Historical Orthophoto of Prague 1945

Workshop on Geoprocessing and Archiving of Historical Aerial Images
Paris, 3rd – 4th June 2019

Patrik Meixner
Basic facts

• Summer 2014 – first contact with Luftbilddatenbank Dr. Carls GmbH, who introduced us to the so far unknown wonder of WWII reconnaissance aerial imagery and its exploitation

• 2015 – PRIMIS started acquisition in Czech Republic – large cities, open-cast mines + surrounding chemical industry (usually founded shortly before or during WWII in Sudetenland), large factories active during WWII (e.g. Skoda Works, Pilsen – arms producer during WWII)

• At the end of 2015 PRIMIS commissioned by IPR Prague to make an orthophotomap of Prague from archival aerial reconnaissance photographs taken by the Allies in the spring of 1945
Aerial photos in Allied archives

- Prague was the target for Allied bombing missions on 5. 11. 1944, then 14. 2. 1945 and finally 25. 3. 1945

- More than 1,200 casualties, and significant material and property damage in Nové Město, Holešovice, Smíchov, Vršovice, Vinohrady, Žižkov, Libeň, Kbely, Letňany and Čakovice

- Of course incomparable with German cities, but please take into account that Czechoslovakia was formally on the Allied side via its government in exile and its armed forces fighting both on the western and eastern fronts (UK, USSR)

- Bombing of Prague as collateral damage

- Detailed research by Luftbilddatenbank Dr. Carls GmbH
- Found 10 reconnaissance mission by Allied air forces
- All photos captured in April-May 1945
- Photo scale ranges from 1 : 7 000 to 1 : 50 000
- 1 : 50 000 scale photos used only in places with no coverage by larger scale photos
Aerial photo recce missions found in Allied archives

- 104W-115C, 46 photos
- 104W-136C, 75 photos
- 104W-167C, 71 photos
- 30-6091, 124 photos
- 31-4874, 194 photos
- 31-4875, 145 photos
- 32-1014, 143 photos
- 32-1032, 141 photos
- 7-152B, 124 photos
- 7-160B, 19 photos

- Altogether 1082 photos
104W-115C, 46 photos, scale 1 : 7 200, 17th April 1945
104W-136C, 75 photos, scale 1 : 9 000, 20th April 1945
104W-167C, 71 photos, scale 1 : 7 500, 26th April 1945
30-6091, 124 photos, scale 1 : 10 000, 4th May 1945
31-4874, 194 photos, scale 1 : 10 000, 16th April 1945
31-4875, 145 photos, scale 1 : 10 000, 16th April 1945
32-1014, 124 photos, scale 1 : 12 500, 16th April 1945
32-1032, 122 photos, scale 1 : 12 000, 19th April 1945
7-152B, 124 photos, scale 1 : 7 000, 20th April 1945
7-160B, 19 photos, scale 1 : 12 500, 26th April 1945
1044 photos in scales 1 : 7 200 to 1 : 12 500
32-1032 a 32-1014, 38 photos, scales 1 : 48 000 and 1 : 50 000, 16th and 19th April 1945
All aerial photos available for the orthophoto job
Only 7.9 km² = 1.6% of the actual (2018) territory of the city of Prague not covered by the archival photos
Orthophoto production

- Imagery obtained scanned already – no scanning in PRIMIS
- Geo-referencing in ArcGIS – reason given on next slides
- Geo-referenced using CPs from the actual orthophoto (summer 2015)
- Conventional orthophoto production in Hexagon ImageStation OrthoPro
- Automatic seamlines with manual editing
- In case of multiple coverage, the mission with the best visual quality and covering the widest continuous area used
- Final mosaicking in GSD of 25 cm
Geo-referencing in ArcGIS

- Type of transformation – ADJUST - polynomial transformation with triangulated irregular network (TIN) interpolation
- Usually minimum 20 control points used
- RMS below 1 m
Geo-referencing in ArcGIS – adverse effects

- Cuts outside of the “point envelope” caused by the transformation type
- Inconvenient in single photo geo-referencing (PROJECTIVE leads to comparable results without the cuts)
- Careful mosaicking takes care about the problem during standard orthophoto production – cuts covered by the overlapping photos
Standard AT – no go in the case of recce photos

• Non-photogrammetric scanning leads to highly distorted imagery
• Fiducial marks identification sometimes dubious – though good IO results obtained more often than not
• Self-calibration ineffective – distortions not systematic
• Long focal lengths (24”, 36”, 40”) do not help the standard photogrammetry – on the contrary – they help the GIS geo-referencing approach
Representation of results

• Several websites

• Two Pragues [http://www.dveprahy.cz/](http://www.dveprahy.cz/)


• Story Map
Thank you for your attention.

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