Improved Environmental Control Unit (IECU) Program Overview

JOCOTAS Technical Working Group Meeting

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Report Documentation Page

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Agenda

- 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 Fuel Savings

IECU vs MIL STD Fuel Savings for One Year

IECU Size (kBTU/hr)	Fuel Cost/gal. ($) (1)	Annual Usage (hrs) (2)	Fleet Size (3)	gal/hr (MIL/STD) (4)	gal/hr (IECU) (5)	Fuel Savings (gal/hr)	% Fuel Savings	IECU Fuel Savings ($)
9	14.33	3880	3660	0.287	0.206	0.081	28%	16,483,295
18	14.33	3880	3710	0.403	0.380	0.023	6%	4,744,382
36	14.33	3880	2330	0.741	0.613	0.128	17%	16,582,263
60	14.33	3880	5560	1.051	0.881	0.170	16%	52,553,498
					Total Fuel Savings ($)			**90,363,438**
					Total Fuel Savings (gal)			**6,305,892**

(1) per TEP ORD, Table 17,section 8.0.4, extract from "More Capable Warfighting through Reduced Fuel Burden", D0D 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 useage 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

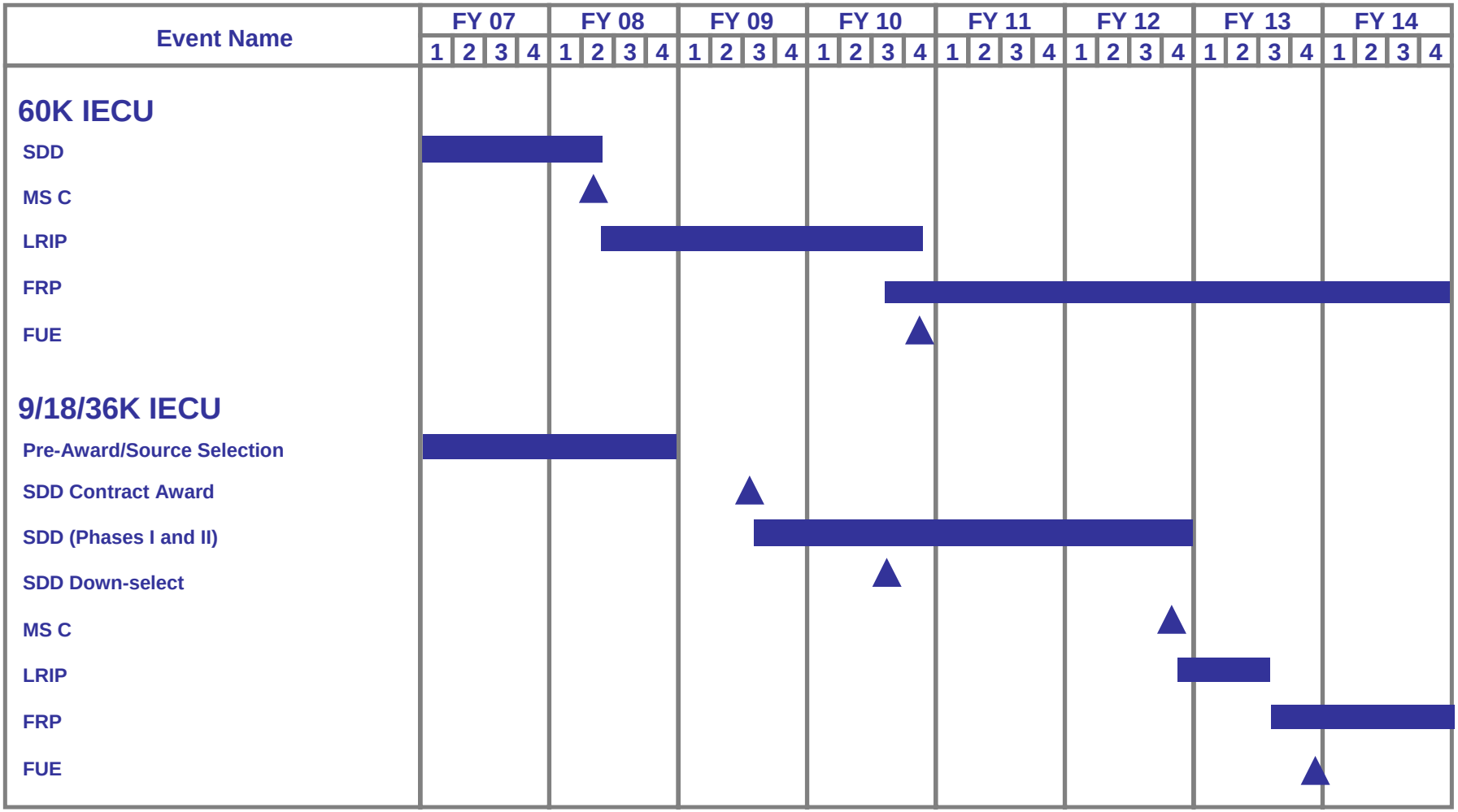
- **60K IECU Continues LRIP Phase**
  - Produce 160 LRIP units (Jan-Sept 2010)
  - Conduct First Article Testing (FAT)
  - Receive Type Classification (TC) and Full Materiel Release (FMR) approval
  - Tentative First Unit Equipped 4th Qtr FY10
- **9, 18, and 36K IECU SDD Phase**
  - Contract Award in 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

