

IceCube Upgrade Logistics Overview, Assumptions, and Philosophy

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WBS 1.2

Upgrade Logistics Review
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Speaker Bio

- IceCube Upgrade Implementation Manager
- South Pole Station Operations Manager 2014-2020,
 - managed vehicle maintenance, equipment operations, flight operations, fuels, survey, and waste departments
 - Assisted with planning and implementing contractor support for science projects including SpiceCore, ARA, & Bicep Upgrade
 - Lead planner/implementer for South Pole Retrograde Initiative (SPRI)
- 11 Austral summer seasons at the South Pole and 2 deployments to Summit Station in Greenland
- Involved in remote operations/construction for 14 years in Northern Maine, Alaska, Greenland, and Antarctica
- Educational background: Automotive Technology, Engineering, Resource Management, and Circumpolar Studies



Overview

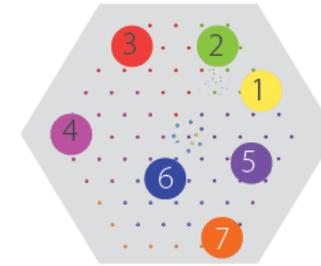
- IceCube-Gen1 cargo and logistics
- Current USAP logistics
- IceCube Upgrade cargo estimating methodology
- IceCube Upgrade cargo philosophy/assumptions

IceCube-Gen1 by the numbers

- 4.7 million pounds of cargo shipped over eight seasons FY04 – FY11
 - 1.2 million pounds comprised of drill components
 - Average 628,000 pounds per season with peak of 1.1 million pounds in 2004-05
 - Tie down equipment roughly 450k lbs
 - 500k of contractor support materials
 - Remaining 2.25 million pounds sensors, cables and support equipment/materials
 - Fuel & people not included
- Population
 - Peak populations averaged between 46-50
 - Frequently used double deployments (rotating staff)

