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Biography, Research Paper, and Slide Presentation

FLYING IN ANTARCTICA

Legal Framework and Operational Considerations

Comprehensive Briefing for Lawyer-Pilots

Delivered to the Lawyer-Pilots Bar Association

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Biography of Mark T. Doll

With 40 years of combined military and civilian aviation experience totaling more than 12,500 flight hours, Mark Doll brings unparalleled expertise to aviation legal matters. He has achieved the rare distinction of having flown on all seven continents, including operations to the South Pole and the Arctic. His unique combination of extensive flight experience, military leadership, and legal education provides clients with exceptional representation backed by real-world operational knowledge and command of the Federal Aviation Regulations.

Professional Experience

Mr. Doll is affiliated with the Law Offices of Robert Strumor, LLC, and Barnett Law Offices. He has served as a pilot with a major airline since 2000, accumulating over 5,800 civilian flight hours across the A320, A330, B757, B767, B727, L-382, and various light aircraft, and currently serves as A320 Captain.

His distinguished military career includes 6,700 flight hours in the C-17, LC-130H, C-130E/H, C-12F/J, C-26B, T-37, and T-38. As Deputy Commander of Joint Task Force–Support Forces Antarctica, he served as forward-deployed commander of all DoD and DHS personnel and assets in Antarctica and New Zealand supporting the U.S. Antarctic Program. He also served as Military Assistant to the Deputy Assistant Secretary of the Air Force for Reserve Affairs at the Pentagon, where his inspiration to pursue a legal career developed as he gained deep insight into the intersection of military operations and regulatory frameworks. Earlier assignments include Branch Chief for Mobility Forces Operations and Training, Air National Guard Liaison to the National Science Foundation, and sixteen years as LC-130 Chief Pilot and Chief of Arctic Operations.

Education

Juris Doctor, *magna cum laude* – Mitchell Hamline School of Law (2022).

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Airline Transport Pilot Certificate, Multi-Engine Land. Type rated: A-320, A-330, B-757, B-767, BE-1900, L-382, SA-227. Admitted to the Minnesota Bar; United States Court of Appeals for the D.C. Circuit. Sustaining member, Lawyer-Pilots Bar Association. Life member, National Guard Association of the United States.

Military Honors

Defense Superior Service Medal; Meritorious Service Medal with three bronze oak leaf clusters; Aerial Achievement Medal with three bronze oak leaf clusters; Antarctica Service Medal.

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Biography of Mark T. Doll 2
Professional Experience 2
Education 2
Certifications, Admissions & Affiliations 2
Military Honors 2
INTRODUCTION 8
Agenda 8
PART 1: EARLY HISTORY OF ANTARCTIC EXPLORATION 9
1.1 Contested Discovery (1820s) 9
1.2 Exploration and the Legal Doctrines of Sovereignty 9
Discovery Doctrine 9
Effective Occupation 9
Sector Theory 9
The Hughes Doctrine (1924) 10
1.3 Early Aviation Before the Treaty 10
Hubert Wilkins — First Antarctic Flight (1928) 10
Richard Byrd — South Pole Overflight (1929) 10
Lincoln Ellsworth — Trans-Antarctic Flight and Territorial Claim (1935) 10
Operation Highjump (1946–47) 10
International Geophysical Year (1957–58) 11
PART 2: THE ANTARCTIC TREATY AND GOVERNANCE 12
2.1 Who Owns Antarctica? 12
2.2 Treaty Basics 12
Article I — Peaceful Purposes Only 12
Article IV — The Sovereignty Freeze 12
Article VII(5) — Advance Notification 13
The Protocol on Environmental Protection (Madrid Protocol, 1991) 13
The Role of COMNAP 13
2.3 Force of International Aviation and Maritime Conventions in the Treaty Area 13
The Chicago Convention (1944) 13
ICAO Standards, Annexes, and the FIR Question 14
The Montreal Convention (1999) and Warsaw System 14
IMO Conventions, SOLAS, and the Polar Code 14

Tokyo, Hague, and Montreal Offenses Conventions 14
Cape Town Convention 15
Practical Synthesis: Three Indirect Mechanisms 15
PART 3: OVERFLIGHT TOURISM AND THE MOUNT EREBUS DISASTER 16
3.1 The Birth of Antarctic Overflight Tourism (1977) 16
3.2 The Mount Erebus Disaster 16
The Accident (November 28, 1979) 16
The Navigational Error 16
Whiteout and Sector Whiteout 16
The Investigations 16
Aftermath and Implications 17
PART 4: ATCM RESOLUTIONS ON AVIATION AND TOURISM 18
4.1 Recommendation XVIII-1 (1994) 18
4.2 Measure 4 (2004) — Insurance and Contingency Planning 18
4.3 Resolution 4 (2004) / Resolution 6 (2017) 18
4.4 Resolution 4 (2007) — Ship-Based Tourism 18
4.5 Resolution 5 (2007) 18
4.6 Resolution 7 (2009) — General Principles 18
4.7 Resolution 5 (2022) — Permanent Tourism Facilities 18
4.8 Resolution 4 (2023) — Urgent Measures on Tourism 18
4.9 Decision 6 (2019) — Manual of Regulations 19
4.10 Resolution 3 (2022) — Air Operations and AFIM 19
PART 5: THE IAATO FRAMEWORK 20
5.1 Overview 20
5.2 Membership and Operational Requirements 20
5.3 Aviation-Specific Requirements 20
5.4 Aviation-Related Contributions 20
5.5 Enforcement Mechanisms 20
5.6 The Significance and Limitations of Self-Regulation 21
PART 6: STATUTORY & REGULATORY GUIDELINES 22
6.1 The Antarctic Conservation Act and 45 CFR Part 670 22
Penalties 22
6.2 Advance Notification Requirements 22

6.3 Environmental Impact Assessment 22
6.4 Wildlife Protection and Overflight Restrictions 22
6.5 Waste Management and Fuel Handling 22
PART 7: INSURANCE REQUIREMENTS AND COST RECOVERY 24
7.1 The Insurance Landscape 24
Minimum Coverage Requirements by Operation Type 24
Required Coverage Components 24
The Reality of Evacuation Costs 24
7.2 U.S. Policy on Cost Recovery 24
7.3 IAATO and Insurance: The Gap in Self-Regulation 25
PART 8: THE BUZZ ALDRIN INCIDENT — A CASE STUDY 27
8.1 Background 27
8.2 The Medical Emergency 27
8.3 The Evacuation Chain 27
8.4 Legal and Policy Analysis 27
8.5 The Broader Implications 27
PART 9: NATIONAL ANTARCTIC PROGRAM AVIATION 29
9.1 Overview of National Program Aviation 29
9.2 The United States Antarctic Program (USAP) 29
9.3 Other National Programs 29
PART 10: CONTEMPORARY NGO AVIATION ACTIVITIES 31
10.1 Overview: Three Categories of NGO Aviation 31
10.2 Antarctic Overflights 31
Qantas Antarctic Sightseeing Flights (1994–Present) 31
Regulatory Position of Overflights 31
10.3 Intercontinental Flights to Antarctica 31
Gateway Routes 31
Weather Requirements and Constraints 32
ETOPS and Extended Diversion Time Operations 32
Point of Safe Return (PSR) 33
Antarctic Runways for Intercontinental Operations 33
Principal Intercontinental NGO Operators 34
The Widebody Revolution 34

10.4 Intracontinental Operations 35
Kenn Borek Air 35
Antarctic Logistics & Expeditions (ALE) 35
Ship-Based Helicopter Operations 35
Intracontinental Weather and Operational Hazards 35
10.5 AFIM: Building a Fused Air Picture 35
10.6 Sustainability 36
10.7 Emerging Challenges 36
PART 11: SEARCH AND RESCUE AND RESCUE COORDINATION CENTERS 37
11.1 The SAR Framework: No Dedicated Rescue Authority 37
11.2 Rescue Coordination Centers (RCCs) 37
11.3 Available SAR Assets: A Stark Reality 38
National Program Aircraft 38
NGO Contractor Aircraft 38
Helicopters 38
Maritime Assets 38
11.4 The SAR Gap: Commercial Volume vs. Rescue Capacity 38
11.5 Coordination Mechanisms 39
11.6 Legal Obligations and the Duty to Rescue 39
SUMMARY: KEY TAKEAWAYS 41
APPENDIX A: GLOSSARY OF ABBREVIATIONS 42
APPENDIX B: KEY WEBSITES AND REFERENCES 44
Treaty System and Governance 44
United States Government 44
International Aviation Organizations 44
International Maritime Organizations 45
Industry and Self-Regulatory Organizations 45
National Antarctic Programs 45
Search and Rescue Coordination 45
New Zealand Government — Erebus Disaster 46
Commercial Operators Referenced 46
APPENDIX C: KEY STATUTES, TREATIES, AND REGULATIONS 47
International Treaties and Conventions 47

United States Federal Statutes 48
United States Federal Regulations 48
United States Executive Instruments 48
ATCM Instruments Referenced in This Briefing 49

INTRODUCTION

We're going to cover a topic that sits at the intersection of aviation law, international treaty law, and some of the most challenging flight operations on Earth: flying aircraft in Antarctica.

This is not a standard aviation briefing, and Antarctica is not a standard operating environment. There is no sovereign airspace authority. There is no FAA, no EASA, no ICAO member state exercising jurisdiction in the conventional sense. The regulatory framework is built from a 1959 treaty, a patchwork of non-binding resolutions adopted over decades, and the practical realities of operating in the most remote and hostile environment on the planet.

As lawyer-pilots, you are uniquely positioned to appreciate both the legal complexity and the operational risk. By the end of this briefing, you will understand how we got here, what the rules are—and are not—and what happens when things go wrong.

Agenda

Part	Topic
1	Early History of Antarctic Exploration & Aviation
2	The Antarctic Treaty & Governance
3	Overflight Tourism & the Mount Erebus Disaster
4	ATCM Resolutions on Aviation & Tourism
5	The IAATO Framework
6	Operational Requirements & Restrictions
7	Insurance Requirements & Cost Recovery
8	Case Study: The Buzz Aldrin Evacuation
9	National Antarctic Program Aviation
10	Contemporary NGO Aviation
11	Search and Rescue & Rescue Coordination Centers

PART 1: EARLY HISTORY OF ANTARCTIC EXPLORATION

1.1 Contested Discovery (1820s)

The question of who first sighted Antarctica remains genuinely contested among three nations, each with credible claims. This is not merely a historical curiosity—it forms the foundation for territorial claims that directly affect modern aviation operations.

Russian Expedition (January 27, 1820): Fabian Gottlieb von Bellingshausen, commanding the Vostok and Mirny, recorded sighting an ice shelf now identified as the Fimbul Ice Shelf. Russia considers this the first confirmed sighting of the Antarctic continent. This early presence underpins Russia's later "reserved rights" position under the Antarctic Treaty.

British Expedition (January 30, 1820): Edward Bransfield, a Royal Navy officer aboard the Williams, sighted the Trinity Peninsula—the northernmost point of the Antarctic mainland. The United Kingdom relies in part on this sighting, combined with subsequent exploration and administration, for its claim to the British Antarctic Territory.

American Expedition (November 1820): Nathaniel Palmer, a Connecticut sealer operating the sloop Hero, sighted what is now the Palmer Peninsula. While Palmer's sighting came later than the others, it contributed to the U.S. position of "reserved rights"—the basis of claim that has never been formally asserted.

1.2 Exploration and the Legal Doctrines of Sovereignty

The "Heroic Age" of Antarctic exploration (roughly 1895–1922) saw expeditions by Scott, Shackleton, Amundsen, Mawson, and others that combined scientific ambition with national prestige. For lawyers, this era is significant because it tested—and ultimately discredited—several doctrines of territorial sovereignty as applied to Antarctica.

Discovery Doctrine

Under traditional international law, discovery of new territory could establish an inchoate title. Multiple nations pointed to their explorers' first sightings as a basis for sovereignty. The problem: at least three nations claimed "first sighting," and mere sighting of an ice-covered coastline is a weak basis for sovereignty under any standard.

Effective Occupation

The more rigorous doctrine required a discovering nation to effectively occupy the territory—establishing settlements, exercising governmental authority, and administering the land. Antarctica's extreme conditions made year-round occupation nearly impossible until the mid-20th century, rendering this doctrine impractical for most claimant nations.

Sector Theory

Several nations (notably Argentina and Chile) advanced the sector theory, projecting their national boundaries southward to the Pole, similar to the Arctic sector claims by Canada and Russia. This theory produced the infamous triple-overlap in the Antarctic Peninsula region

(20°W to 80°W), where Argentina, Chile, and the United Kingdom all assert sovereignty over the same territory.

