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Assessing Critical Infrastructure Vulnerability to Small Unmanned Aircraft Systems (sUAS) Vulnerability Assessment Methodology

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Homeland Security

National Protection and Programs Directorate (NPPD)

Assessing Critical Infrastructure Vulnerability to Small Unmanned Aircraft Systems (sUAS)

Vulnerability Assessment Methodology

Background

In support of NPPD's efforts to assess vulnerability within and across critical infrastructure sectors, the Institute for Defense Analyses (IDA) developed a vulnerability assessment methodology for sUAS threats. The methodology supports decision-makers in determining the degree of vulnerability sUAS threats pose to critical infrastructure assets. A complete description of the methodology and results for NPPD can be found in the IDA paper *Critical Infrastructure Vulnerability to Small Unmanned Aircraft Systems (sUAS): Options for the Department of Homeland Security* (FOUO).

Objective

To determine the degree of vulnerability sUAS threats pose to critical infrastructure assets.

Requirements

Important requirements include:

- **Asset Categorization Taxonomy –** An infrastructure asset categorization scheme is required to conduct the assessment. The Department of Homeland Security's infrastructure data taxonomy (DHS IDT) is one such tool available to infrastructure owners, operators, and risk assessors, and was employed in IDA's research.

  Note: The current DHS IDT is considered dated as it corresponds to industry asset types and groupings.
- **Infrastructure Experts –** Vulnerability determinations require infrastructure sector experts who can make approximate decisions on the general composition and vulnerability of asset categories.

Methodology

The methodology follows a three-step approach. The first step is determining the specific infrastructure assets and groups of assets that are to be assessed. These groups would ideally follow an established asset categorization taxonomy (e.g., the DHS IDT). Each asset group is then organized into "asset classes" based on a series of questions (examples provided below) that examine the common physical features and operational attributes of targeted infrastructure assets.

1. **Question:** Is the asset *open-air* or *enclosed*?
2. **Question:** Does the asset contain *hazardous material*?

Sub-Sector 17.1 – Nuclear Facility

Physical Features	Operational Attributes
Physical Structure: Fixed	Occupancy: *Not* high-occupancy
Domain: Land	Additional Hazards: HAZMAT
Organization: Centralized	Operational Access: Controlled/Denied
Exterior Boundary: Open-air	
Interior Space: Non-air-navigable interior	
Hardness: Hardened	

= (Fixed Land) *A Centralized Open-Air Hardened HAZMAT Controlled* Asset

Critical Infrastructure Asset Classification (Source: IDA)

Once the asset classes are defined, they are then matched to individually characterized sUAS attack vectors and assessed by infrastructure experts to determine the degree of vulnerability for specific asset classes. These degrees are recorded as either:

- **Higher Vulnerability (Red):** Higher likelihood of successful attack – *will* cause exploitation/disruption/ destruction to asset
- **Lower Vulnerability (Yellow):** Lower likelihood of successful attack – *may* cause exploitation/disruption/ destruction to asset, but highly dependent on specific asset characteristics
- **Limited/No Vulnerability (Green):** Little or no likelihood of successful attack – likely will not cause exploitation/disruption/destruction to asset

Vulnerability in this methodology follows the *DHS Risk Lexicon* description (2010 edition).

Illustrating Results

Results for this qualitative assessment can be presented as a stoplight table for each sub-sector-level asset group, or averaged across sub-sectors to visualize an entire critical infrastructure sector.

	sUAS Attack Vectors						
	Surveillance	Direct			Standoff		Chemical Biological Radiological (CBR)
Asset Class		Impact	Impact with Mounted Weapon	Impact with Explosive	Ballistic and Projectile Weapons	Directed Energy Weapons	CBR Payload
Centralized HAZMAT Open-Air Assets							
Distributed HAZMAT Open-Air Assets							
Centralized HAZMAT Enclosed Assets							
Centralized Enclosed Assets, Without Air-Navigable Interiors							

Vulnerability Results for the Chemical Sector (Source: IDA)

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