



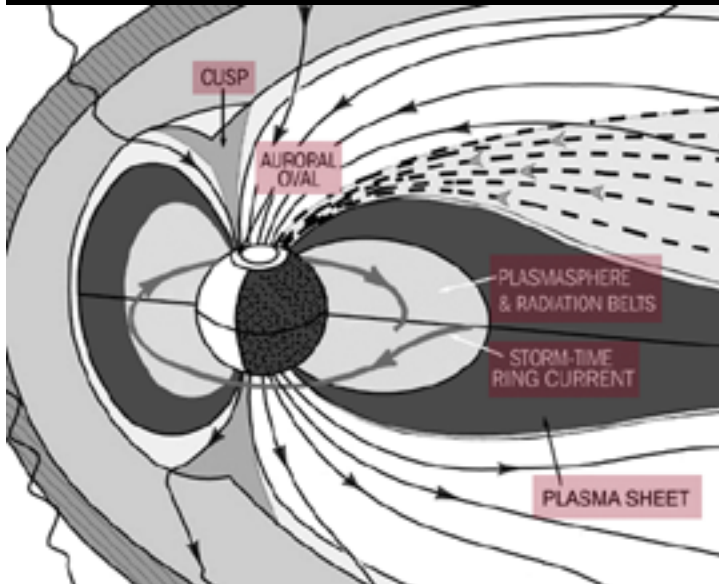
# “Aurora ” Flip Book

Images courtesy of the POLAR/VIS Instrument (Earth Camera), John Sigwarth and Lou Frank, University of Iowa.



**Spectacular Northern Lights on 14 July 2000**

## What Are the Auroral Ovals?



Above is a schematic of the Earth surrounded by its magnetosphere.. The lines depict magnetic field lines. The dark gray region depicts the Earth's plasma sheet, a reservoir of relatively dense plasma cutting through the center of the magnetic tail. The magnetic field lines of the plasma sheet map down onto the atmosphere in two ovals encircling the magnetic poles. In active times, electrons from the plasma sheet strike the atmosphere producing auroral lights in an oval pattern in much the same manner as images are formed on a TV screen. This oval of light can clearly be seen in the flip book. When the electrons smash into the atmosphere, they slow down, exciting the atmospheric particles and causing them to glow. When viewed from a spacecraft orbiting around the Earth, the whole auroral oval is visible. Currents in these ovals can reach a million amperes. Dissipated electric power can reach 10 times the annual US electrical power consumption . When the Space Shuttle passes over an auroral light display, the astronauts see bright flashes even when their eyelids are

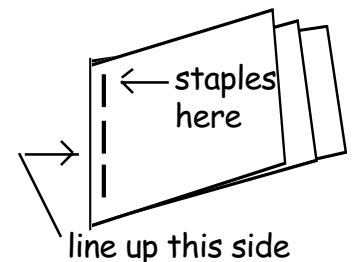
closed. These flashes are caused by auroral electrons passing through their eyes.

## Earth Camera View of the Aurora

The images that make up this flip book were taken by the Earth camera on the POLAR spacecraft as it circled the Earth during a recent space weather superstorm on 15-16 July 2000. This auroral display occurred during a G5 magnetic storm -- the most severe on the rating scale. The aurora reached peak intensity at 00:30 UT (8:30 p.m. EDT) on July 16. At this time, it covered the sky over the eastern two-thirds of the continental United States. Unfortunately, it was not visible to US observers because night had not yet fallen. Observers in Great Britain and over continental Europe were treated to a spectacular show. By dusk, the aurora had receded into Canada. Satellites in near-Earth space were engulfed in a cloud of high energy protons, corrupting satellite images of the sun, scientific measurements, and GOES 8/10 and 11 meteorological satellite images. The auroral currents induced significant ground currents which produced voltage swings in transformers on electric power grids in New York, Maine, Wisconsin and Virginia.

