

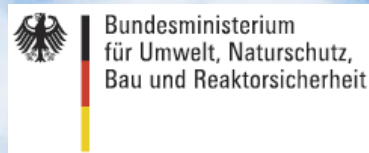
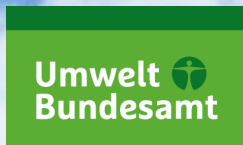
Code of Good practice: case study of Environmental Guidelines for Remotely Piloted Aircraft Systems (RPAS) in Antarctica



Unmanned Aircraft Systems (Drones) in protected areas:
opportunities and threats
International Conference

26 – 27 March 2018

Toblach/Dobbiaco – Nature Parks South Tyrol (ITALY)



Development process for Environmental Guidelines for RPAS

1. Legal framework
2. Develop systematic framework
3. Review literature / scientific research
4. Other guidance – large piloted aircraft
5. Discussion fora – Science Workshop / Political / Operational
6. Common ground in Environmental Guidelines for RPAS
7. ‘Environmental’ vs ‘Operational’ considerations
8. ‘Recreational’ vs ‘Professional’ uses
9. Environmental Guidelines for RPAS:
 1. Pre-deployment planning & preparation
 2. On-site operation
 3. Post-flight actions and reporting
10. Distance guidelines – uncertainty vs practicality

