 0.62 gal/hour = 3.72 gal/day
SOF Crew Required	No (But aircraft Crew)	Yes: 2 (MOS 77W)	No (Additional Duty)
Transportable by C-130	Yes	Yes	Yes
Moveable by Hand (2-4 soldiers)	No	No	Yes
Transportable by HMMWV	Yes: 3 (1 Drum Each)	No (Overweight)	Yes: 1
Transportable by Helicopter	Yes UH-60A (External)	Yes UH-60A (External)	Yes UH-60A (Internal)
Helicopter Sorties Required	1 per day	2 (for each insertion and extraction)	1 (for each insertion and extraction)

Figure 3-11 Non-Dollar Decision Costs

Fuel consumption is also quite different for the different systems. To transport 750 gallons per day to the operating area by helicopter would require about 227 gallons of fuel per day, assuming an hour flight each way to the area. The generator for the 600 GPH ROWPU, on the other hand, would require just over 2 gallons for the one hour needed to produce 800 gallons of potable water from a fresh water source. The LWP is, of course, a smaller unit. According to the Operational Mode Summary/Mission Profile (OMS/MP) of the ORD, it is expected to operate for about 6 hours a day using a fresh water source. This is estimated to require about 3.72 gallons of fuel.

Only the 600 GPH ROWPU would require a crew -- the normal crew is two soldiers with MOS 77W. The LWP will be operated by a soldier as an additional duty. Although shipping the water in by aircraft would require no crew, some effort would be required to set up the water distribution point in the operating area.

All of the alternatives are transportable by C-130 aircraft and by UH-60 helicopters. The water drums and the 600 GPH ROWPU and its generator would be transported as external loads. The LWP might be transported as an internal load, an external loads, or by a combination of both.

The Draft Operational Requirements Document for the LWP states that it must be capable of being moved by 2 to 4 soldiers. The 600 GPH ROWPU and its generator are too heavy to meet this requirement -- the Marine Corps version of the ROWPU weighs 3.65 ST, and the generator 1.4 ST. Likewise, the filled water drums weigh just over one short ton each. They can be dragged for a short distance by a vehicle, but cannot be moved easily by hand. Thus only the LWP can meet the ORD requirement to be moved by hand by 2-4 soldiers.

Similarly, only the LWP can be transported by the 1¼ Ton HMMWV in one load as the ORD requires. In the Base Case, after the filled water drums have been transported to the operational area by helicopter, moving them would require 3 vehicles, each with one drum of water, or three trips by one vehicle. To move the 600 GPH ROWPU requires a 5-ton or larger cargo truck because of its weight and size.

Shipping the water to the operating area by helicopter would require a great deal of aviation support -- one UH-60 sortie per day for the duration of the operation. The 600 GPH ROWPU and the LWP, on the other hand, would require aviation support only during insertion and extraction. The ROWPU would require two sorties, one for the unit and one for the generator. One sortie will probably be sufficient for the LWP.

As this discussion indicates, these non-dollar costs are not so easy to quantify as dollar costs. Nevertheless, they need to be considered in selecting among the alternative approaches.

3.4 TRADE-OFF ANALYSES

3.4.1 Cost Uncertainties

3.4.1.1 Base Case: Shipping Water to the Operating Area by Helicopter or Fixed Wing Aircraft

All estimates are by their nature uncertain, but the uncertainties in this Cost and Operational Effectiveness Analysis (COEA) are considerably greater in some areas than in others. For the Base Case, estimates of the operating costs of the UH-60 helicopter -- replenishment parts and POL costs per hour -- are based on data published by DA and developed by the US Army Cost and Economic Analysis Center (USA CEAC) from Sample Data Collection (SDC). Consequently these estimates are probably quite accurate. On the other hand, as Section 3.3.2.1.2 made clear, the water required per day, the flight distance, and the number of exercise days per year are all based on assumptions. Varying the assumptions will obviously change the costs of the alternative.

3.4.1.2 600 GPH ROWPU - Rebuy of Marine Corps Version

The Development Costs for the 600 GPH ROWPU are Sunk Costs and hence are not included in the Decision Cost Estimate. The Manufacturing Costs are based on the cost in the June 1995 Army Master Data File (AMDF), converted to FY96 dollars. Actual production costs for the small quantity required might be somewhat higher, but will probably not be greatly different.

The estimates of O&M Costs, on the other hand, have more cost uncertainties. The item manager at Aviation and Troop Command (ATCOM) was not able to furnish data on actual consumption of Depot Level Reparables and Consumables. Consequently, based on experience with similar systems, costs of parts for the ROWPU were estimated at 5% of manufacturing cost per year. Costs for parts for the generator per operating hour, on the other hand, were based on data on a similar generator developed by the US Army Cost and Economic Analysis Center (USA CEAC) from Sample Data Collection (SDC). POL Costs per hour were based on actual data from the same source and are probably accurate. Operating hours per year, however, are only an estimate. Based on the Operational Mode Summary/Mission Profile, the LWP was estimated to operate about 744 hours per year. (See Section 3.4.1.4 for the detailed breakdown.) Since the 600 GPH ROWPU can produce the same amount of water as the LWP in about one-fourth the time, the 600 GPH was estimated to operate about 200 hours per year, including both field exercises and local training. Actual operating hours, however, might be either higher or lower than this estimate.

3.4.1.3 600 GPH ROWPU - Rebuilding Existing Units

The Decision Cost Estimates for the alternative of rebuilding existing 600 GPH ROWPUs are the same as for the rebuy, except that Procurement Costs are deleted and the costs of rebuilding or overhauling the units is added. Consequently this alternative has the same cost uncertainties as the Rebuy Alternative for Depot Level Reparables, Consumables, and POL Costs. Rebuild Costs were estimated at 50% of the cost of the ROWPU and generator. Actual rebuild costs may well be different.

3.4.1.4 Lightweight Water Purifier (LWP)

The equipment for the other alternatives, the 600 GPH ROWPU and the UH-60 helicopter, have been in the field for several years. Hence actual data or reliable estimates are available for their Procurement and O&M Costs. The Lightweight Water Purifier (LWP), on the other hand, is at an early stage in the acquisition process. Hence there are probably more uncertainties involved in these cost estimates than in those for the other alternatives.

Estimates of Development Engineering Costs are based on those for similar systems -- the 1500 GPH ROWPU and the 3000 GPH ROWPU -- scaled down for a smaller piece of equipment with less development required. If an off-the-shelf model proves to be suitable for the LWP and a pure NDI acquisition strategy can be used, these estimates may be too high. On the other hand, if components from various manufacturers are acquired and assembled into the LWP, much more time and Development Engineering might be required.

For Manufacturing Costs, the average of the costs of the commercial models recommended at the 23 May 1994 Joint Working Group Meeting was used. Obviously Manufacturing Cost for any specific model will vary from this average.

Based on experience with similar systems, it was estimated that the replenishment spares and repair parts cost for the LWP will be 5% of the Manufacturing Cost each year, divided equally between the two Cost Elements. This estimate depends on estimates of Manufacturing Cost and may be either too high or too low. It is, however, the same assumption as was made for the 600 GPH ROWPU. Although the LWP may use host nation power or power from a common power plant, for costing purposes it is assumed to use a separate generator comparable to a PU-625 power unit (2 * 3 kw). Estimates of costs for parts and POL for this unit are based on data published by DA and developed by the US Army Cost and Economic Analysis Center (USA CEAC) from Sample Data Collection (SDC). Based on the Operational Mode Summary/Mission Profile (Annex B to the ORD), the LWP was estimated to operate an average of 744 hours per year (120 days per year, 5% at 10 hours per day and 95% at 6 hours per day). This includes all local training as well as more extensive field training. Actual operating hours may be higher or lower than this estimate.

3.4.2 Sensitivity Analyses

3.4.2.1 General

In the sensitivity analyses the values of the input parameters in each area of uncertainty identified above were varied one at a time. The purpose of these analyses was to determine whether the outputs are sensitive to the input changes, to bound the estimates, and to highlight the cost drivers. This section reports the results of these analyses.

3.4.2.2 Base Case: Shipping Water in by Helicopter or Fixed Wing Aircraft

As Section 3.4.1.1 indicated, operating costs per hour for the helicopter are based on actual data and hence are probably accurate. Consequently the Sensitivity Analysis concentrates on varying the assumptions.

If the number of personnel supported were decreased from 125 to 60, the amount of water required would decrease to 360 gallons per day. This could be supplied by one helicopter mission every other day instead of every day. In this case the total of depot level reparables and consumables would decrease to $53,570K, POL to $2,642K and total O&M Costs to $56,200K. If the number of soldiers supported remained 100 but exercises were reduced to one 15-day exercise, the results would be exactly the same. Again the total of depot level reparables and consumables would decrease to $53,570K, POL to $2,642K and total O&M Costs to $56,200K. Combining reduced numbers supported with only one 15-day exercise per year would reduce total O&M Costs to $28,100K.

On the other hand, the one-hour average flight assumed from the airfield to the water point to the operating area seems quite short. If the average flight increased to 1½ hours, total flying time for these missions would increase to 90 hours per year. This would increase the total of depot level reparables and consumables to $160,700K, POL to $7,925K and total O&M Costs to $168,600K. The magnitude of these changes indicates how sensitive these estimates are to changes in the assumed average flying time.

3.4.2.3 600 GPH ROWPU - Rebuy of Marine Corps Version

As the discussion in Section 3.4.1.2 indicated, the Manufacturing Costs are based on the cost in the June 1995 Army Master Data File (AMDF) converted to FY96 dollars. Since only 50 of the units are being procured, the actual costs could be higher than these estimates. If the actual manufacturing costs for both the ROWPU and the generator are 10% higher than those estimated, Cost Element 2.021 Manufacturing would increase to $6,019K and Total Procurement Costs to about $6,971K. These increases are within the margin of error of the cost estimates.

Costs of depot level reparables, consumables, and POL are a function of annual operating hours. In supporting SOF and medical units, the 600 GPH ROWPU was estimated in this COEA to operate 200 hours per year, including all local training as well as more extensive field exercises. This estimate was based on the Operational Mode Summary/ Mission Profile for the LWP, but it might turn out to be either too low or too high. If the unit and its generator operated only 100 hours per year, the total of depot level reparables and consumables would decrease to $2,471K, POL to $160K and total O&M Costs to $2,731K. On the other hand, the annual operating hours could well increase over the 200 hours estimated -- the original BCE for the 600 GPH ROWPU estimated that it would operate an average of 1000 hours per year, and it is designed to operate 20 hours a day for considerable periods. Since SOF usually operate in fairly small detachments, the water requirements at one location are probably not large enough to require such high production. If the 600 GPH ROWPU operated 400 hours per year, however, the total for depot level reparables and consumables would increase to $9,885K, POL to $640K, and total O&M Costs to $10,620K.

3.4.2.4 600 GPH ROWPU - Rebuild Existing Units

For this alternative the existing 600 GPH ROWPUs were assumed to require a rebuild or major overhaul before being issued to SOF units. Costs for this rebuild or overhaul were estimated to be 50% of the cost of the generator and ROWPU or 0.5 * ($92.445K + 16.995K) = $54.72K each (FY96$). If the cost of the overhaul could be reduced to one-third of the manufacturing cost, the cost for overhauling each unit would decrease to $109.440K/3 = $36.48K. The total for overhauling all 50 units (Cost Element 5.06) would then be only $1824.0K and Total O&M Costs $7,281K.

Aside from the costs for the overhaul, the operating costs for the rebuilt 600 GPH ROWPU are, of course, the same as for the rebuy. Consequently changing the assumed operating hours from 200 per year to 100 and to 400 would have the same effect. In the first case, the total of depot level reparables and consumables would decrease to $2,471K, POL to $160K and total O&M Costs (including the rebuild or overhaul) to $5,562K. If the reduced operating hours were combined with the lower overhaul costs, Total O&M Costs would be reduced to $4,650K. In the second case, increasing the annual operating hours to 400 would increase the total parts cost to $9,885, POL to $640K, and total O&M Costs to $13,450K.

3.4.2.5 Lightweight Water Purifier (LWP)

As Section 3.4.1.4 indicates, estimates of Development Engineering Costs for the LWP are based on those for similar systems -- the earlier 1500 GPH ROWPU and the 3000 GPH ROWPU -- scaled down for a smaller piece of equipment with less development. required. The result in the Program Life Cycle Cost Estimate (PLCCE) is a Development Engineering program of 3 contract manyears and 8 government manyears spread over five years. This is a relatively lean program and assumes that a suitable off-the-shelf model requiring only minor modifications can be found. If the program becomes a pure NDI approach, the effort required for Development Engineering might be reduced by as much as 25%. This would reduce Development Engineering to $826.0K and Total RDT&E to $2,158K. On the other hand, if no commercially available unit proves suitable, the modified NDI approach would change to assembling a system using NDI components from various manufacturers, as is being done for the 1500 GPH ROWPU. Such a program would require considerably more Development Engineering. Costs for this Cost Element could easily be about the same as those estimated for the current 1500 GPH ROWPU program, $5,945K (PLCCE for 1500 GPH ROWPU). This would increase total RDT&E Costs to $7,267K. The LWP program may well be too small to support RDT&E Costs of this magnitude.

For an estimate of Manufacturing Costs the PLCCE used the average of the costs of the commercial models recommended at the 25 May 1994 Joint Working Group Meeting and added 20% for a generator and minor modifications. The costs for the water purification units ranged from $17K to $45K (in FY95 dollars). If the least expensive model were selected, Manufacturing Cost would decrease to $1,051K, and Total Procurement Costs would be about $2,025K. Selecting the most expensive alternative, on the other hand, would increase Manufacturing Costs to $2,781K and Procurement Costs to $3,755K.

Based on the Operational Mode Summary/Mission Profile, the LWP was estimated to operate about 744 hours per year. (See Section 3.4.1.4 for the detailed breakdown.) If this were reduced by 50%, as was done for the other alternatives in Sections 3.4.2.3 and 3.4.2.4, the total of depot level reparables and consumables for the LWP would be reduced to $1,673K, POL to $179K and total O&M Costs to $2,487K. On the other hand, if the annual operating hours were doubled to 1488 hours, total parts cost would increase to $6,690K, POL to $714K and total O&M Costs to $8,040K. This would represent a high usage rate for a device like the LWP -- an average of 28.6 hours per week.

3.4.2.6 Summary of Sensitivity Analysis

Figure 3-12 presents a summary of the results of the sensitivity analysis.

APPROACH	COST ELEMENT NUMBER AND TITLE	PARAMETER CHANGED	COST ELEMENT LOW/HIGH	TOTAL COST CATEGORY LOW/HIGH	COMMENTS
Shipping Water to Operating Area	5.03 Replen: Depot Level Reparables 5.04 Replen: Consumables 5.05 POL	Soldiers supported decreased from 125 to 60 people.	Parts:53,565 POL:2,642 Parts:107,100 POL:5,280	56,210 112,400	
Shipping Water to Operating Area	5.03 Replen: Depot Level Reparables 5.04 Replen: Consumables 5.05 POL	Exercises reduced to 15 days per year.	Parts:53,565 POL:2,642 Parts:107,100 POL:5,280	56,210 112,400	Combining reduced numbers with fewer exercises would reduce total O&M to 28,100.
Shipping Water to Operating Area	5.03 Replen: Depot Level Reparables 5.04 Replen: Consumables 5.05 POL	Average flight time increased to 1½ hours each way	Parts:107,100 POL:5,283 Parts:160,700 POL:7,925	112,400 168,600	
600 GPH ROWPU: Rebuy	2.021 Manufacturing Cost	Manufacturing Cost increases by 10% (Both ROWPU and Generator)	5,472 6,019	6,418 6,971	

Figure 3-12 (Continued through page 3-29) Summary of Results of Sensitivity Analyses

(Costs in Thousands of FY 96 Dollars)

APPROACH	COST ELEMENT NUMBER AND TITLE	PARAMETER CHANGED	COST ELEMENT LOW/HIGH	TOTAL COST CATEGORY LOW/HIGH	COMMENTS
600 GPH ROWPU: Rebuy	5.03 Replen: Depot Level Reparables 5.04 Replen: Consumables 5.05 POL	Annual operating hours: Low: 100 High: 400	Parts:2,471 POL: 160 Parts:9,885 POL:640	2,731 10,620	
600 GPH ROWPU: Rebuild	5.06 Depot Overhaul	Overhaul/Rebuild Cost one-third of manufacturing cost instead of one-half.	1,824 2,736	7,281 8,193	
600 GPH ROWPU: Rebuild	5.03 Replen: Depot Level Reparables 5.04 Replen: Consumables 5.05 POL	Annual operating hours: Low: 100 High: 400	Parts:2,471 POL: 160 Parts:9,885 POL:640	5,562 13,460	Combining the lower operating hours with the lower overhaul costs would reduce Total O&M Costs to 4,650.
LWP	1.01 Development Engineering	Pure NDI: Manhours decreased by 25%	826.0 1101.0	2,158 2,433	

Figure 3-12 (Continued through page 3-29) Summary of Results of Sensitivity Analyses

(Costs in Thousands of FY 96 Dollars)

APPROACH	COST ELEMENT NUMBER AND TITLE	PARAMETER CHANGED	COST ELEMENT LOW/HIGH	TOTAL COST CATEGORY LOW/HIGH	COMMENTS
LWP	1.01 Development Engineering	NDI Components Only: 1.01 changed to that for 1500 GPH ROWPU.	998 5,945	2,320 7,267	
LWP	2.021 Manufacturing Cost	Manufacturing Cost Low: $17K Each High: $45K Each (FY95$)	1,051 2,781	2,025 3,755	
LWP	5.03 Replen: Depot Level Reparables 5.04 Replen: Consumables 5.05 POL Cost	Annual operating hours: Low: 372 High: 1488	Parts: 1,673 POL: 179 Parts: 6,690 POL: 714	2,487 8,040	

Figure 3-12 (Concluded) Summary of Results of Sensitivity Analysis

(Costs in Thousands of FY 1996 Dollars)

3.4.3 Uncertainty Analysis

3.4.3.1 General

In the Sensitivity Analyses in Section 3.4.2 the values of input parameters in the various areas of uncertainty were varied one at a time and the resulting changes calculated and analyzed. In the Uncertainty Analysis, on the other hand, the values of an entire set of parameters were changed at one time. This section reports the results of this analysis.

3.4.3.2 High Estimates

Figure 3-13 presents the Decision Costs of the alternatives using the HIGHEST estimates from the Sensitivity Analyses above for each cost element. Section 3.4.1.1 indicated that there are significant cost uncertainties for the Base Case, shipping water to the operating area by helicopter. The cost estimates for this alternative are based on assumptions regarding the water required per day, the number of exercise days per year, and the average flight time to the operating area. Varying these assumptions produces large changes in the estimated costs. Merely increasing the average flight time from 1 hour each way to 1½ hours increased the Total Decision Cost by about $56 million -- a larger increase from the basic estimates than for any of the other alternatives. This is still the most expensive alternative, and by a larger margin than in the basic analysis.

Since the LWP is a new program, it has greater uncertainties than the two approaches using the 600 GPH ROWPU. It is not surprising, therefore, that its costs increased more. Using the high estimates, the LWP is more expensive than either of the 600 GPH ROWPU alternatives.

3.4.3.3 Low Estimates

Figure 3-14 presents the Decision Costs of the approaches using the LOWEST estimates from the Sensitivity Analyses above for each cost element. The order among the alternatives ranked by cost is the same as for the basic estimates, although the differences between alternatives are, of course, smaller. The Base Case, shipping water to the operating area by helicopter, is again the most expensive alternative. However, combining a reduction in the number of soldiers to be supported with a reduction in the number of exercises per year produces a very large reduction in costs. Rebuilding the 600 GPH ROWPUs is still the least expensive alternative. The LWP costs about $2.0 more than the rebuild alternative but $2.75 million less than a rebuy of the 600 GPH ROWPU.

	BASE CASE: SHIPPING WATER TO OPERATING AREA	**600 GPH ROWPU FOR SOF: REBUY**	**600 GPH ROWPU FOR SOF: REBUILD**	**LWP**
APPENDIX	N/A	E	N/A	F
1.0 RDT&E	**0.0**	**0.0**	**0.0**	**7,267.0**
1.01 Development Engineering	0.0	0.0	0.0	5,945.0
1.04 Prototype Manufacture	0.0	0.0	0.0	204.0
2.0 PRO-CUREMENT	**0.0**	**6,971.0**	**0.0**	**3,755.0**
2.021 Manufacturing	0.0	6,019.0	0.0	2,781.0
3.0 MIL CONSTRUCTION	0.0	0.0	0.0	0.0
4.0 MIL PERSONNEL	0.0	0.0	0.0	0.0
5.0 O&M (20 yrs)	**168,600.0**	**10,620.0**	**13,450.0**	**8,040.0**
5.03 Depot Level Reparables plus 5.04 Consumables	160,700.0	9,885.0	9,885.0	6,690.0
5.05 POL	7,925.0	640.0	640.0	714.0
5.06 Depot Overhaul	0.0	0.0	2,736.0	0.0
5.07 Transportation to and from Depot	0.0	0.0	95.1	0.0
TOTALS	**168,600.0**	**17,590.0**	**13,450.0**	**19,060.0**

Figure 3-13 Dollar Decision Costs - HIGH Estimates

(In Thousands of FY 1996 CONSTANT Dollars)

	BASE CASE: SHIPPING WATER TO OPERATING AREA	600 GPH ROWPU FOR SOF: REBUY	600 GPH ROWPU FOR SOF: REBUILD	LWP
APPENDIX	N/A	E	N/A	F
1.0 RDT&E	**0.0**	**0.0**	**0.0**	**2,158.0**
1.01 Development Engineering	0.0	0.0	0.0	826.0
1.04 Prototype Manufacture	0.0	0.0	0.0	204.0
2.0 PRO-CUREMENT	**0.0**	**6,418.0**	**0.0**	**2,025.0**
2.021 Manufacturing	0.0	5,472.0	0.0	1,051.0
3.0 MIL CONSTRUCTION	0.0	0.0	0.0	0.0
4.0 MIL PERSONNEL	0.0	0.0	0.0	0.0
5.0 O&M (20 yrs)	**28,100.0**	**2,731.0**	**4,650.0**	**2,487.0**
5.03 Depot Level Reparables plus 5.04 Consumables	26,780.0	2,471.0	2,471.0	1,673.0
5.05 POL	1,321.0	160.0	160.0	179.0
5.06 Depot Overhaul	0.0	0.0	1,824.0	0.0
5.07 Transportation to and from Depot	0.0	0.0	95.1	0.0
TOTALS	**28,100.0**	**9,419.0**	**4,650.0**	**6,670.0**

Figure 3-14 Dollar Decision Costs - LOW Estimates

(In Thousands of FY 1996 CONSTANT Dollars)

3.4.3.4 High-Low Comparisons

Figure 3-15 presents in graphical form the results of the Uncertainty Analysis of the four alternatives. The vertical lines show the range between the high and low estimates for each alternative. The horizontal tick marks indicate the Basic Decision Cost Estimates for each system.

The Base Case, shipping water to the operating area by helicopter, is the most expensive alternative under all assumptions. Even the lowest estimate is higher than the highest estimate for any of the other alternatives. The alternative of rebuilding 600 GPH ROWPUs for SOF is generally the least expensive, but the lowest estimates for the LWP are cheaper than some of the estimates for the rebuild alternative. In fact, as the figure makes clear, there is a great deal of overlap among the estimates for the LWP and the two 600 GPH ROWPU alternatives -- the lowest estimate for any one of the three is less expensive than the high estimate for any of the others. Thus any one of these three approaches could turn out to be the least expensive in practice.

3.4.3.5 Conclusions of the Uncertainty Analysis

Although the Uncertainty Analysis produces quite large changes in the dollar decision costs, there are no changes in the ordinal comparison among the three approaches. The Base Case, shipping water to the operating area by helicopter, is always the most expensive approach, and Rebuilding the 600 GPH ROWPU is the cheapest, followed closely by the LWP.

Even though it does not produce changes in the ranking of the approaches, the Uncertainty Analysis does underline the importance of considering a range of costs rather than a single estimate for each cost element. The Uncertainty Analysis also provides envelopes within which there is a very high probability that the actual system costs will fall. In addition, Figure 3-15 clearly indicates the overlap in the cost estimates for three of the alternatives.

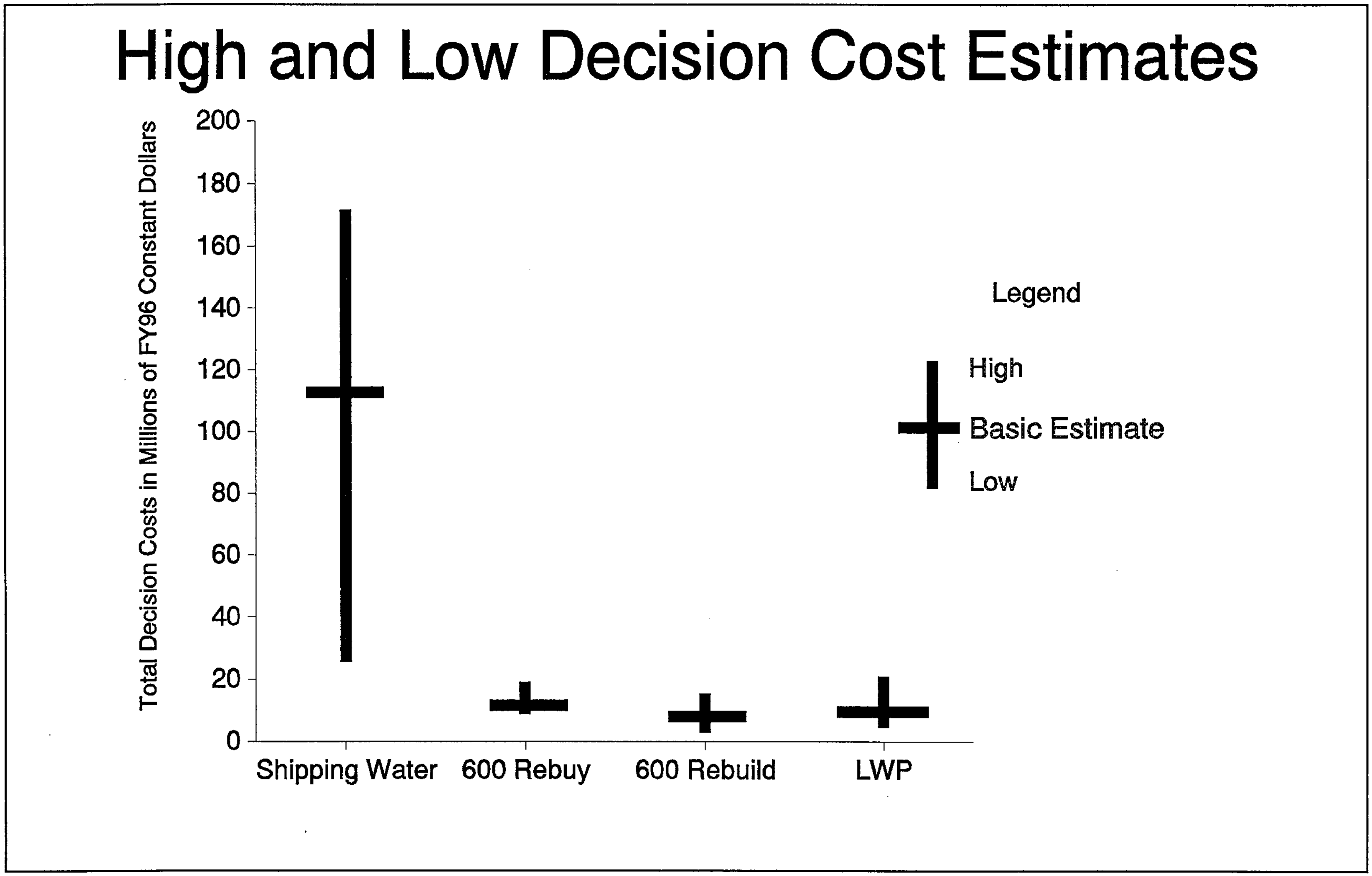

Figure 3-15 High and Low Decision Cost Estimates

3.5 DECISION CRITERIA

3.5.1 General

This section integrates the Operational Effectiveness Analysis from Section 3.2, the Cost Analysis from Section 3.3, and the Trade-Off Analysis from Section 3.4. Suggested criteria for selecting among the four alternatives are discussed.

3.5.2 Operational Effectiveness vs. Cost Comparison

The primary function of a Lightweight Water Purifier (LWP) is to provide water support to special forces detachments and selected medical units during contingency operations and during operations other than war. Conduct of operations at remote sites and often in hostile/non-permissive environments are the key elements of the concept. Water production, ease of operations, mobility, transportability, and performance are major considerations. Figure 3-16 below compares selected values for some of the chief Measures of Effectiveness (MOE).

CRITERIA	BASE CASE SHIP BY AIR	600 GPH ROWPU REBUY	600 GPH ROWPU REBUILD	LWP
OVERALL	.287	.171	.171	.371
PERFORMANCE	.264	.182	.182	.373
LOG/READI	.331	.124	.124	.422
CRIT SYST CHARACT'CS	.417	.178	.178	.226
MOBILITY	.150	.153	.153	.545
WATER OPNS	.155	.299	.299	.247
TIME/EFFORT	.322	.112	.112	.454
DURABILITY	.625	.125	.125	.125
TRANSPORT	.215	.118	.118	.549
TOTAL DCE (CONSTANT $)	$112.40 Million	$11.78 Million	$8.19 Million	$9.59 Million
TOTAL DCE (CURRENT $)	$184.50 Million	$16.33 Million	$11.90 Million	$12.94 Million

Figure 3-16 Measures of Effectiveness Comparison Matrix

3.5.3 Decision Criteria

- Cost: If cost were the only criterion, the decision would be simple -- a Rebuild of the existing 600 GPH ROWPU is clearly the cheapest of the four approaches in terms of Constant FY96 dollars. The rebuild option is $ 1.4 million less than the LWP and $ 3.6 million lower than a rebuy of the 600 GPH. Of particular interest is that the Base Case of Shipping Water by Air is, by an order of magnitude, the most expensive option. When viewed from the perspective of the base case, all the other alternatives are essentially equivalent in terms of cost.

- Operational Effectiveness: However, if operational effectiveness in terms of overall capability were the only gauge, the LWP is clearly superior to the other alternatives.

- Cost and Operational Effectiveness: In most real-world decisions, both cost and operational effectiveness must be considered. Figure 3-17 provides a graphic comparison of decision cost and operational performance. This diagram sharply reveals the cost-effective advantages of the Lightweight Water Purifier (LWP). The LWP offers the opportunity to significantly improve on the Base Case at a cost nearly equal to the least expensive altrnative.

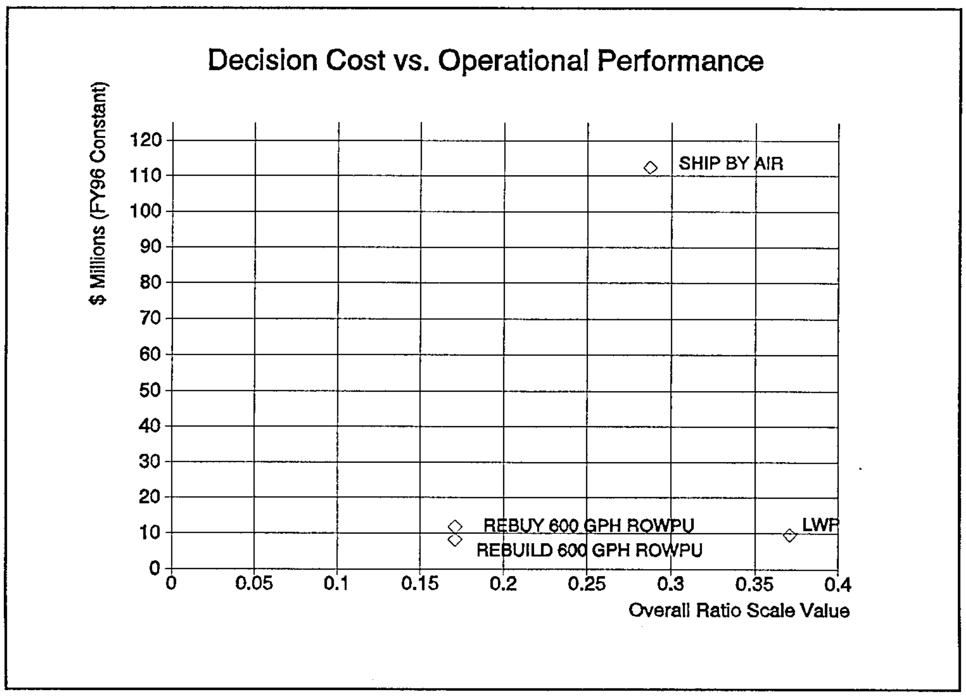

Figure 3-17 Cost and Operational Effectiveness Comparison

SECTION 4

SUMMARY OF RESULTS

4.1 THE ACQUISITION ISSUE

The U.S. Army has a need to provide a safe, potable water supply for small units and detachments, to include Special Operations Forces (SOF), engaged in early entry, long range surveillance, and contingency missions. Missions during Operations other than War (OOTW) may also include nation building, civil affairs assistance, and disaster relief. These units may operate independently for extended periods or at remote sites and at distances inconsistent with the established water distribution network. The need has been documented in the Mission Need Statement (MNS) for the Lightweight Water Purifier (LWP) approved by Headquarters, Department of the Army (HQDA) on 6 October 1993 (Appendix A) and in the draft Operational Requirements Document (ORD) for the Lightweight Water Purifier (LWP) (Appendix B).

The Lightweight Water Purifier (LWP) responding to this requirement shall be capable of producing potable water from fresh, brackish, and sea water sources or water sources tainted with nuclear, biological, or chemical contaminants. Water produced by the LWP must meet the US Army field water quality standards contained in Technical Bulletin, Medical (TB MED 577). The LWP shall be suitable for use by organic unit personnel in selected units with minimal training.

4.2 ALTERNATIVES

4.2.1 Listing

As required by the Task Order Statement of Work, this Cost and Operational Effectiveness Analysis (COEA) investigated alternative approaches to meeting the requirement. The alternatives investigated were:

- Base Case, Haul Water by Aircraft
- Rebuy - Water Purification Unit, Reverse Osmosis, 600 GPH w/o Trailer, Flatbed Cargo, 5 Ton, 4 Wheel Tandem (REBUY 600 GPH)
- Rebuild - Water Purification Unit, Reverse Osmosis, 600 GPH w/o Trailer, Flatbed Cargo, 5 Ton, 4 Wheel Tandem (REBUILD 600 GPH)
- Lightweight Water Purifier (LWP)

4.2.2 Principal Characteristics

Figure 4-1 lists some of the principal operational characteristics of the alternatives. Production quantities (*) shown are based on part time operations of a maximum of four (4) hours per day.

