



CLEAR FLIGHT SOLUTIONS

ACI EUROPE / SESAR WORKSHOP
Oslo 26 November 2018



Drone operations integrated into life airport traffic environment



About the company

Founded in December 2012

2012 & 2013:	STW Grants for high potential tech start-ups
2015:	€1.6M investment - Cottonwood Technology Fund
2015:	Partnership Pilgrim Technologie - France
2016:	Robird operations: Dredging project Kazakstan
2017:	Partnership Aerium Analytics – North America
2017:	Robird & Drone operations Edmonton International Airport; Southampton International Airport; Kazakhstan
2017:	€2.6M investment - Aerium Analytics & Cottonwood Technology Fund
Team:	28 people including partners – Europe & North America
Focus:	Wildlife control; Industrial inspections; Safety & Security



Partnerships

- UAS-as-a-Service business
 - CFS head office – The Netherlands
 - Pilgrim Technology head office – Thouaré-sur-Loire, France
 - AERIUM ANALYTICS head office – Calgary, Canada & USA
- Fully integrated drone service model
 - Bird control & Wildlife management
 - Infrastructure inspections
 - Aerial mapping
 - Data processing and analysis



New York, Hudson - January 15, 2009



\$2,000,000,000 - \$8,000,000,000

Annual financial damage due to bird strikes for commercial aviation worldwide



`Population of Geese in the Netherlands
1976 – 200.000
2016 – 2.500.000

Aviation

1965 – 87% 3 or 4 engines

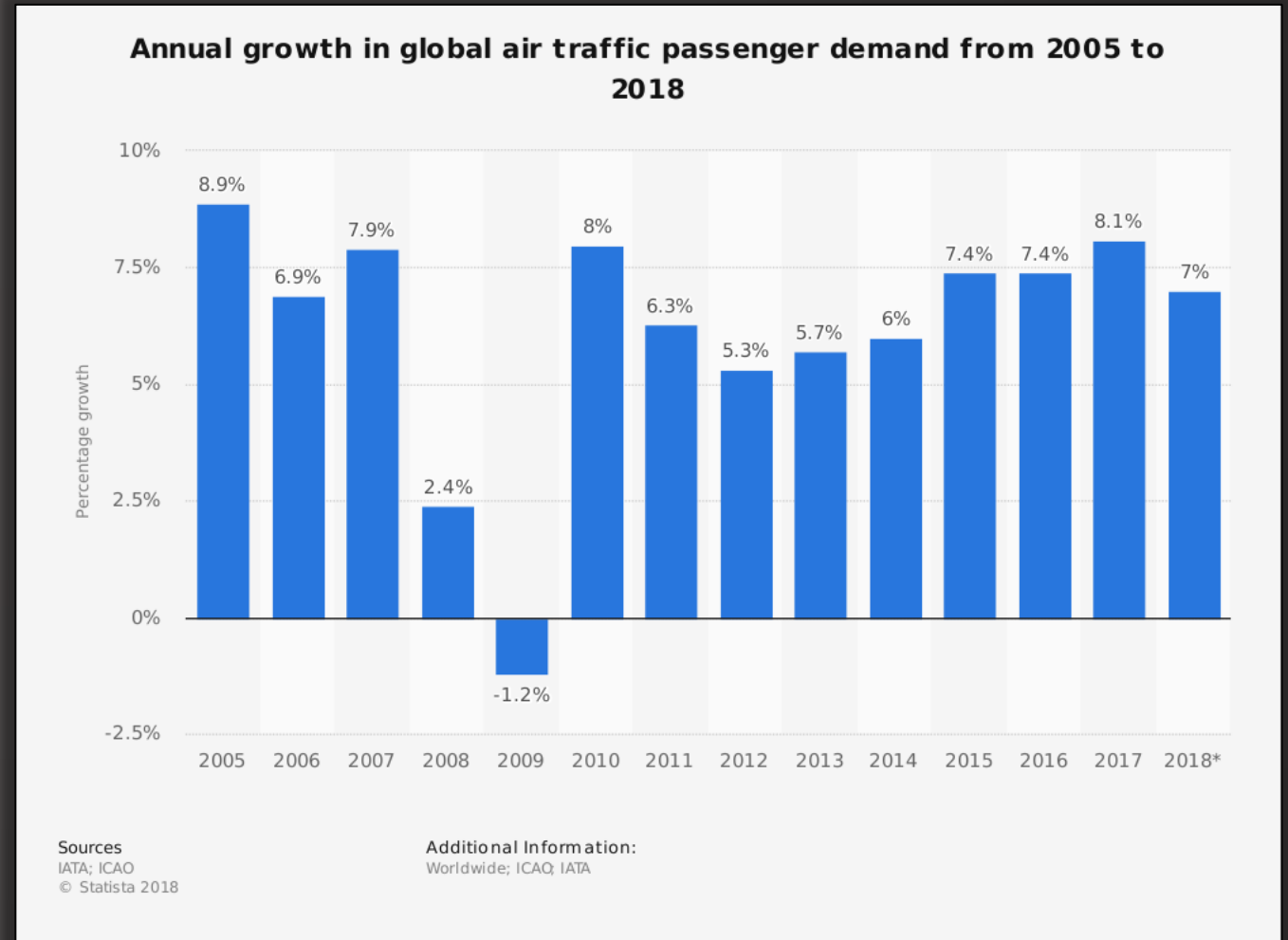
1990 – 32% 3 or 4 engines

Faster and quieter airplanes



Passengers

6.2 % average growth in global air traffic demand in the last 14 years



Bird Intelligence and Habituation

- Birds have a cognitive ability