The Hughes Doctrine (1924)

U.S. Secretary of State Charles Evans Hughes articulated the American position that discovery alone, without subsequent settlement or effective occupation, could not establish valid sovereignty claims. This doctrine foreshadowed the U.S. decision never to formalize any Antarctic territorial claim, despite extensive American exploration.

1.3 Early Aviation Before the Treaty

Aviation came to Antarctica remarkably early, and each pioneering flight carried both scientific and political significance.

In the early days of Antarctic exploration, expeditions experimented with the use of aircraft. The first flight in Antarctica by any type of aircraft was made by Robert Falcon Scott in the captive hydrogen balloon, *Eva*, on the British *Discovery* expedition. On 4 February 1902, Scott reached a height of 250 meters over the Ross Ice Barrier. The first Antarctic aerial photographs taken on the pioneering balloon flights gave a glimpse of what lay beyond the horizon.

Douglas Mawson saw the great potential for aerial exploration on the 1911 Australasian Antarctic Expedition (AAE). He planned to use a small single-engine Vickers REP Monoplane for reconnaissance at Commonwealth Bay. When the aircraft was damaged during a demonstration flight prior to departure, these plans were abandoned. Although the monoplane was not airborne in Antarctica, Mawson adapted it to serve as tractor transport on land traverses.

Hubert Wilkins — First Antarctic Flight (1928)

Australian explorer Sir Hubert Wilkins made the first powered flight in Antarctica on November 16, 1928, flying a Lockheed Vega from Deception Island over the Antarctic Peninsula. This flight demonstrated that aircraft could operate in polar conditions and immediately raised questions about whether aerial survey could establish territorial claims.

Richard Byrd — South Pole Overflight (1929)

On November 29, 1929, Rear Admiral Richard E. Byrd led the first flight over the South Pole in a Ford Trimotor, departing from Little America base on the Ross Ice Shelf. The flight lasted 18 hours and 41 minutes and required jettisoning emergency food supplies to gain sufficient altitude to clear the Polar Plateau at approximately 11,000 feet.

Lincoln Ellsworth — Trans-Antarctic Flight and Territorial Claim (1935)

Ellsworth completed the first trans-Antarctic flight on November 23, 1935, flying a Northrop Gamma monoplane from Dundee Island to the Bay of Whales—approximately 2,200 miles. Upon landing, Ellsworth claimed the territory for the United States. The U.S. government never formalized this claim, consistent with the Hughes Doctrine.

Operation Highjump (1946–47)

The largest Antarctic expedition ever mounted, Operation Highjump involved 4,700 personnel, 13 ships, and 33 aircraft. Led by Admiral Byrd, the operation produced approximately 70,000 aerial photographs covering 1.5 million square miles. The extensive use of military aviation raised international concerns about potential militarization—concerns that directly contributed to the Antarctic Treaty.

International Geophysical Year (1957–58)

The IGY was the watershed moment that made the Antarctic Treaty possible. Sixty-seven nations participated in coordinated scientific research, and multiple nations established permanent stations requiring regular aerial resupply. The U.S. Operation Deep Freeze established the logistics framework—centered on military aviation support—that remains the backbone of American Antarctic operations to this day.

Author's Note: *This is the key transition point: the IGY proved that cooperation worked. Nations recognized that continued sovereignty disputes would undermine research and potentially militarize the continent. This directly led to the Antarctic Treaty, signed December 1, 1959.*

PART 2: THE ANTARCTIC TREATY AND GOVERNANCE

2.1 Who Owns Antarctica?

The short answer is: no one—and, depending on whom you ask, everyone. Seven nations have formally asserted territorial claims: the United Kingdom (1908), New Zealand (1923), France (1924), Australia (1933), Norway (1939), Chile (1940), and Argentina (1943). Australia's claim is the largest, covering approximately 42 percent of the continent. The Antarctic Peninsula is claimed simultaneously by Argentina, Chile, and the United Kingdom, creating a triple overlap between 20°W and 80°W.

Two additional powers—the United States and Russia—maintain "reserved rights" positions: neither has made a formal claim, neither recognizes others' claims, and both explicitly reserve the right to assert claims in the future.

For the lawyer-pilot, this creates a genuinely novel legal environment. Consider: a U.S.-registered aircraft, operated by an Argentine company, carrying Australian tourists, crashes in territory claimed by the United Kingdom but also asserted by Argentina and Chile. Which nation's courts have jurisdiction? Which law applies to wrongful death claims? These questions lack clear answers under current international law—which is precisely why the Antarctic Treaty exists.

2.2 Treaty Basics

The Antarctic Treaty was signed on December 1, 1959, in Washington, D.C., by the twelve nations active during the IGY. It entered into force on June 23, 1961. Today there are 56 treaty parties, of which 29 are Consultative Parties. Decisions require consensus. Through the Treaty, acceding Parties can attain consultative status by demonstrating 'substantial scientific research activity' in Antarctica.

Article I — Peaceful Purposes Only

"Antarctica shall be used for peaceful purposes only. There shall be prohibited, inter alia, any measures of a military nature, such as the establishment of military bases and fortifications, the carrying out of military maneuvers, as well as the testing of any type of weapons."

Aviation implication: Military aircraft MAY operate for peaceful purposes such as logistics and scientific support. The U.S. utilizes LC-130 Hercules operated by the 109th Airlift Wing, C-17 from the 62/446 Airlift Wing operated by the U.S.A.F. under civilian NSF authority.

Article IV — The Sovereignty Freeze

"Nothing contained in the present Treaty shall be interpreted as: (a) a renunciation by any Contracting Party of previously asserted rights of or claims to territorial sovereignty in Antarctica; (b) a renunciation or diminution by any Contracting Party of any basis of claim to territorial sovereignty..."

Claims are neither recognized nor renounced. Activities during the Treaty period do not strengthen or weaken claims. For aviation, there is no universally recognized sovereign authority

over Antarctic airspace. The Chicago Convention framework does not apply in the conventional sense.

Article VII(5) — Advance Notification

Requires advance notification of all expeditions to and within Antarctica. For U.S. persons, implemented through Form DS-4131, required at least three months prior to departure.

The Protocol on Environmental Protection (Madrid Protocol, 1991)

The Protocol on Environmental Protection to the Antarctic Treaty, signed in Madrid in 1991 and entering into force in 1998, designates Antarctica as a "natural reserve, devoted to peace and science." The Protocol requires environmental impact assessments for all activities, including aviation operations. It established the Committee for Environmental Protection (CEP) as the advisory body to the ATCM on environmental matters. For aviation operators, the Protocol's requirements for environmental assessment, waste management, and wildlife protection impose direct operational constraints.

The Role of COMNAP

The Council of Managers of National Antarctic Programs (COMNAP) coordinates operational cooperation among national programs. For aviation, COMNAP manages the Antarctic Flight Information Manual (AFIM), convenes Antarctic Aviation Workshops, maintains the Air Operations Expert Group, and facilitates the information-sharing framework that substitutes for conventional ATC coordination. COMNAP's role is operational rather than regulatory—it provides the practical infrastructure for flight safety that the Treaty system does not mandate.

2.3 Force of International Aviation and Maritime Conventions in the Treaty Area

Author's Note: *This section addresses one of the most analytically challenging questions in Antarctic aviation law: what is the legal force of the major international aviation and maritime conventions within the Treaty area? The answer is more nuanced than most practitioners expect, and it goes to the heart of the sovereignty freeze's practical consequences.*

Virtually all international aviation and maritime conventions are built on the assumption of sovereign states exercising jurisdiction over defined territory and airspace. The Antarctic Treaty's Article IV sovereignty freeze removes that foundation without replacing it with anything equivalent. The result is not that these instruments are void—it is that their application is indirect, contested, and often uncertain.

The Chicago Convention (1944)

The Convention on International Civil Aviation establishes the framework of sovereign airspace—each contracting state has "complete and exclusive sovereignty over the airspace above its territory" (Article 1). In Antarctica, no state exercises universally recognized sovereignty, so the Convention does not apply in the conventional sense. Claimant states (the United Kingdom, Australia, New Zealand, and others) would argue their aviation regulations extend to their claimed sectors, but non-claimant states and reserved-rights states do not recognize those claims. The practical result is that no state issues approach plates, no state

provides mandatory ATC, and no state's aviation authority certifies Antarctic airfields. Operators default to their flag state's regulatory framework—a U.S.-registered aircraft follows FARs, an Australian-registered aircraft follows CASA regulations—but enforcement depends on the flag state, not territorial authority. ICAO Standards and Recommended Practices (SARPs) are followed as best practice and through COMNAP/AFIM coordination, but there is no contracting state on the ground to mandate compliance.

ICAO Standards, Annexes, and the FIR Question

Antarctica is not within any conventional Flight Information Region. ICAO Annex 12 (Search and Rescue) is the most operationally relevant piece—SAR regions have been allocated to surrounding states (New Zealand, Chile, Argentina, South Africa, Australia), and their Rescue Coordination Centers have nominal responsibility, but they are thousands of kilometers from the continent with no direct response capability. The Antarctic Flight Information Manual (AFIM) essentially substitutes for an Aeronautical Information Publication (AIP), but it is a COMNAP product without ICAO regulatory status.

The Montreal Convention (1999) and Warsaw System

These liability conventions apply based on the contracts of carriage—specifically the places of departure, destination, and the carrier's domicile or principal place of business. For intercontinental flights (Cape Town to Wolf's Fang, Punta Arenas to Union Glacier), the convention framework applies through the gateway city and the carrier's state of incorporation. The harder question arises for purely intracontinental carriage or incidents occurring in the Treaty area—jurisdiction for claims would likely fall to the passenger's or operator's home state, but serious choice-of-law disputes would attend any multi-national incident.

IMO Conventions, SOLAS, and the Polar Code

The International Maritime Organization's Polar Code (mandatory since January 2017 under SOLAS Chapter XIV and MARPOL Annexes I and II) is the strongest of the international frameworks in Antarctic application, because it governs the vessel regardless of where it operates. Flag state enforcement applies. The Polar Code's requirements for ship design, construction, equipment, manning, and environmental protection are binding on vessels registered in IMO member states operating in polar waters south of 60°S. ATCM Resolution 6 (2017) explicitly references the Polar Code. This is notably more robust than any aviation-specific framework in the Treaty area.

Tokyo, Hague, and Montreal Offenses Conventions

These conventions apply based on state of registration, state of the operator, and state of landing. For offenses aboard aircraft in Antarctic airspace, the registration state would have primary jurisdiction. The absence of a territorial state actually simplifies this in one sense—there is no competing territorial claim to jurisdiction—but complicates enforcement if the aircraft is on the ground in Antarctica.

Cape Town Convention

The Convention on International Interests in Mobile Equipment applies based on the states of registration and the debtor's and creditor's location, not the operational location of the aircraft, so Antarctica does not create a meaningful gap.

Practical Synthesis: Three Indirect Mechanisms

These instruments apply in the Antarctic Treaty area through three indirect mechanisms: (1) flag state jurisdiction (state of aircraft or vessel registration); (2) nationality jurisdiction (state of the operator, crew, or passengers); and (3) gateway state jurisdiction (the departure and arrival points outside the Treaty area). What is missing is territorial jurisdiction—the enforcement layer that, everywhere else on Earth, provides the primary regulatory framework for aviation and maritime operations.

This is precisely why the ATCM framework, COMNAP coordination, and IAATO self-regulation have filled the gap—imperfectly and without binding force, but practically. The irony is that the most dangerous operating environment on Earth has the weakest jurisdictional framework for the conventions designed to make aviation and maritime operations safe.

For purposes of analysis, the conventions may be understood as a hierarchy of applicability: the Polar Code sits at the top (binding on flag states, directly addressing polar operations); followed by the Chicago Convention framework (applying through flag state but lacking territorial enforcement); the Montreal liability regime (applying through contract of carriage but with jurisdictional uncertainty for Antarctic-only segments); and the ATCM instruments at the bottom in terms of legal force (non-binding resolutions and unratified measures) but arguably at the top in terms of practical operational relevance.

PART 3: OVERFLIGHT TOURISM AND THE MOUNT EREBUS DISASTER

3.1 The Birth of Antarctic Overflight Tourism (1977)

In February 1977, Air New Zealand and Qantas simultaneously launched commercial sightseeing flights over Antarctica—a concept with no precedent in commercial aviation. A widebody aircraft would depart from Australia or New Zealand, fly south, spend several hours at low altitude over the continent, and return the same day—without ever landing.

Air New Zealand operated DC-10 widebody aircraft from Auckland. Qantas operated from Australian cities using Boeing 747s. The flights proved immediately popular. Expert Antarctic guides provided live commentary, and flights descended as low as 2,000 feet over McMurdo Sound. Air New Zealand operated from 1977 through November 1979. Tickets cost approximately NZ$359 per person. Dignitaries including Sir Edmund Hillary served as onboard guides.

