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MASTERARBEIT

MILITARIZED LANDSCAPE AT THE BORDER BETWEEN BOSNIA AND HERZEGOVINA- CROATIA

FORMER MILITARY AIRBASE BIHAĆ

ausgeführt zum Zwecke der Erlangung des akademischen Grades
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unter der Leitung

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To my mother.

ZUSAMMENFASSUNG

Die Arbeit über die militärische Landschaft an der Grenze Bosnien und Herzegowina - Kroatien, der ehemalige Militärflugplatz Bihać, ist mit einem Forschungszweck geschrieben. Der soll helfen zu verstehen, wie militärische Einrichtungen in der menschlichen Umwelt funktionieren. Es ist eine Arbeit, wo die Idee der militärische Umweltschutz zum Anschein gebracht wird, wo beim Bau, Betrieb und Abrissen von dieser Art von Anlagen der Status von der natürlichen Umgebung sowie menschlichen und nicht- menschlichen Bewohner der militarisierten Landschaften betrachtet werden sollte, weil militärische Aktivitäten oft nicht ökologisch unbedenklich sind.

Der Mensch sollte, egal zu welchem Zweck es dient, für ihr Handeln in der Natur verantwortlich sein. Das Bauen oder das Abreißen von Gebäuden, insbesondere die für militärische Zwecke dienen, sollte keine Lebewesen gefährden.

Die Militäranlage ist durch Kriegsumständen verlassen und zerstört worden. Durch die Analyse an diesem Ort hat man erfahren, dass die Boden-und Grundwasserströme besonders mit PCB (polychlorierte Biphenyle) verseucht sind. In der Nähe gibt es die Stadt Bihać, den Fluss Una (Bosnien und Herzegowina), die Plitvicer Seen, das berühmte Ferienort (Kroatien , EU). Ein Teil der Fluganlage befindet sich unter dem Berg Plješevica, was für eine enorme Vielfalt von Flora und Fauna bekannt ist, wobei einige von ihnen endemische Arten sind.

Diese Arbeit ist in drei Teile unterteilt. Der erste Teil konzentriert sich auf die historische Entwicklung und die Zerstörung des unterirdischen Luftwaffenstützpunkts Bihać, der Kaserne im Željava Dorf und der Radarstation auf dem Gipfel „Gola“ des Plješevica Berges und ihre kurze Analyse nach den Interviews und den verfügbaren Materialien. Im zweiten Teil gibt es einen Bericht über die ökologischen Schäden und das Potenzial der Lage als auch der Vergleich mit einem ähnlich bekannten Objekt in Schweden, welches in einem Museum umgewandelt wurde. Der dritte Teil konzentriert sich auf den Vorschlag für eine mögliche Verwendung und Verbesserung von diesem Bereich durch einem Konzept der weiteren Entwicklung.

Seit Jahren ist dieser Ort ein Ort für die illegale Überquerung der Grenze, eine Minenzone und eine Quelle der Verschmutzung der natürlichen Umwelt, der Wasserströme und des Bodens. Es ist ein Ort der Phantasie, weil es versteckt und kaum zugänglich ist.

ABSTRACT

Militarized landscape at a border Bosnia and Herzegovina- Croatia, former military airbase Bihać is a work written with a research purpose. It is intended to help understand the way military facilities in human environment functions. It is a work where the idea of military environmentalism is brought to attention, where natural environment should be considered during construction, use and demolition of this type of facilities as well as the status of human and non-human occupants of militarized landscapes because military activities are often not ecologically harmless.

Human being should be responsible for its actions in nature, no matter what purpose they have. Building or destroying objects, particularly those for military purpose, should be considered in such way not to endanger any living being.

At the border between Bosnia and Herzegovina- Croatia one military facility is due to war circumstances abandoned and destroyed. According to analysis done in this location the ground and underground water flows are polluted in particularly with PCB (polychlorinated biphenyl). In near closeness there are city of Bihać and river Una (Bosnia and Herzegovina) and Plitvice lakes, famous tourist resort (Croatia, EU). Underground part of the Airbase is located in a base of mountain Plješevica, which is known for an enormous variety of fauna and flora, and some of them are endemic species.

This work is divided into three parts. First part focuses on historical development and destruction of the underground Airbase Bihać, military barracks and radar station on the top of Plješevica mountain „Gola” and their brief analysis according to interviews and available materials. In second part there is a report about ecological damage and potentials of this location as well as the comparison with one similar known object in Sweden which was transformed into museum. Third part focuses on proposal for possible use and improvement of this area through a concept of a further development.

For years now, this location is a place for human trafficking, a mine zone and a source of pollution to natural environment, water streams and ground. It is a place that stirs imagination because it is hidden and hardly accessible.

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Each of them have actively participated in my work, giving me strong suggestions and helping me a lot to understand and learn as much as possible about this type of facilities. They have devoted their free time, expressing their will to answer all of my questions regarding to this type of structures.

I owe a special thanks to people from LIBY forum and My city military forum because they have allowed me to use their photographs and materials collected through years.

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I would like to thank to my mother Nada Rokvić for her patience and support through my studies and through life.

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SERBO-CROAT-BOSNIAN ALPHABET PRONUNCIATION IN ENGLISH AND DEUTSCH

English	Deutsch
A /a/, a as in car	Wie das a im Deutschen (Apfel, alt)
B /b/, b as in bat	Wie das b im Deutschen (Bein, beten)
C /ts/, c as in cats	wie z im Deutschen (Zentrum, zahlen)
Č /tʃ/, č as in chalk	als stimmloser, zischender tsch-Laut (klatschen, tschilpen)
Ć /tɕ/, ć as in church	Als stimmhafter, leiserer tsch-Laut (tschüss)
D /d/, d as in dig	Wie das d im Deutschen (Dach, denken)
Dž /dʒ/, dž as in gin	Als stimmhafter dsch-Laut; wird „hart“ ausgesprochen (Dschungel)
Đ /dʒ/, đ as in jack	Als stimmloser dsch-Laut; wird „weich“ ausgesprochen (ital.: giorno (dt. Tag))
E /ɛ/, e as in let	immer als offenes e (Kerbe, messen)
F /f/, f as in fit	Wie im Deutschen auch (Fenster, fehlen)
G /g/, g as in game	Wie das g im Deutschen (Gönner, genießen)
H /x/, h as in heaven	Mehr wie ein ch-Laut im Deutschen (Bach, krachen)
I /i/, i as in east	Als offenes i (April, bis)
J /j/, j as in year	wie das j im Deutschen (Juni, Jacke)
K /k/, k as in cut	wie k im Deutschen (Kino, kalt)
L /l/, l as in love	Wie l im Deutschen (Land, blau)
Lj /ʎ/, lj as in million	wie der lj-Laut in französischen oder spanischen Wörtern (brillant)
M /m/, m as in mice	wie m im Deutschen (Monat, mischen)
N /n/, n as in nice	wie n im Deutschen (Nacht, niesen)
Nj /ɲ/, nj as in onion	Wie der ñ-Laut im Spanischen (span.: niño (dt. Kind), ital.: signore (dt. Herr))
O /ɔ/, o as in autmn	Immer als offenes o (Post, boxen)
P /p/, p as in pick	wie das p im Deutschen (Panne, pendeln)
R /r/, r as in Fritz	Rollendes r (rot, Haar)
S /s/, s as in sound	Immer als stimmloses s (Hals, aus)
Š /ʃ/, š as in shut	Immer als sch (Schule, scheinen)
T /t/, t as in time	Wie t im Deutschen (Ast, teilen)
U /u/, u as in shoot	Als offenes u (Buch, bewusst)
V /v/, v as in verb	Wie das w im Deutschen (Wort, winken)
Z /z/, z as in zest	Als stimmhaftes s (Saal, sein)
Ž /ʒ/, ž as in pleasure	Wie das j im Französischen (Garage franz.: Jaques (dt. Jakob))

PREFACE

Military architecture is a different form of architecture in comparison to representational one, though there is also military representational architecture. In this work I focus primary on not representational one, which is pure form of architecture, without anything additional being added. Clear intentions in building and devotion to make it functional and by far the most protected, is what fascinates and steers imagination.

Most of these objects are developed to protect, and not to attack.

For building of such facilities newest and best construction materials and solutions are being used, allowing them to be the last word of technique for its time. And when they are ruined, there is so much to be said about their existence, construction and function.

In search for a theme which could motivate me, I have found out about Airbase Bihać. It was not easy to determine the precise course of my work because the topic seemed full of potential in one moment, while in the other it seemed not to have potential at all. There were so much highs and lows while writing this work. That was also one more thing for me very interesting to explore. Does everything ruined ought to be left for nature to take care of it, or in spite of all bad predictions should be repaired and brought to life?

The process of collecting literature was long and exhausting, because there were so much different sources due to be compared and analysed, and yet not much directly related literature which I could use in analysing this type of objects. Without help of the people i have talked to, it would be very hard to write this work, and for their help I am extremely grateful.

Purpose of this work is to show that human should be aware of his negative influence Caused by often unpredictable behaviour and to be aware of negative influence of wars, which directly influence architecture, but primarily, to learn to be responsible for his actions in nature.

I would say that my work was partially a search for this answer. Other concern, very important to me was natural environment in which this airport was situated in. As a human I feel that I am responsible for my actions in nature. As an architect I feel this responsibility even more.

INTRODUCTION

This work deals with military architecture and its relationship with natural environment. Airbase Bihać is situated at the border between Bosnia and Herzegovina and Croatia, and was a Yugoslav army airbase.

The work itself is divided into four parts. First part focuses on historical development, and answers to the questions why and when the airbase was built, which were the reasons for its creation. In this part the construction and destruction of object are described.

In second part there are thorough analysis done according to available literature, interviews and photographs. Some of these analysis were done using different sources, but it was important to show all possible and available solutions because precise measurements and analysis of existing facilities were not publicly represented, so there is no reliable material which accurately represents the whole facility.

Third part is devoted to potentials of location, by analysing and presenting the importance of Plitvice lakes, as a unique world resort, historical importance of city of Bihać, river Una and magnificent mountain Plješevica. In this part natural environment and its importance in particular is emphasized. In this part, it is explained why this natural variety was developed and which natural factors caused this particular and in world unique formation. Various species, most of them protected, are listed in order to bring more attention to this site and its importance in world ecosystem.

Part of the work is devoted to the damage which was made by destroying underground facility, as well as ground and water flows analysis. Also, there are informations about minefield areas in Bosnia and Herzegovina and necessity to sweep them. There is also a comparison with one similar object done in Sweden, which was turned into a museum.

Fourth part is about proposal for possible solution, guidelines for development of this area where in particular potentials of military barracks are highlighted.

In appendix there are reference files and maps used in making analysis, which are important in order to compare and perhaps understand more about function of facility itself. There is a list of known species on mountain Plješevica which seems important in observing the natural environment as well as original interview, in Serbian as well as translated into English, done by Prof. Radmila Tonković with late constructor Dragoslav Sobotka.



WIDER ENVIRONMENT MAP

[Http://en.wikipedia.org/wiki/Plitvice_Lakes_National_Park](http://en.wikipedia.org/wiki/Plitvice_Lakes_National_Park)

● PLITVICE LAKES

- 1. Prošćansko jezero
- 2. Ciginovac
- 3. Okrugljak
- 4. Batinovac
- 5. Veliko jezero
- 6. Malo jezero
- 7. Vir
- 8. Galovac
- 9. Milinovo jezero
- 10. Gradinsko jezero
- 11. Buk
- 12. Kozjak
- 13. Milanovac
- 14. Gavanovac
- 15. Kaluđerovac
- 16. Novakovića brod

● FORMER MILITARY AIRBASE BIHAĆ

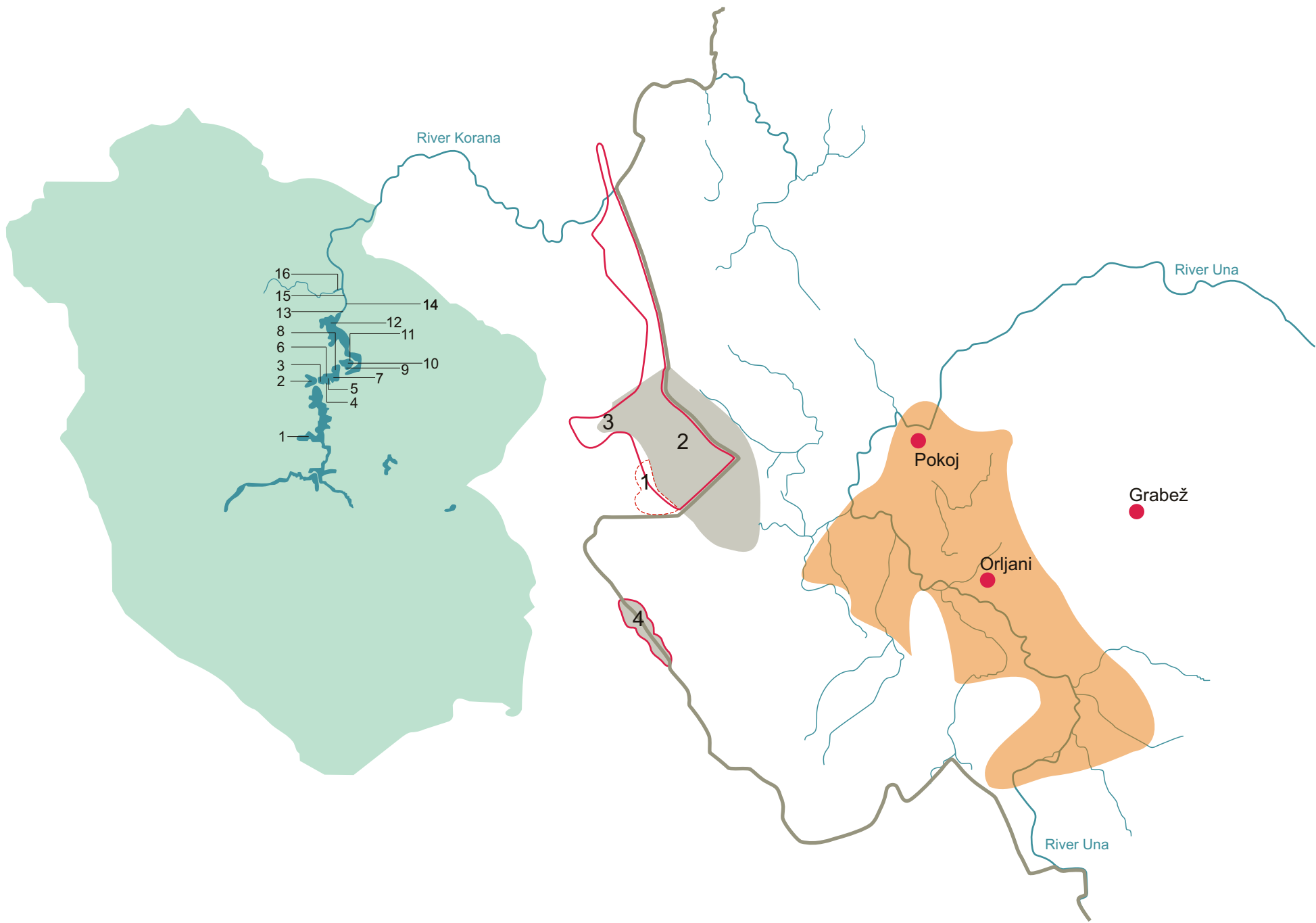
- 1. Underground airbase „Object Klek”
- 2. Runways
- 3. Military barracks
- 4. Mountain top „Gola” Plješevica, radar station

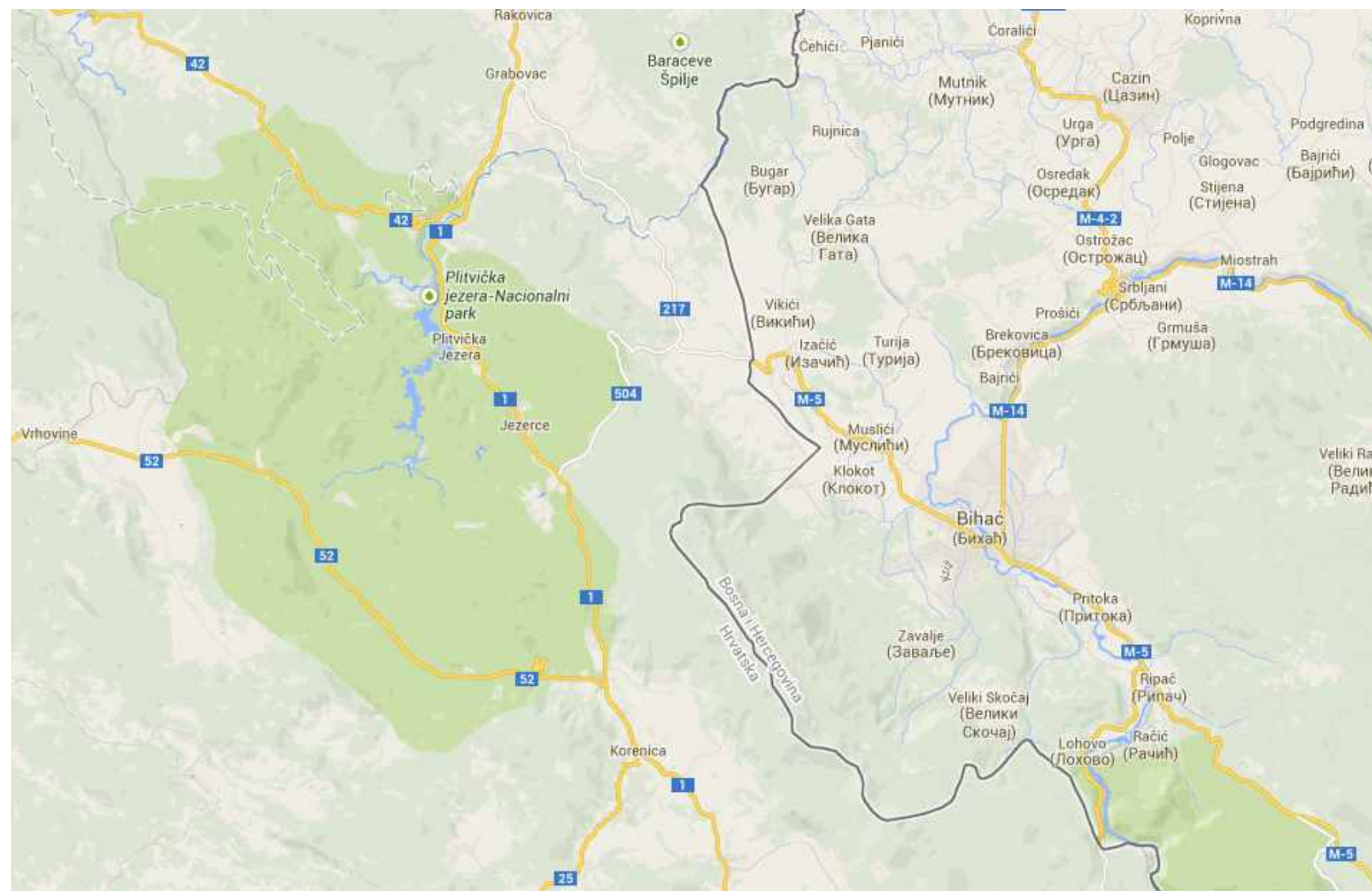
— Minefields area mostly from Croatian side of the border

● MUNICIPALITY BIHAĆ

● Other places relevant for Airbase Bihać

— Borderline between Bosnia and Herzegovina and Croatia







IMMEDIATE ENVIRONMENT MAP

LIČKO PETROVO VILLAGE

IZAČIĆ- BORDER CROSSING
(IZAČIĆ VILLAGE)

NOVO SELO KORENIČKO - VILLAGE

FORMER ŽELJAVA MILITARY BARRACKS
(FORMER ŽELJAVA VILLAGE)

RUNWAYS

FORMER UNDERGROUND AIRBASE- OBJEKT KLEK

MAIN ROAD PLITVICE LAKES T.KORENICA

BALJEVAC VILLAGE

BIHAĆ

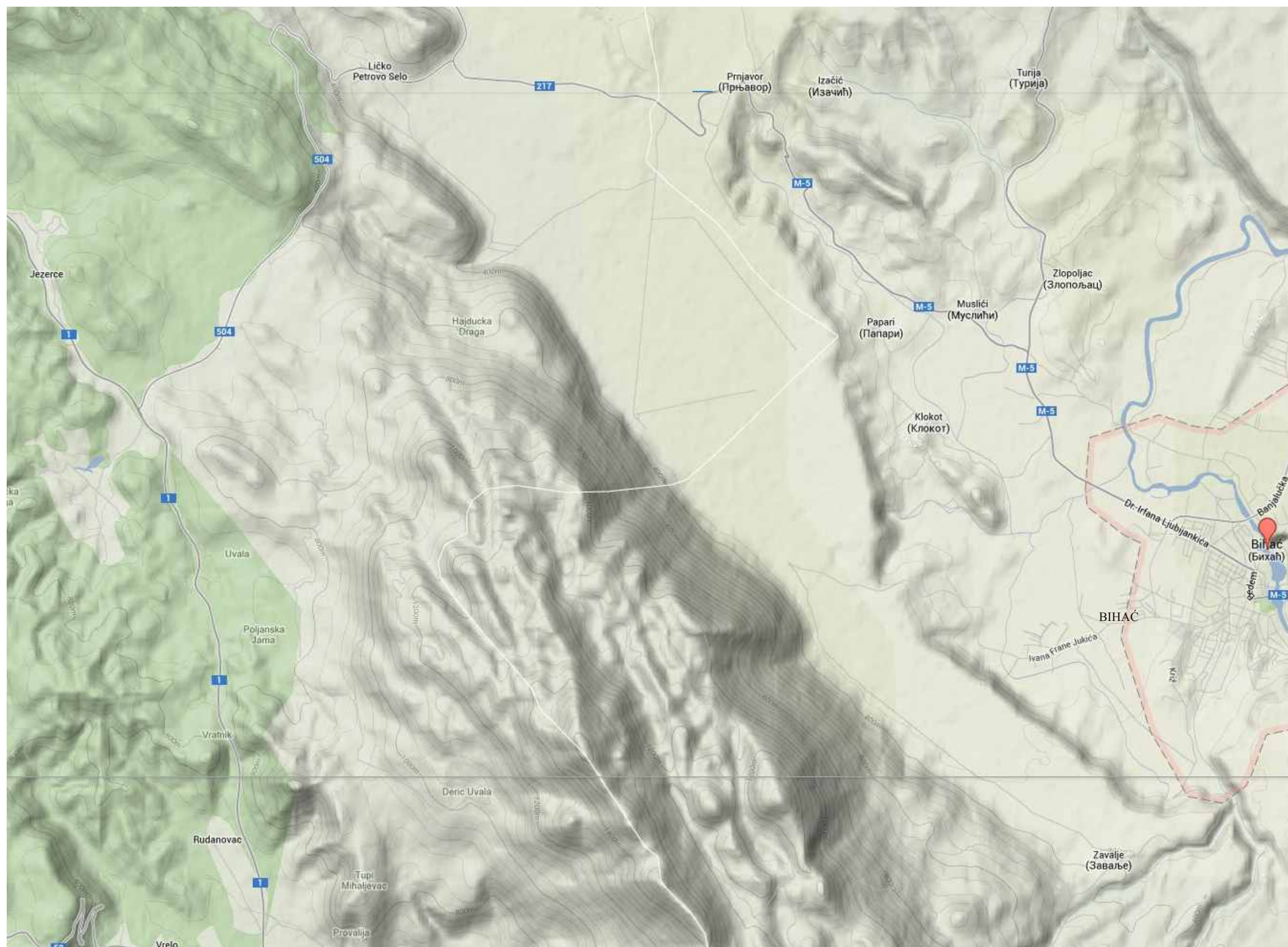
FORMER RADAR STATION- MOUNTAIN TOP „GOLA”

ZAVALJE VILLAGE

— Borderline between Bosnia and Herzegovina and Croatia

— Roads

- - - Helicopter connections from the top of the mountain



1. HISTORICAL DEVELOPMENT

First airports for military purpose were built in small sizes. Mostly grassy area and meadows were used for this purpose. Number of those airports grew along with the development of aviation and increasing number of aircraft. Aircraft became more powerful, faster, bigger, more stable, more numerous and tasks were increasingly diverse. Therefore it was needed to create surfaces which will satisfy the newly need of aircraft. The construction and organisation of one military airport became more complex. Operational- tactical and construction- technical requirements must be satisfied. In construction- technical sense terrain ought to be suitable for the organization of the runways, which are the basic and most important element of the airport, suitable for take off and landing aircraft of appropriate species in all directions during day, at night and in all seasons.

The idea for a construction of an airport of the tactical-technical performance was created in 1948 at the time of resolution of the Cominform Yugoslavia (1) in response to the threat of force that came from the headquarters of "Warsaw Pact", USSR, with the search for an ideal micro-location in order to position underground airport complex and runways.

Plateau at the base of the mountain Plješevica, situated west of the city of Bihać, was ideal for This purpose.

With runways on Plješevica plateau, deep inside mountain Plješevica was build up a „city” which was protected from atomic impact. For years, mountain Plješevica was Hiding at that time this top secret of Yugoslavian People’s Army and Socialist Federal Republic of Yugoslavia. (2)

Airbase encompasses an area of ca. 7.5x3.5 kilometres with GPS coordinates 44°50'12.20"S 15°45'28.76"I (measured ca. in the middle of the triangle in front of the underground part).

Construction of entire facility ended in year 1978 but, because of Soviet invasion on Czechoslovakia, airbase was in use since 1968 before all facilities were finished. At that time it was the largest underground airport and military airbase in former Yugoslavia and one of the largest in Europe.

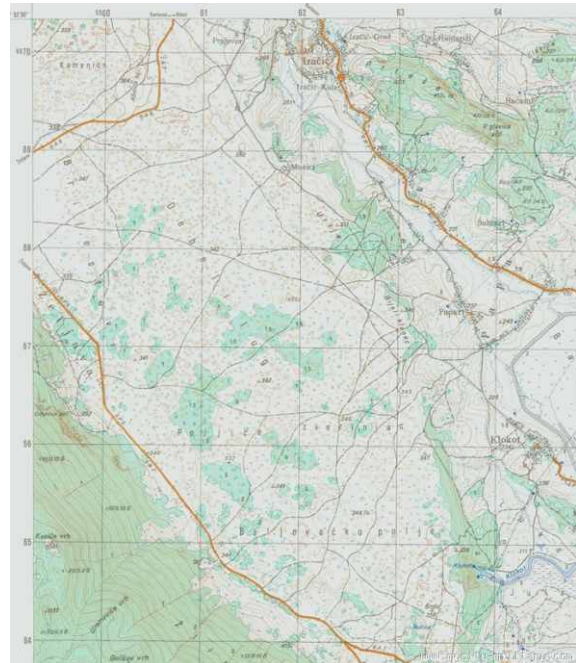


Image 1. In this map, there could be seen how ideal was Plješevica plateau for building of runways, but not only that, the mountain itself had an ideal stone composition which allowed easy mining and building of tunnels.

(1) Founded in 1947, "Cominform" (Communist Information Bureau) is the common name for what was officially referred to as the Information Bureau of the Communist and Workers' Parties. It was the first official forum of the international communist movement since the dissolution of the Comintern, and confirmed the new realities after World War II, including the creation of an Eastern Block.

[Http://en.wikipedia.org/wiki/Cominform](http://en.wikipedia.org/wiki/Cominform)

(2) [Http://www.zeljjava.com/eng/index.html](http://www.zeljjava.com/eng/index.html)

Disposition of Yugoslav Air, Air Defense and Naval Forces

Figure 2



Image 2. This map shows the disposition of Yugoslav Air, Air Defence and Naval Forces by the CIA. The division line (stronger dashed black line) represents reach of surveillance systems, Bihać and Priština.

In former Yugoslavia there were two military airbases for defence, one in Bihać and the other one in Priština, Kosovo, so the whole country could be covered under surveillance system. For air defence purposes, Yugoslavia was divided into two zones which control and direct the activity of all of the air defence resources in their geographic area.



Image 3. Underground military airbase Bihać, Bosnia and Herzegovina- Croatia
MiG-21F13 exiting through custom door



Image 4. Underground Military airbase Slatina, Priština, Kosovo

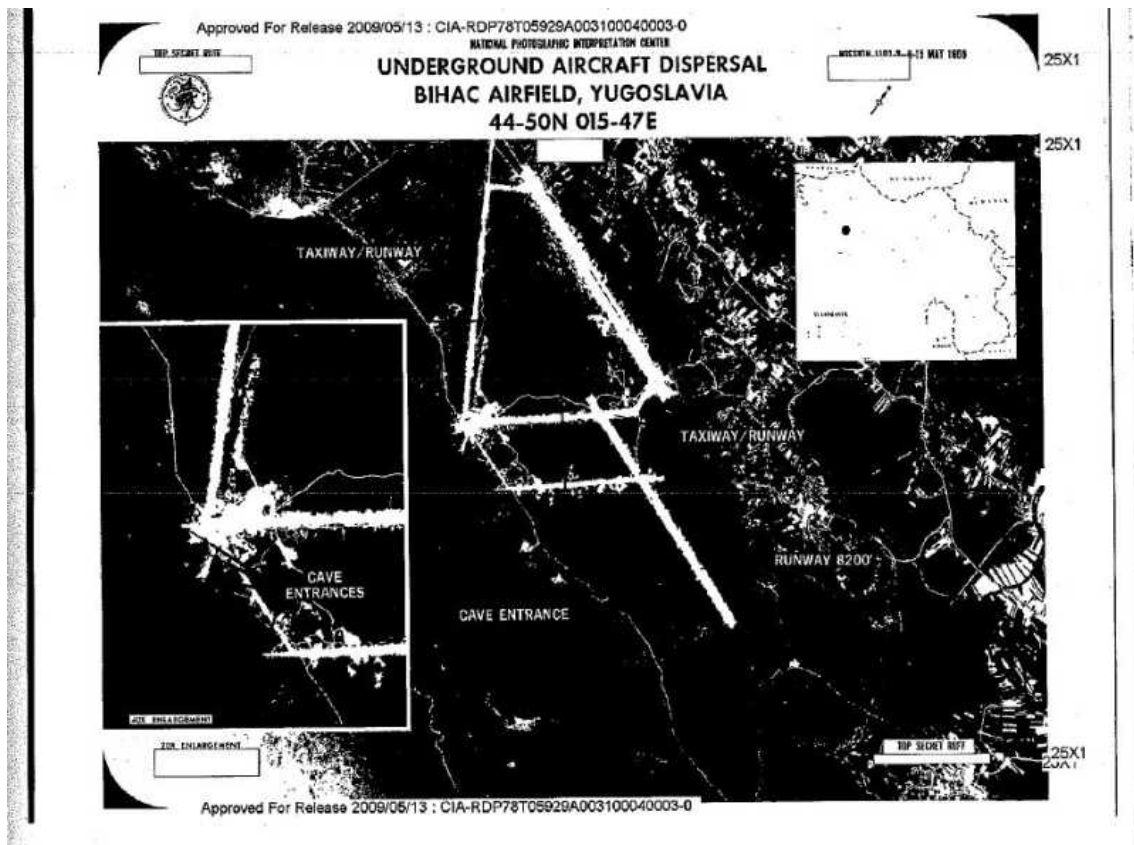


Image 5. A photo of Željavo, made by the CIA in 1968. (3)

First identification on KH photography of underground aircraft dispersal in Yugoslavia. The airfield has been observed and photographed on several occasions by western military attaches

In documents of The Central Intelligence Agency (CIA) which were approved for release on 13. May 2009, it can be seen that this facility was a top secret of Yugoslavian Army. (A3)

The idea was to build an airport that has the strategic depth of the territory (the central part of SFR Yugoslavia), with a large accommodation facilities (60-80 aircraft), with a construction designed and built to sustain a direct hit from a 20-kiloton nuclear bomb and to be autonomous for a long time in terms of nuclear war.

