



ASSURE Research Update for AMUSE 2021 March 2021

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Overview

Goal

Provide basic understanding of ASSURE and provide opportunity for questions and discussions on opportunities for collaboration going forward

ASSURE

- Why? What? Who?
- Center of Excellence (COE)
- Non-COE (ASSURE Global)

ASSURE Research

- Focus on where FAA and we are and where we are going
 - NASA Research
- International Efforts, First-responder UAS and Other Initiatives

ASSURE Guiding Principles

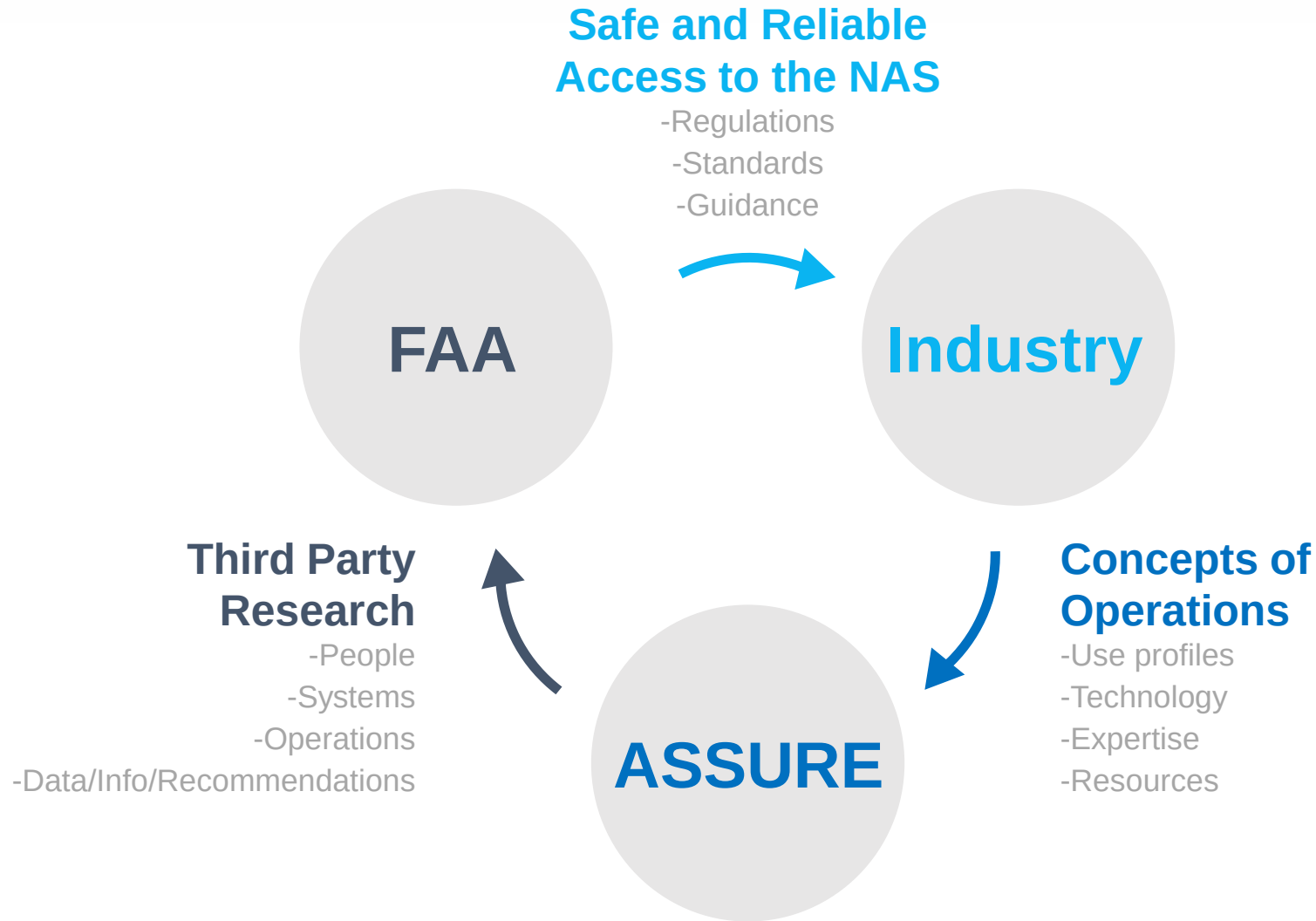
Vision

ASSURE is the go-to high-quality research organization and brand for working complex autonomy issues with focus on unmanned aircraft systems (UAS) in policy, regulations, standards, training, operations, and education.