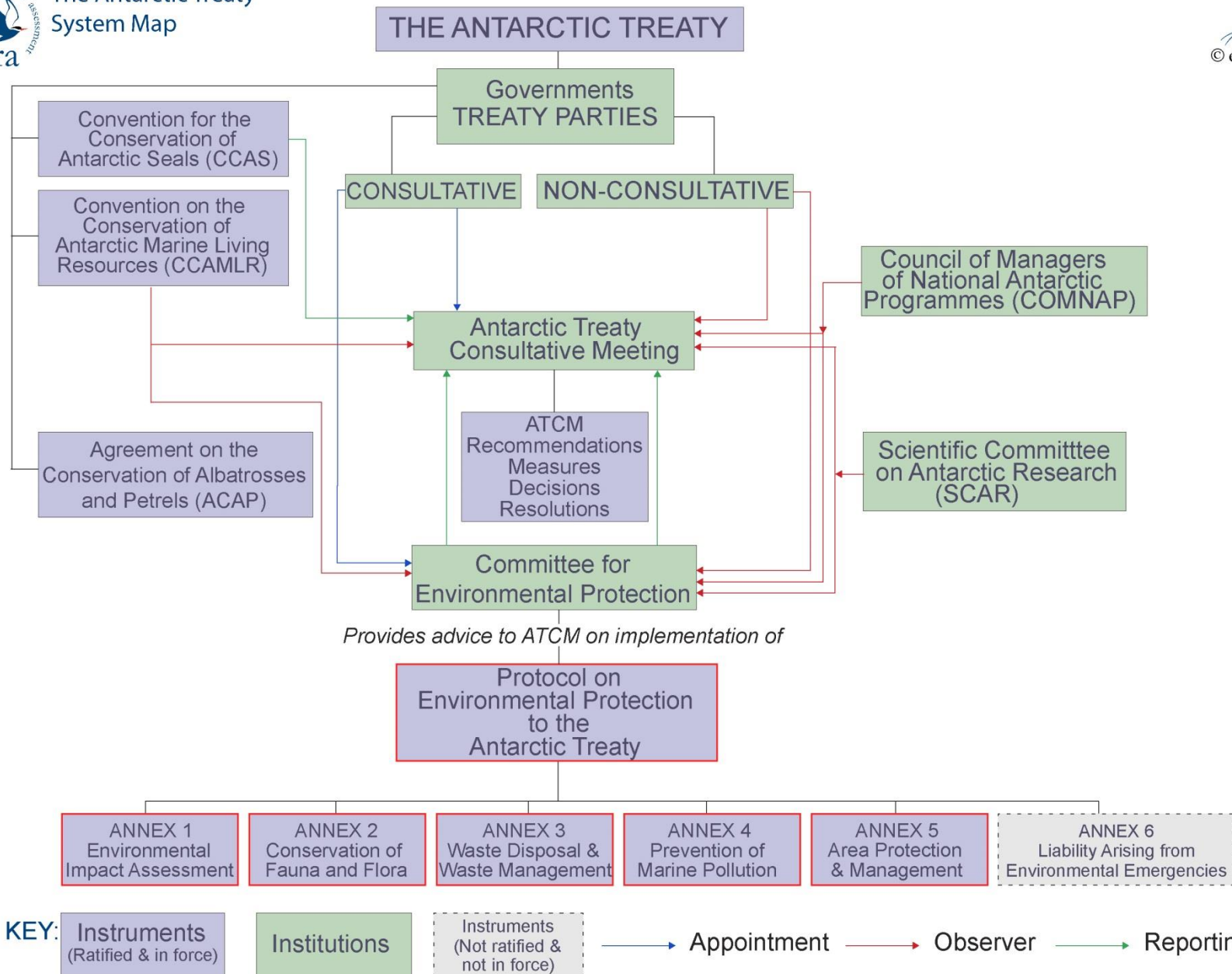
Legal framework

- Antarctic Treaty System
- 53 countries – 29 ‘Consultative Parties’
- Decision-making by consensus
- The largest protected area in the world
- Antarctica “Natural Reserve devoted to peace and science”
- Legal framework and institutions

