Foreword and Acknowledgements

After the publication of the 4th edition at the end of 2001, I continued updating of my docu-
mentation work as a retiree at home — not for any 5th edition — but rather for eventual 
electronic update versions of the book.

The website documentation of the “history,” i.e. the 1st chapter of the book, presents a con-
siderable update of the version published in the 4th edition [enlargement from 150 to 634 
(Jan. 8, 2007), to 635 (Apr. 11, 2007), to 642 (July 4, 2007), to 649 (Oct. 1, 2007), to 677 (Feb. 
7, 2008), to 682 (April 4, 2008) to 703 (July 1, 2008) to 732 (Oct. 2, 2008), to 742 (Jan. 4, 
2009), to 756 (April 2, 2009), to 768 (July 1, 2009), to 800 (Oct. 1, 2009), to 815 (January 2, 
2010), to 825 (April 1, 2010), to 841 (July 1, 2010) to 857 (Oct. 1, 2010), to 883 (January 1, 
2011), to 896 (April 1, 2011), to 905 (July 4, 2011) to 915 (Oct. 13, 2011), to 928 (Jan. 02, 
2012), to 956 (July 25, 2012), to 971 (Oct. 16, 2012), to 979 (Jan. 3, 2013), to 992 (April 
02,2013), to 1002 (July 01, 2013), to 1017 (Oct. 1, 2013), to 1033 (Jan. 2, 2014), to 1048 (April 
1, 2014), to 1056 (July 4, 2014), to 1074 (Oct. 1, 2014), to 1090 (January 6, 2015) to 1095 
(April 1, 2015), to 1104 (July 1, 2015), to 1116 (Oct. 01.2015), to 1126 (Jan. 16, 2016) to 1135 
(April 4, 2016) to 1148 (July 2, 2016), to 1157 (Oct. 1, 2016) to 1163 (Jan. 2, 2017) to 1179 
(April 1, 2017), to 1188 (July 3, 2017) to 1196 (Oct. 1, 2017), to 1204 (Jan. 2, 2018) to 1212 
(Apr. 3, 2018), to 1221 (August 1, 2018), to 1226 (October 1, 2018), to 1235 (January 1, 
2019), to 1236 (April 1, 2019), to 1240 (July 1, 2019).

The intent is to provide the reader with context information and historic background on 
some topics of technology introduction in spaceflight. The thematic approach led also to 
multiple mentioning of instruments, missions, observation techniques and/or technologies 
in various contexts of the documentation. Hopefully to a better overview and understanding 
of the subject matter. The history is told in a very condensed (almost abstract) fashion to 
keep it manageable to all involved.

In spite of all efforts — I am quite aware of the fact that my history is incomplete and a bit 
lopsided in favor of the western spacefaring nations. In particular, it does not reflect properly 
the accomplishments of the Soviet/Russian space program in the field of Earth observation. This is definitely not intended. The unavailability (and/or non—existence) of documenta-
tion on the Russian space program with regard to sensor developments is the prime reason for this deficit. My requests for reviews, for critical comments and for background 
information on particular topics were only of very limited success. The language barrier, the 
secrecy of the past political system, the heritage of a military—dominated space program, 
and the working habits of the Russian research community are at the root of the problem. 
The nature of any reliable history depends, however, on access to multiple information 
resources for checks and cross checks for verification.

A further intent of this electronic version of the history is to get in contact with the reader community. A feedback could certainly help to eliminate some errors and to update those topics in obvious need of correction/elaboration. However, experience with the first electronic version in the first 3—month period resulted in a total return of two e—mails (out of over 6000 website contacts).

I am aware of the fact that the history alone contains more than two thousand references. Many of them are simply URL (Uniform Resource Locator) labels of the Internet and as such rather unreliable sources. They may be changed or deleted by the provider — making them eventually inaccessible to the reader. The situation reflects actually the fast—changing environment of today. Sometimes this is the only access available to me (I always try to get published references). I am also aware of the vast amount of acronyms used in the text. Well, this is the way things are conveyed today among the people involved. For this reason, I have added Appendix B “Acronyms and Abbreviations” that should provide a fairly reliable look—up source in case of need. Frequent use of the history should give the reader a certain
degree of familiarity with the acronyms and the language of the global survey. In addition, a “Glossary” (100+ pages) has been added as of April 11, 2005.

In November 2003, I was very fortunate in receiving an offer of financial support from ESA/ESRIN (Gunther Kohlhammer). The objective is to continue updating of my extensive documentation database in Earth observation and to place the mission and instrument descriptions successively onto the Earth Observation Portal of ESA/ESRIN (whenever the information is sufficiently stable and verified). I am grateful for these new developments and hope to be of service to the reader community.

