VISUALIZATION OF THE MOUNTAIN BATTLEFIELD ON THE SOČA FRONT LINE

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Abstract

The paper presents different visual presentations of the selected battlefield sections on the Soča front line in the World War I. Based on available historical data, sketches and written documents, topographic maps, aerial orthophotos and satellite images, the locations of front lines and their movements during the battles have been captured. Using GIS technology, the complex model of front lines was built from which different types of presentations were prepared. Interactive maps were made as Google Maps and Google Earth mashups for larger areas and in ESRI environment for selected smaller areas. Animations as flights over the areas were prepared, too, and merged together with textual data, historical images and voice background into complete joint web page.

Key words: visualization, Soča front line, web GIS, Google Earth

Introduction

In the years between 1915 and 1917 in the World War I along Soča (ital. Isonzo) river valley and surroundings there were wrathful clashes of arms between two major alliances, the Entente and the Central Powers. The northern part of front line spread out in the mountain area of the Julian Alps and its foothills. This was one of the largest battle fields in the high mountain area in world history and the largest ever army fight in the territory of Slovenia. On both sides, Italian and Austro-Hungarian, soldiers from different nations, Germans, Hungarians, Italians, Slovenes, Croatians, Serbs, Bosnians, Czechs and many others fought against each others (www1). Faced with the forthcoming 100th anniversary of those sad and terrible times, a lot of activities have been initiated to recall the memory of thousands of dead and injured soldiers. Some of such activities are visualizations of the mountain battlefield on the Soča front line. Visualizations were made as a part of research project "For Freedom of the Homeland, War in the Julian Alps 1915 – 1917".

High mountain area with extreme steepness, bad climate conditions like storms or high snow in winter, lack of drinkable water, slow and complicated supply, bad protection against the enemy soldiers, caused the terrible war itself even more difficult for the soldiers in the time of battlefield. Nowadays, decades later, such steep terrain enables efficient and attractive 3D visualization of the area and specific sites. On the other side, due to uninhabited and hardly accessible territory a lot of traces remained in the area and that, together with the archive material in museums, enable authentic reconstruction of the situation in World War I. The resulting visualizations, together with other material prepared in the project mentioned above, will be used for educational and promotional purposes at the Ministry of Defence and as a multimedia presentation in the military museum of Slovenian Armed Forces. A DVD copy will also accompany a history book about the battles.

Selected areas

Different types of visualizations of the part of battlefield area, with the emphasis on the Soča valley with high mountains above it, were selected. The Soča front line was about 90 km long battlefield area from Mount Rombon (2208 m a.s.l.) on the north to the Gulf of Trieste on the south. Figure 1 shows Soča battlefield area with position of both armies' front lines: red line shows the Italian and blue line shows the Austro-Hungarian positions. For the entire area of presentation web GIS applications using the XML-based KML language, which is the standard for managing the display of 3D geospatial data in Google Maps and Google Earth, was used (www2). The area covers 3500 sq. km and visualization shows mostly geomorphologic characteristics of the entire front line area.
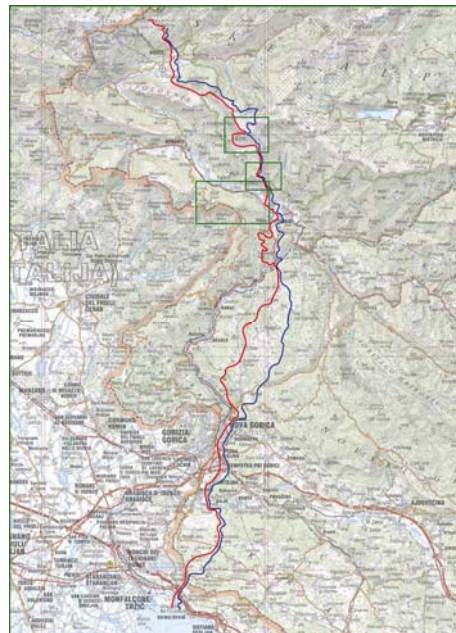

Figure 1: The Soča battlefield area with position of both armies' front lines with three selected areas

Additional visualizations of three the most significant places (shown with green rectangles in Figure 1) were made using ESRI solutions. In the areas of Batognica (2164 m a.s.l.) and Mrzli vrh (1359 m a.s.l.) the first front lines of enemy soldiers were only some tens of meters apart which resulted in thousands of victims in this positional war conflict, assuring no significant progress for any side. The third area is Kolovrat mountain with surroundings, where Italian troups had the secondary front line, which was broken in the last, 12th battle in October 1917. Since the size of each of the three areas is less then 50 sq. km much more detailed data model was established and different computational environment for presentations was used.

