MAR 11185

INCORPORATED

# CONFORM PROGRAM BIBLIOGRAPHY AND DOCUMENT ABSTRACTS LISTING, AUGUST 1988

(A003)

Technical Report No. 781

September 1988


Contractor: MAR, Incorporated
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Order Performed By: Band, Lavis and Associates, Inc.
Severna Park, MD 21146

Sponsor: DTRC
Mr. J. Off utt, Code 1231
Bethesda, Maryland 20084-5000



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## 1. GENERAL INFORMATION

The **goals of** the **Surface Ship Continuing Concept Formulation** (CONFORM) program are the definition and evaluation of promising total ship concepts meeting operational needs of the future and the identification and assessment of advanced technologies needed to achieve these concepts. CONFORM is an exploratory ship design study program, the objectives of which were approved by OPNAV in 1980. The program gives the U.S. Navy a look at future (15 to 25 years) total ship concepts which are intended to contribute to long range material force level planning by providing a design study baseline from which Tentative Operational Requirements (TOR) can be developed by OPNAV. The CONFORM Program also provides guidance to R&D planners by identifying advanced technologies and assessing the R&D needed to achieve advanced ship system concepts. The program continually develops information useful to OPNAV and NAVSEA in focusing decisions for pursuing promising ship concepts and innovative technologies which can meet future U.S. Navy mission needs. The structured approach used by the CONFORM Program is intended to allow R&D tasks to be completed in a time frame compatible with future ship acquisition.

The CONFORM program is primarily a future-ship feasibility design study program with approximately 60% of funding allocated to development of Ship Feasibility Design Studies. Each year four to seven mission areas are addressed by the development of alternative ship design solutions. Products are comprehensive design reports at the feasibility study level of detail. The CONFORM Program to date has generated and examined over 100 new Ship Feasibility Design Studies for more than 50 missions, including combatants, auxiliaries, and amphibious ships, using both conventional and advanced hull forms incorporating advanced technology subsystems. Table I-I provides a summary overview of the CONFORM Ship Feasibility Design Studies. The remaining 40% of the funding is spent on interpreting mission requirements, forecasting technology trends, performing generic design analysis and tool development, and assessing completed design studies.

In the course of fulfilling the CONFORM Program objectives during the past nine years, over 200 separate documents have been produced. This CONFORM Program Bibliography and Document Abstracts Listing serves to catalog and reference the numerous CONFORM products so that this resource can be exploited by the ship designer and system technologist. A bibliography of the CONFORM reports published to date is contained in Section II of this document. The reports are listed chronologically by date-of-issue under the categories of:

**Program Documents**
**Final Design Reports**
**Draft Design Reports**
**Design Reports In Preparation**
**FY88 Designs**
**Back-Up Studies For Design Reports**
Design Synthesis Tool Reports
**HM&E Technology Study/Survey Reports**
**Combat System Technology Study/Survey Reports**
**Cost** Study **Reports**
Design Assessment **Reports**

The bibliography comprises the report **Title, Author, Date, Security Classification, NAVSEA TN Number, SEA 501 Ship Design Technical File (SDTF) Accession Number, Defense Technology Information (DTIC) Number, and National Technical Information Service (NTIS) Number.**

All CONFORM documents are available from the SEA 501 Ship Design Technical File (SDTF) library (drafts may not be available). A limited number of hard copies can be produced for distribution and may be requested by SDTF number (ACC #). For further information, SDTF Manager Steve Viscidi, may be contacted at (202) 692-9592.

A number of the CONFORM documents are available from the Defense Technology Information Center (DTIC) which can be contacted at (202) 274-7633. Unclassified documents approved for public release are forwarded to the National Technical Information Service (NTIS) which can be contacted at (703) 487-4650. The majority

of CONFORM documents are on file at the David Taylor Research Center in the Advanced Ship Data Bank (ASDB). However, the ASDB is presently closed due to lack of funding.

Section III of this document contains a narrative abstract of each CONFORM report, These abstracts have been developed as accurate summaries of the content of each document. The purpose of the summaries is to provide the ship designer, system technologist, R&D planner, or operations strategist with the information required to determine the relevance and value of a specific report to a current task or program. The abstracts comprise a single listing arranged chronologically by SDTF accession number (ACC #). The abstracts for those few reports which may not yet have been issued an accession number are contained at the end of the listing and are ordered chronologically by issue date.

Table 1-1. CONFORM Designs FY80 - FY88

| MISSION | CONFORM DESIGN | HULL TYPE: MONOHULL | HYDROFOIL | SURFACE EFFECT SHIP | SWATH | AIR CUSHION VEHICLE | PLANING MONO OR CAT | SEA CATAMARINE | WIG | FY | SDTF ACC # (IN PREPARATION) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SURFACE COMBATANT | Heavy Combatant (HC) | • | | | | | | | | 80 | 54971 |
| | Hydrofoil Combatant Growth Variant (PHMVAR) | | • | | | | | | | 80 | 54964 |
| | Light Patrol Hydrofoil (LPH) | | • | | | | | | | 80 | 54970 |
| | Advanced Combat System Frigate (ACSF) | • | | | | | | | | 80 | 60891 |
| | High Survivability Cruiser (HSC) | • | | | | | | | | | 58882 |
| | Corvette Escort Hydrofoil (CH) | | • | | | | | | | 81 | 58875 |
| | Low Detectability Ship (LDS) | • | | | | | | | | 82 | 58903 |
| | Battle Group Escort CTOL (CGVCTOL) | • | | | | | | | | 82 | 59152 |
| | Light Battle Group Escort (KEX) | • | | | | | | | | 82 | 59675 |
| | Dispersed Strike (DISSTK) | • | • | • | | | • | | | 82 | 60919 |
| | Battle Group Escort VSTOL (CGVVSTOL) | • | | • | • | | | | | 83 | 71400 |
| | ASW Destroyer (DS) | • | | | • | | | • | | 83 | 71260 |
| | Advanced DDG (ADDG) | • | | • | • | | | | | 84 | 70442 |
| | Shallow Water ASW Ship (ASWPC) | • | | • | • | | | | | 84 | 71447 |
| | Patrol Combatant Multi-Mission (PCM) | | | • | | | | | | 84 | ... |
| | Mobilization Frigate (MOBFF) | • | | | | | | | | | 71399 |
| | Fleet Command Ship (FCS) | • | | | | | | | | 85 | 71259 |
| | Advanced Mobilization Corvette (AMK) | | | • | | | | | | 85 | 71913 |
| | Cruiser Continuing Baseline (CGBL) | • | | | | | | | | 86 | 71293 |
| | VSTOL Variable Mission Air Platform (VMAP) | • | | | • | | | | | 86 | 71531 |
| | NATO ASW Hydrofoil (NATOHYD) | | • | | | | | | | 86 | 71290 |
| | NATO SES ASW Corvette (NATOSES) | | | • | | | | | | 86 | 71327 |
| | Destroyer Continuing Baseline (DDBL) | • | | | | | | | | 87 | ( ) |
| | Frigate Continuing Baseline (FFBL) | • | | | | | | | | 87 | ( ) |
| | VSTOL Cruiser II (CGV STOL II) | • | | | | | | | | 87 | ( ) |
| | ASW SWATH (ASW SWATH) | | | | • | | | | | 87 | ( ) |
| | Intra-Theater Sealift Ship (ITSL) | | | • | | | | | | 88 | TBD |
| | US/UK SWATH Frigate (SWATH ASW) | | | | • | | | | | 88 | ( ) |
| AMPHIBIOUS WARFARE | LVT Carrier (LVTC) | | | • | | | | | | 82 | 60718 70238 |
| | Landing Fire Support Ship (LFS I) | • | | | | | | | | 83 | 70788 |
| | Landing Ship Utility (LSUX) | | | • | | | | | | 83 | 70432 |
| | Assault Follow-On Echelon Lighter (AFOE LTR) | | | | | • | | | | 84 | 71072 |
| | LPX (LPX) | • | | • | | | | | | 85 | ( ) |
| | SWATH LPH (SWATH LPH) | | | | • | | | | | 85 | TBD |
| | Small SES Assault Ship (LSCS) | | | • | | | | | | 86 | TBD |
| | Fire Support Ship (LFS II) | • | | | | | | | | 86 | 71403 |
| MINE WARFARE | Mine Clearance System 2000 (MCM/ACV) | | | • | | • | | | | 81 | 59374 |
| | Small Producible MCM (SPMCM) | | | • | | • | • | | | 85 | TBD |
| | SWATH MCM System (SWATH MCM) | | | | | | | | | 88 | ( ) |
| AUXILIARY SHIPS | Universal Ship (UNIV AUX) | • | | | | | | | | 80 | 60279 |
| | Salvage/Rescue Ship (ARSX) | • | | | | | | | | 82 | 60172 |
| | SES Tug-Barge (SES T/B) | | • | | | | | | | a2 | 59990 |
| | Universal UNREP Ship (UNREP) | | | | | | | | | 82 | 58901 |
| | Advanced Base Repair Ship (ABR) | • | | | | | | | | 83 | 60257 |
| | Multi-Product Shuttle Ship (MPSS) | | | | | | | | | 84 | 70366 |
| | High Speed Salvage/Rescue Ship (ATSX) | • | | | • | | | | | 86 | ( ) |
| | Submersible Support Ship (SSS) | • | | | • | | | | | 87 | ( ) |
| SPECIAL MISSION | Rigid Inflatable Boat (RIB) | | | | | | • | | | 81 | 70423 |
| | TAGX Parent Hull (SWATH TAGX) | | | | • | | | | | 85 | TBD |
| | Arctic ACV (AACV) | | | | | • | | | | 85 | 70776 |
| | High-Speed Amphibious Raider (HSAR) | | | • | | • | | | | 88 | ( ) |
| | Amphibious PAR WIG (APW) | | | | | | | | • | 88 | ( ) |

## 2. CONFORM DOCUMENTS BIBLIOGRAPHY

## 2.1 Program Documents

| Title | Author | Date | Class | NAVSEA TN# | Acc. # | DTIC/NTIS |
|---|---|---|---|---|---|---|
| Design Summaries FY 81 (Final) | SEA 05R14 | 01/02/82 | C | | 58871 | DTIC |
| Conform RDT&E Needs - 81 | SEA 03RD | 02/00/82 | U | | 50076 | |
| Conform Supportability (Draft) | NSRDC 18 | 07/01/82 | U | | 59737 | |
| Design Summaries-FY82 (Final) | SEA 05R14 | 04/01/83 | C | 041-05R1-TN-007 | 59231 | DTICC034273 |
| Design Summaries-FYI3 (Final) | SEA 05R14 | 06/01/84 | C | 041-05R-TN-0012 | 60499 | DTICC039318 |
| Annual Compendium of Ship Designs and Innovations (Draft) | SEA 05R14 | 04/01/85 | C | | 70418 | DTIC AD-CO39767 |
| Design Summaries-FY84 (Final) | SEA 05R14 | 05/01/85 | C | 041-05R-TN-0011 | 70417 | DTIC CO39319 |
| Conform Innovations and R&D Needs Applicable to Future Frigate Design (Draft) | SEA 05R/BLA | 07/01/85 | C | | 70427 | |
| Program Master Plan (Flnal) | SEA 05R14 | 04/01/86 | U | | 70959 | DTIC B103735 |
| Compendium of Future Ship Design Studies & Technology Characterizations | SEA 05R/5015/ CHENG R | 07/01/87 | C | | | DTIC |
| Deslgn Summarles-FY85-FY87 (Draft) | SEA 05R14 | 08/01/87 | C | | | DTIC |

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## 2.2 Final Design Reports

| Title | Author | Date | Class | NAVSEA T | Acc. # | DTIC/NTIS |
|---|---|---|---|---|---|---|
| PHM-3 Series Patrol Combatant Missile-Hydrofoil-Improved & Enlarged Variants (Final) *(PHM VAR)* | Boeing | 11/12/80 | U | | 54964 | |
| Light Patrol Hydrofoil-Vol. I-Feasibility & Vol. II-Performance & Effectiveness (Final) *(LPH)* | Grumman | 11/25/80 | C | | 54970 | DTIC |
| Universal Ship Final Design Report (Final) *(UNIV AUX)* | SEA 501 | 02/01/81 | U | | 60279 | |
| Advanced Configuration Frigate and Combat System Concept (Final) *(ACSF)* | SEA 501 | 04/30/81 | C | | 60891 | |
| Concept Formulation of Model 928-80 Hydrofoil Combantant Growth Variant of PHM Hull Development (Final) *(PHM VAR)* | 928-80 | 10/01/81 | U | | 70426 | |
| Model 928-80 Hydrofoil Combatant Growth Variant PHM-Ship Description (Final) *(PHM VAR)* | Boeing | 10/16/81 | U | | 54967 | |
| Corvette Escort Hydrofoil-Final Design Report (Final) *(CH)* | SEA 501 | 11/01/81 | C | | 56675 | DTIC CO34272 |
| Advanced Conflguration Frigate *(ACSF)* | Sperry | 08/01/82 | S | | | |

## 2.2 Final Design Reports (cont'd)

| Title | Author | Date | Class | NAVSEA TN# | Acc. # | DTIC/NTIS |
|---|---|---|---|---|---|---|
| Heavy Combatant Final Design Report (Final) *(HC)* | SEA 501 | 08/01/82 | C | | 54971 | DTIC CO34309 |
| High Survivability Cruiser Final Design Report (Final) *(HSC)* | SEA312 | 08/01/82 | C | | 58882 | DTIC |
| Universal Ship Final Design Report (Final) *(UNREP)* | SEA 501 | 11/01/82 | U | 041-501-TN-004 | 58901 | DTIC 808578 |
| Light Battle Group Final Design Report (Final) *(KEX)* | SEA 501 | 12/01/82 | C | 041-501-TN-0003 | 59675 | DTIC C035864 |
| Low Detectability Ship-Final Design Report (Flnal) *(LDS)* | SEA 501 | 12/01/82 | C | 041-501-TN-002 | 58903 | |
| CGV CTOL Final Design Report (Final) *(CGV CTOL)* | SEA 501 | 02/01/83 | C | 051/501-TN-0002 | 59152 | DTIC |
| Mine Clearance System 2000 (Final) *(MCM/ACV)* | SEA 501 | 04/01/83 | C | 479-051-TN-001 | 59374 | DTIC 8082191 |
| 26' Rigid Inflatable Boat (Final) *(RIB)* | NSCSES | 06/01/83 | FOUO | NSCSES No. 60-I 10 | 70423 | DTIC |
| 3500-Tonne Surface Effect Ship as an LCT Carrier (Final) *(LVTC)* | SEA 501 | 08/01/83 | C | | 70238 | DTIC |

## 2.2 Final Design Reports (cont'd)

| Title | Author | Date | Class | NAVSEA TN# | Acc. # | DTIC/NTIS |
|---|---|---|---|---|---|---|
| SES Tug-Barge Flnal Design Report (Final) *(SES T/B)* | SEA 501 | 10/01/83 | C | 041-501-TN-0008 | 59990 | DTIC AD-C039353 |
| Two SES Craft Conflgured as LVT Carriers (Final) *(LVTC)* | SEA501 | 11/01/83 | C | 041-501-TN-006 | 60718 | DTlCC03917 |
| Salvage/Rescue Ship Final Deslgn Report (Final) (ARSX) | SEA501 | 02/01/84 | U | 041-501-TN-0011 | 60172 | DTIC |
| Advanced Base Repair Ship Final Deslgn Report (Final) *(ABR)* | SEA501 | 03/01/84 | U | 041-501-TN-0009 | 60257 | DTIC AD-B103825 |
| Dispersed Strike Feasiblity Design Final Report (Final) *(DISSTK)* | SEA501 | 10/01/84 | C | 041-501-TN-0016 | 60919 | DTIC C039320 |
| Landing Fire Support Ship (FY83) Final Design Report (Final) *(LFS1)* | DTRC1222 | 11/01/84 | C | 041-501-TN-0017 | 70788 | DTIC |
| Design Impact Assessment Multi-Product Shuttle Flnal Report (Final) *(MPSS)* | NSRDC1213 | 04/01/85 | U | 041-501-TN-0020 | 70366 | |
| Arctlc ACV Final Design Report (Final) (AACV) | SEA 501 | 08/01/85 | C | 041-501-TN-0012 | 70776 | DTIC C039314 |
| Assault Follow-On Echelon Lighter Flnal Report (Final) *(AFOE L TR)* | DTRC 1222 | 09/01/85 | C | 041-501-12-85 | 71072 | DTIC C039315 |

## 2.2 Final Design Reports (cont'd)

| Title | Author | Date | Class | NAVSEA Acc. #/N# | DTIC/NTIS |
|---|---|---|---|---|---|
| SWATH T-AGX Feasibility Design Study (Final) *(SWATH TAGX)* | SEA 501 | 06/00/86 | C | 05501-TN-0005 | |
| Battle Group Escort (CGV) VSTOL Variants, Vol. ii • Monohuii FY83 Final Design Report (Final) *(CGVSTOL)* | SEA5011 | 07/01/86 | C | 041-501-TN-0029 | 71141 DTIC |
| NATO SES ASW Corvette Final Design Report (Final), Vol. I *(NATOSES)* | SEA501 | 09/01/86 | C | 041-501-TN-0025 | 71326 DTIC |
| Landing Fire Support Ships (FY86), Final Design Report (Final) *(LFS II)* | DTRC 1222 | 10/01/86 | C | 041-501-TN-0027 | 71403 DTIC |
| NATO ASW Hydrofoil Final Design Report (Final) *(NATOHYD)* | DTRC 1222 | 11/01/86 | C | 041-501-TN-0026 | 71290 DTIC |
| Fleet Command Ship Final Design Report (Final) *(FCS)* | SEA05 | 12/01/86 | C | 041-501-TN-0035 | 71259 DTIC |
| ASW Destroyer DS(X) Final Design Report (Final) | SEA 05R | 01/01/87 | C | 051-501-TN-0017 | 71260 DTIC |
| Continuing Baseline Final Design Report (Final) *(CGBL)* | SEA 5011 | 01/01/87 | C | 041-501-TN-0039 | 71293 DTIC |
| Advanced DDG Ship Design Study (Final) *(ADDG)* | DTRC12 | 03/00/87 | C | 041-501-TN-0036 | |

## 2.2 Final Design Reports (cont'd)

| Title | Author | Date | Class | NAVSEA TN# | Acc. # | DTIC/NTIS |
|---|---|---|---|---|---|---|
| Battle Group Escort (CGV) VSTOL Variants, Vol. III • SWATH FY83 Flnal Deslgn Report (Final) *(CGVSTOL)* | SEA 5011 | 04/01/87 | C | 041-501-TN-0029 | 71401 | DTIC |
| Battle Group Escort (CGV) VSTOL Variants, Vol. IV • *SES FY83* Final Design Report (Final) *(CGVSTOL)* | SEA5011 | 04/01/87 | C | 041-501-TN-0029 | 71402 | |
| Mobilization Frigate Final Design Report (Final) *(MOBFF)* | SEA5011 | 04/01/87 | C | 041-501-TN-0030 | 71399 | DTIC |
| NATO SES ASW Corvette Flnal Design Report (Final), Vol. II *(NATOSES)* | SEA501 | 05/01/87 | U | 041-501-TN-0025 | 71327 | DTIC |
| NATO SES ASW Corvette Final Design Report (Final), Addendum *(NA TOSES)* | SEA501 | 05/01/87 | C | 501-6-87 | 71530 | |
| Landing Ship Combat Support (Final) *(LSCS)* | SEA 501 | 06/00/87 | C | | 71409 | |
| Battle Group Escort (CGV) VSTOL Variants, Vol. I • Comparative FY83 Flnal Deslgn Report (Final) *(CGVSTOL)* | SEA5011 | 06/01/87 | C | 041-501-TN-0029 | 71400 | DTIC |
| SWATH LPH Flnal Design Report (Final) *(SWATH LPH)* | SEA501 | oamoia7 | C | | | |
| Shallow Water ASW Ship Final Design Report (Flnal) *(AS WPC)* | SEA 501 | 08/01/87 | C | 041-501-TN-0040 | 71447 | |

## 2.2 Final Design Reports (cont'd)

| Title | Author | Date | Class | NAVSEA TN# | Acc. # | DTIC/NTIS |
|---|---|---|---|---|---|---|
| Advanced Mobilization Corvette Final Design Report (Final) *(AMK)* | DTRC 12 | 09/00/87 | C | | 71913 | |
| SWATH T-AGX Parent Hull Design Report (Final) *(TAGX)* | SEA50151 | 09/01/87 | C | 050-501-TN-0005 | 71573 | |
| Small SES Assault Ship Final Design Report (Final) *(LSCS)* | SEA501 | 09/00/87 | C | | | |
| VSTOL Variable Mission Air Platform Final Design Report (Final) *(VMAP)* | SEA501 | 09/01/87 | C | 041-501-TN-0051 | 71531 | |
| A Feasibility Design for an Intra-Theater Sealift Ship (Final) *(ITSL)* | SEA501 | 02/00/88 | C | 041-501-TN-0061 | | |

## 2.3 Draft Design Reports

| Title | Author | Date | Class | NAVSEA TN# | Acc. # | DTIC/NTIS |
|---|---|---|---|---|---|---|
| Feasibility Study for 120' Planning Hull Fast Attack Craft (P HFAC) (Draft) *(PHFAC)* | NAVSEA | 02/01/83 | U | | 60497 | |
| Parametric Analysis, Landing Ship Utility LSU(X) (Draft) *(LSUX)* | NSRDC *12* | 01/01/85 | U | | *70432* | |
| Samll Producible Mine Countermeasures Craft Feasibility Design Study (Draft) *(SPMCM)* | JJMA | 11/00/87 | C | | | |

## 2.4 Deslgn Reports in Preparation

| Title | Author | Date | Class | NAVSEA TN# | Acc. # | DTIC/NTIS |
|---|---|---|---|---|---|---|
| LPX Monohull (FY85) *(LPX)* | | | | | | |
| High Speed Salvage/Rescue Ship (FY86) *(ATSX)* | | | | | | |
| Destroyer Continuing Baseline (FY87) *(DDBL)* | | | | | | |
| Frigate Continuing Baseline (FY87) *(FFBL)* | | | | | | |
| Submersible Support Ship (FY87) *(SSS)* | | | | | | |
| VSTOL Cruiser II (FY87) *(CGV STOL II)* | | | | | | |
| ASW SWATH (FY87) *(ASWSWATH)* | | | | | | |

## 2.5 FY88 Designs

| Title | Author | Date | Class | NAVSEA TN# | Acc. # | DTIC/NTIS |
|---|---|---|---|---|---|---|
| High-Speed Amphibious Raider *(HSAR)* | | | | | | |
| Amphibious PAR WIG *(APW)* | | | | | | |
| SWATH MCM System *(SWATH MCM)* | | | | | | |
| US/UK SWATH Frigate *(SWATH ASW)* | | | | | | |

## 2.6 Back-Up Studies for Design Reports

| Title | Author | Date | Class | NAVSEA TN# | Acc.# | DTIC/NTIS |
|---|---|---|---|---|---|---|
| ACV mission Analysis Report (Draft) | Asset | 08/09/81 | C | | 54501 | DTIC |
| Ship Characteristics in the Port Clearance Mission-ACV MCM Working Paper No. 1 (Draft) | NCSC | 01/01/81 | C | | 60800 | DTIC |
| Modular Concepts for Auxiliary Ship Missions (Final) | Mantech | 02/28/81 | U | | 54530 | DTIC B080822 |
| Preliminary Motion Transfer Functions for SWAM T-AGOS (Memo) | DTRC | 03/05/81 | U | | 54505 | |
| Conform 2000 Amphibious Ship Capabilities (Draft) | Presearch | 06/24/81 | U | | 54528 | |
| Corvette Escort-Analysis for the Employment and Candidate Sensors-Weapons (Final) | Adler | 07/17/81 | C | | 58872 | DTIC |
| Canadian Province Class Destroyer DDG-300 | MIT | 10/10/81 | U | | 54966 | |
| Auxiliary Ship Capabilities for Univ. UNREP (Draft) | SEA 501 | 10/01/81 | U | | 54529 | DTIC 8080717 |
| Combat System for a BOO-Ton Hydrofoil-Proposed-C.H. (Final) | NSWC | 10/01/81 | C | | 58866 | DTIC |
| Alternate Mission Davit Launched Craft (Draft) | NAVSEA-NORDET | 11/01/81 | U | | 58874 | |
| Heavy Combatant-Topside Design Study (Final) | SEA06 | 11/30/81 | U | | 58880 | |

## 2.6 Back-Up Studies for Design Reports (cont'd)

| Title | Author | Date | Class | NAVSEA TN# | Acc. # | DTIC/NTIS |
|---|---|---|---|---|---|---|
| CGV Inboard and Outboard Profiles-Vsrslon 3 | NAVSEA | 01/01/82 | U | | 71111 | |
| RCS Reduction for Light Battle Group Escort | NKF | 03/01/82 | C | | 54517 | DTIC |
| IR Signature Suppression Measures for LIght Battle Group Escort (Draft) | NKF | 04/01/82 | C | | 54516 | DTIC |
| Universal Ship Technology Characterization Section (Draft) | Band, Lavis | 06/0 1182 | U | | 54504 | |
| Battle Group Escort-CGV-Study to Develop & Explain Candidate Design (Draft) | Dec. Eng. | 06/15/82 | C | | 54541 | DTIC |
| ACV Handling Study (Draft) | Rosenblatt | 07/01/82 | C | | 54513 | |
| Planing Hull Fast Attack Craft ▪ Feasibillty Study (Draft) | NAVSEANORDET | 07/01/82 | U | | 60507 | |
| Projected Employment & Unitized Equipment Packages for Salvage/ Rescue Scenarios (Final) | SEACO | 07/01/82 | U | | 60068 | |
| Required Operation Capabilities for U.S. Navy Craft-Rationale (Final) | NAVSEANORDET | 07/01/82 , | C | | 54514 | DTIC |
| SES & ACV Mine-Countermeasures System | Band, Lavis | 07/01/82 | U | | 54524 | |
| Survivable Cruise Concept Formulation Study-Vulnerablllty Results (Final) | NSRDC 17 | 07/01/82 | C | | 54968 | DTIC |

## 2.6 Back-Up Studies for Design Reports (cont'd)

| Title | Author | Date | Class | NAVSEA TN# | Acc. # | DTIC/NTIS |
|---|---|---|---|---|---|---|
| An Air Cushion Salvage Uft Device | RAMCOR | 07/30/82 | U | | | |
| Heavy Combatant Final Design Drawings (Flnal) | SEA 501 | 08/01/82 | U | | 54972 | DTIC |
| Fire Support Ship Design Study Conform Program (Final) | RAMCOR | 09/01/82 | | | 58900 | |
| Dispersed Strike Concept-Launch and Retrieval Hydrofoil (Draft) | Grumman | 09/30/82 | U | | 54518 | DTIC |
| Dispersed Strike Combat Systems (Draft) | NSWC | 10/01/82 | C | | 59230 | DTIC |
| Advanced Base Tender-ADR(X) Tech. Sectlon for Conform Level Require-ments (CLR) (Draft) | Band. Lavis | 12/01/82 | U | | 59729 | |
| Amphibious Landing Ship Tech Section for CLR | Band, Lavis | 12/01/82 | U | | 59728 | |
| Arctic Amphibious Landing Ship Tech. Sectlon for CLR (Draft) | Band, Lavis | 12/01/82 | U | | 59727 | |
| Battle Group Escort Tech. Section for for CLR | Band, Lavis | 12/01/82 | U | | 59726 | |
| Landlng Fire Sup. Ship Tech Sectlon for CLR | Bend, Lavis | 12/01/82 | U | | 60466 | |
| MCM Hellcopter Ship Tech. Sectlon for CLR | Band, Lavis | 12/01/82 | U | | 59730 | |

## 2.6 Back-Up Studies for Design Reports (cont'd)

| Title | Author | Date | Class | NAVSE Acc. #N# | DTIC/NTIS |
|---|---|---|---|---|---|
| Requirements Def. Study for LVT Carrier | Presearch | 12/01/82 | U | 59735 | DTIC |
| Submarine Destroyer (DS) Tech. Section Section for CLA (Draft) | Band, Lavis | 12/01/82 | U | 69466 | |
| Deep Submergence Rescue Vehicles-Description of Handling Systems (Draft) | Busby | 01/01/83 | U | 60067 | |
| ABR ILS Concept Assessment (Draft) | Adtech | 03/01/83 | U | 59188 | |
| ABR-Assessment of ADP impacts (Draft) | Adtech | 03/01/83 | U | 59200 | |
| Fire Support Ship Study (Draft) | Dec. Eng. | 06/01/83 | U | 60237 | |
| Combat Suite for the LFS (Final) | NSWC | 09/30/83 | C | 70480 | |
| An Evaluation of Candidate Replacement Landing Craft for the Marine Amphibious Force Assault Follow-On Echelon | Band, Lavis | 10/17/83 | U | | |
| CLR Technology Sections for Conform FY84 Designs | Band, Lavis | 12/00/83 | U | | |
| FY84 Conform Program CLR Support Analysis EW Ship, MPSS, ADV, DDG (Draft) | Delex | 12/01/83 | C | 70422 | DTIC |
| Multi-Product Shuttle Ship Technoigy Characterlratlon of Cargo Systems | MAR | 04/00/84 | U | 71113 | |

