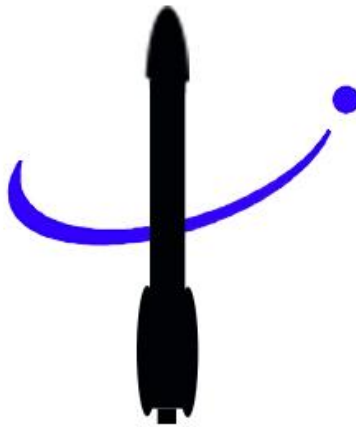


Rocket Master

All You CAN Fly



April 8th to 11th, 2010



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Acronyms list

CDR	Critical Design Review
COIAE	Professional Association of Aerospace Engineers
COITAE	Professional Association of Technical Aerospace Engineers
CONOPS	Concept of Operations
INTA	National Institute for Aerospace Technology
LCO	Launch Control Officer
LEEM	Laboratory for Space and Microgravity Research
MSDS	Material Safety Data Sheet
NAR	National Association of Rocketry
PDR	Preliminary Design Review
RSO	Range Security Officer
TRA	Tripoli Rocketry Association
UPM	Technical University of Madrid



1. Introduction to *Rocket Master*

The ‘**Rocket Master**’ competition offers to students and professionals an exceptional opportunity for interacting between themselves, designing and developing rockets, during several exhibitions and competitions.

The inscription for participants will be opened until February 28th 2010, on the competition website (<http://fly.leem.es/>). All teams must pass a Preliminary Design Review (PDR)

This competition is opened to all student community –high school and university- as well as professionals from any country.

2. *Rocket Master* Categories

The 2010 competition covers the following categories:

2.1 *Battle of Rockets*

All participants must use the same engines, one ‘H’ or two ‘G’, to be chosen among the several given types (specified on the 4.1 Engines section). The engines will be provided by the Organization.

Performances of each team will be evaluated based on the following parameters:

2.1.1 MS – Maximal speed

Maximum speed reached by the rocket.

2.1.2 MH – Maximal High

Maximum apogee reached by the rocket.

Rocket data (high and speed) will be measured by on board electronic equipment, supplied by the Organization and specified on the 4.3. *Electronic Module* section. The rocket must be recovered with no damage. The jury will evaluate each rocket on the launch field.

Note: In the case of the rocket will not be recovered in good condition, the jury will evaluate the global performance of the team to give their verdict.

2.2 *Technological Demonstration – Rockets*

This category is open, and it is oriented for all those people who want to test certain systems, engines, and so on, in any of the previous categories or who want to develop any kind of scientific experiments.

LEEM suggests some examples as: braking and recovery system, rocket developments allowing experiment under microgravity conditions, ejection systems, rocket engines, and so on.

In this category, the jury will take in account academic level of the team members, external support received, working hours spent and total project budget. It will be done in order to value the effort done by the students/professionals.



The achievement of each team in relation to the proposed objectives will be evaluated during the results briefing act. It will be done the day before to the launching season. The Organization and the jury will finally decide if the project presented by the team pass the security requirements to fly. If not, the rocket not will be launched under any circumstance.

3. The Rocket

In the *Battle of Rockets* category, all rockets must house the electronics supplied by the Organization which will collect all necessary data in order to evaluate the teams' performance in the same way. Its dimensions are specified in the *4.3 Electronic Module* section. Moreover, each rocket should have its own ejection and brake system, to be able to recuperate its structure. It is mandatory the recuperation of the rocket with no damage.

Teams which will participate in any of the categories should build a rocket which complain the following specifications:

1. Inspections
 - 1.1. Design. During the Preliminary Design Review the rocket design will be analyzed according to the documentation provided by the teams. The jury will be able to request any change to guarantee the security of its operation.
 - 1.2. Rocket. The first day of the competition the rocket will be analyzed to verify its structure as well as its robustness. The launch of the rocket it will be authorized only if the jury considers that it fulfills the requirements to perform a safe and stable flight.
2. The maximal high which the rocket is allowed to reach is 3 Km.
3. The rocket structure should house the electronics module provided by the organization and described in the *4.3 Electronic Module* section. The electronic module should be fixed rigidly to the structure. On the other hand the integrity of the module will be reviewed in the PDR.
4. The rocket should adapt and slide on the launch pad profile described in the *4.Interfaces* section.
5. The rocket should house correctly the engine provided by the organization, as well as to block TOTALLY its axial movement. The engine is introduced only minutes before the ignition. Its dimensions, mass and thrust are specified in the *4. Interfaces* section.

3.1 Rocket acceptance inspection

The rocket acceptance inspection will be performed by turns during the afternoon of the first day of competition. During the briefing, it will be assigned to each team a specific time to perform the inspection. The parameters to verify will be the following ones:

- **Maximum thrust load:** The thrust bay, which house the engine, should support a static load equal to the maximum push of the engine selected by the team. For this test, the structure will be simply leaned on its upper side (to be defined by the organization according to the design) and on the thrust bay the force will be applied.



