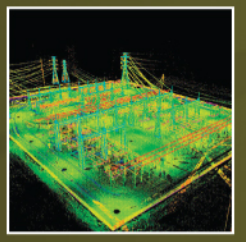
DOD Airfield Obstruction Collection and Mapping: A GIS Approach



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Tom Cirillo

GEOSPATIAL SOLUTIONS

July 23, 2015

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 Airfield 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.

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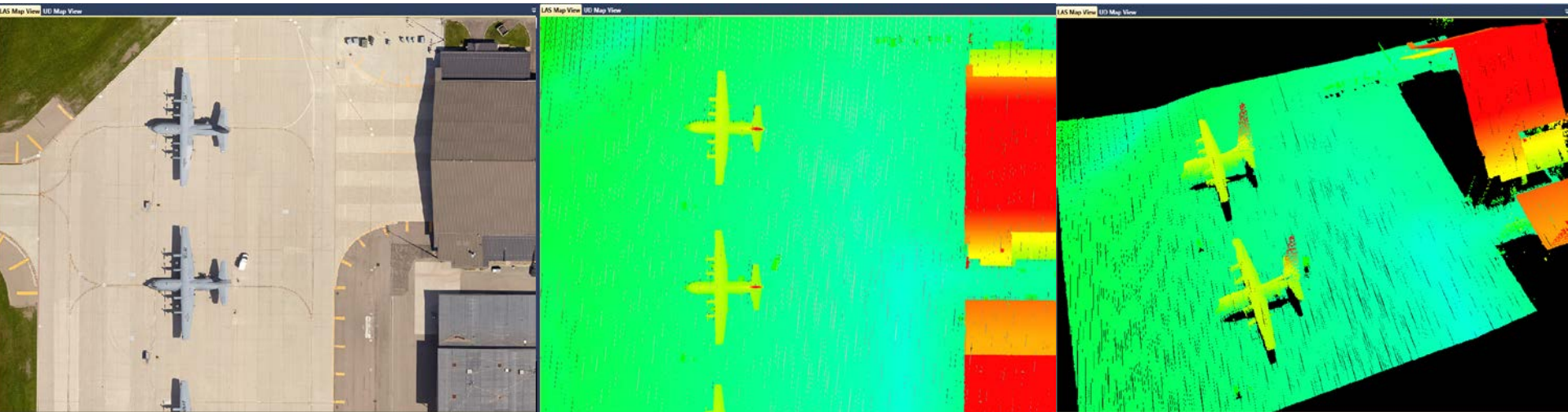
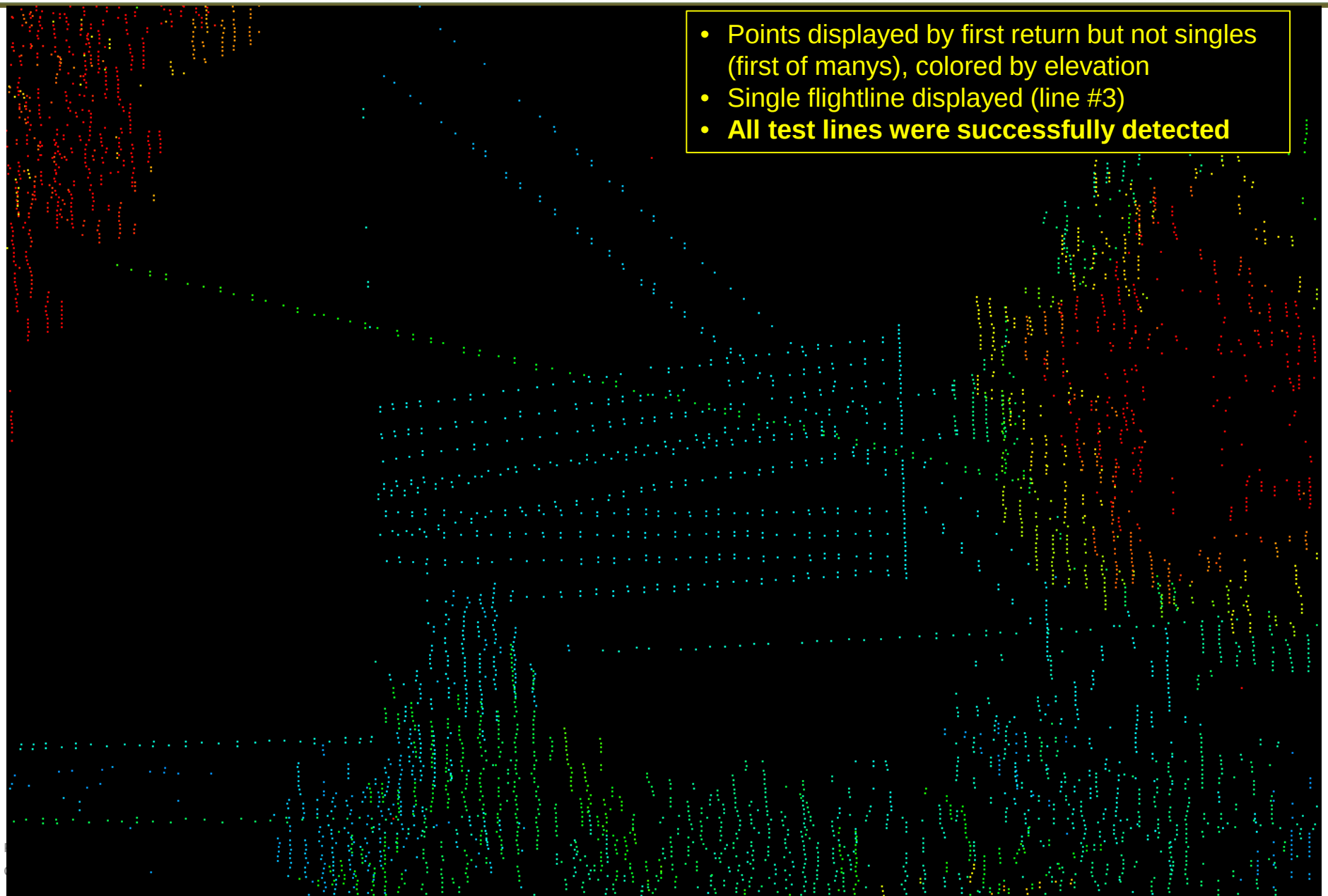
Imagery / Lidar

- 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



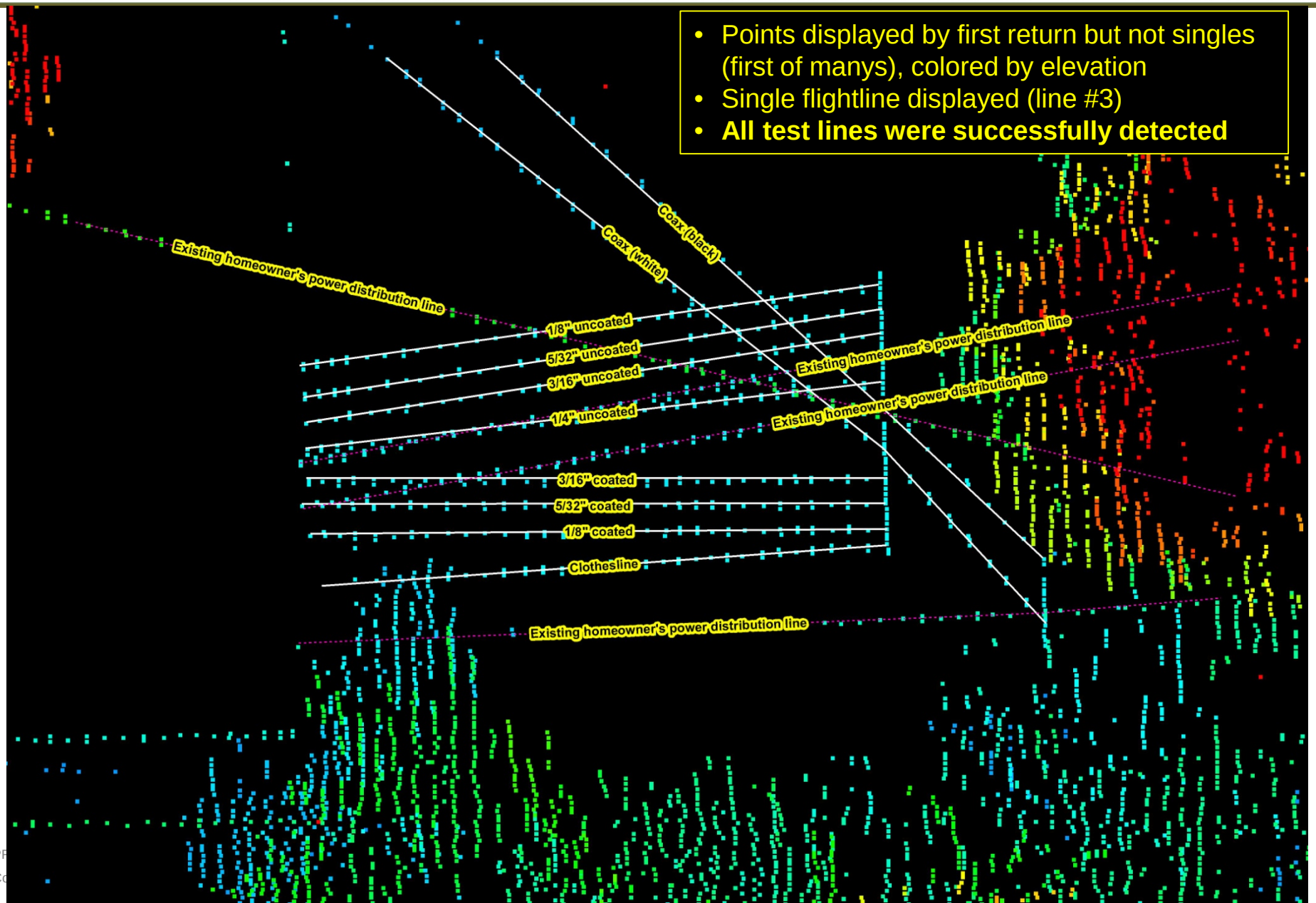
Wire Detection Test Site – Air Photo

Wire Detection Test Site Results – (First of Many)



