



# Survey Paper on HDEV Experiment

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**Abstract:** New step closer to earth. The HDEV it means high definition earth viewing. It is an experiment which is developed by NASA. This system is connected to the international space Station. The system made of four specialized high definition video cameras, role of these cameras are to record video of the earth from multiple angles. The main primary purpose is overcome with problems of data loss, errors, wrong data which transmitted from space and maintenance of hardware system. In this paper, we are going to see what is HDEV, how it works, the purpose of this Experiment and some interesting things yet many readers are unknown from this.

**Keywords:** HDEV description, operation, application.

## I. INTRODUCTION

HDEV is first large non-pressurized experiment of NASA configured on the European space agency's Columbus laboratory module. The max work is done by the team of students. The activation of HDEV experiment with ISS starts from 30 April 2014. It includes several HD cameras pointed on earth they are enclosed in such type of housing (Fig 1), which is temperature controlled and pressurized.

For the purpose of stream live video of the earth to watch online it is placed on out the body of the space station on ISS (Fig 2) (It is a habitable artificial satellite in low earth orbit. It gives that environment where scientific research can perform). It will help engineers analysing the effect of space over the working time of HDEV on video quality to decide which cameras are useful in future missions.

This special camera have that ability to check the quality of the camera while taking images of earth also having the hardware's ability to survive and work accurately in the hard radioactive environment.

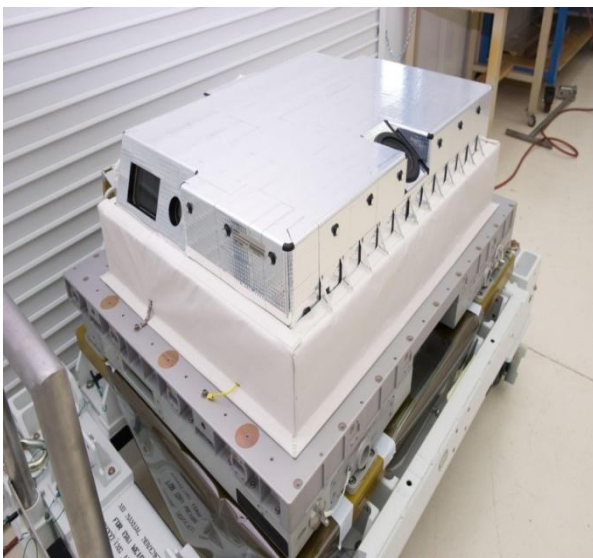


Fig 1: HDEV BOX



Fig 2: ISS

## II. EXPERIMENT DESCRIPTION

The base object of the high definition earth viewing is to insure the performance of the space based cameras on diversity of operating modes to experiment and demonstrate the features such as longevity of the COTS equipment for future ISS program use. The purpose is engineering one: monitoring the rate at which stage image quality of HD camera low, effect of the space environment specially cosmic ray and verify the strength of HDEV housing Vastly earth viewing several camera systems is contained in this payload using COTS (commercial off the shelf) cameras. The HDEV organized assembly is arranged of a camera system of four COTS cameras, integrated command and data handling (C+DH), aeronautics (Ethernet) & for allowing this payload's component to interface with the ISS Columbus module a power distribution box. The HDEV includes such type of video Cameras that doesn't requires zoom, pan or no tilt mechanism its fixed payload camera system. These cameras placed (Fig 3) on connecting in such manner that can capture pictures of the earth's surface and seen from the ISS .Oriented in different directions having multiple views relative to travel direction of ISS. 1 looking forward is pointed forward into station's velocity vector; this camera is a Hitachi GV-HD301, Looking nearly straight



down pointed nadir is a Toshiba IK-HR1s and 2 looking back on the after .They are a Sony FCB-EH4300 and a Panasonic AGHMC150 Videos can see on any computer in this format only internet connection is required. All video only transmitted to the ground real time the HDEV not allow to record or store data video on board the ISS .If any needed recording of video found as ground operator .The cots encoder the cameras and other electronic devices are enclosed in a box which is pressurized for protection of devices/system from space conditions This box contains dry nitrogen at atmospheric pressure.

Before the HD video starts each camera must turn off and next camera turn on in 8 to 10 Sec changing time. The forward looking camera starts first, then the deeper (nadir) camera following each aft looking camera, as the ISS pass HDEV follows the location on earth. Through this efficient data can be collected on each camera; also provide a bonus, different views of earth (Fig 4) .

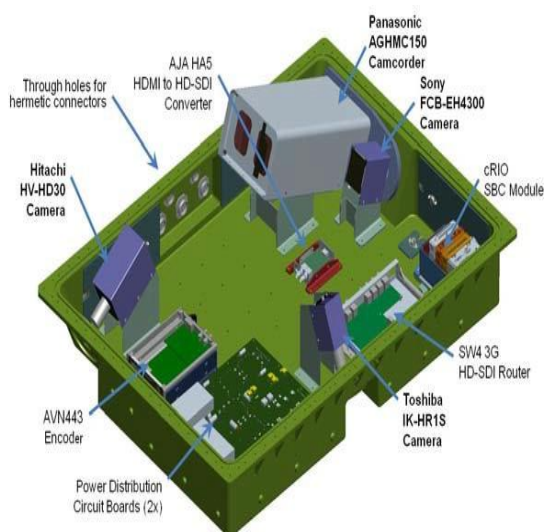


Fig 3.1 Layout (Inside)

