DOD Airfield Obstruction Collection and Mapping: A GIS Approach

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Purpose

- Conduct airfield obstruction survey for 5 installations in the CONUS (between 10/1/2013 and 9/30/2014).
- Update E-Tab mapping products.
- Collect high resolution (helicopter based) LiDAR for each installation to:
  - Assist with obstruction surveys.
  - Generate high resolution topographic products (DTM, DEM, DSM, 1ft contours) for each installation.
- Collect high resolution Orthophotography for each installation.
- Generate a comprehensive tree management plan.
Imagery / Lidar

- Orthoimagery – 3” pixel resolution inner area and 6” outer area. Both areas Mosaic together.

- LiDAR
  - Nominal Point Spacing of about 25 points per square meter.
  - RMSE(z) .03m
  - NSSDA achievable contour of .1m
  - ASPRS Class 1 achievable contour 0.09m
Wire Detection Test Site – Air Photo
Wire Detection Test Site Results – (First of Many)

- Points displayed by first return but not singles (first of many), colored by elevation
- Single flightline displayed (line #3)
- All test lines were successfully detected
Wire Detection Test Site Results - Lines Labeled

- Points displayed by first return but not singles (first of many), colored by elevation
- Single flightline displayed (line #3)
- All test lines were successfully detected
Obstruction Mapping

- Identify objects that are obstructions that can potentially pose hazards to aircraft, aircrews, and ground personnel.
- Follow regulations stated specifically in UFC 3-260-01
- Construct spatial 3D imaginary surfaces that follow the criteria of
  - Class B Army Runway Airspace Imaginary Surfaces.
  - Class B Air Force and Navy Runway Imaginary Surfaces.

A – Primary Surface (304M (1,000 USFT Wide)
B – Clear Zone Surface (Not Shown)
C – Approach Departure Clearance Surface (Slope (50H:1V Ratio)
D – Approach-Departure Clearance Surface (Horizontal)
E – Inner Horizontal Surface (45.72M (105 USFT Elevation)
F – Conical Surface (20H:1V)
G – Outer Horizontal Surface (152.4M (500 USFT Elevation)
H – Transitional Surface (7H:1V)
I – Not used
J – Accidental Potential Zone (APZ) Not Shown
Obstruction Mapping

Classifications of Obstructions

- **Waiver** – (permanent, temporary or construction) – An obstruction that violates airspace per UFC 3-260-01 is temporary for construction (construction waiver), cannot be reasonably corrected (permanent), or is expected to be corrected within 5 years (temporary). Requests for waivers must present compelling justification to violate criteria and clearly demonstrate no viable, practical alternative that meets criteria exists.

- **Permissible Deviations** - An obstruction required to support airfield operations that is not required to meet airfield clearance criteria that must meet siting criteria.

- **Exemption** - An obstruction (facility or other item) constructed/sited under a previous, typically less stringent siting standard. No waiver is required. Facilities or other items constructed/sited under current standards that are behind and beneath a MAJCOM-approved Building Restriction Line (BRL) are considered exemptions and therefore do not require a waiver.
Airspace Surface rendered in 3-D (vertically exaggerated).
Airspace Surface rendered in 3-D w/ Light Detection and Ranging (LiDAR) point cloud
Approach-Departure Clearance Surface (C) w/ obstructions identified using LiDAR

Features in violation of the geometric airfield
Approach-Departure Clearance Surface (C) w/ obstructions identified using LiDAR

Features in violation of the geometric airfield

Obstructions above Airspace Imaginary Surface (C)

Above ground features, non-violation.

Ground

Airspace Imaginary Surface (C)
Approach-Departure Clearance Surface (C) w/ obstructions identified using LiDAR (cont)

Obstructions above Airspace Imaginary Surface (C)

Above ground features, non-violation.

Transmission Lines

Ground
Relevant Map E Series

- **E-1** - On-Installation Obstructions to Airfield Criteria. Specifically primary surfaces and a specified clear zone.

- **E-2** - Approach/Departure Zone Obstructions to 10,000 ft from beginning of runway (glide angle).

- **E-3** - Approach/Departure Zone Obstructions from 10,000 ft to 10 miles (more for natural terrain hazards such as hills).

- **E-4** - Shows obstructions to air navigation (natural and man-made) within the airspace control surfaces.

- **E-5** - Terminal Enroute Procedures (TERPS) Automation Plan (highest feature in master obstacle chart).

- **E-6** - Airfield and Airspace Clearances.

- **E-9** - Aircraft Parking Plan.

- **E-9-1** - Proposed Aircraft Parking Plan.

- **E-10** – Airfield Lighting System.
All Features that impact the primary surface and specified clear zones.
E-1 - On-Installation Obstructions to Airfield Criteria
E-2 - Approach/Departure Zone
Obstructions to 10,000 ft
E-3 - Approach/Departure Zone
Obstructions from 10,000 ft to 10 miles
E-4 - Obstructions to Air Navigation within Airspace Control Surfaces.
E-5 Identifies highest feature is Master Obstacle Chart. Grid “Wagon Wheel” splays radiates from airport reference point and lists max z.
E-9 - Aircraft Parking Plan.

E-9-1 - Proposed Aircraft Parking Plan.
E-10 – Airfield Lighting System.
Conclusions

- Lidar and Orthophotography are instrumental for E-Tab series obstruction mapping.
- Lidar and Orthophotography assist with the both the pre-survey planning for obstruction mapping and post survey verification.
- Spatial Analyst and Lidar analysis software are instrumental for detecting which features break the 3D imaginary surface plane.
- Utilizing high resolution Lidar and Orhtophotography (complimented with the field survey) assist with classifying obstructions as waivers, permissible deviations or exemptions.
- Mobile scanning is a viable alternative for primary surface (E1) obstruction collection.
Conclusions (Collection Methods)

- Fixed-Wing
- Helicopter
- Stationary
- Surface - Mobile
THANK YOU

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