Autonomy means longer safe stay for people and combat techniques, regardless of the war situation. It was considered that only such an airport could respond adequate to the possible aggressor through some kind of retaliation, because in the hypothetical nuclear war people and techniques would be saved. Forced opening of the Object 505 and operational activities were started in 1968, during the Czech crisis although construction was not quite finished (auxiliary facilities were not yet constructed). The official address of the airbase was VP-4868 Bihać. Number 48 represented a year which meant the birth of an idea for airbase construction and number 68 the year in which the airbase was forced to be put in operation. Object 505 was the 200th airbase and it represented the host airbase or the most important Airbase in SFR Yugoslavia. (4)

(3) Approved for release 2009/05/13 CIA-RDP78T05929A003100040003-0, TOP SECRET RUFF, (C) National photographic interpretation center

(4) Novaković, Rajko



Image 6. Aircraft maintenance inside aircraft tunnel, in 1970s.

The whole complex was built purely by domestic firms, domestic materials and domestic equipment of Socialist Federal Republic of Yugoslavia. The largest parts of object construction were done by construction firm "Planum" from Belgrade, at that time the capital of Serbia and SFR Yugoslavia. All of the equipment were specially produced by firms "Rade Končar" Zagreb, "Iskra" Kranj, "Energoinvest" Sarajevo, "Litostroj" Ljubljana, "Rudi Čajavec" Banjaluka, "Famos" Sarajevo, "Đuro Đaković" Slavonski Brod, "Prva petoletka" Trstenik, "Soko" Mostar, etc.

Construction costs were estimated between 4 and 8 billion dollars, though other sources says that the costs were between 150 and 175 million dollars. However, at that time it was one of the most expensive military constructions in Europe.

The airport was built until 1968. when it was officially opened and put into operation. Only the lack of funding delay time for completion of this grand project. After 24 years of existence and work this giant of the airport was blown into the air with 56 tons of explosive in the maximum short period of just a few minutes. (5)

During construction underground facility was code-named „Object 505" and after construction renamed into „Object Klek". According to International Civil Aviation Organization (ICAO), pre 1995 it was named LYBI, current LQBI.

1.1 CONSTRUCTION OF THE AIRBASE BIHAĆ

In order to built this type of military airbase with underground facilities and runways it was necessary to find a suitable ground for it. The surface for runways ought to be flat and a mountain should provide the space for underground facilities with firm and stable rock. Underground hangars buildings are located near the airport, in the mountain range where a layer of rock or other material above the hangars protects the planes from the effects of direct hits and toughest tools, as well as from effects of all forms of radiation.

The thickness of the protective layer is determined by its quality, the type of offensive weapons and the range of the hangar and the lowest range is 50m. In floor plan hangar is in the form of a wider corridor, where planes stand in a row one behind another. Default width is 14-16m, while length of hangar depends on the size and numbers of planes that are placed inside. Common height is 5-6m.

Hangar location depends on current opportunities. It should be built in such way so that the aircraft would be able to take off directly from the inside of hangar. Regardless of the size of the underground hangars they must be built with at least two doors, for entry and exit of planes.

Directly related to the hangar are underground shelters for fuels and storage for dangerous materials. Hangars are equipped with installations for ventilation and air conditioning, water supply system, sewage and electrical installation. It is foreseen for underground hangar to have its own source of electricity.

Directly related to the hangar are underground shelters for fuels and storage for dangerous materials. Hangars are equipped with installations for ventilation and air conditioning, water supply system, sewage and electrical installation. It is foreseen for underground hangar to have its own source of electricity.

A high level of fire protection is required. Underground hangars are built in the form of concrete or reinforced concrete vault. Their construction is the most developed in Sweden, where there are very favourable terrain conditions.

Construction works began in 1948. Constructor of this object was Dragoslav Sobotka, a graduate civil engineer and retired colonel, of Czech origin. He attended elementary school in Užice, Serbia. His father was an engineer who built the famous "Šarganska osmica" ("Šargan Eight").⁽⁶⁾

Since 1935 he has been a member of the Academic Aero Club. There he worked as secretary and treasurer in 1936. As a student he performed the duties of the Secretary of the Sailing School in Zlatibor from 1936 until the 1940, where he became a pilot sailor by passing all three exams - A, B and C, as well as motor pilot.



Image 7. Constructor, Dipl. Ing. Dragoslav Sobotka

(6) The Šargan Eight (Serbian: Šarganska osmica) is a narrow-gauge heritage railway in Serbia, running from the village of Mokra Gora to Šargan Vitasi Station, http://en.wikipedia.org/wiki/%C5%A0argan_Eight

At the International aeronautical exhibition, held in 1938 in the Old fairground in Belgrade, Sobotka has participated as an organizer and expert consultant. He participated in NOR (National Liberation War) and after the liberation of the country he participated in the construction of a large number of important structures and was the chief architect of a large number of facilities for civilian and military purposes.

His life's work as a civil engineer is a project of the underground airport Bihać, which was one of the largest military airports in Europe at that time and was the second airport of its type in Europe (after the airport in Sweden).

The airport is located at an altitude of 330 meters, and the whole plateau with length of 15 km and a width of 5 km was intersected with sink holes and together with mountain Plješevica it resembled on the giant aircraft carrier, who had a centre with a dominant radar at the top of the mountain. (7)(A1)

His introduction to the special protective facilities of underground type for the Air Force dates back to 1954, when he was a part of the air force military delegation, which was visiting the Swedish Air Force. Then they have, among other things, examined the underground facility of the older type for housing or repairing aircraft with all the necessary premises and installations for peacetime and war purposes, one underground reservoir of classical type, fuel storage and an underground weapons factory "Bofors".

With Swedish military experts it was discussed on the various elements about protection of underground facilities from the effects of shock waves caused by conventional and nuclear offensive means. Therefore this visit was extremely important as an example for building similar objects in former Yugoslavia.

Construction of this facility was based upon previous experiences on other similar buildings in Sweden. Beside Sweden, such buildings also have been built in Germany and Switzerland.

In year 1955 Command of Air Force's has formed a commission which has, by considering the tactical- technical requirements, made a decision for the creation of the project plan and documentation for an object of future underground complex at the military airport near Željava village, near Bihać.

Dragoslav Sobotka, was determined for the main and leading designer in the Bureau for Special Design of Construction Administration JNA (Yugoslav National Army).

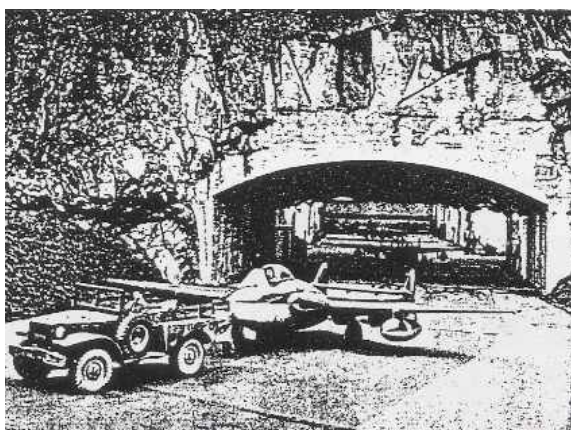


Image 8. Figure shows portal and entrance to the underground tunnel shelter for aeroplanes in Sweden. Protective doors being open, the interior of the shelter is visible.

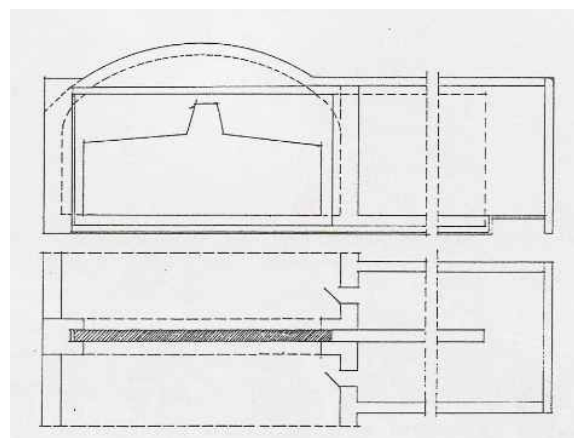


Image 9. Sketch of reinforced concrete door at the entrance to the underground facility

1.2 DESTRUCTION OF THE AIRBASE BIHAĆ

After 24 years in fully function and use by Yugoslavian Air Forces, in 1992 this airbase complex was destroyed with 56 tones (8) of explosive which detonations lasted about two days.

When military leadership decided to withdraw the Yugoslav National Army (JNA) from Croatian and Bosnia and Herzegovina, it became clear that the fate of the airport has become uncertain. The deadline for the withdrawal of the JNA from Bosnia was determined for 19. May 1992. In the early morning hours, explosives, which was set in the "wells" for blasting (specially designed for the purpose of self-destruction, explosive positions were built-in during the construction phase of the airbase and as part of its design) a few months earlier at the airbase, were activated by a remote control from a helicopter on 16th May 1992.

An additional 56 tons of explosives was set off in order to prevent any possible future use of the complex and preclude any advantage to an opposing party.

Thirteen minutes before 8:00 am Bihać was shook by this huge explosion, and from the slopes of the mountain Plješevica flame and smoke have sprung, the mountain was on fire, the flame on the horizon reach up to the sky, the scene was eerie and surreal, cataclysmic.

Underground installation with hangars, workshop spaces, warehouses... was destroyed. (9)

While designing military and other facilities important for state defence, it is necessary to predict and build in places that will be set up for potentially explosive demolition. This type of mining is called tectonic mining, whose aim is not complete demolition, but disabling the use of an airport. Disabling refers to static instability of an airport because powerful explosions inside KLEK have disturbed molecular structure of rock and there is high possibility that object itself could be completely torn down due to minor or major Tectonic disturbance.

In the same way runways are disabled, but are still able to receive light weight aircraft or planes of smaller dimensions and weight. When repaired, it will be possible for them to take larger aircraft, even airliners because they were made for large planes as well.



Image 10. The photo is a screen shot from the video footage that was recorded by a local TV from Bihać in a time when the explosion echoed in an Airbase. Television has taken this material and broadcasted it with the news that the Airbase Bihać was blown into the air. Date on the footage is 16th May 1992. (Photo Rajko Novakovic)

The ensuing series of explosion was so powerful that the nearby city of Bihać shook violently For two days. Villagers said that there was smoke coming from inside of the tunnels even 6 Months after the destruction. (10)

(8) Aeromagazin, Aerodrom kojeg vise nema, Nr. 26, page 38, BB-Soft, ISSN- 1450- 6068, March 2001

(9) Aeromagazin, Aerodrom kojeg vise nema, Nr. 26, page 37, BB-Soft, ISSN- 1450- 6068, March 2001

(10) [Http://www.ronaldv.nl/abandoned/airfields/hr/karlovac.html](http://www.ronaldv.nl/abandoned/airfields/hr/karlovac.html)

Flame and explosions destroyed one of the largest and secured airports in Europe, which worth was estimated \$ 8 billion dollars, although actually costs do not meet the estimated Sum, primarily due to "free" labour force that was engaged in the construction of this airport and because of the long-term (10 years) airport construction. (11)

It is estimated that construction of this airport cost about 4.5 billion U.S. dollars without aircraft and equipment that goes with it. Taking into account that this data is from 1970s today this figure is incomparably greater because of U.S. dollar inflation.

Unquestionably the human creations are proof of its superiority and creativity and often outlive their builder and creator. The damned war should be blamed for everything because it had destroyed all, taken away a lot from people who were committed into creating and building, and because the forces of war are able to destroy decades of human effort and work in seconds. In one moment war makes every sense into nonsense, because it is nonsense itself. (12)

At that time, Airbase Bihać had immense significance for The Yugoslav People's Army Air Force and Anti-Air Defence (RV and PVO) and the country as a whole, in defence, security and political connotation of former Yugoslavia and its position in the entire world.

(11) Aeromagazin, Aerodrom kojeg vise nema, Nr. 26, page 37, BB-Soft, ISSN- 1450- 6068, March 2001

(12) Aeromagazin, Aerodrom kojeg vise nema, Nr. 26, page 38, BB-Soft, ISSN- 1450- 6068, March 2001

2. MILITARY AREA ANALYSIS

Former military Airbase Bihać is situated at the border between Bosnia and Herzegovina-Croatia, Plitvice lakes and Municipality of Bihać. It is divided into four main areas: underground airbase (formerly called „Object KLEK” and „Object 505”) , runways, military barracks in Željava village and radar station on mountain top. (Map 2)
Whole area has been abandoned, mined and ruined.

2.1 UNDERGROUND COMPLEX INFRASTRUCTURE

There were 4 entrances for military aircraft into underground complex protected by 100-ton pressurized doors.

Main entrance into “KLEK” at the Airbase Bihać was entrance No. 2. Entrance No. 4 is connected with entrance No. 3 through a tunnel that forms a gentle curve. This curve was probably formed because of the possibility that the aircraft could flew directly From the inside of the mountain itself.

It was built in a visionary way for 21st century with all the detailed planning that resulted with indestructible object, invulnerable to then known ordnance of potential attackers. However, the evacuation of the underground was considered as well, therefore the ventilation openings and air chambers were adapted to humans in order to safely leave the underground facility in case of emergency. (13)

The underground tunnels ran a total length of 3.5 kilometres (in some literature sources length of underground facility is estimated on 2.7 kilometres (14))

Besides the main purpose of a protected radar installation, a control centre, secure communications and related facilities, the air base contained underground tunnels for the use, parking, and maintenance of three complete squadrons, two fighter and one reconnaissance. (15)

The units based there were equipped with MiG-21bis fighter aircraft and MiG-21R reconnaissance-fighter aircraft. Entrances were made in shape of the aircraft, and later adjusted to the new form of planes.

Profiles of galleries, their walls and counter attack deflector, automatic heavy bullet-proof Armoured doors could not be directly hit during the potential attack.

Entire underground facility with entrances was well hidden into the relief slopes of Plješevica mountain. This position of underground entrances has guaranteed to protect Against direct nuclear explosion.

(13) Novaković, Rajko

(14) [Http://www.zeljjava.com/html/infrastruktura.html](http://www.zeljjava.com/html/infrastruktura.html)

(15) [Http://www.ronaldv.nl/abandoned/airfields/hr/karlovac.html](http://www.ronaldv.nl/abandoned/airfields/hr/karlovac.html)

While making underground tunnels inside of a mountain using method of mining, whose aim was not to distort the firmness of rock which remains as a vault/ceiling, or a wall in the tunnel, was applied. For the first time a special method of concreting was used as well as the system for catching the leakage of water and wet points. The water was then conducted through drain below underground structure.

The complex included an underground water source, power generators, crew quarters, and other strategic military facilities. It also housed a mess hall that could feed 1000 people simultaneously, along with enough food, fuel, and arms to last 30 days without resupply. (16)

However, when put into use, it became clear that the building is vulnerable inside due to the possibility of fire. For this reason, the installation for aircraft fuelling were rapidly deactivated, discharged and additional fireproofing ensured.

As the building was susceptible to sabotage and diversionary operations, the building was very well supplied with multiple guards, patrols, ambushes, dog guards and optoelectronic means.

There were galleries to accommodate aircraft and other associated equipment, workshops for aircraft repair and maintenance of equipment for all levels (known as ATW (VTR) ... Aviation Technical Workshop (Vazdusna tehnicka radionica)), parachute section , rechargeable stations, operating centres, warehouses of all necessary materials and ordnance, air chambers that provide clean air also in nuclear war conditions, water sources, autonomous sewage system of waste materials, waste disposal depot, power plant (hall with electricity generators powered by diesel engines), rooms for people (including classrooms), recreation rooms, kitchen with restaurant, infirmary with a small dispensary and even the morgue. (17)

At entrance No. 3 there was a kerosene storage. Because of the explosions it is possible that this part of object is now unstable.

Apparently, there were a lot of problems during constructing because of underground gaps and watercourses.

Inside „Object KLEK” there was build in kerosene tank of colossal sizes, air conditioning system, kerosene pipelines and self-power engineering system. Entire underground complex was alight and air conditioned with constant temperature of 22°C and a certain level of humidity because of kerosene evaporation.



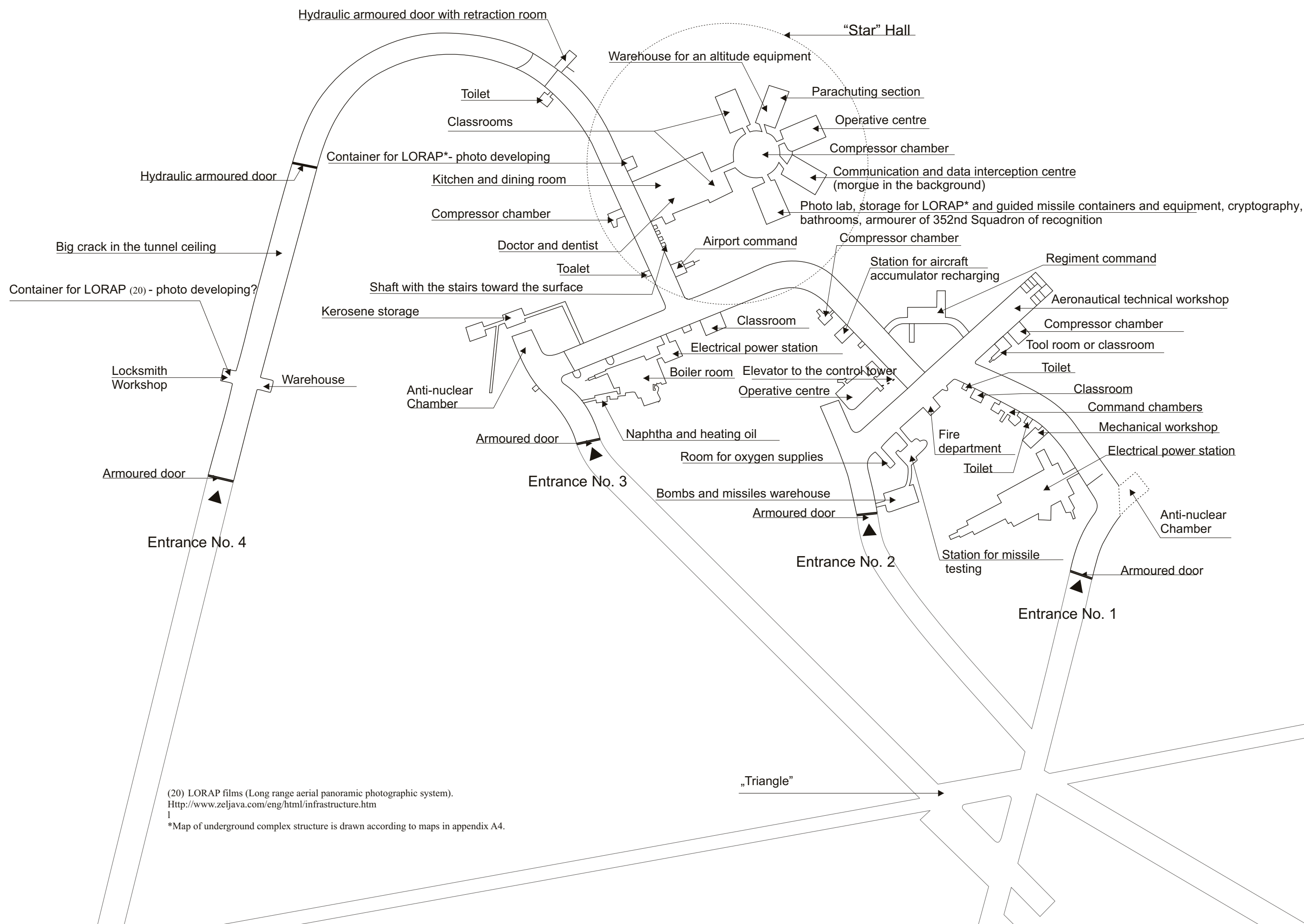
Image 11. It can be seen here that the installations for maintaining the inside of the tunnel were enormous.

Room for high-quality technical maintenance of planes, engines and electronic equipment of aircraft was remarkable construction which was the highest and the widest in entire underground complex. Under entire floor of this facility was a huge abyss.

(16) [Http://www.pastremanants.com/381eljava-airbase.html](http://www.pastremanants.com/381eljava-airbase.html)

(17) Novaković, Rajko

2.1.1 UNDERGROUND COMPLEX MAP



(20) LORAP films (Long range aerial panoramic photographic system).
[Http://www.zeljava.com/eng/html/infrastructure.htm](http://www.zeljava.com/eng/html/infrastructure.htm)

1

*Map of underground complex structure is drawn according to maps in appendix A4.

2.1.2 UNDERGROUND COMPLEX PICTURE GALLERY



Image 14. Entrance No.2

Entrance was made in a shape of aircraft, symbolically painted and built into mountain.



Image 15. Entrance No.2

Inner side of the entrance, where damage can be seen. A small embankment in front of the entrance was built To protect from human entrance into ruined facility.



Image 16. Tunnel in entrance No.4

Tunnel ceiling and walls in relative good condition, floor was ruined due to explosions.

Dust particles, found mostly on floor of the object are most polluted with PCBs as well as with other metals which should not be inhaled.



Image 17. Massive armoured, 100-ton pressurized door, near to the one of entrances. Ruined by explosions. In this picture can be seen the strength of this construction, when taking into account that the entire facility was ruined with about 56 tones of explosives and through years, by neglect.



Image 18. In this photo there is one of the tunnels, where it can be seen an enormous height of object, at middle point, as well as the width of the tunnel. As seen here, other tunnels have smaller height. It can also be concluded that this part of underground facility is in relative good condition.



Image 19. Massive armoured, 100-ton pressurized door, near to the one of entrances. Ruined by explosions. This are the same door as in image 17. On this one, however, it can be seen the direction of explosion, and actual strength of it. Armature being ripped out of concrete still seems very dynamical and surreal.



Image 20. Ruined armoured, 100-ton pressurized door.



Image 21. Ruined entrance door. This door, as seen here, were modified for new shape of aircraft.



Image 22. The remains of the destroyed structure in background.



Image 23. Weather conditions such as humidity have strong impact on construction especially in entrance area.



Image 24. Armoured, 100- ton pressurized door. Seems as if they are untouched by explosion, but ruined due to neglect and weather conditions.



Image 25. Through underground facility there are many corridors and passages left to be explored.



Image 26. Opening, probably for installations.



Image 27. This structure built into the wall was probably a toilet. They were built in regular spans through the whole object.

2.2 RUNWAYS AIRBASE BIHAĆ

Runways, as surface infrastructure, are particular in technical and technological terms because they require an excellent construction connoisseurs because of karst terrain, which is intersected by a series of sink holes, caves and valleys. In aviation runways are named PSS (Poletno-sletna staza), take off and landing runways.

In front of Plješevica mountain on its plateau, formed from „Baljevačko polje”, „Poljice” „Zverinjac” and „Debeli lug” areas, were built runways.

In Airbase Bihać there were 5 runway axis built. Two of them are take off and landing, and three of them take off runways. Also, two of them were dimensioned for landing largest Transportation aircraft. These three for take off were unable for safe landing due to close elevations (Celopek hill and mountain Plješevica).

Runway 1: 14R/32L - 2545m/8350 feet - concrete, covered with asphalt (CLOSED), in Bosnia and Herzegovina & Croatia

Runway 2: 14L/32R - 2510m/8235 feet - concrete, covered with asphalt (CLOSED), in Bosnia and Herzegovina

Runway 3: 08R/26L - 2325m/7628 feet - concrete, covered with asphalt (CLOSED), in Bosnia and Herzegovina & Croatia

Runway 4: 08L/26R - 2215m/7267 feet - concrete, covered with asphalt (CLOSED), in Bosnia and Herzegovina & Croatia

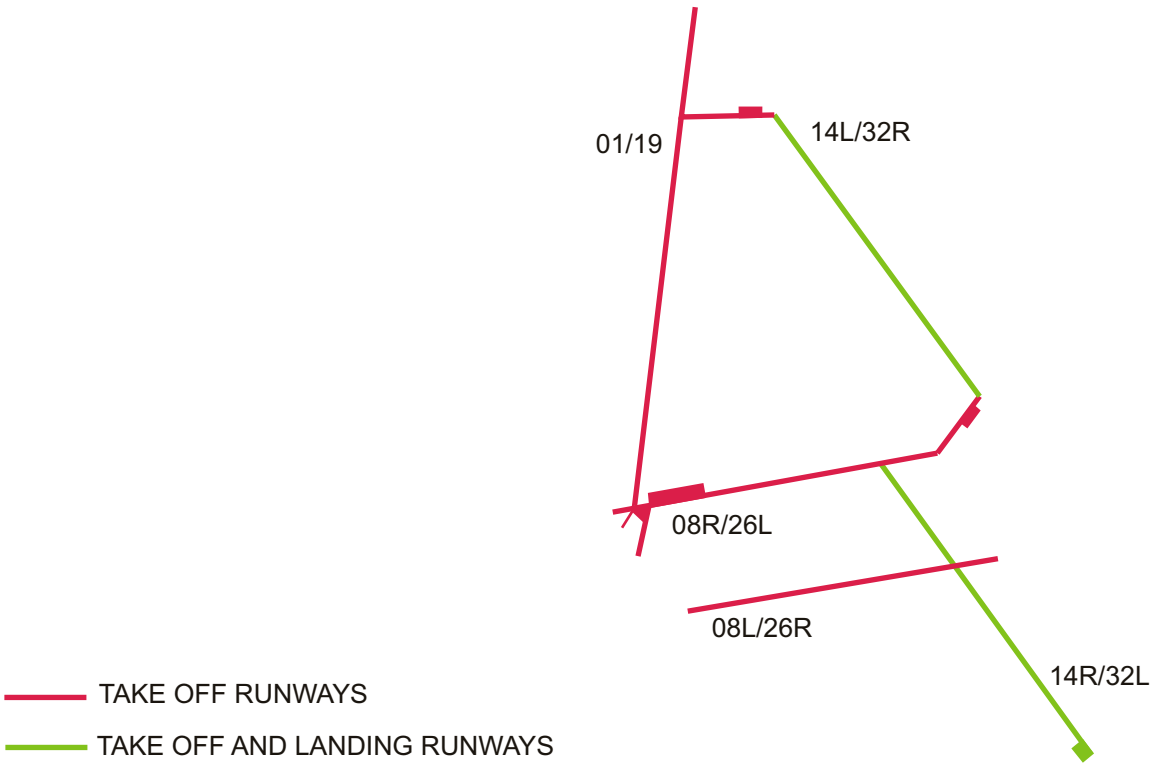
Runway 5: 01/19 - 3630m/11,909 feet - concrete, covered with asphalt (CLOSED), in Croatia
(21)

Runway codes show azimuth at which the runway extends regarding to the direction of approaching. That way runway 1 from Rakovice is marked 14L which would mean 140° Left. L because there is a parallel runway 2 that has mark 14R which is parallel to the runway 1 and is located on the right side of that direction of approaching, which means 140° Right. Same marking applies from the counter direction, but 180 degrees opposite. Runway 1 is marked 32R (320° Right) and runway 2 32L (320° Left).

This L and R is used only if there are two or more parallel runways.

