

# **THE GLOBE OF AUSTRIA-CARTOGRAPHIC DESIGN, PRODUCTION AND SOME SELECTED PROBLEMS**

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## **Abstract**

For nearly 100 years the Federal Office of Metrology and Surveying has cooperated with the Military Geography of the Austrian Armed Forces in producing the national topographic maps and especially the military topographic maps of Austria. But in spite of this close cooperation, a partnership had not been constituted. In 2007, the Institute of Military Geography (IMG) and the Federal Office of Metrology and Surveying decided to sign a strategic partnership, to 'legalise' this long lasting relation. It is obvious to make a gift to the partner at the ceremony of foundation of this partnership. The IMG decided to produce something special, a globe of the territory of Austria with the locations of both partners.

The cartographic design and the production of this globe was a new challenge due to missing knowledge, as this is not a common work for a cartographer. In this article, the problems of cartographic design of this globe, concerning this special theme, and some selected cartographic problems during the production, dependent on the used technique, are discussed.

The globe was realised by means of vector and raster programs as usually used to produce conventional maps. The only exception was a special plug-in used within the raster program to generate the segments of the globe. This article explains in detail the necessary steps from the flat map to the finalised segments that could be used to produce the globe. During the cartographic production, some problems using symbols and lettering occurred that had to be solved. Finally some special difficulties of the manual production of the globe are shown and the realised solutions are presented.

The result of this work is a unique "globe of Austria", to be illuminated, on a special manufactured pedestal with a 10.5 mm cartridge, indicating the importance of this partnership concerning the work of the Federal Office of Metrology and Surveying and the very close conjunction to and the relevance for the military.

## 1 Introduction

The first systematic mapping survey of Austria and the territory of the Austrian monarchy started in the second half of the 18<sup>th</sup> century under Empress Maria Theresia. This was done by military officers, especially educated in cartography and mapping techniques at the Military Academy. The first mapping survey, except of the area of Milan (cadastral and topographic maps by Marinoni) and Tyrol (Atlas Tyrolensis by Anich/Hueber), with thousands of hand-drawn map-sheets in the scale of 1 : 28 800, was finished under Emperor Josef II and is called “Josephinische Landesaufnahme”.

The second mapping survey, which could not be finished in the eastern and north-eastern part of the monarchy, started at the beginning of the 19<sup>th</sup> century under Emperor Franz I and is called “Franzisceische Landesaufnahme”. Additional to the scale of 1 : 28 800, maps at the scales of 1 : 144 000 and 1 : 288 000 were produced for the first time for public use.

The third mapping survey under Emperor Franz Joseph I is called “Franzisco-Josephinische Landesaufnahme” and started in 1869 under the responsibility of the new founded Military Geographic Institute (MGI). The main product was the military as well as civilian “Spezialkarte” at the scale of 1 : 75 000 with an acquisition scale of 1 : 25 000.

In 1896 the fourth mapping survey, interrupted by World War I, started as a “precision mapping” to complete the whole territory of the monarchy in the scale of 1 : 25 000. At the end of World War I, the military map production was stopped in Austria and the Military Geographic Institute was transformed into a civil enterprise, the Cartographic Institute. During World War II, the cadastral survey from the Federal Office of Metrology and Surveying and the Cartographic Institute were incorporated into the “Reichsamt für Landesaufnahme”.

After World War II the Federal Office of Metrology and Surveying (BEV) was established again, and the civil and military mapping survey became a legal task under the government’s responsibility. The fourth mapping survey was re-launched as a military and civilian map at the scale of 1 : 50 000.

Military geography was originally operated by a small section within the ministry of defence. In 1997 the Institute of Military Geography (IMG) was founded, which up to now has been responsible for the design of military information and, together with the Federal Office of Metrology and Surveying, for the design of the maps, while the latter is responsible for data acquisition, update and production of printed as well as digital maps.