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

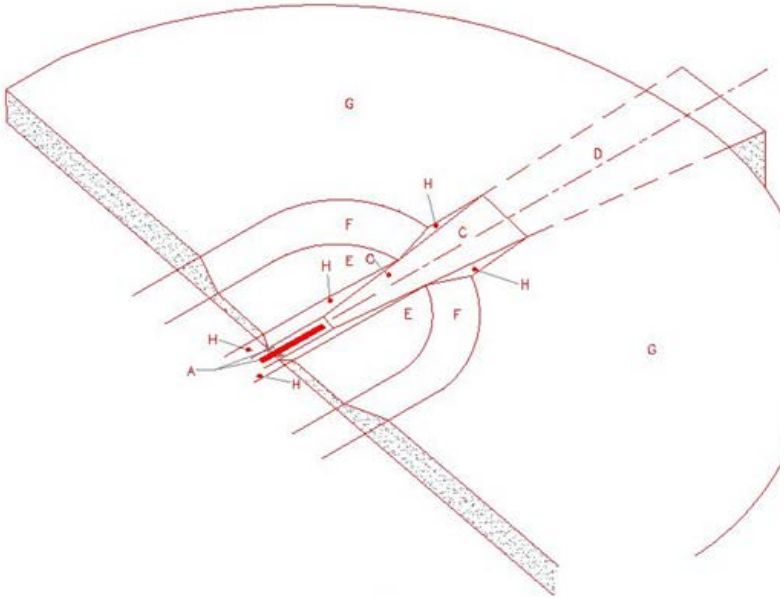
Wire Detection Test Site Results - Lines Labeled



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

Airfield 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 Airspace Imaginary Surfaces.



A – Primary Surface (304M (1,000 USFT Wide)

B – Clear Zone Surface (Not Shown)

C – Approach Departure Clearance Surface (Sloped)

D – Approach-Departure Clearance Surface (Horizontal)

E – Inner Horizontal Surface (45.72M (150 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

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Obstruction Mapping

- Classifications of Obstructions
  - Waiver – (permanent, temporary or construction) – An obstruction manmade or naturally occurring that violates airspace per UFC 3-260-01, that 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 violating the airfield surfaces but is required in support of airfield operations. These objects/facilities must be built in accordance with criteria in order to be considered Permissible.

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Obstruction Mapping

- 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.
- BRL Exempt – An obstruction that violates UFC 3-260-01 criteria but resides behind and beneath a MAJCOM-Approved 'Building Restriction Line' (BRL). No waiver is required.

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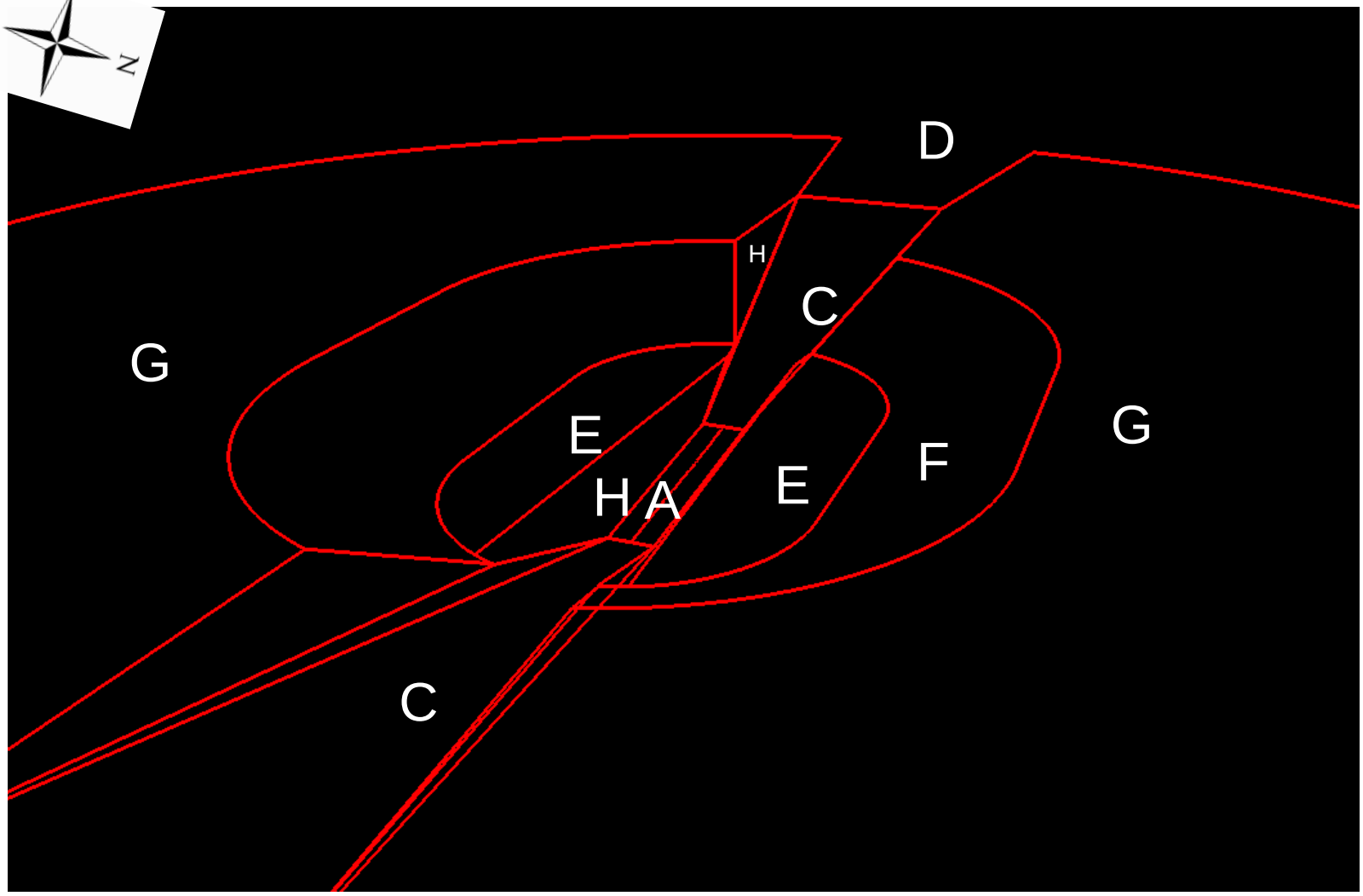
Airspace Surface rendered in 3-D (vertically exaggerated)



