UAS Beyond Visual Line of Sight (BVLOS) for Regulators

Target Audience

- Experienced aviation regulators with limited UAS experience who are interested to know more about BVLOS

What Does this Webinar seek to Achieve?

- General understanding of BVLOS UA Operations

- Where have such operations been trialed, where is there ongoing BVLOS activity?
- Drone’s eye view

What is Beyond Visual Line Of Sight?

- BVLOS is a broad spread of existing and potential UAS operations whose only common factor is the Unmanned Aircraft (UA) being out of sight of the remote pilot

Why is BVLOS Capability Important?

- Potential value of ubiquitous BVLOS capability is massive

- New capability will provide considerable societal benefits and save costs for governments to provide essential services to the masses

What is so Difficult about BVLOS?

……..the far side of the Moon was photographed from a remotely piloted spacecraft in 1959…..

…….why can't we have BVLOS in our city yet?

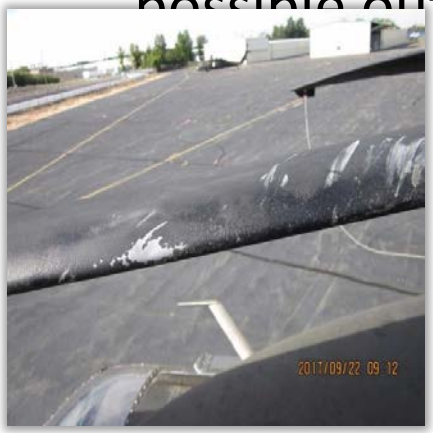
What is so Difficult about BVLOS?

- Easy
  - Empty space is easy (remote areas, ocean, outer space??)
- Not so challenging
  - Automation (possible even with mechanical or transistor)
- More challenging (things that affect safety and profitability)
  - Reliability
  - Separation from other airspace users and ground obstacles
- Most challenging
  - Populated areas with dense air traffic
  - Consistently making money
  - Achieving non-monetary objectives

BVLOS Without Consideration of Safety Isn't Difficult

When it goes wrong it is bad…….

……and we may not have seen the worst possible outcome yet



National Transportation Safety Board
Aviation Incident Final Report

Location:	Hoffman Island, NY	Incident Number:	DCA17IA202A
Date & Time:	09/21/2017, 1920 EDT	Registration:	None
Aircraft:	DJI Phantom	Aircraft Damage:	Destroyed
Defining Event:	Midair collision	Injuries:	1 None
Flight Conducted Under:	Part 107: Small UAS		

Analysis

The United States Army UH-60M helicopter was operating under visual flight rules within Class G airspace about 300 ft above mean sea level (msl) when it collided with a privately owned and operated DJI Phantom 4 small unmanned aircraft system (sUAS). The helicopter sustained minor damage and landed uneventfully; the sUAS was destroyed. Although the pilot flying the helicopter saw the sUAS before impact and immediately applied flight control inputs, there was insufficient time to avoid the collision.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this incident to be:

the failure of the sUAS pilot to see and avoid the helicopter due to his intentional flight beyond visual line of sight. Contributing to the incident was the sUAS pilot's incomplete knowledge of the regulations and safe operating practices.

Safe Routine BVLOS is More Challenging

- Routine safe BVLOS UAS operations must
  - Preserve existing levels of aviation safety
  - Not introduce new unacceptable societal risks
  - Not impose other undesirable impacts on society (e.g. privacy, environmental)
  - Deliver the value their stakeholders seek

Capabilities for Operator Approval of Enduring Safe BVLOS?

- Unmanned aircraft
- Link
- Organizational Management systems
- Separation

Unmanned Aircraft Suited to Operational Environment

- UA - Populated area operational circumstance
  - Guaranteed reliable
- UA - Remote area operational circumstance
  - Forgiving of aircraft failure

Mix of Aircraft and Environmental Mitigations

- Almost guaranteed reliable UAS
  - Frangible design to limit impact risk
  - Reliable failsafe emergency systems (parachute, redundant structures and power)
- More benign operating area with disparate populations
  - Populations can be mostly avoided, reducing exposure to acceptable levels

Data Link = C2 Link

- Link that is robust and ensures reliable operation in all operational circumstances
- Most likely a combination of technologies

Organizational Management Systems

- Management system commensurate with the complexity of the operation

Separation

A system that assures UA are and will remain segregated from manned traffic and other unmanned aircraft

Segregated, Accommodated and Integrated Operations

- ICAO – *Remotely Piloted Aircraft System (RPAS) Concept Of Operations (CONOPS) for International IFR Operations*
  - **Segregated airspace** – Airspace of specified dimensions allocated for exclusive use to a specific user(s)
  - **Accommodated** – ……..can operate along with some level of adaptation or support that compensates for its inability to comply within existing operational constructs……
  - **Integrated** – refers to a future when RPA may be expected to enter the airspace system routinely without requiring special provisions…….

BVLOS UAS Operations - operational type	Example	Separation management
Near BVLOS • Localized “wide” area survey • Blocked from remote pilot view (building, tree, terrain)	• Small/medium agriculture or survey • Fire, Police, EMS	Segregated visually (potential intruding manned aircraft can be seen), <150m
Remote area BVLOS	• Outback agriculture • Arctic/Antarctic survey	Segregated by arrangement with local operators, NOTAM, <150m
Linear survey/patrol	Rail corridor, pipelines, electrical lines	Segregated <150m and operator liaison/ NOTAM
Wide area survey	Mining, oil and gas	Segregated <150m and operator liaison/ NOTAM
Cargo delivery (urban, rural)	Wing, Zipline	Accommodated <150m and operator liaison/ NOTAM, UTM
High Altitude Pseudo Satellite (HAPS)	Airbus Zephyr, Hawk30, Loon	Integrated/segregated procedurally ATC services /operator, Self separation, collaborative traffic management in stratosphere
RPAS - IFR flight integrated with manned traffic (future)	International, IFR cross border and high seas	Integrated ATC separation services, Detect and Avoid System

BVLOS Operations

- Requires professional, skilled crew
- Rigorous and well tested operational procedures
- Complex and proven equipment and systems
- CAAs need well trained safety inspectors for BVLOS oversight

Civil Unmanned BVLOS Activity by Continent

- Africa
  - Rwanda, Ghana
  - Tanzania
- Antarctica
  - Australian territory
  - South Shetland Island
- Asia
  - China, Japan
- Europe
  - Poland
  - United Kingdom
  - Germany
  - Switzerland
- Oceania
  - Australia (85 operators)
  - New Zealand
  - Vanuatu
- North America
  - Canada (33 operators)
  - USA
  - Mexico
- South America
  - Brazil
  - Colombia

National BVLOS Legislations

- Much full BVLOS activity is performed “outside” mainstream rules
  - authorization, permission, waiver
    - …operator must remain VLOS unless…..permitted by CAA
  - Advantage - allows for flexibility in an evolving science
- Remote BVLOS Canada (presently consulting policy)
- Near BVLOS Australia
- Poland

Where to now ?

- Regulators and industry need to work collaboratively to facilitate the required safe growth and reliability of BVLOS
- The worst thing that can happen …….. a flawed operation is approved that causes a catastrophic event thereby setting industry back years


Safe BVLOS flight is technically challenging
…….but CAAs globally are actively working with industry to approve viable safe BVLOS operations

ICAO

THANK YOU