LANTMÄTERIET

2021-05-07

PRODUCT DESCRIPTION

Orthophoto (Ortofoto)

DOCUMENT VERSION: 2.6

Figure 1.Example orthophoto.

Table of contents

1 General description

Orthophotos are radiometrically processed aerial photography data, geometrically projected to an orthogonal map projection by using an elevation model.

In an orthophoto the scale or distance between points are not affected by variations in the terrain, which is the case in an aerial photo with central projection.

1.1 Contents

The product Orthophoto contains orthogonal projected aerial photos (orthophotos) with different combinations of wavelength bands and resolutions:

Table 1. Product variants.

Resolution	Monochrome (b/w)	4-channel (Band order: Red, green, blue, Infrared)	Colour (Band order: Red, green, blue)	IR (Band order: Infrared, red, green)
0,5 m/pixel (until. 2018)	Yes	No	Yes	Yes
0,25 m/pixel (until. 2018)	Yes, from 2006	No	Yes, from 2006	Yes *
0,4 m/pixel (from. 2019)	Yes	Yes	Yes	Yes
0,16 m/pixel (from. 2019)	Yes	Yes	Yes	Yes

* Orthophoto in IR with resolution of 0,25 m/pixel is available from 2011 onwards and also over certain localities that were photographed in 2009, for example entire Stockholm. Information regarding Plans and outcomes and overview information, can be found on Orthophoto - Lantmäteriet.

1.2 Geographic coverage

Orthophoto, with 0,5 m resolution, is available within Sweden's entire territory, limited by country and territorial borders, with the exception for surfaces consisting only of open water. The year 2000 was the first year with an entire nationwide coverage of digital orthophotos. Those were orthophotos in black and white with the resolution of 1 m. Since then several updates have been made and nowadays there is complete orthophoto coverage of the entire country, both in colour and IR, with the resolution of 0,5 m. From 2019 the orthophotos have 0,4 m resolution instead of 0,5 m and can also be delivered as 4-channel orthophotos.

Orthophotos with 0,25 m resolution, is available from 2006 onwards for a selection of the largest localities and from 2012 onwards extended to cover the entire southern part of the country and along the coast of Norrland (approximately 44 % of the country), as a part of the national image provision programme. From 2019 the orthophotos have 0,16 m resolution instead of 0,25 m and can also be delivered as 4-channel orthophotos.

More information about The long term image provision programme.

1.3 Geographic cut-out

Orthophotos were until 2005 produced and stored in 5 x 5 km tiles according to the Property Maps former sheet lines, which were adjusted to the reference system RT 90 2,5 gon V.

From 2006 onwards orthophotos with 0,5 m resolution (from 2019 with 0,4 m resolution) are produced and stored in files of 5 x 5 km and orthophotos with 0,25 m resolution (from 2019 with 0,16 m resolution) are produced and stored in files of 2,5 x 2,5 km, adjusted to the reference system SWEREF 99 TM. The designation of the index tiles was changed 2014-09-17. More information regarding the index system and the new designation of the index tiles can be found in Infoblad 11 (in Swedish).

Below are the file coverage and file sizes for each product presented.

Table 2. Coverage area and file size for each product variant.

Product	File coverage	Average file size for LZW-compressed GeoTIFF (the size can vary relatively much)
Orthophoto b/w 1 m/pixel	5 x 5 km (5 000 x 5 000 pixels)	21 MB
Orthophoto b/w 0,5 m/pixel	5 x 5 km (10 000 x 10 000 pixels)	85 MB
Orthophoto colour/IR 1 m/pixel	5 x 5 km (5 000 x 5 000 pixels)	50 MB
Orthophoto colour/IR 0,5 m/pixel	5 x 5 km (10 000 x 10 000 pixels)	202 MB
Orthophoto b/w 0,25 m/pixel	2,5 x 2,5 km (10 000 x 10 000 pixels)	85 MB
Orthophoto colour/IR 0,25m/pixel	2,5 x 2,5 km (10 000 x 10 000 pixels)	202 MB
Orthophoto colour/IR 0,4 m/pixel	5 x 5 km (12 500 x 12 500 pixels)	240 MB
Orthophoto colour/IR 0,16 m/pixel	2,5 x 2,5 km (15 625 x 15 625 pixels)	400 MB
Orthophoto 4-channels 0,4 m/pixel	5 x 5 km (12 500 x 12 500 pixels)	320 MB
Orthophoto 4-channels 0,16 m/pixel	2,5 x 2,5 km (15 625 x 15 625 pixels)	520 MB