	BASE CASE HAUL BY AIR	**REBUY 600 GPH**	**REBUILD 600 GPH**	**LWP**
Quality	TB Med 577	TB Med 577	TB Med 577	EPA Stds
Fresh Qty*	720 gpd	3840 gpd	3840 gpd	800 gpd
Brackish Qty*	720 gpd	3840 gpd	3840 gpd	800 gpd
Sea Water Quantity*	720 gpd	2400 gpd	2400 gpd	500 gpd
Design TDS	35K mg/l	35K mg/l	35K mg/l	45K mg/l
Dimensions (inches)	120x108x80 (rigged)	113x83x68	113x83x68	84x36x60 est maximum
Basic Weight Generator Total	6450 lbs N/A 8000 lbs	7300 lbs 2850 lbs 10150 lbs	7300 lbs 2850 lbs 10150 lbs	est 541 lbs 370 lbs <911 lbs
Crew	2 (riggers)	2 (MOS 77W)	2 (MOS 77W)	1 (Non-Specific)
Temp Range	+32 to +110 ° Fahrenheit	+32 to +90 ° Fahrenheit	+32 to +90 ° Fahrenheit	-25 to +120 ° Fahrenheit
Set-Up	2 soldiers- 30 to 45 min	2 soldiers- 4 hours	2 soldiers- 4 hours	1 soldier- 45 min
Slingloads	1 UH-60 min	2 UH-60 min	2 UH-60 min	1 UH-60 min
per C-130	4 platforms	4 skid mtd	4 skid mtd	4 HMMWV mtd/ 10-13 skid mtd
per C-141	8 platforms	6 skid mtd	6 skid mtd	8 HMMWV mtd/ 30-36 skid mtd

Figure 4-1 Comparison of Selected Performance Elements for Alternatives

4.3 ANALYSIS OF ALTERNATIVES

4.3.1 Comparison of Alternatives

Figure 4-2 compares the Ratio Scale values for the Overall Capability, principal operational criteria, several of the subordinate performance criteria, and the Total Decision Costs in both Constant FY96 and Current Year dollars.

CRITERIA	BASE CASE SHIP BY AIR	600 GPH ROWPU REBUY	600 GPH ROWPU REBUILD	LWP
OVERALL	.287	.171	.171	.371
PERFORMANCE	.264	.182	.182	.373
LOG/READI	.331	.124	.124	.422
CRIT SYST CHARACT'CS	.417	.178	.178	.226
MOBILITY	.150	.153	.153	.545
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TIME/EFFORT	.322	.112	.112	.454
DURABILITY	.625	.125	.125	.125
TRANSPORT	.215	.118	.118	.549
TOTAL DCE (CONSTANT $)	$112.40 Million	$11.78 Million	$8.19 Million	$9.59 Million
TOTAL DCE (CURRENT $)	$184.50 Million	$16.33 Million	$11.90 Million	$12.94 Million

Figure 4-2 Comparison of Decision Costs and Operational Effectiveness

4.3.2 Decision Criteria

- Cost: If cost were the only criterion, the decision would be simple -- a Rebuild of the existing 600 GPH ROWPU is clearly the cheapest of the four approaches in terms of both Constant FY96 and Current Year dollars. Of particular interest is that the Base Case of Shipping Water by Air is, by an order of magnitude, the most expensive option. When compared to the base case, the other alternatives are about equal in cost.

- Operational Effectiveness: However, if operational effectiveness in terms of overall capability were the only gauge, the LWP is clearly superior to the other alternatives.

- Cost and Operational Effectiveness: From a "best value" perspective, both cost and operational effectiveness must be considered. Figure 4-3 provides a graphic comparison of decision cost and operational performance. This diagram sharply reveals the cost-effective advantages of the Lightweight Water Purifier (LWP). The LWP offers the opportunity to significantly improve on the Base Case at a decision cost only slightly higher than the cheapest option.

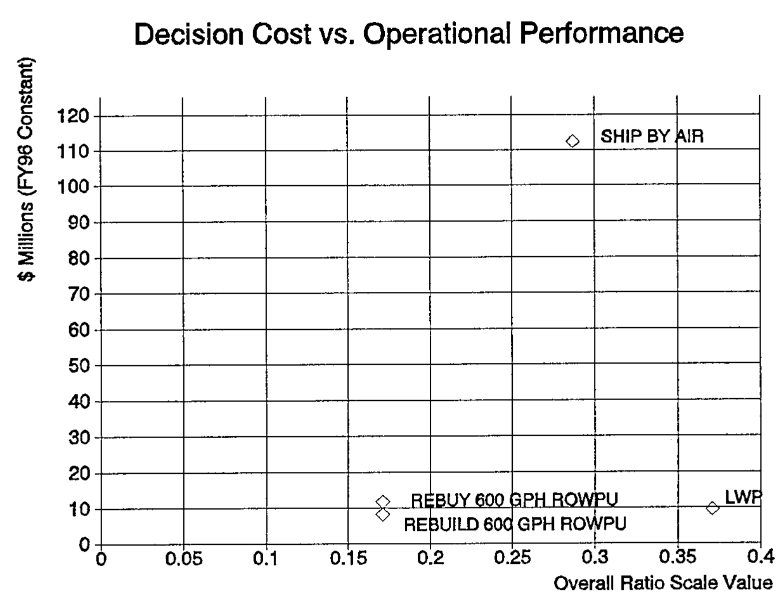

Figure 4-3 Cost and Operational Effectiveness Comparison

4.4 RECOMMENDATION

Based on the criteria and analysis presented herein, the Lightweight Water Purifier (LWP) described in Section 2 is the recommended alternative to satisfy the requirement defined in the Mission Needs Statement and the current Operational Requirement Document. Costs for the LWP are substantially lower than the current base case and roughly equivalent to the other options. However, for essentially the same decision cost, the LWP offers a marked improvement in performance.

APPENDIX A

MISSION NEED STATEMENT (MNS) FOR LIGHTWEIGHT WATER PURIFIER (LWP)

APPROVED
6 OCTOBER 1993

APPENDIX B

OPERATIONAL REQUIREMENTS DOCUMENT (ORD) FOR THE LIGHTWEIGHT WATER PURIFIER (LWP), Draft
7 April 1995

APPENDIX C

HIERARCHY WEIGHTING JUDGMENTS (REQUIREMENT)

APPENDIX D

OPERATIONAL SENSITIVITY ANALYSES

APPENDIX E

DECISION COST ESTIMATE SUMMARY FOR 600 GPH REVERSE OSMOSIS WATER PURIFICATION UNIT (ROWPU) FOR SPECIAL OPERATIONS FORCES (SOF)

APPENDIX F

PROGRAM LIFE CYCLE COST ESTIMATE (PLCCE) SUMMARY FOR LIGHTWEIGHT WATER PURIFIER (LWP)

Pages 3-26 through 3-32
to be provided separately
by 5 August 1994

MANPOWER, PERSONNEL, AND TRAINING ASSESSMENT

FOR THE

LIGHTWEIGHT WATER PURIFIER
(LWP)

in support of
MILESTONE I/II

25 JULY 1995

1. The purpose of this document is to present the Manpower, Personnel, and Training Assessment (MPTA) considerations for the Lightweight Water Purifier (LWP) in support of the Milestone I/II Developmental Approval Decision Review.

2. System Description. The Lightweight Water Purifier (LWP) is a modular, lightweight, highly mobile, and rapidly emplaced water purification system intended to provide potable water support for small units or detachments operating in remote or isolated areas. The LWP is a Combat Service Support (CSS) item of equipment which is set up and operated by selected CMF 18 Special Forces or CMF 91 Medical soldiers in tactical and training environments. The system can be operated by soldiers without complicated or lengthy training. It will be operated part-time by one soldier to meet the daily water consumption and personal hygiene requirements of the organization. The LWP can produce up to 125 gallons of potable water per hour depending on the quality and character of the raw water source. The LWP also provides an organic storage and dispensing capability for up to 800 gallons of potable water. The system is transportable in a High Mobility Multi-Purpose Wheeled Vehicle (HMMWV) or by UH-60 helicopter and can be emplaced by no more than four soldiers.

3. Operational Concept.

a. The LWP will be used to purify water from any ground or surface water source. Product water will meet the proposed Tri-service Standards for long term consumption. The concept of operation is to produce water as far forward as possible using a flexible and highly mobile treatment system during war- and peace-time scenarios. The LWP is intended to support small units with limited potable water production quantities to meet daily consumption needs. The LWP will be employed throughout a wide range of areas from highly developed, densely populated urban areas to isolated rural areas in undeveloped countries. Employment of the LWP will be governed by Mission, Enemy, Terrain, Time, and Troops Available (METT-T) considerations since water sources generally must be identified and approved while an operation develops. The LWP will support ground, amphibious, air mobile, and airborne units.

b. Wartime. The LWP will be employed throughout the Special Operations Forces operational area as a direct support asset. Special Forces Groups will locate the LWP where acceptable water sources exist. Acceptability and selection of an approved water source will be determined according to command medical guidelines and standards. The LWP will be capable of producing a safe and reliable supply of potable water. It will be used to produce water that will be distributed at the point of production, transported to forward supply points, and/or delivered to major consumers (e.g. local indigenous forces). It will be operated in basic (-25 to 110°F) and hot (88-120°F) climate conditions and a variety of environmental conditions such as rain, wind, dust, snow, fog, etc. The LWP is not Nuclear, Biological, and Chemical (NBC) survivable unless wholly contained inside a NBC safe structure.

c. Peacetime. The LWP will be deployed for foreign internal defense, unconventional warfare, special activities, and field training exercises in the United States or abroad. Additionally, the LWP may be used to support Operations Other Than War (OOTW) (e.g. disaster relief, humanitarian assistance, etc.) and the operational concept will be tailored to meet specific situational needs. Peacetime mission durations may range from two weeks for field training to one year deployments.

4. Manpower Assessment.

a. This issue addresses the adequacy of personnel authorized and/or available to operate the Lightweight Water Purifier (LWP).

b. The LWP will not replace any existing bulk water purification capability within the designated special operations and medical units. It will, however, supplement currently available individual emergency purification methods and will support populations of up to 100 to 125 persons with potable water meeting Tri-service water quality standards. The LWP will be compact and lightweight enough to be transported by vehicle or helicopter. It is intended to be operated on a part time basis by soldiers without formal water purification training. According to the Operational Mode Summary/Mission Profile for the system, actual production may require up to 6 to 10 hours per day (actual time will depend on the raw water source quality and the required daily quantity). Therefore, use of the system must be suitable for unattended operation except for periodic monitoring or servicing.

c. Introduction of the LWP must not generate requirements for additional dedicated manpower to operate the LWP nor divert unmanageable levels of manpower from other primary mission duties.

d. A Manpower Assessment rating of GREEN is assessed for to this domain. No critical or major manpower issues have been identified during component and technical feasibility testing to date. The LWP is not expected to generate requirements for additional or dedicated personnel. Technical and user testing scheduled to be accomplished during Phase II will ascertain specific levels of manpower required to set up and run the LWP system during continuous purification operations. Set up or tear down of the system will not take longer than 45 minutes. This infrequent requirement does not represent a significant manpower impact. However, the actual daily manpower burden of attended operations for the LWP has not been determined. Data on attended versus total operational time is not currently available. Furthermore, a maximum allowable percent of a soldier's daily available time which may be diverted to water purification operations without impacting on the unit's primary mission has not been established. A limit of 25 percent over 12 hours (3 hours) is assumed.

5. Personnel Assessment.

a. This issue addresses the adequacy of the Military Occupational Specialties and skill levels of personnel authorized and/or available to operate and maintain the LWP.

b. The LWP will be suitable for part time operation by special forces and medical soldiers unskilled in water treatment and purification equipment operations.

c. The LWP will be operated and maintained in the unit by Career Management Field (CMF) 18 soldiers in special operations forces (SOF) units and CMF 91 in medical or health care units. Military Occupational Specialty (MOS) 18C, Special Forces Engineer Sergeant; 18D, Special Forces Medical Sergeant; and 91B, Medical Specialist are assumed to be the principal operators, unit level trainers, and maintainers for the system. Repair and the replacement of damaged modules will be accomplished at the direct support level by MOS 63J, Chemical and Chemical Equipment Repairer. Maintenance at the General Support (GS) and Depot levels will be accomplished by contract and will consist mostly of repair of those modules replaced at lower levels.

d. In special forces units, the LWP will be operated by CMF 18 soldiers at skill level 30 or 40. These soldiers are highly trained, often operate independently, and frequently use low density, unique, or complex equipment. In medical units, operators may be assigned at skill levels 10 through 40. The LWP may also be occasionally operated by other CMF 18 personnel at the 30-40 skill level (the basic qualifications are the same within CMF 18). MOSs 18C/D and 91B, however, have very different physical and mental aptitude prerequisites. Limiting strength and technical abilities are defined by the skills of the 91B10 Medical Specialist.

e. A Personnel domain rating of GREEN is assessed for the LWP. No critical or major personnel skill or aptitude issues have been identified. The LWP will not create requirements for a new military occupational specialty or additional skill identifier. Earlier testing on similar equipment was performed using commercial water purifiers and non-77W (i.e. 77F, 52D, 88M) soldiers at skill level 10. The average operator had 11 months or less military experience. One supervisory sergeant, MOS 77F20, has 56 months service. With approximately eight hours of initial equipment training, operators were able to successfully execute fresh water and sea water operational tests which included multiple set up, tear down, and movement cycles.

6. Training Assessment.

a. This issue addresses the adequacy of operator training to ensure that the LWP is operated in accordance with the manufacturer's specifications.

b. There will be no formal institutional training for the LWP integrated into the existing Programs of Instruction (POI) for CMF 18 or 91 soldiers. New Equipment Training (NET) will be provided to gaining units concurrent with fielding. Sustainment training will be a unit responsibility using an LWP and the operator's technical manual as the principal training aids. Supplementary aids such as exportable training packages or video tapes may be considered during development.

c. The training package will be suitable for the most restrictive MOS and skill level aptitudes within either of the gaining types of units. The aptitude and skills of the 91B10 soldier within medical detachments are expected to represent the critical limiting training abilities. Since the bulk (42 of 50) of LWP systems will be fielded to special forces units, cost-performance tradeoffs should be considered in training development to assess the impact of restricting designs for other than the primary 18C/18D soldier audience.

d. The manufacturer will be required to provide New Equipment Training (NET) and complete technical manuals as part of the equipment fielding requirements necessary to satisfy the Initial Operational Capability (IOC). The IOC is projected for 1QFY01 and is estimated at approximately three months after the First Unit Equipped (FUE) date.

e. A Training domain rating of GREEN is assessed for the LWP. No critical or major training problems or issues have been identified. Personnel participating in early tests of commercial purifiers received eight hours of familiarization training on the equipment and were able to operate the system satisfactorily. During earlier tests of similar equipment, comments made by test personnel on the exit questionnaire highlighted difficulties with commercial manuals provided with the test purifiers.

7. Conclusions. The Lightweight Water Purifier (LWP) will be a unique, low density item of specialty equipment within the receiving SOF and medical organizations. Set up and operation of the LWP must be easy and procedures must be simplified so that unskilled soldiers who have not been school trained in water treatment can operate the system safely and effectively. The LWP must not require an operator to be present at all times and must be suitable for unattended operations after initial set up and check out.

8. Overall MPT Assessment. The Lightweight Water Purifier (LWP) is assessed with an overall Manpower, Personnel, and Training Assessment of GREEN. There are no critical or major issues identified. Any minor issues remaining will be addressed in the next phase of development. The LWP is recommended for transition to Phase II, Engineering and Manufacturing Development.

Summary of Critical Problems for the Manpower, Personnel, and Training Domains for the Lightweight Water Purifier (LWP)

1. Definition. A critical problem is a system characteristic which, if not remedied, could reasonably be expected to result in death or serious bodily injury, mission abort, system loss, inability of the system to perform its intended mission, or an unacceptable impact on system manpower, personnel, or training (MPT) requirements.

2. Problem. None.

Summary of Major or Minor Problems for the Manpower, Personnel, and Training Domains for the Lightweight Water Purifier (LWP)

1. Major Problems.

a. Definition. A major problem is a system characteristic which, if not remedied, could reasonably be expected to result in major bodily injury, reduced mission effectiveness, extensive system damage, seriously diminished system capacity to perform its intended mission, or a significant negative impact on system manpower, personnel, or training (MPT) requirements.

b. Problem. None.

2. Minor Problems.

a. Definition. A minor problem is a system characteristic which, if not remedied, could reasonably result in soldier discomfort or minor bodily injury, reduced mission effectiveness, system damage, or a negative impact on system manpower, personnel, or training (MPT) requirements.

b. Manpower Issue. Quantification of Manpower Required for Attended Operations.

(1) Operational Significance. The Lightweight Water Purifier (LWP) will be fielded to small units or detachments with limited available manpower. Potable water production is an additional duty to be performed concurrently with the primary mission. The amount of time that an operator must be physically present to periodically monitor and service the equipment during purification operations cannot detract from other mission priorities. The requirement clearly states that no added requirements for manpower can be generated. It is known that the larger 600 GPH and 3000 GPH Reverse Osmosis Water Purification Units (ROWPUs) do not require constant observation and are essentially semi-automatic once initial operations are underway. However, the extent of operator involvement depends on factors related to the quality of the source water. For example, filters and elements must be changed more frequently when source water is high in turbidity.

(2) Recommendation. A level of 25 percent of one soldier's time over the total production period has been assumed as the maximum allowable impact on other duties. This assumption must be confirmed or reevaluated. Test procedures for PPQT and IOT must be capable of determining the expected impact on manpower in terms of attended, unattended, and total operational times. It is further recommended that any requirements for set up, tear down, or movement of the system be excluded from the manpower calculation since they represent periodic demands on an intermittent basis.

c. Personnel Issue. Operation by diverse Military Occupational Specialties (MOS).

(1) Operational Significance. The Lightweight Water Purifier (LWP) will be fielded to special forces units and medical or health care detachments. Although much of the testing to date has used personnel trained in water purification, earlier testing of similar systems used a variety of non-77W personnel. It has been assumed that MOS 18C and 18D will operate the LWP in special forces organizations. MOS 91B is assumed as the primary operator in medical units. Neither of these career fields have been involved in testing. The skills and aptitudes of these two career fields are very different. However, the majority of the systems will be operated in special forces units. It is probable that a system engineered specifically for the abilities of a special forces engineer sergeant will be less restrictive than a system configured for use by the 91B private. Conversely, a system oriented toward junior medical personnel may adversely impact system costs with little apparent operational benefit in the majority of the using units.

(2) Recommendation. The current requirement does not identify operators in either of the gaining units. The cited MOSs have been assumed based on knowledge of the units and personnel densities in typical organizations. The specific specialties that will operate the system must be determined or confirmed. A decision by the user community must be made concerning whether system density or limiting MOS aptitudes will be used as a basis for skills assessment. Then, user testing should assure integration of the correct personnel.

d. Training Issue. Adequacy of the New Equipment Training Package.

(1) Operational Significance. Training for the Lightweight Water Purifier (LWP) will not be performed within the military training institution. Introductory New Equipment Training (NET) at fielding will be the only formal training on the system. Sustainment training will take place in the unit. Most operators will have no prior background or experience in water purification or water quality testing. Earlier testing on similar equipment demonstrated an ability to successfully operate small purifiers with about eight hours of training. However, numerous comments were received on the adequacy of technical manuals, shortage of photographs and drawings, and the lack of water quality measurement instructions.

(2) Recommendation. The training package and technical manual level of detail must be oriented toward personnel with little or no prior knowledge in water purification. This requirement must be clear and unambiguous in the Statement of Work and the Purchase Description for the LWP. Adequacy of the contractor's commercially available manuals must be evaluated early in the development process and incorporated into the source evaluation if possible.

****************** CASCOM LETTERHEAD ******************

ATCL-MES Revised 25 July 1995

MEMORANDUM FOR

Chief, Human Research Engineering Directorate Field Office, ATTN: AMSRL-HR-MK, Fort Belvoir, VA 22060-5818
Chief, Integrated Logistics Support Division, ATTN: AMSAT-I-FBL, Fort Belvoir, VA 22060-5818

SUBJECT: Manpower, Personnel, and Training Assessment (MPTA) for the Lightweight Water Purifier (LWP).

1. References.

a. Memorandum, AMSRL-HR-M, 30 January 1995, Subject: MANPRINT Integration Report (MIR).

b. AR 602-2, 19 April 1990, Subject: Manpower and Personnel Integration (MANPRINT) in the Materiel Acquisition Process.

c. DA Pam 70-3, Part 7, Section B, MANPRINT, dated 28 February 1995.

2. In accordance with the cited references, the MPTA for the LWP is enclosed for your information and use in preparing program documents for the subject program.

3. A Manpower, Personnel, and Training Assessment (MPTA) rating of GREEN has been assigned for the Lightweight Water Purifier (LWP). No outstanding critical or major MPT problems or issues have been identified during Phase 0. Recommend that the program continue to Phase II, Engineering and Manufacturing Development.

4. Request that you contact CPT Scott Wright, DSN 687-0496 or Commercial (804)734-0496, if you have additional questions or comments regarding this document.

FOR THE COMMANDER:

Encl Authorized Signature Block

PERFORMANCE SPECIFICATION

Draft 31 October 1995

for the

LIGHTWEIGHT WATER PURIFIER (LWP)

1.0 SCOPE.

1.1 Scope. This performance specification establishes the performance and test verification requirements for the Lightweight Water Purifier (LWP). The LWP provides the United States Army with a safe and reliable water purification capability to support small units and detachments. It is intended particularly to support Special Operations Forces (SOF) and small health care units engaged in Low Intensity Conflict (LIC), nation building, civil affairs actions, peacekeeping, disaster relief operations and additional Operations Other Than War (OOTW). The LWP must operate in isolated areas that are remote from normal support assets. In these types of contingency operations, local water supplies are often unacceptable from a quality or health perspective. Resupply of water through logistics channels is normally not practicable in such circumstances. Existing and projected military water purifiers which support larger units (i.e. brigade, division, and corps) require heavy vehicles and material handling equipment not available to smaller or independent elements. Large purifiers also exceed available power and expendable resupply capabilities of isolated units in these contingencies.

1.2 Current and Future Emphasis. Over the past several years, the number of small unit deployments required to support national objectives has risen substantially. Increased emphasis on Operations Other Than War (OOTW) in contingency support, nation building, civil affairs, humanitarian assistance, peacekeeping missions, and disaster relief roles has made necessary the use of tailored support packages. The ability to produce and resupply potable water to isolated small units in the absence of a traditional service support structure is essential to successful execution of these missions. Expectations are that this revised emphasis will continue well into the 21st Century.

1.3 System Definition. The Lightweight Water Purifier (LWP) is a small, self-contained, highly transportable, 75-125 GPH water purification system. One soldier with little or no formal training in water treatment operations will operate the LWP on a part time basis. The objective is to develop a modular system which makes maximum use of commercially available or non-developmental components. Special Operations Forces (SOF) detachments, health care or medical detachments, and other small units will use the LWP when operating under field conditions in isolated locations and apart from standard water support. The LWP will provide these units with an self-sufficient means of water supply. The LWP will produce up to 750 gallons of potable water per day in a 6 to 10 hour period and can sustain the daily consumption and personal hygiene water needs for populations up to 125 people. The LWP will purify water from fresh, brackish, and saltwater sources. These sources may consist of creeks, streams, rivers, ponds, lakes, wells, pools, seas, oceans, or other large or small bodies of water.

The LWP will have a storage capacity for up to 800 gallons of potable water. A copy of the user's Operational Requirement Document (ORD) is provided at Attachment A for reference purposes only. In the event that requirements differ, this performance specification shall take precedence.

Light tactical vehicles (i.e. 1¼ ton capacity or less) will be the primary transport for the LWP both on- and off-road. Transport may occur frequently over unimproved roads and trails. When access to remote areas is limited, the LWP can also be delivered by helicopter or by airdrop, using military airdrop containers. The LWP is intended to be emplaced without material handling equipment and with a minimum of site preparation, set-up time, and manpower. Actual water production operations will be conducted on an intermittent basis to meet daily needs. Water purified using the LWP will be stored for immediate distribution or later use. Once deployed, the LWP may remain on-site in temporary situations, with durations measured in hours or days, or assigned to semi-permanent applications lasting several weeks or months. Upon completion of a mission, the LWP will be repacked, reloaded, and transported for use at a new site.

The LWP will be used in a wide variety of weather, climates and environments under tactical field conditions. The LWP will require only minimal training and will be simple to set up and operate. The LWP must be highly reliable, easily maintainable, suitable for use by soldiers in a field environment over an expected 20 year life. In addition, the LWP will be durable and rugged enough to withstand frequent loading, unloading, set-up and operation including recurrent periods of outside use, exposure, and storage in a wide range of environmental and climatic conditions.

2.0 APPLICABLE DOCUMENTS.

2.1 Government Standards and Specifications. None. Commercial standards and accepted commercial practice will be used wherever possible.

2.2 Other Government Documents, Drawings, and Publications. The following Other Government Documents form a part of this performance specification to the extent specified herein. Unless otherwise stated, issues are those in effect on the date of this RFP.

DIRECTIVES/STATUTES:

Title 29 CFR 1910	Occupational Safety and Health Administration (OSHA) Standards
Title 40 CFR	Health and Safety
Title 49 CFR	Transportation

2.3 Non-Government Publications. The following Non-Government Publications form a part of this performance specification to the extent specified herein. Unless otherwise stated, the issues of the documents which have been adopted by the Department of Defense (DoD) are those listed in the current edition of the Defense Index of Specifications and Standards (DODISS) and supplements thereto cited in the solicitation.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO):

AASHTO	Legal Maximum Dimensions and Weights of Motor Vehicles Compared with AASHTO Standards

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM):

ASTM D 3951	Standard Practice for Commercial Packaging
ASTM E 380	Metric Practice, Standard for

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI):

ANSI A8402	Quality Assurance Terms and Definitions

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE):

SAE J925	Minimum Access Dimensions for Construction and Industrial Machinery

2.4 Other Publications. The following Other Miscellaneous Publications form a part of this performance specification to the extent specified herein. Unless otherwise stated, the issues of the documents are those in effect on the date of this solicitation.

IRF Guides	International Road Federation Limits of Motor Vehicle Sizes and Weights
ISO 3631	Vibration
ISO DIS 2631	Guide to the Evaluation of Human Exposure to Whole Body Vibration

2.5 Order of Precedence. In the event of a conflict between this document and references cited herein, the text of this document takes precedence. Nothing in this performance specification shall constitute a waiver of compliance with applicable laws and regulations unless a specific exemption has been obtained.

3.0 SYSTEM REQUIREMENTS.

3.1 Performance Requirements. In this performance specification, the minimum acceptable performance threshold requirements are indicated with the imperative "shall" throughout the text. Objective capabilities are noted using the words "should", "desired", or "desirable". Section M of this RFP details the source selection implications of this distinction.

3.1.1 Raw Water Sources. The LWP shall be capable of purifying water from surface or ground water sources which contain fresh, brackish, or sea water. For the purposes of this performance specification, sea water is defined as source water with a salinity of 15,001 milligrams/liter (mg/L) Total Dissolved Solids (TDS) content or greater. Fresh water is defined as source water with a salinity of 1,000 mg/L TDS or less. Brackish water is categorized as between 1001 and 15,000 mg/L TDS. In addition, the LWP shall also be capable of purifying source water which is NBC contaminated when configured with a Nuclear, Biological, and Chemical (NBC) treatment module or component.

3.1.2 Flow Rate Requirements. The LWP shall produce at least 75 gallons of product water per hour (GPH) from a source with a salinity of 45,000 mg/L TDS and 125 GPH from a source with a salinity of 1,000 mg/L TDS. An objective capability of 75 GPH from sources with a salinity of 60,000 mg/L TDS is desired. Product water flow rates shall be normalized based on a feed water temperature of 77 degrees Fahrenheit.

3.1.3 Water Quality Standards. Water produced, stored, and dispensed by the LWP shall meet or exceed the minimum standards set forth for long term exposure in the revised Tri-Service Field Water Quality Standards, Technical Bulletin (Medical) 577, "Occupational and Environmental Health: Sanitary Control and Surveillance of Field Water Supplies," STANAG 2136, and QSTAG 245. An extract of these guidelines is provided for reference at Attachment B.

3.1.4 Component Flexibility. The LWP shall contain interchangeable raw water and product water distribution pumps.

3.1.5 Power Sources and Interfaces. The LWP shall include its own source(s) of power for the operation of all modules and components. This power may be fuel powered pumps, electrically driven pumps, or a combination of both. Fuel driven systems shall use multipurpose fuel (e.g. JP-8). Electrically driven systems shall be able to interface with standard, 60 Hz, 208V - 3 phase or 120V - 1 phase military diesel engine generator sets and military standard mobile electric power distribution equipment, connectors, and plugs.

3.1.6 Site Access/Suction and Discharge Requirements. The LWP shall be suitable for use at source water sites where there are steep banks or limited access to vehicles, equipment, or personnel. The LWP must be able to perform routine water purification missions by minimizing the number and type of modules which must be positioned in close proximity to the water's edge. As a minimum, the raw water feed pump shall be capable of drawing water from any source a minimum vertical distance of 3.05 meters (10 feet) and a horizontal distance of 15.25 meters (50 feet). This pump shall also be capable of pumping water a vertical distance of at least 7.62 meters (25 feet) and a horizontal distance of at least 30.5 meters (100 feet).

3.1.7 Product Water Dispensing Rates. The LWP shall be capable of dispensing product water from storage units to user containers at a rate of at least 10 gallons per minute. A method to regulate dispensing rates and service simultaneous users is desirable.

3.1.8 Weight and Size Restrictions. The LWP must be lightweight and compact. The LWP with power source, Basic Issue Items (BII), and 150 hours of expendable supplies shall not exceed a total gross weight of 1000 pounds. An objective weight of 750 pounds is desired. In its transport configuration, the complete LWP (including its power source and supplies) shall fit in the cargo compartment of the M1097A series High Mobility Multi-Purpose Wheeled Vehicle (HMMWV). The complete LWP system shall also be able to be transported internally by the UH-60 Blackhawk in a single lift. Individual modules or components of the LWP must fit inside standard A22 airdrop container(s).

3.1.9 Component Lift and Carry Restrictions. The LWP shall be capable of being emplaced and recovered from operational sites by a maximum of four (4) male soldiers without using material handling equipment. Reduction of this requirement to 2 soldiers is desired. It is also desirable that a combined male-female crew of no more than four (4) persons be able to emplace the LWP. Handles or hand holds shall be provided for lifting. Emplacement and recovery include the loading and unloading of LWP modules or components from the primary means of transport (i.e. M1097A or UH-60) and positioning them for purification operations. Maximum human factors lift and carry restrictions as computed from MIL-STD-1472D are shown below for reference purposes:

Condition	**Combined Male and Female** (Max Single Item)		**Male Only** (Max Single Item)	
	2 person	4 person	2 person	4 person
Lift to 5 feet or less	74 lbs	129.5 lbs	102 lbs	186 lbs
Lift to 3 feet or less	88 lbs	154 lbs	174 lbs	304.5 lbs
Carry up to 10 meters (or up to 32.8 feet)	84 lbs	147 lbs	164 lbs	287 lbs

3.1.10 Set Up and Tear Down Requirements. After all components or modules have been positioned at the site, the LWP shall be able to be put in to operation by one

(1) soldier within 45 minutes. Set up time includes performing all pre-operation checks and services, establishing initial settings, making all mechanical or electrical connections, installing expendable items or supplies, making adjustments, and adding fluids or chemicals. Preparing the LWP for movement to another site (or to its transporter) shall take one (1) individual no more than 45 minutes. (An additional maximum allowance of 40 minutes may be required to empty potable water storage containers, during which time other components or modules can be loaded for transport).

3.1.11 Disinfectant Capability. The LWP shall eliminate water-borne disease and health hazards by adding disinfectant to the product water. The LWP shall have a capability to monitor, meter, and adjust the disinfectant level in order to maintain a free available chlorine disinfectant residual equal to or greater than 2 parts per million (ppm) after 30 minutes contact time.

3.1.12 Potable Water Storage. The LWP shall include two (2) 400-gallon storage bags to be used as holding tanks for source water and/or product water tanks. These bags shall be closed to the atmosphere to preclude reinfection or chemical contamination and shall have separate inlets and outlets, so that filling and withdrawing operations can take place at the same time. The distribution system shall include a nozzle compatible with standard military 5-gallon water cans and canteens.

3.1.13 Product Improvements. Additional desired performance features for the LWP should include:

- Storage and transit in hot climates (up to 160 degrees Fahrenheit).
- The ability to treat water from chlorinated sources.
- Provide 75 GPH from source water with TDS content of 80,000 mg/L.
- Provide continuous monitoring of chemical and biological agents and compounds identified in Army Field Manual FM 3-9.
- Incorporate automatic shutdown (and warnings) when chemical contaminants exceed the safe levels established in Field Water Quality standards.
- Reduce energy consumption by 25%.
- Improve the Mean Time Between Essential Function Failure by 25%

3.2 Transportation. The LWP system must be transportable by ground, air, and sea transports routinely used by the military. The LWP shall be equipped with lifting and tie-down points necessary to permit safe handling and shipment of the system.

3.2.1 Containerized Loads. The LWP shall be capable of containerized transport. All components, sections, modules, or elements of the LWP (including power sources and 150 hours of expendable supplies) shall fit inside a single 8 foot x 8 foot x 20 foot International Standardization Organization (ISO) container.

3.2.2 Highway. The LWP shall be capable of unrestricted movement by highway in the U.S. and NATO Europe when transported in the cargo compartment of the HMMWV.

3.2.3 Rail. The LWP shall pass the rail impact test and meet the GIC equipment rail outline diagram when transported in the cargo compartment of the M1097A HMMWV.

3.2.4 Military Aircraft. The LWP shall be capable of internal air transport in one lift by the UH-60 helicopter and C-130 aircraft. LWP modules shall be airdroppable from the C-130 or C-141 aircraft using the standard A22 airdrop container.

3.2.5 Sealift. The LWP shall be capable of sea transport by Breakbulk, Container, Roll-On/Roll-Off (RO/RO), Fast Logistic Ship (T-AKR), and Fast Sealift Transport (FST) ships when shipped separately or when loaded in the cargo area of the M1097A HMMWV.

3.2.6 Shipping Data Plate. Each separate shipping unit shall be furnished with a shipping plate. All shipping data plates shall show a silhouette of the main unit or modules in their transport configuration indicating the center of gravity and the location and capacity of the lifting and tie-down provisions. The plates shall be permanently attached in a location that is visible and accessible but protected from damage during handling.

3.3 Logistics and Readiness. The LWP system shall be durable, reliable, and available for normal military use as defined below over an expected life of 20 years.

3.3.1 Durability. The LWP shall be rugged and durable to prevent damage during handling, lifting, set-up and tear down by soldiers in a field environment. The LWP shall be capable of being operated in Basic (-25°F to 110°F) and Hot (88°F to 120°F) climatic conditions and stored and transported in Basic (-28°F to 145°F) climatic conditions, as defined by AR 70-38. A separate winterization kit or warming facility (e.g. tent, building, or vehicle) is considered an acceptable alternative to prevent freezing during cold weather operations.

