Project Embla

Bjørn Gitle Hauge[1]

Abstract *¾ The Embla project was born in 1998 as a joint research program between Istituto di Radioastronomia, Bologna, Italy and Østfold College, Norway. This project is carried out by scientists and engineering students from Italy and Norway. The goal of project Embla is to study the electromagnetic behavior of the unexplained luminous phenomena occurring in the atmosphere in a remote Norwegian valley, Hessdalen. Since this phenomena shows a random type of behavior and appearance, it was necessary for scientists to establish contact with engineers that could develop fully automated surveillance systems. This program has become a big inspiration for engineering students that motivates them to combine science and engineering. The motivation is based upon the mystery that "The Hessdalen phenomena" is to science.*

MOTIVATION AND INSPIRATION

Project Embla is one of the most inspiring and challenging project ever undertaken to motivate students into the fields of engineering and physics.

Project Embla's basis is a unsolved mystery, a mystery that call's for new surveillance solutions, the surveillance of an atmospheric light phenomena that may lead us into new concepts in physics, and possibly give us new understanding of energy storing mechanism's. This phenomena has for over 50 years managed to hide its secrets, and thereby being the origin for speculations worldwide about flying saucers, ghosts and secret military aircrafts. Attempts done by the US Air Force through "Project Blue Book", the Condon Report (published 1969), and numerous other scientific investigations of this mystery, have failed to give any answers. This mystery and its implications affects people worldwide, and it will make the scientists who solve the mystery famous, at least for killing the "flying saucer theory" once and for all. Participants in Project Embla is faced with the almost impossible task, to extract new valid data from a fast moving luminous atmospheric phenomena as shy and tricky to catch as the Lynx. A phenomenon, which has escaped the resources of US Air Force, and several other national agencies worldwide.

But this is not the only problem, participants are not only faced with the mystery and its intellectual challenges in engineering and physics, but also physical challenges due to the hostile environment in the area where the projects main research station are located.

In a remote mountainside at 1000m altitude in north Norway, people and equipment must fight against temperatures down to minus 50 degrees Celsius, darkness and snowstorms. This place is situated in a small valley 120km south of Trondheim city, called Hessdalen. The valley is remote and not more than 100 people are living there. For over 20 years this valley has been haunted by a luminous phenomena in its atmosphere, frightening the inhabitants, giving newspapers and TV-stations huge amounts off stories to tell about, and giving scientists and ufo-believers a hard time. The task of Project Embla is to study the electromagnetic behavior of "The Hessdalen Phenomena", giving engineering students a unique opportunity to do real science, motivated by a mystery and its worldwide implications.

THE MYSTERY

In 1981 reports were coming from the Hessdalen valley about a "flying light-ball" that showed up almost daily. In low altitudes, it flew around in the valley while blinking on off. It was able to stop and stand still for almost an hour, shining continuously and enlightening the ground under. The size was reported to max diameter 30m, and the closest observation was done from approximately 100 m. The Hessdalen Phenomena, HP, was seen by hundreds of people and quickly it became a tourist attraction. The phenomena was reported to show up in tree different types:

TABLE I

*Ref.[1] *Colour temperature is estimated Planck radiation,*

Color	*Color Temp	Emission	Shape	Altitude	Speed
Blue-white	24000 K	Pulsating	Ball	High	Medium
Yellow-white	12000 K	Continuous	Ball or bullet	Low	Zero to fast
Yellow-red	4000 K	Random	Chain of light-balls	High	Slow

But what was it? Speculations grew high, and no one could give good answers. For three years, Norwegian official agencies neglected the phenomena totally, until MSc. Erling Strand and a team of 40 researchers entered the valley in January 1984.

[1] Bjørn Gitle Hauge, Ostfold College, department of engineering and natural sciences, Box 1192 1705 Sarpsborg Norway, bjorn.g.hauge@hiof.no

Supported by the Norwegian Defense Research establishment, the University in Oslo and Bergen, and equipped with sophisticated scientific instrumentation, they carried out a five-week long investigation of the Hessdalen light phenomenon. From 21 of January until 22 of February 1984 they observed 188 different luminous phenomena's, where 53 was classified as The Hessdalen Phenomena, HP. Several pictures were taken, and "armed" with Radar they made 36 registrations and measured the maximum speed to 8500m/sek, 30600km/hr! In three cases the HP was observed optical while tracked on Radar. The earth's magnetic field was monitored by a magnetometer, and 40% off the magnetic pulsations was correlated with the HP. They used two active devices, Radar and a red Laser. Hit by the Laser-beam the HP started to interact in an unexpected way. 8 times the HP started to double-blink! When the beam was removed, the HP stopped to double-blink and continued with single-blink. This type was the 24000K blue-white. With a spectrum analyzer, "radio-spikes" spaced 80MHz apart was also detected in the electromagnetic band from 0,01 – 1250MHz. These registrations are still unexplained, and no correlation with an optical sighting of the HP was done. The table below lists instrumentation and registrations from the investigation in 1984.

