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EFFECTIVENESS OF SAM* USAGE TO DEFUSE UNMANNED AERIAL VEHICLES (*SAM: SURFACE TO AIR MISSILE)

Abstract:

Nowadays, UAVs (Unmanned Aerial Vehicles) are used in a wide range of areas. Particularly, the priority task of the UAV used in various tasks in different military operational environments has been intelligence, reconnaissance and surveillance (ISR). From gun loaded operative UAVs which are able to be flown 30,000 ft in altitude to basic UAVs that can be flown by hand, all UAVs' common feature is to transfer the momentary tactical picture related to the hostile operational environment to their command and control centers. This study initially examines surface combatants secrecy necessity, especially during crises and wartime, in an operation environment. Later, it presents a number of proposals for developing new generation weapon systems, in order to neutralize hostile UAVs without spending SAMs when warships detect an enemy UAV, which can send information about their position and formation.

Keywords:

UAV (Unmanned Aerial Vehicle), SAM (Surface to Air Missile), Guided Naval Gun Systems, Electromagnetic (EM) Weapon Systems, Laser Weapon Systems, Naval Operation Area

1. INTRODUCTION

Since the end of the 1980s, started to use UAVs are used in a wide range recently. These unmanned systems nowadays serve human being in a lot of places such from agriculture to meteorology, cargo transportation to forest fires monitoring, protecting the critical infrastructure to interfering social events ¹ while previously they were most used in military and public areas. ² UAVs fulfill duties like reconnaissance-surveillance, target acquisition/ illumination, attacking, destruction and electronic warfare within the scope of military use of space. ³

UAVs weight of 2 kg (micron) ranging up to 600 kg and at 30,000 ft altitude capable of performing 24-hour operation are mainly used in reconnaissance-surveillance missions effectively in today's operational environment where human life gained more importance. ⁴

Owing to have very little influence from chemical and biological attacks, low Radar Cross Section (RCS) and radar echo-absorbent external case they can provide uninterrupted information transfer without giving any signs to enemies. ⁵

2. UAV USE IN MARITIME OPERATIONS

UAVs used to shape the maritime operation environment and form the tactical picture can transmit real-time information to the main command and control centers without being detected easily by the surface platforms. Even though they cost low, they help us to easily identify the opponent ship's position, formation, type and class. So their function in defining the naval environment is so crucial. In this context, if UAV is used for identification-diagnosis purposes, it becomes one of the best vehicles which have minimum risk but maximum gain. ⁶

On the other hand, this subject draws more attention in terms of surface warships' survival. Although warships perform operations trying not to emit their signature, enemy can provide the essential information about them from long distances by using a tactical UAV. Ships must defuse the enemy UAV for their survival when they detect it. Though

¹ Choi-Fitzpatrick, A., 2014. Drones for Good: Technological innovations, social movements, and the state. *Journal of International Affairs*, 68(1), p.19.

² Integration of Civil Unmanned Aircraft Systems (UAS) in the National Airspace System (NAS) Roadmap (First Edition 2013) U.S Department of Transportation

³ Nitschke, S. & Eshel, T. 2002, "UAV in anti-surface warfare", *Naval Forces*, vol. 23, no. 2, pp. 27-33.

⁴ Crouch, C.C., 2005. Integration of mini-UAVs at the tactical operations level implications of operations, implementation, and information sharing (Doctoral dissertation, Monterey California. Naval Postgraduate School).

⁵ Nitschke, S. & Eshel, T. 2002, "UAV in anti-surface warfare", *Naval Forces*, vol. 23, no. 2, pp. 27-33.

⁶ Akyürek, S., Yılmaz, M.A. and Taşkıran, M., 2012. İnsansız Hava Araçları Muharebe Alanında ve Terörle Mücadelede Devrimsel Dönüşüm. Bilge Adamlar Stratejik Araştırmalar Merkezi Yayınları, İstanbul, 2.

UAVs seem simple and negligible for their low cost and ease of operation, they must be prevented immediately from their action because of their reconnaissance, surveillance, identification, diagnosis and early warning support to hostile. This is vitally important for the ships future.

3. DETECTING AND INTERCEPTING UAVS

Warships will take precautions and intercept the enemy UAV with best available weapon system according to UAV's altitude, speed and RCS after they detect it. In this context, ships -taking into account the amount of available weapons onboard- first will use Naval Gun Systems in case the UAV to fly at low altitude next will launch SAMs in order to neutralize UAV. SAMs must be spent carefully because they are critical munitions for the ship's survival. Ships store them in a limited number onboard and it is not easy to replenish missiles during wartime. However, if the UAV flies at high altitude and stays far away the Gun Systems maximum effective range, ships will have to spend their SAMs urgently to hamper the UAV. .⁷

SAMs are kept on board in a limited number due to their occupied area and cost. They have very crucial role to defend ships survival. SAMs on board are used primary to destroy enemy aircrafts and incoming missiles. Frigates and corvettes contain this kind of munitions in a limited number and it is not easy to replenish specifically in the naval operational area after they spend them. So warships must fire these missiles carefully and commanders must think twice before they launch. Light surface platforms which do not contain SAMs on board will have to utilize only their Gun Systems to destroy enemy UAVs.

