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Air Force Research Laboratory



Integrity ★ Service ★ Excellence

UAS Rapid Runway Inspection

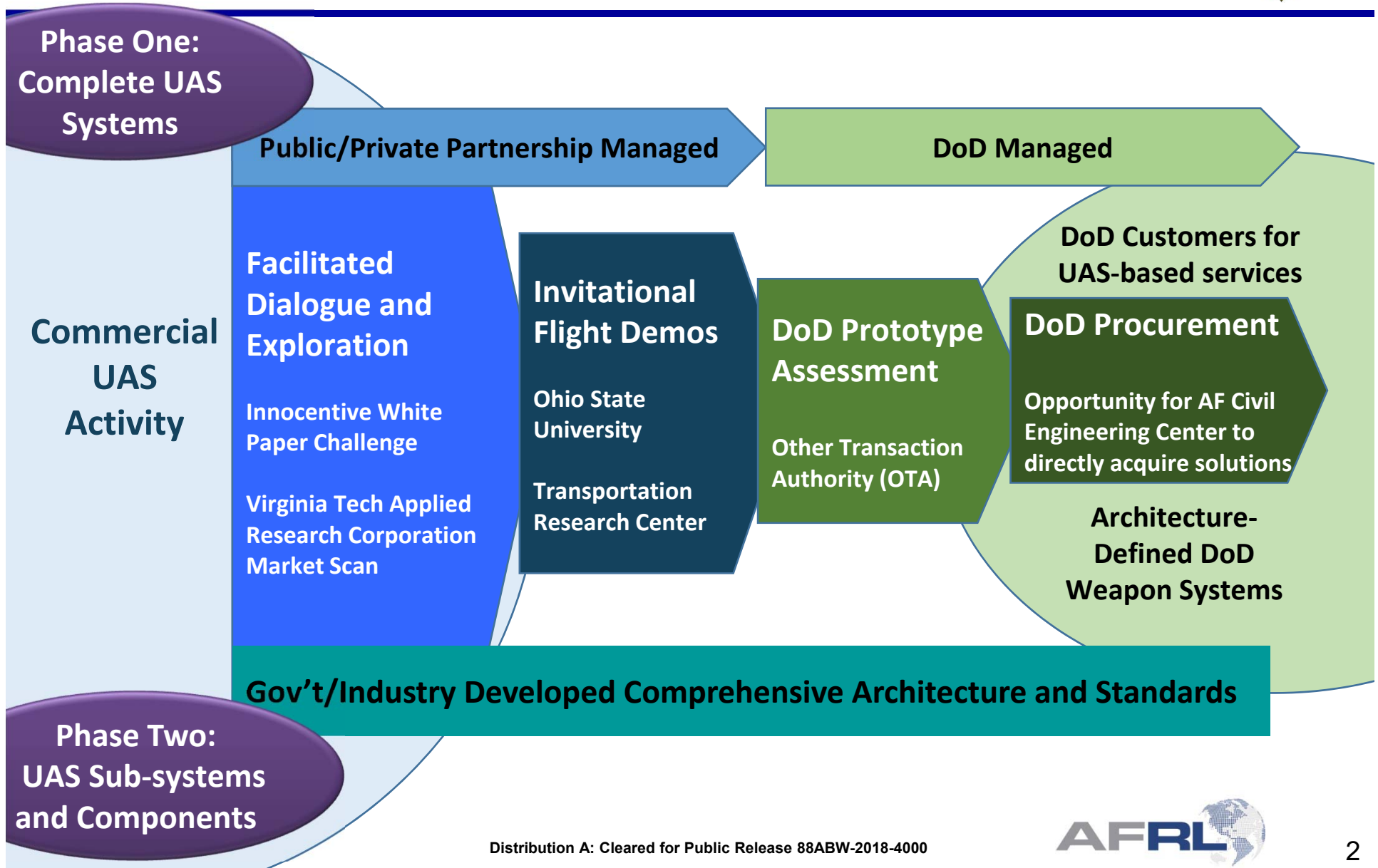
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Thomas Howell, Ph.D
Materials Engineer
AFRL/RQQE



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Interface to Commercial UAS Activity Tailored Pathway for Rapid Transition





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Overview



- **Rapid, reliable, and flexible assessment of runway conditions is paramount to maintaining and improving airfield resiliency post attack or following severe weather**
- **Airstrip can be rendered unusable or degraded, leaving voids such craters and camouflets, unexploded ordnance (UXO), and foreign object debris (FOD).**
- **Recovery requires rapid assessment of conditions and identification of options to maintain operations.**





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Challenge



- **Current airfield damage assessment teams are slow (2+ hours)**
 - **Performed by ground vehicles driving over the pavement with up to 3 people in the vehicle**
 - **Identify, record and communicate damage and UXO via radio with the emergency operations center**
 - **Multiple teams working simultaneously**





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Assessment Process Goals (<30 Minutes)



Data Collection

- UAS Platform
- Sensors
- Communications

Requirements

- 450' x 110,000' area
- Paved/semi-improved surfaces
- Day/night
- All weather (e.g. fog)

