

## Zaroshchens'ke Launch Site

### *Claims and Reality*

A bellngcat Investigation



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## Summary

This report analyzes in detail one aspect of the downing of Malaysia Airlines Flight 17 (MH17) by a Buk missile system in eastern Ukraine: the plausibility that Zaroshchens'ke was the launch site. First, the Russian Ministry of Defense (MoD) claimed in a press briefing on 21 July 2014 that Ukrainian Buk M1 TELARs (transporter erector launcher and radar) were positioned in an area south of Zaroshchens'ke. The Russian MoD supported this assertion with a satellite picture of the area showing the vehicles. While it was not explicitly stated that a missile was fired from this position in the briefing, the information is persistently interpreted as evidence of possible Ukrainian involvement in the downing of MH17.

Later, a larger area south of Zaroshchens'ke that included the Russian MoD's Buk position was claimed to be the launch site of the Buk M1 missile that downed MH17. This claim stems from Almaz-Antey, the successor company of the original Buk M1 producer. Almaz-Antey's analysis uses publicly available pictures of the wreckage of MH17 and is primarily based on a calculation of the missile's last position using the impact direction of the warhead fragments. Almaz-Antey claimed that this method allowed them to identify the possible launch site using the trajectory profiles of the particular missile used.

This report assesses the validity of both the Russian MoD's and Almaz-Antey's claims using open-source information. In particular, the analysis utilizes maps showing the situation in eastern Ukraine and Google Earth satellite imagery. The satellite imagery is used to identify with varying degrees of certainty the locations of military positions in the area surrounding the alleged launch site. This information is then used to reconstruct the area under control on 17 July 2014, the day MH17 was shot down. This report also draws upon various press reports from the area.

Based on this report's analysis of the aforementioned information, two conclusions are reached, namely, on 17 July 2014:

- The area south of Zaroshchens'ke was not under Ukrainian control
- There were no Ukrainian Buk M1 (TELARs) in the area identified by Almaz-Antey as the launch site

It is also possible to assess the likelihood of a missile launch from the area south of Zaroshchens'ke on 17 July 2014. While it is not possible to reject that claim completely, it can be concluded that:

- It is highly unlikely that a missile was launched from the area south of Zaroshchens'ke on 17 July 2014

This assessment also provides additional evidence that the Russian MoD misinformed the general public in their 21 July 2014 briefing. The satellite image presented that claimed to show Ukrainian Buk M1 TELARs south of Zaroshchens'ke must be either a fabrication or a deliberately misinterpreted satellite photo meant to mislead or confuse the public.

Keywords: MH17, Zaroshchens'ke, Russian MoD briefing, Almaz-Antey launch site

# Introduction

The tragedy of the downing of MH17 on 17 July 2014 is one of the key events in the Russian-Ukrainian<sup>1</sup> war. So far, the question of guilt has not been definitely answered. It is widely acknowledged, however, that MH17 was downed using a Buk M1 surface-to-air (SAM) missile system. This claim is supported by Western sources and social media information,<sup>2</sup> but also by Almaz-Antey,<sup>3</sup> the successor to the original producer of the Buk M1. Other claims, such as the notion that MH17 was downed by a Ukrainian Su-25 ground attack jet have been either completely unfounded or, in some cases, clearly refuted.<sup>4</sup>

Using satellite information, the United States (US) Department of Defense (DoD) identified an area east of Snizhneas the likely launch site. There are also various reports that a Buk M1 TELAR was in the area on 17 July 2014, and photos of the presumed missile trail have been geolocated there as well. Journalists on the ground in the area identified a burned area in a field, indicating a missile launch. Moreover, various interviews with inhabitants of a nearby village confirm a missile launch in the area on 17 July 2014. This report, however, will cover a different aspect of the events surrounding the downing of MH17 and will not assess this findings.

This report assesses two claims: First, Russian MoD's assertion in their 21 July 2014 briefing that Ukrainian Buk M1 TELARs were present near the small Ukrainian village of Zaroshchens'ke (and therefore in range of MH17), and second, Almaz-Antey's claim that the launch site of the missile responsible for the downing of MH17 must have been south of Zaroshchens'ke.

This report is organized into five sections. Section one establishes and describes the locations posited by the Russian MoD and Almaz-Antey. Section two describes the situation on the ground and the areas under control using contemporary situations maps from three sources. These maps are either official or used public information to assess the actual situation on the ground. In section three, satellite maps are used to analyze the area between Shakhtarsk and Amvrosiivka. Positions or likely positions of forces and infrastructure (e.g., checkpoint, and camps) are presented and briefly described. Section four draws upon the information presented in chapters one through three to provide a final assessment of the questions raised above. This involves testing three different hypotheses. The final section of the report concludes with a brief discussion of the results.

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1 Instead of using "pro-Russian separatists" or a similar formulation, the terms "Russia" or "Russian troops" are used in this report. This term includes official (i.e., regular) Russian armed forces, unofficial Russian armed forces (mainly formed by Russians and supported and/or trained by Russia) and the locally recruited pro-Russian armed forces. This naming convention reflects the reality of Russia's deep involvement in the Russian-Ukrainian war and is meant to avoid the impression that the war in eastern Ukraine is a solely internal conflict.

2 cf. <http://news.ge/en/news/story/142248-still-no-suspects-in-downing-of-mh17-over-ukraine> (last accessed: 27 June 2015).

3 cf. <http://tass.ru/boeing-presentation/vvedenie> (last accessed: 27 June 2015).