## 2.6 Back-Up Studies for Design Reports (cont'd)

| Title | Author | Date | Class | NAVSEA TN# | Acc. # | DTIC/NTIS |
|---|---|---|---|---|---|---|
| Advanced Base Repair Ship Risk Assessment | AMT | 07/31/84 | U | | 71089 | |
| Hull, Mechanical & Electrical Technology Characterization and Evaluatlon for a Frigate | DE | 10/00/84 | U | | | |
| CLR Technology Sections FY85 Designs (Draft) | Band, Lavis | 11/01/84 | | | 60750 | |
| Seakeeping Survey of Amphibious, Replenishment and Auxiliary Ships Vol. 1 and Vol. 2 (Final) | SEA 55W | 07/15/85 | C | 079-55W-TN-004 | 70187<br>70188 | DTIC |
| Arctic ACV-Environmental Studies (Draft) | Arctec | 08/01/85 | U | | 70479 | |
| LSCS Variants & Mission Roles for Landing Force Operations in 1988 & Beyond (Draft) | ORI | 04/01/86 | C | | 70177 | DTIC |
| NATO SES ASW Corvette, Volume II • Appendices | SEA 501 | 05/00/86 | U | 041-501-TN-0025 | | |
| Advanced Survivability Systems for FY82 Surface Ship Contlnulng Conform (Draft) | NAVSEA 50152 | | C | | 71109 | |

## 2.7 Deslgn Synthesis Tool Reports

| Title | Author | Date | Class | NAVSEA TN# | Acc. # | DTIC/NTIS |
|---|---|---|---|---|---|---|
| SWATH Ship Hull Form Selection Handbook (Resistance) (Draft) | NSRDC III | 08/00/80 | U | | 54507 | |
| Ballast Management Aboard SWATH Ships-Preliminary Assessment (Draft) | NSRDC-12 | 09/03/80 | U | | 54500 | DTIC |
| Canadian Concept Exploration Model - An Evaluation Report (Final) | NSRDC | 01/01/81 | U | | 59738 | |
| Design Synthesis Model for Air-Cushion Vehicles (Draft) | Band, Lavis | 03/01/81 | U | | 54527 | |
| Siam Pressure Loads-Design Aid for SWATH | NSRDC 17 | 04/00/81 | U | | 54506 | DTIC 8081427 |
| Enhanced Manpower Determination Model, EMDM, Users Guide (Final) | SEA 55 | 05/31/81 | U | | 58873 | |
| Addition to Enhanced Manpower Determination Model, EMDM-3 (Final) | SEA 55 | 07/28/81 | U | | 54521 | |
| Computer-Alded Design Lab-XXIIA-Informatlon Executive System (Final) | SEA 55 | 07/28/81 | U | | 54963 | DTIC |
| Powering Presentation-SWATH Ship (Draft) | NSRDC 12 | 08/01/81 | U | | 54508 | |
| RCS & IR Ship Signature Reductlon Methodology (Draft) | NKF | 10/00/81 | C | | 54540 | DTIC |
| ASW Communications Requirements Manual (Draft) | NOSC | 02/15/82 | C | | 58868 | DTIC |

## 2.7 Design Synthesis Tool Reports (cont'd)

| Title | Author | Date | Class | NAVSEA TN# | Acc. # | DTIC/NTIS |
|---|---|---|---|---|---|---|
| Low Profllalntegrated Stack Design (Draft) | Baham | 12/01/82 | U | | 59191 | DTIC |
| Surface Shlp Designs-RCS Predlctlons (Draft) | Georgia Tech | 01/01/83 | C | | 59185 | DTIC |
| SWATH Maneuverlng Predlctlons (Final) | NSRDC 15 | 06/01/83 | U | | 54977 | DTIC B080575 |
| Seakeeplng Response of 30,000 Ton SWATH Series (Final) | NSRDC 15 | 07/01/83 | U | | 54985 | DTIC |
| SES Seakeeping Study (Draft) | DTRC 1630 | 0710185 | U | | 71071 | |
| SWATH Synthesis Model Enhancement, Vol. II ▪ Conform (Draft) | G&C | 08/01/85 | U | | 70775 | |
| Advanced Marine Vehicles Hullform Design Practices: A Conform Survey Report (Final) | SEA 501 | 04/15/86 | U | 041-501-TN-0024 | 70960 | |
| NATO SWG/6 Advanced Naval Vehicles Methodology for Assessing Vehicle Concepts | SEA 501 | 07/01/86 | U | | 71532 | |
| Surface Ship Conform FY86 SWATH Volume Utilization Study (Flnal) | SEA 50151 | 07/01/87 | U | 050-501-TR-005 | | |
| A Revlew of U.S. Navy Design and Assessment Tools (Draft) | Band. Lavis | 12/00/87 | U | | | |

## 2.8 HM&E Technology Study/Survey Reports

| Title | Author | Date | C / I | NAVSEA TN# | Acc. # | DTIC/NTIS |
|---|---|---|---|---|---|---|
| Technology Trends & Deficiencies for R&D Programs Related to Planing Craft (Final) | NAVSEA-NORDET | 08/01/80 | U | | 54510 | DTIC 8081399 |
| Future Surface Combatant Volume Demands-Conform (Final) | SEA 3211 | 10/01/80 | U | | 54969 | |
| Technology Characterlxatlon-Surface Ship Structures-Year 2000 (Draft) | Band, Lavis | 01/01/82 | U | | 54531 | |
| Conform Design Managers & Leaders of Related Navy Research-Report on Interviews (Draft) | Band, Lavis | 03/01/82 | U | | 54532 | |
| Technology Forecast Structures (Final) | NSRDC 17 | 03/17/82 | U | | 54515 | DTIC |
| Conform-Technology Trends for Propulsion Plants for U.S. Navy Ships (Final) | Band, Lavis | 06/01/82 | U | | 71192 | |
| Hull Structure Design of U.S. Navy Ships - Tech. Trends (Draft) | Band, Lavis | 06/01/82 | U | | 70434 | |
| Landlng Craft Retrieval-Advanced Concepts (Draft) | RAMCOR | 07/30/82 | U | | 58898 | |
| Propulsor Design Technology Trends. Appendix B (Draft) | Baham | 08/01/82 | C | | 54503 | DTIC CO34239 |
| Advanced Survivable Superstructure Concepts Applicatlon and Ship Impact (Final) | Gibbs & Cox | 01/01/83 | C | | 71110 | |

## 2.8 HM&E Technology Study/Survey Reports (cont'd)

| Title | Author | Date | Class | NAVSEA TN# | Acc. # | DTIC/NTIS |
|---|---|---|---|---|---|---|
| Propulaor Design Technology Trends (Draft) | Baham | 01/01/83 | U | | 56676 | DTIC |
| Mechanical Drive Pod Power Plants for Naval Surface Combatants (Draft) | Dec. Eng. | 01/15/83 | C | | 58896 | DTIC B081428 |
| Technology Trends for Selected Ship Subsystems Rev. B (Draft) | Band, Lavis | 10/01/83 | C | | 60055 | DTIC |
| Electrical Loads of U.S. Navy Surface Combatants (Draft) | SEA 56D5 | 03/15/84 | U | | 60099 | DTIC AD-B106137 |
| Ingalls IRAD Study (Final) | Litton Systems | 10/01/84 | U | | 71073 | |
| Steam Technology In U.S. Navy Surface Fleet (Final) | Baham/56D5 | 01/28/85 | U | 200-56-D-TN-0002 | 60877 | DTIC AD-B107294 |
| Conform Innovatlona and R&D Needs Applicable to Future Frigate Design | SEA 501 | 04/01/85 | C | 041-501-TN-0021 | 71406 | DTIC |
| High Speed Seawater Pump Designs (Draft) | DTRC 2712 | 07/01/85 | U | DTRC TM-27-84-53 | 71069 | |
| Applications of Robotics and Artificial Intelligence for Ship Operations and Mission Actlvltiea - An Overview, Vol. I (Final) | NSWC | 05/01/86 | U | NSWC MP 84-478 | 70846 | DTIC B099050 |
| SES Technology: State of Development Evaluation and RDT&E Prioritization | Band, Lavis | 05/14/86 | U | | | |
| Application of Ice Strengthening Criteria to Surface Ship and Preliminary Design Studies | DTRC | 09101186 | U | DTRC/SSID-86/DRIO | 71388 | |

## 2.8 HM&E Technology Study/Survey Reports (cont'd)

| Title | Author | Date | Class | NAVSEA TN# | Acc. # | DTIC/NTIS |
|---|---|---|---|---|---|---|
| Conform Technology Engineering: Electrical Power Distribution | D&P | 09/01/86 | U | | 71448 | |
| Conform ▪ Technology Characteristics and Ship impact Assessments of Technologies Applicable to DDG-80 Design | SEA 501 | 06/01/87 | U | | 71328 | |

## 2.9 Combat System Technology Study/Survey Reports

| Title | Author | Date | Class | NAVSEA TN# | Acc. # | DTIC/NTIS |
|---|---|---|---|---|---|---|
| RPVs - Shipboard Interface (Viewgraphs Only) | DTRC 16 | 08/08/81 | U | | 54860 | |
| Forecast: Towed Array Technology FY83, Tech Memo (Draft) | NSWC | 01/01/82 | C | | 60893 | |
| Bistatic Sonar Reacquisition and Localization | Underwater Sys. | 12/01/82 | C | N60921-82-M-6686 | 71085 | |
| ASW Technologies (Draft) | NSWC | 03/25/83 | S | | | |
| Surface Ship/ASW Mutual Impact Assessment | ADTECH | 08/01/83 | C | | 70419 | |
| Surface Ship/ASW System, Mutual Impact Assessment (Draft) | NUSC/ADTECH | 08/00/83 | C | | 59719 | |
| RPV Technology Forecast (Final) | NSWC | 06/25/84 | U | | 70420 | |
| SSATS/DS(X) Mutual Impact Assessment (Tech Memo) | NUSC | 07/25/84 | C | | 60783 | |
| Surface Ship Torpedo Defense System (Draft) | NSWC | 08/28/84 | S | | | |
| Covert Communications Equipment & Techniques (Draft) | NOSC | 01/16/85 | C | | 60876 | DTIC |
| Twin Hull Shlp and Sonar Mutual Impact Considerations with Emphasis on Future FFX Platforms (Final) | NUSC | 08/06/85 | C | | 70774 | |

## 2.9 Combat System Technology Study/Survey Reports (cont'd)

| Title | Author | Date | Class | NAVSEA TN# | Acc. # | DTIC/NTIS |
|---|---|---|---|---|---|---|
| Conform Program Ship Exploratory Design Study and ASW Suites of the Future | SEA 05R14 | 08/29/85 | C | | 71407 | |
| Shallow Water ASW Potential HYCATS/PCM Design Applications (Draft) | Sperry | 11/25/85 | C | | 71068 | |
| Three Conceptual Designs for Short Takeoff Arrested Landing ASW/ASIW Aircraft | DTRC 16 | 08/01/86 | U | DTRC/ASEC-86/01 | 71389 | |
| The Impact of Electronics Warfare on Future Ship Designs | SEA 05R14 | 08/15/86 | C | | 71408 | |

## 2.10 Cost Study Reports

| Title | Author | Date | Class | NAVSEA Acc. #TN# | DTIC/NTIS |
|---|---|---|---|---|---|
| Cost Module for Enhanced Manpower Determination Model (Final) | SEA 55 | 06/30/81 | U | 54522 | |
| Ship Class Operating & Support Cost Estimatlng Relationships (Final) | Info. Spect. | 06/30/81 | U | 54523 | |
| Operating and Support Cost Estimate Relations and Statistical Cost Baseline Form VAMOSC (Final) | Info. Spect. | 01/10/85 | U | 60899 | |
| Evaluation of Construction Costs and Constructability of a Monohull and SWATH T-AG Acoustic Research Vessel (Cost Analysis) | Blue Sea McClure | 05/01/85 | FOUO | 70433 | |
| SWATH/Monohull Cost Schedule and Producibility Study Vols. I & II (Draft) | BIW | 05/30/85 | FOUO | 70429 | |
| Conform Advanced Base Repair Ship (ABR) Ufe Cycle Cost (Final) | SEA 5014 | 05/31/85 | U | 70428 | |
| Evaluation of the Fast-E Model for Estimating Ship Cost (Draft) | NRL | 06/01/85 | U | 70961 | |
| Universal UNREP Ship CONFORM Feasibility Study (Final) | SEA 5014 | 08/24/85 | U | 70430 | |

## 2.11 Design Assessment Reports

| Title | Author | Date | Class | NAVSEA TN# | Acc. # | DTIC/NTIS |
|---|---|---|---|---|---|---|
| Mother Ship Concept - Approach to Enhanced Naval Warfare (Draft) | NSRDC | 10/01/80 | U | | 54611 | DTIC |
| Heavy Monohull Combatant-Engineering Assessment of (Draft) | G&C | 10/01/81 | C | | 54509 | DTIC |
| High Survivability Cruiser Combat Systems Tech. Risk Assessment (Draft) | SEA 5014 | 10/30/81 | C | | 58870 | DTIC |
| Rapid Deployment Force Push Tug/Barge Concept Assessment (Interim Report) | NSRDC 16 | 01/01/82 | U | | 70431 | |
| ACV-SES Design Synthesis Model Sensitivity Study of MCM/SES (Draft) | Band, Lavis | 07/01/82 | U | | 54526 | DTIC |
| Risk Assessment on Conform Feasibility Designs-Memo (Final) | SEA 50151 | 03/16/83 | U | | 59732 | |
| Hydrodynamic Performance Assessment Multi-Pod Concept-Conform (Final) | NSRDC | 05/01/83 | U | | 59751 | DTIC |
| SES Tug/Barge-Feasibility Design Assessment Study (Final) | RMI | 09/02/83 | U | | 60100 | |
| Universal UNREP Ship Assessment (Draft) | Dec. Eng. | 12/01/83 | U | | 60060 | |
| Heavy Combatant Concept Formulation Study FY82 Vulnerability Assessment Results | DTRC, Luri | 12/01/83 | C | | 71114 | DTIC |
| Landing Ship Utility (LSUX) Assessment (Draft) | Dec. Eng. | 02/01/84 | U | | 70421 | |

## 2.11 Design Assessment Reports (cont'd)

| Title | Author | Date | Class | NAVSEA TN# | Acc. # | DTIC/NTIS |
|---|---|---|---|---|---|---|
| LVT Carrier Assessment | Rains, D.A. | 02/01/84 | C | | 71106 | DTIC |
| Comparative Naval Architectural Analysts of USSR Sarancha Class Hydrofoil and USS Pegasus (Final) | NSRDC 12 | 06/01/84 | C | | 60627 | DTIC |
| CGV Conform Structural Design and Weight Estimate for Monohull, SWATH & SES (Final) | NSRDC | 06/01/84 | FOUO | | 60669 | |
| A Survey of Modern Marine Craft ACVs, SES, Hydrofoils & SWATH (Final) | Band, Lavis | 08/01/84 | FOUO | | 60719 | |
| Battle Group Escort (CGV) VSTOL Variants Enclaving Assessment | SEA 501 | 02/15/85 | C | | 70202 | DTIC |
| Analysis of Three Hull and Propulsion System Candidates for FFX Surface Ships | DTRC, JAC | 05/01/85 | C | | 71104 | DTIC |
| CGV Comparative Assessment (Draft) | TRACOR | 07/26/85 | C | | 71067 | DTIC |
| A Review of the Hydrodynamic and Seakeeping Characteristics of the Surface Effect Ship | Band, Lavis | 08/00/85 | C | | | |
| A Review of Conform SES Designs | Band, Lavis | 08/28/85 | C | | | |
| Fleet Command Ship $C^3$ Study (3 Vol.) (Draft) | NAVELEX | 12/15/85 | C | Vol. 1<br>Vol. 2<br>Vol. 3 | 71076<br>71079<br>71080 | DTIC |

## 2.11 Design Assessment Reports (cont'd)

| Title | Author | Date | Class | NAVSEA TN# | Acc. # | DTIC/NTIS |
|---|---|---|---|---|---|---|
| Oceanography & Oceanographic Vessel Design (Final) | SEA 501 | 03/01/86 | C | 501-7-86 | 70184 | DTIC |
| A Study of the Potential of SES for the FFX Mission | BLA | 06/27/86 | C | Tech Rpt. #570 | 71086 | DTIC |
| NATO Naval Armament Group Special Working Group 6 (SWG/6) on Advanced Naval Vehicles, Assessment of Point Designs, Volume 1 Synopsis, (Draft) | SEA 501 | 04/01/87 | C | Vol. 1 (Synopsis) | 71404 | DTIC |
| NATO Naval Armament Group Special Working Group 6 (SWGI6) on Advanced Naval Vehicles, Assessments of Point Designs, Volume II, Assessment (Draft) | SEA 501 | 04/01/87 | C | Vol. II (3rd Issue) | 71405 | DTIC |
| LPX Cargo and Landing Craft Handling | MacGregor, NAVIRE | 05/01/87 | U | | | |

## 3. CONFORM DOCUMENTS ABSTRACTS

## 3. TECHNICAL ABSTRACTS OF THE SURFACE SHIP CONFORM DOCUMENTS

### Foreword

The goals of the Surface Ship Continuing Concept Formulation (CONFORM) program are the definition and evaluation of promising total ship system concepts meeting operational needs of the future and the identification and assessment of advanced technologies needed to achieve these concepts. CONFORM is an exploratory ship design study program. The objectives of the program were approved by OPNAV in 1980. This program gives the U.S. Navy a look at future (15 to 25 years) total ship concepts which are intended to contribute to long range material force level planning by providing a design study baseline from which a Tentative Operational Requirement (TOR) can be developed by OPNAV and by providing guidance to R&D planners. The CONFORM Program to date has generated and examined over 100 new Ship Feasibility Design Studies for more than 50 missions, including combatants, auxiliaries, and amphibious ships, using both conventional and advanced hull forms incorporating advanced technology subsystems. These efforts have proved valuable in identifying promising designs and new technologies. The program continually develops information useful to OPNAV and NAVSEA in focusing decisions for pursuing promising ship concepts and innovative technologies which meet future U.S. Navy mission needs as initiated and defined by OPNAV.

The CONFORM program has produced over 245 documents to date. These documents comprise Design Study Reports, Back-Up Studies for Ship Designs, Evaluations of Analysis/Synthesis Tools, Technology Studies, Combat System Studies, Cost Studies, and Design Assessments. All of these documents are cataloged and available in the SEA 501 Ship Design Technical File (SDTF).

Technical Abstracts, organized by sequential SDTF Accession Number are being prepared for all of the CONFORM documents. This report contains abstracts for the majority of these CONFORM documents. Abstracts not included for those documents prepared and published to date include three documents not assigned SDTF numbers to date, three documents classified to the secret level, and five documents unavailable from the NAVSEA Ship Design Technical File (SDTF) library. These eleven documents are listed in Table 3-1.

The entry format for the abstracts lists accession number, title, type of report, author, organization, date of publication and report classification.

Table 3-I. Document Listing for Which Abstracts Are Not Available

| Report Title | Author | Date | Conform Category | Comments |
|---|---|---|---|---|
| LPX Cargo and Landing Craft Handling | MacGregor, NAVAIR | 05/01/87 | Assessments | No SDTF |
| Surface Ship CONFORM FY86 SWATH Volume Utilization Study (Final) | SEA 50151 | 06/01/87 | Design Synthesis/Tools | No SDTF |
| CHENG R/CONFORM Technology Characterizations/Compendium of Future Ship Designs | SEA 05R/5015/ CHENG R | 07/01/87 | Program Documents | No SDTF |
| Advanced Configuration Frigate (Final) | Sperry | 08/01/82 | Final Design Reports | Secret Classification |
| ASW Technologies (Draft) | NSWC | 03/25/83 | Combat System Technologies | Secret Classification |
| Surface Ship Torpedo Defense System (SSTD) (Draft) | NSWC | 08/28/84 | Combat System Technologies | Secret Classification |
| Canadian Concept Exploration Model - An Evaluation Report (Final) | NSRDC | 01/01/81 | Design Synthesis/Tools | Unavailable SDTF 59738 |
| RPVs - Shipboard Interface (Viewgraphs) | DTNSRDC 16 | 08/08/81 | Combat System Technologies | Unavailable SDTF 54860 |
| CONFORM Design Managers & Leaders of Related Navy Research - Report on Interviews (Draft) | BLA, Inc. | 03101182 | Technology Studies | Unavailable SDTF 54532 |
| CONFORM Supportability (Draft) | NSRDC 18 | 07/01/82 | Miscellaneous | Unavailable SDTF 59737 |
| Universal UNREP Ship Final Design Report (Final) | SEA 501 | 11/01/82 | Final Design Reports | Unavailable SDTF 58901 (DTIC B08578) |

**54500 Ballast Management Aboard SWATH Ships (Preliminary Assessment), Final**
**NSRDC 12, 09/03/80, U**

This report, presented in narrative format, is a discussion intended to be used as an introduction to a SWATH Ship Damage Stability Parametric Study, documented in a separate report (not referenced). An introduction is presented which describes how a SWATH responds to wave excitation, why it is more sensitive to weight changes than a conventional monohull, and what ballasting can accomplish to reduce this tendency. The study's objective is to provide a general background for evaluation of the feasibility of using ballast systems on SWATH ships to correct undesirable trim and heel attitudes due to load variations (fuel, stores, etc.), and of enhancing seakeeping by controlling trim and draft. Preliminary design tasks such as pipe layout, pump sizing and system control studies are not attempted.

Three ballast system types are discussed in the study: pumped, compressed air and eductor. The method of operation of each system and the advantages and disadvantages of each type are presented in general terms. A more detailed discussion explains how ballast system requirements apply specifically to SWATH ships. The discussion includes:

- Trim and heel control: load changes due to movement of aircraft, stores, etc.; dynamic changes due to variation of hydrodynamic pressure on hulls and struts; trim changes to improve seakeeping.
- Draft control: primarily needed to mitigate the impact of loading and consuming fuel oil. Four candidate ballast methods are discussed: clean, compensating, partially compensating, and bladder.
- Ballasting to reduce motion response: controlling draft to reduce slamming, changing pitch response frequency by influencing the ship's radius of gyration, shafting ballast to reduce roll, "tuning" tank frequency.

Concluding remarks provide a summary of the points made in the discussions. Recommendations include performing a study to explore alternative philosophies for using ballast to mitigate the effects of damage. A reference list is included.

**54501 ACV Mission Analysis Report, FY80, Draft**
**Asset, Inc., C**

This report addresses potential naval warfare missions for Air Cushion Vehicles (ACVs) in the period 1990-2000. It reviews historical developments, pertinent studies and other related literature, and current craft technology. It also projects outyear capability shortfalls, and matches no-risk or low-risk ACV-technology to those shortfalls. A priority list of ACV-satisfiable missions, based on requirements and level of technical risk, is provided. A sample ACV mine countermeasures (MCM) scenario is included. Conclusions and recommendations highlight areas of potential near-term ACV mission application and early development effort.

**54503 Technology Trends for Propulsion Design of U.S. Navy Ships - Appendix B -**
**Propulsion Characteristics of Naval Ships, Draft**
**Baham Corp., 08182, C**

This appendix describes the technology trends in propulsive characteristics of U.S. Navy Ships. Along with propulsive characteristics, trends in open water propeller efficiency and propulsive coefficient for twin screw destroyers and cruisers and for single screw frigates are disclosed. These trends are presented graphically versus design year for many of the Navy's ships, Also included are trends in propulsive loading coefficients.

**54504 Universal Ship Technology Characterization Section, Final**
**Office of Naval Research, 06/82, U**

This report describes a universal underway replenishment ship designed to carry Mission-Oriented Payload Packages (MOPP) in the form of a pre-loaded barge. The MOPP may carry fuel oil, ammunition or miscellaneous dry

stores. Technical aspects of the payload, the platform and system engineering are described and technical risk items are identified.

**54505 Preliminary Motion Transfer Functions for SWATH T-AGOS, Memo**
**DTNSRDC, 03/04/80, U**

This is a collection of preliminary motion transfer functions for the SWATH T-AGOS. The figures are an enclosure to a memo for their forward to Commander, Naval Sea Systems Command (NAVSEA 03RD) from David Taylor Naval Ship Reseach & Development Center, Bethesda, on the subject of the preliminary results of the SWATH T-AGOS motion parametrics study.

For a systematic series of 2500-ton tandem strut SWATH ships, the effects of longitudinal metacentric height, and of the separation between the longitudinal centers of bouyancy and flotation on motion responses in regular and irregular seas were investigated. The enclosure consists of the preliminary transfer functions for heave and pitch, and for absolute bow and stern motions.

54506 Design **Aid for** SWATH Ship **Slam Pressure Loads, Design Aid**
**DTNSRDC, 04/81, U**

This report describes a general method for calculating preliminary slamming pressure loads for SWATH structural design. This method should be used carefully due to its limited data base (see restrictions in report).

The method is based upon (1) relatively small structural weight penalties brought about by relatively large variations in pressure loads, and (2) the avoidance of the valuable, but costly, model experiments otherwise needed. In this report, slam pressure data from two conventional SWATH configurations serves as the basis, restricting the method's use to "conventional" (described in the report) designs. Pressures are estimated in terms of significant wave height, cross-structure clearance, volume Froude Number, and two pressure reduction coefficients. Uniformly distributed slam pressure loads can be calculated for structural design areas on the bow, cross-structure, and struts. Wave slap load criteria is also provided. Slam and wave slap pressure loads are calculated for a design example. Hull particulars for model sources are given.

54508 SWATH Ship **Powering Study, Draft**
**DTNSRDC, 08/80, U**

This report provides insight into configuration parameters affecting SWATH resistance. Most of the work presented applies to the proposed 2900 Ton SWATH developmental planform. However, many form variations were incorporated into the study.

Parametric results are accompanied by graphs or charts. Some of these parameters include strut design, rudder location, waterplane coefficient and machinery plant constraints. Also included is a hull form selection matrix, which gives values of several hull form parameters for six different optimization criteria.

**54509 Conform Engineering Assessment of Heavy Monohull Combatant, Final**
**G&C, Inc., 10181, C**

This study investigates concepts in large surface combatant design from the standpoint of increasing survivability in a combat situation, using the following techniques:

- Excess volume
- Increased reserve buoyancy
- Longitudinal, lateral, and vertical dispersal of critical combat, propulsion, and command and control system components
- Propulsion system redundancy including the use of take-home systems
- Protected distributive systems

- Redundant and damage resistant primary structure
- No asymmetric flooding

The combatant concepts considered are a conventional combatant, a midsize combatant and a large volume combatant. Arrangement drawings are available for these three concepts. The techniques used in the evaluation are well supported for each concept through figures. Tabulated data include survivability **summaries,** weight estimates, volume summaries and range/speed characteristics for each of the three concepts. Recommendations and concluding remarks are provided.

**54510 Technology Trends and Deficiencies for R&D Programs Related to High-Speed, Hard-Chine Planing Craft, Final**
**NAVSEANORDET, 08/01/80, U**

This report is presented in three sections. Section I is a short treatise explaining how Operational Requirements can be matched to a proper craft design. This requires a logical design procedure coupled with a complete data base and sound design criteria. A narrative explanation and supporting figures as applied to hard-chine planing craft are included to demonstrate this approach. Figures include Ship Speed versus Wave Height, Speed versus Displacement for Volume Froude Numbers (Fn) from 0.5 to 6.0, a similar plot including Total SHP, Useful Load Fraction versus Volume Froude Number and Four-Hour-Ride Quality versus Wave Height for various design speeds.

Section II is a listing of general subject areas which need better definition to improve design capability for hard-chine planing craft. Each subject area includes a list of specific subtopics. General subject areas are seakeeping, maneuvering and control, propulsors, hydrodynamics, design synthesis procedures, machinery, hardware and equipment, structures, vulnerability, weapons and sensors, and stability.

Section III, entitled "Priorities", is a set of task statements illustrating objective, background, and task statement. When executed, these are intended to improve the state-of-the-art in each task area for hard-chine planing craft design. Statements are included for Transcavitating Propellers, Control Surfaces, Spray and Wake Reduction, Dynamic Transverse Stability, Impact Loads, Motions, Design Trade-Off Interrelationship, Overload Condition, Small Craft Pre-Planing (Speed) Range Performance, and Hydroelastic Effects in Larger Vessels. No references are made.

**54511 The Mother Ship Concept a Logical and Rational Approach to Enhanced Naval Warfare, Final**
**NSRDC, 10/01/80, U**

This report provides a narrative explanation of a concept utilizing a Mother Ship and a number of Transportable Fast Attack Craft (TFAC) for carrying out various Naval Warfare missions. Background is given for some recent operational history of small combatants in naval warfare. The threat which these craft could be expected to effectively counter is identified. A mother ship of approximately 7000 ton displacement and 20 knot speed is postulated to carry nine TFACs in a dry storage welldeck. The craft can be launched and recovered reliably in seas up to sea state 4. The mother ship will provide all support - fuel, ordinance, provisions, complete organizational and depot maintenance and crew accommodations. It will also be equipped to perform various missions without support from the TFACs. A list of the proposed missions is provided.

The TFACs, as conceived, are planing craft of 110 ft. LOA and 20-22 ft. beam with diesel power capable of speeds of 40 kts in sea states of 3 to 4. Armament includes surface-to-surface and surface-to-air missiles, MK 46 torpedoes and mines. A table with additional specifications is included. Using more advanced TFAC approaches, such as high L/B SES's, hydrofoils and catamaran hulls, is also mentioned. The report gives some explanation of how the craft will operate for various missions, highlighting their viability and effectiveness. Missions postulated include covert surveillance, surveillance, harassment, attack, deception and various support applications. An appendix describes TFAC missions and tasks in more detail.

**54513 Report on ACV Handlling Study, Final**
**Rosenblatt, 07/01/82, C**

**This report presents a very conceptual look at some improved** designs for an LSD type amphibious support ship for launching and retrieving Air Cushion Vehicles (ACVs). The objective of the study is to determine how to increase the carrying capacity of an LSD from the current LSD 41 capacity of four ACVs. Five new concepts are presented. A short description, a sketch and a list of advantages and disadvantages is included for each concept. Only two concepts (A and B-4) require ballasting for launch and retrieval.

