Overview

- Air Force Cyber/Information Environment
- Example Enabling Technologies for Cyber Vision 2025
  - Resilient Future C2 Architectures
  - Human/Machine Risk Assessment & Autonomy
  - ISR Mission Analysis
- Information Technology Transition Process
Air Force cyber and C2/ISR missions are distributed often dynamic networked environment

- AFOSR uses advanced mathematics to secure, model, and protect
Fundamental research questions from Cyber Vision 2025 can be addressed through Complex Networks and in AFOSR information science programs.

### Enabling Technology For Cyber Vision 2025

<table>
<thead>
<tr>
<th>Area</th>
<th>Near (FY12-FY15)</th>
<th>Mid (FY16-20)</th>
<th>Long (FY21-25)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foundations</td>
<td>Measurement, Analysis,&amp; Verification</td>
<td>Taxonomy of System Vulnerability</td>
<td>Quantum Methods for Vulnerability Assessment and Security</td>
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<tr>
<td>Agility and Resiliency</td>
<td>Secure Virtualization for Critical Infrastructure</td>
<td>Online Vulnerability Identification, Adaptation and System Repair</td>
<td>Autonomous Physically Secure Cyber Systems</td>
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<tr>
<td>Human/Social/Machine Systems</td>
<td>Advanced Situational Awareness for Cyber Operators</td>
<td>Online Assessment of Cyber Operator Performance</td>
<td>Cyber Operator Performance Augmentation</td>
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**Areas discussed**
Critical network, software, and hardware states can be measured and verified with optical quantum states.

Measurement Based Verification
Enables Automated Code Repair and Risk Quantification

Current Systems
Future Quantum Layer

Critical Information Software/Hardware
Information Loss/Compromise
Automated Code Repair/Recovery/Protection

Quantum Layer Feedback
Measured Quantum State

Quantum Verification
Enables Instantaneous Physical Layer Analysis/ Protection
Many problems in cyber and C2/ISR have roots in the autonomy area. - Missions performed by human vs. machines can be assessed and arbitrated using data-driven risk metrics as conditions evolve.
ISR mission infrastructures are critically dependent on resources such as electromagnetic spectrum to both sense and communicate.

- Automated strategies for spectrum resource allocation must be developed to support higher level mission functions.
Introduce measurement algorithms and components into existing systems and future architectures

- Transition cycles in information technology can be as short as 2-3 years

**Introduce Advanced Mathematical and Modeling Techniques Into System Components (AFOSR)**

**Systems Components in Architecture + Future (AFRL/AFMC)**

**Mission Performance Guarantees (User)**

**Mathematical Systems Analysis**