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Evaluating the Use of Manned and Unmanned Aircraft Systems in Strategic Offensive Tasks

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Abstract—Today countries want to reach their aims in the fastest way due to economical, political and humanitarian aspects. The most efficient way to make these aims real is penetrating strategic targets. Strategic targets are generally located deep inside the countries and are defended by modern and efficient surface to air missiles (SAM) platforms which operate integratedly with Intelligence, Surveillance and Reconnaisance (ISR) systems. On the other hand, these high valued targets are burried deep underground and hardened with strong materials against attacks. That is why, penetrating these targets requires very detailed intelligence. This intelligence process should include a wide range from weaponry to threat assessment and will determine the frame of the attack package.

This mission package have to execute missions in a high threat environment. The way to minimize the risk here is utilizing packages which are formed by UAVs. On the other hand, due to flying UAVs which are controlled by ground command and control units, UAVs have very limited capability to make the right decision in dynamic situations. Therefore, UAVs can hardly execute a mission in deep regions of a country. To solve this problem we should generate a mission package which include semi-autonomous UAVs with leadership of a fifth generation aircraft. Thus, we can easily penetrate in the depths of the enemy, decide according to changing conditions and also finally destroy the strategic targets.

This article determines the autonomous level of the UAVs, examines the features of a mission package and presents what kind of a mission package we should establish in order to make maximum benefit and effect in attacking strategic targets.

Keywords—UAV, autonomy, mission package.

I. Introduction

SINCE in the begining of 1980s UAVs have been progressed rapidly due to very much low risk and cost. When they are firstly seen in operation area, they only used for ISR missions, but in time they started using for bombing purpose with gaining capability to carry bombs. They will not be limited to support functions such as reconnaissance [1]. When we examine recent days operations in the world for analysing to air vehicle which are used to negate targets, we see lots of UAVs like almost equal manned air vehicle. As an example; The U.S. Air Force trained 350 drone pilots in 2011, compared with only 250 conventional fighter and bomber pilots trained that year because of increasing count of UAVs. But there is a question about using UAVs [2]. How can we use these UAVs the most efficient. Actually answer to these question should be depends on lots of variabilities, like weaponary, endurance, survive and so on. But for my opinion the most important point is tactic, which have been used in operation area. Especially after the begining of 2000s, UAVs have been developed about weaponary, endurance and jamming for more efficient mission success. With these properties, UAVs are very proper to using in CAS mission. For example in Afganistan allied forces react in 7 minute (which include getting request, respond and going of UAVs to operation area), when troops need any help [3]. As we understand in these example UAVs are generally used in tactic missions. With rising capabilities of UAVs, it is assesed to using in strategic missions. UAVs with long range, carriying modern and stand off munitions, jamming, stealth, semi or full autonomous capabilities are used in high threat area with low risk to destroy targets. At this point we should consider tactics which we use in operation area to get marginal utility. Especially it is considered that using autonomous UAVs is more efficient than UAVs with guided by ground unit. But in my opinion these efficiency can be gotten by not full autonomous UAVs. These efficiency can be gotten by human who has full SA (Situation Awareness) in operation area. So there should be a human who take a decision in dynamic situation. For efficiency of these process we need to make clear which level of UAVs should be used in operation area.

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II. Why do we need autonomy?

The motivation in producing UAVs is the desire to execute task and reduce risk in high threat area. First generation UAVs does not use flexibility because of low payload capability, low endurance and short range [4]. In addition, control of UAVs is very hard with the guidance of UAVs by ground unit. Due to lack of SA, ground unit operator can take bad decision. Additionally, another weak point of this type of UAVs is communication link. Lack of security in communication link can be exploited by malicious enemy hacker.

Due to these reasons, experts have struggled to produce UAVs that have autonomous capability. With the producing of

this kind of UAVs, risk of braking link temporarily by enemy is denied and human factor is reduced. So the required number of human operator will be reduced significantly. And also one operator can control more than one UAVs with the autonomous capability.

Some expectations are seen at the below with the autonomous capability.

- The task is executed via route which is recorded before with the aid of sensor.
- The purpose of minimum radar exposure, route is selected which provide to avoiding catch.
- They provide optimum exchange about communication, command and control station.
- Mission is executed according to preplan flight profile, coordinate, altitude and TOT.
- Depends on emergency characteristic, they will take essential precaution and execute.
- According to changing situation they will take new commands.
- UAVs will be able to execute a mission together as a flight package [5].

