

Preface

This book has evolved from the “Spacecraft Operations Course,” a 1-week series of lectures and exercises, which has been held annually for the last 14 years at the German Space Operations Center (GSOC) in Oberpfaffenhofen. Originally, our plan was simply to create a handout for this course. However, as we found that there is currently no up-to-date book that deals exclusively with the operations of spacecraft, we extended our project, supplemented, and detailed the chapters, allowing us to complete it in form of a book. That said, most of the 22 subsections are still based on lectures from our current “Spacecraft Operations Course.” In addition to the participants of the course, the target group of this book includes students of technical or scientific studies as well as technically interested parties, who wish to gain a deeper understanding of spacecraft operations.

The book begins with a brief summary of the space segment (Chap. 1), introducing the “Space Environment,” “Space System Engineering,” and “Space Communications,” which establishes the connection to the ground segment.

The book now follows the classical fields of operations: mission operations, ground infrastructure, flight dynamics, and mission planning.

The mission operations system is described in Chap. 2. This chapter is based on the life cycle of a mission and is therefore chronologically represented along the phase model used in astronautics. The ground and communications infrastructure, however, provides cross-mission support services; hence, the representation of Chap. 3 is oriented towards the systems. The flight dynamics system (Chap. 4) in turn has the focus on the attitude and orbit control of the satellite platform while the mission planning system (Chap. 5) takes care of an effective management and utilization of the payload.

The two last chapters deal with the details of specific mission types: Chap. 6 describes the operation tasks of the various subsystems of a classic unmanned satellite in Earth orbits. Chapter 7 describes the special requirements of other mission types which are caused by the presence of astronauts, due to a satellite approaching at another target satellite, or by leaving the Earth orbits in interplanetary missions and landing on other planets and moons.

The process of writing of this book had some analogies to the preparation of a space mission: while initially there was a systematic planning process, the implementation was more of an evolutionary process including various mutations and selections. Planned sections were modified, merged, rearranged, or occasionally disappeared, new sections were introduced. Every now and then the book project came in competition with the preparation and implementation of space flight missions, so that chapters had to be put on hold. On the other hand, launch delays in space missions are a regular occurrence and this is something you learn to cope with. However, after 2 years of preparation, our book project is finally on the way to the launch pad.

This is the moment at which we like to thank all our supporters. Firstly, all authors who have endured to the end and somehow found enough spare time in addition to their ongoing mission projects to provide valuable input. A very warm thank you to our layout team Petra Kuß, Adriane Exter, and Juliane von Geisau, who provided significant support, particularly at the end of the project. We also would like to thank Bernd Dachwald of the FH Aachen, who supported us during the early planning process, Sergei Bobrovskyi and Frank Roshani, who gave valuable support when editing formulas, as well as Simon Maslin, who supported us linguistically as a “native speaker.” Last but not least, our thanks go to Beate Siek from Springer publishing for her patience during the development of this book.

It is now time to inject our book into orbit—we hope you enjoy reading it.

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