The five concepts are briefly described below:

Concept A, a derivative of the current LSD 41 design, uses an elevator to stow ACVs on an upper deck. Total ACV capacity is seven. Its major disadvantage is that ACV deployment will be greatly hindered if the elevator becomes disabled.

Concept B-I is similar to A except that two ramps are used to direct ACVs to either the upper or lower deck. Total ACV capacity is again seven. Its major disadvantage is the ramp system which will be expensive, difficult to maintain and will hinder or prevent ACV deployment if it becomes disabled.

Concept B-2 is similar to concept B-I except that shorter ramps are used to direct ACVs to either deck. While only six ACVs can be accommodated, the ramp system is simpler, less expensive and assumed to be more reliable. However, a ramp casualty will still hinder or prevent ACV deployment.

Concept B-3 is a modification of the LSD 41 Hull, with beam increased from 84 ft. to 106 ft. (maximum beam for Panama Canal passage). Eight ACVs can be stowed in adjacent rows on two levels. Two decks are used to improve clearance between the rows of ACVs. A combination inclined ramp and stowage deck on one side allows access to the adjacent upper deck. Only a relatively short stern ramp is used, increasing reliability.

Concept B-4 uses a 106 ft. beam and two rows of ACVs, for a total capacity of eight. To improve clearance between rows, the deck for each row is on the same level but slanted slightly outward either side of a longitudinal center line. The launching deck is the full double row width and only a short stern ramp is used. This concept is concluded to be the most advantageous and is recommended for further development.

**54514 List of Selected Required Operation Capabilities Applicable to Designated Boats/Craft**
**NAVSEA NORDET, C**

In order to have a standard, accepted way of describing the things a craft should be expected to do, the "Required Operational Capabilities" (ROCs) provide OPNAVINST C3501.2E, 1 0/77 a fair starting point. This document lists 833 ROCs phrased in terms of specific actions to be performed. The basic list of ROCs were examined for capabilities which could properly apply to the considered craft. This evaluation yielded a sub-list of ROCs which should be used as the spectrum from which to select ROCs for each craft in compliance with the task it is to perform.

**54515 CONFORM Surface Shlp Structures Technology Forecast**
**DTRC, 02/1 9/82, U**

The first section of this paper is titled A Summary of Short-Term, High Potential Payoff R&D Programs for Naval Surface Ship Structures. The research goals as outlined by SSC are broken down into seven areas: load criteria, response criteria, materials criteria, fabrication techniques, reliability criteria, design methods and advanced concepts. Each of these areas is reviewed and suggestions for projects with potential high short-term payoff are made. A flow chart of general ship structural design procedure is also included.

**The second** section is **A Summary of Significant Long Range U.S. Navy Structural R&D Programs and Projects. A** list of proposed projects is given for each **of the seven areas indicated above. These lists are followed by a series of** program sequencing charts, and are intended to relate indicated projects and project areas to each of the described program **areas.**

**54516 Infrared Signature Suppression Measures for the Light Battle Group Escort Conform Design, Draft**
**NKF Engineering Assoc., Inc., 04/01/82, C**

This report summarizes a study of ship infrared (IR) signatures and suppression measures. Discussion of infrared theory is presented with descriptions of infrared countermeasures currently available. Those infrared signature suppression measures which appear to have the greatest potential for shipboard application are summarized. Finally, specific infrared signature suppression measures for the Light Battle Group Escort are recommended. Figures **are** included to illustrate several points of interest in infrared theory and many aspects of infrared signature suppression design. Comparisons are tabulated for IR radiation from a suppressed and unsuppressed stack, and, for HVAC versus IR suppression requirements. Performance results for the economizers (which serve as an IR signature reduction device) installed aboard the LHA 1 class ship are also tabulated.

**54518 CONFORM Dispersed Strike Concept Feasibility Study: Launch & Retrieval-Hydrofoil Craft**
**Grumman Aerospace Corporation, 09/30/82, U**

This report describes an investigation of launch and recovery methods for the Grumman design Ml 71 Hydrofoil Craft from a base ship. Arrangement descriptions for three base ship configurations, including scaled sketches are provided. Modifications of existing ships necessary to fulfill the mission goals are examined. Handling gear, as well as single-digit weight summaries and powering requirements are estimated for each arrangement. Launch and retrieval feasibility are examined as well.

Also investigated are descriptions of specific modules and their installation. Sketches (scaled) are provided which show outboard profiles of the modules.

**54521 Further Enhancements to the Enhanced Manpower Determination Model (EMDM) Three Feasibility Studies, Final**
**Management, Consulting and Research, Inc., 07/28/81, U**

The enhanced manpower determination model (EMDM) is one analytical tool that can help in the assessment of the effects of new technologies on requirements for ship manpower. The EMDM currently provides good estimates for ships that are similar to existing ships. **It** is less, capable of estimating manpower for new, high-technology ships such as those considered by CONFORM. This report specifies current **and** possible future deficiencies in the EMDM and looks at possible methods for enhancing the capabilities of the EMDM.

**54522 Incorporating a Cost Module into the Enhanced Manpower Determination Model (EMDM) Feasibility Study and Test Cost Module Calculations**
**Management Consulting and Research, Inc., 06/30/81, U**

This paper investigates the possibility of incorporating a cost module into the enhanced manpower determination model (EMDM). Cost estimates would be very useful in evaluating notional ships. Four sources which provide manpower cost data are evaluated:

- Navy Billet Cost Model (BCM)
- Navy Program Factors Manual (NARM Factors)
- Navy Composite Standard Rate (NCSR)
- OSD **Average Cost Handbook (ACH)**

Each of these sources is analyzed to determine which is most suited to EMDM use. Both positive and negative aspects of each alternative are discussed. It is concluded that the ACH source is the best alternative. Exhibits provided in the study include:

- Comparison of and Costs Included in Data Sources
- Cost Elements of Billet Cost Model
- BCM Life Cycle Navy Costs (Officer & Enlisted)
- Sample Calculations using BCM Data
- Sample Calculations using NARM Data
- Sample Calculations using NCSR Data
- Sample Calculations using ACH Data

Conclusions on best alternative cost data source is provided.

**54523 Development of Ship Class Operating and Support Cost Estimating Relationships, Final**
**Inf. Spect., 06/30/81, U**

The statistical analysis presented in this report was accomplished to aid the NAVSEA Economic Analysis Office in developing methodologies for Life Cycle Cost (LCC) analysis of conceptual ship designs. Previous efforts used the Navy Resource Model (NARM) (referenced) to estimate Operating and Support (O&S) costs. This effort used the Visibility and Management of Operating and Support Cost (VAMOSC) Total Support System (TSS) historical O&S resources expenditures (for FY 79) at the Unit Identification Code (UIC) level to derive O&S Cost Estimating Relationships (CERs). Statistical regression and variance analysis procedures were used to derive the relationships.

Results of the study represent the initial steps required to develop a comprehensive O&S cost estimating methodology. Statistical CERs, applicable to surface combatants, were developed for a large number of O&S cost elements representing a large portion of the annual direct cost of operating and maintaining the surface fleet. Statistical baselines were developed for the remaining O&S elements.

The body of the report contains the approach, results and conclusions of the study. Section 2.0 presents the ship class sample and Cost Element Breakdown Structure (CEBS) used. Section 3.0 explains the data types used and includes a detailed list of parameters and their sources. A separate data supplement, which includes the actual data used, is referenced. Section 4.0 gives the initial data analysis process including data normalization and reduction, initial hypotheses, simple descriptive statistical analysis, scatter plots and correlation analysis. This results in a set of potential cost driving parameters to be tested further in the detailed statistical analysis stage of Section 5.0, using regression and analysis of variance procedures. Section 6.0 presents the results of the study. Detailed regression relationships or a table of baseline cost values are provided for the identified cost elements. Limitations on the application of these CERs and baselines to new ship designs are discussed in Section 7.0. Recommendations for further analysis to improve the estimating capability are given in Section 8.0. References are given for the data and methods used in developing the study.

Appendices are included for ship class and number of ships, cost element breakdown structure, details of developing the initial hypothesis for each cost element, variance combinations for scatter plots, variance combinations for regression analyses, regression statistics for alternative CERs, and for a list of acronyms. A cover sheet for a foldout list of variable names is shown but the list is not included.

**54524 The Feasibility-Level Design of a Combined SES and ACV Mine-Countermeasures Task Force, Draft**
**BLA, Inc., 02/82, U**

This report serves to describe input to a final report concerning a feasibility level design study for a mine clearance system consisting of a large surface effect ship transporting three air cushion vehicles equipped with modularized mine warfare equipment. This report provides the parametric investigation and the feasibility design of the mother and daughter craft (SES and ACVs). Figures and tables supporting these tasks are provided.

**54526 Application of an ACV/SES Design Synthesis Model to Conduct a Sensitivity Study of 10,000 LT SES**
**BLA, 07/01/82, U**

This report describes a brief sensitivity study performed in attempt to identify areas of development which would be most rewarding for the 1 OK SES MCM task. The sensitivity study is considered a further step in the development of the design synthesis model of an MCM task force comprising of an SES (mother ship) and ACV (daughter ship). The ACV/SES model is described, inclusive of principle characteristics for both the baseline SES and the ACV, and the necessary adaptation of the model to the 1 OK MCM SES.

The study includes the sensitivity of weight, with relation to midship bending moment; of payload to the overall SES geometry, in terms of L/B and pressure-to-length ratios; of thrust power to forward speed, and the relation between lift air flow, thrust power and speed. The study also considers the effects of lift system efficiency and the propulsion coefficient on the payload and total installed power; and, the effect of the SPF (specific fuel consumption) on fuel weight and payload capability.

**54528 CONFORM 2000 - Amphibious Ship Capabilities, Draft**
**Presearch, Incorporated, 06/24/81, U**

This repot-t summarizes and documents the results of an investigation of the functional capabilities needed in amphibious ships that will join the fleet in the year 2000 and beyond (post LHDX). Previously completed and ongoing analyses were investigated to determine a forecast of the operational environment in 2000, the nature of changes in landing force organization and equipment, the specialized support required in 2000, and the character of the force extent in 2000. Functional capabilities needed were then derived. The work was conducted for the Commander, Naval Sea Systems Command (SEA 03D) under Contract N00024-79-C-4113.

54529 Documentation of Auxiliary Ship Capabilities - **Final Report**
**SEA 501, 1 0/01/81, U**

This report supports the ongoing Universal Ship design in the Surface Ship Continuing Concept Formulation Program. Force levels are derived for a 600-Ship Navy in the year 2000. Ships considered in the force levels are surface combatants, amphibious warfare ships, submarines, Mobile Logistics Support Force (MLSF) ships and tenders.

Gross capabilities for MLSF Ships and destroyer tenders to support that force level are defined and quantified. Combinations of quantified capabilities are then placed in a single ship hull in varying commodity and services mixes to determine the number and types of Universal Ships required to support the fleet. Figures include illustration of the U.S. Navy auxiliary payload volume from present to the 600-ship objective, several cases of MLSF - Tender payload distribution, a transfer rate comparison of the cases, and, an example of a MOPP storage site. Tables are provided for data corresponding to the figures. Listings of the principle characteristics, the 600-ship derivation and the functional capabilities of the Auxiliary ship are also included.

54530 Modular Concepts **for Auxiliary Shlp Missions, Final**
**Mantech International Corporation, 02/28/81, U**

Requirements peculiar to each of four missions, AD, AE, AO and LPA were determined for an "Envelope" ship design concept in the areas of hull, electric communication and control, auxiliary, and, outfit and furnishings, including the accommodations for personnel directly involved in operating, maintaining, and supporting mission equipment. Estimates were provided for weight, volume, deck area, electric power, communications, HVAC, and fluid requirements. These requirements were translated into concepts for modularizing mission suites for each of these missions, in order to be compatible with the concept of a hull and machinery "envelope" ship, similar to the proposed tri-mariner design where the large wet-deck provides the "payload pocket" into which modules were installed.

The primary concept developed was that of a series of modules floated into and secured in the wet well of the envelope ship. The barges, or mission oriented payload packages (MOPPs), are integrated among themselves and with the envelope ship through interconnecting devices to provide for intercommunications, alarms, hotel services, etc. The entity of MOPPs and envelope ship thus form the universal ship.

Alternative concepts are also explored, including the MOPPs as primarily designed in a stand-alone capacity, with provision of hotel services from the shore or from an auxiliary systems MOPP; multiple MOPPs, which may eliminate redundancy built into the present MOPP; dry hold MOPPs that are stored ashore and lifted into a dry well; and, partial or special MOPPs into which modules, including SES modules, would be inserted.

The report concludes that the MOPP/Envelope ship concept offers the Navy a flexible means of fulfilling a wide variety of ship missions, singly or in multiples. A relatively small number of envelope ships can therefore perform a proportionally much wider range of missions than current Navy ship designs that are generally limited to a single mission.

The report gives figures showing general MOPP arrangements, as well as inboard profiles for the missions examined. Tables in the appendices give deck area requirements for the various missions. Also provided for each MOPP are tables of hydrostatics and the following figures:

- Draft versus Displacement
- Draft versus Transverse KM & BM
- Draft versus Trim Moment
- Draft versus CG, CP, CM
- Draft versus TPI

54531 Technology Characterization Surface **Ship Structures • Year 2000, Final**
Office **of Naval** Research, **06/82,** U

This report reviews the state-of-the-art of the structures of the U.S. Navy surface combatant ships. Technological needs to develop lower-cost, more efficient structures are identified and evaluated. Anticipated developments are described. Topics discussed include structural materials, and the estimation and calculation of structural loads and responses.

**54532 Report on Inverviews with CONFORM Design Managers and Leaders of Related Navy Research, Final**
**BLA, Inc., 06/82, U**

As part of a project to characterize the present and future technology that can be applied to Navy ships, a series of interviews was conducted with 27 current leaders in twelve different fields. This report summarizes these interviews which were focused on identifying current status, future trends and requirements for future research in each field of activity.

**54540 Radar Cross Section and Infrared Ship Signature Reduction Methodology and Impact for Conceptual Design Studies**
**NKF Engineering Assoc., Inc., 10/81, C**

This report describes the results of an investigation of the application of signature reduction measures, infrared and radar cross section. The study was to produce parametric formula adjustments for use in the DD08 destroyer/cruiser design model. The ship types used in the studies are the Heavy Monohull (HM), a large independent operation capable cruiser, and a Low Detectability Ship (LDS) • an air-capable, independent operation destroyer incorporating radical signature reduction techniques. An assessment of future enemy radar and infrared detection devices, including current problems in detectability, in an effort to forecast means of reducing ship detection probability, is also disclosed. The results of this study are fully supported through figures, tabulated data and appendices. Recommendations for additional work in the ship signature area and conclusions are provided.

**54541 A Study to Develop and Explain Candfdate Designs for the Battle Group Escort, Final Dec. Eng., 06/1 5182, C**

This report describes in brief, a concept level study of two variants for a Battle Group Escort (CGV). The purpose of the study was to generate two near-term, low first cost small carrier designs - a STOAL, Short Takeoff/Arrested Landing (Concept I, 910, 39,850 LT) and a CTOAL, Catapult Takeoff/Arrested Landing (Concept II, 720, 34,490 LT). Requirements include: cruiser variant with aircraft plus missile capability, ability to carry 10 to 12 CTOL aircraft, MFAR or SPY-ID radar, 3 to 4 VLS Missile banks, enhanced survivability, minimum detectability, minimum cost per aircraft based, determination of reprogramming of battle group assets necessary to provide CGV.

A study matrix is included for each concept which shows the effect on displacement of ten alternative designs. Variables include diesels, gas turbine and steam turbine generators; diesel gas turbine and nuclear/gas turbine propulsion and variations of armor, arresting gear and catapult types. The resulting differences in displacement among the alternatives and the selected propulsion plants for both concepts is discussed.

Additional considerations addressed in a cursory manner are: aircraft spotting, combat system suite, manning requirements, electric load, energy consumption (including trail shaft operation) and survivability, detectability (noise signature and radar cross section) and asset analyses. No references are given and no methodology is stated for carrying out the study. Concept conclusions are provided.

54963 Computer **Aided Design Lab - Information Executive Manager System Massachusetts Institution of Technology, 10/01/80, U**

This report described the indexing and consolidation of all naval architecture design related computer aides available at MIT. Besides being cataloged and centrally located, these routines are being put into one convenient format. This is an ongoing process and the report lists some of the initial programs and some guidance to the indexing and interfacing systems.

**54964 Improved and Enlarged Variants of the PHM-3 Series Patrol Combatant Missile (Hydrofoil), Final Boeing, 11/12/80, U**

This document describes the PHM-Extended Hullborne Range (PHM-EHR) and the enlarged Model 928-78 variants of the PHM-3 series ships. Provided are descriptions and graphical support of the ships, their configuration, ship's systems, mission capability and equipment, manning, and performance. Among the tabulated support are a range extension options weight summary, Model 928-78 weight summary, mission equipment listing, manning description, and propeller characteristics of the Model 928-78.

**54967 Concept Formulation of the Model 928-80 Hydrofoil Combatant Growth Variant of PHM-Ship Description, Final Boeing, 1 0/1 6/81**

The purpose of this document is to describe the results of the concept formulation and design studies of Model 928-80 Hydrofoil Combatant, a growth variant of the PHM-3 Series of hydrofoils. The ship's configuration, weights, arrangements, system descriptions and performance are presented. The military mission potential for Model 928-80 as well as the more significant design risks and issues are discussed. A conservative number of figures, sketches and tables are provided to support the design description, subsystems and equipment description, performance results, and mission potential description.

**54969 Future Surface Combatant Volume Demands, Final SEA 3211, 1 0/01/80, U**

Projected space demand estimators for 1990 surface combatant designs are presented for NAVSEA 321 l-cognizant functions. Each estimator is comprised of two elements, an historically-derived baseline linear equation relating

space demand to specified Contract Design data, and a projected demand change multiplier reflecting a potential departure from current practice. The approach used to derive these estimators is described, and the supportive data are included. Recommendations for further related research are presented.

**54970 Mark II Hydrofoil for the U.S. Navy, Volume I, Feasibility Investigation; Volume II, Performance and Effectiveness**
**Grumman Aerospace Corp., 11/25/80, C**

This document describes a Grumman MARK II hydrofoil craft adapted for U.S. Navy use. In detail, it examines feasible combinations of various system elements and the MARK II's capability to accommodate these elements of space, weight, personnel and support systems. Resulting configurations yield modern, versatile, open-sea weapons which possess high mission capability and are simultaneously cost effective.

A progressive design summary is provided as well as discussion on combat systems, and $C^3$, and descriptions of ship systems, Also included are a payload weight estimate, payload assessment and risk (description and discussion on static stability. The ship design description is well supported through the provision of figures.

**54971 CONFORM Feasibility - Heavy Combatant, Final**
**SEA 501, 031'01184, U**

This report describes the study to define feasible ship alternatives satisfying specific mission requirements identified for the mid 1990's, and, to assess the potential for the improvement of ship survivability associated with increase in ship size. In general, the two major classes of surface vessels comprising a task force are combatants and replenishment vessels. The combatants nominally possess short range and sustainability characteristics and require moderately frequent replenishment. Five ship alternatives are defined - three AEGIS cruisers of increasing size and two AOE - type variants of two of the cruiser variants.

The Heavy Combatant (HC) CONFORM design is required not only to encounter long range and extended duration obstacles but must be capable of opposing the primary expected threats of adversaries. A large cruiser carrying VLS missiles and an AEGIS combat system is used as the basis for exploring the advantages of increased ship volume to provide mission and ship survivability. The two larger HC variants are examined with respect to payload increase and are then converted to AOE types to examine their survivability. The results show significant advantages in survivability, with moderate increase in cost.

The report presents the mission requirements, technology base, ship design description including payload/platform performance and configurations, descriptions on margins, manning, hullform, weights and volume characteristics, stability, systems engineering and subsystems. Assessment, R&D needs and technical risk discussions are also included. CONFORM requirements, weight estimates, general arrangements, and magazine arrangement options are among the appendices offered. Figures include floodable length curves, stability curves, damage location schematics, midship sections, propulsion system schematic, speed-power curves, firemain systems, and collective protection system schematics. Among the tables presented are generated payload summaries, endurance information, payload summaries for weapons systems, command and surveillance, principle characteristics, hullform parameters, manning information, and, weight and volume summaries. Heavy combatant threat characteristics are also included.

**54972 Heavy Combatant Final Design Drawings**
**Naval Sea Systems Command, 5D1, 01/08/82, U**

This package includes final design drawings for a baseline cruiser (HC-A), midsize cruiser (HC-B), large cruiser (HC-C), midsize ADE (HA-B), and large AOE (HA-C).

These are a set large drawings not reproducible.

**54977 A Model Series for SWATH Ship Maneuvering Performance Predictions, Final**
**NSRDC 15, 06/01/83, U**

The maneuvering capabilities of a series of Small Waterplane Area Twin Hull (SWATH) designs are compared. This series of hull forms is based upon the SWATH-GA design which varies the relative strut length for a fixed displacement and waterplane area. The report describes a technique developed for the sizing of SWATH rudders. This technique is based on ship geometric characteristics and the desired maneuvering performance capability, and, requires the estimation of horizontal plane hydrodynamic coefficients. The coefficients are empirically obtained from model scale results and are represented as functions of the geometric characteristics of the hull form.

A method of predicting the maneuvering performance of any SWATH design using the hydrodynamic coefficients is also presented. The methods described include an approximate linear solution to Euierian equations of motion, and a time domain computer code. The result of the computer simulations presenting the steady-state turn diameter as a function of forward speed are compared for the four designs. Maneuvering performance of the extended strut configuration with respect to rudders area and position are examined.

Figures included in the report illustrate for each design the variations of the coefficients with respect to fixed and variant Froude Numbers, including several cases where rudders were located in two different positions: ahead and behind the propellers.. Also, a variation of the turn diameter versus forward speed for the four designs with a fixed rudder area ratio is included. Geometric characteristics for the four designs are tabulated as are the hydrodynamic coefficients for the designs. Also tabulated are a comparison of geometric characteristics of a full scale and 1/2-scale SWATH and the results obtained from a maneuvering prediction.

**54985 Response Characteristics of a Systematic Series of 30,000 Ton SWATH Configurations, Final**
**NSRDC 15, 07/01/83, U**

The response characteristics of a systematic series of seventy-nine 30,000 ton appended SWATH configurations with lower hulls having elliptical cross sections have been investigated analytically. Three values each of waterplane area, strut length, longitudinal center of buoyancy, and longitudinal center of flotation are used to define the hullforms. For each configuration, root mean squared (rms) values of heave, pitch, relative bow motion, and absolute stern motion are presented for a unit significant *wave* height and a range of modal periods for head and following seas at four speeds. Performance assessments in which the highest significant wave height for which several seakeeping criteria are not exceeded are given. Trends among the performance assessments for the various configurations are noted and provide a seakeeping reference for the designer for potential 30,000 ton SWATH ships. Tabulated in the report are characteristics of the hullforms, limiting seakeeping criteria, and seakeeping performance assessments. Figures include illustration of heave and pitch rms responses in head and following seas. Also presented are relative bow and absolute stern motion rms responses each in head and following seas.

**58866 A Proposed Combat System for a 600-Ton Hydrofoil, Final**
**Naval Surface Weapons Center, 10/01/81, C**

This report proposes a combat system to meet the requirements of a proposed oceangoing hydrofoil. Such a ship would serve as a battle group escort with specialized missions to take advantage of its speed. The combat system proposal reflects what technology could provide to meet the ship's role while remaining within size and weight constraints imposed by the ship's design.

The report describes the mission; proposed equipment including anti-submarine, anti-air, and anti-surface warfare, electronic warfare, and communications; ship impact; and, operation concepts, including ASW perimeter barrier, ASW inner screen, choke point blockage, investigation of enemy surface units, and, jamming of enemy surface units. Also, discussed is the rationale behind and the listing of rejected candidates, various sensors, launchers and munitions. Conclusions and recommendations are provided with specific emphasis on effective sensors and the weapon package.

**58868 Conform ASW Communlcatlons Requirements Manual, Draft**
**Systems Exploration, Inc., 02/15/82, C**

The purpose of this manual is to identify and justify external tactical ASW information exchange requirements for various CONFORM ship designs operating in multiple operational scenarios, and, to translate these requirements into numbers and types of ASW-related generic communication equipment for these ship designs. The report establishes a methodology that provides an analytical tool by which communication equipment requirements may be determined for various ship designs independent of operational scenarios.

The report describes the platform designs, a $C^3$ functional analysis, an ASW information exchange analysis, and an ASW communications analysis. Text content is fully supported through figures and tables. Some of the figures afforded include a methodology flowchart, Battle Group and convoy connectivities, and 28 different circuit summaries.

**58870 High Survivability Cruiser Combat Systems - Technical Risk Assessment, Draft**
**NAVSEA, 1 0/30/81, C**

This report is an assessment of combat system technical risks in the conceptual design of a High Survivability Cruiser. It presents design and operational concepts with supporting rationale. Candidate combat systems are cited and their capabilities relative to the High Survivability Cruiser missidn and concepts are explored. Proposed functional arrangements and combat system configurations are illustrated. Concluding remarks and recommendations concerning combat system architecture, hull, machinery and electrical considerations, and areas of critical analyses are included.

**58871 Conform Ship** Design **Summary - 81**
NAVSEA 03RD, 02/82, C

This report provides CONFORM program background and methodology, and, ship design summaries by type and program future plans for the following CONFORM designs:

- High Survivability Cruiser
- Heavy Combatant
- Low Detectability Ship
- Light Patrol Hydrofoil
- PHM Growth Variants
- Corvette Hydrofoil
- Advanced Combat Systems Frigate
- Universal Auxiliary Ship
- Merchant Ship Weaponization
- Ships Boat

Section II of the report discusses the measures used to assess the designs; descriptions and assessments are provided in Section Ill of the report. The final section summarizes the program results and plans. A bibliography lists reports, other informational material and statistical data that served as the source material for the development of this report. Figures are provided illustrating task areas, typical CONFORM planning sequence, CONFORM design overview, and, the CONFORM designs. Research and development required to support those concepts herein described are summarized in a companion report entitled, "Conform RDT&E Needs - 81 ."

**58872 Corvette Escort - Analysis of the Operatlonal Employment and Candidate Sensors, Weapons, Vlew-graph Presentation**
**Adler Corp., 07/17/81, C**

The Corvette Escort is a small hydrofoil ship with an IOC of 2000 intended to serve as a Battle Group Escort ship. The objective of this analysis was to evaluate typical operational employments based on both combat missions and

support functions, and then to select candidate sensors and weapons based on functional requirements established for each operational concept.

Presented are a review of the Conform Level Requirements (CLR) and a rationale for the integration of combat missions appropriate to a year 2000 Battle Group Escort with the special missions listed in the CLR. A methodology for combat system selection is outlined, and a number of operational concepts presented show how the Corvette Escort may be effectively utilized as a combatant in various warfare areas (ASW, ASUW and AAW/EW) as well as some support functions. Three typical operational sequence time lines show the synergistic integration of combat capabilities, support activities, and ship characteristics, with each sequence highlighting a different warfare area and different level of hostilities.

Functional requirements are presented, as determined by the analysis of the operational concepts. These requirements lead directly to candidate sensors and weapons whose capabilities and status are discussed. Sensor/weapon combinations capable of accomplishing all or most of the primary missions are grouped into alternative combat suites within the weight limit of the hydrofoil. Also provided are brief results and key recommendations emphasizing the role of the Corvette Escort as a combatant as well as a support ship.

**58873 The Enhanced Manpower Determination Model (EMDM) Users Guide**
**Management Consulting and Research, Inc., 05/31/81, U**

The enhanced manpower determination model (EMDM) is a tool that allows manpower analysts to estimate ship manpower requirements for ships in the early stage of design.

This report explains the analytical method used by the model to determine manpower requirements. It also contains listing of commands for both the user and the database administrator. Basic procedure for running the EMDM program is also discussed with exact procedures for several terminal types and locations. A listing and explanation of data files used and created by the program is also included in the report.

**58874 Alternate Mission David Launched *Craft* (AMDLC) CONFORM, Final**
**NAVSEANORDET, 11/01/81, U**

This report documents a program to accomplish the design and specification of two new generic type ship's boats, intended to replace the existing inventory of seven boat types. The report is broken into 14 major sections. Also included are two addenda which do not appear in the table of contents. Each section is of a different level of detail and complexity. The objective, to apply projected advances in subsystems and craft concepts to improve ships boat performance, is explained. Required Operating Capabilities (ROCs) are discussed, considering the types of ships the boats must service in the year 2000. Improvements in small boat design and construction, expected to be available in the year 2000, are considered. A list of parameters governing the task is given. Two craft to be used in the design task are defined, a 44' Multi-Mission Boat (MMB) and a 26' Resilient Ship's Boat (Fast) RSB (F). Figures and tables are shown for speed versus wave height, small boat types versus ship type, small boat mission warfare areas, and characteristics of current ship's boats. NAVSEADET Norfolk report 6660-78 (AMDLC Conform Level Requirements) is included as Section II. Four appendices are provided listing primary mission areas, alternate mission areas (larger craft), design constraints (larger craft) and small craft technology characteristics for the year 2000.

A short narrative description of the type of construction proposed for the two craft is offered. A short narrative description of the approach to installing and connecting the payload modules is given, along with a figure to show the payload module footprint and tiedown points for each craft. A short discussion of the mission payload modules concept is offered along with a table of sizes and weights of the modules and a figure showing module installation on each craft. A structural specification, suitable for either module (the module characteristics are to be filled in) is presented. It is intended to be the basis for a final draft suitable for inclusion in a procurement document.