(21) [Http://www.ronaldv.nl/abandoned/airfields/hr/karlovac.html](http://www.ronaldv.nl/abandoned/airfields/hr/karlovac.html)

2.2.1 RUNWAYS AIRBASE BIHAĆ MAP



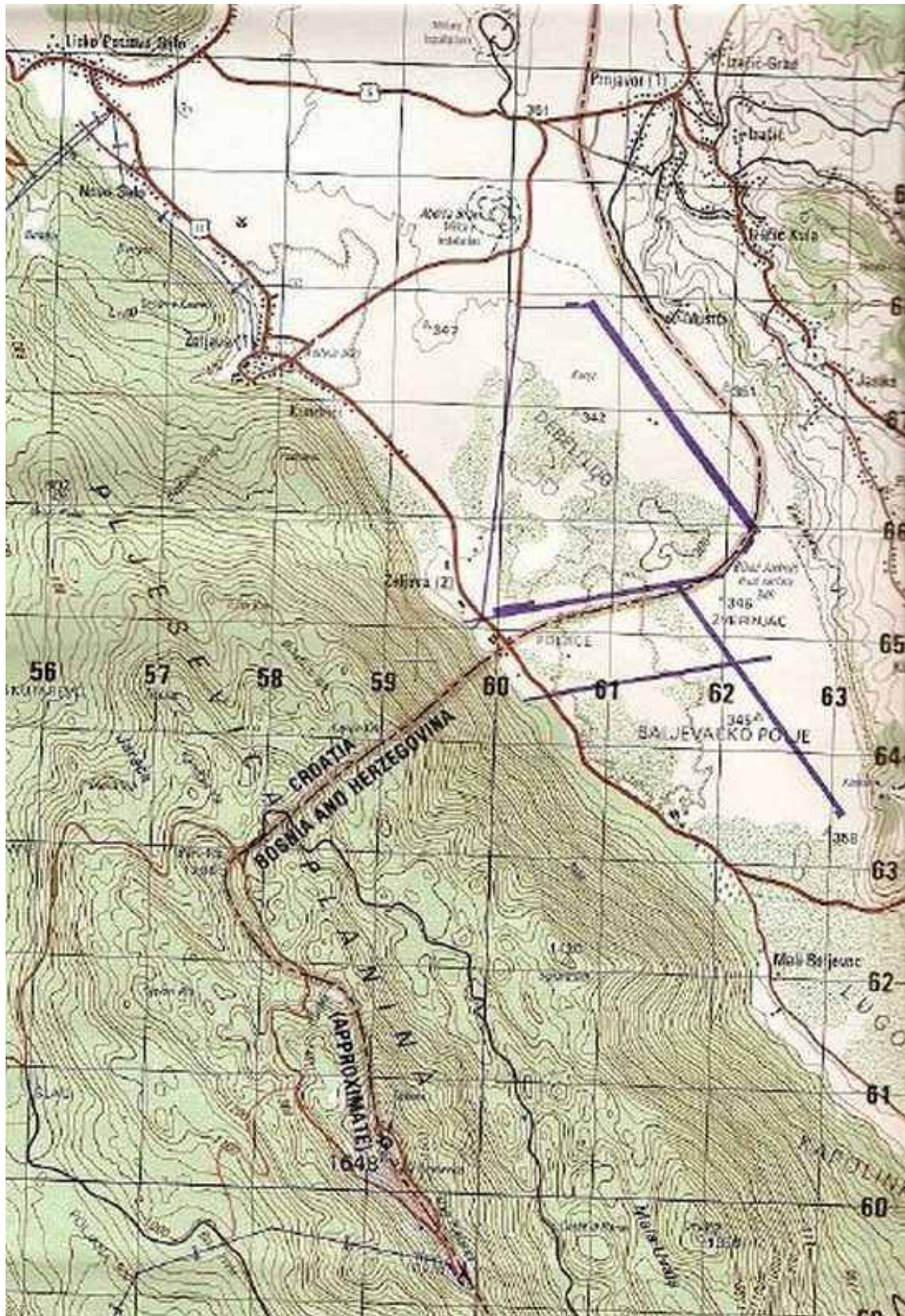


Image 28. Relief map of mountain Plješevica and plateaus „Baljevačko polje”, „Poljice”, „Zverinjac” and „Debeli lug” with Airbase Bihać runways and approximate borderline Bosnia and Herzegovina- Croatia.

2.2.2 RUNWAYS, AIRBASE BIHAĆ PICTURE GALLERY



Image 29. Runway 08R/26L

Runways for taking off were wavy. This is in particular because for aeroplane to take off faster, even at a first slope (if the plain is light weight, without additional fuel and weapons).

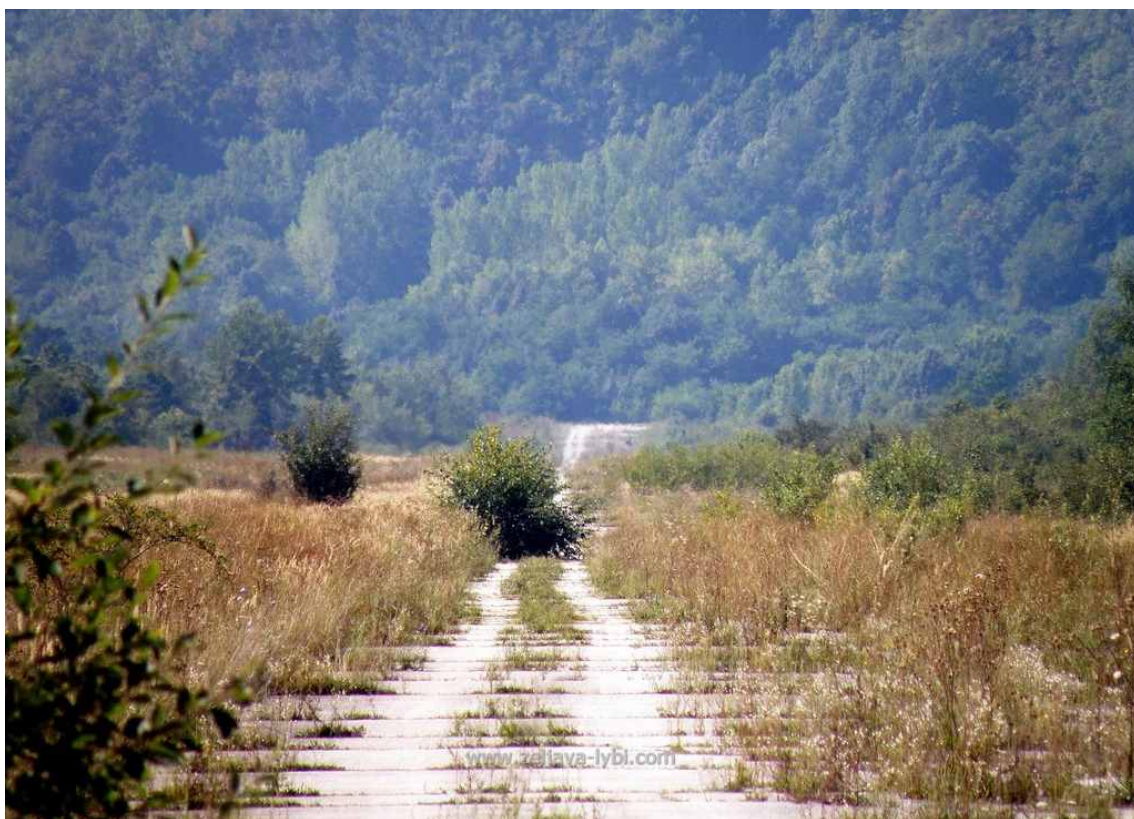


Image 30. The longest runway was 01/19 with a length of 3630m. Today it is covered with grass and neglected.



Image 31. Runway 14L/32R

It is one of runways which is still today in good condition. This is the widest of all five.

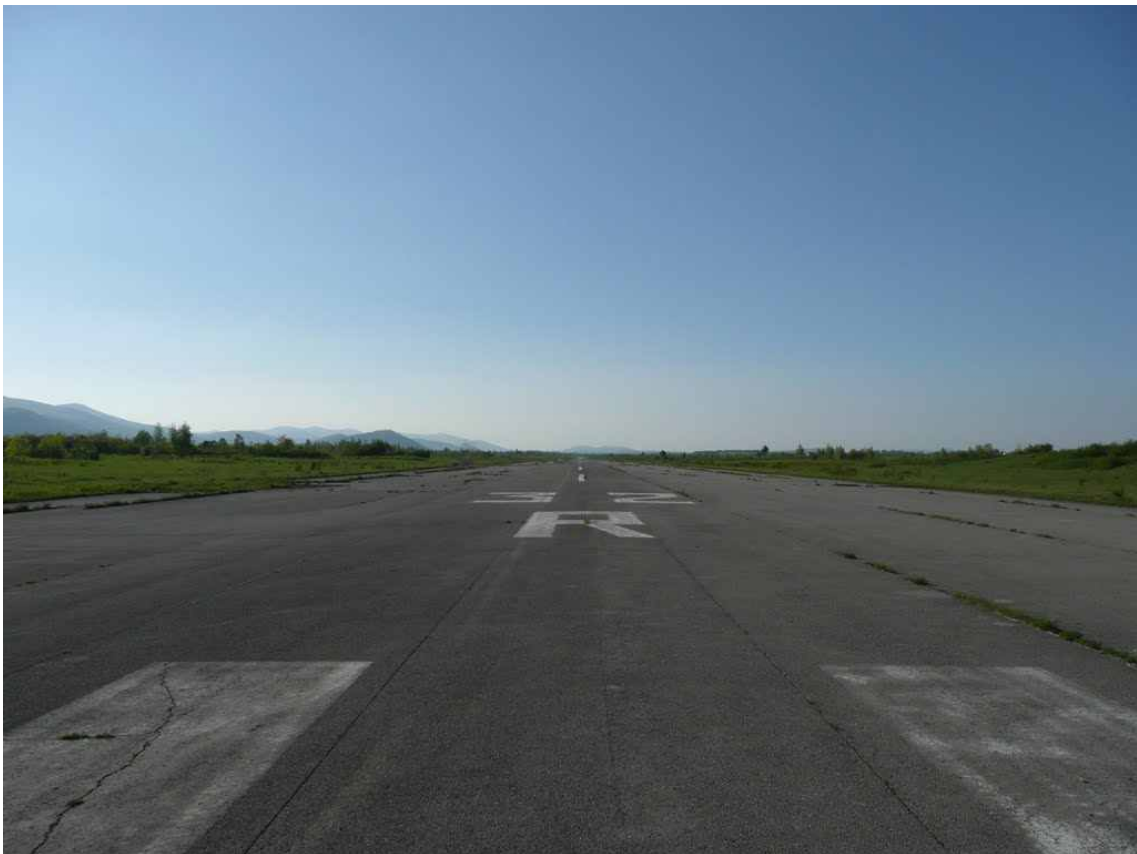


Image 32. Runway 14L/32R

Photo taken from another direction.



Image 33. Runway 01/19



Image 34. Runway 01/19



Image 35. Runway 14R/32L



Image 36. Runway 14R/32L



Image 37. One of the runways with entrance to KLEK in the background.



Image 38. Runway 08R/26L with entrance to KLEK in the background.



Image 39. Runway 14R/32L



Image 40. „Triangle” position.
Entrance No.1 and 2



Image 41. View from above on runways.



Image 42. View from above. „Triangle” and entrance No.2 can be seen in this view.

2.3 MILITARY BARRACKS IN ŽELJAVA VILLAGE

There are four main part of this entire complex. Each of them is different, has ist own character and is built in different way.

Top of the mountain has only one concrete building on the surface and underground tunnels, which are not remeasured or analysed after war, so the accurate plan is still missing.

Underground complex „KLEK” is statically insecure, and without further analysis it would be impossible to predict in what purpose it could be used.

Runways are not much damaged, but as seen in photographs, there is still a lot to repair in order for them to function as runways.

In the direction of Ličko Petrovo village, three kilometres away, there are situated former military barracks in Željjava village. There were placed all the operational units that were in a function of the Airbase from physical security to operational and flying structure.

Also, there were rooms to accommodate soldiers of all units, stadium with terrains for all types of sports, sport hall, a large restaurant for soldiers on duty authorities, a car park with all necessary vehicles for the transport of people and goods, technical workshop for the maintenance of the vehicle with the station for technical review, internal fuel taproom, various warehouses of military equipment, heating plant, construction section for facilities maintenance, infirmary. Of course, the dominant unit was the Aircraft base, which was also the host of the airport. The command of this unit took care of that the airport is functioning perfectly in all the technical sense. All the others, including the Flying Regiment, were guests at the airport who were performed tasks assigned by their superiors.

Today there is a minefield and only secure space for movement is road. Some objects are completely destroyed, while others have suffered damage due to weather conditions or were devastated.

In this case, most buildings were not ruined due to explosions, but due to weather conditions. However, it is hard to estimate real damage. It is also difficult to say if those facilities are safe for further use or not.

But, it must not all be that bad because, *für Stadtplaner und Architekten eröffnet sich hier ein weites Betätigungsfeld mit oft reizvollen Einzelaufgaben. Es ist befriedigender, in Kasernen Wohnraum zu schaffen als neue Kasernen zu bauen. Es ist eine schöne Aufgabe, ehemals militärische Sperrgebiete zu öffnen und sie als Park und Erholungsraum der Öffentlichkeit zugänglich zu machen. Es ist erstaunlich, welche unterschiedlichen Nutzungsmöglichkeiten eine ehemalige Kaserne bietet: vom Wohnen über den Gewerbehof, bis hin zur Universität...*
(22)

Human experience with old abandoned military facilities or industrial areas which are sometimes far more dangerous, are there to remind us, that with free will of people these areas could be improved and cleaned, made into recreational places or places with other types of purposes.

(22) Neue Nutzungen für Militärstützpunkte und Industrieflächen (Conversation of Military Bases and Industrial Areas), Karl Krämer Verlag Stuttgart + Zürich ,1997, page

2.3.1 MILITARY BARRACKS IN ŽELJAVA VILLAGE MAP

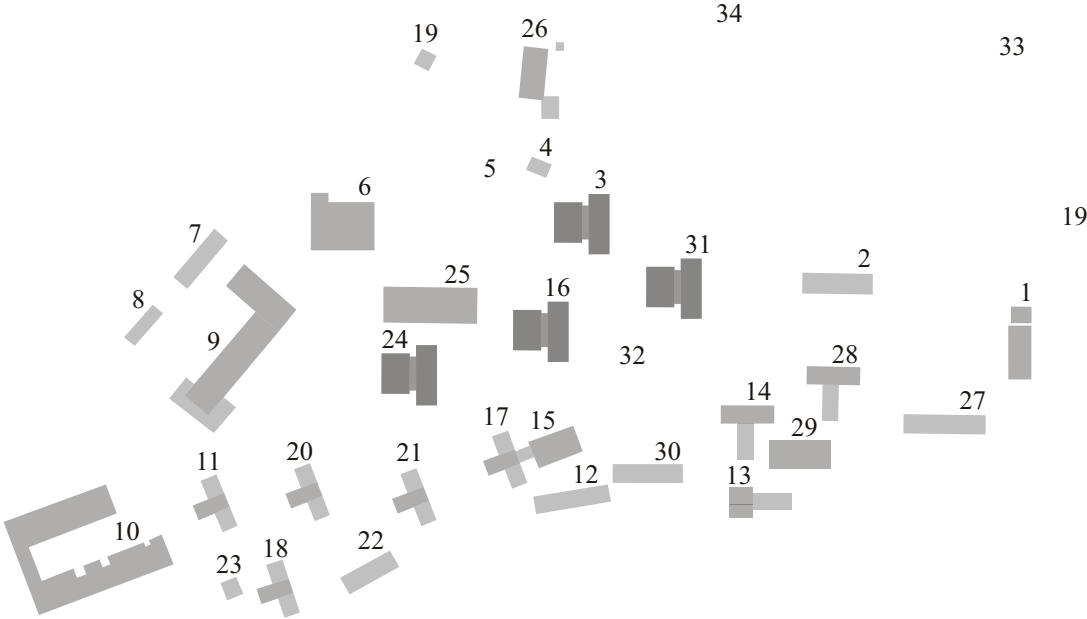




Image 43. Military barracks in Željava village

1. Base HQ (headquarters);
2. bVOJIN (Vazduhoplovno osmatranje, javljanje i navodenje en. Air mobility reconnaissance command) HQ;
3. Building for the accommodation of soldiers
4. Building (probably former private house) in which was technical workshop of technical platoon VOJIN;
5. Ruins, where probably was a building for accommodation of soldiers (built in mid-80s);
6. Restaurant and kitchen;
7. Storage for food and supplies;
8. Pumping stations for fuel;
9. Technical and car workshop;
10. The old car shop. After the construction of new one (No.9), this became a warehouse and a garage for buses;
11. Construction section with a carpenter's workshop;
12. Carpenter's workshop;
13. Heating plant;
14. Infirmary;
15. Soldierly club with a library and cinema hall;
16. These three buildings in a row, belonged to a flying regiment and a reconnaissance squadron;
17. Infantry building (unit that was physically guarding the airport probably military police);
18. Accumulator station;
19. Entrance (gate);
20. četa veze?;
21. ABHO (atomsko-biolosko-hemijska odbrana eng. atomic-biological-chemical defence) company;
22. Unknown purpose;
23. Unknown purpose;
24. Building VOJIN;
25. New building of engineering company;
26. Sport hall;
27. Construction section;
28. Laundry room;
29. Central heating room and storage of coal;
30. Unknown purpose;
31. VOJIN building;
32. Aligning plateau;
33. Football field;
34. Handball or/and basketball playground;
35. Access road through the barracks.

2.3.2 MILITARY BARRACKS IN ŽELJAVA VILLAGE PICTURE GALLERY



Image 44.
1. Base HQ (headquarters), winter



Image 45.
1. Base HQ (headquarters), June 2011



Image 46 and 47.
3. (VOJIN) AMRC (23) Building for accommodation of soldiers.



Image 48.
6. Restaurant



Image 49.
6. Economic entrance in restaurant kitchen

(23) VOJIN (Vazduhoplovno osmatranje, javljanje i navođenje) en. AMRC (Air mobility reconnaissance command), winter and summer conditions



Image 50.
7. Storage for food and supplies



Image 51.
7. Storage for food and supplies



Image 52.
9. Technical and car workshop



Image 53.
9. Technical and car workshop



Image 54.
9. Technical and car workshop



Image 55.
9. Technical and car workshop



Image 56.
9. Technical and car workshop



Image 57.
9. Technical and car workshop



Image 58.
10. Probably the old car workshop. After the construction of the new (No.9), this is converted into a warehouse and a garage for buses.



Image 59.
10. Probably the old car workshop.



Image 60.
12. Carpenter's workshop, summer



Image 61.
12. Carpenter's workshop, winter



Image 62.
13. Heating plant



Image 63.
15. Soldierly club with a library and cinema hall



Image 64.
15. Soldierly club with a library and cinema hall



Image 65.
15. Entrance to the Soldierly club with a library and cinema hall



Image 66.
15. Entrance hall of the Soldierly club

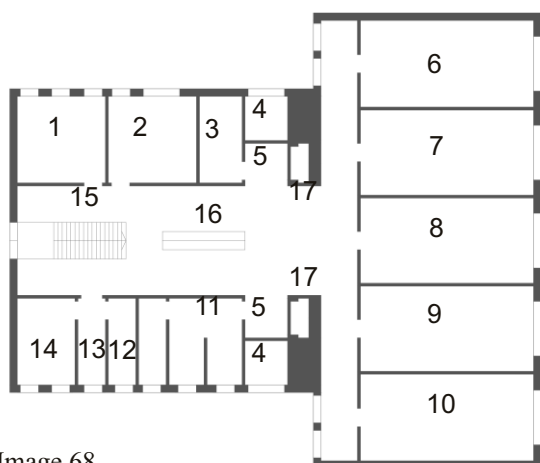


Image 68.
Typical floor plan of the building of flying regiment:
1. Classroom 1-lab
2. Commander office 1-lab
3. Warehouse 1-lab
4. Balcony
5. Box
6. Dormitory 2nd platoon 1-lab
7. Dormitory 1st platoon 1-lab
8. Classroom 3-lsrb
9. Dormitory 3-lsrb
10. Warehouse 3-lsrb
11. Sanitary block
12. Warehouse and an office
13. Corridor
14. Commander office 3-lsrb
15. Stairway
16. Place for weapons and equipment
17. Storage for weapons and ammunition



Image 71.
Road to the entrance gate



Image 67.
16. These green buildings in a row, belonged to a flying regiment and a reconnaissance squadron.



Image 69.
19. Entrance gate, view from above



Image 70.
19. Entrance with sign for mine danger



Image 72.
Ruined aeroplanes in front of the entrance gate



Image 73.
25. New building of engineering company



Image 74.
Entrance to the New building of engineering company



Image 75.
26. Sport hall, summer



Image 76.
26. Sport hall, winter



Image 77.
28. Laundry room



Image 78.
34. Handball and/or basketball playground



Image 79.
35. Access road through the barracks, winter



Image 80.
35. Access road through the barracks, summer

2.4 RADAR STATION

On Plješevica there was located 1st company (lowest tactical unit) VOJIN (Air Surveillance, Reporting and Guidance). *First company belonged to 51st battalion VOJIN. The battalion belonged to the 5th regiment VOJIN, and the regiment was within the 5th Corps of the PVO (anti-air defence). Company had its operational unit on Plješevica, within radar station. Command and the operational centre of 51st battalion VOJIN were located in the underground airport (KLEK). Commands and operational centres of 5th regiment VOJIN and 5th Anti-Air Defence Corps were stationed in Zagreb.* (24)

Radar domes were huge and seen from city of Bihać. They were protecting radars from strong wind, rain and ice. There were two domes built on Plješevica radar position with 6 and 18m in diameter. They've been built from duraluminium on concrete foundation. They both were formed from triangular shape elements coated with special elastic wax. Structures like these enabled them to survive strong wind impact.

Unit for controlling airspace was located at the airport and was guiding hunting aircraft for needs of flight regiment (Centre for Air Reconnaissance/Intelligence and Guidance), which belonged to Anti-Aircraft Artillery of Yugoslavian People's Army. It has provided assistance in navigating to the affected ones in the surveillance zone of 800 kilometres in diameter, it has given a variety of informations about the condition in the airspace of the entire community to the level of municipalities, it has collaborated closely with the Regional air traffic control centre in Zagreb in whose jurisdiction were civilian domestic and international flights.



Image 81. Photo: Rajko Novaković, the final adjustment of signal processors in radar station 1988th, for the purposes of advertising, informative content military magazine "Kрила Armije"



Image 82.
Photo: Rajko Novaković, Military Magazine „Front”, Scan

In order to enable the unit to perform such complex tasks, it had to be equipped with highly sophisticated radar system. Such a system was installed at the top of Plješevica mountain. It was built somewhere around 1977. It had a dominant position and excellent possibility to detect targets at extreme high, high, medium, low and extreme low altitudes. Nothing metal that flies could not pass without being noticed and identified.

On Plješevica was installed the radar of the British series S- 600 (producer Marconi electronic Chelmsford near London). As this position was remarkable by tactical characteristics and radar itself was the last word of technique at that time, it was decided that Plješevica, in addition to 24 -hour duty in the air defence system, works for the flight regiment based on aero-base Bihać. Only in that context link between position Plješevica and the airport can be made. It was not built to raise operability of flight regiment, but for the air defence system in which were positions on top of Ljubljana Hill, Jahorina and Kopaonik. The fact that the radar position is at Plješevica mountain and that fits right into the airport complex in the terms of infrastructural, tactical and operational sense, it is probably coincidence of favourable geographical position of Plješevica mountain.

For the purpose of an airbase itself there was radar station "Kota", which was in close proximity to the airport (about 2 km in the direction of extension of the runway 4, near the village of Izačić). There was operational centre of air observation, reporting and control (abbreviated VOJIN- vazdušno osmatranje, javljanje i navođenje).

Entrance to the tunnel from the access road is marked under number 3. Immediately behind the door, on the right side, there was a room where devices for postal connection Bihać were.

In some pictures it can be seen the caponier covered with epoxy mask. This mask protected the parabolic antenna in caponier. Tunnel ran more to the right, and it lead to energy hall (number 7). The tunnel consisted of straight sections, sections with a slight rise and sections with stairs (adjusted for people). It is possible that one branch leads to the underground residential building. Most probably the tunnel ended in energy hall (number 7).

Tunnel of housing facility to the radar complexes, is positioned more to the south from the road, so the altimeter (number 8) could be reached through a few steps from tunnel, and into caponier of observation radar (number 6) with a fairly steep climb length of 15 meters.

When viewed from a residential building, the tunnel is positioned more left, so that the domes were situated more right from the tunnel itself.

Small room which is used to accommodate some of the equipment for connections (number 16) and an exit to the surface are situated right, next to road, and diagonally toward the heliport.

Stand for the antenna of radio station (number 5) is situated right from the road, toward heliport. Room from accommodation and equipment and stand for antenna of the radio station were positioned very close to each other.

Dome for accommodation of parabolic antenna devices for communication is marked with number 11. Antennas are placed circular in a dome. They were used for redirection of the connection between the various high-frequency radio relay facilities in the area of the former Yugoslavia.

It is important to say that the radio-relay room, energy hall with three generators, handy kitchen, medical clinic with dispensary (15-beds) and handy reservoir of water (10 cubic meters) (number 13) and energy hall (number 7) have an exit to the surface.

Tunnel of housing facility to the radar complexes, is positioned more to the south from the road, so the altimeter (number 8) could be reached through a few steps from tunnel, and into caponier of observation radar (number 6) with a fairly steep climb length of 15 meters.

When viewed from a residential building, the tunnel is positioned more left, so that the domes were situated more right from the tunnel itself.

Small room which is used to accommodate some of the equipment for connections (number 16) and an exit to the surface are situated right, next to road, and diagonally toward the heliport.

Stand for the antenna of radio station (number 5) is situated right from the road, toward heliport. Room from accommodation and equipment and stand for antenna of the radio station were positioned very close to each other.

Dome for accommodation of parabolic antenna devices for communication is marked with number 11. Antennas are placed circular in a dome. They were used for redirection of the connection between the various high-frequency radio relay facilities in the area of the former Yugoslavia.

It is important to say that the radio-relay room, energy hall with three generators, handy kitchen, medical clinic with dispensary (15-beds) and handy reservoir of water (10 cubic meters) (number 13) and energy hall (number 7) have an exit to the surface.

Exit from radio-relay room (number 13) is on the southern slope of the mountain, and in a lower position of the basement of the residential building.

Exit from the energy hall (number 7) was directed toward heliport and through the road connected with it. Entrances and exits were dimensioned in order for vehicle of larger dimensions to enter.



Image 83. Photo: Rajko Novaković, RP Plješevica while in operating period, taken from the main road Plitvice Lakes T.Korenica.

There is a residential building (3) (roof dominates and the front of the building with a terrace), small arctic dome (altimeter) (2) and big arctic dome (observation radar)(1).

Right from building is an object with rigid construction and is smaller in size. There were placed antennas (parabolas) of devices for radio-relay connection. (4)

On southern slope, directly under the building (right toward the radar), there were two reservoirs for drinking water. With system of pipes and pumps, complete facility was supplied with water, as well as underground handy reservoir. Tunnels are marked with red dashed line, and red arrows are used to mark the entrances or exits to the surface.

Exit near the heliport has metal door parallel to the slope and they are inclined. Tunnel (from building to the exit near the heliport) is about 80m long, inverted trapezoidal shape. The lower part of the tunnel is about 1.5m wide and above about 2m. The height of the tunnel is the standard for all parts (about 2.2m). Tunnel (from road, to energy hall) is longer (perhaps up to 150m). The entire section of the tunnel is a combination of steps, flat sections and gentle slopes. It is about 1.5m wide, with a height of about 2.2m. Upper part of the tunnel is oval shaped.

Rooms in residential building are different sizes. The biggest room is dinning room with a surface of around 80 square meters. The smallest are office rooms with about 12 - 15 square meters. On the first floor there were 12 rooms (with toilets and storages).

The ground floor consisted of dormitory for soldiers, kitchen , bakery , dining room and wash room facilities. In the basement there were located warehouses for food and weapons, heating plant, canteen and various auxiliary facilities. All rooms were about 3m hight. Average dimensions differ from room to room, depending of purpose.

Room (number 13) consisted of three parts. First part were hospital, handy kitchen and wash room facility of about 80 square meters total. The second part was radio- relay room about 80 square meters. The third part was energy hall of about 60 square meters. Radio relay hall was elongated with oval vault height of about 4m.

The room (number 7) is about 60 square meters and 3m height. Caponier (A) had about 40 square meters, and caponier B about 120 square meters. In caponiers were radar devices.

Military intelligence not only established the basis for a new landscape- that of war-by organizing the social territory with its strategic routes and its forts, it also produced its own atmosphere. Just as there are two times, the time of peace and the time of declared war, there are two atmospheres and not just one. (25)

2.4.1 RADAR STATION MAP

1. Access road from the main road Plitvice-Korenica
2. Access road
3. Entrance to the tunnel which lead into the building for accommodation of people and into the radar complex
4. Heliport
5. Platform was used for mounting the antenna of radio station for automatic guidance
6. Caponier of observation radar
7. Energy hall
8. 1st caponier, radar to measure the height (altimeter)
9. Tunnel which connects the residential building and a radar complex (*length, by a free assessment, 80 meters* (26))
10. Reinforced concrete residential building
11. Dome for accommodation of parabolic antenna devices for communication
12. Antennas
13. Radio-relay room, energy hall with three generators, handy kitchen, medical clinic with dispensary (15-beds) and handy reservoir of water (10 cubic meters)

Whole underground was protected from nuclear attack with special anti-shock valves.