3.2 The Mount Erebus Disaster

Author's Note: *This is one of the most significant accidents in the history of Antarctic aviation, carrying direct lessons for this audience. The Erebus disaster was caused by an intersection of navigational error, organizational failure, and the unique visual hazards of the Antarctic environment.*

The Accident (November 28, 1979)

Air New Zealand Flight TE901—a McDonnell Douglas DC-10 (ZK-NZP)—departed Auckland at approximately 8:20 a.m. for a scheduled 11-hour sightseeing flight. The aircraft carried 237 passengers and 20 crew members. At 12:49 p.m. NZST, it struck the lower slopes of Mount Erebus on Ross Island at approximately 1,465 feet above sea level. All 257 people on board were killed instantly. It was, and remains, the worst civil disaster in New Zealand's history.

The Navigational Error

The root cause was a change to the aircraft's flight plan coordinates made by Air New Zealand's navigation section the morning of the flight. The original coordinates directed the aircraft down McMurdo Sound, well clear of Mount Erebus. The amended coordinates shifted the path approximately 27 nautical miles east, directly over Ross Island. The crew was never informed. They believed they were flying the standard route down McMurdo Sound.

Whiteout and Sector Whiteout

A meteorological phenomenon known as "sector whiteout"—in which an overcast sky above flat white terrain renders the horizon indistinguishable—made the rising slope of Mount Erebus effectively invisible. The GPWS activated only seconds before impact.

The Investigations

The initial investigation attributed the accident to pilot error. A subsequent Royal Commission of Inquiry under Justice Peter Mahon reached a starkly different conclusion: the primary cause was the unauthorized coordinate change and the failure to inform the crew. Mahon found that Air

New Zealand executives had engaged in “an orchestrated litany of lies.” It was not until 2019—forty years later—that formal apologies were issued.

Aftermath and Implications

Air New Zealand permanently ceased Antarctic flights. Qantas suspended its overflights for 15 years. The disaster demonstrated that Antarctic aviation carries unique visual hazards that can defeat experienced crews, exposed organizational risks of complex operations managed at a distance, and raised questions about navigation procedures that informed the later development of the AFIM and COMNAP safety procedures.

PART 4: ATCM RESOLUTIONS ON AVIATION AND TOURISM

Author's Note: *Tourism was essentially unforeseen when the Treaty was drafted in 1959. The regulatory framework has been built ad hoc through ATCM Resolutions, Measures, and Recommendations. Critically, Resolutions are non-binding; Measures require ratification by all Consultative Parties and many remain unratified.*

4.1 Recommendation XVIII-1 (1994)

The first comprehensive ATCM instrument addressing tourism. Established the foundational principle that tourist activities must comply with the Antarctic Treaty and Environmental Protocol.

4.2 Measure 4 (2004) — Insurance and Contingency Planning

Status: NOT YET IN FORCE. The ATCM's most direct attempt to require insurance and contingency planning. Requires operators to demonstrate appropriate contingency plans "not reliant on support from other operators or national programs without their express written agreement."

4.3 Resolution 4 (2004) / Resolution 6 (2017)

Non-binding parallels to Measure 4, updated in 2017 to account for the IMO Polar Code.

4.4 Resolution 4 (2007) — Ship-Based Tourism

Recommended discouraging landings from vessels carrying more than 500 passengers. Established the 1:20 guide-to-passenger ratio and 100-passenger shore limit.

4.5 Resolution 5 (2007)

Recommended discouraging tourism that may substantially degrade the Antarctic environment.

4.6 Resolution 7 (2009) — General Principles

Established that scientific research takes priority over tourism; operators should cooperate on environmental and safety best practices.

4.7 Resolution 5 (2022) — Permanent Tourism Facilities

Recommended preventing construction of multi-season tourism facilities with more than minor or transitory environmental impact.

4.8 Resolution 4 (2023) — Urgent Measures on Tourism

Recommended discontinuing off-ship activities from vessels with 500+ passengers and helicopter recreational use in wildlife areas.

4.9 Decision 6 (2019) — Manual of Regulations

Created the Manual of Regulations and Guidelines compiling all relevant instruments into a single reference.

4.10 Resolution 3 (2022) — Air Operations and AFIM

Recommends that all operators be provided the AFIM. Emphasizes that "any increase in air activity brings with it increased risks" and that national programs are "often called upon to respond." This resolution represents the ATCM's most direct acknowledgment that the growth of NGO aviation is straining existing safety and SAR capacity.

Author's Note: *The central takeaway is the gap between aspiration and enforcement. ATCM Resolutions articulate sound principles, but they are non-binding. Measures that carry legal weight remain unratified. The practical result is a framework of expectations without a mechanism for compulsion.*

PART 5: THE IAATO FRAMEWORK

Author's Note: *Placing the IAATO Framework immediately after the ATCM Resolutions highlights the relationship between the Treaty system's aspirational instruments and the self-regulatory framework that fills the enforcement gap in practice.*

5.1 Overview

Founded in 1991 by seven private tour operators, the International Association of Antarctica Tour Operators (IAATO) is the de facto standard-setter for commercial Antarctic operations. IAATO is registered in Rhode Island, USA, and its membership today comprises more than 100 companies. Membership is voluntary—non-members are not bound by its standards. IAATO's April 2025 Bylaws and published operational guidelines establish the current framework.

5.2 Membership and Operational Requirements

IAATO categorizes operators into seven categories: vessels carrying 13–200 passengers with landings (C1); vessels carrying 201–500 passengers with landings (C2); cruise-only vessels making no landings (501+ passengers); land operations; air operations (overflights only); air/cruise operations; and sailing or motor vessels carrying 12 or fewer passengers.

Under Article X of the Bylaws, all operators must: maintain vessels, aircraft, and equipment suitable for Antarctic conditions; have "appropriate contingency plans for all aspects of their operations"; hire sufficient expedition staff (80% with relevant experience, 50% with Antarctic experience); complete post-visit site reports and end-of-season reports; and adhere to Antarctic Treaty System obligations.

5.3 Aviation-Specific Requirements

Article X, Section D of the Bylaws imposes additional conditions on aircraft operators: hire sufficient experienced ground handling staff; liaise in advance with National Antarctic Programs when flying near or landing near their stations; and incorporate IAATO requirements, guidelines, and operational procedures into their own operating procedures. Failure to comply can result in action by the Compliance and Dispute Resolution Committee and sanctions by the membership.

5.4 Aviation-Related Contributions

IAATO's aviation-related contributions include: flight schedule coordination to prevent conflicts; ship-based helicopter operational standards; data-sharing with COMNAP on flight activity; ATCM representation on tourism matters; vessel tracking (mandatory for all SOLAS passenger vessels south of 60°S); and a Deep Field and Air Operations standing committee that develops policies for land-based and air operations.

5.5 Enforcement Mechanisms

The Compliance and Dispute Resolution Committee can review member conduct and recommend reprimand, probation, or expulsion—but this is triggered by complaints and violations, not by proactive auditing. The Mandatory Observation Scheme places an IAATO

observer aboard each new operator's first season, and existing operators are observed every five years. The observation checklist focuses on environmental compliance, guide ratios, wildlife protocols, and operational procedures.

5.6 The Significance and Limitations of Self-Regulation

IAATO is consistently held up by ATCM parties as the model of responsible self-regulation. It operates within the framework of the Antarctic Treaty System and IMO Conventions. However, as a voluntary trade association, IAATO's standards bind only its members. Non-member operators—a growing concern as Antarctic tourism expands—are not subject to IAATO requirements, guidelines, or enforcement mechanisms. The growth of Antarctic aviation raises the question of whether voluntary self-regulation remains adequate as the scale and complexity of operations increase.

PART 6: STATUTORY & REGULATORY GUIDELINES

6.1 The Antarctic Conservation Act and 45 CFR Part 670

The Antarctic Conservation Act (16 U.S.C. § 2401 et seq.) makes it unlawful for any U.S. citizen to engage in certain Antarctic activities without a permit. The implementing regulations at 45 CFR Part 670 establish the permit system: prohibitions on taking native species, harmful interference, ASPA entry, and non-indigenous species introduction. Aviation operations that overfly wildlife, land near protected areas, or generate waste require ACA permits. Processing takes 45–60 days including a 30-day Federal Register comment period.

Penalties

Up to approximately $34,457 per violation and one year imprisonment. Civil penalties can accrue per violation per day. Additional regulations at 45 CFR Part 671 (waste management), 45 CFR Part 673 (non-governmental expeditions), and 40 CFR Part 8 (environmental assessment) also apply.

6.2 Advance Notification Requirements

Under Article VII(5) of the Antarctic Treaty, all expeditions to and within Antarctica require advance notification. U.S. persons and organizations must file Form DS-4131 with the Department of State at least three months prior to departure. The notification must include details of all transport, including aircraft type, registration, routes, and operational dates. Failure to file carries administrative and potential criminal penalties under the Antarctic Conservation Act.

6.3 Environmental Impact Assessment

The Madrid Protocol requires environmental impact assessment at three levels: Preliminary Assessment (for activities with less than minor or transitory impact), Initial Environmental Evaluation (IEE, for activities with potentially minor or transitory impact), and Comprehensive Environmental Evaluation (CEE, for activities likely to have more than minor or transitory impact, requiring ATCM review). Most aviation operations require at minimum an IEE. Establishing new airfields or significant increases in flight frequency may trigger a CEE.

6.4 Wildlife Protection and Overflight Restrictions

Annex II to the Madrid Protocol and its implementing regulations impose restrictions on aircraft operations near wildlife. Fixed-wing aircraft must generally maintain minimum altitudes over concentrations of birds or marine mammals. Helicopter operations near wildlife are subject to stricter limitations. Antarctic Specially Protected Areas (ASPAs) may prohibit overflight entirely or impose altitude minima. Operators must obtain specific permits for any activity within an ASPA.

6.5 Waste Management and Fuel Handling

Annex III to the Madrid Protocol governs waste disposal. Aviation operators must remove all waste generated by their operations, including fuel drums, maintenance waste, and human waste

from field camps. Fuel spills must be reported and remediated. The “clean as you go” principle applies to all field operations, and aviation fuel caches must be properly contained and documented.

PART 7: INSURANCE REQUIREMENTS AND COST RECOVERY

7.1 The Insurance Landscape

Antarctic insurance requirements emerge from multiple sources: ATCM instruments, national legislation (45 CFR Part 673), gateway country requirements, and practical necessity. No single comprehensive mandate exists.

Minimum Coverage Requirements by Operation Type

Operation Type	Minimum Coverage	Source
Standard Antarctic Ops (Peninsula / Cruise)	$100,000/person	*General industry minimum; required by most cruise and expedition operators*
Interior (Ellsworth Mtns)	$150,000/person	*ALE, Travel Insurance Requirements (antarctic-logistics.com)*
Interior (Outside Ellsworth Mtns)	$300,000/person	*ALE, Travel Insurance Requirements (antarctic-logistics.com)*
White Desert (Queen Maud Land)	$500,000/person	*White Desert, pre-trip requirements (white-desert.com)*

Required Coverage Components

Policies must specifically reference Antarctica. Required components include: personal injury, medical expenses, repatriation (to home country, not merely nearest port), evacuation including air evacuation, pre-existing conditions, and SAR cost recovery coverage. Coverage must extend for the duration of operations plus seven days.

The Reality of Evacuation Costs

Field camp to station: $10,000–$50,000. Station to South America: $100,000–$300,000+. Specialized medical evacuation: can exceed $500,000. An LC-130 Hercules flight costs approximately $60,000–80,000 per flight hour. A South Pole evacuation requires multiple legs over many hours. The potential cost exposure is enormous.

7.2 U.S. Policy on Cost Recovery

The NSF's policy is stark: the U.S. government is unable to offer support to private expeditions. In emergencies, the U.S. is prepared to attempt rescue provided there are no unacceptable risks. Emergency assistance is limited to rescue of personnel. NSF reserves the right to seek recovery of all direct and indirect costs.

Author's Note: *The cost-recovery principle is real but imperfectly enforced. In practice, the U.S. has rarely pursued full cost recovery—but the legal authority exists, and the political pressure increases with each high-profile rescue of a private party using government assets funded for science.*

7.3 IAATO and Insurance: The Gap in Self-Regulation

Author's Note: *This section addresses a significant gap that many practitioners assume does not exist: IAATO, the de facto standard-setter for Antarctic tourism, does not impose specific insurance requirements on its member operators.*

IAATO does not impose specific insurance requirements on member operators as a condition of membership. The April 2025 Bylaws are silent on the subject. Article X—the operational procedures section that sets out detailed conditions for vessel, aircraft, and land operations—never mentions insurance. It requires contingency plans, experienced staff, post-visit reporting, and coordination with national programs, but there is no bylaw provision requiring members to carry minimum insurance coverage, demonstrate specific policy limits, or submit proof of insurance to the Secretariat.

