

## TRUETYPE FONT SYMBOL LIBRARY FOR CARTOGRAPHY OF EMERGENCY SITUATIONS

**Pavel Špulák, Jan Brothánek**

Capt Ing. Pavel Špulák;

Ministry of the Interior – Directorate General of Fire and Rescue Service of the Czech Republic  
Department of Information and Communication Technologies;

Kloknerova 26, PO Box 69, 148 01 Prague 4;

Tel.: +420 950 819 851, Fax: +420 950 819 965, E-mail: pavel.spulak@grh.izscr.cz;

Capt Ing. Jan Brothánek;

Ministry of the Interior – Directorate General of Fire and Rescue Service of the Czech Republic  
Department of Information and Communication Technologies;

Kloknerova 26, PO Box 69, 148 01 Prague 4;

Tel.: +420 950 819 655, Fax: +420 950 819 965, E-mail: jan.brothanek@grh.izscr.cz;

*This contribution deals with the process of creation of symbol libraries for emergency situations cartography. The libraries were created as a TrueType font files. Two symbol libraries were created. The first one is a set of symbols for description of map orientation (compass roses and north arrows) with correct national (in this case Czech) description. The second one is a set of symbols for description of CBRN (chemical, biological, radiological, and nuclear) threats and another CBRN issues.*

*The TrueType font files are used as symbol libraries in various ESRI products. The font libraries created in this form are easily transferable between various operating systems and GIS programs and also can be easily converted into various different vector graphics formats.*

*The whole process of font creation has taken place under Linux environment. Fortunately main programs used in this process are multiplatform and could be used under Linux, MS Windows and other various computer operating systems. All software used during the process of font creation was part of Ubuntu repository and it was obtained free of charge.*

**Keywords:** *TTF, TrueType font, font creation, map symbology, emergency situations, disaster, cartography*

### INTRODUCTION

Well prepared map play a key role in management of emergency situations. In order to comply with the high demands superimposed on such maps we must pay big attention to the process of its preparation. The symbology selection is a one of the important steps during this process and we must avoid to the symbology which can cause misunderstanding or can be misleading.

In this contribution one of the possible ways for creation of the symbol libraries, which can be used during the process of preparation of such maps, is presented. Every possible asset, connected to an emergency, has to be prepared before the emergency strikes. The time just before the presentation of real emergency situation map is not a right time for playing with symbology.

This contribution deals with the symbol libraries creation for cartography of emergency situations. The libraries were created as a TrueType font files. Two symbol libraries were created. The first one is a set of symbols for description of map orientation (compass roses and north arrows) with correct national (in this case Czech) description. The second one is a set of symbols for description of CBRN (chemical, biological, radiological, and nuclear) threats and another CBRN issues.

The symbols were created as the TrueType font (TTF) glyphs. In typography a glyph is a particular graphical representation, in a particular typeface, of an element of written language [Glyp10]. In this case various symbols are glyphs in the TTF font library instead of the usual elements of the written language, like letters, numbers, marks etc. The distribution of the various symbols as TTF symbol libraries is not unusual. One can recall the Symbol font distributed with Windows operating system. The font libraries created in this form are easily transferable or

convertible between various operating systems or GIS programs. There is also the possibility of its conversion into various formats of vector graphics and its further modification and use.

The TTF symbol libraries are also used through various ESRI products. This work is based on the demands of the practices of daily use of various ESRI products, especially ArcView and ArcEditor, for various task connected with emergency management.

The creation of the graphic design of the new symbol or fonts is very fine art and is a work for well educated and skilled designers. We are trying to create the symbols in order to test this way and we fully accept any comments to the design of the font symbols. Fortunately, large portion of the computer typography fine work, which must be done by the creation of the new fonts, can be omitted if the new font is created as a symbol library. The main reason for is this fact that the symbols will be used entirely separately. It is possible to omit for example the issues like kerning, diacritical marks and the others similar issues.

## **THE SYMBOLS FOR DESCRIPTION THE OF MAP ORIENTATION**

The map has to be equipped with symbol of map orientation (north arrow or compass rose) with correct national description [Zasa10]. There are at least two reasons for this demand. First, it is illogical to combine different languages into one map; second, the use of the abbreviation coming from different language for cardinal points can be confusing. This is the case, especially if the map is used by the persons, who are not specially trained in cartography or geography, or if the map is used under the stress, in the case of emergency. For example in the Czech language the letter “S” (labeling south on English map) is used instead of “N” as an abbreviation for he north, because of the world for north in the Czech language is “sever”. The situation is quite similar in various Slavic languages.