With these capabilities, autonomous UAVs will be able to execute difficult and complex missions. And also with these capabilities, the number of essential personnel in a mission will be reduced significantly thus reducing cost. The mission will be executed as it is preplan. By the way, thanks to the development of the technology, UAVs can be improved permanently depend on desire. Actually this improvement generally include logic flight and payload enhancement. Especially in ISR mission these capabilities will be very useful for operators to reduce workload. In addition, the risk of communication link getting intercepted is eliminated. Despite the relatively high level of autonomy a UAV has, at certain point, a human operator will eventually be required to carry out the decision process. At the process of joint decision, each person of group wants to have high SA. With this integration management of data preparing mission and program are done easily and in very short time. With the data transfer systems, personnel can interface UAVs whenever they want. By this means, the mission will be executed in operation area with the pack of UAVs. The operator will control all UAVs and direct them easily. In spite of all the advantages of autonomous UAVs, the most important thing for the operator is SA. When the operator is on the ground, operator's SA will be very low because of lack of visual angle and long range to target. To obtain full SA in order to direct all UAVs in a mission like an orchestra chief, a human who drive fifth generation aircraft have to be in the air to manage operation. The right decision depend on changing situations can only be taken by human who is located at the middle of the operation area [6].

III. LEVELS OF AUTONOMY

According to firm of BAE, level of autonomy can be diverged to six, which are:

Human operated: All activity within the system is the direct result of human-initiated control inputs. The system has no autonomous control of its environment, although it may have information-only responses to sensed data.

Human assisted: The system can perform activity in parallel with human input, acting to augment the ability of the human to perform the desired activity, but has no ability to act without accompanying human input. An example is automobile automatic transmission and anti-skid brakes.

Human delegated: The system can perform limited control activity on a delegated basis. This level encompasses automatic flight controls, engine controls, and other low-level automation that must be activated or deactivated by a human input and act in mutual exclusion with human operation.

Human supervised: The system can perform a wide variety of activities given top-level permissions or direction by a human. The system provides sufficient insight into its internal operations and behaviours that it can be understood by its human supervisor and appropriately redirected. The system does not have the capability to self-initiate behaviours that are not within the scope of its current directed tasks.

Mixed initiative: Both the human and the system can initiate behaviours based on sensed data. The system can coordinate its behaviour with the human's behaviours both explicitly and implicitly. The human can understand the behaviours of the system in the same way that he understands his own behaviours. A variety of means are provided to regulate the authority of the system with respect to human operators.

Fully autonomous: The system requires no human intervention to perform any of its designed activities across all planned ranges of environmental conditions [7].

IV. THE LEVEL OF AUTONOMY AS STRATEGIC CAPABILITY TO ACHIEVE STRATEGIC TARGETS

In UAV systems, the level of autonomous skill required depends on the nature of the task in general. For example, in a simple reconnaissance mission, while one UAV system requires less autonomous capabilitiy, in a complex task of a package UAV requires much more autonomous capability to handle the task. In addition, according to some of the current regulations, it is not suitable for UAVs to be fully autonomous. As a well-accepted fact in airspace management, risk of having

air traffic accidents increases as air traffic density increases. In this case, a fully autonomous UAV needs a complete analysis of reliability. At this point, instead of a full autonomous UAVs, human supervised (semi-autonomous) capability is considered to be appropriate with the use of UAVs. In this way, operations will be kept under constant surveillance and human will be the leading part of the critical decision-making process.

