THE REMOTE AND MOBILE AIR TRAFFIC CONTROL TOWER AND ITS POSSIBLE APPLICATION TO THE OPERATIONAL AREA

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The concept of remote and mobile Air Traffic Control Tower (ATC TWR) and its development has started in Europe, Australia and also in the USA, in order to improve the efficiency of Air Traffic Management (ATM) systems in terms of air transportation safety. These new technologies are applicable in many countries in peace time, but on mobility reasons these are promoted to achieve commitments in the operational area. This article describes the devices and range of equipment of mobile and remote tower, and their specifications, which can even serve a medium sized airport, furthermore examines, whether how can those provide the air traffic services at an operational airfield

Key words: *remote tower, mobile tower, air traffic control, civilian airport, operational airfield.*

1. INTRODUCTION

Airports, as the ground element of air transportation infrastructure, usually possess limited capacity. Moreover, a range of factors could influence their optimal utilization. Essentially, these factors are the following: location of the airport, details of runway (s) (length, width, pavement concrete number and average runway reservation time), features of airport lighting and navigation equipment, dimensions of aprons and taxiways, and, last but not least traffic capacity and type of air traffic services as well.

What mainly determines the capacity of the airport, of course closely related to the above, is nothing else but how many and which category of aircraft the airport could receive and serve in a given time of period, from arrival to departure. The next term, from departure to arrival can also vary depending on the departure airport and the destination, the purpose of flight, as well and the occurrence of delay, typically in case of civilian and commercial flights. For example, the endurance of a trans-Atlantic flight takes 9-10 hours, so the departure time is scheduled in the evening in the majority of Western European airports, and hence the usual landing time on the other shore is in the morning. The same is valid for the flights departing from the American continent in the evening and landing in Europe in the morning. In the remaining time, for example the transfers to the Atlantic flights, the majority of the traffic makes up the feeding flights of the airport. These flights could be domestic or intra-continental, lasting for about 1-1.5 hour and even for a 6-8 hour period, which makes the airports loaded mostly at noon and in the early afternoon.

The total number of flights from and to an airport, also referred to as “total movements” is usually influenced by tourism seasonality, but also by economic or political effects that can drastically affect the growth or decline of movements. For example, according to the published

data in the annual reports of the Budapest Airport (LHBP) called Liszt Ferenc (Fig.1), the movement number dropped from 120,000 to 80 000 in the last few years.

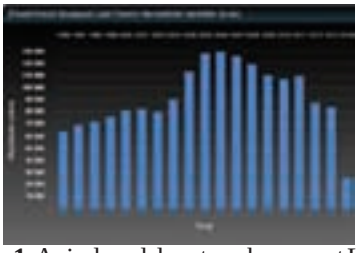

Figure1: Arrivals and departures by years at LHBP

The question that emerges concerns the means by which, considering the declining numbers of air traffic, an air traffic service provider keeps its profit while maintaining qualitative service, without disturbing aviation safety. This issue of cost-effectiveness is equally important for the two other international airports of Hungary, namely Sármellék and Debrecen, where the airliners schedule 14-20 flights per week, depending on winter or summer time. The costs involve the air traffic service of the above mentioned airports, and also the maintaining of the building and infrastructure of airport control tower. To optimize the cost of air traffic services is a key issue in many European and overseas countries. In order to resolve it, as a result of efforts made in Sweden a remotely operated airport control tower model, the so called virtual airport control tower model, has been developed and is under testing. During the tests the traffic of the Örnsköldsvik airport was controlled from the Sundsvall Centre, which is almost 100 km away.

In the area of military aviation, cost-effectiveness is not a negligible factor even though there are other aspects that prevail. In this respect, it is worth reminding that the current military operations in which Hungarian forces are involved, take place in remote location. Moreover the military exercises preparing our forces for new challenges, demand new solutions. At the beginning of operations in remote countries, where the local infrastructure has not been built or it has been completely destroyed, it is necessary to establish an airfield, that proves suitable for receiving logistics, deploying necessary services and maintenance, and which later on, after returning back to national purpose, could be sufficient for the local demands. A temporarily installed airport in the area of operations or even on the terrain hit by disaster- where the adequate airport infrastructure is not available and the air transportation is the only way to send supply- require mobile and fast installation of an airfield. Considering the facts mentioned above, the military requires a device, which can be easily and quickly installed, whose maintenance is sustainable in field conditions, and is equipped with communication, navigation and controlling tools for receiving the expected air traffic. In this case, besides the airport control tower (hereinafter called ATC tower) it could be necessary to install navigation, communication, lighting systems and maybe radar or the possibility to receive and display the signals of remote radar. Herein below, two options will be presented. One of them is an absolutely mobile device, which has already served for missions, and the other one has still been under testing and by this time has been developed for civilian purposes.

