

We visit: Goddard Space Flight Center

As the first step to fulfil the vision about visiting the Moon again, and possibly build a base there, the Goddard Space Flight Center (GSFC) is now in the final stages of building the spacecraft for the first mission, the Lunar Reconnaissance Orbiter. Seeing this, in addition to the new spare parts for the Hubble Space Telescope in the clean rooms, were the highlights during our visit to the well-known research center in Maryland, USA.

The main entrance for the Visiting Centre.

The centre, named after the American rocket pioneer, Goddard, is one of the ten large research centres connected to the American space agency, NASA, and it



is situated in rural surroundings outside Washington. The main task for this centre is to support the building of hardware for space research missions, managing the missions, supporting downloading of data, and distributing this to the users.

Accompanied by a pleasant host from Goddard, and a very knowledgeable guide from Norway, Erik Tandberg, together with presentations from key persons connected to the last service mission to Hubble as well the next mission to the Moon, the visit was a very interesting event.

NASA's Goddard Space Flight Center



Mission Manager in the visiting room explaining the goal with the service mission and how the mission shall be carried out

will have a prominent role in implementing President Bush's Vision for Space Exploration, but that is only one of the missions the research centre has had since the opening in 1959. The centre has managed more than 275 completed science missions since the start, and has therefore a unique position in the American space programmes.

They also develop and build their own instruments, and among others, one of the instruments for the next mission to the Moon.

GSFC has three main divisions, the Earth-Sun Exploration Division, Exploration of the Universe Division and the Solar System Exploration Division. Mainly, the Goddard centre will build, manage and download data from space probes and orbiting platforms to fulfil NASA's mission to explore the solar system and beyond, and search for life elsewhere in the universe. However, it is not only the far space that is interesting for the centre, Goddard has also vigorous Earth science research programmes that employ satellites and sensors to meet the national need for information about the

global climate change. Additionally, they support operational weather organisations, apply cutting edge technologies, and modelling capabilities and data management systems critical to protecting our home planet. Projects connected to the climate on Earth is directed under the Earth-Sun Exploration Division, a division that also investigates the Sun-Earth interaction, and thus, also the possible effect the sun may have as a contributing factor to the climate changes on Earth.

Goddard is a huge institution with more than eight thousand people working at an area of 5700 acres, in addition to working at the facilities at Wallops Flight Facility and White Sands Complex. Mostly the employees are Americans, for natural reasons, but the environment is relatively international, mainly because many of the projects are international, but also because many guest researchers are associated with the centres.

Managing the SOHO-project.

A great part of the activities at Goddard is managing satellites in orbit and probes ways to different far objects. Since the start more than 275 missions have been successfully completed, and several are still running. One of these is the SOHO-project. Launched in 1995, the satellite is still in activity in L1 Langrange point.

This is a joint American/European project and Pål Brekke, a Norwegian, represented ESA in the SOHO team from 1999-2005. He was amongst others project coordinator and media contact for the team and had to report to the ESA's organisation. His group consisted of six persons together with several researchers, but the whole SOHO team consisted of about one hundred people. The team was very international, and because ESA was responsible for several instruments onboard, many of the employers and researchers came from European countries.

Today the team is somewhat smaller, not because the interest is decreasing,

Text and photo:
Bård Kringen, Nordicspace

but because many of the former manual operations and data downloading processes have been automated, and the number of operators has been reduced. Still, the satellite is in complete modus, but that will be changed where the next solar observatory has been launched. After that the satellite will operate somewhat reduced, and in a completely automatic modus towards 2013.

Pål Brekke, now advisor at the Norwegian Space Centre, told to us that staying in the Goddard Space Centre was very inspirational, exciting and challenging. The centre was a meeting place for international space researchers within all fields and the stay provided him with a great circle of acquaintances.

Lunar Reconnaissance Orbiter (LRO)



The last preparations of the Lunar Reconnaissance Orbiter in the clean room. The picture is taken through two layers of glass, and is therefore somewhat diffused.

The first step to return to the Moon within near future is an unmanned mission to create a comprehensive atlas over the moon's features, and with that, follow up the work Ranger, Lunar Orbiter and Surveyor starts in connection with the Apollo Programme. The main focus for these missions was to investigate the areas around the Moon's equator as a preparation for the future moon-landing. Even later missions such as Clementine, SMART 1 and others have continuously collected information, something which is very vital, in addition to gathering



An engineering model of LRO outside the clean room. The folded solar arrays are visible on the left side of the satellite.

more accurate data about the body and the environment, and especially, more knowledge about the polar areas.

The main goal for the first new mission is to try to find areas where it is possible to build a lunar outpost for spending extended periods of the lunar surface. LRO will focus on the selection of safe landing sites, identification of lunar resources, and studies of how the lunar radiation environment will affect humans.