Mission

Provide high-quality research & support to autonomy stakeholders both within the US and beyond to safely & efficiently integrate autonomous systems into the national & international infrastructure, thereby increasing commerce and overall public safety & benefit.

Why ASSURE (FAA Center of Excellence for UAS)



What is ASSURE/COE?



Long Title

The Alliance for System Safety of UAS through Research Excellence – The Federal Aviation Administration's Center of Excellence for Unmanned Aerial Systems

Short Title

The FAA's Academic Drone Research Center

Funding Vehicles

- Grants (Mandatory one-to-one cost share)
- IDIQ Contracts (cost share negotiable)

Congress added \$5MM in FY14-16; \$10MM in FY17; \$14MM in FY18-21 (~\$30MM Level of Effort); Projecting \$18+M next year

The FAA's Center of Excellence for UAS Research

ASSURE

Alliance for System Safety of UAS through Research Excellence



CORE TEAM

Alabama
UNIVERSITY of ALABAMA in HUNTSVILLE

Alaska
UNIVERSITY of ALASKA in FAIRBANKS

Arizona
EMBRY AERONAUTICAL UNIVERSITY-PRESCOTT

California
UNIVERSITY of CALIFORNIA DAVIS

Florida
EMBRY RIDDLE AERONAUTICAL UNIVERSITY

Kansas
KANSAS STATE UNIVERSITY
UNIVERSITY of KANSAS
WICHITA STATE UNIVERSITY

Montana
MONTANA STATE UNIVERSITY

New Mexico
NEW MEXICO STATE UNIVERSITY

North Carolina
NORTH CAROLINA STATE UNIVERSITY

North Dakota
UNIVERSITY OF NORTH DAKOTA

Oregon
OREGON STATE UNIVERSITY

Ohio
THE OHIO STATE UNIVERSITY

Pennsylvania
DREXEL UNIVERSITY

AFFILIATE TEAM

Alabama
AUBURN UNIVERSITY
TUSKEGEE UNIVERSITY

Indiana
INDIANA STATE UNIVERSITY

Israel
TECHNION - ISRAEL INSTITUTE OF TECHNOLOGY

Louisiana
LA TECH UNIVERSITY

Ohio
SINCLAIR COMMUNITY COLLEGE

Canada
CONCORDIA UNIVERSITY

United Kingdom
UNIVERSITY of SOUTHAMPTON

Singapore
NANYANG TECHNOLOGICAL UNIVERSITY

MISSISSIPPI STATE UNIVERSITY
LEAD UNIVERSITY



The FAA's Center of Excellence for UAS Research
Alliance for System Safety of UAS through Research Excellence

Industry and Government Partners

UNITED STATES

ALASKA
Indemnity, Inc.

CALIFORNIA
A33 by Airbus
GoPro
Intel
Keysight Technologies, Inc.

COLORADO
Aeryon

CONNECTICUT
Pratt & Whitney

FLORIDA
R Cubed Engineering

KANSAS
Kansas Department of Commerce
State of Kansas

ILLINOIS
Boeing

IOWA
Rockwell Collins

MARYLAND
ConsortiQ, LLC

MASSACHUSETTS
GreenSight Agronomics, Inc.

MICHIGAN
Altair Engineering, Inc.

MISSOURI
Mike Toscano - Ghafoor, Cook, & Associates, LLC

MISSISSIPPI
Soaring Eagle Imaging, LLC
The Ciriot Agency

MONTANA
Arlin's Aircraft Service, Inc.
Montana Aircraft

NEVADA
Sierra Nevada Corporation

NEW YORK
NUAIR

NEW MEXICO
Sandia National Laboratories

NORTH CAROLINA
Honeywell
SenseFly
PrecisionHawk
REIN Technologies, Inc.

NORTH DAKOTA
North Dakota Department of Commerce

OHIO
GE Aviation
Ohio/Indiana UAS Center (ODOT)
Simlat Ltd.

OKLAHOMA
Intelligent Aerospace Radar Team

PENNSYLVANIA
Keystone Aerial Surveys, Inc.

