**DRAPER LABORATORY**

RSVP-99-025

TO: Program Officer
Office of Naval Research
Ballston Tower One
800 North Quincy Street
Arlington, Virginia 22217-5660
Attn: James Gagorik

FROM: Kenneth Fox, Draper RSVP Program Manager

SUBJECT: RSVP Technical and Financial Status Report for September 1999

DATE: 13 OCTOBER 1999

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Defense Technical Information Center

REFERENCE: Contract N00014-99-C-0033

**19991019 044**

## INTRODUCTION

This monthly Technical and Financial Status Report is submitted in compliance with CDRL A001 of the referenced contract and covers the period of September 1999.

## TECHNICAL STATUS REPORT

### WBS 1.2.1 Architecture Development

Data Fusion and Sensor Cluster/RF demonstration rehearsals were conducted during the month and on 28 September demonstrations were conducted for Draper Management.

Draper participated in the Execution IPT at Annapolis on 21 September. Draper tasking status and ICAS/RSVP integration status were presented.

Draper participated in meetings via conference calls concerning ICAS/RSVP integration on 2,14,16 and 22 September. Other participants were NAVSEA, NSWC, PSU, BBN, and Honeywell.

Draper hosted a technical interchange meeting on RSVP "middleware" on 24 September.

Anticipated activities for October:
- Meet with representative of Kinesix (potential vendor of workstation graphics) and RSVP machinery personnel at Draper on 5 October
- Use availability model to perform sensitivity analysis
- Produce draft of Integrated Communication Specification
- Demos of BB Sensor Cluster/RF and Data Fusion scheduled for week of 25 October.

### WBS 1.2.1.1 System Architecture Modeling

All of the code modifications to the GATOR Discrete Event simulation for tracking Operational Availability of the RSVP system operation in a typical ship compartment were completed. These code modifications included: 1) building Sensor Clusters from input, 2) providing for delayed repair until k-on-n failures occurred, 3) up-grading capabilities 1) & 2) for multi-phased missions, 4) providing on-screen diagnostics for easy testing and previewing, and 5) up-grading output file for new capabilities. The code was tested and reviewed by Gary Schwartz.

Several versions of the actual RSVP ship compartment architecture have been set up as input files and are running as expected. These are ' mammoth' files with approximately 500 pieces of equipment and nearly 200 entries in the compartment configuration/operational block diagrams. Typical scenarios are run at a mission timeline of 50,000 hours. Special coverage considerations for the machines as well as Access Points have been included.

Anticipated activities for October:
- Generate data for RSVP Operational Availability and perform sensitivity /trade studies on architecture and operational operations.

## WBS 1.2.2 Sensor Cluster Breadboard

Two dry runs of the Sensor Cluster/RF demonstration were conducted during the month and, on 23 September, a demonstration was conducted for Draper management. Budgets and schedules were developed for GFY00.

Anticipated activities for October:
- Investigate lower power sound technique.
- Complete budgets and schedules for GFY00.

## WBS 1.2.3 Wireless Communications

### RF Network Risk Reduction

Effects of Fire

Complete

Ship Susceptibility/ Radiated Interference

Complete

Sailor Location

A draft memo summarizing the Sailor Location Study is in review.

RF Network Design

A draft RF Network design specification has been developed. Specification of the AP-Sensor Cluster Network is complete. The remaining part of the network specification remains TBD since both Sarcos and Penn State/BBN appear to be going to independent radios.

Sensor Cluster Interface

A draft sensor cluster ICD was completed. The Sarcos and Penn State/BBN interface remain TBD. The sensor cluster/ radio interface was verified in the September Demo.

**AP/Sensor Cluster RF Comms**

Two dry runs of the Sensor Cluster/RF demonstration were conducted during the month and, on 23 September, a demonstration was conducted for Draper management.

Anticipated activities for October:
- Fabricate two additional radios.
- Perform EMI testing on radio breadboard.
- Begin design of Phase 2 radio breadboard.
- Test planning for Shipboard Radio Testing.
- Select communications processor for AP radio.
- Determine Sarcos and Penn/State radio plans.

**WBS 1.2.4 Data Fusion**

A dry run of the Data Fusion Phase I demonstration was conducted early in the month and a demonstration was conducted for Draper management on 23 September.

A Technical Interchange Meeting was held with BBN on 24 September to discuss AP and AP to Watchstation communication architectures. A draft block diagram of RSVP communication was generated for supporting ICD development.

Budgets and schedules were developed for GFY 00 tasking.

Anticipated activities for October:
- Developing the preliminary AP requirements.
- Reviewing the ICD.
- Meeting with Kinesix and BBN to discuss "SAMMI" software as Middleware/COM software for AP development.

**Program Management**

This task provides the program management and support functions required to properly execute the Draper RSVP contract including program planning, schedule and budget maintenance, program reporting, and management of major subcontracts.

Program management participated in the Execution IPT at Annapolis on 21 September.

## SCHEDULES

Included in this report is the Draper RSVP Master Schedule that shows the schedule and progress for each GFY99 Draper task. The schedule has been updated to show progress through September 1999.


## FINANCIAL STATUS REPORT

The attached Program Financial Status Plots provide a summary of monthly and cumulative contract costs (not including fee) verses budgeted costs for the overall contract as well as for individual tasks. These costs include committed as well as expended costs. The total costs for September were $118K. The total accumulated costs through September were $2,508Kwhich includes committed costs of $1,017K for subcontracts. The overall contract is $17K overbudget as of 1 October.

# Draper RSVP Master Schedule

| ID | Task Name |
|---|---|
| 1 | 0 DRAPER RSVP PROGRAM (GFY99) |
| 2 | 1.0 SYSTEMS ENGINEERING |
| 3 | 1.1 Systems Architecture |
| 4 | 1.1.1 Systems Engineering Study |
| 5 | 1.1.2 TSC Interface |
| 6 | 1.1.3 Architecture Development |
| 7 | Develop sens cluster/RF demo requirem |
| 8 | 1.2 Modeling and Simulation |
| 9 | 1.2.1 Performance |
| 10 | Functional Requirements |
| 11 | Investigation |
| 12 | Initial RF Comm Modeling |
| 13 | Initial model design |
| 14 | Peer review |
| 15 | Develop and test prototype model |
| 16 | Model iterations |
| 17 | Deliver working prototype model |
| 18 | Exercise prototype model |
| 19 | 1.3 Data Fusion |
| 20 | 1.3.1 Develop Demo Requirements |
| 21 | Develop high level requirements |
| 22 | Specify HW/SW requirements |
| 23 | Develop example demo script |
| 24 | Peer review |
| 25 | Deliver demo requirements |
| 26 | 1.3.2 Develop Demo system design |
| 27 | Define HW/SW Functionality |
| 28 | Determine availability of existing lat |

Timeline months: January, February, March, April, May, June, July, August, September

Legend:
- Task
- Progress
- Baseline
- Milestone
- Baseline Milestone
- Summary
- Rolled Up Task
- Rolled Up Milestone
- Baseline Summary
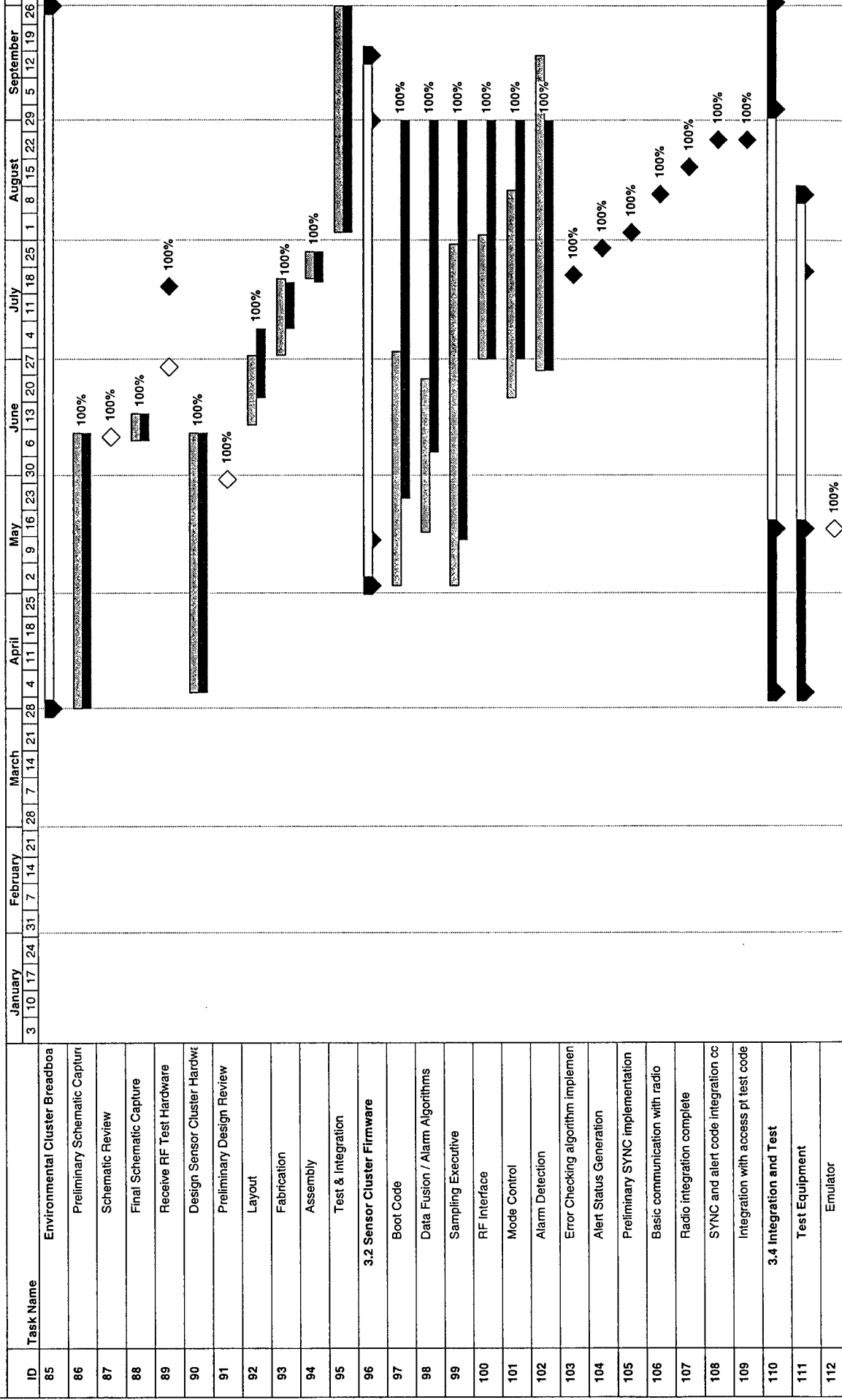- Rolled Up Baseline
- Rolled Up Baseline Milestone
- Rolled Up Progress