Orthophotos are delivered in files according to the index tiles they are stored in, but can also be ordered in a preferred cut-out, with min-max coordinates. When ordered in cut-outs, polygons or tiles larger than the index tiles they are stored in, all affected index tiles will be delivered.

1.4 Coordinate system

Horizontal: SWEREF 99 TM and associated local zones.

Vertical: RH 2000.

2 Quality description

In Table 3 quality, including quality themes and quality parameters as described in the standard SS-EN ISO 19157:2013 Geografisk information – Datakvalitet, is presented. More detailed description of lineage and quality can be found in the text below.

Tabell 3. Quality themes and quality parameters for orthophoto.

Quality theme	Quality parameter	Quality
Positional accuracy	• Absolute positional accuracy • Positional accuracy of raster data	The geometric positional accuracy in an orthophoto partly depends on the geometry in the aerial photo and partly on the quality of the elevation model being used. For older orthophotos with resolution 0,5 m the elevation data 50 m (i.e. the old elevation model) has been used, which gives an expected horizontal standard error of approximately 1 m. For newer orthophotos with 0,5 m resolution, based on the 20 m grid from the new elevation model, the horizontal standard error is approximately the same. In the production of orthophotos with 0,25 m resolution an elevation model with a grid of 10 m is used, which gives a calculated horizontal standard error in the orthophoto of approx. 0,30 m. Orthophotos from 2019 with resolution 0,16 m/pixel and 0,4 m/pixel have approximated horizontal standard errors of 0,2 m and 0,8 m respectively. Also see chapter 2.4.1 Positional accuracy.

2.1 Purpose and utility

Orthophotos are above all used as a base for producing maps. The orthophotos are also used for other purposes, for example community planning, environmental monitoring, planning and follow-up of land use and as background material for other information and in GIS-software.

Photos taken before leafing do not contain that much IR-information. Therefore, the photos can be more or less suitable for different areas of application, depending on the time of photography. In appendix 1 there are examples showing effects of different vegetation at different times of photography. Other factors can also give some amount of variation in the photos.

Examples of such factors are fog, sun angle and conditions on the ground, such as drought, at the time of photography.

At the production of orthophotos radiometric processing and correction is made, which results in changes of pixel values. Hence, it is not possible to perform correct radiometric measurements in an orthophoto.

Depending on where in the aerial photo a building lies, i.e. how far away from a building the flight line is, more or less of the façade can be visible on the orthophoto. For more information regarding this phenomenon, see appendix 2 in this document.

For orthophotos with resolutions of 0,5 m (from 2010 onwards), 0,25 m, 0,4 m and 0,16 m, the pixels without any picture information (that lie outside the orthophotos cut polygon or coverage) have the value (0,0,0), in order to be distinguished from for example dark surfaces like water. This is mainly used when the photos do not cover an entire 5 x 5 or 2,5 x2,5 km tile. If the format is GeoTIFF this is included as embedded information in the shape of No Data Value. There are in these cases not any pixels with the value (0,0,0), or any pixels containing any 0-value at all, within the coverage of the orthophoto.

For orthophotos with 0,5 m resolution before the year 2010 the pixels without any picture information (that lie outside the orthophotos cut polygon or coverage) also have the value (0,0,0). If the format is GeoTIFF this is included as embedded information in the shape of No Data Value. There might however in this case occur pixels with the value (0,0,0) within the coverage of the orthophoto.

The orthophotos usually have invisible seams between the included aerial photos.

