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THE JUSTIFICATION OF MILITARY RESERVE AIRFIELDS IN MODERN WARFARE, ASPECTS, AND CHARACTERISTICS OF THEIR DESIGN

A KATONAI TARTALÉK REPÜLŐTEREK
LÉTJOGOSULTSÁGA A MODERN HADVISELÉSBEN,
KIALAKÍTÁSUK SZEMPONTJAI, SAJÁTOSSÁGAI

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Abstract

With the end of the Cold War, the methods of warfare and the military's strategic policy objectives have changed in the European Union and thus in our country. Since the 1990s, thanks to the process of force reduction and the peace settlement model of the European countries, the number of airports, barracks, armies, and the amount of equipment in the armies has also been reduced. Air Force plays a crucial role in the defence of a country. As their maintenance is extremely costly, the protection of airfields and maintenance of aircraft and technical equipment combat-ready preserving is a priority task. During the Cold War, all countries built and maintained reserve or emergency airfields, so that they could deploy their flying forces at short notice in the event of an expected or unexpected attack. Nowadays, most of these airports have been closed or are in civil use. In this article, the author seeks to answer the question of whether reserve airfields have a place and role in today's modern warfare in Hungary and examines aspects and characteristics of their design from the point of view of the aircraft in use today.

Keywords: aviation, airport, camp, temporary, landing site

Absztrakt

A hidegháború végével a harcászati módszerek és a katona politikai stratégiai célok az Európai Unióban és így hazánkban is megváltoztak. Az

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1990-es évektől kezdődően a haderő csökkentési folyamatnak, valamint az európai országok békére való berendezkedési modelljének köszönhetően, a repülőterek, a laktanyák, a hadseregek létszáma, valamint a hadseregek eszközparkjának mennyisége is lecsökkent. Egy ország védelmében a légierőnek meghatározó szerepe van. Mivel fenntartásuk rendkívül költséges, ezért a repülőterek védelme, a repülőgépek és a technikai eszközök hadrafoghatóságának megőrzése kiemelt feladat. A hidegháború alatt, minden ország tartalék, vagy szükségrepülőtereket épített és tartott fent, azért, hogy az országot ért várt, vagy váratlan támadás esetén a repülő erőket rövid időn belül szét tudja telepíteni. Napjainkban ezeknek a repülőtereknek a többsége megszűnt, vagy polgári hasznosításban üzemel tovább. Ebben a cikkben a szerző arra keresi a választ, hogy Magyarországon, a mai modern hadviselésben van-e helye és szerepe a tartalék repülőtereknek, továbbá vizsgálja azok kialakításának szempontjait, jellemzőit a ma használatos repülőeszközök szemszögéből.

Kulcsszavak: repülés, repülőtér, tábori, ideiglenes, leszállóhely

Introduction

Well-developed and equipped military airfields and the aircraft they operate play an important role in a country's air defence. In peacetime, aircraft are deployed and operated from well-established and equipped airbases, but in wartime, provision must be made for the use of reserve airfields or temporary landing sites. For helicopters, the designation of temporary landing sites is easier due to their vertical take-off and landing capability, but fixed-wing military aircraft need an operational area of appropriate size due to their take-off and landing speeds and strict operational requirements. Exceptions to this are fixed-wing aircraft with vertical take-off capability. The designation and construction of reserve or temporary airfields should be carried out in peacetime so that they can be deployed in a relatively short time in the event of an emergency. As in the case of permanent airports, several factors must be taken into account when designating the area. For example, the length of the take-off and landing area, their width, accessibility, and the operational characteristics of the aircraft, etc.

Most places used as Hungarian military airfields already were chosen between the two world wars, so a military airport network very sim-

ilar to the current airport network has been established. Several air bases were established in the 1941-42 and 1942-43 military orders of the Royal Hungarian Air Force in the present territory of the country.²

After the Second World War, in addition to civil aviation organisations and Hungarian military aviation units, Soviet aviation units were also deployed at the airfields, which were referred to in various documents as "VA"- guest units³. After the change of regime, the deterioration of the country's economic situation, the withdrawal of guest forces, the transformation of the social system, and the downsizing of the armed forces led to a reduction in the number of military airports. With the exception of Ferihegy airport, the transfer of airports from civilian and soviet troops has resulted in a clear negative trend in the operational quality of airports. (For example: Kunmadaras, Sármellék, Kiskunlacháza, etc.)

