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Author: Mr. Xavier López  
Spain

Mr. Victor Ubieto  
Spain

Mr. Nestor Fuertes  
Spain

DESIGN AND CONSTRUCTION OF A RELIABLE, VERSATILE AND INEXPENSIVE ROCKET  
LAUNCHER FOR CANSAT COMPETITIONS.

**Abstract**

Founded in 2016, Cosmic Research is a non-profit student association focused on suborbital rockets for scientific applications. In 2017, the association launched its first CanSat. Every year since then, Cosmic Research has signed launch contracts with regional and national Spanish CanSat organisers, who are directly supported by European Space Agency's education branch. To the present date, the association has launched a total of 54 CanSats. In Spring 2019, the exponential growth of participants in these competitions called for the development of a new launcher. This new rocket should be capable of launching more CanSats during the same time slot, and do so in a reliable, inexpensive, and easily replicable process. Cosmic Research would apply all its knowledge and experience to develop a rocket that could outperform commercial out-of-the-shelf kits. The design of a prototype started in October 2019, and was first launched in February 2020. The flight was successful and a modified version of the prototype will be used during 2020 Spanish CanSat Competitions. This paper covers the design and manufacturing process of that prototype. The result was a 150 mm wide and 2.15 m long rocket named "Christa", named after Christa McAuliffe, U.S. high school teacher and astronaut. The rocket is capable of launching up to 6 CanSats to a desired altitude between 500 and 1,000 meters. It can withstand ground winds up to 8 m/s and has a dual-deployment parachute system aimed at reducing its recovery distance. The rocket can be reused up to a 94% of its initial launch mass and has a modular design, accepting a large range of diameters of amateur solid rocket motors. The launcher is easy to assemble and does not use any fix unions, meaning broken parts can quickly be replaced after the launch. The payload section is made of a radio-transparent material that enables constant communication between a CanSat and its ground station. Furthermore, the payload section is designed in a way that the CanSats can be integrated in the rocket prior to the installation of any pyrotechnical device. This feature greatly reduces the risk for the participants, aged between 14 and 18 y.o. Eventually, Christa has also proved to be more cost-effective than pre-existing commercial rocket kits. This new launcher could effectively respond to the growing demand for CanSat launches in Europe and worldwide, enabling more students develop their talent in space.