

PROJECT TOGETHER INTO THE STRATOSPHERE

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ABSTRACT

Stratosphere is easily accessible near-space environment with potential to be extensively used for experiments and interdisciplinary research requiring harsh conditions difficult to simulate on Earth. But it turns out that it has other properties as well. It can also connect people. In this case young people, students and scientists from both sides of former Czechoslovak border, which led to project called „Together into stratosphere“. It is a cross-border collaboration project between Valašské Meziříčí Observatory in Czech Republic and Slovak Organization for Space Activities in Slovakia, which started in 2013. By sending probes on meteorological balloons to stratosphere, members of this project already executed multiple experiments, which involved biological experiments, measurements of cosmic radiation, technology experiments like tests of photovoltaic panels, IR radiation measurements, R-wave measurements, tests of picosatellite, communication between ground station and stratospheric platform and tests of GPS.

Key words: stratosphere, experiments.

1. INTRODUCTION

The project „Together into the stratosphere“ is a result of previous cooperation between Valašské Meziříčí Observatory and Slovak Organization for Space Activities (SOSA for short) within other common cross-borders project, where one of the activities was dedicated to space technologies and their development. During course of the project, key players from both organizations met several times and decided to design a brand new project with focus on student research activities. And this is how the project „Together into the stratosphere“ started.

The key factor here was, that SOSA had already

partially developed and tested technology for flights into the stratosphere (<http://sosa.sk/stratosfericky-balon/>). So, the project was designed in a way, where the Valašské Meziříčí Observatory was responsible for finances, public outreach, education activities and student competition for experiments to be sent to stratosphere and SOSA took responsibilities for their technology and flight experts.

2. EXPERIMENTS

Experiments selected for stratospheric flights called SDS 03 and SDS 04 described here were chosen from total count of 10 registered proposals submitted by students in a competition.

SDS 03 experiment RAbTeZA – Height-dependent Absorption Distribution of IR Radiation in Atmosphere

The main aim of this experiment was to determine change of thermal radiation at various altitudes, which can tell us about how much energy is absorbed or radiated, in other words, reflected from individual atmospheric layers. The change should be dependent on concentration of green house gases affecting our climate conditions. The measurements of thermal radiation in direction from Earth up and from top down as function of altitude should allow us to determine stratification of green house gases in our atmosphere.

SDS 03 TEFOS – Photovoltaic Test System for Stratospheric Applications

The aim of this experiment was to test options for supplying energy to electronics by photovoltaic cells on stratospheric probe having unstable motion (rotation, wobbling). Undertaken measurements here involved total system power and its changes as function of probe's motion and changes of electric current



Figure 1. SDS 03 shortly before take off



Figure 2. Picture of Earth from SDS 03 in stratosphere

and voltage with regards to loss of Sun's light. We tested ability of the system to supply enough of energy with required stability not facing the Sun and collected information about system behaviour with regards to its altitude.

SDS 03 CTS - CzechTechSat – A Space-friendly CubeSat-Class Picosatellite

CzechTechSat is a student cubesat with 1U size, which is dedicated to development of electronic subsystems with enhanced radiation resistance based on components, which do not fall under export restrictions (ITAR). Aim of this experiment was to check functionality of developed subsystem in near-space environment.

SDS 04 ZARV – R-Wave Record

This experiment focused on detection of R waves, which propagate along Earth's magnetic field and are responsible for electron acceleration to relativistic velocities. The mechanism is not quite known. These electromagnetic waves have low frequencies comparable to acoustic waves. They are produced at increased rate during geomagnetic storms but there is a high probability of capturing them also during normal stratospheric conditions.

SDS 04 Life and Conditions in Stratosphere

This experiment was about detection of local intensities of UV radiation, temperature, pressure and humidity in order to determine influence of conditions



Figure 3. Preparation of living organisms for experiment in stratosphere onboard of SDS 04

in stratospheric altitudes on viability of various types of model organisms. Its aim was to test resistance of the life forms under extreme conditions.

3. SUMMARY AND FUTURE OUTLOOK

We have started a cooperation project dedicated to stratospheric experiments called „Together into the stratosphere“ and already executed several of them. These experiments involved technology demonstration missions, biological experiments and climate condition observations. Our group and cooperative institutions want to keep on advancing our stratospheric flights. We prepare already two new flights with biochemical, biological and other experiments and we are looking for partners for future projects.

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