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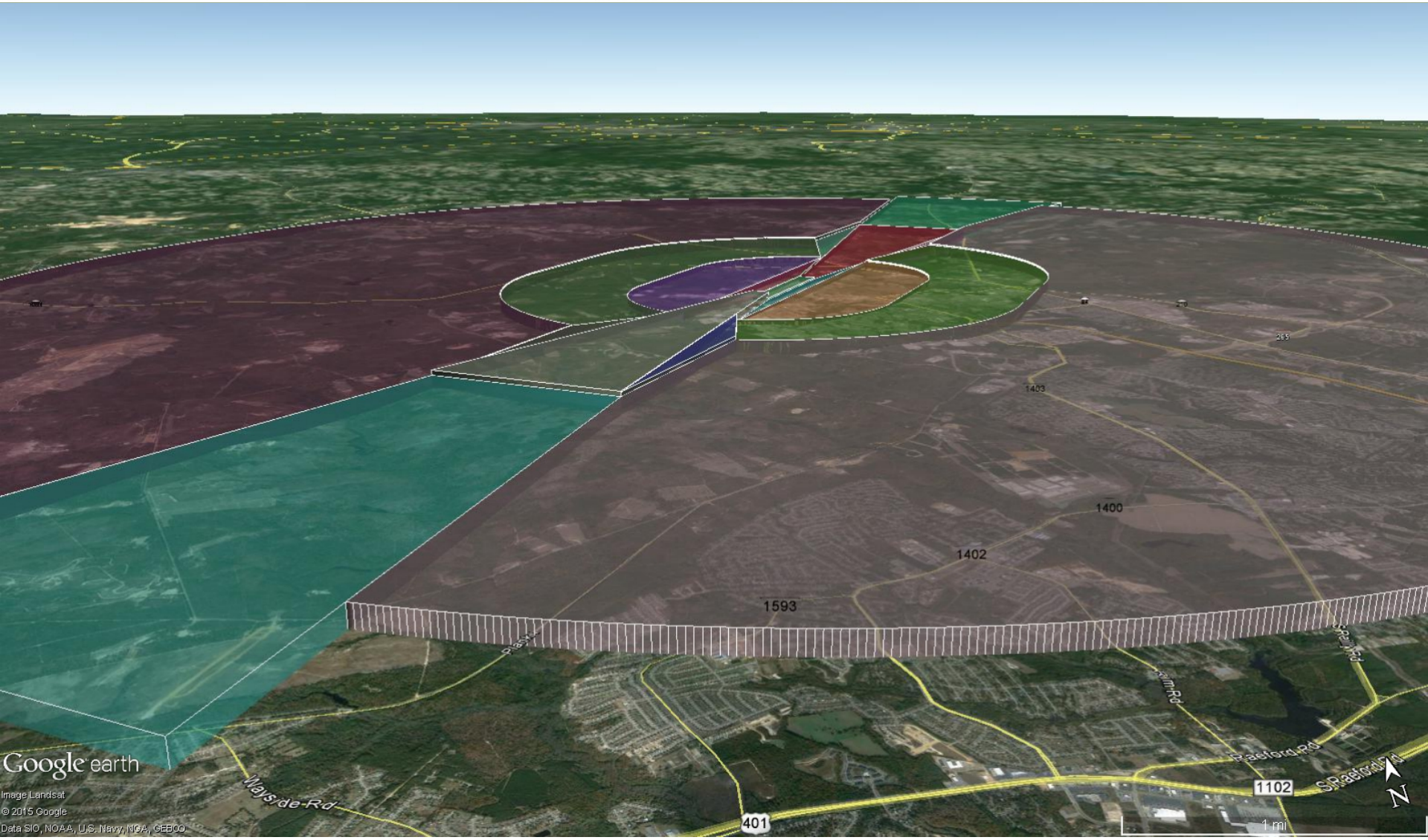
Airspace Surface rendered in 3-D (vertically exaggerated)



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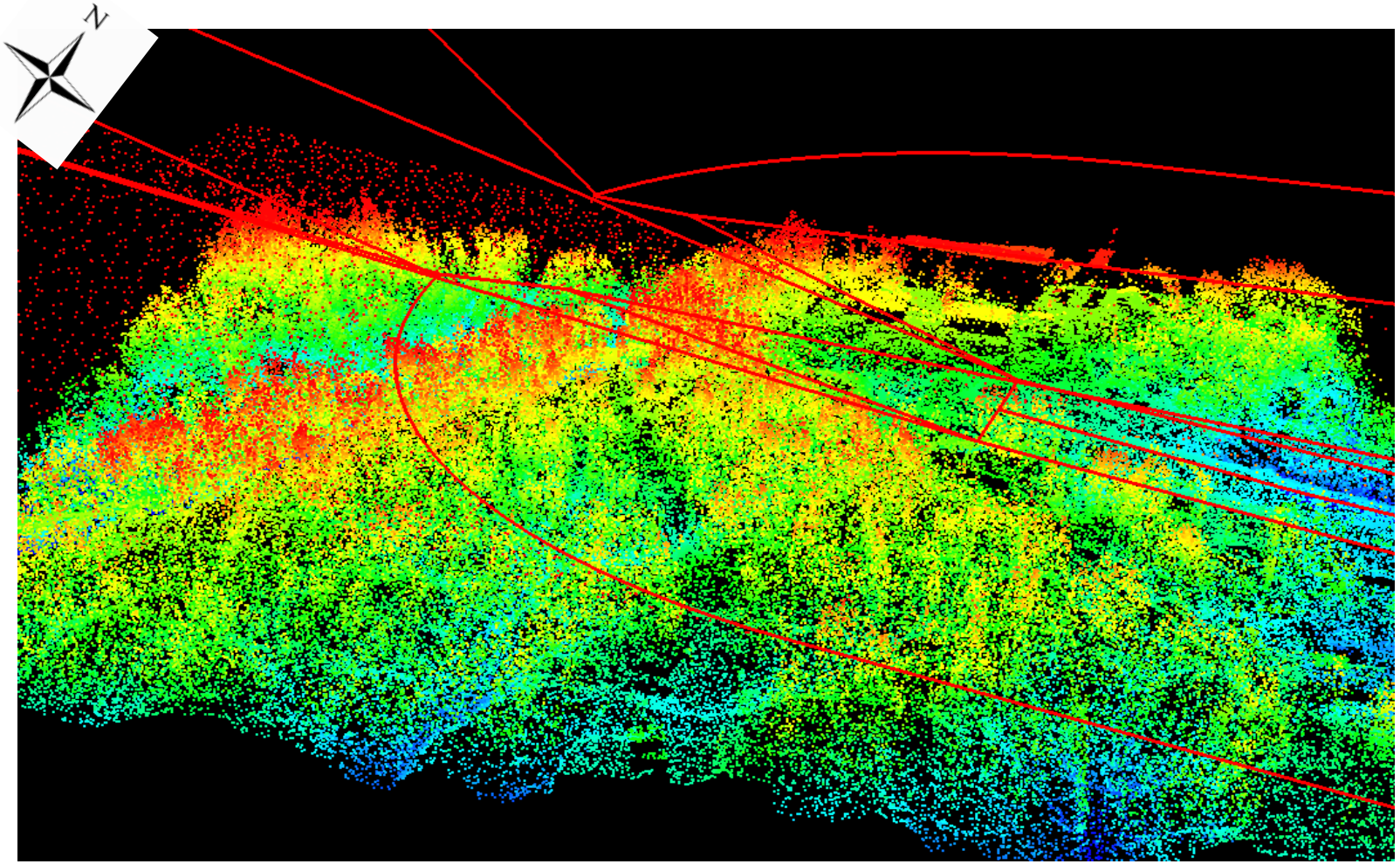
Airspace Surface rendered in 3-D w/ Light Detection and Ranging (LiDAR) point cloud



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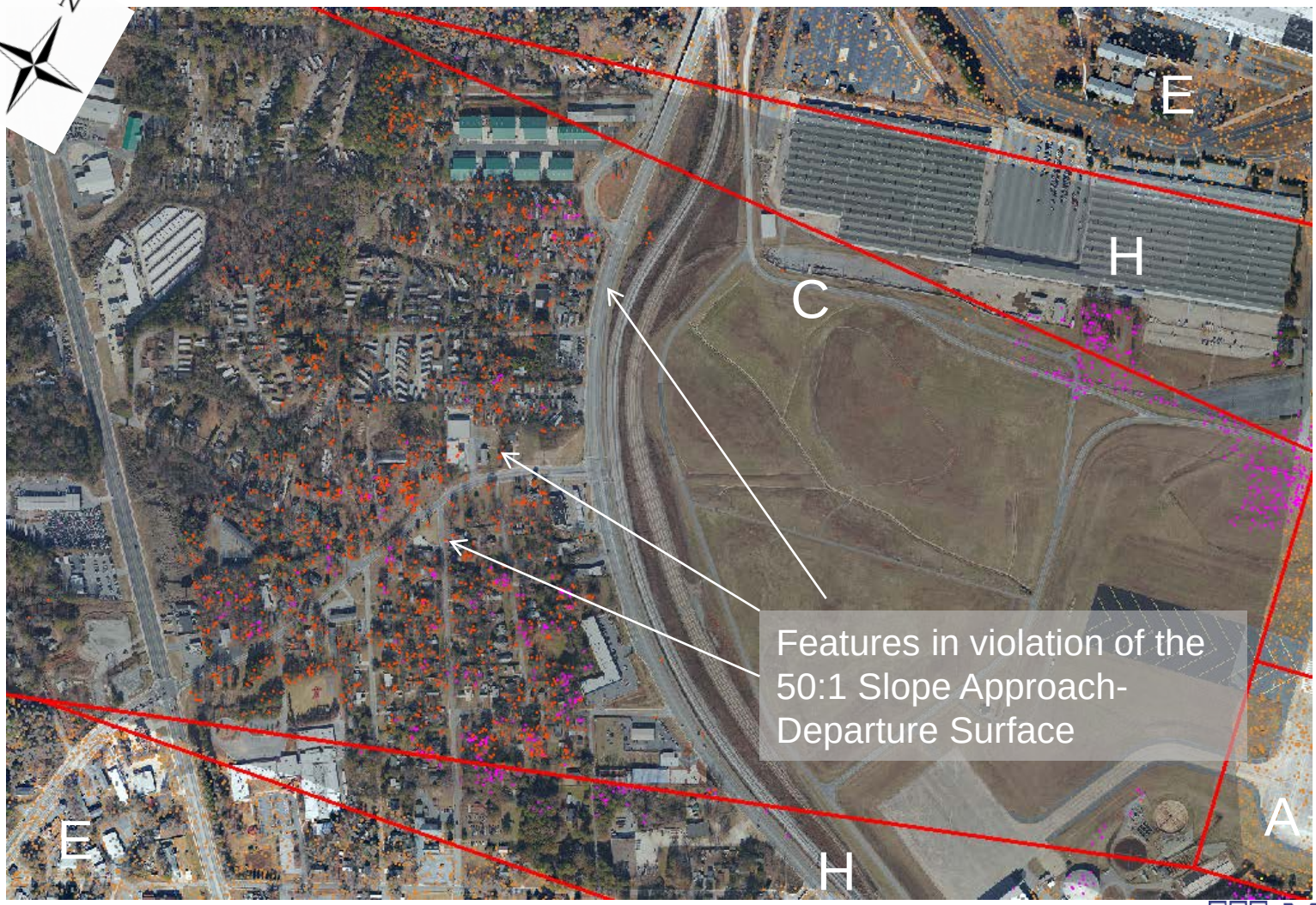
Approach-Departure Clearance Surface (C) w/ obstructions identified using LiDAR