Data capturing

Visual presentation of the situation in World War I requires authentic and reliable data about the military objects, positions of the army front lines, facilities and even land cover of the area in that time. Unfortunately reliable documents do not exist. Aerial photography was at that time only in early beginnings. Situations are mostly available on sketches, whiteout any georeference such as scale or coordinates, and on few amateur black and white photographs of the terrain. Such situation encouraged many amateur collectors and researchers to systematically collect, measure and search for any remained tracks and items on the terrain. Their findings are presented in museums and published in several books (Klavora 1991-2008, Simić 1996, Simčič 2006). Books include also sketches and maps, but most of them are not georeferenced.

For the entire battlefield presentation only the main front lines of both armies were captured. Detailness and precision of captured lines were not very important since the scale of the visualized area is small. However, for the three smaller selected areas all data were captured precisely and in detail. Fortunately, even 90 years after the battles on the mountain areas, the tracks of fire trenches are still visible on the terrain and in some cases, also on contemporary aerial orthophotos and lidar scans. Using available historical data, sketches and written documents, we interpreted the exact position of fire trenches, supply tracks, barracks, cable lifts and other objects on contemporary images (Figure 2).
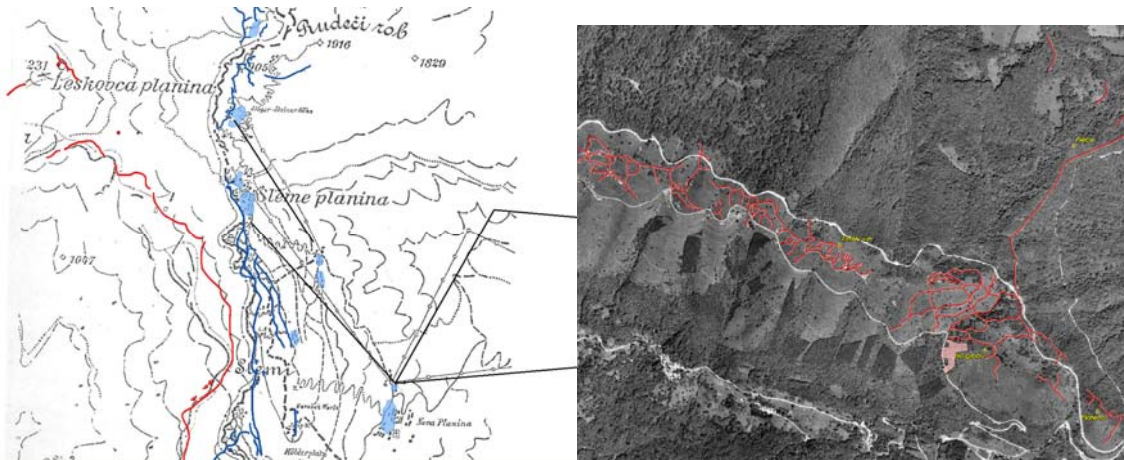
Figure 2: The position of fire trenches on historical sketch (left) and recognised on aerial image (right)

Model background data

The presentation of entire battlefield area was prepared in Google Maps and Google Earth environment, where SRTM 90 - Shuttle Radar Topographic Mission 90 m Digital Elevation Data (www3) and Google satellite images are used (Figure 3).

Figure 3: Front lines in Google Earth environment

The height accuracy of SRTM is estimated to 16 m, which is not precise enough for closer views. Zooming closer one can notice some morphological errors in the DTM. Since the enemies' front lines were often close to each other on the opposite sides of narrow mountain ridges, such errors give the users completely wrong and different explanation of the situation.

Hence, the official Slovenian digital elevation model with a 12.5 m grid cell was used for the three selected areas. The elevation model was draped with orthophoto images at 1:5000 and with raster topographic maps at 1:50.000 (Figure 4).
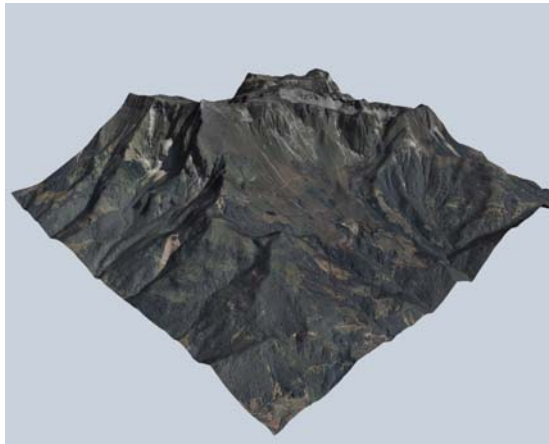