According to the ESRI local representatives statement it is not allowed, due to the license condition, to modify the original ESRI symbols, which are distributed and used as the special TrueType font. We have obtained an advice to create own fonts, but we have been warned that the user created fonts are not covered by the technical help line of the ESRI or ESRI local representatives and these subjects don't guarantee the usability of such fonts. Another possible solution of the problems with symbols of map orientation, labeled with correct national labels, is the pasting of the pictures with user created symbol as the picture created in graphical editor. But, in this case there will arise the problems with the map orientation if the orientation of the map will change.

According the above mentioned advice on the process of the creation of new TrueType font symbol library containing symbols of indication of map orientation (north arrows and compass roses) with correct Czech labeling of cardinal points were started.

The new symbols were inspired with various sources. We cannot deny the inspiration by the original ESRI library because this library covers wide area of the symbol types. It is very difficult to design new symbol which will not have a similar counterpart in original ESRI library. Another source of inspiration was the pictures of the north symbol on the internet, especially on the Wikipedia web pages [Coro10]. We also seek inspiration in various printed books, encyclopedias, travel and adventure books.

The examples of the created symbols for description of the map orientation are shown on figure number 1.

























				
noname U+0000 (0)	at U+0040 (64)	A U+0041 (65)	B U+0042 (66)	C U+0043 (67)
				
D U+0044 (68)	E U+0045 (69)	F U+0046 (70)	G U+0047 (71)	H U+0048 (72)
				
I U+0049 (73)	J U+004a (74)	K U+004b (75)	L U+004c (76)	M U+004d (77)
				
N U+004e (78)	O U+004f (79)	P U+0050 (80)	Q U+0051 (81)	R U+0052 (82)
				
S U+0053 (83)	T U+0054 (84)	U U+0055 (85)	V U+0056 (86)	W U+0057 (87)

Figure 1. The created symbols for description of map orientation

## CBRN THREATS SYMBOLS

The special symbol font was designed in order to cover the demands on marking of special issues connected with CBRN (chemical, biological, radiation and nuclear) threats. The part of the symbol was taken over from the Wikipedia [Hasy10]. By the use of these symbols we paid special attention on the follow up of the copyright condition of the original svg pictures. The other sources of the inspiration were the various military and civil manuals dealing with the CBRN topics [Hava81]. The rest of the symbols were designed from beginning according to the actual demands of the daily Fire and Rescue Corpse practices.

In case of taken over svg symbols is necessary to pay special attention on its final adjustment before its import to the program for font creation. For example all overlapped polygon must be merged, the polygons must be closed and the lines must be converted into polygons.

The figure number 2 shows the results of the efforts leading to the symbols for making of CBRN threads and other CBRN issues.


































				
noname U+0000 (0)	A U+0041 (65)	B U+0042 (66)	C U+0043 (67)	D U+0044 (68)
				
E U+0045 (69)	F U+0046 (70)	G U+0047 (71)	H U+0048 (72)	I U+0049 (73)
				
J U+004a (74)	K U+004b (75)	L U+004c (76)	M U+004d (77)	N U+004e (78)
				
O U+004f (79)	P U+0050 (80)	Q U+0051 (81)	R U+0052 (82)	S U+0053 (83)
				
T U+0054 (84)	U U+0055 (85)	V U+0056 (86)	W U+0057 (87)	X U+0058 (88)
				
Y U+0059 (89)	Z U+005a (90)	bracketleft U+005b (91)	backslash U+005c (92)	bracketright U+005d (93)
				
asciicircum U+005e (94)	underscore U+005f (95)	c U+0063 (99)		

Figure 2. The created symbols for description of CBRN threats and another CBRN issues.

## COPYRIGHTED FONTS

During the process of the creation of the new symbol we have faced the necessity of use of other fonts contacting the letters of the alphabet.

The creation of the fonts for typographical purposes is a very fine and demanding work and owing to this fact the high-quality fonts are strictly copyrighted. According to our point of view, the use of such copyrighted fonts in the process of creation of our symbol is not only the violation of the laws, but also immoral. In order to manage this problem we have looked for the alternative solution. We have tested the following solutions:

1. The creation (geometrical construction) of the new font containing necessary characters for description of the cardinal points from begging. We focused our effort on the letters (S, Z, V, J), which are

the abbreviation of the description of the cardinal points in Czech language. Unfortunately this lead to the results, which wasn't satisfying us. The creation of the good letter glyphs is very demanding task.

