



Air Force Civil Engineer Center



AFCE Ground Robotic and Autonomy Needs

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Overview

- **CE Overview**
- **Prime Beef/Redhorse Missions**
- **Expeditionary Engineering Needs**
- **Emergency Services Needs**
- **Upcoming Programs**
- **Summary**



Air Force Physical Plant Profile

161 Air Force Installations

Family Housing



74,500 Homes
3 x Bermuda

Facilities



615M Sq Ft of Buildings
3 x Target
205 x Dallas Cowboys stadium



9M Acres of Land
3 x Connecticut



Plant Replacement Value
\$240B PRV
Revenue of entire
US restaurant industry

Airfields



184M Sq Yds of Pavement
169 x Atlanta
Hartsfield-Jackson Airport
Dormitories



66,300 Dorm Rooms
1/2 total hotel rooms
in Las Vegas

We Fly, Fight and Win in Air, Space and Cyberspace from Installations



Installations Enable

Enduring Air Force Contributions

Installations

- Power projection platforms -- CONUS, OCONUS, expeditionary
- Enable air & space superiority
- Assure Cyberspace access
- Provide infrastructure necessary to hold targets at risk anywhere across the globe
- Facilitate ISR exploitation
- Host robust C2 networks
- Build partnerships with allies & developing nations by forward basing US forces



“Air bases are a determining factor in the success of air operations. The two-legged stool of men and planes would topple over without this equally important third leg.” General of the Air Force Henry H. “Hap” Arnold



CE Mission

The mission of Air Force Civil Engineering is to provide, operate, maintain and protect sustainable installations as weapon-system platforms through engineering and emergency response services across the full mission spectrum.



Air Force Civil Engineers

What We Do



Installation Engineering



Expeditionary Engineering



Emergency Services



Environmental and Energy



Housing



AFCEC BLUF

- AFCEC activated 1 Oct 12
- Cornerstone of Civil Engineering Transformation
 - Merges legacy FOA roles and missions (AFCEE, AFCESA, AFRPA)
 - Further **centralizes** some major command and installation functions
 - Leads AF effort to transform and optimize key civil engineering capabilities and programs





CE Support to Combatant Commands

To support the COMAFFOR (Commander, Air Force Forces) and Joint Expeditionary Taskings, civil engineers are deployed as Prime Base Engineer Emergency Force (BEEF) or RED HORSE.





CE Support to Combatant Commands

Prime BEEF Capabilities

- Engineer command & control
- Civil engineer operational planning
- Technical design
- Advanced construction management
- Intermediate and depot-level repair support
 - Power generation
 - Electrical distribution
 - Aircraft arresting systems
- Airfield Damage Repair
- Emergency Services





CE Support to Combatant Commands

RED HORSE Capabilities

- Water-well drilling
- Explosive demolition
- Quarry operations
- Concrete and Asphalt Batch Plant Operations
- Material Testing
- Large Expedient Facility Erection
- Concrete and Asphalt Paving
- Airborne RED HORSE





Air Force Civil Engineers

What We Do: Expeditionary Engineering

- Expeditionary engineering consists of those activities required to *establish, operate, maintain, recover, and reconstitute installations*
- Focuses on force beddown and facilities and utilities construction, repair, modification, maintenance, and operation.



PNT Needs

- Precision surveying
 - Indoor, outdoor, underground
 - Cm level accuracy
- Precision construction operations
 - Tool control – cutting, digging, trenching
 - Horizontal & vertical precision required
- Unmanned equipment operations
 - Route following
 - Up to highway speeds
 - Personnel tracking for avoidance & safety



Air Force Civil Engineers

What We Do: Emergency Services

- Emergency services consists Explosive Ordnance Disposal, Fire Emergency Services, and Emergency Management & CBRN Defense
- Wide range of global operations in all environments, terrain and weather conditions



PNT Needs

- Precision localization
 - Personnel trackers
 - Remote distance measuring
 - Low cost equipment and system localization
- Indoor navigation
 - First responder nav aids
 - Virtual bread crumbs
 - Hazardous environments
- Unmanned systems
 - Low cost, high accuracy and precision nav systems
 - Small footprint – size, weight & power, antennas
- Difficult environments
 - Tunnels/culverts
 - High multipath environments – aircraft ramps, clustered buildings, forest canopies



Robotics & Unmanned Systems

RDT&E, Procurement, Sustainment **(CXAE)**

Unmanned systems & equipment technologies to support the full range of CE Missions





Robotic Technologies

- **Research & Development Areas**

- Airfield Damage Repair & UXO Response
- EOD Robotics & Technologies
- Fire & Emergency Services
- Robotics for Airbase Operations and Support

- **Benefits to the Warfighter**

- Reduced manpower/time/cost
- Increased safety of personnel
- Technical expertise
- Reduction of development time with existing systems and new capabilities



**AOE
Excavator**



MACE



**Airborne
ARTS
In theater**



BOMBOT





Upcoming Programs



Robotic EOD Technologies



- Develop technologies for unmanned EOD operations
- Focus on detection and neutralization of conventional military munitions
- Provide rapid response and neutralization of IEDs
- Increase operational capability of EOD personnel by decreasing mission time and increasing stand-off
- Employ state-of-the-art sensors on robotic systems



COTS EOD Robot

- **Back-Packable system weighing less than 30 lbs**
- **Remotely perform EOD operations - reconnaissance and assessment**
- **Increases capability of EOD personnel against larger threat spectrum**
- **Targeting 160 systems for deployment and training**
- **10 year support requirement**
- **RFP estimated Q1 FY15**





Airfield Damage Repair

- Actions required to prepare airfield operating surface to establish or sustain operations at a forward operating location
- Recover the airbase in hours instead of days
- ADR operations spectrum includes
 - Open the airbase
 - Establish/robust the airbase
 - Operate the airbase
 - Repair the airbase





Multiple UXO Removal System

- System of systems (UGV and UAV) to detect and remove ordnance from airfields
- Utilizes a GIS based application utilized to visualize and process airfield damage inputs
- Able to identify, remove, and render safe ordnance left on airfield with minimal human interaction





Automated Airfield Construction and Repair



- **Unmanned ground vehicles automatically performing airfield construction and repair**
 - **Operation at 50-75% manned tempo**
 - **Integrate robotic appliques for airfield construction equipment**
 - **Implement multi-robot and convoy ops**
 - **Leader/follower**
 - **Coordinated material handling**
 - **Operations sequencing**
 - **Develop network of robots that can navigate and repair damaged runways**
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Unmanned Civil Engineering Operations



- Automated ground systems to perform AF Civil Engineer Operations
 - Aviation firefighting, hazardous incident response, aircraft decontamination, etc.
- Integrate and control appliques or retrofit systems to existing AF platforms
- Demonstrate unmanned systems that minimize exposure to risks associated with hazardous operations



Fire and Emergency Services

Minimize direct human interaction in hazardous operations

- Develop autonomous capabilities for aircraft firefighting/rescue operations
- Integrate appliques and sensors to provide remote fire detection and fighting ability
- Provide initial firefighting response



- Develop and integrate software and sensors for remote detection of CBRNE materials
- Provide detection of hazardous materials in threat environment or post disaster analysis
- Assessment via multi-spectral imaging and CBRNE sensors



Summary

- **Provide robotic and autonomous systems for AF CE capabilities**
 - Do the dull, dirty, and dangerous, and much more...
 - **Require low cost, high accuracy and precision systems that operate in GPS denied/difficult environments**
 - **Must work in a military relevant environment**
 - **Support both personnel and equipment operations**
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Questions?

