

Monitoring Civil Projects and Operations using UAVs

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Abstract— UAVs (Unmanned Aerial Vehicles) have been used for military operations for many decades for surveillance, spying and targeted attacks. Now it is the time for the Civil Projects and Operations to get its benefits. Especially they are highly useful in the areas where deployment of the manpower is full of risks and more costly than having a UAV to monitor the concerned project or operation site. The use of state of the art ground station and satellite communication links has enabled the UAVs to perform reliable takeoff, flight, observations and precise landing. At present battery operated UAVs can provide observations for a few kilometers for few hours and the fuel based UAVs can provide observations for many hundred kilometers for many hours. Recent advancements in solar energy are promising to enable battery operated UAVs to fly thousands of kilometers for years. This paper presents the possibilities to use the UAVs for the monitoring and control of civil project and operations within the constraints of cost and required performance.

Keywords— UAVs; Projects; Operations; Monitoring;

I. INTRODUCTION:

The unmanned air vehicles (UAVs) have been in use by the armed forces around the world since Second World War. The use has been primarily for the purpose of spying of the target territory and the obtained information was used to hit the targets precisely. It supported the air, land and naval forces to identify the targets and to plan the mission with best possible geographic options. The manned air vehicles were also used extensively by defence forces since their inception but parallel development by the commercial sector has made the commercial aviation a massive reality. So there is a categorization of manned air vehicles as War Planes or Fighter Planes, Commercial Planes or Passenger Planes and Cargo Planes. Similarly in unmanned air vehicles the usability options are expanding. These can be Spy UAVs, Attack UAVs or monitoring and surveillance UAVs. In the commercial sector some examples of use are for agriculture, oil and gas, marine and coastal areas, mining, wildlife, media, sports and geographic survey. This civil use of unmanned air vehicles is promising to use them as a tool for monitoring civil projects and operations, especially in the areas where deployment of manpower is full of risks or not possible at all. The complete infrastructure to operate the UAVs is known as Unmanned Aircraft System (UAS) which includes the UAV, the communication links, ground control station and related equipments and manpower. The latest technological innovations are promising to make the whole UAS to be effectively and efficiently utilizable for the monitoring of the civil projects and operations. There are options of battery

operated to fuel operated UAVs. The recent development in solar powered UAV is a promising factor for monitoring activities over a large area for a longer duration. All projects and operations have some constraints and risks. Especially when risks are high the risk management and mitigation becomes a costly endeavor. Some time the whole project or operation gets halted or terminated because of the inadequate management of risk factors. Projects and operations which are scattered over a large geographic area need comprehensive monitoring activities. Also the geographic areas with risks of natural disasters, wild attacks or enemy attacks are especially prone to huge disasters and can cause the failure to the whole project or operation. UAVs can serve as a valuable tool for the monitoring activities for projects and operations. The deployment of complete UAS incorporates the UAV which captures the imagery of the monitored site, Communication Link which gives the transmission of the imagery, Ground Control Station which receives the imagery and provides it to the analyst and observatory staff. The analyst then analyzes and submits observations to the concerned manager who can take timely decisions to act for any signs of risk and disaster. As a monitoring tool the UAVs can prove to be cost efficient and may be in some cases the only option for precise monitoring needs. In this paper we will describe the brief history of UAVs, types of UAVs, the proposed framework for use in Civil Projects and Operations, the suppliers of Civil UAVs and finally the conclusion and suggestions for further research.

A. Brief History of UAVs

The efforts for unmanned air vehicles started after a very short period of the manned aircraft flight. In 1916 early efforts by Glenn Curtiss for the Curtiss Flying Boats give a door opener. Efforts continued in USA, United Kingdom, Germany and many other countries. In World War II Germans used their V-1 “Buzzbomb” UAV to attack on London. In 1960 US Air force awarded a contract to produce “Red Wagon” UAVs. During the Vietnam War Americans used “Lightning Bug” and the “Buffalo Hunter” UAVs. These UAVs were highly successful in their missions and suffered very low loss as compared to manned aircrafts [1]. United States has success in deploying “Pioneer” UAVs from 1980s onwards, “Hunter” and “Predator” UAVs from 1990s onwards, “Fire Scout”, “Shadow” and “Global Hawk” UAVs from 2000 onwards. More recently combat variants of UAVs are also produced known as “UCAF-AF” to be used by US Air force and “UCAF-N” to be used by US Navy [2]. Recent developments have witnessed the use of UAVs for commercial and civil purposes. UAVs producers all over the world are now targeting the markets for commercial use of the UAVs. Producers from China

