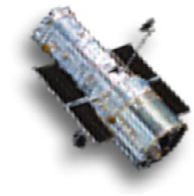
Hubble Facts



HST Program Office

Goddard Space Flight Center
Greenbelt, Maryland 20771

Wide-Field Camera 3 (WFC3)

Essentials of the Instrument:

Installation on HST	**SM4 (~2005)**
Function	**Wide-field imaging from the NUV to the near-IR**
__ range	**0.2-1.7_m**
Optical Elements	**Filters, grisms**
Detectors	**- 4096^2 CCD - 1024^2 HgCdTe**
Field(s) of View	**160^2, 135^2 arcsec, resp.**
Scale (arcsec/pixel)	**0.04, 0.13 arcsec, respectively**
Enhancement factor over predecessor instrument (if any)	**- 11x discovery efficiency advantage over NIC3 in near-IR - 35x discovery eff. factor over ACS in NUV**
Cost	**$83M**
Current status/health	**Assembled, undergoing testing and calibration, awaiting Launch**

Design and Capabilities of WFC3

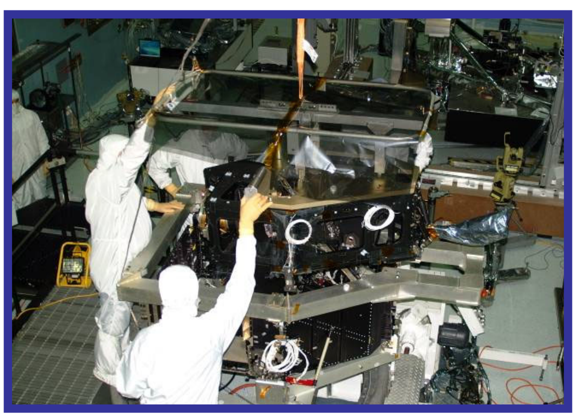
The Wide Field Camera 3 (WFC3) is a fourth-generation HST instrument designed to replace the Wide-Field Planetary Camera 2 (WFPC2). It is being developed to ensure imaging capability late in the life of HST, and will be installed in HST during Servicing Mission 4.

The main theme for WFC3 is the enabling of panchromatic imaging over a very broad 0.2-1.7_m wavelength interval not before realized on HST in wide-field applications. Therefore WFC3 is *anything but* a "clone" of previously existing capabilities, in spite of the fact that it is being built on a low-cost paradigm that maximizes the reuse of existing designs and parts.

The WFC3 is configured as a two-channel instrument. The incoming beam from HST is directed into WFC3 using a pick-off mirror, and once within the instrument is directed to either the "UVIS" CCD channel or the IR channel with its HgCdTe detector. The WFC3 wide-wavelength coverage with high efficiency is made possible by this dual-channel design using two detector technologies. WFC3 is diffraction-limited down to 3000A in the UVIS channel and at 1_m in the IR channel.

The UVIS channel uses two large format, 2048x4096 pixel CCDs butted together to provide a total 4096^2 format (same design as ACS Wide-Field Channel). The CCD coatings provide greater than 50% quantum efficiency (QE) at 2500A, which when combined with its field of view results in a ~35x improvement over the rate at which ACS's High-Resolution Channel can tile an area of sky to a given photometric depth (also known as "discovery efficiency").

The near-IR channel uses a state-of-the-art HgCdTe focal plane array. This detector is a highly advanced, 1024^2 version of the 256^2 pixel detectors in the NICMOS instrument. The combination of field-of-view, quantum efficiency, and low noise results in a ~16x enchancement in discovery efficiency for WFC3/IR over the currently operating NICMOS Camera 3. Tailoring the long-wavelength cutoff to a shorter wavelength than is usual is another innovation in the WFC3 HgCdTe detector . This cutoff (at ~1.7 μm) allows the detector to operate at relatively warm temperatures (~ −120C) with acceptable dark current. This feature simplifies the instrument, allowing the use of thermoelectric cooling systems instead of the cryogens or mechanical cryo-coolers that are typical in other IR instruments.



The fabrication of WFC3 is nearly complete.

Anticipated Science from WFC3

Observing time on WFC3 will be eagerly sought by the scientific community. The following are a handful of the likely proposed uses of WFC3, some of which may involve partnering with an additional instrument such as ACS, thereby exerting the maximum possible observing power of HST on important astrophysical questions. Pathfinding for JWST will also be an exciting/important part of WFC3/IR science.

•Utilize z=1-2 Type Ia supernovae as quantitative probes of the universe's expansion history, with specific emphasis on "dark energy", the epoch of transition from decelerating to accelerating expansion, and a possible non-zero cosmological constant.

•Carry out high-sensitivity mapping of gravitational lenses to determine the character and distribution of dark matter in galaxy clusters. Measure cosmic shear to probe dark matter distribution on finer scales.

•Push studies of galaxy formation and early evolution 2 magnitudes deeper than the original Hubble Deep Field in ultradeep surveys. Efficient wide-field surveys will increase morphology and precise photometry samples by 1-2 orders of magnitude to enable more precise mapping of galaxy evolution from z>3 to the present day.

•Explore galaxy evolution over the range z=3-7, and detect extremely high-redshift proto-galaxies out to z=10, if they exist.

•Use wide-field UV imaging to probe the detailed star formation histories and stellar populations in nearby and more distant galaxies, to significantly deeper levels than has been possible with previous instruments. Such deep datasets will be critical for galaxy evolution studies.