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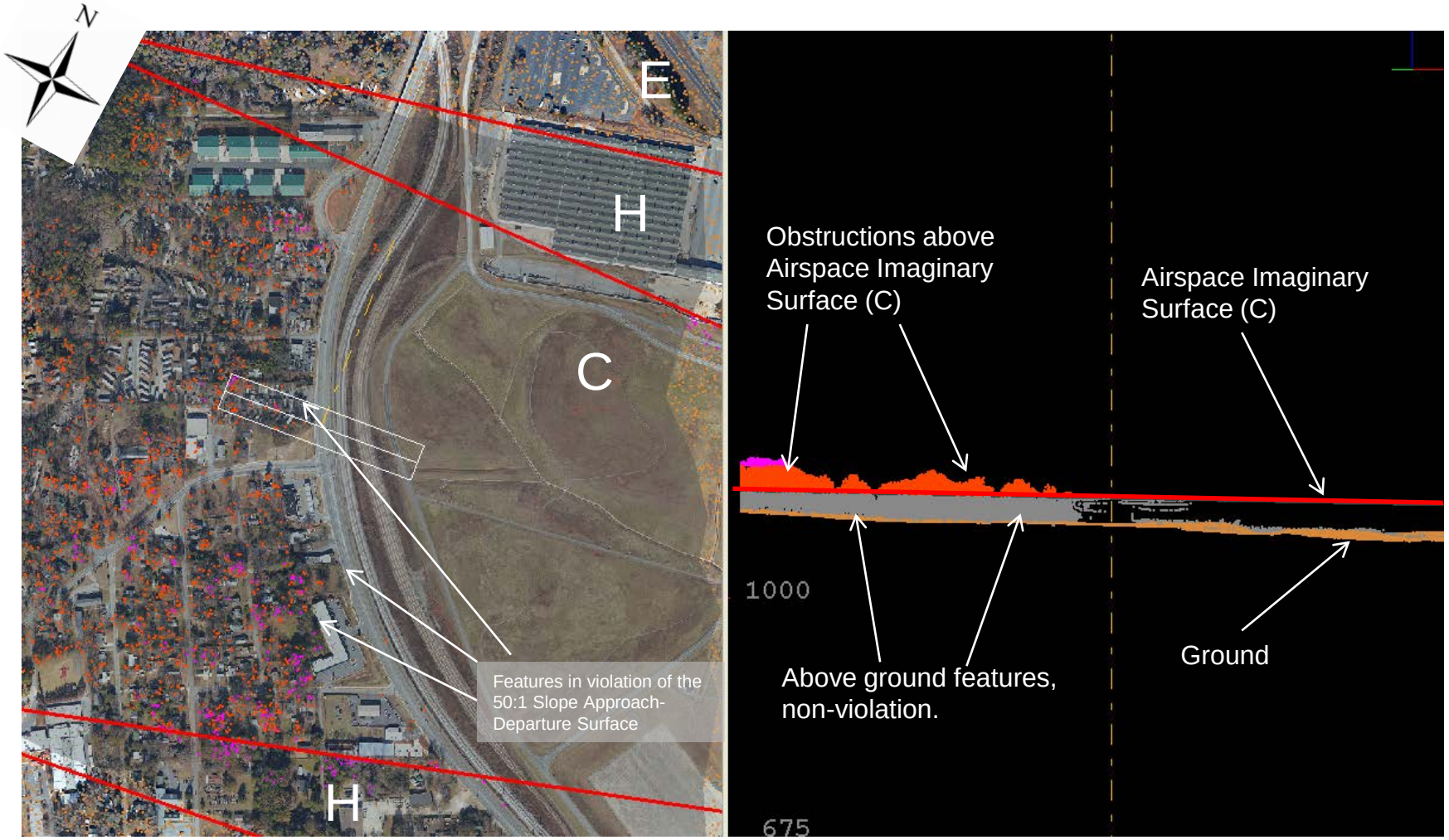
Approach-Departure Clearance Surface (C) w/ obstructions identified using LiDAR



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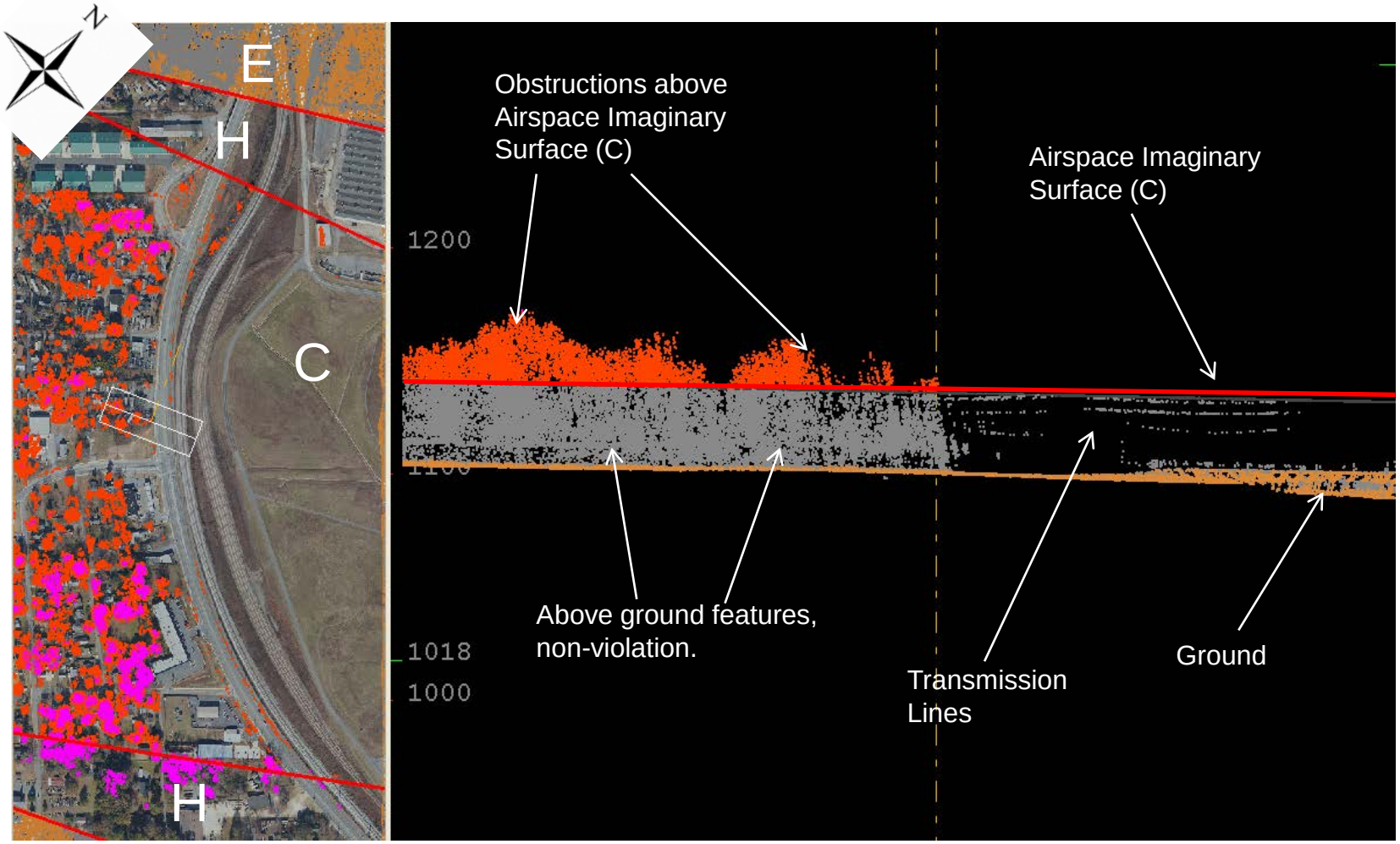
Approach-Departure Clearance Surface (C) w/ obstructions identified using LiDAR (cont)



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Relevant E-Tab Maps

- E-1 - On-Installation Obstructions to Airfield Criteria. Specifically primary surfaces and a specified clear zone.
- E-2 - Approach/Departure Zone Obstructions beginning at the end of the Primary Surface extending outward 10,000 ft.
- E-3 - Approach/Departure Zone Obstructions from 10,000 ft to 10 miles (more for natural terrain hazards such as hills).
- E-4 - Shows off-installation obstructions to air navigation (natural and man-made) within a ten (10) mile radius extending outward from each runway.
- 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.

