Scientific Committee for Oceanographic Aircraft Research

United States Antarctic Program (USAP)

Approach to Approving UAS/UAV Operations

28-29 June 2016

Tim McGovern, Ocean Projects Manager
Division of Polar Programs, National Science Foundation

National Science Foundation
Celebrating 50 Years


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AFSRB

Airworthiness & Flight Safety Review Board

Members comprised of….

- NSF science/ship/station/air operations and environmental program managers
- Space and Naval Warfare Systems Command (weather and air traffic control)

- Department of Defense, Joint Task Force - Support Forces Antarctica
- Department of Interior, Office of Aviation Services

Air Operations Manual - UAS

Chapter 4

- 4.1.4 Policy. The National Science Foundation, Division of Polar Programs (PLR) shall establish procedures to ensure that all Antarctic UAS flights are properly approved and documented. PLR also shall ensure that UAS flight crews and operations receive direct oversight by SPAWAR's Office of Polar Programs (SOPP) and the Department of the Interior's Office of Aviation Services (OAS). Because UAS are aircraft, other forms of control, specific to aviation, apply to their employment. The most common are air control, airspace control, and air direction, which are exercised by aviation personnel and agencies.
- 4.1.5 UAS Command and Control Systems. UAS Pilots in Command (PIC) must have the capability to command, control flight path / airspeed, coordinate, and manage the UAS. In addition, the UAS must independently have the capability to be remotely piloted and / or controlled. These systems include air control and airspace control as discussed below.
- 4.1.5.1 Air Control. Air control is the authority to direct the physical maneuvers of a UAS in flight or to direct a UAS to gather data or operate in a specific area.
- 4.1.5.2 Airspace Control. Airspace control provides for the coordination, integration, and regulation of the use of a defined airspace and identification of all airspace users. Any airborne object that may interfere with the flight path or trajectory of any other object within the USAP (and neighboring) airspace is of concern and requires airspace coordination and integration. Airspace control is the authority to direct the maneuvers of a UAS (along with other aircraft and airspace users) for the best use of the airspace. Airspace control is accomplished through established USAP procedures for coordination of airspace by ATC. Principles and procedures of airspace control used in manned flight operations apply to UAS operations. UAS capable of long-distance flight are normally routed through…..