The closest the IAATO framework comes to addressing insurance is in its published Guidance for Organizers, which draws from ATCM Recommendation XVIII-1 (1994). That guidance instructs organizers to "consider the question of insurance (subject to requirements of national law)." The operative word is "consider"—not "obtain," not "maintain," not "demonstrate."

On self-rescue, the IAATO framework is slightly more robust but still framed aspirationally rather than prescriptively. The Guidance for Organizers states that operators should "ensure that activities are fully self-sufficient and do not require assistance from Parties unless arrangements for it have been agreed in advance." The Bylaws require "appropriate contingency plans" but do not define what "appropriate" means, do not specify minimum standards for self-rescue capability, and do not require submission of contingency plans for Secretariat review.

IAATO does maintain an organization-wide Emergency Contingency and SAR Plan, which provides a framework for mutual assistance among member vessels. That system relies on the mandatory vessel tracking requirement for SOLAS passenger vessels south of 60°S and the vessel database that makes asset information available to Maritime Rescue Coordination Centers. There is a collective contingency architecture, but individual operator self-rescue requirements remain general.

The enforcement mechanism is also telling. The Compliance and Dispute Resolution Committee can review member conduct and recommend reprimand, probation, or expulsion, but this is triggered by complaints and violations, not by proactive auditing of insurance or contingency adequacy. The Mandatory Observation Scheme focuses on environmental compliance, guide ratios, wildlife protocols, and operational procedures—not insurance documentation.

This creates a significant paradox: IAATO is consistently held up by ATCM parties as the model of responsible self-regulation, yet its own bylaws do not require the very insurance and self-rescue measures that ATCM Resolution 4 (2004) and the still-unratified Measure 4 (2004) identify as essential. The ATCM tells operators to carry insurance and demonstrate self-sufficiency. IAATO tells operators to "consider" insurance and have "appropriate" contingency plans. In practice, major operators such as White Desert and ALE carry comprehensive insurance and maintain embedded medical staff because commercial and practical realities demand it—not because IAATO requires it.

The gap is filled in practice by national authority requirements. U.S. operators must comply with 45 CFR Part 673, which requires contingency plans. Gateway countries impose their own

conditions. But IAATO as an institution occupies a curious position: stronger on environmental standards and wildlife protocols (where its requirements are detailed and specific) than on the insurance and self-rescue issues that pose the greatest risk to human life and national program resources.

PART 8: THE BUZZ ALDRIN INCIDENT — A CASE STUDY

Author's Note: *Use this case study to tie together every thread: history, legal framework, insurance, SAR coordination, and cost recovery.*

8.1 Background

In late November 2016, Edwin "Buzz" Aldrin—the second human to walk on the Moon—traveled to Antarctica with White Desert. Then 86 years old, he became the oldest person ever to reach the geographic South Pole.

8.2 The Medical Emergency

After arriving at the Amundsen-Scott South Pole Station, Aldrin experienced shortness of breath. Station medical staff found lung congestion with low oxygen saturation—symptoms consistent with high-altitude illness. The South Pole sits at approximately 9,301 feet above sea level. A decision was made to evacuate on the first available flight.

8.3 The Evacuation Chain

Leg 1 — South Pole to McMurdo Station: LC-130 Hercules, 109th Airlift Wing. Approximately 840 nautical miles.

Leg 2 — McMurdo to Christchurch, NZ: Approximately 2,415 nautical miles. Described by NSF as a "humanitarian medical evacuation."

Leg 3 — Hospital Care in Christchurch: Diagnosed with fluid in lungs. Treated with antibiotics.

Leg 4 — Repatriation to the United States: Medical escort arranged by Seven Corners insurance.

8.4 Legal and Policy Analysis

Neither Aldrin nor his manager initially knew he had travel insurance. Seven Corners provided coverage as part of the White Desert tour package—coordinating medical care, a nurse escort, and family travel. This illustrates why the obligation is placed on the OPERATOR to ensure insurance, not on individual participants.

White Desert had its own medical staff embedded with the tourist group—a model of responsible operations. But even this well-planned expedition ultimately depended on national program assets for evacuation.

8.5 The Broader Implications

The Aldrin evacuation crystallizes the central tension: commercial operators bring paying tourists to one of the most remote environments on Earth, with the implicit understanding that government-funded programs will provide emergency support. As the number of tourists grows—105,000+ in 2022–23—the frequency and cost of these incidents will only increase.

PART 9: NATIONAL ANTARCTIC PROGRAM AVIATION

Author's Note: *Before examining NGO aviation, it is essential to understand the governmental aviation that forms the infrastructure upon which all Antarctic flight activity depends.*

9.1 Overview of National Program Aviation

More than 30 National Antarctic Programs maintain a presence on the continent, and the majority rely on air transport for personnel deployment, research support, resupply, and medical evacuation. National program aviation falls into three categories: intercontinental airlift, intracontinental fixed-wing operations, and rotary-wing operations.

9.2 The United States Antarctic Program (USAP)

The USAP, managed by the National Science Foundation under Presidential Memorandum 6646, operates the largest aviation enterprise on the continent. The DoD provides logistics support under an NSF/DoD Memorandum of Agreement. The Deputy Commander of Joint Task Force–Support Forces Antarctica (DCJTF-SFA) is responsible for safe operations of all DoD air assets.

Intercontinental airlift: USAF C-17 Globemaster IIIs, RNZAF C-130 Hercules and Boeing 757s; and LC-130H Hercules—the only ski-equipped heavy-lift aircraft in the world.

Intracontinental operations: NSF-contracted Basler BT-67 and Twin Otter aircraft as well as helicopters.

Airfields: USAP maintains three McMurdo-area airfields: Williams Field (snow skiway), Phoenix Airfield (compacted snow for wheeled aircraft), and historically the Pegasus blue-ice runway. All operate as Prior Permission Required.

ATC Services: USAP airspace is managed by the Naval Information Warfare Center Atlantic (NIWC). McMurdo Center provides ATC on HF.

The USAP Inter-Agency Air Operations Manual governs all aspects of flight operations including standardized routing, instrument approaches, point-of-safe-return calculations, and coordination between military and civilian aircraft.

9.3 Other National Programs

British Antarctic Survey (BAS): Operates from Rothera's 900-meter gravel runway and contracts Kenn Borek Air for deep-field operations.

Norwegian Polar Institute (NPI): Operates Troll Airfield—now a major hub for widebody jet operations with Boeing 787-9 and 767 charters.

Antarctic New Zealand: Coordinates with RNZAF for C-130 and 757 airlift.

Australian Antarctic Division (AAD): Operates an Airbus A319; coordinates with RAAF for C-17.

Russia: Maintains aviation at Novolazarevskaya.

Argentina and Chile: Operate C-130 logistics from the Antarctic Peninsula.

Cross-program coordination is achieved through COMNAP's Air Operations Expert Group, the Antarctic Aviation Workshops, and the AFIM.

Author's Note: *National program aviation provides the infrastructure and safety net upon which all other Antarctic flying depends. The airfields, ATC services, SAR assets, and weather reporting are all government-funded. When NGO operators fly in Antarctica, they depend on this infrastructure.*

PART 10: CONTEMPORARY NGO AVIATION ACTIVITIES

10.1 Overview: Three Categories of NGO Aviation

Non-governmental aviation in Antarctica falls into three distinct operational categories, each with different regulatory profiles, risk characteristics, and infrastructure requirements:

1. Antarctic overflights: Sightseeing flights that transit the Treaty Area without landing (Qantas)—highest volume by passengers.

2. Intercontinental flights: Gateway cities to Antarctic landing sites (White Desert, ALE)—highest operational complexity.

3. Intracontinental flights: Within Antarctica, connecting stations to interior camps and field sites (Kenn Borek Air, ALE)—highest environmental exposure.

10.2 Antarctic Overflights

Qantas Antarctic Sightseeing Flights (1994–Present)

Qantas resumed Antarctic sightseeing flights in 1994 under the "Antarctica Flights" brand following a 15-year suspension after the Erebus disaster. The airline now operates exclusively with Boeing 787-9 Dreamliners. The 2025–26 season comprises seven scheduled departures from Melbourne, Sydney, Brisbane, and Perth.

Each flight covers approximately 9,500 to 10,500 kilometers round trip and lasts 12 to 14 hours. The aircraft spends three to four hours over Antarctica, flying as low as 2,000 feet. Routes are selected from 19 different flight plans based on weather and visibility. Passengers swap seats at the midpoint for window access. Fares range from approximately AU$1,199 to significantly higher for Business Deluxe.

Regulatory Position of Overflights

Overflights occupy a unique regulatory position. Because they never land, they do not require the same Antarctic-specific permitting as landing operations—yet they overfly the Treaty Area. The Chicago Convention's framework of sovereign airspace does not apply in Antarctica, and no ATCM instrument specifically governs overflight-only operations. This regulatory gap means overflights are governed primarily by the flag state's aviation authority (CASA for Qantas) and the operator's own safety standards.

10.3 Intercontinental Flights to Antarctica

Author's Note: *This section addresses one of the most operationally demanding categories of commercial aviation anywhere in the world. Intercontinental flights to Antarctica combine long over-water sectors, absence of diversion airfields, extreme weather variability, and unconventional runway surfaces.*

Gateway Routes

Intercontinental flights to Antarctica operate from three primary gateway cities, each serving different Antarctic regions:

Cape Town, South Africa to Queen Maud Land: Approximately 4,200 km / 2,270 NM to Wolf's Fang or Troll Airfield. Flight time approximately 5–5.5 hours. Operated by Hi Fly (A330/A340) and Norse Atlantic (787-9).

Punta Arenas, Chile to the Ellsworth Mountains / Antarctic Peninsula: Approximately 3,100 km / 1,675 NM to Union Glacier. Flight time approximately 4–4.5 hours. Operated by ALE using IL-76 cargo aircraft.

Christchurch, New Zealand to the Ross Sea region: Approximately 3,850 km / 2,080 NM to McMurdo-area airfields. Primarily USAP and RNZAF military/government flights (C-17, C-130, 757).

Weather Requirements and Constraints

Weather is the single greatest operational variable for intercontinental Antarctic flights. Conditions at the Antarctic destination can change from VMC to below minimums within hours, and weather forecasting relies on a sparse observation network. Key weather considerations include:

Departure criteria: Flights typically require favorable weather conditions confirmed at the Antarctic destination before departure. Most operators use a "go/no-go" window based on satellite imagery, automated weather stations, and reports from personnel on the ground.

Visibility and ceiling minima: Blue ice and compacted snow runways lack precision instrument approaches. Minimum visibility requirements are typically higher than conventional airports—often 5,000 meters visibility and 1,500-foot ceilings for blue ice operations.

Wind limitations: Crosswind limits on ice runways are generally lower than on paved surfaces due to reduced braking action. Katabatic winds—gravity-driven drainage winds descending from the ice sheet—can accelerate rapidly and without warning, reaching speeds exceeding 100 knots in coastal areas.

Whiteout risk: Sector whiteout conditions (as discussed in the Erebus disaster) can develop when overcast skies coincide with snow-covered terrain, eliminating the visible horizon and making terrain features invisible to the crew.

Seasonal window: Intercontinental flights operate exclusively during the austral summer season, typically November through February. The usable window is constrained by daylight hours, temperature limits for runway surfaces (blue ice softens in warm conditions), and the availability of forecasting support.

ETOPS and Extended Diversion Time Operations

Twin-engine intercontinental flights to Antarctica present one of the most extreme ETOPS (Extended-range Twin-engine Operations Performance Standards) scenarios in commercial aviation. The core challenge is the near-total absence of diversion airfields along the route.

No conventional alternates: Between Cape Town and Queen Maud Land, there are no ICAO-compliant airports. The nearest diversion options are the departure point itself (Cape Town) and, depending on the route, potentially Îles Kerguelen or other sub-Antarctic islands—none of which are equipped for widebody jet operations.

ETOPS classification: Twin-engine widebody operations (such as the A330 flights to Wolf's Fang or 787-9 flights to Troll) require ETOPS certification. The A330's ETOPS rating of up to 180 minutes (or beyond-180 with extended approval) is critical, as the midpoint of the Cape Town–Antarctica route may exceed 180 minutes from any suitable alternate.

Operational implications: Operators must file ETOPS flight plans, carry additional fuel reserves, ensure engine and systems serviceability meets ETOPS dispatch requirements, and maintain continuous monitoring of the equal-time point (ETP) throughout the flight. Crew training must include ETOPS-specific decision-making for engine failure, depressurization, and medical diversion scenarios in an environment where diversion may mean a return to the departure city—a decision that could take three or more hours to execute.

Four-engine alternatives: ALE's use of the IL-76 and Hi Fly's earlier use of the A340 avoided ETOPS constraints entirely. The December 2025 transition to the A330 twin-engine widebody for Wolf's Fang operations marked a significant shift in the risk profile of intercontinental Antarctic aviation.

