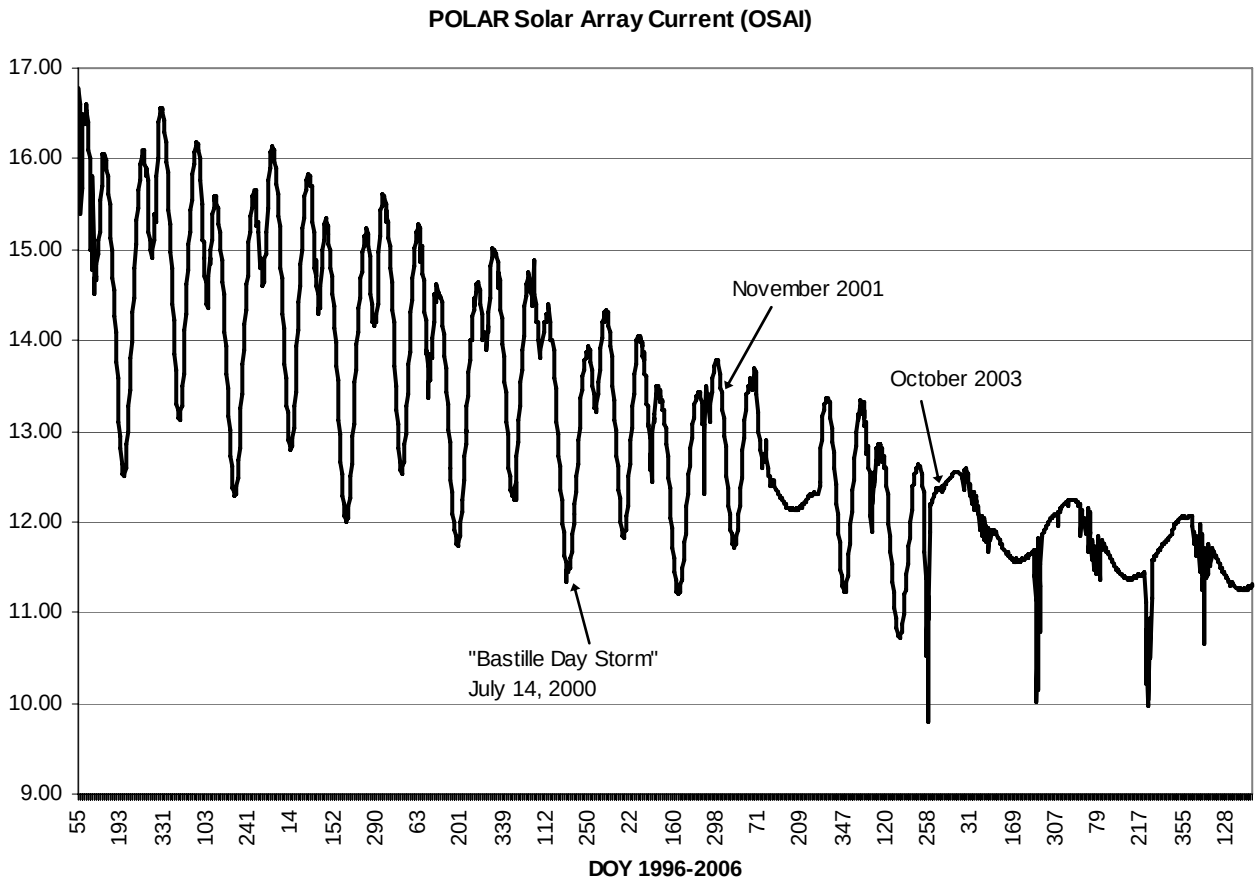
Satellite Power Loss - Polar



The Polar satellite, launched on February 24, 1996 is located in a highly elliptical orbit, with apogee at 9 earth radii and perigee at 1.8 earth radii geocentric. The inclination is 86° and the period about 18 hours. It spends most of its time inside Earth's protective magnetosphere. The graph above shows the electrical current decline from the solar panels between February 24, 1996 ('55' on the horizontal axis) and May 8, 2006 ('128').

Problem 1 - What is the average slope of this amperage curve in Amperes/year?

Problem 2 - What is the percent change in the solar power in percent/year?

Problem 3 - What is the amperage of the solar panels by 1/1/2010?

Problem 1 - What is the average slope of this amperage curve in Amperes/year?

Answer: Slope = (y2 - y1) / (x2 - x1). For reasonable choices of the points (x1,y1) and (x2, y2) as for instance (2/24/1996, 16.0) on the far-left and (5/8/2006,11.3). Next, we have to calculate the number of years between the given dates. This is about 2006.35-1996.15 or 10.2 years. Then the slope is just m = (11.3 - 16.0)/(10.2)
And so **m = -0.46 amperes/year**.

Problem 2 - What is the percent change in the solar power in percent/year?
Answer: The average amperage during this time is just (11.3 + 16.0)/2 = 13.7 amperes, so the average rate of change of the amperage is just P = 100% x (-0.46/13.7) so **P = -3.4%/year**.

Problem 3 - What is the amperage of the solar panels by 1/1/2010?

Answer: The number of years since 2/24/1996 is just 13.8, so the current loss from the aging panels is just A = 16.0 - 0.46 x 13.8 so **A = 9.7 amperes.**