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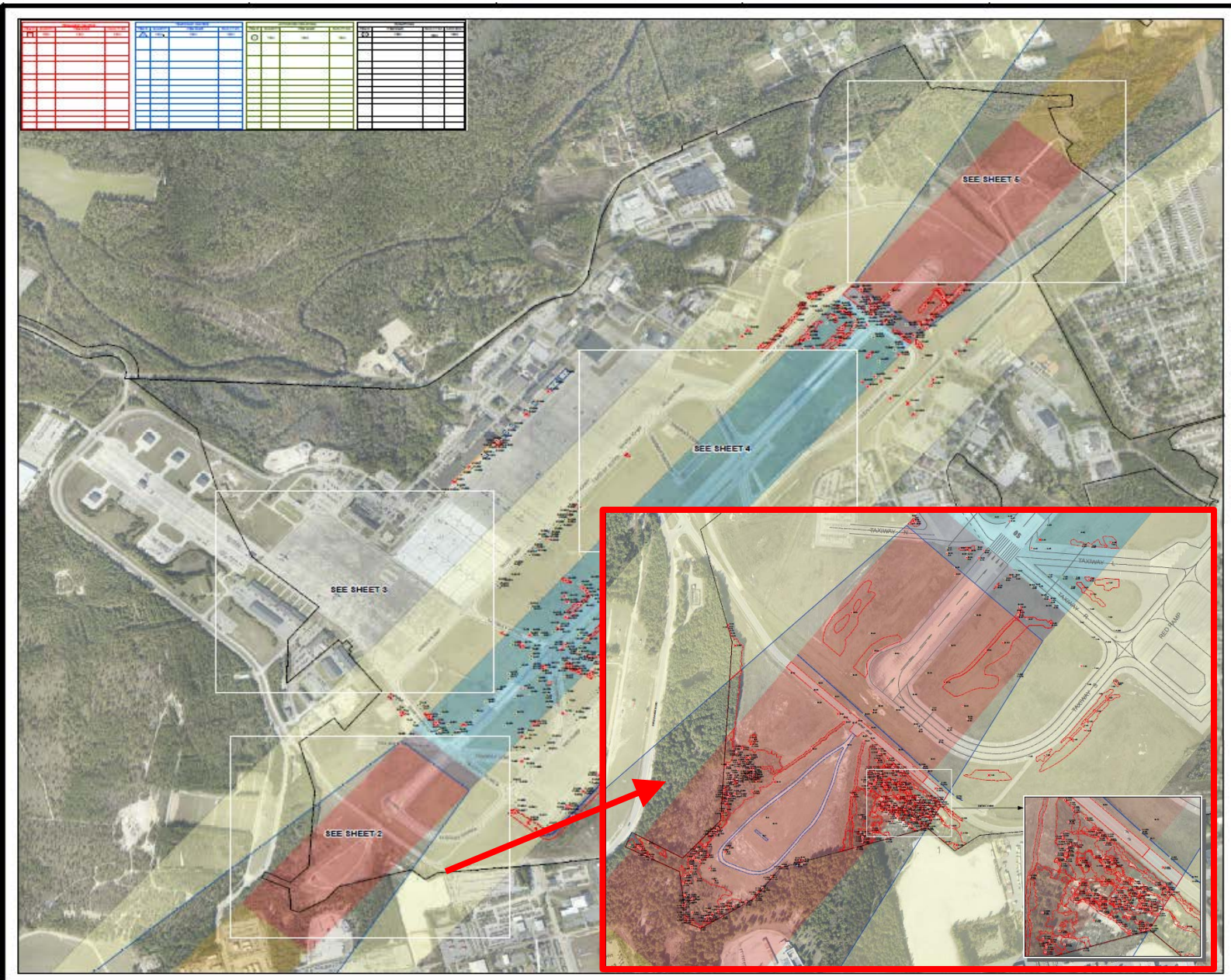
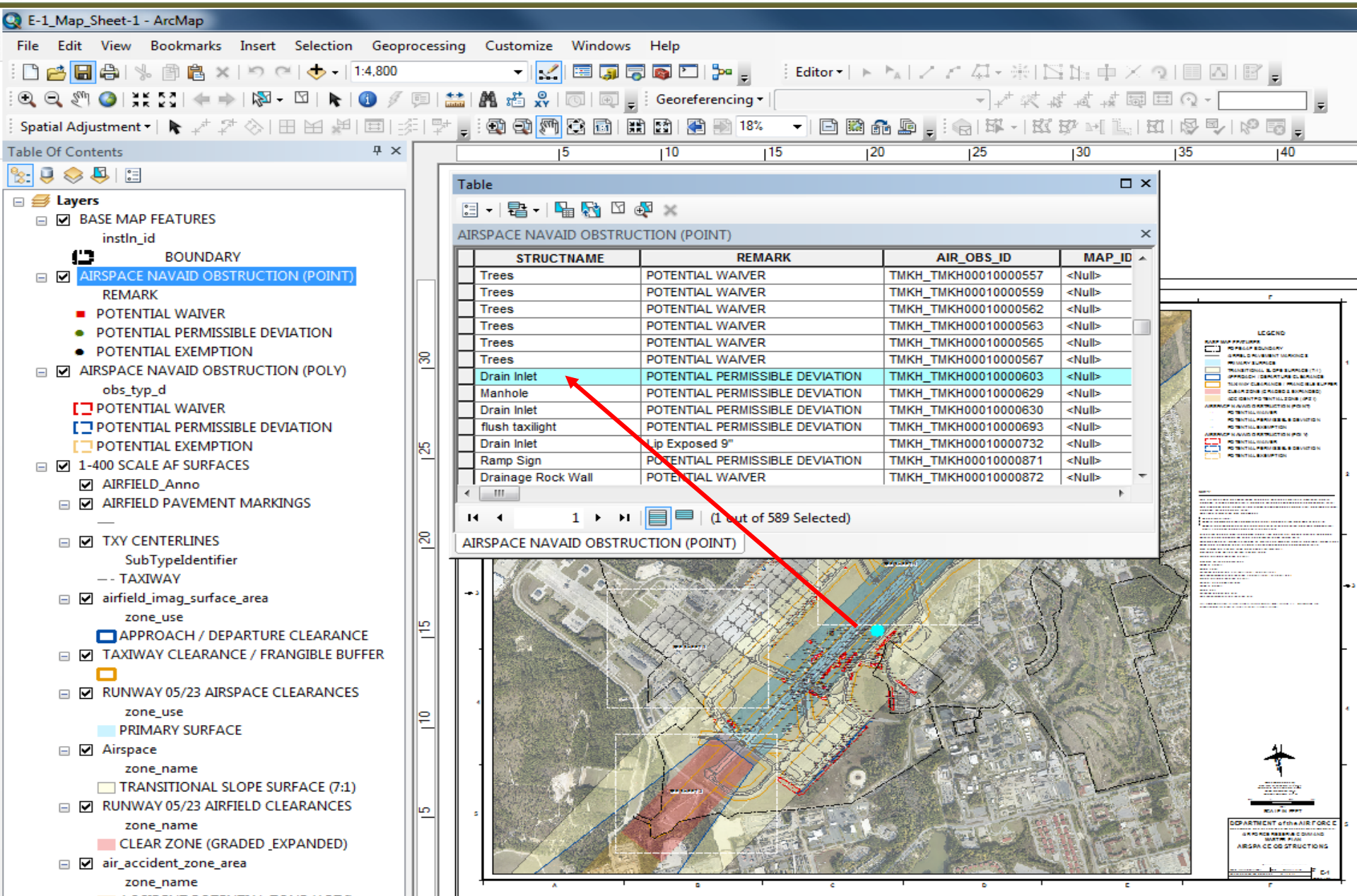
E-1 - On-Installation Obstructions to Airfield Criteria