In July 2009, the “Current Table of Contents” was retired and will not be updated anymore. The reason: I am encountering lately problems in file handling on my desktop. I suspect, these problems are due to the fact of different format widths that I am using for publishing a book — and for publishing the project files for the eoPortal (and the generation of a new Table of Contents requires the standard book format in the current version).

The online service of the eoPortal was not available in the timeframe March 27 to July 24, 2012. In this period, ESA upgraded its system hardware and software and modernized the access schemes. Throughout this period, I was able to continue my documentation work, submitting over 130 files with updates and to add some new missions.

March 26, 2014: The eoPortal website has been updated and the site is now on a single platform. The previous content remains, and the new site offers an upgraded interface and new features including a search function. 1)

Gilching, 01 July 2019

Herbert J. Kramer

1) https://eoportal.org/web/eoportal/news/content/-/article/eoportal-website--updated
After 11 years of documentation work on the eoPortal for ESA in early 2015, I am realizing that my “history”, with quarterly updates loaded, has become rather sketchy throughout the years. Updates are required everywhere.

Well, I started out with my desktop “history” already in the mid—1990s, kept as a private archive to collect EO events, measurement techniques, and the introduction of new technologies on a global scale. The archive gave me more and more orientation and context whenever I was confronted with a new situation in writing up a description of a new mission.

The first history was published in the 4th edition of my book as chapter 1, containing 150 pages. I felt that my private “history of technology introduction” should also be part of the eoPortal, to be available to the reader community; hence, I kept updating this document until it reached a volume of ~1100 pages in 2015.

Naturally, the updating of the history has suffered quite a bit during the past years because the documentation and updates for the EO missions grew ever more in the number of missions to be covered as well in the investment of my time. I have invested 70 hour weeks on a continuous basis as long as I am working for the eoPortal of ESA in my retirement. A lot of dedication and interest in the subject is needed to continue on this basis.

I am realizing, that the history itself has become a fulltime job to be done in an orderly way. On the other hand, I still need the history as a resource for myself to find context and to be sure that I am in the right ballpark when introducing a new topic. At my current advanced engagement, I will try to continue to update the history, but to a lesser degree. Hence, the reader community must live with this growing deficiency.

Table 1: A note to the reader community regarding the “history of technology introduction”

Acknowledgments after the 4th edition (2002):

I would like to thank the following individuals for their cooperation in providing information, their expertise/reviews, or for general support services — making possible this update of my documentation. Naturally, this includes all topics of the documentation and not just the history. There is no particular order to the following list except that the individuals are grouped to institutional affiliations. I do value this cooperation of volunteers very much.


Tye Brady, Charles Stark Draper Laboratory, Cambridge, MA, USA; Christopher Jekeli of Ohio State University (OSU), Columbus, OH, USA; Jennifer Gebelein, Florida Interna-
tional University, Miami, FLA, USA; Peter Melvin of B—Gravity Inc., MD, USA (formerly of NRL, Washington, DC); Erik Henrikson, Arizona State University (ASU) Tempe, AZ; Ronald I. Phelps, NPS (Naval Postgraduate School), Monterey, CA, USA; Terrance Yee, Microsat Systems Inc., Littleton, CO, USA; Raid Suleiman, SÃO (Harvard—Smithsonian Astrophysical Observatory), Cambridge, MA, USA; Thomas U. Kampe, BATC (Ball Aerospace & Technology Corporation), Boulder, CO, USA; Scott Bailey, Geophysical Institute, University of Alaska, Fairbanks, AK, USA; Neal Hurlburt, Karel Schrijver, LMSAL (Lockheed Martin Solar & Astrophysics Laboratory), Palo Alto, CA, USA; David A. Williamson, The Circle Mountain Co., Tempe, AZ, USA; Robert E. Murphy, IPO (Integrated Program Office), Silver Spring, MD, USA; Robert Haring, Hamilton Sundstrand, Pomona, CA, USA; Timothy J. Schmit, NOAA/NESDIS, Madison, WI, USA; Michael Keidar, Christopher Ruf, University of Michigan, Ann Arbor, MI, USA; Vassilis Angelopoulos, UCB/SSL (University of California, Berkeley/Space Sciences Laboratory), Berkeley, CA, USA; Charles P. Herring, DigitalGlobe Inc., Longmont, CO, USA; Michael Cai, LANL (Los Alamos National Laboratory), Los Alamos, NM, USA; Gregg Parent, Christopher O’Connors, OSA (Office of Satellite Operations), NOAA/NESDIS, Suitland, MD, USA; Marcin D. Pilinski, Xinlin Li, of the University of Colorado, Boulder, CO, USA; Andrew Klesh, University of Michigan, Ann Arbor, MI, USA; Erik Stromberg, USU/SDL (Utah State University/Space Dynamics Laboratory), Logan, Utah, USA; Donald M. Boroson, MIT/LL (Massachusetts Institute of Technology / Lincoln Laboratory), Lexington MA, USA; Conor Brown, NanoRacks, LLC, Houston, TX, USA; Benjamin K. Malphrus MSU (Morehead State University), Morehead, KY, USA.