2. COUNTRIES DEVELOPING MOBILE TOWERS

Among countries developing mobile and deployable ATC towers special attention should be paid to Sweden, which, as a result of investing into new hardware and software technologies, despite the limited space installed the same controlling devices, equipment and displays in the container, that is also part of the conventional ATC tower. The control tower [2] is placed in

a 20-foot-long container, which is mounted on a trailer, but it can be set up and installed without lifting. It is generally expected that the container provides a 360° perspective for the air traffic controller (hereinafter called ATC). In the Swedish development, there are three positions for ATC personnel, whose duty depends on the duration of air traffic at the airport. The integrated control tower (Fig.2) allows each controller position to complete various functions. It also provides traffic handling, indication, presentation and sharing of control displays among positions. However, the displays are minimized and they provide compact working position, where the head-down time is reduced so that situational awareness capability increases. The tower equipment enables the provision of flights in all weather conditions, through day and night. The integrated tower is available also for civilian application not only for military use, so depending on requirements there are two different versions deployed with Military Off The Shelf (MOTS) or Commercial Off The Shelf (COTS) hardware. Standard interfaces are used for communication with external systems that would otherwise support redundant processing and can display all flight data scalable for ATC. All the three working positions are fully equipped with display of radar data, flight plan management system, radio system, weather information display, voice communication system, objective control device for archiving, the runway light system control panel and RCMS (Remote Control and monitoring System).

Figure 2: Units of I-tower

Among the conventional part of the communications systems are the Very High Frequency/ Ultra High Frequency (VHF/ UHF) radios and roof-mounted antenna system, the fiber optic cable, Satellite Communication (SATCOM) and Global System for Mobile Communication (GSM) standard analog phone lines, meteorological sensors, radar contact and Aeronautical Fixed Telecommunication Network (AFTN) station. The container can be lifted to 4.4 meter height, which means 6.0 meters high from the ground, the electronically controlled hydraulic system, and the operation requires 400V voltage 32A amperage. For the cargo a C130 aircraft is available. This ATC container is one of the logistic elements of an air force battalion, so its installation takes a couple of hours.

The Aeronav Group, which is based in Montreal, constructed and supplied the ANT-26 [1] type of mobile ATC tower in two different sizes. Concerning their equipment and functions, these are very similar to the Swedish model. The installation is quick and simple, they are suitable for military operation in a temporary landing site, and even appropriate for operation in the area affected by natural disasters. The mobile TWR can be combined with the permanently localized ATC systems as well (Fig.3), in order to, for example, monitor remote jobs like prevention of runway incursion. A number of configurations exist, the system may be expanded easily, it can operate autonomously, the unique air distribution system provides for operation reliability. Transportation of mobile TWR is possible in cargo aircraft, helicopters (as external cargo) or on a boat.

Figure 3: Combined operation with standard ATC TWR

In the queue of countries developing mobile towers there is also the US with its Sierra Nevada Corporation, that delivers for the U.S. Army the MSQ 135 Mobile Tower System (MOTS) easily installing ATC tower [3], associated with a 36 kW generator, a lighting system and meteorological sensors as well (Fig. 4). Its design allows its transportation on armored vehicles, and also its dropping into the area of operation by C17 or CH 47 helicopters. Basically, the MSQ 135 MOTS is used for military ATC operations. Therefore, besides standard air traffic control systems, there are others as well for theater management.

