Air Force Installation & Mission Support Center

Airbase Technologies Branch (ABT): Tech Transition

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AFCEC/CXAE

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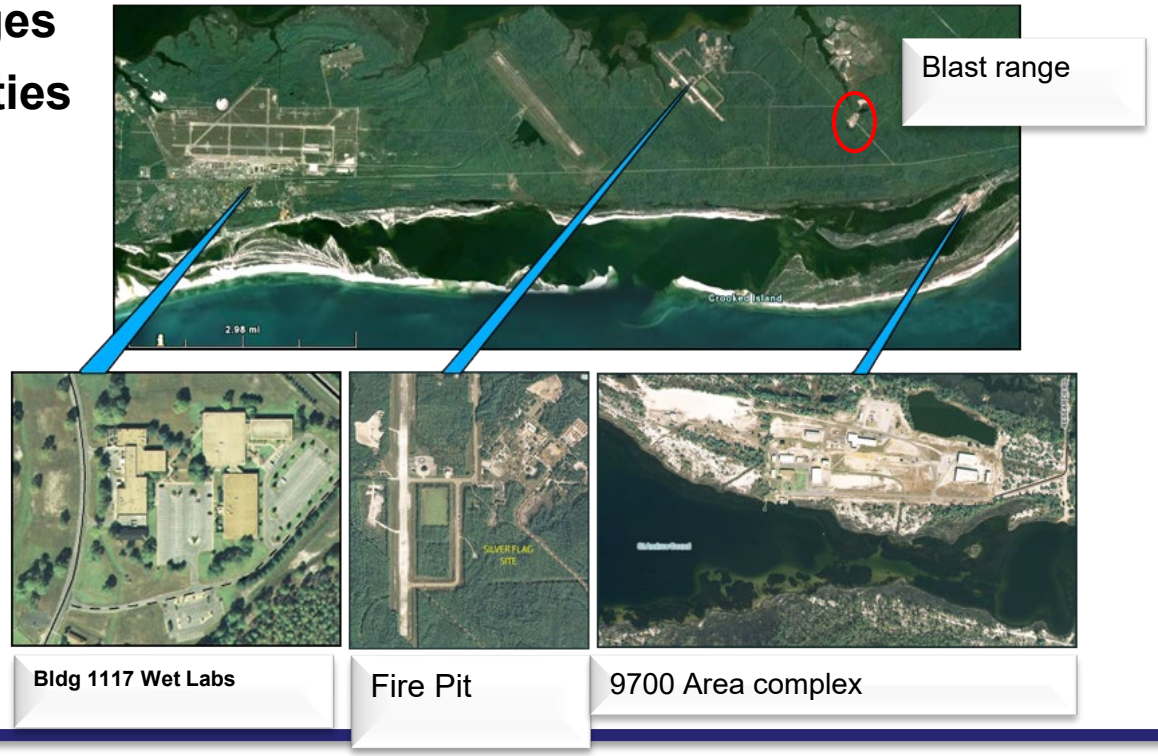
Overview

- Airbase Technologies Branch (CXAE)
- Technology Transition
- Managing AFFF Training Wastewater
- Conclusions
- Questions

AIRBASE TECHNOLOGIES (ABT)

ABT Branch Personnel and Facilities

- **Personnel– 1 Mil, 13 Civ (10 Perm/3 Term)*, 128 Ctr****
  - **Mil/Civ – 3 PhDs, 7 Masters; Ctr - 6 PhDs, 17 Masters**
- **Facilities Overview**
  - **4 compounds, 20 facilities, 143 acres of T&E ranges**
  - **250,000+ sq ft of laboratories and industrial facilities**
  - **100+ RDT&E vehicles**
  - **$25M+/- equipment**
  - **12 miles between facilities**
  - **Defense Research & Engineering Network**
  - **Silver Flag Exercise Site**
  - **Utah Test Range**



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- **Acquisition: develop, evaluate, and field technology**
  - Develop (RDT&E) and field new technology/prototypes
  - Provide CE unique test & evaluation facilities/ranges
  - Evaluate commercially available technology/equipment (COTS)
  - Modify existing equipment
  - Procure and sustain material solutions
  - Provide expert technical advice and reach back support
  - Focused on 7 primary technical areas that encompass the entire scope of airbase technology needs