The armed conflict between Russia and Ukraine proves the relevance of this article, during which the Russian air force disabled several airports in Ukraine. In this article, the author describes the situation of airfields, including military air bases, after the change of system, and examines the characteristics and basic requirements that are essential for modern aircraft to be able to operate from reserve airfields under field conditions. Several professional articles have been published on the subject, of which I will highlight just three. **Lukács László, Kovács Zoltán, Tóth Rudolf**: „Rombolt repülőterek helyreállításának műszaki feladatai”; **Tóth András**: „JAS 39 Gripen EBS HU többfeladatú vadászrepülőgép” és **Hennel Sándor**: „Légi járművek repülőtéren kívüli szükségesszállóhelyeinek harcászati korlátai, alkalmazhatósága, kialakulásának körülményei”. In these articles, the cause-and-effect relationships that highlight the need for field airfields are clearly visible.

1. The need to build reserve airports

My research on the subject has shown that already in World Wars I and II, flying troops carried out their combat activities mainly from reserve and field airfields. This is to increase their defences by dispersing

² Budaörs, Mátyásföld, Debrecen, Kecskemét, Pápa, Szolnok, Szombathely, Tapolca, Veszprém, Székesfehérvár – Börgönd, Székesfehérvár – Sóstó, Nyíregyháza, Szeged. The air force also had, of course, reserve operational airfields. For example: Miskolc, Tiszalök, Rakamaz, Hajdúböszörmény, Mezőkeresztes, Sajóörs, Felső-Ábrány (Bükkábrány)

³ „VA"- guest units: Soviet Troops temporarily stationed in our country.

their own aircraft and technical equipment, to reach enemy airfields and troops in the shortest possible time and to support their own military forces more effectively. The technical standard of aircraft at the time meant that grass airfields were sufficient for landing and taking off, while hard-surfaced airfields were only needed for large transport aircraft. (For example: C-17 Globemaster, An-26 Curl, Airbus A319.) Most of today's modern aircraft can no longer be operated from grass airfields, but it may still be necessary to disperse air forces to protect them.

During the Cold War, most military aircraft were designed to operate in field conditions from grass airfields. A good example of this is the Mig-21 interceptor fighter aircraft family shown in „Figure 1”, of which various variants were in service in the Hungarian Air Force from the early 1960s until the mid-2000s.⁴



Figure 1. MiG 21 UM aircraft during landing at Kenyeri, with braking chute and MiG 21 MF before landing in the 1980s.⁵

During this period, all military bases in Hungary had reserve airfields, most of which were grass airfields, (For example: Balatonkiliti, Pér, Börgönd, Ócsény, Kenyeri,⁶ Szolnok-Szanda, Orosháza, etc.) and

⁴ Kelecsényi István: „MIG-21-SZTORI: MAJD NEGYSZÁZ ÉV MAGYARORSZÁGON – 2. RÉSZ Source:

<https://iho.hu/hirek/mig-21-sztori-majd-negyven-ev-magyarorszagon-2-resz-150215>

(Date of download: 13.03.2022.)

⁵ Pörnczi Tamás: „OMLADOZÓ MÚLT...REPTÉR, Idén nyolcvan éves az egykori Kenyeri repülőtér,”

Source: https://kenyeri.blog.hu/2018/09/14/omladozo_mult_a_repuloter.

(Date of download: 13. 03. 2022.)

⁶ Kenyeri reserve airport: About 40 kilometres from Pápa is a grass airfield, that was used by Hungarian Pumas during the war and later by the Soviets as an airfield. From the 1960s it was under joint operation, and after the withdrawal of the Soviet troops, it was completely taken over by Hungarians. (Benedek Levente: „Kenyeri tartalék reptér,”

Source: https://kameraaltal.blog.hu/2013/09/26/kenyeri_tartalek_repter.

(Date of download: 13.03.2022.)

only Mezőkövesd had concrete paving. These airfields are no longer used by fixed-wing fighters due to the change of type, but helicopters can use them on a limited, one-to-one basis. The justification for reserve or emergency airfields in wartime is significant because the dispersal of flying bases over several points is not only advantageous from a defence point of view, but also because it is more difficult to detect.

The primary objective when starting a war is to cripple the enemy's air force, to gain air superiority. This is not limited to the destruction of aircraft only, but also includes air surveillance radar installations, control centres, battle stations, air defence missile sites and airfields capable of receiving and launching aircraft.

The concrete runways at today's military airports are designed to accommodate not only military passenger and cargo aircraft but also helicopters and fighter jets for various purposes. If they are demolished, the airport will become inoperable and will be unable to receive, service, control, and safely operate fixed-wing aircraft until they are restored.