VERMONT
University of Vermont

VIRGINIA
Adams Communications & Engineering Technology
Adaptive Aerospace Group, Inc.
Association for Unmanned Vehicle Systems International (AUUSI)

WASHINGTON, D.C.
Federal Aviation



INTERNATIONAL

AUSTRALIA
Drone Complier

AUSTRIA
Natex Research

CANADA
Kongsberg Geospatial

CZECH REPUBLIC
AgentFly Software

CHINA
DJI

ISRAEL
Israel Aerospace Industries (IAI)

UNITED KINGDOM
Rolls Royce



ASSURE Global

Solve Problems and seek opportunities outside the FAA



With only one contract and NDA, if required

- ASSURE does the rest to leverage our teammates to best meet the needs of the sponsor.
- Master Teaming agreement with subordinated funded Task Orders

Another mechanism to conduct FAA and government work

Leverages ASSURE alliance and its relationships, in addition to the knowledge and experience gained from FAA research

Currently partnered with contractors supporting NASA, DoD, State DoTs, and Foreign Governments



ASSURE/COE Research

Regulatory Research Supporting the FAA

ASSURE Completed Projects: Basic Issues

(\$25 Million Level of Effort)

- A1 - Certification Test Case to Validate sUAS Industry Consensus Standards
- A2 - Small UAS Detect and Avoid Requirements Necessary for Limited Beyond Visual Line of Sight (BVLOS)
- A3 - UAS Airborne Collision Severity Evaluation (Peer Reviewed)
- A4 - UAS Ground Collision Severity Evaluation (Peer Reviewed)
- A5 - UAS Maintenance, Modification, Repair, Inspection, Training, and Certification Considerations*
- A6 - Surveillance Criticality for Sense and Avoid (SAA)
- A7 - Human Factors Control Station Design Standards
- A8 - Unmanned Aircraft Systems (UAS) Noise Certification
- A9 - Secure Command and Control Link with Interference Mitigation
- A10 - Human Factors Considerations of UAS Procedures, & Control Stations *
- A11 - Part 107 Waiver Request Case Study
- A12 - Performance Analysis of UAS Detection Technologies Operating in Airport Environments
- A13 - UAS Ground Collision Research Plan (Peer Reviewed)
- A14 - UAS Ground Collision Severity Studies
- A15 - STEM II
- A19 - UAS Test Data Collection and Analysis: Phase I
- A20 – UAS Parameters, Exceedances, Recording Rates for ASIAs

ASSURE Ongoing Projects (1 of 2)

- A16 - Airborne Collision Severity Evaluation – Structural Impact
- A17 - Airborne Collision Severity Evaluation – Engine Ingestion
- A18 - sUAS DAA Requirements Necessary for Limited BVLOS Operations: Separation Requirements & Testing
- A21 - Integrating Expanded & Non-Segregated UAS Operations into the NAS: Impact on Traffic Trends and Safety
- A23 - Low Altitude Detect and Avoid
- A24 - UAS Safety Case Development, Process Improvement, and Data Collection
- A25 - UAS Safety Case: Waivers
- A26 - Establish pilot proficiency requirements
- A27 - Establish risk-based thresholds for approvals needed to certify UAS for safe operation
- A28 - Disaster Preparedness and Response
- A29 - UAS as a STEM Outreach Learning Platform for K-12 Students and Educators
- A31 - Safety Risks and Mitigations for UAS Operations On and Around Airports
- A33 - Science and Research Panel (SARP) Support
- A35 - Identify Wake Turbulence and Flutter Testing Requirements for UAS
- A36 - Urban Air Mobility: Safety Standards, Aircraft Certification & Impact on Market Feasibility and Growth Potentials
- A37 - UAS Standards Tracking, Mapping, and Analysis
- A38 - Cyber Security and Safety Literature Review
- A40 - Validation of Low-Altitude Detect and Avoid Standards

ASSURE Ongoing Projects (2 of 2)

- A41 - Investigate & Identify the Key Differences Between Commercial Air Carrier Operations & Unmanned Transport Operations
- A42 - From Manned Cargo to UAS Cargo Operations: Future Trends, Performance, Reliability, and Safety Characteristics Towards Integration into the NAS
- A43 - High-Bypass Turbofan UAS Engine Ingestion Test
- A44 - Mitigating GPS and ADS-B risks for UAS
- A45 - Shielded UAS Operations: Detect and Avoid
- A46 - Validation of Visual Operation Standards for Small UAS
- A47 - Small UAS Mid-Air Collision Likelihood
- A48 - UAS Detection and C-UAS
- A49 - UAS Flight Data Research in Support of ASIAs