Civil Engineer Materials & Processes (CEMP)

CE materials & processes RDT&E

- Airfield damage repair
- High-strength, heat-resistant pavements
- Cementitious & asphalt-based pavements
- High-strength, fire-resistant structures
- Fire extinguishing agents & fire-resistant materials
- Deployable waste reduction and energy recovery
- Water filtration, reuse and recovery
- Chem/Bio-resistant fabrics and coatings (CBRN)

Facilities

- Dedicated materials & processes laboratories
- Chemistry, microbiology & pilot-scale laboratories
- Microwave chemistry laboratory
- Additive manufacturing laboratory

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Airbase Operating Surfaces

Aviation pavements construction and repair technologies

- Advanced materials development
- Equipment development & modernization
- Rapid damage assessment & repair
- Expeditionary repair & construction

Facilities

- Material, soil, asphalt, concrete labs
- Full-scale runway test facility
- Aircraft load simulators
  - C17 and F15 load carts
- Inclement weather test area
- Covered concrete test pad

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Robotics & Unmanned Systems

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

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

Facilities

- Engineering & Rapid Prototyping
  - Machining & Fabrication
  - Electrical & Electronics
- High-speed & All-terrain wooded tracks
- UAS/RPA Operations - Restricted airspace
- Amphibious—open water access







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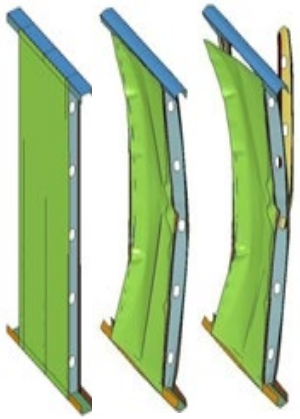
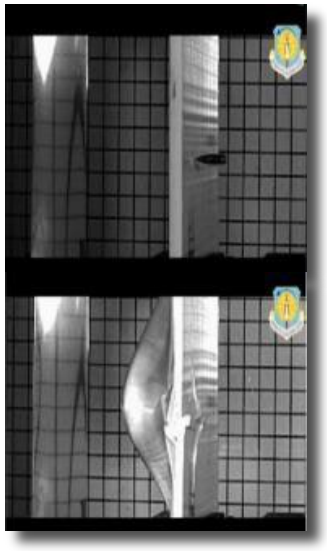
Engineering Mechanics and Explosive Effects

Ballistics and explosive threat protection technologies for airbase protection and resiliency

- Aircraft & equipment protection
- Infrastructure protection & retrofit
- New construction guidelines (UFCs)
- Non-traditional threat protection (VBIED)
- Emerging weapons protection
- Blast & ballistic model development & verification





Facilities

- Ballistic laboratory up to 20mm
- 2000lb NEW explosives range – Tyndall
- Unlimited NEW – Utah Test Range - UTTR
- Full-bay test structure
- Exterior wall structure
- Interior blast structure
- Specific load testing instruments/systems

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Fire & Emergency Services

Technologies for aviation & airbase firefighting

- Fire extinguishing agents/material development & testing (AFFF)
  - Aircraft, ARFF, Structural, Deployed, Wildland
- Firefighting equipment and PPE
- Extinguishing techniques and procedures

Facilities

- Small-scale laboratory
- Energetic materials fire facility
- Total flood test facility
- Medium-scale indoor fire test facility
- Full-scale outdoor fire test facility
  - (C-130)

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Energy & Utilities

Installation and expeditionary energy & utilities technologies

- Energy optimization
- Base self-sufficiency/resiliency
- Power generation
- Waste & fuel reduction

Facilities

- Chemistry/Biology lab
- Energy system lab
- Wastewater treatment system lab
- Full-scale demo sites
- BEAR Technology Evaluation & Integration Laboratory (BTEIL)

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Vehicle Maintenance, Ops and Range Support

