The Chandra Telescope & Scientific Instruments

Why does an X-ray telescope need to be different from an optical telescope?
The high energy of X-rays causes them to reflect off mirrors only if they strike at grazing angles, like a stone skipping across a pond. For this reason, X-ray mirrors have to be carefully shaped and aligned nearly parallel to incoming X-rays. The Chandra telescope is an assembly of four pairs of glass, barrel-shaped mirrors. By nesting the mirrors inside one another, the collection area – and therefore the sensitivity – of the telescope is increased.

Chandra’s mirrors are the largest, most precisely shaped and aligned, and smoothest X-ray mirrors ever constructed. How smooth are the mirrors? If the surface of the Earth were polished to the same relative smoothness, Mt. Everest would be less than one foot tall!

What happens to the X-rays collected by the mirrors?
The telescope mirrors will reflect cosmic X-rays into a small region of the telescope called the focus. The science instruments that will be used at the focus are the High Resolution Camera and the CCD Imaging Spectrometer. These instruments record the number, position and energy of the cosmic X-rays – information which can be used to make an X-ray image and to study other properties of the source.

Besides the science instruments used to detect X-rays at the focus, Chandra will have two sets of finely-ruled gold gratings, which can be swung into position between the mirrors and the focal plane. When used with either of the science instruments, the gratings will allow precise determination of the energies of the X-rays.

Imagine an Earth with nothing over one foot tall. What kinds of natural and man-made things would be impossible? Why do the Chandra mirrors have to be so smooth?