A short narrative discussing propulsion powering options for each craft is included. Fuel tank requirements are discussed and the various available power plants are listed. Possibilities for the smaller craft include diesel inboard and gasoline engines, diesel and multi-fuel outboard engines. For the larger craft straight drive, stern drive or vee

drive can be used with either two-stroke diesel or multi-fuel Curtiss Wright rotary power. Profile and plan view sketches are shown for some engine and drive train alternatives. A specification for procurement of a propulsion engine is given. Propulsion gearboxes, shafting, shaft seals, etc., are not covered. It is intended to be the basis for a final draft suitable for inclusion in a procurement action. The specifics of the engine are intended to be included in the procurement document.

A short discussion of the "theory" of establishing small boat strength criteria is given and a table is shown ranking various hull materials against some specific criteria. Since a legend describing the materials has been left off, the table is of limited value.

A specification for the Resilient Ship's Boat (Fast), is presented. Characteristics (length, beam, draft, etc.) are listed, with details to be filled in. It is intended to be the basis for a final draft suitable for inclusion in a procurement document. A specification for the Multi Mission Boat (Fast), is presented. An incomplete list of characteristics is included. It is identical to the specification for the Resilient Boat except that the final page of resilient boat specification, covering "Interior Tube Foam" and "Coated cloth," is omitted. Sketches showing outboard and inboard views for various 44' MMB alternative configurations are included. An abbreviated table of weights for major weight groups is given for three engine types. Sketches showing outboard and inboard views for various 26' RSB alternative configurations are included. Propulsion concepts with one or two outboard engines are shown. An abbreviated table of weights for major weight groups is given for the two outboard engine arrangement. Diagrams for speed versus wave height, EHP versus Speed and SHP versus Speed are shown for both craft. The power versus speed diagrams are for varying displacements, for sea states zero and three. No explanatory text is included.

The first unlisted addendum explains, at the CONFORM level, the steps necessary to develop the AMDLC craft. It is meant to be used as a guide for developing specific program plans for each craft as soon as enough specific information about each is developed. Also included is an explanatory introduction outlining the purpose of the craft and a suggested time table for implementing the plan. The second unlisted addendum gives some basic information on capability, technical approach, operational effectiveness, technology requirements and costs for the 26' RSB. The sketch of profile and plan views and the speed versus wave height diagram presented in the first section are again shown. A cost and schedule diagram is included.

Except for the references made to Mil Specs in the Specifications sections, no references to other documents are given.

**58875 Surface Shlp Continuing Concept Formulation Feasibility Design Study Final Report, Corvette** Escort (Hydrofoil)
NAVSEA **31242, 11/81,** C

This report describes the results of a FY81 Surface Ship CONFORM design study for an IOC 2000 Carrier Battle Group Escort hydrofoil ship. The report describes the study's objectives, design rationale, technical approach and results. Significant trade-off studies are summarized, areas of technical risk are analyzed and discussed, and ship resource requirements (raw material, manning, energy) are provided. Pursuant to CONFORM objectives, R&D initiatives which are prerequisites to delivering such a fleet asset in the year 2000 time frame are included.

The report supports subsystem technology descriptions, ship system design descriptions (e.g., performance, stability, combat system impact), systems engineering descriptions (e.g., vulnerability, survivability, manning and life-cycle cost estimates) with figures and tabulated data. Appendices provide performance curves, hydrostatic curves of form, stability curves, weight and moment estimates and ship drawings. Conclusions are summarized along with a risk assessment and recommendations.

**58876 Surface Ship Continuing Concept Formulation Program (CONFORM) RDTLE Needs-81**
**NAVSEA, 02182, U**

**The Surface Ship Continuing Concept** Formulation (CONFORM) Program is to identify the whole ship concepts and their R&D requirements for the period 1995 - 2000 IOC. The Program has been in operation for almost two years and ten concepts are summarized in this report.

This report gives information on the Program background, methods, technical risk measures; the RDT&E needs identified with each CONFORM design by payload and platform; whole ship system engineering; and, conclusions and recommendations.

The CONFORM Designs summarized:

| | |
|---|---|
| High Survivability Cruiser | (HSC) |
| Heavy Combatant | (HC) |
| Low Detectability Ship | (LDS) |
| Light **Patrol** Hydrofoil | (LPH) |
| PHM Growth Variants | (PHMV) |
| Corvette Hydrofoil | (CH) |
| Advanced Combat Systems Frigate | (ACSF) |
| Universal Auxiliary Ship | (UAS) |
| Merchant Ship Weaponization | (MSW) |
| Ship's Boat | (SB) |

**58880 CONFORM Heavy Combatant** Topside **Design Study, Final**
**SEA 06, 11/30/81, U**

This report was prepared to provide topside arrangement guidance for the mid-size SL-7/AOE variant of the CONFORM heavy monohull combatant. An Engineering Assessment of the heavy combatant was reported separately. A list of topside payload items, required to be accommodated, is provided. Two arrangements are given in appendices. The baseline arrangement generally follows the equipment locations given in the engineering assessment. The second arrangement provided modifies the baseline for improved performance. A listing and explanation of the changes made and the improvements resulting from these changes are provided.

Each appendix includes: a list of items used as input to the computer model; ship pictorials showing plan, oblique, and detail views; pictorial views and plots of topside weapon and sensor coverage; topside physical characteristics including weights and moments of the total topside arrangement and of the individual arrangeable items.

The engineering assessment study and computer synthesis model used are referenced. No conclusions are drawn nor are recommendations made.

**58882 Surface Ship CONFORM** High **Survivability Cruiser Feasibility Study, Final**
**NAVSEA SEA 312, 01/82, C**

Survivability against weapon attack is so fundamental to ship design that it should be considered and incorporated at the beginning of the design process. The difficulties involved in the current survivability backfit program have demonstrated this fact. Designs can be developed to withstand hits of the largesl: weapons, with the obvious exception of nuclear warheads. Survivability innovations are being studied under ship protection research and development programs. To insure that our future ship designs benefit from these innovations for survivability against current threats, conceptual designs that incorporate these features are developed and evaluated.

The subject design is of a highly survivable, battle group defense guided missile cruiser. Threats used were hits of major weapons. The C-3 combat readiness level was the minimum post-attack goal. A baseline cruiser design was developed for comparison. The two ships were compared in three ways: acquisition cost, vulnerability, and operational effectiveness.

Concluding remarks concerning the survivability of a cruiser against large modern weapon threat, and conclusions reached comparing cost estimates are provided.

**58896 Mechanical Drive Pod Powerplants for Naval Surface Combatants, Final**
**RAMCOR Eng., 01/15/83, C**

The principal focus of this report is a conceptual level study of mechanical drive pod propulsion for a 30-knot destroyer. The report borrows heavily from a previous electric drive pod study (referenced) and compares the advantages and disadvantages of each. Pertinent parameters from a baseline twin shaft General Purpose Destroyer (from a referenced study by Bradford National) are used as a benchmark.

The study compares ship size and displacement while holding other significant parameters fixed so that changes due only to propulsion plant modifications are seen. Variants include two pod (aft) using three or four LM 2500 gas turbines and four pod (two forward, two aft) using four LM 2500s. Sketches showing propulsion system arrangements, pod layout, cross connect gearing and right angle gearboxes are given with supporting calculations and references. The advantages of composite shafting, contra-rotating propellers, planetary gear reduction and bevel gearing, as applied to pod drive, are discussed. Influence coefficients (obtained from a referenced report) are used to determine ship size, displacement and fuel weight. Trade-off studies to determine these parameters are not performed. Turning radius, detectability, pod cavitation, stability, survivability, RMA, and producibility are addressed in a cursory manner. Other possible applications for pod drive are highlighted including a two engine destroyer, four engine cruiser, air capable cruiser and light carrier-cruiser. Conclusions describe advantages and disadvantages between mechanical and electric drive pod propulsion, and, conventional layouts. An excerpt from DTNSRDC report PAS-77-36 (March 1978), "Right-Angle Gear Design Utilizing Nonrolling Contact Bearings (Part I)," by A.B. Harbage, is included as an appendix.

**58898 Advanced Concepts of Landing Craft Retrieval, Draft**
**Dec. Eng., 07/30/88, U**

New concepts are being sought in landing craft mother ship design to speed the process of retrieval-reload-relaunch, to eliminate space-wasting well decks and specialized ballasting machinery, and to better suit this operation to air cushion vehicle (ACV) use. This report identifies eight possible configurations to accomplish these goals but no work has been done. Sketches of configuration for monohull landing craft (LCM) and ACVs are included.

**58900 Fire Support Ship Study for CONFORM 1983, Final**
**RAMCOR, Inc., 09/01/82**

This report was prepared to provide design parameter guidance and initial evaluation of the fire support ship concept as part of CONFORM 1983. The work is conceptual in scope, documenting the results' of computer aided effectiveness studies. Results are presented in text and tabular form, intended to form the basis for more detailed ship design work. Ships are not developed enough for sketches or drawings of the conceptualized ships to be included.

The fire support ship is to provide firepower for anti-surface unit warfare (ASUW), shore strike and amphibious assault operations. Very general requirements of minimum draft and stability in beam seas at a range of 5000 NM at 20 knots, and at sustained speed in excess of 25 knots are specified. Two combat system suites were specified as part of study input, differing in amount (approximately double) but not type of weaponry. Concerning ship parameters, both Pielstick SA=2.5 diesels and GE LM 2500 gas turbine powerplants are considered along with 2000 KW diesel ship service generators. Ships are investigated with and without enhanced survivability features. An appendix gives parameter details (weights, power plants, range, combat payload, volume, characteristics, costs and survivability) for each ship. Weapons chosen are various combinations of 8 inch 55 caliber lightweight gun, assault

60750 **CONFORM-Level Requirement (CLR) Technology (T-) Sections for the CONFORM 1985 Designs, Final**
**BLA, Inc., 1 1/01/84**

This working paper presents a review of potential technologies for input to the Technology (T-) Sections of the CONFORM-Level Requirements (CLRs) for seven of the 1985 CONFORM designs. Each section has been prepared in accordance with a common format and each can be considered as a stand-alone report. For this reason there is repetition of information between sections, especially in the areas of platform, propulsion and electric plants. The sections are broken down into subsections covering mission and payload, platform description, descriptions of SWBS areas, and a list of references. The SWBS areas are treated in varying level of detail, with hull and propulsion consistently well developed. The amount of development of other areas depends on their importance to the ship's mission. The section for the Readily Reproducible Mine Countermeasures Craft (RRMCM) includes an extra table of technology options, at the 3digit SWBS level, outlining the design impact and development status of each candidate item.

A brief description of the designs is given below:

Readily Reproducible Mine Countermeasures Craft (RRMCM) - A mine search or mine neutralization craft requiring mine detection sonar and a precise means of navigation. Only low speeds are required but with good control. A small, cheap monohull or hovercraft of GRP construction is envisioned using a "magnetically treated" cast iron diesel for propulsion.

Arctic Operations Support Ship (AOSS) - A craft to provide submarine support and rescue, surveying, mine countermeasures, minelaying, $C^3I$, and limited capabilities for icebreaking, amphibious assault and surface salvage and rescue. The principal candidate is a monohull with both air and ACV assets. Geared diesel with controllable pitch propellers or full-frequency-controlled AC/DC electric drive with fixed pitch propellers are propulsion options.

Salvage and Rescue Ship (ATS) - A steel monohull ship, built to ABS standards, is postulated to assist and retrieve damaged or stranded ships. A possible alternative is an SES, which could reach an accident scene sooner, but designing an SES with sufficient towing capability is a major problem. Conventional diesel, diesel-electric, and diesel cruise - gas turbine boost with ducted screw propeller and baselines, with more novel propulsor types considered as options.

Mobilization Frigate (MOBFF) - A monohull Frigate, built to commercial standards, for merchant/URG escort is considered with AAW/ASW/ASUW suite. Emphasis is placed on seakeeping and quiet operation with a minimum sustained speed of 22 knots. A SWATH may be considered as a more risky alternative. Consideration will be given to conventional diesel or diesel electric propulsion to supply the approximately 20,000 SHP needed for driving a conventional fixed pitch propeller. More novel propulsor types are also described for consideration.

Ocean Surveying Ship (TAGS(X)) - A large, long-range ocean survey ship, using a modular payload concept and operated by a civilian crew, is envisioned. SWATH or monohull versions are considered, of 3000 to 15,000 tons displacement with a 14 to 20 knot speed and range of 6000 to 10,000 nm. The propulsion machinery and propeller variants are similar to those for the Mobilization Frigate. A bow propulsion unit will be used for positioning.

Amphibious Assault Ship (Multipurpose) (LPX) - The ship's primary mission is amphibious support, to carry one-third of a Marine Amphibious Unit (MAU). A secondary mission is to support a Surface Action Group (SAG). A well deck and flight deck equipped monohull of 25,000 to 30,000 tons is postulated, having a 12,000 nm range and sustained speed of 22 knots. A 35 to 50 knot SES will be an option. Propulsion for the monohull version will consider 40,000 HP steam or gas turbine with RACER and fixed pitch propellers. The SES version will require about 120,000 HP for propulsion and 40,000 hp for lift. Novel power transmission schemes and propulsor types will also be explored.

Fleet Command Ship (AGFX) - The ship is to serve as headquarters for a fleet commander, with payload of offices, computer equipment, quarters and communications equipment. Emphasis is on low signatures, high survivability, $C^3I$

and self defense. A monohull of 12,000 tons is envisioned having good seakeeping. sustained high speed and flight operations capability. Recant developments in bow and stern shape and appendage design will be applied. No major advances in hull structure or propulsion are necessary to meet requirements but tradeoffs among the various outlined technologies will be performed.

**60783 Surface Ship Conform Study: SSATS/DS(X) Mutual impact Assessment, Tech Memo**
**Naval Underwater System Center, 07/25/84, C**

One of the tasks of the NAVSEA Conform program is the assessment of the mutual impact between future generation sonar systems and future U.S. Navy surface ships. This report expands on previous work by quantitatively assessing the mutual impact of the Surface Ship Advanced Tactical Sonar (SSATS) system in a monohull version and a SWATH version of a future destroyer, DS(X), scheduled for introduction into the fleet in the year 2000. Figures provided include SSATS configuration array equipment and installations configurations, performance curves, lines and body plans with and without the sonar dome. Tables include principal, HRA/LFT and ships characteristics, towed array equipment list, and data to support heave, pitch and deck wetness versus ship speed with respect to the sonar dome configuration.

60800 ADV **MCM** Ship **Characteristics In the Port Clearance Mission**
**Naval Coastal System** Center, 01101181, C

This working paper briefly describes operational requirements for ACV/SES MCM ships assigned to MCM operations in CONUS Atlantic ports. Consideration is not given to subsequent operations in how they are to get there or how the operations are performed. Current MCM equipment in fleet or under development is considered.

The content of this working paper include a description of the port MCM mission: referenced British intelligence reports on hovercraft MCM experience; MCM equipment including mechanical sweeps, influence sweeps, and detection and neutralization systems; ACV mine vulnerability including exposure susceptibility and mine activation; and, desired ACV MCM ship characteristics.

**60876 Covert Communications Equlpment and Techniques, Draft**
**NCSC, 01/1 6/85, C**

This document analyzes communications requirements for various ship designs in the Conform program and presents the status of covert communication programs. Each band of the RF and electro-optic spectrum is considered and discussed separately. The methods used to collect information were of document review and personal interview of the principals involved. Reference: documents are contained in an appendix. The investigation was limited to those programs having some affiliation with Naval Ocean System Center. Also including in appendices are a dispersed strike covert communications requirements analysis and a description of equipment operating modes.

**60877 A Study of the Future Utilization of Steam Technology in the U.S. Navy Surface Fleet,**
**Technology Study**
**02/85, U**

This report provides a contrasting study of the relative merits of a steam main propulsion plant, as opposed to diesel or gas turbine plants, for future Navy ships such as CGVX, FFX/FFGX, LSDX, AORX, and SWATH FFX. Included in the report is a study of fuel types, availability, costs and characteristics for current and projected time frames. Extensive charts and tables are presented with references. Steam generation and steam plant technology are discussed and evaluated with respect to the growth of the Navy and its needs. Included with this evaluation are several general plan arrangements and possible machinery layouts for steam propulsion in the above mentioned ship classes. The impact of other forms of propulsion, for example gas turbine and diesel, are also examined along with a discussion of the computer model used for the evaluations. Conclusions of relative merit for the three considered propulsion plants are stated for current and possible future time frames, being based largely on fuel quality, availability, cost. etc.

**60891 Surface Shlp Conform Combat System Support • Advanced Configuration Frigate Combat System Concept, Final**
**NSWC, 04/30/81, C**

This report, investigating the advanced configuration frigate combat system concept, responds to the threat and combat subsystem parameters for the Conform FFG 7 roles and missions. Those missions include convoy and replenishment group protection and amphibious assault group protection: the FFG 7 providing protection against missile attack from air, surface and submerged platforms, and, protection against torpedo attack.

The study combined number of threats, measure of effectiveness and estimated kill probability to determine the number of interceptors needed to satisfy the measure of effectiveness. The report covers anti-air, anti-submarine and anti-surface warfare systems. Also included are proposed changes to the combat support and discussion on radial threat considerations and ship impact. Graphical support includes the functional sequence for surveillance radar, the proposed advanced configuration combat system, sonar performance and impact correlations, and, the radial target combat system configuration. Provided in tabular form are the baseline equipment, advanced configuration frigate equipment, and advanced configuration frigate equipment for the radial target system.

**60893 FY83 Conform Technology Task T1A • Towed Array Technology, Tech Memo**
**NSWC, 01/01/82, C**

Enclosed in this technical memorandum are descriptions of on-going technology programs which identify new ship sonar system developments and specific on-going research programs describing ship sonar technology. The task is to assess future possible applications of these research programs. The on-going technology programs which are included in this technical memorandum are grouped into the following categories:

general acoustic sensor studies
array technology
acoustic noise reduction
processor and software development
laser thermo-acoustic sound generation
transmission characteristics of sound in water
sensors/devices
system improvement programs, and
- ASW combat simulation.

**60899 Operating and Support Cost Estimating Relationships and Statistical Cost Baselines from VAMOSC • Ships Data, Final**
**Information Spectrum, Inc., 0111 0/85, U**

The purpose of this study is to develop cost estimation relationships (CERS) by analysis of conventionally powered escorts. The CERS are developed through analysis of cost driving variables. Cost data for the study was taken from the VAMOSC-Ships TSS Database. Lists of cost elements and ship class physical, performance and operational parameters are presented in tabular form. The findings of the study are presented in groups defined by ship type. The regression equations developed for conventionally powered escorts are tabulated. CERS are then given, along with engineering analysis and statistical results, for several items including:

- Manpower Cost
- Repair Parts Cost
- Restricted Availability Cost
- Exchange Cost
- Training Cost
- Ammunition Handling Cost

Recommendations are given for further analysis of conventionally powered escort ships, as well as for other surface ships.

**60919 Dispersed Strike CONFORM Feasibllty Design - *final* Report**
**SEA 501, 10/01/84, c**

This report describes a study to determine the feasibility of carrying high performance attack craft on a base ship. The Dispersed Strike Design concept exploits the beneficial characteristics inherent in small high-performance craft, and circumvents those characteristics that normally limit their utility. The Dispersed Strike concept combines a team of several fast attack craft with a base ship which provides them the support, open ocean range, endurance and mission flexibility usually associated with a larger combatant. The report documents the study's objectives, mission requirements, technology base, design description, subsystems descriptions, R&D needs/technical risk, assessment and conclusions. The ship design description consists of presentation of the payload/platform performance; configuration including the design approach and results for the craft-ship interface, attack craft type, size and performance requirements; margin policy; and for each ship (base ship, hydrofoil, SES and planing hull attack craft): the configuration, margins, manning, hullform size, weight and area/volume summaries (base ship & SES only), stability and seakeeping.

included in the appendices are the CONFORM level requirements, general arrangements, weight and area/volume estimates for the base ship, stability curves for the hydrofoil and planing hull attack craft, and performance curves for the SES and planing hull attack craft. Comprehensive representation of key technologies is included through figures. Among those are craft profiles, craft arrangements; operating profiles, craft arrangements; weapon systems and arrangement; planing hull floodable length curves, stability curves, resistance, pitch, roll and range versus speed analyses; SES resistance, speed-power curves, and range versus speed analyses. Presented in tabular form are ship characteristics, defense and combat system components and characteristics, defense and combat system components and characteristics, weight and area/volume summaries for each vessel, craft propulsion plants, base ship load (crew, ammunition, stores, fuel and cargo), and life-cycle cost.

**70187 Seakeeplng Survey of Amphlblous, Replenishment and Auxiliary Ships, Volumes I and II, Final**
**NAVSEA 55W3, 07/85, C**

This report summarizes an analysis of the responses of the Commanding Officers of U.S. Navy amphibious, replenishment, and auxiliary ships to a Seakeeping Questionnaire sponsored by the Commanders of the U.S. Atlantic and Pacific Surface Forces. The survey was conducted for the Commander, Naval Sea Systems Command, Washington, DC. It provides data and graphical support on ship speed versus sea state, the sea state in which speed is voluntarily reduced, and the sea state limits for amphibious and replenishment operations, including the operations of own ship weapons and sensors. it also includes the operator's subjective assessment of the seakeeping performance of their ships. The seakeeping questionnaire and actual responses are provided as appendices (responses comprise Volume ii).

**70166 Seakeeping Survey of Amphibious, Replenishment and Auxiliary Ships, Volumes I and II, Final**
**NAVSEA,** 07185, C

This report summarizes an analysis of the responses of the Commanding Officers of U.S. Navy amphibious, replenishment, and auxiliary ships to a Seakeeping Questionnaire sponsored by the Commanders of the U.S. Atlantic and Pacific Surface Forces. The survey was conducted for the Commander, Naval Sea Systems Command, Washington, DC. Volume I provides data and graphical support on ship speed versus sea state, the sea state in which speed is voluntarily reduced, and the sea state limits for amphibious and replenishment operations, including the operations of own ship weapons and sensors. It also includes the operator's subjective assessment of the seakeeping performance of their ships. This volume (Volume ii) provides the responses to the seakeeping questionnaire.

ballistic rocket system, ramjet powered 8 inch rocket, 16 inch ballistic missile and Tomahawk. The weapons used for each design are tabulated in the report. An appendix consisting of manufacturers data gives more detail on each weapon.

The assessment approach, using various computer programs described below, consists of examining ship performance in the amphibious assault mission in terms of fraction of mission accomplished for various enemy threat levels. Different configurations or sets of design parameters are tested to determine their relative performance. Cost data including first cost, operating costs, cost of ordinance expended, and ship losses are analyzed to form a Measure of Effectiveness to determine mission performance. Various computer models are described for performing the studies. The basics of operation of these models is explained and sample input and output is included as part of the report text and appendices. Models include two that are ship-type dependent for developing ship characteristics plus models for the amphibious assault mission, group defense, ship damage assessment and total probability of ship survival.

Conclusions are presented in text and tabular form. Concluding remarks include discussion on power plant type, effectiveness improvements on RCS reduction, highly survivable arrangements, fire support ship-amphibious assault advantages, and cost effectiveness between small and large payload ships. References (provided) were used to establish the threat and costs, and effectiveness of the combat systems. No reference is made to documentation for the computer models used.

58903 Surface Ship Continuing Concept Formulation FY81 Design Study ▪ Low Detectability Ship
SEA 501, 12/01/82, C

This report describes the results of a FY81 Surface Ship CONFORM design study for a Low Detectability Ship (LDS) for the twenty-first century. The study was undertaken to design a feasible ship which could operate as an offensive platform while remaining as covert as possible. To allow the LDS to operate in a covert mode, the primary design objective has been to minimize ship signatures. The report describes the study's objective, design rationale, technical approach and results. Significant trade-off studies are summarized and areas of technical risk are analyzed and discussed. Pursuant to CONFORM objectives, R&D initiatives which are prerequisites to delivering an LDS in the year 2000 time-frame are delineated.

The text presents the design in detail, including description of mission requirements, operations concepts/profiles, functional requirements, threats and environmental factors; the technology base, including technical risk constraints, signatures and combat systems; the design description of the LDS, consisting of performance, configuration, margins, manning, seakeeping, systems engineering; subsystems; technical risk/R&D needs; and assessment and conclusions. CONFORM level requirements, signature reduction approach, general arrangements, weight estimate and area/volume requirements are included as appendices. The figures and tables included represent a comprehensive representation of damage and intact stability for various conditions, LDS reliability block diagram and LDS speed-power curve. Included in tabular form are ship cost estimates, electrical load and technical data inputs to the computer algorithm employed for the study.

**59152 Battle Group Escort (CGV) ▪ CTOL Variant, Final**
**SEA 501, 12/01/82, C**

This report describes the results of a CONFORM feasibility study of a Battle Group Escort (CGV) for the mid 1990's: an AEGIS cruiser with the capacity of supporting a limited number of conventional take-off and landing (CTOL) aircraft. Four CGV versions are developed and ship characteristics such as hull form and arrangements, weights, manning, stability, structures, seakeeping, powering and combat system arrangements are determined and discussed. These ship characteristics are determined to the level of detail necessary to achieve CONFORM life-cycle cost estimates.

The report text describes in detail the design base and technologies. Among the appendices included are the CONFORM level requirements, general arrangements, weight and space estimates, combat system performance, reliability measures and VLS-air operations interaction. There are figures for each CGV version illustrating a

simplified flight and hangar deck; combat system arrangements; flight deck configurations; simplified inboard profile; body plan; general configuration sketches; midship sections; and, proposed uptake routing schemes. Also presented graphically are the magazine protection scheme; baseline system machinery arrangements and schematic; the COGAC and RACER system arrangements; waterjet propulsion system; torpedo defense system; VDS FISH illustration; and a schematic of the weapon "suite" consisting of torpedo launcher and anti-torpedo rocket sketches and the launcher stations and acoustic apertures positioning. For the different CGV versions characteristics, manning estimates, accommodations, area/volume summaries, and single-digit weight summaries are tabulated. Also included in tabular form are endurance capabilities, the weapon suite equipment plan, a comparison of principle characteristics for the CGV variants, ship motion limiting criteria, worsecase seakeeping performance, equipment requirements for cruise and assault operation modes, structural measures, propulsion and alternate systems equipment (including a comparison matrix), and the required communications equipment.

**59185 RCS Predictions for Surface Shfp Designs, Final**
**Georgia Institute of Technology, 01/83, C**

The Georgia Tech ship radar cross section (RCS) prediction model CROSS is used to estimate the radar signatures of three generic ship configurations. RCS predictions are presented for 360-degree ship aspect coverage, at three elevation angles (0.2, 10, and 30 deg) for sea states zero and three. Polar plot comparisons are afforded for each sea state • elevation combination. Mean, median and peak predicted RCS values are tabulation for each configuration according to elevation • sea state combinations. Recommendations and concluding remarks are included.

59188 Integrated Logistic Support Assessment of the Advanced Base Tender Concept, Interim
NAVSEA 55W17, 03/83, U

The report discusses the Integrated Logistic Support impacts of the Advanced Base 'Tender design and provides recommendations to improve repair and support capabilities.

The report presents the assessment of the advanced base tender concept, specifically the integrated logistic support considerations. The required manning and equipment needed to meet the unique mission requirements of the craft are discussed in detail. New trends in supply support and their impact on the ADR designs are examined.

For those systems expected to be in the fleet by 2000 • AEGIS, RACER, VLS and CPS -- effects on maintenance and support requirements are discussed.

The "floating SIMA" concept, an alternative to ADR, would install the repair capabilities of a SIMA on a non self-propelled platform. The positive and negative impacts of this design are also presented. A description of the SIMA at Long Beach, California is appended.

**59191 Low Profile/Integrated Stack Design, Final**
**Baham, 12/01/82, U**

This report studies the effects of the turbulent zone, generated by the airflow past ships' superstructures, on exhaust plume trajectory. Test results performed on recently built U.S. Navy and Royal Navy ships are reviewed and compared with a mathematical model. Visual effectiveness and topside design aesthetics are also emphasized in attempt to reduce the turbulent zone height and thus attain a low profile stack design. The computer programs described in this report are used to determine the exhaust plume trajectory and its interpenetration (INTERPNF), the probability of a topside point exceeding some critical temperature (PLUME or OLDPLUME), and the probability of stack gas to crosswind velocity ratios in sectors for any of 9 environmental areas (PROBVR) of the world's oceans.

Turbulent zone evaluation methods, plume trajectory calculation procedures and algorithm verification are presented in the text. Also included as separate appendices are a summary of the plume theory mathematical model and documentation of the computer algorithm employed.

**59200 Assessment of Automated Data Processing Impacts on the Advanced Base Tender, Interim**
**Samuel D. Judge, 04/83, U**

The report examines the supply support functions and repair of the ADR and assesses the impact of automated data processing (ADP) on improving productivity in these areas.

Applications of ADP within the tender, between tender and tended ship, and between tender and shore facilities are discussed. These applications include handling of work requests, supply support functions, and technical library functions.

Using the present SNAP I and SNAP II programs as a baseline for future ADP applications, projections are made estimating types and quantity of ADP equipment required, weight and space impacts, manning requirements, and productivity benefits.

**59230 Dispersed Strike CONFORM Feasibility Design, Final**
**DTRC 1213, 1 0/84, C**

This study explores the feasibility of carrying high performance attack craft on a base ship which provides them the support, open ocean range and endurance and mission flexibility usually associated with a larger combatant. Investigated as possible attack craft are a planing hull, hydrofoil, and surface effect ship (SES).

The report includes ship functional requirements as they pertain to attack craft, its base ship, targets and threat, and an operating profile. The technology base includes projected technology for each attack craft and base ship, and, attack craft combat systems. The ship design description includes discussion on attack craft selfdefense, anti-surface warfare modules, anti-submarine warfare modules. and platform performance. Configuration descriptions are provided for each attack craft and the base ship and include margins, manning, hullform size, weight and space estimations, stability and seakeeping analyses. Systems engineering is provided for the base ship; subsystem descriptions are provided for each of the four craft.