Legal requirements / context



The Antarctic Treaty
System Map

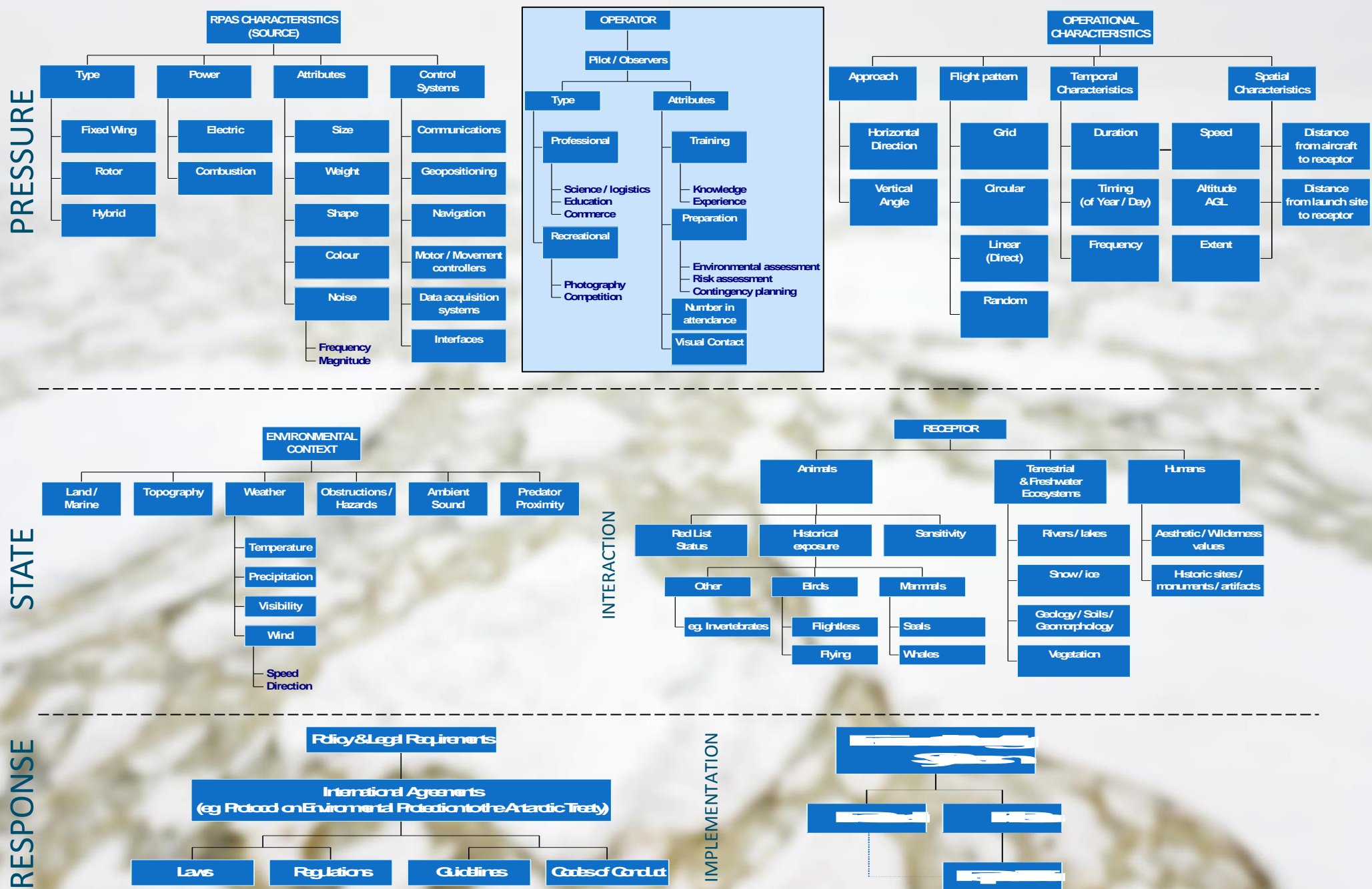




Develop systematic framework

Key factors influencing the risk of
environmental impacts of Remotely Piloted
Aircraft Systems (RPAS) in Antarctica

Figure 1. Key factors influencing the risk of environmental impacts of Remotely Piloted Aircraft Systems (RPAS) in Antarctica



Literature review / Scientific research

Definitions

- Drone
- Unmanned Aerial Vehicle (UAV)
- Unmanned Aerial Systems (UAS)
- Unmanned Aircraft Systems (UAS)
- Unmanned Aerial Vehicle Systems (UAVS)
- Model Aircraft
- Remote Controlled Aircraft (RCA)
- Radio Controlled Aircraft (RCA)
- Remotely Piloted Aircraft (RPA)
- Remotely Piloted Vehicle (RPV)
- Remotely Piloted Systems (RPS)
- Remotely Piloted Aerial Systems (RPAS)
- **Remotely Piloted Aircraft Systems (RPAS)**
- Remotely Piloted Aerial Vehicle (RPAV)
- Remotely Piloted Aerial Vehicle Systems (RPAVS)

International Civil Aviation Authority (ICAO) (2015):

Remotely Piloted Aircraft System (RPAS):

“A remotely piloted aircraft, its associated remote pilot station(s), the required command and control links and any other components as specified in the type design”

Literature review / Scientific research

Global publications

- Mulero-Pázmány *et al.* (2017)
 - 56 publications reviewed
 - data on 250 flights over 17 field campaigns (2011-14)
 - 'target-oriented' flight pattern increased probability / intensity of wildlife reaction
 - grid pattern lower probability of response
 - Reactions more likely with combustion engined RPAS
 - Significant differences by species: least responsive underwater > terrestrial mammals > birds most responsive
 - Animal life-history stage important
 - Animals **in** breeding period showed **less** reaction
 - 'Active Reaction' greater in large aggregations
 - Larger RPAS caused more 'Active Reactions'
- Other publications – marine mammals, bears, birds etc
 - No reactions in whales down to 10 m ASL
 - Reactions by seals >30 m – less than 1%
 - Black bears – behavioural response minimal yet heart rate elevated (Ditmer *et al.* 2015)

Literature review / Scientific research

~25 Antarctic publications reviewed

- Behavioural reactions elevated when
 - Overflight <50 m (penguins).
 - takeoff / landing site <100 m from birds.
 - directly / vertically approached.
- Reactions vary by species – Southern Giant Petrel most sensitive.
- Stress (elevated heart rate) yet minimal behavioural response (King Penguins)
- No apparent reactions by seals to small quadcopter at 23 m
- Studies have focused on whether ‘disturbance’ was observed visually
- Any reaction classed as ‘disturbance’ – ‘vigilance’, ‘agonistic’, ‘escape’
- Significance of ‘disturbance’ not studied (ie impact on populations / individuals)

Other guidance – large piloted aircraft

Antarctic Resolution 2 (2004)

‘Guidelines for the Operation of Aircraft near birds’

- Penguin, albatross and other bird colonies should not be overflown below 2000 ft (~610 m)
- Landings within ½ mile (~930 m) of wildlife should be avoided
- Never hover or make repeated passes over wildlife
- Where practical landings should be downwind
- Avoid takeoff towards birds
- Where practical, fly outside of breeding season