2.2 Data capture

2.2.1 LINEAGE

The orthophoto production is tightly linked to the aerial photography for the national image provision programme. After new aerial photos have been taken in Lantmäteriets image provision programme, orthophotos are produced.

Aerial photography is carried out, and has been carried out, from different altitudes (2500 m - 7400 m) depending on the type of camera used and the desired resolution of the photo.

From 2019 orthophotos in 4 channels, colour and IR are produced from the pan-sharpened 4-channel aerial photos over the areas that are photographed. Before that orthophotos in colour and IR were produced from the pan-sharpened aerial photos in colour and IR over the areas that were photographed. Orthophotos in black and white are produced in connection to the delivery; from 2019 onwards from 4-channel orthophotos and before that mainly from orthophotos in colour, but if no such photos are available orthophotos in IR are used instead.

The aerial photos are recalculated from central projection to orthogonal projection and thereafter corrected for scale variations caused by height differences in the terrain. The scale corrected photos are thereafter put together in large mosaics, where the seams between the photos are covered as much as possible. Only the most central parts of each aerial photo are included in the final orthophoto. Orthophotos from the middle of the 1990s until 2005, have been produced from scanned analogue aerial photos or by scanning analogue orthophotos. They are generally not mosaics, but instead produced from a single photo.

The result is orthophotos fitted in a pre-determined coordinate system. As a result, the seams and information about each aerial photo are also saved, for example the date and time when the aerial photo was taken.

Each orthophoto is normally produced from aerial photos from the same flight year, but a few orthophotos may have been produced from aerial photos from different flight years.

Until 2011 orthophotos were only produced with 0,5 m resolution, in colour and IR. From 2012 some parts of the aerial photography were carried out with higher resolution, 0,25 m/pixel. From 2019 onwards orthophotos are produced with 0,4 m resolution instead of 0,5 m and with 0,16 m resolution instead of 0,25 m and those orthophotos can also be delivered as 4-channel orthophotos.

Regardless of the original resolution, orthophotos over the whole country can be delivered with a lower resolution, i.e. an orthophoto with the original resolution 0,25 m can be delivered with 0,5 m resolution.

2.2.2 GEOMETRIC RESOLUTION

Flight altitude and the type of camera used for the photography determine the geometrical resolution of the photos. Aerial photos with resolution 0,48 m produce orthophotos with 0,5 m/pixel, which corresponds to 0,5 x 0,5 metres on the ground. Aerial photos with resolution 0,24 m produce orthophotos with 0,25 m/pixel, which corresponds to 0,25 x 0,25 metres on the ground. Aerial photos with resolution 0,37 m produce orthophotos with 0,4 m/pixel and aerial photos with resolution 0,15 m produce orthophotos with 0,16 m/pixel. An orthophoto can always be recalculated to a lower resolution. An orthophoto with 0,5 m resolution can for instance be recalculated and delivered with 1 m resolution.

2.2.3 RADIOMETRIC RESOLUTION

Orthophotos in colour (RGB) and IR (IRG) have a radiometric resolution of 24 bits (8 bits per each colour band) and orthophotos in 4 channels have a radiometric resolution of 32 bits. The orthophotos usually have invisible seams between the included aerial photos.

The aerial photos used to produce the orthophotos have been processed to achieve as neutral and reality consistent colours as possible, red and blue discolourations have been removed from the photos.

2.3 Maintenance

2.3.1 MAINTENANCE FREQUENCY

The ambition is to photograph approximately 30 % of the country each year; more frequently and with higher resolution in densely built-up areas in the south of Sweden and along the coast of Norrland, but less frequently and with lower resolution in the inland of Norrland and in the northern mountain ranges.

The entire country is photographed according to a long-term aerial photography plan. The annual aerial photography plan can however not always be completely carried out, due to for example poor weather conditions in the mountain areas.

Big parts of the country are photographed every 4:th year and the mountain regions every 6:th – 10:th year with 0,37 m resolution (before 2019 with 0,48 m resolution), while the southern part of the country and along the coast of Norrland are photographed every other year with 0,15 m resolution (before 2019 with 0,24 m resolution). Apart from that, several localities, outside the 0,15 m coverage, are photographed with the higher resolution, with an interval of 2 to 4 years.