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# Draper RSVP Master Schedule

| ID | Task Name |
|----|-----------|
| 29 | Create system design document |
| 30 | Develop interface spec for SC, RF, |
| 31 | Peer review |
| 32 | Demo system design |
| 33 | **1.3.3 Develop Demo software design** |
| 34 | Develop high level object-oriented : |
| 35 | **1.3.4 Setup Demo system developmer** |
| 36 | Specify HW, SWE IDE and other S' |
| 37 | Acquire HW, SW IDE and other SW |
| 38 | Install HW, SW IDE and other SW 1 |
| 39 | Train staff with IDE and other tools |
| 40 | **1.3.5 Develop data fusion algorithms** |
| 41 | Develop/acquire data fusion algoritt |
| 42 | Specify interfaces |
| 43 | Internal review |
| 44 | **1.3.6 Implement software** |
| 45 | Develop detailed design |
| 46 | Deliver detailed design |
| 47 | Internal Tech Demo |
| 48 | Implementation |
| 49 | Unit test |
| 50 | Deliver Source |
| 51 | **1.3.7 Test system** |
| 52 | Develop test suite |
| 53 | Test suite complete |
| 54 | Informal review |
| 55 | Exercise code using test suites |
| 56 | Fix problems |

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Legend:

- Task
- Progress
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- Milestone ◆
- Summary
- Rolled Up Task
- Rolled Up Milestone ◇
- Baseline Milestone ◇
- Baseline Summary
- Rolled Up Baseline
- Rolled Up Baseline Milestone ◇
- Rolled Up Progress

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# Draper RSVP Master Schedule

| ID | Task Name |
|----|-----------|
| 57 | 1.3.8 Demonstration |
| 58 | Setup, run, and document system c |
| 59 | Demo complete |
| 60 | 2.0 ACCESS POINTS |
| 61 | 3.0 SENSOR CLUSTER |
| 62 | 3.0.1 Task Management |
| 63 | organization |
| 64 | maintenance |
| 65 | Hourly Support |
| 66 | M & S Misc |
| 67 | 3.1 Sensor Cluster Hardware |
| 68 | 3.1.1 Design |
| 69 | Receive System Engineering Study |
| 70 | Preliminary RF Interface Spec |
| 71 | Distribute Preliminary RF Interface |
| 72 | Preliminary Firmware Algorithm Sp |
| 73 | Distribute Preliminary Firmware De |
| 74 | Preliminary Design Spec |
| 75 | Distribute Preliminary Design Spec |
| 76 | 3.1.2 Fabrication and Test |
| 77 | Sensors |
| 78 | selection |
| 79 | complete sensor selection |
| 80 | purchase |
| 81 | Electronic Components |
| 82 | selection |
| 83 | complete electronic componen |
| 84 | purchase |

Timeline columns: January 3 10 17 24 31 | February 7 14 21 28 | March 7 14 21 28 | April 4 11 18 25 | May 2 9 16 23 30 | June 6 13 20 27 | July 4 11 18 25 | August 1 8 15 22 29 | September 5 12 19 26

Legend:
Task — Baseline Milestone ◇ — Baseline Summary
Progress — Summary — Rolled Up Baseline
Baseline — Rolled Up Task — Rolled Up Baseline Milestone ◇
Milestone ◆ — Rolled Up Milestone ◇ — Rolled Up Progress

# Draper RSVP Master Schedule

Months (timeline header): January | February | March | April | May | June | July | August | September

| ID | Task Name |
|----|-----------|
| 85 | Environmental Cluster Breadboa |
| 86 | Preliminary Schematic Captur |
| 87 | Schematic Review |
| 88 | Final Schematic Capture |
| 89 | Receive RF Test Hardware |
| 90 | Design Sensor Cluster Hardw |
| 91 | Preliminary Design Review |
| 92 | Layout |
| 93 | Fabrication |
| 94 | Assembly |
| 95 | Test & Integration |
| 96 | 3.2 Sensor Cluster Firmware |
| 97 | Boot Code |
| 98 | Data Fusion / Alarm Algorithms |
| 99 | Sampling Executive |
| 100 | RF Interface |
| 101 | Mode Control |
| 102 | Alarm Detection |
| 103 | Error Checking algorithm implemen |
| 104 | Alert Status Generation |
| 105 | Preliminary SYNC implementation |
| 106 | Basic communication with radio |
| 107 | Radio integration complete |
| 108 | SYNC and alert code integration cc |
| 109 | Integration with access pt test code |
| 110 | 3.4 Integration and Test |
| 111 | Test Equipment |
| 112 | Emulator |

Legend:

| Symbol | Label | Symbol | Label | Symbol | Label |
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| | Task | | Milestone | | Rolled Up Milestone |
| | Progress | | Summary | | Baseline Milestone |
| | Baseline | | Rolled Up Task | | Rolled Up Baseline |
| | Milestone | | | | Rolled Up Baseline Milestone |
| | | | Baseline Summary | | Rolled Up Progress |

# Draper RSVP Master Schedule

| ID | Task Name |
|----|-----------|
| 113 | Assembler |
| 114 | Prom / PAL burner |
| 115 | Test Breadboards (for evaluati |
| 116 | Deliverable Demonstration |
| 117 | Prep for Demonstration |
| 118 | Ready for demo dry run |
| 119 | Demo dry runs |
| 120 | Demonstration |
| 121 | 4.0 RF COMMUNICATIONS |
| 122 | 4.1 RF Network Risk Reduction |
| 123 | 4.1.1 Effects of Fire |
| 124 | S.O.W. for NPS |
| 125 | Monitor NPS activity |
| 126 | Shadwell Test |
| 127 | Live Flame Tests at WPI |
| 128 | 4.1.2 Ship Interference Susceptability |
| 129 | Test Plan |
| 130 | Distribute Test Plan |
| 131 | EMI Measurement Prep |
| 132 | Acquire equipment |
| 133 | Deliver equipment to Norfolk |
| 134 | Shipboard setup |
| 135 | Sea Tests |
| 136 | Complete Sea Test |
| 137 | Shipboard Test Report |
| 138 | Data Reduction |
| 139 | Shipboard Test Report |
| 140 | Distribute Shipboard Test Rep |

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Task
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Milestone ◆

Baseline Milestone ◆
Summary
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Rolled Up Milestone ◇

Baseline Summary ◇
Rolled Up Baseline
Rolled Up Baseline Milestone ◇
Rolled Up Progress

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# Draper RSVP Master Schedule

| ID | Task Name |
|----|-----------|
| 141 | **4.1.3 Radiated Interference Testing** |
| 142 | Investigate Reqs (MIL461...) |
| 143 | Measure emissions |
| 144 | **4.1.4 Sailor Location Tracking** |
| 145 | Survey of commercial systems |
| 146 | Demo commercial sys (if available) |
| 147 | Report |
| 148 | Distribute report |
| 149 | **4.1.5 RF Network Design** |
| 150 | Evaluate System Docs |
| 151 | Input to engineering study |
| 152 | Evaluate Algorithms |
| 153 | Integrated Spec |
| 154 | Deliver RF Network Integrated Spe |
| 155 | Simulation of Critical Areas |
| 156 | Develop input to system sim |
| 157 | Provide System Sim Inputs |
| 158 | **4.1.6 Sensor Cluster Interface** |
| 159 | Personnel |
| 160 | Machinery |
| 161 | **4.2 AP/Sensor Cluster RF Comms** |
| 162 | **4.2.1 Design** |
| 163 | Technology Survey |
| 164 | Candidate Designs |
| 165 | Design Analysis |
| 166 | Design Docs |
| 167 | Design Review |
| 168 | **4.2.2 Fabrication** |

Legend:

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| Progress | Summary |
| Baseline | Rolled Up Task |
| Milestone ◆ | Rolled Up Milestone ◇ |

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| Rolled Up Baseline Milestone ◇ | |
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# Draper RSVP Master Schedule

| ID | Task Name |
|---|---|
| 169 | Acquire Demo Boards |
| 170 | Package Circuitry |
| 171 | Fabrication Complete |
| 172 | 4.2.3 Test |
| 173 | Hardware Test |
| 174 | Deliver Prototype to Sensor Cluster |
| 175 | September Demo |
| 176 | Generate code for demo |
| 177 | Preparation for Demo |
| 178 | Demonstration Dry Run |
| 179 | Measure RSVP Demo EMI |
| 180 | Distribute RSVP EMI Results |
| 181 | 5.0 SYSTEM INTEGRATION & TEST |
| 182 | 6.0 WATCH STANDER STATION |
| 183 | 7.0 SYSTEMS/PROGRAM MANAGEMENT |
| 184 | 7.1 Program Management |
| 185 | 7.2 Subcontracts |
| 186 | 7.3 Quality Assurance |
| 187 | 7.4 Configuration Management |

Timeline headers: January 3 10 17 24 31 | February 7 14 21 28 | March 7 14 21 28 | April 4 11 18 25 | May 2 9 16 23 30 | June 6 13 20 27 | July 4 11 18 25 | August 1 8 15 22 29 | September 5 12 19 26

Legend:
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- Progress
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- Summary
- Rolled Up Task
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- Baseline Milestone
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Cost with Commitments:

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| Cum: | rev3/99 | 8.6 | 70.8 | 175.6 | 776.9 | 1053.7 | 1256.0 | 1539.5 | 2173.7 | 2351.2 | 2490.8 | 2490.8 | 2490.8 |
| | Actual | 8.6 | 70.8 | 175.7 | 801.1 | 1026.9 | 1212.0 | 1521.2 | 1709.9 | 2389.9 | 2507.8 | | |
| | Variance | 0.0 | 0.0 | 0.0 | -24.2 | 26.8 | 44.0 | 18.3 | 463.9 | -38.6 | -17.0 | | |