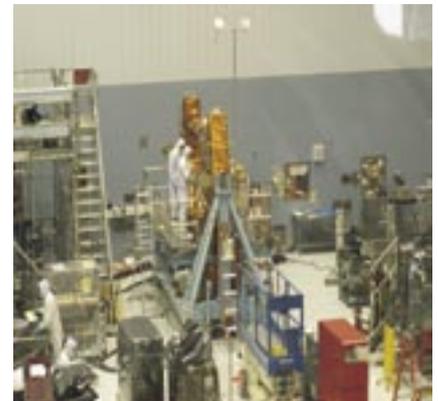
Later this year the satellite will be placed in a circular polar orbit approximately 50 km over the surface. LRO will spend at least one year in the low orbit and collect detailed information about the moon and its environment. The payload consists of six instruments, and together, they will give the scientist new knowledge about possible hazard radiation and better knowledge about the terrain at possible landing zones. If ice or water is found, it will most likely be close to the poles. Ice, and with that water, will have a very positive effect on a human outpost, and a future outpost on the Moon will most probably be situated near the south poles. The prime task for several of the instrument onboard is therefore, in different ways, try to find ice in the polar areas.

One of the instruments onboard, Lunar Orbiter Laser Altimeter (LOLA) is developed and built at Goddard. LOLA will fire a laser pulse twenty eight times per second to the surface of the Moon, providing measurements of the surface features.

Hubble Space Telescope Servicing Mission 4

The second main project the technicians at Goddard were working with the day we visited them was the forth, and last servicing mission to the Hubble Space Telescope. To be ready for launch this autumn, the team is now in the most hectic period to complete all the spare parts for transport to Kennedy Space Center and implement this in the Space Shuttle.

The last servicing mission is somewhat lagging behind several years. After the Columbia Accident NASA decided to cancel the mission, because the orbit the telescope has, did not provide enough safety measure in case of an emergency. However, the Shuttle has now been deemed safe and secure enough so that the mission is enrolled in the launching programme again, and the mission will take place when all preparations are completed. However, one Shuttle more will stand ready at the launch pad to assist the other one if necessary.



Spare parts for the service mission in the clean room, nearly ready for shipping to Kennedy Space Center.

With Service Mission 4 (SM4) astronauts will bring new instruments to Hubble, together with gyros, batteries and other components critical for the telescope's management towards 2013.

The mission will feature the installation of two new cutting-edge science instruments to enhance Hubble's capabilities by large factors, the refurbishment of Hubble's subsystem and extension of operating life to at least 2013. Astronauts will also attempt the first ever on-orbit repair of two existing instruments.

and Kennedy Space Center

GLAST

When we were at the centre, another of the satellites built at Goddard, stood at the launch pad at Cape Canaveral, ready for launch. The GLAST satellite, where GLAST stands for Gamma-ray Large Area Space Telescope, is an international project where amongst others Sweden participates. The primary task is to study the cosmos in an energy range between 10 keV to > 300 GeV.



The assembly hall for the Saturn 5 and for the Space Shuttle. That is the world's third largest building and is 160 metres high, something which proves important again when the new launchers Ares I and are going to be assembled inside the building.



The last preparations before launch of GLAST. The picture is taken at the launch pad, and the first half of the fairing is already at the right place. Photo: NASA/Goddard.



The Space Shuttle almost ready at the launch pad. The mission with the Japanese Kibo laboratory for the International Space Station should initially have been launched during our visit, but was delayed by some days and all we could see was the top of the main fuel tank and one of the main boosters.



The Crawler. A very especial vehicle, designed for transport of Saturn 5, used for the Space Shuttle and from 2015 possibly used for the new generation of American moon launchers.



A view towards Cape Canaveral. In the very flat landscape one can see one of the commercial launch platforms. Inside the service tower a Delta launcher stands with the GLAST satellite at the top, during the last preparations for launch.



The last reminder launch constructions for Saturn 1B in the foreground, while the launch pad for the new Delta 4 is in the background. Both the launch pads are placed at the military areas at Cape Canaveral. One can catch a glimpse of the rust red mid section and one of the side tanks. Delta 4 has three main engines, placed side by side.



Our excellent guide, Erik Tandberg, explains how the Americans during the next decade are planning to land on the Moon again.

We asked Erik Tandberg why they still preferred to land with a splash in an ocean, when the Space Shuttle now lands elegantly on a runway. The answer is, says Erik, that the Shuttle has several security problems, and the well tested "Apollo techniques" have proved that the simple techniques function very well. The only question is now, landing on the sea or on shore. In the picture the new Moon Lander is placed at the new Ares V launcher:



Cutting edge activities such as space exploration sometimes fail and accidents occur, unfortunately. This is the memorial for the many brave astronauts that served their nation and gave their lives for science, working for NASA.



The next generation. A model of the Apollo like Orion Crew Exploration Vehicle. Inside it is place for six astronauts for a trip to the International Space Station, or four for a trip to the Moon.