Vehicle Maintenance

Operations Support

Range and Ops Support

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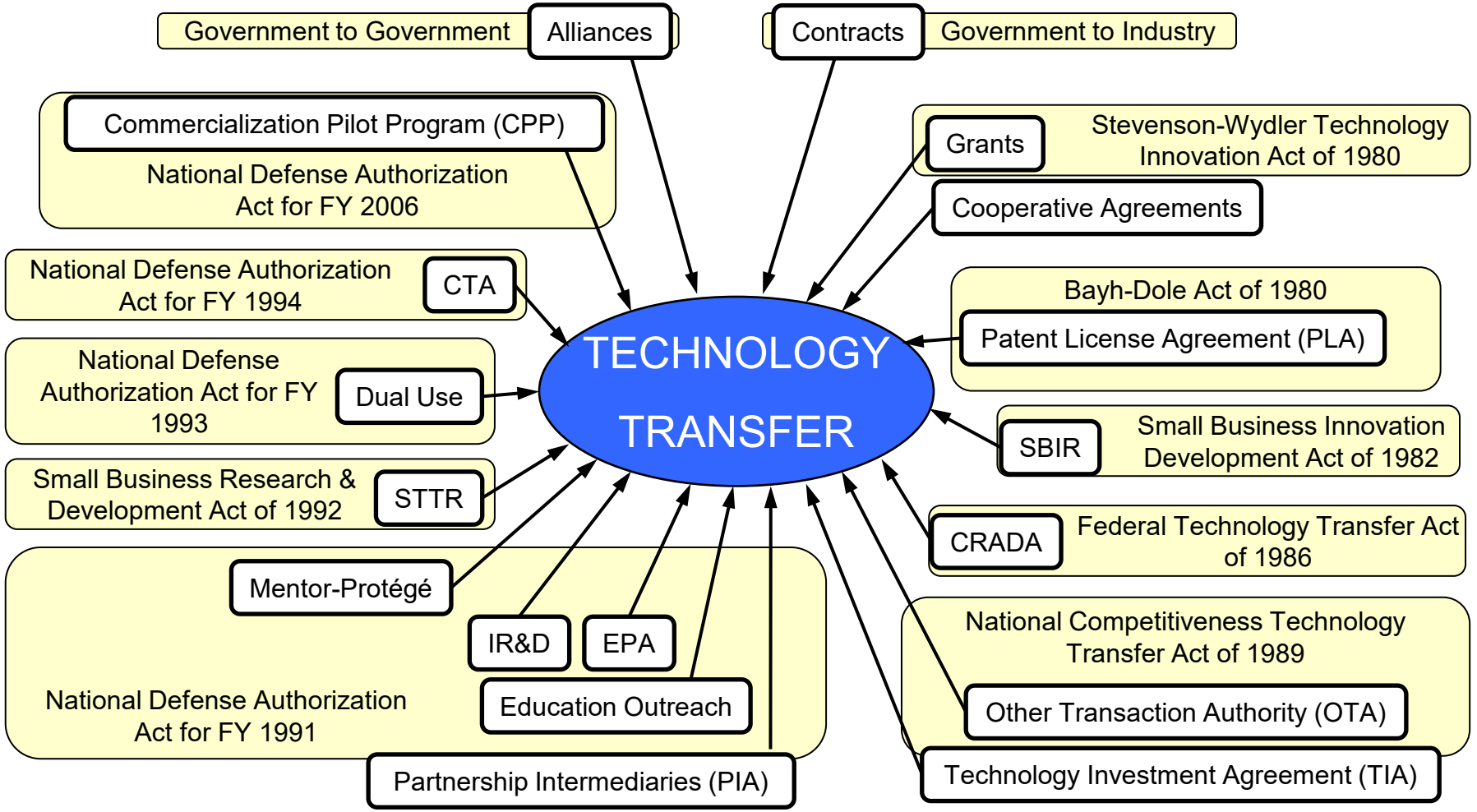
Technology Transfer Authorizations



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Office of Research and Technology Applications (ORTA)

Ms. Debra Richlin

Dr. Bridgett Ashley

Technology Transfer Managers

Air Force Civil Engineer Center

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Office of Research and Technology Applications

- **AFCEC ORTA established in 2013**
- **Technology Transfer (T2) Managers:**
  - Supports scientists and engineers (S&Es) in transferring technology
  - Coordinates and develops transfer opportunities
  - Assists commercial sector (industry and academia) in identifying technologies and POCs
  - Ensures all activities are in compliance with DOD and service-specific policies
- **This is an additional Duty for AFCEC T2 Managers**

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ORTA Tech Transition: Overview