On the 30<sup>th</sup> of July 1986 a contract, adapted to the actual conditions in 2006, of two-way assistance on projects and work programs within their legal framework based on Article

22 of the Austrian Federal Constitutional Law was signed by representatives of the Federal Ministry of Constructions and Technology, now Federal Ministry of Economic Affairs, Family and Youth (BMWFJ), and of the Federal Ministry of Defence (BMLV). This inter-ministerial contract regulates a general framework of available facilities in an efficient, economical and appropriate way and to further develop the traditionally grown cooperation between the surveying service and national defence (cp. Franzen, 2009).

But this contract does not embody the excellent close collaboration between the Institute of Military Geography and the Federal Office of Metrology and Surveying. In 2007 these two departments decided to sign a strategic partnership contract to evince their personal relationship, extended to social and sportive activities, and to advance the personal contact of their staff-members. The IMG decided to create a special gift for the associate partner to present at the ceremony of foundation of this partnership. It should be a gift that is unique and not available in trade: it was decided to create a special globe of the territory of Austria.

## 2 Cartographic design of the map

The vector data used for the production of the globe of Austria were acquired from the Federal Office of Metrology and Surveying. These data were originally generated for the EuroGlobalMap project at a scale of 1 : 1 000 000 (cp. Eurogeographics, 2009). The reason for using data of the Federal Agency of Metrology and Surveying was the familiar quality. On the other hand these data ended at the border of Austria and no other data, harmonized to that scale from abroad, could be acquired.

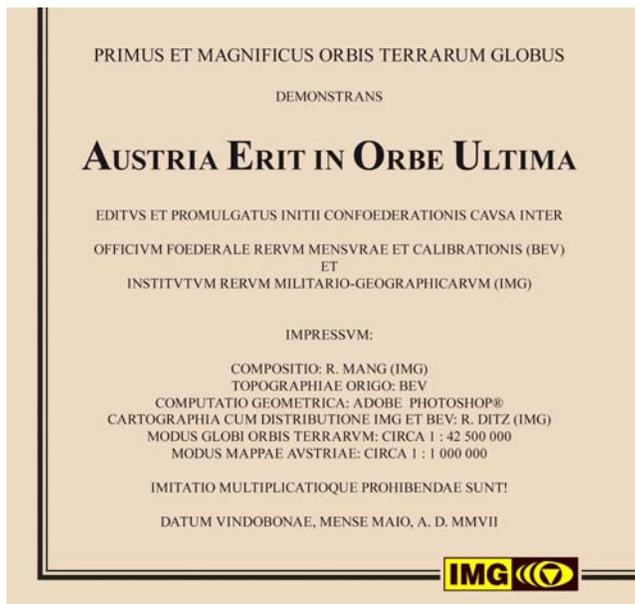


Figure 1: Imprint of the map in Latin language

As a result, a solution with a map on which only Austria is mapped in full was chosen and the areas beyond the border of Austria are portrayed as a sea. The advantage of this solution does not make a problematic and difficult matching at the adjoining edge necessary. And the two lakes at the border of Austria, the Neusiedler See and the Bodensee, “flow” into the surrounding sea, where also sufficient space could be created to place an imprint in Latin language (see figure 1) quite legibly.

The features used to create the map are the hydrology (water bodies and lakes), administrative borders and boundary bands, a hypsometric tint combined with glaciers, some selected cities and lettering, symbols presenting locations in the context of the Federal Office of Metrology and Surveying and the Military Geography, and a geographic grid, as shown in figure 2.



Figure 2: Detail of the map of Austria

The first program used to design the map was ESRI ArcGIS (ESRI, 2009) to define the projection, to select the portrayed features and to compute a shaded relief in a swiss style (cp. Buckley et al, 2008). The second step was to import the vector data into ADOBE Illustrator (Adobe, 2009) using AVENZA MAPublisher (AVENZA, 2009). With this tool the projection and the scale of the map could be defined before the geo-referenced data with all attributes of the features were imported into the vector program. After the import, the cartographic design of the map, the creation of the symbols and the

assignment of line width, colour and all other graphical attributes of the displayed features had to be done. The last step of the production workflow was the export as a raster file to continue processing with ADOBE Photoshop.