This can be achieved by the attacking parties through several types of attack operations:

- From a distance with missiles and artillery.
- Close air-to-ground missiles launched from aircraft, with destroyer bombs, (for example the BLU-107 Durandal shown in „Figure 2”⁷ with help of cluster bombs.
- With explosions by ground troops or fire from armoured fighting vehicles.

⁷ „**Concrete destroyer bombs:** their main purpose is the destroying of runways, bunkers and various concrete structures. They work in a similar way to armour-piercing bombs, using their hard metal nose section to drill deep into the concrete and explode inside it, increasing the destructive power.” (Zsibrita Dániel, „Nyugati és keleti blokkban rendszeresített légibombák összehasonlító elemzése (Szakdolgozat),” 2018. Nemzeti Közzolgálati Egyetem, Hadtudományi és Honvédtisztképző Kar, Katonai Repülő Intézet, Fedélzeti Rendszerek Tanszék, Repülőfedélzeti Fegyvertechnikai modul, p.13 Source: http://www.repulestudomany.hu/tdk/2018_Zsibrita_Daniel_SZD.pdf (Date of download: 14.03.2022.)) „One such bomb is the French-made Durandal concrete demolition bomb, which after exploded on impacting to a crater 2 m deep and 5 m in diameter. Concrete demolition bombs are accompanied by mines, which explode on contact, to obstruct reconstruction work after an impact.” (Sp. p.13)

Enemy strikes inflict heavy damage, but by quickly changing airfields and dispersing before the attack, damage can be reduced to a great extent and the level of combat effectiveness maintained.⁸



Figure 2. BLU-107 Durandal destroyer bombs and their consequences⁹

The vulnerability of airfields was already proven during the Six Day War when a series of unexpected air strikes by Israel destroyed the enemy's aircraft fleet still on the ground.^{10 11}

⁸ Vándor Károly: „Légierő társbérletben, avagy A Szovjet Légierő és Légyvédelem-története Magyarországon és Ausztriában (1944–1991),” 1. kötet, Budapest: VPP Kiadó, 2009. pp. 69-282.

⁹ Hennel Sándor: „Civil, katonai és rendvédelmi célra fejlesztett légijárművek és be-
rendezéseik vizsgálata,” Doktori (PhD) Értekezés, NEMZETI KÖZSZOLGÁLATI
EGYETEM KATONAI MŰSZAKI DOKTORI ISKOLA, Budapest 2017, p. 29,
Source: [https://docplayer.hu/108436202-Phd-ertekezes-hennel-sandor-or-
nagy.html](https://docplayer.hu/108436202-Phd-ertekezes-hennel-sandor-or-nagy.html) (Data of download: 14.03.2022.)

¹⁰ In 1967, Egyptian President Nasser and the members of the coalition he forged (Egypt, Jordan, Syria, Iraq) committed themselves to a major war against Israel. The four countries had more than 1,800 tanks, 660 combat aircraft and a well-armed army of 364,000 men. The Israeli army, on the other hand, had only 800 tanks, 300 combat aircraft and 264 000 troops, and was preparing for a war that threatened to fully destroy it. The crisis that erupted when the entrance to the Gulf of Aqaba was blocked became the spark that ignited the inevitable conflict. On 5 June 1967, the Israeli Air Force launched simultaneous air strikes against the air forces of all four enemy countries, with the participation of the full Israeli Air Force. The result was devastating: 75% of the Arab states' entire air force was destroyed in a single day. Most part of the 452 aircraft destroyed met their destiny on the runway. Israel suddenly became absolute master of the airspace of the Middle East on 5 June 1967 and managed to change the outcome of the war. (Hennel Sándor: „Légi járművek repülőtérén kívüli szükségleszállóhelyeinek harcászati korlátai, alkalmazhatósága, kialakulásának körülményei,” *Repüléstudományi Közlemények, Különszám* 2010. Source: http://www.repulestudomany.hu/kulonszamok/2010_cikkek/Hennel_Sandor.pdf (Date of download: 17.03.2022.)

