Next Generation Space Telescope[1]

John Mather*[a], NASA/GSFC; H.S. Stockman[b], STScI
[a] Goddard Space Flight Center, Code 685, Greenbelt MD 20771
[b] Space Telescope Science Institute, 3700 San Martin Drive, Baltimore MD 21218

ABSTRACT

The Next Generation Space Telescope (NGST), planned for launch in 2009, will be an 8-m class radiatively cooled infrared telescope at the Lagrange point L2. It will cover the wavelength range from 0.6 to 28 μm with cameras and spectrometers, to observe the first luminous objects after the Big Bang, and the formation, growth, clustering, and evolution of galaxies, stars, and protoplanetary clouds, leading to better understanding of our own Origins. It will seek evidence of the cosmic dark matter through its gravitational effects. With an aperture three times greater than the Hubble Space Telescope, it will provide extraordinary advances in capabilities and enable the discovery of many new phenomena. It is a joint project of the NASA, ESA, and CSA, and scientific operations will be provided by the Space Telescope Science Institute.

Keywords: Infrared, space, telescope, instrumentation, NGST, NASA

1. INTRODUCTION

The Next Generation Space Telescope (NGST) is a key component of NASA's Origins Program. Reflecting major current astrophysics research themes as restated in NASA's Space Science Enterprise strategic plan [1], Origins responds directly to the questions:

- How did the Universe, galaxies, stars, and planets evolve? How can our exploration of the Universe and our Solar System revolutionize our understanding of physics, chemistry, and biology?
- Does life in any form — however simple or complex, carbon-based or other — exist elsewhere in the Universe? Are there Earth-like planets beyond our Solar System?

NGST has been under study since 1995 and is planned to be launched around 2009, nearly 400 years after Galileo discovered the moons of Jupiter, over 60 years after Lyman Spitzer proposed space telescopes, and 50 years after the National Space Act created NASA. The mission is a logical successor to the Hubble Space Telescope (HST), and fits in the context of the other Origins missions: FUSE, SOFIA, SIRTF, SIM, and the Terrestrial Planet Finder and Planet Imager, which are planned or under construction. NGST logically depends on technology developed by SIRTF and HST, and, in turn, future missions will use NGST technology to search for terrestrial-sized planets.

NGST will be an 8 m class deployable, radiatively cooled telescope, optimized for the 1 – 5 μm band, with background limited sensitivity from 0.6 to 10 μm or longer, operating for 10 years near the Earth-Sun second Lagrange point (L2), 1.5 million km from Earth. It will be a general-purpose observatory, operated by the Space Telescope Science Institute (STScI) for competitively selected observers from the international astronomy community. NASA, the European Space Agency (ESA), and the Canadian Space Agency (CSA) will build NGST, with construction to start in 2003. The planned NASA part of the construction budget is $500 M (FY96), but the combined total of NASA, ESA, and CSA contributions, including launch, operations, grants, technology development, and inflation, will be around $2B (in real year dollars). This sum represents about one quarter of the amount invested in HST.

NGST will be a unique scientific tool, with excellent angular resolution over a large field of view, deep sensitivity and a low infrared (IR) background. As a cold space telescope, NGST will achieve far better sensitivities than ground-based telescopes. Figure 1.1 [1.2] shows the background levels from Mauna Kea and in space. They differ by one to six orders of magnitude, depending on wavelength. NGST will have diffraction limited resolution at 2 μm or better, and will achieve much higher

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[1] Major portions of this manuscript are drawn from a report to the Panel on Ultraviolet, Optical, and Infrared Astronomy from Space Astronomy and Astrophysics Survey Committee, National Research Council.

* Correspondence: email john.mather@gsfc.nasa.gov; Telephone 301-286-8720; Fax 301-286-1753