14. Tunnel which lead into the building for accommodation of people and into the radar complex
15. Radar complex
16. Small room which is used to accommodate some of the equipment for connections has an exit to the mountain

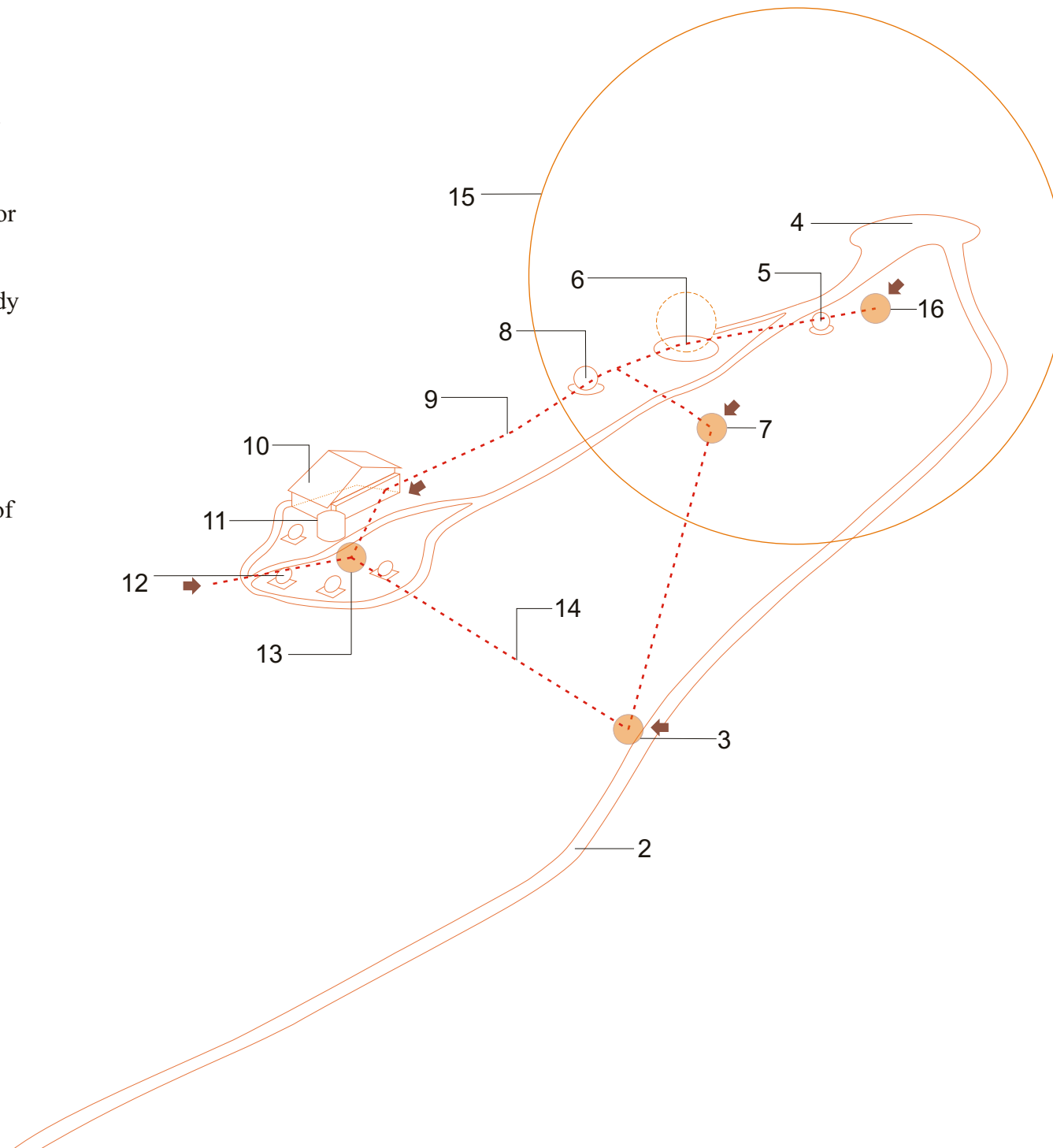
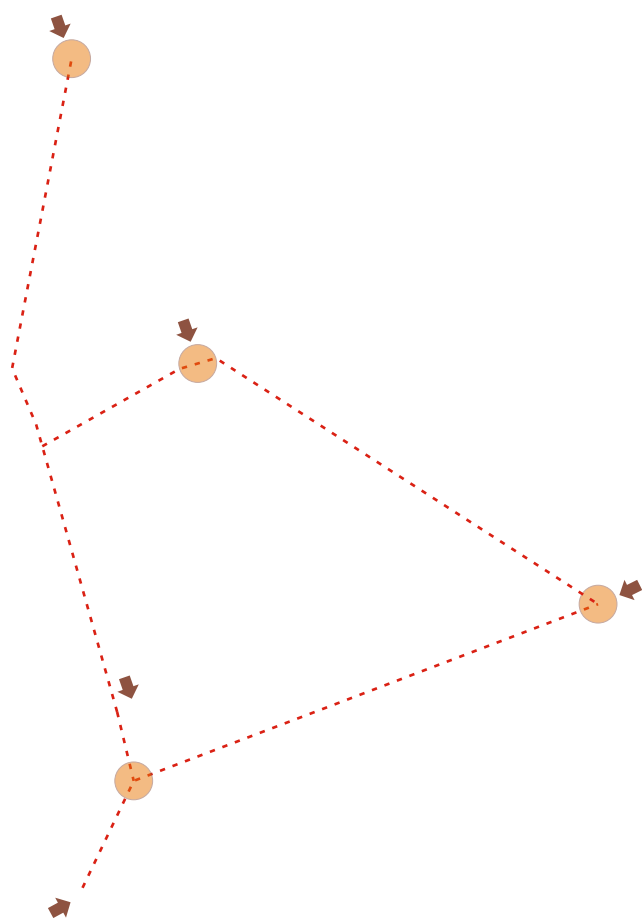




Image 84.
Mountain Plješevica; view on radar position with a residential facility as dominant.



Plan of underground tunnels according to literature sources and conversation with Rajko Novaković



2.4.2 RADAR STATION PICTURE GALLERY



Image 85. Radio antennas on mountain top where building of television is situated. Before year 1991 this position was shared with Television Sarajevo (TV SA) (Bosnia and Herzegovina) and Television Zagreb (TV ZG) (Croatia).

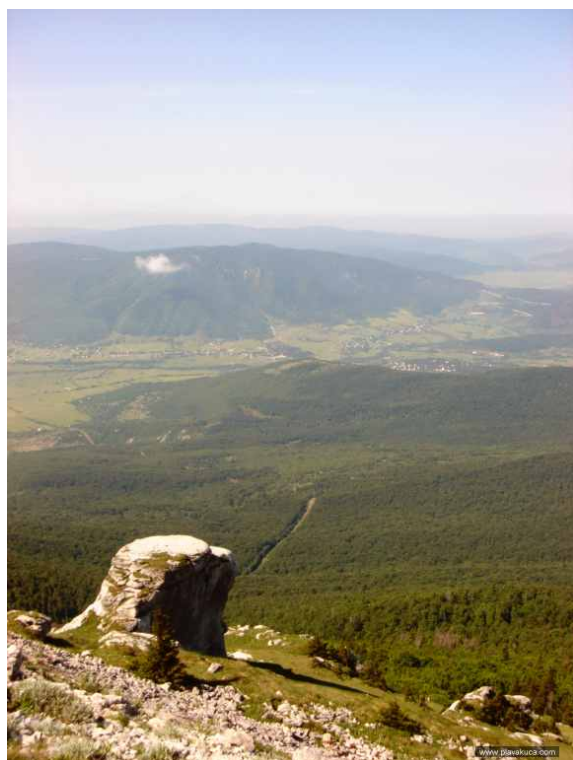


Image 86.
Dominant stone structure on the south slope of Plješevica mountain. In this direction there is a road to Plitvice- Korenica.



Image 87.
Plješevica, antennas (green, left), in plan marked with number 12 and dome for accommodation of parabolic antenna devices for communication (right) marked with number 11

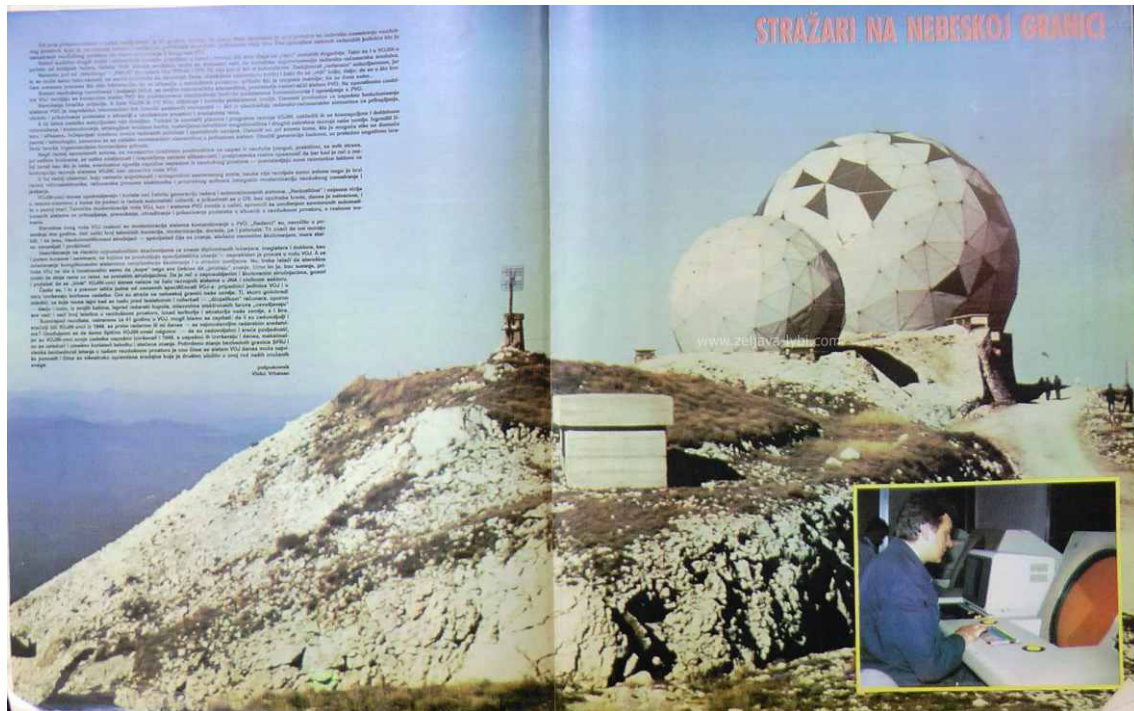


Image 88.

These two pictures can be used for comparison of what used to be, and how domes used to look like, with condition today, when they are not there any more.

This photo is excerpt from the magazine.



Image 89.

Plješevica, position where domes used to be. Most of the materials there were taken away by military, but what was left behind has been taken away because of the valuable metal parts. Through time weather conditions have changed this scenery.



Image 90.
Stand for big dome.



Image 91.
Stand for small dome. Behind roof of residential building can be seen.



Image 92.
Residential building had three stories, and an an access to an underground tunnel.



Image 93.
Dome for accommodation of parabolic antenna devices for communication near residential building.



Image 94.
One of the entrances into an underground tunnel. Entrances were big enough even for larger terrain vehicles.

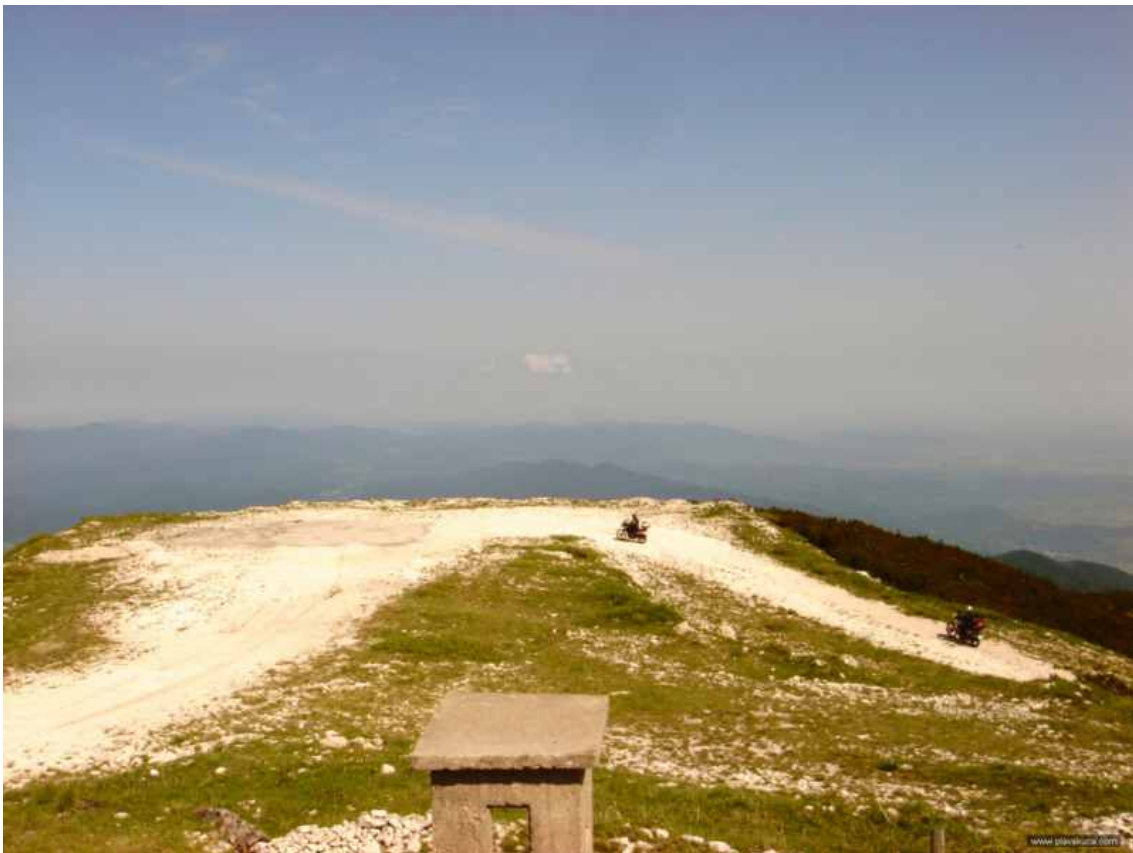


Image 95.
Once this circular structure was heliport.



Image 96.
Entrance to the tunnel which lead into the building for accommodation of people and into the radar complex.



Image 97.
Interior of one oval shaped tunnel on Plješevica mountain. There is possibility that installations may be functional even today.



Image 99.
Tunnel in form of inverted trapezoid.

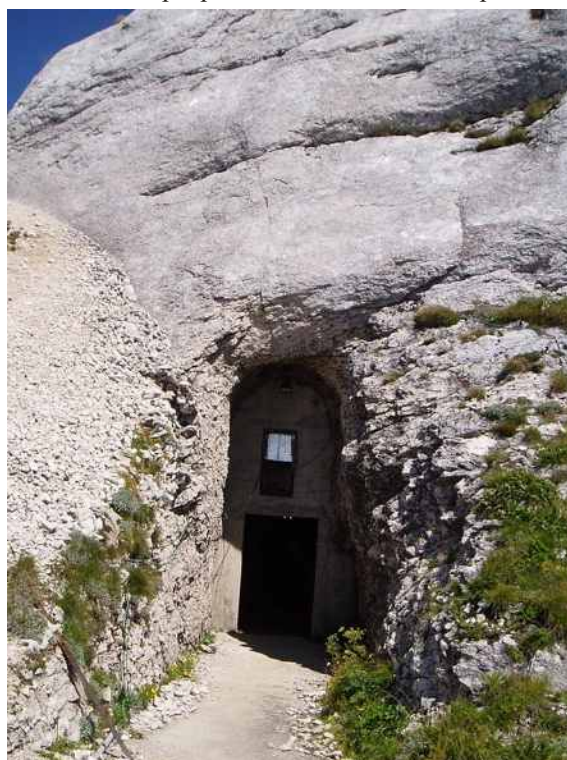


Image 98.
Hidden entrance to the underground tunnel from the south slope of Plješevica mountain, in the immediate vicinity of residential building, which is situated above.

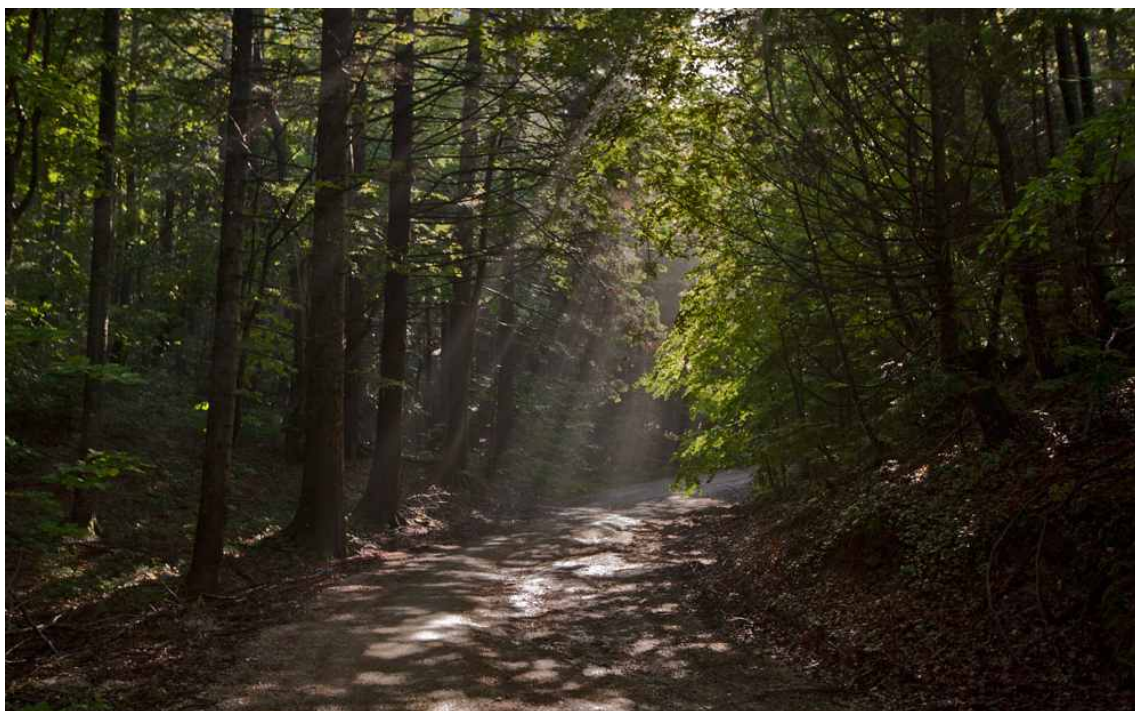


Image 100.

For Plješevica there is only one way road and it is carved into the rock of mountain Plješevica. On the main road between Plitvice and Korenica behind the motel Vinetu there is a turn in direction of the Plješevica forest. The road is bad, not maintained and true off-road for a jeep. It is needed up to 45 minutes until the radio station. A path leads through a forest full of beautiful and fragrant flowers and butterflies. (27)

Image was made in August 2011.

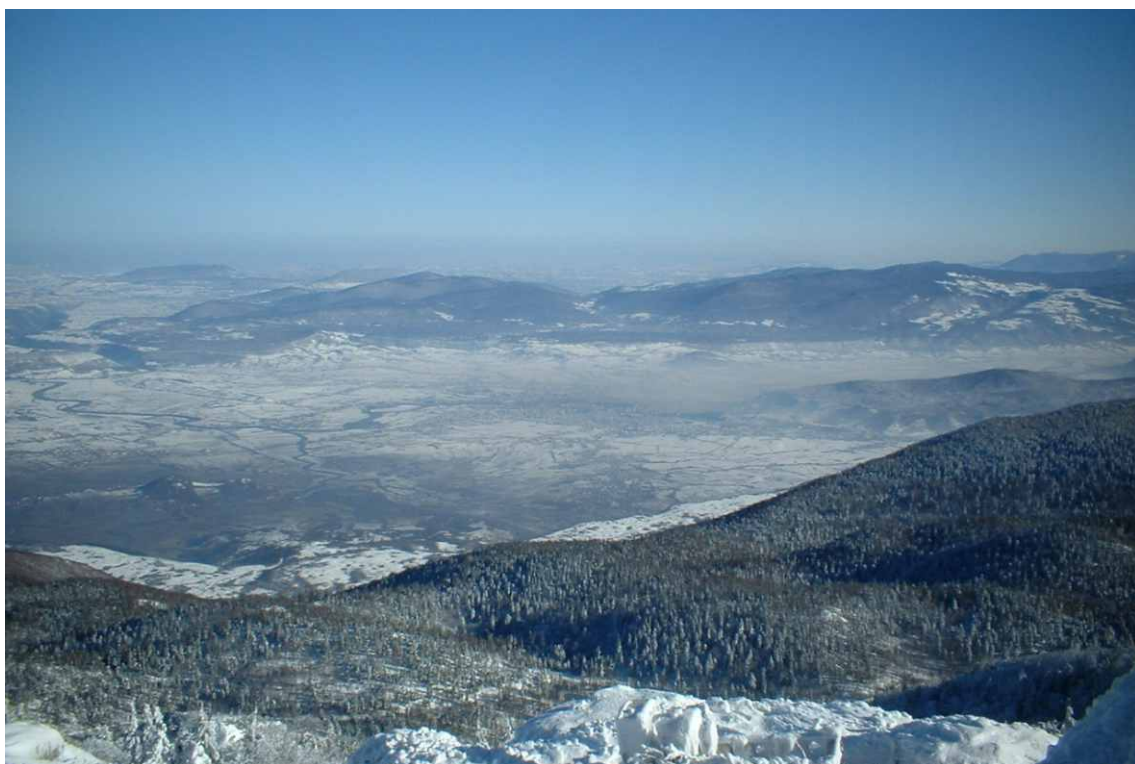


Image 101.

View from above is phenomenal, clouds fly next to and in front of you and air is so pure it feels as if it bites for lungs. And when wind blows man feels like a piece of paper. (28)

(27) Smolka, František

(28) Smolka, František

3. ECOLOGY AND THE AIRBASE BIHAĆ

Human behaviour in natural environment is not often imperceptible. We are witnessing how human tries to be superior of nature.

Bridges, massive constructions, tunnels of different length, underground facilities which goes deep into the ground, all of those are indeed monuments for human power over nature. What makes this sites so attractive to people is a feeling of power they get when they visit it.

Someone dared to change natural landscape, to interact with nature personally, to prove his power. But experiments can often go wrong, what can be seen today by witnessing many nuclear catastrophes and problems in disposing nuclear waste.

By releasing of toxic substances into the ground and underground water flows plants and living organisms in water as well as people who consume this water are directly affected. Minefield itself is dangerous for people as well for animals and many of them on Plješevica mountain are protected species. Ruined underground facility is a potential waste deposit place, which was witnessed on several occasions. Structure is statically questionable. Borderline is sometimes used for people trafficking.

How much is human responsible for his actions in nature?

Maybe these facilities should be left for nature to dispose them, but maybe not. There is a strong potential for this area to develop, but lack of will to realise it. There is also a huge interest from people all over the world for this landscape, who are visiting it on their own risk.

Bei der Gegenüberstellung von technischen Maßnahmen und Naturschutz handelt es sich also nicht um einen Gegensatz von Kultur und Natur, sondern um die Gegenüberstellung zweier Formen der Konstruktion. Sofern „Natur“ als das aus sich selbst heraus existierende definiert ist, kann und muss sie aber gerade nicht des Schutzes bedürfen. Die Naturschutzgebiete und Denkmalschutzzonen sind Produkte der Gegenwart; ihre Existenz verdankt sich einer aktuellen konservierenden Absicht, nicht aber dem Lauf der Dinge. (29)

Wars and conflicts always create so much space for debate about this type of facilities. Military facilities are known for their strong and functional structure and in this case it was built to sustain a nuclear attack. But the structure itself did not live to be nuclear attacked neither was used for war purposes. What else attracts to this landscape is that „hole” inside of the mountain, that empty space, and long system of tunnels left to be explored. Not often in the world this type of structures are allowed to be seen or visited. That is one more reason for interest in this place.

(29) Rolf Peter Sieferle, Rückblick auf die Natur, Eine Geschichte des Menschen und seiner Umwelt, Luchterhand Literaturverlag GmbH, München 1997, page 220

3.1 MINE FIELDS

Bosnia and Herzegovina is known by its mine fields. It is estimated that there are about 3 million mines that were not yet activated there. It has a lot land mines and explosive remnants of war. Most of those were formed during a division of The Socialist Federal Republic of Yugoslavia, and wars from 1991- 1995.

The mine contamination is generally low density. Mines were used extensively along confrontation lines, which moved frequently. The zone of separation between the two entities is 1,100 kilometres long and up to four kilometres wide.



Image 102.
Mine danger sign photographed in military barracks in Željava village.

Every month land mines kill or injure 30-35 people, 80% of them civilians. The presence of these deadly weapons is hindering reconstruction, severely reducing food production and diverting resources needed to rebuild society. So far, only a small percentage of mine-contaminated land has been cleared according to humanitarian standards. Most minefields remain unmarked. (30)

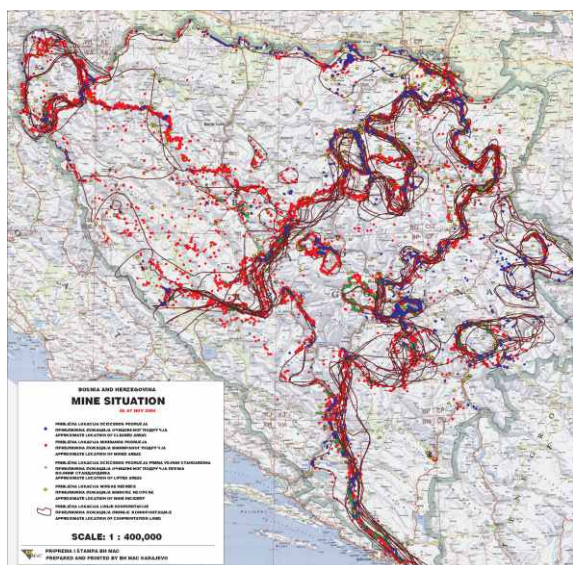


Image 103.
Minefields map of Bosnia and Herzegovina. Due to flooding which happened in May 2014 in Bosnia and Herzegovina and Serbia, some of these places have been moved, so it is more difficult to estimate precise position of these fields.



Image 104.
It is forbidden to enter, observe or photograph here. In order to do so special permission is needed and it can be obtained from border police.

(30) <http://listverse.com/2008/08/11/10-countries-with-the-most-landmines/>

3.2 POLYCHLORINATED BIPHENYL (PCB) POLLUTION

Polychlorinated biphenyls (PCBs) are a group of persistent organic pollutants known as POP. POPs are chemicals spread across the globe, which is long retained unchanged in the environment, absorbed in natural absorbers such as soil and sediment, or conifer needles and accumulated in the fat tissue of people and animals. PCBs are not naturally occurring in the environment.

Polychlorinated biphenyls (PCBs) were widely used as dielectric and coolant fluids, for example in transformers, capacitors, and electric motors. Due to PCBs' environmental toxicity and classification as a persistent organic pollutant, PCB production was banned by the United States Congress in 1979 and by the Stockholm Convention on Persistent Organic Pollutants in 2001. According to the U.S. Environmental Protection Agency (EPA), PCBs have been shown to cause cancer in animals, and there is also evidence that they can cause cancer in humans.

Individuals can be exposed to PCBs through breathing in contaminated air, consuming contaminated food, and by skin contact with old electrical equipment that contain PCBs. Once exposed, some PCBs may change to other chemicals inside the body. These chemicals or unchanged PCBs can be excreted in faeces or may remain in a person's body fat or other organs for months. PCBs may also collect in milk fat and be transmitted to infants through breast-feeding. (31)

In former Yugoslav countries PCB is only permitted in closed systems of old facilities until replaced.

Underground part of the airbase was badly damaged by the JNA, which destroyed it in 1992, some parts of the tunnels are in very bad shape, so they are in danger of complete collapse. The entire facility is contaminated with PCBs and therefore hazardous to health. Ionization smoke detectors, which were hundreds of them on tunnels ceilings, contain radioactive americium-241, which is easily absorbed by the lungs and can cause cancer and genetic damage in extreme cases. By destroying the airport great ecological damage was made. High concentrations of chemical compounds, polychlorinated biphenyls (PCBs), especially in the tunnel 1 where their concentration is 164 ppm (parts per million), are detected.

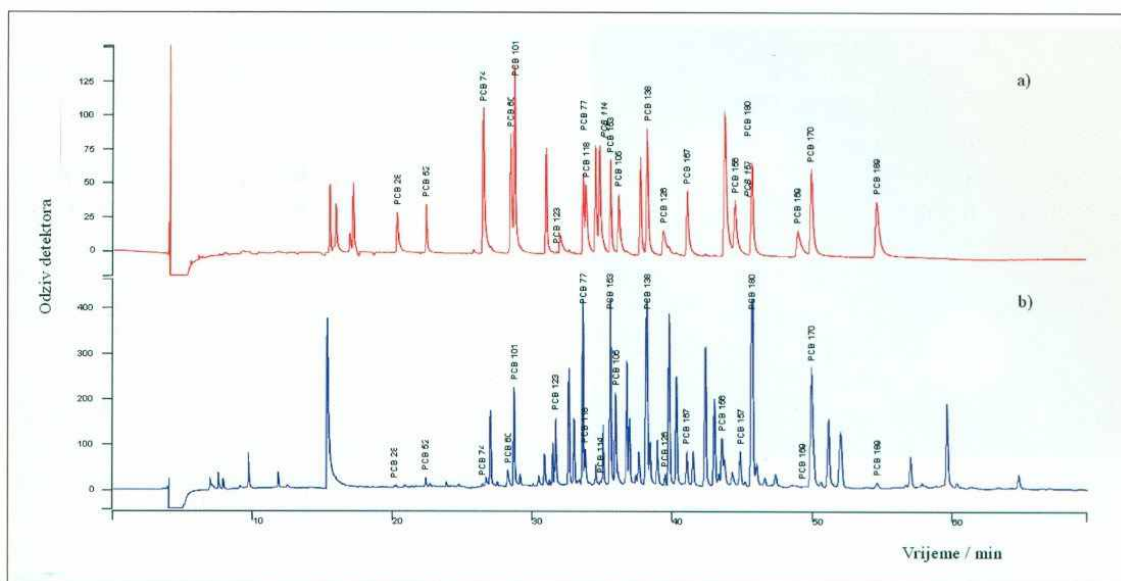
Analysis were done by Hrvoje Grgić in 2007 and 2008, Picer N. And collaborators 2005. Levels of global pollution are $0.0001 \text{ mg kg}^{-1}$. It follows that the concentrations of PCBs in Airbase Bihać soil samples are several million times higher than the global pollution.

Samples that were obtained by analysing pine needles are in the level of global pollution, that means that the highest contamination is related to the interior of the underground structure.

Soil samples of underground part of Airbase can lead to DNA damage, but that damage is limited to a small proportion of the total cell genome. Short contact with it would not leave a significant biological effect on genetic material of human. Possible adverse effects appeared to be after years of frequent exposure to soil samples, by inhaling dust particles that rise from the substrate in a closed minefields of underground airport. (32)

(31) http://en.wikipedia.org/wiki/Polychlorinated_biphenyl

(32) Speleolog, ISSN 0490- 4109, Zagreb, 2008, page 56



a) Kromatogram standarda 20 kongenera PCB-a (crveno), b) Kromatogram uzorka tla Željave (plavo)

Image 105.

Chromatogram of standard of 20 PCB congeners (red) and chromatogram of soil sample in airbase (blue)
When compared, these two graphic curves obviously show different values.

Analyses have shown that there are high PCB pollution there, but most of it is in underground tunnel „Object Klek”. PCB usually is found in dust particles, and when entering such object, floor should not be disturbed.

If one wants to visit the place it would be important to protect the respiratory system from dust because it is known for the existence of PCB compounds in tunnel. *Unknown is the fate of ionization smoke detectors, which were hundreds of them on tunnels ceilings. During normal use these are not dangerous, but if the casing breaks (which could be the case because of the explosions, or not if they were taken away before the explosion) the radioactive component of americium-241 could be released into air and easily absorbed by the lungs, causing cancer and genetic damage in extreme cases.* (33)



Image 106.

