Unmanned/Robotic Systems

A Revolutionary Technology on an Evolutionary Path

ASEE Presentation
February 9, 2016

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USZ
(Unmanned Systems Zealot)
Challenge or Tasker

Policy Questions

- What should our policies be?
- What do we discuss with our legislators and senators?
When do you think unmanned systems will be part of your everyday life?
# Game-Changing Technology

<table>
<thead>
<tr>
<th>Cost</th>
<th>Service</th>
<th>Risk</th>
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What causes policy change?
What Causes Policy Change?

- Human Injustice
- Social Awareness
- Revolutionary Technology
Revolutionary/Disruptive Technology

- Improves Existing Capabilities
- Creates New Jobs
- Eliminates Some Jobs
- Requires New Laws or Policies
Unmanned Aircraft Systems (UAS) or Drones

- Do Two Things Very Well
  - Situational Awareness
  - Delivery
Automated Vehicle Systems (AVS) or Driverless Cars

- Revolutionize Mobility
- Create New Business Model
What are the cyber security policy issues for unmanned systems?
Assumptions

- This is a Revolutionary Technology
  - Technology Always Wins
- Different Level of Autonomy
  - Smart Cars will get Smarter
- There will be a Traffic Management System
Rate of Infusion/Acceptance of UAS and Driverless Cars is Based on SAFETY
Safety of Unmanned Systems Depends on

- Hardware
- Software
Hardware

- The more you use it, sooner or later
  IT BREAKS

Software

- The more you use it, sooner or later
  IT WORKS
Software Will Get Better

- Moore’s Law
- Metcalf’s Law
- Artificial Intelligence
- Learning Machines
What Major Factors Affect Policies and Laws of Unmanned Systems?

- Technology Maturation
- Risk Acceptance
- Leadership
Position on UAS Privacy

All stakeholders can work together to advance UAS technology, while protecting Americans’ safety, as well as their rights.

- **Transparency Measures**
  - Register unmanned aircraft and pilots with the Federal Aviation Administration (FAA)

- **Prohibiting Weaponization**
  - FAA already prohibits the deployment of weapons on civil aircraft

- **Data Retention Policies**
  - Governing the collection, use, storage, sharing, and deletion of data
  - Policies should be available for public review and comment
  - Policies should outline strict accountability
  - Requires government and industry standards

- **Accountability**
  - Fourth Amendment already protects against unreasonable searches
  - People should be prosecuted for violating privacy laws

- **Technology Neutral Laws**
  - Any new laws or regulations should focus on whether the government can collect and use data, not how it is collected
Challenges

- UAS Regulations on Commercial Use of UAS
- Current Privacy Issues in the Civil Market
  - “Lettuce doesn’t care if it’s spied on”
- Solutions Need to Meet the Triple Bottom Line
  - Cost-effective
  - Beneficial to society
  - Good for environment
- Cost-effectiveness of sensors for UAS and UGS
  - Not many available
- Dexterous manipulation
  - Robotic technology can fly a 747 across the country, but is challenged with the simple task of picking a strawberry
Back to Assumptions

- This is a Revolutionary Technology
  - Technology Always Wins
- Different Levels of Autonomy
  - Smart Cars will get Smarter

There will be a Traffic Management System
UAS Traffic Management (UTM) System (same for AVS/DC)

- Federally Created
- Government and Industry
- Works for Manned and Unmanned Systems
Summary

- Unmanned Systems/Robotics has the potential to be a revolutionary technology
  - Major economic drive/job maker
  - Significant improvement to quality of life
  - Improve national security/defense operations
- The White House (OSTP) and Congress are supportive/encouraging unmanned systems/robotics (STEM)
- Unmanned Systems/Robotics will continue to grow and be part of our future
What *Should* Our Policies Be?
I Wish I Was 20 Years Younger!

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Back-up Slides
# What is an Unmanned System?

