

Preface to the Second Edition

Almost two years have passed since the publication of the first edition of the book you are holding. During this time a lot has been accomplished and many things have changed. Nevertheless, there are many that will argue that what has been done is still not enough. It has been a year since the small Unmanned Aircraft Systems (UAS) rulemaking committee submitted its recommendations to the Federal Aviation Administration and although its term ended in the end of 2009, no term extension was given up until the time these lines are written and no policy is expected to be available before 2013. Moreover, certification of civilian UAS in the restricted category is not expected before 2015 and routine access to the NAS for at least five years after that. The challenges identified two years ago, largely remain. Sense and avoid remains an important issue, as is communications latency, security and reliability. It is still not possible to fly in the National Airspace with similar procedures and/or restrictions as those that are currently in effect for manned aviation.

The gap in UAS regulation remains, albeit there are signs from all over the world that this is starting to close. Regardless, one must also consider another gap that exists between the civilian market and universities, research centers and companies developing the UAS of the future. Although there are several civilian applications enumerated in the literature, the civilian market seems mostly oblivious to the benefits of incorporating UAS in its business. There are several reasons for this: UAS are still seen as immature technology; the partners that develop this technology are segregated from the actual civilian market; the lack of regulation lowers interest in UAS, which in turn reduces the pressure for developing regulation faster. In fact, FAA predicts that commercial activities will begin only in 2018 and expects that no extraordinary demand will bring about a quicker introduction of UAS in the NAS.

On the other hand, at any given moment there are over 30 UAS flying over Iraq and Afghanistan, many operated via satellite from the other side of the globe. All together, 135,000 hours were flown by UAS, over these two countries in 2009 alone and the one million cumulative flight hours mark has already been reached. Several UAS are also armed and have deployed weapons on multiple occasions, drawing the criticism of the international community while doing so. The use of UAS in the military domain is expected to result in significant savings in the long-term due

to lower acquisition costs, lower fuel consumption and reduced requirements for personnel overseas. We are rapidly reaching the point where military UAS will take over the role of the protagonist from their manned counterparts, as shown by the accumulated flight hours and the announced procurement programs.

In civilian airspace UAS have been extensively used by US Customs and Border Patrol (CBP) where they assisted with over 4,000 arrests and the seizure of approximately 20,000 pounds of illegal drugs between September 2005 and March 2008. Other government agencies have introduced UAS into their activities both in the US and Europe. UAS have already been used successfully for ensuring the security of important events. On the technology front, flight endurance records are broken repeatedly, the Aerovironment Puma, a backpackable UAS, achieved over 9 hours of flight time, the A160T unmanned helicopter edged close to 19 hours, the Ion Tiger accomplished 26 hours in November of 2009 using a fuel cell engine and the solar-powered Zephyr was airborne for over 82 hours in October of 2009 and two weeks in July of 2010! In the meantime DARPA is aiming towards systems that can stay aloft for 5 years! And the advances are not limited to endurance. UAS performance is improving constantly, coupled with increases in capabilities and autonomy.

On a similarly optimistic note, the Teal Group is now forecasting a market worth \$62bn worldwide with almost 8% annual compound growth rate over the 2009–2018 period. The capacity for growth is also evident by the number of acquisitions and partnerships between UAS developers that occurred in the last three years. Hopefully the tide is finally turning and although military applications have been the driving force behind this change, civil applications will start to emerge. About 50 countries are currently producing close to 1,000 different UAS models. Some of these models are aimed at non-military applications like earth monitoring or law enforcement. Even with restrictions and problems, UAS are finally taking to the (civil) skies!

For this second edition of the book several things have changed and almost all chapters include major updates and corrections. Nevertheless, the largest revisions are focused in the following three chapters, as well as a new appendix chapter:

Chapter 2: The historical overview has been improved to incorporate information on the early drone designs and how they finally led to the UAS we know today. In addition to that, new high quality photos were used where possible.

Chapter 4: The Chapter on Unmanned Aircraft regulations has been updated to reflect the latest information on the topic. Information on light/small UAS has been moved to a separate section, to highlight the differences of such systems and their importance in the near-term developments.

Chapter 5: This Chapter has been reorganized, rewritten and enhanced with new material. It is now more than twice the length with a new material layout, which the authors believe is both more clear and more comprehensive. To improve the presentation, the Section containing case studies has been moved to a separate chapter.

Appendix A: As a complement to Chapter 5, a chapter on human vulnerability has been added to the appendix that provides an overview of estimating expected

injury severity given different trauma mechanisms. This Chapter is accompanied by 6 figures and 3 tables that assist the reader with understanding and comparing the different human vulnerability models available.

The authors are also grateful to all the comments and corrections submitted by readers of the first edition. Without their diligence and willingness to help, this book would be much poorer.

Last, but not least, the authors acknowledge wholeheartedly the continuous support of the Springer group and in particular the support of our Editor, Ms. Nathalie Jacobs.

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National Airspace System

Issues, Challenges, Operational Restrictions,
Certification, and Recommendations

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