Updated information regarding the outcome of the orthophoto production.

2.4 Data quality

2.4.1 POSITIONAL ACCURACY

The geometric positional accuracy in an orthophoto partly depends on the geometry in the aerial photo and partly on the quality of the elevation model being used. This means that there may be possible deviations in some orthophotos and also differences between different year classes of orthophotos.

Possible errors in the elevation model decrease the positional accuracy in the orthophoto the further away from the centre you get. Which elevation model that has been used is presented in the metadata included in the delivery.

For older orthophotos with resolution 0,5 m the elevation data 50 m (i.e. the old elevation model) has been used, which gives an expected horizontal standard error of approximately 1 m. For newer orthophotos with 0,5 m resolution, based on the 20 m grid from the new elevation model, the horizontal standard error is approximately the same. The reliability is however higher and locally the geometry can be significantly better, especially in the outer rims of the flight lines where the elevation model has the most impact. In the most central parts of each included aerial photo the elevation model has relatively small effect on the geometry in the orthophoto.

In the production of orthophotos with 0,25 m resolution an elevation model with a grid of 10 m was used, which gives a calculated horizontal standard error in the orthophoto of approx. 0,30 m. For individual localities the

elevation model has earlier been produced through image matching and manual editing.

Where the new elevation model has been available a grid with 4 m resolution has been used. That only marginally affects the accuracy in the orthophoto, but locally the geometry can be significantly better, especially in the outer rims of the flight lines. That depends among other things on the fact that the new elevation model is a pure elevation model while the matched one with 10 m resolution is a mix of an elevation- and surface model, for example in dense forests.

Orthophotos with 0,16 m resolution and 0,4 m resolution (i.e. orthophotos from 2019) have approximated horizontal standard errors of 0,2 meters and 0,8 meters respectively. The new elevation model has during the build-up been used, wherever it has been ready and complete, for all the orthophoto areas that have been produced, regardless of resolution.

2.5 Metadata

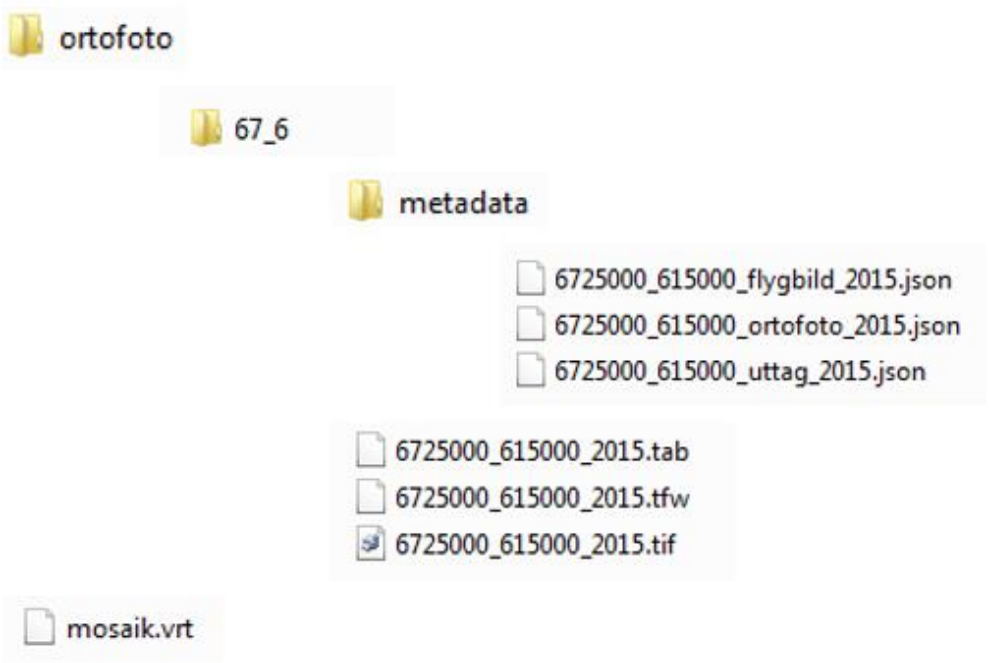
Orthophoto with 0,5 m/0,4 m and 0,25 m/0,16 m resolutions are delivered in files covering 5x5 and 2,5x2,5 km respectively, adjusted to the chosen coordinate system. The associated metadata files, also adjusted to the chosen coordinate system, show which orthophotos they are comprised of and their spread, together with information regarding the included aerial photos. Together with orthophotos from 2010 onwards the seamlines and time of flight for each included aerial photo are delivered, seamlines are shown in the shape of polygons. For orthophotos with resolution 0,5 m (2006-2009) image exposure position files in shape format, containing information about time of flight for every aerial photo, can be downloaded and matched against the orthophotos.