<table>
<thead>
<tr>
<th><strong>UAS</strong></th>
<th><strong>UGV</strong></th>
<th><strong>UMV</strong></th>
<th><strong>Subsystems</strong></th>
<th><strong>Services</strong></th>
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<tbody>
<tr>
<td><strong>End User</strong></td>
<td>• Military</td>
<td>• Military</td>
<td>• Military</td>
<td>• Payloads</td>
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<td>• Civil</td>
<td>• Civil</td>
<td>• Civil</td>
<td>• Components</td>
<td>• Integration</td>
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<td>• Commercial</td>
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<td>• Commercial</td>
<td>• Communications</td>
<td>• Logistics</td>
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<td>• Academic/Research</td>
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<td>• Academic/Research</td>
<td>• Command/Control</td>
<td>• Training</td>
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<tr>
<td><strong>Category/Classification</strong></td>
<td>• HALE</td>
<td>• EOD/Bomb Disposal</td>
<td>• Navigation</td>
<td>• Maintenance</td>
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<tr>
<td>• MALE</td>
<td>• Logistics/Transport</td>
<td>• Avionics</td>
<td>• Operational</td>
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<td>• Tactical</td>
<td>• Surveillance/Recon</td>
<td>• Software</td>
<td>• Consulting</td>
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<tr>
<td>• Small Tactical</td>
<td>• Combat</td>
<td>• Propulsion/Power</td>
<td>• R&amp;D</td>
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<td>• Small</td>
<td>• Medevac</td>
<td>• Displays</td>
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<td>• Miniature/Micro</td>
<td>• HAZMAT Detection</td>
<td>• Control Stations</td>
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<tr>
<td>• Vertical Takeoff/Landing</td>
<td>• Combat</td>
<td>• Launch/Recovery</td>
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<tr>
<td>• Combat</td>
<td>• Inspection</td>
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<td>• Lighter than Air</td>
<td>• Communications Relay</td>
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<tr>
<td>• Optionally Piloted</td>
<td>• Message Broadcast</td>
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<td><strong>Mission (Most Common)</strong></td>
<td>• Firefighting</td>
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<td>• Surveillance</td>
<td>• Search and Rescue</td>
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<td>• Precision Strike</td>
<td>• Perimeter Patrol</td>
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<td>• Precision Agriculture</td>
<td>• Archeology</td>
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<td>• Inspection</td>
<td>• Research</td>
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<tr>
<td>• Communications</td>
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<td>• Monitoring/Research</td>
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<td>• Cargo Delivery</td>
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<td>• Recreation</td>
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- **Category**
  - Unmanned Underwater Vehicles
  - Unmanned Surface Vehicles
  - Remotely Operated Vehicles

- **Mission (Most Common)**
  - Mine Clearance
  - Surveillance
  - Environmental Monitoring
  - Infrastructure Inspection
  - Marine Life Monitoring
  - Oil & Gas
  - Hull Inspection
  - Search and Rescue
  - Security/Patrol
  - Other Inspection
  - Marine Life Monitoring
  - Research

- **Subsystems**
  - Avionics
  - Software
  - Propulsion/Power
  - Displays
  - Control Stations
  - Launch/Recovery

- **Services**
  - Engineering
  - Integration
  - Logistics
  - Training
  - Maintenance
  - Operational
  - Consulting
  - R&D
## Unmanned Systems Potential Applications

<table>
<thead>
<tr>
<th>Border Security</th>
<th>Industrial Logistics</th>
<th>Search &amp; Rescue</th>
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<tbody>
<tr>
<td>Arctic Research</td>
<td>Pollution Monitoring</td>
<td>Volcanic Research</td>
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<td>Firefighting</td>
<td>Storm Research</td>
<td>Pipeline Monitoring</td>
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<td>Flood Monitoring</td>
<td>HAZMAT Detection</td>
<td>Filmmaking</td>
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<td>Crop Dusting</td>
<td>Asset Monitoring</td>
<td>Crowd Control</td>
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<td>Mining</td>
<td>Event Security</td>
<td>Aerial News Coverage</td>
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<tr>
<td>Farming</td>
<td>Port Security</td>
<td>Wildlife Monitoring</td>
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<td>Aerial Photography</td>
<td>Construction</td>
<td>Forensic Photography</td>
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<td>Real-estate</td>
<td>Cargo</td>
<td>Power line Surveying</td>
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<td>Communications</td>
<td>Broadcasting</td>
<td>Damage Assessment</td>
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Why Automated Vehicles?

Safety
- 32,719 highway deaths
- 6,300,000 crashes/year
- Leading cause of death for ages 4-34

Mobility
- 4,200,000,000 hours of travel delay
- $80,000,000,000 cost of urban congestion
- $242,000,000,000 annual economic cost

Environment
- 2,900,000,000 gallons of wasted fuel

(2013 Data)
Automated Vehicles by 20XX!

- Automated vehicles could be the next transportation revolution:
  - Improving driver safety
  - Reducing pollution
  - Easing traffic congestion
  - Aiding mobility of millions of elderly and disabled in the U.S. and around the world
- Innovation and technological advancement will be key for the U.S. automotive industry to stay competitive
Benefits of Automated Vehicles

- Faster reaction time than a human
- Can see 360 degrees and process thousands of vehicle-to-vehicle and vehicle-to-infrastructure information packets a second
- Programmed to follow local traffic laws
- Never gets distracted, tired, or impaired
- Potential to dramatically reduce crashes and car-related injuries and deaths
- Allow for mobility for those who may have difficulty safely driving a vehicle—blind, aging, physically impaired
Challenges for Automated Vehicles

Legal Issues/Liability/Privacy
- Who’s responsible when there is an accident? How do we ensure drivers’ rights to privacy are protected?

Insurance
- How will the insurance industry handle this revolution in transportation? What will the emerging insurance models entail, and how will automated vehicles be covered?

Cultural
- How do we instill trust in the driving public? How do we market a “cool” driverless car to auto and driving enthusiasts? How do we influence consumer behavior and societal acceptance?

Regulatory/Policy
- How will automated vehicles be regulated? What standards will they have to meet? How will regulations and policies differ from state to state? How will these vehicles be vetted, tested, and ultimately integrated onto existing highways with traditional vehicles?