

## Test balloon breaks endurance record

**NASA's pumpkin-shaped balloon stays aloft for more than 42 days.**

**Eric Hand**

A NASA test balloon coasting in stratospheric breezes around Antarctica broke the duration record for balloons today. It has surpassed a record set in 2005, when a balloon carried a cosmic-ray experiment aloft for almost 42 days.

"It's been a superb flight," says David Pierce, chief of NASA's balloon programme at Goddard Space Flight Center's Wallops facility in Virginia. "We're proving this is a viable platform."

Balloons have long been a cheap way for scientists to get instruments above 99% of the atmosphere that confounds most experiments: nearly to the edge of space, but without the expense of rockets and the long development lead times of satellites. The Achilles heel, however, is that experiments are limited to days or a few weeks, before the balloons start to leak helium and fall back to Earth.

But 100-day flights are the stated goal for the style of balloon tested by this latest prototype. The paper-thin plastic skins that encompass these so-called 'super-pressure' balloons are sealed to the atmosphere. The pumpkin-shaped balloon withstands pressure differences caused by daily temperature swings with ribs or 'tendons' that stop it expanding. Most conventional balloons, shaped like those that carry people, are open to the atmosphere, and fluctuate in altitude like a sine wave as day turns to night. That has restricted long flights of conventional balloons to the constant daylight of polar summers. But even there, the balloons vary in altitude by thousands of metres — which can be a challenge for astronomers to account for.



NASA is aiming for 100-day flights.  
NASA

## Riding high

Super-pressure balloons therefore offer not just the extra data gathered with more time aloft, but greater stability and, in turn, the potential to cover other regions of Earth, as they can fly around the Earth at mid-latitudes at any time of year. That would open up regions of the sky unseen by balloon-borne telescopes, and also regions of the spectrum — namely X-rays and  $\gamma$ -rays — that can't be studied as effectively at the poles because of the strong background of charged cosmic rays funnelled in by Earth's magnetic field.

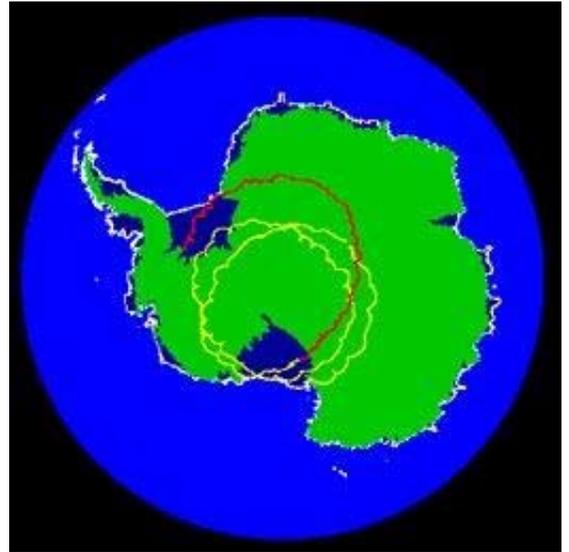
In July, Nature News profiled the potential of super-pressure balloons to become a cheap alternative to rockets and satellites, as heralded by a daylong test of a smaller super-pressure balloon. The current record-breaking test — by a balloon more than three times the size of the earlier one — means that that day is closer, says Pierce.

The test balloon was launched from McMurdo Station on 28 December into the bright clear cold above a perfect launch pad: the flat expanse of the Ross Ice Shelf. The balloon is carrying a basic test instrumentation package of cameras, radios and temperature and pressure gauges. It also has test sensors for the space physics programme known as BARREL (Balloon Array for RBSP Relativistic Electron Losses), but is not undertaking any real experiments.

The last of the NASA balloon staff left McMurdo Station last week, but the balloon continues to drift in lazy circles around the continent at 33,800 metres, says Dwayne Orr, deputy site manager for NASA's balloon facility in Palestine, Texas, and team leader for this past season of flights from Antarctica. Orr says the balloon has fluctuated in altitude by just 700 metres in its flight so far. "It's been about as dull as you can get, which is exactly what you want in a balloon."

## Down to Earth

The balloon won't reach the 100-day goal on this flight, because Pierce wants to bring it down over the continent so that staff can recover it during the next summer season. The polar vortex winds that push the balloon around in circles have started to break up, and the balloon will eventually veer off course. And so, probably by the end of the month, engineers will bring the balloon down by remotely tearing a hole in it and deploying a parachute.



The test balloon's flight path.  
*CSBF/NASA*

But plans continue apace to increase the size and duration of super-pressure balloons. One such balloon will be launched from Sweden in June, and by the end of the year, the balloon team will return to Antarctica to deploy a balloon twice as big.

Eventually, in 2010, they will test balloons three times as big, capable of carrying one tonne of instrumentation for 100 days. Considering that the total cost of launching the balloons is about \$1 million — compared with several tens of millions of dollars for a satellite — the super-pressure flights would be a bargain for scientists.

At an astronomy conference last month, NASA astrophysics division director Jon Morse talked about plans to reinvigorate the agency's balloon programme, and Pierce says he's starting to see the effects. "We see a ramping up of our budget in the out years. We see very, very strong support for the super-pressure balloon from NASA headquarters. We see more payloads coming. And we see more flights coming."



The balloon was launched from the Ross ice shelf on 28 December.  
*Henry Cathey/ NMSU Physical Science Laboratory*