3 Contents of the delivery

3.1 Folder structure at delivery

At delivery the files are sorted under different folders, see example below of a delivery of Orthophoto in SWEREF 99 TM.

Figure 2.Folder structure at delivery.



3.1.1 THE FOLDER ”ORTOFOTO”

This folder contains the file mosaik.vrt; a file that creates a virtual mosaic of all the orthophotos in the delivery.

3.1.2 THE FOLDER ”67_6”

The naming of this folder is based on the coordinates of the orthophoto, hence it is dynamic. The name of the folder consists of the first two digits in the north-south direction (northern) and the first digit in the east-west direction (eastern) of the lower left corner, for example 67_6.

Beneath this folder lie the image files in LZW-compressed GeoTIFF-format or in JPEGformat. Together with the image files the associated WORLD-files for the above mentioned formats lie (with the file extensions.tfw and .jgw respectively) and also specifically for MapInfo (with the file extension .tab).

3.1.3 KATALOGEN METADATA

This folder contains metadata in three different GeoJSON-files for the aerial photos the orthophoto consists of (including their spread), the orthophoto itself and the orthophotos it consists of (including their spread) and the whole orthophoto extraction.

The files are adjusted to the chosen coordinate system. The file contents can differ somewhat, depending on whether the orthophotos are from 2010 onwards or from the years 2006-2009. For more information regarding file contents, see chapter 3.3.

Schemes for the GeoJSON-files can be downloaded from a scheme server.

3.2 Delivery format

Orthophotos are delivered in LZW-compressed GeoTIFF- or JPEG-format. 4-channel orthophotos can however only be delivered in LZW-compressed GeoTIFF-format. We also always supply separate WORLD-files. Orthophotos can be delivered in SWEREF 99 TM and associated local zones.

For the GeoTIFF-format orthophotos are delivered with insertion point ”area” (Pixel Is Area), i.e. the value of a pixel covers the whole area of the pixel. For more information we refer to the GeoTIFF-specifikationen.

3.3 File sets

The file name for a 5x5 km tile and a 2,5 x 2,5 km tile can consist of the designation of the tile according to the index system, or the coordinates for the lower left corner of the tile, or the corners of the circumscribing rectangle (minN_minE_maxN_maxE), followed by the year of the orthophoto with four digits.

The file name for an arbitrary cut-out can consist of the coordinates for the lower left corner of the cut-out, or the corners of the circumscribing rectangle (minN_minE_maxN_maxE), followed by the year of the orthophoto with four digits.

The year in the file name is set according to the flight year, if an orthophoto consists of aerial photos from different flight years it is the flight year of the main part of the surface that is presented here.

However, if the orthophoto consists of parts from orthophotos from different years, it is the year from the main part of the surface that is indicated in the file name. If surfaces from different years should be of exactly the same size, the most recent year of those surfaces is presented in the file name.

Files delivered in SWEREF 99 TM local zones are named with a zone prefix first in the file name, for example 1200_.

More information about the index system and the designation of the index tiles can be found in Infoblad 11.

Table 4. File contents in image and coordinate files.