Those areas of discussion and results are well supported by figures and tabulated data. Appendices include base ship general arrangements, weight and space estimates, stability curves for the hydrofoil and planing hull attack craft, and performance curves for the SES and planing hull attack craft.

**59231 FY82 Conform Feasibility Design Summaries, Final**
**NAVSEA 05R14, 04/83, C**

This report summarizes the designs developed in the FY82 CONFORM programs. The summary includes background, mission, technology, design results, RDT&E needs, and conclusions and recommendations for each of the following designs: Heavy Combatant, Battle Group Escort (CGV(X)), Light Battle Group Escort (KE(X)), Dispersed Strike, LVT Carrier, Universal UNREP, RDG SES Tug/Barge, Salvage/Rescue Ship (ASRS(X)), and Mine Clearance System SES/ACV. The summaries are well supported by figures and tables for each of the designs

**59374 Surface Shlp Continulng Concept Formulation (CONFORM) FY82 Feaslbiillty Deslgn, Final Study - Mine Clearance System 2000, 04/83, U**

Described in this report is the feasibility level design study for a mine clearance system consisting of a large surface effect ship (SES) transporting three air cushion vehicles (ACV) equipped with modularized mine warfare equipment. It was concluded in the report that the ACVs could be constructed from existing technologies but the large SES mother ship would require a great deal of research. Recommendations for further studies are made.

All supporting calculations, tables and figures for this design are included. Among those provided are speeddrag and thrust curves for sea state 0 and 4, a comparative ride quality plot for SES, installed power plots for ACVs and SESs, a two-digit weight estimation and area-volume summary, comparative maneuvering for ACV, and, mission endurance principal characteristics for the SES and ACV.

**59675 Surface Ship Continuing Formulation (CONFORM) FY82 Feasibility Design Study • Final Report • Light Battle Group Escort KE(X)**
**SEA 501, 12/01/82, C**

This report documents the results of a CONFORM design study for a Light Battle Group Escort, KE(X) for the twenty-first century. The report describes the study's objectives, design rationale, technical approach and results. Significant trade-off studies are summarized and areas of technical risk are analyzed and discussed. Pursuant to CONFORM objectives, R&D initiatives which are prerequisites to delivering a KE(X) in the year 2000 time frame are delineated.

This study was undertaken in order to provide a feasibility design for a force option currently under examination in the Alternative Battle Group Concept Study (ABGCS). The KE(X) is intended to function as part of both main (carrier) Battle Groups and Surface Action Groups (SAG) in the main battle force. The principle mission characterization of the KE(X) at the force level is that it be small enough to be untargetable by airborne radars from long range (upwards of 50 nmi or greater). The baseline KE(X) is required to be low cost, such that several can be procured for the price of one destroyer, and still be capable of serving as a long range acoustic sensor platform in the outer screen. The KE(X) concept seeks to exploit the capability of advanced ships small enough to be undetectable from long range and therefore approach immunity to anti-ship missile attack from long range to operate in rough seas in small sizes. This enables the payload of the baseline KE(X) to be limited to the primary acoustic sensor (passive towed array), $C^3$ and ASMD, with no other weapons.

Among the appendices included are the CONFORM level requirements, general arrangements, weight and space estimates, RPV characteristics, reliability measures, and radar cross section and acoustic signature reduction analysis. The figures included are of a comprehensive list representing the key technologies. Among the figures are representation of drag curves, foilborne range versus speed, attributes, advantages and disadvantages of SECAT, power comparisons, speed-power and range-speed curves for sea state 3, cushion interference effects, length to beam ratio effect on resistance, deck arrangements and profiles for SECAT and KE(X), damage and intact stability for different levels, foil effects on hullborne and cushionborne motions, effect of cushion height on bow accelerations, ride control system, propulsion and electrical systems schematics, structures arrangements and details. Seal and finger illustration, combat suite representation, comparative cruising dispositions, cumulative capability loss (North American Campaign), and a torpedo attack baseline comparison. The report also affords a comprehensive group of tables. Among those presented are listings of characteristics, cost trade-off, size and performance margins, one-digit weight breakdowns, area/volume summaries, structured weight estimate, reliability and availability of SECAT and alternate designs, equipment reliability, KE(X) life-cycle, investment and annualized operations and support cost summaries, foil/strut systems, strength characteristics of bag (seal) materials, propulsion and electrical system components, and loads weight breakdown.

**59676 Technology Trends for Propulsor Design of U.S. Navy Ship, Draft**
**The Baham Corporation, 08/82, U**

This report is a very detailed, in-depth study in which forecasts summarizing trends in propulsor research and development are made. An overview of propulsor technology for CONFORM application is provided, and, propulsor technology characterization is presented. This study serves to:

- Present current propulsors, advantages and disadvantages
- Identify propulsor data sources
- Present propulsion data for various ship classes ($\eta_o$, $\eta_h$, etc.)
- Discuss concepts to improve performance
- Identify advanced propulsion systems
- Quantify expected trends in propulsor technology.

The report provides extensive information concerning subcavitating propulsors, transcavitating and supercavitating propellers, and, waterjet propulsion. In the subcavitating propulsor section, standard propeller series, acoustic

vibration characteristics, RMA considerations, and ducted, contra-rotating and semi-submerged propellers are discussed in detail. The information in this section is accompanied by many figures showing blade outlines and section shapes, performance characteristics, thickness distribution, and various efficiencies and comparisons. Pod and Hybrid propulsion systems are studied in the following section. Trends in propulsor technology are discussed; conclusions and recommendations are made. An extensive list of references is included along with applicable technical data sheets. The appendix dealing with propulsive characteristics of naval ships is bound separately.

**59719 Surface Ship/ASW System Mutual Impact Assessment**
**Advanced Tech., Inc., 08/83, C**

This is an initial report prepared in support of the NAVSEA Conform program. It was developed for the ship and sonar array designers to assist them in considering ship/sonar array mutual impact during concept design of future U.S. Navy surface ships. Many of the important factors discussed are based upon extensive body of knowledge developed for conventional displacement hulls. Application of the factors to small waterplane area twin-hulled (SWATH) ship and surface effect ship (SES) are discussed as well as the limitations of existing design information. It is intended that follow-on reports will refine and apply these ship/array mutual impact considerations to specific ship classes, such as FFG(X), DS(X), CGV(X), in the FY84 CONFORM program.

Included in the report are sonar system descriptions, as an appendix; figures include array configurations, anchoring possibilities and harbor availability on the U.S. Atlantic Pacific and Gulf Coast as a function of mean low-water depth; damage risk levels are tabulated.

59726 Technology Characterization Section **for FY83 CGV(X) Battle Group Escort**
**BLA, Inc., 12/82, U**

The paper summarizes the pros and *cons* of emerging concepts and systems being considered in the conceptual design of the CGV(X) platform. Several of the areas discussed include hullform (SWATH, SES, Monohull), structures and materials (high-strength low-alloy steels and composites, detectability, survivability, propulsion units, propulsion systems, propulsors, fans, radar and sonar systems and more. Each concept is also given a risk factor (low, medium, high).

An in-depth discussion of design trends follows. This section includes details on many of the above concepts. Also presented are requirements for manning, reliability and logistic support. Standardization and pollution control are also discussed.

**59727 Technology Characterization Section for FY83 LSU(A) • Arctic Amphibious Landing Ship Utility**
**BLA, Inc., 12182, U**

This paper summarizes the pros and cons of emerging concepts and systems being (considered in the conceptual design of the LSU(A) platform. Areas covered include hullform (ACV variations), structures and materials (HSLA steels, composites), seal systems, detectability, power plant, propulsors, transmission (mechanical, electric), and lift fans. An in-depth discussion of design trends follows. This section provides details on rnany of the above concepts.

Also presented are requirements for manning, reliability, and logistic support. Standardization and pollution control are discussed, as well as payload requirements.

**59728 Technology Characterization Section For: FY83 LSU(X) Amphiblous Landing Ship Utility**
**BLA, Inc., 12/82, U**

The paper summarizes the pros and cons of emerging concepts and systems being considered in the conceptual design of the LSU(X) platform. Areas covered include hullform (SWATH, SES, Monohull), structures, materials

59751 **Multi-Pod Propulsion Concept Hydrodynamic Performance Assessment, Final**
**NSRDC, 05101183, U**

This repot-l documents an assessment of the hydrodynamic performance of a Heavy Combatant ship propelled by four pod mounted propellers. Pods are attached two forward and two aft in order to increase the survivability of the propulsion system. Ship parameters are taken from a March 1982 CONFORM design study (referenced). The ship assumed has a length of 749 ft., beam of 84 ft. and displacement of 25,000 tons. Variations analyzed include a baseline conventional four shaft design with controllable pitch propellers, and six pod (designs having fixed pitch, controllable pitch and counter-rotating propellers in pusher and tractor arrangements. The conventional ship has mechanical drive (with and without cross-connect); the pod drive ships assumed superconducting and conventional variants of electric drive. The ship effective horsepower, propeller performance and propeller-hull interaction coefficients used as input were calculated from model test data (referenced). Comparisons are made for each in terms of effective and shaft horsepower, required engine power, installed power, propulsion fuel flow rate, range, required propulsion fuel weight and fuel cost. A sensitivity analysis is also included, using the (best performing) counter-rotating pusher configuration as baseline, to determine the impact of pod size, displacement, propeller performance and engine power rating.

Comparative results are provided for pod propulsion ▪ shaft horsepower relation, fuel flow rate, pusher propellers versus tractor propellers ▪ shaft horsepower impact, propeller performance characteristics and pod diameters, and sensitivity results for fuel consumption relative to engine power rating and maximum power requirements. Results are provided in the form of bar graphs, tables and explanatory narrative.

An R&D plan for Continued support of pod propulsion hydrodynamics is included as Appendix 1.

59990 Surface Ship Continuing Concept Formulation (CONFORM) FY82 Feasibility Design Study ▪ Rapid Deployment Force SES Tug/Barge, Final
SEA 501, 10/01/83, C

This report documents the results of a FY82 CONFORM design study for a Light Battle Group Escort, KE(X) for the twenty-first century. The report describes the study's objectives, design rationale, technical approach and results. Significant trade-off studies are summarized and areas of technical risk are analyzed and discussed. Pursuant to CONFORM objectives, R&D initiatives which are prerequisites to delivering a KE(X) in the year 2000 time frame are delineated.

This study was undertaken in order to provide a feasibility design for a force option currently under examination in the Alternative Battle Group Concept Study (ABGCS). The KE(X) is intended to function as part of both main (carrier) Battle Groups and Surface Action Groups (SAG) in the main battle force. The principle mission characterization of the KE(X) at the force level is that it be small enough to be untargetable by airborne radars from long range (upwards of 50 nmi or greater). The baseline KE(X) is required to be low cost, such that several can be procured for the price of one destroyer, and still be capable of sewing as a long range acoustic sensor platform in the outer screen. The KE(X) concept seeks to exploit the capability of advanced ships, small enough to be undetectable from long range and therefore approach immunity to anti-ship missile attack from long range, to operate in rough seas in small sizes. This enables the payload of the baseline KE(X) to be limited to the primary acoustic sensor (passive towed array), $C^3$ and ASMD, with no other weapons.

Among the appendices included are the CONFORM level requirements, general arrangements, weight and space estimates, RPV characteristics, reliability measures, and radar cross section and acoustic signature reduction analysis. The figures included are of a comprehensive list representing the key technologies. Among the figures are representation of drag curves, foilborne range versus speed, attributes, advantages and disadvantages of SECAT, power comparisons, speed-power and range-speed curves for sea state 3, cushion interference effects, length-to-beam ratio effect on resistance, deck arrangements and profiles for SECAT and KE(X), damage and intact stability for different levels, foil effects on hullborne and cushionborne motions, effect of cushion height on bow accelerations, ride control system, propulsion and electrical systems schematics, structures arrangements and details. Seal and finger

illustration, combat suite representation, comparative cruising dispositions, cumulative capability loss (North American Campaign), and a torpedo attack-baseline comparison. The report also affords a comprehensive group of tables. Among those presented are listings of characteristics, cost trade-off, size and performance margins, one-digit weight breakdowns, area/volume summaries, structured weight estimate, reliability and availability of SECAT and alternate designs, equipment reliability, KE(X) life-cycle, investment and annualized operations and support cost summaries, foil/strut systems, strength characteristics of bag (seal) materials, propulsion and electrical system components, and loads weight breakdown.

60055 Technology **Trends for Selected Ship Subsystems, Draft**
**BLA, Inc., 10/01/83, C**

This report documents the results of a study conducted to identify the state-of-the-art of selected ship subsystems and to project possible future trends in their characteristics. Nine separate subsystems, listed below, were selected for the study in response to existing Navy priorities:

Propulsion reduction gear
Ships service power cable system
Switch gear and panels
Ventilation system
Air-conditioning system
Firemain and flushing seawater system
Drainage and ballasting system
Compressed-air system
Fire-extinguishing system

Design information is developed and presented, for each subsystem in the form of easily usable technology data sheets. These data sheets graphically and/or numerically describe the trends in component or subsystem performance and weight as a function of the principal shipdesign parameters which would normally be available during conceptual design. Each system is analyzed according to subsystem characteristics related to subsystem capability or performance parameters and IOC year, and, required subsystem performance or capability related to ship descriptors. Emphasis is on the characterization of subsystems for noncombatant ships, including auxiliary and amphibious warfare ships. Recommendations and concluding remarks are provided for each subsystem studied.

**60060 Universal Unrep Ship Assessment, Draft**
**Decision Engineering, 12/01/83, U**

This report describes the results of a cost effective analysis which compared a universal unrep ship fleet and a fleet of conventional station and shuttle ships. Measures of effectiveness are computed as the fraction of required cargo carried per dollar invested (first cost or life cycle cost/year). The objectives, background and scope are presented. Loads carried are ammunition, provisions, fuel and JPS. Peacetime and wartime situations are considered. An Apple II+ program was developed to analyze the five model cases considered, and is included. The limitations and flexibility of the program are presented, and a description of each model is given. Key assumptions are listed in tabular form. An analysis is given for the results of each model case. Tables accompany these analyses and list the number of conventional ships and universal unrep ships required, as well as the measure of effectiveness. It is concluded that the conventional ship fleet is more effective overall than the universal unrep ship, due to the high first cost of the UUS.

**60067 Description of Handling Systems with Potential Application to the Deep Submergence Rescue Vehicles, Final**
**Busby, 01101183, U**

This study was conducted as part of the Surface Ship Concept Formulation Program (CONFORM) salvage, rescue, ship design study. The objective of the effort was to assess the techniques presently used, and those in the conceptual development stage, for launching and retrieving manned submersibles from both monohull and SWATH (semi-

submersible) platforms. The risk of adapting promising techniques to launching and retrieving the Deep Submergence Rescue Vehicles (DSRVs) by the year 2000 was also assessed.

The study provides a description of each system, including the following:

- Components, operation and manpower requirements
- Weight and dimensions of each system and its components
- Sketches of each system showing a typical arrangement, including location and size of components
- Estimate of system component requirements in terms of shipboard electrical, mechanical and hydraulic power, stowage, and operating fluids
- Estimate of the relative risk of developing and deploying a system by the year 2000.

The first major section of the study describes launch and retrieval techniques for submersibles from monohull or SWATH vessels. All vehicles are untethered types, as are the DSRVs. Pertinent physical and handling characteristics of 51 submersibles in use by the industrial and scientific community are tabulated and summarized. The study shows that the DSRVs are unique because of their heavier dry weight, greater length and requirement for two lift points.

Four vehicles currently have launch and retrieval systems, or proposals for systems, which are considered most appropriate for potential development to the DSRVs - ALVIN, TAURUS, SHINKAI and SM 360. All are or will be deployed from a monohull vessel. An ALVIN system is described which is taken from a proposal by Woods Hole Oceanographic Institution for modifying ALVIN to single point launch and retrieval. Five additional concepts are described, in varying detail, from which the Woods Hole proposal was adapted. All are A-frame or U-boom, over the stern designs. A short description of the SM 360 (COMEX Industries) system is given, covering its pertinent parameters and its method of operation. The Perry Oceanographics design, for a 20 metric ton submarine is covered in more detail, including parameter specifics and drawings. The Techwest TUMS design is accorded an abbreviated description and the SHINKAI 2000 system is described in detail.

The second major section describes the semi-submersible launch and retrieval systems of two tethered and one untethered submersibles. These are the Mobile Diving Unit Launch and Retrieval System (MDU LARS), the MOB vehicles and the PC-18. The MDU LARS and the MOB operate tethered and are much lighter than the DSRVs, and therefore are of limited interest. The PC-18 operates untethered but is also much lighter than the DSRVs. It is of greater interest since it operates from a SWATH-type platform.

60068 Projected **Employment and Unitized Equipment Packages for CONFORM Salvage/ Rescue Scenarios, Final**
**SEACO, Inc., 07182, U**

This report describes the many MSNAP scenarios designated as the basis for developing CONFORM scenarios for the year 2000. Each scenario is accompanied by a recommended salvage/rescue operation. Details concerning required equipment and manpower, as well as conflicting factors affecting these items are highlighted.

Information concerning diving/salvage systems is presented, along with matrices listing the ARs installed, portable, and unitized systems required for each scenario.

Navigation, location, target classification and technical information availability problems occurring in general (deep water) salvage operations are presented as a matter of immediate concern.

In many cases, scaled plan views of the salvage ship are given, including equipment arrangements.

**60099 A Study of Electrical Loads of United States Navy Surface Combatants, Final Technical Study**
**SEA 56D5, 03/15/84, U**

The study described in this report is part of a larger R&D task to determine algorithms for forecasting ship service electrical loads early in the design process. The purpose of the study is to determine time varying relationships of ship parameters and electrical &ads for destroyers, frigates and guided missile cruisers. Load data was taken from DDG, FFG, CG, FF, DD and CGN-class ships, summaries are categorized into a 3-digit SWBS breakdown and the load distributions are collected into groups (after SWBS organization). Trends are derived by normalizing the load groups against ship parameters and are plotted with respect to time. The relationships are examined and compared; results for each group are presented in graphical and tabular form. In addition to time relationships, generating capacity trends and performance trends on heating, air-conditioning and ventilation loads are presented in figures. Electrical load summaries for each ship studied are tabulated, along with the tabulation of the load organization. Electrical and heating loads are each compared for the gas turbine powered ships. HVAC loads are also tabulated for the DDG-51. Electrical loads for the year 2000 are predicted by combining the study's resulting data with estimation of the influence of technological advancements.

**60100 Assessment of Surface** Ship Continuing **Concept Formulation (CONFORM) FY-82**
Feasibility **Design Study - Rapid Deployment Force SES Tug/Barge, Design Assessment**
**RMI, Inc., 09/02/83, U**

This report is an in-depth assessment of the rapid deployment force tug/barge design. The payload/platform performance is studied in detail, for both the tug/barge and the tug. Plots of drag and thrust versus speed in sea state 4 are given for both configurations. Comparisons of performance predictions for the tug/barge in sea state 4 are tabulated, and include weight, velocity, drag, percent efficiency, horsepower, number of propellers, and percent submergence. Comparisons of performance predictions for the tug alone include velocity, advance coefficient, percent efficiency, horsepower, RPM, and the number of propellers. Configuration of payload and platform are reviewed and the effects of varying the L/B ratios of the tug and tug/barge are investigated. Plots are given of drag and thrust versus speed for varying sea states. Size and manning margins are evaluated. One digit weight estimates for groups 100 - 600 are given, and suggestions for adjustments of these weights are made. Brief stability assessments are discussed, as well as assessments of hull structure, propulsion systems and electric plant. Risk assessments are reviewed in detail, and suggestions are made. A final tabulation of performance and risk comparison between the design study and the RMI assessment is given.

**60172 Salvage/Rescue Ship CONFORM Feasibility Study, Final**
Designers **and Planners, Inc., 12/83, U**

This study investigated the feasibility of combining the missions of a salvage ship and a: submarine rescue ship into one ship. Two monohull and two SWATH configurations were developed and investigated for deep water salvage and near-shore, shallow water rescue and amphibious salvage.

This study indicated that salvage or rescue missions may be performed with the same hull but that the two missions are also mutually exclusive. It was also concluded that a great many other subsystems needed further development and testing.

Arrrangements for the developed ships are presented along with assorted characteristic curves and tables such as comparative thruster curves, speed-power curves/power performance, ARS speed-polar diagrams, and righting arm/heeling arm curves.

**60237 Fire Support Ship Design Study, Final**
**Dec. Eng., 06101183, U**

This report describes a brief concept level study of Fire Support Ships (FSS), commissioned to support the preparation of a CLR. The FSS design requires minimum draft, maximum number of guns, point defense ASW and AAW, sustained speed greater than 25 knots, range greater than 4500 nm, stable seakeeping, good survivability, with

emphasis on fragment protection, and low radar cross section. A previously developed parametric ship design model was exercised to determine the ship characteristics and costs reported in the study. The program is documented in appendix II and a listing (in BASIC) is provided. A short rationale is included explaining the selection of study. A description of the larger (203-nm 36caliber) vertical load of the two guns considered is given as Appendix I.

The powerplant utilizes LM 2500 gas turbine prime movers, high-speed composite shafting and aft mounted hardened and ground gears driving semi-submerged propellers. Results of values for length, beam, draft, displacement and volume are shown for two to six guns of two sizes. Sensitivity to sustained speed was also determined. These variables are concluded to have a strong influence on the outcome of the study. Sketches and tabulated values of ship configuration and unique features are presented. The report concludes that FSS ships in the 4000 - 8000 ton range, meeting ground rule requirements and which are capable of great firepower for significant periods, can be designed.

60257 CONFORM Feasibility Design Final **Report Advanced Base Repair Ship, Final**
SEA 501, 03/01/84, u

This is a CONFORM Feasibility Design Report (FY83) for an Advanced Base Repair Ship for the year 2000. It is one of the several design studies produced each year by the CONFORM program to provide OPNAV with alternative feasible total ship concepts for varying IOC's and to provide R&D planners with feedback regarding future total ship impact of R&D alternatives.

The primary objective of the CONFORM Advanced Base Repair Ship study is to identify new concepts which could provide the mobile intermediate maintenance support required by U.S. Navy ships in the post 2000 time-frame as well as providing some mobility and flexibility to SIMA facilities.

Two complete feasibility designs have been developed. Both designs provide similar maintenance and repair functions and capabilities. However, each design represents a significantly different approach to providing these facilities on a mobile platform. One design, designated ABR(A), is of a self-propelled ship capable of performing all the functions normally assigned to current tenders and repair ships. The ABR(A) is intended to perform the same operational missions as the current AD, AR, and AS Class tenders. The second design, designated ABR(B), is of a non-self-propelled platform which carries only maintenance and repair facilities. The ABR(B) is intended to operate as a floating SIMA, performing its intermediate maintenance functions in one primary location, but capable of being relocated to another location if required by fleet operational needs. Personnel living facilities and other support functions which can be accommodated in facilities ashore or other support barges are not incorporated into the ABR(B). The ABR(R) will be dependent on Navy or commercial tugs for mobility. These two designs are intended to represent the range of capability which could be incorporated into mobile intermediate maintenance facilities.

The report describes in detail the feasibility designs. Included in the report presentation are descriptions of mission requirements; the technology base; the "ship design", which includes details on platform/payload performance, the configuration, margins, manning, hullform, weight and volume, stability and systems engineering; subsystems: R&D needs and technical risk; and, an assessment. Also included within the report, as appendices, are the CONFORM requirements, a conceptual illustration of automated work centers, weight estimates, and an area/volume summary. Provision of figures and tables is comprehensive. Some of the figures afforded are inboard and outboard profiles, arrangements, body plans, speed-power curves, floodable length curves, machinery/system schematics and a figure illustrating CPS pressure zones. The tables present, for example, such information as ship system technologies, performance and power requirements for handling systems, electrical loads, weights for propulsion and electrical plants and auxiliary boilers, weight and area/volume summaries hullform characteristics, electrical loads and CPS impacts.

**60279 Universal Shlp Contlnuing Concept Formulatlon Phase I - Final Report**
**SEA 501, 02/01/81, U**

This study investigates the feasibility of developing an envelope ship (hull, machinery and basic accommodations) to serve as the basic platform for a Universal Auxiliary Ship. The Universal Ship consists of the envelope ship dis-

cussed herein and a set of Mission Oriented Payload Packages (MOPPs). The Universal Ship can be reconfigured to meet various mission requirements by substituting appropriate MOPP sets.

The report describes the study, including such design aspects as the design philosophy and logic, efficiency of MOPP loading, propulsion, resistance, stability, machinery, propulsors, MOPP interface and design goals. Weight and area/volume summaries and principle characteristics are included in appendices and tables. Figures include lines and body plans of the Universal Ship configurations, sketches of the machinery arrangements and a midship section concept for the Universal Ship.

**60465 Technology Characterization Section for FY83 DS(X) - Submarine Destroyer**
**BLA, Inc., 12/82, U**

This paper summarizes the pros and cons of emerging concepts and systems being considered in the conceptual design of the DS(X) platform. Areas covered include hullform (SWATH, SES, Monohull, SECAT), survivability, propulsion systems and propulsors, lift systems, sonar, radar and auxiliary systems. In-depth discussion of technological trends follows, including the major topics listed above.

Information on systems engineering is presented. Requirements are provided for manning, reliability, and logistic support. Standardization and pollution control information follows.

**60466 Technology Characterization Section for FY83 LFS(X)-Landing Fire Support Ship**
**BLA, Inc., 12/82, U**

The paper summarizes the pros and cons of emerging concepts and systems being considered in the conceptual design of the LFS(X) platform. Areas covered include hullform (monohull, SES, SECAT, Catamaran), structures and materials (HSLA steels, composites), detectability, survivability, propulsion systems, propulsors, fans, and auxiliary systems. An in-depth discussion of technological trends follows, which includes the major topics listed above.

Information on systems engineering is presented. Requirements are provided for manning, reliability, and logistic support. Standardization and pollution control information follows.

**60497 Feasibility Study for a 120' Planing Hull Fast Attack Craft (PHFAC) Under Ships CONFORM, Final**
**NAVSEANORDET, 07/01/82, U**

This report describes the design of a high-speed 120-foot Planing Craft capable of entering the well deck of a base ship. The design is part of the Dispersed Strike task which consists of the development of an SES. hydrofoil and a planing craft. The proposed design is based on information from extensive full-scale 'testing and evaluation of the CPIC(X) prototype craft and evaluations (TECHEVAUOPEVA) of several other small planing combatants currently in the U.S. Navy. Past model test data was used to supplement the full-scale data.

The report affords principal characteristics, a l-digit SWBS weight breakdown including margins, speed power predictions, information on range endurance and fuel consumption, ride quality, structural, propulsion and auxiliary systems, the electrical plant, outfit and furnishings, stability and maneuvering. Figures include resistance, power, drag/weight, range, endurance, fuel consumption, acceleration, roll, pitch, and turn radius and rate versus speed: fuel consumption versus time; and, a schematic on the fire-fighting system. Inboard and outboard profiles, with deck arrangement are provided as are lines, offsets and curves of form. Stability curves, including a dynamic stability analysis, and floodable length curves are provided. The tables included present the principle characteristics, weight summary, scantling size and frame thicknesses, and, lists the elements of the fire protection system.

**60499 FY83 CONFORM Feasibility Design Summaries, Final**
**SEA 05R14, 06/01/84, C**

This report summarizes the designs developed in the FY84 CONFORM program. The designs included are the Advanced DDG (ADDG), Shallow Water ASW Craft (ASWPC), Patrol Combatant Multi-Mission (PCM), SWATH LPH,

**70202 Battle Group Escort (CGV) VSTOL Variants Enclavlng Assessment, Final**
**NSWC, 02/15/85, C**

The three configurations (Monohull. SWATH and SES) of the FY83 CONFORM CGV were "enclaved" to improve post-hit combat readiness. Enclaving is the subdivision of a ship into units with rearrangement, and possibly some duplication, of weapon and HM&E systems so that each subdivision, or enclave, can retain some combat capability in the event of loss of other enclaves. This report describes the enclaving methodology and applications to the three CGV designs. For each design application, the following are discussed: combat system distribution, battle organization, operational philosophy, weapon system readiness, HM&E systems requirements, and enclaving impacts. The study's application of enclaving is well supported through figures and tables. Among the tabulated data provided are enclaved combat elements and system services loads for each design, and, major functional space relocations. Appendices include descriptions of weapon system readiness after loss of vital components. Post-hit readiness improvements through snclaving are discussed with respect to cost in weight, volume and manning, for each of the three conform CGV designs.

**70238 Surface Ship Continuing Concept Formulation (CONFORM) N-82 Feasibility Design Study 3500-Tonne Surface Effect Ship as an LVT (Landing Vehicle, Tracked) Carrier**
**SEA 501, 08/01 /83, C**

One of two Surface Ship Continuing Concept Formulation (CONFORM) designs developed to enhance delivery of LVTs (Landing Vehicle, Tracked) from an amphibious force to shore is presented. This seif-deployable ship is designed to carry LVTs from the port of departure to within 2000 meters of the shore in the amphibious operational area. The 3500-tonne surface effect ship is capable of carrying 20 LVTP-7s and housing 500 combat-equipped troops. The ship, which can operate at speeds up to 40 to 50 knots, is driven by two LM 5000 gas turbines. These turbines generate 95 kilometric horsepower that the electric power train distributes to two 5-meter partially submerged, supercavitating propellers and two lift fans to provide ship's service power. The ship has a range of 2000 to 5000 nautical miles, depending upon load out, and carries a crew of 97. The LVT Carrier (ship) has an **IOC of 2000** and incorporates technology that can be available by 1992. The major technical risk is in the development of the superconducting electric power train, which will require increased funding to be ready for inclusion in the design. This report includes concept design requirements, drawings, ship weight breakdown, space allocation, and feasibility analysis for the LVT Carrier (ship).