- **AFCEC/CX is authorized to enter into:**
  - **Cooperative Research and Development Agreements (CRADAs)**
  - **Educational Partnership Agreements (EPAs)**
  - **Commercial Test Agreements (CTAs)**
  - **Patent License Agreements (PLAs)**

- **Educational Partnership Agreements is a formal agreement between a defense lab and an educational institution (university, high school, etc.) to transfer tech applications and assist at all levels of education (pre-kindergarten and up)**
  - **Judge science fairs**
  - **Donation of equipment**
  - **Teach classes and give seminars**
  - **Advise capstone projects**
  - **Faculty, staff and students can work in defense labs on projects**
- **AFCEC/CXAE has EPAs with numerous local high-schools and universities, has provided capstone project advisors and equipment, provides support for Science Technology Engineering and Mathematics programs, serve on graduate and advisor committees, etc.**

CTA and PLA

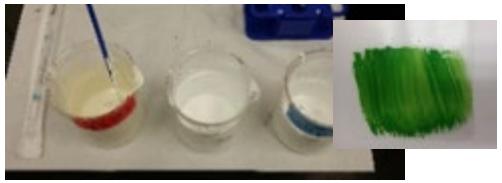
- A Commercial Test Agreement allows a commercial entity to pay the Air Force to use our unique resources for RDT&E.
- A Patent License Agreement allows a commercial entity to license Air Force patents and pay royalties.
- AFCEC/CX has no current CTAs.
- AFCEC/CXAE has two active PLAs – one for biocidal additives and one for cementitious materials.
  - TechLink, a DoD funded tech transfer specialist, assists companies with finding and developing PLAs with DoD labs.

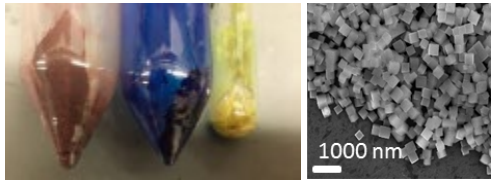
CRADA

- **A CRADA is an agreement between the government and a commercial entity.**
  - **NO Funds may transfer from government to non-federal party**
  - **The federal lab may commit personnel, facilities, equipment and other resources to co-develop technology with the non-federal party**
- **AFCEC/CX has entered into many CRADAs over the last 10 years**
  - **Matter of Trust: to develop natural fiber filtration technology**
  - **Florida State University: to further research into microwave chemistry applications**
  - **Battelle Memorial Institute: to test and evaluate PFAS Free Foams for use by DoD**
  - **TDA: to allow use of AFCEC/CXAE facilities for test and evaluation of fire suppression additives**
  - **Theriax: To develop and transition CXAE patented technologies for commercial purposes**

Collaborative Efforts (Fire & CEMP)

Theriax, LLC (Small Business) CRADA with AFCEC	• License holder of AFCEC patents • Tech transition of biocidal and decontamination catalysts in paint
Florida State University CRADA with AFCEC	Understanding microwave interactions to control magnetic nanocrystal growth
Natick (NSRDEC)* Univ. South Alabama	Self-decontaminating textiles (decontamination of chemical warfare agents)
Natick (NSRDEC)* Univ. South Alabama	Antimicrobial liners for chem-bio protective uniforms
Matter of Trust (Small Business) CRADA with AFCEC	Natural fibers for foam/PFAS filtration





*Natick Soldier Research, Development & Engineering Center

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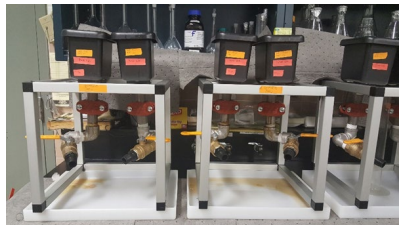
Collaborative Efforts (Fire & CEMP)

Organization	Technology
Federal Aviation Administration (FAA)	Rosenbauer Firetruck with CAFS
Battelle CRADA with AFCEC	ESTCP Proposal for Fluorine Free AFFF Testing and Demonstration/Validation Against Mil-Spec
Navy Expeditionary Warfare Center	Validation of Rinsing Agent Protocols for AFFF Holding Tanks
University of Maryland Fire Protection Engineering Department	General Research/Demonstration/Validation of Water Mist Systems for Aircraft Hangars
National Defense Center for Energy and Environment (NDCEE)	• Wastewater Evaporators • HF Detector • Plasma Destruction of PFAS