2. We also tried the digitalization of the letters coming form old printed books [Broc96] or stencils in order to avoid the problems with copyright. This way was successful and lead to the usable letters. Only one problem connected with this way is, that the obtained shape of the letters correspond to the time of the printing of the book or creation of the stencil, so the final map symbols aren't suitable for all currently produced maps. For example compass roses created with help o these glyphs are suitable for the maps in adventure stories of Jules Verne, but looks like a little bit strange in the flood plans or CBRN situation reports. The symbology of the map has to correspond to its content, time of creation and cultural framework.
3. We also successfully tried the use of the letter glyphs coming from the fonts which are distributed under the GNU General Public License [Fref10]. Such fonts can be redistributed and/or modified under the terms of the GNU General Public License as published by the Free Software Foundation [Gpli10]. These fonts looks like very modern and can be used in various types of applications.

The results of the efforts focused on the creation of the new fonts, containing the letters necessary for description of the cardinal points in the Czech language are depicted on the figures 3 and 4. The first of these figures shows the letters obtained via vectorization of the pictures of the letters coming from the printed books. The second picture shows the letters obtained through the vectorization of the image of the stencil. The use of the glyphs, which are shown on figure 3, for creation of the map orientation symbols is shown on figure one. The last symbol in the last line was created with help of these glyphs.

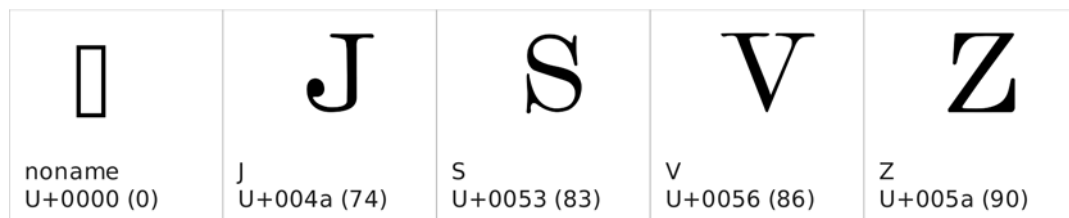


Figure 3. The TTF glyphs obtained via vectorization of the letters from printed books.

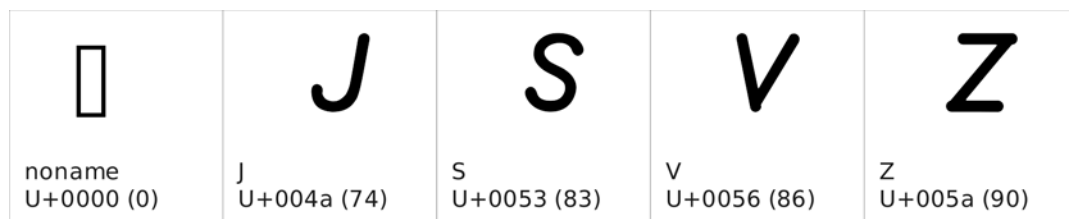


Figure 4. The TTF glyphs obtained via vectorization of the stencils.

## COMPUTER PROGRAMS USED FOR TRUETYPE FONT SYMBOL LIBRARIES CREATION

The whole process of font creation has completely taken place under the Linux operating system. It is necessary to underline the fact, that the TrueType fonts symbol libraries were created with help of the computer programs running under the Linux, and obtained with no charge, were used without the problems under Windows operating system.

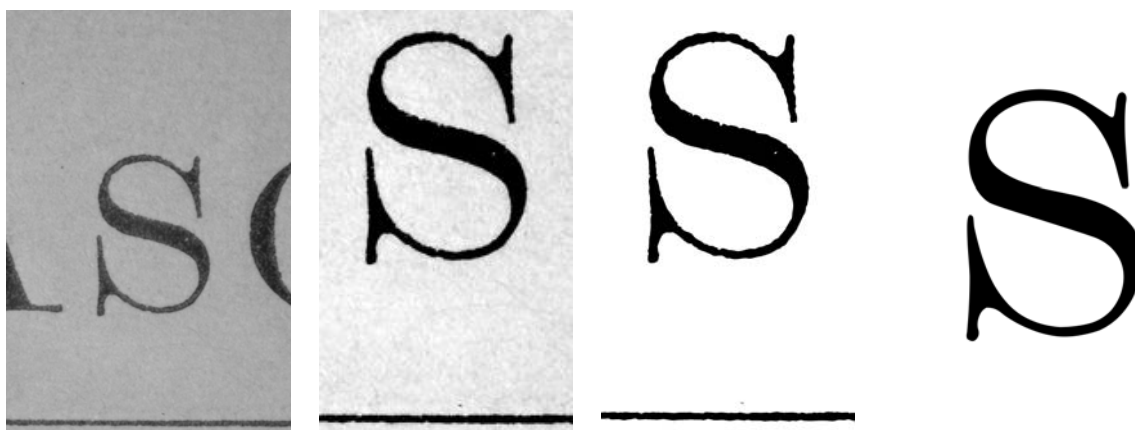
Linux distribution Ubuntu, version 8.10 (code name Intrepid Ibex) was selected because of its outstanding performance, management, installation and broad hardware support [Ubun10]. Fortunately main programs used for creation of the fonts, Inkscape [Inks10] and FontForge [Fof10], are multiplatform and could be used under Linux, MS Windows and other various computer operating systems. All above mentioned software tools, used during the process of font creation, were part of Ubuntu repository and were installed via standard Ubuntu procedures.