70366 CONFORM Design **Impact Assessment Multi-Product Shuttle Ship ▪ Final Report**
**NSRDC 1213, 04/01/85, C**

This report documents a CONFORM Multi-Product Shuttle Ship (MPSS) study to investigate design alternatives for future Mobile Logistics Support Force (MLSF) shuttle ships which would be capable of delivering all consumable commodities required by the deployed fleet. Mission requirements are identified and a survey of related technology developments is conducted in attempt to provide increased cargo load mix flexibility and/or container utilization. Selected design alternatives are incorporated into an existing baseline design to assess their feasibility and resulting ship impacts.

The report presents the study's mission requirements, the technology base, design approach, alternatives and impacts approaches, R&D needs/technical risk, conclusions and recommendations. For each design alternative, load summaries and light ship weight impacts are provided as appendices. Figures are included as graphical representation of key design technologies for the design alternatives. Among the tabulated documentation included are a projected cargo demand range for the year 2000; cargo container characteristics for general, refrigerated and liquid cargo; MPSS alternative principle characteristics; baseline light ship weight and loads:, cargo capacities for flatracks and average containers, and, capacities for liquid, dry and ordnance cargo; and load mix flexibility with modified compartments.

**70417 FY84 CONFORM Feasibility Design Summaries, Final**
**SEA 05R14, 05/01/85, C**

This report summarizes the designs developed in the FY84 CONFORM program. The designs included are the Advanced DDG (ADDG), Shallow Water ASW Craft (ASWPC), Patrol Combatant Multi-Mlission (PCM), SWATH LPH, Multi-Product Shuttle Ship (MPSS), and the AFOE tighter. For each design included, the summaries consist of a description of (a) background information, (b) the mission requirements, (c) technology, (d) design results, (e) RDT&E needs, (f) conclusions and (g) recommendations. Characteristics of each design are afforded by tables. Figures included are those that support key technologies for the separate designs, including profiles and the MPSS alternate candidates. Also included is a figure illustrating the CONFORM Program funding profile up through FY84.

**70418 Surface Ship Conform Annual Compendium of Ship Designs and Innovations, Draft**
**NAVSEA 05R14, 04/01/85, C**

This document summarizes the numerous technology, design, and operational innovations employed in the Conform designs. The nature of this document provides feedback *to* the R&D community on new technologies and their use *in* future ship designs.

One section provides a summary of each design along with suggested uses in Material Force Levels. Another section provides a detailed listing of the innovations. The innovations are grouped by different areas of interest and presented in additional listings. Yet another section discusses each innovation in detail.

**70420 RPV Technology Forecast, Draft**
**06/25/88,** U

This report updates the status and technical data on the RDVS contained in Air Vehicle and Ship Compatibility Considerations for a USMC Combat Support System RPV. A table is provided which gives the following characteristics of both existing and conceptual RPV designs:

- Manufacturer
- Vehicle Name
- Gross Weight
- Payload Weight
- Endurance
- Range
- Ceiling
- Speed

Missions of the RPVs are identified. Advantages and disadvantages of fixed and rotary wing RPVs are discussed. Shipboard compatibility and methods of retrieval are presented. Projected weights and performance are estimated in tabular form, and trade-offs between internal combustion and gas turbine engines are made. Appendices provide data and sketches of both existing and conceptual RPVs.

**70421 Landing Ship Utility (LSU(X)) Assessment, Draft**
**Declslon Engineering, 02/01/84, U**

This report presents a parametric study and comparison of several monohull and surface effect ships (SES) performing the mission of a small open ocean amphibious assault ship, LSU(X).

Displacement, size, cost and power data were developed, using Decision Engineering's Landing Craft Synthesis Program, for the following series of ships:

(1) Monohull, 2 or 3 payload modules, 22 or 35 knots sustained speed and 2700, 4,000, or 8000 nautical-mile range, and

(2) **SES, 2 or 3 payload** modules, 22, 35 or 50 knots sustained speed and **2700, 4000 or 8000 nautical-mile** range.

Gas turbine and diesel power plants were considered **for each case. Also for each case, conservative** and optimistic estimates *were* made, based on the extent of technology development.

The results of the study are presented in tabular form as is **a** comparison with NAVSEA parametric studies. Extensive observations and conclusions are made as to how well the studies compare and it is stated that correllation, in **general,** is good but in need of work. Statements are also made as to which possible designs appear most promising. Nomenclature for the design program, the analysis program with nomenclature, and references are included.

**70422 FY84 CONFORM CLR Support Analyses EW Ship, Multi-Product Ship, Advanced DDG, Draft DELEX, 12/01/83, C**

This report presents the development of CONFORM genesis and mission requirements documentation in support of the FY84 advanced ship design program. Development of this documentation is based on investigations of design trade-offs using alternative Battle Group Concept Study (ABGCS) methodology.

The report compiles documentation for three CONFORM designs: EW Ship, Multi-Product Ship, and Advanced DDG. For the EW ship, the report presents information on ship, force and group level functions, mission operations, targets and threats. Scenario description and presentation of forces description, fuel consumption, ordnance utilization, and underway replenishment are included for the multi-product ship. Description of the ADDG design concept includes an aviation analyses and sortie analysis. Graphical support for design concepts are: EW ship yearly quarter breakdown of polar sterographic satellite relative cloud cover for the northern hemisphere over a three-year time frame; Multi-Product Ship - North Atlantic control campaign and sequence of events, North Pacific Strike Campaign and sequence of events, ABGCS limited war analytical methodology, fuel consumption curves; ABGCS high threat ordnance campaign, offensive aviation ordnance expenditure rates, replenishment demand data for high threat strike; AADG - baseline DDG and V/STOL DDG comparison for high and low threat cases, aircraft availability, and graphical representation of cyclic sortie generation. Tabulated data is provided for the key design technologies and figures.

**70423 26' Rigid Inflatable Boat CONFORM Feasibility Design Study Final Report NAVSEA 05RD, 06183, U**

The necessity exists to improve upon the *Navy's* 26' motor whaleboat (MWB) to increase speeds and operational sea states. This report covers a rigid inflatable boat (RIB) concept as the second generation 26' MWBs. Full scale tests of the RIB have been conducted under various conditions by the U.S.S. Scott and it has received enthusiastic revues.

The report contains some principal characteristics, an estimated performance envelope, performance and weight comparisons with the MWB, and horsepower (effective and shaft) versus speed curves in sea states 0 and 3. Vessel sketches are also included.

**70426 Concept Formulation of the Model 928-80 Hydrofoil Combatant Growth Variant of PHM - Hull Development, Revised Draft The Boeing Company, 10/07/81, U**

This document describes work done in conceptual design of the hullform for Boeing Model 928-80 Hydrofoil Combatant (Growth Variant of U.S. Navy Patrol Combat Missile (Hydrofoil) PHM-CLASS Ship). Discussed are displacement, hullform design, weights, longitudinal and vertical centers, and both intact and damaged stability. The failure of this design to meet vertical center of gravity stability criteria is discussed, including possible corrections.

**70427 Conform innovations and R&D Needs Applicable to Future Frigate Design, Final BLA, Inc., 07/85, C**

The NAVSEA Surface Ship Concept Formulation (CONFORM) program has since 1980 produced a large number of whole-ship advanced-iechnology design studies involving ship hull, machinery and electrical (H,M&E) and combat system innovations.

This report, prepared for NAVSEA/DTNSRDC, provides a categorized summary of the results obtained and the status of a total of 51 impact assessment and technology forecasting studies which were conducted under CONFORM funding and which are applicable to the design of future U.S. Navy frigates and for which RDT&E needs have been redefined.

**70428 CONFORM ABR (Advanced Base Repair Ships) Life Cycle Cost, Cost Estimate 05/31/85, U**

This report provides estimates of life cycle costs for the advanced base repair ships (ABR-A, ABR-B). Included in these estimates are development costs, investment costs, and operation and support costs. The report describes what items are covered in each of these areas. A table is presented listing rough cost estimates using FY84 dollars.

**70429 SWATH/Monohull Cost, Schedule and Producibility Study (Vols. I & II), Final Technical Report Bath Iron Works Corporation, 12/30/85, U**

This report is a man-hour and material cost comparison study of the design, construction and test of a 7100 full load displacement ton equivalent payload Small Waterplane Area Twin Hull (SWATH) and a. 5500 full load displacement ton monohull based on FFG-7 Class frigate cost returns and the NAVSEA-provided weight estimates for both ships. Cost, schedule and construction differences are analyzed and equivalent payload SWATH producibility recommendations are provided. Supporting data includes: a Master Program Schedule and three supporting schedules; a manhour and material cost breakdown by three-digit SWBS groups; arrangement drawings; assembly unit breakdown plan; detailed assembly unit plans; conceptual equivalent payload SWATH structural arrangements: program summary networks; electrical drive propulsion; FFG-36 combat suite, fin stabilizer steering control; systemway and equipment outfii packages; and modular diesel generator ships service generator.

**70430 Universal UNREP Shlp CONFORM Feaslblllty Study, Final SEA 5014, 08/24/85, U**

This report documents a CONFORM feasibility level design for a Universal Underway Replenishment (UNREP) Ship. The concept considered divides the ship into two entities - a portion containing five Mission Oriented Payload Packages (MOPPs) and a self-reliant Envelope Ship. MOPPs *are* designed to be floated in and out of the "U"-shaped after portion of the Envelope Ship, between the two side hulls, to tailor the ship to a specific mission. The area between the two side hulls is open to the sea. Total reconfiguration time will be less than 80 hours without the aid of special port facilities.

When five MOPPs are in place in an envelope ship, a Universal Ship is formed. This ship is a high speed combat support vessel capable of on-station duty. The study considered MOPPs for oiler (AO), ammunition (AE) and combat stores (AFS) missions. In practice MOPPs could be used in any combination and other special purpose MOPPs could be devised. This configuration is an evolution of two previous CONFORM designs (referenced) and was necessitated by an increase in the speed requirements to 28 knots with 120,000 shp. Additional requirements are: 3,700 mile range, 35 ft maximum loading draft, 35,000 cu-m payload volume, Panama Canal unlimited passage, twin shafts and rudders. The resulting design parameters are LOA of 822 ft, beam of 105 ft, draft of 29 ft (35 ft ballasted), displacement of 43,600 ft (full load), width of each divided hull of 26.25 ft.

The selected design utilizes state-of-the-art structural technology but will require extensive structural analysis during detail design. A cochleate shaped stern with bulbous (shrouded) shafts is fitted to improve propulsive coefficient. An integrated electric plant using three LM 2500's and two RACER's driving electric generators (per side) connected to water cooled electric motors is used for propulsion. Neither are considered state-of-the-art.

Major systems and subsystems are addressed in the study paper. Appendices are included for CLR, general arrangements, weights, hydrostatics, intact and damage stability, longitudinal strength, powering and fuel. A cost study (Acquisition and Life Cycle) is also included. A space estimate is called out but not included. Auxiliary equipment is not considered in detail but conceded to be of great importance.

The report concludes that the design as described meets the CLR, but that the integrated electric plant may not be feasible for a 1995 ship. The current hull design can accommodate other more conventional propulsion plants. Detailed studies of ship structure and ship motions, self propelled model tests, a propulsion plant trade-off study, a volume and arrangement study, a new weight estimate and detailed trim and stability studies are recommended.

70431 Rapid Deployment Force Push Tug/Barge **Concept Assessment, Interim Report**
**NSRDC 16, 01/01/82, U**

The Rapid Deployment Force Push Tug/Barge CONFORM Level Requirements are examined in light of surface effect ship technology application to that role. Analysis of the value of a vehicle that satisfies the CONFORM Level Mission Requirements is presented as well as the parametric sizing of surface effect ships configured to meet CONFORM level vehicle characteristics. Recommendations to mission requirements are included. The synergistic marriage between surface effect ship technology and the Rapid Deployment Force Push Tug/Barge role as well as potential problems are presented.

Throughput is graphically presented for the Multi-Purpose Ship (MPS), a conventional ship analagous to the MPS, and the SES Tug/Barge. Also included in the figures are an assembly sketch of the push tug/barge profile, a deliverable versus time illustration for cargo throughput and a planform view of the barge. Tabulated in the report are the physical characteristics of the ships used in the study and single-digit weight breakdown of the tug/barge combinations and various tug variants.

**70432 Parametric Analysis Landing Ship Utility, Draft Report**
**NSRDC 12, 01/01/85, U**

This report documents a parametric analysis performed to study several notional beachable landing ships (designated Landing Ship Utility (LSU(X)) to fill the role now performed by the Landing Ship Tank (LST). The technological goal for the study was to identify ways to overcome the limitations of slow speed and low payload fraction of the present LSTs.

The mission of the LSU(X) is to carry Assault Echelon Troops, vehicles and petroleum, oil and lubricants (POL) from U.S. ports directly to the beach. Once the initial payload has been discharged, the craft will continue to operate as a fuel shuttle. An IOC date of 2005 was assumed, requiring critical technologies to be approved for production not later than 1997. The major new technologies applied were SES and.catamaran (for study purposes, an SES with no air cushion) hull forms. Two sets of parametric feasibility studies were undertaken, one for a monohull and one for an SES/catamaran, using the ASSET and SESDOC computer models, respectively. Parameters which were varied are: maximum speeds 22, 35 and 50 knots; range of 2700, 4000 and 8000 nm; one, two or three payload modules. Range for all ships was calculated at 22 knots. All SES variants operated off-cushion at this speed. The payload module used was 559 tonnes of cargo and 150 troops. The figure of merit used to determine the relative performance of each variant was payload fraction: the payload weight divided by ship full load displacement. The single payload module ships have unacceptably low payload fractions at all ranges and speeds. At 22 knots the monohull designs are better. At 35 knots the SES's are better. The SES variants are most sensitive to range and payload changes while the monohulls react most strongly to speed and payload. Range has little impact.

(high-strength low-alloy steels, composites), detectability, survivability, propulsion units and systems, propulsors, fans, radar and sonar systems, and *more.* Each concept is also assigned a risk *factor.*

An in-depth discussion of design trends follows. This report includes details on many of the above concepts. Also presented are requirements for manning, reliability and logistic support. Standardization and pollution control are discussed as well.

59729 CONFORM Level Requirement **for ADR(X) ▪ Advanced Base Tender**
**MAR, Inc., 12/82, U**

This report outlines the foreseeable functions of the ADR(X). These include providing mobile base facilities for support, maintenance, and repair of cruisers, destroyers, and frigates; advanced ships that may be in the fleet; nuclear attack subs; and, embarked aircraft.

Group level as well as specific ship functions are examined. Payload requirements are outlined in detail, along with platform functions. Operational concepts are presented and threats are listed. Environmental and logistics factors are provided.

A technology characterization follows, including payload, platform and systems engineering. Included is a graph of percent time underway versus ship speed. The final section of design characteristics provides the design criteria and approach.

59730 Technology Characterization Section **for FY83 MCMH(X) Mine Countermeasures**
Helicopter **Ship**
**BLA, inc., 12/82, U**

The paper summarizes the pros and cons of emerging concepts and systems being considered in the conceptual design of the MCMH(Xj platform. Areas covered include hullform (SWATH, SES, SECAT, Monohull), structures and materials (HSLA steels, composites), survivability, detectability, propulsion systems, propulsors, fans and auxiliary systems. An in-depth discussion of technological trends follows, which includes major topics listed above.

Information on systems engineering is presented. This section gives requirements for manning, reliability, and logistic support. Standardization and pollution control information is also provided.

**59732 Risk Assessment on CONFORM Feasibility Designs, Memo**
**Surface Ship Concept Formulation, 03/10/83, U**

This memo is a guide for assessing risk associated with CONFORM feasibility designs.

**59735 CONFORM FY82 Requirements Deflnition Study ▪ LVT Carrier**
**Presearch, 12/01/82, U**

This report summarizes and documents the results of an investigation of required and desired capabilities for a future LVT carrier (ship/craft) **and** assesses the potential of alternate system (identified by the Naval Ship Research Development Center) to provide those capabilities. The amphibious operational environment, functional requirements, and future LVT characteristics establish the capabilities needed in a future LVT carrier (ship/craft). Alternate candidates for the LVT carrier role are evaluated in terms of those capabilities. The alternate platform types considered in the investigation are ACV, SES, SEACAT, planing hull, RBH (resilient buoyant hull), barge-like craft, inflatable craft and the conceptual PARLC (power-augmented-ram landing craft).

Multi-Product Shuttle Ship (MPSS), and the AFOE Lighter. For each design included, the summaries consist of a description of (a) background information, (b) the mission requirements, (c) technology, (cl) design results, (e) RDT&E needs, (f) conclusions and (g) recommendations. Characteristics of each design are afforded by tables. Figures included are those that support key technologies for the separate designs, including profiiles and the MPSS alternate candidates. Also included is a figure illustrating the CONFORM Program funding profile up through FY84.

**60627 Comparative Naval Architecture Analysis of the USSR Sarancha Class Hydrofoil (PGGH) and the USS Pegasus (PHM-1), Final**
**DTRC, 06/84, C**

This report compares the design of the Soviet SARANCHA (PGGH) and the USS PEGASUS (PHM-1). Performance, power, range, and seakeeping are compared. Various aspects of the technology applied in the two ships are also compared. Among the graphical support provided are the hydrofoil comparative Naval Architecture methodology, inboard and outboard profiles, transmission system schematics, speed-power, speed-range and payload-range curves, and comparative lift to drag ratios. Tabulated support include comparison of key physical and performance data and hull parameters, comparative combat systems, estimated SARANCHA manning analysis, and comparisons of weights and internal space. References and concluding remarks are afforded.

**60669** CGV **Conform Structural Design and Weight Estimate for Monohull, SWATH and SES, Final**
**DTRC, 06/84, U**

This report describes procedures used to perform structural design and weight studies for monohull, SWATH and SES versions of an '84. CGV air capable cruiser. Presented in the report is the comparative determination of loads including method, design criteria and factors of safety involved. These loads were used along with the structural synthesis design program (SSDP) to produce primary hull scantlings. From these primary scantlings weight estimates were performed. Sketches of midship sections are provided along with the general weight estimates, subdivided into three, six or seventeen categories depending on the design. A detailed breakdown is not provided.

**60718 CONFORM FY82 Requirements Definition Study - LVT Carrier, Final**
**Presearch, Inc., 12/82, U**

This report summarizes and documents the results of an investigation of required and desired capabilities for a future LVT carrier (ship/craft) and assesses the potential of alternate systems (identified by the Naval Ship Research Development Center) to provide those capabilities. The amphibious operational environment, functional requirements, and future LVT characteristics establish the capabilities needed in a future LVT carrier (ship/craft). Alternate candidates for the LVT carrier role are evaluated in terms of those capabilities. Those alternate platform types considered in the investigation are ACV, SES, SEACAT, planing hull, RBH (resilient buoyant hull), barge-like craft, inflatable craft and the conceptual PARLC (power-augmented-ram landing craft).

**60719 A Survey of Modern Marine Craft, Final**
**BLA, Inc., 08/84, U**

The report is a survey of the particulars of 63 military and commercial marine craft. Of the 63 craft, 18 are Air Cushion Vehicles, 9 are Surface Effect Ships, 26 are Hydrofoil Craft and 10 are Small Waterplane Area Twin-Hull ships. The majority of the craft selected for the survey are currently in operation. Wherever possible, a summary of the lessons learned in design, construction and operation has been included.

A description of the origin, general arrangement, hull structure, main machinery, electrical and auxiliary systems, outfit, experience and current status is given for each vessel. This information is accompanied by photos, basic sketches, and lists of references. Tabulated comparison of key design and performance parameters, including country designer, manufacturer, principal use, payload and total service time underway is also included.

**70479 Arctlc ACV**
**Arctec Engineering, Inc., 09/85, U**

This report was contracted to supply design input and review to support the Arctic ACV Program. Covered in the report are possible ACV operational problems and steps to be taken in future design stages to properly realize and compensate for these problems. Data is presented along with descriptions of environmental and operational conditions that are peculiar to the Arctic area. Reports are also included on ACV-Over-Ice model tests and USCGC Polar Sea Ice Breaking Load Tests.

**70480 CONFORM Combat Sulte for the Landing Fire Support Ship (LFS)**
**NSWC, 09/30/83, C**

The purpose of this study is to identify combat system and technology options for the Landing Fire Support Ship (LFS) whose mission is to provide sustained long range general fire support, interdiction and air defense suppression during all phases of amphibious operations.

The report discusses target/threat spectra, combat suite rationale, technology status of the LFS weaponry options, and ship platform selection. The report provides a supportive collection of figures and tables. Some of the figures included are combat system configuration, speed-time distributions for peacetime and wartime, range versus target distribution, and, various combat weaponry characteristics and payload profiles. Tables include weaponry options, equipment plan, and vehicle kill requirements. Appendices provide the LFS CONFORM level requirements, technical station of weaponry options, selection rationale for expendable weapon loadouts and LFS equipment, weight, volume and power data.

**70774 Twin Hull Ship and Sonar Mutual Impact Considerations w/Emphasis on Future FFX Platform, Tech Memo**
**Naval Underwater Systems Center, 08/06/85, C**

This report discusses future surface ship configurations and the mutual impacts of the ships and prospective future sonars. The monohull, SWATH, SES and one type of hydrofoil are potential platforms which match the projected missions for the 1990's and beyond. Particular emphasis is placed on the FFX baseline design. The type of hull mounted sonars which can be placed on the vessels are discussed, and the impacts associated with the performance of the platform and sonar array are reviewed. Recommendations for types of sonars which can be adopted to each ship are presented. The effect of the ship factors on the installation and performance of the array are also examined, especially with respect to problems associated with multiple hulls. Tables include array configurations, FFX baseline configurations and the SWATH weight study parameters. Figures include options for functional classes of surface ships, an extended performance hydrofoil concept, domed transmit, single-hulled transmit and split transmit array sketches, and, submarine acoustic tile installation schematic.

**70775 SWATH** Synthesis Model Enhancement • Volume II
**Gibbs and Cox, Inc., 09/85, U**

This report is the second of two volumes describing characteristics of the SWATH T-AGX. This volume deals with the auxiliary ship systems. A listing of general information including ship mission, complement, principal characteristics, propulsion and electric plant characteristics is given. A basic sketch (dimensions excluded) of the SWATH T-AGX is also provided.

The report presents detailed information on auxiliary ship systems. The system description, design assumptions, design development, SWATH design considerations, 3-digit weight breakdown, area/volume breakdown, and for each system, a list of references and a table of machinery is included. In many instances, basic arrangement sketches are provided (dimensions excluded).

Effectiveness, life-cycle costs, development needs and feasibility of the point designs are addressed. Included throughout the synopsis as comparative baselines are conventional monohull frigates and destroyers. Where information was made available, comparative data on the U.S. FFG 7, the US. DD 963, the NFR 90, the Italian Lupo class, the Spanish Descubierta class, the Canadian Tribal class and representative French and UK monohulls are included.

**71405 NATO Naval Armament Group Special Working Group (SWG/6) on Advanced Naval Vehicles - Assessment of Point Designs, Volume II, Assessment, Draft**
**NATO Naval Armament Group, 08/87, C**

This document is a draft working paper to report the status of the work performed by Special Working Group 6 (SWG/6) of the NATO Naval Armaments Group (NNAG). The purpose is to assess the feasibility, effectiveness and cost of the Advanced Naval Vehicles (ANV) which have been designed at the pre-feasibility level of detail by member nations of SWG/6. Results of work concluded by Canada, France, Germany, Italy, Norway, Spain, the United Kingdom and the United States in effort to provide recommendations by which nations can decide upon their future involvement in NATO applications of ANV technology are summarized. SWG/6 work on this particular project was initiated in 1984 with the development of Outline NATO Staff Targets (ONSTs) for Hydrofoils, **Surface** Effect Ships (SES) and Small Waterplane Area Twin-Hull (SWATH) ships, each ONST describing a multi-mission capability with emphasis on Anti-Submarine Warfare (ASW). The objective was to assess the feasibility of increasing the operational capabilities of NATO Naval Forces by augmenting existing and planned forces with new platforms capable of operating at high speed and maintaining high mission capability through improved seakeeping under all sea conditions.

The several designs developed by SWG/6 at the pre-feasibility level of detail, are accessed as to their military value, affordability and technical feasibility. The development needs for each are identified and most of these are currently being pursued by one or more member nations. The SWG/6 group believes the product of their cooperation effort is a sound basis of data and analysis from which the feasibility phase for NATO ANV Corvettes can be proceeded into whenever a convergence of national interests so indicates.

**71406 CONFORM Innovations and R&D Needs Applicable to Future Frigate Design, Draft**
**BLA, Inc., 04/85, C**

The NAVSEA Surface Ship Concept Formulation (CONFORM) program has since 1980 produced a large number of whole-ship advanced-technology design studies involving ship hull, machinery and electrical (H,M&E), and combat system innovations.

This report, prepared for NAVSEA/DTNSRDC, provides a categorized summary of the results obtained and the status of a total of 51 impact assessment and technology forecasting studies which were conducted under CONFORM funding and which are applicable to the design of future US. Navy frigates and for which RDT&E needs have been defined.

**71407 The CONFORM Program Ship Exploratory Design Study and ASW Suites of the Future**
**NAVSEA 05R, 08/29/85, C**

This report describes the results of a survey of the independent research and development programs of the major U.S. manufacturers of the anti-submarine warfare (ASW) systems. Also provided is an analysis of a suitable ASW system for various proposed platforms. An appraisal of the impact of new engineering 'technologies on the design of future Naval warfare ship systems is also included.

**71408 The Impact of Electronics Warfare on Future Ship Designs, Draft**
**JAYCOR, 04/15/86, U**

To a great extent the availability of Electronic Warfare (EW) systems for the future surface vessels depend on the foresight of the system manufacturers. This report describes the results of the examination or existing EW technol-

Fifty known monohulls are infeasible and 22 knot SES's are all catamarans (i.e., all operate off-cushion). A representative 2-module monohull has a maximum speed of 22 knots, range of 2700 nm, displacement of 5,138 tonnes, length, beam and draft of 123.7, 17.7 and 5.0 meters, respectively, and requires 9,800 metric horsepower. A representative 2-module SES has a maximum speed of 35 knots, range of 2700 nm, displacement of 5,734 tonnes, length, beam and draft (on-cushion) of 115.8, 29.0 and 2.3 meters, respectively, and requires 130, 199 metric horsepower. An SES has the advantage of being able to alter cushion pressure to aid retraction from the beach. All variants have steel hulls and aluminum deckhouses. All use "rubber" engines and propulsors (i.e. their size and weight are calculated by algorithms without regard to the specifics of available equipment). Controllable pitch propellers were used far all cases. Diesels were used for all 22 knot cases. Turbines in a CODOG arrangement were assumed for the 35 and 50-knot cases. No significant work was done in other SWBS areas.

All major risk areas are applicable to the SES variant and include developing a propulsor that can absorb 100 to 200 thousand horsepower and remain compatible with the beaching requirement, reducing1 drag for off-cushion cruise, and increasing cushion seal life. The study concludes that the LSU will be an effective part of a task force, the SES hull form is significantly more effective, two module ships are most effective, 2700 nautical mile ships are less vulnerable, 35-knot ships are most effective, and diesel powered vessels are more effective than gas turbine powered vessels. A 35-knot SES with 2700 nm range and 2-module payload capacity is recommended for further development.

References are given, including an FY 83 CONFORM report documenting a preliminary assessment of an LSU (X).

This repot-l was issued in draft form because of concerns raised during the study review. These concerns included the validity of ASSET and SESDOC comparisons, definition of the payload modules, the benefits of speed vs. cost and speed vs. survivability, and the effect of the 35 knot maximum speed on the monohull parameters. Additional specific comments are included in the margins.

**70433 Evaluation of Construction Costs and Constructability of Monohull and SWATH T-AG Acoustic Research Vessel, Cost Analysis**
**Blue Sea McClure, 05/85, U**

This report covers the *cost* and constructibility estimates given by four independent gulf coast shipyards for the construction of monohull and SWATH acoustic research vessels (T-AG). General vessel specifications including vessel data, system requirements, construction requirements, and general arrangements were supplied to shipyards from NAVSEA conceptual designs and extractions are included in the report. From these specifications each shipyard delivered cost estimates broken down into large subdivisions such as shell, superstructure, miscellaneous, and foundations covering hull structure estimates. Also included are construction schedules submitted by each ship yard. Comparisons are made between monohull and SWATH versions and also the T-AGOS SWATH already in production. Actual cost estimates, shipyard qualifications, and a short cost analysis briefing are included as appendices.

70434 Technology **Trends for Hull Structure Design of U.S. Navy Ships, Final**
**BLA, Inc., 06/82, U**

This report analyzes current and future technological trends for the structures of Navy surface ships. A series of Technology Data Sheets are included to provide guidance and usable design information for the structural designer and for design-synthesis studies.

**71069 High Speed Machhery Technology Part I: Seawater Pump Design, Preliminary**
**J.G. Strlcker, 10/84, U**

This report covers the overall weight impact of advanced lightweight pump design on ship weight. Although all pumping and fan systems would benefit from lighter pump weights, this report chose seawater, fire and flushing systems as examples. The computational basis for **advanced pump design** is based completely on the assumption that the technology of producing high speed pump systems proceeds (as projected) to **meet** theoretical expectations. The theory behind this design is well documented in the report and **a** full list of references is made available. Comparisons are made between existing and projected pump systems and a significant weight reduction was found. Figures are provided for inducer and overall efficiency versus specific speed, flow coefficient versus specific speed, and blade life in cavitating flow versus blade tip speed.