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Managing AFFF Training Wastewater

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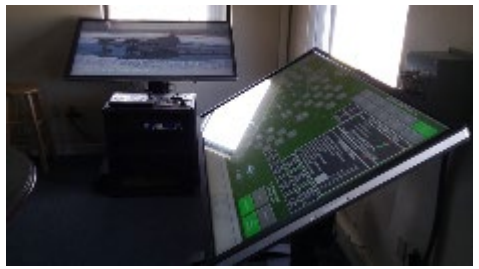
AFCEC Aircraft Fire Research/Training Facility

Components:

- Aircraft simulator
- Centralized control room
- Fuel/water separator
- Propane/jet fuel storage
- Water conservation pond
- All pits are double-lined



Features:

- Touch screen
- system control
- Propane fuel
  - 40 propane ground burners
  - Electrical ignitors
  - Auto spread feature
  - Above ground burners
    - IB/OB/tail engines,
    - wheel, cargo, interior
- 16 jet fuel nozzles
- All pits are double-lined

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Firepit Aerial

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Test Site Waste Stream Management

Upgrade Storage Infrastructure

Minimize rainwater collection

- Covered retention pond and installed 200K gal storage tank
  - Consolidates storage
  - Limits biofouling (e.g., algae)
  - Assists active treatment processes (pump-head pressure, lessen feedstock fluctuations)
- Retention pond design facilitates pre-treatment processes
  - Enhance treatment train concepts

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Test Site Waste Stream Management

- **Minimize "passive" input**
- **Reduce volume for disposal**
  - ***All water collected in training system must be disposed as hazardous waste***
  - ***CXA developing and applying on-site processes that reduce disposal requirements***

Test Site Waste Stream Management

Active Wastewater Reduction
Thermal Evaporator Systems

- Three commercial industrial evaporators on site
  - Pilot Scale Systems – *R&D to optimize process, assess pretreatment options and monitor efficiency*
  - Industrial scale platform – *Effectively eliminated site surplus*
  - Operating 20 months
    - >1.3 million gallons processed to date
    - 98-99.9% reduction in liquid volume per cycle
  - Cost savings vs. commercial disposal >$2.5 M

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Test Site Waste Stream Management

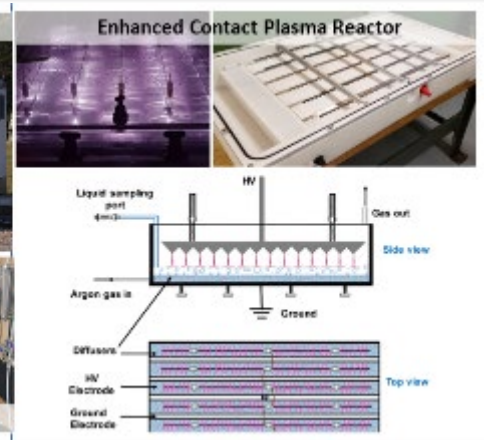
- **Robust test & training tempo produces exceptionally complex waste stream**
  - ***Beyond the PFAS burden–fuels and surfactants complicate downstream processing and thermal evaporation***

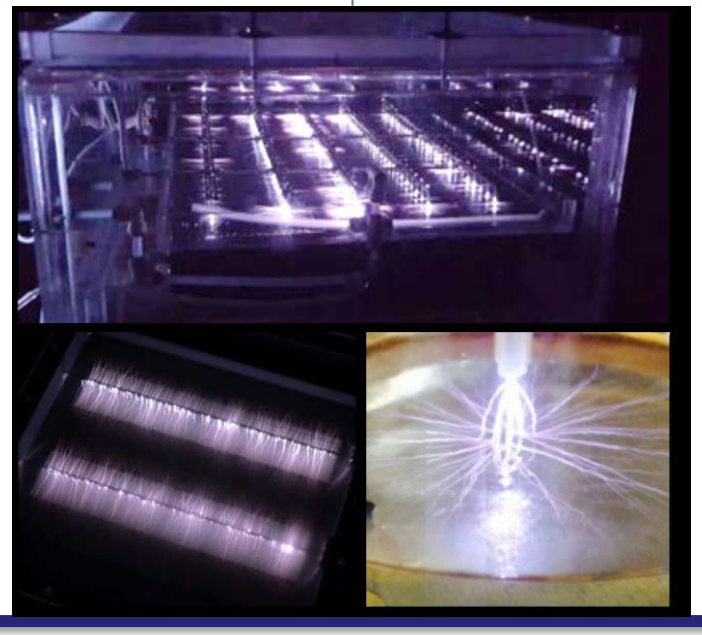
- *Optimize adsorption (reactive filtration) processes to collect contaminants*
  - *Combine commercial and developmental materials in treatment sequences*
- *Develop biologically-mediated processes to sequester and degrade waste stream*
  - *Plant-based evaporation and collection of contaminants*
  - *Microbial degradation of the recalcitrant, but "less-than forever" contaminants*