## Assembly Instructions

Print the following 3 pages. It works best if you can use stiff paper but standard printer paper is fine. Cut out each of the pages for the flip book along the solid line. All of the pages will be slightly different lengths. This makes it easier to flip through the book when it is finished. Arrange them in order according to the number on the top left hand side of each image. Line up all the pages by the edge that has a broken line marking the staples. Staple the left edge along the broken line. Your flip book is ready.



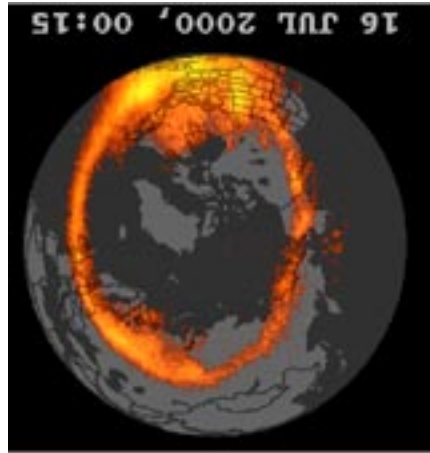
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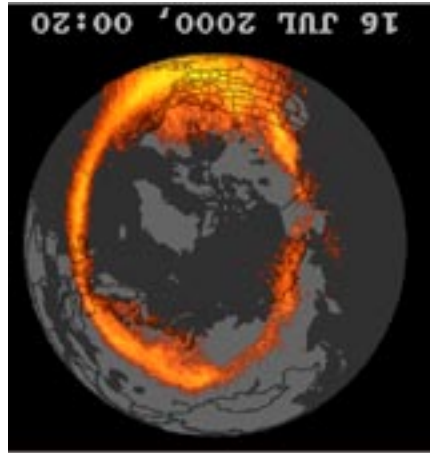
Developed in partnership with:



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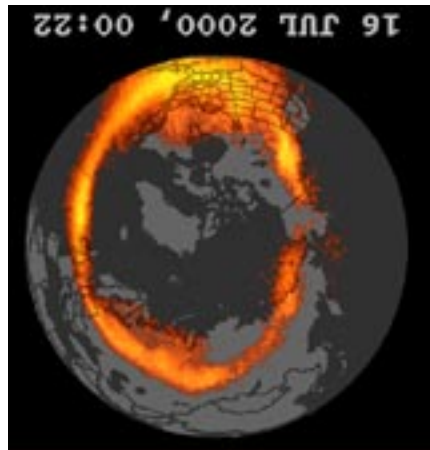
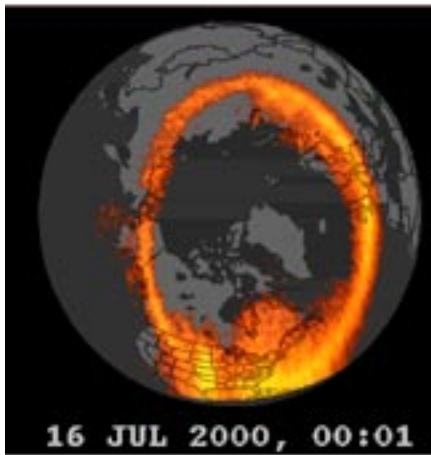
## Flip Book Facts

**What are the Auroral Lights?** In active times, electrons strike the atmosphere producing auroral lights in an oval pattern in much the same manner as images are formed on a TV screen. When the electrons smash into the atmosphere, they slow down, exciting the atmospheric particles and causing them to glow. **Spectacular auroral display 15-16 July 2000:** The images that make up this flip book were taken by the VIS instrument on the POLAR spacecraft as it circled the Earth during a recent space weather superstorm on 15-16 July 2000. At peak intensity, the aurora covered the sky over the eastern two-thirds of the continental United States. Unfortunately, it was not visible to US observers, because night had not yet fallen. Observers in Great Britain and over continental Europe were treated to a spectacular show.