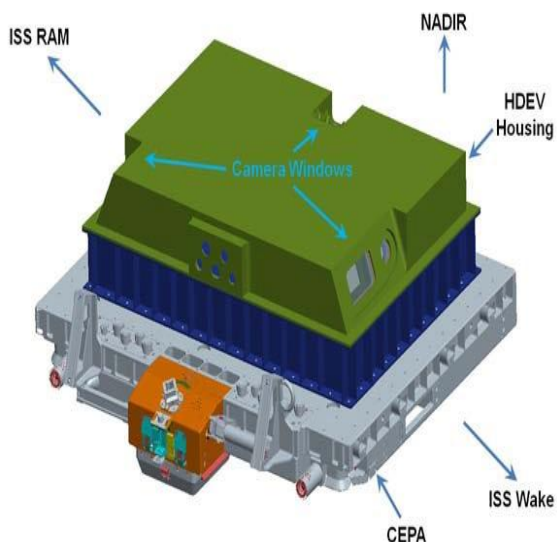


Fig 3.2 Layout (outside)

**III.HDEV DESIGN FOR OPERATION**

HDEV is specially designed. When we start the machine it takes few minutes warm up time (1\_2min) after power on, the cameras are designed or programmed to work in cycle form, it means HDEV operates one camera at a time the cameras are turned on one at a time in repeating cycle.

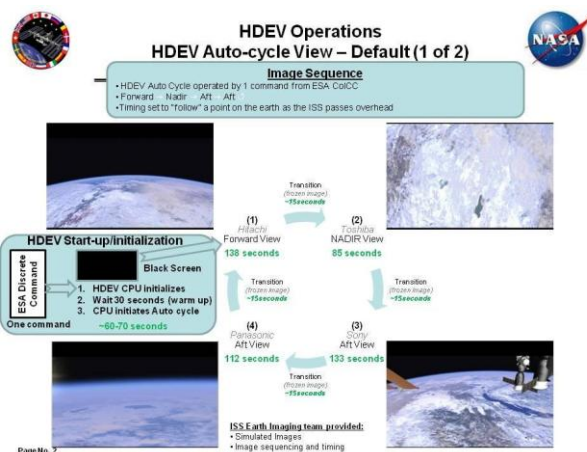


Fig 4: Auto cycle mode

One of the main advantages of being the automatic cycling mode doesn't require any input from ground operators; it means HDEV can be operated any time till the data resources and ISS power are available. Except a one command which is done by ESA'S Columbus control centre is "power on" as a schedule of ISS payload operations. It doesn't mean that ground operator can't make any changes or they don't have control. If desired by ground controllers, they can be commanded to HDEV video. They can change the cycle of the images in auto cycle mode. They can change the length of time cameras are powered on. If wanted ground controllers can command a single camera to stay on and quite the auto-cycle to take place. A standard ISS Trek workstation having HDEF specific software installed, which operate the HDEF.



Fig 5: Circuit





**IV. OPERATIONS**

Camera/system longevity performance: As soon as a camera system on when installed on orbit & video is recorded (on ground) to set up initial camera image quality. The camera video images are recorded during HDEV operations and compared with previous video. Each camera performance depends upon the video image analysis over time. It is the operation of checking camera/system longevity performance.

**V. OPERATION REQUIREMENTS AND PROTOCOLS**

Cameras are automatic and individually powered off and on or as necessary to achieve video data. On the CEPA system is installed externally (Fig 5). Power on is required for periodic video.

**VI. APPLICATIONS**

**SPACE APPLICATION**

HDEV tests mainly for, available HD cameras for future Space missions. Considering cost for space application, using off-the-shelf is more effective than designing a new one. Ground tests confirmed that these cameras could survive the Dummy space environment, but actual low-earth orbit proves how strong and accurately they work in high radioactivity Environment of space.

**EARTH APPLICATION**

The public can view the camera stream live through any system having internet. This high definition videos provide broad area and multiple views of earth. How our earth actually looks from space station. As shown in below Figures (6.1 to 6.7)

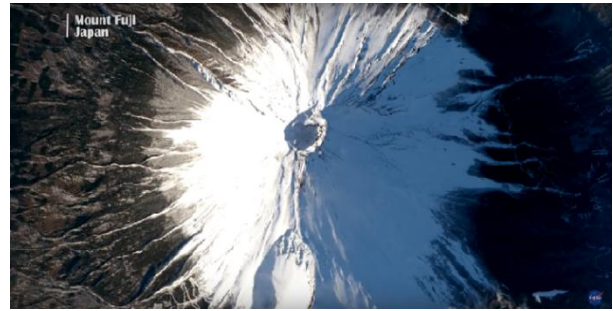


Fig 6.3



Fig 6.4



Fig 6.5



Fig 6.1



Fig 6.6



Fig 6.2

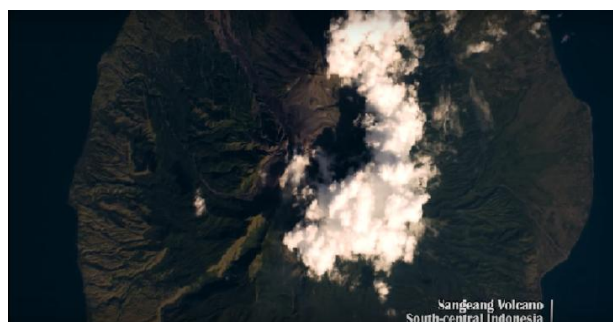


Fig 6.7



## VII.CONCLUSION

This paper presents an introduction to HDEV (HIGH DEFINATION EARTH VIEWING).it defines how HDEV play's main role satellite communication. The HDEV cameras are specially design to survive in space atmosphere so they are very useful to ISI for future mission and that is the main purpose behind this experiment

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