V. AN EXAMPLE OF USING THE MISSION PACKAGE

While planning an offensive strike to a country's critical plant, first the target and our goal should be cleared, next the planning phase should be started. So you first need to determine strategic targets and the desired level of effect. Ammunition required for the desired effect should be determined according to the detailed intelligence work. Then threats of the operational area should be evaluated and without being subjected to threats, planning for the execution of the operation should be performed. If necessary, it is possible to execute the task with some restrictions. For example, for an AAA (antiaircraft artillery) with a short-range low altitude point defense, planning an attack at 10000 feet without being subjected to any threats enables the execution of the task successfully. On the other hand, to perform operations safely in a campaign environment against a threat with a medium altitude and medium-range SAM defense, planning to throw ammunitions without entering the SAM ring will provide the execution of the task. As stated in all these examples, operational level targets are protected with this type of SAMs or anti-aircraft systems. However, considering today's environment, protection of a strategic objects is not necessarily that simple at all. For example, when we think of a nuclear plant as a strategic level target, it is evaluated that it has first ring (inner ring) anti-aircraft system, (the outer ring) medium altitude and medium-range SAM system, (the very outer ring) high-altitude and long-range SAM system and also systems capable of electronic attack. As can be seen, nowadays a strategic objective is protected by very complex structures connected to each other by links and exchanging continuous data between them. Attack package should be planned after evaluating this kind of threat environment. After the target and threat analysis, route planning appears to be another important factor. Planned route for an operation needs to be open to minimum possible detection or if the terrain is available, impossible to detect at all. Here is a wide variety of factors providing detection (AEW- Airborne early warning, such as radar or the human factor.) Planning should be done by taking into account all of these elements. Also along the route planning should be done without entering any threat ring. The data we have achieved as a result of this analysis from the target to come back, will directly affect our final decision process. Addition to these factors we have to take into account capabilities of aircraft systems and ammunition, geographic and meteorological conditions in the planning process. After the process of this analysis, and we create our enemy target as a nuclear plant containing strategic objectives, the following task package is evaluated:

- First of all, ammunition will penetrate the target should be identified as a result of target evaluation,
- Ammunition that could penetrate the target and the platform it will be gunshot should be identified,
- How many planes need to be brought to neutralize the target should be determined,
- As a result of evaluation of threats at the operations area, requirements of the mission package needs to be determined, such as electronic attack platforms, and so on.
- Route planning,
- Mission package coordination,
- Offensive tactics,
- Fuel time planning,
- Planning of the sweep escort needs.

In short, under the headings of Task, Target, Threat and Tactics plans will be made. You need to be careful, strategic objectives, as mentioned above, have complex defense systems to protect the structure. Therefore, the mission package should minimize the risk of the high-threat environment and must ensure the execution of the task. In this regard, use of unmanned aircraft systems would minimize the risk factor [8]. Technical conditions for the execution of the task were evaluated. In this mission package, there should be a final decision authority thus should be considered a manned system. UAV systems that are able to carry enough ammunition for the destruction of the target should be determined. There will be no need for planning sweep or escort for these systems which are considered to be capable of carrying mixed load and has low visibility. However, the position of the target in the territory of the enemy may require a route which threats are likely to be encountered; in this case sufficient sweep or escort planning should be made for the package. Also enough UAV systems should be planned for the mission package, capable of keeping SAM systems and radars under pressure and if necessary make DEAD (Destroyed of Enemy Air Defense) in the operational environment. Lastly, a manned aircraft as the lead orchestra chief should be added to this mission package. This aircraft should be capable of exchanging data with semi-autonomous UAVs. This will be possible with the 5th generation aircrafts under current conditions. In addition, according to the task radius, air-refueling aircraft planning should be made if required. In this case, these high value assets will require an escort planning based on their orbit area. It will not be required if the orbit area is in the friendly territory but it will be required if it is in enemy territory. After the creation of task force, TOTs (Time Over Target) should be determined according to offensive tactics. If we examine the operational tactics at the target area, first SAM system at the outer section of the ring, followed by a medium altitude medium-range SAM system should be suppressed by UAVs capable of electronic attack and then should be disabled by UAVs capable of DEAD. Next

radars should be disabled by UAVs capable of electronic attack and finally in a non-threat operational environment, the target should be destroyed with air-to-ground role UAVs. At every stage of this process, the pilot in the manned aircraft systems will be able to make inputs due to changing situations and will manage the operation such as an orchestra chief. He will be responsible for the leading of the UAVs in the dynamic environment if the process goes out of plan. And he will be in the loop throughout the mission. Following the execution of the task safely and successfully, will return to friendly territory while maintaining the integrity of the package.

VI. CONCLUSIONS

In a period of 30 years, unmanned aircraft systems which indicate a very rapid development, will be a system that has capabilities beyond need. Therefore, it is important that the cretaed systems has the capabilities which meet the needs. When recent developments have taken into account, the potential of problems which full autonomous UAVs may cause makes it more essential to use them in semi-autonomous level. UAVs which are planned to form half of the operational environment in the near future will cause lots of confusion if no inputs are made and let them fly full autonomous tasks. UAVs should be able to perform the task without the need for constant human guidence, but in critical situations, the final decision should be human authority. This will minimize the existing problems as well as the assignment of the minimum staff needed. The use of UAV systems in operational environment have significantly decreased the risk of loss of life. So, in the future it is expected that operational environment will be full of semi-autonomous systems rather than manned systems.

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