



# Sorvegliati Spaziali in the service of Planetary Defense

## Enhancing communication with augmented reality

D. Guidetti<sup>1</sup>, L. Leonardi<sup>2</sup>, M. Galliani<sup>3</sup>, C. Boccato<sup>4</sup>, D. Coero Borga<sup>3</sup>

The remaining authors can be found at the end of the paper.

<sup>1</sup> Istituto Nazionale di Astrofisica – Istituto di Radioastronomia, via Piero Gobetti 101, 40129, Bologna, Italy e-mail: [daria.guidetti@inaf.it](mailto:daria.guidetti@inaf.it)

<sup>2</sup> Istituto Nazionale di Astrofisica – Osservatorio Astronomico di Palermo, piazza del Parlamento 1, 90143, Palermo

<sup>3</sup> Istituto Nazionale di Astrofisica – Sede Centrale, viale del Parco Mellini 84, 00136, Roma, Italy

<sup>4</sup> Istituto Nazionale di Astrofisica – Osservatorio Astronomico di Padova, vicolo dell'Osservatorio, 5, 35122 Padova, Italy

<sup>5</sup> Osservatorio Astronomico di Torino, via Osservatorio, 20, 10025 Pino Torinese, Italy  
The remaining affiliations can be found at the end of the paper.

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**Abstract.** Sorvegliati Spaziali is a communication project of the Istituto Nazionale di Astrofisica (INAF) and one of the world's first public awareness campaigns on Planetary Defense coordinated by a research body. It benefits from the close collaboration with the external company Vitruvio Virtual Reality for the development of innovative digital communication experiences. It is as part of this collaboration that the project's website [sorvegliatispaziali.inaf.it](http://sorvegliatispaziali.inaf.it) and more recently a brochure with AR-enabled content and the dedicated AR app, called Sorvegliati Spaziali, have been created. The app enables to simulate Planetary Defense phenomena in the user's environment, as well as providing in-depth content. Here we present the Sorvegliati Spaziali project, the architecture and content of the website and more in details the AR app.

**Key words.** Communication – Solar System: Sun, Asteroids, Comets, meteors, meteorites, Space Weather – Space Situational Awareness

## 1. Introduction

Among the many threats we face on Earth, those originating from space pose significant challenges, and these are encompassed within the field of Planetary Defense. Such definition is indeed used to cover all the capabilities

needed to reach a full *Space situational awareness* - SSA (Bobrinsky & Del Monte, 2010) of the space surrounding the Earth, including detection of space debris, asteroids and comets that pose a potential threat to our planet, study of the space weather phenomena, and then issue warnings and enable strate-

gies in order to prevent or mitigate their possible effects. While these topics are globally relevant and capture the public's imagination — often perceived as directly impacting our lives — public communication on Planetary Defense is still very fragmentary and embryonic. Indeed, there are few outreach products worldwide designed for communicating all-round Planetary Defense and even fewer are those coordinated by research institutions (i.e. Urakawa et al. 2023; Tichá, Tichí & Honková 2023; Rudawska, Jesse & Jehn et al. 2019).

On the other hand, the public is frequently exposed to sensationalized media reports (i.e. exaggerated claims about newly discovered asteroids being on a sure collision course with Earth), revealing how Planetary Defense is an area of misinformation and fake news. This in the long run risks undermining public trust in science communication (for non-existent and clickbait alarms), and/or in science research due to the perception of scientists making wrong predictions.

This underscores the importance of a well-organized and scientifically grounded public outreach campaign.

The project *Sorvegliati Spaziali – looking up to Space to protect our Planet* was created with this goal: it is a public communication project of the Istituto Nazionale di Astrofisica (INAF) entirely focused on Planetary Defense (Guidetti, Boccato & Coero Borga et al., 2022, 2023), with the endorsement of the Outreach Office of NASA's Planetary Defense Coordination Office.<sup>1</sup>

Sorvegliati Spaziali represents one of the first coordinated public outreach initiatives on such topics by a research body and it is at the forefront for the use of transversal, multidisciplinary, narrative science language.

## 2. Sorvegliati Spaziali's key objectives and communication strategy

From near Earth asteroids and comets to space weather, from meteors and meteorites to space debris, Sorvegliati Spaziali aims specifically to

provide timely scientific and cultural knowledge on Planetary Defense offering information and in-depth content. The communication strategy is based on the realization of cutting-edge multimedia and online resources to facilitate broad dissemination to diverse audiences (including the general public, schools, and enthusiasts) and exploring different communication languages and technologies. The project also points to develop a strong and consistent visual identity.

