



NGAP 2 – MODEL ICAO FORUM 2018





STREAM 1 B



UNMANNED AIRCRAFT SYSTEMS (UAS): Aviation for Next Generation

STREAM LEADERS

- Phil Dawson, ICAO
- Wang Yingxun, President of Yunnan Innovation Institute
- Filippo Tomasello, Professor and Senior Partner, EuroUSC Italia



SAFETY ASSESSMENT OF UAS OPERATION



STREAM 1B - GROUP MEMBERS

- **Enping YANG**, researcher
- **Fozhi ZHENG**, speaker
- **Jiwen XU**, secretary and speaker
- **Markus Aureius Beckstrom LAURANTZON**, technician
- **Matteo PONZIANI**, technician and speaker
- **Raphael PERRET**, graphic designer
- **Sean NG**, speaker
- **Siyao XIAO**, researcher
- **Yawen CAO**, secretary
- **Yingxuan WANG**, technician
- **Yu WANG**, graphic designer

Introduction

Delivery



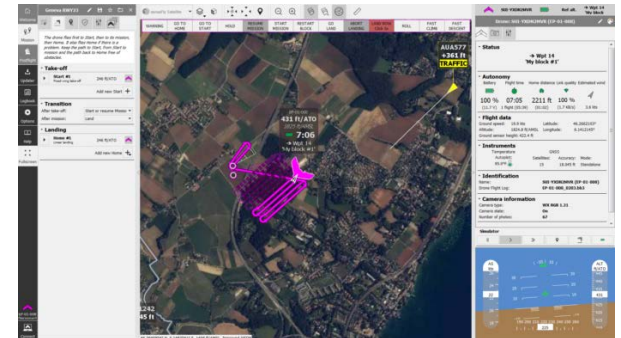
Emergency



Construction



Geographic Information System



Background Information

Type of operation:

Bridge inspection

Task:

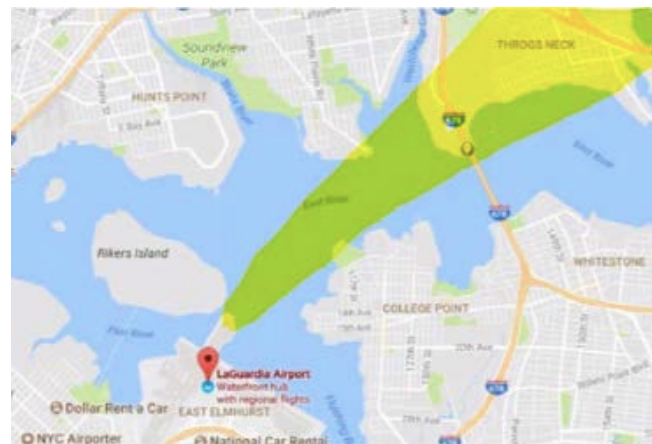
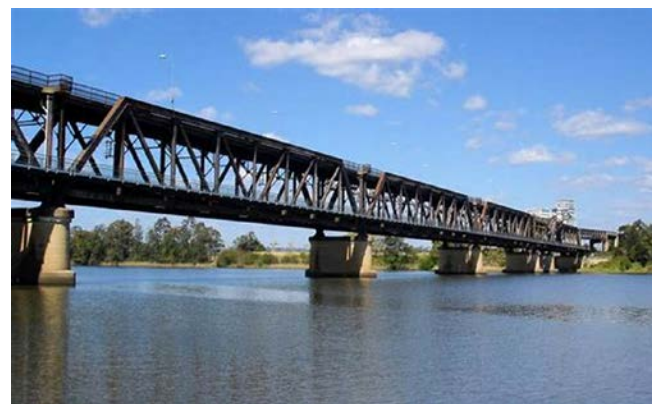
Damage Evaluation & Structural Inspection

Location:

- 5 NM from Laguardia Airport
- Under the approach pathway of Runway 22

Aircraft parameters:

Walkera Scout X4





Type of Operation

Remote pilot(s) and UAS observer(s) information		
10. Name:	11. Type of licence or certificate and number (attach copy of licences or certificates):	12. Experience of remote pilot or UAS observer (detailed description):
a) MARKUS LAURANTON	a) REMOTE PILOT N. R.P. 2151	a) 200h FLIGHT TIME
b)	b)	b)
RPA performance characteristics (including appropriate units of measurement) (attach picture of UA)		
13. Type of aircraft: WALKERA SCOUT X4	14. Maximum take-off mass: 2,27 kg	15. Wake turbulence category: NA
16. Number and type of engine(s): 4	17. RPA dimensions (wing span/rotor diameter): 233 mm	18. Maximum speed: 20 kt
19. Minimum speed: 20 kt	20. Cruising speed: 15 kt	
21. Typical and maximum climb rates: 3 m/s	22. Typical and maximum descent rates: 3 m/s	
23. Typical and maximum turn rates: 10°/sec	24. Maximum aircraft endurance: 25 m	
25. Other relevant performance data or information to declare (maximum operating altitude): 10,000 ft max. OPERATING ALTITUDE		
26. CNS capabilities (including alternate means of communication with remote pilot station(s)): Communications: CPDLC <input type="checkbox"/> VHF <input type="checkbox"/> UHF <input type="checkbox"/> SATCOM <input type="checkbox"/> HF <input type="checkbox"/> Telephone: landline <input type="checkbox"/> mobile phone <input checked="" type="checkbox"/> Navigation: DME <input type="checkbox"/> VOR <input type="checkbox"/> GNSS <input checked="" type="checkbox"/> ADF <input type="checkbox"/> ILS <input type="checkbox"/> GBAS <input type="checkbox"/> RNAV <input type="checkbox"/> RNP <input type="checkbox"/> RVSM <input type="checkbox"/> Surveillance: transponder mode(s): NA ADS-B <input type="checkbox"/> ADS-C <input type="checkbox"/> ACAS <input type="checkbox"/> Other:		
27. Detect and avoid capabilities: NONE		

Operations	
28. Purpose of operation: COMMERCIAL / BRIDGE INSPECTION	
29. Aircraft identification to be used in radiotelephony, if applicable: NA	
30. Date of flight(s): 23/12/18	31. Duration/frequency of flight(s): 1 DAY
32. Flight rules: I <input type="checkbox"/> <input checked="" type="checkbox"/> Y <input type="checkbox"/> Z <input type="checkbox"/>	33. Type of operation: VLOS <input checked="" type="checkbox"/> BVLOS <input type="checkbox"/>
34. Number and location(s) of remote pilot station(s): ONE IN A RADIUS OF 150M FROM THE BRIDGE	
35. Handover procedures between remote pilot stations: NA	
36. Point of departure: 40°48'17.5"N 73°49'54.0"W	37. Point of destination: 40°48'17.5"N 73°49'54.0"W
39. Route: LOCAL	40. Cruising level: MAX 400 ft (100m)
41. Payload information/description: 1 LOOK CAMERA	
Use of communication capabilities	
42. ATS communications: NONE	
43. Command and control (C2) link: 2,4 GHz TRANSMITTER	
44. Communications between remote pilot and RPA observer, if applicable:	
45. Payload data link: 5,8 GHz DATA LINK	
Contingency and emergency procedures	
46. Loss of C2 link (partial or total): AUTOMATIC HOMING	
47. Failure of ATC communications (partial or total): NA	
48. Failure of remote pilot/UAS observer communications: NA	

Definitions

HAZARD: any situation that can cause damage or injury.

SEVERITY: expected loss in case of accident.

PROBABILITY: defined by the following table

RISK PROBABILITY		MEANING
FREQUENT	5	Likely to occur many times
OCCASIONAL	4	Likely to occur sometimes
REMOTE	3	Unlikely but possible
IMPROBABLE	2	Very unlikely to occur
EXTREMELY IMPROBABLE	1	Almost impossible that the event will occur

$$\text{RISK} = \text{PROBABILITY} \times \text{SEVERITY}$$

BARRIER: action used to reduce the risk (MITIGATION)



Hazards

- Loss of control
- Data link loss
- Interference between UAS and people/objects on the ground
- Interference between UAS and aircrafts operating in the approach path

Risk Matrix

RISK FREQUENCY		RISK SEVERITY				
		CATASTROPHIC	HAZARDOUS	MAJOR	MINOR	NEGLIGIBLE
		5	4	3	2	1
FREQUENT	5	25	20	15	10	5
OCCASIONAL	4	20	16	12	8	4
REMOTE	3	15	12	9	6	3
IMPROBABLE	2	10	8	6	2	2
EXTRA IMPROBABLE	1	5	4	3	2	1