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THOUSAND DOLLARS



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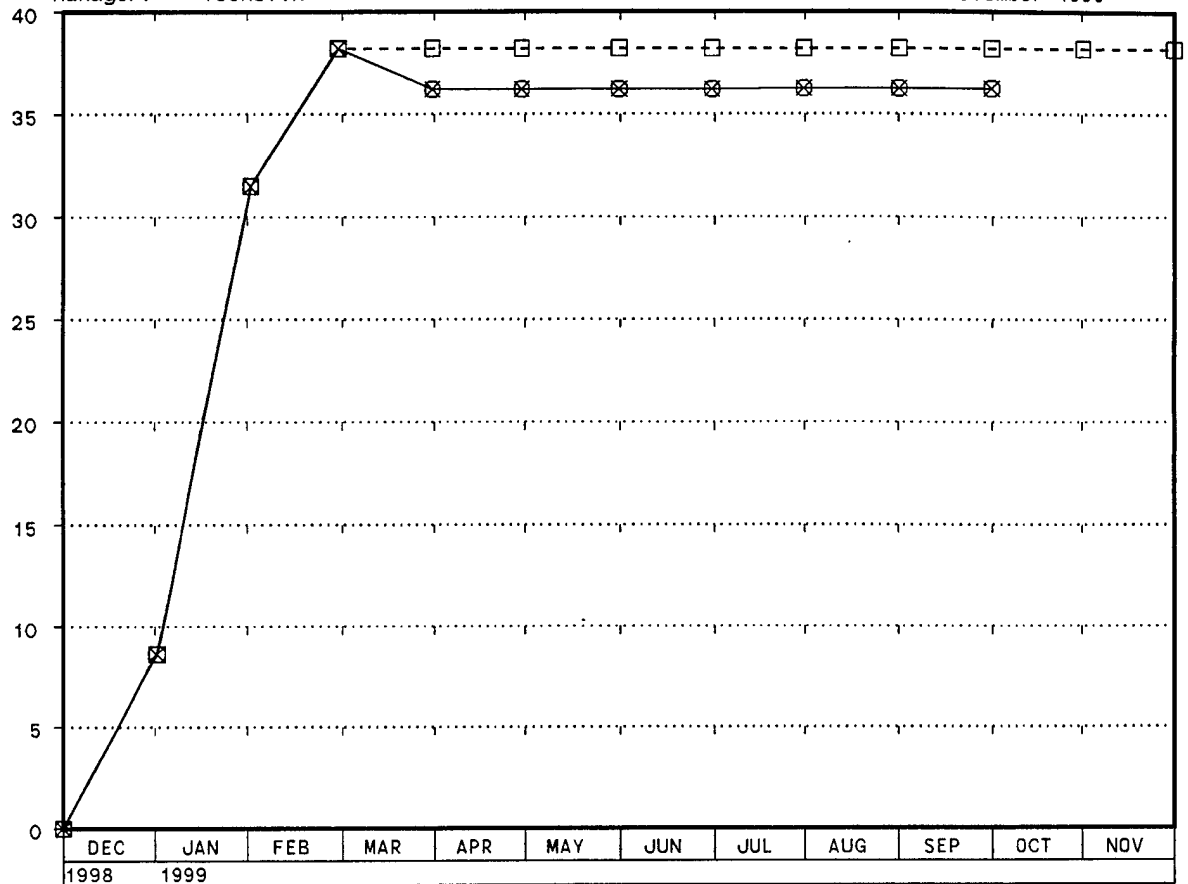
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| | Actual | 8.6 | 22.9 | 6.7 | -2.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | |
| Cum: | rev3/99 | 8.6 | 31.5 | 38.2 | 38.2 | 38.2 | 38.2 | 38.2 | 38.2 | 38.2 | 38.2 | 38.2 | 38.2 |
| | Actual | 8.6 | 31.5 | 38.2 | 36.2 | 36.2 | 36.2 | 36.2 | 36.2 | 36.2 | 36.2 | | |
| | Variance | 0.0 | 0.0 | 0.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | | |

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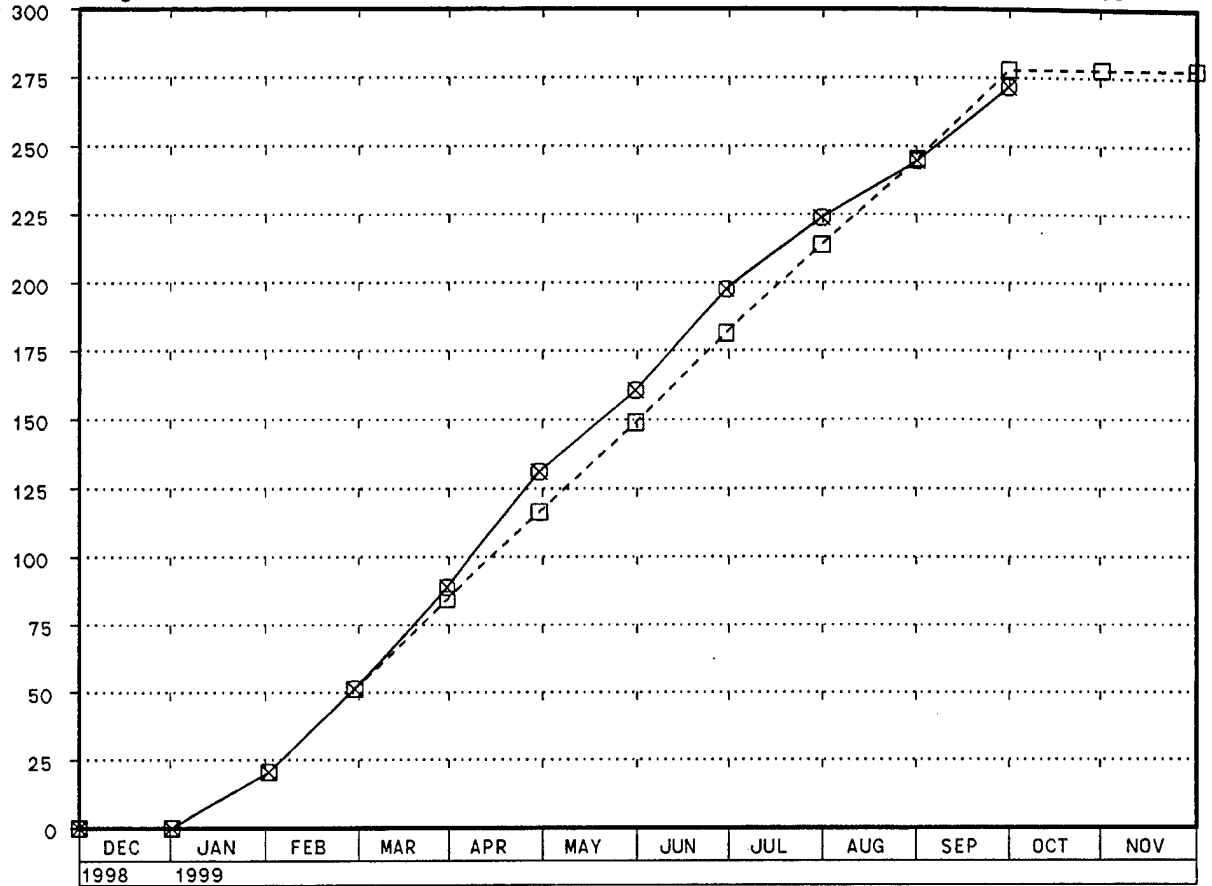
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| | Actual | 0.0 | 20.5 | 30.8 | 37.5 | 42.3 | 29.5 | 37.0 | 26.3 | 20.9 | 26.9 | | |
| Cum: | rev3/99 | 0.0 | 20.5 | 51.3 | 84.5 | 116.5 | 148.9 | 181.4 | 213.9 | 245.5 | 277.9 | 277.9 | 277.9 |
| | Actual | 0.0 | 20.5 | 51.3 | 88.8 | 131.2 | 160.6 | 197.6 | 223.8 | 244.8 | 271.6 | | |
| | Variance | 0.0 | 0.0 | 0.0 | -4.4 | -14.7 | -11.7 | -16.1 | -9.9 | 0.7 | 6.3 | | |

Project: 61505      RSVP SUBCONTRACTS

Manager: FOX JR.K      Period of Plot: December 1998 to November 1999

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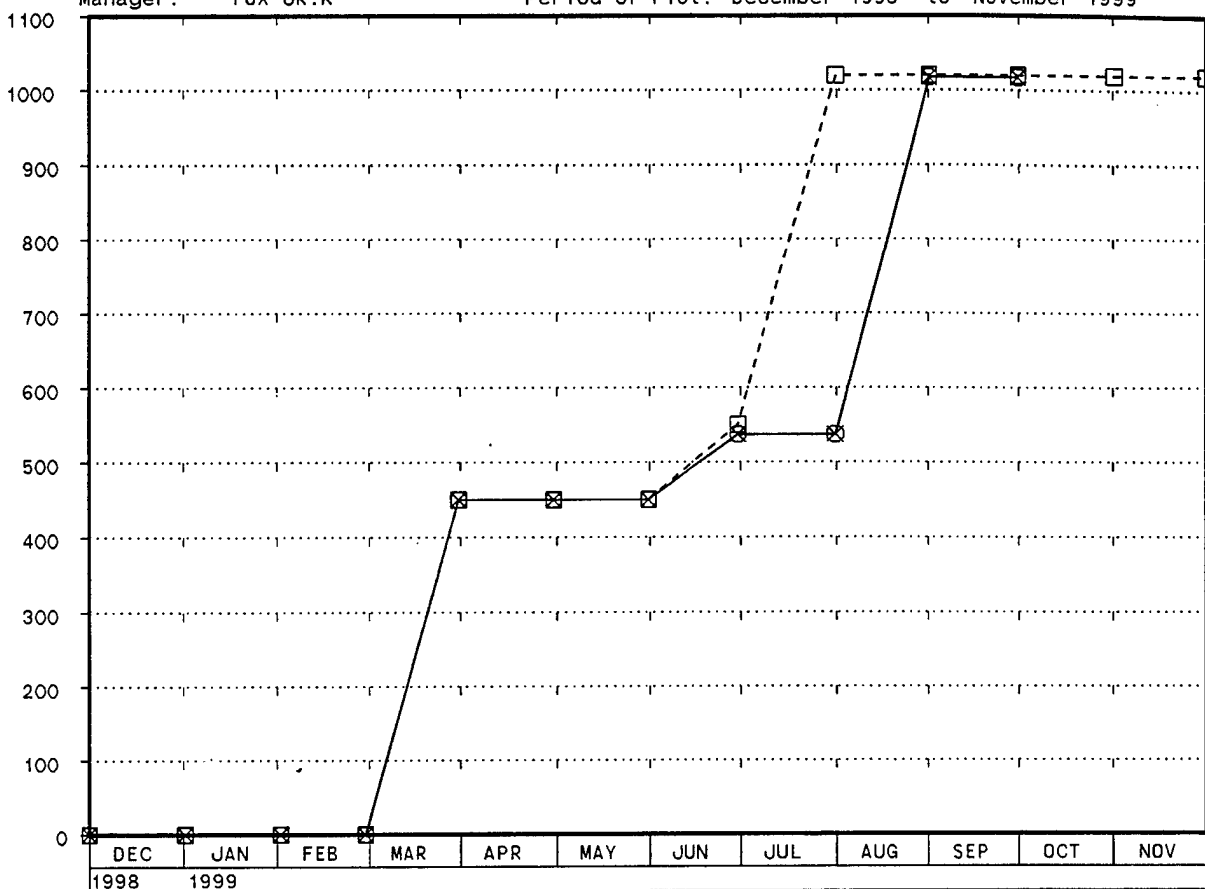
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| | Actual | 0.0 | 0.0 | 0.0 | 450.0 | 0.0 | 0.0 | 87.0 | 0.0 | 480.0 | 0.0 | | |
| Cum: | rev3/99 | 0.0 | 0.0 | 0.0 | 450.0 | 450.0 | 450.0 | 550.0 | 1019.6 | 1019.6 | 1019.6 | 1019.6 | 1019.6 |
| | Actual | 0.0 | 0.0 | 0.0 | 450.0 | 450.0 | 450.0 | 537.0 | 537.0 | 1017.0 | 1017.0 | | |
| | Variance | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 13.0 | 482.6 | 2.6 | 2.6 | | |

