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***Unmanned Combat Aerial Vehicles: Current Types, Ordnance and Operations.* By Dan Gettinger. Wien, Austria: Harpia Publishing, 2021. Distributed by Casemate Publishing, Havertown, PA. ISBN 1950394050. Photographs. Notes. Tables. Sources Cited. Index. 144 Pages. Dimensions 8.5 x 0.63 x 11.18 inches. \$60.83.**

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Unmanned Combat Aerial Vehicles: Current Types, Ordnance and Operations provides a comprehensive review of trends, capabilities, and operations involving unmanned combat aerial vehicles (UCAVs). The scope of the book is limited to drones that were either designed to deploy ordnance or are being re-engineered to do so. Ethical considerations of UCAVs are beyond the scope of the book. The primarily technical monograph begins by defining the two types (UCAV and loitering munition) and three classifications (I, II, and III) of armed drones determined by the performance and payload capabilities of the various platforms. Additionally, the stage of development of each drone was assigned to one of three status levels: operational, undergoing trial but not operational, or conceptual. The trends in UCAVs, loitering munitions, and munitions are instructive for those interested in the rapid growth in popularity and abilities of the various platforms.

Chapter One provides a comprehensive review of trends regarding UCAVs and available munitions. The chapter begins by describing the rapid growth in the popularity of UCAVs. Evidence of the proliferation of UCAVs is provided by the fact that nearly 75% of the 96 UCAVs included in the book have been unveiled since 2015. Gettinger explains that the United States, Turkey, and China are the primary sources of UCAVs for the approximately 25 countries that have them. Tables clearly present the countries possessing UCAVs and those in the process of acquiring them. The tables also explain each platform's type, country of origin, and date of introduction.

Unlike UCAVs that are reusable and deploy ordnance, loitering munitions are expendable and explode on impact with a target. The benefit of loitering munitions over laser-guided missiles is that the loitering munition may circle or hover over a target area before deployment. Gettinger explains that approximately half of the loitering munitions in use across the globe weigh between two and 20 kilograms (4.4 and 44 pounds), and the other half weigh between 20 and 150 kilograms (44 and 331 pounds). Most of the 57 loitering munitions are fixed-wing, with six of the rotary-wing variety and one hybrid version.

Chapter One also overviews the 80 different munitions used with armed drones. Among the types of ordnance deployable by UCAVs are air-to-ground missiles, glide bombs, air-to-air missiles, grenades, and mortars. Some armed drones maximize their utility by deploying as loitering munitions. As Gettinger explains, the ongoing development of increasingly lighter-weight munitions presents new opportunities for UCAV use. Drones previously incapable of carrying munitions are being retrofitted with the lighter weapons, and new models are being designed to maximize the potential of lighter ordnance. More lightweight munitions allow for the development of smaller drones that may be deployed from the field by combat units.

In his presentation of trends relative to operations involving UCAVs, Gettinger makes the cogent point that armed drones allow decision-makers to take risks unacceptable with piloted craft. One characteristic allowing for riskier tasking is the cost to manufacture and operate UCAVs versus traditional combat aircraft. For example, compared to piloted combat aircraft, it costs the United States 82.5% less to run the MQ-9A Reaper. Also, the cost to replace a downed aircraft is exponentially higher than an uncrewed vehicle.

Gettinger mentions that UCAVs are beneficial in asymmetric conflicts because they allow for plausible deniability among state actors. This is somewhat confusing because very few sub-state actors have access to armed drones, which begs the question, at least in most cases, “who but the state actor could have navigated the drone?” More importantly, UCAVs provide for a measured response by government forces against inferior forces. Extremist elements often endeavor to provoke an overreaction by vastly superior government forces. Excessive force delegitimizes the

regime, attracts attention to the group's grievances, and promotes empathy for their plight.

A compelling future trend Gettinger cites is the "loyal wingman" concept. Loyal wingman drones are being developed to support piloted aircraft on combat missions. These UCAVs can attain speeds 150% faster than the current Class III armed drones.

The manufacturers of UCAVs are listed alphabetically by country of origin in Chapter Two. For instance, the chapter begins with Armenia. Images and technical details for two Pride Systems UCAVs produced in Armenia are presented side-by-side. Technical details are presented in well-organized tables and include characteristics such as class, status, length, width, height, speed, range, and armament.

Chapter three disaggregates the deployment of UCAVs by the theatre of operations and date range. For instance, the chapter begins with Afghanistan and Pakistan from 2001 to current (as of 2021). Gettinger outlines the various craft used and by whom. A brief operational history of each UCAV within the specific theatre of operations is also provided.

The current conflict in Ukraine has demonstrated the utility of drones in modern conventional warfare, and that points to the only weakness of the book, that it was published in 2021 and thus could not cover this important case study. Nonetheless, *Unmanned Combat Aerial Vehicles: Current Types, Ordnance and Operations* is an invaluable resource for those interested in the trends, capabilities, and operations involving unmanned combat aerial vehicles (UCAVs). The book is well-organized and comprehensive. The different perspectives offered across the three chapters provide a breadth of information that benefits practitioners, scholars, and students from across the realm of security and intelligence studies.