Servicing the Hubble Space Telescope – an Astronaut's Story

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Outline

- Hubble and the on-orbit servicing concept
- Missions...
- The challenge of working while spacewalking...
- Some results...
- The future

The environment...



The stars and the airglow (STS-75 - February-March 1996)







Primary mirror, 2.4 m diameter

The Space Shuttle - required for initial deploy, and on-orbit servicing



Hubble deployed on its orbit at 600 km altitude - April 1990



Servicing Missions



Crew of HST SM 1 (STS-61), 1993



SM 1 scenarios evaluations in the Virtual Reality Laboratory Johnson Space Center Houston



SM 1 training in the water... MSFC Huntsville, Alabama

...and reality



Ready to go!

NASA

SIDE

-

....

scol

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Lift-off - December 2, 1993 - 4:26AM



...end of rendez-vous over the Indian Ocean, slowly approaching Hubble...











Charging batteries prior to Telescope release...



A happy crew!



Coming over the Atacama Desert in northern Chile VLT in sight!



Milt Heflin



highly respected Lead Flight Director

> Hubble First Servicing Mission



SM 3A Training



Training at GSFC



... our good old friend in sight...



















... it was Christmas Day, 1999!



Golden Rules for Spacewalkers

- Don't do it if you are claustrophobic...
- Stabilize your body to do any useful work
- Take appropriate measures so as not to let anything go free because tools, instruments and astronauts are useless if they are lost in space
- Don't rush... you'll waste time and you might lose control

SM 3B March 2002 .



Last visit to Hubble in May 2009: the SM 4 crew

SM 4 tasks

- Install WFC-3 (Hi Res camera near IR UV)
- Install COS (UV spectrograph)
- Repair STIS (Imaging spectrograph)
- Replace all 6 RSUs (rate Sensor Units)
- Replace batteries (NiH2 type)
- Replace Science Instrument C&D Handling Sys.
- Install soft capture mechanism (for future use)
- Install over-voltage protection kits
- Repair ACS



Mike Massimino training for STIS repair...





last release, with soft capture mechanism visible...

Some Scientific Results...

EAGLE Nebula



Protoplanetary Disks Orion Nebula

HST · WFPC2

PRC95-45b · ST Scl OPO · November 20, 1995 M. J. McCaughrean (MPIA), C. R. O'Dell (Rice University), NASA

Cat's Eye Nebula • NGC 6543



Abell 370



Future



James Webb Space Telescope (JWST)





In the meanwhile, we hope that we will enjoy many more discoveries and stunning pictures from the Hubble Space Telescope in the near future...

The End