3.3.2 Reliability. The LWP shall have a Mean Time Between Essential Function Failure (MTBEFF) of at least 280 hours with a level of confidence of at least 80 percent.

3.3.3 Maintainability. Operator preventative checks and services (PMCS) shall not exceed 30 minutes for each 4 hours of LWP operation. Item replacement or calibration shall not require more than 30 minutes. The LWP shall have a Mean Time to Repair (MTTR) no greater than 1 hour for all unscheduled maintenance demands and a Maximum Time to Repair (MaxTTR) no more than 2 hours for 90% of all Essential Unscheduled Maintenance Demands (EUMD).

3.3.4 Suitability. The LWP will be used by military units and personnel during training and under tactical field conditions. Components shall be resistant to moisture, corrosion, fungus, and oxidation which may affect its performance levels or life expectancy. The LWP shall meet the 20 year design life criterion without incurring damage due fresh or salt water exposure or corrosion, oxidation, mildew or fungus either in operation or during periods of unprotected or outside storage. Corrosion resistance preventative maintenance shall be limited to routine cleaning, washing, flushing, spot painting, periodic inspection, and repair of accidental or incidental damage.

3.3.5 Self-Sustained Operations. The LWP shall be capable of self-sustained operations for not less than 150 operating hours, except for Class III Petroleum, Oil, and Lubricant (POL) products. This includes all consumable and expendable supplies such as replacement filters, chemicals, membranes, and cleaners. Class III POL products will be provided through normal resupply channels.

3.3.6 Fuels and Lubricants. The LWP and ancillary equipment shall operate using multi-purpose fuel, such as JP-8, and standard lubricants.

3.3.7 Hoses, Fittings, Couplings, and Connectors. The LWP shall use standard plumbing connections, hoses, fittings, couplings, and ancillary equipment wherever possible to minimize maintenance and logistics burdens.

3.3.8 Instrumentation and Tools.

3.3.8.1 Identifying Defective RO Membranes. The LWP shall incorporate a means to identify defective reverse osmosis (RO) membranes during operations.

3.3.8.2 Water Quality Monitoring. The LWP shall incorporate in-line water quality monitoring technology. As a minimum, the LWP shall include automatic performance feedback devices which display qualitative or quantitative information regarding turbidity, total dissolved solids (TDS) content, pH, and temperature. The LWP shall also include provisions to measure input and output flow rates and quantity totals. Reported information shall be provided using continuous digital displays and programmable paper recording devices.

3.3.8.3 Procedures and Tools. The LWP shall include Built-in Test/Built-in Test Equipment (BIT/BITE) to isolate faults to a single line replacement unit (LRU). All tools required for normal operations and routine operator maintenance shall be included in the Basic Issue Items (BII) and stored with the LWP for protection, accessibility and transport. At the organization and Direct Support (DS) levels, the LWP shall be maintained with these BII tools plus common tools from the standard general automotive mechanics tool kit SC 5180-90-N26. It is desired that no special maintenance procedures or special tools be necessary at the Organizational or Direct Support level of maintenance. General purpose test equipment must be capable of direct measurement in metric or both metric and inch-pound units.

3.3.8.5 Manuals. The LWP shall be supported using Commercial Off-The-Shelf (COTS) operator and maintenance manuals to the maximum extent possible. Manuals required for the operation and maintenance procedures of the LWP shall be provided and stored with the system. Manuals shall be supplemented as necessary in order to address military operations, procedures, and environments.

3.4 System Survivability Requirements.

3.4.1 Nuclear, Biological and Chemical Contamination (NBCC) Survivability. The LWP shall be capable of processing water from NBC contaminated sources. However, the LWP itself does not require NBC survivability characteristics. When such protection is necessary, the LWP will be operated from an NBC-safe container or shelter.

3.4.2 Ballistic Survivability. The LWP does not require ballistic survivability.

3.5 Environmental Conditions. The LWP shall be capable of being stored, maintained, and operated under field situations and in the environmental conditions listed:

3.5.1 Ambient Conditions. Normal operating and storage conditions for the Lightweight Water Purifier are:

Air Temperature:	Operating:	-25° F to + 120° F
	Storage:	-28° F to + 145° F
	Transport:	-28° F to + 145° F
Relative Humidity:	3% to 95%	

3.5.2 Weather and Adverse Environment Factors. Operating conditions in a military field environment may include the following factors: light or heavy rains, accumulations of up to 4 inches of snow, and exposure to direct sunlight. Winds up to 20 miles per hour (with gusts to 35 mph) with blowing rain, dirt, sand or dust should not prevent water purification operations.

3.6 Computer Resources. No computer resources are envisioned.

3.7 MANPRINT.

3.7.1 Manpower. The LWP system shall be deployable, operable, recoverable and maintainable in daylight and darkness by soldiers dressed appropriately for the anticipated environments of operation (for example, arctic/cold weather clothing and NBC Mission Oriented Protective Posture MOPP IV overgarments).

3.7.2 Personnel. The LWP will be operated and maintained as an additional duty at the unit level by Special Forces and Medical personnel. At organization and Direct Support levels it will be maintained by Quartermaster Equipment Repair Specialists, MOS 63J.

3.7.3 Training. The LWP shall be provided with a training package adequate to train Instructors and Key Personnel (IKPT) and selected military operators on the recommended procedures for set-up, operation, and maintenance of the LWP and ancillary equipment. The training package shall include sufficient written, visual and other training materials to permit safe loading, unloading, packaging, transport, assembly, disassembly, operation, maintenance, and storage of the LWP. The LWP will not require formal institutional training.

3.7.4 Human Factors Engineering Requirements. The contractor shall insure that human factors engineering are an integral part of design and developmental considerations for the LWP. Human factors requirements must include provisions for effective man-machine interface and preclude LWP characteristics which would require extensive cognitive, physical, or sensory skills; complex manpower or training intensive tasks; or which result in frequent or critical human performance errors during operation, maintenance, or deployment of the LWP.

3.7.5 Health and Safety. The LWP shall be safe to operate, transport, and maintain. Safety shall be given major consideration during the engineering and design process. Hazards which expose personnel or equipment to injury or damage shall be eliminated or controlled. The LWP shall not pose any uncontrolled health or safety hazards to trained soldiers. Exposed parts which are subject to high operating temperatures or moving parts that are a hazard to personnel shall be enclosed or guarded. Warning and cautionary placards shall be affixed to the equipment or modules at a prominent location adjacent to identified hazards (i.e. high voltage, heat, toxic vapors, explosion, or radiation). Instructions, training, and manuals shall include clear warnings where appropriate. Protective devices shall not impair operating or maintenance functions.

The use of hazardous materials will be eliminated where possible. Where alternative materials are not feasible or practical, the effects of those materials shall be minimized and isolated. Hazardous materials are defined as anything whose chemical, physical, or biologic nature causes a safety, public health, or environmental concern that requires an elevated level of effort to manage. Materials that are flammable, corrosive, toxic, carcinogens or suspected carcinogens, systemic poisons, asphyxiants, or respiratory irritants will not be used except as part of the purification process where required. Chemicals required for the purification of water shall be packaged in accordance with accepted commercial safety practice and environmental regulations. Procedures for adding, mixing, measuring, handling, and storage of such chemicals shall include detailed safety precautions to insure minimum exposure, handling, or spillage. Such procedures shall also address waste disposal of brine and of contaminated filters. Equipment containing electrical, hydraulic or fuel systems shall include fire fighting or suppression provisions appropriate for the type fire hazard presented. Such fire equipment shall be reasonably and readily available to the operator. Noise levels at the driver's and operator's station, and within a 10 foot radius thereof, shall not exceed a level of 83 dB(A) for less than 12 hrs exposure or 85 dB for less than 8 hrs exposure.

4.0 VERIFICATION.

4.1 General.

The prototypes produced according to this specification will support the Production Qualification Test (PQT) and Initial Operational Test and Evaluation (IOT&E). The general objectives of PQT/IOT are to verify that the Lightweight Water Purifiers built in accordance with this specification under the Acquisition Reform initiatives will meet user requirements.

4.2 Verification Procedures.

During PQT/IOT the LWP will be tested to verify that each of the requirements of Section 3 has been achieved. Table 1 lists the requirements and indicates how each will be verified.

TABLE 1 REQUIREMENTS VERIFICATION MATRIX

PARAGRAPH	BRIEF DESCRIPTION OF REQUIREMENT	VERIFICATION TEST
3.1.1	Use of Fresh, Brackish, Sea Water Sources	The LWP will be operated for sustained periods of time (up to 500 hours for each prototype). Approximately 75% of this time will be using fresh water ($\leq$ 1000 mg/l TDS) and the remainder using salt water ($\geq$ 45,000 mg/l TDS). The LWP must purify water from both sources.
3.1.2	Fresh and Sea Water Flow Rates Compliance	Flow rates will be measured during the testing. Minimum average flow must be $\geq$ 75 GPH from source water with salinity of 45,000 mg/l and 125 GPH from source water with 1000 mg/l (both flow rates normalized to 77° F).
3.1.3	Water Quality Standards	Water produced during the testing will be tested for quality. It must meet Tri-Service Field Water Quality Standards.
3.1.4	Component Flexibility	Examination. The raw water and product water distribution pumps must be interchangeable .
3.1.5	Power Sources and Interfaces	Examination. Fuel driven systems must use multipurpose fuel (e.g. JP-8). Electrically driven systems must be able to interface with standard, 60 Hz, 208V - 3 phase or 120V - 1 phase military diesel engine generator sets and mobile electric power distribution equipment, connectors, and plugs.
3.1.6	Site Access/ Suction and Discharge Requirements	The LWP will be tested to verify that it can draw water from any source a distance of 50 horizontal feet and 10 vertical feet and pump the water a distance of 100 horizontal feet and 25 vertical feet.

PARAGRAPH	BRIEF DESCRIPTION OF REQUIREMENT	VERIFICATION TEST
3.1.7	Product Dispensing Rates	Discharge will be measured during testing to verify that the LWP can distribute potable water from storage bags or tanks ≥ 10 GPM.
3.1.8	Weight and Size Restrictions	Examination. The LWP with power source, Basic Issue Items (BII), and 150 hours of expendable supplies will be weighed. Total gross weight must not exceed 1000 pounds. An objective weight of 750 pounds is desired. The entire system, including power source, BII, and 150 hours of supply, must fit in cargo compartment of M1097A and UH-60.
3.1.9	Lift and Carry Restrictions	The LWP will be tested to insure that it can be emplaced and recovered from operational sites by a maximum of four (4) male soldiers without using material handling equipment. Reduction of this requirement to 2 soldiers is desired.
3.1.10	Set Up and Tear Down Times	The LWP will be tested with a soldier crew to verify that it can be put in to operation or prepared for a move by one (1) soldier within 45 minutes.
3.1.11	Disinfectant Capability	During the testing described for 3.1.1, the free available chlorine in the product water will be measured. It must be ≥ 2 ppm. An examination will determine whether the LWP has the capability of monitoring, metering, and adjusting this level.
3.1.12	Potable Water Storage and Dispensing Capability	Examination. The LWP must include two 400-gal. closed storage bags with separate inlets and outlets.
3.1.13	Product Improvements	Examination to determine whether any of the desired product improvements have been achieved.

PARAGRAPH	BRIEF DESCRIPTION OF REQUIREMENT	VERIFICATION TEST
3.2.1	Fit in 8x8x20 foot ISO container	Examination to verify that the complete system, including the power source and 150 hours of expendable supplies, fits in an 8x8x20 foot ISO container.
3.2.2	Unrestricted Highway Movement in M1097A HMMWV	Examination and measurement to verify that the LWP when loaded in the M1097A HMMWV meets US and NATO highway limits.
3.2.3	Unrestricted Rail Movement in HMMWV or ISO container	Examination and measurement. The LWP must meet the GIC equipment rail outline diagram when transported in the cargo compartment of the M1097A HMMWV. Perform the rail impact test.
3.2.4	Internal Air Movement by UH-60, C-130, C-141. Airdroppable.	Examination to determine whether the system can be loaded into UH-60, C-130, and C-141. Test to verify that the system can be successfully airdropped using the A22 container.
3.2.5	Sealift by Military Sealift Command	Examination to insure that the system can be transported by sea.
3.2.6	Shipping Data Plates Information and Location.	Examination to determine whether shipping plates are attached, visible, legible, and contain required information (silhouette indicating center of gravity and location and capacity of lifting and tie-down provisions).
3.3.1	System Ruggedness for Field Use	The LWP will be set up, operated, and torn down repeatedly by a soldier crew during the testing.
3.3.2	Reliability (at least 280 hours MTBEFF @ 80% confidence)	Each LWP will be operated for up to 500 hours. All breakdowns will be recorded and the MTBEFF calculated. This must be $\geq$ 280 hours.

PARAGRAPH	BRIEF DESCRIPTION OF REQUIREMENT	VERIFICATION TEST
3.3.3	Maintainability	All maintenance required during the tests will be recorded. Minimum acceptable results are: MTTR $\leq$ 1 hr for all unscheduled maintenance and MaxTTR $\leq$ 2 hrs for 90% of all unscheduled maintenance. PMCS $\leq$ 30 min for each 4 hrs operation.
3.3.4	Suitability for Tactical and Field Conditions. Corrosion, moisture, etc. resistance	The LWP will be set up, operated, and torn down repeatedly by a soldier crew during the testing. After testing the system will be inspected for indications of corrosion, oxidation, mildew, and fungus.
3.3.5	Self-sustained Operation	During the sustained testing the consumption of expendable supplies will be carefully recorded. Expendable supplies furnished with the LWP must be sufficient for 150 hours of self-sustained operation, except for Class III POL.
3.3.6	Use Standard Fuels and Lubricants.	Examination to insure that the LWP operates using multipurpose fuel, such as JP-8, and standard lubricants. (See also 3.1.5)
3.3.7	Standard Plumbing Connections	Examination to insure that the LWP uses standard plumbing connections, hoses, fittings, couplings, and ancillary equipment.
3.3.8.1	Identifying Defective RO Membranes	Examination to insure that the LWP incorporates a means of identifying defective RO membranes during operations.
3.3.8.2	Water Quality Monitoring	Examination to verify that the LWP incorporates in-line water monitoring technology for system performance parameters and flow totalizing and recording devices.

PARAGRAPH	BRIEF DESCRIPTION OF REQUIREMENT	VERIFICATION TEST
3.3.8.3	Fault Isolation and Built-in Test/Built-in Test Equipment (BIT/BITE)	Examination to verify that the LWP includes Built-in Test/Built-in Test Equipment (BIT/BITE) to isolate fault to a single line replacement unit (LRU).
3.3.8.3	Maintenance Procedures and Tools	Examination to verify that all tools required for normal operation and operator maintenance are included in BII and that maintenance at Organization and DS levels requires only these plus common tools listed in SC 5180-90-N26.
3.3.8.5	Manuals	Examination to verify that COTS manuals are used to the maximum extent. Use of these manuals by troops operating and repairing the LWP during tests to insure that these manuals are adequate. Verify inclusion of Supplements for military operations.
3.4.1 (and 3.1.1)	Process Water from NBC Sources	LWP will be tested to verify that it can remove NBC contamination from water.
3.5.1	Capable of being operated in Basic and Hot and stored in Basic climatic conditions.	LWP will be tested to verify that it can perform under the following conditions: Operating: -25° F to + 120° F Storage: -28° F to + 145° F Transport: -28° F to + 145° F
3.5.2	Adverse Weather	LWP will be examined and tested to verify that it can operate under adverse weather conditions: light or heavy rains, accumulations of up to 4 inches of snow, exposure to direct sunlight, winds up to 20 miles per hour (with gusts to 35 mph) with blowing rain, dirt, sand or dust.

PARAGRAPH	BRIEF DESCRIPTION OF REQUIREMENT	VERIFICATION TEST
3.7.1 and 3.7.2	Manpower: Operations in daylight and darkness by specified soldiers	During the testing, the LWP will be operated in during daylight and darkness by SOF (CMF 18) and medical (MOS 91B) soldiers as an additional duty and maintained by MOS 63J with or without MOPP4 gear.
3.7.3	Training Package	During the operational testing, the adequacy of the training package will be verified. The LWP will be operated and maintained by SOF (CMF 18) and medical (MOS 91B) soldiers trained using the training package.
3.7.4	Human Factors Engineering	During the testing, the effectiveness of the contractor's human factors engineering will be verified by evaluating how well the LWP design provides for effective man-machine interface.
3.7.5	Health and Safety	During the testing, health and safety issues or hazards will be documented to insure that there are no uncontrolled hazards and that warning placards and instructions are adequate.
3.7.5	Noise Levels at Operator's Station	During testing, noise levels will be measured at the operator's station to verify that the LWP meets specific Army quantified noise requirements (e.g. 83 dB for $\leq$ 12 hrs exposure or 85 dB for $\leq$ 8 hrs exposure).
3.7.5	Hazardous Materials and Handling and Packaging of Chemicals	Examination. The LWP will be examined to verify that the use of hazardous materials has been minimized, that water purification chemicals are packaged in accordance with environmental regulations, and that procedures for handling these chemicals include detailed and adequate safety precautions.

PARAGRAPH	BRIEF DESCRIPTION OF REQUIREMENT	VERIFICATION TEST
3.7.5	Adequacy of Firefighting Equipment	Examination. The LWP will be examined to verify that adequate firefighting or suppression equipment is included and that it is easily accessible and readily available to the operator.

5.0 PREPARATION FOR DELIVERY.

5.1 Preservation and Packaging. The LWP system shall be processed for shipment from manufacturer's facilities to the initial receiving activity or as otherwise specified in the prime contract. Preservation and packaging shall be in accordance with good commercial practice to assure arrival at destination without damage or loss.

5.2 Packing. Parts shipments shall be packed to commercial standards.

5.3 Marking. All containers and shipments shall be marked in accordance with best commercial practice and indicate the contract identification and agency shipping address.

6.0 NOTES.

6.1 Intended Use. The Lightweight Water Purifier (LWP) System is intended to:

- Improve the responsiveness of water support to early entry, highly mobile forces throughout the spectrum of conflict in peace and war.

- Provide quality water support to small units and detachments where distribution of bulk water is not feasible or practical.

- Provide such water support without committing larger water production assets or specially trained personnel from the logistics support structure.

- Tailor water production flow rates to the demands of independent Special Operations Forces, detachments, and units typically engaged in remote site missions.

- Use state-of-the-art technology to reduce the size, weight, and deployment features of existing military water purification equipment.

- Improve water production efficiency and flow rates from sources with high salinity contents (e.g. > 45,000 milligrams/liter of Total Dissolved Solids.

6.2 Definitions. Not Applicable.

6.3 Human Engineering Reference. Guidelines for human engineering factors are referenced in MIL-STD-1472D "Human Engineering Design Criteria for Military Systems, Equipment, and Facilities". HFE considerations include: General Requirements, Control/Display Integration, Visual Displays, Controls, Labeling, Anthropometry, Design for Maintainer, Operational Ground/Shipboard Vehicles, Hazards and Safety, and User-Computer Interface.

ATTACHMENT A

DRAFT
OPERATIONAL REQUIREMENTS DOCUMENT (ORD) FOR THE LIGHTWEIGHT WATER PURIFIER (LWP)

7 April 1995

ATTACHMENT B

PROPOSED
TRI-SERVICE WATER QUALITY
STANDARDS
(EXTRACT)

Proposed Tri-Service Water Standards for Long Term, Large Quantity Consumption

Physical Property	15 liters/day Standard (4.0 gallons per day)
Color (color units)	50
Odor (threshold odor number)	3
pH	5.0 to 9.0
Temperature (Celsius) or Fahrenheit	15° to 22°C (59° to 72°F)
TDS (mg/L)	1000
Turbidity (NTU)	1.0
Chemical Property (mg/L)	
Arsenic	0.02
Cyanide	2.00
Chloride	600.00
Lindane	0.20
Magnesium	30.00
Sulfate	100.00
Microbiological Property	
Coliforms (#/100 ml)	1
Chemical Agents* (μg/L)	
Hydrogen Cyanide	2.0
Incapacitants	2.3
Lewisite	200.0
Mustard *Agent*	47.0
Nerve Agents	4.0
T-2 Toxins	8.7

DEPARTMENT OF THE ARMY
OFFICE OF THE DEPUTY CHIEF OF STAFF FOR OPERATIONS AND PLANS
400 ARMY PENTAGON
WASHINGTON, DC 20310-0400

REPLY TO ATTENTION OF
DAMO-FDR

16 OCT 1993

MEMORANDUM FOR ASSISTANT SECRETARY OF THE ARMY (RESEARCH, DEVELOPMENT, AND ACQUISITION), ATTN: SARD-RP

SUBJECT: Mission Need Statement (MNS) for the Lightweight Water Purifier (LWP)

1. Enclosed Mission Need Statement (MNS) for the Lightweight Water Purifier (LWP) has been reviewed by the Army staff and is approved.

2. The Marine Corps has recommended the Joint Potential Designator to be "Joint Interest".

3. The CARDS reference number is 22-93.

4. Request a Milestone Decision Authority (MDA) be assigned to accomplish the Milestone 0 (MS 0) actions as defined in the DOD 5000 series. Upon assignment, request this office be notified.

5. POC this office is M. Frick, x79712.

Encl

JAY M. GARNER
Major General, GS
Assistant Deputy Chief of Staff
for Operations and Plans,
Force Development

CF:
Secretary, Joint Requirements Oversight Council
Commander, U.S. Army Training and Doctrine Command, ATTN: ATCD-SL, Ft. Monroe, VA 23651-5000
Deputy Chief of Staff for Operations and Plans, ATTN: DAMO-FDL, Wash, DC 20310-0400

MISSION NEED STATEMENT

FOR

LIGHTWEIGHT WATER PURIFIER (LWP)

1. Defense Planning Guide Element. A LWP capability will resolve the deficiencies in U.S. Army Training and Doctrine Command Battlefield Development Plan 94-08, priority #43, which have been reviewed in accordance with (IAW) today's threat and remain valid.

2. Mission and Threat Analyses.

a. Mission Analysis. Small units and detachments, to include special forces, conducting missions such as early entry, long-range surveillance, nation building, civil affairs and disaster relief operations do not possess water purification capabilities to support such missions. This necessitates the use of equipment designed to support division, corps and echelons above corps to resupply water using limited road nets or aircraft or reliance on dubious quality host nation water support. These courses of action impose an undesirable logistical burden or threaten the health of soldiers participating is such operations. Soldiers are at risk from both intentionally placed and natural contaminants in raw water sources. These can be industrial chemical contaminants, natural biological and organic/inorganic substances, or even nuclear, biological, chemical (NBC) contaminants. This threat is further compounded when there is a lack of freshwater sources, as in arid regions of the world. The problems require the desalinization of brackish and salt water and removal of NBC and industrial contaminants. The LWP will provide an increased capability to provide potable water in operations described above and in differing environments.

b. Threat Analysis. The LWP does not counter any specific threat. An LWP capability and its associated personnel are vulnerable to the spectrum of threat destruction and/or disruption capabilities at all levels of conflict along the operational continuum. Though unlikely, the LWP capability also may be attacked as a target of opportunity. Destructive capabilities such as direct and indirect fires, small arms fire and sabotage can harm the system and associated personnel. This capability also will be susceptible to contamination. The NBC operations and weapons effects may render the system temporarily unusable or may destroy it.

3. Nonmaterial Alternatives. Doctrine, training, leadership and organization have been reviewed for possible solutions. The only nonmaterial solution is the use of safe, secure sources of water supply within the area of operation. This cannot be assured in all regions of the world because is requires protection of the source and a secure means of transport by friendly forces. It also assumes a safe level of water quality; however, many third world nations have severe water quality problems.

4. Potential Material Alternatives. There also may be a potential for interservice or allied cooperation on requirements similar to those stated in this MNS. The alternatives are: add NBC

and desalinization capabilities to existing U.S. Marine Corps diatomaceous earth filtration systems; adapt commercial systems to U.S. Army requirements; adapt foreign military material to U.S. Army requirements; develop a system to meet U.S. Army requirements; modify and adapt the 150-gallon per hour (GPH) reverse osmosis water purification unit (ROWPU), (a prototype was developed for Southern Command).

5. Constraints. A LWP system must comply with industry and government safety and health hazard standards and must not present any uncontrolled safety or health hazards throughout the life cycle of the system. The LWP must produce water which meets U.S. Army field water quality standards Technical Bulletin, Medical (TB MED) 577 from fresh, brackish or sea water sources. It must also produce water which meets U.S. Army field water quality standards (TB MED 577) while operating in an NBC environment and/or drawing water from NBC-contaminated sources, and processed potable water shall be protected against NBC contamination/re-contamination. The LWP must be transportable, both internally and externally, by UH-1 and UH-60 U.S. Army aircraft, either by modules or as a single item. It also must be transportable by modules or as a single item, in cargo versions of the High Mobility Multipurpose Wheeled Vehicle (HMMWV) and larger transportation assets. If the LWP is modular, each module should be transportable by no more than four soldiers; two soldier transportability is desired. It must be operable and maintainable by organic unit personnel with minimal training. The LWP must be supported IAW the Army's standard four-level maintenance system and logistics system. It must be repairable within current levels of the Army's maintenance system. Standard tools will be used. No special tools, new tools, or test, measurement or diagnostic equipment will be required to support the LWP. The LWP will have a minimum of components and a maximum commonality in parts. This capability must not increase personnel and training requirements or any additional military occupational specialties (MOS) or skill identifiers. The LWP must be capable of interoperability with current U.S. Army water storage and distribution equipment. This capability is essential to mission enhancement and accomplishment. Therefore, IAW Army Regulation (AR) 70-71, it must be NBC contamination survivable. Its components, in transit and use, will be hardened against the materiel damaging effects of NBC contaminants and capable of being operated, maintained, and resupplied by organic unit personnel during day and night operations in basic climatic environments while wearing the field uniform and full protective ensemble. The LWP must be operated and maintained safely and efficiently be U.S. Army organic unit personnel during day and night operations under conditions specified for hot, basic, and cold. They must also be able to operate the system while wearing the required combat clothing and equipment. The LWP must not expose soldiers to unacceptable health hazards. It must be capable of being stored and transported in climatic environments cold, basic and hot without damage and must be capable of operating without additional protection (i.e. shelters in temperature above freezing). Training will require both institutional and unit training for operator and maintenance personnel.

6. Joint Potential Designator. The Marine Corps has recommended this mission need be designated as Joint Interest.

DEPARTMENT OF THE ARMY
UNITED STATES ARMY COMBINED ARMS SUPPORT COMMAND
AND FORT LEE
FORT LEE, VIRGINIA 23801-6000

REPLY TO
ATTENTION OF

7 April 1995
S: 30 June 1995

ATCL-MES

MEMORANDUM FOR SEE DISTRIBUTION

SUBJECT: Draft Operational Requirements Document (ORD) for the Lightweight Water Purifier (LWP)

1. References.

a. DOD Directive 5000.1, 23 Feb 91, Defense Acquisition.

b. DOD Instruction 5000.2, 23 Feb 91, Defense Acquisition Management Policies and Procedures.

c. DOD 5000.2-M, 23 Feb 91, Defense Acquisition Management Documentation and Reports.

2 Request action addressees review the enclosed draft ORD and provide comments or concurrence NLT 30 June 95. Request other Service addressees' response include the appropriate Joint Potential Indicator. The final draft will be submitted to the U.S. Army Training and Doctrine Command for approval.

3. A Joint Work Group (JWG) will be designated, if necessary, to address and resolve substantive issues developed during the staffing of the draft ORD. CPT Scott Wright, DSN 687-0496, will be the chairperson of the JWG. Request the materiel developer, TACOM (TARDEC), provide a JWG vice-chairperson. Request your representative to the JWG have the authority to represent your organization to resolve any issues in developing the final draft.

4. Our point of contact for this action is CPT Scott Wright, DSN 687-0496, or commercial (804) 734-0496; facsimile DSN 687-0574 or commercial (804) 734-0574.

FOR THE COMMANDER:

Clayton R. Lee

CLAYTON R. LEE
Director, Modernization and
Technology

Encl

ATCL-MES
SUBJECT: Draft Operational Requirements Document (ORD) for the Lightweight Water Purifier

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SUBJECT: Draft Operational Requirements Document (ORD) for the Lightweight Water Purifier

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ATCL-MES
SUBJECT: Draft Operational Requirements Document (ORD) for the Lightweight Water Purifier

DIRECTOR.
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HQ USAF/XORD, 1480 AIRFORCE PENTAGON, WASHINGTON, DC 20330-1480
HQ ACC/CEX (ATTN: MR. FISHER), 129 ANDREWS ST, STE 102, LANGLEY AFB, VA 23665-2769

Coordinating First Draft:4/6/95

Operational Requirements Document
For
Lightweight Water Purifier (LWP)

1. General Description of Operational Capability.

a. Overall Mission Area. The LWP provides water purification and storage capability to small units and detachments, particularly Special Operation Forces (SOF) and small health care units, in low intensity conflict, nation building, civil affairs actions, peace keeping, disaster relief operations, and additional operations other than war (OOTW). The LWP will be used to purify a broad range of water sources. It will be used when logistical support for potable water is not feasible based on existing water delivery systems. The LWP may also be used to support initial and/or early entry of units to an undeveloped theater of operations. This requirement supports the Army's combat, combat support, and combat service support mission.

b. Type of System Proposed. The LWP is an Army program with Joint Service interest from the U.S. Marine Corps which will produce potable water meeting field water quality standards from fresh, brackish, and sea waters, including NBC-contaminated water when configured with an NBC treatment component. The LWP will produce 125 gallons per hour (GPH), which will supply sufficient water to meet consumption and personal hygiene needs of the supported unit with intermittent operation. The LWP will be a multi-module, non-developmental item that can be emplaced by four personnel within one hour. It will be highly transportable (fit in a HMMWV and UH-60 helicopter) for deployment to areas where road nets, airlift assets and/or vehicle support is limited. The LWP will be emplaced, operated, and maintained at the unit level as an additional duty by personnel without specialized operator training.

c. Operational Concept. The concept of operation is to produce water as far forward as possible using a flexible and highly mobile treatment system during war- and peace-time scenarios. The LWP will be employed throughout the range of highly developed, densely populated urban areas to isolated rural areas in undeveloped countries. Employment of the LWP will be governed by METT-T considerations since water sources generally must be identified and approved while an operation develops. The LWP will be compatible with ground, amphibious, air mobile, and airborne units.

(1) Wartime Mission Profile. The LWP will be employed throughout SOF operational areas as a direct support asset. Special Forces Groups will employ the LWP throughout the operational area at locations where acceptable water supplies exist. The Command Medical Authority's designee will coordinate the selection of an acceptable water source from which the LWP will be capable of producing a safe, reliable supply of potable water. The LWP will be used to produce water that will be: distributed at the point of production; transported to forward supply points; and/or delivered to major consumers (e.g., local indigenous forces). It will be operated in basic and hot climate conditions as defined in AR 70-38, including NBC-contaminated environments when the system is contained in an NBC-safe structure. The LWP will not be NBC survivable since it is not a mission essential item.

(2) Peacetime Mission Profile. The LWP will be deployed for foreign internal defense, unconventional warfare, special activities, and CONUS/OCONUS field training exercises. Additionally, the LWP may be used to support OOTW (e.g., disaster relief, humanitarian assistance, etc.) and the operational concept will be tailored to meet situational needs.

d. Support Concept. The LWP will be supported logistically by both military and contract personnel by the most cost-effective means available during peacetime with acceptable risk when in transition to war. Cost-effectiveness is second only to materiel readiness Training will be in accordance with standard Army training policy for systems not requiring specific MOS training.

e. Mission Need Statement Summary. The Mission Need Statement (CARD reference 22-93) for the LWP was approved 6 October 1993. The MNS established a Joint Potential Designator. Joint Interest. to improve the water purification capabilities of small units and detachments. including special operating forces. conducting military missions and operations other than war.

2. **Threat.**

a. The LWP does not defeat a threat capability. US forces deploying worldwide in support of US interests are always subject to a range of health and environmental hazards. These hazards can have a significant impact on soldier performance and overall combat effectiveness. US forces deploying worldwide are especially at risk from both intentionally placed and natural contaminants in water sources. These contaminants include industrial chemical contaminants. natural biological contaminants, organic inorganic substances, and possibly nuclear. biological and chemical contaminants.

b. The LWP will encounter the same battlefield threats as those of employing SOF units/teams. In a hostile environment, the system could experience inadvertent destruction from conventional explosive ordnance (delivered by ground forces, artillery fire, aircraft, or missiles) or, less likely, non-conventional ordnance (nuclear, and chemical weapons). The System Threat Assessment Report (STAR) for Land Warrior has been approved for use as the baseline threat assessment for LWP.

3. **Shortcomings of Existing Systems.**

a. The current means of providing water is to conduct frequent aerial resupply with bottled water. This means of support is expensive and uses valuable cargo space on aircraft supporting SOF and medical teams conducting various missions. Contracting requirements to obtain bottled water and testing bottled water quality to ensure that it is acceptable for human consumption places additional burden on SOF and medical teams. The existing and projected military water purifiers are not designed for use by small units or detachments with limited potable water requirements and limited supplies. The 600- and 3,000-GPH ROWPUs require heavy vehicles, material handling equipment, large generators for power supplies, and dedicated operators. These systems are not practical for the mission requirements identified in paragraph 1.

b. The only non-materiel solution is the use of safe, secure potable water sources within the area of operations. This cannot be assured since many areas of the world have severe water quality problems associated with their municipal water supplies and sufficient secure means of transport are normally unavailable in these areas.

4. **Capabilities Required.** Annex A contains the rationale supporting the following system performance requirements. The system performance capabilities identified in paragraph 4a are listed in priority order.

a. System Performance. The LWP must:

(1) Produce a minimum normalized flow of at least 75 GPH from a source water with salinity 45,000 mg/L total dissolved solids (TDS), and 125 GPH from a fresh water source with salinity 1,000 mg/L TDS. Both flow rates shall be normalized to 77 degrees Fahrenheit. The desired performance objective is 75 GPH from a source water with salinity 60,000 mg/L TDS.

(2) Produce, store and distribute potable water that meets the field drinking water standards identified in TB MED 577, STANAG 2136, and QSTAG 245, and the proposed Tri-Service Field Water Quality Standards from all surface and ground water sources of fresh, brackish, and sea water, including NBC-contaminated water, as described in paragraph 4a(1).

(3) Contain interchangeable raw water and product water distribution pumps.

(4) Operate using multi-purpose fuel (e.g., JP-8) powered, direct drive pumps or electrical motor powered pumps (208V, 3-phase or 120V, 1-phase) driven by a multi-purpose fuel generator set. A combination of both types of pumps is acceptable provided all other requirements are met.

(5) Contain a raw water pump capable of drawing water from any type of water source (ocean, lake, river, well, etc.) a distance of 50 horizontal feet and 10 vertical feet. The raw water pump shall also be capable of pumping the water a distance of 100 horizontal feet and 25 vertical feet.

(6) Contain a product water distribution pump capable of dispensing product water at a minimum rate of 10 gallons per minute.