### 3 Special adaptation of the map for the production of the globe

The plane map had to be transformed into gores to produce the globe. This step was realised by the special Photoshop plug-in Flexify 2 (Flaming Pear Software, 2009). With this program the number of gores and some settings especially for the production, like the appearance of an adhesive strip could be defined, as shown in figure 3. The only drawback of this tool is the used colour model, only raster files with an RGB colour model can be processed.

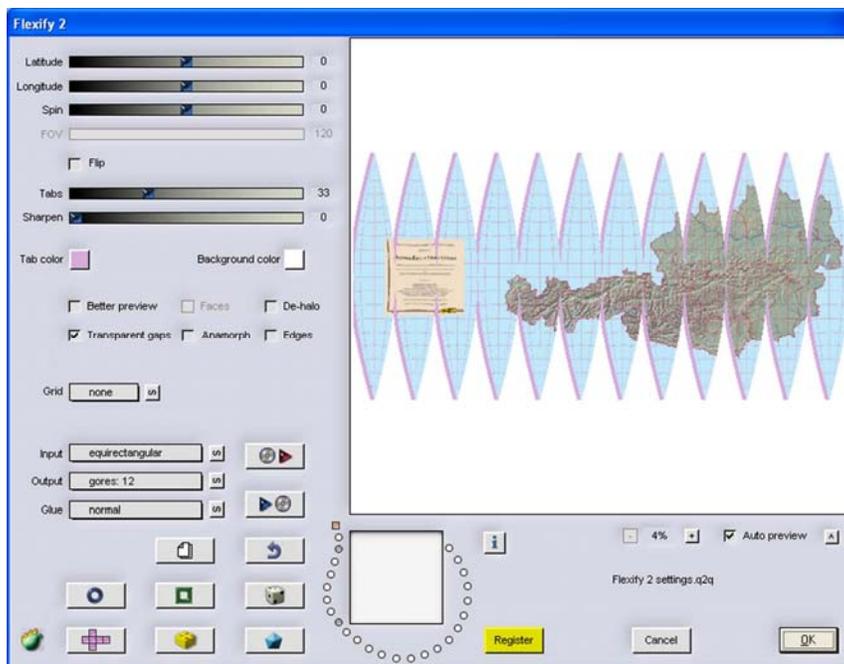


Figure 3: The possibilities for adjustments in the Photoshop plug-in Flexify 2

The first attempt of the production of the globe illustrated the necessity of a post-processing of the map, because symbols and lettering were contracted the closer they were placed to the pole. To guarantee the same size of the symbols and lettering, they had to be placed in a second step within the vector program. To get the appropriate position of the cities to be portrayed, a smaller dot was placed at the first step in the vector program before the gores were computed. This generated map with the gores was then used to place the symbol and the lettering in a second step.

After placing the symbols for the cities, lettering could be realised. The lettering had to be aligned along the grid and symbols had to be aligned to the north, as shown in figure 4. In case of longer names, especially close to the poles, the names have to be split and placed at two segments, so that the spacing between the characters at the adjoining edges of the segments are similar to the rest of the name.