¹¹ Hennel Sándor: „Légi járművek repülőtérén kívüli szükségleszállóhelyeinek harcászati korlátai, alkalmazhatósága, kialakulásának körülményei,”

The alternative of a rapid dispersal to reserve airfields (required field) is clamping in Air Force doctrine. Of course, we cannot conceal the movement and deployment of troops and the establishment of standby airfields from the military satellites in use today, so other alternative defence solutions must be developed and deployed. Such solutions could include the replacement of the former grass camp airports with landing and take-off sites on motorways, better roads or the use of civilian airports. The designation and construction of reserve airports shall take into account the following criteria and requirements:

- Meteorological conditions.
- Landscape topography.
- Approaching routes, obstacles.
- Operational characteristics of the aircraft type.
- The possibility of ensuring logistical supply, the state of the road network ensuring accessibility or the possibility of connecting to the existing one.
- Minimising the detectability of the aircraft.
- The width and length of landing and take-off places, the load capacity of its envelope, slope angle, evenness of the terrain surface.
- The possibility of building landing radars or deploying and camouflaging mobile landing systems.
- Light technology, Possibility of the installation and use of mobile wild animal and bird alarm systems.
- The ability to guard and protect emergency airfields, restricting access and entry by unauthorised people.

Even in peacetime, reserve airports already require significant preparatory work. This means first and foremost the designation of operational airfields, the continuous assessment and maintenance of their condition, the planning of the necessary tasks and works, the creation and organisation of the appropriate "M" organisations. Existing capacities need to be assessed, a scenario for the relocation of aviation equipment needs to be developed, preparations for the replacement of missing capacities need to be made, etc.

2. The situation of reserve airports in Hungary

Until the late 1980s, domestic airports were characterised by continuous improvement, or at least a good level of maintenance. Asphalted airfields used and operated by soviet troops (with the exception of Kalocsa) were refurbished and sufficient sheltered aircraft decks were constructed. But this cannot be said of the after regim-change period. The runways and taxiways of the airfields returned by the Soviet air forces are in good condition (except Kalocsa), but the protected aircraft decks are inoperable, and the airfields and their barracks are practically uninhabitable, remained without infrastructure. These bases (with the exception of Tököl) were taken over by the Treasury Property Management Organisation, under whose supervision the condition of the sites deteriorated further. As a reserve airport, they can only be considered as operational solid pavement facilities where all infrastructure must be provided. Their condition can be compared to, like when you have to set up and operate a grass airfield. With the demise of the MHSZ¹², the technical condition of most of the airports managed by the various flying clubs and civil organisations is steadily deteriorating, with minimal effort being made to preserve them. It is therefore increasingly difficult today to designate military reserve airfields that can be maintained at low cost and brought into service in a short time. Most important, they are not long enough, no hard surface.

As military aircraft developed, they also demanded the improvement of the infrastructure of airports. Initially, large grassy areas were sufficient for operations, but later concrete runways, taxiways, control towers and hangars had to be built to ensure safe flight and operations. The type of aircraft used and operated by the country's air force also plays a major role in determining the requirements for the construction of the airports needed.

During the Cold War, Hungary had three fighter regiments, which had flying bases in Pápa, Kecskemét, and Taszár. The then regular MiG-21 family also could be operated from grass airfields. Each of the three fighter regiments had emergency airfields, where they could de-

¹² Hungarian Defence Association (MHSZ): „was a national paramilitary organisation organising sports and recreational activities between 1948 and 1990.” (Wikipedia: „Magyar Honvédelmi Szövetség,” Source: https://hu.wikipedia.org/wiki/Magyar_Honv%C3%A9delmi_Sz%C3%B6vets%C3%A9g. (Date of download: 03.05.2022.)

ploy their aircraft at short notice. As I mentioned earlier. Such designated bases were the grass airfields of Orosháza, Berettyóújfalu, Balatonkiliti, Kenyeri, Börgönd, and the Warsaw Pact solid surfaced airfield in Mezőkövesd, which was used jointly with soviet troops. Only when in use were they equipped with the mobile tools and equipment necessary for safe flight and operations. These airfields still exist today, they are managed by the Hungarian Defence Forces, but due to the change of aircraft types they are not used, they are only suitable for the reception of rotary-wing aircraft. For example, the grass landing area and its minimal infrastructure at Kenyeri, shown in „Figure 3”, is a reminder of a period of aviation history in Hungary that is slowly but surely being forgotten.¹³



Figure 3. Kenyeri airport and the current state of the building and car cover.¹⁴

Like all countries with air forces, our country needs reserve airfields in wartime. Today's 4th generation JAS-39 Gripen aircraft, shown in Figure 4, cannot be operated from grass airfields, it requires reserve airbases with hard surfacing.¹⁵ These can be civilian airports (Ferihegy,

¹³ Benedek Levente: „Kenyeri tartalék reptér,” Source: https://kameraaltal.blog.hu/2013/09/26/kenyeri_tartalek_repter.
(Date of download: 13.03.2022.)