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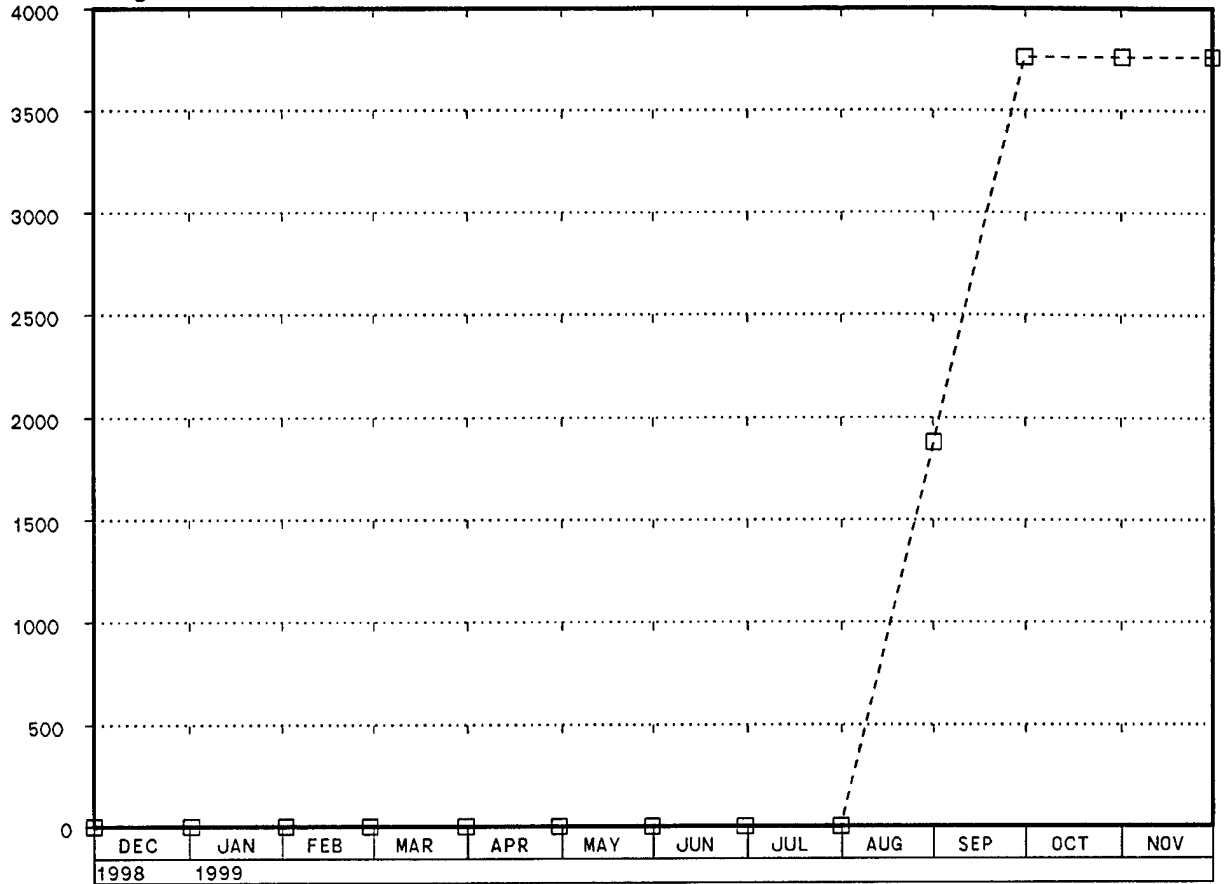
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| | Actual | | | | | | | | | | | | |
| Cum: | rev3/99 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1881 | 3762 | 3762 | 3762 |
| | Actual | | | | | | | | | | | | |
| | Variance | | | | | | | | | | | | |

Project: 61507      RSVP CONF MGMT

Manager: VOZZELLA.M      Period of Plot: December 1998 to November 1999

LEGEND

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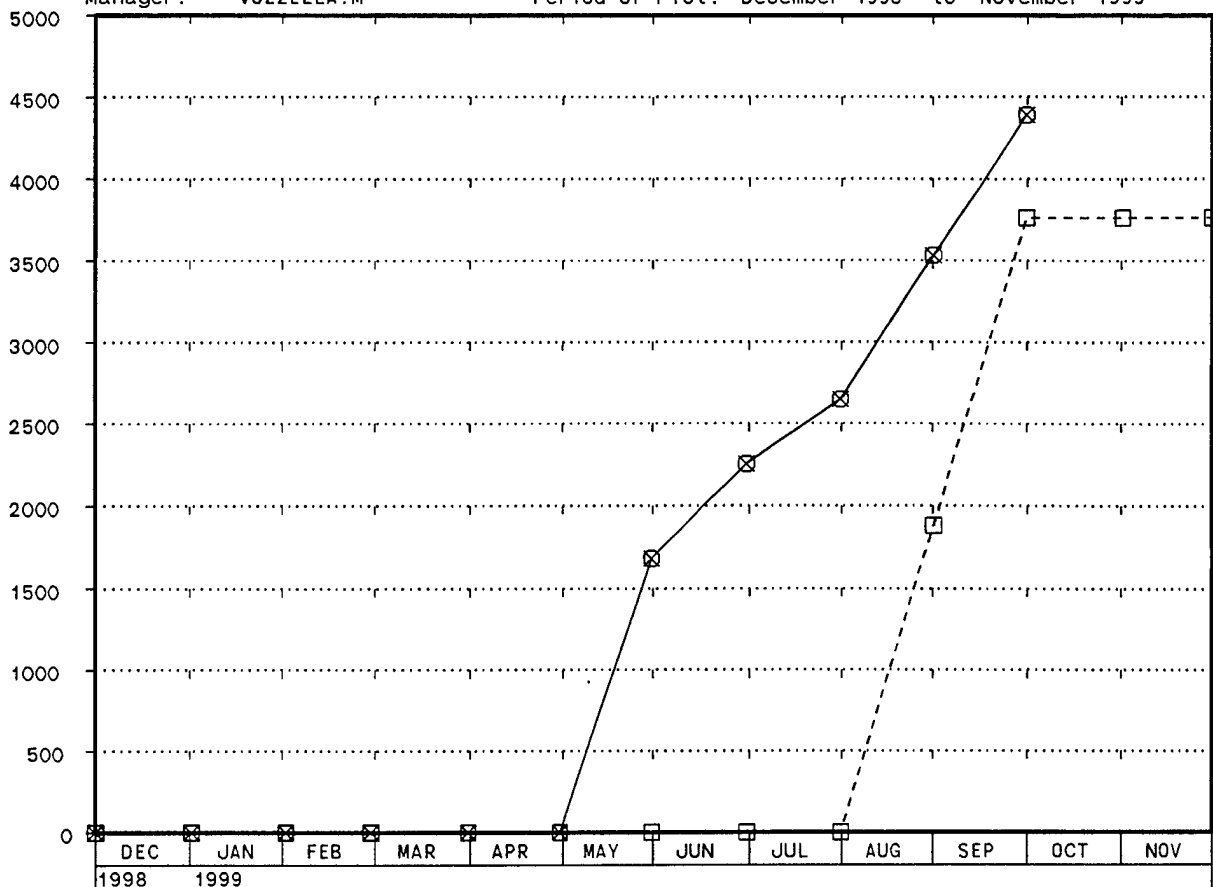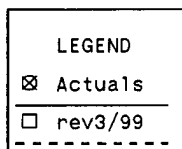
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| Month: | rev3/99 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1881 | 1881 | 0 | 0 |
| | Actual | 0 | 0 | 0 | 0 | 0 | 1681 | 572 | 395 | 881 | 858 | | |
| Cum: | rev3/99 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1881 | 3762 | 3762 | 3762 |
| | Actual | 0 | 0 | 0 | 0 | 0 | 1681 | 2253 | 2648 | 3530 | 4389 | | |
| | Variance | 0 | 0 | 0 | 0 | 0 | -1681 | -2253 | -2648 | -1649 | -626 | | |

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□ rev3/99
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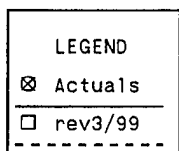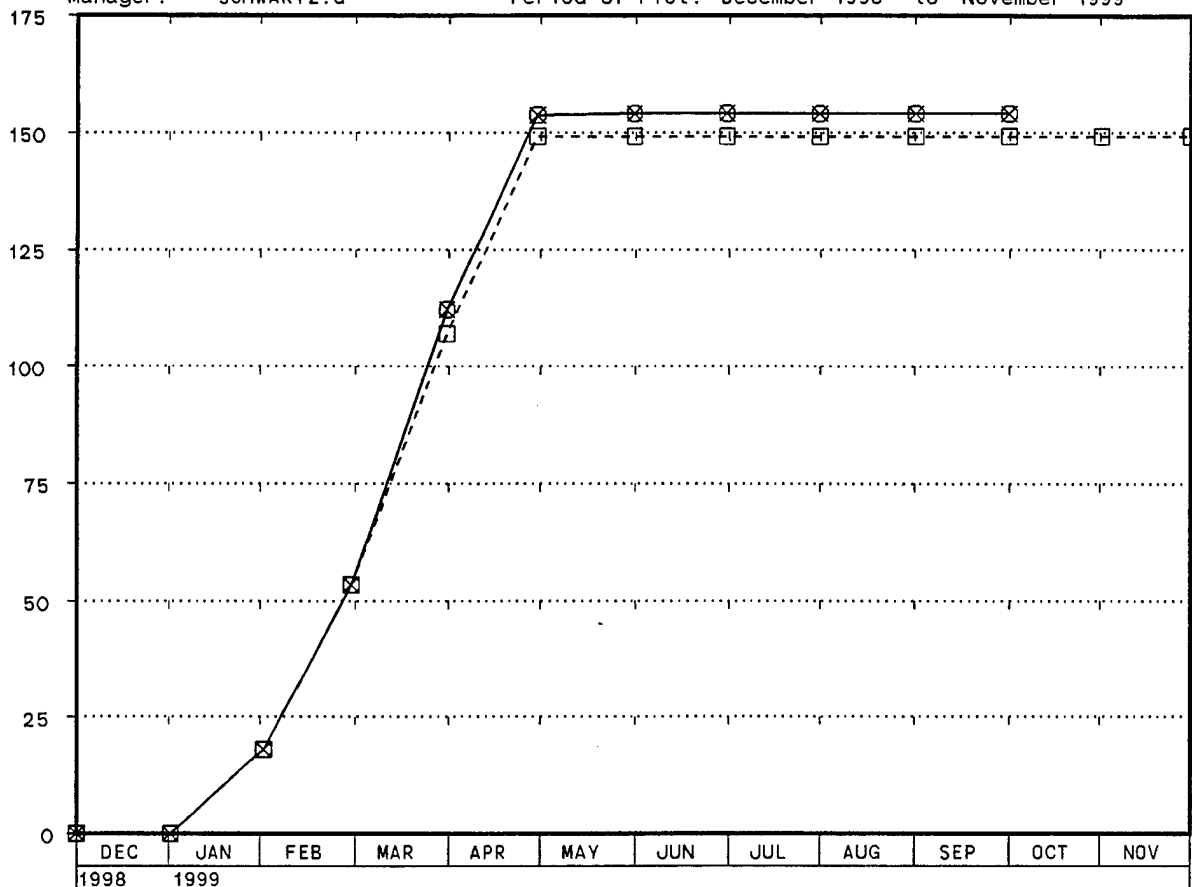
| Month: | | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV |
|--------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Month: | rev3/99 | 0.0 | 18.0 | 35.6 | 53.4 | 42.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Actual | 0.0 | 18.0 | 35.6 | 58.6 | 41.6 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | | |
| Cum: | rev3/99 | 0.0 | 18.0 | 53.5 | 106.9 | 149.2 | 149.2 | 149.2 | 149.2 | 149.2 | 149.2 | 149.2 | 149.2 |
| | Actual | 0.0 | 18.0 | 53.5 | 112.1 | 153.7 | 154.1 | 154.1 | 154.1 | 154.1 | 154.1 | | |
| | Variance | 0.0 | 0.0 | 0.0 | -5.2 | -4.5 | -4.9 | -4.9 | -4.8 | -4.8 | -4.8 | | |