ASSURE Upcoming Projects

- A50 - sUAS Traffic Analysis
- A51 - Best Engineering Practices for Automated Systems
- A52 - Disaster Preparedness and Response Phase II
- A53 - Advanced Materials Investigation – Composite Material Analysis for UAS
- A54 - Propose UAS Right-of-Way Rules for UAS Operations and Safety Recommendations
- A55 - Identify Flight Recorder Requirements for UAS)Integration into the NAS

Current Work- Collision Follow-on Studies (~\$8.3Million Level of Effort)



Air-to-Air

- ✓ Rotorcraft
- ✓ General Aviation
- ✓ Engine Ingest Modeling
- ✓ Boundary Layer Effects
- ✓ Heavier UAS (25 kgs/55 lbs)

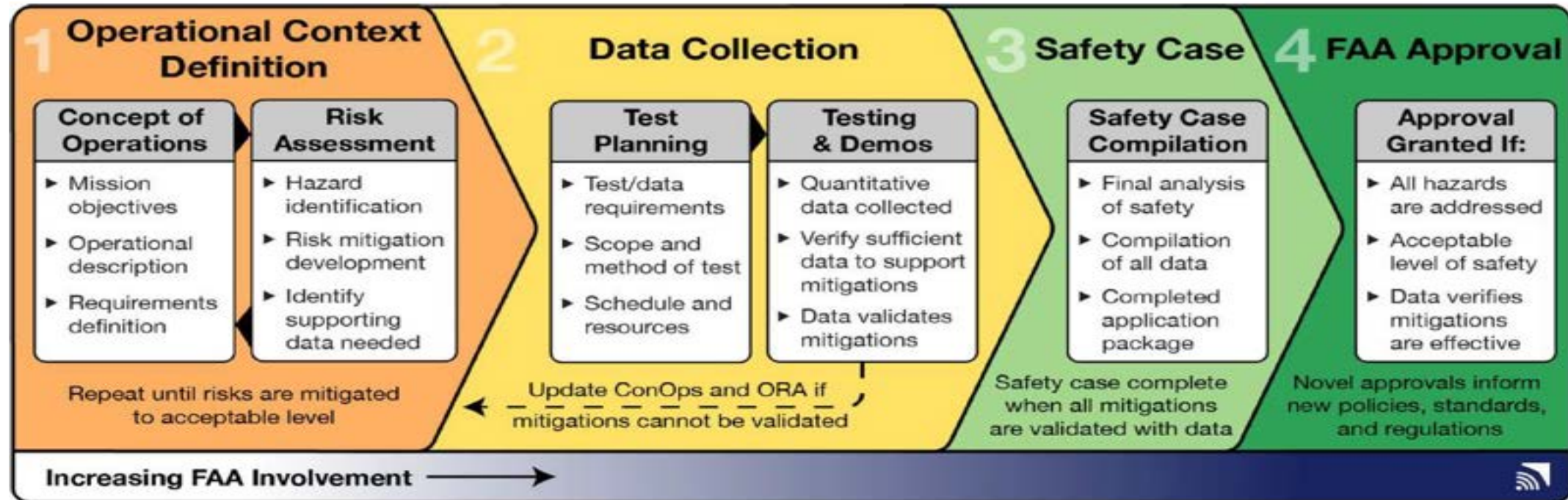
Current Work- Enabling Data/Info Structures (~\$2.6 Million Level of Effort)

Data

Information

Knowledge

- Test Data Collection and Analysis
- ASIAS (Aviation Safety Analysis and Sharing System: Phase I and Phase II)
- Risk-Based Training and Standards for waivers and Issuance

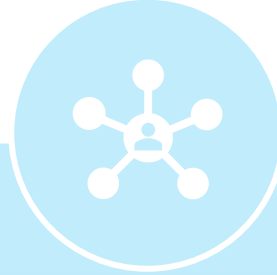


Enablers



Database Infrastructure and Framework (~\$5M Level of effort)