 - They can be taught to make a distinction between “*same*” and “*different*”
AA same as BB different from AB
 - They can learn to make a distinction between “*harmful*” and “*safe*”
 - Recognize objects and situations
 - Recognize “*cause and effect*”
- Birds (like Corvids) share experiences
- Birds have good memory



Robirds Robotics in Bird Control

Perceived predation risk: Instinct

- Silhouette and wing movement
- No habituation – Birds think they're real

Long-term behavioral change

Completely controlled predator

- We are in full control

The only means to effectively herd birds in a desired direction



Drones integrated into daily airport operations

Detailed example: Edmonton International Airport



Safety

- Initial review of all SFOCs and Safety procedures (both Air and Ground)
- Technology Review
- Insurance review
- Hazard Identification Risk Assessment's (HIRA's) for each proposed flight location
- Full stakeholder involvement – EIA, ANSP, CAA Airlines, fixed wing, rotary stakeholders.





AERIUM Hazard Identification Risk Assessment

Operation | Robird Bird Control Daily Flight Operations for Edmonton International Airport (EIA)

Section 1 – Activity Description

Date of Submission:	Friday, 19 May 2017	Operation Start Date:	May 22 nd 2017
Description of Activity:	Conducting Bird Control with Robird Ornithopter.	Operational End Date:	August 18 th 2017
Work Site/Location:	EIA 0220 Airside West	Operational Window:	0600hrs to 2000hrs
Submitted By:	Justin M.G. Quesnel	Reviewed By:	Dean Ervin

BACKGROUND INFORMATION

Reason for Assessment:	UAS Bird Control
Working Area Dimensions:	Ceiling: 100ft AGL, 3.7 Km x 0.2 Km
Mission Details:	See end of document for details

