UAS Weather Forum

Moderated by Matthias Steiner

NCAR | NATIONAL CENTER FOR ATMOSPHERIC RESEARCH

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AUVSI XPONENTIAL™

April 25 – 28 | Orlando, FL
Orange County Convention Center

Co-located Partner Event at AUVSI's XPONENTIAL
Monday, 25 April 2022

The UAS Weather Forum provides a platform for UAS operators; federal & state agencies; weather researchers & providers; trade groups; safety & insurance groups; UAS manufacturers; & others to:

- Share experiences with expected & unexpected weather impacts
- Engage in a dialogue about weather needs for UAS operations
- Collect requirements for developing better weather guidance
- Cultivate strategies on how to make progress with needed weather support
- Assist regulators with safe integration of UAS into the national airspace system considering weather impacts
- Explore opportunities for using UAS-sensed environmental information for enhanced situational awareness & better weather prediction
- Facilitate weather education & outreach

Today's Theme is "Weather & Autonomy"

Matthias Steiner, NCAR
Weather and Autonomy – Setting the Stage

George Gorospe, NASA
Seeing Through the Fog: Perception Testing for Autonomous Flight

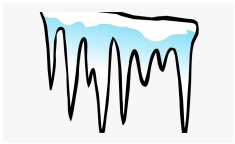
Jack Elston, Black Swift Technologies
UAS Operations in Extreme Weather Environments,
Case Studies and Technological Solutions

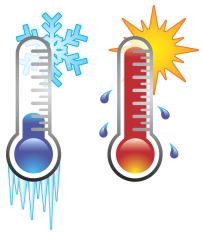
Break

Jamey Jacob, Oklahoma State University
Weather Intelligent Navigation Data and Modeling for Aviation Planning

Andy Thurling, NUAIR
Whose Reality? – Trusting Autonomy in UTM/AAM Weather

Weather & Autonomy





DRONE INDUSTRY INSIGHTS

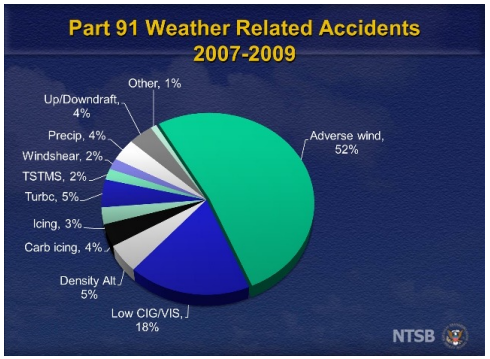
Increasing use of sensors & algorithms

Autonomy Level	Level 0	Level 1	Level 2	Level 3	Level 4	Level 5
Human Involvement						
Machine Involvement						
Degree of Automation	No Automation	Low Automation	Partial Automation	Conditional Automation	High Automation	Full Automation
Description	Drone control is 100% manual.	Pilot remains in control. Drone has control of at least one vital function.	Pilot remains responsible for safe operation. Drone can take over heading, altitude under certain conditions.	Pilot acts as fall-back system. Drone can perform all functions 'given certain conditions'.	Pilot is out of the loop. Drone has backup systems so that if one fails, the platform will still be operational.	Drones will be able to use AI tools to plan their flights as autonomous learning systems.
Obstacle Avoidance	NONE	SENSE & ALERT	SENSE & ALERT	SENSE & AVOID	SENSE & NAVIGATE	SENSE & NAVIGATE

Source: DRONEII.com

Date: March 12th 2019

DRONEII.COM
DRONE INDUSTRY INSIGHTS



Weather can impact safety, efficiency & reliability of flight operations

Evolving Role of Pilot

Taking pilot out of cockpit

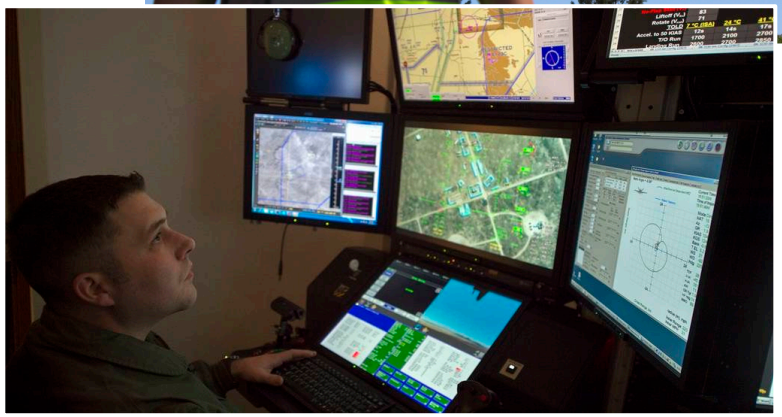
- Losing human pilot as onboard detector of environmental clues for risk assessment
- Remote pilot needs help to effectively oversee a flight
  - increasing use of sensors & algorithms

Human – automation interface

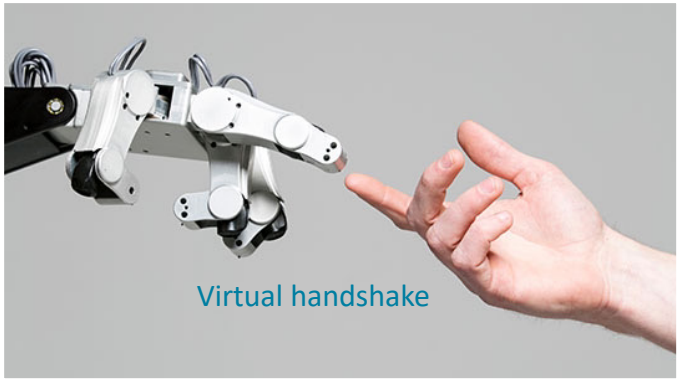
- Remote oversight of flights requires effective communication
  - builds on connectivity & understanding