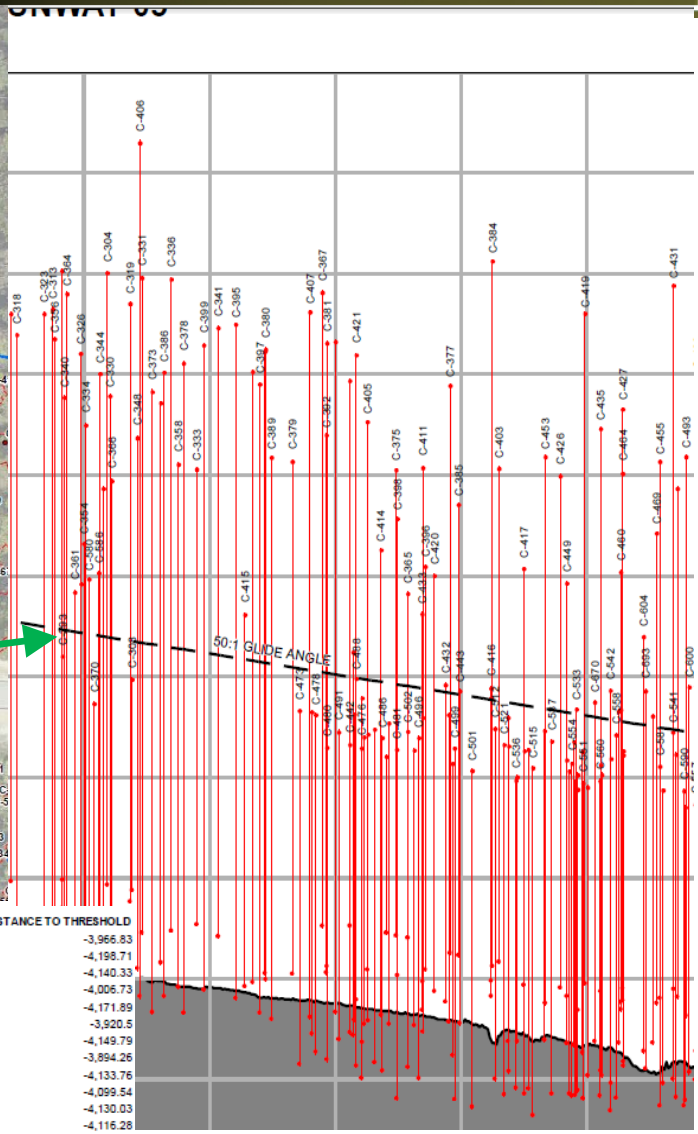


All Obstructions Located within the Installation Boundaries.

E-1 - On-Installation Obstructions to Airfield Criteria



E-2 - Approach/Departure Zone Obstructions to 10,000 ft



MAP ID *	DESCRIPTION	GROUND ELEVATION (MSL)	TOP ELEVATION (MSL)	HEIGHT ABOVE GROUND	AIRSPACE SURFACE VIOLATED	VIOLATION AMOUNT	DISTANCE TO RWY CENTERLINE	DISTANCE TO THRESHOLD
C-117	Trees	257.59	322.4	64.81	50:1 Approach-Departure (Slope)	29.07	1,061.38	-3,966.83
C-118	Trees	261.19	299.43	38.24	50:1 Approach-Departure (Slope)	1.46	860.48	-4,198.71
C-124	Trees	262.41	324.34	61.93	50:1 Approach-Departure (Slope)	27.53	892.33	-4,140.33
C-128	Trees	255.31	335.97	80.66	50:1 Approach-Departure (Slope)	41.84	994.44	-4,006.73
C-132	Trees	260.9	297.29	36.39	50:1 Approach-Departure (Slope)	-0.15	839.01	-4,171.89
C-141	Trees	257.8	313.1	55.3	50:1 Approach-Departure (Slope)	20.69	1,019.62	-3,920.5
C-143	Trees	260.06	291.6	31.54	50:1 Approach-Departure (Slope)	-5.4	821.88	-4,149.79
C-145	Trees	260.62	319.52	58.9	50:1 Approach-Departure (Slope)	27.63	1,032.72	-3,894.26
C-151	Trees	259.64	291.19	31.55	50:1 Approach-Departure (Slope)	-5.49	820.95	-4,133.76
C-152	Trees	258.48	293.87	35.39	50:1 Approach-Departure (Slope)	-2.12	844.9	-4,099.54
C-162	Trees	259.26	294.93	35.66	50:1 Approach-Departure (Slope)	-1.68	806.39	-4,130.03
C-164	Trees	258.76	291.4	32.65	50:1 Approach-Departure (Slope)	-4.92	812.33	-4,116.28
C-165	Trees	258.74	294.71	35.97	50:1 Approach-Departure (Slope)	-1.67	800.6	-4,118.85
C-168	Trees	253.52	315.03	61.51	50:1 Approach-Departure (Slope)	21.58	920.9	-3,972.63
C-169	Trees	261.47	316.96	55.49	50:1 Approach-Departure (Slope)	26.05	1,028.11	-3,845.37
C-173	Trees	256.14	326.56	70.42	50:1 Approach-Departure (Slope)	31.93	855.74	-4,031.32
C-176	Trees	259.06	290.57	31.52	50:1 Approach-Departure (Slope)	-0.75	992.91	-3,866.32
C-178	Trees	259.6	317.16	57.56	50:1 Approach-Departure (Slope)	21.09	779.57	-4,103.35
C-179	Trees	260.78	322.28	61.5	50:1 Approach-Departure (Slope)	31.91	1,021.02	-3,818.23
C-183	Trees	257.22	291.08	33.86	50:1 Approach-Departure (Slope)	-4.29	800.79	-4,068.24

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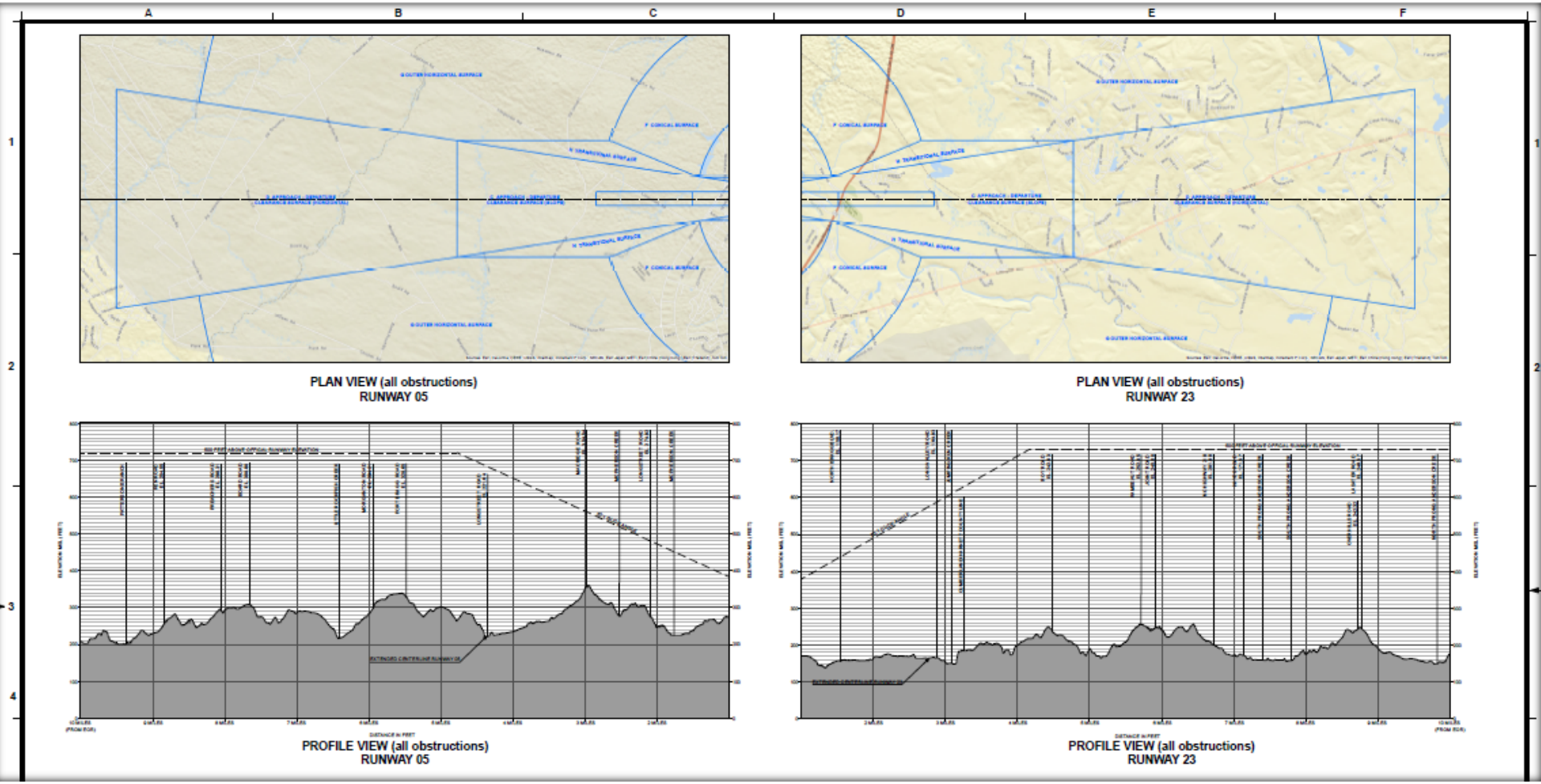
E-3 - Approach/Departure Zone Obstructions from 10,000 ft to 10 miles