PHOTOS/DIAGRAMS



Stakeholders: Regulators & Service Providers



Transport
Canada

Transport Canada

- SFOC



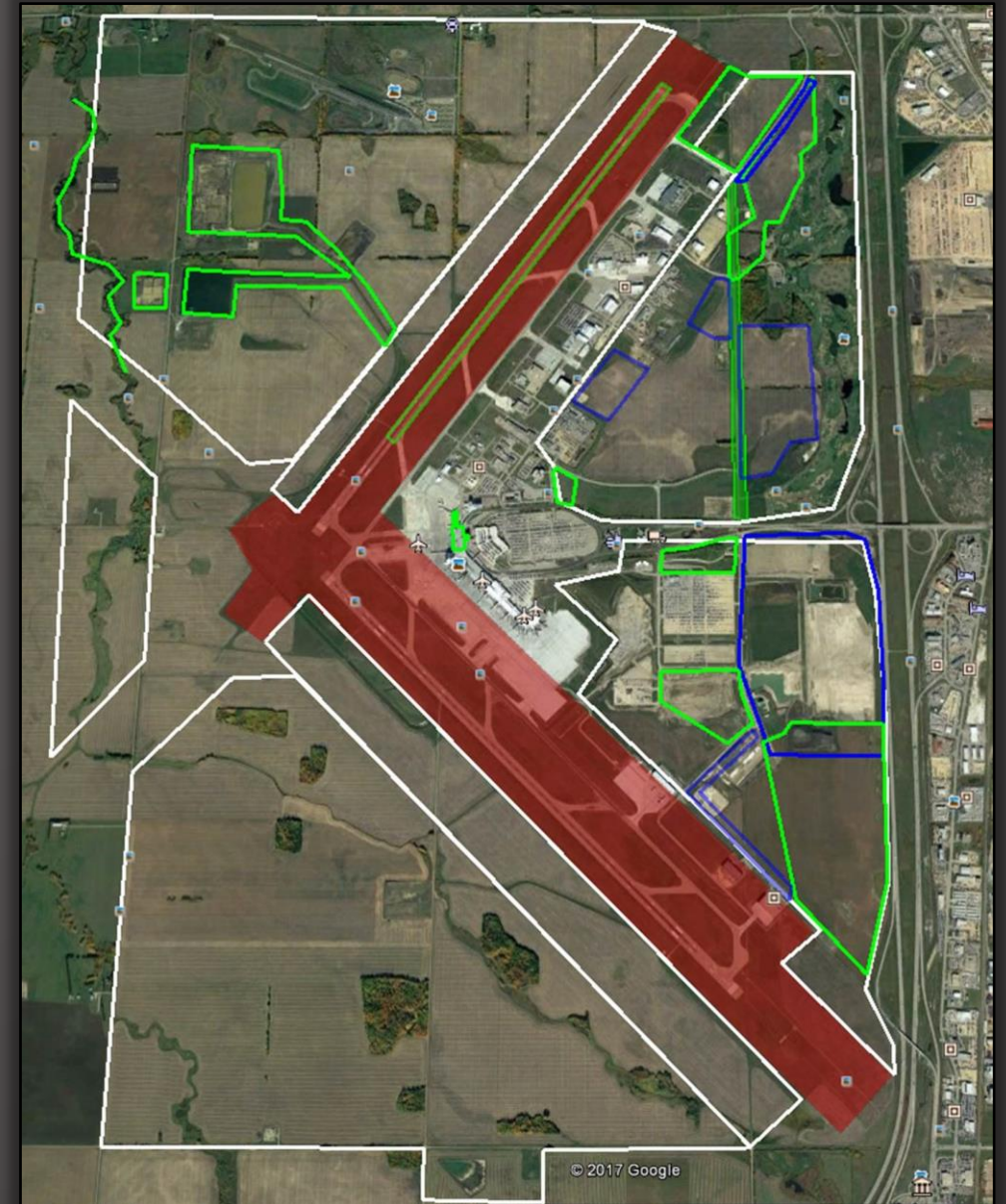
NAV Canada

- Procedures
- Risk Management / Mitigation
- Communication and Coordination



NAV/ATC - Safe Operations

- Area is divided into sectors (one UAV in the air at any given time)
- All operational zones approved in advance after HIRA process completed
- Operational Ceiling – 45m/150ft AGL
- No operations within Critical Area B
- Operations adhere to strict schedule
- Airside OPS – Cell phone coms with tower
- Active monitoring of air and ground radio traffic



Controlled Airspace

Requirement

- Transponder (Mode-S 20 W)
- Two way radio

Alternative

- Geocage
- Mobile Phone contact
- Radio open connection to listen to radio traffic



Project Success

- EIA Airside operations and ATC (NAV Can) review and consent of continuous daily operations
- Hazard Identification Risk Assessments completed for over 5,000 acres of area (over 17 different HIRAs)
- Over 300 Robird Flights
- Public Awareness – Daily Planet, NY Times, Galileo (Germany), The National, etc. etc.

ZERO Incidents



Safe Operations – Southampton



Stakeholders: Regulators & Service Providers



CAA-UK

- PfcO

NATS

NATS

- Procedures
- Risk Management / Mitigation
- Communication and Coordination



Phase 0 – Pre-project documentation

- Consultation and building of trust with all impacted stakeholders (internal and external)
- Understanding of client operations and needs
- Understanding of airspace complexities
- Establishment of safe flying zones or time frames
- Development of Risk Assessments and Safety Case
- Development of communication plans and protocols
- Obtaining CAA permissions and authorizations