Detector Construction

7 seasons of construction, 2004-2011



28,000 person-days to complete construction, or 77 years of continuous work



4.7 million pounds of cargo shipped, 1.2 million of which was the drill



48 hours to drill and 11 hours to deploy sensors per hole



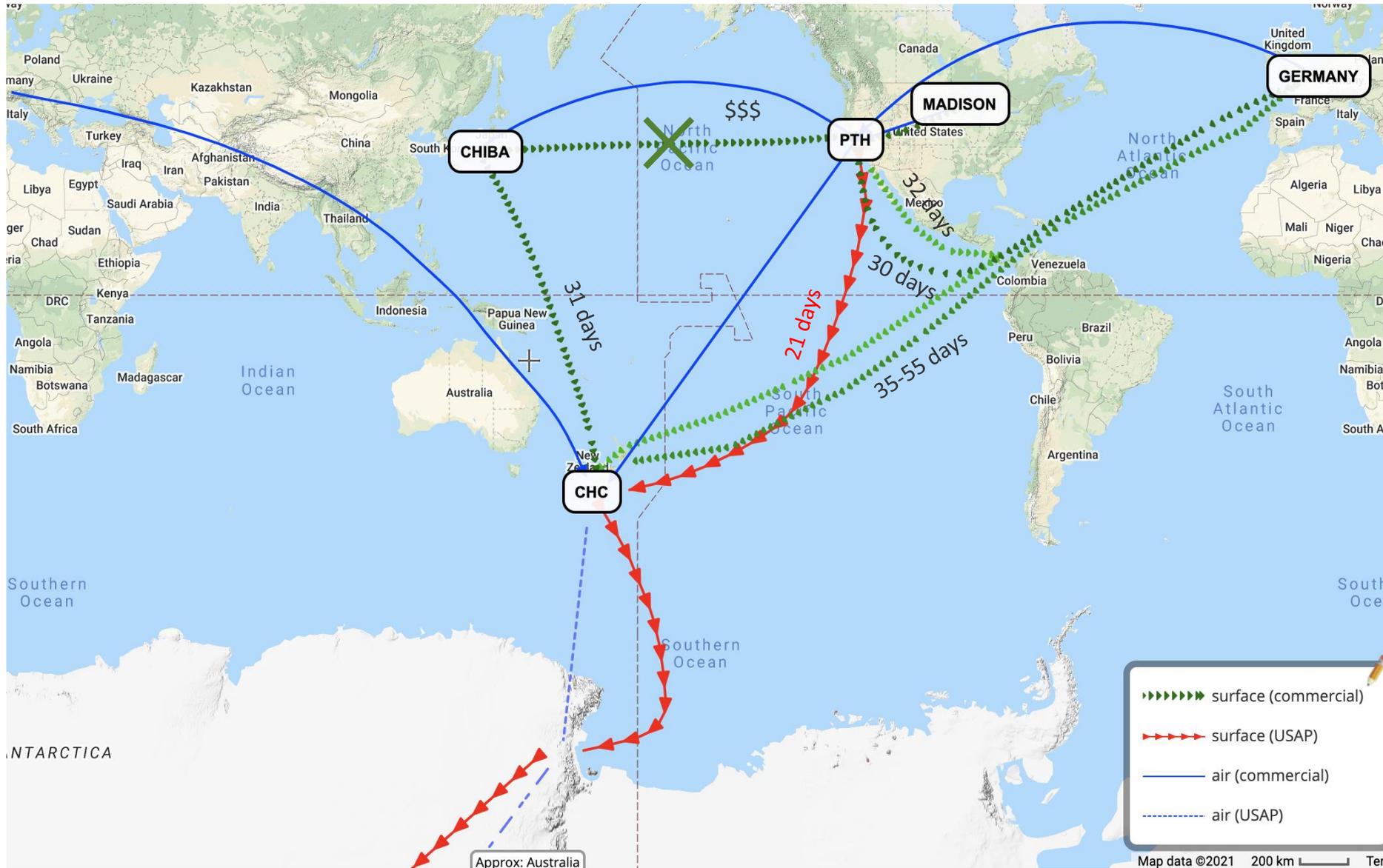
4.7 megawatts of drill thermal power with 200 gallons of water per minute delivered at 88 °C and 1,000 psi

IceCube-Gen1 logistics overview

- All cargo was shipped through Port Hueneme, CA including international shipments departing Germany and Sweden
- Majority of cargo was shipped from Port Hueneme to Christchurch, NZ by commercial surface/air and then to McMurdo by C-141/C-17 aircraft
- There were between 250-350 LC-130 missions to Pole each season
- Shipping containers were accepted for air transport at that time
 - Generator modules and Mobile Drilling Structures (MDS) that make up much of the Enhanced Hot Water Drill were flown
- South Pole overland traverse was still under development, so the LC-130 was only option for cargo movement to station

Current USAP logistics

- USAP cargo system entry site can differ for continental & international shipments
 - Port Hueneme, CA/Lyttelton, NZ
- Summer heavy airlift (SAAM) gap, mid-November/end-January, no C-17 missions flown
 - During this period, NYANG LC130s are the primary link to New Zealand
 - South Pole will see fewer missions as the LC-130s service the north/south intercontinental leg
- The USAP cargo vessel is the preferred mode of transport as it moves cargo directly to McMurdo, minimizing air transportation needs
- The number of LC-130 missions from McMurdo to the South Pole during the summer season now ranges between 80 and 90
 - The Air National Guard no longer accepts full containers
- Overland cargo movement emerging as an option as SPoT adds cargo capacity
 - Cargo containers could travel from their point of origin to the South Pole without being unloaded and repacked



Logistics Philosophy

- Reduce waste
- Minimize surplus materials while maintaining adequate maintenance and repair supplies
- Design systems/components with shipping in mind
- Maximize USAP vessel use and overland transport to the South Pole
- Minimize storage time, where possible
- Minimize touch points, particularly in McMurdo
- Pack institution-owned intermodal shipping containers at point of origin when feasible
- Continuous look to increase logistics efficiencies with ongoing process improvement