File name (exempel)	File contents
6725000_615000_2015.tif	The image in LZW-compressed GeoTIFF-format. In case of delivery of JPEG-format the file has the extension .jpg.
6725000_615000_2015.tfw	WORLD-file (coordinate information) for TIFF-format. In case of delivery of JPEG-format the file has the extension .jgw.
6725000_615000_2015.tab	Coordinate information specifically for MapInfo. Attached regardless of the chosen file format.
mosaik.vrt	Creates a virtual mosaic of all orthophotos in the delivery.

Tabell 5. File contents in metadata files.

<table>
<tr><th>File name (exemple)</th><th>File contents</th></tr>
<tr><td>6725000_615000_ortofoto_2015.json</td><td>File in json format (GeoJSON), containing metadata for the delivered orthophoto, including the orthophotos it consists of.

The file contains:

• produkttyp (Product type): Ortofoto från flygbild (Orthophoto from aerial photo).
• ortoidentitet (Ortho identity), an internal production-id in the format: sey_yx_onnnnn_eeee_uu_skåå.

<table>
<tr><th>Letter comb.</th><th>Meaning</th></tr>
<tr><td>se</td><td>Sverige</td></tr>
<tr><td>y_y(y)</td><td>Resolution in metres/pixel (0_5 = 0,5 m, 0_25 = 0,25 m, 0_4 = 0,4 m, 0_16 = 0,16 m)</td></tr>
<tr><td>x</td><td>m, c, i, or g (multispectral i.e. 4-channels, colour, infrared or grayscale). In some cases, the letter can be followed by the string _sweref.</td></tr>
<tr><td>o</td><td>Orthophoto</td></tr>
<tr><td>nnnnn</td><td>The northern coordinate for the 100-metre tile in the southwest corner.</td></tr>
<tr><td>eeee</td><td>The eastern coordinate for the 100-metre tile in the southwest corner.</td></tr>
<tr><td>uu</td><td>The spread of the quadratic tile, in hundreds of metres.</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>File name (exemple)</th><th>File contents</th></tr>
<tr><td></td><td>
<table>
<tr><td>s</td><td>Spectral area. Can be m, f, i or g (multispectral i.e. 4-channels, colour, infrared or gray-scale).</td></tr>
<tr><td>k</td><td>Source. Can be i, j, l, m, n or o where
i = flight altitude 4800 m, DMC
j = flight altitude 2500 m, DMC
l = flight altitude 7400 m, UCE
m = flight altitude 3700 m, UCE
n = flight altitude 5600 m, UCXp, wa
o = flight altitude 2800 m, UCXp, wa
p = flight altitude 1200 m, UCE
q = flight altitude 7400 m, UCE Mark 3
r = flight altitude 3000 m, UCE Mark 3</td></tr>
<tr><td>åå</td><td>The two last digits of the flight year.</td></tr>
</table>

ortonamn (Ortho name) in the format: onnnnn_eeee_uu_skåå, see above.
gridreferens (Grid reference) in the format: onnnnn_eeee_uu, see above.
flygar (Flight year). An orthophoto may however consist of aerial photos from different flight years. In that case it is the flight year of the main part of the surface that is presented here.
flyghojd (Flight altitude, in metres).
hojdmodell (Elevation model used in the production).
medelfel ((Standard error (RMSE): For a large number of random selected points take the quadratic sum of the difference between measured and approximated value for each point, divide this with the number of points and thereafter take the square root of the result.
vaglangd (Wavelength intervals for Red, Green, Blue, IR (4-channel orthophotos), Red, Green, Blue (colour orthophotos) and IR, Red, Green (IR orthophotos) in micrometres).
produktionstidpunkt (Production date and time according to ISO 8601 Swedish local time, where also the time difference in hours compared to UTC (GMT) is stated; +01 (Swedish standard time) or +02 (Swedish summer time).
The geometries for the orthophotos are shown in the shape of polygons.

</td></tr>
<tr><td>6725000_615000_flygbild_2015.json</td><td>File containing metadata in json format (GeoJSON) for the included aerial photos.

