

Didactic sequence about satellites and space debris in an Astronomy course to the training and capacitation of teachers in Amparo/SP, Brazil

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Abstract. Deactivated satellites and countless objects characterized as space debris endanger orbital regions, air routes and land regions. Considering the problem, in 2018 the didactic sequence Satellites and space debris was carried out in the course Translation of scientific knowledge: Continuing education and training in Astronomy and affiliated sciences for teachers and undergraduates, applied to teachers of the Municipal Secretary of Education of Amparo and undergraduates of the University Center of Amparo/UNIFIA, with materials for the didactic workshop offered by the Brazilian Space Agency (AEB, in Portuguese).

Resumo. Satélites desativados e inúmeros objetos caracterizados como debris espaciais ameaçam regiões orbitais, rotas aéreas e regiões terrestres. Considerando o problema, em 2018 foi realizada a sequência didática Satélites e debris espaciais no curso Tradução do conhecimento científico: Educação continuada e capacitação em Astronomia e ciências afins para professores e graduandos, aplicado às professoras da Secretaria Municipal de Educação de Amparo e graduandas do Centro Universitário de Amparo/UNIFIA

Keywords. Satellites – Space Debris – Teaching of Astronomy

1. Introduction

The space pollution is due to obsolete, deactivated satellites and uncontrolled objects of various proportions [parts, tools, fragments, etc.] orbiting the Earth up to 7,78 m/s [28,000 km/h] designated as space debris [Figure 1], endangering orbital regions, air routes and land locations Ferreira & Voelzke (2016). According to the European Space Agency [ESA], an estimated 34,000 objects larger than 10 cm; 900,000 between 1 cm; and 10 cm and more than 128 million between 1 mm and 1 cm, totaling over 8,400 t (ESA 2019).

2. Development

Astronomical and Scientific Education raises awareness about the serious problem of space debris, so Ferreira, under the guidance of Voelzke, developed and taught from August 2018 to March 2019 the course Translation of Scientific Knowledge: Continuing education and training in Astronomy and affiliated sciences for teachers and undergraduates. (32 hours), offered to teachers of Basic Education of the Municipal Secretary of Education of Amparo, São Paulo, Brazil, and to graduates of the University Center of Amparo/UNIFIA). Among the didactic sequences [DS] of the course, the theme Satellites and space debris contextualizing from Oct. 10 1957, when the Soviet satellite Sputnik I, to the present day. In DS it was discussed about orbits, satellites, spatial debris and the mapping of the Sattelite Catalog (Space-Track.Org 2019). At the request of Ferreira, the Brazilian Space Agency AEB (2017) collaborated offering for a didactic-pedagogical workshop: satellite folding, booklets Coloring and Learning with Cosminho, books of the National Space Activities Program [PNAE, in Portuguese] 2012-2021, informative with five questions and answers from AEB and media [DVD] with digital files [books, manuals and forms] and videos from the Brazilian Space Program [Figure 2].

The covenant [2015-2020] between the Institute of Astronomy, Geophysics and Atmospheric Sciences of the University of São Paulo [IAG-USP, in Portuguese] and the Cruzeiro do Sul University [UNICSUL, in Portuguese], brokered by Voelzke [UNICSUL] and Prof. Dr. Ramachrisna Teixeira [IAG-USP], allows the authors to participate in the monitoring and cataloging of space debris at the “Abrahão de Moraes” Observatory [OAM, in Portuguese], in Valinhos/SP. This way, later allowing itself in the DS to transmit to the cursists information and precise knowledge about the subject.

3. Conclusion

The students showed interest in the theme and the participation of Brazil in space research, and Brazilian Space Agency materials contributed to a better understanding. In addition, activities at the Astronomical Pole of Amparo for satellite recognition at the Planetarium “Prof. Romildo Póvoa Faria” and the unarmed location in the night sky. Regarding the spatial debris, in DS the works developed by the authors through the agreement between the IAG-USP and the Cruzeiro do Sul University were discussed.

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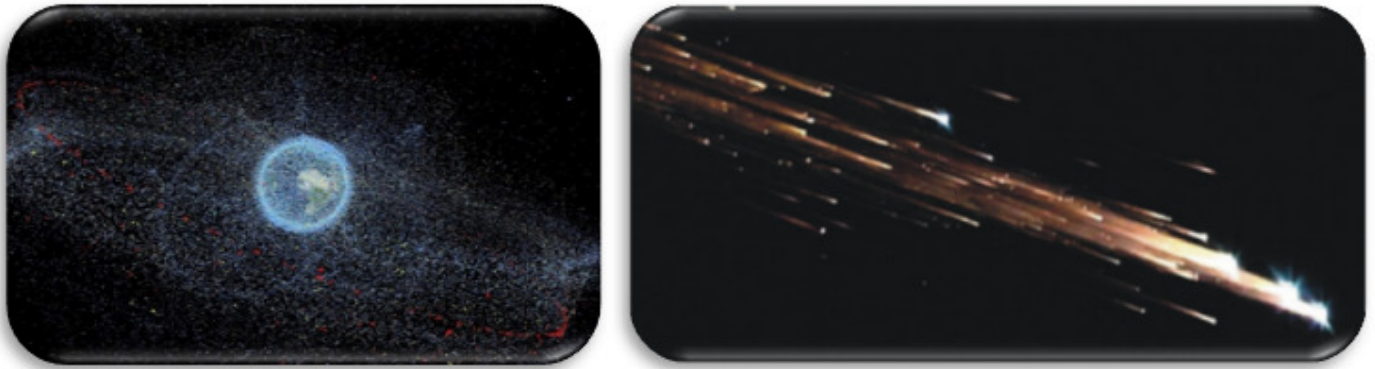


FIGURE 1. Space debris polluting Earth's near orbit and endangering orbital regions, air routes and land locations. Source: European Space Agency (ESA c. 2019): https://www.esa.int/ESA_Multimedia/Images/2019/10/Distribution_of_space_debris_around_Earth.



FIGURE 2. Some teachers of the Municipal Secretary of Education of Amparo and undergraduates of the Amparo University Center/UNIFIA participants in the course *Translation of scientific knowledge: Continuing education and training in Astronomy and affiliated sciences for teachers and undergraduates.*; in the didactic sequence about satellites and space debris received the materials provided by the Brazilian Space Agency (AEB c. 2017). Source: Photos by Ferreira, Orlando Rodrigues, Sep. 22, 2018; for this work, the participants allowed the use of personal images.