



Review

**THE HELICOPTER:
THINKING FORWARD,
LOOKING BACK**by **J. Gordon Leishman**College Park Press, Maryland, USA, 2007
248 pages, ISBN 978-0-9669553-1-6

In this book, Professor Leishman addresses the question of why helicopter performance is still where it is after decades of research, analysis and experimentation. His starting contention is that helicopter performance appears to have reached a plateau, particularly in terms of maximum operational speed, and that unless industry and those who drive industry's efforts, such as government funders, move away from an acceptance of this plateau, then further progress in the exploitation of helicopters will be inhibited. The book is very heavily focused on an aerodynamic view of the topic and is also written from a largely US perspective, and sadly this leads to a lack of balance in much of the discussion. Indeed, it is arguable that whilst US helicopters have totally failed over the past two decades to exploit advances in rotor aerodynamics, this is certainly not true of European designs, for instance EH101 Merlin, Lynx, NH90 and Super Puma.

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After some initial scene setting, including detailing of performance goals set during the early 2000s by US officials, the author presents a potted

history of rotorcraft development, including the landmark innovations of Cierva's autogyros and the step change in performance with the introduction of gas turbine powerplants. The evolution of rotorcraft performance is discussed, the primary criteria being taken as payload, range and speed, from which measures of productivity and transport efficiency are developed; cost is also introduced.

Conventional helicopters as well as other forms of rotorcraft such as tilt rotors, autogyros and compounds are covered. It is from this discussion that the author concludes that performance is stagnating. True as this may be, it is frustrating that the author makes little or no mention of the advances in other fields such as structures, vibration and noise reduction, flight control, avionics, night and adverse weather operational capability, safety, crashworthiness and military survivability, which have been made over the last couple of decades and have greatly advanced the operational effectiveness of modern helicopters. Nor within his narrow view does he even cover limitations such as hot and high performance – currently a major issue for military operations in Afghanistan – which arise through engine as much as rotor limitations. Advances into unmanned rotorcraft barely get a mention.

Thus, this book is the view of an aerodynamicist, as becomes clear when we reach the meat of the text comprising some 13 chapters – two-thirds of the total text – explaining in detail the aerodynamic issues of a rotorcraft and identifying the current weaknesses in analytical modelling tools and corresponding experimental data for their validation. Topics covered include hover and forward flight performance, blade-tip design, aerofoils, airframe aerodynamics, blade stall, rotor wakes, aerodynamic interactions, anti-torque devices and forthcoming advances in rotor technology using 'smart' materials and systems. An extensive reference list is included, albeit predominantly US work. From all this, the author concludes that the only way to enhance rotorcraft performance is via

aerodynamics. I would note at this point that the author suggests that while his book is aimed primarily at engineers, it will appeal to a wider audience including those in management, government and in the military. I doubt that many outside the aeronautical engineering community will persevere with the depth of discussion in these chapters.

Throughout the analyses of performance, the author largely ignores the very effective advances in performance (in all its broad guises) that have been made in Europe. The one exception, gratifying from a UK standpoint, is the author's praise for the UK advanced rotor technology on Lynx and Merlin (the so-called BERP rotor) as a shining example of how technology should be exploited. Only very late in the book does the author acknowledge that through the effective application of advanced technologies the European industry has established a dominant position over the US. Following this, the final section of the book is an impassioned plea to those in authority in the US to take action, by investment and novel approaches to procurement, to reverse the situation.

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In summary, this is a somewhat strange mixture of a relatively detailed treatise on the aerodynamics of rotorcraft, with a highly parochial view of the state of the US industry and the need for government investment to restore its worldwide competitiveness. ■

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