Point of Safe Return (PSR)

The Point of Safe Return—also known as the Point of No Return (PNR) or Last Point of Return—is the position along the route beyond which the aircraft can no longer return to its departure airport with required fuel reserves. PSR calculations for Antarctic flights must account for: headwind/tailwind components for both the outbound and return legs; deteriorating weather at the Antarctic destination requiring a full return; fuel reserves for holding, approach, missed approach, and diversion; the absence of intermediate refueling options; and contingency fuel for unforecast weather changes during the return leg.

Many operators use a "boomerang" decision protocol: the crew continuously updates PSR throughout the flight and will execute a return to the gateway city if weather at the Antarctic destination deteriorates beyond minimums before reaching the PSR. After the PSR, the crew is committed and must rely on the Antarctic destination's actual conditions. This creates a critical decision window—typically two to three hours into the flight—where weather information quality directly determines mission success.

Antarctic Runways for Intercontinental Operations

Antarctic runways used for intercontinental jet operations are unlike any others in commercial aviation. There are three principal surface types:

Blue Ice Runways: Naturally occurring glacial ice fields that have been wind-scoured to expose dense, smooth ice. Wolf's Fang (White Desert) is a 3-kilometer blue ice runway requiring a 22-hour grooming cycle before each operation. Troll Airfield (NPI) also uses blue ice. Advantages include the ability to support heavy aircraft (200+ tons) without paving. Limitations include sensitivity to temperature—ice surfaces soften and become unsafe when temperatures exceed approximately -5°C—limited or no lighting, no precision approaches, and the need for continuous surface monitoring and maintenance.

Compacted Snow Runways: Phoenix Airfield near McMurdo is a compacted snow runway capable of supporting wheeled C-17 Globemaster operations. The surface is created by

mechanically compacting and grooming natural snowfall over many seasons. These runways require intensive maintenance and are affected by temperature and solar radiation.

Ski-Drag Runways: Williams Field near McMurdo and numerous field camp strips serve ski-equipped aircraft (LC-130, Twin Otter, BT-67). These are groomed snow surfaces that do not support wheeled operations. They are the most common Antarctic runway type but are limited to ski-equipped aircraft.

No Antarctic runway has precision instrument approach capability. All approaches are GPS-based, visual, or use non-precision procedures. Runway lighting is minimal or absent; operations are typically limited to daylight hours. NOTAM systems are informal—runway condition reports are communicated directly between operators and airfield managers rather than through standard ICAO NOTAM distribution.

Principal Intercontinental NGO Operators

Operator	Aircraft	Route	Runway	Notes
White Desert	A330 (Hi Fly)	Cape Town–Wolf's Fang	Blue ice	~300 guests/season, $15,950–$110,000/person
ALE	IL-76	Punta Arenas–Union Glacier	Blue ice	Adventure tourism, South Pole access
Norse Atlantic / NPI	Boeing 787-9	Cape Town–Troll	Blue ice	NPI science logistics charter

The Widebody Revolution

The introduction of widebody jet aircraft to intercontinental Antarctic routes represents a fundamental change in the scale and risk profile of Antarctic aviation:

Year	Aircraft	Operator	Runway	Significance
2019	Boeing 767	Titan Airways	Novolazarevskaya	First widebody in Antarctica
Nov 2021	Airbus A340	Hi Fly	Wolf's Fang	First A340 on continent
Jan 2022	Boeing 767	Loftleiðir	Troll	NPI science logistics
Nov 2023	Boeing 787-9	Norse Atlantic	Troll	First 787 Dreamliner
Dec 2025	Airbus A330	Hi Fly	Wolf's Fang	

The widebody revolution carries profound implications: capacity (a 787 carries 200+ passengers per flight), twin-engine risk (no diversion airfields between gateway cities and Antarctica), infrastructure demands (blue ice runways receiving 200-ton aircraft), and a widening SAR gap (a widebody incident would exceed all existing contingency planning).

10.4 Intracontinental Operations

Intracontinental flights operate entirely within Antarctica, connecting coastal stations to interior camps, field research sites, and remote airstrips. These operations involve the smallest aircraft but the highest environmental exposure.

Kenn Borek Air

Kenn Borek Air (Calgary) is the largest global Twin Otter operator and the dominant provider of contract aviation services in Antarctica. The company provides contract aviation to national programs (BAS, Antarctic New Zealand, and others) and private operators. Kenn Borek specializes in ski-drag operations, blue ice approaches, and whiteout GPS procedures. Aircraft types include the de Havilland DHC-6 Twin Otter and Basler BT-67.

Antarctic Logistics & Expeditions (ALE)

ALE provides access to the Ellsworth Mountains and South Pole for adventure tourism and private expeditions. In addition to its intercontinental IL-76 operations from Punta Arenas, ALE uses Twin Otters and BT-67s for intra-Antarctic transport from Union Glacier to the South Pole, Vinson Massif base camp, and other field locations.

Ship-Based Helicopter Operations

IAATO-member expedition ships routinely carry helicopters for passenger transfers, sightseeing, and access to landing sites not reachable by Zodiac. Ship-based helicopter operations are subject to IAATO standards including pilot qualification requirements, weather minima, and wildlife avoidance protocols. The Antarctic Peninsula is the primary area of ship-based helicopter activity.

Intracontinental Weather and Operational Hazards

Intracontinental flights face weather and terrain hazards distinct from intercontinental operations. Katabatic winds can develop with little warning in coastal and valley areas. Flat-light and whiteout conditions make terrain and surface features invisible—a particular hazard for ski landings. Temperature extremes affect engine performance and aircraft systems; the South Pole interior can reach -40°C or colder even in summer. Communication is limited to HF radio in many interior areas, with satellite phone as backup. Navigation is GPS-dependent, as VOR/NDB infrastructure does not exist.

10.5 AFIM: Building a Fused Air Picture

The Antarctic Flight Information Manual (AFIM) is managed by COMNAP and published three times per season (pre-season, mid-season, and end-of-season updates). It provides the closest equivalent to a conventional AIP (Aeronautical Information Publication) for Antarctica. The AFIM contains airfield information, frequencies, reporting procedures, operational contacts, and flight activity schedules from national programs and participating NGO operators. The strategic goal is a “fused air picture” integrating flight data from all sources—military, partner nations, and commercial NGOs—to reduce the risk of conflicts in an environment without mandatory ATC.

10.6 Sustainability

White Desert has maintained CarbonNeutral certification since 2007 and is introducing sustainable aviation fuel (SAF). The sustainability question is acute because Antarctic aircraft emissions have outsized environmental significance—pristine air quality is both a scientific resource and a symbolic value. The growing volume of NGO aviation flights raises questions about cumulative environmental impact that the current ATCM framework is not well-equipped to address.

10.7 Emerging Challenges

Increasing scale: Widebody jet service is now commercially viable, bringing mass-capacity air access to the continent.

Proliferating RPAS: Drones are widespread in tourism and research, but safety implications for manned aviation are largely unaddressed.

SAR capacity gap: The mismatch between commercial volume and national program SAR capacity widens each season.

Regulatory lag: Consensus-based ATCM decision-making is slow relative to commercial growth.

Airspace management: The cooperative information-sharing model may prove insufficient as traffic volume and diversity increase.

PART 11: SEARCH AND RESCUE AND RESCUE COORDINATION CENTERS

Author's Note: *This section addresses one of the most critical—and least understood—aspects of Antarctic aviation. The SAR framework in Antarctica is fundamentally different from anywhere else on Earth. There is no dedicated, standing SAR force. There is no 911 equivalent. Every rescue depends on the ad hoc diversion of assets intended for other purposes, and the resources available are a fraction of what exists in any other region of comparable size.*

11.1 The SAR Framework: No Dedicated Rescue Authority

Antarctica is unique among the world's continents in having no sovereign authority responsible for search and rescue. In contrast to the well-established SAR systems of North America, Europe, and the maritime zones covered by the International Convention on Maritime Search and Rescue (the Hamburg Convention, 1979), Antarctica lacks a central SAR coordinating body with command authority, dedicated SAR aircraft or vessels on standby, mandatory response obligations enforceable by law, and standardized SAR procedures with guaranteed response times.

What exists instead is a cooperative framework, built on goodwill, intergovernmental agreements, and the practical reality that national programs will generally attempt to help when lives are at stake—provided the risk to their own personnel is acceptable.

11.2 Rescue Coordination Centers (RCCs)

Under the International Convention on Maritime Search and Rescue and the Convention on International Civil Aviation (Chicago Convention), the world is divided into Search and Rescue Regions (SRRs), each assigned to a responsible state operating a Rescue Coordination Centre (RCC). The Antarctic region is divided among several RCCs, none of which are physically located on the continent:

RCC New Zealand (RCCNZ), Wellington: Responsible for the Ross Sea region and the New Zealand-claimed Ross Dependency. RCCNZ coordinates SAR for the McMurdo Sound area and the routes between Christchurch and Antarctica. In practice, RCCNZ is the primary coordination point for emergencies involving USAP operations.

MRCC Chile (MRCC Punta Arenas): Responsible for the Antarctic Peninsula and the Drake Passage. Coordinates SAR for the most heavily trafficked maritime and aviation corridor in Antarctica, including ALE flights from Punta Arenas to Union Glacier.

MRCC Argentina (MRCC Ushuaia): Shares responsibility for the Antarctic Peninsula region with Chile. Argentine naval and air force assets at Ushuaia and Marambio Station provide the closest military SAR capability to the northern Antarctic Peninsula.

RCC South Africa (MRCC Cape Town): Responsible for the Queen Maud Land approaches. Coordinates SAR along the Cape Town–Antarctica corridor used by White Desert and NPI charter flights.

JRCC Australia (Canberra): Responsible for the Australian Antarctic Territory—the largest claimed sector—and coordinates SAR from the Australian mainland, over 3,000 km from the Antarctic coast.

Author's Note: *The critical point is that these RCCs are all thousands of kilometers from the Antarctic continent. They can coordinate, but they cannot directly respond. Actual rescue capability depends entirely on assets that happen to be on or near the continent at the time of the emergency.*

11.3 Available SAR Assets: A Stark Reality

The SAR assets available in Antarctica at any given time are extremely limited and were not designed or positioned for SAR purposes. They include:

National Program Aircraft

USAP LC-130 Hercules (109th Airlift Wing): The most capable SAR-relevant aircraft on the continent, with ski-landing capability, long range, and cargo capacity for casualty evacuation. However, these aircraft are tasked for science logistics and are not on SAR standby. Diverting an LC-130 for rescue disrupts the entire USAP logistics schedule.

USAF C-17 Globemaster: Capable of landing on compacted snow runways (Phoenix Airfield) but not on ski-drag or unprepared surfaces. Useful for large-scale evacuations from established airfields but not for field rescue.

BAS, RNZAF, and other national program aircraft: Available on an ad hoc, request-and-agreement basis. Response depends on the requesting program, the location of the emergency, and whether the assisting program can spare the aircraft without jeopardizing its own operations.

NGO Contractor Aircraft

Kenn Borek Air Twin Otters and BT-67s: These aircraft are often the first responders to Antarctic field emergencies by virtue of being in the field. Kenn Borek crews have conducted numerous rescues and emergency evacuations, including a notable midwinter evacuation from the South Pole in 2001. However, these are small aircraft with limited passenger capacity and medical capability.

Helicopters

USAP, BAS, and other programs operate helicopters from their stations, but helicopter range is limited (typically 200–300 NM radius with reserves), and operations are highly weather-dependent. Ship-based helicopters from IAATO expedition vessels can assist in the Peninsula region but are not equipped for extended SAR operations.

Maritime Assets

National program icebreakers and research vessels are present during the summer season but are generally too slow to provide timely response to aviation emergencies. Argentine, Chilean, and other navies maintain patrol vessels in the Drake Passage during the austral summer.

11.4 The SAR Gap: Commercial Volume vs. Rescue Capacity

The central problem is one of scale. Antarctic tourism has grown from a few hundred visitors per year in the 1970s to over 105,000 in the 2022–23 season. Aviation activity has expanded from a handful of national program flights to a complex web of widebody intercontinental jets, intracontinental turboprops, expedition ship helicopters, and RPAS. Yet SAR capacity has not grown commensurately.

Consider the worst-case scenario: a widebody aircraft carrying 200+ passengers is forced to make an emergency landing on the Antarctic plateau, hundreds of kilometers from the nearest station. The entirety of Antarctic SAR assets—every LC-130, every Twin Otter, every helicopter—could not evacuate all passengers and crew before exposure, fuel, or weather closed the operational window. No Antarctic operator or national program has contingency plans adequate to a mass-casualty aviation event in the interior.