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⊠ Actuals
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| | DEC 1998 | JAN 1999 | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
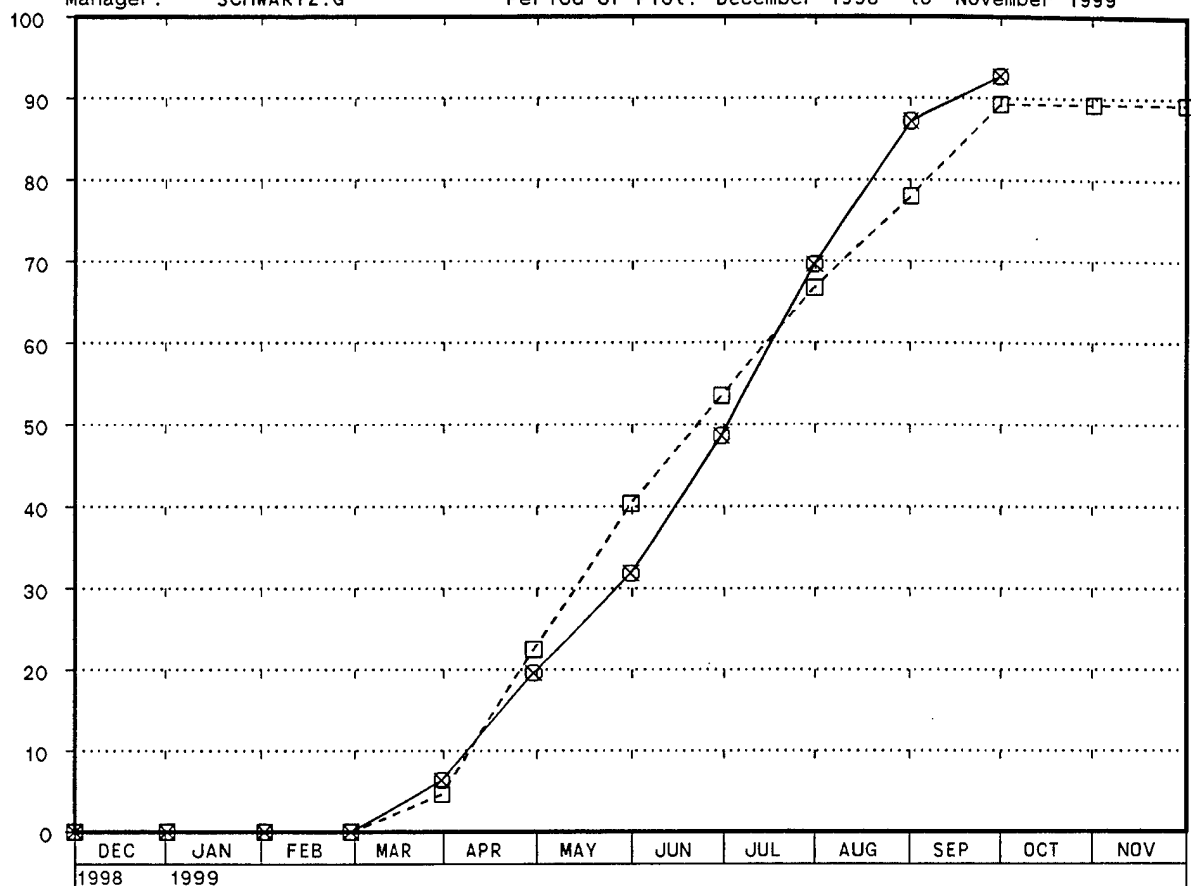
Cost with Commitments:

| Month: | rev3/99 | 0.0 | 0.0 | 0.0 | 4.6 | 17.9 | 17.9 | 13.2 | 13.2 | 11.3 | 11.3 | 0.0 | 0.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Actual | 0.0 | 0.0 | 0.0 | 6.4 | 13.3 | 12.2 | 16.8 | 21.0 | 17.6 | 5.5 | | |
| Cum: | rev3/99 | 0.0 | 0.0 | 0.0 | 4.6 | 22.5 | 40.4 | 53.5 | 66.7 | 78.0 | 89.3 | 89.3 | 89.3 |
| | Actual | 0.0 | 0.0 | 0.0 | 6.4 | 19.6 | 31.8 | 48.6 | 69.6 | 87.2 | 92.7 | | |
| | Variance | 0.0 | 0.0 | 0.0 | -1.7 | 2.9 | 8.5 | 4.9 | -2.9 | -9.2 | -3.4 | | |

**LEGEND**

⊗ Actuals

□ rev3/99 -------



Cost with Commitments:
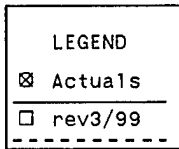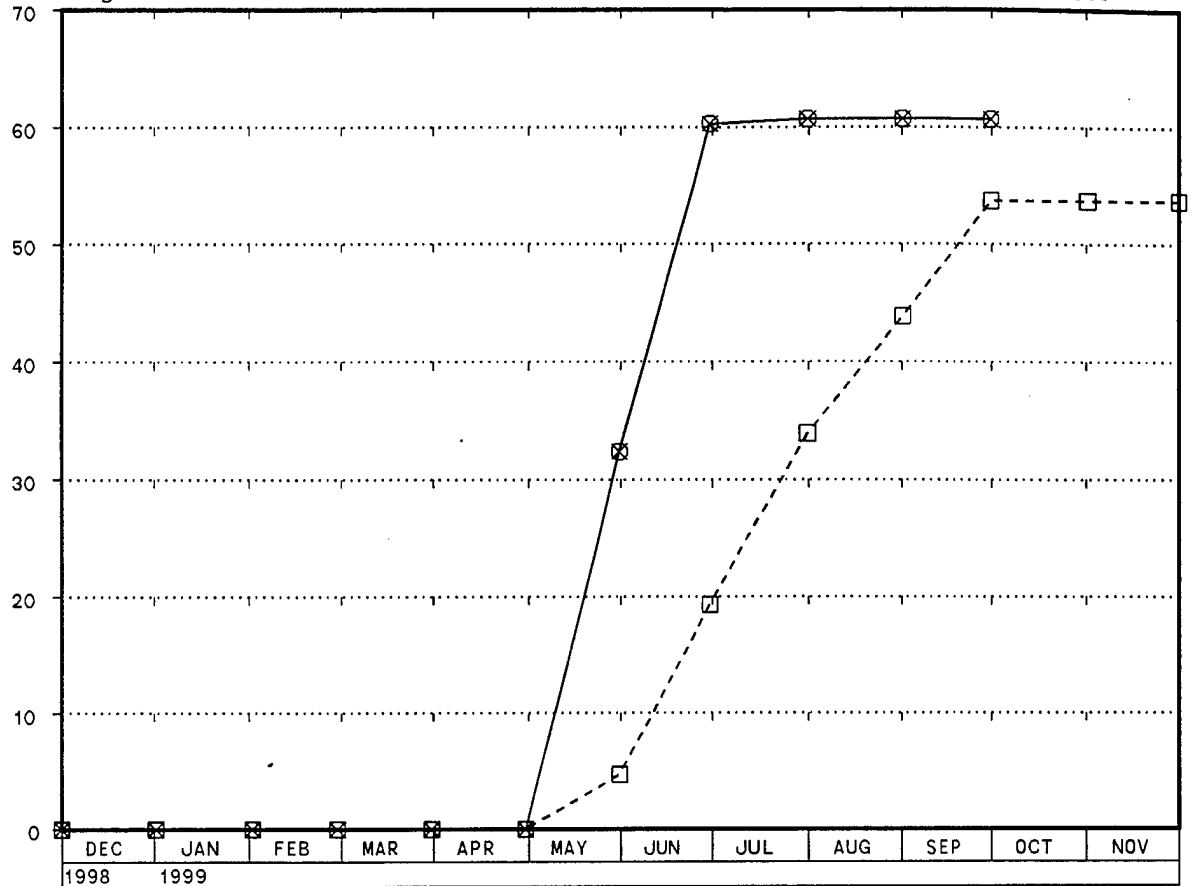
| Month: | | DEC 1998 | JAN 1999 | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month: | rev3/99 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.7 | 14.6 | 14.6 | 9.9 | 9.9 | 0.0 | 0.0 |
| | Actual | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 32.4 | 27.9 | 0.4 | 0.0 | 0.0 | | |
| Cum: | rev3/99 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.7 | 19.3 | 33.9 | 43.8 | 53.7 | 53.7 | 53.7 |
| | Actual | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 32.4 | 60.3 | 60.7 | 60.7 | 60.7 | | |
| | Variance | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -27.7 | -41.0 | -26.8 | -16.9 | -7.0 | | |