¹⁴ Benedek Levente: „Kenyeri tartalék reptér,” Source: https://kameraaltal.blog.hu/2013/09/26/kenyeri_tartalek_repter.
(Date of download: 13.03.2022.)

¹⁵ „The Gripen was designed so that in field conditions, the preparation of the aircraft for repeated combat missions can be carried out by a six-man aircraft maintenance crew in ten minutes.” (Tóth András: „JAS 39 GRIPEN EBS HU1 TÖBBFELADATÚ VADÁSZREPÜLŐGÉP,” Repüléstudományi Közlemények Különszám. 2005. p.3. Source: http://www.repulestudomany.hu/kulonszamok/2005_cikkek/toth_andras.pdf
(Date of download: 19.03.2022.) With hand tools, 4 flying technicians can replace the engine in 45 minutes. (Sp. p.6.) These features ensure flexible operation in peacetime and wartime as well.

Debrecen, Sármellék), airfields returned by soviet troops (Kunmadaras, Kiskunlacháza, Csákvár for helicopters, Kalocsa), or motorways and highways built on the basis of foreign examples, suitable for aircraft take-off and landing. Nyíregyháza, Békéscsaba, Szeged, Pér and Tököl are available for smaller transport aircraft.



Figure 4. „Preparing the aircraft for a repeated mission in field conditions.”¹⁶

The material and labour requirements for preparation and equipment vary from airport to airport. Civilian airports in operation are generally in better condition than empty former Soviet airports. In case of emergency only materials and equipment necessary for operations need to be provided to these airports. In these facilities, it is possible to accommodate staff and ensure working conditions without any special preparation.

Making former Soviet and grass airports operational even in peacetime requires preparatory work. These include the planning, the survey tasks, the creation (organisation) of the operating "M" organisations, the securing of personnel and equipment and, very importantly, the periodic exercise. In addition, the legal framework should be created to allow some of the civilian peacetime investments to be made in the

¹⁶ Tóth András: „JAS 39 GRIPEN EBS HU1 TÖBBFELADATÚ VADÁSZREPÜLŐGÉP,” Repüléstudományi Közlemények Különszám 2005., p.3, Source: http://www.repulestudomany.hu/kulonszamok/2005_cikkek/toth_andras.pdf (Date of download: 19.03.2022.)

interests of national defence. In the context of airports, this could include the selection and assessment of sections of motorways suitable for aviation, the development of runway infrastructure, etc. To this end, defence expectations and requirements should be taken into account at the planning stage.

In our country, there is no tradition of building runways for aircraft take-offs and landings, despite the fact that there are about 15-20 road sections of sufficient size for the designing of the necessary landing and take-off areas. This is because the development and rapid construction of the country's road network began after the change of regime, and the aircraft then in service were able to use grass airports, and higher construction costs, including military aspects, were not provided for by the state in the defence budget.

The construction characteristics of emergency runway airports and their applicability are presented in the next chapter.

3. Motorway reserve (emergency) airport design, applicability

„A motorway emergency airfield is a section of motorway or public road which, because of its design and construction characteristics, can easily be converted from its everyday functions into military and civilian use, into an airport. During the Cold War period, East and West Germany, Switzerland, Austria, Czechoslovakia, Finland, Poland and Sweden built and used such road sections.”¹⁷ Such motorway sections are also found outside Europe, such as in South Korea in the Suwon area shown in „Figure 5.”

In principle, they should be built in peacetime; in wartime, they are built only rarely and when justified. The basic requirement for being able to receive civil and military aircraft, with the necessary dimensions and free territories to serve them, must be met.

¹⁷ Hennel Sándor: „Civil, katonai és rendvédelmi célra fejlesztett légijárművek és berendezéseik vizsgálata,” Doktori (PhD) Értekezés, NEMZETI KÖZSZOLGÁLATI EGYETEMKATONAI MŰSZAKI DOKTORI ISKOLA, Budapest 2017, p.30. Source: <https://docplayer.hu/108436202-Phd-ertekezes-hennel-sandor-ornagy.html> (Date of download: 14.03.2022.)



Figure 5. „Emergency landing site Suwon, South Korea”¹⁸

When designing them, several factors need to be taken into account, which are the following:

- There has to be 2.5-3.5 km of straight road.
- There must be no power lines or other overhead wires, no natural or artificial obstacles, and no overpasses in the direction of descent within 4.0 km and 1.0 km of the selected road section.
- Another important factor is the availability of bypasses and parking spaces, and the width of the road section to be built should be at least 25 m.¹⁹
- To ensure the safe operation of aircraft, the runway load capacity must meet the requirements for the type of aircraft.
- Provide concrete aircraft stands which civilian traffic can use as rest areas when not in military use.

