

*Exceptional service in the national interest*

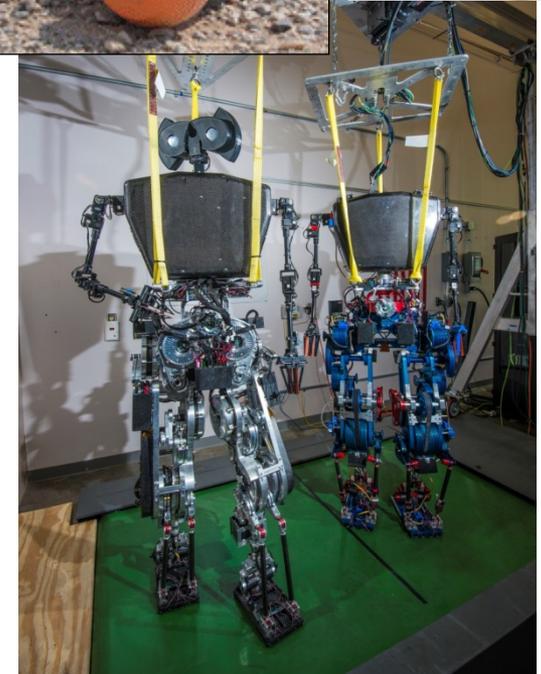
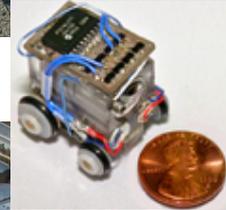


## Unmanned Aerial Systems

**Philip Heermann, Ph.D.**  
**High Consequence Automation and Robotics**  
**Sandia National Laboratories**

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL850008129 C

# Sandia Robotics



- Sandia Interest in Unmanned Aerial Systems
  - Testing and deployment of technology
  - National Security Challenges
  - Protection of government assets and facilities
  - Environmental research and sensing
  - Development of advanced robotic vehicles
  - Integrated simultaneous control of ground, maritime, aerial unmanned vehicles.

# Challenges

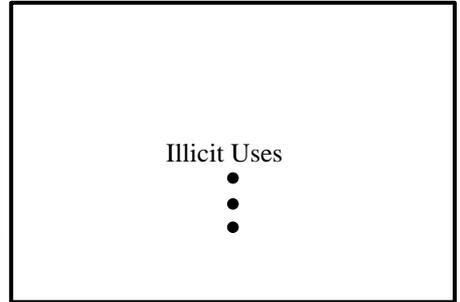
- **Unmanned Aerial Systems (UAS) are the fastest growth sector within the US aviation industry!**
  - Estimated 1,000,000 sold in the U.S. in 2015 alone
  - Near misses happening regularly
    - Dozens > 9,000 ft. above ground level (hobbyist ceiling is 400 ft.)
    - First mid-air collision with manned aircraft reported
- **What is trespassing with small UAS?**
- **Delicate balancing act: public/privacy concerns vs. national security?**
- **Current UAS Technologies were not developed to comply with existing Federal Aviation Administration (FAA) airworthiness standards**
- **Technology revolution has moved development from graduate laboratories to high school student basements**
- **Current research is poised to continue transforming UAS capabilities (rapid evolution!)**
- **Detection and timely assessment of small UAS at range is a challenge**
- **Neutralization is problematic for technical and policy reasons**
  - Continental United States operations may limit use of some technologies



Privacy Concerns

Use the Capabilities/Manage the Challenges

# Technology and Applications



# Quadcopters are a popular type of UAS



# UAS of all types and sizes will be in New Mexico



# Energy efficiency is a key driver to UAS development



# Google: Internet from the Sky



Impact to Telecommunications

Photo courtesy of Google, Inc.