Plasma Technology for Treatment of PFAS-Impacted Waters (NDCEE)

- Project originally an AFCEC/CZ BAA
- Demonstration at Wright-Patterson AFB
- Treated several hundred gallons of water
- System works by oxidizing the PFAS at the surface of the water (and bringing PFAS to the surface of the water to be oxidized)

- Scaled up version (3000+ gallons of water) will be demonstrated
  - First at Tyndall using high level PFAS water
  - Second at Ft. Leavenworth using groundwater





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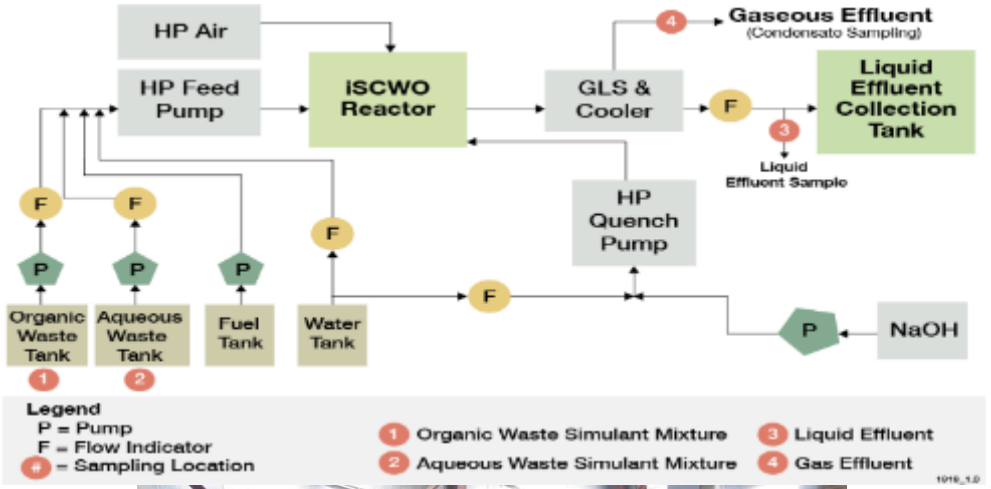
Supercritical Water Oxidation-iSCWO (NDCEE)

- Oxidizes PFAS using supercritical water at 3500 psi
- end process creates inorganic fluoride salts
- System is currently used in industry to eliminate a wide range of organic contaminants, but not PFAS



- Demonstration was conducted at General Atomic's laboratories in California Spring 2021
  - 600 gallons of water from Tyndall is being shipped for the demonstration.
  - Demonstration was successful, with 98% destruction of the PFAS
  - Start up costs are expensive and recommendations are to see how other tech evolves

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Adsorptive Treatment Trains

- Standard industrial adsorbents
  - Granular activated carbon
  - Ion exchange resins
    – Work well but limitations
    – complex waste streams and low molecular weight PFAS
    – not sustainably manufactured

- Bio-adsorbents – Hair, fur, feathers
  – collect and retain PFAS and other contaminants from waste stream
  –scaled process up to support industrial scale evaporator (up to 250 gallons per hour)
  –coupled with granular activated carbon

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Solar Evaporators/Distillers

- Design and build demonstration-scale solar evaporators to determine effectiveness at removing water from PFAS-impacted effluent
- System was built in 2021 and tested
  - There is contamination in the system caused by physical carry over of PFAS
  - Decreasing trend of PFAS in distillate is visible – indicating the system is isolating the water from the PFAS
- Interpretation of results difficult due to contaminations
- <u>But</u> the method looks promising and should be pursued further