Other Guiding Documents

http://www.ats.aq/documents/ATCM39/att/ATCM39_att011_e.pdf

Antarctic Unmanned Aerial Systems (UAS) Operator's Handbook

-prepared by the COMNAP UAS Working Group

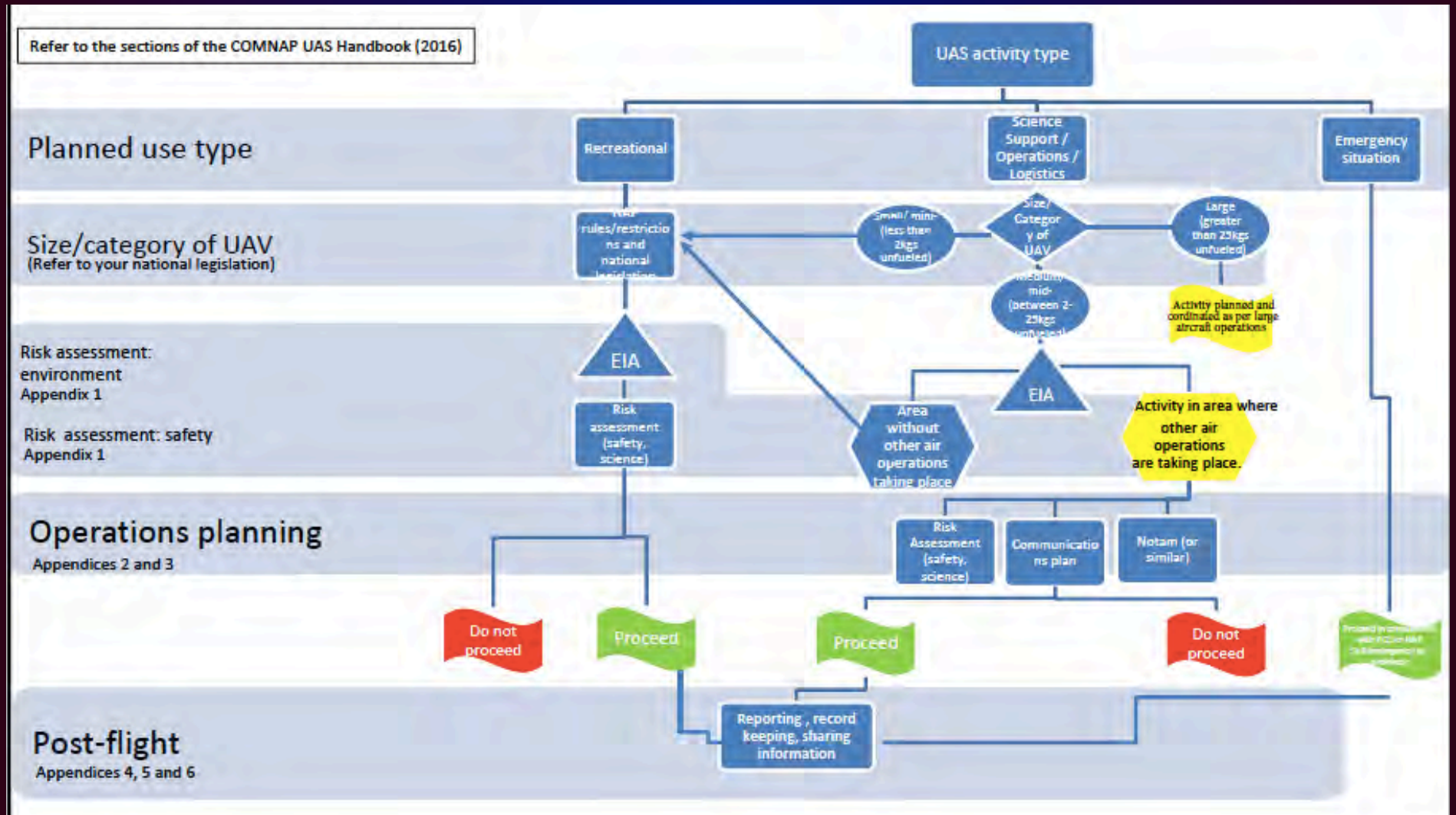
Purpose of this Handbook

The challenge for any national Antarctic programs that is beginning to utilize UAS technologies in the Antarctic Treaty region is to identify and manage risks associated with the technology and to develop guidelines that will regulate UAS use in differing circumstances in order to reduce or mitigate those risks. This handbook may be used to develop a process for UAS deployment in the Antarctic Treaty area.

The COMNAP UAS Handbook should be viewed as a living document which, as UAS technology evolves, and as published research on the use of and impacts, including environmental impacts, from UAS in Antarctica is made available and further developed in conjunction with SCAR and others, the recommendations and appendices are expected to evolve.