## 3. The Sorvegliati Spaziali website

The core of the project is the website *sorvegliatispaziali.inaf.it* available online since October 2021 (in Italian, with some content also provided in English).

The website was developed in collaboration with the Italian web design company demarka<sup>2</sup> to achieve a highly professional, responsive and flexible platform, optimised for navigation both on desktop and mobile devices. Developed in WordPress<sup>3</sup>, the site is entirely graphical and multimedia and offers a clear organisation of the four main Planetary Defense themes, as well as a strong visual, dynamic and intuitive identity. Figure 1 shows a realistic graphic representation of the website homepage.

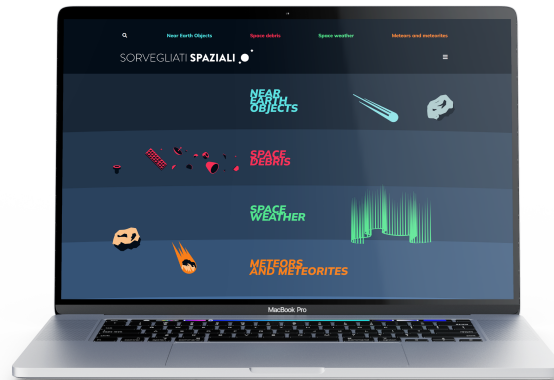
On the site are published most of the communication products developed as part of the project. For each of the four main themes (near-Earth asteroids and comets, space debris, space weather, meteors and meteorites), a specific colour was assigned, which is used consistently for all communication products related to that theme.

Our original communication products published on the website include: news, educational and theatre video clips, interviews, infographics, daily and monthly solar bulletins, monthly bulletins on near-Earth objects, a glossary, reviews of films, books, blogs, a geolocalised map with real-time tracking of satellites and space debris, comics and Augmented Reality (AR) content (Wang et al., 2018). The

<sup>1</sup> [www.nasa.gov/planetarydefense/organization](http://www.nasa.gov/planetarydefense/organization)

<sup>2</sup> <https://demarka.it/>

<sup>3</sup> WordPress Foundation. (n.d.). WordPress



**Fig. 1.** Graphical representation of the section of the homepage with the four main themes of Planetary Defense covered by the project. This visualization highlights the fully graphical nature of the website, where all icons are dynamic and interactive. As users scroll through the homepage, the icons animate, creating a smooth and engaging visual interaction.

AR is a technology that allows digital elements, such as images, sounds or texts, to be superimposed on the surrounding physical world in real time and through devices such as smartphones and tablets. This AR product is extensively described in the following chapter.

#### 4. Sorvegliati Spaziali and the Augmented Reality

AR applications (AR apps) have a great potential for communicating science in an engaging, accessible and more tangible way (Daricello, Rometsch & Di Giacomo et al. 2023 and reference therein). This is especially true for the younger generations, who nowadays have high expectations from digital communication and are attracted by technological innovation and interactivity.

One of the specific objectives of the project was to develop a distinctive and appealing science brochure on Planetary Defense to be dis-

tributed at institutional and public outreach events, and in schools.

To achieve this, we decided to incorporate AR content leveraging the significant potential that nowadays AR holds in modern science communication and public engagement.

##### 4.1. The Augmented Reality Brochure

We developed the AR brochure in collaboration with *Vitruvio Virtual Reality*, a brand of the company responsible for development of the Sorvegliati Spaziali website to ensure the continuity of the graphic style between the brochure and the website.

The brochure is designed in a vertical A5 format and can also be opened vertically. The cover colors align with the main blue shade of the Sorvegliati Spaziali website.

The captivating narrative starts with the cover page, showcasing Earth alongside a trail of elements open to multiple and valid interpretations (top panel of Fig.2): the stars of the

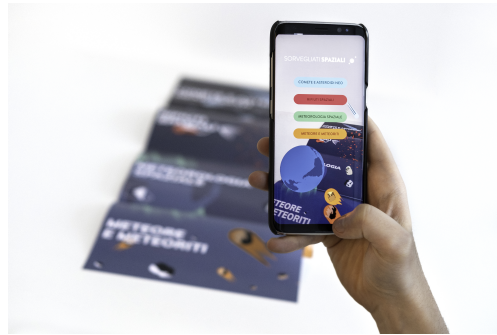
Milky Way, space debris in Low Earth orbit, or the Main Asteroid Belt, the source of potentially hazardous asteroids. The message is that Earth is the protagonist within a spatial context from which it must be protected (the illustration continues on the back cover).