(7) Total weight must not exceed 1,000 pounds. This includes the weight of the power generation equipment utilized to operate the LWP, all basic issue items (BII) plus 150 operating hours of supply. The desired objective total weight is 750 pounds. The LWP must be small enough to fit in the rear compartment area of a M1097A truck, cargo [HMMWV (85"x50"x48")], and must be air transportable inside the UH-60 in one lift. This requirement includes the power generation equipment required to operate the LWP. No single component of the LWP can exceed 53" in length, 48" in width and 48" in height.

(8) Have the capability to add disinfectant and maintain a disinfectant residual.

(9) Contain two (2) 400-gallon storage bags to be used as holding tanks for source water and/or product water tanks. The storage tanks shall be closed to the atmosphere.

(10) Be capable of identifying defective reverse osmosis (RO) membranes during operations.

(11) Incorporate in-line water quality monitoring technology for system performance parameters such as turbidity, TDS, pH, and temperature. Additionally, flow totalizing and recording devices are required for the LWP. Monitoring results should be reported in continuous digital display and programmable paper recording devices.

(12) Preplanned product improvement (P3I) efforts must be targeted at: permitting transit and storage of the LWP in the hot climate category as described in AR 70-38; treat

chlorinated water sources; provide 75 GPH on a source water with 80,000 mg L TDS; provide continuous monitoring of all potential chemical/biological agents and compounds identified in FM 3-9 (NAVFAC P-467, AFR 355-7) Potential Military Chemical/Biological Agents and Compounds; incorporate automatic shutdown systems when concentrations of chemical contaminants exceed field drinking water standards; reduce weight of single modules so that four personnel (male or female) can emplace and recover equipment; and reduce energy consumption by 25% and improve the Mean Time Between Essential Function Failure by 25% so that overall logistics demands are reduced during mission operation.

b. Logistics and Readiness. The LWP shall:

(1) Be emplaced and recovered from operational sites by four personnel. Single modules must not weigh more than 328 pounds. Emplacement and recovery by two individuals is desired.

(2) Following emplacement, be initially put into operation by one individual within 45 minutes without specialized training. Daily operational setup and shutdown will be 15 minutes or less. No more than 45 minutes will be required by one individual to prepare the LWP for movement to another site.

(3) The LWP must have 280 hours Mean Time Between Essential Function Failure (MTBEFF), a Mean Time to Repair (MTTR) no greater than 1 hour for all Unscheduled Maintenance Demands (UMD), and a Maximum Time to Repair (MaxTTR) of 2 hours for 90 percent of all Essential Unscheduled Maintenence Demands (EUMD).

(4) Any LWP item requiring adjustment and/or alignment by the operator must be adjusted and/or aligned within 30 minutes without special training or complex equipment. Preventative maintenance checks and services (PMCS) must not require more than 30 minutes for each four hours of operation and must be accomplished by individuals without specialized training.

(5) Be capable of self-sustained operations (system with on-hand processing supplies) for at least 150 operating hours, excluding Class III requirements.

(6) Not require the establishment of a new MOS. The LWP shall be operated and maintained as an additional duty by personnel in receiving units.

(7) Be supported by standard supply and maintenance systems.

(8) There shall be no performance degradation due to environmental or climatic conditions for the operating conditions identified in paragraph 1c(1).

(9) There shall be no differences in system readiness during war or peace operations. Additional logistics requirements during peace operations may be necessary to support appropriate collection, storage, and disposal of waste products (e.g., brine concentrate) in accordance with local, State, Federal, and/or host nation environmental laws.

c. Critical System Characteristics. The LWP shall:

(1) Meet field drinking water standards identified in TB MED 577, STANAG 2136, QSTAG 245, and the proposed Tri-Service Field Water Quality Standards in all operational environments with no observable deleterious effects caused by blowing rain/sand/soil.

(2) Be capable of storage and transporation in basic (-28 to 145 ^{O}F) climate; be capable of operation in the basic (-25 to 110^{O}F) and hot (88 to 120^{O}F) climate (see AR 70-38). A winterization kit or warming facility (e.g. tent, building, vehicle) is considered an acceptable materiel solution for operating in cold weather conditions where system freezing may occur.

(3) Be designed with appropriate occupational safety, health and environmental protective equipment that minimizes operator exposure to health hazards.

(4) Be transportable as detailed in paragraph 4a(8) and 6b.

(5) Corrosion resistant materials will be used to the maximum extent possible.

(6) Operational and physical security will be provided by the supporting unit.

(7) System safety requirements will be completed by the materiel developer in accordance with the requirements of AR 385-16. At a minimum, system safety hazards must address: unloading/loading; setup/takedown, operation, maintenance, and repairs to the system.

5. Integrated Logistics Support.

a. Maintenance Planning. Support objectives for initial operational capability will be full organic support with no interim contractor support. The LWP will be designed for testability. The use of Built-in Test/Built-in Test Equipment (BIT/BITE) will be used to unambiguously fault isolate to a single line replacement unit (LRU). The LWP will be supported by standard supply and maintenance systems. Operator maintenance and direct support (DS) will consist of PMCS, scheduled services, and modular replacement of defective assemblies. General support (GS) maintenance and depot maintenance will consist of contract repair of assemblies replaced at lower level maintenance support.

b. Support Equipment. Unit-level and DS maintenance will be accomplished with common tools and/or tools in the general mechanics tool kit. General support maintenance and depot level maintenance will be accomplished by contractor support. The Integrated Family of Test Equipment (IFTE) will be used if automatic test equipment (ATE) is required for the LWP.

c. Human Systems Integration.

(1) Manpower and Personnel. No additional manpower or increases to force structure will be required to operate or maintain the LWP.

(2) Training. The LWP and basic issue items will be designed so that institutional training will not be required. Instructor and key personnel training will be provided by the equipment manufacturer. The Materiel Developer will ensure that a New Equipment Training (NET) package will be developed to support unit sustainment training. Unit training will be the responsibility of receiving units.

(3) Systems and Soldier Survivability/Health Hazard Assessment.

(a) Survivability for the soldier should be developed from a systems approach (see AR 70-75, Survivability of Army Personnel and Materiel).

(b) Soldier survivability includes minimizing the system's visual, auditory, and RF signature and exploiting the system's mobility and emplacement and displacement capability. The soldier survivability analysis should also consider typical operator workload, especially during high intensity operations, to ensure that operator overload or fatigue will not lead to operational errors which could jeopardize the support force.

(c) The LWP will meet applicable health, safety, and human engineering design requirements and will not present any uncontrollable safety or health hazards to personnel throughout the life cycle of the system. Health hazard assessments will be completed in accordance with guidelines provided by the Army Surgeon General. The system will be assessed for environmental impact.

(d) Appropriate labels or instructions shall be provided on or near operating equipment to assist soldiers in the safe operation of each piece of equipment.

(4) Human Systems Integration. The LWP will be operable and field maintainable in daylight and darkness by appropriately trained, representative soldiers from Special Operation Forces for gaining units dressed appropriately for the anticipated environments of operation. Operation and maintenance shall be accomplished with less than 5 percent repeated error (errors of omission and commission) in performance of critical tasks. The LWP design shall comply with applicable commercial and military human engineering design requirements. The LWP will be capable of being operated by the target audience while in Mission Oriented Protective Posture 0 through IV and in cold weather overgarments.

d. Computer Resources. None.

e. Other Logistics Considerations. The LWP will be fielded using the total package concept. The LWP will be supported by Electronic Technical Manuals (ETM), unless a waiver is granted by the Logistics Support Activity (LOGSA), Huntsville, AL to use commercial, off-the-shelf (COTS) manuals. If a waiver is obtained, the COTS manuals or ILS addendums to the COTS manuals must include decontaminating procedures for internal LWP components. At a minimum, the procedures must address: internal piping (including RO vessels); waste disposal; and specific operating procedures when treating NBC-contaminated water so that the LWP can be relocated and operated on an uncontaminated source. The materiel developer's ILS manager will prepare the ILS Plan (ILSP). A care of supplies in storage (COSIS) plan will identify long-term storage requirements for reverse osmosis elements and chemicals. Special cold weather storage may be required for the LWP to prevent the system from freezing. Unique storage facilities may be necessary for membrane elements during hot and cold temperature storage and transport. The user requires procedures for safe collection and disposal of brine concentrate during CONUS and OCONUS training operations in accordance with applicable local, State, Federal, and host nation environmental regulations.

6. Infrastructure Support and Interoperability.

a. Command, Control, Communications, and Intelligence. The LWP will not require any integration into the C3I architecture. The system will be deployed with units that will be able to receive or transmit any required C3I information.

b. Transportation and Basing. The LWP must meet US and NATO countries' highway legal limits when carried in a HMMWV; have military standard lifting and tie down provisions; meet the GIC equipment gauge rail outline diagram; pass the rail impact test; and be transportable in 8 ft x 8 ft x 20 ft ISO frame. The LWP must be transportable by a M1097A truck, cargo [HMMWV

(85"x50"x48")], and by internal transport in a UH-60. The LWP must be air dropable from normal airdrop platforms (e.g., C-130 and C-141 aircraft) using current air delivery container systems.

c. Standardization, Interoperability, and Commonality. The LWP will be capable of operating with all U.S. services, NATO forces, and other Allied forces. The LWP will be compatible with standard fuels and lubricants. Standard tools will be used to the maximum extent possible. Electric power or multi-fuel engine requirements will be compatible with standard military generator sets and standard mobile electric power distribution equipment. The LWP should be compatible with standard plumbing connections for hoses and couplings. The US Marine Corps has expressed joint interest in the LWP.

d. Mapping, Charting, and Geodesy Support. Standard Defense Mapping Agency data will be used to assist with surface or ground water site selection.

e. Environmental Support. No requirement will exist for any specific weather, oceanographic, or astrogeophysical support. The LWP will be capable of operating in the temperature, humidity, and solar radiation conditions of the hot and basic climatic design types of AR 70-38.

7. **Force Structure.** The LWP will be issued to Special Forces units and to selected medical detachments. The initial Army purchase is projected at 50 systems: SOF is projected to receive 42 systems; AMEDD is projected to receive 8 systems.

8. **Schedule Considerations.**

a. Initial procurement of the LWP is anticipated for FY99; however, the initial procurement date may change to reflect revised funding schedules.

b. Initial Operational Capability is attained when: all primary and supporting equipment is received; repair parts, expendable items, and field and technical manuals are available; instructor and key personnel training is complete; and the first unit equipped has received its authorized LWP equipment.

c. Full Operational Capability is attained when all authorized units have received their LWP equipment and all standards associated with paragraph 8b is complete.

END OF DOCUMENT

ANNEX A

Supporting Rationale for Capabilities Required by the U.S. Army Special Operations Command

4. **Capabilities Required.** Annex A contains the rationale supporting the following system performance requirements. The system performance capabilities identified in paragraph 4a are listed in priority order.

a. System Performance. The LWP must:

(1) Produce a minimum normalized flow of at least 75 GPH from a source water with salinity 45,000 mg/L total dissolved solids (TDS), and 125 GPH from a fresh water source with salinity 1,000 mg/L TDS. Both flow rates shall be normalized to 77 degrees Fahrenheit. The desired performance objective is 75 GPH from a source water with salinity 60,000 mg/L TDS.

RATIONALE: This flow rate was determined using a water planning factor of 6.0 gal/day/man and a force size of approximately 125 soldiers. Assuming that the LWP will be operated for ten hours per day on a seawater source (worst case conditions), a total of 75 gallons per hour is required to meet the daily requirement of 750 gallons.

(2) Produce, store and distribute potable water that meets the field drinking water standards identified in TB MED 577, STANAG 2136, and QSTAG 245, and the proposed Tri-Service Field Water Quality Standards from all surface and ground water sources of fresh, brackish, and sea water, including NBC-contaminated water, as described in paragraph 4a(1).

RATIONALE: It is necessary for the LWP to produce safe drinking water that meets military water quality standards.

(3) Contain interchangeable raw water and product water distribution pumps.

RATIONALE: Pump failures can have a large impact on water production. This requirement allows the LWP to have greater operational flexibility when performing its missions. The ability to interchange the raw water and distribution pump will allow the LWP to continue to operate in a "work around" mode while the damaged pump is repaired.

(4) Operate using multi-purpose fuel (e.g., JP-8) powered, direct drive pumps or electrical motor powered pumps (208V, 3-phase or 120V, 1-phase) driven by a multi-purpose fuel generator set. A combination of both types of pumps is acceptable provided all other requirements are met.

RATIONALE: The fuel-powered equipment must operate on multi-purpose fuel, including diesel and JP-8, to ensure that the LWP is capable of using any fuel during various missions. The voltage and phase requirements listed above are standard for most US Army generator sets and will allow the LWP to operate powered by standard US Army generators sets if the generator sets supplied with the LWP fail.

(5) Contain a raw water pump capable of drawing water from any type of water source (ocean, lake, river, well, etc.) a distance of 50 horizontal feet and 10 vertical feet. The raw water pump shall also be capable of pumping the water a distance of 100 horizontal feet and 25 vertical feet.

RATIONALE: This requirement ensures that the LWP can access raw water sources under varying conditions and environments.

(6) Contain a product water distribution pump capable of dispensing product water at a minimum rate of 10 gallons per minute.

RATIONALE: This flow rate will allow the LWP to quickly supply its users with potable water. Also, it will allow the unit to empty its storage tanks in the event rapid deployment to another site is required.

(7) Total weight must not exceed 1,000 pounds. This includes the weight of the power generation equipment utilized to operate the LWP, all basic issue items (BII) plus 150 operating hours of supply. The desired objective total weight is 750 pounds. The LWP must be small enough to fit in the rear compartment area of a M1097A truck, cargo [HMMWV (85"x50"x48")], and must be air transportable inside the UH-60 in one lift. This requirement includes the power generation equipment required to operate the LWP. No single component of the LWP can exceed 53" in length, 48" in width and 48" in height.

RATIONALE: Special Operation Forces are inherently small, mobile forces and require their equipment to be lightweight and compact. They traditionally do not have organic support units required to move heavy equipment. The dimensions of the A22 single container that will be used to airdrop the LWP requires that the LWP not exceed 53" in length, 48" in width and 48" in height.

(8) Have the capability to add disinfectant and maintain a disinfectant residual.

RATIONALE: This requirement ensures that disease-causing organisms and viruses are inactivated and that a safe, reliable supply is provided to consumers.

(9) Contain two (2) 400-gallon storage bags to be used as holding tanks for source water and/or product water tanks. The storage tanks shall be closed to the atmosphere.

RATIONALE: This provides the LWP with enough storage capacity to hold one days' water supply. The requirement for a closed tank will reduce the potential recontamination of the product water.

(10) Be capable of identifying defective reverse osmosis (RO) membranes during operations.

RATIONALE: This minimizes the logistical burden caused by replacing all membranes contained in the RO vessels when only one membrane is damaged or defective.

(11) Incorporate in-line water quality monitoring technology for system performance parameters such as turbidity, TDS, pH, and temperature. Additionally, flow totalizing and recording devices are required for the LWP. Monitoring results should be reported in continuous digital display and programmable paper recording devices.

RATIONALE: This requirement ensures that the water quality parameters and production data are routinely recorded and continuous monitoring provides instant feedback to operators on system performance. These devices will enable the operator to make appropriate adjustments as source water quality varies and improve overall system performance. This is particularly important since there will not be a dedicated operator for this system.

(12) Preplanned product improvement (P3I) efforts must be targeted at: permitting transit and storage of the LWP in the hot climate category as described in AR 70-38; treat chlorinated water sources; provide 75 GPH on a source water with 80,000 mg/L TDS; provide continuous monitoring of all potential chemical/biological agents and compounds identified in FM 3-9 (NAVFAC P-467, AFR 355-7) Potential Military Chemical Biological Agents and Compounds; incorporate automatic shutdown systems when concentrations of chemical contaminants exceed field drinking water standards; reduce weight of single modules so that four personnel (male or female) can emplace and recover equipment; and reduce energy consumption by 25% and improve the Mean Time Between Essential Function Failure by 25% so that overall logistics demands are reduced during mission operation.

RATIONALE: The P3I program ensures that the LWP will accommodate future product improvements as technology becomes available. Specifically, RO membranes tend to degrade when stored at temperatures within the hot category for transit and storage; chlorinated waters cannot currently be treated using RO membranes without destroying the membranes; RO membranes are not currently capable of producing sufficient quantities of treated water when source waters have high TDS; no means exists for continuous monitoring of raw or treated water quality which has obvious advantages for ensuring potability and record keeping; although the system is for SOF units (which has no female soldiers), future Army requirements for similar equipment would benefit from modules that can be emplaced and recovered by all soldiers (male or female); any improvement to reliability and maintainability that can reduce logistical demands is a desired performance characterisitc.

b. <u>Logistics and Readiness</u>. The LWP shall:

(1) Be emplaced and recovered from operational sites by four personnel. Single modules must not weigh more than 328 pounds. Emplacement and recovery by two individuals is desired.

RATIONALE: This ensures that the LWP is lightweight and easily transportable under various field conditions. The weight limit addresses the standard lift capability for a four-man lift. Note that there are no females in SOF units.

(2) Following emplacement, be initially put into operation by one individual within 45 minutes without specialized training. Daily operational setup and shutdown will be 15 minutes or less. No more than 45 minutes will be required by one individual to prepare the LWP for movement to another site.

RATIONALE: This requirement ensures that the LWP can be quickly placed into operation when needed. It also ensures that the LWP can be quickly repackaged for movement to another site.

(3) The LWP must have 280 hours Mean Time Between Essential Function Failure (MTBEFF), a Mean Time to Repair (MTTR) no greater than 1 hour for all Unscheduled Maintenance Demands (UMD), and a Maximum Time to Repair (MaxTTR) of 2 hours for 90 percent of all Essential Unscheduled Maintenence Demands (EUMD).

RATIONALE: R&M Requirements Rationale (RRR) is being prepared by TRADOC Combat Development Engineering (CDE). Upon approval, the RRR will be on file at U.S. Army CASCOM, ATTN: ATCL-MES, Fort Lee, VA 23801-6000 and TRADOC CDE, Eastern Regional Office, ATTN: ATCD-SRE, Fort Lee, VA 23801.

(4) Any LWP item requiring adjustment and/or alignment by the operator must be adjusted and/or aligned within 30 minutes without special training or complex equipment. Preventative maintenance checks and services (PMCS) must not require more than 30 minutes for each four hours of operation and must be accomplished by individuals without specialized training.

RATIONALE: This requirement ensures that the LWP can be quickly and easily maintained by the receiving units without extensive training.

(5) Be capable of self-sustained operations (system with on-hand processing supplies) for at least 150 operating hours, excluding Class III requirements.

RATIONALE: This requirement ensures that Special Operations Forces will have an operable system even when logistical support is not readily available.

(6) Not require the establishment of a new MOS. The LWP shall be operated and maintained as an additional duty by personnel in receiving units.

RATIONALE: This requirement ensures that the LWP will not incur additional manpower requirements for operation and maintenance.

(7) Be supported by standard supply and maintenance systems.

RATIONALE: This requirement minimizes the need for special tools, diagnostic, and calibrating equipment which will increase weight/space of the LWP.

(8) There shall be no performance degradation due to environmental or climatic conditions for the operating conditions identified in paragraph 1c(1).

RATIONALE: Normalizing temperatures to 77 °F considers the impact of low and high temperatures on the performance of the RO membrane systems and recognizes that production rates will decrease when operating in extreme environmental conditions. The requirement for no performance degradation stated in this requirement relates to degradation in excess of that permitted by normalizing temperatures to 77°F.

(9) There shall be no differences in system readiness during war or peace operations. Additional logistics requirements during peace operations may be necessary to support appropriate collection, storage, and disposal of waste products (e.g., brine concentrate) in accordance with local, State, Federal, and/or host nation environmental laws.

RATIONALE: The LWP system must be capable of producing potable water for all situations. Compliance with environmental laws, such as the Clean Water Act, and obtaining National Pollution Discharge Elimination System (NPDES) permits to discharge brine concentrate wastes must be addressed during system development.

c. Critical System Characteristics. The LWP shall:

(1) Meet field drinking water standards identified in TB MED 577, STANAG 2136, QSTAG 245, and the proposed Tri-Service Field Water Quality Standards in all operational environments with no observable deleterious effects caused by blowing rain, sand/soil.

RATIONALE: This requirement ensures that the LWP can operate and provide safe drinking water in environmental conditions common to Special Operations Forces missions.

(2) Be capable of storage and transporation in basic (-28 to 145 $^{\circ}$F) climate; be capable of operation in the basic (-25 to 110°F) and hot (88 to 120°F) climate (see AR 70-38). A winterization kit or warming facility (e.g. tent, building, vehicle) is considered an acceptable materiel solution for operating in cold weather conditions where system freezing may occur.

RATIONALE: This requirement will ensure that the LWP can operate effectively in the climatic conditions in which it will be deployed. A winterization kit or heated shelter is required to operate most commercially available systems in sub-freezing conditions.

(3) Be designed with appropriate occupational safety, health and environmental protective equipment that minimizes operator exposure to health hazards.

RATIONALE: This requirement ensures that adequate environmental, health, and safety requirements are designed in the system.

(4) Be transportable as detailed in paragraph 4a(8) and 6b.

RATIONALE: This requirement ensures that the LWP will be transportable in the vehicles and modes used by the gaining units.

(5) Corrosion resistant materials will be used to the maximum extent possible.

RATIONALE: Experience has shown that while the existing ROWPUs are capable of effectively treating sea water, salt deposition on the equipment occurs when the a ROWPU is located near the ocean. As a result, existing ROWPU systems have experienced corrosion. Use of corrosion resistant materials will reduce the potential for system failures and maintenance requirements.

(6) Operational and physical security will be provided by the supporting unit.

RATIONALE: The Special Operating Force will provide all operational or physical security as needed when the LWP is located away from base camp operations. It necessary, the LWP can be relocated to a secure area during periods of inoperation.

(7) System safety requirements will be completed by the materiel developer in accordance with the requirements of AR 385-16. At a minimum, system safety hazards must address: unloading/loading; setup/takedown, operation, maintenance, and repairs to the system.

RATIONALE: System safety is a critical system characteristic.

ANNEX B

Operational Mode Summary/Mission Profile (OMS/MP)

1. **System Description.** The Lightweight Water Purifier (LWP) is a new program which provides small units with the capability to produce potable water for human consumption at about 75 to 125 gallons per hour (1.25 - 2.0 gallons per minute) depending on the water source. The LWP purifies fresh, brackish, and salt waters. It consists primarily of a raw water pump, filtration system, reverse osmosis membrane system, and chemical feed pumps for disinfection. The LWP will fit in a HMMWV and a UH-60 helicopter. It will be accessible and operated from the ground in a skid-mounted configuration.

2. **Operational Mode Summary (OMS).**

a. Operational Concept. The concept of operation is to produce water as far forward as possible, using a flexible and mobile treatment system. The LWP will be used throughout the spectrum of SOF operational continuum in peace and wartime. The typical missions that it will be used in will range from highly developed densely populated urban areas to isolated rural areas in undeveloped countries under various types of mission profiles (see Table 1). The LWP will be used to purify raw water from a broad range of waters for human consumption. The governing parameters are the number of personnel for which support is required, and the climatic conditions in which it will be employed. The system will be mobile, compatible with ground, amphibious, air mobile, and airborne units. The system will be operated in basic (-25 to 110 °F) and hot (88 to 120 °F) climates (see AR 70-38). The system will be stored and transported in the basic (-28 to 145 °F) climate (see AR 70-38). The system will be operated in an NBC-contaminated environment only if the LWP is contained in an NBC-safe structure.

Table 1. Types of Missions.

Mission	% of Occurrence
Foreign Internal Defense	45
Unconventional Warfare	5
Civil Affairs	15
Operations Other Than War	35

b. Wartime.

(1) The LWP will be employed throughout the SOF Operational Area as a Direct Support asset. Special Forces Groups will employ the LWP throughout the operational area at locations where acceptable water supplies exist. The LWP will be used to produce water that will be: distributed at the point of production; line-hauled to forward supply points; and/or line-hauled to major consumers (e.g., local indigenous forces. The anticipated duration for wartime missions is three months to one year. The mission profile will generally consist of 75% operation under the conditions described for Situation 1 and 25% operation under conditions described for Situation 2 (see Table 3).

(2) Threat Matrix.

Table 2. Threat Matrix for LWP.

Threat	Indirect Strike	Direct Strike
Artillery	X	
Rockets	X	
Bombs		X
Nuclear	X	
Biological	X	X
Chemical	X	X
Sabotage		X
Raids	X	
Other theater area attack weapons	X	

c. Peacetime. The LWP will be deployed for support of foreign internal defense; unconventional warfare, special activities, and CONUS/OCONUS field training exercises. It will be operated in the same manner as prescribed in the operational concept and wartime OMS. Additionally, the LWP will be used to support operations other than war (e.g., disaster relief, humanitarian assistance, peace-keeping missions, etc.) using the operational concept tailored to the situation needs. The anticipated duration for peacetime missions is two weeks (field training exercises) and up to one year for operations other than war. The mission profile will generally consist of 95% operation under the conditions described for Situation 1 (see Tables 3 and 4) and 5% operation under conditions described for Situation 2 (see Tables 3 and 4). The remainder of the peacetime operations will generally follow mission requirements.

3. **Mission Profile (MP).**

a. Tables 3 and 4 describe the operation of the LWP and the tasks required during normal operation.

Table 3. Mission Profile for LWP on Fresh Water Source.

Task	Situation 1*: (hrs)	Situation 2§ (hrs)
Produce potable water	6	6
Backwash filters	1	1
Maintenance‡	1.5	1.5
Tear down	0	0.5
Relocate	0	2
Set up	0	0.5

* Extended operations during 24-hour period.
§ Operation with one relocation during at 24-hour period.
‡ Includes operator checks and services conducted during daily operations.

Table 4. Mission Profile for LWP on Sea Water Source.

Task	Situation 1*: (hrs)	Situation 2§ (hrs)
Produce potable water	10	10
Backwash filters	1	1
Maintenance‡	1.5	1.5
Tear down	0	0.5
Relocate	0	2
Set up	0	0.5

* Extended operations during 24-hour period.
§ Operation with one relocation during at 24-hour period.
‡ Includes operator checks and services conducted during daily operations.

b. The production rate of the LWP will vary based on the type of raw water source as shown in Table 5. The production rate is also affected by the specific physical characteristics of the raw water quality (e.g., temperature, TDS, etc.).

Table 5. LWP Mission Profile Based on Source Water Quality.

Type of Source Water†	Frequency of Operation	Production Profile ‡(GPH)
Fresh Water	75%	125
Sea Water	25%	75

† Average water quality characteristics defined in paragraph 5, below.
‡ Average normalized hourly flow rate during operation (6-10 hours) in a 24-hour period. Potable water quality and sampling in accordance with frequency (minimum sampling 1x/4 hours operation) and proposed Tri-Service standards for TB MED 577

4. **Environmental Conditions.** Tables 6 and 7 show the anticipated operating climate conditions and movement terrain for the LWP, respectively.

Table 6. Operating Climatic Conditions.

Climate Conditions	% of Fleet
Hot	30
Basic	70

Table 7. Movement Terrain Conditions.

Terrain	Usage
Improved Roads	25%
Unimproved Roads	55%
Cross Country	20%

5. **Methodologies and References for OMS/MP.**

a. For the purpose of defining the production profile, a fresh water source is defined as having less than 1,000 mg/L TDS. This definition is consistent with the Tri-Service Water Quality Standards for potable water. For the purpose of defining the production profile, sea water source is defined as any water source with a TDS greater than 15,001 mg/L. Additionally, all waters are normalized to the average concentration at 77 degrees Fahrenheit.

b. The treated water quality profile is based on the proposed Tri-Service standards for long-term (greater than one year) exposure.

Table 8. Proposed Tri-Service Water Standards for long-term, large quantity consumption requirements.

Physical Property	**15 liters/day standard**
Color (color units)	50
Odor (threshold odor number)	3
pH	5.0-9.0
Temperature (Celsius)	15-22
TDS (mg/L)	1000
Turbidity (NTU)	1.0
Chemical Property (mg/L)	
Arsenic	0.02
Cyanide	2
Chloride	600
Lindane	0.2
Magnesium	30
Sulfate	100
Microbiological Property	
Coliforms (#/100 ml)	1
Chemical Agents* (µg/L)	
Hydrogen Cyanide	2
Incapacitants	2.3
Lewisite	200
Mustard	47
Nerve Agents	4
T-2 Toxins	8.7
Radiological Property	
Radiological	0.05 µCuries/L

* Chemical Agent standards are based on short-term (less than 7 days) exposure during NBC operation.

ANNEX C

Coordination

ANNEX D

Funding Implications§

Lifecycle Costs‡	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03	FY04	thru FY22	TOTALS
RDTE	0.271	0.605	0.555	0.15	0	0	0	0	0	0	0	1.581
Procurement	0	0	0	0	1.05	3.05	0	0	0	0	0	4.10
Military Construction	0	0	0	0	0	0	0	0	0	0	0	0
Military Personnel†	0	0	0	0	0	0	0.236	0.236	0.236	0.236	0.236	4.72
O&M	0	0	0	0	0	0	0.155	0.155	0.155	0.155	0.155	3.1
TOTALS	0.271	0.605	0.555	0.15	1.05	3.05	0.391	0.391	0.391	0.391	na	13.501

§ Dollar values are in millions of FY95 constant dollars. To convert from FY95 to FY90 dollars, multiply the value in the table by 0.8602.

‡ Lifecycle Costs for five major program areas.

REVISED PROGRAM LIFE CYCLE COST ESTIMATE (LCCE) FOR LIGHTWEIGHT WATER PURIFIER (LWP)

4 OCTOBER 1995

Prepared for US Army Tank Automotive Command,
Mobility Technology Center - Belvoir, under
Contract Number DAAK70-92-D-0003, DO 0039.

ID: 1 Title: LIGHTWEIGHT WATER PURIFIER (LWP) - REVISED 10/04/95

First Year: 1994

DESCRIPTION:

This Program Life Cycle Cost Estimate (LCCE) for the Lightweight Water Purifier (LWP) is a revision of the LCCE for the LWP validated on 25 October 1994. The most significant change is the increase of the Army requirements from 37 to 50 units. In addition, milestone, production, and fielding schedules have been revised to agree with the latest Acquisition Strategy.

The Lightweight Water Purifier (LWP) will support small units and detachments, including special forces conducting early entry, long range surveillance, nation building, civil affairs, and disaster relief operations.

At present small units and detachments conducting operations of these types must carry all required water with them or obtain it from the host nation. This host nation support is often unavailable, and the carrying of heavy, bulky water containers is often impractical. The use of current military water purification equipment, such as the 600 GPH and the 3000 GPH Reverse Osmosis Water Purification units (ROWPU), on the other hand, requires heavier trucks than those available to these small units. In addition, these water purification devices are often too large for the roads found on these missions and may require water sources larger than may be available.

To solve these problems, the LWP will be light weight and highly mobile for deployment in areas where road nets, aircraft assets, and host nation water support may be limited or unavailable. The LWP will purify salt, brackish, and fresh waters, and water contaminated with nuclear, biological, and chemical (NBC) agents. It will function in hot and basic climates as defined by AR 70-38.

TECHNICAL:

	Primary POC	Other POC
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ASSUMPTIONS - LIGHTWEIGHT WATER PURIFIER (LWP)

1. All costs are in thousands of FY 1996 dollars, with inflation applied in accordance with Hq Army Materiel Command (AMCRM-E) Memo, Subject: Inflation Guidance, dated 1 February 1995.

2. Although the Mission Need Statement for the Lightweight Water Purifier (LWP) was approved on 6 October 1993, only a draft Operational Requirements Document (ORD) exists. Present plans call for a Milestone I/II in the first quarter of FY 1996 and Milestone III in the first quarter of FY 1998. Requirements are anticipated to be 8 LWPs for Medical Units and 42 for Special Forces for a total of 50 units. The system is anticipated to have a useful operating life of 20 years.

3. Based on the schedule and requirements above, system costs for this Cost Estimate are allocated across the life cycle cost years based on the following quantities:

Year	Production Quantity	Fielding Quantity	Sustainment Quantity
1999	10		
2000	40		
2001		50	
2002			50
2003			50
2004			50
2005			50
2006			50
2007			50
2008			50
2009			50
2010			50
2011			50
2012			50
2013			50
2014			50
2015			50
2016			50
2017			50
2018			50
2019			50
2020			50
2021			50
2022			0
Σ	50	50	1000 LWP-yrs

4. In Special Forces Units, the LWP will be operated as a part time additional duty by members of CMF 18, probably MOS 18C and 18D. In Medical Units the system will be operated by MOS 91B, again as a part time additional duty. The repairer for the LWP will be MOS 63J, assumed to be E-4, who will probably be located at the base.

5. Initial Deployment of the LWP will be entirely within CONUS.

6. For both operations and training missions the LWP will be deployed to the operating area by fixed or rotary wing aircraft along with the troop unit and its other equipment. Transportation costs for this movement are considered operational or training costs for the unit and are not charged to the LWP program.

ORGANIZATION OF PROGRAM LIFE CYCLE COST ESTIMATE (LCCE)

This Cost Estimate is composed of three parts as follows:

1. This Introduction.

2. Four Cost Matrices:
   a. Cost Totals by Phase in Constant Dollars
   b. Cost Totals by Phase in Current Dollars
   c. Cost Totals by Year in Constant Dollars
   d. Cost Totals by Year in Current Dollars

3. Cost Data Sheets and Variable Information Sheets arranged by cost category:
   1. RDT&E
   2. Procurement
   3. Construction (No Costs)
   4. Military Personnel
   5. O&M

MAJOR DIFFERENCES FROM DECISION COST ESTIMATE

This Program Life Cycle Cost Estimate (LCCE) was developed as one of the Acquisition Management Documents required to support a Milestone I/II In-Process Review scheduled for late FY 1995 or early FY 1996 for the Lightweight Water Purifier (LWP). A Decision Cost Estimate (DCE) for the system differs from this LCCE in two important respects:

1. Sunk costs are excluded from the Decision Cost Estimate (DCE).

2. Military Personnel Costs are excluded from the DCE in accordance with Draft TRADOC Pamphlet 11-8, Para 3-2.c.1 (page 25).

Thus th develop a Decision Cost Estimate for the LWP from this Program Life Cycle Cost Estimate (LCCE), the following must be subtracted:

- Sunk Costs

- Military Personnel Costs: Cost Category 4.0 plus Cost Elements 2.11, 5.11, and 5.12.