Other Guiding Documents

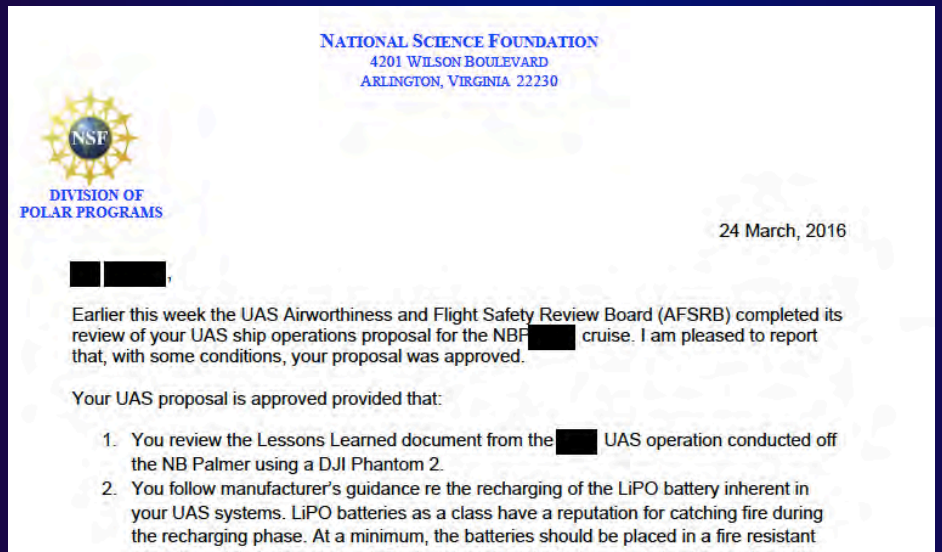
COMNAP UAS Manual – Decision Flow Chart



Current Ship-based Ops

Review Process

- Science Program Manager must support use of UAV under scientific merit and/or outreach efforts
- AFSRB Chair provides grantees with sample Concept of Operations (CONOPS) document
- Once submitted, the AFSRB reviews, provides comments and additional guidance/ requirements.
- Documents are also provided to USAP staff, including vessel master for comment.
- Additional notes and/or requirements are included in the Conditional Letter of Approval



NATIONAL SCIENCE FOUNDATION
4201 WILSON BOULEVARD
ARLINGTON, VIRGINIA 22230

DIVISION OF
POLAR PROGRAMS

24 March, 2016

[redacted],

Earlier this week the UAS Airworthiness and Flight Safety Review Board (AFSRB) completed its review of your UAS ship operations proposal for the NBP[redacted] cruise. I am pleased to report that, with some conditions, your proposal was approved.

Your UAS proposal is approved provided that:

1. You review the Lessons Learned document from the [redacted] UAS operation conducted off the NB Palmer using a DJI Phantom 2.
2. You follow manufacturer's guidance re the recharging of the LiPO battery inherent in your UAS systems. LiPO batteries as a class have a reputation for catching fire during the recharging phase. At a minimum, the batteries should be placed in a fire resistant

Review/Acceptance

- CONOPS and Conditional Letter of Approval (CLOA) are provided to USAP Staff for implementation.
- Failure to adhere to any requirements in CONOPS or CLOA are grounds for immediate halting of all UAS operations.

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3. The air vehicles will be maintained and operated in accordance with all manufacturer provided guidelines, manuals, latest firmware updates, etc.
4. You conduct all your UAS operations in accordance with NBP's standard flight operations procedures and Vessel SOP.
5. If you plan to release any aerial footage obtained via UAS during this cruise to the

Concept of Operation (CONOPS)
NBP[redacted] Unmanned Aerial System (PI [redacted])
25 March 2016

1. Introduction

This document has been written to describe the Concept of Operation (CONOPS) for the unmanned aerial system (UAS) operations planned during Antarctic research voyage NBP1603 aboard the *Nathaniel B. Palmer*. The UAS to be deployed is the DJI Phantom 3 Professional. The Phantom 3 Professional Quadcopter is huge technological improvement over the DJI Phantom 2+ deployed in October [redacted] during Antarctic research voyage NBP[redacted]. The Phantom 3 can receive satellite signals from both GPS and GLONASS, making it a much safer, stable, and accurate UAS to deploy. It will easily receive 14 satellites (up to 36), rendering it completely aware of its location and relation to the pilot. The Phantom 2 could only receive GPS signals, making it more difficult to fly and more likely to lose track of. Additionally improvements have been made to the integrated camera and gimbal system: 4K video, 12 megapixel stills.

2. Overview

All UAS will be deployed and recovered from the helideck of the *Nathaniel B. Palmer* or from land at [redacted]. Access to the glaciers is limited for safety reasons and aerial photographs will provide a unique view of the ice, glacier front, and icebergs. People connect very much with ice, the best example is the numerous photographs of icebergs posted in the internet when anyone mentions Antarctica, either by visits from scientists or tourists, in brochures about polar cruises, in magazines and newspaper articles, etc. With photographs from a quadcopter we can extend that fascination to glaciers, and increase people's awareness of their beauty and their sensitivity to global change.

