James Webb Space Telescope, SAFIR, SPECS, and the future of Space Astronomy

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The James Webb Space Telescope (JWST) is the first in a possible series of deployable infrared to millimeter wave space telescopes. The design process for JWST has already produced ultra-light mirrors, deployment methods, and cooling approaches that could lead to much larger and more capable equipment in the future. We will describe the progress on JWST in the context of its history and illustrate some new concepts for future missions that spring from it. These include the SAFIR (Single Aperture Far Infrared) telescope and the SPECS (Submillimeter Probe of the Evolution of Cosmic Structure). The JWST will operate at the Sun-Earth Lagrange point L2, where radiative cooling lowers the telescope and instrument temperatures to about 35 K. It will have an 18-segment beryllium primary mirror with a 25 m^2 area fitting inside a 6.6 m circumscribed circle, and will provide spectroscopy and imaging over the wavelength range from 0.6 to 28 μm. It is planned for launch in 2011 on an Ariane 5 rocket. The project is a partnership of NASA, ESA, and CSA, and the prime contractor is Northrop Grumman. See http://www.jwst.nasa.gov for more details on JWST.

Missions to follow JWST will be able to draw on a greatly expanded technological base. Other uses ranging from Earth sciences to surveillance demand large space telescopes and interferometric systems, and the infrastructure for remote assembly and astronaut servicing will continue to improve as the Space Station is completed and experience is gained.

The SAFIR (http://safir.jpl.nasa.gov/, http://safir.gsfc.nasa.gov/) and SPECS (http://space.gsfc.nasa.gov/astro/specs/) missions have been approved by NASA for Vision Mission studies. SAFIR was mentioned prominently in the 2000 NRC Decadal Report on Astronomy as "the recommended next step in exploring the cosmos at far-infrared wavelengths." The report furthermore states that SAFIR could "form the basis for developing a far-infrared interferometer in the succeeding decade." We will summarize both of these concepts and the unique science capabilities enabled by these missions as well as outline how they might further develop as other projects come on line, scientific priorities evolve, and technological capabilities expand.