Because of pollution it is necessary to wear a mask and to have good equipment when entering such a facility. There is a lot of corrosion, humidity and moulds there, which should not be inhaled or disturbed.

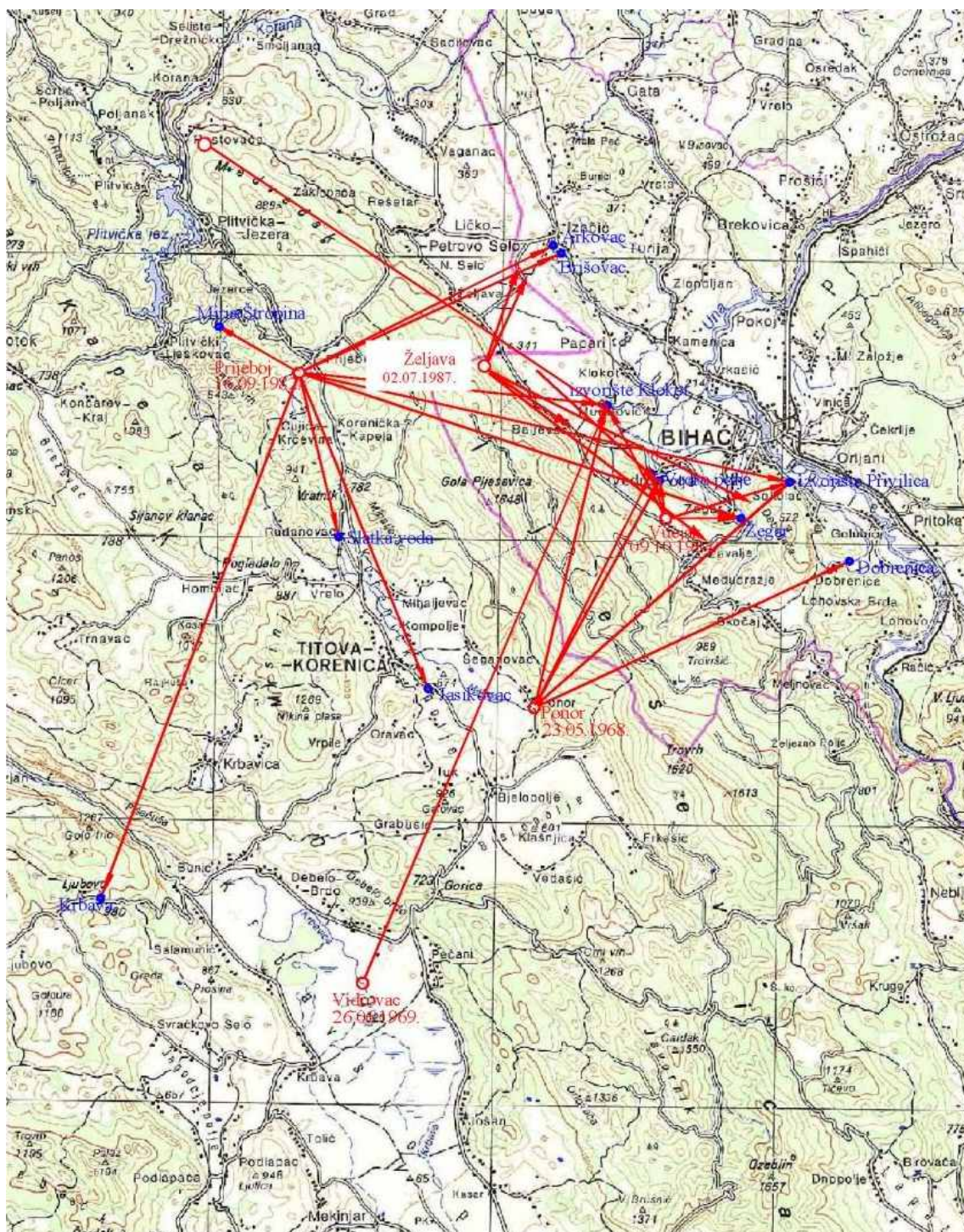


Image 107.

Map of underground water flows and sink holes in Lika and Bihać area, Croatia and Bosnia and Herzegovina. This map shows all underground flows, and because of karst terrain, there is a lot of them. That is good, because mountain flows are almost always the purest water. However because of kerosene and oil storages it is possible that it also comes in contact with water.

Some of these streams are connected with Plitvice and Korana river (Croatia) and some of them with Una river (Bosnia and Herzegovina).

4. POTENTIALS OF LOCATION

Potentials of former military facilities are rarely being recognised, and that is probably because they are bound with war circumstances, although, if in good condition, they represent one of the most powerful architecture and, above all, in the landscape, most influential, which gives a unique character to it. Questions which remain untouched are social, cultural, political, ecological as well as economical. Still the importance of these spaces and necessity for their regeneration should be indicated toward community.

Similar facilities, to these for military purpose, are industrial. Today, in world, there are so many attempts to regenerate industrial areas.

In Germany, for example, there are strong initiatives to do so. In particular is well known the regeneration of Emscher region.

Die Thematisierung Emscherraums als Landschaftspark stellte ein Novum innerhalb Internationaler Bauausstellung dar. Erstmals wurde der Zustand eines ganzen urbanen Landschaftsraumes in den Fokus genommen und nach neuen Formen der Landschaftsplanung und Landschaftsarchitektur gefragt... (34)

In diesem Zusammenhang entstanden auch neue Begriffe wie „Industrienatur“ und „Industrielandschaft“. (35)

Concerning with above mentioned formulations it would be correct to speak or write about „Militarised nature“ and „Military environmentalism“.

(34) Internationale Bauausstellung Emscher Park, Die Projekte 10 Jahre danach, Fachgebiet Städtebau, Stadtgestaltung und Bauleitplanung, Fakultät Raumplanung, TU Dortmund (Hrsg.), Klartext Verlag, Essen, 2008, page 8

(35) Internationale Bauausstellung Emscher Park, Die Projekte 10 Jahre danach, Fachgebiet Städtebau, Stadtgestaltung und Bauleitplanung, Fakultät Raumplanung, TU Dortmund (Hrsg.), Klartext Verlag, Essen, 2008, page 9

4.1 PLJEŠEVICA MOUNTAIN

Configuration of mountain Plješevica, gave a good possibility for defence of underground structure and other ground facilities.

Plješevica (also referred as Lička Plješivica or Plješivica), 44° 47' N, 15° 45' E, is a mountain, today situated in Croatia, at the border with Bosnia and Herzegovina. Plješevica is located in east part of Lika, in Lika-Senj and Zadar county and partially west Bosanska Krajina, Una-Sana Canton. It belongs to a Dinaric system. It is built out of a limestone and has a Paleozoic core. Highest peaks are Ozeblin (1,657 m) in the central part of the mountain, Gola Plješevica (1,649 m) located in the northern part, Plješevički Kamen (1,616 m), in the north-central region and Kremen (1.591 m).

It stretches in the direction north west–east south, from Plitvice Lakes National Park along the Krbava field to the west and the Una River canyon to the east, and ending near Gračac where it touches on Velebit. At the base of Plješevica mountain there are karst fields: Krbavsko, Podlapačko and Koreničko.

The greater part of its surface, on the northern and middle part, is covered by dense forest, although the mountain's name suggests nakedness (Plješa = bald, plješiv - who is bald; which has no trees, no vegetation). In the south grassy pastures prevail. This mountain is a home for some endemic species, such as Crveni jaglac (lat. Primula portenschlagiana), Plješevica's klinčac (lat. Dianthus monanthos) and others. In animal world bears, wolves, martens and deer stand out. (36)

In the 16th century name of Plješevica was „The Devil's Garden” (37). During the Austro-Hungarian wars with the Turks Plješevica had played an important role as a natural barrier against Turkish conquests.

In year 1902, an expedition to south Croatia under Josef Schiller, an Austrian phycologist and hydrobiologist was taken. There the flora of the Plješevica mountain was carefully described. (A5)

Die ruhige, harmonische, gleichgewichtige und ursprüngliche Natur wird Störungen ausgesetzt, welche von einer bewegten, expansiven und bedrohlichen Kultur ausgehen. In Begriffen wie Naturschutz, Umweltschutz oder Landschaftsschutz wird dieser Gegensatz am deutlichsten: Es soll etwas geschützt werden, da es bedroht, aber erhaltenswert ist. (38)



Image 108.
Beautiful Plješevica mountain and its rich floral variety.

(36) [http://sr.wikipedia.org/wiki/%D0%9F%D1%99%D0%B5%D1%88%D0%B5%D0%B2%D0%B8%D1%86%D0%B0_\(%D0%9B%D0%B8%D0%BA%D0%B0\)](http://sr.wikipedia.org/wiki/%D0%9F%D1%99%D0%B5%D1%88%D0%B5%D0%B2%D0%B8%D1%86%D0%B0_(%D0%9B%D0%B8%D0%BA%D0%B0))

(37) http://hr.wikipedia.org/wiki/Li%C4%8Dka_Plje%C5%A1ivica

(38) Rolf Peter Sieferle, Rückblick auf die Natur, Eine Geschichte des Menschen und seiner Umwelt, Luchterhand Literaturverlag GmbH, München 1997, page 24

4.2 PLITVICE LAKES NATIONAL PARK

Plitvice Lakes National Park is the oldest national park in Southeast Europe and the largest national park in Croatia. It was founded in 1949 and is situated in the mountainous karst area of central Croatia, at the border to Bosnia and Herzegovina close to the air base Bihać. It is a protected area which extends over 296.85 square kilometres.

In 1979, Plitvice Lakes National Park was added to the UNESCO (United Nations Educational, Scientific and Cultural Organization) World Heritage register among the first natural sites worldwide. Each year, more than a million tourists come to visit this place and enjoy its beauty.

Plitvice Lakes consist of 16 interconnected lakes between Mala Kapela and Plješevica mountain. Lakes are divided into the upper (Prošćansko, Ciginovac, Okrugljak, Batinovac, Veliko jezero, Malo jezero, Vir, Galovac, Milino jezero, Jezerce, Burgeti and Kozjak) and lower lakes (Milinovac, Gavanovac, Kaluđerovac and Novakovića Brod). The highest is Prošćansko jezero (639 m), and the lowest Novakovića Brod (503 m).

Lakes are arranged in cascades which is a result of the confluence of several small rivers and subterranean karst rivers. The lakes are all interconnected and follow the water flow. They are separated by natural dams of travertine, which is deposited by the action of moss, algae, and bacteria. The particularly sensitive travertine barriers are the result of an interplay between water, air and plants.

The sixteen lakes are separated into an upper and lower cluster formed by runoff from the mountains, descending from an altitude of 636 to 503 m over a distance of some 8 km. South-north oriented, the lakes themselves cover an area of about 2 square kilometres, with the water exiting from the lowest lake forming the Korana River.

The lakes are recognizable for their colours, ranging from azure to green, grey or blue. Change in colour depends on the quantity of minerals and organisms in the water and the angle of sunlight.

Through different climatic influences and the large difference in elevation within the protected area, a multifaceted flora and fauna has been created. National park area is home to many endemic species.

Name Plitvice was first mentioned in a written document in 1777 by Dominik Vukasović, the priest of Otočac. This name was designated due to natural phenomena that have created the lakes. Nature formed shallow basins (Croatian *pličina* or *plitvak*, *plitko* means shallow), which have been filled with water. For centuries, water has changed the limestone and thus the landscape of this area. The emerging travertine barriers decelerated and retained the flowing water. The height of these dams is continuously growing.

River Plitvica flows into the Plitvice Lakes at the lower and final part of the lakes.

The two largest lakes, Prošćansko jezero and Kozjak, cover about 80 percent of the overall lakes area. These lakes are also the deepest, with a depth of 37 and 47 metres respectively. None of the other lakes in the park exceeds 25 metres in depth. The altitude drop from the first lake to the last is 133 metres.



Image 109.
Plitvice lakes

The highest waterfalls are the Large Waterfall (croat. Veliki slap) at the end of the Lower Lakes, over which the Plitvica river falls, and Galovački buk at the Upper Lakes. Within the national park area there are 19 small settlements. Altogether they form the Plitvice Lakes municipality with the seat located in Korenica.

Moderate mountainous climate prevails at the Plitvice Lakes. These climatic conditions prevail due to the Velebit mountain range, which acts as a climatic separator between the coastal region and the Lika high plateau.

The Plitvice Lakes are surrounded by various mountains. The western side of the national park area is enclosed by the Mala Kapela mountain, while the eastern side is enclosed by the Plješevica mountain, which also represents the border to Bosnia and Hercegovina.

Mountain slopes serve as water reservoirs. They are also a refuge for many animal species.

National Park is underlain by karstic rock, mainly dolomite and limestone with many lakes and caves.

Caves that can be visited are Golubnjača Cave (145 m) before the second Korana waterfall and Šupljara Cave (68 m) above Lake Kaluđerovac.

The underground configuration of the Plitvice Lakes consists of various geologic features. Whole area of Plitvice Lakes National Park can be attributed to the South-East European karst area. The typical feature of this karst area is brittle or porous rock, mostly limestone or dolomite. This configuration creates different geomorphological phenomena being referred to as dolina (sink hole).

At first sight, a lack of water in the karst region could be ascertained. However, this is only the case on the surface because major part of natural phenomena takes place underground, where water flows exists.

Due to the features of limestone, many rivers drain away into the rock. Therefore, extensive underground river systems exist. Upon reaching hard rock, rivers emerge on the surface. This phenomenon of underground karst rivers can also be observed at the Plitvice Lakes.

Tufa sediments have been formed from the Pleistocene onwards in sinkholes or depressed areas between the surrounding mountains. Generally seen, the underground of the Plitvice Lakes could be categorized into two zones. The Upper Lakes in the south predominantly consist of dolomite rock. The Lower lakes in the north predominantly consist of limestone rock.

A distinctive feature of the Plitvice lakes is the fact that they do not represent separated, stationary waters. The lakes altogether have always been seen as one composed system of lakes. On the one hand, chalk tufa is being washed away partly. On the other hand, new sediments are continuously being formed. Thus, new waterfalls are being formed while others run dry. Nature itself is continuously adapting to these new conditions.

The sedimentation of chalk and the formation of tufa happens dynamically all along the watercourse and in various forms (fluvatile sedimentation). It is thus not a phenomenon occurring at only single place.

The area of a river, in which the formation of tufa occurs, is called precipitation area. Tufa formation processes thus surpass erosion activities, which would destroy the sensitive barriers of the lakes. It is estimated that the tufa sedimentations at the ground of the lakes date back 6,000 or even 7,000 years.

Water purity is the decisive factor for tufa formation. The water at the influx to the Plitvice Lakes is noted pure from an analytical point of view.

Mosses, algae and water plants play a major role in forming the unique landscape of the Plitvice Lakes and its tufa barriers. Up until the 21. century, it was supposed that plants extract carbon dioxide from the water for photosynthesis purposes and that in return oxygen is being released, thus resulting in the sedimentation of hydrogen carbonate (phytogenesis).

The water masses of the Plitvice Lakes and the river Plitvice form the Korana river.

The water of Plitvice lakes is mineralized, super-saturated with calcium and magnesium-hydrogencarbonate.

Although vegetation is not primarily responsible for the extraction of carbonate from the flowing water, plants indirectly contribute to tufa formation. Pivotal for the sedimentation is the deceleration, aeration and spraying of the water.

Depending on various species, various biological types of travertine can be differentiated.

Photosynthesis activities of algae and mosses in conjunction with the water, however, foster the crystallization of sediments due to the extraction of carbon dioxide. These effects are fostered by millions of microscopically-small bacteria and algae that grow on such plants. They are secreting mucus that is adhered to by the first microcrystals of calcite. The most significant plants of this kind are mosses of the species *bryum* and *cratoneuron*.

The mosses foster not only the creation of tufa barriers but they also become part of the barrier. The moss gets encrusted with travertine and fresh moss grows further out. First a crag is formed but later a cave roof forms under the crag. If the water continues flowing, the cave becomes progressively bigger. Older travertine is filled with fossilized algae and mosses. This type of tufa rock typical of the Plitvice Lakes is called „phytogeneous tufa”.

During the 20th Century, uncontrolled tourism and water pollution caused by waste water from the hotels or agricultural activities in the surroundings of the lakes have left detrimental traces. This has led to an increasing eutrophication of the lakes (increased concentrations of organic substances within the water). For the sustainable formation of tufa any harmful human influence is strictly forbidden and therefore also to bath or swim in lakes.

Bees, dragonflies and various species of insects gather in lush meadows.

At the Plitvice Lakes, various rare species, such as brown bear, wolf, eagle, owl, lynx, wild cat, and capercaillie can be found there, along with many more common species continue to exist. This is a rare case worldwide.

The Plitvice Lakes national park is heavily forested, mainly with beech, spruce, and fir trees, and features a mixture of Alpine and Mediterranean vegetation. It has a notably wide variety of plant communities, and some of them are endemic species as well as protected.

Scientists have so far listed 1,267 different plants out of 109 species that can be found within the area of the national park. There are 75 plants which are endemic, what means that they have first been defined and classified in this area of the world or not far from it. A great number of these plants and species is protected by law. Within the national park area 55 different species of orchids can be found.

Examples of endemic plants to be found in the national park are:

Edraianthus tenuifolius, *Ranunculus scutatus*, a sort of *Ranunculus*, *Scilla litardierei*

Examples of other rare plants: *Cypripedium calceolus*, *Ligularia sibirica*, *Pinguicula vulgaris*, *Telekia speciosa*, *Daphne laureola*

Furthermore, 12 amphibian species, as well as some species of reptiles have been ascertained so far: *viviparous lizard (Lacerta vivipara)*, *the european green lizard (Lacerta viridis)*, *the dice snake (Natrix tessellata)*, *Vipera berus*, *Vipera ammodytes* and *the european pond turtle (Emys orbicularis)*.

Up to now, 157 bird species have been counted. The Plitvice Lakes are also home to many kinds of bats. Recent findings list about 20 different kinds of bat species, among them the rare species of *Plecotus*.

So far, the exact origins of the different fish species have not been entirely identified. As original species the brown trout (*Salmo trutta fario* and *Salmo trutta lacustris*) can be named. *Salmo trutta fario* prevails at the Upper Lakes, while *Salmo trutta lacustris* predominantly exists within Lake Kozjak. These species developed under different life conditions independently from each other within the various lakes.

Lynx (*Lynx lynx*), Brown bear (*Ursus arctos*), Wolf (*Canis lupus*), Eurasian Eagle-owl (*Bubo bubo*), European Polecat (*Mustela putorius*), Golden Eagle (*Aquila chrysaetos*), Alpine Newt (*Triturus alpestris*), White-throated Dipper (*Cinclus cinclus*), European pond turtle (*Emys orbicularis*)

The region once also used to be called the garden of the devil (*hortus diabolus*). The area then formed part of Banovina of Croatia within the Kingdom of Yugoslavia and then part of the Socialist Republic of Croatia within the Socialist Yugoslavia. Today, it is part of the Republic of Croatia.

For the visit of Crown Princess Stéphanie of Belgium, the wife of Crown Prince Rudolf of Austria in 1888, the Plitvice Lakes and their surroundings were arranged for tourist purposes for the first time in history. Two paths still bear the names of the daughters of the Emperor Franz Joseph: "Stephanie's Path" and "Dorothea's Path".

On April 8, 1949, the Plitvice Lakes were declared a national park area and rigorous nature protection measures were established.

During the 1960s, a modern road connection to the Plitvice Lakes was constructed, which led to increasing traffic volumes.

Between 1962 and 1968, many Western film productions of Karl May novels have been shot at the Plitvice Lakes (mainly German-French-Yugoslav cooperations). The most successful film of this series, *The Treasure of Silver Lake* was also produced at some locations within the national park. (Lake Kaluderovac served as scenery for the Silver Lake.

During the 1980s, tourism was booming in Yugoslavia. Plitvice Lakes National Park soon became one of Yugoslavia's most popular tourist attractions.

During the war from 1991 until 1995, many buildings in the national park were destroyed or burnt down. Due to the apparent risk of mines, the park was even put on the UNESCO List of World Heritage in Danger during the war years.

After the war, the Plitvice Lakes were among the first areas to be cleared of mines and renovated.

In 1998, the national park was removed from the List of World Heritage in Danger. In 2000, the national park was expanded by a further 102 square kilometres in order to protect the underground tributary streams.

Within the national park continuous scientific research projects are being carried out. The national park administration currently endeavours to introduce new, progressive protection measures.

It is even hard to believe that Plitvice lakes are in closest proximity to former Airbase Bihać, and that is needed less than 45 minutes to visit both places.

The region of Lika is well known for its low wooden houses with roofs made of straw or shingles. Many features of the ancient living style are still there in local costumes. They tell a lot about life and regional affiliations as well as social standard of those who have worn these costumes and they help in preservation of the unique identity of tourist resort.

All these factors together have combined one unique nature resort for animals and plants as well as for people.



Image 110.
Protected brown bear bathing in Plitvice lakes

4.3 CITY AND MUNICIPALITY OF BIHAĆ

Bihać is a city and municipality on the river Una in the north-western part of Bosnia and Herzegovina, in the Bosanska Krajina region. Bihać is located in the Una-Sana Canton in the Federation of Bosnia and Herzegovina and it is in the immediate vicinity of former military Airbase Bihać. It is one of the oldest cities in Bosnia and Herzegovina with long history.

In the 8th century B.C. the area of Bihać was populated by the tribe of Iapydes (Japodes). Later, during the 2nd century B.C. this area was populated by Romans. In the 6th century this area was populated by Slavs, an Indo-European group of people.



Pečat grada Bihaća iz XIV stoljeća

Image 111.

Stamp of Bihać from 14th century

The name of Bihać was first mentioned in year 1260 in a document of King Béla IV. Bihać became free city in 1262. Once it was the temporary capital of the Croatian Kingdom. It lost its civic status in the 14th century following dynastic struggles in the kingdom, and became a property of the Frankopan nobles. In the 16th century it passed under royal rule, when battles with the Ottoman Empire had begun. Since then Bihać was first under Ottoman Empire, and later under Austria-Hungarian Empire. In 1918 Bihać became part of State of Slovenes, Croats and Serbs, Kingdom of Yugoslavia until 1944, from 1945 until 1992 the Socialist Federal Republic of Yugoslavia. Today city and municipality of Bihać is a part of Bosnia and Herzegovina, Federation of Bosnia and Herzegovina.

A period of peace followed, marked by the 1888 bringing down of the fortress walls that separated the inner city from the outer world. The new government had several schools and civic facilities built, which boosted the city's growth. It remained prosperous after the establishment of Yugoslavia as a centre of western Bosnian region.

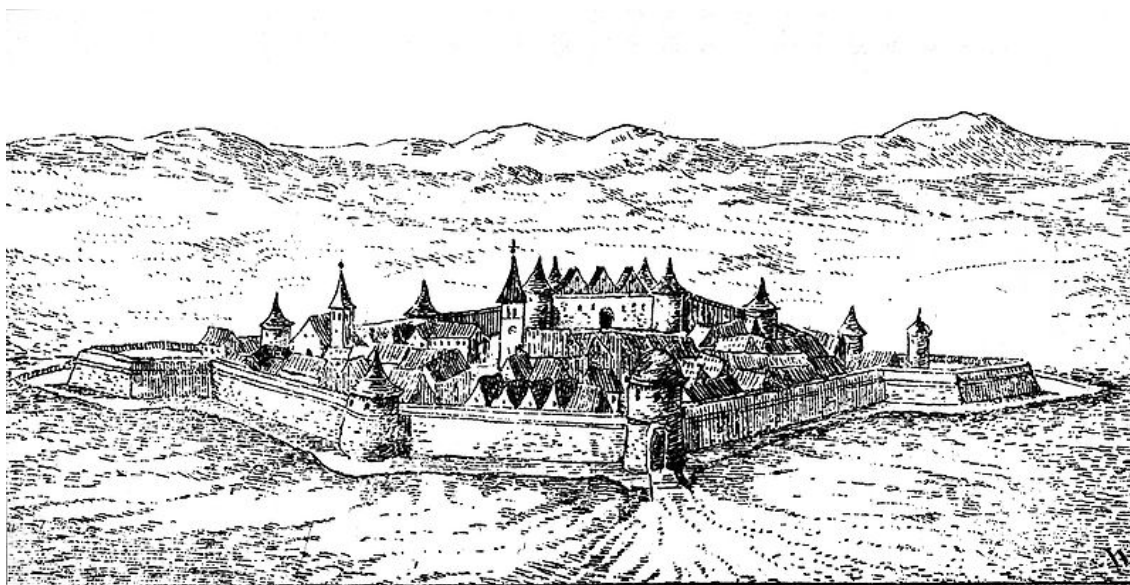


Image 112.

Bihać, approximately 1590.

One of the most attractive places for tourist to visit in Bihać for sure is the Historic building of the Captain's tower which is designated as a National Monument of Bosnia and Herzegovina. It is situated in the lower part of the town of Bihać, on the left bank of the river Una, within the former city walls.

In mediaeval times the town had a fortress and two monasteries, one Dominican and one Franciscan, several churches, a large number of commercial and residential buildings, and several defence towers.

In the 16th century Bihać and its surrounding fortified towns became part of the so-called Military Frontier consisting of a defensive zone fortified against the increasingly frequent incursions by Ottoman troops.

For long period of time, after Bihać spread beyond its walls and became an urban center, Captain's Tower was used as prison until 1959 when it was adopted and turned into Museum, where many artifacts from Illyrian and Roman period can be seen today.

Today Bihać is a mid-size city with close economic ties to Croatia. Much of Bihać's present day economy is based on tourism to the Una river and its beautiful surroundings. Beside the service sector, Bihać also has a varied agricultural sector thanks to the fertile fields around the city.

Border crossings with Croatia are located nearby, in Izačić village, and Ripac village to the south of Bihać.



Image 113.
Historic building of the Captain's tower

4.4 UNA RIVER IN BIHAĆ

Una River, one of the most beautiful and cleanest rivers in Europe runs through the area of Bihać. Name „Una” was given by the Romans referring to it as a "Queen of the rivers", and name itself meant „One" as in „one and only” (lat. una- one, unique).

The river has a total length of 212 km and belongs to both countries- Croatia as well as Bosnia and Herzegovina.

Una River makes numerous waterfalls on its course, containing several slopes, of which the highest one is 25 meter high.



Image 114.

Una waterfalls are attractive for sports activities.

The city and the region are a viable tourist destination because its natural beauty.

Una river valley, where Bihać is situated in, provides the shortest route from Zagreb to Dalmatia so the traffic position is also favourable. Bihać 's summer theatrical event, rafting and regatta are held yearly on Una.

By this river grow more than 170 types of medicinal herbs as well as a rare plant called *Campanula unensis*, the "Una bluebell". This river is also home for more than 28 kinds of fish.

It can be seen now how many natural variety this area has and why is important to retain, improve and protect this whole site.

4.5 AERO CLUB "BIHAĆ"

Air Club "Bihać" was founded on 26th February 1953, although aviation activities started earlier. The intention of the founders was to involve young people in aviation sports such as modelling, gliding, motorized flying, parachuting, hang-gliding and flying UL.

In addition to the sporting aspect, aviation activities in Bihać are important tourist attraction, because the airport is situated in attractive surroundings of the Una river and the mountains Grmeč and Plješevica. Airport is arranged for the reception of general aviation aircraft as well as gliding aircraft. There is parachute circle hangar arranged to accommodate aeroplanes and gliders, airport building and storage tank with equipment for dispensing aviation gasoline.

It is possible to announce and provide all flights, including flights of international aeroplanes up to 5,300 kg. Because it is situated in a valley, surrounded by high mountains, especially mountain Plješevica, it enables all seasons long flying with gliders and paragliding using thermals, especially wave sailing over long and steep slopes.

Air Club "Bihać" won a large number of gold and diamond sailing badges as well as a record in altitude flight for over 8900 meters, which is attained above Bihać in 1959 by sailor Marijan Malčević from Zagreb.

Today in Bihać there are technical as well as all other necessary conditions for sailing a routine flight at high altitude. This region is known by the Air Club "Bihać" who intends to develop its own airport and technical equipment as well as modern and contemporary range of aviation activities.

In this region there is a strong potentials and forcing of air activities. Therefore former airbase Bihać with its runways could become an attractive place for tourist and visitors from all over the world, because those runways are also able to accommodate a large cargo or standard passenger aeroplane.



Image 115.
AeroKlub Bihać



Image 116.
AeroKlub Bihać

4.6 AEROSEUM SWEDEN

Yugoslav underground airbase Bihać and Slatina in Kosovo were built in the similar way as those in Sweden.

Thinking of appropriate solution for a devastated underground military base, one comes to mind to renovate it and use it as a museum. This is exactly what has happened in Sweden. The site, next to Göteborg City airport where the Sweden air force bunkers were located, is today a part of the national cultural heritage and it is pending a cultural memorial status.

Since the spring of 1999, the Aerozeum Foundation has been committed to preserving the Swedish Royal Air Force bunkers located at Säve Depot, next to Göteborg City airport. As part of 'Göteborg – city of events' a centre for experiencing living aviation will come to life – Aerozeum.

The site consists of two rock shelters, one measuring 8,000 square metres and one of 22,000 square meters. The larger, home of the Aerozeum, was built in the early 1950s is nearly 30 metres below ground. Both were built as protective hangars for the contemporary Göta Wing (F 9) of the Royal Swedish Air Force. As the site is part of the national cultural heritage it is pending a cultural memorial status.

All the central and local authorities affected have been briefed on the activities planned. The Swedish Defence Ministry is positive to Aerozeum and handed over the greater hangar on January 1st, 2003, and contribute with a one-of payment.

Since January 1, 2008, Aerozeum is part of a national network called Swedish Military Heritage. This means that the National Defence Museum gives economical and other support.

This cultural site will show the history and development of aviation from Icarus to contemporary fixed and rotary wing flight, civilian and military, Swedish and international.



Image 117. The first rock shelter at Royal Göta Air Wing, F 9 Säve, was completed in 1942. It is one of the world's oldest of its kind. The picture from 1943 shows the Italian-built fighter Fiat CR 42.



Image 118. The nuclear threat of the Cold War forced the new and much bigger hangar even deeper under the surface. Picture was taken in 1958, three years after completion of the hangar.

Aeroseum aims to provide a centre for experiencing flying, so that visitor can enjoy the atmosphere and feel of aircraft with all senses.