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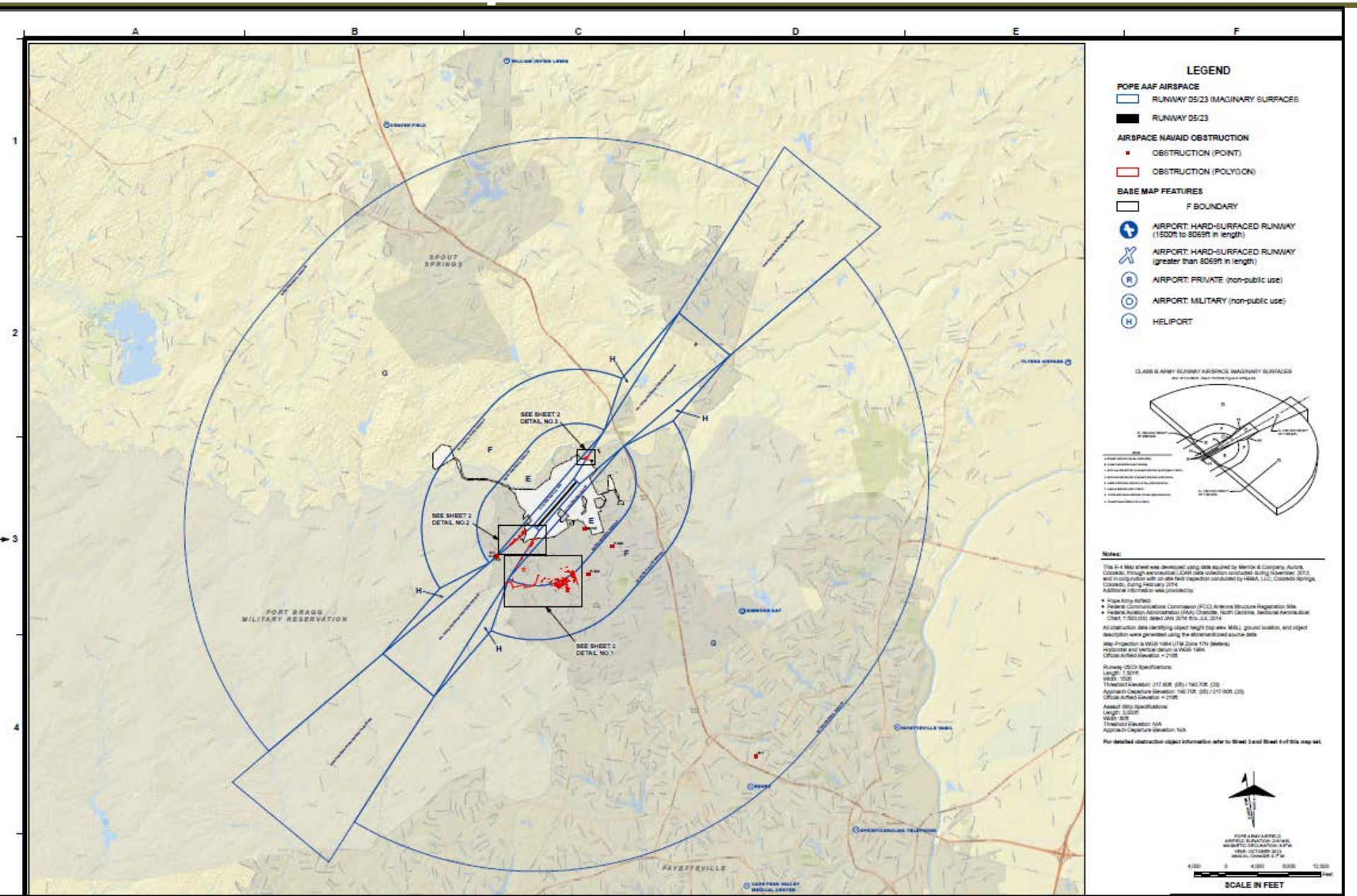
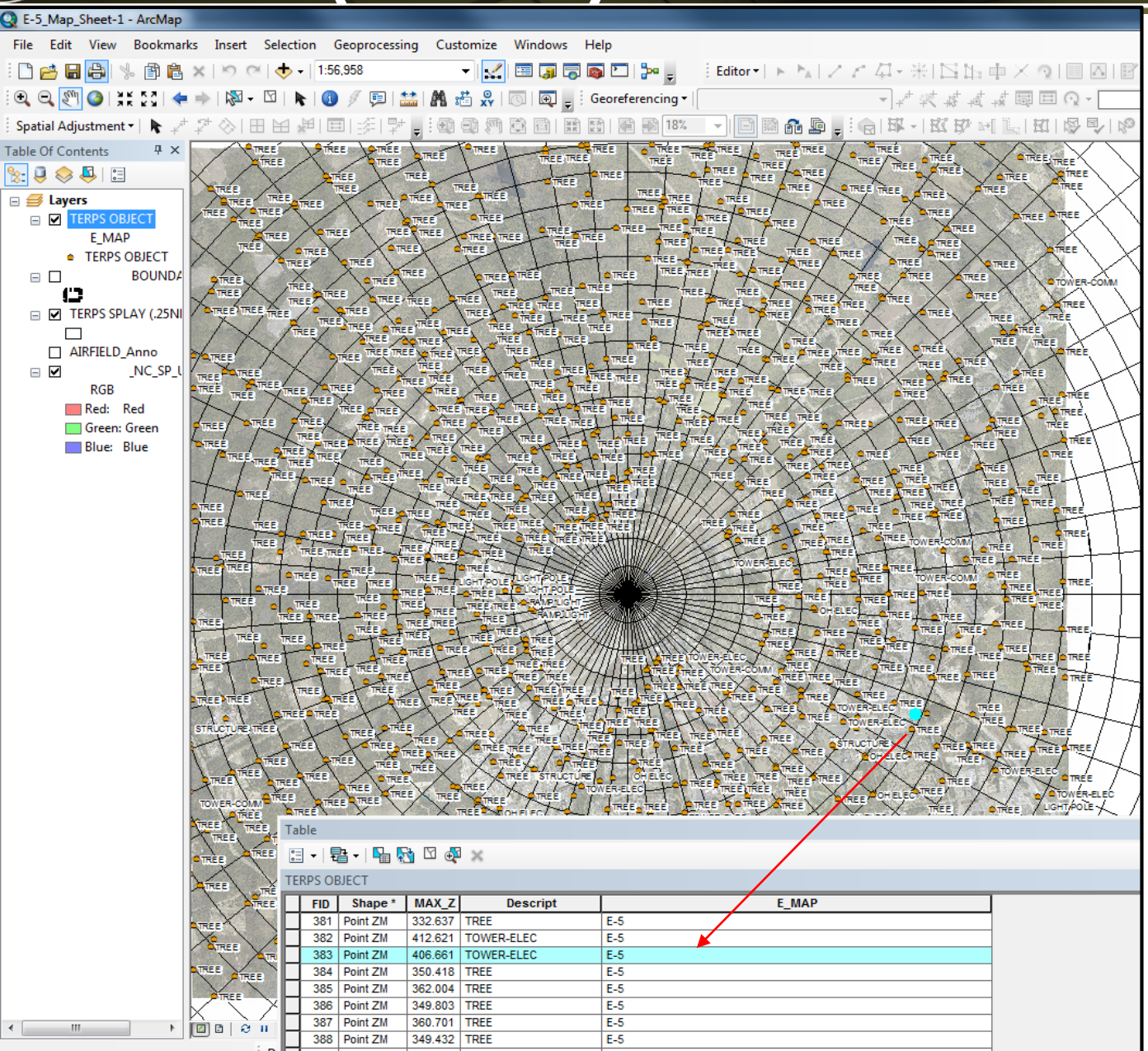
E-4 - Obstructions to Air Navigation within Airspace Control Surfaces



E-5 - Terminal Enroute Procedures (TERPS) Automation Plan



E-5 Identifies highest feature is Master Obstacle Chart. Grid "Wagon Wheel" splays radiates from airport reference point and lists max z.