¹⁸ Sp. p.70.

¹⁹ Hennel Sándor: „Civil, katonai és rendvédelmi célra fejlesztett légijárművek és berendezéseik vizsgálata,” Doktori (PhD) Értekezés, NEMZETI KÖSZOLGÁLATI EGYETEMKATONAI MŰSZAKI DOKTORI ISKOLA, Budapest 2017, pp. 25-33. Source: <https://docplayer.hu/108436202-Phd-ertekezes-hennel-sandor-or-nagy.html> (Date of download: 14.03.2022.)

- Roadside barriers, as shown in „Figure 6”, should be easily removable, allowing sections of the road to be quickly activated.
- Its design should allow for the placement of mobile or fixed equipment and vehicles required for operations and the logistical servicing of aircraft. (Installation of electrical network, telecommunications infrastructure, mobile air traffic control centre, NDB radio navigation equipment, installation of lighting equipment, fuel trucks and tanks, motor vehicles, etc.)²⁰



Figure 6. „Specially designed, quick-release tape barrier.”²¹

On the basis of the above, it can be concluded that, with appropriate architectural design, some sections of motorways can be made suitable for receiving civil and military aircraft, prepared for repeated use. This solution increases the protection of the air force's aircraft and technical equipment in wartime by dispersing aircraft, thereby preserving its operational and combat capability.

3.1. Advantages and disadvantages of motorway airports

Integrating the development of motorway airports into a motorway network is a major task and can only be achieved in a peacetime framework. Their placement should be taken into account in the planning and route planning process prior to deployment. There are several advantages and disadvantages for building such a section, which are the following:

²⁰ Hennel Sándor: „Civil, katonai és rendvédelmi célra fejlesztett légi járművek és berendezéseik vizsgálata,” Doktori (PhD) Értekezés, NEMZETI KÖZSZOLGÁLATI EGYETEMKATONAI MŰSZAKI DOKTORI ISKOLA, Budapest 2017, pp. 70-71. Source: <https://docplayer.hu/108436202-Phd-ertekezes-hennel-sandor-or-nagy.html> (Date of download: 14.03.2022.)

²¹ Sp. p.71.

Advantages of motorway airports:

- Area suitable for road traffic in peacetime.
- Due to the availability of the electricity network, the power supply for the landing equipment can be easily ensured.
- Car parking areas, parking rest and toilets can be provided at aircraft stands for use by operating staff and road users.
- Can be up and running in a few hours with using mobile devices.
- Their construction coincides with the construction of the motorway section, so until the date of deployment, the differences are not noticeable, their protection against early detection is partially ensured.²²

Disadvantages of motorway airports:

- If it is put into use, traffic diversion must be carried out, so it can only be developed in a place where there are drop-off and pick-up possibilities.
- The load-bearing capacity requires a layer of asphalt at least 30-40 cm thick, compared to 20 cm thick sections of a motorway, so it costs more to build.
- It can be built on the section of the motorway track where the runway orientation coincides with the prevailing wind direction in the area, thus there is a need to extend the track by 5-10 kilometers. This also means extra costs.
- Care should be taken for the installation of forest strips to ensure the concealment of aircraft and servicing equipment, at least during the refuelling and rearming of aircraft.

3.2 Equipment and infrastructure for the operation of aircraft at emergency runways

The same equipment used at base airfields is essential for the safe operation of aircraft, but it must be replaced by mobile equipment. These are shown in „Table 1.”

²² Hennel Sándor: „LÉGI JÁRMŰVEK REPÜLŐTÉREN KÍVÜLI SZÜKSÉGLESZÁLLÓHELYEINEK HARCÁSZATI KORLÁTAI, ALKALMAZHATÓSÁGA, KIALAKULÁSÁNAK KÖRÜLMÉNYEI,” *Repüléstudományi Közlemények, Különszám 2010.*
Source:

http://www.repulestudomany.hu/kulonszamok/2010_cikkek/Hennel_Sandor.pdf
(Date of download: 17.03.2022.)

EMERGENCY AIRPORTS AND FLIGHT SAFETY EQUIPMENT

Table number 1.