TABLE II
Numbers extracted from ref. [2]

Type	Instrument	Registrations	Events	Note
Active	Radar	Position and speed	36	3 seen visual
Active	Laser	Range	8	Interaction!
Passive	Optical*	Visual appearance	188	53 classified as HP
Passive	Camera w/grating	Optical specter	4	Continuous specter
Passive	Magnetometer	Magnetic fluctuations	64	40% correlation
Passive	Spectrum analyzer	Electromagnetic radiation	14	0.01-1250MHz No correlation?
Passive	Seismograph	Earth quakes and movements in ground	12	No local activity
Passive	IR-wiever	Infrared specter	2	No IR-radiation
Passive	Geiger counter	Radioactive emission	0	Min. distance 1Km.
Passive	Ear	Sound	0	To far away?

Next year, in 1985, the same team set up another investigation, and former US Air Force investigator, Professor J. Allen Hynek, joined the team. But winter-storms set in, and the team had to evacuate the observation posts, and no registrations were done. The data from 1984 was analyzed carefully, but failed to explain the nature of the Hessdalen phenomena.

THE TASK

The data from Project Hessdalen was studied and debated for ten years, without giving any clue to the solution of the mystery. Reports from other places in the world indicated that this kind of phenomena was not localized to Hessdalen only. Every effort to explain the nature of the HP by known phenomena's as ball lightning, reflection and refraction from car/plane lights, ionisized gas etcetera gave no satisfaction, and the phenomena did not stop to show itself inside the Hessdalen valley. Everything pointed towards that this was a new unexplained natural atmospheric phenomena.

The first scientific congress devoted totally to this kind of phenomena's was held in the Hessdalen valley in March 1994. 27 international scientists with lead physicist Professor Boris Smirnov from the Institute for high temperatures, Moscow, Russia, debated the data collected by Erling Strand in 1984, and presented theories.
No single theory was able to explain the mysterious behavior of this kind of phenomena. Dr. David Fryberger, Stanford Linear accelerator, USA, concluded:

- "The Hessdalen phenomena lies outside already known physics, and more scientific investigations have to be carried out"

More investigations, but how? Erling Strand used a team of 40 persons to do a study for 5 weeks, and the new investigation had to be more accurate, get more data and go over a period of several years, and this in an area with lethal temperatures and climate? This task seemed impossible, and if done, it would need extensive financing and the same kind of organization and equipment used in the war-room of a big battleship! Norwegian scientists from the University in Trondheim were at the congress in 1994 so concerned with the expense, that they did not want to participate because of this.
But an Italian astrophysicist, Dr. Massimo Teodorani was not frightened by the propos ions of the task. The infinity of the universe was not frightening to him and his fellow colleagues at the Medicina radio telescope in Italy. Dr.Teodorani proposed a plan for the investigation of the Hessdalen phenomena, and Erling Strand and Bjørn Gitle Hauge from Østfold College of Engineering in Sarpsborg, Norway, was invited to the University of Bologna by Dr. Stelio Montebugnoli to discuss further investigation. He proposed to use the most powerful resource in a university/college, the students!
The same year, in 1994, astrophysicist Dr. Massimo Teodorani mentored a group of four Norwegian students in their thesis work. Based on the paper proposed at the Hessdalen conference by Dr.Teodorani, their work was to find out what kind of surveillance equipment that was possible to use and build with modest budgets. The combination worked, the wishes from the scientist/physicist

was built and made possible by the engineering student, despite of low budgets.

THE EVOLUTION OF PROJECT EMBLA

After the first work done by the Student Engineering Project, SEP, it was made clear to us that scientist and their demands as basis for engineering inspiration and motivation was a success. Every year since this, students have asked for participating in the Hessdalen/Embla project. And the next project undertaken was a great success.
Four students developed a fully automatic radio frequency position and signal analysis system working from 400-900MHZ, with directional antennas and software triggering and analysis system. This system got a lot of newspaper coverage both in Norway and Italy. This boosted inspiration and motivation further, and involving students in the project started also to open founding's that not had been available unless student had participated. In 1996 two Italian Students took part in the Hessdalen/Embla project, Christiano Miano and Jader Monari. Cristiano Miani investigated the possibility for designing a fast spectrum analyzer for the 21 cm receiver by the use of very fast Sharp LH9124 processors. For the first time, the enormous "firepower" of radio astronomy signal processing and detection was brought into this kind of research. Jader Monari is now a scientist attached to the Medicina Radio telescope, Bologna-Italy, and is still working on, and is one of the central persons behind Project Embla.

