Improved Environmental Control Unit (IECU) Program Overview

JOCOTAS Technical Working Group Meeting

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# Improved Environmental Control Unit (IECU) Program Overview

**Title:** Improved Environmental Control Unit (IECU) Program Overview

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**Performing Organization:**

**PM Mobile Electric Power, Fort Belvoir, VA, 22060**

**Sponsoring/Monitoring Agency:**

**Performer's Organization:**

**Report Number:**

**Distribution/Availability:** Approved for public release; distribution unlimited

**Supplementary Notes:**

6th Bi-Annual DOD JOCOTAS Meeting with Rigid & Soft Wall Shelter Industry & Indoor & Outdoor Exhibition, 2-4 Nov 2009, Panama City Beach, FL

**Security Classification:**

- a. Report
  - Unclassified

- b. Abstract
  - Unclassified

- c. This Page
  - Unclassified

- 17. Limitation of Abstract
  - Same as Report (SAR)

- 18. Number of Pages
  - 13

- 19a. Name of Responsible Person

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Standard Form 298 (Rev. 8-98)

Prescribed by ANSI Std Z39-18
ECU Introduction
Military vs. Commercial ECUs
IECU Capabilities and Benefits
R410a Refrigerant Selection
Estimated IECU Fuel Savings
PM-MEP Top IECU Initiatives
Future Acquisition Efforts
IECU Program Schedule
60k IECU System Description and Layout
Points of Contact
ECU System Introduction

- MIL-STD ECUs Provide Critical Cooling to Vital Command, Control, Communications, Computer, and Intelligence (C4I) and other Military Electronic and Support Systems Equipment
- Importance amplified by:
  - The increasing proliferation of and reliance on digital electronic equipment
  - Current extreme operational environments
- Used in Over 180 Systems Throughout the Army
- MIL-STD ECUs are available in five sizes:
  - 6k, 9k, 18k, 36k, and 60k BTUH
- Over 15,000 MIL-STD ECU Systems are fielded
- IECU family currently in development
  - Provide compliance with Clean Air Act
  - Improve weight, reliability, efficiency, and logistics footprint

Electronic systems will overheat and fail without the critical cooling ECU’s provide
Military IECUs vs. Commercial A/Cs

Centralized ECU management will reduce the purchase and use of commercial equipment to replace standard military systems.

**Improved Environmental Control Units**
- ✔ Designed to operate to 125°F
- ✔ Cooling capacities rated at 125°F
- ✔ Organically supportable
- ✔ Improved NBC and EMP survivability, reduced aural and IR signatures
- ✔ Ruggedized for field use
- ✔ Soft start, limited inrush current
- ✔ High reliability in mission environments

**Commercial A/C Equipment**
- ✗ Designed to operate only to 100°F
- ✗ Cooling capacities rated at 90°F; performance degrades rapidly at temperature extremes
- ✗ Supportable only through contractor support
- ✗ No NBC or EMP survivability, or reduced aural or IR signatures
- ✗ Not ruggedized for field use
- ✗ High inrush current increases size of power generation equipment
- ✗ Reduced reliability in mission environments

*Commercial unit proliferation reduces readiness and increases O&S costs and logistics footprint.*
IECU Capabilities & Benefits

- Form, fit and function replacement of MIL-STD ECUs
- Use R-410A refrigerant, the commercial industry's standard
- Fully operable up to 125 degrees Fahrenheit
- Ruggedized for military environments
- Reduced power consumption
- Reduced weight
- Increased reliability over current MIL-STD ECUs
- Increased supportability through commercially available components
- Organically supportable
- Soft start, limited inrush current
- NBC compatible and EMI protected
- Embedded diagnostics
- Automatic safety controls
- Remote control capability
R410a Refrigerant Selection

• R410a meets mission needs
  – 60k IECU demonstrated operational effectiveness at ambient temp of 135°F, passed all developmental test requirements
  – PATRIOT system’s 24k IECU successfully passed High Temperature Operation testing at 125°F
• R410a thermal efficiency allows for smaller, lighter refrigeration components
• R410a is near-azeotropic and can be “topped-off”
• R410a is emerging as AC industry’s primary refrigerant to achieve EPA compliance
• Use of R410a minimizes logistics impact of introduction of another new refrigerant
### IECU vs MIL STD Fuel Savings for One Year

<table>
<thead>
<tr>
<th>IECU Size (kBTU/hr)</th>
<th>Fuel Cost/gal. ($) (1)</th>
<th>Annual Usage (hrs) (2)</th>
<th>Fleet Size (MIL/STD) (3)</th>
<th>gal/hr (MIL/STD) (4)</th>
<th>gal/hr (IECU) (5)</th>
<th>Fuel Savings (gal/hr)</th>
<th>% Fuel Savings</th>
<th>IECU Fuel Savings ($)</th>
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</thead>
<tbody>
<tr>
<td>9</td>
<td>14.33</td>
<td>3880</td>
<td>3660</td>
<td>0.287</td>
<td>0.206</td>
<td>0.081</td>
<td>28%</td>
<td>16,483,295</td>
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<td>18</td>
<td>14.33</td>
<td>3880</td>
<td>3710</td>
<td>0.403</td>
<td>0.380</td>
<td>0.023</td>
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<td>36</td>
<td>14.33</td>
<td>3880</td>
<td>2330</td>
<td>0.741</td>
<td>0.613</td>
<td>0.128</td>
<td>17%</td>
<td>16,582,263</td>
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<td>60</td>
<td>14.33</td>
<td>3880</td>
<td>5560</td>
<td>1.051</td>
<td>0.881</td>
<td>0.170</td>
<td>16%</td>
<td>52,553,498</td>
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</table>