**71071 Predicted Seakeeping Performance of a Surface Effect Ship Frigate for Helicopter Operations, Final**
**DTRC 1630, 07/85, U**

The seakeeping performance of a surface effect ship (SES) frigate was predicted for conventional helicopter operations based on Froude scaling the Navy's SES-200 testcraft sea trials data, From these data, pitch and roll motion speed polar diagrams were generated for **a 4600** long-ton SES frigate (396-ft cushion length) for scaled sea conditions. Percent **time** of operation for the SES frigate was determined for each sea **condition** from these pitch and roll and other motion values. These percentages were then weighted with the percent occurrence of each sea condition and summed over the range of sea conditions to determine percent **operability.** This was done for four distributions of seas as a function of region, i.e., North Atlantic and northern North Atlantic and season, i.e., annual and winter.

**71072 Assault Follow-On Echelon (AFOE) Llghter Design and Mission Effectiveness Analysis, Technical Report**
**DTRC 1222, 09/01/85, C**

Four conceptual ACV (hoverbarge) assault follow-on lighters are explored through the feasibility design stage. Three low-speed hoverbarges and one high speed hoverbarge are developed. The designs *are* typified by simplicity, modularity, and high payloads. A mission effectiveness analysis of these designs incorporating existing and other conceptual craft proves the operational effectiveness of the hoverbarge concept.

This report documents the study's objectives; mission requirements: design approach: technology base; the mission effectiveness analysis.; descriptions of the conceptual designs including methodology, performance, principal characteristics, subsystems descriptions and margins; general information and principal characteristics of the existing craft; R&D needs/technical risk; and recommendations concerning modularity and land-propulsion. Included as appendices are reprints of a couple of referenced *reports,* excerpts from a description of the Enhanced Logistics Over-the-Shore (E-LOTS) model, and a description of the LVT carrier. Among the graphical support are craft sketches; container weight distributions for variant scenarios/designs; full-load displacement and total power variations with length and beam. Tables provide principal characteristics for the conceptual and existing craft; diesel, propulsor and lift fan characteristics for the hoverbarge; craft interface times from model data bases; comparative ship off-load times; required craft to maintain continuous ship off-loading; craft relative performance rankings, and, a operating cost comparison for AFOE cargo.

**71073 Naval Ship Concepts**
**Litton Systems, Inc., 07/86, U**

A major challenge exists in the integration and implementation of advanced **technology** into combat ship designs. **Ingalls IRAD** Program is primarily concerned with a number of critical development issues associated with applying existing advanced technologies to ship designs. The present goal of the Navy is a 600-ship fleet. In order **to** reach this goal, the Navy must take into account new ships and ships currently in use that will become obsolete or can no longer be modified to meet future predicted threats. These ships will require replacement by 1995. The technology required for the construction of these ships must be developed in the present time frame.

In defining future naval ship concepts, Ingalls IRAD Program will concentrate on developing and examining the technological trends that will have a major affect on naval ship design. The focus will be to determine the affect of existing technologies, develop new technologies for the ship design process, and new technologies on ship producibility from a shipbuilder's standpoint. The task is to consider the Navy's current programs and projected future programs that will result in new ship platform designs that will enhance the effectiveness of the Navy.

This report provides the details of the Ingalls IRAD Program. Major areas of study include the projected missions of the various ships and analyzing the systems that have to be integrated into the ship design and their impact on the ship design process and producibility. The projected threat of missile attack to naval ships, and the countermeasures to deal with this threat effectively, will have a major impact on future naval ship design.

These studies include the latest technologies in the areas of information network (command and decision) required by naval ships to pursue the required functions within the battle group. This includes' sensors, communications, command structure, and data handling. This is the nerve system of the combat capability of the ship. The bearing of these new and existing technologies and their impact on ship designs are evaluated.

Advanced weapon systems and their installation in future naval ship concepts are studied to evaluate design and structural problems associated with integrating weapon systems in surface ships. Future projected propulsion system enhancements and alternate propulsion systems are investigated. These, with all of the <auxiliary systems required in a modern naval surface ship, are evaluated, and trade-off studies are performed in order to establish optimum systems for future ships.

This project, herein reported, also evaluates future ship requirements. It establishes the potential objectives and merits for the individual IRAD technology tasks, which are a part of the total Ingalls IRAD Program. The results of the individual tasks are integrated into the ship design concept studies for total ship effectiveness. The principal ship concepts are divided into the following four tasks:

a. Surface Combatant Ships
b. Amphibious Ships
c. Air Capable Ships
d. Special Ship Concept Studies

71078 Fleet Command **Ship Exterior Communication Requirements Study, Part 1 of 2, Operations Analysis, Technical Report**
**Systems Exploration, Inc., C**

The purpose of this study is to provide an analysis of the communications requirements of the Fleet Command Ship (FCS) and the embarked Numbered Fleet Commander (NFC). The report includes the requirement of such a ship when operating in support of both the Atlantic and Pacific fleets. Specific requirements to support strategic and North Atlantic Treaty Organization (NATO) operations are included.

Based upon a review of the FCS CONFORM level requirements, the ship's mission requirements are developed. Required operational capabilities are identified and related to the mission requirements. An operational situation (OPSIT) and postulated operational event sequence are developed using a major Pacific Fleet Exercise (FLEETEX 85) as the model. Communication circuits and connectivities are identified. Information transfer needs are included and a loading analysis of these needs is conducted. A communication timeline analysis is provided illustrating the maximum simultaneous requirements for the NFC/FCS operating with a Battle Force, and, operating during independent operations. Communication sources supporting strategic, NATO and Allied requirements for the NFC/FCS are also identified. Each communication circuit is characterized by one or more circuit identification number(s) which represent a particular system or combination of equipment.

**71079 Fleet Command Ship Exterior Communication Requirements Study, Part 2 of 2, Tech Report**
**Naval Ocean Systems Center, 11/27/85, C**

This section describes the approach for determining the communication support requirements for the Fleet Command Ship (FCS). The communication requirements identified in Part I were examined for all operational situations, also outlined in Part I. A stressed communications scenario encompassing a five-day period was evaluated for a Battle Force environment. The communication circuits required to support the operational communication services for this stressed scenario were examined along with additional circuits required for other FCS operating situations:

- Battle Force environment
- Independent OPS
- Impart periods
- Search and Rescue/Distress OPS
- Strategic OPS
- NATO OPS

FCS ECS hardware requirements were identified and hardware translated into space, power and weight allocations.

71080 **Fleet Command Ship Exterior Communications Requirements Study - Part 3 of 3**
**Vulnerability, Assessment**
**Systems Exploration, Inc., 12/17/85, C**

This part of the Fleet Command Ship Exterior Communications Requirements study is a vulnerability assessment of the communication services. The navigation systems assessment is conducted for each of the navigation systems/capabilities. An assessment of the operational capability of the navigation systems/capabilities is made based upon an ionospheric disturbance/EMP environment, an ECM environment, the satellite capability intact and the satellite capability lost due to physical destruction. The assessment is made in a graduated sequence using the following categories: Capability Lost, Reduced Capability, Not Affected, Not Applicable.

An assessment of satellite communications service and navigation capability alternatives is made based upon the loss of satellites. An assessment is made if the alternative meets NFC/FCS mission requirements and if a technology shortfall exists. If a technology shortfall is indicated, a supporting narrative provides rationale for that determination. Figures and tabulated data are provided to support the assessments.

**71064 CONFORM Future Technology Assessment Oceanography and Oceanographic Vessel Design, Final**
**NAVSEA 501, 03/86, C**

The fundamental purpose of this report is to provide an introduction to oceanographic missions from the viewpoint of both the requirements writer and the ship designer. As such, it is an attempt to create a basis for the communication of mission requirements (and technological pressures) from the oceanographic vessel user communities to ship designers and planners. Oceanographic missions fall into four general categories:

- Ocean Survey
- Hydrographic (or Coastal Survey)
- Oceanographic Research, and
- Naval Oceanography.

Each of these missions has its own distinct requirements, and calls for a different set of ship characteristics and equipment. However, all oceanographic missions produce a single generic final product, namely information. The interim products vary in detail, but they can be rationally categorized in terms of the types of processes used to produce them in accordance with the principles of group technology.

In general, five functions are involved in any scientific mission:

- Data Acquisition
- Data Handling
- Data Storage and Transmission
- Navigation and Ship-Handling (supporting "scientific" process lanes), and
- Habitability and System Supports.

Using a systematic description of oceanographic missions in terms of processes, this study describes the history and projected developments of the process lanes. The projection provides a basis for the prediction of future ship requirements, and through those requirements, of ship configurations.

The group technology framework presented in this report is intended to serve as a basis for a detailed database of existing (and projected] oceanographic equipment, indexed by process lane. This base will be useful in design in developing a preliminary master equipment list of scientific subsystems, and for input to the weight estimate, electric plant load analysis, and fluids and HVAC design data. Such a catalog of equipment and systems would also serve as a basis for updating parametric analyses of ship impacts, incorporating developments in scientific gear. Appendices included cover mission requirements statements for an ocean survey vessel, coastal survey vessel, oceanographic research vessel, and a naval oceanography vessel; data acquisition equipment, laboratory, workshop and stores equipment and spaces; and, working deck areas and mission deck gear. Concluding remarks are included as well as a technology forecast and discussion on future developments of the group technology analysis.

**71085 Bistatic Sonar Reacquisition and Localization**
**Underwater Systems, Inc., 12/82, C**

This report examines two bistatic sonar concepts for the reacquisition and localization of a convergence zone contact held on a towed array: the "acoustic flare" and "deep julie." The purpose of these two systems is to first determine which convergence zone the contact is located in and then to provide sufficient localization for attack by LAMPS or a Surface ASW Standoff Weapon.

The assessments are well-supported by figures. Among those figures provided are detection areas covered in different convergence zones, an average deep-water ambient-noise spectra, aspect variation of submarine target strength, explosive sonar spectra for different charge weights, average velocity profiles, in different latitudes and in different seasons in an area between New Foundland and Great Britain, increase of echo levels or volume reverberation ratio as a function of bistatic angle, Deep Julie sonobouy deployment sequence, detection ranges versus charge weight, bistatic area coverage as a function of sensor separation, and geometry for localizing the contact using Deep Julies. Tables provide listings of required source levels for electroacoustical projectors, required source levels and charge weights for explosive sources, sequence of events for use of the Deep Julie to support LAMPS, and Deep Julie breadboard system detection score.

**71089 Advanced Base Repair Ship (ABR) CONFORM Design Risk Assessment, Preliminary**
**AME, Inc., 07/31/84, U**

This report discloses an assessment of the risks associated with automating certain work centers aboard the Advanced Base Repair Ship (ABR), a repair ship/tender described in a CONFORM Feasibility Report and being considered for an Initial Operating Capability in the year 2000 with an Approval for Full Production (AFP) date of 1992.

Two separate ABR concepts were addressed in the ABR CONFORM Feasibility Design Report. The first concept is a fully capable self-propelled ship, a mobile Intermediate Maintenance Activity (IMA) similar to the latest destroyer and submarine tenders. The second concept is a barge type platform with shop facilities only, a floating Shore Intermediate Maintenance Activity. Both ABRs could be tasked to provide intermediate level maintenance support to surface combatants (nuclear and conventionally powered), auxiliaries and amphibious ships, nuclear submarines and advanced ship and combat system technology which will be present in the U.S. Navy in the post-2000 time frame.

This report investigates seven work centers of the ABR:

- Metal Fabrication Center (Shipfitter, Sheetmetal, Welding Shop)
- Foundry
- Sandblasting/Coating Center
- Inside Machine Center
- Boiler/Pipe Center
- Electrical Repair Center
- Electronics Repair Center

Report findings have been produced in table format (appended) and are also contained in narrative summary in the text of the report. Risks have been assessed (criteria provided) and consequences arising from the risks then evaluated.

The report is not meant to provide design arrangements for the IMA industrial facilities nor for associated material handling systems. Recommendations for R&D efforts and general discussion of priority of system automation are included. These are based on *years* of previous experience in afloat IMA shop design and equipment selection. The comments are general in nature because no quantitative study has been made concerning future afloat IMA workload which would permit more precise definition of the most fruitful areas of personnel and cost savings. The conclusions and recommendations do however contain information which should be of assistance in planning future development work and preparing plans for ABR shop automation.

**71104 Analysis of Three Hull and Propulsion System Candidates for FFX Surface Ships**
**DTNSRDC, C**

Analysis of three candidate hull types - FFX monohull, SES and SWATH - has been conducted to estimate 1/3-octave band signatures to provide estimation formulas and to provide tactical discussion of general and specific noise control issues. Signatures are provided, along with discussion of the probable noise sources, levels and frequencies affected by the noise sonars. Figures and tabulated data are provided to support discussions.

**71106 LVT Carrier Assessment**
**Decision Englneerlng, 02/01/84, U**

During FY82 many LVT carrier concepts were investigated and three were chosen as the best of the group. The purpose of this study is to assess the relative value of these three concepts. Additionally, the LCAC is evaluated as a LVT carrier to determine its value when compared to the special purpose LVT carriers. The four vehicles evaluated are (1) a steel SES assault craft with an LVT capacity of 10, (2) an aluminum SES assault craft with a LVT capacity of 9, (3) a steel SES ocean-going ship with a LVT capacity of 20, and (4) the LCAC (ACV) with a capacity of 3 LVT. The first craft has diesel engine prime movers while the other vehicles have gas turbine powerplants.

A mission effectiveness computer model is developed to evaluate these LVT carriers. The model computes the mission success (fraction of LVTs that land successfully on the beach) degraded by enemy action and the costs of all ships and ship losses. Three measures of effectiveness (MOE) are computed for various enemy threat levels and task force sizes. The three measures of effectiveness are defined as mission success probability divided by fleet acquisition cost, operational cost or mission cost including losses. Also an increment cost benefit analysis was performed. In addition to the effectiveness analysis, the number of well deck spots required for the LVT carrier craft is determined for some typical task force sizes. While the study does not investigate the details of the landing assault operation, it does model the key aspects of the engagements.

Provided are tables listing the LVT carriers studied, evaluation approach measures of effectiveness, ship costs, target sizes, threat levels for long and short range missiles and the assessment results. Figures provide illustration of mission profiles and a mission model flow diagram.

**71109 Advanced Survivability Systems for FY82 Surface Ship Continuing Concept Formulation - Volume I, Draft**
**DTRC, 82, U**

This report is a draft of the investigation of armor concepts for deckhouses under the Surface Ship Concept Formulation (CONFORM) effort, fiscal year 1981. The task purpose was to identify needs and possible solutions for superstructure armor for cruisers, frigates and destroyers.

Potential weapon threat spectra are considered, from which are developed advanced multi-threat armor concepts. Concept effectiveness is evaluated and the concept of ship design integration is investigated including the effects on cost, design, producibility, and maintenance.

Those protection schemes considered are for countering external air blast or ballistic threats. This draft includes figures to illustrate and support the armor concepts discussed, their estimated effectiveness against appropriate conventional weapon threats, the locations of their incorporation into design of a conceptual cruiser; and, the consequent practicality, direct weight, growth weight, cost and impact are determined and illustrated.

**71170 Advanced Survivable Superstructure Concepts Application and Ship Impact, Final**
**G&C, Inc., 01183, C**

This report describes the means and probable ship impacts of installing twelve armor schemes on U.S. surface combatants. The CONFORM cruiser was used for the study due to its non-specific ship character. The basis of the study was that adding any weight to the superstructure would adversely impact various ship parameters and it was deemed necessary to determine the degree of that impact and the best means to accommodate it.

Tables support the proposed stand-off armor schemes and provide baseline characteristics of the CONFORM conventional cruiser, net armor effects with increased beam and with ballasting, and, net weight impacts due to the beam increase option and due to the added ballast option. Figures illustrate the armor impact options and performance versus added armor weight. Appendices afford weight and cost estimations, super-structure engineering, and ship impact engineering.

**71111 CGV inboard and Outboard Profiles - Version 3, Drawings**
**NAVSEA, 01/01/82, U**

Included in this complete packet of drawings for the CGV (3rd Version) are inboard and outboard profiles, deck arrangements for all levels, body plan, and midship section.

**71113 CONFORM FY84 Multi-Product Shuttle Ship (MPSS) Technology Characterization of Cargo Systems, Final**
**MAR, Inc., 04/84, U**

This report presents the findings of an investigation of the technology and equipment which will be required for MPSS to adequately perform its mission. Trends and developing areas of interest are identified. Where requirements beyond the scope of the current or projected technology were found, R&D needs were established and are identified. Three primary areas of investigation were targeted: flexibility of cargo mix, container utilization, UNREP and material handling systems. The report covers many aspects of logistics, transfer systems (Fast Automatic Shuttle Transfer (FAST) System, current and future UNREP systems), on-board material handling systems and equipment, cargo stowage, and, container and packaging technology. Design alternatives are presented. RDT&E needs discussed emphasize mission and logistics, the future UNREP systems and material handling, and stowage system.

The technologies herein presented are well-supported through figures and tabulated data. References are provided.

**71141 Surface Ship CONFORM Battle Group Escort (CGV) VSTOL Variants Monohull Design Feasibility Study, Final**
**SEA 501, 07/86, c**

The CGV design is one of several studies produced each year by the Surface Ship CONFORM program to provide OPNAV with alternative feasible total ship concepts for IOC's 20 years in the future and to provide R&D planners with feedback regarding the future total ship impact of R&D alternatives.

The concept and requirements for the CGV were developed as part of the OP-36 Afternative Battle Group Concept Study (ABGCS). Begun in 1978, the ABGCS had the purpose of examining alternatives to the existing carrier battle groups that could complement a carrier battle force just after the turn of the century (2001). The stimulus for the VSTOL CGV was a set of studies that showed the need for future battle groups to deploy large numbers of extremely long range offensive and defensive missiles in concert with high endurance surveillance and targeting VSTOL aircraft.

A unique aspect of this particular CONFORM study was to develop candidate designs using three diverse hull forms, namely a conventional monohull, a Small Waterplane Area Twin-Hull (SWATH), and a Surface Effect Ship (SES).

This report describes the monohull version of the CGV VSTOL. Included is discussion of mission requirements; the technology base; ship design description, including payload/platform performance, configuration description of payload and platform, margins, hullform, weights and space, stability and seakeeping; systems engineering; subsystem description; and, R&D needs/technical risk concerning hull structure, propulsion, rrlectric plant, command and communication, auxiliary systems, outfit and furnishings and armament. The design description summaries are well-supported by figures and tables. Appendices provide general arrangements, space and weight estimates, APU-powered speed estimate, and an analysis of the anti-air warfare (AAW) capability of the VSTOL Aviation Guided Missile Cruiser (CGV(V)). Recommendations and concluding remarks are included.

**71188 CONFORM Feasibility Design Report - Arctic ACV, Final**
**SEA 501, 09/01/85, C**

This report documents the results of the FY85 Surface Ship CONFORM Design Study for an Air Cushion Vehicle (ACV) suitable for submarine replenishment and general search and rescue duties in the Arctic. Two complete feasibility designs were developed. The first design was developed with aid of the CONFORM ACV Design Synthesis Math Model. The second design evolved as a derivative of an existing U.S. production craft the LCAC, and as such offered a lower risk, but less capable, approach.,

The report documents the study's objectives, approach and background Arctic ACV experience, mission requirements, the technology base, design description, subsystems description, R&D needs/technical risk, conclusions and recommendations. CONFORM level requirements, environmental factors, computer input and complete output for a selected concept design, lessons learned from AACV operations, sea ice conditions influencing ACV base selection, and a summary of CONFORM technology, design and operational innovations and RDT&E needs for CONFORM AACV's are included as appendices. The figures and tables afforded are of a comprehensive group supporting the key design technologies, including parametric and sensitivity studies.

**71192 Technology Trends for Propulsion Plants for U.S. Navy Ships, Final**
**BLA, Inc., 06/82, U**

This report documents the state-of-the-art of some technological aspects of the propulsion machinery of current U.S. surface combatant ships and attempts to make projections for future developments. A series of Technology Data sheets are included which present the data accumulated in a concise manner and which provide algorithms or procedures which are intended to be suitable for use in ship design-synthesis programs. As further information becomes available, it is anticipated that the Technology Data Sheets should be expanded and updated.

**71259 CONFORM Feasibility Design - Fleet Command Ship - Final Report**
**SEA 05, 12/01/86, C**

This report describes a study to define a feasible command ship, of new constructions, **for a numbered fleet** commander and to direct research and development by identifying **shortfalls in** technology **so** that anticipated needs can be met. The report includes mission requirements; description of the technology base, design approach and subsystems; and R&D needs/technical risk, conclusions and recommendations. The CONFORM level requirements, general arrangements, and two-digit weight and area/volume **summaries** are included as appendices. Graphically represented are inboard and outboard profiles, midship scantlings and configuration, a machinery box sketch and helo and RPV facilities schematic. Tabulated are manning and accommodations, **a** two-digit weight summary, single-digit area/volume summary, propulsion and electrical plant weight summary, electric load summary, and exterior communication system requirements.

**71260 FY83 CONFORM Feasibility Design Study - ASW Destroyer - DS(X), Final**
**SEA 05R, 01/01/87, C**

This report summarizes results of a study of an Anti-Submarine Warfare (ASW) destroyer which employs advanced sonar systems, V/STOL aircraft, ASW stand-off weapons, and defensive mine-laying capability, allowing the ship to operate independently or as part of a Surface Action Group (SAG) or Carrier Battle Group (CVBG). This ship is envisioned as a potential replacement for the DD 963, offering enhanced ASW detection and prosecution capabilities. Such a platform, with S3-configured V/STOL aircraft, has been shown to offer a promising approach to achieving attribution of hostile submarines operating against a CVBG in the open ocean. Four different designs were developed to satisfy the DS(X) mission: a monohull, a Small Waterplane Area Twin Hull (SWATH), a Surface Effect Ship (SES) and a SES catamaran (SECAT).

The report describes the general requirements, technology base, design approach, subsystem descriptions, R&D needs/technical risk, general conclusions and recommendations for each of the four ship designs. Included as appendices are the CONFORM level requirements, general arrangements, 3-digit weight estimates, area/volume estimates, combat system performance, V/STOL aircraft analysis and electric drive information. Graphically represented are war and peacetime speed-power distributions; combat system connectivity; sonar equipment location; SWATH acoustic apertures; VDS and weapon suite for the SWATH; monohull body plan: baseline propulsion plant; SES drag-velocity curves; speed-power curves for sea states 3 - 6; SES and SECAT midship section; and a propulsion plant schematic for the SES DS(X). Tables are included as supportive representation of key design technologies.

**71290 Surface Ship Continuing Concept Formulation (CONFORM) FY86 Feasibility Design Study, Final Report, NATO ASW Hydrofoil**
DTRC 1222, 10186, C

The NATO ASW Hydrofoil is a feasibility level design that meets the performance requirements as defined in the "Outline NATO Staff Target for a NATO Open Ocean Hydrofoil." The ship is designed to meet the operational requirements, to minimize the technical risks, and to reduce costs. All major systems and subsystems are identified and described. Performance predictions have been made; survivability and vulnerability, and, ship interfaces and limitations are discussed. Technical risks are identified and evaluated. Also provided are logistics considerations and life-cycle cost estimates. Appendices provide a 3-digit weight breakdown, area/volume summary, manning analysis, hydrofoil propulsion system summary, electric load analysis, alternate combat system equipment analysis, baseline combat system equipment description, foil/strut material description and fabrication technique, and weight impact studies. Concluding remarks and recommendations are included.

**71293 FY86 CGBL Continuing Baseline Design Report, Final**
**SEA 501, 01/87, C**

The objectives of the FY86 CGBL efforts were to define the CGBL baseline design, establish a procedure for assessing new features and technologies, and establish a procedure for updating the baseline design. (Once these

procedures are established, the baseline design will be updated every 3 years, with assessments being carried out in the interim to determine which feature/technologies to include in the new baseline.) This report describes the CGBL FY86 baseline design only.

In detail this report covers mission requirements; the technology base including projected technology dates and technical risk constraints; ship design description including combat system/platform performance, configuration description of combat system and platform arrangements, margins, manning, weights and space analysis, stability and seakeeping, and systems engineering including a cost assessment; subsystem description; and, R&D needs, technical risks, and assessments. These areas covered are fully supported by graphics and tables. Appendices provide ship arrangement drawings, weight estimates, structural analysis, space report, machinery arrangements, endurance fuel calculations and the seakeeping analysis. Recommendations and concluding remarks are also included.

**71326 NATO ASW SES CORVETTE, Vol. I, Final**
**NAVSEA 50151, 09/86, C**

A 1950-ton corvette was designed for NATO SWG/6. It was one of three ASW SESs designed by the USA, France, and the UK. It is a high L/B ratio craft with a 55-knot top speed. Its mission is to escort surface convoys and provide them with ASW protection. It uses the Sprint and Search method of ASW screening. The design is presented to the Feasibility level of detail, where principal characteristics, performance, subsystems, survivability and vulnerability, and ship interfaces and limitations are summarized with complete support from figures and tables. Appendices (Volume II) provide description of the employed sonar system, propeller design, the structure design with a comparison of structural scantlings, the auxiliary systems, a weight estimate, area/volume summary, and structural drawings provided by the Federal Republic of Germany. Lift-cycle cost estimates, technical risk and recommendations are summarized; concluding remarks are included.

71327 NATO SES ASW Corvette, Volume II, Appendices, Final
NAVSEA 501, 05/86, U

A 1950-ton corvette was designed for NATO SWG/6. It was one of three ASW SESs designed by the USA, France, and the UK. It is a high L/B ratio craft with a 55-knot top speed. Its mission is to escort surface convoys and provide them with ASW protection. It uses the Sprint and Search method of ASW screening. The design is presented to the Feasibility level of detail in Volume I, where principal characteristics, performance, subsystems, survivability and vulnerability, and ship interfaces and limitations are summarized with complete support from figures and tables.

This volume provides the appendices which support the detailed feasibility design of Volume I. The technologies covered as appendices are:

Propeller design
Structural design
Comparison of structural scantlings
Criticality analysis
Drainage system
HVAC system
Fresh water system
Fuel system
Compressed air/nitrogen system
Fire extinguishing system
Hydraulic system
Refrigeration system
Weight estimate
Area/volume summary
Bell-Textron report (propeller design)

- Sulzer-Escher Wyss report (propeller design)
- Structural drawings (provided by the Federal Republic of Germany)

**71328 CONFORM Technology Characterization and Ship impact Assessments of Technologies Applicable to DDG 80 Design**
**NAVSEA, 06/81, C**

This report describes technology innovations and technology surveys which have been explored by the CONFORM Program and summarized in the 1985 CONFORM Compendium of Ship Designs and Innovations and which are applicable to DDG 80 design. It also contains Technology Characterizations developed for the 1987 CONFORM Compendium which also support the Ship R&D Strategy Team initiative.

**71388 Application of Ice Strengthening Criteria to Surface Ship Feasibility and Preliminary Design Studies, Final**
**DTRC 1222, 09/86, U**

This report evaluates the feasibility of using ice strengthening criteria for monohull, surface combatants during the feasibility or preliminary design stages. A literature search was conducted to determine what ice strengthening criteria are presently in use, both commercial and military. Based on an evaluation of these criteria, a design standard was chosen and applied to a notional surface combatant. The resultant changes were analyzed using the Advanced Surface Ship Evaluation Tool (ASSET) to determine the total ship impact. Graphical support includes design ice pressure comparison for constant power, and for constant displacement, an ice belt comparison, a notional DDG shell expansion drawing, and illustration of structural weight addition versus design ice pressure. Among the information included in tables are comparison of plating and framing factors of safety, ice load design pressures and the load bearing capacity of the DDG-51 plating and framing, structural weight additions, predicted stability changes, and, weight and CG changes. Appendices provide sample calculations, an ice strengthening criteria summary, ice terminology and ice climatology information. Conclusions were made regarding the applicability of ice strengthening criteria in early stage design.

**71389 Three Conceptual Designs for Short Takeoff Arrested Landing ASW/ASUW Aircraft, Final**
**DTRC 1660, 08/86, U**

Three conceptual designs for short takeoff arrested landing (STOAL) aircraft capable of conducting ship-based antisubmarine warfarer'antisurface warfare missions are revlewed. Designs include both mechanical and propulsive lift systems. Propulsive lift systems reviewed are based on the circulation control wing concept combined with upper surface blowing or a deflected slipstream. The impact of the lift system and propulsion system of each design on the deck length and wind over deck required for takeoff is identified. For the three designs the length of the deck run required for takeoff varied from 800 feet with the assistance of a 4-deg bow ramp to less than 400 feet. Figures provide illustration of the Lockheed STOAL aircraft design, the circulation control wing concept, lift-drag comparisons for a conventional and circulation control wing, various takeoff performance analyses of the circulation control wing, and a twin-engine configuration of the circulation control wing.

**71399 CONFORM Feasibility Design Mobilization Frigate (MOBFF), Final**
**SEA 501, 01/87, C**

During Total Mobilization there will be a need for a large number of escort ships to replace or supplement those existing at the outbreak of hostilities. The Mobilization Frigate (MOBFF) is a design for such an escort with the emphasis on rapid producibility at third-tier shipyards. The report proposes a design plus several alternatives that employ off-the-shelf components and more easily produced hullforms. An examination of the U.S. industrial base with respect to shipbuilding and specific characteristics that make ships more readily producible, are included. Graphical support include monohull variants, profiles and level arrangements, weapons and sensors, proposed diesel and gas turbine drive systems, body plans, floodable length curves and midship section. For the SWATH variant principal dimensions, weapons and sensors, and an outboard profile are provided. Tabulated data for the monohull variants include a single-digit weight comparison, area summary, a transverse stability comparison, shipbuilding

costs, and alterations of the FFG 7 combat suite to suit the MOBFF. Design characteristics and a single-digit weight estimate is included for the SWATH MOBFF variant.

