IN-FLIGHT PERFORMANCE OF THE ADVANCED CAMERA FOR SURVEYS CCDS

Mark Clampin¹, Marco Sirianni², George F. Hartig³, Holland C. Ford², Garth D. Illingworth³, Bill Burmester⁴, William Koldewynd⁴, Andre R. Martel², Adam Riess¹, Ronald J. Schrein⁴, and Pamela C. Sullivan⁵

¹Space Telescope Science Institute, ²Johns Hopkins University, ³Univ of California Obs/Lick Observatory, ⁴Ball Aerospace and Technology Corp., ⁵NASA Goddard Space Flight Center

Abstract: The Advanced Camera for Surveys (ACS), installed in the Hubble Space telescope in March 2002, will significantly extend HST’s deep, survey imaging capabilities. ACS has met, or exceeded, all of its key performance specifications. In this paper we briefly review the in-flight performance of the instrument’s CCD detectors and preview early ACS science observations.

Key words: Hubble Space Telescope (HST), Advanced Camera for Surveys (ACS), Charge-Coupled Device (CCD), wide field imaging, UV imaging

1. INTRODUCTION

The Advanced Camera for Surveys (ACS) is a third generation instrument for the Hubble Space Telescope (HST). It was installed in HST during the fourth servicing mission (SM3B) in March 2002. ACS replaced a first generation axial bay instrument, the Faint Object Camera (FOC). ACS has three channels, shown schematically in Fig. 1, the Wide Field Camera (WFC), the High Resolution Camera (HRC) and the Solar Blind Camera (SBC). In this paper we will discuss the WFC and HRC CCD detectors.

WFC is a high-throughput, wide field imager (202"×202") designed for deep imaging surveys in the near-IR. WFC provides a factor of 10 gain in discovery efficiency at 800 nm, compared to the Wide Field Planetary Camera-2 (WFPC2). In this context discovery efficiency is defined as the
product of field of view (FOV) and instrumental throughput. WFC employs a 4096×4096 CCD mosaic as its focal plane detector. The plate scale of the WFC is 0.05"/pixel, which delivers near-critical sampling at the near-IR wavelengths for which the camera is optimized.

The HRC is a near-UV to near-IR imager, which provides critically sampled images in the visible, over a 29″×26″ field of view. HRC shares its optical train with the SBC, a far-UV imaging channel utilizing a photon counting MAMA detector. The HRC focal plane detector is a 1024×1024 CCD detector, based on the Space Telescope Imaging Spectrograph (STIS) CCD. The HRC plate scale is 0.027″/pixel, which yields fully sampled images in the visible.

![Figure 1. Schematic showing the optical designs for the WFC (left) and the HRC/SBC (right).](image)

2. **ACS CCD DESIGN**

The selection of CCD detectors for ACS was based on the heritage of the STIS program [1], which employed devices designed and fabricated at Scientific Imaging Technologies (SITe). The design of the ACS CCDs is summarized below in Table 1. The HRC detector is the same basic design as the STIS CCD detector, but with a different backside process offering a significant improvement in near-UV sensitivity.

The WFC focal plane package comprises two SITe 2048×4096 CCDs butted together to provide a 4096×4096 pixel mosaic, as shown in Fig. 2. The CCD design is derived from the three-side buttable, SITe commercial 4096×2048 array (ST-002A). However, concerns regarding term degradation of charge transfer efficiency (CTE), due to the radiation environment in HST’s low earth orbit, prompted a design change to minimize the number of