Current Ship-based Ops

- NSF Media personnel are engaged for any video or still images intended to be released to public.

Current Ship-based Ops

NBP15-03 UAV OPERATIONS

Credit: Frank Nitsche

Summary Researchers from the University of Tasmania and Hokkaido University carried out trials of two separate unmanned aircraft systems with special permission from the National Science Foundation, as part of a cruise in the Southern Ocean aboard the U.S. Antarctic Program (USAP) research vessel Nathaniel B. Palmer. The flights specifically aimed to test aerial mapping of Antarctic sea ice to determine floe-size distribution. This will be

- At the end of each cruise, we ask the PI/UAS Operator to provide a Lessons Learned document
- Assists NSF in improving UAS planning and operations.

Review/Acceptance

Review Process

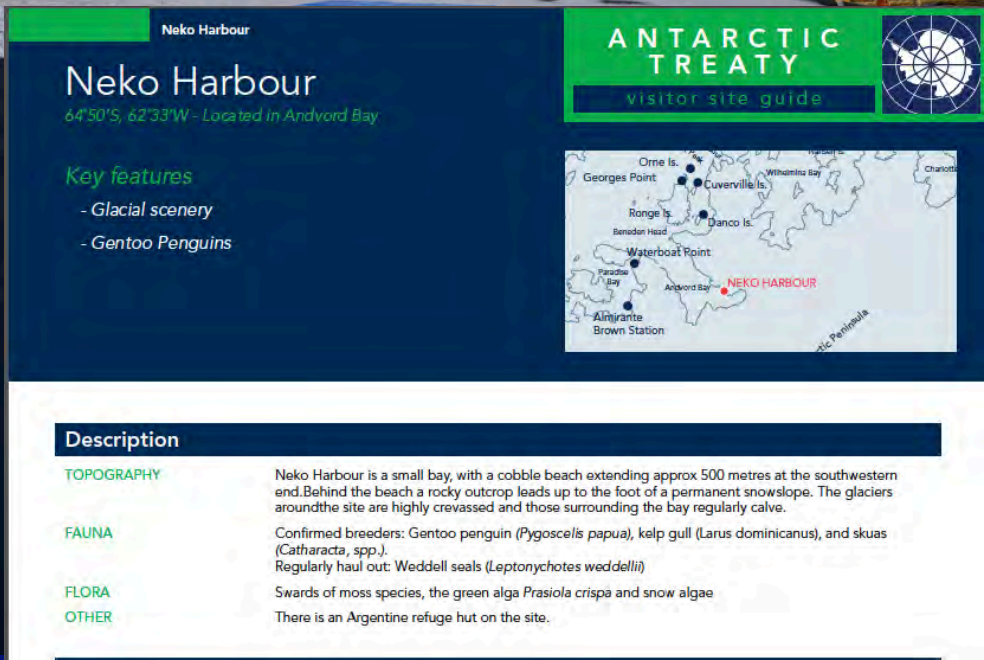
- Internally, we do a Risk Assessment that looks at a range of potential hazards.
- > distance from McMurdo = lower perceived risk