Figure 4: MOTS and supplemented units

Despite its prevalent use in the military, it is recommended for other purposes, because the air traffic control systems meet the International Civil Aviation Organization (ICAO) / Federal Aviation Agency (FAA) regulations, and could be an effective support of disaster management because of its minimal logistics needs. Compared to the former ones, its only backward is that it is not lifted with a hydraulic system. However, the presence of its own power unit and lighting system are clear advantages.

3.REMOTE CONTROL, FROM THE VIRTUAL TOWER [4]

The Remote Tower "r-TWR" (Fig.5) is a truly revolutionary initiative, agreeing with the requirements of all stakeholders like the airport operator, air traffic services and airliners. This is the first real opportunity to combine the use of dynamic resources with sharing information and maintenance of safety environment. The Swedish Defence and Secure Company (SAAB) was among the first that came up with a high-quality, user-friendly product on the international market. The r-TWR is an ideal solution to replace all locally fixed ATC positions. Its features are security, cost-effectiveness and interoperability. The "r-TWR" can be a perfect solution in the following cases:

- to replace the obsolete ATC tower of an airport;
- to establish ATC service in a new airport;
- to keep ATC service of two or more airports in one hand;
- to provide contingency plan and guarantee ATC service;

The costs of reconstructing the outdated devices of an ATC tower are almost similar to installing a smart camera system. Not to mention the fact that the r-TWR can be activated, in case of any traffic uses the airport both for departure or arrival. The camera system provides a 360° panorama of the airport and enables the detection and monitoring of objects in the air and on the ground. The r-TWR is also endowed with a information-sharing capability that contributes to the Collaborative Decision Making (CDM) system functions of modern airports. The task of the CDM system is to facilitate and enhance the flight planning schedules in an extended airspace, like the European airspace, to offer alternative solutions in case weather conditions do not allow using any

sectors or airways, or when air boxes, that general aviation traffic should avoid, are activated. The camera system helps to focus on any significant points of the airport, for example the runway, in order to prevent incursions. The amount of information gained facilitates and enhances situational awareness capability. It is not negligible that the objective control function that relies on image and voice recording supports investigations in case of an event. The r-TWR solution can be operated as a simulator, which helps ATC personnel to maintain their practical skills, enhance and refresh control skills to be used in case of emergency.

Figure 5: The r-TWR

The strategy of r-TWR validation has already made progresses. One of the key elements of the validation process is to re-regulate the operation of air traffic services described in ICAO documents, which are applicable only the "real world" operation not the virtual one. During the tests some shortcomings came out, such as the lack of radar data which can be useful to add to the object detecting function of cameras to provide information in low visibility or at night. Referring to the documentation it is also important to redefine the Air Traffic Controller Officer (ATCO) / Aerodrome Flight Information Service Officer (AFIS) system task, the supervisor's job scope and the area of responsibilities. During the tests all ATC personnel found the technology useful and suggested to extend alerting functions in order to enhance current safety. Among the supporters there is the Air Traffic Controllers European Committee (ATCEUC), but further tests and investigations are still needed in this respect.

4. CONCLUSIONS

Both developments that my article presented redefine the traditional experiences of airport management. The mobile ATC tower presents the opportunity of setting and operating an airport anywhere. Contrary to that, the r-TWR gives the chance to control the traffic of any airport from one place. With a view to that, the mobile tower meets the need to create a functioning airport in a relatively short time in an abandoned area. Accordingly, the mobile tower can be packed easily, its transport and installation takes few hours to achieve the ready function. The r-TWR is a good answer to the economic and political changes which make an airport abandoned and another one busy. However, the r-TWR has not spread yet, it is a trendsetting initiative which can extend the flexibility of airports and air traffic services. However, the question of which one of the above mentioned is suitable for an airfield in areas of operations still remains.

It is true that in current situations the mobile tower seems the most appropriate solution in an area of operation for two reasons: the short time period required for installing and the lack of energy resources. But the airfield which works temporarily during

operations could be the basis of infrastructure in a given country in the future. If the operation of the airport is planned for longer-term needs it is worth thinking over the r-TWR technology. In this respect, the time and cost factors argue in favor of r-TWR rather than of conventional buildings. In addition, the personnel of air traffic services may be in limited numbers which also supports the idea of a centralized ATC service. Finally, it is usually the economic and political changes that generate cost efficient and flexible solutions.

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