**LEGEND**
⊗ Actuals
□ rev3/99
- - - - -

Cost with Commitments:
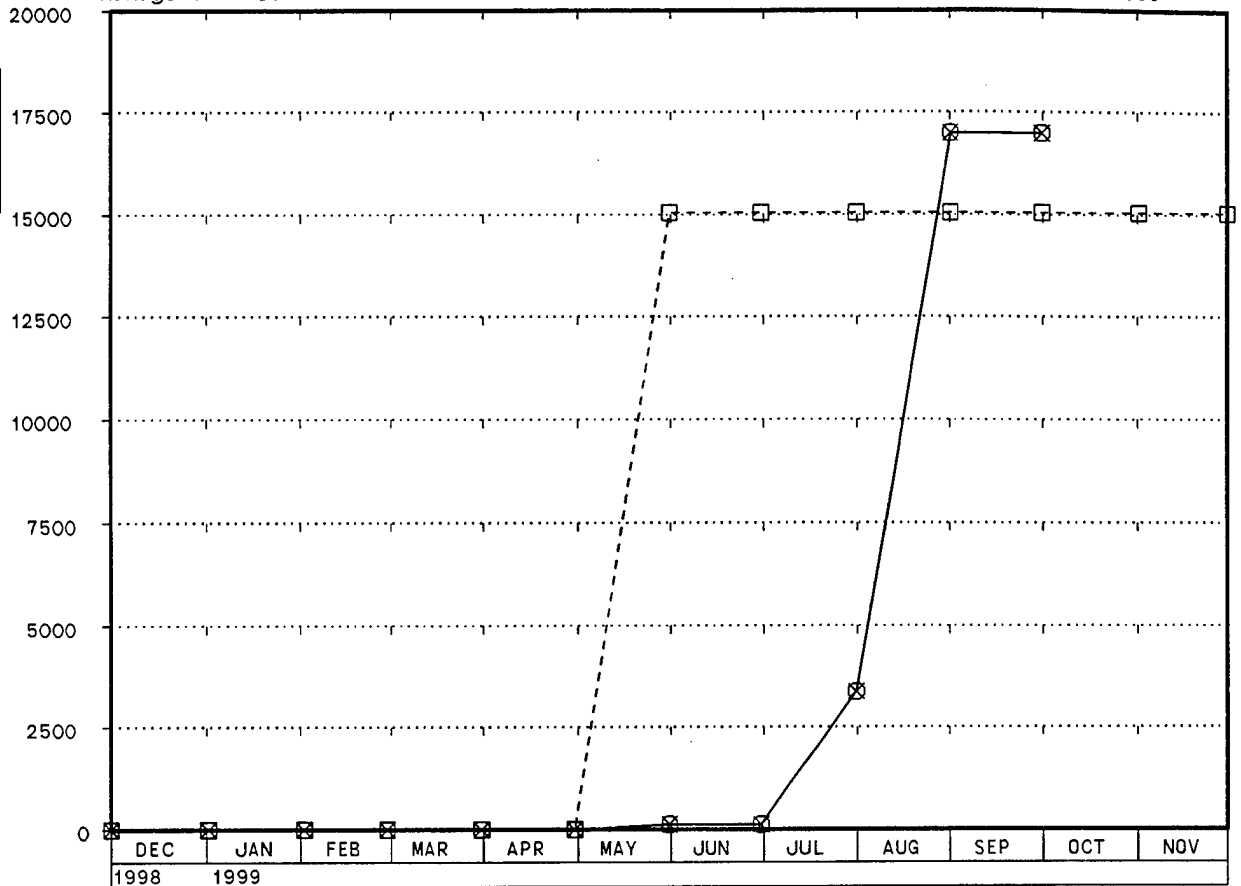
| | | DEC 1998 | JAN 1999 | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month: | rev3/99 | 0 | 0 | 0 | 0 | 0 | 15050 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Actual | 0 | 0 | 0 | 0 | 0 | 117 | 0 | 3250 | 13619 | 0 | | |
| Cum: | rev3/99 | 0 | 0 | 0 | 0 | 0 | 15050 | 15050 | 15050 | 15050 | 15050 | 15050 | 15050 |
| | Actual | 0 | 0 | 0 | 0 | 0 | 117 | 117 | 3367 | 16987 | 16987 | | |
| | Variance | 0 | 0 | 0 | 0 | 0 | 14932 | 14932 | 11682 | -1937 | -1937 | | |

LEGEND

⊗ Actuals

☐ rev3/99
- - - - - - - -

THOUSAND DOLLARS



Cost with Commitments:
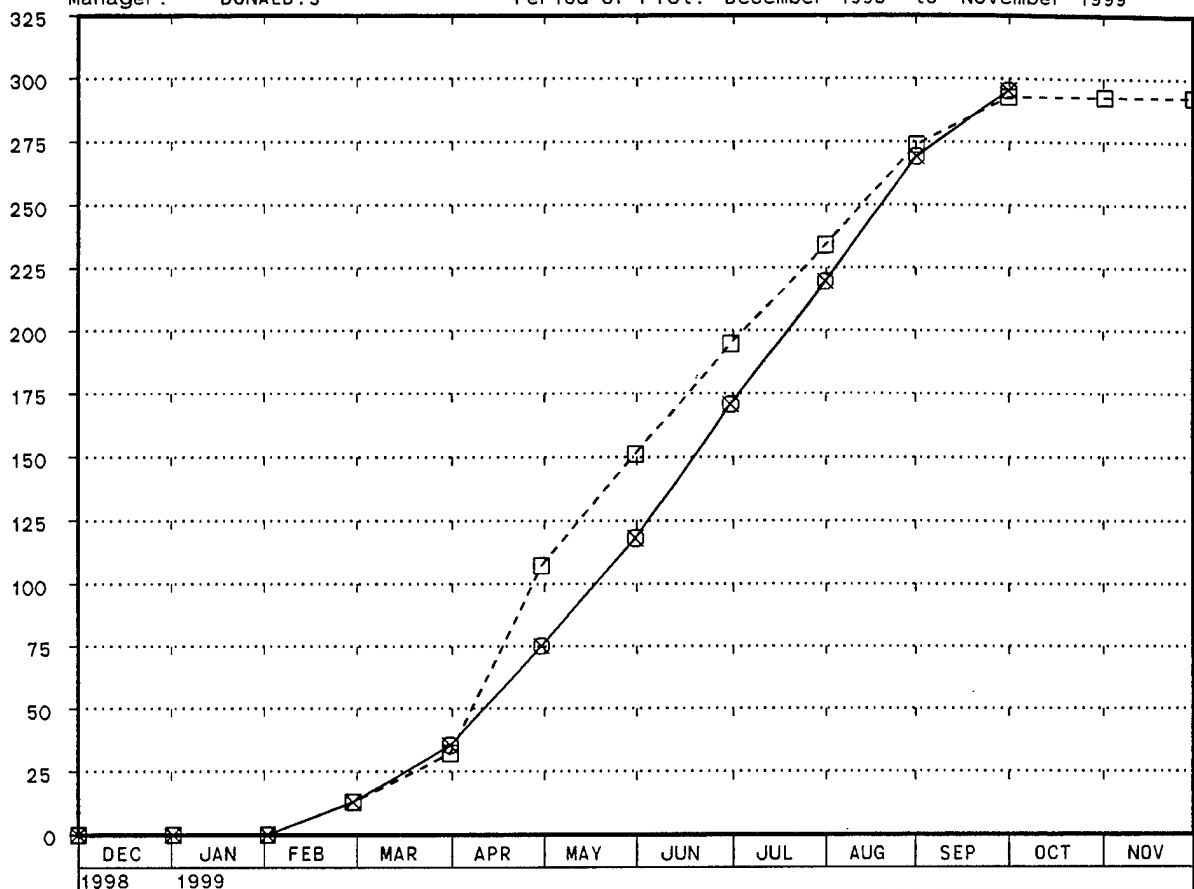
| | | DEC 1998 | JAN 1999 | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month: | rev3/99 | 0.0 | 0.0 | 13.0 | 19.2 | 75.0 | 43.9 | 43.6 | 39.2 | 39.8 | 18.9 | 0.0 | 0.0 |
| | Actual | 0.0 | 0.0 | 13.0 | 22.4 | 39.7 | 43.0 | 52.6 | 48.8 | 49.7 | 26.1 | | |
| Cum: | rev3/99 | 0.0 | 0.0 | 13.0 | 32.2 | 107.2 | 151.1 | 194.7 | 234.0 | 273.8 | 292.7 | 292.7 | 292.7 |
| | Actual | 0.0 | 0.0 | 13.0 | 35.4 | 75.1 | 118.1 | 170.7 | 219.5 | 269.2 | 295.2 | | |
| | Variance | 0.0 | 0.0 | 0.0 | -3.2 | 32.1 | 33.0 | 24.0 | 14.4 | 4.6 | -2.6 | | |

LEGEND
⊗ Actuals
☐ rev3/99



**Cost with Commitments:**
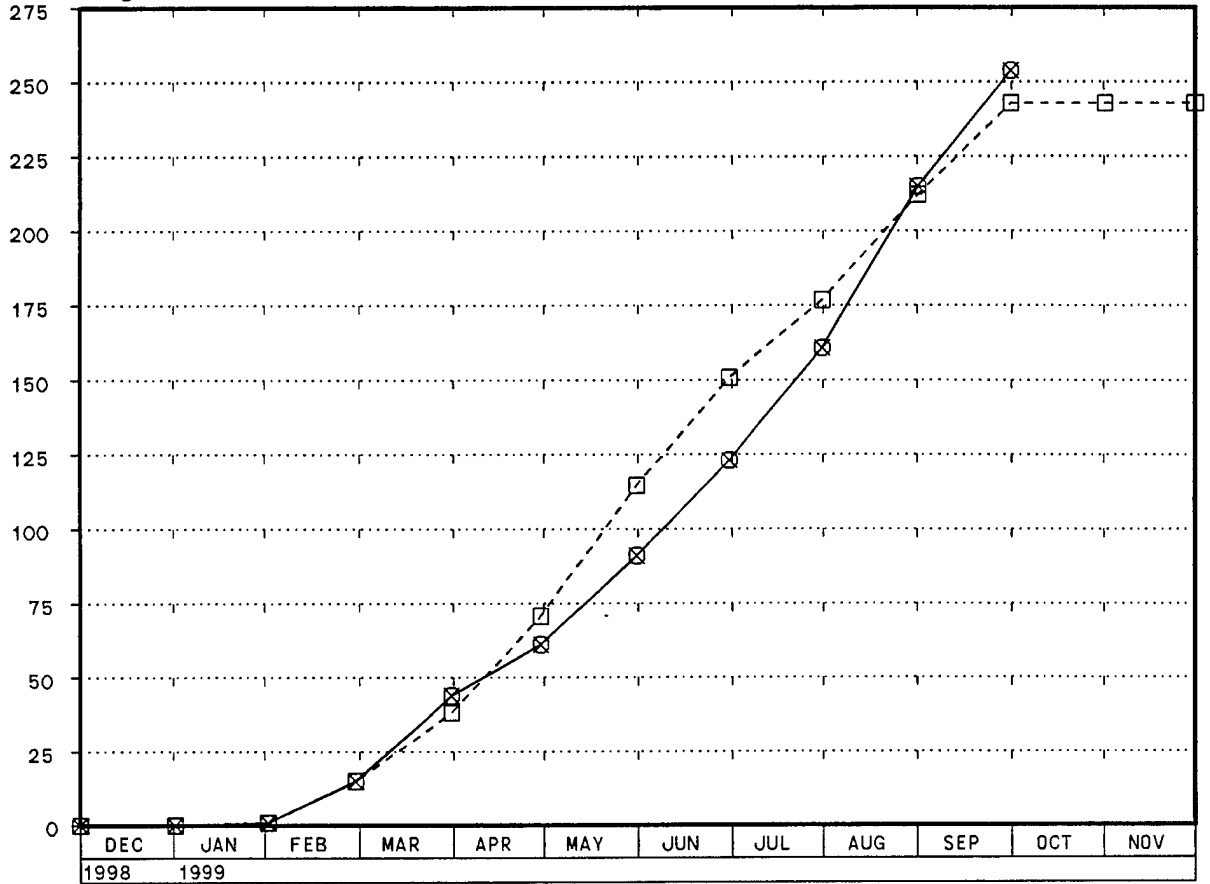
| | | DEC 1998 | JAN 1999 | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month: | rev3/99 | 0.0 | 0.9 | 14.1 | 23.2 | 32.6 | 43.9 | 36.2 | 25.9 | 35.3 | 30.6 | 0.0 | 0.0 |
| | Actual | 0.0 | 0.9 | 14.1 | 28.8 | 17.3 | 29.9 | 32.0 | 37.7 | 54.1 | 38.8 | | |
| Cum: | rev3/99 | 0.0 | 0.9 | 15.0 | 38.2 | 70.8 | 114.7 | 150.9 | 176.8 | 212.1 | 242.7 | 242.7 | 242.7 |
| | Actual | 0.0 | 0.9 | 15.0 | 43.9 | 61.1 | 91.1 | 123.1 | 160.8 | 214.9 | 253.7 | | |
| | Variance | 0.0 | 0.0 | 0.0 | -5.7 | 9.6 | 23.6 | 27.8 | 16.0 | -2.8 | -11.0 | | |