ACCEPTABLE	TOLERABLE	INTOLERABLE
------------	-----------	-------------

(with safety barriers)

Risk Assessment

Risk	Pre-Mitigation		
	Severity	Frequency	Criteria
Loss of control	4	5	20
Datalink Loss	3	3	9
Interference between UAS and aircrafts operating in the approach path	5	3	15
Interference between UAS and people/objects on the ground	4	3	12

ACCEPTABLE	TOLERABLE	INTOLERABLE
------------	-----------	-------------

(with safety barriers)



Risk Mitigation: Loss of Control

- ① **Wind speed maximum: 15 knots;**
- ② **No gusting conditions and Visibility at least 5 km;**
- ③ **Visual and technical inspection before flight;**
- ④ **Emphasize the importance of updating the software and complying with most recent cyber-security standards**

Risk Mitigation: Data link Loss

- ① Improve the auto return function (homing)
- ② Control system redundancy.



Risk Mitigation: Interference between UAS and aircrafts operating in the approach path

- ① Height Limitation: 400 feet;
- ② Highlight the situational awareness of the remote pilot;



Risk Mitigation: Interference between UAS and people/objects on the ground

- ① **Establish a safe area**
- ② **Do not overfly sensitive areas on the ground**



Risk Mitigation:

Risk	Pre-Mitigation			Post-Mitigation		
	Severity	Frequency	Criteria	Severity	Frequency	Criteria
Loss of control	4	5	20	4	2	8
Datalink Loss	3	3	9	1	3	3
Interference between UAS and aircrafts operating in the approach path	5	3	15	5	1	5
Interference between UAS and people/objects on the ground	4	3	12	4	2	8

ACCEPTABLE	TOLERABLE	INTOLERABLE
------------	-----------	-------------

(with safety barriers)



CAA Approval Form

UAS BRIDGE SPECTION - Areas to evaluate	Special authorization	UAS registration	Safety management	Licensing and competencies	Operations	Detect and avoid (DAA)
Criteria for Evaluation by CAA - Reference Questions	Is the work performed commercial or recreational?. Is a special authorization required?	What are the benefits of registration? Is it required?	Does the operation require a full SMS or a hazard and risk assessment	Do we need a remote pilot license or a certificate of competency?	Is an operations manual required or a standart operational procedures document?	How will you detect other aircraft or obstacles and avoid them? Technology, visual contact?
Answer	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Analysis
Action and/or documents required	YES, COMMERCIAL OPERATION AUTHORIZATION REQUIRED	YES, FOR SECURITY	NO SAFETY MANAG. SYSTEM RISK ASSESSMENT REQUIRED	ONLY CERTIFICATE OF COMPETENCY (DUE TO HTOM)	YES, STANDARD OPERATIONAL PROCEDURE	- VLOS - SAFETY AREA - HOMING
Guidance for criteria	Operation must be conducted in accordance with the terms of the authorization. Each contracting State undertakes to insure that the flight of UAS in regions open to civil aircraft shall be so controlled as to obviate danger to civil aircraft".	UAS need to be identifiable; the most common form of identification is registration. By registering the UAS, the owner is acknowledging responsibility and accountability for the safe operation of the aircraft.	RPA shall be operated in such a manner as to minimize hazards to persons, property or other aircraft. The CAA must be satisfied that all identified risks are mitigated at an acceptable level before issuing an authorization	Remote pilots have the same basic responsibilities as pilots of manned aircraft for the operation of the UAS that will fly along manned aircraft. They require licence. Remote pilots for other UAS that will not fly in manned airspace but in its vicinities may require special certificate with specific habilities	A UAS operator must provide either an full approved operations manual with procedures, instructions and guidance of the UAS operations personnel concerned or an standard operating procedures document for that particular operation	Keep the UAS within visual line-of-sight (VLOS) at all times. Sometimes observers are used to support the visual contact with UAS. Geo fencing also mitigate the the possibility of intrusion to an air traffic control (ATC) area

Conditions and limitations

- ① **Ceiling not below than 1000 ft.**
- ② **CAA requires to operate in daylight in specific periods when the air traffic sequence of landings for RWY 22 is suspended.**
- ③ **Additional observer requested.**
- ④ **Require emission of NOTAM (Notice To Airmen).**

Conclusion

«Accidents don't happen by accident»



Thank you for your attention!



Questions?