

# ISS Awareness, Awe and Inspiration: High Definition Earth Viewing (HDEV) is More than Tech Demo.

**Susan Runco**  
Johnson Space Center  
2101 NASA Parkway  
Houston, TX 77058  
281-244-8848  
susan.k.runco@nasa.gov

**Carlos Fontanot**  
Johnson Space Center  
2101 NASA Parkway  
Houston, TX 77058  
281-483-2398  
carlos.fontanot-1@nasa.gov

**Chris Getteau**  
Johnson Space Center  
2101 NASA Parkway  
Houston, TX 77058  
281-244-7359  
christian.getteau-1@nasa.gov

## Abstract

April 30, 2018 marks the fourth year of operation for the ISS High Definition Earth Viewing (HDEV) Payload. Technically, HDEV is still performing admirably. This paper discusses the impact which HDEV has had beyond its primary technical development and demonstration purpose in the areas of ISS awareness, awe of the Earth, and inspiration for STEAM engagement and learning about Earth and Space.

## Introduction/ Purpose:

The HDEV Payload is an external Earth viewing, multiple camera payload using a set of four (4) Commercial-off-the-Shelf (COTS) video cameras <sup>(1)</sup>. The primary objective is to validate the space-based performance of the cameras in a variety of operation modes to exercise and demonstrate the features and longevity of the COTS equipment for future ISS Program usage <sup>(2)</sup>.

However, HDEV's streaming video of Earth has expanded HDEV's contributions to NASA and the ISS program by reaching diverse audiences. HDEV has raised the public's awareness of the ISS being in orbit, created awe from seeing the Earth from space, and provided imagery for numerous uses including developing educational material for STEAM engagement of learners across all ages. See Figure 1.

## Results to Date:

### HDEV in STEAM Engagement:

In anticipation of ESA Astronaut, Dr. Alexander Gerst's flight on ISS Expedition 40 crew in 2014, the German Aerospace Center (DLR), in cooperation with the University of Bonn, initiated a STEAM program using HDEV video titled "Columbus Eye <sup>(3)</sup>". The program continues to incorporate HDEV imagery into geography education activities for German students. Since 2014 Columbus Eye scientists and educators have produced 20 publications and 51 presentations or posters about the results of their project <sup>(3)</sup>.

The inventor of ISS-Above <sup>(4)</sup>, Liam Kennedy, moved his project from being a device which lights up as the ISS orbits overhead, to also being an educational device with a peer-reviewed, on-line, teachers handbook by bringing HDEV

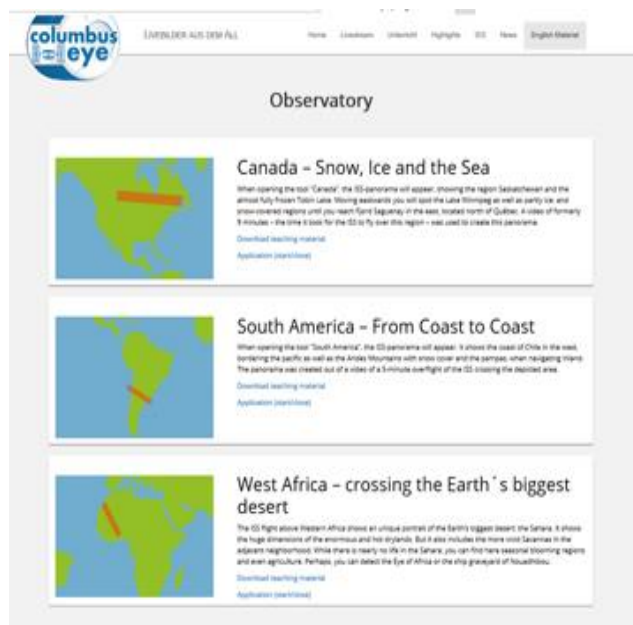


Figure 1. This screen shot from the Columbus Eye website <sup>(3)</sup> shows the location of the HDEV video and links to the associated teaching material and application to start the activity.

and ISS video into the classroom. A middle school teacher, Michelle Mohrweis, held a session at the Space Exploration Educators Conference 2018 on how she used this material for her literacy class.

The Aurora CubeSat team at St. Louis University experimented with HDEV video to provide in-space video for the AI software testing by students for the CubeSat instrument Intelligence Mapping and Monitoring (IMMP): a flying laboratory for testing space sensing, mapping, and monitoring. (2019 launch)

#### ISS awareness and awe of seeing the Earth from space.

HDEV video is used for various types of media and artistic outlets ranging from TV, social media, to art projects and galleries around the world in places such as Sweden, Germany, Korea, Cambodia, and Israel. Examples where HDEV video has been used include: many space agency lobbies, operations or visitor centers, the Weather Channel and other news outlets and documentaries, NASA TV for 4 hours a week, YouTube movies, Blogs such as Adventures and Musings of Dr. Owl <sup>(5)</sup>, Twitter, Facebook, etc. posts, and inspiration for a sunburst quilt square for a global community space quilt project initiated by ISS Expedition 37 ISS astronaut, Karen Nyberg.

In January 2018 the total views of HDEV on USTREAM reached over 200 Million. On average 700-1200 direct viewers are active at any one time. This does not include all of the embedded USTREAM display views. For instance, the JSC Earth Science & Remote Sensing Unit website (7) has 13,270 links on 373 domains

#### **Conclusions and Next Steps**

From peer reviewed educational curriculum to the musings of a traveling wooden Dr. Owl blog by an emeritus professor to a quilt square, HDEV video has provided the inspiration to users of all kinds to share their excitement of the video from the ISS and will continue to do so as long as there is video of the Earth from the ISS. Currently HDEV is scheduled to stop operations around mid-2019 at which time the Atomic clock EnsEmBLE in spAcE (ACES) payload will replace HDEV on the CEPF.

In summary, a representative feedback quote: "...thank you for creating this... I think it is a beautiful and valuable thing to behold, and it brings serenity and perspective to my life every time I watch it." Aileen Duffy

#### **References**

[1] Muri, P., Runco, S., Fontanot, C., Getteau, C. (2017)/ The High Definition Earth Viewing (HDEV) Payload. IEEE Aerospace Conference – Big Sky, Montana, Mar 4-11, 2017, 5.0106

[2] Space Station Research Explorer on NASA.gov, High Definition Earth Viewing (2012). [Web information]. Retrieved May 01, 2018, from [https://www.nasa.gov/mission\\_pages/station/research/experiments/explorer/Investigation.html?id=892](https://www.nasa.gov/mission_pages/station/research/experiments/explorer/Investigation.html?id=892)

[3] Columbus Eye (2016). Learning Materials (in English) [Web Resource]. Retrieved April 24, 2018, from <http://columbuseye.uni-bonn.de/english/>

[4] ISS Above, Inspiring Wonder for Human Spaceflight, Curriculum. [Web Resource]. Retrieved April 24, 2018, from <http://www.issabove.com/schools/curriculum/>

[5] Adventures and Musings of Dr. Owl. Exploring Earth [Web blog]. Retrieved April 24, 2018, from <http://www.drowlgoestomars.com/exploring-earth.html>

[6] USTREAM, an IBM Company (2018). ISS HD Earth Viewing Experiment [Web Resource]. Retrieved May 09, 2018, from <http://www.ustream.tv/channel/iss-hdev-payload>

[7] Earth Science & Remote Sensing Unit, High Definition Earth-viewing System (HDEV) (2014). (Web site). Retrieved May 11, 2018, from <http://eol.jsc.nasa.gov/ESRS/HDEV/>