- Test Data Follow-On: working system for test and safety cases
- Risk-based thresholds for test Case (Evaluation Framework)



Multiplier / Ops Efficiency (~\$5M Level of effort)

- Multi-aircraft control



Risks/ Mitigations/ Security (~\$6.6M Level of effort)

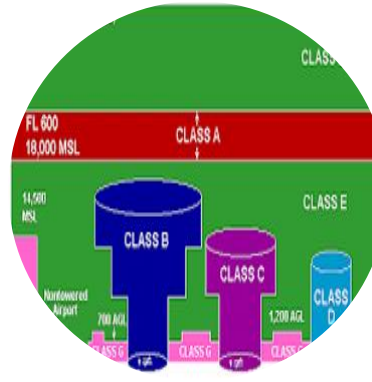
- Wake Turbulence
- Cyber Security
- GPS and ADS-B Risks
- UAS Visual Ops Stds

Current Work- Enabling Airspace Capes (~\$10 Million Level of Effort)



Airspace: Integration and BVLOS

- DAA for BVLOS
- Shielded UAS Ops-DAA



Airspace: Quantitative Risk

- Integrated non-segregated and extended operations in the NAS
- sUAS mid-air collision likelihood



Airspace: Use Forecasting

- E-commerce
- Emerging UAS Network and implication on NAS integrations

Application/Ops Studies

Public Safety (~7.6 Million Level of Effort)

- Disaster Preparation and Recovery
- Ops Over People: Compliance Method
- Safety Research Center (Validation/Verification)
 - ASTM Remote ID
 - Collision Avoidance and Well Clear volumes
 - Standards
 - Tracking
 - Mapping
 - Analysis

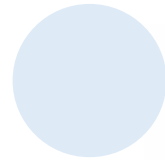


Operations (~8.6 Million Level of Effort)

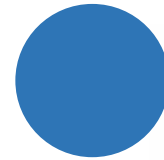
- Airports—Risk Mitigations for UAS Ops
- Air Mobility
- UAS Air Carrier Ops
- UAS Cargo Ops



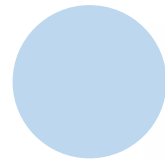
Requirements/Proposals (Starting in ~6 months)



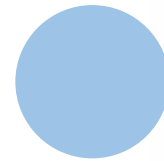
UAS Detection and C-UAS



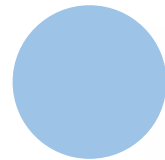
Flight Data Recorder



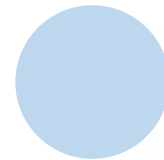
sUAS Traffic Analysis



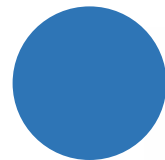
Safe Automation Design and Engineering



UAS Advanced Materials



Live Full-Engine Ingest of UAS



UAS Right-of-Way Rules



Weather

- Validated WX Obs. System for UAS Ops
- WX Standards/Requirements <400'
- UAS Means of Compliance: rain, snow, ice

A photograph of a person in a white shirt and khaki pants running on a gravel path, launching a model airplane. In the background, a white pickup truck is parked next to a blue trailer with a ramp extended. The trailer has a graphic of a model airplane and the text 'MOBILE MODEL AIRCRAFT STATION'. The scene is set in a field of tall grass under a clear blue sky.