The file contains:

bildidentitet (Image identity) for all included aerial photos:
Normal altitude programme:

ååohh_s~åååå-mm-dd_ttmmss_nr (2005-2006)
ååohhffcc_s~åååå-mm-dd_ttmmss_nr (2007-2010)
ååoiuuffcc_s~åååå-mm-dd_ttmmss_nr (2011-)
2011-2013: i=2, 4 or 6. 2014-: i=4 or 6.

Low altitude programme:

åållkkhh_s~åååå-mm-dd_ttmmss_nr (2005-2006)
åållkkhhffcc_s~åååå-mm-dd_ttmmss_nr (2007-2010)

</td></tr>
</table>

<table>
<tr><th>File name (exemple)</th><th>File contents</th></tr>
<tr><td></td><td>

åållkkuuffcc_s~åååå-mm-dd_ttmmss_nr (2011-)
There also exist three special cases where kk=00: Skane 2012, Halland 2013 and Kronoberg 2013.
ååoiuuffcc_s~åååå-mm-dd_ttmmss_nr (2014-, where i=2)

<table>
<tr><th>Letter comb.</th><th>Meaning</th></tr>
<tr><td>åå</td><td>Last two digits of the flight year.</td></tr>
<tr><td>o</td><td>Area designation.</td></tr>
<tr><td>i</td><td>Aerial photography interval zone.</td></tr>
<tr><td>uu</td><td>Resolution of the aerial photo in the horizontal plane in cm.</td></tr>
<tr><td>ff</td><td>The last two letters of the airplane’s registration mark (for example ss).</td></tr>
<tr><td>cc</td><td>Camera number (the two last digits of the serial number).</td></tr>
<tr><td>s(s)</td><td>Flight line number. May consist of 1 or 2 digits.</td></tr>
<tr><td>llkk</td><td>County and municipality code.</td></tr>
<tr><td>åå-mm-dd</td><td>Actual date of photography.</td></tr>
<tr><td>ttmmss</td><td>Time in hours, minutes and seconds (GPS-time).</td></tr>
<tr><td>nr</td><td>Image number in the flight line. May consist of up to 4 digits.</td></tr>
<tr><td>hh</td><td>Planned flight altitude (altitude over average ground level, in hundreds of metres).</td></tr>
</table>

bildnummer (Image number in the flight line).
omrade (Area designation).
strak (Flight line designation).
exponeringspunkt (Exposure position: N- and E-coordinates for the photography position in SWEREF 99 TM).
flyghojd (Flight altitude, in metres).
bildoverlapp (Image overlap, in percent).
strakoverlapp (Side overlap, in percent).
kamera (Camera type and camera individual).
kamerakonstant. (Camera constant).
tidpunkt (Time of photo registration, followed by time difference compared to UTC (GMT), excluding leap year seconds, in hours; +01 (swedish normal time) or +02 (swedish summer time)).
markupplosning (Resolution on the ground, in metres).
solhojd (Solar altitude, in degrees).
solazimut (Sun azimuth, in degrees).
vaglangd (Wavelength intervals for Red, Green, Blue, IR in micrometres).

</td></tr>
</table>

File name (exemple)	File contents
	• Seamlines between the included aerial photos are shown in the shape of polygons. For orthophotos 2006-2009 this file contains no metadata at all, no attributes or seamlines.

6725000_615000_uttag_2015.json	File containing metadata in json format (GeoJSON) for the whole orthophoto extraction.
	
	The file contains:
	
	• ursprung (Origin): Lantmäteriet.
	• land (Country): Sverige.
	• produktionsdatum (Production date and time for the orthophoto extraction).
	• orderidentitet (Order identity).
	• projektion (Projection, EPSG-code).
	• markupplosning (Resolution on the ground, in metres).
	• flygar (Flight year). If the delivered orthophoto consists of parts from orthophotos from different years, it is always the year from the main part of the surface that is indicated in the file name. If surfaces from different years should be of exactly the same size, the most recent year of those surfaces are indicated in the file name.
	• format (Format of the delivered orthophotos).
	• bandstatistik (Band statistics for the different colour bands: Red, Green, Blue, IR (4-channel orthophotos, Red, Green, Blue (colour orthophotos) and IR, Red, Green (IR orthophotos)). Pixels with No data Value (0,0,0) are not included in the statistics.
	  ○ standardavvikelse (Standard deviation)
	  ○ medel (Mean)
	  ○ minimum
	  ○ maximum
	• The geometry for the whole orthophoto extraction is shown in the shape of a polygon.

