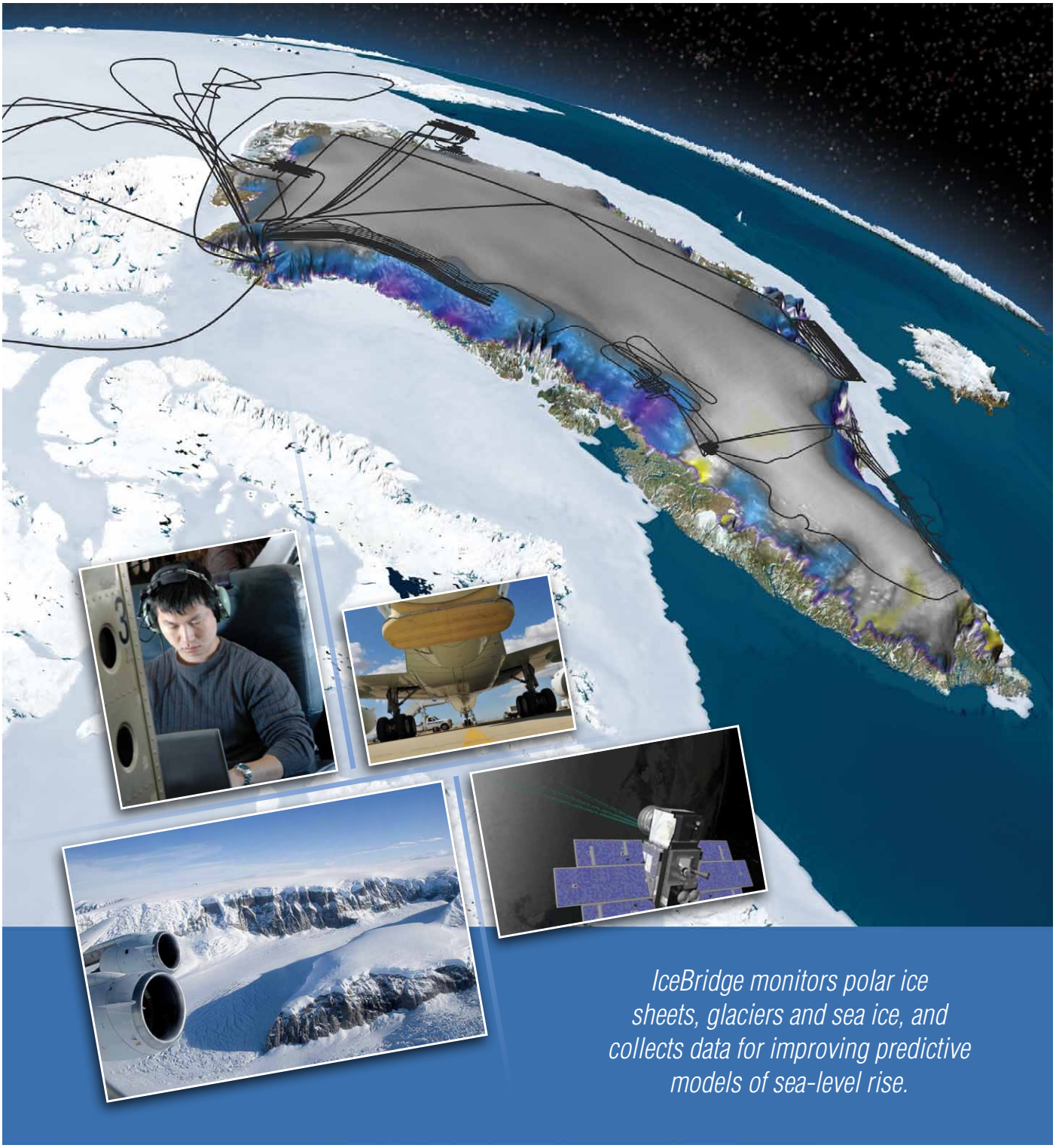
National Aeronautics and Space Administration

Operation IceBridge



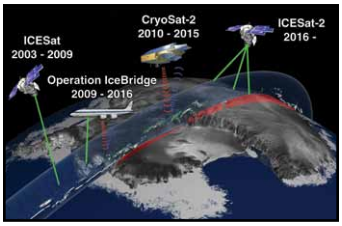
IceBridge monitors polar ice sheets, glaciers and sea ice, and collects data for improving predictive models of sea-level rise.

Operation IceBridge

An airborne mission monitoring Earth's ice sheets, glaciers, and sea ice

About these Images

On the front: With the aircraft resources of NASA's Airborne Sciences Program, Operation IceBridge is taking to the sky to ensure a sustained, critical watch over Earth's polar regions. Flight lines (black) are shown for the 2010 campaign over Arctic sea ice and Greenland's land ice. Many flights target outlet glaciers along the coast where NASA's Ice, Cloud and land Elevation Satellite (ICESat) shows significant thinning. Blue and purple colors, respectively, indicate moderate to large thinning. Gray and yellow, respectively, indicate slight to moderate thickening.



Credit: NASA

Operation IceBridge sustains measurements of polar ice during the period between NASA satellites.