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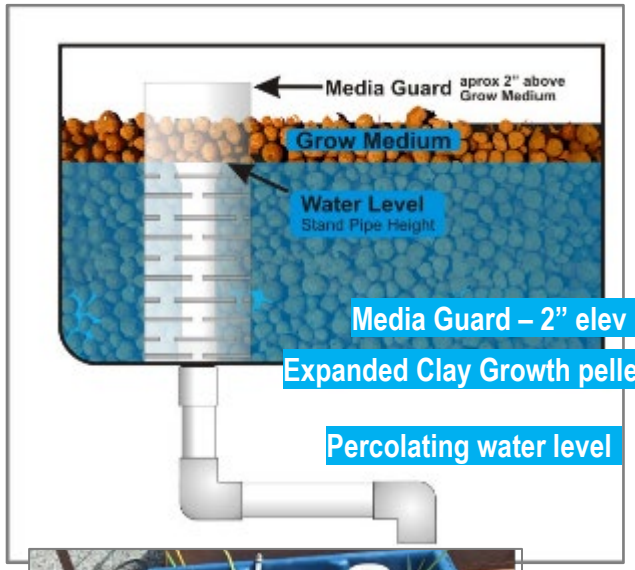
Engineered Reedbeds for Waste Stream Filtration and Bioevaporation

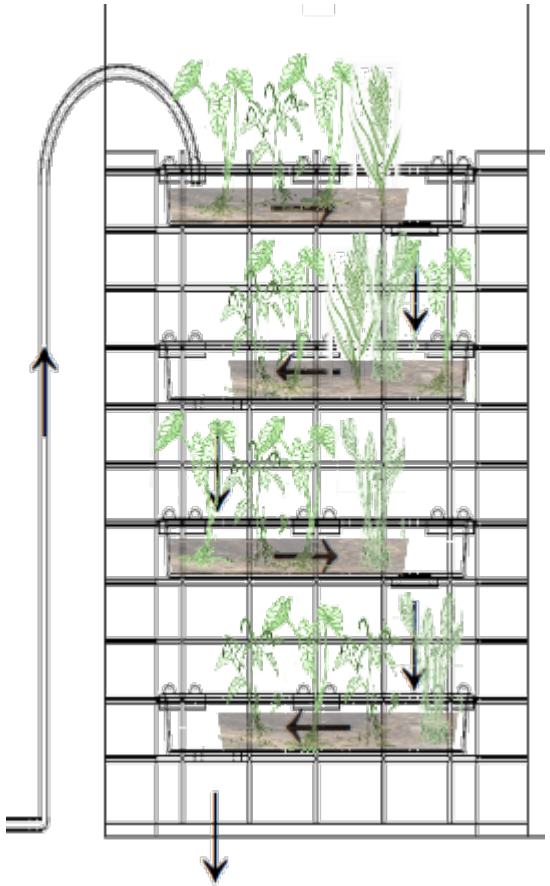


Yellow Flag Irises (*Iris pseudacorus*)

Constructed & engineered wetlands are used extensively for low-impact, sustainable wastewater treatment

CXAE maintained trial (4-years and counting)
– native and non-native wetland plants cultivated in standard media, open environment, continuous contact with test site waste stream

Designing and initial construction of "living walls"
– will increase scale and facilitate monitoring of influent and effluent to determine treatment effectiveness



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SBIR/STTR Projects

PFAS Destruction

- 1 phase 2 awarded 2019 to Liquid Carbonic/University of Missouri
- Based on Supercritical Water breaking down C-F bond
- Phase 2 complete, report available

Fluorine-Free Foam

- Three phase 1 awards 2019
- One phase 2 awarded to TDA, compatible with current hardware
- Blazetech and CertainTech phase 1 reports due Q2FY20

In-Situ PFAS Detection

- 3 phase 1 awards 2019
- Phase 1 final reports complete
- 1 phase 2 awarded to HJ S&T
- Based on micro-concentrator proposed to be connected to GC/MS, using variation on EPA methods.