Appendix 1: Examples of differences before and after leafing

Two IR-orthophotos, where photography has been done before and after leafing. These images show how important the time of photography is for different areas of application. There may also occur quite significant differencies in the colours between different colour orthophotos, depending on what time of year the images were taken.

Figure 3. Two examples. The image to the left is from the 15th of April 2010, the image to the right is from the 4th of June 2010.

Appendix 2: Examples of differences depending on the position of objectives relative to the flight line

When a building lies in the middle of an aerial photo, the photo is taken directly above the building and then you only see the roof of the building and nothing of the façade. When a building lies far away from the flight line, i.e. near the edge of an aerial photo, you see the building obliquely from above, hence you can also see relatively much of the façade. So, depending on where in the aerial photo the building lies, more or less of the façade can be visible.

For this reason, differences may occur between different flight years, due to that the same area has been overflown with different flight lines and side coverage, so that on an orthophoto from a specific flight year the façade of a certain building might not be visible at all, while on an orthophoto from another flight year relatively much of the façade of the same building is visible.

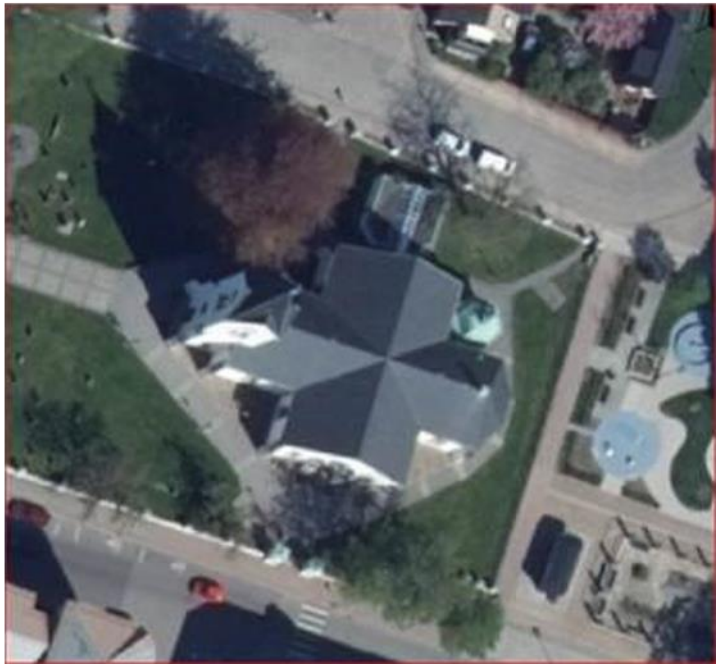
The reason for changing the side coverage or flight line positions can be a change of camera type or resolution. Different types of cameras cover different sizes of areas in the aerial photos and if the resolution is changed in the aerial photos, so are the distances between flight lines. The reason can also be that the normal photography direction from north to south has been abandoned and instead been adjusted to the shape of an area or a smaller location.

Below you can see examples of these differences. The orthophoto to the left is taken 2012 with the DMC-camera. The flight line is directly above the church, hence you can't see the church façade at all. The orthophoto to the right is taken 2014 with the UCE-camera. Here the flight line is far away from the church, hence you can clearly see the church façade.

Figure 4. Example of difference depending on the position of the object in relation to the flight line.

Orthophoto 2012 DMC-camera

Orthophoto 2014 UCE-camera



Appendix 3: Examples of non-desired effects in the seam lines, due to automatic seam generation

The generation of seam lines is done automatically. This may in some occasions cause loops and islands in the seam lines, examples of that are shown here below. These usually cause no or only minor blurry effects in the orthophotos.

Figure 5. Examples of loops in the seam lines.