Figure 4: The digital elevation model draped with orthophoto image (ortophoto provided by the Slovenian Surveying and Mapping Authority)

Prepared presentations

The digital elevation model was additionally draped by different thematic layers, presenting the situation almost 100 years ago. Changes of the front line during some battles were presented using the time-space cube method (Figure 5).
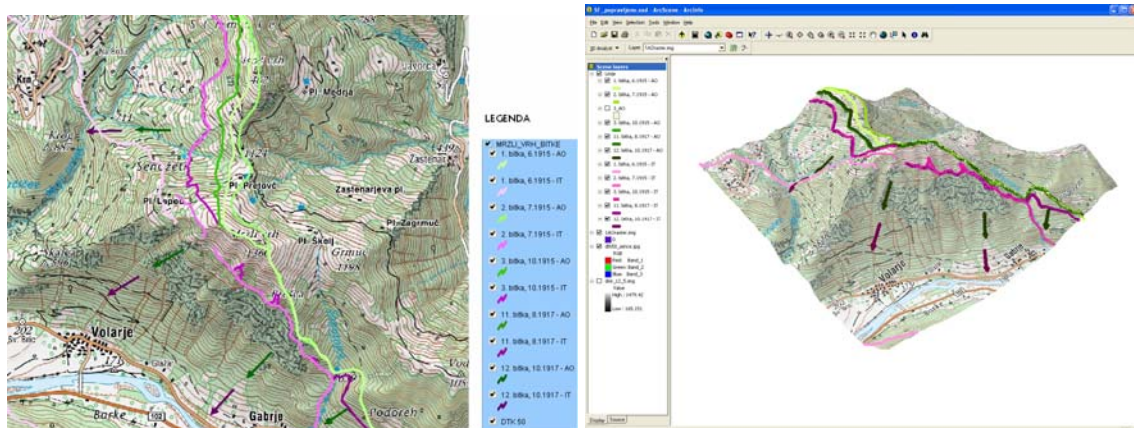

Figure 5: Changes of the front line during some battles

The 3D-visualizations were prepared also as video files, presenting virtual fly over the terrain draped with different thematic data (Figure 6)
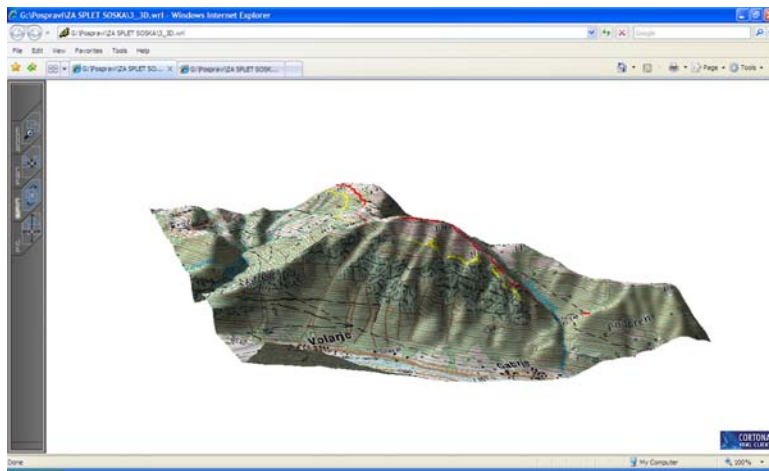
Figure 6: Insert from animated fly over the terrain

Finally, all prepared presentations, interactive maps of the entire battlefield area and the three selected detailed areas, animated fly-overs, texts, historical images and voice background were joined into a HTML format, which can be used either via internet or as a multimedia DVD.

Conclusion

Since the described visualization merges humanistic and military contents with technical geodata, the potential users could be professionals and amateurs with different backgroud. The WW I sites in Slovenia attract growing interest from local and foreign history enthusiasts, hikers, geographers and military historians. Due to multiple consequences of war on local population the battles along the Soča river are studied also from the social aspect. The Kobariški Muzej (WW I museum in the centre of this region) has even won the prestigious award of the European Council as one of the best museums in Europe.

The described project shows the possibilities of different visual presentation of historical facts supported by contemporary datasets. Nowadays, the availability of data, the performance of GIS applications and the visualization techniques enable preparation of different attractive presentations with highly informative, educational and scientific value.

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www 1: http://sl.wikipedia.org (4. 3. 2009)

www 2: http://earth.google.com (4. 3. 2009)

www 3: http://srtm.csi.cgiar.org (5. 3. 2009)