Pilot in cockpit of aircraft

Remote pilot sees aircraft



Remote pilot oversees aircraft



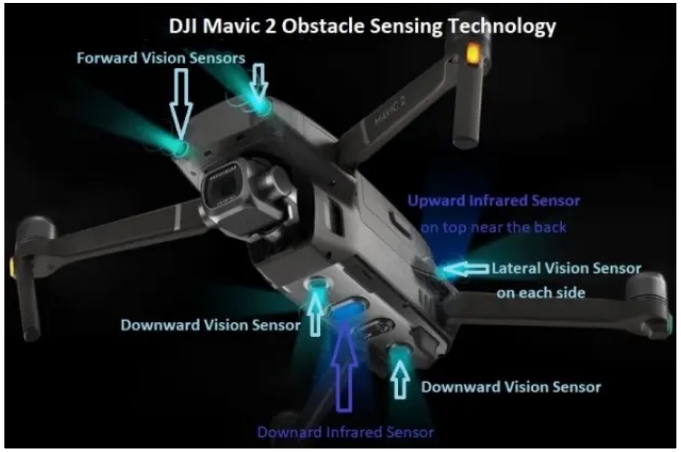
Virtual handshake

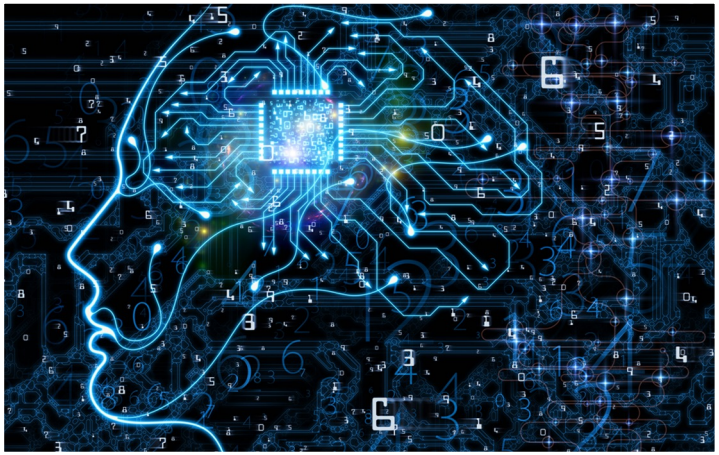
World of Sensors & Algorithms

Monitoring flight status & hazards

- Use of visible, infrared, sonic & microwave sensors for detection & avoidance of hazards
  - hazard sensing should include weather
- Monitoring of critical flight parameters
  - position, altitude, speed, roll, pitch, yaw, etc.

Variety of sensors





Artificial intelligence & cognitive computing

Interpretation & decision making

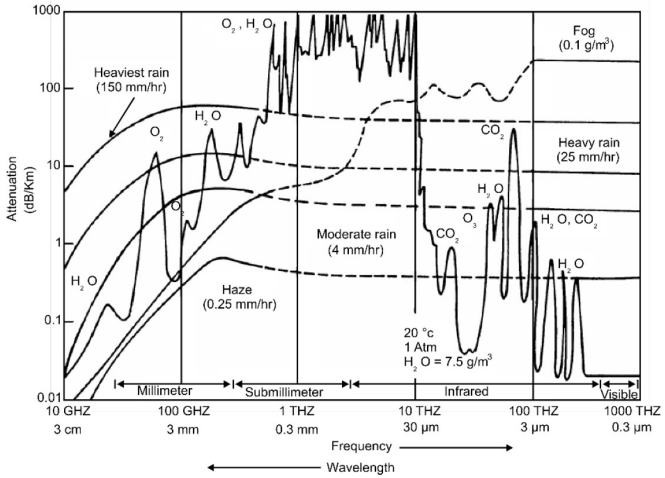
- Data & data quality control are critical
  - misleading/bad data will impact algorithms
- Digestion of information for flight decisions
  - fusion & interpretation of information for decision making
  - emulating what human brain can do well
- Autonomy requires onboard processing

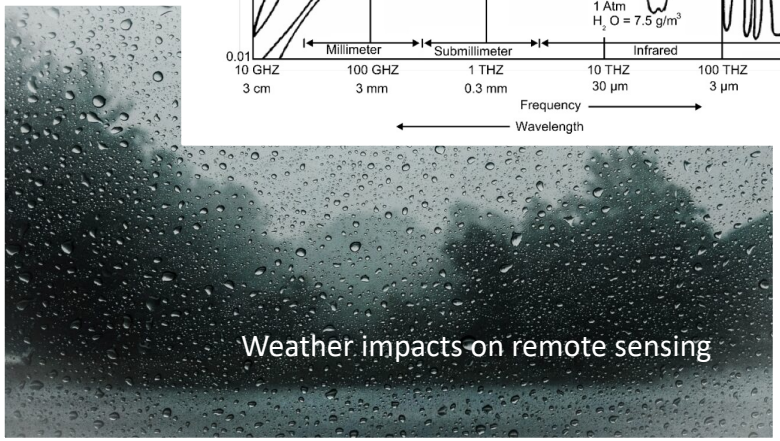
Off-Nominal Situations

Concerns for automated & autonomous flights

- Timely human intervention in off-nominal situations
  - remote pilot may not immediately understand what aircraft is experiencing
  - winds may push aircraft off intended flight path or altitude
  - wind & turbulence may drain battery charge more quickly
- Loss of connectivity & human oversight
  - what if link is lost – it will happen
- Weather can affect flight-critical & payload sensors
  - moisture affects sensor readings (fog, rain, snow, condensation, icing)

Pitot tube reading under icing





Weather impacts on remote sensing

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