11.5 Coordination Mechanisms

COMNAP SAR Workshops: COMNAP convenes periodic workshops to exercise SAR coordination procedures among national programs. These workshops identify gaps and test communication protocols, but they cannot create assets that do not exist.

AFIM flight tracking: The AFIM's goal of a "fused air picture" supports SAR by providing awareness of what aircraft are operating where. However, participation by NGO operators is voluntary.

Bilateral and multilateral agreements: Several national programs have formal or informal mutual assistance agreements. The U.S.–New Zealand logistics partnership is the most mature example. However, these agreements generally do not extend to NGO operations without specific arrangements.

Operator self-rescue: ATCM instruments and IAATO standards encourage operators to maintain self-rescue capability and not rely on national program assets. In practice, any serious emergency in the Antarctic interior will require national program involvement.

11.6 Legal Obligations and the Duty to Rescue

International law imposes a general duty to render assistance to persons in danger—a principle embodied in ICAO Annex 12 and the International Convention on Maritime Search and Rescue. In Antarctica, this duty is complicated by the absence of a sovereign authority to enforce it and the practical reality that responding to a rescue may endanger the rescue crew.

The NSF's stated policy makes the tension explicit: the U.S. government will attempt rescue provided there are no unacceptable risks to its own personnel, but it reserves the right to recover all costs and is under no legal obligation to divert military assets from their primary science-support mission.

For NGO operators, the practical takeaway is unambiguous: do not plan an operation that depends on rescue. Carry the equipment, supplies, and insurance to survive and self-evacuate from any foreseeable emergency. Understand that rescue may come—but it is not guaranteed, and it will not be free.

Author's Note: *Antarctic SAR is a patchwork of goodwill, ad hoc coordination, and assets not designed for rescue. The gap between commercial aviation growth and SAR capability is widening. For lawyer-pilots, this means that personal responsibility, thorough preparation, and conservative decision-making are not merely best practices—they are survival strategies.*

SUMMARY: KEY TAKEAWAYS

1. Antarctic sovereignty claims have deep historical roots but remain unresolved. Seven nations claim territory, two reserve the right to claim, and the Treaty freezes—but does not resolve—these disputes.

2. The Antarctic Treaty's Article IV sovereignty freeze removes the jurisdictional foundation upon which the Chicago Convention, ICAO standards, the Montreal Convention, and other international aviation and maritime instruments depend. These conventions apply indirectly through flag state, nationality, and gateway state jurisdiction—but territorial jurisdiction is absent. The IMO Polar Code is the most robust framework, binding on flag states regardless of operating location.

3. The Mount Erebus disaster (1979) remains the defining accident in Antarctic aviation history, demonstrating the lethal intersection of navigational error, organizational failure, and unique Antarctic visual hazards.

4. The ATCM regulatory framework has evolved ad hoc through non-binding Resolutions and unratified Measures, creating a patchwork of standards without enforcement mechanisms.

5. IAATO serves as the de facto standard-setter for commercial Antarctic operations but does not require specific insurance coverage or defined self-rescue capabilities as conditions of membership—a significant gap in the self-regulatory framework.

6. Insurance and contingency planning are essential, but even the best-insured expedition depends on government assets for serious emergencies. The Antarctic Conservation Act and 45 CFR Parts 670–673 impose real obligations with real penalties.

7. The Buzz Aldrin incident demonstrates every link in the evacuation chain and underscores the gap between the self-sufficiency principle and operational reality.

8. National Antarctic Program aviation provides the infrastructure, ATC services, and SAR capability upon which all Antarctic flight operations depend.

9. Contemporary NGO aviation spans three categories—overflights, intercontinental, and intracontinental—each with distinct operational challenges. Intercontinental twin-engine widebody operations represent the most extreme ETOPS scenario in commercial aviation.

10. The widebody revolution has fundamentally changed the scale and nature of Antarctic aviation. The ATCM and national programs must contend with mass-capacity air access to a continent where SAR infrastructure remains scaled for small expedition parties.

11. Search and rescue in Antarctica depends on a patchwork of distant RCCs, ad hoc national program cooperation, and limited assets not designed for SAR. The gap between commercial aviation volume and rescue capacity is the defining safety challenge of contemporary Antarctic operations.

APPENDIX A: GLOSSARY OF ABBREVIATIONS

AAD	Australian Antarctic Division
AAE	Australasian Antarctic Expedition
ACA	Antarctic Conservation Act (16 U.S.C. § 2401 et seq.)
AFIM	Antarctic Flight Information Manual
AIP	Aeronautical Information Publication
ALE	Antarctic Logistics & Expeditions
ASPA	Antarctic Specially Protected Area
ATC	Air Traffic Control
ATCM	Antarctic Treaty Consultative Meeting
BAS	British Antarctic Survey
BT-67	Basler BT-67 (turboprop conversion of the DC-3)
C-17	Boeing C-17 Globemaster III
C-130	Lockheed C-130 Hercules
CASA	Civil Aviation Safety Authority (Australia)
CEE	Comprehensive Environmental Evaluation
CEP	Committee for Environmental Protection
CFR	Code of Federal Regulations
COMNAP	Council of Managers of National Antarctic Programs
DC-10	McDonnell Douglas DC-10
DCJTF-SFA	Deputy Commander, Joint Task Force—Support Forces Antarctica
DHC-6	de Havilland Canada DHC-6 Twin Otter
DoD	Department of Defense (United States)
DS-4131	Department of State Form 4131 (Advance Notification of Antarctic Expedition)
ETOPS	Extended-range Twin-engine Operations Performance Standards
ETP	Equal-Time Point
FAR	Federal Aviation Regulation
FIR	Flight Information Region
GPS	Global Positioning System
GPWS	Ground Proximity Warning System
HF	High Frequency (radio)
IAATO	International Association of Antarctica Tour Operators
ICAO	International Civil Aviation Organization
IEE	Initial Environmental Evaluation
IGY	International Geophysical Year (1957–58)
IL-76	Ilyushin IL-76 (heavy cargo aircraft)
IMO	International Maritime Organization
JRCC	Joint Rescue Coordination Centre
LC-130	Lockheed LC-130 Hercules (ski-equipped)
MARPOL	International Convention for the Prevention of Pollution from Ships
MRCC	Maritime Rescue Coordination Centre

NDB	Non-Directional Beacon
NGO	Non-Governmental Organization / Operator
NIWC	Naval Information Warfare Center Atlantic
NM	Nautical Mile(s)
NOTAM	Notice to Air Missions
NPI	Norwegian Polar Institute
NSF	National Science Foundation (United States)
NZST	New Zealand Standard Time
PNR	Point of No Return
PSR	Point of Safe Return
RAAF	Royal Australian Air Force
RCC	Rescue Coordination Centre
RCCNZ	Rescue Coordination Centre New Zealand
RNZAF	Royal New Zealand Air Force
RPAS	Remotely Piloted Aircraft System(s)
SAF	Sustainable Aviation Fuel
SAR	Search and Rescue
SARPs	Standards and Recommended Practices (ICAO)
SOLAS	International Convention for the Safety of Life at Sea
SRR	Search and Rescue Region
USAF	United States Air Force
USAP	United States Antarctic Program
VMC	Visual Meteorological Conditions
VOR	VHF Omnidirectional Range

APPENDIX B: KEY WEBSITES AND REFERENCES

Treaty System and Governance

Antarctic Treaty Secretariat

https://www.ats.aq
Official repository of the Antarctic Treaty, Protocol on Environmental Protection, ATCM Measures, Resolutions, and Decisions.

ATCM Final Reports and Documents

https://www.ats.aq/devAS/Meetings/DocDatabase
Searchable database of all ATCM meeting documents, working papers, and information papers.

COMNAP (Council of Managers of National Antarctic Programs)

https://www.comnap.aq
Operational coordination among national programs; publishes the Antarctic Flight Information Manual (AFIM) and air operations guidance.

COMNAP Air Operations Information

https://www.comnap.aq/air-operations
AFIM distribution, Antarctic Aviation Workshop reports, and air operations coordination resources.

United States Government

National Science Foundation — Office of Polar Programs

https://www.nsf.gov/geo/opp
Manages the U.S. Antarctic Program (USAP); issues permits under the Antarctic Conservation Act.

NSF Policy on Private Expeditions to Antarctica

https://www.nsf.gov/geo/opp/antarct/treaty/privexp.jsp
Official U.S. policy on cost recovery, emergency assistance, and obligations of non-governmental expeditions.

U.S. Department of State — Antarctic Affairs

https://www.state.gov/key-topics-office-of-ocean-and-polar-affairs/antarctic/
Advance notification requirements (Form DS-4131), U.S. implementation of Antarctic Treaty obligations.

Electronic Code of Federal Regulations — 45 CFR Part 670

https://www.ecfr.gov/current/title-45/subtitle-B/chapter-VI/part-670
Antarctic Conservation Act regulations: permits, prohibited activities, and penalties.

109th Airlift Wing, New York Air National Guard

https://www.109aw.ang.af.mil
Operates LC-130 Hercules ski-equipped aircraft for USAP Antarctic logistics.

International Aviation Organizations

ICAO (International Civil Aviation Organization)

https://www.icao.int
Sets international aviation standards (SARPs), including Annex 12 (Search and Rescue) and the Chicago Convention framework.

ICAO Document Store

https://store.icao.int
Official source for ICAO Annexes, manuals, and standards referenced in Antarctic aviation operations.

International Maritime Organizations

IMO (International Maritime Organization)

https://www.imo.org
Administers SOLAS, MARPOL, the Polar Code, and the International Convention on Maritime Search and Rescue.

IMO Polar Code Information

https://www.imo.org/en/MediaCentre/HotTopics/Pages/Polar-default.aspx
Summary of the International Code for Ships Operating in Polar Waters, mandatory since January 2017.

Industry and Self-Regulatory Organizations

IAATO (International Association of Antarctica Tour Operators)

https://www.iaato.org
De facto standard-setter for commercial Antarctic tourism operations; publishes bylaws, operational guidelines, and visitor statistics.

IAATO Operator Guidelines

https://www.iaato.org/information-resources/operations
Operational standards for vessel, aircraft, and land-based Antarctic tourism operations.

National Antarctic Programs

Antarctic New Zealand

https://www.antarcticanz.govt.nz
New Zealand's national Antarctic program; coordinates RNZAF logistics and Scott Base operations.

Australian Antarctic Division

https://www.antarctica.gov.au
Australia's national program; operates A319 and coordinates RAAF C-17 support.

British Antarctic Survey

https://www.bas.ac.uk
United Kingdom's national program; operates Rothera airfield and contracts Kenn Borek Air.

Norwegian Polar Institute

https://www.npolar.no/en
Norway's polar research institute; operates Troll Station and Troll Airfield.

Search and Rescue Coordination

RCCNZ (Rescue Coordination Centre New Zealand)

https://www.rccnz.govt.nz
SAR coordination for the Ross Sea region and New Zealand–Antarctica corridor.

JRCC Australia

https://www.amsa.gov.au/safety-navigation/search-and-rescue
SAR coordination for the Australian Antarctic Territory sector.

MRCC Chile (Directemar)
https://www.directemar.cl
Chilean maritime authority; SAR coordination for the Antarctic Peninsula and Drake Passage.

New Zealand Government — Erebus Disaster

Royal Commission of Inquiry into the Mount Erebus Disaster
https://www.erebus.govt.nz
New Zealand government archive of the Mahon Royal Commission findings and related documents.

Commercial Operators Referenced

White Desert
https://www.white-desert.com
Luxury Antarctic tourism operator; operates intercontinental flights via Hi Fly A330 to Wolf's Fang.

Antarctic Logistics & Expeditions (ALE)
https://www.antarctic-logistics.com
Adventure tourism operator; IL-76 intercontinental service from Punta Arenas to Union Glacier.

Qantas Antarctic Flights
https://www.antarcticaflights.com.au
Qantas-operated Boeing 787-9 sightseeing overflights of Antarctica.

Kenn Borek Air
https://www.borekair.com
Contract aviation provider; Twin Otter and BT-67 operations for national programs and private operators.

APPENDIX C: KEY STATUTES, TREATIES, AND REGULATIONS

International Treaties and Conventions

The Antarctic Treaty

Signed December 1, 1959, Washington, D.C. Entered into force June 23, 1961. 12 U.S.T. 794; T.I.A.S. No. 4780. Establishes Antarctica as a demilitarized zone reserved for peaceful purposes and scientific research; freezes territorial sovereignty claims under Article IV.

Protocol on Environmental Protection to the Antarctic Treaty (Madrid Protocol)

Signed October 4, 1991, Madrid. Entered into force January 14, 1998. Designates Antarctica as a "natural reserve, devoted to peace and science." Requires environmental impact assessment for all activities. Includes Annex II (Conservation of Antarctic Fauna and Flora), Annex III (Waste Disposal and Waste Management), and Annex V (Area Protection and Management).