ASSURE NASA Research

Applied Technology Research

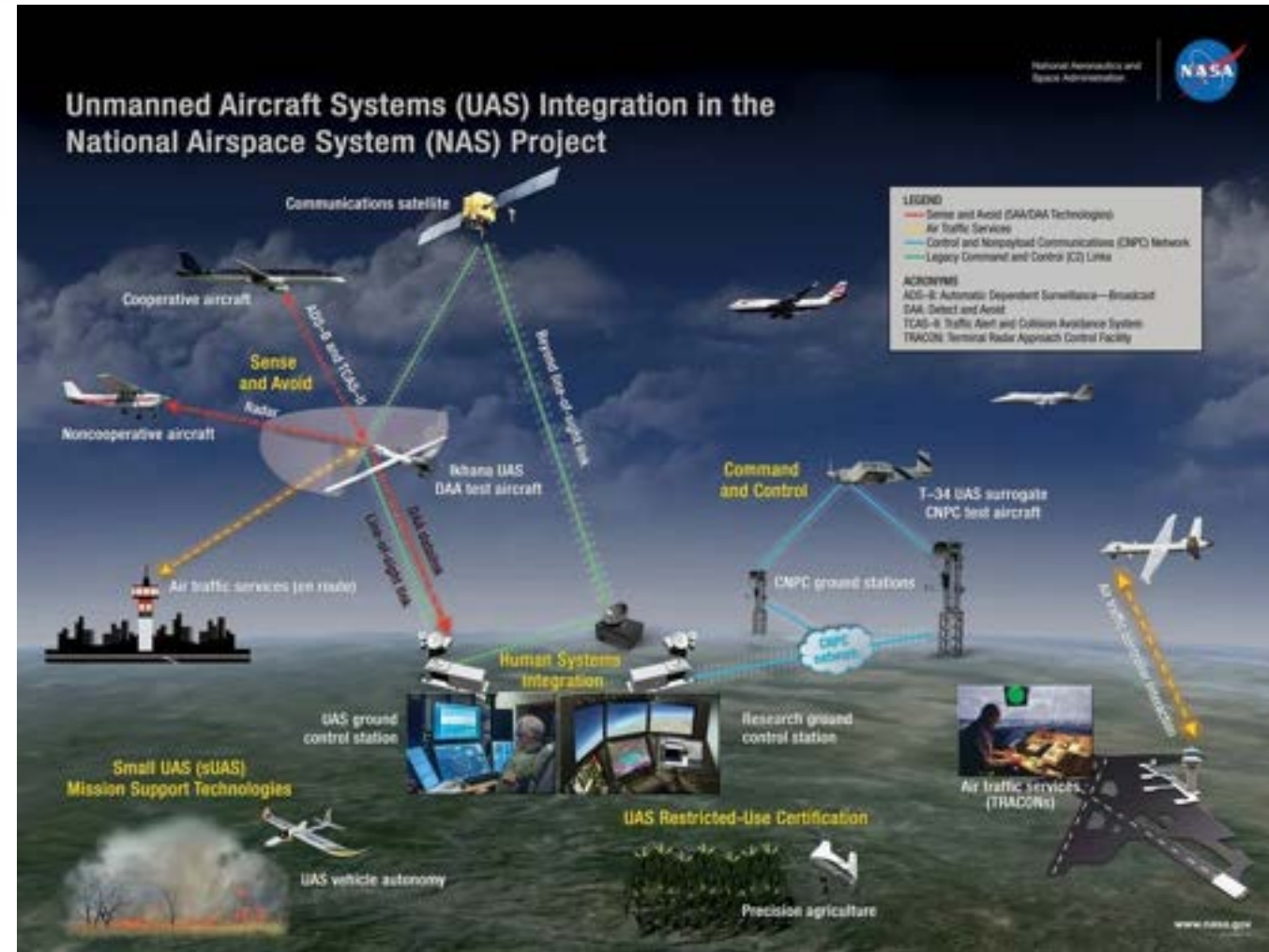
Command, Control, and Communications (C3)