Also a freedom of interaction is given to the visitors. They may see the exhibits, build, help restore, take virtual flights or an actual flight in classic planes and helicopters. In the natural environment above the bunker a flight-themed knowledge park should be constructed.

Everything should be exhibited in order to stimulate curiosity and encourage experimentation in particular is important to awake children's interest in Technology and the Natural Sciences and this is a place where they can study how theory is translated into practice.

Corporations, authorities and societies can entertain customers, employees or members with a variety of activities. Aeroseum will offer memorable experiences not previously accessible to the public, among other things, flights in classic aeroplanes and helicopters.



Image 119.
Entrance to the museum



Image 120.
Viggen fighter inside the underground hangar as an exhibition artefact.

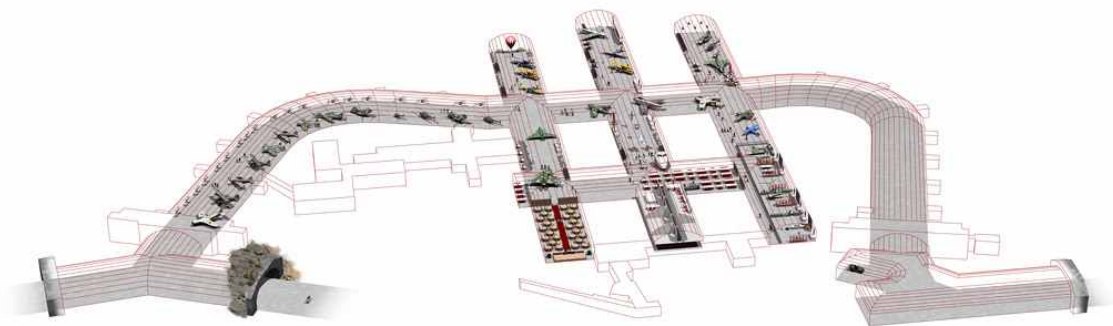


Image 121.
Illustration of the rock hangar with current and planned exhibitions

The former military facility is known for its 22 000 square meter hardened aircraft shelter (HAS). This shelter was built in the early 1950s to protect combat aircraft from the Göta Wing (F9) of the Royal Swedish Air Force.

Entire underground complex had tunnels, command and control rooms, storage and other operational areas. The underground facility required substantial infrastructure to operate and to allow personnel to live inside for extended period of time in case of war. This infrastructure included among others ventilation, air filtration, electrical, fuel, oil and gas storage, fire suppression, and water purification systems.

Swedish Defence Ministry declassified the base in 1999 and in 2008, the Aerozeum became part of the national historical preservation network of Swedish Military Heritage.

The F 9 S ve fighter wing was commissioned in 1940 and the first rock shelter at was completed in 1942 before Airbase Biha  was built. Therefore this should be among the world's oldest shelter of its kind, after Switzerland and Italy. It was initially used to protect Italian-built fighter Fiat CR 42 biplanes, among other aircraft. At the height of the Cold War in the 1950s, the base was greatly expanded with new, deeper and better protected tunnels, which were used for over ten years to house the SAAB J 29 "Tunnan" combat jets.

During the 1950s, the Swedish Air Force built multiple road bases to disperse their aircraft and increase survivability of squadrons. Sweden had one of the most powerful air forces in Western Europe, both numerically and qualitatively, and posed a serious challenge for potential attackers.

Sweden has operated other mountain shelters, such as F13 Norrk ping, F18 Tullinge, F16 Uppsala, F8 Barkarby, F llfors and Arboga, all of which were expanded to house Drakens (Swedish fighter aircraft) and/or Viggens (Swedish single-seat, single-engine, short-medium range combat aircraft).

5. DEVELOPMENT PLAN

It is necessary to analyse the immediate and further environment. There are no accurate estimation of the condition of facilities there. It is not perhaps necessary to write that in order to do precise estimation of whole area a team of different experts is needed. Since this is not a small area and not every aspect of it is reachable strong support in technical equipment is needed.

There are four main areas: former underground airbase „Object Klek”, runways, Željava - military barracks and radar station on mountain top. Radar station is not directly bound to the rest of area. It is reachable by helicopter or by car.

Thorough research of all facilities and surfaces and accurate determination of mined areas is extremely important.

In former underground airbase „Object Klek” it is necessary to accurately capture the underground facilities and estimate damage.

If the underground facility is damaged and potentially dangerous for users, due to mining, it is necessary to develop a plan for cleaning the facility and the possibility of using it for other purposes (warehouse, tunnels for growing mushrooms, etc.).

It is needed to make an accurate map of objects and draw a detailed plan for facilities, also to assess the damage caused by war and weather conditions. This should include possibility to renovate buildings (renovated buildings could serve in educational purposes, the formation of a university campus, which would be based on research in the field of ecology, and partly could be used in commercial purposes - hospitality and purposes of aero club- possibly already existing aero club Bihać).

Considering that the barracks provide installations, and no major damage to buildings has been made, except for one, which was completely destroyed, it is possible to work toward a redevelopment and regeneration of these facilities.

Runways were damaged at the edges to a smaller extent. With a small investment they could be completely revitalized and ready to use (e.g. for aero club purposes, or other small jets or cargo plains purposes). The runways have also the ability to host airliners so there is one more possibility to be considered. Though it is questionable how much would a building of an airport influence environment.

On mountain top the situation is different because of the rough climate there. It is cold and windy. Facilities are under influence of extreme weather conditions, other than that, objects there were not destroyed due to a human factor

With regard to these facilities it is needed to make a survey of the building and tunnels as well as plan for all of them with analyse of the damage. There is much potential here, because the matrix and installation net is already proposed, as well as road structure and accessibility. These objects could be used in educational but also in recreational purposes.

The peak „Gola” at the top of the mountain is 1649m high, so Plitvice and Bihać can be seen. The view from above is outstanding and great visibility all over the field accomplished.

Border between Bosnia and Herzegovina and Croatia represent an aggravating circumstance. This is important to consider because any form of free interaction between states at this point is illegal, and special permission is needed to visit this area. If there could be an agreement between the states, they both should benefit.

It is not desirable to make another area which would pollute or in any kind damage natural water flows, land and other living creatures. If there would be a cargo-airport, there is a possibility that this would do harm to all of those mentioned above, because of the use of fuel and oil.

Why not making it in place for art?

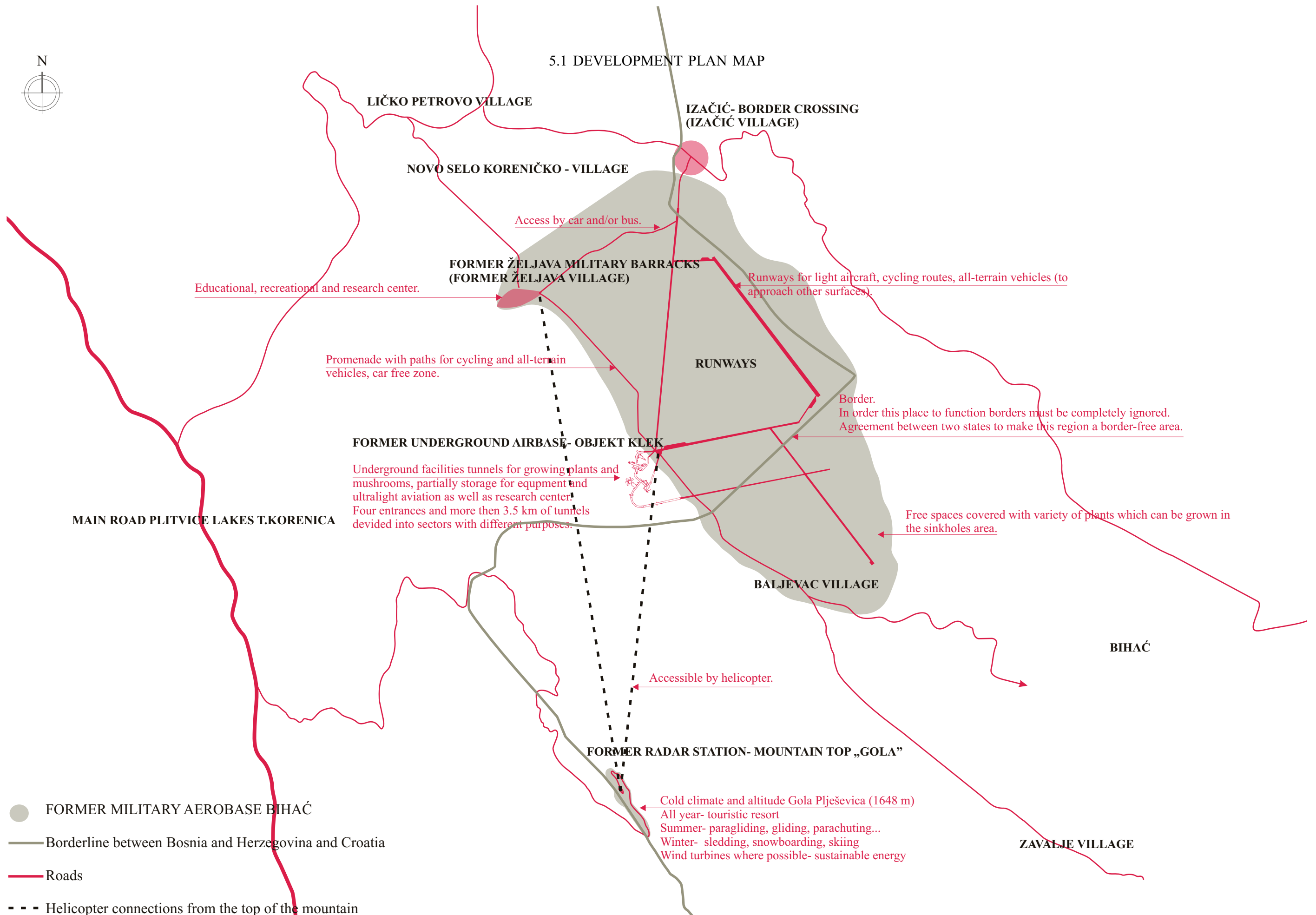
Die künstlerische Arbeit interpretiert, den Ort, den Raum und seine Historie neu. Sie gibt den Bewohnern die verlorene Landschaft visuell zurück und lässt die reale Landschaft als poetische und kritische Imagination wieder entstehen. (39)

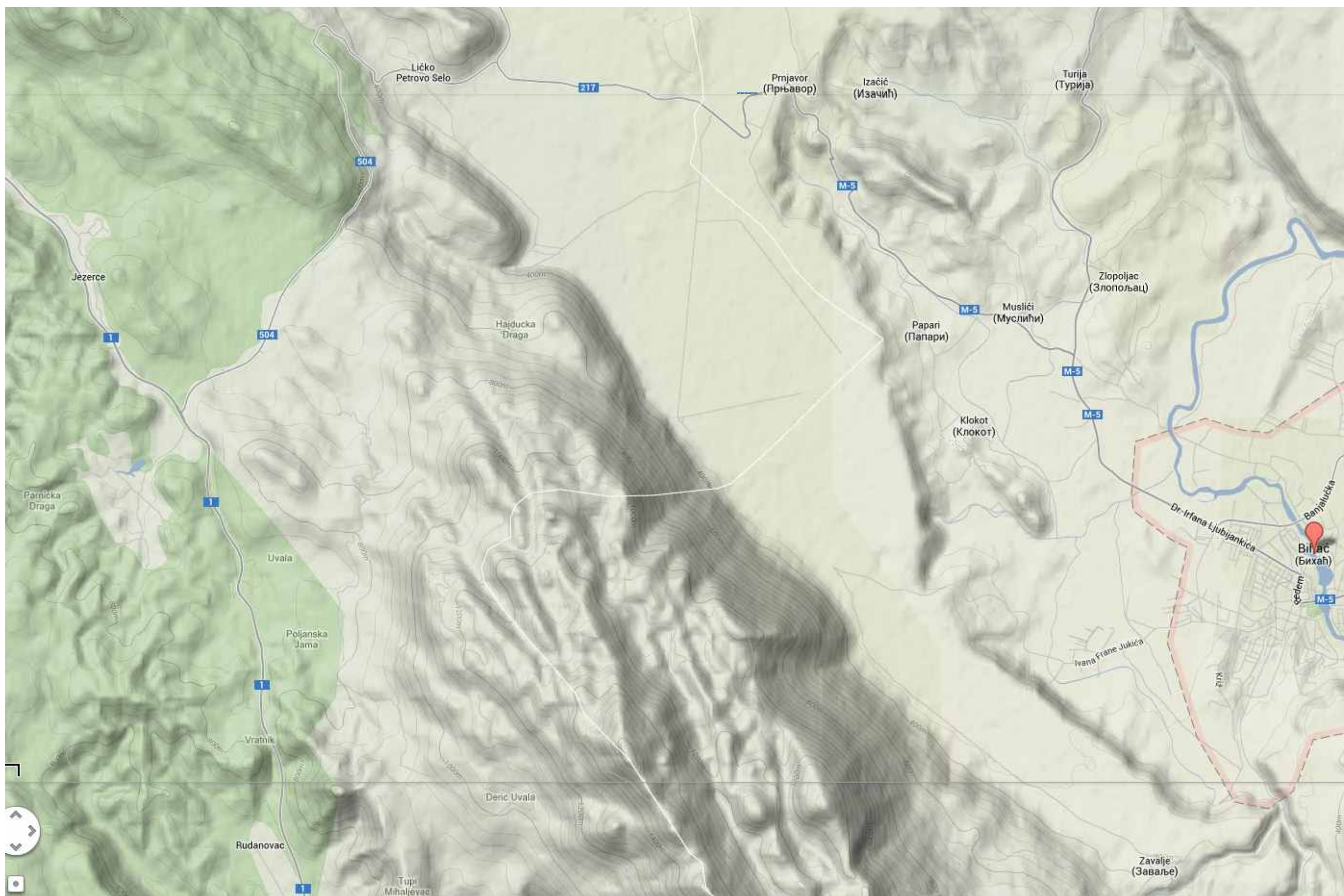
Since this is a unique location, with an enormous potential the best purpose would be educational, recreational and research with a possibility to use tunnels for growing plants and mushrooms and partially in other purposes for example as a storage for equipment. There is a strong potential to make this location into tourist resort with all fields necessary for sports activities. People from all over the world would be attracted to this location in order to explore underground facilities, to recreate themselves, to learn paragliding, gliding, parachuting, flying of lightweight, 1 or 2 seat fixed-wing aircraft- ultralight aviation, to explore nature nad learn about this particular and unique environment.

(39) Erich Raith, Lernen von Allentsteig, Konfrontationen mit einer anderen Stadt, Katharina Blaas- Pratscher, Ein Ort für Kunst, Springer-Verlag Wien New York, 2004, page 114

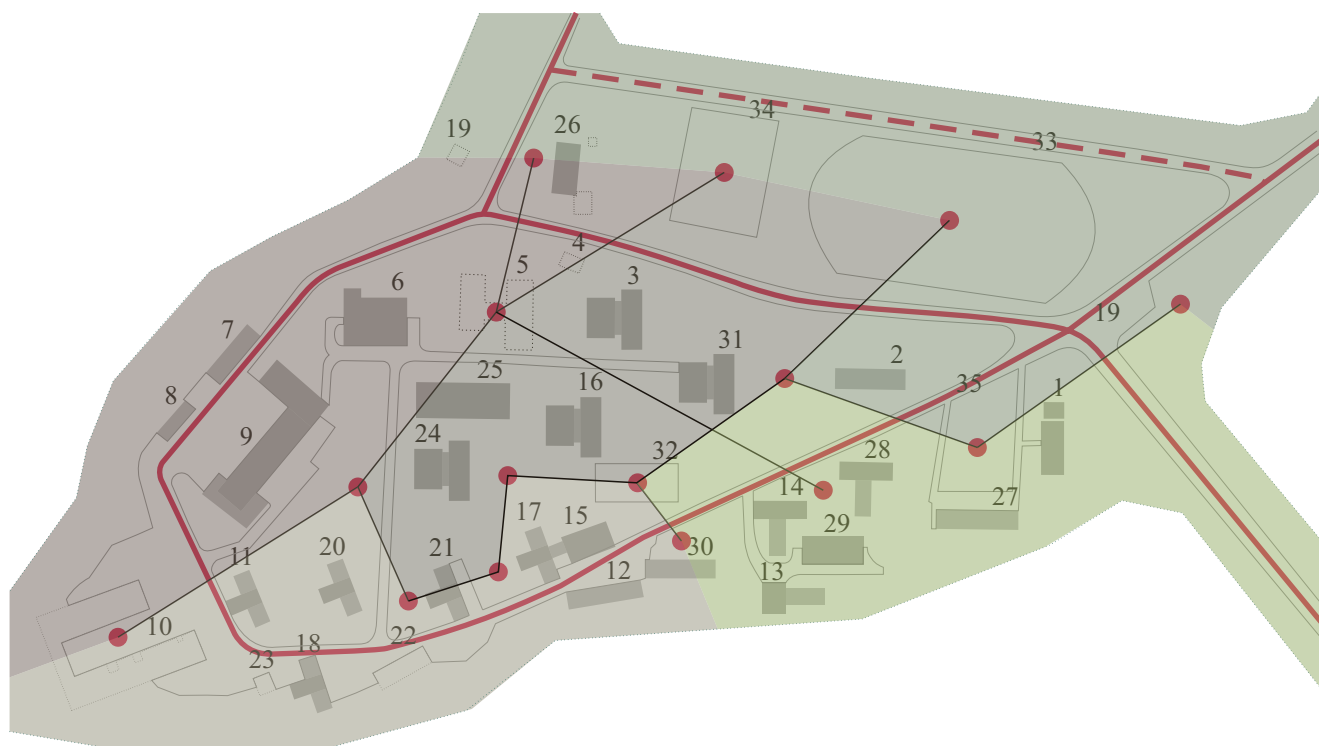


5.1 DEVELOPMENT PLAN MAP





5.2 DEVELOPMENT PLAN CONCEPT FOR FORMER MILITARY BARRACKS IN ŽELJAVA VILLAGE



In accordance with the theme of the work facilities are detained under the assumption that it is more cost-effective to renovate old buildings than to build new ones with new infrastructure.

Legend proposes new use of existing facilities in accordance with the idea that the former military barracks in Željava village become an educational, recreational and research centre. Functions and purposes of those buildings are distributed by grouping of similar facilities or those in immediate vicinity. Different areas intersect with each other and form more dynamic and good connected surfaces.

Legend:

● Proposed gathering places

— Connection line between gathering places, possible path line

--- Secondary road

— Primary road

■ Sport facilities, green surfaces, high and low vegetation

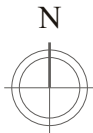
■ Administrative zone, educational buildings and auxiliary buildings (heating plant, infirmary etc.)

■ Library and dormitory buildings

■ Workshops, cinema and theatre building

■ Centre with parking garage, restaurant, gathering places, lake and an overlook

1. Administrative building;
2. Administrative building;
3. Dormitory building;
4. Proposal for new construction;
5. Proposal for demolition of the building because of the bad condition;
6. Restaurant and kitchen;
7. Storage for food and supplies;
8. Pumping stations for fuel;
9. Proposal for a parking garage (EG+3) for administrative centre and sport facilities;
10. Proposal for new construction, an overlook (EG+4), because the old one is in bad condition;
11. Greenhouse;
12. Workshop;
13. Heating plant;
14. Infirmary;
15. Cinema and theatre;
16. Dormitory building;
17. Cinema and theatre;
18. Accumulator station;
19. Entrance, proposal for demolition of the building because of the bad condition;
20. Greenhouse;
21. Greenhouse;
22. Proposal for demolition of the building because of the bad condition;
23. Proposal for demolition of the building because of the bad condition;
24. Dormitory building;
25. Library;
26. Sport hall;
27. Educational building;
28. Educational building;
29. Central heating room and storage of coal;
30. Educational building;
31. Dormitory building;
32. Playground
33. Football field;
34. Handball and basketball playground;
35. Access road through the barracks.



5.2.1 DEVELOPMENT PLAN CONCEPT SITE PLAN



0m 20m 40m

Cycling routes

Site plan



South view

5.2.2 DEVELOPMENT PLAN CONCEPT MODEL



South- west view



East view



South- east view

5.3 IDEAS FOR FURTHER DEVELOPMENT OF OTHER FACILITIES



Tunnels for growing mushrooms.



Recreational and sport activities such as parachuting could take place.



Mountain biking and walks in Plješevica forest.



Tunnels on mountain Plješevica as well as other facilities there could be used for creative artistic purposes.

CONCLUSION

Militarized landscape at the border between Bosnia And Herzegovina- Croatia, Former military Airbase Bihać is a theme which is written in purpose of understanding the way military facilities functions and what role they have in human environment after destruction and abandonment. It is written to bring a term *military environmentalism* closer to awareness of human and architects as well as urban planners.

There is one particular military area used as an example of how chaotic and complicated war circumstances in relation to natural environment can be where border divides territory. Since 1992, this area has stopped to develop itself and it became a huge environmental problem and potential danger for curious visitors.

Through text about historical development one might see the intentions and preparations for building such a facility. It is obvious that is not an easy process, because some circumstances have to be ideal in order to realise it. Not to mention invested money in such a facility complex. For one average person this seems enormous.

Even more fascinating is the construction of object, its walls, ceilings, new methods being used and of course tunnels, inside mountain Plješevica and at the top of the mountain. Clear sign that human was there, and left his monument of existence in nature. It is here where natural and artificial is bound together and yet it does not seem that way.

There is also a focus on the destructiveness of war and damage war makes. It is that we often say that war does not have any sense, and then we see consequences of its destructive nature and we wonder, if it was worth it, and why. Not much of an answer there, but still, it affects all living beings.

Significance of analysis done is enormous, yet it is only a beginning, because there is so much more left there to be explored. Maps and pictures are used to bring closer what is there, what condition is it in and also to stare imagination, because maybe someone would like to visit this place after reading about it.

Important is to be aware of the danger that potential visit brings and therefore ecological damage and danger of mines is thoroughly described.

It seems that in every war human limits his movement by setting mine field, and then it creates *no man's land*, even though it is intentioned for the opposing party to be limited in movement.

This location has so many potentials, and I tried to give a brief analysis to it, to say how important is for this area to be regenerated and how important is to do so because of living beings there and as an example of how something seemingly non- constructive can become constructive again. This is a unique landmark in the world, there is so much beauty around it and in it enough space left to be explored. Airbase Bihać itself today look like a monument of contradictory human actions in nature and human nature itself.

There are many reasons for military environmentalism not to be ignored in this work which hopefully will help in better understanding of this type of facilities as well as their adaptation into human and natural environment.

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APPENDIX

A1. INTERVJU SA KONSTRUKTOROM DRAGOSLAVOM SOBOTKOM

Autor: Profesor Radmila Tonković

Aeromagazin, Aerodrom kojeg vise nema, br. 26, str. 37 and 38, BB-Soft, ISSN- 1450-6068, Mart 2001

U subotu 16.maja 1992 godine u 5 časova i 30 minuta na ulazu u aerodrom „Željava” iz pravca Bihaća, u blizini strelišta, odjeknula je snažna eksplozija. Tačno 5 minuta pre 6 časova začula se serija eksplozija na pistama i svih pet pista je prekrrio gust dim. To su eksplodirala punjenja koja se inače ugrađuju ispod ivica pista vojnih aerodroma.

Trinaest minuta pre 8 časova i Bihać se zatresao od grandiozne eksplozije, a iz obronaka planine Plješevice suknuli su plamen i dim, planina je gorela, plamen je na horizontu dosezao do samog neba, prizor je bio jeziv i nestvaran, kataklizmički. Plamena stihija i eksplozije su uništile jedan od najvećih i najutvrđenijih aerodroma u Evropi, čija se suma procenjivala na sumu od 8 milijardi dolara, iako stvarno utrošena novčana sredstva ne odgovaraju procenjenoj sumi, prvenstveno zbog „besplatne” radne snage koja je angažovana na izgradnji ovog aerodroma, a i zbog dugotrajne (10 godina) izgradnje aerodroma. Uništena je podzemna instalacija sa hangarima, radioničkim prostorijama, magacinima... Uništen je velelepni div- aerodrom, a Plješevica kao da je propala, ulegla se i u svoju utrobu progutala nekad najčuveniju vojnu bazu Jugoslavije, u koju je i za oficire bilo pitanje prestiža i časti da uđu, borave i rade u njoj. Jedino nije uništena radarska stanica na vrhu Plješevice i administrativna granica između Hrvatske i Bosne, koja se protezala sredinom nekadašnjeg aerodroma. Bilo je nepojmljivo da je tu nekada radilo i živelo 2000 zaposlenih vojnih i civilnih lica.

Aerodrom se nalazio na nadmorskoj visini od 330 metara, a ceo plato dužine 15 km i širine 5 km je bio ispresečen vrtačama i zajedno sa planinom Plješevicom podsećao na gigantski nosač aviona, čijim je centrom poput jarbola dominirao radar sa vrha planine.

U potrazi za najmeritornijim i najkompetentnijim odgovorom na ovo pitanje dospela sam do najautenticnije licnosti, do samog glavnog projektanta građevinskog dela i vodećeg projektanta kompleksa podzemnih objekata aerodroma „Željava”- diplomiranog inženjera Dragoslava Sobotke; inače svojevremeno jedriličara sa A, B i C ispitom, motornog pilota, sekretara Akademskog aerokluba do II svetskog rata, organizatora i stručnog konsultanta na Vazduhoplovnoj izložbi 1938. godine na starom Sajmištu u Beogradu, sekretara već legendarne Jedriličarske škole na Zlatiboru pre II svetskog rata (učesnika NOR-a, pukovnika u penziji), čije sam kazivanje u celosti zabeležila:

„Moje upoznavanje sa specijalnim zaštitnim objektima podzemnog tipa za potrebe Ratnog vazduhoplovstva datira od 1954.godine, kada sam u sastavu vazduhoplovne vojne delegacije na čelu sa tadašnjem komandantom generalom Z. Ulepičem bio u poseti ratnom vazduhoplovstvu Švedske. Tada smo, između ostalog, pregledali jedan podzemni objekat starijeg tipa za smeštaj aviona sa potrebnim prostorijama i instalacijama za mirnodopske i ratne potrebe, jedan podzemni rezervoar klasičnog tipa, skladištenje goriva i jednu podzemnu fabriku oružja „Bofors”.

Sem toga, sa njihovim vojnim stručnjacima su vođeni razgovori o raznim elementima zaštite podzemnih objekata od efekata udarnih talasa izazvanih klasičnim i nuklearnim napadnim sredstvima.

Komanda našeg Ratnog vazduhoplovstva je 1955. godine formirala komisiju koja je, razmotrivši taktičko-tehničke uslove, predložila izradu projektnog programa i projektne dokumentacije za jedan objekat od budućeg podzemnog kompleksa na vojnom aerodromu „Željava“ kraj Bihaća. Za glavnog i vodećeg projektanta u Birou za specijalno projektovanje Građevinske uprave JNA sam određen ja – dipl.ing. Dragoslav Sabotka.

Podzemni objekat je bio predviđen za smeštaj dve do tri pojačane eskadrile aviona lovačke avijacije (sa dodatnim prostorom za reglament dva aviona) sa potrebnim prostorijama za komandu, pilote, vazduhoplovno-tehničku službu, vazduhoplovno-tehnička sredstva, municiju, gorivo, tehničku i pijaću vodu, sanitarije i rezervni izvor električne energije. Tokom izrade glavnog projekta investitor je zahtevao, da se u okviru prvobitnog objekta izrade još tri, i to: za smeštaj povećanog broja aviona tj. jednog lovačko-avijacijskog puka (LAP) sastava 3 - 5 eskadrila i kompletnog osoblja uz povećanje komfora u odnosu na raniji projekat, uređaja i službi potrebnih za obezbeđenje života, rada i borbenih dejstava lap-a u uslovima klasičnog i nuklearnog rata – ujedno bi služili i kao novi izlaz i za aerodromsku kontrolu letenja (povezana liftom i šahtom s unutrašnjošću objekta) sa meteo-stanicom.

Objekat je lociran u podnožju planine Plješevice na istočnoj padini (prema Bihaću), morfološki vrlo povoljnoj sa prirodnim uvalama za ulaze i sa grebenima koji ih razdvajaju. Masiv je sastavljen od kraških krečnjaka sa dosta prslina, pukotina i špilja i većim brojem izvorišta (curkova) vode različitog intenziteta. Tokom izgradnje objekta angažovani su i speleolozi za snimanje špilja radi njihovog premošćavanja specijalnim konstrukcijama od armiranog betona. Veću poteškoću su predstavljale špilje, koje su zahvatale ceo profil galerije po dužini, širini i visini i do 20 m pri dnu otvora.

Tri glavne podzemne galerije za smeštaj 58 aviona su međusobno povezane u obliku slova M sa produženim srednjim krakom za reglament, odnosno za pregled i opravku dva aviona i dodatnom galerijom sa strane svodastog su oblika sa vertikalnim oporcima širine 15,40 m pri dnu i visine u temenu oko 10 m. Njihov slobodan profil je podešen prema dimenzijama aviona koje je dao investitor. Na prodorima galerije visina je povećana za 2 m. Ostale prostorije za razne namene i hodnici, izuzev kupole objekta, širine su 3 - 12 m. Ukupna dužina podzemnih tunela (galerija i pomoćnih prostorija) je iznosila 3500 metara.

Kompletan objekat ima 4 ulaza-izlaza, od kojih se srednji prvobitnog objekta koristi kao ulaz za avione i ljudstvo (u slučaju napada preko ustave i degazacione komore), a ostala tri se koriste za izlaz aviona. Svi su oni rulnim stazama povezani sa dve glavne poletno-sletne piste. Avioni su se unutar objekta razmeštali elektroakumulatorskim tegljačima, a izvan objekta do i od PSS su se kretali na sopstveni pogon.

Svako mesto za parkiranje aviona je imalo istakač za punjenje aviona mlaznim gorivom. Predviđeni su svi životni i radni uslovi za namensko korišćenje objekta sa potpunom autonomijom do 30 dana: električna, vodovodna i kanalizaciona mreža; dve rezervne dizel-električne centrale (jedna od 1000 kVA i druga od 625 kVA), skladišta ubojnih sredstava i rezervnih delova, skladište dizel i avionskog goriva sa razvodnom instalacijom po galerijama; prostor za dekontaminaciju aviona; 13 klima-komora sa specijalno zaštićenim ventilacionim šahtovima (koji ujedno služe i kao rezervni izlaz na površinu terena), a postojali su i šahtovi za otpadni vazduh i za izduvne gasove agregata, kao i za instalaciju pogonskog goriva; protivpožarni sistem; stanica za dopunavanje avionskih i zemaljskih akumulatora; kuhinjsko-trpezarijski blok; ambulanta; spavaonice...