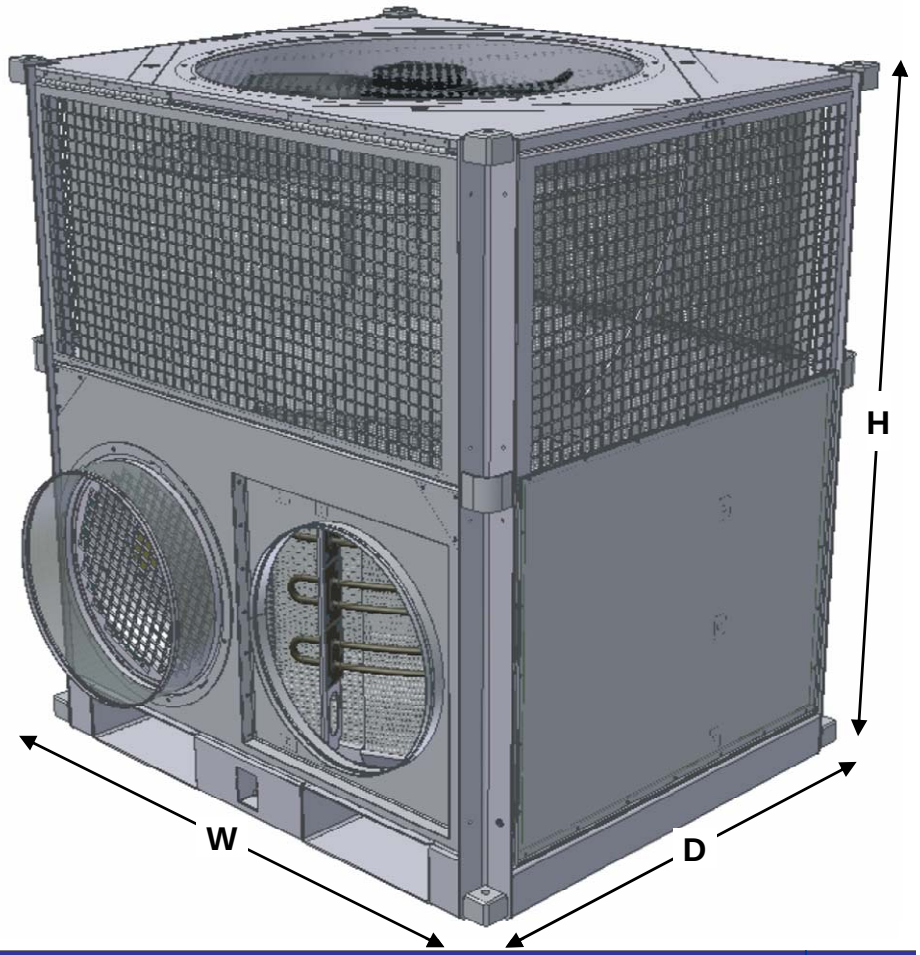
Funding requested in FY 10-15 POM

IECU Program Schedule

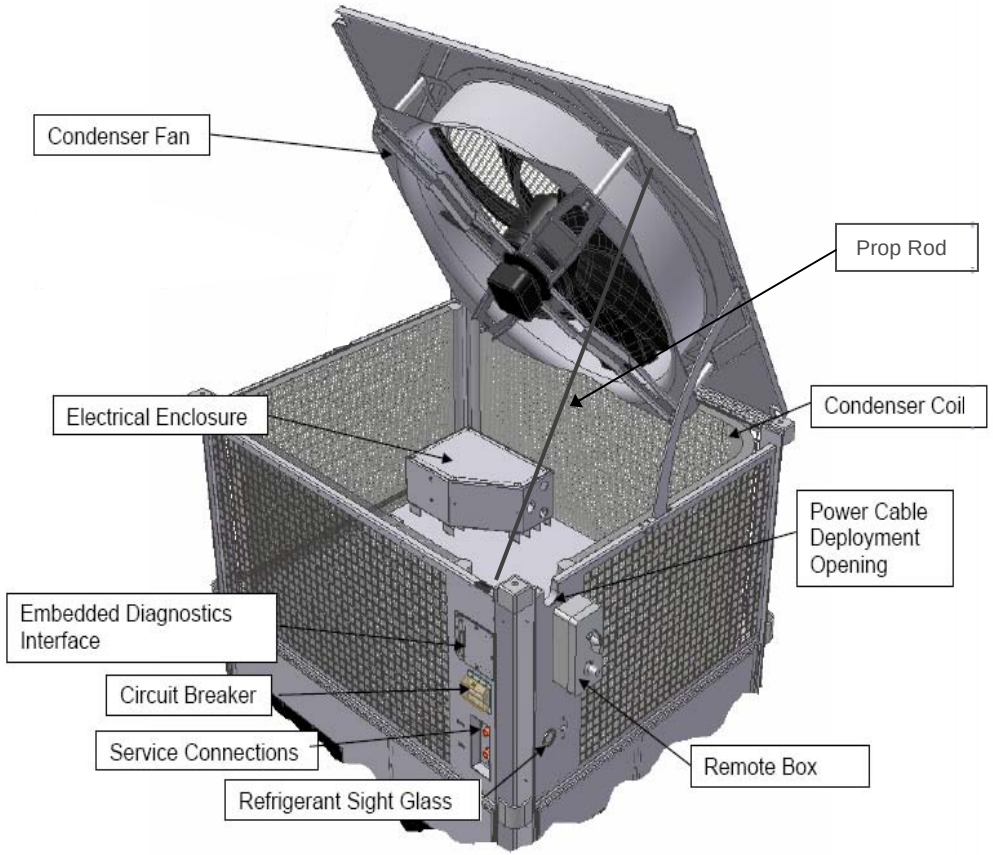


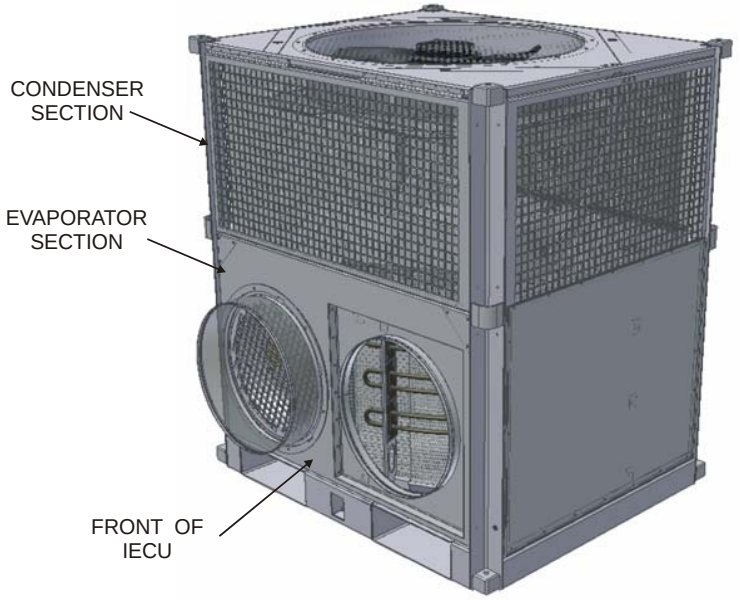
60k IECU System Description

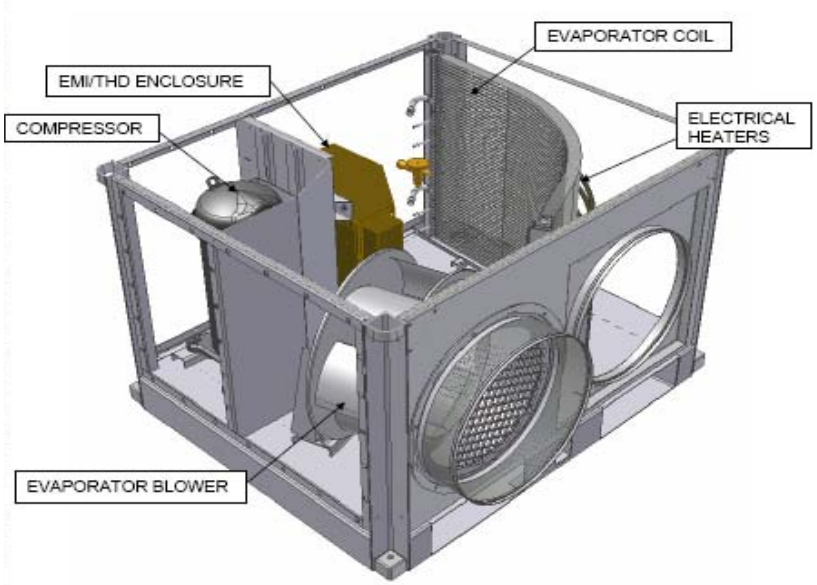
Total Cooling Capacity (BTU/hr)	62,000
Sensible Cooling Capacity (BTU/hr)	40,000
Heating Capacity (BTU/hr)	33,935
Max Power Consumption (kW)	10.6
Power Factor	0.98
Current (A)	33.1
Evaporator Airflow (SCFM)	1,804
Operational Conditions	
Cooling (ºF)	40 to 125
Heating (ºF)	-50 to 80
Weight (lbs)	552
Dimensions (inches)	
Height	46
Weight	42
Depth	35
Reliability [MTBEFF (hrs)]	3590
Soft Start Capability	Yes
Refrigerant Type	410 A
Refrigerant Charge (lbs)	6.7



60k IECU System Layout







EMI/THD: Electro Magnetic Interference/Total Harmonic Distortion

Points of Contact

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