INTRODUCTION

We are the team « Les filles de l’air », from the Institut de la Providence in Ciney, where we follow the « Applied sciences » option. We have ten hours of theoretical courses and laboratory sessions a week. It prepares us for bachelor degree or master degree studies in sciences. Ciney is a small city of about five thousand inhabitants 25 kilometers south east of Namur.

ABOUT OUR SECONDARY MISSION

We’ve decided to measure the humidity, for different reasons : First, by the observing the condensation trails left by airplaines. Some questions arise about their origin. Is the water vapor released while burning kerosene fuel sufficient to explain their appearence. Probabily the presence of micro-particles aggravates this phenomenon. since air traffic is expected to grow steadily, it might be an issue to control these condensation trails. On the other hand, they may be enhanced in order to create artificial cloudiness and temper the global warming.

Ou mission must be seen as part of research program on understanding the condensation phenomenon, and therefore control (artificial) cloudiness, control of mist/smog/fog …

A humidity sensor will be sent in the Cansat, and record the (relative) humidity. Depending on the actual (real) conditions on the launch day, some conclusions can be made by this relatively simple test. Do the cloud bases correspond to the 100 % humidity level ?

Altitude and temperature data are (indirectly) provided by the base mission. The base mission measures pressure (thus atitude) and temperature.

THE CANSAT DESIGN

* Electronics/boards
The cansat is constructed around the T-minus mainboard. The additional plates (Transmitter, Primary mission, secondary mission) are stacked and firmly maintained by steel rods. To ensure that disassembling/reassembling of the stack is easy, we used spacer tubes to minimize the use of nuts. The two mission plates are independent. In case of defective plate, it can be easily replaced.
* Shell
The shell is a regular beverage can. The top of the can has been removed, so the plate assembly can be slided in. A strong metal bottom plate is bolted to the bottom of the can. A can top from a second can covers the top of the cansat to secure and rigidify the structure. The can is drilled to allow the sensors to be in contact with the outside environment.
* Power supply
The power supply consists of a standard 9V non-rechargeable battery. The battery compartment is easily accessible by removing the assembly from the can, and the battery, since it is heavy, is firmly secured between two plates. A master switch can be accessed through a hole in the can.
* Parachute/recovery
The parachute has been made by sewing 12 kite-nylon gores together. The shape of the gores has been calculated to make a half-sphere parachute, with a central hole for stability. The parachute color has been designed for easy recovery.
* Antenna
The onboard antenna has been left unchanged : a quarter wavelength copper wire, hanging out of the metal structure of the can.
The ground station antenna has been modified to strengthen the signal. We decided to use the Yaki, or rake desing with progressive spacing, made of aluminium rods and a wooden bom. The signal receptor consists of two quarter wavelength dipoles. The space between the director rods increases as the distance from the receptor increases. Distances between reflector, receptor dipole and directors are obtained from antenna calculators. since there are numerous results (as much as calculators), the antenna can be trimmed : the length of the rods can be slightly adjusted by a telescopic design, and the distances between the rods can be adjusted thanks to the pre-drilled wooden bom.

PROGRAMMING

The programming has been made straigthforward. Because using data sheets didn’t give satisfactory results, and after seeking help from the Cansat support, we used only equations from calibration curves. The raw data are transformed by functions to useable data, like temperature, pressure …

The programs (sketches) are simplified as much as possible by placing the complexity in dedicated functions, and let the main program loop do only three things :

* read the raw data
* pass raw data to conversion functions
* display the useable results.

TESTING

The tests have been completed.