Prostorije u unutrašnjosti objekta su bile sa 56 teških pancirskih vrata. Za signalizaciju, a u cilju praćenja i regulisanja kretanja i prilazima objektu, kao i u samom objektu, i za druge potrebe, objekat je bio opremljen odgovarajućim signalnim uređajima i ozvučen zvučnicima povezanim u 10 zvučnih krugova.

Ovde je prv put kod nas, a uz prethodno provedena ispitivanja u institutu „Jaroslav Černi“, primenjen tzv. „aqua-sistem“ za skladištenje mlaznog goriva na vodenom jastuku u 5 cilindričnih čeličnih rezervoara (svaki kapaciteta po 100 tona goriva), što je od posebnog značaja za bezbednost objekta od mogućeg požara i eksplozije. Otvor za osmatranje na prostoriji za kontrolu letenja je zaštićen posebnim čeličnim kapkom za zaštitu od direktnih pogodaka mitrljeskih zrna i bliskih pogodaka raketi i bombi.

Objekat u celini je zaštićen od svih kalibara konvencionalnih napadnih sredstava i od prizemne nuklearne eksplozije jačine 20 kT. Razmak između ulaza-izlaza je projektovan tako, da je sprečeno istovremeno uništenje dva ulaza-izlaza, čemu doprinosi konfiguracija padine. Za smanjenje natpritisaka udarnog talasa u ulaznim-izlaznim delovima podzemnog objekta predviđene su specijalne armirano-betonske dijafragme sve do teških armirano-betonskih vrata na početku glavnih galerija, a same dijafragme su dimenzionisane prema avionima. Teška armirano-betonska vrata su smeštena u zasebnim nišama sa strane galerija, u njih su ugrađeni protivudarni ventili, a sama vrata se zatvaraju na ručni i električni pogon. Temperatura i vlažnost su idealne, dok je u galerijama za avione i u nekim skladištima temperatura snižena do 18°C iz praktičnih i ekonomskih razloga.

Po svojim konstrukcijskim osobinama i uređajima kojim je bio opremljen podzemni objekat je obezbeđivao:

- potpunu autonomnost jedinica koje u njemu baziraju,
- sigurnost i neprekidnost komandovanja borbenim dejstvima lovačke i izviđačke avijacije,
- neometano vazduhoplovno-tehničko održavanje lap-a i pri uslovima intenzivnog dejstva neprijateljske avijacije,
- normalne uslove za bezbedan život letaćkog i tehničkog sastava, kao i drugog ljudstva u neposrednoj blizini razmeštajne prostorije svojih jedinica.

Navedene osobine objekta su obezbeđivale vrlo visok itenzitet pripremanja jedinica za borbena dejstva i maksimalno moguće naprezanje lovačke avijacije.

Konfiguracija planine Plješevice, a naročito njenog vrha, pružila je dobru mogućnost za protivvazдушnu zaštitu podzemnog objekta, kao i čitavog aerodroma. Treba naglasiti, da je kod izgradnje ovih objekata, prvi put primenjen i novi sistem podgrade ankerima i špricanim betonom sa i bez čelične mreže, a po potrebi i sa čeličnim remenatama, koji se kasnije koriste bilo kao nosiva obloga, bilo kao njen satavni deo, a sve o zavisnosti vrste i kvaliteta stenske mase. Takođe je prvi put primenjen sistem zahvatanja i sprovođenja curkova vode i vlažnih mesta kanalom ispod podne površine. A od svih uređaja ugrađenih u podzemnom objektu impozantnih 95% je bilo proizvedeno u domaćim fabrikama tadašnje SFRJ.

Aerodrom je građen do 1968. Godine, kada je svečano otvoren i pušten u rad. Samo je nedostatak finansijskih sredstava odugovlačio vremenski rok završetka radova na ovom grandioznom projektu. Nakon 24 godine postojanja i rada ovaj div od aerodroma je dignut u vazduh sa 56 tona eksploziva u maksimalno kratkom roku od samo nekoliko minuta. “Interesantno je napomenuti, da je, osim ovog najvećeg vazduhoplovnog objekta, naš sagovornik projektant i nekoliko manjih objekata za slične namene na prostoru bivše Jugoslavije.

Jedan od njih je izgrađen na magistrali pored mora u krečnjačkom masivu sa dva ulaza – izlaza i sa pistom na proširenom delu magistrale. Ovakav način gradnje se praktikuje u Švedskoj, koja obiluje granitnim brežuljcima i brdima u blizini njihovih aerodroma ili pored auto-puteva.

Drugi podzemni objekat na teritoriji bivše Jugoslavije je rađen kao komandno mesto i pored prilaznog hodnika imao je operativnu salu s ekranom za prikaz situacije na terenu (teritoriji), sve potrebne elektronske uređaje na elastičnom podu, meteorološku stanicu, rezervnu dizel-elektrocentralu sa šahtom do površine terena, klima-komore i sve potrebne instalacije i uređaje.

Svakako jedinstven projekat ovakve vrste u Evropi, a možda i šire, aerodrom „Željava“ je imao nesaglediv značaj za naše RV i PVO i zemlju u celini u odbrambenoj, bezbednosnoj i političkoj konotaciji naše vojske i države u svetu. I svaki potencijalni neprijatelj je i prema njemu i prema SFRJ imao respektujući i zazirući stav. Važno je napomenuti, da su isti razlozi bili imperativni i za njegovu gradnju i za njegovo rušenje, te stoga biva lakše sagledati i prihvatiti ovaj objektivno težak gubitak imponantne i važne građevine.

Neosporno su čovekove tvorevine dokaz njegove nadmoći i kreacija i često nadziva svog graditelja i tvorca. Gospodin Sobotka je nadživeo neke svoje građevine i teško mu je što više ne postoje, jer je sa njima nepovratno otišao i deo njegovog života, stvaranja i gradnje kao glavne vokacije ovog vrsnog projektanta i inženjera. Kaže, da je za sve kriv prokleti rat i da je on sve ovo uništio i oteo od ljudi koji su to predano stvarali i gradili, jer su sile i rat u stanju da za časak unište decenijska ljudska naprezanja i stvarništvo.

*Rat svaki smisao u trenu pretvara u besmisao, jer je i sam besmisao. A posle njega i dalje treba živeti.
Ali kako?*

A2. INTERVIEW WITH CONSTRUCTOR DRAGOSLAV SOBOTKA

Author: Professor Radmila Tonković

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On Saturday, 16th of May 1992 in 5 hours and 30 minutes at the entrance of the airport „Željava” from the direction of Bihać, near the shooting range, a powerful explosion echoed. Exactly five minutes before six hours a series of explosions on the runways was heard and all five runways were covered with thick smoke. Fillings, usually implanted under the edge of the runways of military airports, were exploding.

Thirteen minutes before 8:00 am Bihać was shook by this huge explosion, and from the slopes of the mountain Plješevica flame and smoke have sprung, the mountain was on fire, the flame on the horizon reached up to the sky, the scene was eerie and surreal, cataclysmic. Flame and explosions destroyed one of the largest and secured airports in Europe, which worth was estimated \$ 8 billion dollars, although actually costs do not meet the estimated sum, primarily due to "free" labour force that was engaged in the construction of this airport and because of the long-term (10 years) airport construction. Underground installation with hangars, workshop spaces, warehouses... was destroyed. The impressive giant- airport was destroyed and Plješevica seemed as it was collapsing, sunken, with once most important military air-base in Yugoslavia into its womb, in which for the officers was a matter of prestige and honour to enter, reside and work in it. Only radar station on top of the Plješevica was not destroyed as well as administrative border between Croatia- Bosnia and Herzegovina, which was in the mid of a former airport. It is inconceivable that there once worked and lived 2000 employees of the military and civilians.

The airport is located at an altitude of 330 meters, and the whole plateau with length of 15 km and a width of 5 km was intersected with sink holes and together with mountain Plješevica it resembled on the giant aircraft carrier, who had a centre with a dominant radar at the top of the mountain.

Looking for the best one and the most competent answer to this question I have came to the most authentic personality, to the chief planner of the construction works and the lead planner of underground complex structure of airport "Željava" - a graduate engineer Dragoslav Sobotka; otherwise once a sailor with A , B and C exam, motor pilot, the secretary of the Academic Aero Club until World War II, an organizer and professional consultant to the Air Force exhibition 1938th year at the Old Fair in Belgrade, Secretary of the legendary Sailing school in Zlatibor before World War II (participant of National Liberation War, a retired colonel), which words I have noted in whole:

"My introduction to the special protective facilities of underground type for the Air Force dates back to 1954, when I was part of the air force military delegation, under the guidance of commander Gen. Z. Ulepić, which was visiting the Swedish Air Force. Then we have, among other things, examined an underground facility of the older type to house aircraft with the necessary premises and installations for peacetime and war purposes, one underground reservoir of classical type, fuel storage and an underground weapons factory "Bofors". In addition, with their military experts was discussed on the various elements of protection of underground facilities from the effects of shock waves caused by conventional and nuclear offensive means.

In year 1955 Command of Air Force 's has formed a commission which has, by considering the tactical- technical requirements, proposed the creation of the project plan and project documentation for an object of future underground complex at the military airport " Željavo" near Bihać. I, dipl. ing. Dragoslav Sabotka, was determined for the main and leading designer in the Bureau for Special Design of Construction Administration JNA.

The underground facility was designed to house two or three reinforced aircraft squadron for fighting aeroplanes (with additional space for regiment of two planes) with all necessary premises for the command, pilots, aeronautical and technical service, aeronautical and technical resources, ammunition, fuel, technical and drinking water, sanitary facilities and reserve electrical power source. During the general project development an investor has requested, within the original object, the creation of three new ones, namely: to house the increased number of aircraft that is one hunter-Aviation regiment (lap) from 3- 5 squadron and the entire staff with increased comfort compared to earlier project, equipment and services necessary for the security of life, work and combat operations of LAP in terms of classical and nuclear war- which would also serve as a new outlet for airport air traffic control (connected through a lift and manhole with the interior of the building) with meteorological station.

This object is located at the base of the mountain Plješevica on the eastern slope (toward Bihać), morphologically very good location with ravine for entering and ridges that separate them. The massif is composed of karst limestone with a lot of cracks, crevices and caves and a number of water sources of varying intensity. During construction of the facility speleologists have been engaged to capture caves in order to bridge them with special structures made of reinforced concrete. Greater difficulty for bridging were the caves, which have spread over the entire gallery profile in length, width and height up to 20m at the bottom of the opening.

Three main underground galleries were made to accommodate 58 planes and are interconnected to form the letter M with central extension of the tunnel for regiment, inspection and repair of two aeroplane with additional vault shaped gallery with vertical columns 15.40m width at the base and 10m height. Their free profile is set by the dimensions of the plane given by the investor. Height of galleries is by 2m increased. Other rooms for various purposes and corridors, except of the dome of the facility, are 3-12m width. The total length of underground tunnels (galleries and ancillary facilities) was 3500m.

Complete building has 4 entrances, the middle one of the original object is used as an entrance for aircraft and personnel (in the case of attack over the weir and degassing chamber), and the other three entrances are used by planes. They all are connected with two main take off- landing runways. In inside of the building the planes were arranged by the elektroakumulator towing vehicles and outside, to and from the PSS, the planes were moving on their own power.

Any surface meant for parking aeroplanes had fuel dispensers. It is foreseen to be able to live and work inside of an object with full autonomy up to 30 days: electricity, water and sewerage system; two backup diesel power stations (one of 1000 kVA and the other of 625 kVA), warehouses ordnance and spare parts warehouse, diesel and jet fuel storage with junction installation in galleries; space for decontaminating of an aircraft; 13 air- handling unit with specially protected ventilation shafts (which also serve as a spare exit on the surface); there were also shafts for waste air and exhaust gases of aggregates, as well as for the fuel installation; fire alarm system; station for supplementing of aeroplanes and earth accumulators; kitchen- dining block; ambulance; dormitories.

At the inside of the building there were 56 heavy armoured doors. In order to monitor and regulate the movement and access to the facility, as well as the building itself, and for other purposes, the building was equipped with the appropriate signalling devices and wired speakers connected to 10 audio circuits.

Here is, for the first time in Yugoslavia, and with previously conducted studies at the Institute "Jaroslav Černi" applied so called "Aqua- system" for storage of jet fuel on a water pillow in five cylindrical steel tanks (each with a capacity of 100 tons of fuel), which is of particular importance for the security of the facility from the risk of fire and explosion. The opening for observation in the room for flight control is protected by special steel lid for protection against direct hits of grains of machine guns and close hits of missiles and bombs.

The building in a whole is protected from all calibres of conventional offensive means and from ground nuclear explosion of 20 kT. The distance between the entrances and exits is designed so the simultaneous destruction of two entrances and exits is prevented, which is contributed by the slope configuration. To reduce the overpressure of shock wave at the entrance- exit areas of the underground facility there are special reinforced concrete diaphragm provided, until heavy reinforced concrete door at the beginning of the main gallery, and the diaphragm itself are dimensioned according to the aeroplanes. Heavy reinforced concrete doors are placed in separate niches on the side of the gallery, they have anti shock valves built in, and the doors itself are closed to manual and electric drive. Temperature and humidity are ideal, while in the galleries for aeroplanes and some storages temperature is lowered to 18° C for practical and economic reasons.

According to structural features and devices, which it was equipped with, underground facility had to ensure:

- fully autonomous units that are based there,*
- the safety and continuity of command in combat operations of hunting and reconnaissance aviation,*
- undisturbed aero- technical maintenance of LAP in conditions of intense action of the enemy aviation,*
- normal conditions for the safe life of pilots and technicians, and other personnel in the immediate vicinity of their premises units.*

These features of the object where providing very high intensity of preparing units for combat operations and the maximum possible strain of fighting aeroplanes.

Configuration of mountain Plješevica, especially its top, has provided a good opportunity for anti-aircraft protection of underground facility, as well as the entire airport.

It should be noted that in the construction of this facility, for the first time, there was applied a new system of support with anchors and sprayed concrete with and without steel net, and if necessary with steel straps, which later could be used as a wearable lining, either as part of it, but all depending on the type and quality of the rock mass. It was also the first time that the system for abstraction and implementation of water sources was applied as well as canal system for wet places beneath the floor surfaces. Of all devices installed in the underground facility an impressive 95% was produced in factories of former Yugoslavia.

The airport was built until 1968. when it was officially opened and put into operation. Only the lack of funding delay time for completion of this grand project. After 24 years of existence and work this giant of the airport was blown into the air with 56 tons of explosive in the maximum short period of just a few minutes. "

It is interesting to note, that our source constructor, except for this largest aeronautical facility, had designed several smaller buildings for similar purposes in the former Yugoslavia.

One of them was built on the highway by the sea in the limestone massif with two entrances and exits and with runway on the extended part of the highway.

This method of construction is practised in Sweden, which is abundant in granite hills and mountains near their airports or alongside motorways.

Another underground facility in the former Yugoslavia has been developed as a command post and near the hallway it had an operating room with a screen to display the situation on the ground (territory), all necessary electronic devices on flexible floor, a meteorological station, a backup diesel - power plant with a manhole to the surface of terrain, air chamber and all necessary installations and equipment.

Certainly a unique project of its kind in Europe, and perhaps beyond, airport "Željava" had immense significance for our RV and PVO and the country as a whole, in the defence, the security and political connotation of our army and the state in the world. And any potential enemy toward it had respecting attitude. It is important to note that the same reasons were compelling for its construction and for its destruction, and therefore becomes easier to look and accept this objectively huge loss of such an impressive and important construction.

Unquestionably the human creations are proof of its superiority and creativity and often outlive their builder and creator. Mr Sobotka had outlived some of his buildings and it is difficult for him because they are no longer there, because with those buildings irretrievably a part of his life, creation and construction, as the main vocation of this skilled engineer, was gone. He says that the damned war should be blamed for everything because it had destroyed all, taken away a lot from people who were committed into creating and building, and because the forces of war are able to destroy decades of human effort and work in seconds.

In one moment war makes every sense into nonsense, because it is nonsense itself. And after it, life should continue.

But how?

A3. TOP SECRET FILES, APPROVED FOR RELEASE

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Page <u>1</u>		
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<p>REFERENCE TO: Mission 1103, <u>UNDERGROUND AIRCRAFT DISPERSAL</u> BIHAC AIRFIELD, YUGOSLAVIA</p> <p>1. <u>SIGNIFICANCE:</u> FIRST IDENTIFICATION ON KH PHOTOGRAPHY OF UNDERGROUND AIRCRAFT DISPERSAL IN YUGOSLAVIA.</p> <p>2. <u>LOCATION:</u> 4.5 NM WNW OF BIHAC, ADJACENT TO THE PLJESEVICA MOUNTAINS, AND 58 NM SW OF ZAGREB.</p> <p>3. <u>REMARKS:</u> CONSTRUCTION AT BIHAC AIRFIELD HAS BEEN IN PROGRESS PROBABLY SINCE 1959. THE AIRFIELD HAS BEEN OBSERVED AND PHOTOGRAPHED ON SEVERAL OCCASIONS BY WESTERN MILITARY ATTACHES, WHO HAVE REPORTED SIGHTING CAVE ENTRANCES AND BUILDINGS UNDER CONSTRUCTION ON THE SIDE OF THE PLJESEVICA MOUNTAINS, AND A TAXIWAY EXTENDING FROM THE RUNWAY AREA DIRECTLY INTO THE MOUNTAIN. OTHER INTELLIGENCE SOURCES HAVE ALSO REPORTED RUMORS OF CONSTRUCTION OF EXTENSIVE UNDERGROUND HANGARS AND PERSONNEL AND MAINTENANCE FACILITIES AT THIS AIRFIELD.</p>		
<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p style="font-size: small;">These notes have been prepared for briefing purposes only and should not be used for detailed analytical work. Their use should be restricted to the particular briefing boards (s) they were prepared for and must be considered valid only for the reporting period as indicated by the date of issue. For information concerning these notes contact Chief, Imagery Exploitation Group NPIC.</p> </div> <div style="display: flex; justify-content: space-between; align-items: center;"> <div style="border: 1px solid black; padding: 2px; font-size: x-small;"> GROUP 1 EXCLUDED FROM AUTOMATIC DOWNGRADING AND DECLASSIFICATION </div> <div style="text-align: center; flex-grow: 1;"> TOP SECRET RUFF </div> <div style="border: 1px solid black; width: 100px; height: 30px;"></div> </div>		
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Image 1.

25X1

TOP SECRET RUFF

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Attachment to

17 June 1968

25X1

Page 2

4. COLLATERAL:

[REDACTED] HAS MADE SEVERAL TRIPS TO

25X1

BIHAC AIRFIELD AND REPORTS THESE CONCLUSIONS:

(1) BASED ON A CONVERSATION WITH A YUGOSLAV
MILITARY LIAISON OFFICER, THERE IS A POSSIBILITY
THAT MIG AIRCRAFT ARE BEING STORED UNDERGROUND
IN YUGOSLAVIA. [REDACTED]

25X1

25X1

(2) NATURAL CAVE FORMATIONS IN THE MOUNTAINOUS
REGION AROUND BIHAC COULD RATHER EASILY BE MADE
TO ACCOMMODATE A LARGE NUMBER OF AIRCRAFT, AND
THESE UNDERGROUND HANGARS WOULD BE PROTECTED BY
ALMOST 5,000 FEET OF MOUNTAIN. [REDACTED]

25X1

25X1

(3) ROVING SECURITY PATROLS OPERATE IN THE
MOUNTAINS NEAR THE AIRFIELD, A SECURITY PRACTICE
NOT GENERALLY FOLLOWED AT OTHER AIRFIELDS. THE
EXTREME SECURITY MEASURES TOGETHER WITH THE SIZE
OF THE AIRFIELD AND LONG PERIOD OF CONSTRUCTION,
CONFIRM THE IMPORTANCE TO THE YUGOSLAV AIR FORCE
OF THIS FACILITY. [REDACTED]

25X1

These notes have been prepared for briefing purposes only and should not be used for detailed analytical work. Their use
should be restricted to the particular briefing boards (a) they were prepared for and must be considered valid only for the re-
porting period as indicated by the date of issue. For information concerning these notes contact Chief, Imagery Exploitation
Group NFIC.

25X1

TOP SECRET RUFF

Image 2.

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TOP SECRET RUFF

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Attachment to [REDACTED]
17 June 1968

Page 3

5. FIRST IDENTIFICATION: THIS MISSION.

6. NEGATION DATE: NONE, BUT TWO OF THE FIVE CAVE ENTRANCES WERE
UNDER CONSTRUCTION ON [REDACTED]

7. SUBSEQUENT COVERAGE: NONE.

8. DIMENSIONS/
SPECIFICATIONS: WIDTHS OF CAVE ENTRANCES, READING FROM NORTH TO
SOUTH: [REDACTED]

9. MISSION READOUT: CONTINUING ANALYSIS OF [REDACTED] REVEALS 4.5 NM WNW
OF BIHAC. AN 8,230 X 140 FT NW/SE SERVICEABLE PROBABLE CONCRETE RUNWAY
WITH TWO ALERT APRONS, AND AN 8,200 X 70 FT NW/SE SERVICEABLE PROBABLE
CONCRETE RUNWAY. BOTH RUNWAYS ARE CONNECTED TO AN UNDERGROUND AIRCRAFT
DISPERSAL AREA CONSISTING OF FOUR CAVE ENTRANCES BY THREE TAXIWAYS/RUNWAYS,
MEASURING 7,140 X 75 FT, 8,700 X 70 FT, AND 5,340 X 70 FT. AN ADDITIONAL
CAVE ENTRANCE IS LOCATED 2 NM SOUTH OF THE LONGEST RUNWAY, AND IS CONNECTED
BY ROAD TO THE SOUTHERNMOST TAXIWAY/RUNWAY. A POSSIBLE AIR-WARNING RADAR
FACILITY (NOT SHOWN ON GRAPHIC) IS LOCATED 3.1 NM SSW OF THE CENTER OF THE
LONGEST RUNWAY. NO LARGE SUPPORT FACILITIES ARE OBSERVED. THE AIRFIELD

These notes have been prepared for briefing purposes only and should not be used for detailed analytical work. Their use
should be restricted to the particular briefing boards (s) they were prepared for and must be considered valid only for the re-
porting period as indicated by the date of issue. For information concerning these notes contact Chief, Imagery Exploitation
Group NPIC.

TOP SECRET RUFF

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Image 3.

Approved For Release 2009/05/13 : CIA-RDP78T05929A003100040003-0		25X1
TOP SECRET RUFF		
(c) NATIONAL PHOTOGRAPHIC INTERPRETATION CENTER		
Attachement to [REDACTED]		25X1
17 June 1968		
Page <u>4</u>		
IS PROBABLY EQUIPPED WITH LANDING AIDS.		
[REDACTED]		25X1
IEG/WGD		
<div style="border: 1px solid black; padding: 5px; margin: 10px auto; width: 80%;">These notes have been prepared for briefing purposes only and should not be used for detailed analytical work. Their use should be restricted to the particular briefing boards (s) they were prepared for and must be considered valid only for the reporting period as indicated by the date of issue. For information concerning these notes contact Chief, Imagery Exploitation Group NPIC.</div>		
TOP SECRET RUFF		25X1
Approved For Release 2009/05/13 : CIA-RDP78T05929A003100040003-0		

Image 4.

A4. MAPS OF UNDERGROUND COMPLEX

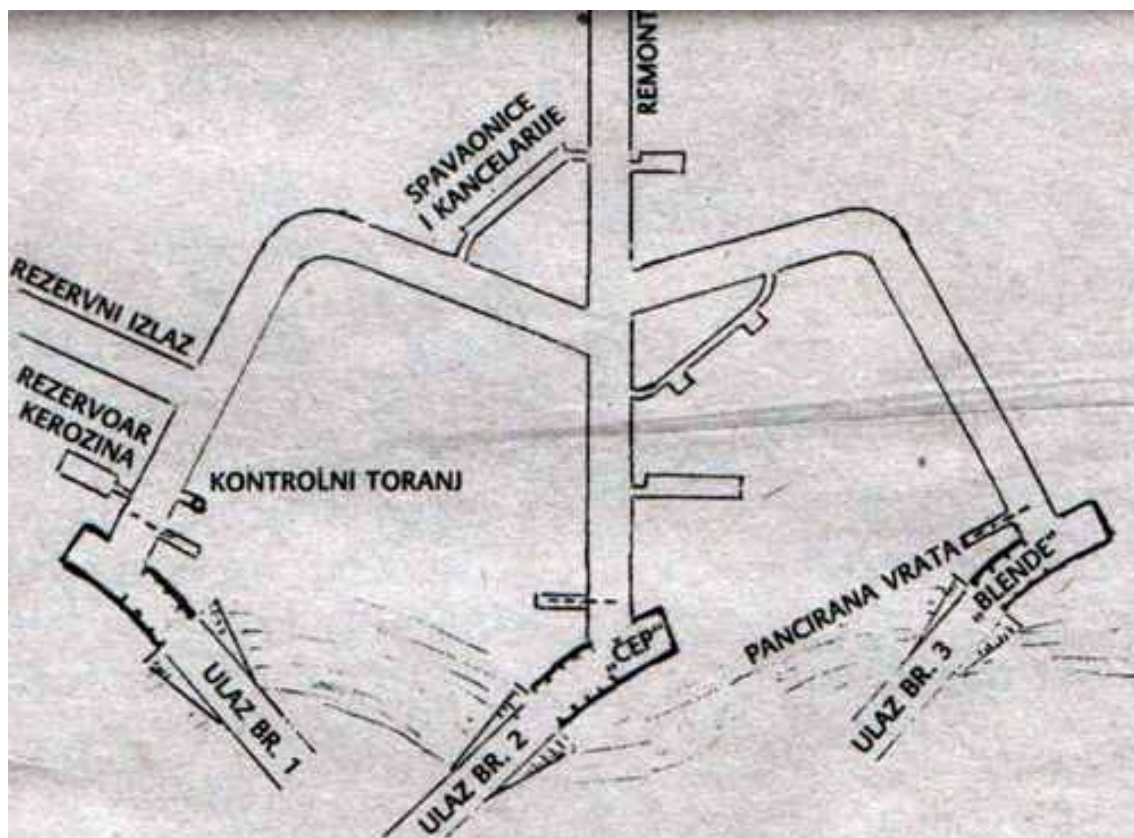


Image 5.

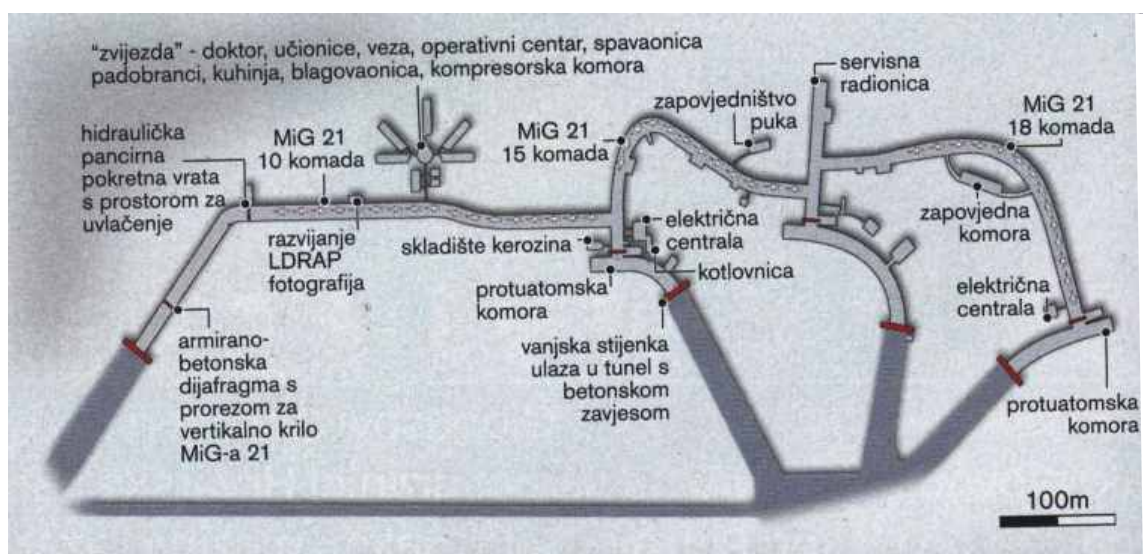


Image 6.

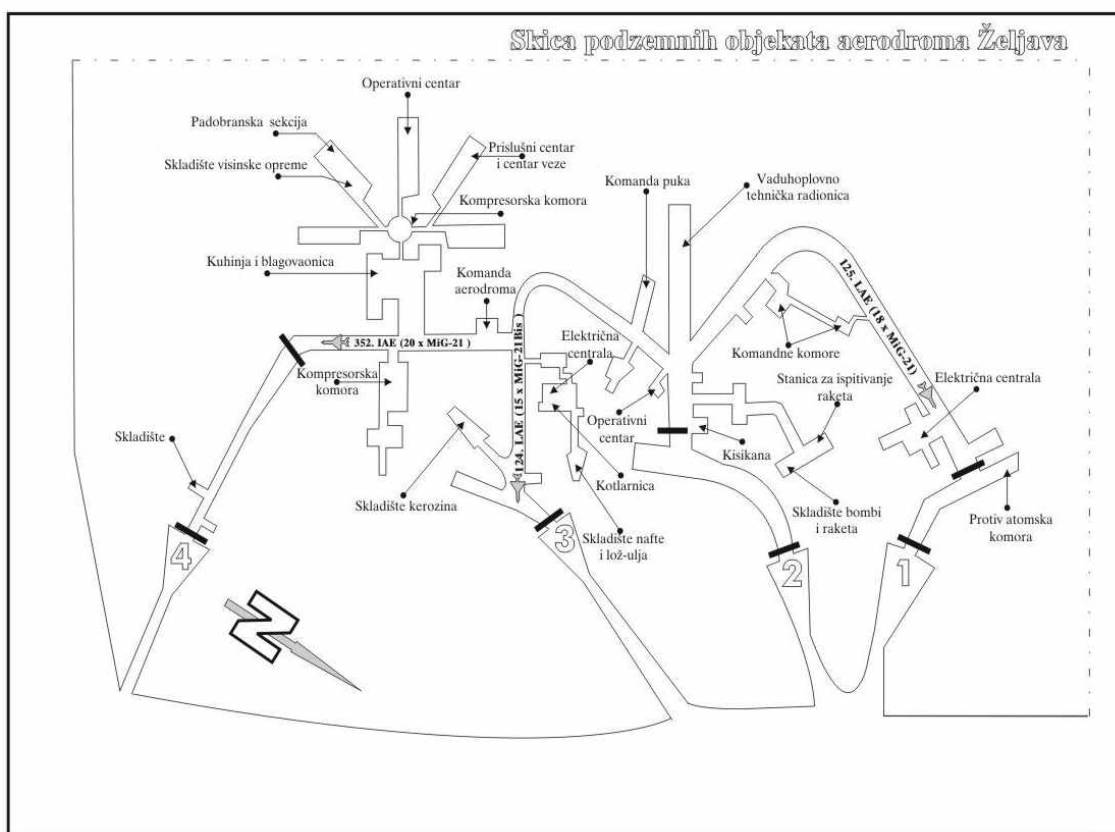


Image 7.