- **Maximum aerodynamic load:** for a transversal wind of 10m/s, the rocket should support the stationary aerodynamic maximum loads. The maximum allowed distortion on the nose cone edge, with the maximum aerodynamic load applied, will be the 1% of the total rocket length (1% regarding to the load-less static position).
- **Aeroelastic loads:** The rocket should be designed to overpass neither the divergence minimum speed nor the flutter speed on wings and structure.
- **Dimensional verification:** Standing the rocket on its thrust bay, the maximum allowed distortion (on the nose cone edge) will be the 1% of the total rocket length, regarding to the motor axis.
- **Static stability verification:** It will be verified: weight, mass center (its variation should be indicated and pressure center. When leaving the launch pad, the pressure center must be at least 1 rocket diameter from the mass center, backward direction.

Inspections will be done for the rocket launch configuration, including the electronic module and engines provided by the organization.

Once the PDR will be delivered, the organization will analyze the design and will inform to the teams about the specific tests that they should pass the day of the flight.

Any rocket will be launched if the organization or the jury considers that it does not fulfill the requirements to guarantee a safety stable flight.

4. Interfaces

All following sections apply only to the competition *Battle of Rockets*, except the section 4.2 which also applies to the category Technological Demonstration.

4.1 Engine

Engines used in this competition are *Cesaroni Pro38* (www.pro38.com). The models available to choose by the teams are:

- Single engine: category H (*dimensions : type 2G*)
 - Pro38 266H125
 - Pro38 273H225
- Two stages: category G (*dimensions : type 1G*)
 - Pro38 150G50
 - Pro38 141G115

(any combination of these two engines is available)



Type	DIM 'A'
1G	4.59
2G	6.89
3G	9.20
4G	11.50
5G	13.81
6G	16.11
6GXL	19.71



Longitude in inches

The engines will not have activated ejection devices. The rocket should include the necessary devices to recuperate totally its structure,

4.2 Launch Pad

The rocket should have a guide to guide it during the take off through the 3m launch pad length. Those rockets which need a longer launch pad should specify it in the PDR.

The profile used is a BOSCH 30x30 with an of 8 mm line. The dimensions of the launch pad profile are shown in the figure 1.

It is recommended to use the standard guide (figure 2) provided by the profile's manufacturer: 8 mm slide bearing, flat (PN 3 842 523 212)

<http://www13.boschrexroth-us.com/catalogs/mge60/sections/section13.pdf>

Figure 1

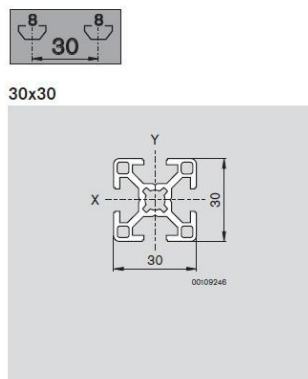
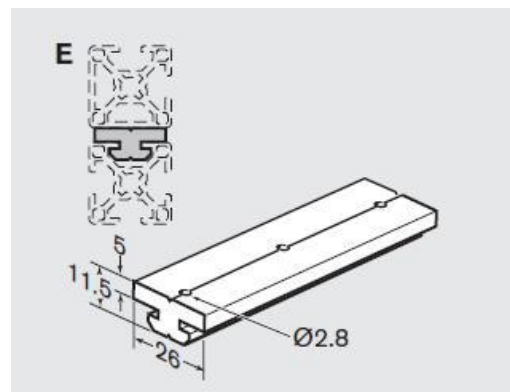


Figure 2



The rockets whose longitude will be more than 700mm should have two guides.



4.3 Electronic module

This module should be integrated in all the rockets, which will participate in the *Battle of Rockets* category, obtaining all necessary data for the competition.

Electronic module provided by the organization will be a commercial altimeter, **PerfectFlite Alt15K/WD Rev2**, whose specifications are available on:

<http://www.perfectflite.com/index.html>



The rocket should house this device and assure a correct assembly as well as integrity during the flight, including the landing

The module will be installed in the rocket just before the launch. In consequence, the fast installation in the rocket should be taken in account by the teams.

The organization will verify the design of the module integration bay, through the documentation delivered in the PDR.

5. Launching procedure

The day of the competition will be published a list with the launch time for each team. Once the teams will be called to the launch zone and the final inspection of the rocket will be performed, the rocket will not be able to exit this zone as well as will not be manipulated by the team.

The organization will inform to the teams before the launch, about the estimated wind profile. The teams will be in charge of specifying AZIMUT & ELEVATION launch angles.

During the access to the launch pad only one person of the team will be allowed to access to this zone joint the launch technicians to perform all the operations required on the rocket. Once the rocket is assembled on the launch pad, this team member should leave the security area.

The organization will be in charge of recuperating the rocket as well as of delivering it to the team.