Convention on International Civil Aviation (Chicago Convention)

Signed December 7, 1944. 61 Stat. 1180; T.I.A.S. No. 1591. Establishes framework of sovereign airspace (Article 1); each contracting state has complete and exclusive sovereignty over its airspace. Does not apply conventionally in Antarctica due to the sovereignty freeze.

Convention for the Unification of Certain Rules for International Carriage by Air (Montreal Convention)

Signed May 28, 1999, Montreal. S. Treaty Doc. No. 106-45. Successor to the Warsaw Convention (1929). Governs air carrier liability for passenger injury/death and cargo damage. Applies through contract of carriage (places of departure, destination, carrier's domicile).

Warsaw Convention

Signed October 12, 1929, Warsaw. 49 Stat. 3000; T.S. No. 876. Original international air carrier liability regime, largely superseded by the Montreal Convention (1999) but still applicable to states not party to Montreal.

International Convention for the Safety of Life at Sea (SOLAS)

Original 1974; amended. Chapter XIV (adopted 2014, effective January 1, 2017) makes the Polar Code mandatory for vessels operating in polar waters.

International Convention for the Prevention of Pollution from Ships (MARPOL)

Annexes I and II amended to incorporate Polar Code environmental provisions, effective January 1, 2017.

International Code for Ships Operating in Polar Waters (Polar Code)

Adopted by IMO, mandatory since January 1, 2017 under SOLAS Chapter XIV and MARPOL Annexes I and II. Binding on flag states regardless of operating location. Governs ship design, construction, equipment, manning, training, and environmental protection in polar waters south of 60°S.

International Convention on Maritime Search and Rescue (Hamburg Convention)

Signed April 27, 1979, Hamburg. Establishes global SAR framework; allocates SAR regions to responsible states. Antarctic SAR regions allocated to New Zealand, Chile, Argentina, South Africa, and Australia.

Convention on International Interests in Mobile Equipment (Cape Town Convention)

Signed November 16, 2001, Cape Town. Applies based on states of registration and debtor/creditor location, not operational location of aircraft.

Convention on Offences and Certain Other Acts Committed on Board Aircraft (Tokyo Convention)

Signed September 14, 1963, Tokyo. Jurisdiction based on state of aircraft registration.

Convention for the Suppression of Unlawful Seizure of Aircraft (Hague Convention)

Signed December 16, 1970, The Hague. Jurisdiction based on state of registration, state of landing, and state of the operator.

Convention for the Suppression of Unlawful Acts against the Safety of Civil Aviation (Montreal Offenses Convention)

Signed September 23, 1971, Montreal. Jurisdiction based on state of registration, state of the operator, and state of landing.

United States Federal Statutes

Antarctic Conservation Act of 1978

16 U.S.C. §§ 2401–2412. Implements the Protocol on Environmental Protection for U.S. persons. Prohibits taking native species, harmful interference with wildlife, entry into Antarctic Specially Protected Areas, and introduction of non-indigenous species without permit. Penalties: up to $34,457 per violation (civil); up to one year imprisonment (criminal).

Antarctic Science, Tourism, and Conservation Act of 1996

16 U.S.C. §§ 2401 note. Amended the Antarctic Conservation Act to implement the Madrid Protocol and extend regulatory authority over U.S. non-governmental expeditions.

United States Federal Regulations

45 CFR Part 670 — Conservation of Antarctic Animals and Plants

Implementing regulations for the Antarctic Conservation Act. Establishes the permit system for activities affecting Antarctic flora and fauna, including aviation operations near wildlife and protected areas.

45 CFR Part 671 — Waste Regulation

Regulations governing waste management in Antarctica for U.S. persons and expeditions, including fuel handling and spill remediation requirements.

45 CFR Part 672 — Enforcement and Hearing Procedures

Administrative enforcement procedures for violations of the Antarctic Conservation Act regulations.

45 CFR Part 673 — Non-Governmental Activities in Antarctica

Requirements for U.S. non-governmental expeditions, including advance notification, environmental assessment, contingency planning, and waste management obligations.

40 CFR Part 8 — Environmental Impact Assessment of Nongovernmental Activities in Antarctica

EPA regulations requiring environmental impact assessment for non-governmental Antarctic activities.

United States Executive Instruments

Presidential Memorandum 6646 (1982)

Assigns the National Science Foundation lead agency responsibility for managing the U.S. Antarctic Program, with Department of Defense providing logistics support.

NSF/DoD Memorandum of Agreement

Governs the provision of military logistics support (including C-17 and LC-130 airlift) to the U.S. Antarctic Program under civilian NSF authority.

ATCM Instruments Referenced in This Briefing

Recommendation XVIII-1 (1994)

First comprehensive ATCM instrument addressing Antarctic tourism. Established the foundational principle that tourist activities must comply with the Antarctic Treaty and Environmental Protocol.

Measure 4 (2004) — Insurance and Contingency Planning

NOT YET IN FORCE. Requires operators to demonstrate appropriate insurance and contingency plans not reliant on other operators or national programs without express written agreement.

Resolution 4 (2004)

Non-binding parallel to Measure 4 on insurance and contingency planning.

Resolution 6 (2017)

Updated non-binding guidance on insurance and contingency planning, incorporating Polar Code references.

Resolution 4 (2007) — Ship-Based Tourism

Recommends discouraging landings from vessels carrying more than 500 passengers; establishes 1:20 guide-to-passenger ratio and 100-passenger shore limit.

Resolution 5 (2007)

Recommends discouraging tourism that may substantially degrade the Antarctic environment.

Resolution 7 (2009) — General Principles of Antarctic Tourism

Establishes that scientific research takes priority over tourism operations.

Decision 6 (2019) — Manual of Regulations

Created the Manual of Regulations and Guidelines compiling all relevant ATCM instruments into a single reference.

Resolution 5 (2022) — Permanent Tourism Facilities

Recommends preventing construction of multi-season tourism facilities with more than minor or transitory environmental impact.

Resolution 3 (2022) — Air Operations and AFIM

Recommends that all operators be provided the AFIM; acknowledges that increased air activity increases risks and strains national program SAR capacity.

Resolution 4 (2023) — Urgent Measures on Tourism

Recommends discontinuing off-ship activities from vessels with 500+ passengers and helicopter recreational use in wildlife areas.

Flying in Antarctica

Legal Framework and Operational Considerations
February 2026 — Mark Doll, Esq.

Agenda

1	Early History of Antarctic Exploration & Aviation
2	The Antarctic Treaty & Governance
3	Overflight Tourism & the Mount Erebus Disaster
4	ATCM Resolutions on Aviation & Tourism
5	The IAATO Framework
6	Operational Requirements & Restrictions
7	Insurance Requirements & Cost Recovery
8	Case Study: The Buzz Aldrin Evacuation
9	National Antarctic Program Aviation
10	Contemporary NGO Aviation
11	Search and Rescue & Rescue Coordination Centers

Biography

Part 1

Early History of Antarctic Exploration

Contested Discovery (1820s)

- Russian Expedition (Jan 27, 1820): Bellingshausen sighted Fimbul Ice Shelf — basis for Russia's "reserved rights" position
- British Expedition (Jan 30, 1820): Bransfield sighted Trinity Peninsula — supports UK claim to British Antarctic Territory
- American Expedition (Nov 1820): Palmer sighted Palmer Peninsula — contributed to U.S. "reserved rights" position
- Competing discovery claims set up the multi-layered sovereignty disputes the Antarctic Treaty had to navigate

Legal Doctrines of Sovereignty

- Discovery Doctrine: Inchoate title from first sighting — weak basis when multiple nations claim priority
- Effective Occupation: Required settlement and governmental authority — impractical in Antarctic conditions
- Sector Theory: Projected national boundaries southward to the Pole — created triple overlap on Antarctic Peninsula
- Hughes Doctrine (1924): U.S. position that discovery without settlement cannot establish sovereignty
  - Foreshadowed U.S. decision never to formalize any Antarctic claim

Early Aviation Before the Treaty

- Scott balloon; Mawson air tractor
- Wilkins (1928): First Antarctic flight — Lockheed Vega from Deception Island over the Peninsula
- Byrd (1929): First flight over the South Pole — Ford Trimotor, 18 hrs 41 min
- Ellsworth (1935): First trans-Antarctic flight (~2,200 mi) — claimed territory for U.S.; never formalized
- Operation Highjump (1946–47): 4,700 personnel, 33 aircraft, 70,000 aerial photos — raised militarization concerns
- International Geophysical Year (1957–58): 67 nations, permanent stations, proved cooperation worked — led directly to the Antarctic Treaty

Part 2

The Antarctic Treaty & Governance

Who Owns Antarctica?

- Seven nations assert formal territorial claims: UK (1908), NZ (1923), France (1924), Australia (1933), Norway (1939), Chile (1940), Argentina (1943)
- Australia's claim is the largest — ~42% of the continent
- Antarctic Peninsula: triple overlap (Argentina, Chile, UK) between 20°W and 80°W
- U.S. and Russia maintain "reserved rights" — neither claims nor recognizes claims
- Jurisdictional nightmare: multi-national aircraft incident in overlapping claim zones — no clear answer on which law applies

Treaty Basics

- Signed December 1, 1959; entered into force June 23, 1961 — now 56 parties, 29 Consultative Parties
- Article I — Peaceful Purposes Only: Military assets MAY operate for logistics/science (e.g., LC-130s under NSF authority)
- Article IV — Sovereignty Freeze: Claims neither recognized nor renounced; no universally recognized airspace authority
- Article VII(5) — Advance Notification: All expeditions require notice; U.S. persons file Form DS-4131 (3 months prior)
- Madrid Protocol (1991): Antarctica designated a "natural reserve" — requires EIAs for all activities including aviation
- COMNAP: Manages AFIM, convenes Aviation Workshops, coordinates inter-program operations

International Conventions in the Treaty Area

- Core problem: Conventions assume sovereign states exercising territorial jurisdiction — Article IV removes that foundation
- **Chicago Convention**: No state issues approach plates, provides mandatory ATC, or certifies airfields; operators default to flag state regulations
- I**CAO**: Antarctica is not within any Flight Information Region; AFIM substitutes for an AIP but lacks ICAO status
- **Montreal Convention**: Applies through contract of carriage for intercontinental flights; jurisdictional uncertainty for Antarctic-only segments
- **IMO Polar Code**: Most robust framework — binding on flag states regardless of operating location

Three Indirect Mechanisms

- Flag state jurisdiction — state of aircraft or vessel registration
- Nationality jurisdiction — state of operator, crew, or passengers
- Gateway state jurisdiction — departure and arrival points outside the Treaty area
- What is missing: Territorial jurisdiction — the primary enforcement layer everywhere else on Earth
- Result: The most dangerous operating environment has the weakest jurisdictional framework

Part 3

Overflight Tourism & the Mount Erebus Disaster

Birth of Overflight Tourism (1977)

- Air New Zealand (DC-10) and QANTAS (747) launched simultaneous sightseeing flights over Antarctica
- Flights descended as low as 2,000 ft over McMurdo Sound; expert guides provided live commentary
- Air New Zealand operated 1977–1979 from Auckland; tickets ~NZ$359/person
- Sir Edmund Hillary among onboard guides

The Mount Erebus Disaster (Nov 28, 1979)

- Air New Zealand Flight TE901 (DC-10) struck Mt. Erebus at 1,465 ft — all 257 killed
- Root cause: Navigation section changed flight coordinates the morning of the flight without notifying the crew
- Original route: McMurdo Sound, clear of terrain. Amended route: directly over Ross Island
- Sector whiteout made the rising slope invisible; GPWS activated seconds before impact
- Royal Commission (Justice Mahon): "An orchestrated litany of lies" by airline executives
- Aftermath: Air NZ ceased Antarctic flights permanently; Qantas suspended 15 years

Part 4

ATCM Resolutions on Aviation & Tourism

Key ATCM Instruments

- Recommendation XVIII-1 (1994): First comprehensive tourism instrument — activities must comply with Treaty & Protocol
- Measure 4 (2004): Insurance & contingency planning — NOT YET IN FORCE (requires ratification by all Consultative Parties)
- Resolution 4 (2007): Discourage landings from vessels with 500+ passengers; 1:20 guide ratio; 100-passenger shore limit
- Resolution 7 (2009): Scientific research takes priority over tourism
- Resolution 4 (2023): Discourage off-ship activities from 500+ pax vessels; restrict recreational helicopter use near wildlife
- Resolution 3 (2022): Recommends all operators receive AFIM; acknowledges increased air activity brings increased risk

The Enforcement Gap

- Resolutions are non-binding — they articulate principles but lack compulsion
- Measures carry legal weight but remain unratified (consensus requirement)
- Decision 6 (2019): Manual of Regulations compiles instruments into one reference — helpful but still non-binding
- Central takeaway: Sound principles exist, but no mechanism for enforcement
- Consensus-based ATCM decision-making is slow relative to commercial growth