Bridging the Gap

NASA's Operation IceBridge, a six-year mission of annual flights over the Arctic and Antarctic, is the largest-ever airborne survey of polar ice. The flights bridge the gap between ICESat—which stopped collecting surface elevation data in 2009—and ICESat-2, scheduled for launch in 2016. Scientists use surface elevation data to monitor changes to sea ice and land ice.

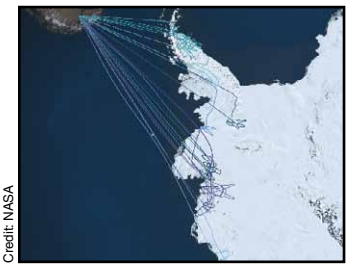
Credit: NASA

NASA's P-3B awaited the arrival of instrument teams and crew for a flight from Kangerlussuaq, Greenland, during IceBridge's Arctic 2010 campaign.

Airborne Laboratories

NASA's DC-8 and the P-3B are the workhorses of IceBridge. The DC-8, from NASA's Dryden Flight Research Center, is a 157-foot-long airborne laboratory adapted each year to accommodate the mission's instruments. The DC-8 carries enough fuel for the long Antarctic flights. The P-3B, from NASA's Wallops Flight Facility, is a smaller, maneuverable four-engine turboprop that carries instruments and researchers over Greenland's meandering outlet glaciers and Arctic sea ice. In future campaigns, unpiloted aerial vehicles and smaller aircraft will also be flown.

The aircraft carry a full suite of instruments including lasers and radars, as well as a gravimeter, camera, and a magnetometer. The lasers measure the ice surface elevation while the radars peer into the ice, imaging the snow layers and the bedrock below the ice. The gravity instrument is used to see below floating ice tongues to determine the shape of the water-filled cavities below.



Credit: NASA

The DC-8 makes flights during Antarctic campaigns (mapped above for 2009) from the mission's base in Chile to science targets along the Peninsula and West Antarctica.

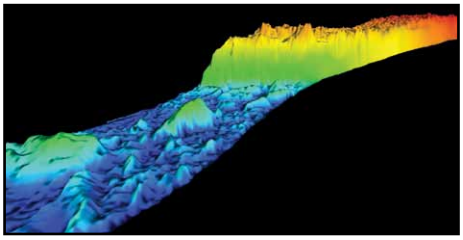
Polar Campaigns

Arctic: Throughout the duration of the mission, IceBridge annually surveys Arctic land ice and sea ice during a campaign that falls during the northern hemisphere's springtime, from March to May. Flights are most often made from Thule and Kangerlussuaq, Greenland, as these sites are home to airports from which the aircraft can reach the study targets.

Antarctic: IceBridge flies over Antarctica's land and sea ice during the annual campaign that falls during the northern hemisphere's autumn season from October to November, which is spring in the southern hemisphere. Each flight transits from the mission's base in Punta Arenas, Chile, to targets in Antarctica and back.

Mission collaborators fly smaller aircraft over ice in East Antarctica and Alaska.

Monitoring Change



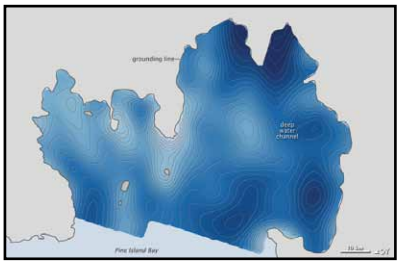
Credit: Kyle Krabill/NASA ATM team

A laser instrument flown during IceBridge's Arctic 2010 campaign mapped the 90-meter-tall calving front of Greenland's Jakobshavn Glacier.

Land ice: The airborne perspective allows a close-up look not possible from orbit. The suite of instruments on each flight provides detailed information about the surface, snow and bedrock. IceBridge mission planners carefully select targets most prone to change or where ice dynamics are not well understood, such as West Antarctica's Pine Island Glacier, the Antarctic Peninsula, and Greenland's many outlet glaciers.

Sea ice: Sea ice, too, is dynamic and contributes to climate feedback processes. How are the physical characteristics—age, thickness, and snow depth on top of sea ice—changing? Is Arctic sea ice continuing to shrink in extent and thin in thickness? Both seasonal (first-year) and perennial (multi-year) sea ice are targeted during IceBridge flights.

Sea-Level Rise



Credit: NASA/Earth Observatory

In October 2009, IceBridge instruments mapped areas of deep water (dark blue) and shallower water (light blue and white) beneath Antarctica's Pine Island Glacier, revealing a deepwater channel.

One of IceBridge's goals is to better constrain predictive models for sea-level rise. That requires a clear understanding of the factors that control ice dynamics and regular, detailed mapping of ice sheets and outlet glaciers.

For example, Antarctica's Pine Island Glacier drains more than 19 cubic miles of ice per year from the West Antarctic Ice Sheet, but how will that rate change in the future? Which of Greenland's glaciers will accelerate and which will slow? How does contact with the bedrock or melting from contact with a warm ocean impact these processes? Data from IceBridge will contribute to studies that seek to answer such questions.

Data Access

IceBridge data is available online from the National Snow and Ice Data Center in Boulder, Colorado. http://nsidc.org/data/icebridge/

On the Web

Operation IceBridge http://www.nasa.gov/icebridge

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