Hendrik Lübbe, Fritz Merkle, Danela Sell, and Ingo Engeln of OHB—System, Bremen, Germany; Joachim H. G. Enders, FGAN, Wachtberg, Germany; Gunter Schreier, Ursula Benz, Markus Heynen, Definiens Imaging GmbH, Munich, Germany; Frithjof Barner, Euromap, Neustrelitz, Germany; Winfried Posselt, Rainer Killinger, Michael Mittnacht, Thomas Usbeck, Eveline Gottzein, Christopher T. F. Kühl, Wolfgang Pitz, Walter Fichter, Peter Hill, Werner Hupfer, Roger Wilson, all of Airbus DS (former EADS Astrium GmbH), Germany; Helmut Weber, Westcomp Systems, Gilching, Germany; Ursula Weisgerber, Springer Verlag, Berlin, Germany; Christoph Reigber, Rolf König, Franz—Heinrich Massmann, Markus Rothacher, Frank Flechtner, all of GFZ, Potsdam, Germany; Silvia Scheithauer, University of Bremen (ZARM), Bremen, Germany; Urs Mall of MPAe (Max—Planck—Institut für Aeronomie), Katlenburg—Lindau, Germany; Reinhold Spang, FZJ (Forschungszentrum) Jülich, Germany; Herbert Mosebach of Kayser—Threde GmbH, Munich, Germany; Georg Grillmayer, Sebastian Walz, of IRS (Institut für Raumfahrtsysteme) at the University of Stuttgart, Germany; Hanno Ertel, University of Stuttgart, Germany; Klaus Schilling, Julius Maximilians University, Würzburg, Germany; Joern Pfingstgraeff, Technical University of Braunschweig, Germany; Udo Renner, Stephan Roemer, Hakan Kayal, and Martin Herfort, TUB (Technical University of Berlin), Germany; Abelardo Perez Albinana, EUMETSAT, Darmstadt, Germany; Joern Pfingstgraeff,
King, CRCC (Communications Research Centre Canada), Ottawa, Canada; Marc-André Soucy, ABB Bomem Inc., Québec, QC, Canada; Ian C. McDade, York University, Toronto, ON, Canada; Robert D. Richards, Optech Inc., Toronto, Canada; Peter F. Bernath, University of Waterloo, Waterloo, Ontario, Canada;

Valter Tamilia, Paolo Valle, AlcatelAlenia Space, Rome, Italy; Vittorio de Cosmo, ASI (Agenzia Spaziale Italiana), Rome, Italy; Gelsomina Pappalardo, Aldo Amodeo, CNR/IMAA (Institute of Methodologies for Environmental Analysis), Potenza, Italy; Massimiliano Spelat, Politecnico di Torino, Torino, Italy; Paolo Tortora, University of Bologna, Forlì, Italy; Filippo Graziani, Chantal Cappelletti, University of Rome, “La Sapienza,” Rome, Italy; Daniele Titomanlio, of Techno System Development, Naples, Italy; Mariana Gousheva, Space Research Institute, Bulgarian Academy of Sciences, Sofia, Bulgaria; Gokhan Yuksel, Middle East Technical University, Ankara, Turkey; Baris Gencay, of TUBITAK–UZAY (Space Technologies Research Institute), Ankara, Turkey; Mehmet Fecizi Ünal, Alim Rüstem Aslan, ITU (Istanbul Technical University), Istanbul, Turkey;

Manuela Unterberger of the Graz University of Technology (TU Graz), Graz, Austria; Werner Balogh of UNOOSA (United Nations Office for Outer Space Affairs), Vienna, Austria; Cesar Martinez Fernandez, Fany Sarmiento Ares, Ignacio Arruego Rodriguez, all of INTA (Instituto Nacional de Tecnica Aeroespacial), Madrid, Spain.

Salem Al Marri of EIAST (Emirates Institution for Advanced Science and Technology), Dubai, UAE (United Arab Emirates); Oleg Lapshinov, SSRE CONECS, Lviv, Ukraine, Alexander Makarov, Yuzhnoye Design Office (SDO), Dnepropetrovsk, Ukraine; Alexander Mostovoy, International Cooperation Office of KGS (Kazakhstan Gharysh Sapary), Astana, Kazakhstan; Romina Acevedo of ABAE (Bolivarian Agency for Space Activities), Caracas, Venezuela.