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Space exploration was initiated only 50 years ago but it has already given mankind a different perspective on the way we look at the universe and at our position within it.

Human spaceflight is the pinnacle of space exploration, and the International Space Station (ISS), with its global international participation and its outstanding achievements, tangibly demonstrates what can be accomplished. The ISS Programme is the most complex space project ever undertaken, with 15 countries involved. Its construction began in 1998 and was completed in 2010, with a total mass of about 400 metric tons and the size of a football field.

The European Space Agency (ESA) joined the ISS programme in 1995, with several projects; among those, the most important contribution is the Columbus Laboratory, a multi-user research outpost orbiting the Earth at an altitude of 400 km, with a speed of 28,000 km/h, in a permanent state of low gravity.

The Columbus Laboratory, attached to the ISS since 2008, is outfitted with a variety of multi-user scientific equipment to conduct investigations in different fields, from human physiology to biology, materials science, fundamental physics and others. Columbus is planned to be in operation until at least 2020.

Gravity is the only physical parameter that has never changed since the Earth was formed and investigations conducted in low gravity conditions, such as those offered by the Columbus Laboratory, are expected to lead to major discoveries, which will make a key contribution to the innovation cycle crucially needed in Europe.

Indeed, the availability of open, competitive and quality-based access to pan-European global research infrastructures is becoming increasingly important at European Union (EU) level. Resolutions adopted at meetings of the Space Council have advocated a strong synergy between the EU Framework Programmes and ESA activities; the European Parliament has also formulated a similar encouragement.

In line with the above, ESA has initiated actions aiming to integrate the Columbus Laboratory, as a unique multi-user European research infrastructure in orbit, into the European Research Area. The European segment of the ISS including

Columbus can be defined as the European Laboratory in Space, and the research conducted onboard will have a multiplier effect on the R&D budgets of the EU.

An early example of the advocated synergy between ESA and the EU in the field of human space exploration is the ULISSE project, funded by the EU.

The ULISSE project is aiming, among other goals, to set up a system that makes the scientific data generated onboard the ISS easily available to a vast community of researchers, while ESA will generate the scientific data onboard Columbus.

The combination of these activities is considered a fundamental concrete step towards increasing the return on investment for the European population, and playing an important role in responding to the Grand Challenges Europe is facing, as well as in supporting the Europe 2020 Vision strategy.

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This book originates from the results of the ULISSE project, which is co-funded by the European Commission within the Seventh Framework Programme.

It is worth noting the context in which the project has arisen and the needs and perspective it is attempting to address: the context of the global knowledge society. Everything is becoming global, this has both benefits and drawbacks; however one area in which this general trend leads only to advantages is the generation of global knowledge and the possibility to share the benefits derived from cooperative scientific research.

Scientific research in Space can be seen as a paradigm of how a common objective can be achieved through a worldwide cooperation, and the building of the International Space Station is one of the clearest examples of that.

Even if access to Space and its use and control remain some of the most widely discussed arguments, due to their direct impact on the security of nations, nevertheless in the field of scientific research in Space it is time that the results obtained up to now became a common heritage for all humanity, to enable citizens to take advantage in their daily life. In this, Europe can be an example to all other nations.

The International Space Station is an exceptional Laboratory, the availability of advanced facilities in a stable space environment with humans on board makes it one of the most prominent research infrastructures available for the European science communities. However, there remains a fundamental gap that still needs to be filled.

This is mainly due to the fact that the results obtained are accessible only to a restricted community of users who became more acquainted with experimentation in microgravity in the last two decades. These results need to be made available to a wider community of researchers, even those not directly involved in space experimentation. They will be able to look at these results from a different perspective enhancing the interdisciplinary approach and supporting research in fields different from the ones in which the experiments were originally conceived. This approach will stimulate new ideas and new possibilities to discover applications with an impact on the daily life of citizens. Not only should space results be exploited to

their maximum potential, they also need to be part of the education of new generations in order to establish a common knowledge on which we can build our future.

Today we have in our hands technologies that offer us unprecedented possibilities to integrate and share distributed knowledge, and to develop tools for the analysis, promotion and dissemination of the body of knowledge generated by space experimentation. The ULISSE project intends to apply these technologies so that an ever-growing number of users is able to access data for developing new applications and new research perspectives, on the ground as well as in Space, looking at planetary exploration, and, last but not least, to contribute to promoting a cultural change in the way citizens consider Space – as an environment in which it is possible to work and achieve results that improve our lives.

To accomplish these results, many issues and challenges have been faced, some have been solved, others need further research, but all the people involved have a clear understanding of the relevance of the perspective they are working on, and all are confident that ULISSE will ultimately reach Ithaca.

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