

# High G Flight: Physiological Effects and Countermeasures

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High G flight is a significant challenge facing crew in high performance military aircraft, spacecraft, and in some other settings, such as acrobatic and tourism-based fighter jet aircraft in the civilian sector. It may also be experienced in high G simulators and commercial fighter jet tourist experiences. G is defined as “a dimensionless ratio which expresses the applied acceleration that an object undergoes as a multiple of the normal acceleration due to Earth’s gravity” (p19).<sup>1</sup> This first edition of *High G Flight: Physiological Effects and Countermeasures* is a textbook encapsulating a definitive review of aerospace medical research in the high G environment, which is supported by an impressive 60 pages of references.

The 1<sup>st</sup> edition of *High G Flight: Physiological Effects and Countermeasures* is presented as a 16 x 24 x 2 cm hardcover textbook, which is widely available online for purchase. The book contains a table of Contents, List of Figures, a Foreword by Lieutenant General (Dr) Thomas W Travis, a Preface, Acknowledgements, a List of Abbreviations, four main parts, 12 Chapters, References and a comprehensive Index. There is no glossary, which would be useful for non-medical readers, nor a list of equations, of which there are many in this textbook.

The primary target audience of *High G Flight: Physiological Effects and Countermeasures* is not clearly defined in the textbook, but it could be targeted at the author’s colleagues working in aerospace medicine, aerospace physiologists, and researchers in this field. It would also be a useful reference for those undertaking postgraduate studies in high G flight or undertaking advanced studies in aerospace medicine. As it may be of interest to a wider group, such as flight crew, these readers without broader aerospace medical training may be challenged by some of the medical terminology, such that a glossary may be useful to consider in future editions, as previously mentioned. The textbook will also be of passing interest to the growing band of travel medicine practitioners and aerospace physicians, who are providing advice to tourists exposed to high G flight, including various jet fighter experience programs, such as “edge of space” adventures<sup>2</sup>, and

simulator training and sub-orbital flights into space planned by a number of commercial operators.

*High G Flight: Physiological Effects and Countermeasures* is divided up into four (4) parts, which provide a logical flow of discussion. Commencing with the origin and causes of G-related flight conditions in part “1. Mechanisms of G”, the textbook then covers physiological effects of those conditions and tolerance and adaptation mechanisms in pilots in part “2. Physiology of G” and part “3. Tolerance and Adaption” and concludes with a discussion of existing countermeasures against G effects in part “4. Countermeasures”. Chapters include “1. The Physics of Gravity”; “2. High G Flight”; “3. The Cardiovascular System at +1 Gz”; “4. The Cardiovascular System at High Gz”; “5. Respiratory Effects of G”; “6. Musculoskeletal Effects of G”; “7. Miscellaneous Clinical Effects of G”; “8. Tolerance to High G”; “9. Cardiovascular Adaption to Acceleration”; “10. The Anti-G Straining Manoeuvre”; “11. The G Suit”; and “12. Positive Pressure Breathing for G Protection”. The textbook is well supported with 32 figures, which effectively help to convey complex concepts. There are also numerous equations, which some may find challenging. There have been other book reviews, which have also been complimentary about the present work.<sup>3,4</sup> One of these reviews mentions a number of instances of misprints and missing information,<sup>4</sup> some of which were seen, but are difficult to confirm and do not disrupt the flow. These errors will need to be rectified in future editions.

Single author textbooks are becoming more uncommon, but they have the advantage of being highly consistent in style. The author, David G. Newman, MB, MB Monash, DipAvMed RCP(UK), MBA Deakin, PhD Newcastle, FRAeS, FAsMA, FACAsM, FAICD, FAIM, has impeccable credentials in both aerospace medicine and high G flight experience. As well as being a consultant in aviation medicine, David Newman is currently Associate Professor and Head of the Aviation Medicine Unit in the School of Public Health and Preventive Medicine, Monash University, Melbourne, Australia. He has also served with the Royal Australian Airforce (RAAF) for 13

years, including two years as Chief Instructor at the RAAF Institute of Aviation Medicine, and is also trained as a pilot with flying experience in a number of military jet aircraft. Professor Newman has also been recognised with a number of highly respected international awards, most recently the John Paul Stapp Award from the Aerospace Medical Association (USA) in 2014.

*High G Flight: Physiological Effects and Countermeasures* is a compact, succinct and easy to read publication, despite the physics and physiological concepts that need to be digested. It appears to be one of the first textbooks of its type published by an aerospace physician. It is an essential resource for those working in aerospace medicine with crew experiencing high G forces and complements standard textbooks of aerospace medicine. It provides access to information, which

has traditionally been the domain of military aviation medicine courses. This 1<sup>st</sup> edition of *High G Flight: Physiological Effects and Countermeasures* will be a much sought after textbook for both professional and academic libraries supporting the civilian and military components of aerospace medicine.

### Declaration of Interests

The reviewer won this present work as a book prize at the Australasian Society of Aerospace Medicine Conference held in Adelaide, Australia, 2015.

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### References

1. Newman DG. Ch. 2. High G Flight. In. *High G Flight: Physiological Effects and Countermeasures*. Farnham, UK: Ashgate, 2015: 19-35.
2. Space Affairs. Edge of Space with MIG-29UB. URL. [http://www.space-affairs.com/index.php?wohin=edge\\_of\\_space](http://www.space-affairs.com/index.php?wohin=edge_of_space) (accessed April 24, 2016)
3. Smith A. Book Review. High G Flight: Physiological Effects and Countermeasures (by David G Newman). *J Aust Soc Aerospace Med* 2015; 10(1): 27.
4. Kleinke S. Book Review. High G Flight: Physiological Effects and Countermeasures (by David G Newman). *Int J Aviat Aeronautics Aerospace* 2015; 2(3): 5.