Keith A. Rigby

Aircraft Systems Integration of Air-Launched Weapons

Aerospace Series

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AIRCRAFT SYSTEMS INTEGRATION OF AIR-LAUNCHED WEAPONS

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Series Preface

The Aerospace Series has concerned itself largely with the design of aerospace vehicles and their systems, comprehensively covering aspects of structural and system design in theoretical and practical terms. There has been reference to military aircraft types in the books of the Series, sometimes as developments of commercial aircraft for surveillance or transport roles, and other times as specific combat types. However, there has been no detailed consideration of one aspect that is quite specifically applicable to military types – the carriage and release of air launched weapons.

In this book, the author takes a systems engineering view of the weapon and platform as an integrated whole for both manned and unmanned aircraft. The importance of considering the integration of the weapon with the airframe and with the aircraft systems is stressed as it is vital to the achievement of a safe and successful launch with a high probability of target destruction. This aspect of integration is important to the introduction of precision weapons with a high degree of accuracy to reduce the incidence of collateral damage, as well as making best use of costly weapons.

It is important for engineers and designers to visualise the totality of a system in order to gain an understanding of all that is involved in the establishment of requirements and the certification process to arrive at a coherent design of vehicle and infrastructure. Understanding the impact of external weapons installation on aircraft performance and handling, and the needs of the weapon for navigation and attitude information, is key to understanding how to aim, fuze and release a weapon for maximum effect. This understanding enables developments in new aircraft types and new weapon types to be understood and adapted so that the most effective weapon system can be selected and developed for a particular aircraft in order to respond to changing threats.

This book is a comprehensive treatise on the subject of air launched weapons and will be of great value to all design engineers, support engineers, air crew and armourers working on armed military aircraft. The message is reinforced by the introduction of a worked example of integration of a smart weapon with the airframe. It also provides a good background to people

who have an interest, professional or casual, in the design of aircraft weapon systems. It is worth noting that the book carefully avoids any areas of security classification, thereby making the book accessible to a wide audience.

Peter Belobaba, Jonathan Cooper and Allan Seabridge

Preface

For any military conflict where Western air forces are involved, the public is accustomed to media coverage of weapons being targeted against the enemy. Whether this is an Air-to-Ground missile being aimed at a particular window in a building or a smart bomb destroying a strategically located bridge, the public understand that in modern warfare precision weapons can provide surgical attack capabilities whilst minimising collateral damage and harm to non-combatants.

However, the terminal accuracy of a guided weapon significantly depends on its priming prior to release. Simply, the launch aircraft and weapon together form a complex system where the performance of each component is interdependent on the performance of the other.

It is unusual for a weapon to be designed specifically for operation with a single aircraft type; it will generally be designed to provide a particular military capability when operated with a range of aircraft. The Weapon Design Organisation will generally define an idealised set of requirements to be placed on the launch aircraft such that if they are satisfied, the weapon can achieve its specified performance. However, although the Weapon Design Organisation has responsibility for the design, development and certification of the weapon, generally, it is the Aircraft Design Organisation that has responsibility for the design, development and certification of the total aircraft and for certification of the aircraft/weapon combination. As the aircraft may not be able to satisfy the set of ideal requirements placed on it by the weapon, the terminal performance of the weapon may be degraded.

Whenever a weapon has to be integrated with an aircraft, there will be a need for the Aircraft and Weapon Design Organisations to collaborate to satisfy the needs of the Government agency (the Contracting Agency) which contracts for the integrated capability. Whilst this may bring many organisational interaction challenges, the pure engineering activities which need to be undertaken are many and complex.

For the purposes of this book, weapons integration is divided into systems integration activities and aeromechanical activities (e.g. covering aerodynamics, structures and the airborne environment). Whilst all activities must be undertaken to realise the certified integrated product, this book concentrates on the aircraft systems integration aspects of air-launch