BRTRC - Baseline Cost Model - V1.2
Cost Totals by Phase (Constant Dollars) ($k)

LIGHTWEIGHT WATER PURIFIER (LWP) - REVISED 10/04/95

	Total	Phase I	Phase II	Phase III	Subsys 3	Subsys 4	Subsys 5
1.0 RDT&E-FUNDED ELEMENTS	2433.26	2433.26					
1.01 DEVELOPMENT ENGINEERING	1101.34	1101.34					
1.02 PRODUCIBILITY ENGR AND PLAN (PEP)	0.00	0.00					
1.03 DEVELOPMENT TOOLING	0.00	0.00					
1.04 PROTOTYPE MANUFACTURING	272.53	272.53					
1.05 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	50.00	50.00					
1.051 PROJECT MGMT ADMIN (PM CIV/MIL)	50.00	50.00					
1.052 OTHER	0.00	0.00					
1.06 SYSTEM TEST AND EVALUATION	369.11	369.11					
1.07 TRAINING	50.59	50.59					
1.08 DATA	589.70	589.70					
1.09 SUPPORT EQUIPMENT	0.00	0.00					
1.091 PECULIAR	0.00	0.00					
1.092 COMMON	0.00	0.00					
1.10 DEVELOPMENT FACILITIES	0.00	0.00					
1.11 OTHER RDT&E	0.00	0.00					
2.0 PROCUREMENT-FUNDED ELEMENTS	2835.87	2835.87					
2.01 NON-RECURRING PRODUCTION	0.00	0.00					
2.011 INITIAL PRODUCTION FACILITIES (IPF)	0.00	0.00					
2.012 PRODUCTION BASE SUPPORT (PBS)	0.00	0.00					
2.013 OTHER NON-RECURRING PRODUCTION	0.00	0.00					
2.02 RECURRING PRODUCTION	1952.30	1952.30					
2.021 MANUFACTURING	1849.32	1849.32					
2.022 RECURRING ENGINEERING	102.98	102.98					
2.023 SUSTAINING TOOLING	0.00	0.00					
2.024 QUALITY CONTROL	0.00	0.00					
2.025 OTHER RECURRING PRODUCTION	0.00	0.00					
2.03 ENGINEERING CHANGES	92.47	92.47					
2.04 SYSTEM ENGNRNG/PROGRAM MANAGEMENT	100.00	100.00					
2.041 PROJECT MGMT ADMIN	100.00	100.00					
2.042 OTHER	0.00	0.00					
2.05 SYSTEM TEST & EVALUATION, PRODUCTION	230.22	230.22					
2.06 TRAINING AIDS & EQUIPMENT	0.00	0.00					
2.07 DATA	242.26	242.26					
2.08 SUPPORT EQUIPMENT	0.00	0.00					
2.081 PECULIAR	0.00	0.00					
2.082 COMMON	0.00	0.00					
2.09 OPERATIONAL/SITE ACTIVATION	0.00	0.00					
2.10 FIELDING	205.59	205.59					
2.101 INITIAL DEPOT LEVEL REPARABLE (SPARES	92.47	92.47					
2.102 INITIAL CONSUMABLES (REPAIR PARTS)	92.47	92.47					
2.103 INITIAL SUPPORT EQUIPMENT	0.00	0.00					
2.104 TRANSPORTATION (EQUIPMENT TO UNIT)	8.53	8.53					
2.105 NEW EQUIPMENT TRAINING (NET)	12.14	12.14					
2.106 CONTRACTOR LOGISTICS SUPPORT	0.00	0.00					
2.11 TRAINING AMMUNITIONS/MISSILES	13.03	13.03					
2.12 WAR RESERVE AMMUNITION/MISSILES	0.00	0.00					
2.13 MODIFICATIONS	0.00	0.00					
2.14 OTHER PROCUREMENT	0.00	0.00					
3.0 MILITARY CON-FUNDED ELEMENTS	0.00	0.00					
3.01 DEVELOPMENT CONSTRUCTION	0.00	0.00					
3.02 PRODUCTION CONSTRUCTION	0.00	0.00					
3.03 OPERATIONAL/SITE ACTIVATION CON	0.00	0.00					
3.04 OTHER MC	0.00	0.00					
4.0 MIL PERSONNEL-FUNDED ELEMENTS	3327.51	3327.51					
4.01 CREW	0.00	0.00					
4.02 MAINTENANCE (MTOE)	2593.10	2593.10					
4.03 SYSTEM-SPECIFIC SUPPORT	0.00	0.00					
4.04 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00					
4.041 PROJECT MGMT ADMIN (PM MIL)	0.00	0.00					
4.042 OTHER	0.00	0.00					
4.05 REPLACEMENT PERSONNEL	734.41	734.41					
4.051 TRAINING	563.10	563.10					
4.052 PERMANENT CHANGE OF STATION (PCS)	171.31	171.31					
4.06 OTHER MP	0.00	0.00					
5.0 O&M-FUNDED ELEMENTS	4876.66	4876.66					
5.01 FIELD MAINTENANCE CIVILIAN LABOR	0.00	0.00					
5.02 SYSTEM-SPECIFIC BASE OPERATIONS	0.00	0.00					
5.03 REPLEN DEPOT-LEVEL REPARABLE (SPARES)	973.33	973.33					
5.04 REPLEN CONSUMABLES (REPAIR PARTS)	2372.05	2372.05					
5.05 PETROLEUM, OILS AND LUBRICANTS (POL)	357.12	357.12					
5.06 END-ITEM SUPPLY AND MAINTENANCE	535.33	535.33					
5.061 OVERHAUL (P7M)	535.33	535.33					
5.062 INTEGRATED MATERIEL MANAGEMENT	0.00	0.00					
5.063 SUPPLY DEPOT SUPPORT	0.00	0.00					
5.064 INDUSTRIAL READINESS	0.00	0.00					
5.065 DEMILITARIZATION	0.00	0.00					
5.07 TRANSPORTATION	0.00	0.00					
5.08 SOFTWARE	0.00	0.00					
5.09 SYS TEST AND EVAL, OPERATIONAL	0.00	0.00					
5.10 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	100.00	100.00					
5.101 PROJ MGMT ADMIN (PM CIV)	100.00	100.00					
5.102 OTHER	0.00	0.00					
5.11 TRAINING	332.22	332.22					
5.12 OTHER O&M	206.62	206.62					
6.0 DEFNSE BUS OPERATION FUND (DBOF) ELEM	0.00	0.00					
6.01 CLASS IX WAR RESERVE	0.00	0.00					
6.02 OTHER DBOF	0.00	0.00					
TOTALS	13473.31	13473.31					

BRTRC - Baseline Cost Model - V1.2
Cost Totals by Phase (Current Dollars) ($k)

LIGHTWEIGHT WATER PURIFIER (LWP) - REVISED 10/04/95

	Total	Phase I	Phase II	Phase III	Subsys 3	Subsys 4	Subsys 5
1.0 RDT&E-FUNDED ELEMENTS	2509.17	2509.17					
1.01 DEVELOPMENT ENGINEERING	1133.64	1133.64					
1.02 PRODUCIBILITY ENGR AND PLAN (PEP)	0.00	0.00					
1.03 DEVELOPMENT TOOLING	0.00	0.00					
1.04 PROTOTYPE MANUFACTURING	277.62	277.62					
1.05 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	51.34	51.34					
1.051 PROJECT MGMT ADMIN (PM CIV/MIL)	51.34	51.34					
1.052 OTHER	0.00	0.00					
1.06 SYSTEM TEST AND EVALUATION	387.87	387.87					
1.07 TRAINING	53.16	53.16					
1.08 DATA	605.54	605.54					
1.09 SUPPORT EQUIPMENT	0.00	0.00					
1.091 PECULIAR	0.00	0.00					
1.092 COMMON	0.00	0.00					
1.10 DEVELOPMENT FACILITIES	0.00	0.00					
1.11 OTHER RDT&E	0.00	0.00					
2.0 PROCUREMENT-FUNDED ELEMENTS	3334.82	3334.82					
2.01 NON-RECURRING PRODUCTION	0.00	0.00					
2.011 INITIAL PRODUCTION FACILITIES (IPF)	0.00	0.00					
2.012 PRODUCTION BASE SUPPORT (PBS)	0.00	0.00					
2.013 OTHER NON-RECURRING PRODUCTION	0.00	0.00					
2.02 RECURRING PRODUCTION	2292.34	2292.34					
2.021 MANUFACTURING	2172.43	2172.43					
2.022 RECURRING ENGINEERING	119.91	119.91					
2.023 SUSTAINING TOOLING	0.00	0.00					
2.024 QUALITY CONTROL	0.00	0.00					
2.025 OTHER RECURRING PRODUCTION	0.00	0.00					
2.03 ENGINEERING CHANGES	107.67	107.67					
2.04 SYSTEM ENGNRNG/PROGRAM MANAGEMENT	116.44	116.44					
2.041 PROJECT MGMT ADMIN	116.44	116.44					
2.042 OTHER	0.00	0.00					
2.05 SYSTEM TEST & EVALUATION, PRODUCTION	264.11	264.11					
2.06 TRAINING AIDS & EQUIPMENT	0.00	0.00					
2.07 DATA	282.09	282.09					
2.08 SUPPORT EQUIPMENT	0.00	0.00					
2.081 PECULIAR	0.00	0.00					
2.082 COMMON	0.00	0.00					
2.09 OPERATIONAL/SITE ACTIVATION	0.00	0.00					
2.10 FIELDING	250.23	250.23					
2.101 INITIAL DEPOT LEVEL REPARABLE (SPARES	112.54	112.54					
2.102 INITIAL CONSUMABLES (REPAIR PARTS)	112.54	112.54					
2.103 INITIAL SUPPORT EQUIPMENT	0.00	0.00					
2.104 TRANSPORTATION (EQUIPMENT TO UNIT)	10.38	10.38					
2.105 NEW EQUIPMENT TRAINING (NET)	14.77	14.77					
2.106 CONTRACTOR LOGISTICS SUPPORT	0.00	0.00					
2.11 TRAINING AMMUNITIONS/MISSILES	21.94	21.94					
2.12 WAR RESERVE AMMUNITION/MISSILES	0.00	0.00					
2.13 MODIFICATIONS	0.00	0.00					
2.14 OTHER PROCUREMENT	0.00	0.00					
3.0 MILITARY CON-FUNDED ELEMENTS	0.00	0.00					
3.01 DEVELOPMENT CONSTRUCTION	0.00	0.00					
3.02 PRODUCTION CONSTRUCTION	0.00	0.00					
3.03 OPERATIONAL/SITE ACTIVATION CON	0.00	0.00					
3.04 OTHER MC	0.00	0.00					
4.0 MIL PERSONNEL-FUNDED ELEMENTS	4860.30	4860.30					
4.01 CREW	0.00	0.00					
4.02 MAINTENANCE (MTOE)	3787.59	3787.59					
4.03 SYSTEM-SPECIFIC SUPPORT	0.00	0.00					
4.04 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00					
4.041 PROJECT MGMT ADMIN (PM MIL)	0.00	0.00					
4.042 OTHER	0.00	0.00					
4.05 REPLACEMENT PERSONNEL	1072.71	1072.71					
4.051 TRAINING	822.49	822.49					
4.052 PERMANENT CHANGE OF STATION (PCS)	250.22	250.22					
4.06 OTHER MP	0.00	0.00					
5.0 O&M-FUNDED ELEMENTS	8003.53	8003.53					
5.01 FIELD MAINTENANCE CIVILIAN LABOR	0.00	0.00					
5.02 SYSTEM-SPECIFIC BASE OPERATIONS	0.00	0.00					
5.03 REPLEN DEPOT-LEVEL REPARABLE (SPARES)	1597.41	1597.41					
5.04 REPLEN CONSUMABLES (REPAIR PARTS)	3892.98	3892.98					
5.05 PETROLEUM, OILS AND LUBRICANTS (POL)	586.10	586.10					
5.06 END-ITEM SUPPLY AND MAINTENANCE	878.58	878.58					
5.061 OVERHAUL (P7M)	878.58	878.58					
5.062 INTEGRATED MATERIEL MANAGEMENT	0.00	0.00					
5.063 SUPPLY DEPOT SUPPORT	0.00	0.00					
5.064 INDUSTRIAL READINESS	0.00	0.00					
5.065 DEMILITARIZATION	0.00	0.00					
5.07 TRANSPORTATION	0.00	0.00					
5.08 SOFTWARE	0.00	0.00					
5.09 SYS TEST AND EVAL, OPERATIONAL	0.00	0.00					
5.10 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	164.12	164.12					
5.101 PROJ MGMT ADMIN (PM CIV)	164.12	164.12					
5.102 OTHER	0.00	0.00					
5.11 TRAINING	545.24	545.24					
5.12 OTHER O&M	339.10	339.10					
6.0 DEFNSE BUS OPERATION FUND (DBOF) ELEM	0.00	0.00					
6.01 CLASS IX WAR RESERVE	0.00	0.00					
6.02 OTHER DBOF	0.00	0.00					
TOTALS	18707.82	18707.82					

BRTRC - Baseline Cost Model - V1.2
Cost Totals by Year (Constant Dollars) ($k)

LIGHTWEIGHT WATER PURIFIER (LWP) - REVISED 10/04/95

	Total	1994	1995	1996	1997	1998	1999
1.0 RDT&E-FUNDED ELEMENTS	2433.26	262.06	450.99	610.34	878.96	230.91	0.00
1.01 DEVELOPMENT ENGINEERING	1101.34	102.98	198.46	398.46	298.46	102.98	0.00
1.02 PRODUCIBILITY ENGR AND PLAN (PEP)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.03 DEVELOPMENT TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.04 PROTOTYPE MANUFACTURING	272.53	31.15	124.58	0.00	116.80	0.00	0.00
1.05 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	50.00	10.00	10.00	10.00	10.00	10.00	0.00
1.051 PROJECT MGMT ADMIN (PM CIV/MIL)	50.00	10.00	10.00	10.00	10.00	10.00	0.00
1.052 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.06 SYSTEM TEST AND EVALUATION	369.11	0.00	0.00	73.82	295.28	0.00	0.00
1.07 TRAINING	50.59	0.00	0.00	10.12	40.47	0.00	0.00
1.08 DATA	589.70	117.94	117.94	117.94	117.94	117.94	0.00
1.09 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.091 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.092 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.10 DEVELOPMENT FACILITIES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.11 OTHER RDT&E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.0 PROCUREMENT-FUNDED ELEMENTS	2835.87	0.00	0.00	0.00	0.00	0.00	868.94
2.01 NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.011 INITIAL PRODUCTION FACILITIES (IPF)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.012 PRODUCTION BASE SUPPORT (PBS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.013 OTHER NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.02 RECURRING PRODUCTION	1952.30	0.00	0.00	0.00	0.00	0.00	421.35
2.021 MANUFACTURING	1849.32	0.00	0.00	0.00	0.00	0.00	369.86
2.022 RECURRING ENGINEERING	102.98	0.00	0.00	0.00	0.00	0.00	51.49
2.023 SUSTAINING TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.024 QUALITY CONTROL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.025 OTHER RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.03 ENGINEERING CHANGES	92.47	0.00	0.00	0.00	0.00	0.00	46.23
2.04 SYSTEM ENGNRNG/PROGRAM MANAGEMENT	100.00	0.00	0.00	0.00	0.00	0.00	50.00
2.041 PROJECT MGMT ADMIN	100.00	0.00	0.00	0.00	0.00	0.00	50.00
2.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.05 SYSTEM TEST & EVALUATION, PRODUCTION	230.22	0.00	0.00	0.00	0.00	0.00	230.22
2.06 TRAINING AIDS & EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.07 DATA	242.26	0.00	0.00	0.00	0.00	0.00	121.13
2.08 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.081 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.082 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.09 OPERATIONAL/SITE ACTIVATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.10 FIELDING	205.59	0.00	0.00	0.00	0.00	0.00	0.00
2.101 INITIAL DEPOT LEVEL REPARABLE (SPARES	92.47	0.00	0.00	0.00	0.00	0.00	0.00
2.102 INITIAL CONSUMABLES (REPAIR PARTS)	92.47	0.00	0.00	0.00	0.00	0.00	0.00
2.103 INITIAL SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.104 TRANSPORTATION (EQUIPMENT TO UNIT)	8.53	0.00	0.00	0.00	0.00	0.00	0.00
2.105 NEW EQUIPMENT TRAINING (NET)	12.14	0.00	0.00	0.00	0.00	0.00	0.00
2.106 CONTRACTOR LOGISTICS SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.11 TRAINING AMMUNITIONS/MISSILES	13.03	0.00	0.00	0.00	0.00	0.00	0.00
2.12 WAR RESERVE AMMUNITION/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.13 MODIFICATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.14 OTHER PROCUREMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.0 MILITARY CON-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.01 DEVELOPMENT CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.02 PRODUCTION CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.03 OPERATIONAL/SITE ACTIVATION CON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.04 OTHER MC	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.0 MIL PERSONNEL-FUNDED ELEMENTS	3327.51	0.00	0.00	0.00	0.00	0.00	0.00
4.01 CREW	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.02 MAINTENANCE (MTOE)	2593.10	0.00	0.00	0.00	0.00	0.00	0.00
4.03 SYSTEM-SPECIFIC SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.04 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.041 PROJECT MGMT ADMIN (PM MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.05 REPLACEMENT PERSONNEL	734.41	0.00	0.00	0.00	0.00	0.00	0.00
4.051 TRAINING	563.10	0.00	0.00	0.00	0.00	0.00	0.00
4.052 PERMANENT CHANGE OF STATION (PCS)	171.31	0.00	0.00	0.00	0.00	0.00	0.00
4.06 OTHER MP	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.0 O&M-FUNDED ELEMENTS	4876.66	0.00	0.00	0.00	0.00	0.00	0.00
5.01 FIELD MAINTENANCE CIVILIAN LABOR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.02 SYSTEM-SPECIFIC BASE OPERATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.03 REPLEN DEPOT-LEVEL REPARABLE (SPARES)	973.33	0.00	0.00	0.00	0.00	0.00	0.00
5.04 REPLEN CONSUMABLES (REPAIR PARTS)	2372.05	0.00	0.00	0.00	0.00	0.00	0.00
5.05 PETROLEUM, OILS AND LUBRICANTS (POL)	357.12	0.00	0.00	0.00	0.00	0.00	0.00
5.06 END-ITEM SUPPLY AND MAINTENANCE	535.33	0.00	0.00	0.00	0.00	0.00	0.00
5.061 OVERHAUL (P7M)	535.33	0.00	0.00	0.00	0.00	0.00	0.00
5.062 INTEGRATED MATERIEL MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.063 SUPPLY DEPOT SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.064 INDUSTRIAL READINESS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.065 DEMILITARIZATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.07 TRANSPORTATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.08 SOFTWARE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.09 SYS TEST AND EVAL, OPERATIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.10 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	100.00	0.00	0.00	0.00	0.00	0.00	0.00
5.101 PROJ MGMT ADMIN (PM CIV)	100.00	0.00	0.00	0.00	0.00	0.00	0.00
5.102 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.11 TRAINING	332.22	0.00	0.00	0.00	0.00	0.00	0.00
5.12 OTHER O&M	206.62	0.00	0.00	0.00	0.00	0.00	0.00
6.0 DEFNSE BUS OPERATION FUND (DBOF) ELEM	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.01 CLASS IX WAR RESERVE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.02 OTHER DBOF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTALS	13473.31	262.06	450.99	610.34	878.96	230.91	868.94

BRTRC - Baseline Cost Model - V1.2
Cost Totals by Year (Constant Dollars) ($k)

LIGHTWEIGHT WATER PURIFIER (LWP) - REVISED 10/04/95

	2000	2001	2002	2003	2004	2005	2006
1.0 RDT&E-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.01 DEVELOPMENT ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.02 PRODUCIBILITY ENGR AND PLAN (PEP)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.03 DEVELOPMENT TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.04 PROTOTYPE MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.05 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.051 PROJECT MGMT ADMIN (PM CIV/MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.052 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.06 SYSTEM TEST AND EVALUATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.07 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.08 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.09 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.091 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.092 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.10 DEVELOPMENT FACILITIES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.11 OTHER RDT&E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.0 PROCUREMENT-FUNDED ELEMENTS	1748.31	205.59	0.65	0.65	0.65	0.65	0.65
2.01 NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.011 INITIAL PRODUCTION FACILITIES (IPF)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.012 PRODUCTION BASE SUPPORT (PBS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.013 OTHER NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.02 RECURRING PRODUCTION	1530.94	0.00	0.00	0.00	0.00	0.00	0.00
2.021 MANUFACTURING	1479.45	0.00	0.00	0.00	0.00	0.00	0.00
2.022 RECURRING ENGINEERING	51.49	0.00	0.00	0.00	0.00	0.00	0.00
2.023 SUSTAINING TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.024 QUALITY CONTROL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.025 OTHER RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.03 ENGINEERING CHANGES	46.23	0.00	0.00	0.00	0.00	0.00	0.00
2.04 SYSTEM ENGNRNG/PROGRAM MANAGEMENT	50.00	0.00	0.00	0.00	0.00	0.00	0.00
2.041 PROJECT MGMT ADMIN	50.00	0.00	0.00	0.00	0.00	0.00	0.00
2.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.05 SYSTEM TEST & EVALUATION, PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.06 TRAINING AIDS & EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.07 DATA	121.13	0.00	0.00	0.00	0.00	0.00	0.00
2.08 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.081 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.082 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.09 OPERATIONAL/SITE ACTIVATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.10 FIELDING	0.00	205.59	0.00	0.00	0.00	0.00	0.00
2.101 INITIAL DEPOT LEVEL REPARABLE (SPARES	0.00	92.47	0.00	0.00	0.00	0.00	0.00
2.102 INITIAL CONSUMABLES (REPAIR PARTS)	0.00	92.47	0.00	0.00	0.00	0.00	0.00
2.103 INITIAL SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.104 TRANSPORTATION (EQUIPMENT TO UNIT)	0.00	8.53	0.00	0.00	0.00	0.00	0.00
2.105 NEW EQUIPMENT TRAINING (NET)	0.00	12.14	0.00	0.00	0.00	0.00	0.00
2.106 CONTRACTOR LOGISTICS SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.11 TRAINING AMMUNITIONS/MISSILES	0.00	0.00	0.65	0.65	0.65	0.65	0.65
2.12 WAR RESERVE AMMUNITION/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.13 MODIFICATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.14 OTHER PROCUREMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.0 MILITARY CON-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.01 DEVELOPMENT CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.02 PRODUCTION CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.03 OPERATIONAL/SITE ACTIVATION CON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.04 OTHER MC	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.0 MIL PERSONNEL-FUNDED ELEMENTS	0.00	0.00	166.38	166.38	166.38	166.38	166.38
4.01 CREW	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.02 MAINTENANCE (MTOE)	0.00	0.00	129.66	129.66	129.66	129.66	129.66
4.03 SYSTEM-SPECIFIC SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.04 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.041 PROJECT MGMT ADMIN (PM MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.05 REPLACEMENT PERSONNEL	0.00	0.00	36.72	36.72	36.72	36.72	36.72
4.051 TRAINING	0.00	0.00	28.15	28.15	28.15	28.15	28.15
4.052 PERMANENT CHANGE OF STATION (PCS)	0.00	0.00	8.57	8.57	8.57	8.57	8.57
4.06 OTHER MP	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.0 O&M-FUNDED ELEMENTS	0.00	0.00	243.83	243.83	243.83	243.83	243.83
5.01 FIELD MAINTENANCE CIVILIAN LABOR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.02 SYSTEM-SPECIFIC BASE OPERATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.03 REPLEN DEPOT-LEVEL REPARABLE (SPARES)	0.00	0.00	48.67	48.67	48.67	48.67	48.67
5.04 REPLEN CONSUMABLES (REPAIR PARTS)	0.00	0.00	118.60	118.60	118.60	118.60	118.60
5.05 PETROLEUM, OILS AND LUBRICANTS (POL)	0.00	0.00	17.86	17.86	17.86	17.86	17.86
5.06 END-ITEM SUPPLY AND MAINTENANCE	0.00	0.00	26.77	26.77	26.77	26.77	26.77
5.061 OVERHAUL (P7M)	0.00	0.00	26.77	26.77	26.77	26.77	26.77
5.062 INTEGRATED MATERIEL MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.063 SUPPLY DEPOT SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.064 INDUSTRIAL READINESS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.065 DEMILITARIZATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.07 TRANSPORTATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.08 SOFTWARE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.09 SYS TEST AND EVAL, OPERATIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.10 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	5.00	5.00	5.00	5.00	5.00
5.101 PROJ MGMT ADMIN (PM CIV)	0.00	0.00	5.00	5.00	5.00	5.00	5.00
5.102 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.11 TRAINING	0.00	0.00	16.61	16.61	16.61	16.61	16.61
5.12 OTHER O&M	0.00	0.00	10.33	10.33	10.33	10.33	10.33
6.0 DEFNSE BUS OPERATION FUND (DBOF) ELEM	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.01 CLASS IX WAR RESERVE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.02 OTHER DBOF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTALS	1748.31	205.59	410.86	410.86	410.86	410.86	410.86

BRTRC - Baseline Cost Model - V1.2
Cost Totals by Year (Constant Dollars) ($k)

LIGHTWEIGHT WATER PURIFIER (LWP) - REVISED 10/04/95

	2007	2008	2009	2010	2011	2012	2013
1.0 RDT&E-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.01 DEVELOPMENT ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.02 PRODUCIBILITY ENGR AND PLAN (PEP)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.03 DEVELOPMENT TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.04 PROTOTYPE MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.05 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.051 PROJECT MGMT ADMIN (PM CIV/MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.052 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.06 SYSTEM TEST AND EVALUATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.07 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.08 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.09 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.091 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.092 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.10 DEVELOPMENT FACILITIES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.11 OTHER RDT&E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.0 PROCUREMENT-FUNDED ELEMENTS	0.65	0.65	0.65	0.65	0.65	0.65	0.65
2.01 NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.011 INITIAL PRODUCTION FACILITIES (IPF)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.012 PRODUCTION BASE SUPPORT (PBS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.013 OTHER NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.02 RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.021 MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.022 RECURRING ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.023 SUSTAINING TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.024 QUALITY CONTROL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.025 OTHER RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.03 ENGINEERING CHANGES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.04 SYSTEM ENGNRNG/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.041 PROJECT MGMT ADMIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.05 SYSTEM TEST & EVALUATION, PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.06 TRAINING AIDS & EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.07 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.08 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.081 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.082 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.09 OPERATIONAL/SITE ACTIVATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.10 FIELDING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.101 INITIAL DEPOT LEVEL REPARABLE (SPARES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.102 INITIAL CONSUMABLES (REPAIR PARTS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.103 INITIAL SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.104 TRANSPORTATION (EQUIPMENT TO UNIT)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.105 NEW EQUIPMENT TRAINING (NET)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.106 CONTRACTOR LOGISTICS SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.11 TRAINING AMMUNITIONS/MISSILES	0.65	0.65	0.65	0.65	0.65	0.65	0.65
2.12 WAR RESERVE AMMUNITION/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.13 MODIFICATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.14 OTHER PROCUREMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.0 MILITARY CON-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.01 DEVELOPMENT CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.02 PRODUCTION CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.03 OPERATIONAL/SITE ACTIVATION CON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.04 OTHER MC	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.0 MIL PERSONNEL-FUNDED ELEMENTS	166.38	166.38	166.38	166.38	166.38	166.38	166.38
4.01 CREW	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.02 MAINTENANCE (MTOE)	129.66	129.66	129.66	129.66	129.66	129.66	129.66
4.03 SYSTEM-SPECIFIC SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.04 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.041 PROJECT MGMT ADMIN (PM MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.05 REPLACEMENT PERSONNEL	36.72	36.72	36.72	36.72	36.72	36.72	36.72
4.051 TRAINING	28.15	28.15	28.15	28.15	28.15	28.15	28.15
4.052 PERMANENT CHANGE OF STATION (PCS)	8.57	8.57	8.57	8.57	8.57	8.57	8.57
4.06 OTHER MP	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.0 O&M-FUNDED ELEMENTS	243.83	243.83	243.83	243.83	243.83	243.83	243.83
5.01 FIELD MAINTENANCE CIVILIAN LABOR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.02 SYSTEM-SPECIFIC BASE OPERATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.03 REPLEN DEPOT-LEVEL REPARABLE (SPARES)	48.67	48.67	48.67	48.67	48.67	48.67	48.67
5.04 REPLEN CONSUMABLES (REPAIR PARTS)	118.60	118.60	118.60	118.60	118.60	118.60	118.60
5.05 PETROLEUM, OILS AND LUBRICANTS (POL)	17.86	17.86	17.86	17.86	17.86	17.86	17.86
5.06 END-ITEM SUPPLY AND MAINTENANCE	26.77	26.77	26.77	26.77	26.77	26.77	26.77
5.061 OVERHAUL (P7M)	26.77	26.77	26.77	26.77	26.77	26.77	26.77
5.062 INTEGRATED MATERIEL MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.063 SUPPLY DEPOT SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.064 INDUSTRIAL READINESS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.065 DEMILITARIZATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.07 TRANSPORTATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.08 SOFTWARE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.09 SYS TEST AND EVAL, OPERATIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.10 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	5.00	5.00	5.00	5.00	5.00	5.00	5.00
5.101 PROJ MGMT ADMIN (PM CIV)	5.00	5.00	5.00	5.00	5.00	5.00	5.00
5.102 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.11 TRAINING	16.61	16.61	16.61	16.61	16.61	16.61	16.61
5.12 OTHER O&M	10.33	10.33	10.33	10.33	10.33	10.33	10.33
6.0 DEFNSE BUS OPERATION FUND (DBOF) ELEM	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.01 CLASS IX WAR RESERVE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.02 OTHER DBOF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTALS	410.86	410.86	410.86	410.86	410.86	410.86	410.86

BRTRC - Baseline Cost Model - V1.2
Cost Totals by Year (Constant Dollars) ($k)

LIGHTWEIGHT WATER PURIFIER (LWP) - REVISED 10/04/95

	2014	2015	2016	2017	2018	2019	2020
1.0 RDT&E-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.01 DEVELOPMENT ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.02 PRODUCIBILITY ENGR AND PLAN (PEP)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.03 DEVELOPMENT TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.04 PROTOTYPE MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.05 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.051 PROJECT MGMT ADMIN (PM CIV/MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.052 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.06 SYSTEM TEST AND EVALUATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.07 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.08 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.09 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.091 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.092 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.10 DEVELOPMENT FACILITIES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.11 OTHER RDT&E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.0 PROCUREMENT-FUNDED ELEMENTS	0.65	0.65	0.65	0.65	0.65	0.65	0.65
2.01 NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.011 INITIAL PRODUCTION FACILITIES (IPF)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.012 PRODUCTION BASE SUPPORT (PBS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.013 OTHER NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.02 RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.021 MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.022 RECURRING ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.023 SUSTAINING TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.024 QUALITY CONTROL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.025 OTHER RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.03 ENGINEERING CHANGES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.04 SYSTEM ENGNRNG/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.041 PROJECT MGMT ADMIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.05 SYSTEM TEST & EVALUATION, PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.06 TRAINING AIDS & EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.07 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.08 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.081 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.082 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.09 OPERATIONAL/SITE ACTIVATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.10 FIELDING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.101 INITIAL DEPOT LEVEL REPARABLE (SPARES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.102 INITIAL CONSUMABLES (REPAIR PARTS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.103 INITIAL SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.104 TRANSPORTATION (EQUIPMENT TO UNIT)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.105 NEW EQUIPMENT TRAINING (NET)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.106 CONTRACTOR LOGISTICS SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.11 TRAINING AMMUNITIONS/MISSILES	0.65	0.65	0.65	0.65	0.65	0.65	0.65
2.12 WAR RESERVE AMMUNITION/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.13 MODIFICATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.14 OTHER PROCUREMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.0 MILITARY CON-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.01 DEVELOPMENT CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.02 PRODUCTION CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.03 OPERATIONAL/SITE ACTIVATION CON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.04 OTHER MC	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.0 MIL PERSONNEL-FUNDED ELEMENTS	166.38	166.38	166.38	166.38	166.38	166.38	166.38
4.01 CREW	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.02 MAINTENANCE (MTOE)	129.66	129.66	129.66	129.66	129.66	129.66	129.66
4.03 SYSTEM-SPECIFIC SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.04 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.041 PROJECT MGMT ADMIN (PM MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.05 REPLACEMENT PERSONNEL	36.72	36.72	36.72	36.72	36.72	36.72	36.72
4.051 TRAINING	28.15	28.15	28.15	28.15	28.15	28.15	28.15
4.052 PERMANENT CHANGE OF STATION (PCS)	8.57	8.57	8.57	8.57	8.57	8.57	8.57
4.06 OTHER MP	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.0 O&M-FUNDED ELEMENTS	243.83	243.83	243.83	243.83	243.83	243.83	243.83
5.01 FIELD MAINTENANCE CIVILIAN LABOR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.02 SYSTEM-SPECIFIC BASE OPERATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.03 REPLEN DEPOT-LEVEL REPARABLE (SPARES)	48.67	48.67	48.67	48.67	48.67	48.67	48.67
5.04 REPLEN CONSUMABLES (REPAIR PARTS)	118.60	118.60	118.60	118.60	118.60	118.60	118.60
5.05 PETROLEUM, OILS AND LUBRICANTS (POL)	17.86	17.86	17.86	17.86	17.86	17.86	17.86
5.06 END-ITEM SUPPLY AND MAINTENANCE	26.77	26.77	26.77	26.77	26.77	26.77	26.77
5.061 OVERHAUL (P7M)	26.77	26.77	26.77	26.77	26.77	26.77	26.77
5.062 INTEGRATED MATERIEL MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.063 SUPPLY DEPOT SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.064 INDUSTRIAL READINESS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.065 DEMILITARIZATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.07 TRANSPORTATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.08 SOFTWARE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.09 SYS TEST AND EVAL, OPERATIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.10 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	5.00	5.00	5.00	5.00	5.00	5.00	5.00
5.101 PROJ MGMT ADMIN (PM CIV)	5.00	5.00	5.00	5.00	5.00	5.00	5.00
5.102 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.11 TRAINING	16.61	16.61	16.61	16.61	16.61	16.61	16.61
5.12 OTHER O&M	10.33	10.33	10.33	10.33	10.33	10.33	10.33
6.0 DEFNSE BUS OPERATION FUND (DBOF) ELEM	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.01 CLASS IX WAR RESERVE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.02 OTHER DBOF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTALS	410.86	410.86	410.86	410.86	410.86	410.86	410.86

BRTRC - Baseline Cost Model - V1.2
Cost Totals by Year (Constant Dollars) ($k)