RPAS Discussion Fora – Science Workshop / Political / Operational

- Scientific Committee on Antarctic Research Workshop –
 - ‘Drones in Antarctic Biology’ July 2017 Leuven, Belgium
- Antarctic Committee for Environmental Protection
 - Active discussion since 2014
 - 10 countries, SCAR, COMNAP in discussions Aug 2017 – Mar 2018
 - June 2018 – Meeting of the CEP, Buenos Aires
- Council of Managers of National Antarctic Programs (COMNAP)
 - Handbook for RPAS Operations

'Drones in Antarctic Biology' July 2017 Leuven, Belgium

Group	Species	Multicopter / electric ¹	Fixed wing / electric ¹	Fixed wing / gas fueled ¹
Penguins	Gentoo penguin	50 m	?	?
	Chinstrap penguin	50 m	?	?
	Adélie penguin	> 50 m	< 350 m	> 350 m
	King penguin	> 50 m	?	?
	Macaroni penguin	50 m	?	?
	Southern rock-hopper penguin	50 m	?	?
Mammals	Fur seal	50 m	?	?
	Weddell seal	50 m	?	?
	Leopard seal	50 m	?	?
Other birds	Kelp gull	30 m	30 m	?
	Antarctic Tern	?	>100 m	?
	Southern giant petrel	200 m	200 m	?
	Northern giant petrel	≥ 50 m	?	?
	Brown Skua	100 m	200 m	?
	South Polar Skua	100 m	200 m	?
	Wandering albatross	> 50 m	?	?
	Sooty albatross	50 m	?	?
	Light-mantled sooty albatross	> 50 m	?	?
	Imperial cormorant	> 50 m	?	?

Table 1. Minimal distances with no proven disturbance by RPAS.

Common ground in environmental guidance – RPAS

Global:

Vas *et al.* 2015

Hodgson & Koh 2016

Mulero-Pázmány *et al.* 2017

Antarctica:

Goebel *et al.* 2015

IAATO 2016

Common elements in:

- Pre-flight planning
- In-flight operations
- Post-flight Actions

Environmental Guidelines for RPAS recommended by three or more research teams.

Pre-flight Planning

1. Take a precautionary approach.
2. Select low noise, electric, RPAS by preference.
3. Maintain RPAS in good condition.
4. RPAS pilots should be well-trained and experienced before undertaking on-site operations.
5. RPAS operations should comprise at a minimum a pilot and an observer.

Environmental Guidelines for RPAS recommended by three or more research teams.

In-flight Operations

1. Always maintain visual contact with RPAS.
2. Locate RPAS launch / landing sites at least 100 m from animals.
3. Avoid RPAS manoeuvres such as ascent or descent over animals.
4. Fly as high as practicable when operating over animals.
5. Pilots /observers: watch for signs of wildlife disturbance.
6. Should animal disturbance be observed, pilots should increase RPAS distance from animals, and cease operations if disturbance persists.

Environmental Guidelines for RPAS recommended by three or more research teams.

Post-flight Actions and Reporting

1. Observe and record animal reactions before, during and after RPAS flights.
2. Publish observations to help refine Best Practice Environmental Guidelines for RPAS use.

'Environmental' vs 'Operational' considerations

- Committee for Environmental Protection responsible for **environmental** aspects of implementation of the Madrid Protocol.
- Council of Managers of National Antarctic Programs responsible for **operational** aspects of program implementation
- Environmental and Operational aspects of RPAS **interrelated**

'Recreational' vs 'Professional' uses

- Recreational use defined as non-commercial, personal enjoyment, leisure (including photography).
- Professional use defined as scientific, logistic, search and rescue, educational and / or commercial purposes.
- Guidelines to cover ALL uses.
- **Decisions on whether a particular use is allowed in any particular place is separate, although if allowed then the guidelines would apply**
- Guidelines apply primarily to small- to medium-sized RPAS (≤ 25 kg) operating in Visual Line of Sight (VLOS).
- Larger RPAS and operating BVLOS need special management.

Environmental Guidelines for operation of Remotely Piloted Aircraft Systems (RPAS) in Antarctica (v 3.1)

1. Pre-deployment Planning and Environmental Impact Assessment (EIA)

Legal Requirements:

1. Environmental impact assessment.
2. Conservation of Fauna and Flora.
3. Waste disposal and contingency plans.
4. Entry to Antarctic Specially Protected Areas.