EDMONTON AIRPORTS: Hazard and Risk Assessment									
CYEG:02/20 AIRSIDE WEST									
Conducted	13-Jun-07								
Initially conducted by:	Dean Ervin EIA								
Reviewed by:	Grant Wadell (Stars), Gerald Skocdoploe (Canadian North), Jordan Cicoria (Aerium), Bob Lamoureux (Enviro Avi), Dave Owen (Aurora), Robbie Benusic (Rob Hough (EA), Dean Ervin (EA), Ramon Wind (Robird), Justin Quesnel (Aerium), Jul Wojnowski (EA).								
Background									
Proposing to utilize the ROBRID Peregrine Falcon for wildlife control at YEG. The peregrine falcon is the world's most widespread bird of prey, its breeding grounds ranging from the Arctic tundra to the tropics. They are the fastest animals on Earth, capable of reaching speeds beyond 320 km/h while diving for prey. The peregrine falcon feeds almost exclusively on medium-sized birds such as gulls, pigeons, songbirds, waterfowl, etc. It is also known for hunting smaller birds of prey such as kestrels. The Robird version of the peregrine is just as intimidating to birds as the real deal. After a couple of flights, the bird population understands that they are living in a dangerous hunting territory, and will take their business elsewhere.									
CFS Robird - Key Mission Operational Details									
Key Mission Operational Details:									
1. Resolution: NA									
2. Overlap: NA									
3. Area: Within 150m of Pilot									
4. Altitude: ~150ft									
5. Number of Photos: NA									
6. Estimated Flight Time: 5 minutes per flight									
7. Estimated Flight Distance: Mission Dependent									
8. Working Area Radius: Bound by Geofences									
9. Working Area Ceiling: 45m (147 feet AGL)									
10. Communications: Check in with Tower before launch and after landing.									
Security Actions:									
a. Geofence breached									
b. GPS Loss - Robird circles for 5 seconds to regain GPS signal, if it cannot regain signal, the wings are automatically raised up to landing position and the Robird performs a linear landing insitu.									
c. C2 Loss - Transmitter signal loss of any length will send a command for the Robird to Return home.									
d. Low Battery									
e. Catastrophic Failure									

RISK MATRIX	
Low	
Medium	
High	



Hazard	Description	Outcome	Probability	Severity	Initial RISK	(Potential) Mitigation	Controlled RISK	
1 ROBRID vs. Aircraft: Commercial fixed wing aircraft.	Robird makes contact or is ingested.	More likely on circling from missed approach. Causing property damage, possible injury.	C	3	C3	Approved TC SFOC for operations at an Aerodrome. Approved NAV Canada authorization for operating UAV in the requested locations. Approval form the EIA Airport Authority to conduct operations at the aerodrome. Geofence in place for critical borders of Critical Area "B". All pre-checks, precautions, flight ops are conducted as per established processes and guidelines as outlined in the ROBRID Operational Instruction Manual. All processes and procedures are documented. Communication processes and protocols are in place and tested (e.g. radio communication Tower/Ops if required etc.). Appropriate NOTAMs in place. Stakeholders affected are advised in advance of the operations and locations identified. Established operational heights of MAX 150' is identified.	B2	Aviation Hazard
2 ROBRID vs. Aircraft (Rotary wing aircraft).	Robird makes contact or is ingested.	More likely in typical areas adjacent to ground locations. Causing possible property damage, injury.	C	4	C4	Approved TC SFOC for operations at an Aerodrome. Approved NAV Canada authorization for operating UAV in the requested locations. Approval form the EIA Airport Authority to conduct operations at the aerodrome. Geofence in place for critical borders of Critical Area "B". All pre-checks, precautions, flight ops are conducted as per established processes and guidelines as outlined in the ROBRID Operational Instruction Manual. All processes and procedures are documented. Communication processes and protocols are in place and tested (e.g. radio communication Tower/Ops if required etc.). Appropriate NOTAMs in place. Stakeholders affected are advised in advance of the operations and locations identified. Established operational heights of MAX 150' is identified.	B2	Aviation Hazard
3 ROBRID vs. Aircraft (Rotary wing TRAINING aircraft).	Robird makes contact or is ingested.	More likely in areas that are identified for HNZ training operations. Causing property damage, injury.	C	4	C4	Approved TC SFOC for operations at an Aerodrome. Approved NAV Canada authorization for operating UAV in the requested locations. Approval form the EIA Airport Authority to conduct operations at the aerodrome. Geofence in place for critical borders of Critical Area "B". All pre-checks, precautions, flight ops are conducted as per established processes and guidelines as outlined in the ROBRID Operational Instruction Manual. All processes and procedures are documented. Communication processes and protocols are in place and tested (e.g. radio communication Tower/Ops if required etc.). Appropriate NOTAMs in place. Stakeholders affected are advised in advance of the operations and locations identified. Established operational heights of MAX 150' is identified. Company specific communication will be conducted for training operators.	B2	Aviation Hazard

Phase 1 – Demonstrations of safety systems

- Outside of the airfield perimeter
- Geofence / Geocage capabilities
- Emergency landing procedures
- September 11 – 15



Phase 2 – Eastern side operation

- Flights inside the airport fence
- Under control of ATC (call sign ROBIRD-1)
- Full bird control without entering manoeuvring area
- No crossing of the burn line
- September 18 – 28



Phase 3 – Runway Operation

- Flights inside the airport fence
- Under control of ATC (call sign ROBIRD-1)
- Full bird control without entering manoeuvring area
- Including runway and manoeuvring area
- Oct 2 – Nov 10