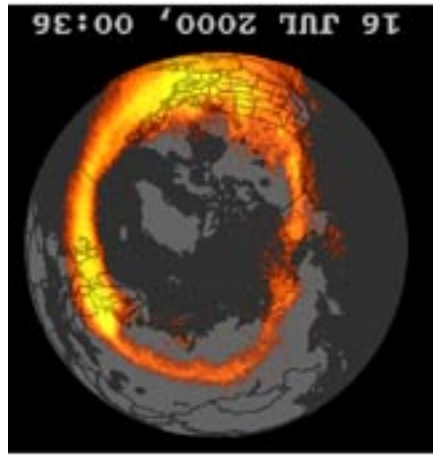
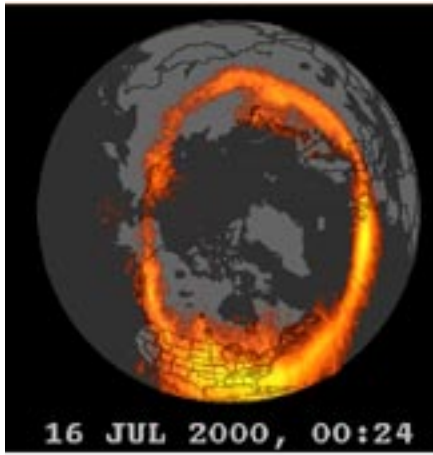
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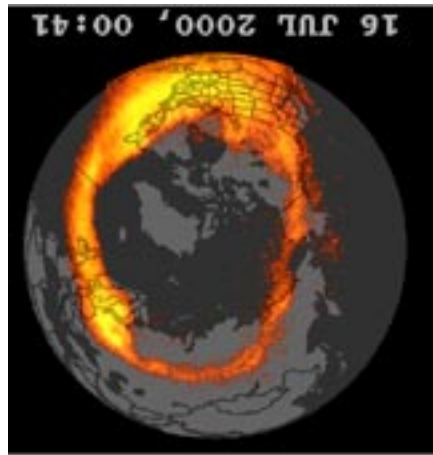
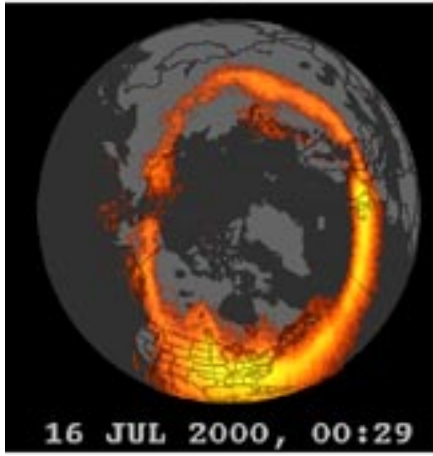
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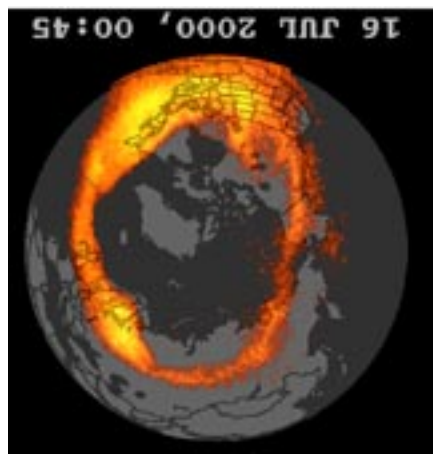
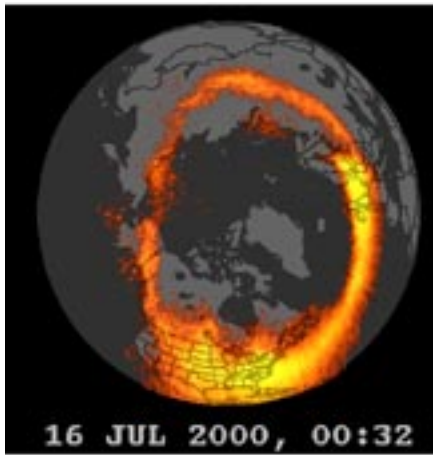
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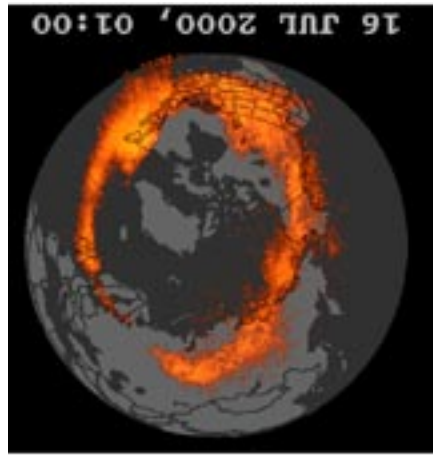