LIGHTWEIGHT WATER PURIFIER (LWP) - REVISED 10/04/95

	2021	2022	2023	2024	2025	2026	2027
1.0 RDT&E-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.01 DEVELOPMENT ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.02 PRODUCIBILITY ENGR AND PLAN (PEP)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.03 DEVELOPMENT TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.04 PROTOTYPE MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.05 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.051 PROJECT MGMT ADMIN (PM CIV/MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.052 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.06 SYSTEM TEST AND EVALUATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.07 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.08 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.09 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.091 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.092 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.10 DEVELOPMENT FACILITIES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.11 OTHER RDT&E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.0 PROCUREMENT-FUNDED ELEMENTS	0.65	0.00	0.00	0.00	0.00	0.00	0.00
2.01 NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.011 INITIAL PRODUCTION FACILITIES (IPF)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.012 PRODUCTION BASE SUPPORT (PBS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.013 OTHER NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.02 RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.021 MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.022 RECURRING ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.023 SUSTAINING TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.024 QUALITY CONTROL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.025 OTHER RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.03 ENGINEERING CHANGES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.04 SYSTEM ENGNRNG/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.041 PROJECT MGMT ADMIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.05 SYSTEM TEST & EVALUATION, PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.06 TRAINING AIDS & EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.07 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.08 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.081 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.082 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.09 OPERATIONAL/SITE ACTIVATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.10 FIELDING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.101 INITIAL DEPOT LEVEL REPARABLE (SPARES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.102 INITIAL CONSUMABLES (REPAIR PARTS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.103 INITIAL SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.104 TRANSPORTATION (EQUIPMENT TO UNIT)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.105 NEW EQUIPMENT TRAINING (NET)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.106 CONTRACTOR LOGISTICS SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.11 TRAINING AMMUNITIONS/MISSILES	0.65	0.00	0.00	0.00	0.00	0.00	0.00
2.12 WAR RESERVE AMMUNITION/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.13 MODIFICATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.14 OTHER PROCUREMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.0 MILITARY CON-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.01 DEVELOPMENT CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.02 PRODUCTION CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.03 OPERATIONAL/SITE ACTIVATION CON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.04 OTHER MC	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.0 MIL PERSONNEL-FUNDED ELEMENTS	166.38	0.00	0.00	0.00	0.00	0.00	0.00
4.01 CREW	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.02 MAINTENANCE (MTOE)	129.66	0.00	0.00	0.00	0.00	0.00	0.00
4.03 SYSTEM-SPECIFIC SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.04 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.041 PROJECT MGMT ADMIN (PM MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.05 REPLACEMENT PERSONNEL	36.72	0.00	0.00	0.00	0.00	0.00	0.00
4.051 TRAINING	28.15	0.00	0.00	0.00	0.00	0.00	0.00
4.052 PERMANENT CHANGE OF STATION (PCS)	8.57	0.00	0.00	0.00	0.00	0.00	0.00
4.06 OTHER MP	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.0 O&M-FUNDED ELEMENTS	243.83	0.00	0.00	0.00	0.00	0.00	0.00
5.01 FIELD MAINTENANCE CIVILIAN LABOR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.02 SYSTEM-SPECIFIC BASE OPERATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.03 REPLEN DEPOT-LEVEL REPARABLE (SPARES)	48.67	0.00	0.00	0.00	0.00	0.00	0.00
5.04 REPLEN CONSUMABLES (REPAIR PARTS)	118.60	0.00	0.00	0.00	0.00	0.00	0.00
5.05 PETROLEUM, OILS AND LUBRICANTS (POL)	17.86	0.00	0.00	0.00	0.00	0.00	0.00
5.06 END-ITEM SUPPLY AND MAINTENANCE	26.77	0.00	0.00	0.00	0.00	0.00	0.00
5.061 OVERHAUL (P7M)	26.77	0.00	0.00	0.00	0.00	0.00	0.00
5.062 INTEGRATED MATERIEL MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.063 SUPPLY DEPOT SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.064 INDUSTRIAL READINESS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.065 DEMILITARIZATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.07 TRANSPORTATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.08 SOFTWARE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.09 SYS TEST AND EVAL, OPERATIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.10 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	5.00	0.00	0.00	0.00	0.00	0.00	0.00
5.101 PROJ MGMT ADMIN (PM CIV)	5.00	0.00	0.00	0.00	0.00	0.00	0.00
5.102 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.11 TRAINING	16.61	0.00	0.00	0.00	0.00	0.00	0.00
5.12 OTHER O&M	10.33	0.00	0.00	0.00	0.00	0.00	0.00
6.0 DEFNSE BUS OPERATION FUND (DBOF) ELEM	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.01 CLASS IX WAR RESERVE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.02 OTHER DBOF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTALS	410.86	0.00	0.00	0.00	0.00	0.00	0.00

BRTRC - Baseline Cost Model - V1.2
Cost Totals by Year (Constant Dollars) ($k)

LIGHTWEIGHT WATER PURIFIER (LWP) - REVISED 10/04/95

	2028	2029	2030	2031	2032	2033	2034
1.0 RDT&E-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.01 DEVELOPMENT ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.02 PRODUCIBILITY ENGR AND PLAN (PEP)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.03 DEVELOPMENT TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.04 PROTOTYPE MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.05 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.051 PROJECT MGMT ADMIN (PM CIV/MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.052 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.06 SYSTEM TEST AND EVALUATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.07 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.08 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.09 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.091 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.092 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.10 DEVELOPMENT FACILITIES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.11 OTHER RDT&E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.0 PROCUREMENT-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.01 NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.011 INITIAL PRODUCTION FACILITIES (IPF)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.012 PRODUCTION BASE SUPPORT (PBS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.013 OTHER NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.02 RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.021 MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.022 RECURRING ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.023 SUSTAINING TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.024 QUALITY CONTROL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.025 OTHER RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.03 ENGINEERING CHANGES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.04 SYSTEM ENGNRNG/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.041 PROJECT MGMT ADMIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.05 SYSTEM TEST & EVALUATION, PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.06 TRAINING AIDS & EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.07 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.08 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.081 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.082 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.09 OPERATIONAL/SITE ACTIVATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.10 FIELDING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.101 INITIAL DEPOT LEVEL REPARABLE (SPARES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.102 INITIAL CONSUMABLES (REPAIR PARTS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.103 INITIAL SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.104 TRANSPORTATION (EQUIPMENT TO UNIT)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.105 NEW EQUIPMENT TRAINING (NET)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.106 CONTRACTOR LOGISTICS SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.11 TRAINING AMMUNITIONS/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.12 WAR RESERVE AMMUNITION/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.13 MODIFICATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.14 OTHER PROCUREMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.0 MILITARY CON-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.01 DEVELOPMENT CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.02 PRODUCTION CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.03 OPERATIONAL/SITE ACTIVATION CON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.04 OTHER MC	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.0 MIL PERSONNEL-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.01 CREW	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.02 MAINTENANCE (MTOE)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.03 SYSTEM-SPECIFIC SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.04 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.041 PROJECT MGMT ADMIN (PM MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.05 REPLACEMENT PERSONNEL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.051 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.052 PERMANENT CHANGE OF STATION (PCS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.06 OTHER MP	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.0 O&M-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.01 FIELD MAINTENANCE CIVILIAN LABOR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.02 SYSTEM-SPECIFIC BASE OPERATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.03 REPLEN DEPOT-LEVEL REPARABLE (SPARES)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.04 REPLEN CONSUMABLES (REPAIR PARTS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.05 PETROLEUM, OILS AND LUBRICANTS (POL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.06 END-ITEM SUPPLY AND MAINTENANCE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.061 OVERHAUL (P7M)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.062 INTEGRATED MATERIEL MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.063 SUPPLY DEPOT SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.064 INDUSTRIAL READINESS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.065 DEMILITARIZATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.07 TRANSPORTATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.08 SOFTWARE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.09 SYS TEST AND EVAL, OPERATIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.10 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.101 PROJ MGMT ADMIN (PM CIV)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.102 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.11 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.12 OTHER O&M	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.0 DEFNSE BUS OPERATION FUND (DBOF) ELEM	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.01 CLASS IX WAR RESERVE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.02 OTHER DBOF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTALS	0.00	0.00	0.00	0.00	0.00	0.00	0.00

BRTRC - Baseline Cost Model - V1.2
Cost Totals by Year (Current Dollars) ($k)

LIGHTWEIGHT WATER PURIFIER (LWP) - REVISED 10/04/95

	Total	1994	1995	1996	1997	1998	1999
1.0 RDT&E-FUNDED ELEMENTS	2509.17	253.34	449.05	626.33	929.06	251.40	0.00
1.01 DEVELOPMENT ENGINEERING	1133.64	99.55	197.61	408.90	315.48	112.11	0.00
1.02 PRODUCIBILITY ENGR AND PLAN (PEP)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.03 DEVELOPMENT TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.04 PROTOTYPE MANUFACTURING	277.62	30.11	124.05	0.00	123.46	0.00	0.00
1.05 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	51.34	9.67	9.96	10.26	10.57	10.89	0.00
1.051 PROJECT MGMT ADMIN (PM CIV/MIL)	51.34	9.67	9.96	10.26	10.57	10.89	0.00
1.052 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.06 SYSTEM TEST AND EVALUATION	387.87	0.00	0.00	75.76	312.12	0.00	0.00
1.07 TRAINING	53.16	0.00	0.00	10.38	42.78	0.00	0.00
1.08 DATA	605.54	114.01	117.43	121.03	124.66	128.40	0.00
1.09 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.091 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.092 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.10 DEVELOPMENT FACILITIES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.11 OTHER RDT&E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.0 PROCUREMENT-FUNDED ELEMENTS	3334.82	0.00	0.00	0.00	0.00	0.00	996.85
2.01 NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.011 INITIAL PRODUCTION FACILITIES (IPF)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.012 PRODUCTION BASE SUPPORT (PBS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.013 OTHER NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.02 RECURRING PRODUCTION	2292.34	0.00	0.00	0.00	0.00	0.00	483.38
2.021 MANUFACTURING	2172.43	0.00	0.00	0.00	0.00	0.00	424.31
2.022 RECURRING ENGINEERING	119.91	0.00	0.00	0.00	0.00	0.00	59.07
2.023 SUSTAINING TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.024 QUALITY CONTROL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.025 OTHER RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.03 ENGINEERING CHANGES	107.67	0.00	0.00	0.00	0.00	0.00	53.04
2.04 SYSTEM ENGNRNG/PROGRAM MANAGEMENT	116.44	0.00	0.00	0.00	0.00	0.00	57.36
2.041 PROJECT MGMT ADMIN	116.44	0.00	0.00	0.00	0.00	0.00	57.36
2.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.05 SYSTEM TEST & EVALUATION, PRODUCTION	264.11	0.00	0.00	0.00	0.00	0.00	264.11
2.06 TRAINING AIDS & EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.07 DATA	282.09	0.00	0.00	0.00	0.00	0.00	138.96
2.08 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.081 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.082 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.09 OPERATIONAL/SITE ACTIVATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.10 FIELDING	250.23	0.00	0.00	0.00	0.00	0.00	0.00
2.101 INITIAL DEPOT LEVEL REPARABLE (SPARES	112.54	0.00	0.00	0.00	0.00	0.00	0.00
2.102 INITIAL CONSUMABLES (REPAIR PARTS)	112.54	0.00	0.00	0.00	0.00	0.00	0.00
2.103 INITIAL SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.104 TRANSPORTATION (EQUIPMENT TO UNIT)	10.38	0.00	0.00	0.00	0.00	0.00	0.00
2.105 NEW EQUIPMENT TRAINING (NET)	14.77	0.00	0.00	0.00	0.00	0.00	0.00
2.106 CONTRACTOR LOGISTICS SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.11 TRAINING AMMUNITIONS/MISSILES	21.94	0.00	0.00	0.00	0.00	0.00	0.00
2.12 WAR RESERVE AMMUNITION/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.13 MODIFICATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.14 OTHER PROCUREMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.0 MILITARY CON-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.01 DEVELOPMENT CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.02 PRODUCTION CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.03 OPERATIONAL/SITE ACTIVATION CON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.04 OTHER MC	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.0 MIL PERSONNEL-FUNDED ELEMENTS	4860.30	0.00	0.00	0.00	0.00	0.00	0.00
4.01 CREW	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.02 MAINTENANCE (MTOE)	3787.59	0.00	0.00	0.00	0.00	0.00	0.00
4.03 SYSTEM-SPECIFIC SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.04 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.041 PROJECT MGMT ADMIN (PM MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.05 REPLACEMENT PERSONNEL	1072.71	0.00	0.00	0.00	0.00	0.00	0.00
4.051 TRAINING	822.49	0.00	0.00	0.00	0.00	0.00	0.00
4.052 PERMANENT CHANGE OF STATION (PCS)	250.22	0.00	0.00	0.00	0.00	0.00	0.00
4.06 OTHER MP	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.0 O&M-FUNDED ELEMENTS	8003.53	0.00	0.00	0.00	0.00	0.00	0.00
5.01 FIELD MAINTENANCE CIVILIAN LABOR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.02 SYSTEM-SPECIFIC BASE OPERATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.03 REPLEN DEPOT-LEVEL REPARABLE (SPARES)	1597.41	0.00	0.00	0.00	0.00	0.00	0.00
5.04 REPLEN CONSUMABLES (REPAIR PARTS)	3892.98	0.00	0.00	0.00	0.00	0.00	0.00
5.05 PETROLEUM, OILS AND LUBRICANTS (POL)	586.10	0.00	0.00	0.00	0.00	0.00	0.00
5.06 END-ITEM SUPPLY AND MAINTENANCE	878.58	0.00	0.00	0.00	0.00	0.00	0.00
5.061 OVERHAUL (P7M)	878.58	0.00	0.00	0.00	0.00	0.00	0.00
5.062 INTEGRATED MATERIEL MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.063 SUPPLY DEPOT SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.064 INDUSTRIAL READINESS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.065 DEMILITARIZATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.07 TRANSPORTATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.08 SOFTWARE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.09 SYS TEST AND EVAL, OPERATIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.10 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	164.12	0.00	0.00	0.00	0.00	0.00	0.00
5.101 PROJ MGMT ADMIN (PM CIV)	164.12	0.00	0.00	0.00	0.00	0.00	0.00
5.102 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.11 TRAINING	545.24	0.00	0.00	0.00	0.00	0.00	0.00
5.12 OTHER O&M	339.10	0.00	0.00	0.00	0.00	0.00	0.00
6.0 DEFNSE BUS OPERATION FUND (DBOF) ELEM	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.01 CLASS IX WAR RESERVE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.02 OTHER DBOF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTALS	18707.82	253.34	449.05	626.33	929.06	251.40	996.85

BRTRC - Baseline Cost Model - V1.2
Cost Totals by Year (Current Dollars) ($k)

LIGHTWEIGHT WATER PURIFIER (LWP) - REVISED 10/04/95

	2000	2001	2002	2003	2004	2005	2006
1.0 RDT&E-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.01 DEVELOPMENT ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.02 PRODUCIBILITY ENGR AND PLAN (PEP)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.03 DEVELOPMENT TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.04 PROTOTYPE MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.05 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.051 PROJECT MGMT ADMIN (PM CIV/MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.052 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.06 SYSTEM TEST AND EVALUATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.07 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.08 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.09 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.091 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.092 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.10 DEVELOPMENT FACILITIES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.11 OTHER RDT&E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.0 PROCUREMENT-FUNDED ELEMENTS	2065.80	250.23	0.82	0.84	0.87	0.89	0.92
2.01 NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.011 INITIAL PRODUCTION FACILITIES (IPF)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.012 PRODUCTION BASE SUPPORT (PBS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.013 OTHER NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.02 RECURRING PRODUCTION	1808.96	0.00	0.00	0.00	0.00	0.00	0.00
2.021 MANUFACTURING	1748.12	0.00	0.00	0.00	0.00	0.00	0.00
2.022 RECURRING ENGINEERING	60.84	0.00	0.00	0.00	0.00	0.00	0.00
2.023 SUSTAINING TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.024 QUALITY CONTROL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.025 OTHER RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.03 ENGINEERING CHANGES	54.63	0.00	0.00	0.00	0.00	0.00	0.00
2.04 SYSTEM ENGNRNG/PROGRAM MANAGEMENT	59.08	0.00	0.00	0.00	0.00	0.00	0.00
2.041 PROJECT MGMT ADMIN	59.08	0.00	0.00	0.00	0.00	0.00	0.00
2.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.05 SYSTEM TEST & EVALUATION, PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.06 TRAINING AIDS & EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.07 DATA	143.13	0.00	0.00	0.00	0.00	0.00	0.00
2.08 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.081 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.082 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.09 OPERATIONAL/SITE ACTIVATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.10 FIELDING	0.00	250.23	0.00	0.00	0.00	0.00	0.00
2.101 INITIAL DEPOT LEVEL REPARABLE (SPARES	0.00	112.54	0.00	0.00	0.00	0.00	0.00
2.102 INITIAL CONSUMABLES (REPAIR PARTS)	0.00	112.54	0.00	0.00	0.00	0.00	0.00
2.103 INITIAL SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.104 TRANSPORTATION (EQUIPMENT TO UNIT)	0.00	10.38	0.00	0.00	0.00	0.00	0.00
2.105 NEW EQUIPMENT TRAINING (NET)	0.00	14.77	0.00	0.00	0.00	0.00	0.00
2.106 CONTRACTOR LOGISTICS SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.11 TRAINING AMMUNITIONS/MISSILES	0.00	0.00	0.82	0.84	0.87	0.89	0.92
2.12 WAR RESERVE AMMUNITION/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.13 MODIFICATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.14 OTHER PROCUREMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.0 MILITARY CON-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.01 DEVELOPMENT CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.02 PRODUCTION CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.03 OPERATIONAL/SITE ACTIVATION CON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.04 OTHER MC	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.0 MIL PERSONNEL-FUNDED ELEMENTS	0.00	0.00	195.18	199.52	203.96	208.50	213.16
4.01 CREW	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.02 MAINTENANCE (MTOE)	0.00	0.00	152.10	155.48	158.94	162.48	166.11
4.03 SYSTEM-SPECIFIC SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.04 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.041 PROJECT MGMT ADMIN (PM MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.05 REPLACEMENT PERSONNEL	0.00	0.00	43.08	44.04	45.02	46.02	47.05
4.051 TRAINING	0.00	0.00	33.03	33.76	34.52	35.28	36.07
4.052 PERMANENT CHANGE OF STATION (PCS)	0.00	0.00	10.05	10.27	10.50	10.73	10.97
4.06 OTHER MP	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.0 O&M-FUNDED ELEMENTS	0.00	0.00	297.87	306.79	316.01	325.47	335.25
5.01 FIELD MAINTENANCE CIVILIAN LABOR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.02 SYSTEM-SPECIFIC BASE OPERATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.03 REPLEN DEPOT-LEVEL REPARABLE (SPARES)	0.00	0.00	59.45	61.23	63.07	64.96	66.91
5.04 REPLEN CONSUMABLES (REPAIR PARTS)	0.00	0.00	144.88	149.23	153.71	158.31	163.07
5.05 PETROLEUM, OILS AND LUBRICANTS (POL)	0.00	0.00	21.81	22.47	23.14	23.83	24.55
5.06 END-ITEM SUPPLY AND MAINTENANCE	0.00	0.00	32.70	33.68	34.69	35.73	36.80
5.061 OVERHAUL (P7M)	0.00	0.00	32.70	33.68	34.69	35.73	36.80
5.062 INTEGRATED MATERIEL MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.063 SUPPLY DEPOT SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.064 INDUSTRIAL READINESS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.065 DEMILITARIZATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.07 TRANSPORTATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.08 SOFTWARE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.09 SYS TEST AND EVAL, OPERATIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.10 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	6.11	6.29	6.48	6.67	6.87
5.101 PROJ MGMT ADMIN (PM CIV)	0.00	0.00	6.11	6.29	6.48	6.67	6.87
5.102 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.11 TRAINING	0.00	0.00	20.29	20.90	21.53	22.17	22.84
5.12 OTHER O&M	0.00	0.00	12.62	13.00	13.39	13.79	14.20
6.0 DEFNSE BUS OPERATION FUND (DBOF) ELEM	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.01 CLASS IX WAR RESERVE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.02 OTHER DBOF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTALS	2065.80	250.23	493.86	507.15	520.83	534.86	549.33

BRTRC - Baseline Cost Model - V1.2
Cost Totals by Year (Current Dollars) ($k)

LIGHTWEIGHT WATER PURIFIER (LWP) - REVISED 10/04/95

	2007	2008	2009	2010	2011	2012	2013
1.0 RDT&E-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.01 DEVELOPMENT ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.02 PRODUCIBILITY ENGR AND PLAN (PEP)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.03 DEVELOPMENT TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.04 PROTOTYPE MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.05 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.051 PROJECT MGMT ADMIN (PM CIV/MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.052 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.06 SYSTEM TEST AND EVALUATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.07 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.08 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.09 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.091 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.092 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.10 DEVELOPMENT FACILITIES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.11 OTHER RDT&E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.0 PROCUREMENT-FUNDED ELEMENTS	0.95	0.98	1.00	1.03	1.07	1.10	1.13
2.01 NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.011 INITIAL PRODUCTION FACILITIES (IPF)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.012 PRODUCTION BASE SUPPORT (PBS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.013 OTHER NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.02 RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.021 MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.022 RECURRING ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.023 SUSTAINING TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.024 QUALITY CONTROL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.025 OTHER RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.03 ENGINEERING CHANGES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.04 SYSTEM ENGNRNG/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.041 PROJECT MGMT ADMIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.05 SYSTEM TEST & EVALUATION, PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.06 TRAINING AIDS & EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.07 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.08 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.081 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.082 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.09 OPERATIONAL/SITE ACTIVATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.10 FIELDING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.101 INITIAL DEPOT LEVEL REPARABLE (SPARES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.102 INITIAL CONSUMABLES (REPAIR PARTS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.103 INITIAL SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.104 TRANSPORTATION (EQUIPMENT TO UNIT)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.105 NEW EQUIPMENT TRAINING (NET)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.106 CONTRACTOR LOGISTICS SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.11 TRAINING AMMUNITIONS/MISSILES	0.95	0.98	1.00	1.03	1.07	1.10	1.13
2.12 WAR RESERVE AMMUNITION/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.13 MODIFICATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.14 OTHER PROCUREMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.0 MILITARY CON-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.01 DEVELOPMENT CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.02 PRODUCTION CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.03 OPERATIONAL/SITE ACTIVATION CON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.04 OTHER MC	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.0 MIL PERSONNEL-FUNDED ELEMENTS	217.90	222.78	227.74	232.83	238.03	243.36	248.80
4.01 CREW	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.02 MAINTENANCE (MTOE)	169.81	173.61	177.47	181.44	185.50	189.65	193.89
4.03 SYSTEM-SPECIFIC SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.04 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.041 PROJECT MGMT ADMIN (PM MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.05 REPLACEMENT PERSONNEL	48.09	49.17	50.26	51.39	52.54	53.71	54.91
4.051 TRAINING	36.87	37.70	38.54	39.40	40.28	41.18	42.10
4.052 PERMANENT CHANGE OF STATION (PCS)	11.22	11.47	11.72	11.99	12.25	12.53	12.81
4.06 OTHER MP	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.0 O&M-FUNDED ELEMENTS	345.29	355.65	366.33	377.31	388.65	400.30	412.30
5.01 FIELD MAINTENANCE CIVILIAN LABOR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.02 SYSTEM-SPECIFIC BASE OPERATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.03 REPLEN DEPOT-LEVEL REPARABLE (SPARES)	68.92	70.98	73.12	75.31	77.57	79.90	82.29
5.04 REPLEN CONSUMABLES (REPAIR PARTS)	167.95	172.99	178.19	183.53	189.04	194.71	200.54
5.05 PETROLEUM, OILS AND LUBRICANTS (POL)	25.29	26.04	26.83	27.63	28.46	29.31	30.19
5.06 END-ITEM SUPPLY AND MAINTENANCE	37.90	39.04	40.21	41.42	42.66	43.94	45.26
5.061 OVERHAUL (P7M)	37.90	39.04	40.21	41.42	42.66	43.94	45.26
5.062 INTEGRATED MATERIEL MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.063 SUPPLY DEPOT SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.064 INDUSTRIAL READINESS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.065 DEMILITARIZATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.07 TRANSPORTATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.08 SOFTWARE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.09 SYS TEST AND EVAL, OPERATIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.10 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	7.08	7.29	7.51	7.74	7.97	8.21	8.45
5.101 PROJ MGMT ADMIN (PM CIV)	7.08	7.29	7.51	7.74	7.97	8.21	8.45
5.102 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.11 TRAINING	23.52	24.23	24.96	25.70	26.48	27.27	28.09
5.12 OTHER O&M	14.63	15.07	15.52	15.99	16.47	16.96	17.47
6.0 DEFNSE BUS OPERATION FUND (DBOF) ELEM	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.01 CLASS IX WAR RESERVE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.02 OTHER DBOF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTALS	564.14	579.41	595.07	611.17	627.74	644.76	662.23

BRTRC - Baseline Cost Model - V1.2
Cost Totals by Year (Current Dollars) ($k)

LIGHTWEIGHT WATER PURIFIER (LWP) - REVISED 10/04/95

	2014	2015	2016	2017	2018	2019	2020
1.0 RDT&E-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.01 DEVELOPMENT ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.02 PRODUCIBILITY ENGR AND PLAN (PEP)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.03 DEVELOPMENT TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.04 PROTOTYPE MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.05 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.051 PROJECT MGMT ADMIN (PM CIV/MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.052 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.06 SYSTEM TEST AND EVALUATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.07 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.08 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.09 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.091 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.092 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.10 DEVELOPMENT FACILITIES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.11 OTHER RDT&E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.0 PROCUREMENT-FUNDED ELEMENTS	1.16	1.20	1.24	1.27	1.31	1.35	1.39
2.01 NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.011 INITIAL PRODUCTION FACILITIES (IPF)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.012 PRODUCTION BASE SUPPORT (PBS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.013 OTHER NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.02 RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.021 MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.022 RECURRING ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.023 SUSTAINING TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.024 QUALITY CONTROL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.025 OTHER RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.03 ENGINEERING CHANGES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.04 SYSTEM ENGNRNG/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.041 PROJECT MGMT ADMIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.05 SYSTEM TEST & EVALUATION, PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.06 TRAINING AIDS & EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.07 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.08 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.081 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.082 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.09 OPERATIONAL/SITE ACTIVATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.10 FIELDING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.101 INITIAL DEPOT LEVEL REPARABLE (SPARES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.102 INITIAL CONSUMABLES (REPAIR PARTS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.103 INITIAL SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.104 TRANSPORTATION (EQUIPMENT TO UNIT)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.105 NEW EQUIPMENT TRAINING (NET)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.106 CONTRACTOR LOGISTICS SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.11 TRAINING AMMUNITIONS/MISSILES	1.16	1.20	1.24	1.27	1.31	1.35	1.39
2.12 WAR RESERVE AMMUNITION/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.13 MODIFICATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.14 OTHER PROCUREMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.0 MILITARY CON-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.01 DEVELOPMENT CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.02 PRODUCTION CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.03 OPERATIONAL/SITE ACTIVATION CON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.04 OTHER MC	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.0 MIL PERSONNEL-FUNDED ELEMENTS	254.36	260.06	265.88	272.27	278.80	285.48	292.34
4.01 CREW	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.02 MAINTENANCE (MTOE)	198.22	202.66	207.20	212.18	217.26	222.48	227.82
4.03 SYSTEM-SPECIFIC SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.04 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.041 PROJECT MGMT ADMIN (PM MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.05 REPLACEMENT PERSONNEL	56.14	57.40	58.68	60.09	61.53	63.01	64.52
4.051 TRAINING	43.04	44.01	44.99	46.08	47.18	48.31	49.47
4.052 PERMANENT CHANGE OF STATION (PCS)	13.09	13.39	13.69	14.02	14.35	14.70	15.05
4.06 OTHER MP	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.0 O&M-FUNDED ELEMENTS	424.68	437.41	450.53	464.04	477.96	492.32	507.08
5.01 FIELD MAINTENANCE CIVILIAN LABOR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.02 SYSTEM-SPECIFIC BASE OPERATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.03 REPLEN DEPOT-LEVEL REPARABLE (SPARES)	84.76	87.30	89.92	92.62	95.40	98.26	101.21
5.04 REPLEN CONSUMABLES (REPAIR PARTS)	206.57	212.76	219.14	225.71	232.48	239.47	246.65
5.05 PETROLEUM, OILS AND LUBRICANTS (POL)	31.10	32.03	32.99	33.98	35.00	36.05	37.13
5.06 END-ITEM SUPPLY AND MAINTENANCE	46.62	48.02	49.46	50.94	52.47	54.04	55.66
5.061 OVERHAUL (P7M)	46.62	48.02	49.46	50.94	52.47	54.04	55.66
5.062 INTEGRATED MATERIEL MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.063 SUPPLY DEPOT SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.064 INDUSTRIAL READINESS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.065 DEMILITARIZATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.07 TRANSPORTATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.08 SOFTWARE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.09 SYS TEST AND EVAL, OPERATIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.10 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	8.71	8.97	9.24	9.52	9.80	10.10	10.40
5.101 PROJ MGMT ADMIN (PM CIV)	8.71	8.97	9.24	9.52	9.80	10.10	10.40
5.102 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.11 TRAINING	28.93	29.80	30.69	31.61	32.56	33.54	34.54
5.12 OTHER O&M	17.99	18.53	19.09	19.66	20.25	20.86	21.48
6.0 DEFNSE BUS OPERATION FUND (DBOF) ELEM	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.01 CLASS IX WAR RESERVE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.02 OTHER DBOF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTALS	680.20	698.67	717.65	737.58	758.07	779.16	800.80

BRTRC - Baseline Cost Model - V1.2
Cost Totals by Year (Current Dollars) ($k)

LIGHTWEIGHT WATER PURIFIER (LWP) - REVISED 10/04/95

	2021	2022	2023	2024	2025	2026	2027
1.0 RDT&E-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.01 DEVELOPMENT ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.02 PRODUCIBILITY ENGR AND PLAN (PEP)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.03 DEVELOPMENT TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.04 PROTOTYPE MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.05 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.051 PROJECT MGMT ADMIN (PM CIV/MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.052 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.06 SYSTEM TEST AND EVALUATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.07 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.08 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.09 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.091 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.092 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.10 DEVELOPMENT FACILITIES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.11 OTHER RDT&E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.0 PROCUREMENT-FUNDED ELEMENTS	1.43	0.00	0.00	0.00	0.00	0.00	0.00
2.01 NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.011 INITIAL PRODUCTION FACILITIES (IPF)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.012 PRODUCTION BASE SUPPORT (PBS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.013 OTHER NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.02 RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.021 MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.022 RECURRING ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.023 SUSTAINING TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.024 QUALITY CONTROL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.025 OTHER RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.03 ENGINEERING CHANGES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.04 SYSTEM ENGNRNG/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.041 PROJECT MGMT ADMIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.05 SYSTEM TEST & EVALUATION, PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.06 TRAINING AIDS & EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.07 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.08 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.081 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.082 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.09 OPERATIONAL/SITE ACTIVATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.10 FIELDING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.101 INITIAL DEPOT LEVEL REPARABLE (SPARES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.102 INITIAL CONSUMABLES (REPAIR PARTS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.103 INITIAL SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.104 TRANSPORTATION (EQUIPMENT TO UNIT)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.105 NEW EQUIPMENT TRAINING (NET)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.106 CONTRACTOR LOGISTICS SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.11 TRAINING AMMUNITIONS/MISSILES	1.43	0.00	0.00	0.00	0.00	0.00	0.00
2.12 WAR RESERVE AMMUNITION/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.13 MODIFICATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.14 OTHER PROCUREMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.0 MILITARY CON-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.01 DEVELOPMENT CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.02 PRODUCTION CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.03 OPERATIONAL/SITE ACTIVATION CON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.04 OTHER MC	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.0 MIL PERSONNEL-FUNDED ELEMENTS	299.36	0.00	0.00	0.00	0.00	0.00	0.00
4.01 CREW	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.02 MAINTENANCE (MTOE)	233.29	0.00	0.00	0.00	0.00	0.00	0.00
4.03 SYSTEM-SPECIFIC SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.04 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.041 PROJECT MGMT ADMIN (PM MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.05 REPLACEMENT PERSONNEL	66.07	0.00	0.00	0.00	0.00	0.00	0.00
4.051 TRAINING	50.66	0.00	0.00	0.00	0.00	0.00	0.00
4.052 PERMANENT CHANGE OF STATION (PCS)	15.41	0.00	0.00	0.00	0.00	0.00	0.00
4.06 OTHER MP	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.0 O&M-FUNDED ELEMENTS	522.29	0.00	0.00	0.00	0.00	0.00	0.00
5.01 FIELD MAINTENANCE CIVILIAN LABOR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.02 SYSTEM-SPECIFIC BASE OPERATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.03 REPLEN DEPOT-LEVEL REPARABLE (SPARES)	104.24	0.00	0.00	0.00	0.00	0.00	0.00
5.04 REPLEN CONSUMABLES (REPAIR PARTS)	254.05	0.00	0.00	0.00	0.00	0.00	0.00
5.05 PETROLEUM, OILS AND LUBRICANTS (POL)	38.25	0.00	0.00	0.00	0.00	0.00	0.00
5.06 END-ITEM SUPPLY AND MAINTENANCE	57.33	0.00	0.00	0.00	0.00	0.00	0.00
5.061 OVERHAUL (P7M)	57.33	0.00	0.00	0.00	0.00	0.00	0.00
5.062 INTEGRATED MATERIEL MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.063 SUPPLY DEPOT SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.064 INDUSTRIAL READINESS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.065 DEMILITARIZATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.07 TRANSPORTATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.08 SOFTWARE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.09 SYS TEST AND EVAL, OPERATIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.10 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	10.71	0.00	0.00	0.00	0.00	0.00	0.00
5.101 PROJ MGMT ADMIN (PM CIV)	10.71	0.00	0.00	0.00	0.00	0.00	0.00
5.102 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.11 TRAINING	35.58	0.00	0.00	0.00	0.00	0.00	0.00
5.12 OTHER O&M	22.13	0.00	0.00	0.00	0.00	0.00	0.00
6.0 DEFNSE BUS OPERATION FUND (DBOF) ELEM	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.01 CLASS IX WAR RESERVE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.02 OTHER DBOF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTALS	823.08	0.00	0.00	0.00	0.00	0.00	0.00

BRTRC - Baseline Cost Model - V1.2
Cost Totals by Year (Current Dollars) ($k)

LIGHTWEIGHT WATER PURIFIER (LWP) - REVISED 10/04/95

	2028	2029	2030	2031	2032	2033	2034
1.0 RDT&E-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.01 DEVELOPMENT ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.02 PRODUCIBILITY ENGR AND PLAN (PEP)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.03 DEVELOPMENT TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.04 PROTOTYPE MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.05 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.051 PROJECT MGMT ADMIN (PM CIV/MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.052 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.06 SYSTEM TEST AND EVALUATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.07 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.08 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.09 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.091 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.092 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.10 DEVELOPMENT FACILITIES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.11 OTHER RDT&E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.0 PROCUREMENT-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.01 NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.011 INITIAL PRODUCTION FACILITIES (IPF)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.012 PRODUCTION BASE SUPPORT (PBS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.013 OTHER NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.02 RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.021 MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.022 RECURRING ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.023 SUSTAINING TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.024 QUALITY CONTROL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.025 OTHER RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.03 ENGINEERING CHANGES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.04 SYSTEM ENGNRNG/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.041 PROJECT MGMT ADMIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.05 SYSTEM TEST & EVALUATION, PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.06 TRAINING AIDS & EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.07 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.08 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.081 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.082 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.09 OPERATIONAL/SITE ACTIVATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.10 FIELDING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.101 INITIAL DEPOT LEVEL REPARABLE (SPARES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.102 INITIAL CONSUMABLES (REPAIR PARTS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.103 INITIAL SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.104 TRANSPORTATION (EQUIPMENT TO UNIT)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.105 NEW EQUIPMENT TRAINING (NET)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.106 CONTRACTOR LOGISTICS SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.11 TRAINING AMMUNITIONS/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.12 WAR RESERVE AMMUNITION/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.13 MODIFICATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.14 OTHER PROCUREMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.0 MILITARY CON-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.01 DEVELOPMENT CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.02 PRODUCTION CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.03 OPERATIONAL/SITE ACTIVATION CON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.04 OTHER MC	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.0 MIL PERSONNEL-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.01 CREW	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.02 MAINTENANCE (MTOE)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.03 SYSTEM-SPECIFIC SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.04 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.041 PROJECT MGMT ADMIN (PM MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.05 REPLACEMENT PERSONNEL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.051 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.052 PERMANENT CHANGE OF STATION (PCS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.06 OTHER MP	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.0 O&M-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.01 FIELD MAINTENANCE CIVILIAN LABOR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.02 SYSTEM-SPECIFIC BASE OPERATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.03 REPLEN DEPOT-LEVEL REPARABLE (SPARES)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.04 REPLEN CONSUMABLES (REPAIR PARTS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.05 PETROLEUM, OILS AND LUBRICANTS (POL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.06 END-ITEM SUPPLY AND MAINTENANCE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.061 OVERHAUL (P7M)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.062 INTEGRATED MATERIEL MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.063 SUPPLY DEPOT SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.064 INDUSTRIAL READINESS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.065 DEMILITARIZATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.07 TRANSPORTATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.08 SOFTWARE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.09 SYS TEST AND EVAL, OPERATIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.10 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.101 PROJ MGMT ADMIN (PM CIV)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.102 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.11 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.12 OTHER O&M	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.0 DEFNSE BUS OPERATION FUND (DBOF) ELEM	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.01 CLASS IX WAR RESERVE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.02 OTHER DBOF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTALS	0.00	0.00	0.00	0.00	0.00	0.00	0.00

REVISED DECISION COST ESTIMATE FOR 600 GPH REVERSE OSMOSIS WATER PURIFICATION UNIT (ROWPU) FOR SPECIAL OPERATIONS FORCES (SOF)

11 JULY 1995

DEVELOPED IN SUPPORT OF COST AND OPERATIONAL EFFECTIVENESS ANALYSIS FOR
LIGHTWEIGHT WATER PURIFIER (LWP)

Prepared for US Army Tank Automotive Command, Mobility Technology Center - Belvoir under contract number DAAK70-92-D-0003, DO 0039.