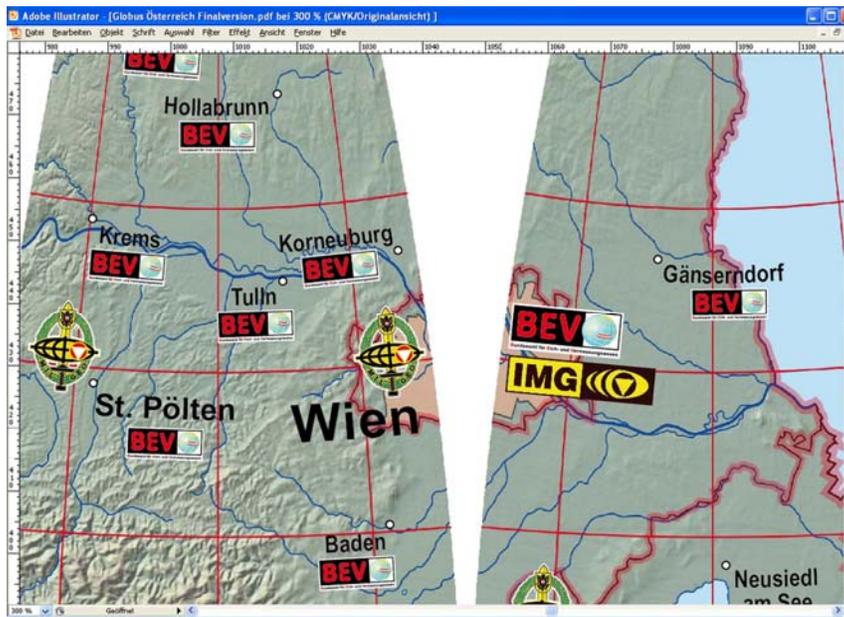


Figure 4: Cartographic fine-tuning for placing symbols and lettering

#### 4 Production of the globe

The production of the globe was an interesting challenge due to missing knowledge and the special circumstances concerning the used components to assemble the globe. The base material was a garden lamp with a ground spike, to enable a lighting of the globe. This spike was removable from the lower part of the lamp upon which a plastic sphere is set. This lower part was fitted in a military workshop onto a 10.5 mm cartridge, indicating the importance of this partnership concerning the work of the Federal Office of Metrology and Surveying and the very close conjunction to and the relevance for the military. This cartridge was set on a special manufactured wooden pedestal with a power supply line through the cartridge to the globe.

To apply the gores on to the plastic sphere, a special glue had to be used that is fluid enough to correct distortions even after a longer processing time, but also permanent enough to avoid a sliding of already finally placed segments. The paper used for printing the gores had to be strong enough to avoid moistening, and the ink had to be water resistant. These are the pre-conditions for the production of the globe.

The most challenging problem for the preparation of the plastic sphere to apply the gores was to define the 'equator' and the 'north pole' to get a clue for the application of the segments. Placing the sphere on a horizontal plane and attaching a vertical plane defined an outermost point, a point on the 'equator'. Spinning the sphere and attaching a crayon marked the line of the 'equator'.

The determination of the 'north pole' was unequally demanding. As a first step the sphere was pivot-mounted on a nail, put inside the sphere, to adjust the lower flat kerb horizontally. After achieving this situation, the 'north pole' was marked with a crayon on the exterior side; this point was then controlled in a second step with a thin string tighten around a needle fixed at the 'north pole'. With that approach the length from the pole to the flat kerb at the bottom of the sphere could be proved and small aberration could finally be adjusted.



Figure 5: Brigadier General and the author producing the globe

The rest of the production was almost unproblematic. The segments had to be cut out exactly and then applied on to the plastic sphere, as figure 5 illustrates. In spite of working assiduously it could not be avoided that some distortions occurred. These distortions become apparent especially at the grid, but were quite negligible.

## 5 Results

On the 18<sup>th</sup> September 2007 the contract of this partnership was signed by Mr. Hochwartner, the President of the Federal Office of Metrology and Surveying and Brigadier General Mang, the Head of the Institute of Military Geography (cp. Federal Ministry of Defence, 2009). At the ceremonial act, Brigadier General Mang emphasised the importance of this partnership and explained humorously the reasons for the cartographic design of this special globe as shown in figure 6. He illustrated that the globe of Austria

- shows the earth after the end of the climate catastrophe: no ice caps at the pole, all continents have been sunken, only Austria remains sustainable increased on a shrunken earth
- shows Austria alone at the sea as an 'Isle of the Blessed': AEIOU (see Wikipedia, 2009)
- shows the future global tasks for both institutions - prepares a global data acquisition
- shows spatial dissemination of Military Geography and the Federal Office of Metrology and Surveying in Austria
- shows, that Vorarlberg and Burgenland are not that far, as commonly assumed
- and shows on the imprint the adequate control of the Latin language.



Figure 6: Brigadier General Mang with the special globe of Austria (Austrian Armed Forces Photograph)

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