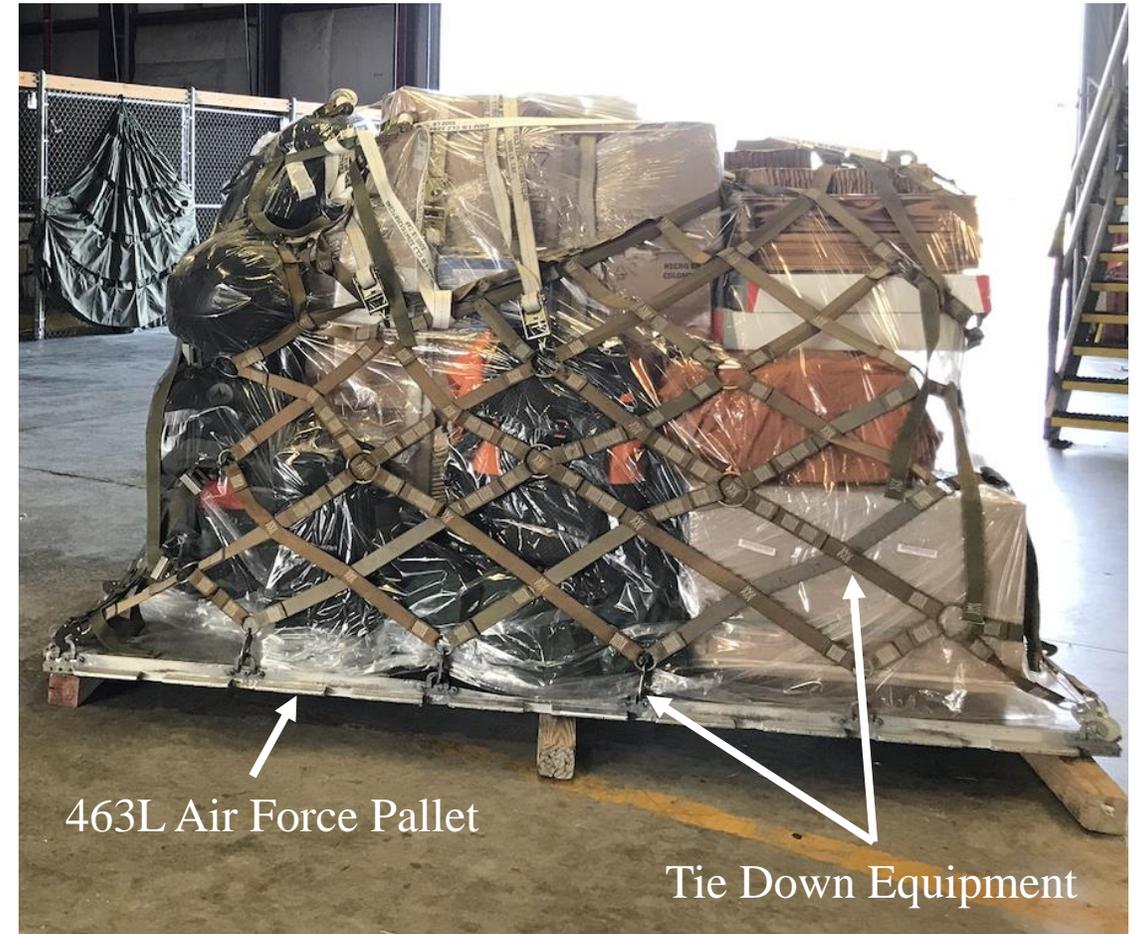
USAP Transportation and Logistics Assumptions