Designation	Applicability
Erectable aircraft shelter and tents	Storage, hiding doing minor technical jobs. Protecting aircraft from weather conditions. ²³
Mobile generator sets	Powering landing systems, radars, lighting equipment, radio communication equipment and other equipment.
Mobile landing radars, equipment	Emitting the correct glideslope and glideslope angle signals, ensuring communication between landing controllers and flight crews. For instance: Az RSzP-7(-7T) ²⁴ , RSP-10ML ^{25 26}
Mobile NDB/ADF mid-range direction emitter	All-round radio signal emission in all directions in the KHz frequency range. It always transmits the same signal, which is nothing more than the letter code of the marker and Morse code. ²⁷
Tanker truck	Provides re-fuelling of aircraft. It can be used in both field and airport conditions. ²⁸

²³ Szabó Sándor: „A LÉGIERŐ TEVÉKENYSÉGÉNEK MŰSZAKI TÁMOGATÁSA,” *Repüléstudományi Közlemények*, 2009. Különszám
Source: http://www.repulestudomany.hu/kulonszamok/2009_cikkek/Szabo_Sandor.pdf (Date of download: 21. 03.2022.)

²⁴ „The RSzP-7 (T) Landing system was built with a radio-locator station set, a ZIL-157K tgc with a cabin body (ZIL-131), a 2PN-2 twin-axle tarpaulin and a 1-AP-1,5 single-axle trailer carrier.” (Csépké Béla: „RSzP-7(-7T) leszállító rádiolokátor állomás,” p.1. Source: https://docplayer.hu/18115974-Rszp-7-7t-leszallito-radiolokator-allomas.html#download_tab_content (Date of download: 19.03.2022.) In this one kit 5 functions have been integrated, namely landing radar, airport surveillance radar, short-range radar, and 2 sets of URH flight AM radio transceivers and radio direction finders. (Sp.) The RSp-10ML is an improved version.

²⁵ Csépké Béla: „RSzP-7(-7T) leszállító rádiolokátor állomás,” Source: https://docplayer.hu/18115974-Rszp-7-7t-leszallito-radiolokator-allomas.html#download_tab_content (Date of download: 19.03.2022.)

²⁶ litaktak.com: „RSP-10ML,” Source: <https://www.litaktak.com/product/radar-systems/RSP-10ML/>. (Date of download: 19.03.2022.)

²⁷ Tóth Gábor: „Automatikus Fedélzeti Irányító,” Source: http://www.kjit.bme.hu/images/Tantargyak/Valaszthato_targyak/Legi_kozlekedes/TG_EA.pdf. (Date of download: 27.03.2022.)

²⁸ docplayer.hu: „Műszaki Specifikáció H25.206DAE-002 tip. Háromtengelyes katonai terepjáró üzemanyagszállító és töltő bázisjármű ADR-FL osztályú kivitelben,” Source: <https://docplayer.hu/4115056-M-o-s-z-a-k-i-s-p-e-c-i-f-i-k-a-c-i-o.html>. (Date of download: 27.03.2022.)

Towing vehicles, cranes	Lifting the aircraft after a missed landing, performing rescue operations. ²⁹
Fire-fighting vehicle	Used to extinguish fires in aircraft and other fires, and to cool the fuselage of an aircraft. It is equipped with built-in water and foam tanks, normal and high-pressure water pumps, foam mixer, roof and nose nozzle and compressed air foam extinguishing system. ³⁰
Airport maintenance and cleaning vehicles	Carrying out winter and summer maintenance work on airport runways and aprons. ³¹
Ambulance car	A vehicle suitable for transporting injured flight crew members to hospital, for which the Hungarian Defence Forces use Mercedes Sprinter 316CDI military ambulances. ³²
Mobile or fix installed lighting equipment	For night operations, lighting and marking of runways. ³³

²⁹ Borsos Dávid: „MI-24 / Helikopter Daruzása – Budaörs,” Source: <http://daruzas.hu/wordpress/?p=3687>. (Date of download: 27.03.2022.)

³⁰ Török Nikolett: „A kecskeméti repülőtéri tűzoltók is felkészültek a hétvégi rendezvényre,” Source: <https://honvedelem.hu/hirek/hazai-hirek/a-kecskemeti-repuloteri-tuzoltok-is-felkeszultek-a-hetvegi-rendezvenyre.html>. (Date of download: 27.03.2022.)

³¹ Szabó Sándor: „Az unimog típusú bázisjárművekre szerelhető repülőtér-karbantartó műszaki technikai eszközök,” *Repüléstudományi Közlemények* 2011. Source: http://epa.oszk.hu/02600/02694/00055/pdf/EPA02694_rtk_2011_2_Szabo_Sandor.pdf (Date of download: 27.03.2022.)