4. NEUTRALIZING UAVS

UAVs actually are not direct threat to ships unlike air vehicles such as aircrafts, helicopters, guided missiles, etc. So they are set apart from these threats because of their unique characteristics. However, although they do not seem a direct threat to surface platforms, they are able to transmit the important information about warships location and formation to opponent continuously. So, if a warship conducts secret operations with running only passive sensors, the probability for being attacked by hostile will be increased. Because of this, if a ship detects an enemy UAV, she will destroy it by using SAM systems -if necessary- without hesitating.

⁷ Richardson, D. 2014, "Radar-guided SAMs could make UAV operations impractical", Jane's Missiles & Rockets, vol. 18, no. 7.

In case of firing SAMs against UAVs, they will be spent without having an actual battle. So SAMs will not be able to fulfill their preferred objective which is defending the ship from incoming missiles and aircrafts. SAMs will be used against a basic UAV operating only in passive reconnaissance-surveillance mission. The number of SAMs onboard will reduce and ships will need to replenish as soon as possible. They will have to leave from their position, otherwise without SAMs they just behave as an easy target. Thus, a ship's removal from the operational area will create a big gap for operations safety.

5. RESULTS AND SUGGESTIONS

New weapon systems able to defuse UAVs, cost-effective and easy to store onboard with abundant quantities have to be developed.

a. Cost-Effective SAMs and MANPADs

New SAM systems whose missiles being stored abundant should be deployed onboard ships. These missiles must be reloaded to the launcher or cell easily by the crew during naval operations. Sailing without berthing a port for replenishment will increase the warship's efficiency. It is necessary for the newly developed systems to reach at least 30,000 ft altitude⁸ where operative UAVs perform operation. This requirement is important in order to neutralize them.

Furthermore, the new generation shoulder-launched (MANPAD) SAMs must be taken into consideration, too. They are operated easily. Their recent models such as RBS 70, Mistral, Stinger and SA-7 Grail are successful examples for MANPADs.

b. New Type Naval Gun Systems

New type naval gun systems and smart munitions that can be utilized against middle/high altitude UAVs should be used on board ships. Within this context, one example of such systems today is the Oto Melara 76/62 Strales gun system developed by Fimeccanica Co. Strales enables Oto Melara 76/62 mm naval artilleries which has been used by navies to be modernized. The system gets updated via addition of radio frequency guidance system to fire control system and utilization of smart DART (Driven Ammunition Reduced Time-of-Flight) ammunition instead of conventional ordnance.⁹

⁸ Hanford, S.D., Long, L.N. and Horn, J.F., 2005. A small semi-autonomous rotary-wing unmanned air vehicle (UAV). AIAA2005-7077.

⁹ Annati, M. 2005, "Evolution of 'Smart' Naval Munitions: Blurring the Border Line Between Gun-Fired Projectiles and Missiles", Naval Forces, vol. 26, no. 4, pp. 46-48,50-52.

The effective cost of the system and no additional space requirement onboard ships are considered as the best parts of the new system. DART flies towards the target by following a radio frequency beam produced by the guidance system and have a high probability of neutralization.¹⁰

c. Laser Weapons

Laser weapons which have strong laser beam should be utilized on board. With this powerful laser beam, destruction of the UAVs will be aimed. Even if the UAV remains resilient and intact, the laser beam -thanks to the high energy it contains- will affect the flight electronic systems and damage UAVs' electro-optical (E/O) systems used in surveillance. Even the combustion of a small diode stored inside the UAV will impede the operation of the system effectively. So, even if the enemy UAVs will not be able to shot down, they will stay out of operation. It is because the mission could not be fulfilled due to the lack of information.

LaWS (Laser Weapon System) can be a good example used by U.S. Navy for laser weapons. The LaWS consists six laser beams, adjustable to either low output for warning and sensor crippling, or high output for target destruction. The U.S. Navy successfully tested the LaWS system at the beginning of 2010s. The weapon neutralized a surveillance drone and several small boats. This was the first ever shoot down of drones from a High Energy Laser system on a U.S. vessel. (12) LaWS which is currently deployed onboard a U.S. ship ordered in the Persian Gulf is a good example for laser weapon concepts.¹¹

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