# Example UAS Capabilities

## Hexacopter:

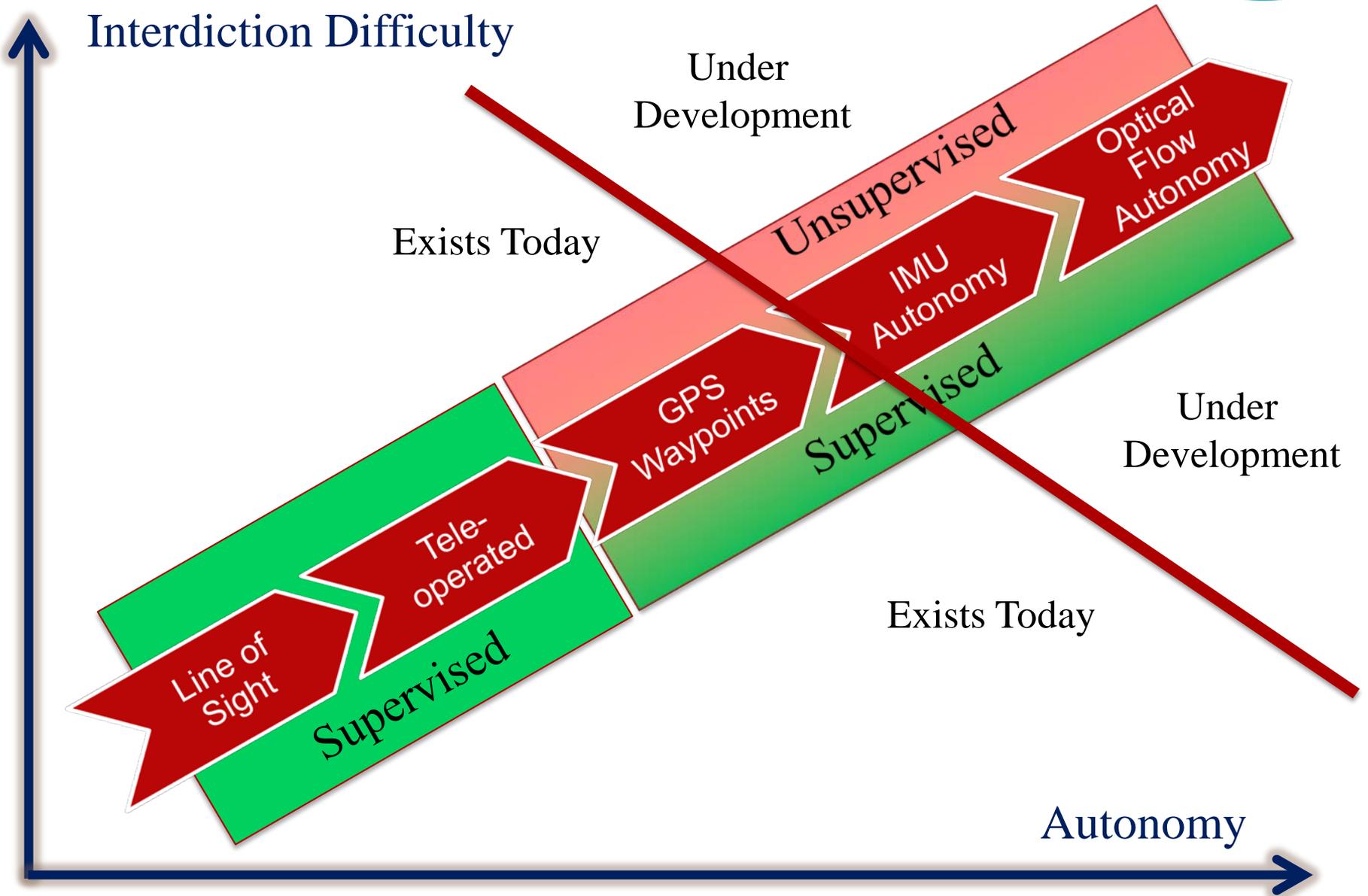
- 4lb payload
  - 10-12 minutes
- 10lb
  - 5 minutes



## Octocopter:

- 12lb payload
  - 10-12 minutes
- 20lb
  - 5 minutes

**Speeds of 60-80 MPH**



# Government Use of UAS

## ■ National security

- Military
- Site protection

## ■ Homeland security

- Situational awareness
- Pursuit/response

## ■ Infrastructure protection/inspection

- Critical infrastructure
- Landmarks



## ■ Near-term development solutions

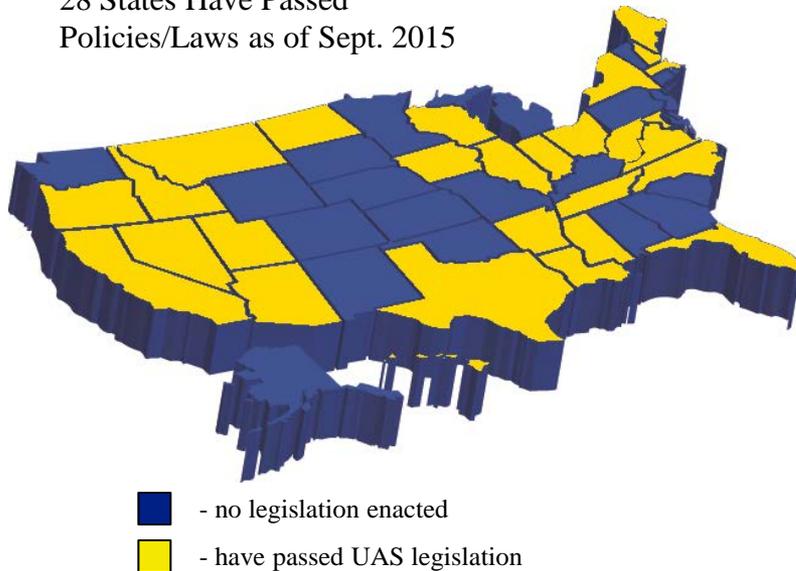
- Situational awareness
- Determine intent
- Attribution

## ■ Mid to long-term development solutions

- Alarm assessment
- Tagging and tracking
- Delay and denial tactics
- Bird-on-bird neutralization

# State Legislation to Date

28 States Have Passed  
Policies/Laws as of Sept. 2015



Category	# States* with Legislation Passed
Privacy	12
Law Enforcement Restriction	12
State Operations	7
Hunting Restrictions	6
Critical Infrastructure / Use at Public Events	4
Weaponization	2
State Primacy of UAV Laws	1
Restrictions Over Prisons	1

\* - Cities and municipalities have enacted most radical laws to date



ABQ Photo courtesy Bill Tongreau [www.sumnerdene.com](http://www.sumnerdene.com)

# Key Points for Small UAS

- UAS technology is rapidly evolving
- Care must be taken to not limit security and public service use
  - As policy is developed, it is important to consider all impacts of regulations that may affect local and national security and local/state economy
- Very Large Market Forces and Potential
  - Major corporations are sponsoring the advancement of UAS
  - Applications are still being identified



Questions?