Part 5

The IAATO Framework

IAATO: Overview & Membership

- Founded 1991 by seven operators; registered in Rhode Island; 100+ member companies
- Membership is voluntary — non-members not bound by its standards
- Seven operator categories: vessels (13–200 pax, 201–500 pax, 501+ cruise-only), land ops, air ops, air/cruise, sailing/motor ≤12 pax
- Requirements: suitable equipment, contingency plans, experienced staff (80% relevant, 50% Antarctic), post-visit reporting
- Aviation-specific: experienced ground handling staff, liaise with national programs, incorporate IAATO procedures

IAATO: Significance & Limitations

- Consistently held up by ATCM as the model of responsible self-regulation
- Contributions: flight schedule coordination, ship-based helicopter standards, data-sharing with COMNAP, vessel tracking
- Enforcement: Compliance Committee can reprimand/probate/expel — but triggered by complaints, not proactive auditing
- Mandatory Observation Scheme: observer on new operators' first season; every 5 years thereafter
- Critical limitation: Only binds members — non-member operators (growing concern) are not subject to IAATO standards

Part 6

Operational Requirements & Restrictions

Operational Requirements (U.S. Operators)

- Antarctic Conservation Act (16 U.S.C. § 2401 et seq.) — unlawful for U.S. citizens to conduct certain activities without a permit
- Penalties: Up to ~$34,457/violation + 1 year imprisonment; civil penalties accrue per violation per day
- Advance Notification: Form DS-4131, 3 months prior, including aircraft type, registration, routes, dates
- Environmental Impact Assessment: Three levels — Preliminary, IEE, or CEE (most aviation ops require at least an IEE)
- Wildlife Protection: Fixed-wing altitude minima over bird/mammal concentrations; stricter helicopter limits; ASPA overflight restrictions
- Waste Management: Remove all waste; report and remediate fuel spills; "clean as you go" principle

Part 7

Insurance Requirements & Cost Recovery

Insurance Landscape

- Requirements emerge from multiple sources: ATCM instruments, 45 CFR Part 673, gateway country requirements, practical necessity
- No single comprehensive mandate exists
- Policies must specifically reference Antarctica and cover: injury, medical, repatriation (to home country), air evacuation, pre-existing conditions, SAR cost recovery
- Coverage should extend for duration of operations plus a reasonable period for contingencies

Evacuation Costs & Cost Recovery

- Field camp to station: $10,000–$50,000
- Station to Gateway City: $100,000–$300,000+
- Specialized medical evacuation: Can exceed $500,000
- LC-130 flight: ~$60,000–$80,000 per flight hour
- NSF policy: "Unable to offer support to private expeditions" — will attempt rescue if no unacceptable risk to own personnel
- NSF reserves right to recover all direct and indirect costs

The IAATO Insurance Gap

- IAATO does NOT impose specific insurance requirements as a condition of membership
- April 2025 Bylaws are silent on insurance — Article X never mentions it
- Guidance for Organizers: Operators should "consider" insurance — not "obtain," "maintain," or "demonstrate"
- Contingency plans required but undefined: no minimum standards, no submission for review
- Major operators carry comprehensive insurance because commercial reality demands it — not because IAATO requires it
- Paradox: IAATO is stronger on environmental/wildlife protocols than on insurance and self-rescue

Part 8

Case Study: The Buzz Aldrin Evacuation

The Buzz Aldrin Incident (Nov 2016)

- Aldrin (age 86) traveled with White Desert — became oldest person to reach the South Pole
- Experienced shortness of breath at Amundsen-Scott Station; lung congestion with low O_2 saturation (altitude ~9,301 ft)
- Evacuation chain: South Pole → McMurdo (LC-130, ~840 NM) → Christchurch (~2,415 NM) → U.S.
- Neither Aldrin nor his manager initially knew he had travel insurance — Seven Corners provided coverage through the White Desert package
- Illustrates why obligation is on the OPERATOR to ensure coverage, not individual participants

Broader Implications

- Even a well-planned expedition (White Desert: embedded medical staff) ultimately depended on national program assets
- Central tension: Commercial operators bring paying tourists with implicit understanding that government programs will provide emergency support
- 105,000+ tourists per season — frequency and cost of incidents will only increase
- Crystallizes the gap between self-sufficiency principles and operational reality

Part 9

National Antarctic Program Aviation

USAP Aviation — The Backbone

- Managed by NSF under Presidential Memorandum 6646; DoD provides logistics support
- Intercontinental: USAF C-17, RNZAF C-130/757, NY ANG LC-130H (only ski-equipped heavy-lift aircraft in the world)
- Intracontinental: Contracted Basler BT-67, Twin Otter, helicopters
- Three McMurdo-area airfields: Williams Field (snow skiway), Phoenix (compacted snow/wheeled), historically Pegasus (blue ice)
- ATC: NIWC manages USAP airspace; McMurdo Center on HF; all airfields Prior Permission Required

Other National Programs

- BAS (UK): 900m gravel runway at Rothera; contracts Kenn Borek Air for deep-field ops
- Norwegian Polar Institute: Troll Airfield — now a major hub for widebody jet ops (787-9, 767 charters)
- Antarctic New Zealand: Coordinates with RNZAF for C-130/757 airlift
- Russia: Aviation at Novolazarevskaya
- Argentina & Chile: C-130 logistics from King George Island on the Antarctic Peninsula
- Cross-program coordination through COMNAP Air Operations Expert Group, Aviation Workshops, and AFIM
- National program aviation provides the infrastructure and safety net upon which ALL other Antarctic flying depends

Part 10

Contemporary NGO Aviation Activities

Three Categories of NGO Aviation

- 1. Antarctic Overflights: Sightseeing flights transiting Treaty Area without landing (Qantas) — highest volume by passengers
- 2. Intercontinental Flights: Gateway cities to Antarctic landing sites (White Desert, ALE) — highest operational complexity
- 3. Intracontinental Flights: Within Antarctica, connecting stations to interior camps (Kenn Borek, ALE) — highest environmental exposure

Antarctic Overflights — QANTAS

- Resumed 1994 under "Antarctica Flights" brand (15-year suspension post-Erebus)
- Boeing 787-9 Dreamliners; 2025–26 season: 7 departures from Melbourne, Sydney, Brisbane, Perth
- ~9,500–10,500 km round trip; 12–14 hours; 3–4 hours over Antarctica as low as 2,000 ft
- 19 different flight plans based on weather; passengers swap seats at midpoint
- Unique regulatory position: No landing = different permitting; no ATCM instrument governs overflight-only ops
- Governed primarily by CASA (flag state) and operator's own standards

Intercontinental Flights — Gateway Routes

- Cape Town → Queen Maud Land: ~2,270 NM, 5–5.5 hrs (Hi Fly A330/A340; Norse Atlantic 787-9)
- Punta Arenas → Ellsworth Mtns: ~1,675 NM, 4–4.5 hrs (ALE IL-76)
- Christchurch → Ross Sea: ~2,080 NM (primarily USAP/RNZAF military/government flights)
- Weather is the single greatest operational variable — conditions can change from VMC to below minimums within hours
- Blue ice operations: typically require 5,000m vis / 1,500 ft ceilings; no precision approaches
- Season: November–February only; constrained by daylight, ice temps, forecasting support

ETOPS & Point of Safe Return

- Near-total absence of diversion airfields between gateway cities and Antarctica
- Twin-engine widebody ops (A330, 787-9) require ETOPS certification — among most extreme ETOPS scenarios in commercial aviation
- Dec 2025: A330 twin-engine widebody replaced A340 quad-engine for Wolf's Fang — significant risk profile shift
- Point of Safe Return (PSR): Position beyond which aircraft cannot return to departure with required reserves
- "Boomerang" protocol: Continuously update PSR; return if weather deteriorates before PSR; committed after PSR
- Critical decision window typically 2–3 hours into flight

Antarctic Runways

- Blue Ice Runways: Wind-scoured glacial ice; supports 200+ ton aircraft; softens above ~-5°C; 22-hr grooming cycle (Wolf's Fang)
- Compacted Snow Runways: Phoenix Airfield — supports wheeled C-17 ops; intensive maintenance required
- Ski-Drag Runways: Williams Field and field camps — ski-equipped aircraft only (LC-130, Twin Otter, BT-67)
- No Antarctic runway has precision instrument approach capability
- All approaches GPS-based or visual; lighting minimal or absent; daylight ops only
- NOTAMs informal — conditions communicated directly rather than through standard ICAO distribution

The Widebody Revolution

- 2019: Boeing 767 (Titan) — first widebody in Antarctica
- 2021: A340 (Hi Fly) at Wolf's Fang
- 2022: Boeing 767 (Loftleiðir) at Troll
- 2023: Boeing 787-9 (Norse Atlantic) at Troll — first Dreamliner
- 2025: A330 (Hi Fly) at Wolf's Fang — twin-engine widebody
- Implications: 200+ pax per flight, twin-engine risk with no diversions, 200-ton aircraft on ice runways, and a widebody incident would exceed all existing contingency planning

Intracontinental Operations

- Kenn Borek Air (Calgary): Largest global Twin Otter operator; dominant Antarctic contract aviation provider
- ALE: Twin Otters and BT-67s from Union Glacier to South Pole, Vinson Massif, and field locations
- Ship-based helicopters: Passenger transfers and sightseeing on Antarctic Peninsula
- Hazards: Katabatic winds, flat-light/whiteout, temps to -40°C+, HF-only comms, GPS-dependent nav
- AFIM: COMNAP-managed, published 3x per season; closest equivalent to an AIP; goal is a "fused air picture"

Part 11

Search and Rescue & Rescue Coordination Centers

SAR Framework: No Dedicated Rescue Authority

- Antarctica is the only continent with NO sovereign authority responsible for search and rescue
- No central SAR coordinating body with command authority
- No dedicated SAR aircraft or vessels on standby
- No mandatory response obligations enforceable by law
- No standardized SAR procedures with guaranteed response times
- What exists: Cooperative framework built on goodwill, agreements, and the practical reality that programs will generally try to help

Rescue Coordination Centers

- RCCs are all thousands of kilometers from the continent — they coordinate but cannot directly respond
- RCCNZ (Wellington): Ross Sea / McMurdo; primary for USAP emergencies
- MRCC Chile (Punta Arenas): Antarctic Peninsula / Drake Passage; ALE corridor
- MRCC Argentina (Ushuaia): Shares Peninsula responsibility; closest military SAR to northern Peninsula
- MRCC South Africa (Cape Town): Queen Maud Land approaches; White Desert / NPI corridor
- JRCC Australia (Canberra): Australian Antarctic Territory — over 3,000 km from the Antarctic coast

Available SAR Assets

- LC-130 Hercules (109th AW): Most capable, ski-landing, long range — but NOT on SAR standby; diversion disrupts USAP logistics
- C-17 Globemaster: Compacted snow only; useful for established airfield evacuations, not field rescue
- BAS, RNZAF, other national programs: Ad hoc, request-and-agreement basis only
- Kenn Borek Twin Otters/BT-67s: Often first responders by virtue of being in the field; small capacity
- Helicopters: 200–300 NM radius; highly weather-dependent
- Maritime assets: Too slow for timely aviation emergency response

The SAR Gap

- Tourism: from hundreds/year (1970s) to 105,000+ (2022–23) — SAR capacity has not grown commensurately
- Worst case: Widebody with 200+ pax forced landing on the plateau — ALL Antarctic SAR assets could not evacuate before conditions close
- No operator or national program has contingency plans adequate for a mass-casualty aviation event in the interior
- COMNAP SAR Workshops: Identify gaps and test comms — cannot create assets that don't exist
- AFIM flight tracking supports SAR awareness — but NGO participation is voluntary
- NSF: Will attempt rescue if no unacceptable risk; reserves right to recover all costs; no legal obligation to divert military assets

Key Takeaways

- Sovereignty claims unresolved — Treaty freezes but does not resolve disputes
- Chicago Convention does not apply conventionally — conventions apply indirectly through flag state, nationality, and gateway jurisdiction
- Mt. Erebus (1979) remains the defining accident — navigational error, organizational failure, Antarctic visual hazards
- ATCM framework: non-binding Resolutions + unratified Measures = standards without enforcement
- IAATO: de facto standard-setter but no insurance or self-rescue requirements for membership
- Insurance essential — but even best-insured expeditions depend on government assets for serious emergencies
- National program aviation is the infrastructure upon which ALL Antarctic flight depends
- Widebody revolution has fundamentally changed scale — SAR capacity has not kept pace
- SAR is a patchwork of goodwill and ad hoc cooperation — no guaranteed rescue in Antarctica

Questions?