- USAP resupply vessel departs annually (mid-Dec.), arrives in McMurdo (early Feb.) is the preferred method of transport
 - Special Airlift Assignment Missions (SAAM) shipments limited to sensitive equipment and seasonal resupply
- COMSUR shipping can provide cargo movements from international locations and the continental US outside the resupply vessel timeline
 - Cargo will be delivered to Lyttelton, NZ for loading onto the USAP resupply vessel (preferred) or delivered to the Christchurch Air Cargo Yard for SAAM shipment (if no other option)
- COMAIR is to be used only for sensitive cargo or urgent resupply –
 - Permission for use of COMAIR is granted through the contractor by NSF
- Very little 'Do Not Freeze storage' is available at either McMurdo or the South Pole
- McMurdo to South Pole leg
 - overland transport preferred
 - fewer LC missions during gap – plan accordingly
- Modular shipping approach
 - As much as possible, cargo should be loaded in 20' Intermodal shipping containers prepared for overland transport
 - Cargo inside containers should be packaged in crates that work well with 463L palletization when possible

Key Component: Air Force pallet

463L Air Force Pallet

- External dimensions are: 108"W X 88"L X 2.25"H
- Pallet weight: 300 lbs
- Max load capacity 9700 lbs (including tie down equipment)
- 463L pallets can be linked together into pallet trains up to 5 pallets long (LC-130) - requires special handling so it should be avoided if possible
- Max usable footprint (T1 pallet)*: 102" W x 88" L
- Max usable footprint (T2 pallet)*: 102" W x 176" L
- *includes 6-inch walkway on W dimension (108" → 102")
- Max height of 102" H (96" is preferred for loading ease)
- The dimensions above INCLUDE user provided wood/plastic pallet



[HTTPS://WWW.AARCORP.COM/463L-HCU-6/E-PALLET/](https://www.aarcorp.com/463L-HCU-6/E-PALLET/)

Key Component: USAP Airlift

- SAAM (C17)
 - Heavy airlift link to New Zealand for passengers and cargo
 - Two flight periods at beginning and end of summer season
 - 1st in October – 1st week in November
 - 1st week in February – end of February
 - Pallet positions in heavy demand w/ station critical items prioritized



Key Component: USAP Airlift

- LC-130
 - Primary airlift to South Pole for cargo and passengers (also delivers fuel)
 - Roughly 80-90 flights per year (changes based on need and availability annually) between November 1 and February 15.
 - Fewer flights during “the gap”, the time between SAAM flight periods



Key Component: Intermodal containers

- 20' shipping containers
 - Can be loaded onto trucks, vessels, C17 aircraft and South Pole Traverse
 - Intermodal shipping reduces cargo handling, improves security, reduces damage/loss, and allows freight to be transported faster
 - Fairly low cost



Key Component: South Pole overland Traverse (SPoT)

- 3 traverses each year – primary mission hauling fuel
 - SPoT 1 – generally arrives by Thanksgiving
 - SPoT 2 – arrives between Christmas and New Years
 - SPoT 3 – generally arrives in 3rd week of January
- Overland cargo movement relatively new and still in development
 - Containerized cargo and large components well suited for overland transport
 - Do Not Freeze (DNF) and other sensitive components/materials not well suited



Questions?