are providing low cost alternatives to all popular types of UAVs. Now UAVs can be deployed for commercial use for as low as 1000\$.

B. Types of UAVs:

UAVs can be fixed wing like a normal airplane, Single Rotary like a Helicopter or Multi Rotary. Fixed wing UAVs have Fuselage and Wings. The fixed wing UAV needs a runway or a throw mechanism to make it airborne. Single Rotary UAV like a Helicopter can take off and land vertically. Multi Rotary UAVs like Tri Copter, Quad Copter and Hex Copter are more stable and precise as compared to single rotary UAVs in take off, landing and flight. UAVs can be powered by Rechargeable Batteries, Fuel or by Solar Energy. At present UAVs with Rechargeable Batteries can provide monitoring for few hours for few kilometers whereas fuel based UAVs can provide monitoring for many hours for many hundred kilometers. Recent advancements in Solar Powered UAVs are promising to provide monitoring facilities for thousands of kilometer for many months or years. NASA's Helios UAV is powered by the solar panels. It has already flown to the height of 100,000 feet. NASA has plans to develop a UAV that can fly day and night for months. This can enable the UAVs to provide services like a huge telecommunication relay or surveillance tower [3].

C. Proposed Framework for use in Civil Projects and Operations.

UAVs can be used for monitoring of the Civil Projects and Operations by applying the following steps.

1. Assessment of Monitoring Needs
2. Selection of Appropriate UAV System.
3. Deployment of the Selected UAV System.
4. Flights for Monitoring and Data Collection
5. Performance Measurement

Monitoring Needs can be different for every other project or operation. This needs to be clearly understood so that to finalize the requirement of flight hours and the area to be monitored. Depending on the flight time and area to be covered an appropriate UAV Systems need to be selected and deployed. Flights are made whenever the monitoring is required and data is collected. This monitoring activity needs to be measured in terms of the performance factors like cost and time. The overall UAV System will include the UAV, Ground Control Station, the Communication Link and the trained manpower for successful operation.

D. Suppliers of Civil UAVs:

Many UAV producers around the world are targeting the commercial sector to provide the UAVs for Civil use. One of the Leading names in the suppliers is INSITU which is a subsidiary of Boeing Company. Boeing has a huge experience of manufacturing manned aircraft for commercial aviation for decades [7]. Another leading name is C-ASTRAL which is producing UAVs for precise commercial imaging [6]. Many other producers from around the world regularly showcase their products at the annual display events e.g. at The Commercial UAV Show UK, Airtech Show Germany, TUSEXPO Netherlands

etc. Many Chinese manufacturers are providing low cost solution for the commercial use UAVs. Example includes the Phantom UAV by DJI [5]. This small UAV has brought a revolution in the field of video capturing and imaging for commercial and personal purposes and costs as low as 1000\$. CIVI-UAVs a Pakistan based company is providing UAVs for commercial use. There products provide monitoring for short, tactical and medium range areas [4].

II. Conclusion and Suggestion for future research:

As an analogy to manned aircraft the unmanned aircraft can also be used for civil and commercial projects and operations. The reliability, cost effectiveness and time saving are the key factors which make the UAVs a good tool for monitoring activities. UAVs from the size of few inches to many feet long are now available around the world. Chinese manufacturers have made it cost effective and affordable for use in commercial sector. Future work is suggested to apply the framework proposed in this paper and obtain the real statistics of cost involved and performance obtained by using UAVs for a commercial project or operation. The advancement in technology will make it further easier for incorporation in civil use.

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