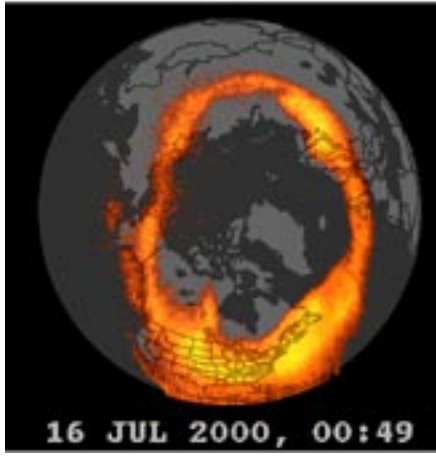
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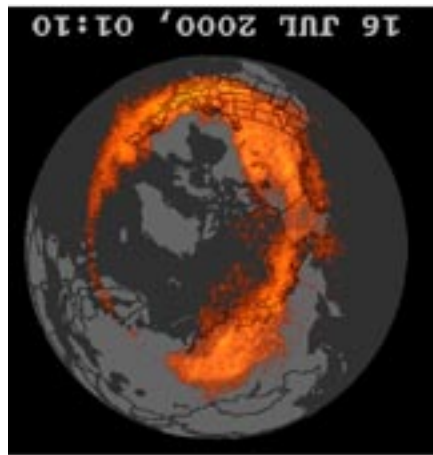
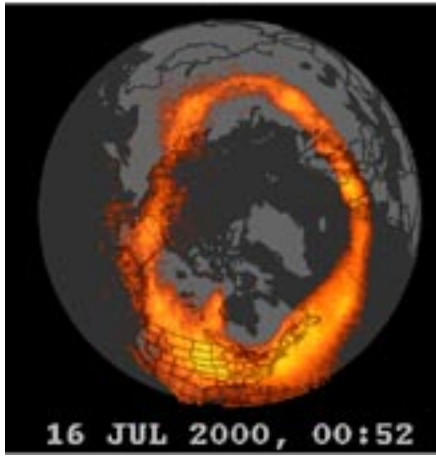
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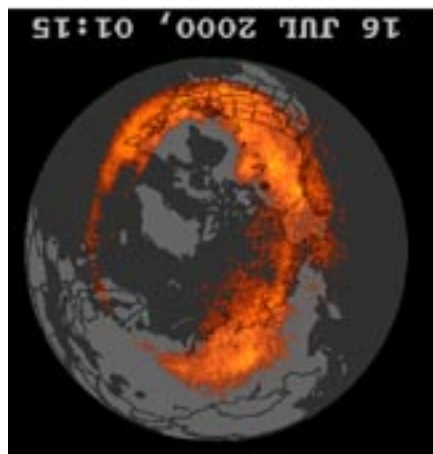
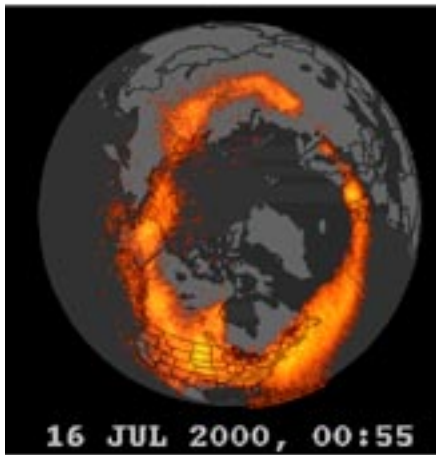
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