Results

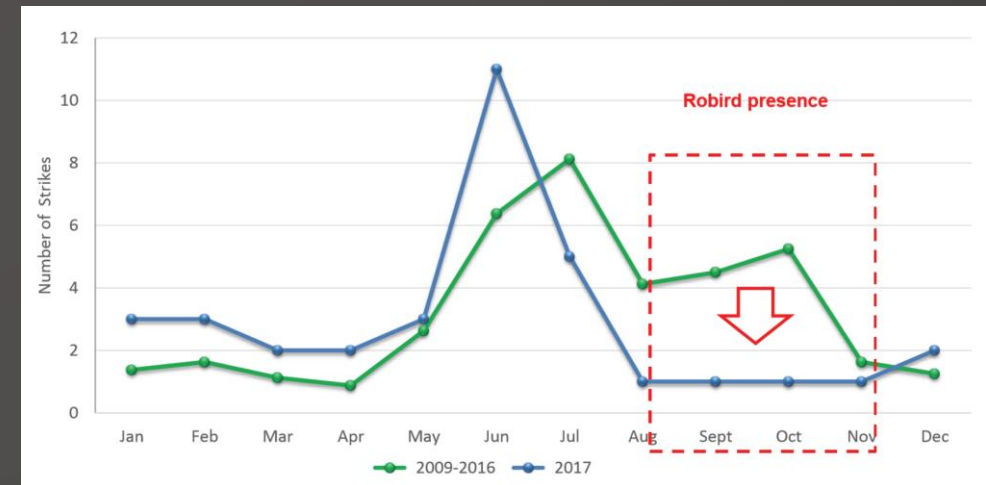
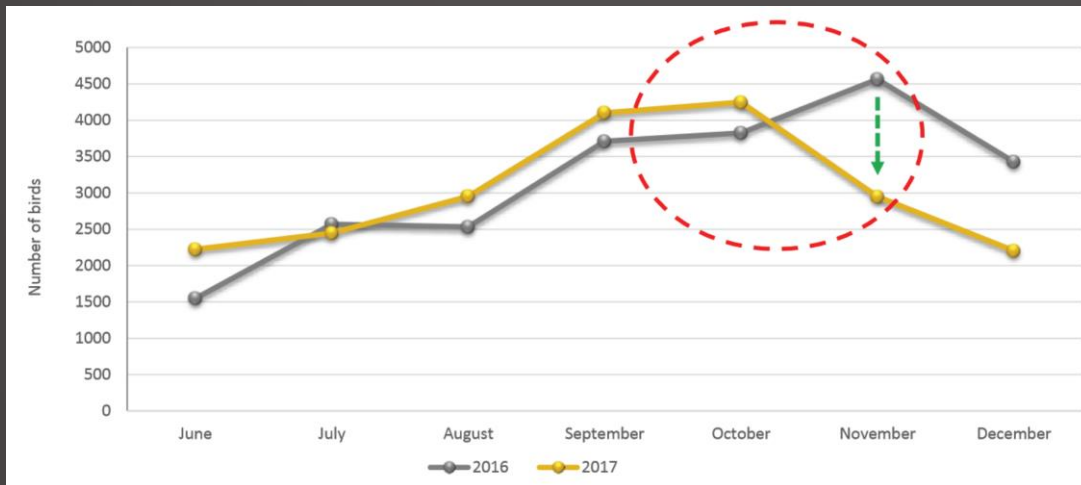
201 total flights

62% Operability Rate

258 interactions with birds

106 interactions rated high to very high effectivity of Robird®

68 flights 'no birds' rating



- The tendency of Corvids presence was **higher** in 2017 with respect to 2016 until Robird® trial was started
 - 2016 experienced highest number of Corvids presence in **November**, however the figures reduced significantly during November 2017
 - The number of **bird strikes** decreased substantially during Robird® testing period
 - The bird strikes that took place when Robird® was being tested occurred in periods of time in which the **drone was not deployed** at the airfield
- According to **fire-10**, SOU wildlife management responsible, **Robird's presence** has **diminished** the bird activities on the SOU airfield specially of **Corvids**.
- Robird® only flew **36 minutes on average per day** during the testing period; which reinforces the effectiveness of this solution.

Conclusions and next steps

As it is very evident that:

- The risk of bird strikes will increase in the coming years
- Traditional bird control measures do not work

Drone technology will bring huge cost savings on airports

To name a few:

- Aircraftbody inspections
- Runway inspections
- FOD detection
- PAPI calibration
- ILS calibration
- Infrastructure inspection
- Perimeter inspection
- And many more



Thank you for your attention



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