Back-up slides

IceCube equipment per season

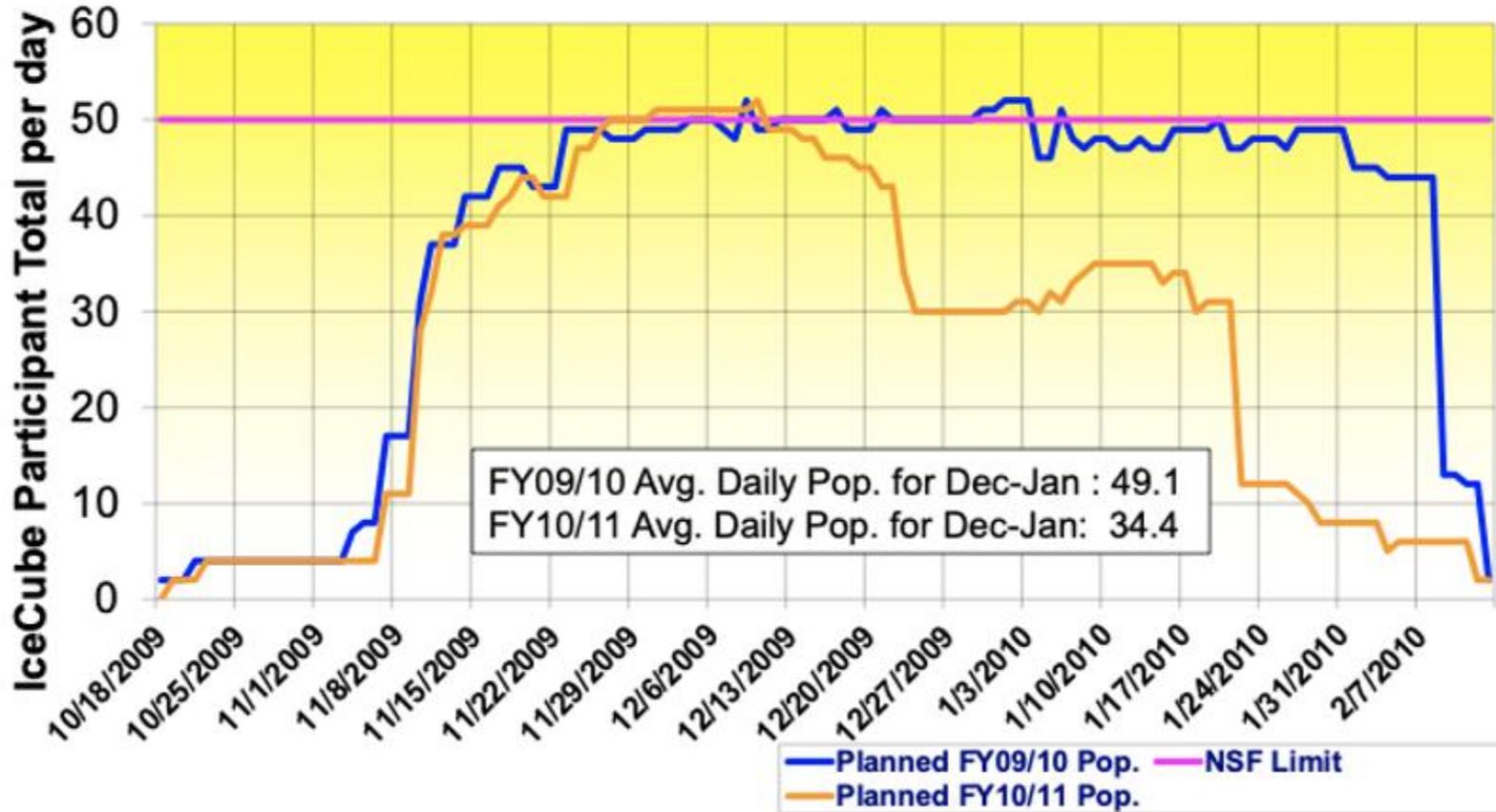
Season	IceCube	RPSC	Total	TDE	Total
03-04	65,833	16,515	82,348	8,729	91,077
04-05	800,673	171,092	971,765	103,007	1,074,772
05-06	517,524	153,784	671,308	71,159	742,467
06-07	512,112	105,994	618,106	65,519	683,625
07-08	501,063	27,861	528,924	56,066	584,990
08-09	561,665	10,732	572,397	60,674	633,071
09-10	534,190	20,058	554,248	58,750	612,998
TOTAL	3,493,060	506,036	3,999,096	423,904	4,423,000

TDE = 10.6%

*weights do not include fuel, people, etc.



FY09/10 v. FY10/11 IceCube Daily NPX Population



FY09/10 IceCube Daily Population at South Pole