The first page concisely explains Planetary Defense and the Sorvegliati Spaziali project and provides the QR code for downloading the AR app. Opening the brochure reveals a brief overview of the four Planetary Defense themes, while a further vertical opening shows a version of the website's homepage with high-contrast color adjustments, necessary to trigger AR content via a mobile device (bottom panel of Fig.2).

The brochure was realized in both Italian and English.



**Fig.2.** The cover (top) and one of the internal pages (bottom) of the Sorvegliati Spaziali brochure.



**Fig.3.** Representation of the use of the Sorvegliati Spaziali AR app via a mobile device to activate augmented reality content from the brochure.

#### 4.2. The Sorvegliati Spaziali AR App

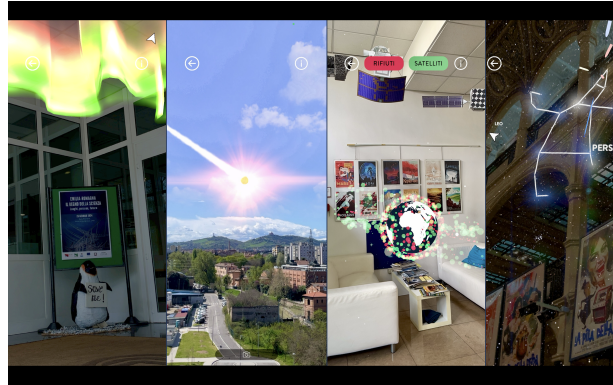
The AR App of the project is called *Sorvegliati Spaziali* and enables to simulate Planetary Defense phenomena in the user's environment, as well as providing in-depth content. It can be used with or without the brochure and offers four main AR experiences plus an extra one when used in combination with the brochure (Fig.3). The AR app utilizes 3D graphic content created using modeling software and then integrated into the Unity platform<sup>4</sup>.

By navigating our AR App, the user can gain an overview of the Sorvegliati Spaziali project or dive into the immersive AR experiences. The main AR experiences, one for each of the four Planetary Defense topics are (see Fig.4):

1. a dynamic and colorful aurora whose sound can also be heard thanks to the sonification of emitted radio waves into sound waves
2. entry and explosion of an asteroid into the Earth's atmosphere, followed by a meteorites search on the ground.
3. active satellites and space debris orbiting Earth and visible from different angles
4. three meteor showers (Perseids, Leonids and Eta Aquarids) superimposed on the starry sky and in particular on their own constellations and branching off from a point known as a radiant. Colors and brightness are consistent with observation in statistical studies (McBeath, 1991).

<sup>4</sup> Unity Technologies





**Fig. 4.** Screenshots of the four main Sorvegliati Spaziali AR experiences

Moreover, photos of the AR experiences can be taken with the rear camera of the mobile device.

Besides being an entertainment product, the app offers in-depth content for each AR experience and can be used for educational purposes with the aim of making learning more engaging and helping to keep students' attention high.

The Sorvegliati Spaziali AR app<sup>5</sup>, is free and available for iOS and AR-compatible Android mobile devices (mobile phones and tablets), both in Italian and English.

## 5. Conclusions

INAF Sorvegliati Spaziali is one of the world's first public awareness campaigns on Planetary Defense coordinated by a research body. By combining innovative digital communication tools, such as the dedicated website hosting a variety of outreach products exploring different communication languages, and the Augmented Reality app, the project points to engage diverse audience in terms of interests, cultures and age groups.

The use of multimedia content and interactive AR experiences not only enhances comprehension but also fosters a deeper understanding

of the complexities of Planetary Defense phenomena.

It is essential to emphasize that our communication approach goes beyond mere edutainment; rather, it represents as well a strategic approach to addressing critical issues such as risk perception and communication associated with space events, particularly toward younger generations. This dimension is particularly significant in light of 2029, a year that could be declared the International Year of Planetary Defense, during which global attention will focus on protecting Earth from potential space threats.

## Authors

D. Gardiol<sup>5</sup>, P. Soletta<sup>6</sup>

## Affiliations

<sup>6</sup> Istituto Nazionale di Astrofisica – Osservatorio Astronomico di Cagliari, Via della Scienza, 5, 09047, Selargius, Italy

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