ID: 1 Title: 600 GPH (ROWPU) FOR SPECIAL OPERATIONS FORCES (SOF) 07/11/95

First Year: 1994

DESCRIPTION:
This Decision Cost Estimate (DCE) develops the costs for using the 600 GPH ROWPU for Special Operations Forces (SOF) as an alternative to developing and acquiring the Lightweight Water Purifier (LWP).

This DCE is a revision of the DCE for this system validated on 25 October 1994. The most significant change is the increase of the Army requirements from 37 to 50 units. In addition, production and fielding schedules have been revised to agree with the latest Acquisition Strategy for the LWP.

For this Decision Cost Estimate the US Marine Corps version of the 600 GPH ROWPU is used. This unit differs from the Army version in that it is skid mounted and the 5-ton, 4-wheel tandem trailer is not included. A separate 30 kw generator, such as LIN J36109, NSN 6115-00-1118-1240, is required. The unit is capable of producing drinking water from polluted fresh water, brackish water, and sea water. It is also capable of removing chemical and radiological contaminants from the water.

The Marine Corps version of the 600 GPH ROWPU is lighter than the Army version and weighs only 7,300 pounds. The generator, LIN J36109, weighs an additional 2850 pounds. Hence the ROWPU and its generator could be transported to the SOF operating area by a UH-60 or CH-47D helicopter -- in both cases as external loads. Alternatively, the unit and the generator could be airdropped into the operating area by a C-130 or larger aircraft.

TECHNICAL:

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ASSUMPTIONS - 600 GPH ROWPU FOR SPECIAL OPERATIONS FORCES (SOF)

1. All costs are in thousands of FY 1996 dollars, with inflation applied in accordance with Hq Army Materiel Command (AMCRM-E) Memo, Subject: Inflation Guidance, dated 1 February 1995.

2. The version of the 600 GPH ROWPU used for this Decision Cost Estimate is the Marine Corps version. It is skid mounted rather than mounted on a 5-ton trailer like the Army version. Hence is more suitable to support SOF missions. Although it is possible that surplus units could be obtained from the Marine Corps and rebuilt, this Decision Cost Estimate assumes a rebuy. Requirements are anticipated to be the same as for the Lightweight Water Purifier; that is, 8 for Medical Units and 42 for Special Forces for a total of 50 units. The system is anticipated to have a useful operating life of 20 years.

3. Based on the schedule for the LWP and the requirements above, system costs for this Cost Estimate are allocated across the life cycle cost years based on the following quantities:

Year	Production Quantity	Fielding Quantity	Sustainment Quantity
1999	10		
2000	40		
2001		50	
2002			50
2003			50
2004			50
2005			50
2006			50
2007			50
2008			50
2009			50
2010			50
2011			50
2012			50
2013			50
2014			50
2015			50
2016			50
2017			50
2018			50
2019			50
2020			50
2021			50
2022			0
Σ	50	50	1000ROWPU-yrs

4. Initial Deployment of the 600 GPH ROWPU for Special Operations Forces will be entirely within CONUS.

5. For both operations and training missions the ROWPU will be deployed to the operating area by fixed or rotary wing aircraft along with the troop unit and its other equipment. Transportation costs for this movement are considered operational or training costs for the unit and are not charged to this program.

ORGANIZATION OF DECISION COST ESTIMATE (DCE)

This Cost Estimate is composed of three parts as follows:

1. This Introduction.

2. Four Cost Matrices:
   a. Cost Totals by Phase in Constant Dollars
   b. Cost Totals by Phase in Current Dollars
   c. Cost Totals by Year in Constant Dollars
   d. Cost Totals by Year in Current Dollars

3. -Cost Data Sheets and Variable Information Sheets arranged by cost category:
   1. RDT&E (No costs)
   2. Procurement
   3. Construction (No Costs)
   4. Military Personnel (No costs)
   5. O&M

MAJOR DIFFERENCES FROM PROGRAM LIFE CYCLE COST ESTIMATE

This Decision Cost Estimate was developed as to support the Cost and Operational Effectiveness Analysis (COEA) for the Lightweight Water Purifier (LWP). It differs from the Program Office Life Cycle Cost Estimate (POLCCE) or Baseline Cost Estimate for the system in two important respects:

1. Sunk costs are excluded from the Decision Cost Estimate (DCE).

2. Military Personnel Costs are excluded from the DCE in accordance with Draft TRADOC Pamphlet 11-8, Para 3-2.c.1 (page 25).

BRTRC - Baseline Cost Model - V1.2
Cost Totals by Phase (Constant Dollars) ($k)

600 GPH (ROWPU) FOR SPECIAL OPERATIONS FORCES (SOF) 07/11/95

	Total	Phase I	Phase II	Phase III	Subsys 3	Subsys 4	Subsys 5
1.0 RDT&E-FUNDED ELEMENTS	0.00	0.00					
1.01 DEVELOPMENT ENGINEERING	0.00	0.00					
1.02 PRODUCIBILITY ENGR AND PLAN (PEP)	0.00	0.00					
1.03 DEVELOPMENT TOOLING	0.00	0.00					
1.04 PROTOTYPE MANUFACTURING	0.00	0.00					
1.05 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00					
1.051 PROJECT MGMT ADMIN (PM CIV/MIL)	0.00	0.00					
1.052 OTHER	0.00	0.00					
1.06 SYSTEM TEST AND EVALUATION	0.00	0.00					
1.07 TRAINING	0.00	0.00					
1.08 DATA	0.00	0.00					
1.09 SUPPORT EQUIPMENT	0.00	0.00					
1.091 PECULIAR	0.00	0.00					
1.092 COMMON	0.00	0.00					
1.10 DEVELOPMENT FACILITIES	0.00	0.00					
1.11 OTHER RDT&E	0.00	0.00					
2.0 PROCUREMENT-FUNDED ELEMENTS	6418.26	6418.26					
2.01 NON-RECURRING PRODUCTION	0.00	0.00					
2.011 INITIAL PRODUCTION FACILITIES (IPF)	0.00	0.00					
2.012 PRODUCTION BASE SUPPORT (PBS)	0.00	0.00					
2.013 OTHER NON-RECURRING PRODUCTION	0.00	0.00					
2.02 RECURRING PRODUCTION	5636.78	5636.78					
2.021 MANUFACTURING	5472.00	5472.00					
2.022 RECURRING ENGINEERING	164.78	164.78					
2.023 SUSTAINING TOOLING	0.00	0.00					
2.024 QUALITY CONTROL	0.00	0.00					
2.025 OTHER RECURRING PRODUCTION	0.00	0.00					
2.03 ENGINEERING CHANGES	54.72	54.72					
2.04 SYSTEM ENGNRNG/PROGRAM MANAGEMENT	50.00	50.00					
2.041 PROJECT MGMT ADMIN	50.00	50.00					
2.042 OTHER	0.00	0.00					
2.05 SYSTEM TEST & EVALUATION, PRODUCTION	460.45	460.45					
2.06 TRAINING AIDS & EQUIPMENT	0.00	0.00					
2.07 DATA	121.13	121.13					
2.08 SUPPORT EQUIPMENT	0.00	0.00					
2.081 PECULIAR	0.00	0.00					
2.082 COMMON	0.00	0.00					
2.09 OPERATIONAL/SITE ACTIVATION	0.00	0.00					
2.10 FIELDING	95.18	95.18					
2.101 INITIAL DEPOT LEVEL REPARABLE (SPARES	0.00	0.00					
2.102 INITIAL CONSUMABLES (REPAIR PARTS)	0.00	0.00					
2.103 INITIAL SUPPORT EQUIPMENT	0.00	0.00					
2.104 TRANSPORTATION (EQUIPMENT TO UNIT)	95.18	95.18					
2.105 NEW EQUIPMENT TRAINING (NET)	0.00	0.00					
2.106 CONTRACTOR LOGISTICS SUPPORT	0.00	0.00					
2.11 TRAINING AMMUNITIONS/MISSILES	0.00	0.00					
2.12 WAR RESERVE AMMUNITION/MISSILES	0.00	0.00					
2.13 MODIFICATIONS	0.00	0.00					
2.14 OTHER PROCUREMENT	0.00	0.00					
3.0 MILITARY CON-FUNDED ELEMENTS	0.00	0.00					
3.01 DEVELOPMENT CONSTRUCTION	0.00	0.00					
3.02 PRODUCTION CONSTRUCTION	0.00	0.00					
3.03 OPERATIONAL/SITE ACTIVATION CON	0.00	0.00					
3.04 OTHER MC	0.00	0.00					
4.0 MIL PERSONNEL-FUNDED ELEMENTS	0.00	0.00					
4.01 CREW	0.00	0.00					
4.02 MAINTENANCE (MTOE)	0.00	0.00					
4.03 SYSTEM-SPECIFIC SUPPORT	0.00	0.00					
4.04 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00					
4.041 PROJECT MGMT ADMIN (PM MIL)	0.00	0.00					
4.042 OTHER	0.00	0.00					
4.05 REPLACEMENT PERSONNEL	0.00	0.00					
4.051 TRAINING	0.00	0.00					
4.052 PERMANENT CHANGE OF STATION (PCS)	0.00	0.00					
4.06 OTHER MP	0.00	0.00					
5.0 O&M-FUNDED ELEMENTS	5362.25	5362.25					
5.01 FIELD MAINTENANCE CIVILIAN LABOR	0.00	0.00					
5.02 SYSTEM-SPECIFIC BASE OPERATIONS	0.00	0.00					
5.03 REPLEN DEPOT-LEVEL REPARABLE (SPARES)	2311.13	2311.13					
5.04 REPLEN CONSUMABLES (REPAIR PARTS)	2631.13	2631.13					
5.05 PETROLEUM, OILS AND LUBRICANTS (POL)	320.00	320.00					
5.06 END-ITEM SUPPLY AND MAINTENANCE	0.00	0.00					
5.061 OVERHAUL (P7M)	0.00	0.00					
5.062 INTEGRATED MATERIEL MANAGEMENT	0.00	0.00					
5.063 SUPPLY DEPOT SUPPORT	0.00	0.00					
5.064 INDUSTRIAL READINESS	0.00	0.00					
5.065 DEMILITARIZATION	0.00	0.00					
5.07 TRANSPORTATION	0.00	0.00					
5.08 SOFTWARE	0.00	0.00					
5.09 SYS TEST AND EVAL, OPERATIONAL	0.00	0.00					
5.10 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	100.00	100.00					
5.101 PROJ MGMT ADMIN (PM CIV)	100.00	100.00					
5.102 OTHER	0.00	0.00					
5.11 TRAINING	0.00	0.00					
5.12 OTHER O&M	0.00	0.00					
6.0 DEFNSE BUS OPERATION FUND (DBOF) ELEM	0.00	0.00					
6.01 CLASS IX WAR RESERVE	0.00	0.00					
6.02 OTHER DBOF	0.00	0.00					
TOTALS	11780.51	11780.51					

BRTRC - Baseline Cost Model - V1.2
Cost Totals by Phase (Current Dollars) ($k)

600 GPH (ROWPU) FOR SPECIAL OPERATIONS FORCES (SOF) 07/11/95

	Total	Phase I	Phase II	Phase III	Subsys 3	Subsys 4	Subsys 5
1.0 RDT&E-FUNDED ELEMENTS	0.00	0.00					
1.01 DEVELOPMENT ENGINEERING	0.00	0.00					
1.02 PRODUCIBILITY ENGR AND PLAN (PEP)	0.00	0.00					
1.03 DEVELOPMENT TOOLING	0.00	0.00					
1.04 PROTOTYPE MANUFACTURING	0.00	0.00					
1.05 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00					
1.051 PROJECT MGMT ADMIN (PM CIV/MIL)	0.00	0.00					
1.052 OTHER	0.00	0.00					
1.06 SYSTEM TEST AND EVALUATION	0.00	0.00					
1.07 TRAINING	0.00	0.00					
1.08 DATA	0.00	0.00					
1.09 SUPPORT EQUIPMENT	0.00	0.00					
1.091 PECULIAR	0.00	0.00					
1.092 COMMON	0.00	0.00					
1.10 DEVELOPMENT FACILITIES	0.00	0.00					
1.11 OTHER RDT&E	0.00	0.00					
2.0 PROCUREMENT-FUNDED ELEMENTS	7526.99	7526.99					
2.01 NON-RECURRING PRODUCTION	0.00	0.00					
2.011 INITIAL PRODUCTION FACILITIES (IPF)	0.00	0.00					
2.012 PRODUCTION BASE SUPPORT (PBS)	0.00	0.00					
2.013 OTHER NON-RECURRING PRODUCTION	0.00	0.00					
2.02 RECURRING PRODUCTION	6619.94	6619.94					
2.021 MANUFACTURING	6428.07	6428.07					
2.022 RECURRING ENGINEERING	191.87	191.87					
2.023 SUSTAINING TOOLING	0.00	0.00					
2.024 QUALITY CONTROL	0.00	0.00					
2.025 OTHER RECURRING PRODUCTION	0.00	0.00					
2.03 ENGINEERING CHANGES	63.72	63.72					
2.04 SYSTEM ENGNRNG/PROGRAM MANAGEMENT	58.22	58.22					
2.041 PROJECT MGMT ADMIN	58.22	58.22					
2.042 OTHER	0.00	0.00					
2.05 SYSTEM TEST & EVALUATION, PRODUCTION	528.23	528.23					
2.06 TRAINING AIDS & EQUIPMENT	0.00	0.00					
2.07 DATA	141.04	141.04					
2.08 SUPPORT EQUIPMENT	0.00	0.00					
2.081 PECULIAR	0.00	0.00					
2.082 COMMON	0.00	0.00					
2.09 OPERATIONAL/SITE ACTIVATION	0.00	0.00					
2.10 FIELDING	115.85	115.85					
2.101 INITIAL DEPOT LEVEL REPARABLE (SPARES	0.00	0.00					
2.102 INITIAL CONSUMABLES (REPAIR PARTS)	0.00	0.00					
2.103 INITIAL SUPPORT EQUIPMENT	0.00	0.00					
2.104 TRANSPORTATION (EQUIPMENT TO UNIT)	115.85	115.85					
2.105 NEW EQUIPMENT TRAINING (NET)	0.00	0.00					
2.106 CONTRACTOR LOGISTICS SUPPORT	0.00	0.00					
2.11 TRAINING AMMUNITIONS/MISSILES	0.00	0.00					
2.12 WAR RESERVE AMMUNITION/MISSILES	0.00	0.00					
2.13 MODIFICATIONS	0.00	0.00					
2.14 OTHER PROCUREMENT	0.00	0.00					
3.0 MILITARY CON-FUNDED ELEMENTS	0.00	0.00					
3.01 DEVELOPMENT CONSTRUCTION	0.00	0.00					
3.02 PRODUCTION CONSTRUCTION	0.00	0.00					
3.03 OPERATIONAL/SITE ACTIVATION CON	0.00	0.00					
3.04 OTHER MC	0.00	0.00					
4.0 MIL PERSONNEL-FUNDED ELEMENTS	0.00	0.00					
4.01 CREW	0.00	0.00					
4.02 MAINTENANCE (MTOE)	0.00	0.00					
4.03 SYSTEM-SPECIFIC SUPPORT	0.00	0.00					
4.04 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00					
4.041 PROJECT MGMT ADMIN (PM MIL)	0.00	0.00					
4.042 OTHER	0.00	0.00					
4.05 REPLACEMENT PERSONNEL	0.00	0.00					
4.051 TRAINING	0.00	0.00					
4.052 PERMANENT CHANGE OF STATION (PCS)	0.00	0.00					
4.06 OTHER MP	0.00	0.00					
5.0 O&M-FUNDED ELEMENTS	8800.47	8800.47					
5.01 FIELD MAINTENANCE CIVILIAN LABOR	0.00	0.00					
5.02 SYSTEM-SPECIFIC BASE OPERATIONS	0.00	0.00					
5.03 REPLEN DEPOT-LEVEL REPARABLE (SPARES)	3793.00	3793.00					
5.04 REPLEN CONSUMABLES (REPAIR PARTS)	4318.18	4318.18					
5.05 PETROLEUM, OILS AND LUBRICANTS (POL)	525.18	525.18					
5.06 END-ITEM SUPPLY AND MAINTENANCE	0.00	0.00					
5.061 OVERHAUL (P7M)	0.00	0.00					
5.062 INTEGRATED MATERIEL MANAGEMENT	0.00	0.00					
5.063 SUPPLY DEPOT SUPPORT	0.00	0.00					
5.064 INDUSTRIAL READINESS	0.00	0.00					
5.065 DEMILITARIZATION	0.00	0.00					
5.07 TRANSPORTATION	0.00	0.00					
5.08 SOFTWARE	0.00	0.00					
5.09 SYS TEST AND EVAL, OPERATIONAL	0.00	0.00					
5.10 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	164.12	164.12					
5.101 PROJ MGMT ADMIN (PM CIV)	164.12	164.12					
5.102 OTHER	0.00	0.00					
5.11 TRAINING	0.00	0.00					
5.12 OTHER O&M	0.00	0.00					
6.0 DEFNSE BUS OPERATION FUND (DBOF) ELEM	0.00	0.00					
6.01 CLASS IX WAR RESERVE	0.00	0.00					
6.02 OTHER DBOF	0.00	0.00					
TOTALS	16327.46	16327.46					

BRTRC - Baseline Cost Model - V1.2
Cost Totals by Year (Constant Dollars) ($k)

600 GPH (ROWPU) FOR SPECIAL OPERATIONS FORCES (SOF) 07/11/95

	Total	1994	1995	1996	1997	1998	1999
1.0 RDT&E-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.01 DEVELOPMENT ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.02 PRODUCIBILITY ENGR AND PLAN (PEP)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.03 DEVELOPMENT TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.04 PROTOTYPE MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.05 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.051 PROJECT MGMT ADMIN (PM CIV/MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.052 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.06 SYSTEM TEST AND EVALUATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.07 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.08 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.09 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.091 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.092 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.10 DEVELOPMENT FACILITIES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.11 OTHER RDT&E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.0 PROCUREMENT-FUNDED ELEMENTS	6418.26	0.00	0.00	0.00	0.00	0.00	1750.16
2.01 NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.011 INITIAL PRODUCTION FACILITIES (IPF)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.012 PRODUCTION BASE SUPPORT (PBS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.013 OTHER NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.02 RECURRING PRODUCTION	5636.78	0.00	0.00	0.00	0.00	0.00	1176.79
2.021 MANUFACTURING	5472.00	0.00	0.00	0.00	0.00	0.00	1094.40
2.022 RECURRING ENGINEERING	164.78	0.00	0.00	0.00	0.00	0.00	82.39
2.023 SUSTAINING TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.024 QUALITY CONTROL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.025 OTHER RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.03 ENGINEERING CHANGES	54.72	0.00	0.00	0.00	0.00	0.00	27.36
2.04 SYSTEM ENGNRNG/PROGRAM MANAGEMENT	50.00	0.00	0.00	0.00	0.00	0.00	25.00
2.041 PROJECT MGMT ADMIN	50.00	0.00	0.00	0.00	0.00	0.00	25.00
2.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.05 SYSTEM TEST & EVALUATION, PRODUCTION	460.45	0.00	0.00	0.00	0.00	0.00	460.45
2.06 TRAINING AIDS & EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.07 DATA	121.13	0.00	0.00	0.00	0.00	0.00	60.57
2.08 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.081 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.082 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.09 OPERATIONAL/SITE ACTIVATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.10 FIELDING	95.18	0.00	0.00	0.00	0.00	0.00	0.00
2.101 INITIAL DEPOT LEVEL REPARABLE (SPARES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.102 INITIAL CONSUMABLES (REPAIR PARTS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.103 INITIAL SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.104 TRANSPORTATION (EQUIPMENT TO UNIT)	95.18	0.00	0.00	0.00	0.00	0.00	0.00
2.105 NEW EQUIPMENT TRAINING (NET)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.106 CONTRACTOR LOGISTICS SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.11 TRAINING AMMUNITIONS/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.12 WAR RESERVE AMMUNITION/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.13 MODIFICATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.14 OTHER PROCUREMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.0 MILITARY CON-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.01 DEVELOPMENT CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.02 PRODUCTION CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.03 OPERATIONAL/SITE ACTIVATION CON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.04 OTHER MC	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.0 MIL PERSONNEL-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.01 CREW	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.02 MAINTENANCE (MTOE)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.03 SYSTEM-SPECIFIC SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.04 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.041 PROJECT MGMT ADMIN (PM MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.05 REPLACEMENT PERSONNEL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.051 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.052 PERMANENT CHANGE OF STATION (PCS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.06 OTHER MP	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.0 O&M-FUNDED ELEMENTS	5362.25	0.00	0.00	0.00	0.00	0.00	0.00
5.01 FIELD MAINTENANCE CIVILIAN LABOR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.02 SYSTEM-SPECIFIC BASE OPERATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.03 REPLEN DEPOT-LEVEL REPARABLE (SPARES)	2311.13	0.00	0.00	0.00	0.00	0.00	0.00
5.04 REPLEN CONSUMABLES (REPAIR PARTS)	2631.13	0.00	0.00	0.00	0.00	0.00	0.00
5.05 PETROLEUM, OILS AND LUBRICANTS (POL)	320.00	0.00	0.00	0.00	0.00	0.00	0.00
5.06 END-ITEM SUPPLY AND MAINTENANCE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.061 OVERHAUL (P7M)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.062 INTEGRATED MATERIEL MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.063 SUPPLY DEPOT SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.064 INDUSTRIAL READINESS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.065 DEMILITARIZATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.07 TRANSPORTATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.08 SOFTWARE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.09 SYS. TEST AND EVAL, OPERATIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.10 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	100.00	0.00	0.00	0.00	0.00	0.00	0.00
5.101 PROJ MGMT ADMIN (PM CIV)	100.00	0.00	0.00	0.00	0.00	0.00	0.00
5.102 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.11 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.12 OTHER O&M	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.0 DEFNSE BUS OPERATION FUND (DBOF) ELEM	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.01 CLASS IX WAR RESERVE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.02 OTHER DBOF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTALS	11780.51	0.00	0.00	0.00	0.00	0.00	1750.16

BRTRC - Baseline Cost Model - V1.2
Cost Totals by Year (Constant Dollars) ($k)

600 GPH (ROWPU) FOR SPECIAL OPERATIONS FORCES (SOF) 07/11/95

	2000	2001	2002	2003	2004	2005	2006
1.0 RDT&E-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.01 DEVELOPMENT ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.02 PRODUCIBILITY ENGR AND PLAN (PEP)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.03 DEVELOPMENT TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.04 PROTOTYPE MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.05 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.051 PROJECT MGMT ADMIN (PM CIV/MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.052 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.06 SYSTEM TEST AND EVALUATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.07 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.08 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.09 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.091 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.092 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.10 DEVELOPMENT FACILITIES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.11 OTHER RDT&E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.0 PROCUREMENT-FUNDED ELEMENTS	4572.91	95.18	0.00	0.00	0.00	0.00	0.00
2.01 NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.011 INITIAL PRODUCTION FACILITIES (IPF)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.012 PRODUCTION BASE SUPPORT (PBS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.013 OTHER NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.02 RECURRING PRODUCTION	4459.99	0.00	0.00	0.00	0.00	0.00	0.00
2.021 MANUFACTURING	4377.60	0.00	0.00	0.00	0.00	0.00	0.00
2.022 RECURRING ENGINEERING	82.39	0.00	0.00	0.00	0.00	0.00	0.00
2.023 SUSTAINING TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.024 QUALITY CONTROL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.025 OTHER RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.03 ENGINEERING CHANGES	27.36	0.00	0.00	0.00	0.00	0.00	0.00
2.04 SYSTEM ENGNRNG/PROGRAM MANAGEMENT	25.00	0.00	0.00	0.00	0.00	0.00	0.00
2.041 PROJECT MGMT ADMIN	25.00	0.00	0.00	0.00	0.00	0.00	0.00
2.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.05 SYSTEM TEST & EVALUATION, PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.06 TRAINING AIDS & EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.07 DATA	60.57	0.00	0.00	0.00	0.00	0.00	0.00
2.08 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.081 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.082 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.09 OPERATIONAL/SITE ACTIVATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.10 FIELDING	0.00	95.18	0.00	0.00	0.00	0.00	0.00
2.101 INITIAL DEPOT LEVEL REPARABLE (SPARES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.102 INITIAL CONSUMABLES (REPAIR PARTS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.103 INITIAL SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.104 TRANSPORTATION (EQUIPMENT TO UNIT)	0.00	95.18	0.00	0.00	0.00	0.00	0.00
2.105 NEW EQUIPMENT TRAINING (NET)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.106 CONTRACTOR LOGISTICS SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.11 TRAINING AMMUNITIONS/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.12 WAR RESERVE AMMUNITION/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.13 MODIFICATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.14 OTHER PROCUREMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.0 MILITARY CON-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.01 DEVELOPMENT CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.02 PRODUCTION CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.03 OPERATIONAL/SITE ACTIVATION CON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.04 OTHER MC	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.0 MIL PERSONNEL-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.01 CREW	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.02 MAINTENANCE (MTOE)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.03 SYSTEM-SPECIFIC SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.04 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.041 PROJECT MGMT ADMIN (PM MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.05 REPLACEMENT PERSONNEL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.051 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.052 PERMANENT CHANGE OF STATION (PCS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.06 OTHER MP	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.0 O&M-FUNDED ELEMENTS	0.00	0.00	268.11	268.11	268.11	268.11	268.11
5.01 FIELD MAINTENANCE CIVILIAN LABOR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.02 SYSTEM-SPECIFIC BASE OPERATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.03 REPLEN DEPOT-LEVEL REPARABLE (SPARES)	0.00	0.00	115.56	115.56	115.56	115.56	115.56
5.04 REPLEN CONSUMABLES (REPAIR PARTS)	0.00	0.00	131.56	131.56	131.56	131.56	131.56
5.05 PETROLEUM, OILS AND LUBRICANTS (POL)	0.00	0.00	16.00	16.00	16.00	16.00	16.00
5.06 END-ITEM SUPPLY AND MAINTENANCE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.061 OVERHAUL (P7M)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.062 INTEGRATED MATERIEL MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.063 SUPPLY DEPOT SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.064 INDUSTRIAL READINESS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.065 DEMILITARIZATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.07 TRANSPORTATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.08 SOFTWARE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.09 SYS TEST AND EVAL, OPERATIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.10 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	5.00	5.00	5.00	5.00	5.00
5.101 PROJ MGMT ADMIN (PM CIV)	0.00	0.00	5.00	5.00	5.00	5.00	5.00
5.102 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.11 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.12 OTHER O&M	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.0 DEFNSE BUS OPERATION FUND (DBOF) ELEM	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.01 CLASS IX WAR RESERVE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.02 OTHER DBOF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTALS	4572.91	95.18	268.11	268.11	268.11	268.11	268.11

BRTRC - Baseline Cost Model - V1.2
Cost Totals by Year (Constant Dollars) ($k)
600 GPH (ROWPU) FOR SPECIAL OPERATIONS FORCES (SOF) 07/11/95

	2007	2008	2009	2010	2011	2012	2013
1.0 RDT&E-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.01 DEVELOPMENT ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.02 PRODUCIBILITY ENGR AND PLAN (PEP)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.03 DEVELOPMENT TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.04 PROTOTYPE MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.05 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.051 PROJECT MGMT ADMIN (PM CIV/MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.052 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.06 SYSTEM TEST AND EVALUATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.07 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.08 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.09 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.091 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.092 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.10 DEVELOPMENT FACILITIES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.11 OTHER RDT&E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.0 PROCUREMENT-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.01 NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.011 INITIAL PRODUCTION FACILITIES (IPF)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.012 PRODUCTION BASE SUPPORT (PBS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.013 OTHER NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.02 RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.021 MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.022 RECURRING ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.023 SUSTAINING TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.024 QUALITY CONTROL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.025 OTHER RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.03 ENGINEERING CHANGES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.04 SYSTEM ENGNRNG/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.041 PROJECT MGMT ADMIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.05 SYSTEM TEST & EVALUATION, PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.06 TRAINING AIDS & EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.07 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.08 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.081 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.082 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.09 OPERATIONAL/SITE ACTIVATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.10 FIELDING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.101 INITIAL DEPOT LEVEL REPARABLE (SPARES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.102 INITIAL CONSUMABLES (REPAIR PARTS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.103 INITIAL SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.104 TRANSPORTATION (EQUIPMENT TO UNIT)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.105 NEW EQUIPMENT TRAINING (NET)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.106 CONTRACTOR LOGISTICS SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.11 TRAINING AMMUNITIONS/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.12 WAR RESERVE AMMUNITION/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.13 MODIFICATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.14 OTHER PROCUREMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.0 MILITARY CON-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.01 DEVELOPMENT CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.02 PRODUCTION CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.03 OPERATIONAL/SITE ACTIVATION CON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.04 OTHER MC	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.0 MIL PERSONNEL-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.01 CREW	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.02 MAINTENANCE (MTOE)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.03 SYSTEM-SPECIFIC SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.04 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.041 PROJECT MGMT ADMIN (PM MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.05 REPLACEMENT PERSONNEL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.051 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.052 PERMANENT CHANGE OF STATION (PCS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.06 OTHER MP	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.0 O&M-FUNDED ELEMENTS	268.11	268.11	268.11	268.11	268.11	268.11	268.11
5.01 FIELD MAINTENANCE CIVILIAN LABOR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.02 SYSTEM-SPECIFIC BASE OPERATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.03 REPLEN DEPOT-LEVEL REPARABLE (SPARES)	115.56	115.56	115.56	115.56	115.56	115.56	115.56
5.04 REPLEN CONSUMABLES (REPAIR PARTS)	131.56	131.56	131.56	131.56	131.56	131.56	131.56
5.05 PETROLEUM, OILS AND LUBRICANTS (POL)	16.00	16.00	16.00	16.00	16.00	16.00	16.00
5.06 END-ITEM SUPPLY AND MAINTENANCE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.061 OVERHAUL (P7M)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.062 INTEGRATED MATERIEL MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.063 SUPPLY DEPOT SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.064 INDUSTRIAL READINESS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.065 DEMILITARIZATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.07 TRANSPORTATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.08 SOFTWARE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.09 SYS TEST AND EVAL, OPERATIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.10 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	5.00	5.00	5.00	5.00	5.00	5.00	5.00
5.101 PROJ MGMT ADMIN (PM CIV)	5.00	5.00	5.00	5.00	5.00	5.00	5.00
5.102 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.11 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.12 OTHER O&M	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.0 DEFNSE BUS OPERATION FUND (DBOF) ELEM	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.01 CLASS IX WAR RESERVE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.02 OTHER DBOF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTALS	268.11	268.11	268.11	268.11	268.11	268.11	268.11

BRTRC - Baseline Cost Model - V1.2
Cost Totals by Year (Constant Dollars) ($k)