Data Analysis

- Damage Location
- Damage Measurement
- Damage Classification

Requirements

- Location: +/-1'
- Measurement: +20%
- Classify: Camouflet, crater, spall, or UXO

Data Processing

- Minimum Airfield Operating Surface (MAOS) Selection
- Geospatial Expeditionary Planning Tool (GeoExPT)

Requirements

- Faster repair time
- Least amount of damage





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Near Term Solution

- SUAS platforms download or wirelessly transmit data/images
- Fixed cameras on existing infrastructure and forward observer binoculars
- Human analyst uses GeoExPT to digitize damage and UXO





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Possible Future Solutions

Data Collection Platform

- All-Weather SUAS
- Fixed Installation (Towers)
- Ground Mobile
- Forward Observer (FO) Binoculars



Data Collection Sensors

- EO Standard/High Def/Low light
- MWIR
- LWIR
- LIDAR
- RADAR
- Acoustic

Data Analysis & Processing

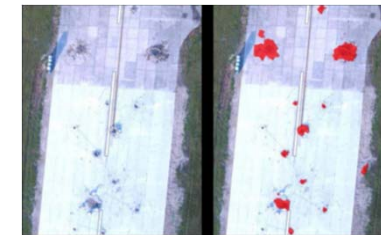
- Automated Damage and UXO Detection
- GeoExPT



Color EO



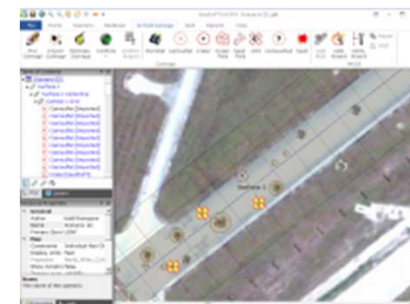
MWIR FO Binoculars



Auto Damage Detection



Fixed/Mobile Towers



GeoExPT



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Facilitated Dialogue and Exploration



- **Posted on Innocentive Website under the Tec^Edge Pavilion from 1 May until 1 July 2018**
 - 4 papers received 10k cash awards and invitation to next step
- **Two part challenge**
 - **Now: Engineering paper analysis to demonstrate a reasonable probably of meeting the criteria**
 - **Next: Winner invited to demonstration of technology for AF customers**
- **Main Criteria for Judging**
 - **Time to complete inspection with a goal of 30 minutes or less**
 - **Accuracy of identifying foreign object debris as small as 1.5"**
 - **All weather capabilities including day/night, -45°F to 130°F temperatures, fog, rain and high wind (25 knts)**



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Facilitated Dialogue and Exploration



- **Virginia Tech Applied Research Corporation**
 - Market survey of companies with patents and patent licensing related to topic provided in two weeks time
 - Companies from market survey are evaluated by AFRL subject matter experts
 - AFRL invites companies of interest to demonstrate their technologies at Transportation Research Center

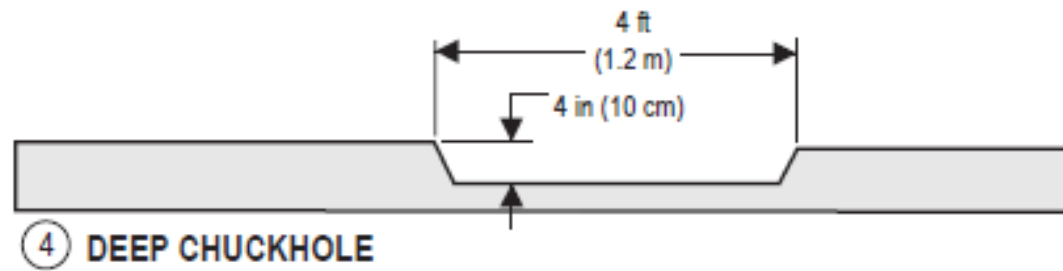
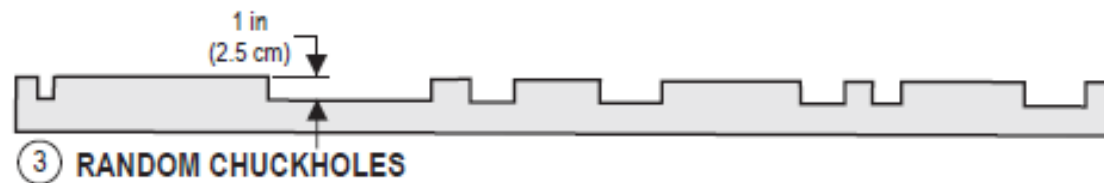


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Demonstration Transportation Research Center



- **Bus and Truck durability (~2000' course)**
 - Provides simulated craters with deep chuckholes and camouflets with random chuckholes
 - Soda cans and 2 inch pipe nipples can be added to the course as UXO





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Demonstration Ohio State University



- **Systems will be judged on**
 - Time for completion of the truck and bus durability course (~2000')
 - Time to transmit and process images
 - Operation in hot (125F) and cold (temperatures (Environmental Chamber)
 - Operation in high winds (Skid Pad)
 - Accuracy of identification
 - Number of personnel needed to operate system



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