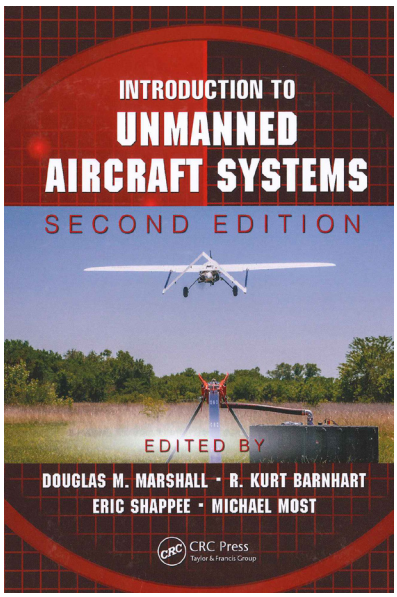

Introduction to Unmanned Aircraft Systems, 2nd Edition

Douglas M Marshall, R. Kurt Barnhart, Eric Shappee, and Michael Most, editors

CRC Press: Boca Raton, Fl. 2016. xvii and 377 pp., diagrams, photos, images, tables, index. Hardcover. ISBN 978-1-4822-6393-0.

Reviewed by: Benjamin W. Heumann, Assistant Professor, Department of Geography, Central Michigan University, Mt. Pleasant, Michigan.

The 2nd edition of *Introduction to Unmanned Aircraft Systems* is an update and expansion of the 1st edition of the book by the same title. The aim of the book is an introduction and survey of the topic suitable for undergraduate coursework. In the preface, the editors state that the motivation for the text was a lack of a textbook for a university course on unmanned aircraft systems (UAS). Although the book is designed as a textbook to compliment other course materials and activities, it is also well suited as a general survey and reference for professionals interested in the topic. The book is organized into 17 chapters by subject ranging from history, applications, regulations, and technical aspects of UAS. The book was written by both academics and experts from industry, with a different author or authors for each chapter. Each chapter has a set of discussion questions, and some chapters also include exercise questions or further readings. The book also contains an "Epilogue" which provides a summary of each chapter along with recent updates. There is also an index at the end of the text.

Chapters 1 to 3 serve as an introduction covering the history of UAS, applications in UAS, and various components of UAS. Chapter 4 provides an overview of remote sensing with UAS that many remote sensing professionals will find superficial but adequate given the limited space and the nature of this textbook. Chapters 5 and 8 cover regulatory issues including FAA regulations and Export Control in the United States. Chapters 6 and 7 detail human factors in UAS operations and safety assessments including hazard analysis, risk assessment, and safety evaluation. Chapters 9 through 15 describe the technical systems of the UAS aircraft including aircraft design, electrical systems, communication systems, command and control systems, subsystem integration, and detection and avoidance systems. The concluding chapters, 16 and 17, address policy and perception, including privacy and education, and the future of UAS with an emphasis on market growth and emerging technologies.

The book is generally well written and presented. However, there is noticeable variation in the structure, form of presentation, and types of content (e.g. figures, tables, equations, sample problems) between chapters. This is not surprising when each chapter is written by different authors that come from across academic fields and industrial sectors. Most of the chapters are organized logically although in the chapters 2 ("UAS Applications") and 3 ("The 'System' in UAS), there is noticeable overlap in content and style that feels like more editing or direction from the editors is needed. Similarly chapter 4 ("UAS Sensing: Theory and Practice") seems like an orphan in terms of content compared to the other chapters. The use of figures, tables, and equations varies greatly between chapters, likely as both a function of the topic, but also each author(s) approach. Those chapters that provide these materials beyond just text stand out from the other chapters. Chapter 12 ("Communication Systems") especially feels like a college textbook that guides the student through the materials rather than just providing an overview on the topic; I would have liked to have seen more chapters presented in this manner. The technical chapters, 9 through 15, stand out as the most detailed and well organized, individually and as a whole. This may be distracting or confusing for students used to more unified textbooks. Additionally, that lack of consistency in supplemental content, such as figures or sample problems, makes this book better as supplemental reading for established courses rather than the focus on the content. Instructors used to working

Photogrammetric Engineering & Remote Sensing
Vol. 83, No. 7, July 2017, pp. 469–470
0099-1112/17/469–470

doi: 10.14358/PERS.83.7.469

with textbooks from major publishers that provide a wealth of instructional materials will need to devote considerable effort to classroom lecture and activities.

For the most part, the information appears accurate, although some additional detail about some of the challenges in the design and application of UAS would be useful to help highlight potential pitfall to those new to the field. For example, major challenges to UAS remote sensing such as bidirectional reflectance function or avoiding common mistakes that abound in the UAS remote sensing industry such as using radiometrically uncorrected data to calculate vegetation indices and model biophysical parameters are not addressed or mentioned, but are important to ensuring quality data products

As with any book that covers a technology that is rapidly evolving and advancing, some of the details already seem out of date. Recent developments such as the new FAA rules did not make it into the book as it went to press, which the authors note in the epilogue. Other areas that are lacking in the book are details of the technical aspects of applied UAS such as sprayers for agriculture or advancements in computer vision that now allow consumer-grade UAS to track objects. One curious note is the use of the term "UAS" to refer to unmanned aircraft systems, rather than unmanned aerial systems as defined by the FAA and commonly used across the industry. This adds yet another term to the plethora of terms that refer to unmanned aerial systems including drones, radio-controlled (RC) aircraft, remote piloted vehicles, semi-autonomous aircraft, and unmanned aerial vehicles, among others.

Despite some detractors, the book is a good text on all aspects of UAS from design to application to regulation and policy. While the text is geared towards technical or engineering students, the book provides useful information for any student or even professionals interested in UAS, even if all the technical details are not necessarily of required for operations. While many researchers and professionals seek turn-key UAS solutions for UAS remote sensing, the background provided by this book will help any UAS user understand and appreciate the design and development of these systems.

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continued from page 468

for assessment items is being conducted, and a CMS-UAS Professional and UAS Technologist certification programs will be submitted to the ASPRS Board for approval and implementation in June 2017.

Recertification

To remain actively certified, currently certified practitioners at the professional level must be recertified every five years; at the technologist level, every three years. The recertification process requires an application, fee, and four personal references. If recertification does not occur within the required time frame, the individual becomes "in-active." If the in-active status exceeds I year, an individual may become active by applying for and passing the exam in their field.

Accreditation

On January 1, 2013, the ASPRS professional and technologist certification programs each received accreditation from the Council of Engineering and Scientific Specialty Boards (CESB). CESB voted to approve accreditation for the professional Certified Photogrammetrist (CP), Certified Mapping Scientist-Remote Sensing (CMS/RS) and Certified Mapping Scientist-GIS/LIS (CMS/GISLIS) programs, along with three related technologist certification categories – Photogrammetric Technologist, Remote Sensing Technologist and GIS/LIS Technologist. During the review process leading to accreditation, CESB required ASPRS to make several minor changes to the Program, including: shifting the continuing education requirement from the previous proprietary points-based system to Professional Development Hours (PDH); increasing the PDH requirement from 75 hours to 100 hours for the professional recertification and from 50 hours to 60 hours for the technologist recertification.

Conclusion

The ASPRS certification program as approved is entirely voluntary. It applies equally to persons associated with the several subdivisions of photogrammetry and the mapping sciences, which by Society definition includes aerial photography, photogrammetric photographic interpretation, geographic information systems, remote sensing systems, and land information systems. However, in accordance with the Society's Code of Ethics persons certified should decline to undertake any work within, or related to the fields of photogrammetry and mapping sciences that is outside their range of competence.