**71400 Surface Ship Continuing Concept Formulation FY83 Feasibility Design Study Battle Group Escort (CGV) VSTOL Variants, Final**
**G&C, Inc., 06/87, C**

The CGV design is one of several studies produced each year by the **Surface Ship** CONFORM program to provide OPNAV with alternative feasible total ship concepts for IOC's 20 years in the future and to provide R&D planners with feedback regarding total ship impact of R&D alternatives. This report describes the study results of three designs for a Battle Group Escort (CGV), an AEGIS cruiser with the capability of supporting a limited number of short take-off and vertical landing (STOVL) aircraft. Detailed information on each design can be found in the appropriate volume:

| | |
|---|---|
| Volume I | Comparative |
| Volume II | Monohull Design |
| Volume III | SWATH Design |
| Volume IV | SES Design |

The designs are well-supported by figures and tabulated data. Among those figures provided are various aircraft dimensions, combat system arrangements, body plans, structural sections, machinery arrangements for each design, and a combat system block diagram. Tabulated data include summary characteristics of the CGV variants, HM&E equipment risks, weapon suite equipment plan, aircraft spotting summary, endurance capabilities, margins, manning, weight estimates, area summary, survivability features, maintenance area requirements, and a summary of major powering machinery equipment for the three designs. Technical risks are discussed for SWBS groups 100 - 700. An assessment is provided along with recommendations and concluding remarks.

**71401 Surface Ship CONFORM Battle Group Escort (CGV) VSTOL Variants SWATH Deslgn Feasibility, Final**
**SEA 501, 04/87, C**

The CGV design is one of several studies produced each year by the Surface Ship CONFORM program to provide OPNAV with alternative, feasible total ship concepts for IOC's 20 years in the future and to provide R&D planners with feedback regarding the future total ship impact of R&D alternatives.

The concept and requirements for the CGV were developed as part of the OP-96 Alternative Battle Group Concept Study (ABGCS). Begun in 1978, the ABGCS had the purpose of examining alternatives to the existing carrier battle groups that could complement a carrier battle force just after the turn of the century (2001). The stimulus for the VSTOL CGV was a set of studies that showed the need for future battle groups to deploy large numbers of extremely long range offensive and defensive missiles in concert with high endurance surveillance and targeting VSTOL aircraft.

A unique aspect of this particular CONFORM study was to develop candidate designs using three diverse hull forms, namely a conversational monohull, a Small Waterplane Area Twin-Hull (SWATH), and a Surface Effect Ship (SES).

This report describes the study results of the Small Waterplane Area Twin-Hull (SWATH) CGV VSTOL version. The SWATH design description is well-supported by figures and tabulated data. Among those figures provided are various aircraft dimensions, combat system arrangements, body plans, structural sections, and machinery arrangements for the SWATH design, a combat system block diagram, countermeasure and launching system, torpedo defense system, towed array handling, equipment and subsystem illustrations, aircraft elevator concept, and a high energy laser weapon system. Tabulated data include summary characteristics and key features for the SWATH, HM&E equipment risks, weapon suite equipment plan, aircraft spotting summary, endurance capabilities, margins, manning, weight estimates, area/volume summary, survivability features, seakeeping criteria, communications equipment required for the SWATH, and a summary of the auxiliary systems for the SWATH. Technical risks and an assessment are provided along with recommendations and concluding remarks.

**71402 Surface Ship CONFORM Battle Group Escort (CGV) VSTOL Variants SES Design Feasibility Study, Final**
**SEA 05, 04/87, c**

The CGV design is one of several produced each year by the Surface Ship CONFORM program to provide OPNAV with alternative feasible total ship concepts for IOC's 20 years in the future and to provide R&D planners with feedback regarding the future total ship impact of R&D alternatives.

The concept and requirements for the CGV were developed as part of the OP-96 Alternative Battle Group Concept Study (ABGCS). Begun in 1978, the ABGCS had the purpose of examining alternatives to the existing carrier battle groups that could complement a carrier battle force just after the turn of the century (2001). The stimulus for the VSTOL CGV was a set of studies that showed the need for future battle groups to deploy large numbers of extremely long range offensive and defensive missile in concert with high endurance surveillance and targeting VSTOL aircraft.

A unique aspect fo this particular CONFORM study was to develop candidate designs using three diverse hull forms, namely a conversational monohull, a Small Waterplane Area Twin-Hull (SWATH), and a Surface Effect Ship (SES).

This report describes the study results of the SES version CGV VSTOL design. The SES design description is well-supported by figures and tabulated data. Among those figures provided are various aircraft dimensions, combat system arrangements, body plans, structural sections, and machinery arrangements for the SES design, a combat system block diagram, countermeasure and launching system, torpedo defense system, towed array handling, equipment and subsystem illustration, aircraft elevator concept, and a high energy laser weapon system. Tabulated data include summary characteristics and key features for the SES, HM&E equipment risks, weapon suite equipment plan, aircraft spotting summary, endurance capabilities, margins, manning, weight estimates, area/volume summary, survivability features, seakeeping criteria, communications equipment required for the SES, and a summary of the auxiliary systems for the SES. Technical risks and an assessment are provided along with recommendations and concluding remarks.

**71403 Landing Fire Support (LFS) Ship Design Study, Technical Report**
**DTRC 1222, 10186, C**

Feasibility design study results for several Landing Fire Support (LFS) ship alternatives are presented. Ship alternatives include five new-construction designs for five unique combat suites and two merchant ship conversions to accommodate two of the combat studies. These studies are sponsored by the Surface Ship Continuing Concept Formulation (CONFORM) Program. The Landing Fire Support Ship concepts in this study provide a single-mission solution to the requirement for providing amphibious assault fire support for the pre-assault, assault, post-assault phases of an amphibious operation.

**71404 NATO Naval Armament Group Special Working** Group **6 (SWG/6) on Advanced Naval Vehicles, Assessment of Point** Designs, Volume **1** Synopsis, Draft
**NATO Naval Armament Group, 08/87, C**

This report is a synopsis of the results of an assessment study conducted by Special Working Group 6 (SWG/6) of the NATO Naval Armaments Group (NNAG) in an attempt to provide **a** sound basis upon which nations can decide on their future involvement in the area of application of Advanced Naval Vehicles to the NATO Anti-Submarine Warfare (ASW) mission. The nations developed Outline NATO Staff Targets (ONSTs) with principle emphasis on ASW requirements. Each ONST, however, exploited each platform's unique characteristics and included different performance goals and thresholds. These ONSTs were subsequently approved by the NNAG. Five nations developed pre-feasibility level "Point-Design Studies," based on these ONSTs, of five ships designed for operational service in the year 2000. The designs initially included three SES developed by the United Kingdom, France, and the USA with input from the Federal Republic of Germany, one Hydrofoil developed by the USA and one SWATH developed by Canada with USA input. Subsequent to initial assessment, the study was **expanded** to include, where possible, a Spanish SES design and a Canadian Low-Cost Hydrofoil option.

ogy, including the independent research and development (IR&D) programs of a major US manufacturers of EW and Command, Control, Communications and Intelligence ($C^3I$) systems, investigation of the feasibility of developing a shipboard Electronic Battle System (EBS) and the impact of an EBS on the current Surface Ship Continuing Concept Formulation (CONFORM) Program ship designs. The study attempts to assess the applicability of current EW systems and developing technologies to future surface ships, and to investigate current corporate independent reserach and development (IR&D) programs suitable for inclusion in EW systems.

**71447 Surface Shlp CONFORM Shallow Water ASW Ship (ASWPC), Final**
**NAVSEA 501, 08/87, C**

The ASWPC design is one of several studies produced each year by the Surface Ship CONFORM program to provide OPNAV with alternative feasible total ship concepts for IOC's 20 years in the future and to provide R&D planners with feedback regarding the future total ship impact of R&D alternatives. The ASWPC design was proposed as a look at the needs for combating submarines in shallow coastal waters contiguous to the continental U.S.

This report describes the results of a monohull and surface effect ship (SES) Shallow Water ASW Patrol Craft. Figures include general arrangements, profile and plannings for both variants, resistance and power versus speed for the SES in various seaways, structural midship section for the SES, machinery arrangements for various configurations for the monohull, and, a baseline plant machinery arrangement for the SES. Tables provide summary characteristics; SES maximum sustained speed and maximum hullborne speed (with electric: and direct drive) in various seaways at full-load displacement; design acquisition margins; area/weight summaries; machinery plant weight estimates and plant characteristics; and, the ASWPC combat system. Appendices include life-cycle costs, propeller trade-off study, and ASWPC shallow water conditions.

**71448 Surface Ship CONFORM Technology Engineering Electric Power Dlstributlon, Final**
**D&P, 09/86, U**

The CONFORM Program is investigating advanced concepts for Naval ships and the associated technology required to design and produce them. To assist in this goal, in-process and planned Navy electrical power system/component and companion power system protection and control technology development programs for possible application to post-1995 ship acquisitions were identified. Their program objectives, payoffs, products, current status, life cycle managers and performing activities are given. Estimated size, cost and weight payoffs are given in quantitative terms where available. Recommended additional efforts are detailed.

**71530 CONFORM FY86 Feaslblllty Deslgn Study Addendum NATO SES ASW Corvette, Final**
**NAVSEA 50151, 05/01/87, C**

In response to the NATO SWG/6 Chairman's Assessment Team, the U.S. SES designer has presented additional data on Seakeeping, Cushion airflow, resistance, and stability. The data supports the original predictions in these areas. Additional data is also provided on weight, which shows that the SES uses different systems and procedures from conventional ships. These differences are identified and highlighted. The ship impact of staying with conventional practice is also given. Supportive figures include the NATO ASW SES body plan, the SES modelled as a SWATH, sea state 0, hullborne resistance, and a lift fan flow-speed curve for heavy ship test condition at various fan rpms. Tables provide the SES principal characteristics, hullborne drag values, cushion air flow versus sea state characteristics, wave pumping calculations and weight estimates for SWBS groups 200, 300, 500 and 600. Provided as appendices *are* seakeeping estimation results, lenticular hull resistance prediction, and, SWATH resistance estimation and tool validation plots.

**71531 FY86 Continuing Concept Formulation (CONFORM) Variable Mission Aircraft Platform Feasibility Study, Final**
**G&C, Inc, 08/87, C**

This report summarizes the results of a study of an IOC 2005 Variable Mission Aircraft Platform (VMAP) which has the capability to operate different types of aircraft as its mission changes. By using different airwings, the VMAP could support CV Battle Groups, Surface Action Groups, Underway Replenishment Groups, Amphibious Groups, or act as an escort to convoys. Up to 21 aircraft (depending on their mix) can be accommodated. Two hullforms were developed, a monohull and a Small Waterplane Area Twin-Hull (SWATH).

The report covers mission requirements, the technology base, ship design description and subsystems descriptions. The ship design description includes payload/platform performance, aircraft support facilities and platform arrangements, margins, manning, weights and space, stability and seakeeping, and, systems engineering. Figures and tabulated data fully support the report's summarization of the study results. Appendices include weight and space estimations, machinery studies, seakeeping support, aviation facilities and general arrangement drawings.

**71573 CONFORM FY85 Feasibility Design Study, Final Report, SWATH T-AGX**
**NAVSEA 501, 09/87, C**

This report documents the results of the FY85 Surface Ship CONFORM Design Study for a SWATH T-AGX using a common hull approach. The report includes designs for four ship types (T-AGOS, T-AGI, T-AGOR and T-AGS) all designed to a common hull with common subsystems. The study is one of several design studies produced each year by the CONFORM program to provide OPNAV with alternative feasible ship concepts for varying IOC's and to provide R&D planners with feedback regarding future total ship impact of R&D alternatives.

The report discusses in detail mission requirements, the technology base, ship design description and subsystems descriptions. The design description covers payload/platform performance and arrangements, performance and size margins, manning, hullform size, weights and space, stability and seakeeping and system engineering including acquisition and life-cycle costs. Appendices are provided to detail the weight and space estimates, the structure, seakeeping and damage stability analyses, and the cost analysis. Figures provide inboard and/or outboard profiles and deck arrangements for the four designs, and, strut/haunch and lower hull plans for the T-AGOS and T-AGOR designs. Tables afford T-AGX design and operational parameters, and performance margins and accommodations; also provided are one-digit weight estimates for each of the four designs. A sensitivity analysis, technical validation/assessment, and a military effectiveness assessment are provided in the text. References, recommendations and concluding remarks are also included within the report.

**71913 Surface Ship Continuing Concept Formulation (CONFORM) Advanced Mobilization Corvette (AMK) Feasibility Design Study**
**DTRC 1222, 07187, C**

The Advanced Mobilization Corvette (AMK) feasibility study sought to determine whether a high speed ASW escort for the T-AKR 287 class could be developed and if the design developed could be produced under mobilization conditions. A feasible 'design is presented along with a sonar system and operational scheme to protect the T-AKR 287 from submarines. Assumptions used for the development of the design are included in the report. Advanced technology applications are noted and developmental risks are presented. The mobilization aspects of the AMK are analyzed; resulting conclusions are discussed. The design study herein reported is well supported through graphics and tabulated data. Among the figures included for the AMK are inboard and outboard profiles, midships and structural midship sections, speed-time profiles, speed-drag curves for various seaways, pitch, roll and vertical accelerations for different seaways, superstructure and deck arrangements, propulsion arrangement, and a power system schematic. Included in tabulated data are life-cycle, investment, and annualized operation and support cost estimates. Among the appendices afforded are weight estimates, area/volume summaries and a sonar system capability description.

**Input to CONFORM SWATH LPH Draft Final Report**

This report is a draft version of the documentation for CONFORM point design of **a** SWATH LPH, intended to be the SWATH equivalent of the Iwo Jima (LPH 2) class monohuil. Certain significant parameters and sections are missing from the report, underscoring its status as a "draft". Notable among the missing sections are Conform **Level** Requirements, schedule information, R&D needs and technical risk constraints, propulsion margins and seakeeping information. All requirements and constraints were the same as those used in designing the LPH 2 monohull, except for those specifically applicable to the SWATH configuration.

The propulsion system consists of a single LM 2500 gas turbine and ranking cycle energy recovery (RACER) system per sidehull. These drive into **a** reversible combining gear with a TOSI coupling to supply the reversing function. The combined output drives into a contrarotating epicyclic gear, which then drives a set of contrarotating propellers. The electric load, assumed the same as the LPH 2 monohull, is supplied by four 2500 KW generators (type not specified) and one 1500 KW emergency generator. Command and control, auxiliary systems, outfit and furnishings and armament were essentially taken directly from LPH 2. Fuel loads were derived from the SWATH resistance output and the installed machinery specifications.

The bulk of the effort was concentrated on hull structural design. Seven "midship" section models were developed using the (referenced) Structural Synthesis Design Program (SSDP). This development required extensive iteration. The design loads used and a midship section sketch, showing longitudinal and transverse structure, are included in the text. An appendix is attached showing the results of the section calculations. Appendices are also included for general arrangements sketches, weight estimates, space estimates and a (very) rough cost estimate. References are included to substantiate the design methodology used. Conclusions include discussion on seakeeping, powering, and damaged stability.

CONFORM Feasibility **Design Draft Report High Speed Salvage Tug ATS (X), Draft Final**

This draft report documents a comprehensive feasibility study for **a** high speed salvage tug. After the Falklands conflict it became apparent that a vessel was needed which was capable of operating with a battle group to conduct emergency repair and firefighting, and to tow casualties out of the immediate battle zone. The ARS 50 class comes close to meeting some of the ATS (X) requirements and was used as a point of departure for the ATS (X) design. This study developed two variants, a monohull and a SWATH, having as much commonly as possible. Significant differences were draft, seakeeping and aircraft capability. The following approach was used for the study:

- Future salvage/rescue mission scenarios were investigated.
- Platform requirements were developed from these scenarios.
- Current commercial and recently developed Navy technology were investigated.
- The above were combined to produce feasibility level ship designs for both variants.

The designs were developed using the NAVSEA SWATH synthesis program for the SWATH variant and traditional manual means for the monohull. Standard CONFORM margin requirements and normal NAVSEA design practices were assumed. ABS standards were used for non-mission essential areas. The IOC date used for the ATS (X) was the year 2000.

Detailed discussions for mission requirements, technology base, ship design descriptions, subsystems, and R&D needs/technical risks are included.

The concept of operation, ship functional requirements, threat environment, environmental factors and mission scenarios are outlined. Technical risk constraints and the projected technology considered and used are discussed. The use of a large SWATH is not considered to be projected technology. The capabilities and characteristics of both ship types are described in detail in sections covering payload/platform performance, configuration, margins, manning

and size. Stability and seakeeping and systems engineering sections are called out but not included. Hull structure, propulsion plant, electric plant, command and surveillance, auxiliary systems, outfit and furnishings, armament (small arms only) and loads are addressed for both ship types. Specific areas in which R&D effort will be needed are listed and explained. These are categorized as either fundamental risks (basic unanswered questions), or developmental or programmatic risks (performance, time, cost). Fundamental risks are judged to be entirely related to the SWATH configuration.

No specific technical or military effectiveness assessment was performed but both ATS (X) variants are judged to meet CLR requirements. A number of issues were raised during study review regarding the requirements used to develop the designs in areas of firefighting, weight handling, diving ice strengthening and station keeping. Conclusions and recommendations sections are called out but are not included.

Appendices are included, some of which are "stand alone" reports, for the following: CONFORM Level Requirements, General Arrangements (both ship types), Weight Estimate (both ship types), Space Estimate (both ship types), Technology Assessment for Auxiliary Systems, Propulsion and Electrical Machinery Trade-Off Studies (monohull only), Self Erectable Lifting System Study, 35 ft. Workboat Study, and HSLA Sensitivity Study. A list of references is included for the study itself and for some of the appendices. Some information is incomplete, for example missing tables, an occasional missing value, and the conclusions and recommendations sections already mentioned, underscoring the draft nature of the report.

A Review of the Hydrodynamic and **Seakeeping Characteristics of the Surface Effect Ship, Draft**
**BLA, Inc., 05/15/85, U**

This report provides a comparison of future predicted surface effect ship (SES) performance with proven, full scale SES performance. This is done so that the SES predictions can be evaluated against proven performance and not other prediction methods (although there is some scaling involved). Comparisons are provided in the areas of speed and power, hullform, seakeeping, and on-cushion stability. Extensive plots of speed-power and speed-drag are given along with plots of resistance versis froude number, installed power versus displacement, and planform density ($\Delta/(LOA)^2B$) versus length-to-beam (UB) ratio. Pages 48 - 61 (seakeeping and stability) are missing as well as sections on side hull shapes. Conclusions are made as to current and future technologies, even for sections not included.

**Simulation and Analytical Results AFOE Candidate Lighters Year 2005 Operations**
**ORI, Inc., 12/13/84, U**

The lighterage modelling program E-LOTS developed by the Army is used in this report to compare the lightering performance of existing equipment (baselines) such as LCU, LCM8, CSP+1, LCAC and LACV-30 with year 2005 technologies such as 'M-ton subhump, 150-ton subhump, 150-ton sub/over hump, 300-ton subhump, and stretch LCAC hoverbarges (HR).

The report proposes two possible scenarios for lightering and runs comparisons for weight limitations, volume limitations, craft characteristics, operational differences, interface times, offloading times, number of ships required, and craft productivities (avg. tonnes/craft/day). Conclusions are presented as to which lighter shows the best performance.

**An Estimate of Design Loads for the Interface Joint of an SES Tug/Barge, Final**
**BLA, Inc., 02/82, U**

In order to develop design configurations for a tug-barge interface joint on the SES rapid deployment force push-tug/barge (described in DTNSRDC Oct 81), an estimate of loading at the tug/barge interface was needed. This report attempts to correllate the limited available data and develop a general interface loading without model testing the configuration. Data from previous experimentation is presented (bending moment, shear, acceleration plots) with comparisons of ship characteristics and comparative limitations. A method for obtaining very approximate forces and moments is derived with a notation that more exact values demand model testing.

**CONFORM - Level Requirement (CLR) Technology Characterization (T-) Section for the CONFORM 1986 Landing Ship Combat Support (LSCS), Final**
**BLA, Inc., 12/85, U**

Recommendations are made for the contents of the CONFORM-Level Requirements (CLR), Technology T-Section, for the FY86 CONFORM LSCS ship feasibility design study. The report includes an Appendix which provides justification for the recommendations and identifies additional advanced technologies for possible additional consideration.

**ME 4721: Marine Vehicle Design I Preliminary Design Concept/Analysis of a "Large Planing-Type Amphibious Assault Landing Craft", Draft**
**LCDR H.K. Kline, USN, 09/18/80, U**

This report contains a preliminary design/analysis of a large (136 ft) planing, amphibious assault landing craft. Discussed in the report are design requirements and restraints, principal considerations, and different technologies assessed for suitability.

Hydro statics/dynamics of the proposed vessel were assessed and presented with assorted sketches of load/buoyancy versus length, forces and moments versus length, and accelerations versus speed.

Power transmission, electrical, control, fuel, cargo handling, emergency systems, manning, and cost were also generally addressed in the report.

This design did not meet its request for proposal (RFP) in size or payload capacity.

**Integrated Technology Assessment Program, Technical**
**DTNSRDC 1204, BLA, Inc., 02/85, U**

A plan is defined, which, when implemented in FY85 by the Ship Systems Integration Department of DTNSRDC, will provide a mechanism for improved transfer of technology from the 6.2 Exploratory Development efforts at the Center to the 6.3 Advanced Development design activities at NAVSEA.

**Integrated Technology Assessment Program (ITAP) Plan of Action and Milestones, Final**
**BLA, inc., 10/85, U**

A need is identified to integrate the assessment of new technology within the Navy design community. A plan is presented for coordinating the many aspects of technology forecasting and assessment. The plan proposes an organization, defines sources of information, the uses to which that information can be put and the development of an automated data bank. The periodic program reports and technology documentation are also defined in outline form.

**Input to CONFORM SWATH LPH Draft Final Report**
**G&C, Inc., 03/86, U**

This report briefly describes the configuration subsystems and assessment of the SWATH, LPH, which was conceived as an equivalent of the IWO JIMA (LPH 2) class monohull.

Included in the configurations are payload and platform arrangements, principal dimensions, and the margins used. Sketches of general arrangements are given, as well as tabular results of a three-digit weight estimate and stability calculations.

Subsystem descriptions provide a table of SSDP generated design loads, and details concerning the propulsion and electric plants, auxiliary systems and outfit.

The assessment gives a brief overview of the sensitivity analysis performed, and indicates that neither technical nor military effectiveness assessments were performed.

Landing Ship Combat Support **(LSCS),** Draft
NAVSEA **501, 06/01 /87,** C

Described herein is the Landing Ship Combat Support (LSCS) design study investigating surface effect ships as the amphibious assault craft. SES in the amphibious role, offer two primary advantages; speed and craft shallow draft. This study considered three SES of varying displacement.

The report discusses general background and mission requirements, roles, threats and environmental factors. The technology base is discussed in terms of projected technology and technical risk constraints. Included are a ship design description, and a subsystem description including brief discussion on hull structure, propulsion and electrical plants, command and control, auxiliary, outfit and furnishings, armament and loads. R&D needs and technical risks are discussed concerning propellers, the SES hullform, bow and stern seals, and the bow ramp. A sensitivity analysis, technical assessment, and military effectiveness assessment are included as well as concluding remarks and recommendations.

Appendices afford general arrangements, space-arrangements, single-digit weight estimates, fuel rates for various load, speed and pressure settings, and payload-fuel-range estimates, each for the three displacements investigated.

**70776 Conform Feasibility Design Report Arctlc ACV, Final**
**BLA, Inc., 09185, C**

This report documents the results of the FY85 Surface Ship CONFORM Design Study for an IOC year-2000 Air Cushion Vehicle (ACV) suitable for submarine replenishment and general search and rescue duties in the Arctic. The study is one of several design studies produced each year by the CONFORM program to provide OPNAV with alternative feasible total ship concepts for varying IOC's and to provide R&D planners with feedback regarding future total ship impact of R&D alternatives.

Two complete feasibility designs were developed. The first design was developed with aid of the CONFORM ACV Design Synthesis Math Model. The second design evolved as a derivative of an existing U.S. production craft, the LCAC.

Mission requirements **are** summarized including force interaction, target/threat statements and environmental factors. Ship design descriptions are well-supported with tables and figures. A sensitivity analysis, and R&D needs/technical risks concerning hull and skirt structure, navigation and communication, and obstacle detection system are summarized. Appendices afford CONFORM level requirements, summarization of environmental factors, lessons learned from Arctic ACV operations, sea ice conditions influencing ACV base selection, and CONFORM technology, design and operational innovations for CONFORM Arctic ACV's. Also provided is computer input and output for the selected concept design.

**70788 Landing** Fire Support (LFS) Requirements and **Feasibility Design Study, Technical Report**
**DTRC 1222, 1 1/01/84, C**

Requirements and feasibility design study results for several Landing Fire Support (LFS) ship alternatives are presented. These studies are sponsored by the Surface Ship Continuing Concept Formulation (CONFORM) Program. The LFS concepts in this study provide a single-mission solution to the requirement for providing amphibious assault fire support for the pre-assault, assault, and post-assault phases of an amphibious operation.

The report documents the study's objectives; approach: mission requirements; technology base: including technical risk constraints; the ship design descriptor; subsystems descriptions; and R&D needs, assessments and conclusions. Included as appendices are the CONFORM level requirements, ship arrangement sketches, weight estimates; a draft of the 203 mm Modular Gun Mount Advanced System Concept; gear size estimates for several combined power plant options; general description of the Marine Integrated Fire & Air Support System; and the propulsion alternative study. The graphical representations afford comprehensive support of the study's key technologies. Included are ship arrangements and speed-power curves for the LFS monohull variants; LFS SES inboard profile and hullform; the combat suite; electronic countermeasures and launching system; radar components; schematic of a typical pressurized fan room; comparative gun mount profiles; and conceptual installations of the assault ballastic rocket system.

70846 Applications of Robotics **and Artificial Intelligence for Shlp Operations and Mission Activities** • An Overview Volume I, Final
**Naval Surface Weapons Center (Code R402), 05/01/85, U**

This report presents the results of an investigation to assess applications of robotics and artificial intelligence (Al) for ship operations and mission activities which involve high risk of injury and/or repetitive environments which result in high accident rates. High injury tasks are identified and the requirements to perform these tasks **are** compared to capabilities of robotic and Al systems.

**Many** specific applications are identified with task description, installation approach and time frame, technical risks, and related on-going efforts. Issues of necessary further research are discussed briefly and a robotics technology/capability forecast (percent • 5 years • 10 years) is included. An extensive bibliography is also presented.

**70959 Surface Ship Continuing Concept Formulation (CONFORM) Program Master Plan, Draft**
**NAVSEA, 04/86, U**

This document provides a brief overview of the intermediate and long range **goals** of the surface ship continuing concept formulation (CONFORM) program and addresses the method and planning to **achieve these goals.** Resources required to carry out these CONFORM objectives are also discussed, along with resource **allocation.** This is not a final document but is subject to periodic reviewing and updates.

**70960 Advanced Marine Vehicles Hullform Design Practices, A CONFORM Survey Report, Final**
**NAVSEA 501, 04/86, U**

The purpose of this CONFORM paper is to provide an overview of hullform design practices as applied by NAVSEA 501 in the design of hydrofoils, Small Waterplane Area Twin-Hulls (SWATH), Surface Effect Ships (SES), and Air Cushion Vehicles (ACV) for the U.S. Navy. For each hull type general design considerations are discussed, and graphically supported, in the context of specific examples of recent advanced vehicle hull form design. For example, hydrofoil takeoff speed-drag relationships, SES wave drag and dynamic stability control concepts, and ACV over-water drag and skirt system designs are provided in figures. Tables provide hydrofoil displacement-length ratios and nondimensional SWATH form parameters.

**70961 Evaluation of the Fast-E Model for Estimating Ship Cost, Evaluation**
**Alvin Owens, Mark Montesano, U**

This paper discusses the usefulness of the Fast-E model for cost estimation of navy ships. This study differs from the RCA price model study in that only total ship data is used. Results are presented as a set of complexity equations derived from a 44-ship data base. A comparison of the Fast-E and price models is made, assumptions *are* listed, and weight ranges of ships studied are tabulated. The complexity range for each ship is also listed in tabular form. Finally, resulting equations and correlation coefficients are given for various ship types. A sample program run is included.

**71067 CGV Comparative Assessment, Draft**
**TRACOR, 07/26/85, C**

This task was funded to prepare a comparative analysis of three CONFORM CGV air capable cruiser designs. The three designs are developed from common requirements and each platform carries the same combat system. The resulting ship designs, however, demonstrate the applicability of radically different hull types. In addition, each of the variant designs features several innovative ship systems. A comparative analysis of the three differing designs is needed to highlight each design's strengths and weaknesses.

The analytic hierarchy process (AHP) is the approach to the decision analysis described. The AHP is suggested to be an effective way of structuring problems with many decision criteria, and analyzing facets of the problem in turn.

**71068 Shallow Water ASW Potential HYCATS/PCM Design Application (CDRL A007), Draft**
**Sperry Corp., 1 1/85, C**

This report summarizes the results of an assessment of the potential use of the AN/SSQ-87(V) Hydrofoil Collision Avoidance and Tracking System (HYCATS) in shallow water anti-submarine warfare (SWASW) applications. Specifically, the report discusses the unique characteristics of the shallow water acoustic environment and their impact on ASW operations, identifies the technologies required to improve SWASW operational performance, assesses the technical risks involved in developing a SWASW-capable ship, and addresses the various requirements and necessary changes for adapting HYCATS to an ASW-support role. Supporting figures include illustration of the HYCATS ASW contact/search management and weapon management functions, a conceptual sensor system data transmission unit and a conceptual HYCATS console ASW switch configuration. Tables provided include SWATH platform candidates, HYCATS/ASW manning requirements summary, size/power characteristics and input/output interfaces, and, function and requirements listings of the sensor system data transmission unit pushbutton switch.