**LEGEND**

⊗ Actuals

☐ rev3/99

THOUSAND DOLLARS



Cost with Commitments:
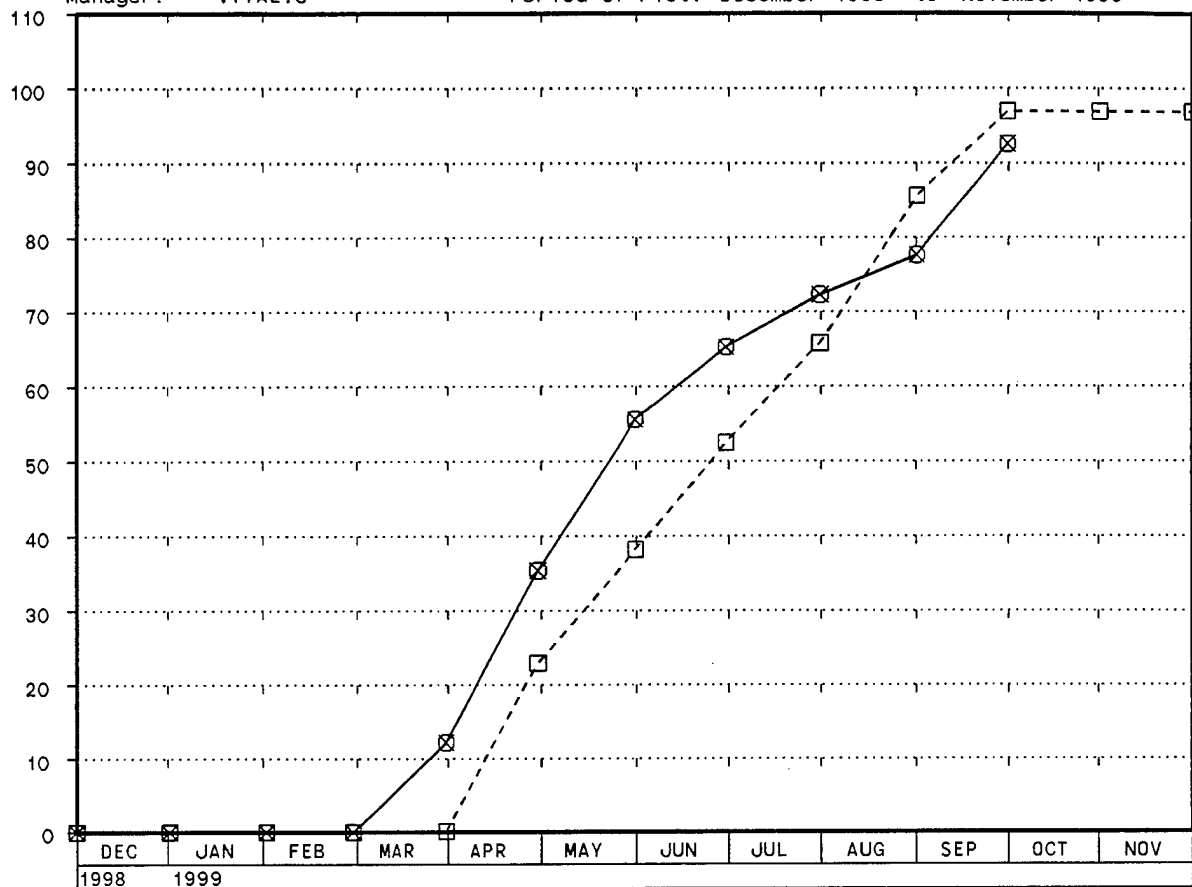
| Month: | | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month: | rev3/99 | 0.0 | 0.0 | 0.0 | 0.1 | 22.8 | 15.3 | 14.3 | 13.3 | 19.8 | 11.3 | 0.0 | 0.0 |
| | Actual | 0.0 | 0.0 | 0.0 | 12.2 | 23.2 | 20.2 | 9.7 | 7.0 | 5.3 | 14.9 | | |
| Cum: | rev3/99 | 0.0 | 0.0 | 0.0 | 0.1 | 22.9 | 38.2 | 52.5 | 65.8 | 85.6 | 96.9 | 96.9 | 96.9 |
| | Actual | 0.0 | 0.0 | 0.0 | 12.2 | 35.4 | 55.6 | 65.3 | 72.3 | 77.6 | 92.5 | | |
| | Variance | 0.0 | 0.0 | 0.0 | -12.1 | -12.5 | -17.4 | -12.8 | -6.5 | 8.0 | 4.4 | | |

LEGEND
⊠ Actuals
☐ rev3/99
- - - - - - -

T H O U S A N D   D O L L A R S



Cost with Commitments:
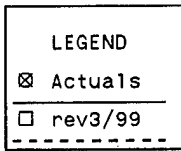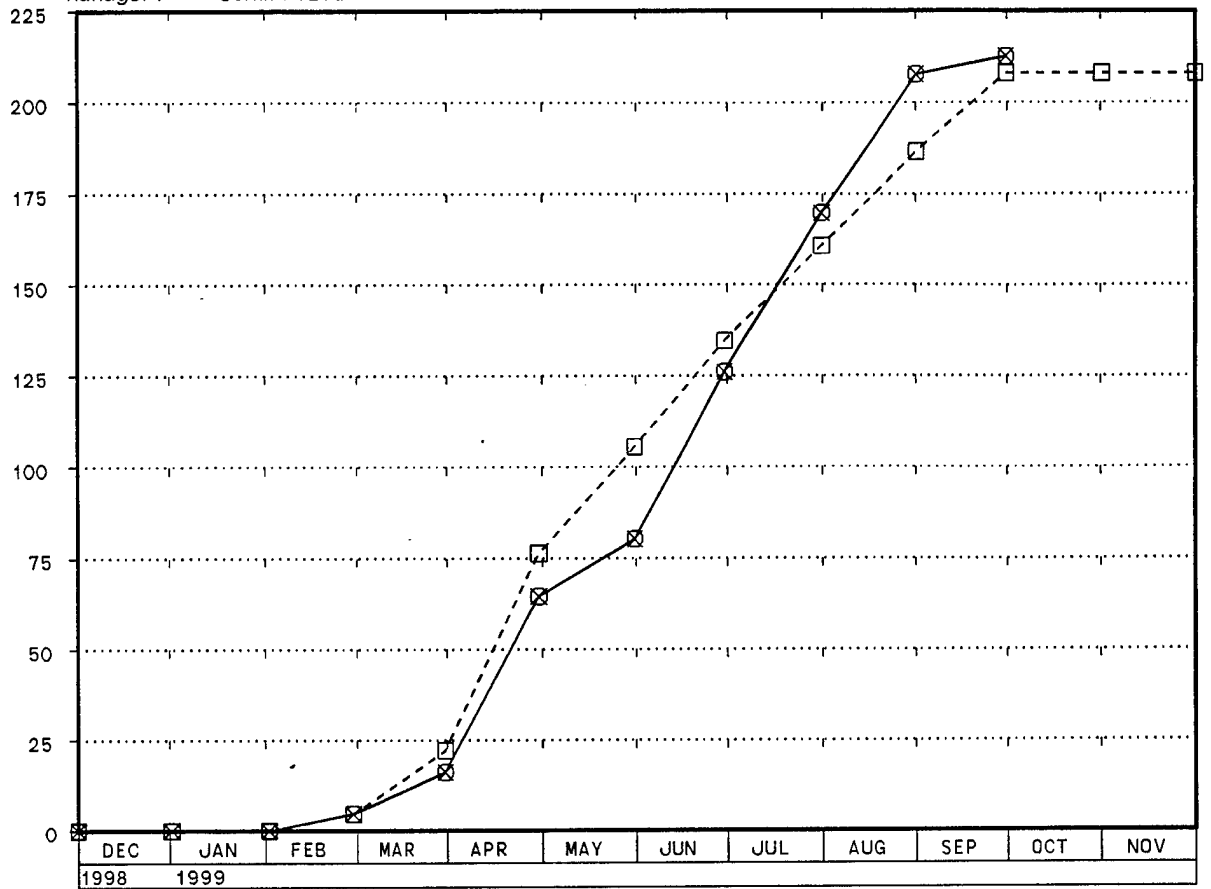
| Month: | | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV |
|--------|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Month: | rev3/99 | 0.0 | 0.0 | 4.6 | 17.5 | 54.3 | 29.1 | 29.1 | 26.1 | 26.1 | 21.4 | 0.0 | 0.0 |
|        | Actual | 0.0 | 0.0 | 4.6 | 11.5 | 48.5 | 15.7 | 45.6 | 43.8 | 37.9 | 4.9 | | |
| Cum: | rev3/99 | 0.0 | 0.0 | 4.6 | 22.1 | 76.5 | 105.5 | 134.6 | 160.6 | 186.7 | 208.0 | 208.0 | 208.0 |
|      | Actual | 0.0 | 0.0 | 4.6 | 16.1 | 64.6 | 80.4 | 126.0 | 169.8 | 207.7 | 212.6 | | |
|      | Variance | 0.0 | 0.0 | 0.0 | 6.0 | 11.8 | 25.2 | 8.6 | -9.2 | -21.0 | -4.5 | | |

# Subcontractor Reports

# SRC

**Sarcos Research Corporation**

360 Wakara Way
Salt Lake City, UT 84108
Telephone: 801-581-0155
Fax: 801-581-1151

**Monthly Report**
**September-99**

Contract #     N00014-99-C-0033
Subcontract #      1027

Mr. Paul Monticone
Subcontracts Manager
Charles Stark Draper Laboratory
555 Technology Square, MS27
Cambridge, MA 02139-3563

October 9, 1999

Contract #N00014-99-C-0033
Subcontract #1027

Project work accomplished in September included:

1. Initial over molding of the ISU electronics package was completed. Santoprene was over molded on both the epoxy coated board and on polypropylene, polyethylene and ABS board housings. The polypropylene housing exhibited better adhesion than the other two. The epoxy coated board survived the over molding temperature and pressure but ECG input wires were damaged so that the EGC circuitry could not be tested. Access to the broken wires revealed that the ECG circuit survived the over molding process.

2. The radio footprint and interface has yet to be determined by Draper. Because of this uncertainty Sarcos is proceeding with the implementation of both SPI and SCI standard interfaces for the CIU microcontroller.

3. Johnson has continued modification of the CIU. The accelerometer is fully implemented and gait detection software is being written. Gait detection will be used as a power management feature. Shivering, body position and heart rate all have been implemented in the ISU. Data can be up dated every 15 seconds rather than every minute as in the Ranger PSM implementation.

Work Planned for October:

1. Sarcos will continue the modification of the ISU. Molds will be redesigned to make the ISU package smaller
2. Sarcos will continue modifications of the CIU especially the radio interfaces and gait recognition code.
3. Sarcos will send a representative to Draper at the end of October to participate in quarterly review preparation meeting as well as the Quarterly review meeting and IPT meeting in early November.