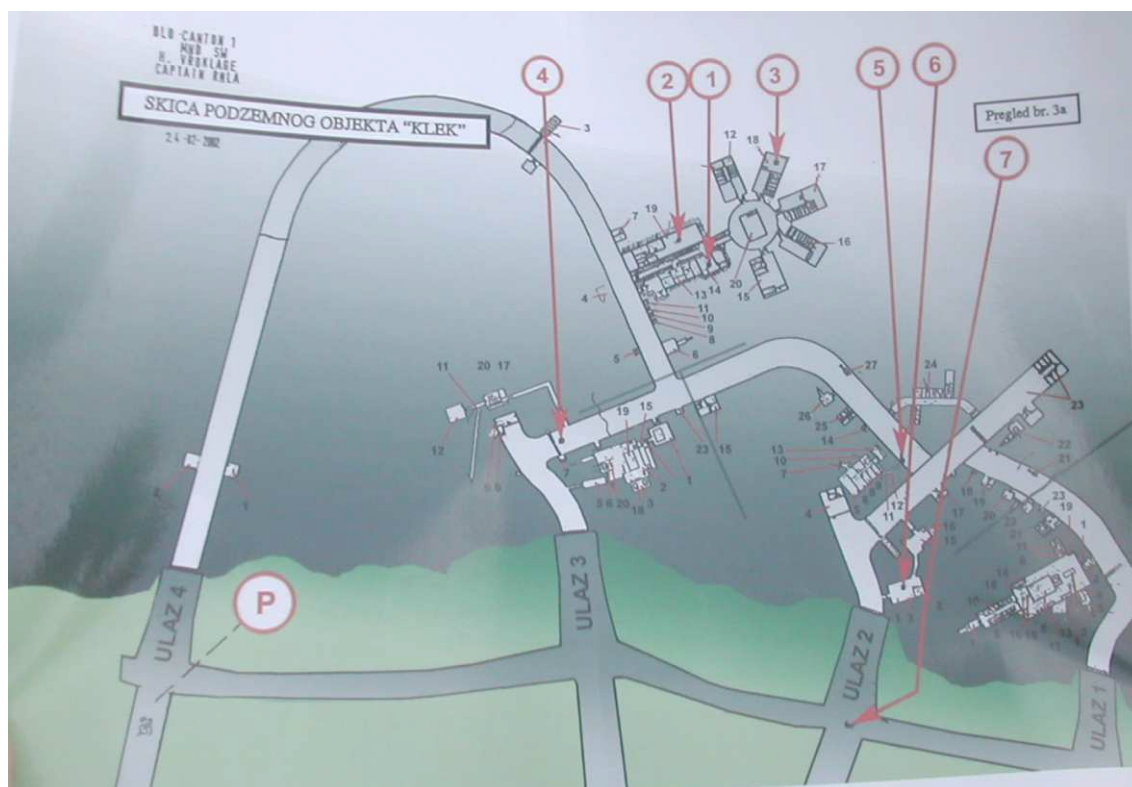
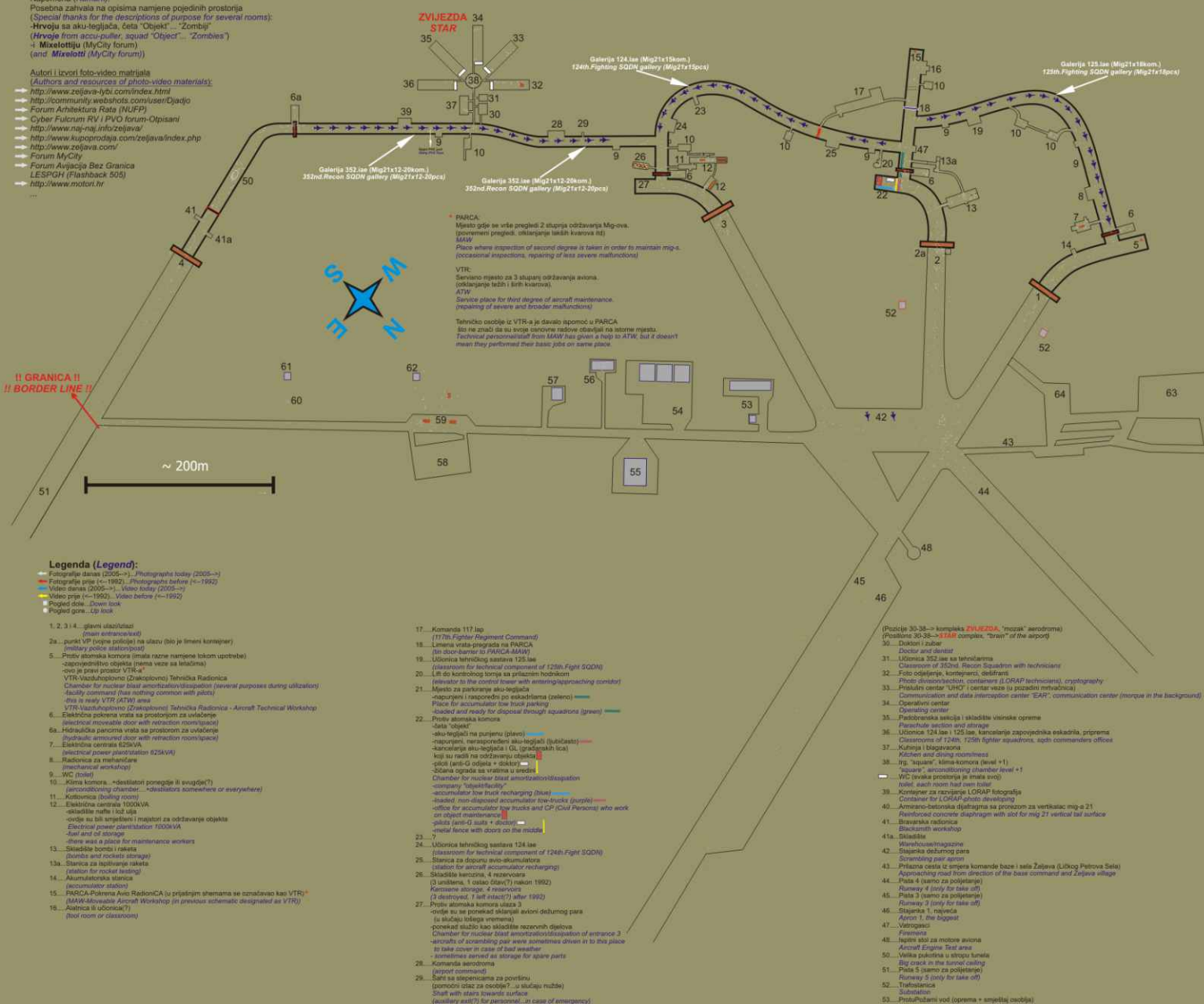


Image 8.

Aerodrom Željava, shema podzemnog objekta "KLEK" (Objekt 505) Airfield Zeljava, schema of the underground facility "KLEK" (Object 505)

Napomena (Remark):
Posebna zahvala na optimis namjene pojedinih prostorija
(Special thanks for the descriptions of purpose for several rooms):
-Hrvoje sa aku-egijača, četa "Objekt" - "Zombis"
(Hrvoje from accu-puller, squad "Object" - "Zombies")
- Mixelotij (MyCity forum)
(and Mixelotij (MyCity forum))

Autori i izvori foto-video materijala
(Authors and resources of photo-video materials):
- <http://www.zeljava-tyb.com/index.html>
- <http://community.webshops.com/user/Djadjio>
- Forum Arhitektura Rata (NUFP)
- Cyber Fulcrum RV i PVO forum - Otpisani
- <http://www.naj-naj.info/zeljava/>
- <http://www.kupoprodaja.com/zeljava/index.php>
- <http://www.zeljava.com/>
- Forum MyCity
- Forum Avijacija Bez Granica
- LESPGH (Flashback 505)
- <http://www.motori.hr>



Shema je napravljena na osnovu svih dostupnih podataka.
Podloga sheme je satelitska karta na Google Maps-u koja je za ovaj sektor u prilično slaboj rezoluciji.
Zbog toga ovo mjerilo treba uzimati sa rezervom, ali mislim da nema velikog odstupanja od stvarnih dimenzija.
Sporadni prostorije i prolazi do njih u tunelima su malo predimenzionirani kako bi detalji bili što vidljiviji.

Schema has been made on the basis of all available data.
Background for this drawing were satellite map on Google Maps which is for this sector in a pretty low resolution.
Because of that this picture may have to be taken with little reserve, but significant deviations from real dimensions don't exist for sure.
Side rooms and their corridors are showed with little bigger dimensions than they really are because of easier drawing.

A5. BEITRÄGE ZUR FLORA DER PLJESEVICA PLANINA. 1649 M.
44" 50' BIS 44" 40' N. BR., 33" 22' BIS 33° 40' ö. L. VON FERRO.
VON JOSEF SCHILLER.

Als die sieben Mitglieder des „Naturwissenschaftlichen Vereines an der Avienner Universität“ auf ihrer Reise 1902 durch das südliche Kroatien über die Plitvicer Seen gegen Bosnien sich wandten, beschlossen die beiden Teilnehmer an der Reise Stark und der Verfasser, das mächtige Züge bildende Grenzgebirge zwischen Kroatien und Bosnien, die Pljesevica planina, einer genaueren botanischen Besichtigung zu unterziehen, wenngleich das Gebiet schon des öfteren von Botanikern besucht worden war. Im nachfolgenden veröffentliche ich die Ergebnisse des Besuches und bemerke, daß die allgemein verbreiteten und weiter nichts Besonderes bietenden Spezies von uns, besonders von Stark, an Ort und Stelle diagnostiziert wurden, während alles übrige aufgesammelt wurde.

Zu lebhaftem Danke fühle ich mich Herrn Professor v. Wettstein für die Unterstützung und die Erlaubnis zur Benützung des Universitätsherbares und des Herbarium Kerner verpflichtet; ferner dem Herrn Dr. Fr. Vierhapper für die Bestimmung einiger Gramineen und Cyperaceen und dem Herrn Dr. Rechanger für die Bestimmung dreier Rumexarten. In der Autorzitation und Anordnung bin ich Fritsch, Exkursionsflora für Österreich, gefolgt. Genauere Autoren- und Literaturzitate sind stets den Originalquellen entnommen.

Hauptsächlich benützte Literatur.

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Ascherson u. Kanitz, Catalogus cormophyt. et anthophyt. Serbiae, Bosniae, Herzegovinae, Montis Scodri, Albaniae.
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Schlosser et Farkas-Vukotinovic, Syllabus Florae Croatiae (Zagrabiae 1857), Flora croatica (Zagrabiae 1869).
Waldstein R. et Kitaibel P., Descriptiones et Icones plant, rar. Hungariae (Viennae 1802—1812).
Wettstein R. von Westersheim, Beiträge zur Flora Albaniens (Bibliotheca botanica, Heft 26, 1892).

Polypodiaceae.

Die mit einem * versehenen Arten wurden gesammelt.

Polypodium vulgare. L. In den Voralpen hin und wieder.

Pteridium aquilinum Kuhn. Am Fuße des Gebirges bei Priboj Bestände bildend. *Blechnum*

Spicant Sin. Höhere Voralpenwälder, an feuchten Stellen.

Scolopendrium vulgare Sm. Vereinzelt, aber in großen prachtvollen Exemplaren.

Athyrium filix femina. Roth. Bei zirka 1000 m auf der Nordseite.

Asplenium Trichomanes. L.

— *viride* Huds. Höher gelegene Wälder, zirka 1200 m.

Phegopteris Dryopteris Tee. Hin und wieder bis zirka 1200 m.

**Aspidium lobatum* S\w. Alpenwälder, zirka 1000 m.

* — *spinulosum* Sw. Hin und Avieder bis zirka 1200 m.

Cystopteris fragilis Bernh.

* — *alpina* Desv. Zerstreut bis zirka 1300 m.

Coniferae.

Pinus montana Mill. Gipfelregion 1600 m.

Pinus silvestris L. Untere Teile der Voralpenwälder eingestreut.

Abies alba Mill. Tritt bei zirka 1100 m mit *Fagus* gemischt auf und bildet erst weiter oben bei zirka 1200 m schöne alte Bestände.

Picea excelsa Lk. In den unteren und mittleren Teilen des Gebirges nicht häufig.

Bei zirka 1200 m häufiger und bis in die baumlose Region.

Juniperus nana Willd. In der baumlosen Region zirka 1550 m.

Gramineae.

Anthoxanthum odoratum L. In den niedriger gelegenen Waldungen.

Milium effusum. L. Höhere Waldregion zirka 1200 m.

Phleum pratense. L.

Agrostis vulgaris. L.

Holcus lanatus. L., Waldrand und lichte Waldstellen.

Sesleria tenuifolia Schrad. Gipfelregion.

Cynosurus cristatus. L. Bei Priboj am Fuße des Gebirges.

Poa annua. L. Häufig im lichten Walde.

„ *nemoralis* L. Häufig im lichten Walde.

**Poa alpina*. a) var. *flavescens* (Rchb.) Ascherson & Graebner.

. * „ „ β) var. *contracta* Ascherson & Graebner. Gipfelregion, häufig.

Synosp. d. mitteleur. Flora. Ascherson & Graebner, 10. u. 11. Liefg., Seite 326.

Brachypodium silvaticum E. et. Seh. Wälder.

Nardus stricta L. Gipfelregion.

Festuca ovina. L.

* — *pungens* Kit. Gipfelregion, Gola, 1640 m.

Lolium perenne. L. An Wegrändern bis in die höheren Teile.

Elymus europaeus. L. Lichtere Stellen im Buchenwald.

Cyperaceae.

**Carex laevis*. Hoppe. Gipfelregion, Gola. 1649 m.

— *ornithopoda* Willd. Wälder.

Juncaceae.

Luzula pilosa, Willd. Voralpenwälder, zirka 900 m.

Liliaceae.

- Veratrum album*. L. Nordseite der Pljesevica, zirka 1100 m.
 **Allium Victorialis*. L. Gipfel der Gola.
Allium ursinum. L. Höhere Voralpen, zirka 1200 in.
Polygonatum verticillatum. All. Hin und wieder in höher gelegenen Teilen. 1300 m.
Paris quadrifolia. L. Zerstreut.
 **Lilium Carniolicum*. Bernh. Höchste Teile, Gola. 1640 m.

Orchideae.

- Orchis ustulata*. L. Gipfelregion.
Gymnadenia conopsea R. Br. Gipfelregion.

Betulaceae.

- Corylus Avellana*. L. Am Fuße des Gebirges häufig und das buschbildende Element.

Fagaceae.

- Fagus silvatica* L. Von zirka 800 bis 1350 m öfter Wald bildend, mit herrlichen uralten Bäumen, dann gemischt mit *Abies alba*. u. *Picea excelsa*.

Santalaceae.

- **Thesium alpinum* L. Höchste Teile des Gebirges, Gola, kaum 1600 m.

Polygonaceae.

- **Rumex silvestris*. Wallroth. Baumlose Eegion. Neben der typischen Form finden sich auch l'bergangsformen zu **R. obtusifolius*. L. (Rechinger).
 **Polygonum viviparum*. L. Gipfel der Pljesevica plan. 1400 m. Auf grasigen Matten.
Polygonum aviculare. L. Häufig.

Caryophyllaceae.

- **Alsine verna* Bartl. Gipfelregion auf steinigen Stellen.
 **Moehringia muscosa*. L. Auf schattigen Stellen der Voralpenregion.
 **Cerastium ciliatum* Waldst. et Kit. Desc. et scon. plant. rar. Hung. III. Pag. 250, Taf. 225 (1812). Gipfelregion auf grasigen Stellen. 1600 m.
 **Cerastium silvaticum* Waldst. et Kit. In Voralpenwäldern.
 **Dianthus Kitaibelii*. Janka. Die Exemplare sind durch den dunkelpurpurnen Kelch, was bei dieser Art ja sehr selten ist, und durch die verhältnismäßig weniggeschlitzten Petalen auffallend. Gipfelregion 1600 m.
Silene venosa. Ascherson. Untere Voralpenwälder, häufig.
 **Heliosperma quadrifidum*. A. Br. Reichenb. Icon. Flor. Germ. V. pag. 78 (1841). Auf schattigen Stellen der Voralpenwälder.
Melandryum rubrum. Garcke. Vom Fuße des Gebirges an bis hoch hinauf.

Ranunculaceae.

- Clematis Vitalba*. L. Am Fuße des Gebirges häufig.
 **Thalictrum aquilegifolium*. L. Die Exemplare zeigen bläulich gefärbte Antheren. In Felsritzen und Spalten der Felsregion. 1650 m.
 **Eranunculus Thora*. L. var. *scutatus*. A. Waldst. et Kit. Descr. et Icon. plant, rar. Hung. II, pag. 265, Tab. 187 (1805). Gipfelregion auf der dem Winde am meisten ausgesetzten Nordwestseite der Gola. 1600 m.

Cruciferae.

**Biscutella laevigata*. L. var. *asperifolia*. Neilr. Gipfelregion 1500 m.

**Roripa Lippicensis*. Rchb. Gipfelregion, 1600 m.

**Dentaria polyphylla*. Waldst. et Kit.

— *bulbifera*. L. Beide Arten zerstreut.

Lunaria rediviva. L. Höhere Teile bei zirka 1300 m.

Bursa pastoris. Wigg. Häufig.

**Draba ciliata*. Scop. Flora, carn. II, pag. 33. Felsregion, 1500 m.

**Arabis alpina*. L. Voralpenwälder.

**Erysimum pannonicum*. Cr. Unterste Teile auf lichter Stellen.

Saxifragaceae.

**Saxifraga aizoon*. L. Gipfelregion, Gola, 1600 m.

* — *aizoides*. L. Voralpen.

* — *rotundifolia*. L. Häufig in der höheren Voralpenregion. 1000—1400 m.

Chrysosplenium alternifolium. L. Höhere Teile bis in die Gipfelregion.

Oenotherae.

Epilobium roseum. Schreb. Bei Priboj.

Circaea alpina. L. Hin und wieder an schattigen Stellen in den Voralpenwäldern.

Araliaceae.

Hedera Helix. L. Verbreitet.

Umbelliferae.

**Astrantia major*. L. Höhere Voralpenwälder.

**Chaerophyllum hirsutum*. L. Zerstreut.

**Anthriscus silvestris*. Wimmer et Grab, in Flora Siles. ed. prima I, pag. 289 (1827).

Sanicula Europaea. L. Hin und wieder im Waldgebiete.

**Bupleurum aristatum*. Bartl. Am Fuße des Gebirges auf Wiesen in winziger Form.

**Trinia Hoffmanni*. M. B. In der baumlosen Region. 1560 m. Die Pflanze stimmt mit den im Universitätsherbar befindlichen Pflanzen vollkommen überein, so daß ich kein Bedenken trage, sie als diese Spezies anzusehen, obwohl sie für das Gebiet, soweit ich aus der mir zur Verfügung stehenden Literatur Ersehen konnte, neu ist. Entwickelte Früchte an der Pflanze vorhanden.

**Athamantha Haynaldi*. Borbas et Mechtritz. var. *pilosa*. Wettstein. (Beitrag zur Flora Albaniens, Bibliotheca botanica, Heft 26, Cassel 1902.)

Forma Croatica. Hüllchen zur Blütezeit so lang wie die Blütenstielchen. Sonst stimmt die Pflanze mit denen von Dörfler an Ljubitriz (SarDagli) gesammelten überein.

**Oenanthe media*. Griseb. Sumpfwiesen bei Priboj.

Ericaceae.

Erica carnea. L. Baumlose Region, 1400—1600 m.

Vaccinium Myrtillus. L. Hin und wieder in ganz kleinen Ansammlungen.

Primulaceae.

Cyclamen europaeum. L. Untere Voralpenwälder.

Gentianaceae.

**Gentiana symphyandra*. Murbeck. Gipfelregion. Diese Zierde der felsigen Höhe findet sich zwischen Felsen an vor dem Winde gut geschützten Stellen.

Gentiana pannonica. L. Voralpenwälder, zirka 1000 m.

Borragineae.

Cynoglossum officinale. L. Zerstreut.
Pulmonaria officinalis. L. Zerstreut.
Myosotis silvatica. Hoffm.
 * — *alpina*. Hoppe. Gipfelregion 1550 m.
Cerinth minor. L. Voralpenwälder, zirka 900 m.
Echium vulgäre. L. Bei Priboj. 660 m.

Labiatae.

**Brunnella grandiflora*. L. Im tiefer gelegenen Walde läufig. Ebenso die folgenden.
Brunnella vulgaris. L.
 * — *laciniota*. L.
Melittis melissephyllum. L. Voralpenwälder, selten.
Salvia glutinosa. L. Tiefere Teile der Voralpenwälder und charakteristisch.
Thymus marginatus. Kern, Gipfelregion, Gola. 1600 m.
Galeobdolon luteum. Hds. Bis 1200 m.

Solanaceae.

Atropa Belladonna. L. Untere Partien der Voralpenwälder. Nicht häufig.

Scrophulariaceae.

Scrophularia Scopolii. Hoppe. In Voralpenwäldern bis zirka 1000 m gegen Norden.
Scrophularia nodosa. L. In Voralpenwäldern bis zirka 1000 in gegen Norden.
 * — *laciniata*. Waldst. et Kit. Baumlose Region, Gola, Kamm. Die Pflanze ist entweder niedrig bis 16 cm hoch, Blätter tiefer fiederspaltig, oder 25 bis 35 cm hoch und dann aufsteigend und Blätter weniger tief fiederig.
Veronica montana. L. Wälder auf der Nordseite.
 * — *latifolia* (= *V. urticaefolia* Jaqu.). Im Voralpengebiet zerstreut.
Digitalis ambigua. Murr. Bei zirka 1250 m Nordseite.
 **Pedicularis verticillata*. L. Höchste Teile, Gola, Kamm auf Matten, 1600 m.

Rosaceae.

Aruncus silvester. L. Nordostseite bei 1200 m.
Cotoneaster integerrima. Med. N. O. 1300 m.
 * — *tomentosa*. Südl. Felsregion bei 1560 m.
Fragaria vesca. L.
 **Potentilla Clusiana*. Jacquin. Flor. Austr. II, pag. 10, Taf. 116 (1774). Gipfel.
Alchemilla arvensis. Scop. Häufig am Fuße des Gebirges.
 — *vulgaris*. L.
 * — *alpina* L. Höhere Teile bis in die Gipfelregion.
 **Rosa Ebelii*. H. Braun. Siehe Beck, Annalen des k. k. Naturhist. Hofmus. Flora von Südbosnien und der angrenzenden Herzegovina, pag. 101, T. II—III.
 Ascherson und Graebner. Syn. der mitteleurop. Flora. Eoseae (Keller) S. 302.

Leguminosae.

Anthyllis vulneraria. L. Häufig im tieferen Voralpenwälder.
Trifolium pratense. L. Häufig.
 — *repens*. L. Am Fuße des Gebirges.
 — *filiforme*. L. Am Fuße des Gebirges.
Lotus corniculatus. L. Am Fuße des Gebirges.
 **Hippocrepis comosa*. L. 1500—1600 in. Gipfelregion zwischen Geröll.
Vicia Cracca. L. Bei 1400 m. Auf Matten.
 * — *oroboides*. Wulf. 1500 m. Selten.
Lathyrus vernus. Bernh. Häufig.

Geraniaceae.

Geranium phaeum. L. Höhere Voralpenwälder, zirka 1200 m.

— *Robertianum*. L. Häufig.

* — *silvaticum*. L. Bis 1200 m.

Lineae.

**Linum fiavum*, L. Baumlose Region auf grasigen Matten. 1400 m.

Polygalaceae.

Polygala vulgaris. L. Häufig bis 1200 m.

— *amara*. L. Häufig bis 1200 in.

Euphorbiaceae.

Mercurialis perennis. L. Höher gelegene Wälder, zirka 1200 m.

**Euphorbia platyphylla*. L. Bei Priboj.

* — *amygdaloides*. L. Voralpenwälder. .

* — *veiTucosa*. Lam. Bei Priboj.

Anacardiaceae.

Cotinus. *Coggygia* Scop. Baumlose Region. 1600 m.

Acerineae.

Acer obtusatum. Kit. In den Buchenwald eingestreut. Selten.

Guttiferae.

**Hypericum Richeri*. Vill. var. *alpinum*. Waldst. et Kit. *Descript. et Icon. plant. rar. Hang. III, pag. 294, Tab. 265 (1812).*

Cistineae.

**Helianthemuin alpestre*. Dun. Baumlose Region, 1600 m.

— vulgäre Gärt. Bei 1300 m.

Thymelaeaceae.

Daphne Mezereum. L. Voralpenwälder.

— *Cneorum* L. Voralpenwälder.

Globulariaceae.

**Globularia cordifolia*. L. Gola, Kamm häufig, 1600 m.

Plantagineae.

Plantago lanceolata. L. Untere Teile des Gebirges häufig.

Rubiaceae.

Sherardia arvensis. L. Untere Teile bei Priboj.

Galium rotnndifolium. L. Schattige Stellen.

— *Mollugo*. L. Höher gelegene lichte Waldstellen.

* — *aureum* Vis.

Caprifoliaceae.

Sambucus racemosus. L. Lichte Waldstellen.

Sambucus Ebnlus. L. Bei Pfiboj an Rainen und am Waldrande häufig.

Viburnum Lantana. L. Im Voralpenwalde hin und wieder.

Valerianaceae.

**Valeriana tripteris*. L. Hoher gelegene "Wälder bis 1500 m.

* — *montana*.

Dipsaceae.

**Scabiosa silenifolia*. Waldst. et Kit. Baumlose Region in Felsspalten. 1600 m.

Campanulaceae.

**Phyteuma Vagneri*. Kerner. Schedae ad floram exsiccata Austr. Hung. III, pag. 107, Nr. 904. Das gesammelte Material stimmt mit den von S c h u l t z e durchbestimmten Pflanzen des Universitätsherbars und des Herbarium Kerner überein. Voralpenregion bei 1300 m selten.

Phyteuma orbiculare. L. Lichte Stellen im Voralpenwalde.

**Hedraeanthus Kitaibelii*. De Cand. var. *alpinus* Wettstein, Monographie der Gattung *Hedraeanthus* 1877. pag. 11 und 12. Gipfelregion.

Compositae.

Eupatorium caunabinum. L. Am Fuße des Gebirges häufig.

**Adenostyles Alliariae* Kern. Im lichten Walde an feuchten Stellen hie und da.

Bellis perennis. L. Häufig.

**Achillea Clavenae*. L. Waldlose Region, ziemlich häufig, 1500—1600 m.

**Chrysanthemum Leucanthemum*. L. Häufig in den Voralpen, var. *rupestre*. Untere Blätter aus langkeiligem Grunde eilänglich, mittlere lanzettlich, sitzend, etwas umfassend. Unterblätter entweder fast ganzrandig oder nur bis ein Drittel herab schwach gekerbt, mittlere in der Regel vollständig ganzrandig. Alle Blätter dicklich, kahl. Immer einköpfig. In den höchsten Teilen, in Felsspalten. 1600 m. *F. lanceolata* Beck. Grasige Stellen in der baumlosen Region.

**Homogyne silvestris*. Cass. In höher gelegenen Wäldern.

**Doronicum austriacum*. Jacqn. Flor. austr. II, pag. 18, Taf. 130 (1805).

**Senecio rupestris*. Waldst. et Kit. Blätter kahl.

forma nudus. In der baumlosen Region auf grasigen Matten.

**Senecio crassifolia*. Kit. Auf grasigen Matten in der Gipfelregion. 1600 m.

* — *Saracenicus*. L. Auf Waldblößen hin und wieder.

* — *Doronicum* L. f. *nudus* Früchte kahl, sonst typisch. In der baumlosen Region auf Gräsermatten. 1600 m.

**Cirsium Erisithales*. Scop. Auf lichterem grasigen Stellen.

lanceolatum. Scop. Untere Teile des Gebirges bei Priboj.

**Centaurea variegata*. L. [Hayek, Monogr. der Gattung *Centaurea*] (= *Centaurea Floccosa*. Schloss. et Vukot.) In der Gipfelregion zwischen Felsen. Es fanden sich nebst den rötlichen Blüten auch schön weiße.

**Aposeris foetida*. Less. Häufig und von unten bis in die Gipfelregion gehend.

Leontodon hispidus. L. Lichte Stellen in höher gelegenen Teilen.

Mulgedium alpinum. Less. Hie und da an schattigen feuchten Stellen, bei 1250 m.

Lactuca niuralis. Fres. Häufig.

Crepis biennis. L.

Prenanthes purpurea. L. Häufig.

**Hieracium villosum*. L. Die Form nähert sich durch die weniger abstehenden und gleichen inneren und äußeren Hüllblättchen sehr der Form, *villosiceps*

Naegeli u. Peter. Hieracien Mitteleuropas, II, 52.

**Hieraciuni silvaticum*. L. Voralpenwälder.

* — *alpinum*. L. Gipfelregion auf steinigen Stellen.