The main application used for creation of the fonts was program FontForge. Unfortunately this program has a little bit nonstandard build-in editor for editing of the glyph shapes. Owing to this fact, the program Inkscape was used for editing of the glyph shapes instead of the build in editor. The glyphs were created in svg format in Inkscape and imported in FontForge on the selected place in Unicode character table. In order to better manage the organization of the process, each fail, containing glyph shape, has a name according the hexadecimal value of the Unicode character on which position it was placed. The FontForge program can be used for creation of various font types, not only for creation of TrueType fonts.

The dimension of the canvas in Inkscape was set on 2048 x 2048 pixels. In the same way was also set the dimension of the glyph in the program FontForge. All layers were set as a quadratic because TrueType fonts use quadratic Bezier splines. In this case, if the shape of the glyph is created, there is only one control point between two end points and that point determines the slope of the spline at both end points.

For vectorization of the images of the letters the programs Potrace [Potr10] and AutoTrace [Autr10] with Potracegui [Potg10] for its easy management were used. First, the picture of the letter was taken from the book as a jpeg image via Canon EOS 350D with help of the bellows placed between camera body and camera lens. After that, the images were converted and adjusted as a tiff image.

The adjustment was done in GIMP program [Gimp10]. The tiff format without the compression of the image was selected in order to prevent image degradation during the processing. The results of the vectorization were obtained as eps file. Finally this eps file was loaded into Inkscape program, saved as svg file, revised and transferred to the FontForge. The whole process is illustrated on the series of pictures depicted on figure 5.



*Figure 5. The set of the pictures illustrating the way leading to the svg vector image of the letter "S". The first picture is a jpg picture of the letter from the book taken via Canon EOS 350D camera with bellows. The second picture is an adjusted tiff image of the original jpeg picture. The next picture is an eps picture showing the vectorization results. The last picture is final svg vector image of the letter "S" ready for import into FontForge program for creation of TrueType font. For publication reason all these pictures were converted to the jpeg format. The horizontal line, which was presented in original text, was scanned together with the letters in order to control the precise horizontal orientation of the letter.*

In the case of the vectorization of the letters in stencils, the stencil was scanned on the desktop scanner with white background behind it as a jpeg file and rest of the procedure was the same like in the case of above mentioned pictures of the letters from the books.

For a final control of the fonts, the program Fontmatrix was used.

## CONCLUSIONS

In this article we have described one of the possible ways leading to the new TrueType font symbols libraries, which are usable for cartography of emergency situations. We demonstrate this way on the creation of two libraries, one containing the symbols for description of the map orientation and the second containing various symbols for description of CBRN threats and other CBRN issues.

The described way can be used for creation of various types TrueType font symbol libraries, not only for symbols created for above mentioned purposes. Some steps described in this article are more common and can be used during the process of creation of the symbols in various forms, not only as a TrueType fonts or another type of fonts. The use of the created symbols in real Fire and Rescue Service daily practices of the management emergencies is demonstrated on the figure 6. The created symbols are for disposition and can be used for various cartography and GIS tasks according to the demand of daily practices of the Service.



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Published on 5 January 2010 [Cited on 24 April 2010]. Available on:  
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Capt Ing. Pavel Špulák

I was born in Prague on the 7<sup>th</sup> July of 1973. In 1991 I have finished Chemical Industrial College and in 1997 I have finished The Institute of Chemical Technology, Prague and obtained the title chemical engineer. After that I work in various research institutions and universities. My work was mainly focused on various types of spectroscopy and photonics. Since 2005 I have become of the Fire and Rescue Service of the Czech Republic and I am working on Directorate General. At present time I am a member of Department of Information and Communication Technologies. My work is focused on various ICT, GIS, CBRN, and population protection issues.



Capt Ing. Jan Brothánek

I was born in Ostrava on the 12<sup>th</sup> April of 1983. I have finished the College of Civil Engineering in 2002 and in 2008 I have finished the Technical University of Ostrava and obtained the title engineer. My studies there were specialized on GIS. After finishing of the University I worked as implementation specialist in software development center of PPF group. Since 2010 I am member of the Fire and Rescue Service of the Czech Republic and I am working on Directorate General as a GIS specialist. I am focusing on coordination of GIS issues in the scope of Czech Fire and Rescue service and project management.