**SRC**

Sarcos Research Corporation

360 Wakara Way
Salt Lake City, UT 84108
Telephone: 801-581-0155
Fax: 801-581-1151

# Monthly Report
## September-99

Contract #    N00014-99-C-0033
Subcontract #    1027

Issued by:
**Draper Laboratory**
PO Box 390435
Cambridge, MA 02139-0803

| Element of Cost | Sep-99 | Cumulative | |
|---|---|---|---|
| Direct Labor | 5,076.00 | 15,262.00 | 10,186.00 |
| Material | 374.00 | 922.00 | 548.00 |
| Consulting | 1,146.00 | 12,573.00 | 11,427.00 |
| Other Direct Cost | 1,672.00 | 4,832.00 | 3,160.00 |
| Subcontract | 21,779.00 | 50,284.00 | 28,505.00 |
| Outstanding Commitments | 1,730.00 | 1,730.00 | 0.00 |
| **Subtotal Direct Costs** | 31,777.00 | 85,603.00 | 53,826.00 |
| | | | |
| Benefits      @ 26.59% | 1,349.71 | 4,054.89 | 2,705.18 |
| Overhead      @ 86.21% | 5,539.60 | 16,427.60 | 10,887.99 |
| G & A         @ 26.87% | 9,924.79 | 27,436.34 | 17,511.55 |
| **Total Burdens @billing rates** | 16,814.10 | 47,918.83 | 31,104.73 |
| | | | |
| **Grand Total** | **48,591.10** | **133,521.83** | 84,930.73 |

# PSU/ARL RSVP ATD
## Progress Report
## September 1999

1. **Task Title (current work):**

   1.2.2.2  Machinery Sensor Cluster
   1.2.4     Data Fusion/ Archive Architecture
   1.2.6     Operator Interface

2. **FY99 Funds Received**            **$830,000**
   **FY99 Funds Expected**            **$ 2,206**

|  | Sept 99 | Cumulative |
|---|---|---|
| 1.1  Systems Engineering Study | $ 0 | $ 239,600 |
| 1.2  Detailed System Architecture Design | | |
| 1.2.2  Sensor Cluster | | |
| 1.2.2.2 Machinery Sensor Cluster (ICHM/SHM) | $ 55,600 | $ 223,300 |
| 1.2.4 Machinery Data Fusion/Archive Architecture | $ 36,500 | $ 79,200 |
| 1.2.6 Operator Interface | $ 11,000 | $ 25,400 |
| Demo Planning | $ 0 | $ 0 |
| **Total Expenditures** | **$ 108,100** | **$ 608,600** |

3. **Work Accomplished During Sept 99**

   1.2.2.3  Conceptual Design of a Hierarchical Distributed Architecture HMS

   OST started work on the concept design architecture. OST has identified system design options for the concept design including data acquisition, diagnostic algorithm, data processing distribution (on/off sensor), localized trend analysis, and wireless networking. OST identified a near-term (1st Qtr 00) HMS sensor prototype that could be available for an on-line demonstration.

   Interface with fleet

   Supported the RSVP working meeting aboard CVN75 on 09/08/1999. The RSVP team interacted with the officers and chiefs who operate and maintain CVN75's MMR, AMR, CDC, and flight critical systems. The team reviewed the RSVP project while the fleet provided useful comments and insights. The crew briefed the RSVP team on a variety of CVN75 systems that are both mission critical and workload intensive. The crew also provided a verbal "wish-list" of future system capabilities, outlined the future of the CVN75 network back-bone, and related their experiences with other new technologies that have been incorporated into the CVN75 design. The CHENG invited the RSVP team to observe a Flight Qual. cruise in the near future to better acquaint the team with the realities of active fleet operations and practices.

   Briefing for Execution Manager

   OST held a briefing for the Execution Manager in Virginia Beach, VA on 09/30/1999. The topics discussed included Machinery Monitoring Architecture, RF Scheme, System Integration, and Algorithm processing. Also in attendance was NSWC, PSU-ARL, LCDR Murphy, and GHL.

### 1.2.4 Data Fusion/Archive Architecture

Begun assessment of existing ship workstation SW/HW (ICAS) for use in RSVP. Awaiting signed NDA's for access to the ICAS SW.

Began definition of the approach for exchange of data/info between HCI and lower levels of the RSVP system. Original proposal was to target machinery with objective of application to other functional areas. This is not practical as Draper SW development efforts are underway and the system must be designed for easy integration with the NDDS SW they are using. Currently evaluating HCI/Network SW that makes this possible.

### 1.2.6 Operator Interface

Currently assessing commercially available packages for developing the human computer interface. Identified a number of available packages and most include built-in network and GUI code, built-in security and alarms, auto-switching of servers in case of failure. The most viable so far is SAMMI by Kinesix, which is COTS development toolkit for rapidly developing mission critical graphical systems for decision and control. SAMMI manages all commands, events, and data between the users, the GUI and peer-to-peer or client-server applications and has built-in networking capabilities through an Application User Interface. The API manages all network connectivity and communications between distributed application code and GUI. SAMMI uses TCP/IP and Remote Procedure Calls (RPC) to handle data transmission/conversion. The API eliminates need to write network interface code, implement peer-to-peer server protocols, tune the system for optimal network performance, manage address name spaces, or deal with machine-dependent data type issues. Other features:

- Built-in network and GUI code
- Built-in security and alarms
- Failover capabilities enable switching servers automatically in case of failure
- Remote views of live data using common internet browser
- Fewer than 50 API function calls
- Fully open object-oriented architecture
- Object-oriented graphics (drag & drop)
- Cross-platform portability
- Application development kit $9900
- Upgrade to Sammi development kit is $3500 (for graphics coding if more advanced features are needed, but this is not expected)
- Training $5000
- Runtime environment (needed for each data server) $990
- 15,000 licenses in 25 countries

BBN presented the SAMMI SW to Draper and PSU representatives and brought Kinesix in to have them explain the SW in further detail. Draper agrees that it is an attractive option for developing the HCI given that it has the networking built-in. BBN and Draper are of the opinion that the NDDS SW could easily be interfaced to SAMMI using the APIs of the two SW packages.

### 1.2.6.3 Conceptual Development Virtual Presence Approach

LCDR Murphy, Dan McCarthy, Les Johnson (ACI), Scott Lang attended a meeting hosted by the NSWCCD Philadelphia Gas Turbines Code to request SSGTG documentation/information for K34 to K17 transition. Attended by Jack McGruarty, Don Hoffman, Vincent Wagner, Matt Hoffman, Jim Burns, Nick Mangraviti. A list of information/documents were compiled, due dates were set, and plans for future discussions/ involvement were set. Working Group meeting scheduled for 15 Oct.

## 4. Projected Work (3 months)

1.2.2.2 Machinery

Obtain required supporting documentation for K17 from alternate source. Complete RCM analysis to identify monitoring requirements for K17 vs. K34 to support RSVP demonstration.

HMS functional, performance and integration goals (SHM-HCI)

Define the health monitoring system (HMS) functional, performance, and integration requirements (communications) at and above the SHM level (Compartment (access point) level to Platform (HCI) level).

Refine functional, performance and integration requirements captured in IPPD workshops in collaboration with other team members.

Finalize production cost estimates, begin O&S cost evaluation

In conjunction with development of technical approach identify machinery technical, schedule and programmatic risks – develop risk mitigation plan.

1.2.4 Data Fusion/ Archive Architecture

Assess levels of data fusion at the machinery, compartment and platform level (HCI) in support of SSGTG and A/C Plant integration efforts. Identify cross-functional data fusion requirements.

1.2.4.1 Machinery Level – SHM

Identify interfaces to be controlled for SSGTG and A/C Plant systems with assistance from PSU/ARL, Honeywell and OST. Identify critical integration issues based on development efforts of the CBM ACI Program.

Identify interfaces to be controlled for Machinery Monitoring and RSVP (Access Points) system with assistance from PSU/ARL, Draper, OST and other team members.

Develop baseline Interface Control Specification and Control Documents defining communication protocols, message formats, file structures, and additional information as required to fully define the interface between the SSGTG and A/C Plant systems and the compartment access points.

1.2.4.2 Compartment Level – Access Point

Define requirements and developing approach for exchange of data/ information (data fusion) at the compartment level (access point) between the four RSVP defined functional areas; Machinery, Environmental, Structural, and Personnel.

Begin assessment of RSVP compartment level data/information exchange requirements with respect to approach and hierarchical architecture developed under the ONR ACI Program.

1.2.4.3 Watchstanding - HCI

Assist in assessment of existing ship workstation software and hardware for implementation of RSVP HCI.

Define approach for exchange of data/information between the HCI and lower levels of the RSVP System. Select COTS SW package for HCI development that has built-in networking capability.

1.2.6 Operator Interface

Obtain copy of ICAS software to ascertain applicability and integration issues for FY01 demo. Provide high level User Interface requirements to ICAS developers for review and assessment of ICAS software changes that may be required. Iterate concept user interface screens.

Review and assess existing User Interface and Manning programs. Support a 4$^{th}$ quarter 1999 Flight Qualification cruise aboard CVN75 to understand the maintenance and watch-standing issues the fleet faces. Identify and characterize RSVP carrier applications and quantify the operational environment for an HMS.

Assist in the definition of operator's data/information requirements to support machinery virtual presence. Continue working with LCDR Murphy on this issue.

Develop objectives and MOE's in conjunction with scenario development and identification of virtual presence information requirements

5. **Near term deliverables:**

1. Letter Report: SSGTG HMS Functional, Performance, and Integration Goals – 12/8/99

2. Letter Report: Description of SSGTG HMS Functional Requirements and Comments on Carlow RSVP Functional Analysis Report - waiting for copy of final report

3. Letter Report: Analysis of Reliability and Maintenance Experience of the K-17 SSGTG – 12/8/99

4. Report: Conceptual Design of a Hierarchical, Distributed Architecture HMS for the 501-K17 SSGTG - 12/8/99

5. Letter Report: Baseline K17 HMS Hardware and Software Requirements – 12/31/99

6. Letter Report: Support Requirements for Shipboard Demonstration of a K17 HMS – 12/31/99

7. Letter Report: Systems Requirements Document for York 200 Ton A/C Plant HMS – 12/31/99

8. Letter Report: Approach to Integrate Results and Design of Independently Developed A/C Plant and SSGTG Health management Systems for RSVP Demonstration – 12/31/99

9. Report: Conceptual Interface Specifications and Control Documents to Integrate HMS Information for A/C Plant and SSGTG (Access Point) - 12/31/99

10. Letter Report: Conceptual Definition of Data/Information Requirements to Support Virtual Presence – 12/31/99

6. **Problems:**

Continued delay in receipt of information on SSGTG K17 engine affecting completion of deliverables 3,4,5,6 and 10 listed above.

Delay in signing of NDA's to receive ICAS software has limited ability to assess and determine applicability/costs/risks of using ICAS for RSVP FY01 demonstrations.

Delays in issuing subcontracts affecting original deliverable schedule.

7. **Efforts to Resolve Problems:**

SURFLANT POC identified, information request to be submitted week of 10/11/1999

Alternate commercial software under evaluation, requirements for HCI submitted to ICAS representative at NSWC – official response requested, indicating effort and funding required to support RSVP demo requirements.

Aggressive schedule established and agreed to - all FY99 deliverable to be completed by 12/31/99.