C3 Comprehensive Assessment

C3 in Denied/Degraded Environments

UTM Spectrum Considerations

Multi-Vehicle Ops Approaches

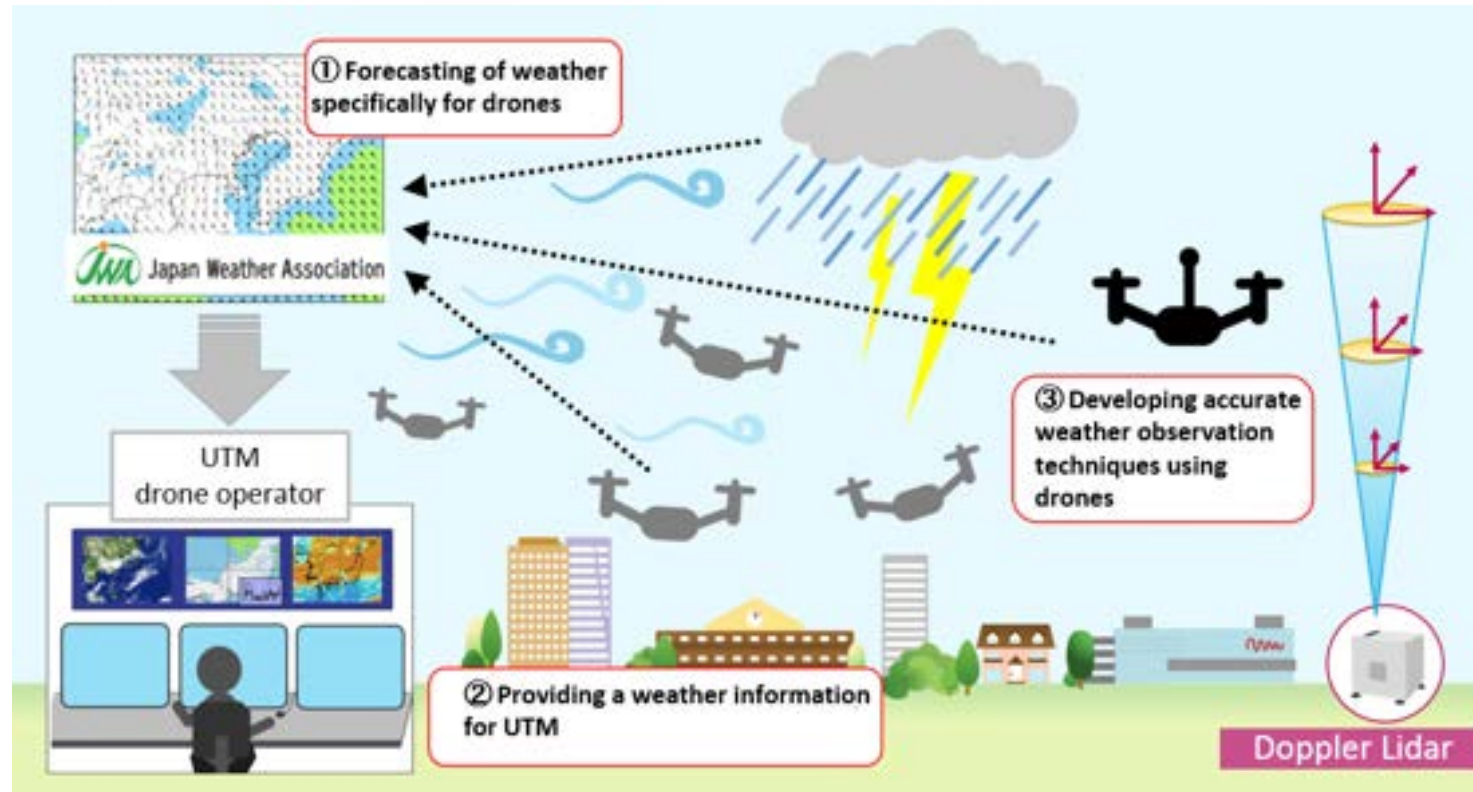


Beyond-Visual-Line-of-Sight (BVLOS) Ops



- BVLOS Economic Benefit Analysis
- Minimum Operator Display Requirements
- sUAS DAA Flight Testing
- Develop Safety Cases for BVLOS

Develop detailed, open-source WX forecasting for low-altitude UAS ops



ASSURE Other Initiatives

International

- Success with Transport Canada & Israel
 - Participate in projects together
 - Top off research for particular nation's needs
 - Different expertise and needs
- FAA International Regulator Roundtable on Research
- Growing International Network, Collaboration and Coordination
 - S. Korea, Singapore, Australia
 - Member of European Advisory Board for Beyond Visual Line of Sight Operations

Training & Certification/Credentialing

- First Responders use of UAS
- Support to Disaster Prep & Recovery

Autonomy Institute

- Research digitalization infrastructure supporting autonomous transportation/ops



Working with ASSURE

Working with ASSURE

Collaborate with ASSURE COE Partners

- Join ASSURE through our website:
www.ASSUREuas.org
- Participate and influence research

IDIQ Contract with the FAA

- Align/Fit into 11 FAA UAS Research Areas
- Memo between Federal Agencies
- MIPR Funds: FAA will contract and provide program management

ASSURE Global 501(c)3 Non-Profit (Recommended Focus)

- Single contract vehicle with MSU. We do the rest through Master Service Agreements with our schools and partners.
- Leverages: ASSURE Alliance and its relationships, knowledge and experience gained from FAA research
- No cost: ad hoc teaming based on need

Questions/Comments



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