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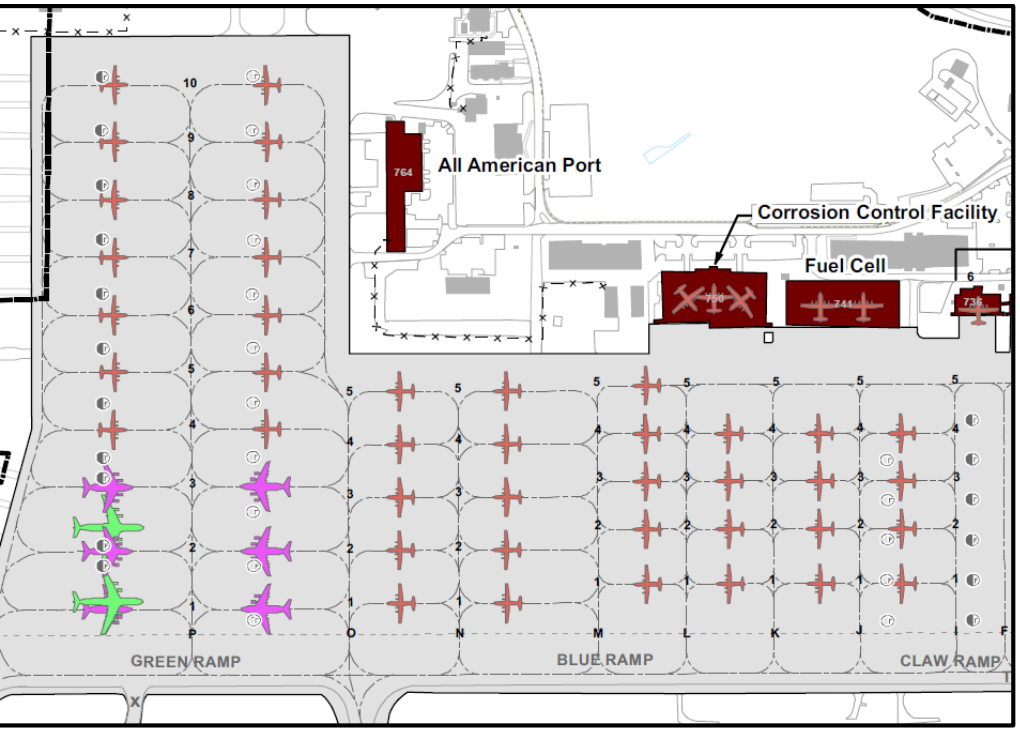
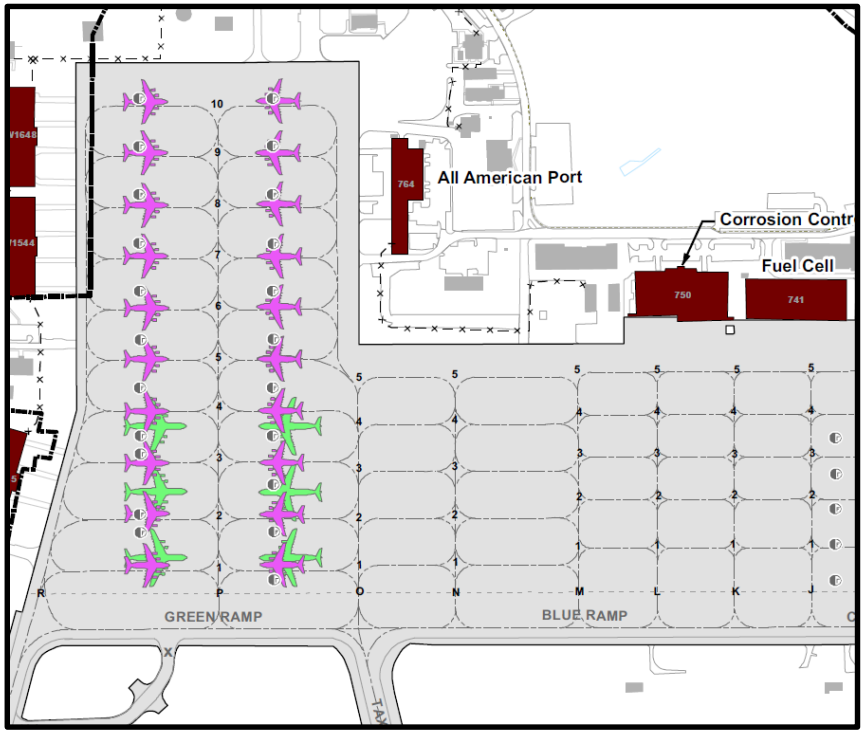
E-9 - Aircraft Parking Plan



E - 9



E – 9 .1

E-9 - Aircraft Parking Plan.
E-9.1 - Proposed Aircraft Parking Plan.

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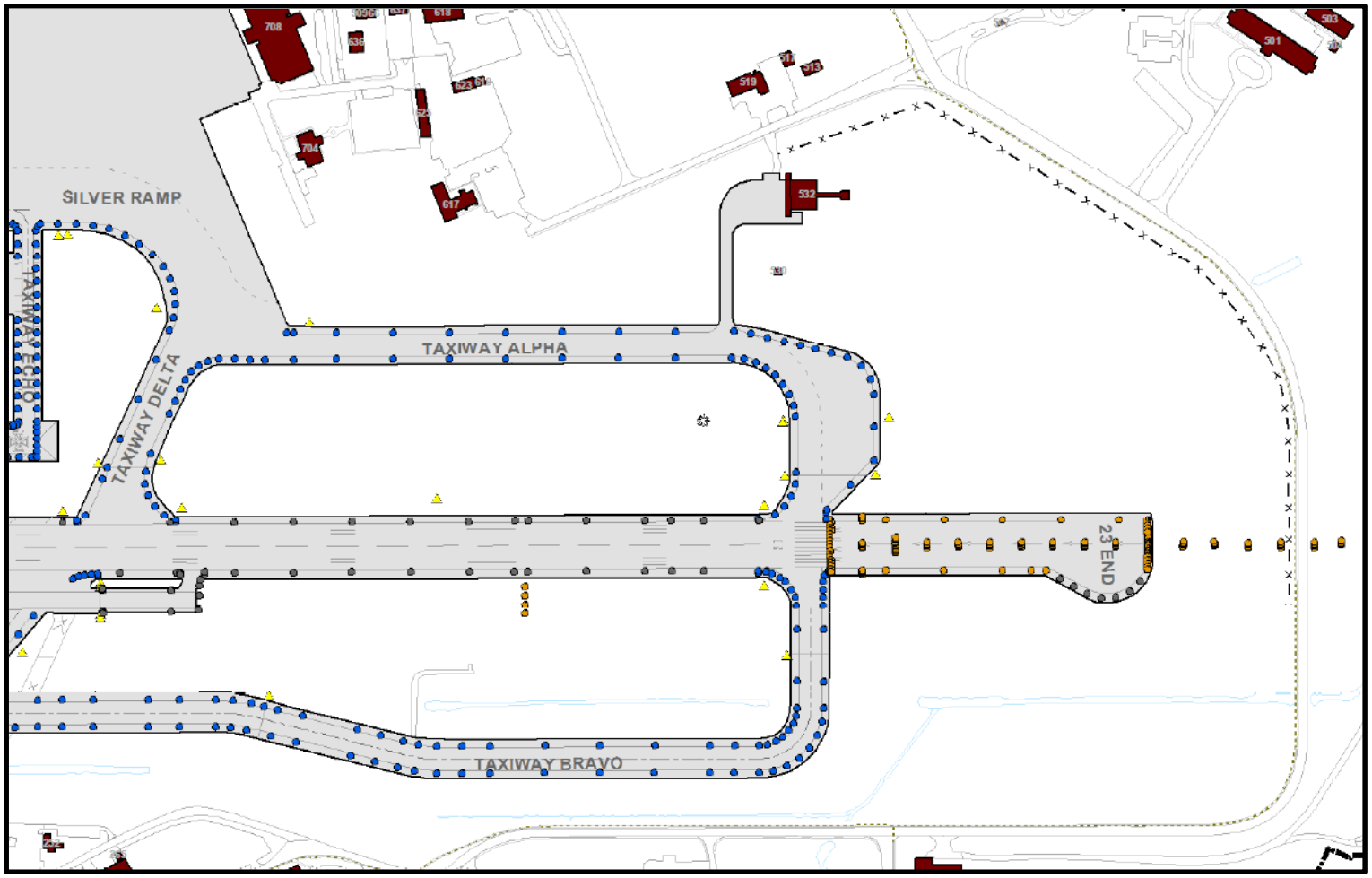
E-10 – Airfield Lighting System.



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Conclusions

- Lidar and Othropotography are instrumental for E-Tab series obstruction mapping.
- Lidar and Othropotography 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 Orhtopotography (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.

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Conclusions (Collection Methods)

Fixed-Wing

Helicopter

Stationary

Surface - Mobile

THANK YOU

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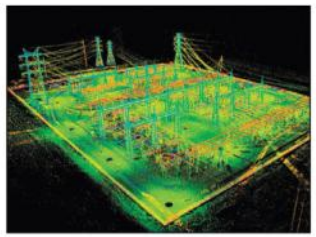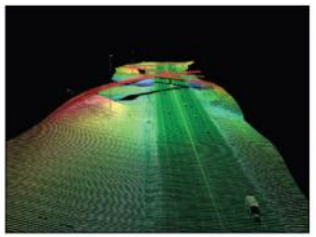
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