Hazard	Event	As Described in ConOps			Recommended Controls	Residual With Controls in Place		
		Prob	Sev	Risk		Prob	Sev	Risk
Loss of control (pilot error)	Collision with manned aircraft	0	C	5	Crew qualifications and currency IAW AOM Chap 4	IV	C	5
	Collision with another UAS	IV	D	5	Crew qualifications and currency IAW AOM Chap 4	IV	D	5
	Injury to person(s) on vessel	IV	D	5	Crew qualifications and currency IAW AOM Chap 4	IV	D	5
	Damage to property on vessel	II	D	5	Crew qualifications and currency IAW AOM Chap 4	IV	D	5
	Environmental incident	II	D	4	Crew qualifications and currency IAW AOM Chap 4	III	D	5
	Crash obstructing helo deck	II	D	4	Crew qualifications and currency IAW AOM Chap 4	III	D	5
Loss of control (technical)	Collision with manned aircraft	IV	C	5	System airworthiness, flight safety review, and maintenance IAW AOM Chap 4	IV	C	5
	Collision with another UAS	0	D	5	System airworthiness, flight safety review, and maintenance IAW AOM Chap 4	IV	D	5
	Injury to person(s) on vessel	IV	D	5	System airworthiness, flight safety review, and maintenance IAW AOM Chap 4	IV	D	5
	Damage to property on vessel	II	D	5	System airworthiness, flight safety review, and maintenance IAW AOM Chap 4	IV	D	5
	Environmental incident	II	D	4	System airworthiness, flight safety review, and maintenance IAW AOM Chap 4	III	D	5
	Crash obstructing helo deck	II	D	4	System airworthiness, flight safety review, and maintenance IAW AOM Chap 4	III	D	5
Loss of control (weather)	Collision with manned aircraft	0	C	5	Flight planning IAW AOM Chap 4	IV	C	5
	Collision with another UAS	IV	D	5	Flight planning IAW AOM Chap 4	IV	D	5
	Injury to person(s) on vessel	IV	D	5	Flight planning IAW AOM Chap 4	IV	D	5
	Damage to property on vessel	IV	D	5	Flight planning IAW AOM Chap 4	IV	D	5
	Environmental incident	III	D	5	Flight planning IAW AOM Chap 4	IV	D	5
	Crash obstructing helo deck	III	D	5	Flight planning IAW AOM Chap 4	IV	D	5
Failure to follow course rules and operational procedures	Collision with manned aircraft	0	C	5	Publish course rules, train pilots, test pilots on knowledge; flight briefing IAW AOM Chap 4	IV	C	5
	Collision with another UAS	IV	D	5	Publish course rules, train pilots, test pilots on knowledge; flight briefing IAW AOM Chap 4	IV	D	5
Failure of airframe or propulsion	Injury to person(s) on vessel	IV	C	5	System airworthiness, flight safety review, and maintenance IAW AOM Chap 4	IV	C	5
	Damage to property on vessel	III	D	5	System airworthiness, flight safety review, and maintenance IAW AOM Chap 4	IV	D	5
	Environmental incident	II	D	4	System airworthiness, flight safety review, and maintenance IAW AOM Chap 4	III	D	5
	Crash obstructing helo deck	III	D	5	System airworthiness, flight safety review, and maintenance IAW AOM Chap 4	IV	D	5
Electomagnetic interference	Interference with critical aviation communications	0	D	5	Flight briefing IAW AOM Chap 4; spectrum management	IV	D	5
	Interference with administrative or scientific communications	II	D	4	Flight briefing IAW AOM Chap 4; spectrum management	III	D	5
Manual recovery	Injury to flight crew	II	D	4	Prohibit manual recovery and wear PPE	IV	D	5
Recharging LiPO batteries	Fire	II	C	3	Charge batteries in accordance with instructions and within a fireproof container	II	D	4

Review/Acceptance

Primary Concerns

- Safety of personnel
  - On the ship, on shore
- Safety to the environment
- Operator Training Levels



Other Guiding Documents

Recently established rules and guidelines will be reviewed and incorporated as appropriate

Press Release – DOT and FAA Finalize Rules for Small Unmanned Aircraft Systems

For Immediate Release

June 21, 2016
Contact: Les Dorr or Alison Duquette
Phone: 202-267-3883

Regulations will create new opportunities for business and government to use drones

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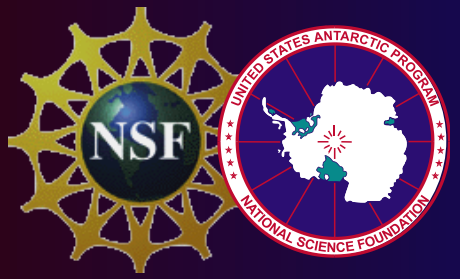
WASHINGTON – Today, the Department of Transportation's Federal Aviation Administration has finalized the first operational rules (PDF) for routine commercial use of small unmanned aircraft systems (UAS or "drones"), opening pathways towards fully integrating UAS into the nation's airspace. These new regulations work to harness new innovations safely, to spur job growth, advance critical scientific research and save lives.



Questions?

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