1. Pre-deployment Planning and Environmental Impact Assessment (EIA)

General considerations

1. Undertake detailed pre-flight planning: site assessment. Carry out simulated flights.
2. Map flight plans, and prepare contingency plans.
3. Assess site features, wildlife / plants. Avoid sensitive breeding periods.
4. Identify specially protected sites.
5. Consider cumulative environmental impacts of multiple RPAS operations.

RPAS Characteristics

1. Select RPAS type and sensors appropriate for objectives. Carry out test flights outside Antarctica.
2. Select RPAS with lowest noise levels and non-threatening shapes, sizes and / or colours, if operating near wildlife.
3. Ensure RPAS is well-maintained with sufficient power or fuel. Monitor battery performance. Check for fuel leaks.
4. To reduce the risk of non-native species transfer, ensure RPAS are clean.

Operator Characteristics

1. RPAS pilots should be well-trained and experienced.
2. RPAS operations should comprise a pilot and an observer who have good site knowledge.

2. *On-site and In-flight Operations*

General considerations

1. Pilots and observers should maintain visual contact with the aircraft.
2. (Special conditions may be needed for Beyond Visual Line of Sight, to be determined in EIAs)
3. Be vigilant and maintain good communications.
4. Complete flight operations with as few flights as practicable.

Operations over or near wildlife

1. Select RPAS launch / landing site(s) carefully, and:
 - for electric RPAS at least 100 m (~330 ft) away; and
 - for combustion engine RPAS at least 400 m (~1300 ft) away.
2. Avoid unnecessary overflight of wildlife while attaining flight altitude.
3. Monitor the proximity and behaviour of predators that could attack animals or the aircraft.
4. Avoid unnecessary or sudden aircraft manoeuvres over wildlife.
5. If possible avoid flying aircraft directly at or from above wildlife, and fly grid flight patterns.

2. *On-site and In-flight Operations*

Operations over or near wildlife... cont...

6. Fly as high as practicable when operating near or over wildlife. For electric RPAS interim minimum horizontal and / or vertical separation distances are recommended as a guide:
 - >15 m (~50 ft) over or near mammals at sea
 - >30 m (~100 ft) over or near seals on land / ice
 - >50 m (~150 ft) over or near penguins on land / ice
 - >100 m (~300 ft) over or near other birds on land / ice
7. If wildlife disturbance is observed at any separation distance, a greater distance should be maintained. Where multiple species are present, follow the most precautionary guideline.
8. Consider up to four times the minimum separation distances when operating combustion engine RPAS.

2. On-site and In-flight Operations

Operations over terrestrial & freshwater ecosystems

1. Minimize disturbance to sensitive geological or geomorphological features, soils, rivers, lakes and vegetation, and avoid sensitive sites.
2. Should it be necessary to retrieve a lost aircraft, minimize disturbance to site features.

Human considerations

1. Avoid operating RPAS over Historic Sites / Monuments to minimize risk of aircraft loss at these sites.
2. Many people value Antarctica for its remoteness, isolation and aesthetic and wilderness values. Respect the rights of others to appreciate these values, and where practicable adjust flight operations (e.g. timing, duration, distance) to avoid or minimize intrusion.

3. Post-flight Actions and Reporting

Actions

1. In the event of an unplanned forced landing or crash, retrieve the aircraft if:
 - It is safe to do so;
 - There is a risk that human life, wildlife or important environmental values are endangered, in which case notify the authorities;
 - The environmental impact of removal is not likely to be greater than that of leaving the aircraft in situ;
 - The aircraft does not lie within a protected area, in which case notify the authorities.

Reporting and updating these Guidelines

1. Observe and record animal reactions before, during and after RPAS flights.
2. Post-activity reporting should include details of environmental impacts to improve RPAS best practices in the future.

10. Distance guidelines – uncertainty vs practicality

Uncertainty

1. Few studies, results preliminary.
2. Basic knowledge of behavioural effects.
3. Poor knowledge of physiological effects.
4. Almost no knowledge of impacts long-term.
5. Lack of clarity on ‘disturbance’ – what is significant?

Practicality

1. Distance guidelines are imperfect but practical measures.
2. Guidelines should be ‘living documents’, and Best Practices will need to be updated as scientific knowledge improves.
3. Meanwhile, RPAS users need relatively simple, practical guidance they can understand and follow.
4. Practical measures will improve environmental protection.

Thank you
Questions?