In 1997 a 3x3x3m steel container was equipped with instruments and computers, transported up to the Hessdalen valley and installed in the mountainside at 1000m altitudes. See picture 1.

PICTURE I

This container is equipped with a video detection system that reacts automatic every time a unusual light appears, and the registration is recorded with a VCR. At the same time a picture is sent to a server at the Østfold College of Engineering and published on a Internet page. This page has web address:

- http://hessdalen.org

The automatic video detection and registration system started almost immediately to give results. Weekly, unexplained phenomena's was photographed and displayed on the web page. Interest was enormous, and daily "hit" rates on the web pages could reach 10000.
In 1998 Bjørn Gitle Hauge from Østfold College of Engineering and Dr. Stelio Montebugnoli started to develop the Embla plan. The Idea was to install more equipment in the container in Hessdalen, equipment that was able to detect in which part of the electromagnetic spectrum the Hessdalen phenomena was emitting energy. The formal plans and strategies was worked out next summer, in 1999, when a group of two Norwegian students was attached to the research facility at the radio telescope in Medicina, Bologna, Italy. In Italy, this group of two Norwegian engineering students, were conducted by radio astronomers and scientists in astrophysics. One of the main targets in the Embla plan was a 5 week field investigation in the Hessdalen valley, in the summer of 2000. This field investigation is called Embla 2000. A receiving system for extremely low frequencies was developed by the Italian Student Andrea Cremonini, and Norwegian students started to work on a receiver for the waterline emission at 21cm wavelength.
In the summer of 2000 a team of 7 Italians moved to Norway for a 5 week field investigation. They supplied the container with 4 new receivers/spectrometers which was able to detect radiation in different emission bands. Ref. [3]

- ELFO correlation receiver and spectrometer sensitive to the magnetic field in 1KHz – 14KHz.
- INSPIRE receiver and spectrometer sensitive to the electric field in 1KHz – 100KHz.
- SENTINEL-1 / SS-5 receiver and spectrometers for 1420 MHZ with different resolution.
- SPECTRUM ANALYZER kovering 0.1 – 1.8GHz

This field reaserch was very sucsessfull [3], and in spring 2001 Norwegian and Italian Students, Herrmann Fjeldberg, Maria Erring and Simona Righini started to prosess the data receiver by the new instruments in the 2000 field reaserch. New equipment was also devlloped and installed in the container. The permanent surveilance equipment in the container in summer 2001 is:

- ELFO correlation receiver and spectrometer
- 3-D video tracking and registration system

- Magnetometer
- RADAR

Theese instruments are fullly automatic, and the container monnitors the area by 24h's daily. The local community supports the project with free accomondation and in the summmer of 2001 there will be another new field investigation.

THE FUTURE

The ammount of data comming from the instruments in the container is increasing. In fact the summer 2000 field work gave 21GB of unprocessed data! The plan is to install more instrumenntation and involve more students and reaserchers. The Embla project will focus on theese main topics:

- International student reaserch program
- Involve teaching of students into the program
- Use Embla as motivation/recruting for Natural scienses in primary school.
- Devellop a international SCIENCE-CAMP concept for youth every summer.
- Solve the mystery

70 Norwegian and Italian students have been working on the container and its instrumentation from 1994 and until 2001. Norwegian students have got the oportunity to stay in Italy at a highly respected reaserch facility, The Medicina radio Telescope, and Italian students have been in Norway. The Embla project is is in fact a international student exchange program, and we wishes to devellop this further.
The solution of the atmospheric ligthphenomena in Hessdalen lies in very complex instrumentation and higly skilled scientists, physcisists. The amount of work that needs to be done, and the processingtime of the data is increasing. There is no indication that the solution of the problem is in close range, both regards to techniques and time.
The facilities in Italy and Norway, and the people connected to the project has unike qualyties, that must be shared and could motivate unger people into natural sciences. This can be done by summer camps in science-engineering where the mystery in Hessdalen is the motivating basis.
.

ACKNOWLEDGMENT

The author of this article are deeply indebted to the following unrecplaceable persons:

- Dr. Stelio Montebugnoli
- Msc.Erling Strand
- Dr.Massimo Teodorani

REFERENCES

[1] Haavik, L, *UFO fenomenet, Vision forlag Norway, 1987*

[2] *Strand, E,P, Project Hessdalen-final technical report,1985*

[3] Teodorane, M, Ph.D, First Steps of the Embla project in Hessdalen, report 2001.