600 GPH (ROWPU) FOR SPECIAL OPERATIONS FORCES (SOF) 07/11/95

	2014	2015	2016	2017	2018	2019	2020
1.0 RDT&E-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.01 DEVELOPMENT ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.02 PRODUCIBILITY ENGR AND PLAN (PEP)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.03 DEVELOPMENT TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.04 PROTOTYPE MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.05 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.051 PROJECT MGMT ADMIN (PM CIV/MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.052 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.06 SYSTEM TEST AND EVALUATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.07 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.08 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.09 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.091 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.092 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.10 DEVELOPMENT FACILITIES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.11 OTHER RDT&E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.0 PROCUREMENT-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.01 NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.011 INITIAL PRODUCTION FACILITIES (IPF)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.012 PRODUCTION BASE SUPPORT (PBS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.013 OTHER NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.02 RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.021 MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.022 RECURRING ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.023 SUSTAINING TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.024 QUALITY CONTROL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.025 OTHER RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.03 ENGINEERING CHANGES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.04 SYSTEM ENGNRNG/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.041 PROJECT MGMT ADMIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.05 SYSTEM TEST & EVALUATION, PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.06 TRAINING AIDS & EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.07 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.08 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.081 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.082 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.09 OPERATIONAL/SITE ACTIVATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.10 FIELDING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.101 INITIAL DEPOT LEVEL REPARABLE (SPARES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.102 INITIAL CONSUMABLES (REPAIR PARTS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.103 INITIAL SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.104 TRANSPORTATION (EQUIPMENT TO UNIT)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.105 NEW EQUIPMENT TRAINING (NET)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.106 CONTRACTOR LOGISTICS SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.11 TRAINING AMMUNITIONS/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.12 WAR RESERVE AMMUNITION/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.13 MODIFICATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.14 OTHER PROCUREMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.0 MILITARY CON-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.01 DEVELOPMENT CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.02 PRODUCTION CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.03 OPERATIONAL/SITE ACTIVATION CON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.04 OTHER MC	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.0 MIL PERSONNEL-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.01 CREW	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.02 MAINTENANCE (MTOE)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.03 SYSTEM-SPECIFIC SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.04 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.041 PROJECT MGMT ADMIN (PM MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.05 REPLACEMENT PERSONNEL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.051 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.052 PERMANENT CHANGE OF STATION (PCS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.06 OTHER MP	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.0 O&M-FUNDED ELEMENTS	268.11	268.11	268.11	268.11	268.11	268.11	268.11
5.01 FIELD MAINTENANCE CIVILIAN LABOR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.02 SYSTEM-SPECIFIC BASE OPERATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.03 REPLEN DEPOT-LEVEL REPARABLE (SPARES)	115.56	115.56	115.56	115.56	115.56	115.56	115.56
5.04 REPLEN CONSUMABLES (REPAIR PARTS)	131.56	131.56	131.56	131.56	131.56	131.56	131.56
5.05 PETROLEUM, OILS AND LUBRICANTS (POL)	16.00	16.00	16.00	16.00	16.00	16.00	16.00
5.06 END-ITEM SUPPLY AND MAINTENANCE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.061 OVERHAUL (P7M)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.062 INTEGRATED MATERIEL MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.063 SUPPLY DEPOT SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.064 INDUSTRIAL READINESS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.065 DEMILITARIZATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.07 TRANSPORTATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.08 SOFTWARE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.09 SYS TEST AND EVAL, OPERATIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.10 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	5.00	5.00	5.00	5.00	5.00	5.00	5.00
5.101 PROJ MGMT ADMIN (PM CIV)	5.00	5.00	5.00	5.00	5.00	5.00	5.00
5.102 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.11 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.12 OTHER O&M	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.0 DEFNSE BUS OPERATION FUND (DBOF) ELEM	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.01 CLASS IX WAR RESERVE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.02 OTHER DBOF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTALS	268.11	268.11	268.11	268.11	268.11	268.11	268.11

BRTRC - Baseline Cost Model - V1.2
Cost Totals by Year (Constant Dollars) ($k)
600 GPH (ROWPU) FOR SPECIAL OPERATIONS FORCES (SOF) 07/11/95

	2021	2022	2023	2024	2025	2026	2027
1.0 RDT&E-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.01 DEVELOPMENT ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.02 PRODUCIBILITY ENGR AND PLAN (PEP)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.03 DEVELOPMENT TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.04 PROTOTYPE MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.05 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.051 PROJECT MGMT ADMIN (PM CIV/MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.052 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.06 SYSTEM TEST AND EVALUATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.07 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.08 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.09 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.091 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.092 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.10 DEVELOPMENT FACILITIES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.11 OTHER RDT&E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.0 PROCUREMENT-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.01 NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.011 INITIAL PRODUCTION FACILITIES (IPF)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.012 PRODUCTION BASE SUPPORT (PBS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.013 OTHER NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.02 RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.021 MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.022 RECURRING ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.023 SUSTAINING TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.024 QUALITY CONTROL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.025 OTHER RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.03 ENGINEERING CHANGES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.04 SYSTEM ENGNRNG/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.041 PROJECT MGMT ADMIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.05 SYSTEM TEST & EVALUATION, PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.06 TRAINING AIDS & EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.07 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.08 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.081 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.082 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.09 OPERATIONAL/SITE ACTIVATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.10 FIELDING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.101 INITIAL DEPOT LEVEL REPARABLE (SPARES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.102 INITIAL CONSUMABLES (REPAIR PARTS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.103 INITIAL SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.104 TRANSPORTATION (EQUIPMENT TO UNIT)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.105 NEW EQUIPMENT TRAINING (NET)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.106 CONTRACTOR LOGISTICS SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.11 TRAINING AMMUNITIONS/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.12 WAR RESERVE AMMUNITION/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.13 MODIFICATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.14 OTHER PROCUREMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.0 MILITARY CON-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.01 DEVELOPMENT CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.02 PRODUCTION CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.03 OPERATIONAL/SITE ACTIVATION CON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.04 OTHER MC	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.0 MIL PERSONNEL-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.01 CREW	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.02 MAINTENANCE (MTOE)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.03 SYSTEM-SPECIFIC SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.04 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.041 PROJECT MGMT ADMIN (PM MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.05 REPLACEMENT PERSONNEL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.051 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.052 PERMANENT CHANGE OF STATION (PCS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.06 OTHER MP	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.0 O&M-FUNDED ELEMENTS	268.11	0.00	0.00	0.00	0.00	0.00	0.00
5.01 FIELD MAINTENANCE CIVILIAN LABOR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.02 SYSTEM-SPECIFIC BASE OPERATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.03 REPLEN DEPOT-LEVEL REPARABLE (SPARES)	115.56	0.00	0.00	0.00	0.00	0.00	0.00
5.04 REPLEN CONSUMABLES (REPAIR PARTS)	131.56	0.00	0.00	0.00	0.00	0.00	0.00
5.05 PETROLEUM, OILS AND LUBRICANTS (POL)	16.00	0.00	0.00	0.00	0.00	0.00	0.00
5.06 END-ITEM SUPPLY AND MAINTENANCE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.061 OVERHAUL (P7M)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.062 INTEGRATED MATERIEL MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.063 SUPPLY DEPOT SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.064 INDUSTRIAL READINESS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.065 DEMILITARIZATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.07 TRANSPORTATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.08 SOFTWARE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.09 SYS TEST AND EVAL, OPERATIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.10 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	5.00	0.00	0.00	0.00	0.00	0.00	0.00
5.101 PROJ MGMT ADMIN (PM CIV)	5.00	0.00	0.00	0.00	0.00	0.00	0.00
5.102 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.11 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.12 OTHER O&M	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.0 DEFNSE BUS OPERATION FUND (DBOF) ELEM	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.01 CLASS IX WAR RESERVE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.02 OTHER DBOF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTALS	268.11	0.00	0.00	0.00	0.00	0.00	0.00

BRTRC - Baseline Cost Model - V1.2
Cost Totals by Year (Constant Dollars) ($k)
600 GPH (ROWPU) FOR SPECIAL OPERATIONS FORCES (SOF) 07/11/95

	2028	2029	2030	2031	2032	2033	2034
1.0 RDT&E-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.01 DEVELOPMENT ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.02 PRODUCIBILITY ENGR AND PLAN (PEP)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.03 DEVELOPMENT TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.04 PROTOTYPE MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.05 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.051 PROJECT MGMT ADMIN (PM CIV/MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.052 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.06 SYSTEM TEST AND EVALUATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.07 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.08 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.09 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.091 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.092 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.10 DEVELOPMENT FACILITIES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.11 OTHER RDT&E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.0 PROCUREMENT-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.01 NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.011 INITIAL PRODUCTION FACILITIES (IPF)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.012 PRODUCTION BASE SUPPORT (PBS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.013 OTHER NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.02 RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.021 MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.022 RECURRING ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.023 SUSTAINING TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.024 QUALITY CONTROL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.025 OTHER RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.03 ENGINEERING CHANGES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.04 SYSTEM ENGNRNG/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.041 PROJECT MGMT ADMIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.05 SYSTEM TEST & EVALUATION, PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.06 TRAINING AIDS & EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.07 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.08 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.081 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.082 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.09 OPERATIONAL/SITE ACTIVATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.10 FIELDING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.101 INITIAL DEPOT LEVEL REPARABLE (SPARES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.102 INITIAL CONSUMABLES (REPAIR PARTS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.103 INITIAL SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.104 TRANSPORTATION (EQUIPMENT TO UNIT)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.105 NEW EQUIPMENT TRAINING (NET)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.106 CONTRACTOR LOGISTICS SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.11 TRAINING AMMUNITIONS/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.12 WAR RESERVE AMMUNITION/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.13 MODIFICATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.14 OTHER PROCUREMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.0 MILITARY CON-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.01 DEVELOPMENT CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.02 PRODUCTION CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.03 OPERATIONAL/SITE ACTIVATION CON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.04 OTHER MC	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.0 MIL PERSONNEL-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.01 CREW	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.02 MAINTENANCE (MTOE)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.03 SYSTEM-SPECIFIC SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.04 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.041 PROJECT MGMT ADMIN (PM MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.05 REPLACEMENT PERSONNEL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.051 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.052 PERMANENT CHANGE OF STATION (PCS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.06 OTHER MP	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.0 O&M-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.01 FIELD MAINTENANCE CIVILIAN LABOR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.02 SYSTEM-SPECIFIC BASE OPERATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.03 REPLEN DEPOT-LEVEL REPARABLE (SPARES)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.04 REPLEN CONSUMABLES (REPAIR PARTS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.05 PETROLEUM, OILS AND LUBRICANTS (POL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.06 END-ITEM SUPPLY AND MAINTENANCE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.061 OVERHAUL (P7M)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.062 INTEGRATED MATERIEL MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.063 SUPPLY DEPOT SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.064 INDUSTRIAL READINESS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.065 DEMILITARIZATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.07 TRANSPORTATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.08 SOFTWARE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.09 SYS TEST AND EVAL, OPERATIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.10 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.101 PROJ MGMT ADMIN (PM CIV)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.102 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.11 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.12 OTHER O&M	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.0 DEFNSE BUS OPERATION FUND (DBOF) ELEM	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.01 CLASS IX WAR RESERVE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.02 OTHER DBOF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTALS	0.00	0.00	0.00	0.00	0.00	0.00	0.00

BRTRC - Baseline Cost Model - V1.2
Cost Totals by Year (Current Dollars) ($k)

600 GPH (ROWPU) FOR SPECIAL OPERATIONS FORCES (SOF) 07/11/95

	Total	1994	1995	1996	1997	1998	1999
1.0 RDT&E-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.01 DEVELOPMENT ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.02 PRODUCIBILITY ENGR AND PLAN (PEP)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.03 DEVELOPMENT TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.04 PROTOTYPE MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.05 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.051 PROJECT MGMT ADMIN (PM CIV/MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.052 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.06 SYSTEM TEST AND EVALUATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.07 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.08 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.09 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.091 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.092 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.10 DEVELOPMENT FACILITIES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.11 OTHER RDT&E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.0 PROCUREMENT-FUNDED ELEMENTS	7526.99	0.00	0.00	0.00	0.00	0.00	2007.79
2.01 NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.011 INITIAL PRODUCTION FACILITIES (IPF)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.012 PRODUCTION BASE SUPPORT (PBS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.013 OTHER NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.02 RECURRING PRODUCTION	6619.94	0.00	0.00	0.00	0.00	0.00	1350.01
2.021 MANUFACTURING	6428.07	0.00	0.00	0.00	0.00	0.00	1255.50
2.022 RECURRING ENGINEERING	191.87	0.00	0.00	0.00	0.00	0.00	94.52
2.023 SUSTAINING TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.024 QUALITY CONTROL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.025 OTHER RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.03 ENGINEERING CHANGES	63.72	0.00	0.00	0.00	0.00	0.00	31.39
2.04 SYSTEM ENGNRNG/PROGRAM MANAGEMENT	58.22	0.00	0.00	0.00	0.00	0.00	28.68
2.041 PROJECT MGMT ADMIN	58.22	0.00	0.00	0.00	0.00	0.00	28.68
2.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.05 SYSTEM TEST & EVALUATION, PRODUCTION	528.23	0.00	0.00	0.00	0.00	0.00	528.23
2.06 TRAINING AIDS & EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.07 DATA	141.04	0.00	0.00	0.00	0.00	0.00	69.48
2.08 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.081 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.082 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.09 OPERATIONAL/SITE ACTIVATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.10 FIELDING	115.85	0.00	0.00	0.00	0.00	0.00	0.00
2.101 INITIAL DEPOT LEVEL REPARABLE (SPARES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.102 INITIAL CONSUMABLES (REPAIR PARTS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.103 INITIAL SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.104 TRANSPORTATION (EQUIPMENT TO UNIT)	115.85	0.00	0.00	0.00	0.00	0.00	0.00
2.105 NEW EQUIPMENT TRAINING (NET)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.106 CONTRACTOR LOGISTICS SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.11 TRAINING AMMUNITIONS/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.12 WAR RESERVE AMMUNITION/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.13 MODIFICATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.14 OTHER PROCUREMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.0 MILITARY CON-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.01 DEVELOPMENT CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.02 PRODUCTION CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.03 OPERATIONAL/SITE ACTIVATION CON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.04 OTHER MC	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.0 MIL PERSONNEL-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.01 CREW	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.02 MAINTENANCE (MTOE)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.03 SYSTEM-SPECIFIC SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.04 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.041 PROJECT MGMT ADMIN (PM MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.05 REPLACEMENT PERSONNEL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.051 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.052 PERMANENT CHANGE OF STATION (PCS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.06 OTHER MP	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.0 O&M-FUNDED ELEMENTS	8800.47	0.00	0.00	0.00	0.00	0.00	0.00
5.01 FIELD MAINTENANCE CIVILIAN LABOR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.02 SYSTEM-SPECIFIC BASE OPERATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.03 REPLEN DEPOT-LEVEL REPARABLE (SPARES)	3793.00	0.00	0.00	0.00	0.00	0.00	0.00
5.04 REPLEN CONSUMABLES (REPAIR PARTS)	4318.18	0.00	0.00	0.00	0.00	0.00	0.00
5.05 PETROLEUM, OILS AND LUBRICANTS (POL)	525.18	0.00	0.00	0.00	0.00	0.00	0.00
5.06 END-ITEM SUPPLY AND MAINTENANCE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.061 OVERHAUL (P7M)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.062 INTEGRATED MATERIEL MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.063 SUPPLY DEPOT SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.064 INDUSTRIAL READINESS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.065 DEMILITARIZATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.07 TRANSPORTATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.08 SOFTWARE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.09 SYS TEST AND EVAL, OPERATIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.10 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	164.12	0.00	0.00	0.00	0.00	0.00	0.00
5.101 PROJ MGMT ADMIN (PM CIV)	164.12	0.00	0.00	0.00	0.00	0.00	0.00
5.102 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.11 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.12 OTHER O&M	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.0 DEFNSE BUS OPERATION FUND (DBOF) ELEM	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.01 CLASS IX WAR RESERVE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.02 OTHER DBOF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTALS	16327.46	0.00	0.00	0.00	0.00	0.00	2007.79

BRTRC - Baseline Cost Model - V1.2
Cost Totals by Year (Current Dollars) ($k)
600 GPH (ROWPU) FOR SPECIAL OPERATIONS FORCES (SOF) 07/11/95

	2000	2001	2002	2003	2004	2005	2006
1.0 RDT&E-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.01 DEVELOPMENT ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.02 PRODUCIBILITY ENGR AND PLAN (PEP)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.03 DEVELOPMENT TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.04 PROTOTYPE MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.05 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.051 PROJECT MGMT ADMIN (PM CIV/MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.052 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.06 SYSTEM TEST AND EVALUATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.07 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.08 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.09 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.091 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.092 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.10 DEVELOPMENT FACILITIES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.11 OTHER RDT&E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.0 PROCUREMENT-FUNDED ELEMENTS	5403.36	115.85	0.00	0.00	0.00	0.00	0.00
2.01 NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.011 INITIAL PRODUCTION FACILITIES (IPF)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.012 PRODUCTION BASE SUPPORT (PBS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.013 OTHER NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.02 RECURRING PRODUCTION	5269.92	0.00	0.00	0.00	0.00	0.00	0.00
2.021 MANUFACTURING	5172.57	0.00	0.00	0.00	0.00	0.00	0.00
2.022 RECURRING ENGINEERING	97.35	0.00	0.00	0.00	0.00	0.00	0.00
2.023 SUSTAINING TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.024 QUALITY CONTROL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.025 OTHER RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.03 ENGINEERING CHANGES	32.33	0.00	0.00	0.00	0.00	0.00	0.00
2.04 SYSTEM ENGNRNG/PROGRAM MANAGEMENT	29.54	0.00	0.00	0.00	0.00	0.00	0.00
2.041 PROJECT MGMT ADMIN	29.54	0.00	0.00	0.00	0.00	0.00	0.00
2.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.05 SYSTEM TEST & EVALUATION, PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.06 TRAINING AIDS & EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.07 DATA	71.56	0.00	0.00	0.00	0.00	0.00	0.00
2.08 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.081 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.082 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.09 OPERATIONAL/SITE ACTIVATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.10 FIELDING	0.00	115.85	0.00	0.00	0.00	0.00	0.00
2.101 INITIAL DEPOT LEVEL REPARABLE (SPARES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.102 INITIAL CONSUMABLES (REPAIR PARTS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.103 INITIAL SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.104 TRANSPORTATION (EQUIPMENT TO UNIT)	0.00	115.85	0.00	0.00	0.00	0.00	0.00
2.105 NEW EQUIPMENT TRAINING (NET)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.106 CONTRACTOR LOGISTICS SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.11 TRAINING AMMUNITIONS/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.12 WAR RESERVE AMMUNITION/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.13 MODIFICATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.14 OTHER PROCUREMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.0 MILITARY CON-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.01 DEVELOPMENT CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.02 PRODUCTION CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.03 OPERATIONAL/SITE ACTIVATION CON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.04 OTHER MC	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.0 MIL PERSONNEL-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.01 CREW	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.02 MAINTENANCE (MTOE)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.03 SYSTEM-SPECIFIC SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.04 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.041 PROJECT MGMT ADMIN (PM MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.05 REPLACEMENT PERSONNEL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.051 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.052 PERMANENT CHANGE OF STATION (PCS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.06 OTHER MP	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.0 O&M-FUNDED ELEMENTS	0.00	0.00	327.53	337.34	347.47	357.88	368.63
5.01 FIELD MAINTENANCE CIVILIAN LABOR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.02 SYSTEM-SPECIFIC BASE OPERATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.03 REPLEN DEPOT-LEVEL REPARABLE (SPARES)	0.00	0.00	141.16	145.39	149.76	154.24	158.88
5.04 REPLEN CONSUMABLES (REPAIR PARTS)	0.00	0.00	160.71	165.52	170.50	175.60	180.88
5.05 PETROLEUM, OILS AND LUBRICANTS (POL)	0.00	0.00	19.55	20.13	20.74	21.36	22.00
5.06 END-ITEM SUPPLY AND MAINTENANCE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.061 OVERHAUL (P7M)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.062 INTEGRATED MATERIEL MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.063 SUPPLY DEPOT SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.064 INDUSTRIAL READINESS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.065 DEMILITARIZATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.07 TRANSPORTATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.08 SOFTWARE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.09 SYS TEST AND EVAL, OPERATIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.10 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	6.11	6.29	6.48	6.67	6.87
5.101 PROJ MGMT ADMIN (PM CIV)	0.00	0.00	6.11	6.29	6.48	6.67	6.87
5.102 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.11 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.12 OTHER O&M	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.0 DEFNSE BUS OPERATION FUND (DBOF) ELEM	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.01 CLASS IX WAR RESERVE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.02 OTHER DBOF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTALS	5403.36	115.85	327.53	337.34	347.47	357.88	368.63

BRTRC - Baseline Cost Model - V1.2
Cost Totals by Year (Current Dollars) ($k)

600 GPH (ROWPU) FOR SPECIAL OPERATIONS FORCES (SOF) 07/11/95

	2007	2008	2009	2010	2011	2012	2013
1.0 RDT&E-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.01 DEVELOPMENT ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.02 PRODUCIBILITY ENGR AND PLAN (PEP)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.03 DEVELOPMENT TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.04 PROTOTYPE MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.05 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.051 PROJECT MGMT ADMIN (PM CIV/MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.052 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.06 SYSTEM TEST AND EVALUATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.07 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.08 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.09 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.091 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.092 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.10 DEVELOPMENT FACILITIES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.11 OTHER RDT&E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.0 PROCUREMENT-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.01 NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.011 INITIAL PRODUCTION FACILITIES (IPF)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.012 PRODUCTION BASE SUPPORT (PBS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.013 OTHER NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.02 RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.021 MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.022 RECURRING ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.023 SUSTAINING TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.024 QUALITY CONTROL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.025 OTHER RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.03 ENGINEERING CHANGES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.04 SYSTEM ENGNRNG/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.041 PROJECT MGMT ADMIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.05 SYSTEM TEST & EVALUATION, PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.06 TRAINING AIDS & EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.07 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.08 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.081 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.082 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.09 OPERATIONAL/SITE ACTIVATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.10 FIELDING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.101 INITIAL DEPOT LEVEL REPARABLE (SPARES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.102 INITIAL CONSUMABLES (REPAIR PARTS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.103 INITIAL SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.104 TRANSPORTATION (EQUIPMENT TO UNIT)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.105 NEW EQUIPMENT TRAINING (NET)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.106 CONTRACTOR LOGISTICS SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.11 TRAINING AMMUNITIONS/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.12 WAR RESERVE AMMUNITION/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.13 MODIFICATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.14 OTHER PROCUREMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.0 MILITARY CON-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.01 DEVELOPMENT CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.02 PRODUCTION CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.03 OPERATIONAL/SITE ACTIVATION CON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.04 OTHER MC	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.0 MIL PERSONNEL-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.01 CREW	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.02 MAINTENANCE (MTOE)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.03 SYSTEM-SPECIFIC SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.04 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.041 PROJECT MGMT ADMIN (PM MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.05 REPLACEMENT PERSONNEL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.051 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.052 PERMANENT CHANGE OF STATION (PCS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.06 OTHER MP	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.0 O&M-FUNDED ELEMENTS	379.67	391.07	402.81	414.88	427.34	440.16	453.35
5.01 FIELD MAINTENANCE CIVILIAN LABOR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.02 SYSTEM-SPECIFIC BASE OPERATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.03 REPLEN DEPOT-LEVEL REPARABLE (SPARES)	163.64	168.55	173.61	178.81	184.19	189.71	195.39
5.04 REPLEN CONSUMABLES (REPAIR PARTS)	186.30	191.89	197.65	203.57	209.69	215.98	222.45
5.05 PETROLEUM, OILS AND LUBRICANTS (POL)	22.66	23.34	24.04	24.76	25.50	26.27	27.05
5.06 END-ITEM SUPPLY AND MAINTENANCE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.061 OVERHAUL (P7M)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.062 INTEGRATED MATERIEL MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.063 SUPPLY DEPOT SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.064 INDUSTRIAL READINESS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.065 DEMILITARIZATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.07 TRANSPORTATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.08 SOFTWARE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.09 SYS TEST AND EVAL, OPERATIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.10 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	7.08	7.29	7.51	7.74	7.97	8.21	8.45
5.101 PROJ MGMT ADMIN (PM CIV)	7.08	7.29	7.51	7.74	7.97	8.21	8.45
5.102 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.11 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.12 OTHER O&M	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.0 DEFNSE BUS OPERATION FUND (DBOF) ELEM	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.01 CLASS IX WAR RESERVE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.02 OTHER DBOF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTALS	379.67	391.07	402.81	414.88	427.34	440.16	453.35

BRTRC - Baseline Cost Model - V1.2
Cost Totals by Year (Current Dollars) ($k)

600 GPH (ROWPU) FOR SPECIAL OPERATIONS FORCES (SOF) 07/11/95

	2014	2015	2016	2017	2018	2019	2020
1.0 RDT&E-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.01 DEVELOPMENT ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.02 PRODUCIBILITY ENGR AND PLAN (PEP)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.03 DEVELOPMENT TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.04 PROTOTYPE MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.05 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.051 PROJECT MGMT ADMIN (PM CIV/MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.052 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.06 SYSTEM TEST AND EVALUATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.07 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.08 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.09 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.091 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.092 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.10 DEVELOPMENT FACILITIES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.11 OTHER RDT&E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.0 PROCUREMENT-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.01 NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.011 INITIAL PRODUCTION FACILITIES (IPF)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.012 PRODUCTION BASE SUPPORT (PBS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.013 OTHER NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.02 RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.021 MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.022 RECURRING ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.023 SUSTAINING TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.024 QUALITY CONTROL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.025 OTHER RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.03 ENGINEERING CHANGES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.04 SYSTEM ENGNRNG/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.041 PROJECT MGMT ADMIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.05 SYSTEM TEST & EVALUATION, PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.06 TRAINING AIDS & EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.07 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.08 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.081 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.082 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.09 OPERATIONAL/SITE ACTIVATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.10 FIELDING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.101 INITIAL DEPOT LEVEL REPARABLE (SPARES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.102 INITIAL CONSUMABLES (REPAIR PARTS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.103 INITIAL SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.104 TRANSPORTATION (EQUIPMENT TO UNIT)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.105 NEW EQUIPMENT TRAINING (NET)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.106 CONTRACTOR LOGISTICS SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.11 TRAINING AMMUNITIONS/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.12 WAR RESERVE AMMUNITION/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.13 MODIFICATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.14 OTHER PROCUREMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.0 MILITARY CON-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.01 DEVELOPMENT CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.02 PRODUCTION CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.03 OPERATIONAL/SITE ACTIVATION CON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.04 OTHER MC	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.0 MIL PERSONNEL-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.01 CREW	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.02 MAINTENANCE (MTOE)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.03 SYSTEM-SPECIFIC SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.04 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.041 PROJECT MGMT ADMIN (PM MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.05 REPLACEMENT PERSONNEL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.051 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.052 PERMANENT CHANGE OF STATION (PCS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.06 OTHER MP	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.0 O&M-FUNDED ELEMENTS	466.97	480.97	495.39	510.24	525.55	541.35	557.57
5.01 FIELD MAINTENANCE CIVILIAN LABOR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.02 SYSTEM-SPECIFIC BASE OPERATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.03 REPLEN DEPOT-LEVEL REPARABLE (SPARES)	201.26	207.30	213.51	219.92	226.51	233.32	240.31
5.04 REPLEN CONSUMABLES (REPAIR PARTS)	229.13	236.00	243.08	250.36	257.88	265.63	273.58
5.05 PETROLEUM, OILS AND LUBRICANTS (POL)	27.87	28.70	29.56	30.45	31.36	32.31	33.27
5.06 END-ITEM SUPPLY AND MAINTENANCE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.061 OVERHAUL (P7M)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.062 INTEGRATED MATERIEL MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.063 SUPPLY DEPOT SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.064 INDUSTRIAL READINESS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.065 DEMILITARIZATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.07 TRANSPORTATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.08 SOFTWARE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.09 SYS TEST AND EVAL, OPERATIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.10 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	8.71	8.97	9.24	9.52	9.80	10.10	10.40
5.101 PROJ MGMT ADMIN (PM CIV)	8.71	8.97	9.24	9.52	9.80	10.10	10.40
5.102 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.11 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.12 OTHER O&M	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.0 DEFNSE BUS OPERATION FUND (DBOF) ELEM	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.01 CLASS IX WAR RESERVE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.02 OTHER DBOF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTALS	466.97	480.97	495.39	510.24	525.55	541.35	557.57

BRTRC - Baseline Cost Model - V1.2
Cost Totals by Year (Current Dollars) ($k)

600 GPH (ROWPU) FOR SPECIAL OPERATIONS FORCES (SOF) 07/11/95

	2021	2022	2023	2024	2025	2026	2027
1.0 RDT&E-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.01 DEVELOPMENT ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.02 PRODUCIBILITY ENGR AND PLAN (PEP)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.03 DEVELOPMENT TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.04 PROTOTYPE MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.05 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.051 PROJECT MGMT ADMIN (PM CIV/MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.052 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.06 SYSTEM TEST AND EVALUATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.07 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.08 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.09 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.091 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.092 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.10 DEVELOPMENT FACILITIES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.11 OTHER RDT&E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.0 PROCUREMENT-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.01 NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.011 INITIAL PRODUCTION FACILITIES (IPF)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.012 PRODUCTION BASE SUPPORT (PBS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.013 OTHER NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.02 RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.021 MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.022 RECURRING ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.023 SUSTAINING TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.024 QUALITY CONTROL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.025 OTHER RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.03 ENGINEERING CHANGES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.04 SYSTEM ENGNRNG/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.041 PROJECT MGMT ADMIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.05 SYSTEM TEST & EVALUATION, PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.06 TRAINING AIDS & EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.07 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.08 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.081 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.082 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.09 OPERATIONAL/SITE ACTIVATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.10 FIELDING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.101 INITIAL DEPOT LEVEL REPARABLE (SPARES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.102 INITIAL CONSUMABLES (REPAIR PARTS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.103 INITIAL SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.104 TRANSPORTATION (EQUIPMENT TO UNIT)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.105 NEW EQUIPMENT TRAINING (NET)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.106 CONTRACTOR LOGISTICS SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.11 TRAINING AMMUNITIONS/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.12 WAR RESERVE AMMUNITION/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.13 MODIFICATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.14 OTHER PROCUREMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.0 MILITARY CON-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.01 DEVELOPMENT CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.02 PRODUCTION CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.03 OPERATIONAL/SITE ACTIVATION CON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.04 OTHER MC	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.0 MIL PERSONNEL-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.01 CREW	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.02 MAINTENANCE (MTOE)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.03 SYSTEM-SPECIFIC SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.04 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.041 PROJECT MGMT ADMIN (PM MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.05 REPLACEMENT PERSONNEL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.051 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.052 PERMANENT CHANGE OF STATION (PCS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.06 OTHER MP	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.0 O&M-FUNDED ELEMENTS	574.30	0.00	0.00	0.00	0.00	0.00	0.00
5.01 FIELD MAINTENANCE CIVILIAN LABOR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.02 SYSTEM-SPECIFIC BASE OPERATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.03 REPLEN DEPOT-LEVEL REPARABLE (SPARES)	247.52	0.00	0.00	0.00	0.00	0.00	0.00
5.04 REPLEN CONSUMABLES (REPAIR PARTS)	281.79	0.00	0.00	0.00	0.00	0.00	0.00
5.05 PETROLEUM, OILS AND LUBRICANTS (POL)	34.27	0.00	0.00	0.00	0.00	0.00	0.00
5.06 END-ITEM SUPPLY AND MAINTENANCE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.061 OVERHAUL (P7M)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.062 INTEGRATED MATERIEL MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.063 SUPPLY DEPOT SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.064 INDUSTRIAL READINESS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.065 DEMILITARIZATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.07 TRANSPORTATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.08 SOFTWARE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.09 SYS TEST AND EVAL, OPERATIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.10 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	10.71	0.00	0.00	0.00	0.00	0.00	0.00
5.101 PROJ MGMT ADMIN (PM CIV)	10.71	0.00	0.00	0.00	0.00	0.00	0.00
5.102 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.11 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.12 OTHER O&M	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.0 DEFNSE BUS OPERATION FUND (DBOF) ELEM	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.01 CLASS IX WAR RESERVE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.02 OTHER DBOF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTALS	574.30	0.00	0.00	0.00	0.00	0.00	0.00

BRTRC - Baseline Cost Model - V1.2
Cost Totals by Year (Current Dollars) ($k)
600 GPH (ROWPU) FOR SPECIAL OPERATIONS FORCES (SOF) 07/11/95

	2028	2029	2030	2031	2032	2033	2034
1.0 RDT&E-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.01 DEVELOPMENT ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.02 PRODUCIBILITY ENGR AND PLAN (PEP)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.03 DEVELOPMENT TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.04 PROTOTYPE MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.05 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.051 PROJECT MGMT ADMIN (PM CIV/MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.052 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.06 SYSTEM TEST AND EVALUATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.07 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.08 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.09 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.091 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.092 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.10 DEVELOPMENT FACILITIES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.11 OTHER RDT&E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.0 PROCUREMENT-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.01 NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.011 INITIAL PRODUCTION FACILITIES (IPF)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.012 PRODUCTION BASE SUPPORT (PBS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.013 OTHER NON-RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.02 RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.021 MANUFACTURING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.022 RECURRING ENGINEERING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.023 SUSTAINING TOOLING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.024 QUALITY CONTROL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.025 OTHER RECURRING PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.03 ENGINEERING CHANGES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.04 SYSTEM ENGNRNG/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.041 PROJECT MGMT ADMIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.05 SYSTEM TEST & EVALUATION, PRODUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.06 TRAINING AIDS & EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.07 DATA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.08 SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.081 PECULIAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.082 COMMON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.09 OPERATIONAL/SITE ACTIVATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.10 FIELDING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.101 INITIAL DEPOT LEVEL REPARABLE (SPARES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.102 INITIAL CONSUMABLES (REPAIR PARTS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.103 INITIAL SUPPORT EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.104 TRANSPORTATION (EQUIPMENT TO UNIT)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.105 NEW EQUIPMENT TRAINING (NET)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.106 CONTRACTOR LOGISTICS SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.11 TRAINING AMMUNITIONS/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.12 WAR RESERVE AMMUNITION/MISSILES	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.13 MODIFICATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.14 OTHER PROCUREMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.0 MILITARY CON-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.01 DEVELOPMENT CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.02 PRODUCTION CONSTRUCTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.03 OPERATIONAL/SITE ACTIVATION CON	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.04 OTHER MC	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.0 MIL PERSONNEL-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.01 CREW	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.02 MAINTENANCE (MTOE)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.03 SYSTEM-SPECIFIC SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.04 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.041 PROJECT MGMT ADMIN (PM MIL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.042 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.05 REPLACEMENT PERSONNEL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.051 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.052 PERMANENT CHANGE OF STATION (PCS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.06 OTHER MP	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.0 O&M-FUNDED ELEMENTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.01 FIELD MAINTENANCE CIVILIAN LABOR	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.02 SYSTEM-SPECIFIC BASE OPERATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.03 REPLEN DEPOT-LEVEL REPARABLE (SPARES)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.04 REPLEN CONSUMABLES (REPAIR PARTS)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.05 PETROLEUM, OILS AND LUBRICANTS (POL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.06 END-ITEM SUPPLY AND MAINTENANCE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.061 OVERHAUL (P7M)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.062 INTEGRATED MATERIEL MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.063 SUPPLY DEPOT SUPPORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.064 INDUSTRIAL READINESS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.065 DEMILITARIZATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.07 TRANSPORTATION	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.08 SOFTWARE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.09 SYS TEST AND EVAL, OPERATIONAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.10 SYSTEM ENGINEERING/PROGRAM MANAGEMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.101 PROJ MGMT ADMIN (PM CIV)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.102 OTHER	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.11 TRAINING	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.12 OTHER O&M	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.0 DEFNSE BUS OPERATION FUND (DBOF) ELEM	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.01 CLASS IX WAR RESERVE	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.02 OTHER DBOF	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTALS	0.00	0.00	0.00	0.00	0.00	0.00	0.00

APPENDIX F

PROGRAM LIFE CYCLE COST ESTIMATE (PLCCE) SUMMARY FOR LIGHTWEIGHT WATER PURIFIER (LWP)