Total Fuel Savings ($) 90,363,438

Total Fuel Savings (gal) 6,305,892

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1. per TEP ORD, Table 17, section 8.0.4, extract from "More Capable Warfighting through Reduced Fuel Burden", DOD Study, January 2001
2. per summary of Calculations for 3880 Annual Hours of IECU Operation, Oct 2007
3. 9/18/36k IECU based on AAO and CECOM LCMC analysis, 60k IECU per AAO and washout requirements as presented at Milestone "C" review
4. based on FAT power consumption test data and calculation of expected fuel usage per TQG data
5. based on prototype power consumption test data and calculation of expected fuel usage per TQG data
PM-MEP IECU Top Initiatives

- **60K IECU Continues LRIP Phase**
  - Produce 160 LRIP units (Jan-Sept 2010)
  - Conduct First Article Testing (FAT)
  - Receive Type Classification (TC) and Full Materiel Release (FMR) approval
  - Tentative First Unit Equipped 4th Qtr FY10

- **9, 18, and 36K IECU SDD Phase**
  - Contract Award in FY09- Begin R&D efforts w/ (2) Contractors building (2) variants
  - Contract Award in FY10- Continue R&D efforts on four variants w/ (1) Contractor
    - 9K 115V/1PH/60Hz
    - 18K 208V/3PH/60Hz
    - 18K 230V/1PH/60Hz
    - 36K 208V/3PH/Hz
IECU Future Acquisition Efforts

- **Trailer-mounted** variant of 60K to support TOC standardization efforts
  - Currently an unfunded requirement
- **120k BTU/hr IECU:**
  - Revalidate the requirement with the Combat Developer
  - Determine user application and AAO
  - Currently an unfunded requirement
- **Co-Generation System Development**
  - Self powered, export power capable systems
  - Currently an unfunded requirement

Funding requested in FY 10-15 POM
## IECU Program Schedule

<table>
<thead>
<tr>
<th>Event Name</th>
<th>FY 07</th>
<th>FY 08</th>
<th>FY 09</th>
<th>FY 10</th>
<th>FY 11</th>
<th>FY 12</th>
<th>FY 13</th>
<th>FY 14</th>
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<td><strong>9/18/36K IECU</strong></td>
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<td>SDD Contract Award</td>
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<td>SDD (Phases I and II)</td>
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</table>
## 60k IECU System Description

<table>
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<tr>
<th>Specification</th>
<th>Value</th>
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<tr>
<td>Total Cooling Capacity (BTU/hr)</td>
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<tr>
<td>Sensible Cooling Capacity (BTU/hr)</td>
<td>40,000</td>
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<tr>
<td>Heating Capacity (BTU/hr)</td>
<td>33,935</td>
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<td>Max Power Consumption (kW)</td>
<td>10.6</td>
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<td>Power Factor</td>
<td>0.98</td>
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<td>Current (A)</td>
<td>33.1</td>
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<td>Evaporator Airflow (SCFM)</td>
<td>1,804</td>
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<tr>
<td>Operational Conditions</td>
<td></td>
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<tr>
<td>Cooling (°F)</td>
<td>40 to 125</td>
</tr>
<tr>
<td>Heating (°F)</td>
<td>-50 to 80</td>
</tr>
<tr>
<td>Weight (lbs)</td>
<td>552</td>
</tr>
<tr>
<td>Dimensions (inches)</td>
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<tr>
<td>Height</td>
<td>46</td>
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<tr>
<td>Weight</td>
<td>42</td>
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<tr>
<td>Depth</td>
<td>35</td>
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<tr>
<td>Reliability [MTBEFF (hrs)]</td>
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<td>Soft Start Capability</td>
<td>Yes</td>
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<td>Refrigerant Type</td>
<td>410 A</td>
</tr>
<tr>
<td>Refrigerant Charge (lbs)</td>
<td>6.7</td>
</tr>
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</table>
60k IECU System Layout

EMI/THD: Electro Magnetic Interference/Total Harmonic Distortion

PM MEP
POWERING THE FORCE
# Points of Contact

<table>
<thead>
<tr>
<th>Name</th>
<th>Role</th>
<th>Phone Number</th>
</tr>
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<tbody>
<tr>
<td>LtCol. Edward Taylor</td>
<td>Product Manager</td>
<td>(703) 704-3160</td>
</tr>
<tr>
<td>Mr. Pete Shively</td>
<td>Assistant Product MGR</td>
<td>(703) 704-2016</td>
</tr>
<tr>
<td>Mr. Ike Lee</td>
<td>9/18/36k IECU Engineer</td>
<td>(703) 704-2639</td>
</tr>
<tr>
<td>Mr. Jeff Taylor</td>
<td>60k IECU Engineer</td>
<td>(703) 704-3208</td>
</tr>
<tr>
<td>Ms. Kim Hall</td>
<td>IECU Logistician</td>
<td>(703) 704-3172</td>
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