³² Trautmann Balázs: „Fotók - Új mentőautók a Magyar Honvédségnél,” Source: <https://www.haborumuveszete.hu/egyeb-hirek/fotok-uj-mentoautok-a-magyar-honvedsegnel>. (Date of download: 07.05.2022.)

³³ Vas Tímea, Fekete Csaba Zoltán, Gajdos Máté: „Telepíthető repülőtér navigációs és fénytechnikai berendezései,” *Repüléstudományi Közlemények*. XXVII. évfolyam 2015 2. szám, pp. 169 – 181., Source: http://www.repulestudomany.hu/folyoirat/2015_2/2015-2-14-0219-Vas_T-Fekete-Cs-Gajdos_M.pdf (Date of download: 07.05.2022.)

The tasks carried out at emergency airports also include:

- Aircraft repairing, storing, camouflaging, and protecting aircraft from bad weather conditions, and arming.
- Providing power for communications and other equipment.
- Providing the supply of fuel for aircraft.
- Personal and technical rescue.
- Airport maintenance, ensuring safe take-off and landing, taxiing, engine start-up and shutdown.



Figure 7. Power generating sets designed for military use³⁴, RSP-7(-7T) delivery radio locator station in the middle,³⁵ Rába fuel transport vehicle and filling wagon on the right.³⁶

The tools mentioned above are essential for safe operations in peacetime, but only some of them are indispensable in wartime. In war, the options are limited, but the generating sets, landing systems and refuelling vehicles shown in „Figure 7” are indispensable. From the above, it can be concluded that the construction of motorway airports is costly, and has several known advantages and disadvantages, but is important for the defence of the country. It can also be concluded that the safe operation of aircraft requires the same equipment as base airfields, but in wartime conditions some of it may be dispensable.

³⁴ akkumega.hu: „ÁRAMFEJLESZTŐ – GENERÁTOR,” Source: <https://www.akkumega.hu/generator-aramfejleszto-diesel-benzines-vontathato-trailer/>. (Date of download: 21.03.2022.)

³⁵ Csépké Béla: „RSzP-7(-7T) szállító rádiólokátor állomás,” p.1., Source: https://docplayer.hu/18115974-Rszp-7-7t-leszallito-radiolokator-allomas.html#download_tab_content (Date of download: 19.03.2022.)

³⁶ docplayer.hu: „Műszaki Specifikáció H25.206DAE-002 tip. Háromtengelyes katonai terepjáró üzemanyagszállító és töltő bázisjármű ADR-FL osztályú kivitelben,” Source: <https://docplayer.hu/4115056-M-o-s-z-a-k-i-s-p-e-c-i-f-i-k-a-c-i-o.html>. (Date of download: 27.03.2022.)

Conclusions

As described above, it can be shown that reserve, or emergency airfields have a role in modern warfare. The Six Days War highlighted the fact that if the runways at the airport are destroyed, the aircraft cannot do their job, even if they are not damaged. Furthermore, if the aircraft are not dispersed, they are more likely to be destroyed in the event of an attack, thus reducing the operational and combat capability of the airbase.

Most of our country's airports are not suitable for reserve airport functions or can only be made so with major modifications. The grass airfields used during the Cold War are no longer usable today because fourth generation aircraft types require solid pavement flying bases.

Civilian airbases already in operation, as well as airfields returned by soviet troops with adequate runways and landing strips, can be designated as reserve airfields, but there is a significant cost to make them operational, for which financial resources are not available for the Ministry of Defence.

It could also include sections of domestic motorways, which may be suitable for reserve landing site (runway) and have adequate load capacity and dimensions. Although older legislation deals with deployment requirements, such as HM Instruction 021/1975 (HK No. 6), in practice these have not been implemented. If new legislation or instructions have been issued on the subject, the content of such legislation or instructions cannot be disclosed due to its classification.

There are several motorway emergency airports in Europe, mainly in Germany, Switzerland, the Czech Republic and Poland. These include those for military use, which are also used periodically for training purposes. Some are secret, but some are public and available on the internet. From looking at the coordinates found, it is difficult to discern the military function of these sites, but a specialist's eye can see that these also were built for a secondary function.

The safe take-off and landing of aircraft requires almost all the tools and equipment that are essential for airports. The difference is the mobility of the devices, which makes the dispersal possible.

On the basis of the above, it can be said that reserve airfields are still necessary in modern warfare, but their deployment must always be in line with the operational characteristics of the aircraft type.

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