Hi-Ex Foam Rapid Clean-UP

- 2 phase 1 awards 2019
- Phase 1 final reports complete
- 1 phase 2 awarded to TDA, kick-off TBD
- Deliver heated salt solution to rapidly deflate foam

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Conclusions

- Airbase Technologies Branch of AFCEC at Tyndall AFB FL has the mission of RDT&E to transition technologies to Air Force Civil Engineers
- Unique PFAS “situation” and test bed that can be leveraged for other remediation problem sets
- Collaboration is the key to success

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Airbase Technologies Branch
RDT&E, Procurement, Sustainment

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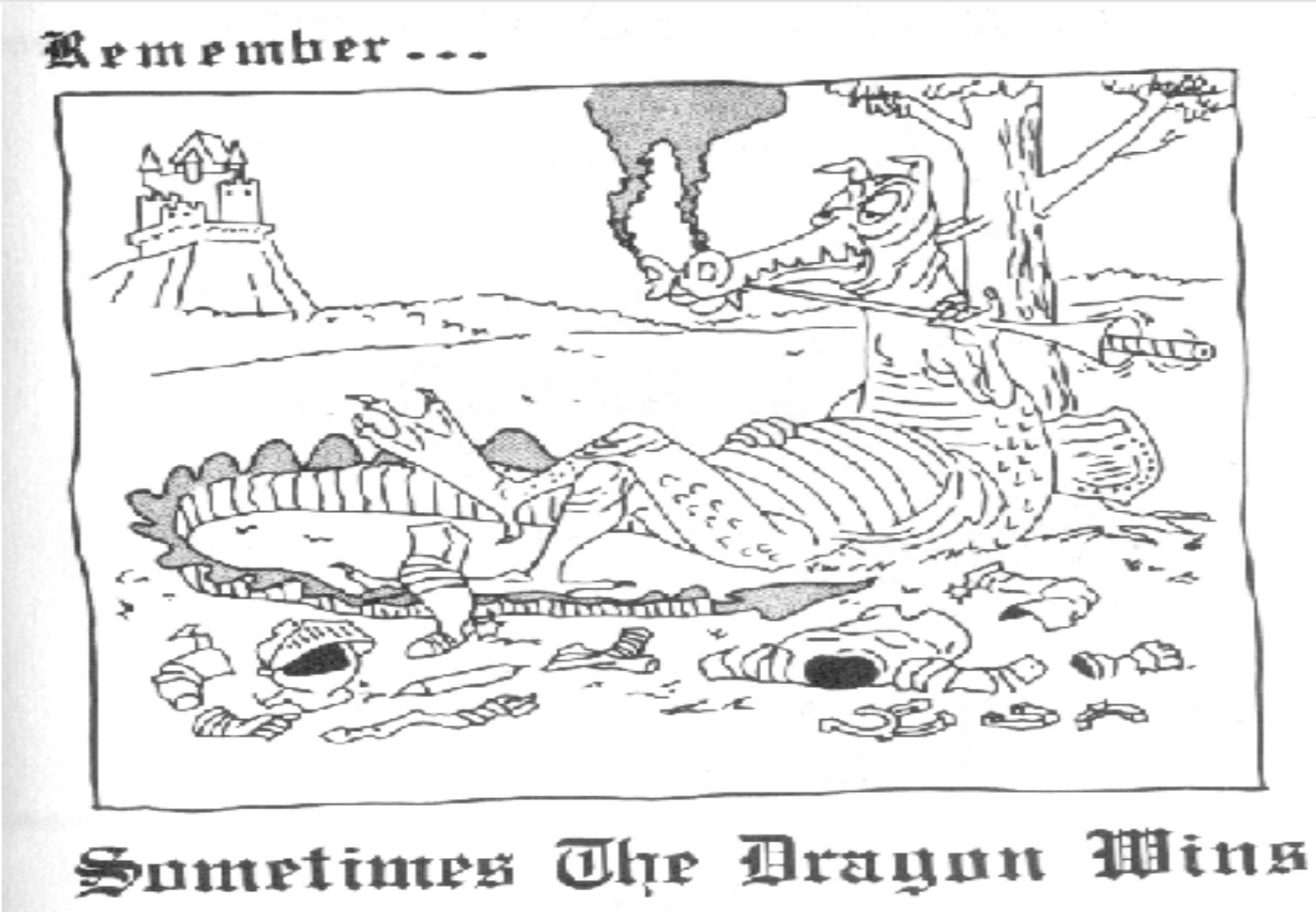
Questions?



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