4 cf. <https://www.bellingcat.com/news/uk-and-europe/2015/03/13/vladimir-babak-and-reuters-missile-launch-witnesses-how-do-they-fit-with-what-we-know-about-mh17-so-far/>; <https://www.bellingcat.com/news/uk-and-europe/2015/01/10/su-25-mh17-and-the-problems-with-keeping-a-story-straight/>; <http://www.sueddeutsche.de/politik/krieg-in-der-ukraine-mh-wurde-vom-boden-aus-abgeschossen-1.2386385-2> (last accessed: 27 June 2015).

## Identification of the Zaroshchens'ke Launch Site

The launch site south of Zaroshchens'ke was first proposed by the Russian MoD on 21 July 2014. However, the Russian MoD did not overtly claim that a missile was launched from this position; instead, they only claimed to have captured Ukrainian Buk M1 TELARs in this area around the time MH17 was downed. A larger area south of Zaroshchens'ke was identified as likely launch site by Almaz-Antey in their press conference on 2 June 2015.<sup>5</sup> Both the Russian MoD briefing and Almaz-Antey point approximately to the same area.

Figure 1 shows the Russian MoD briefing picture and the same area in Google Earth6 on 16 July 2014. Because the Russian MoD provided the coordinates, the exact position could be easily identified. The area is approximately 500 meters south of Zaroshchens'ke, six kilometers south of Shakhtarsk, and 20 kilometers north of Amvrosiivka.



Figure 1: Russian MoD photo and Google Earth imagery; Source: [http://stat.multimedia.mil.ru/images/military/military/photo/mh17\\_brief\\_06-900.jpg](http://stat.multimedia.mil.ru/images/military/military/photo/mh17_brief_06-900.jpg)

Figure 2 shows the Almaz-Antey launch site and attempts to identify the region in Google Earth using street layouts and prominent terrain features visible in the Almaz-Antey presentation slide. The area could be identified, like claimed in the slide, to be south of Zaroshchens'ke. The position presented in the Russian MoD briefing lies within this area and is marked red in the Google Earth satellite photo.

5 cf. <http://tass.ru/boeing-presentation/vvedenie> (last accessed: 27 June 2015)

6 Nearly all satellite images presented in this report originate from Google Earth. All figures without an explicitly stated source are from Google Earth. If a different source is used, the origin of the photo or map is stated in the caption.



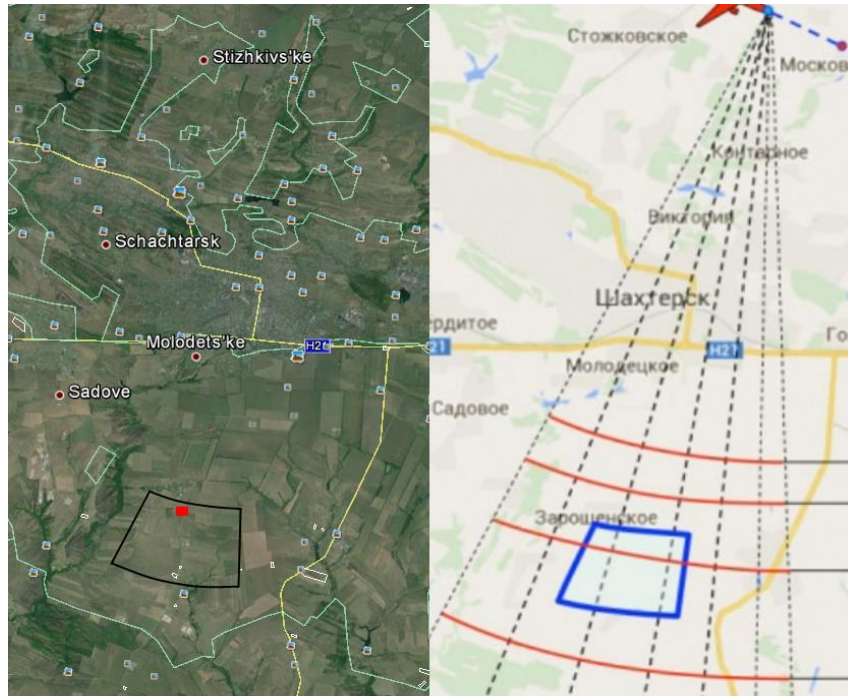


Figure 2: Almaz-Antey launch site; Left: estimated position in Google Earth; Red square: Russian MoD site; Right: Detail of Almaz-Antey's presentation slide; Source: <http://tass.ru/boeing-presentation/vvedenie/>

The Almaz-Antey launch site covers a much larger area than the MoD site, which is only a tiny part of the region. The Almaz-Antey area almost covers the entire region between Zaroshchens'ke and Shaposhnykove, a small village three kilometers south of Zaroshchens'ke. A closer look at the area in question is presented in figure 3.



Figure 1: Almaz-Antey launch site; A closer look at the purported area

## Situation Maps

The following section presents conflict situation maps from three different sources for the days between 11 July and 17 July. In addition to the official Ukrainian National Security and Defense Council (NSDC) maps, maps from LiveUAmap and the Kot Ivanov blog<sup>7</sup> are included in the overview. LiveUAmap is considered to be a pro-Ukrainian site, while Kot Ivanov may be seen as pro-Russian. Situation maps from other sources either did not cover these dates or did not cover the area in question.<sup>8</sup>

### Maps of the Ukrainian NSDC

The Ukrainian NSDC publishes maps on nearly a daily basis depicting the situation in eastern Ukraine as of the time specified. In addition to portraying the various factions' control of territory, the maps also illustrate locations of hostilities and troop positions. These official Ukrainian maps were shared on twitter and were also available on an official website. However, the old official website is no longer fully functional and some of the maps for the period in question are no longer available there.<sup>9</sup>

Figure 4 shows the situation on 17 July 2014. This was the last report showing the situation in eastern Ukraine before the downing of MH17. It is clear from the map that the entire area south of Shakhtarsk up to Amvrosiivka is not under Ukrainian control.



Figure 4: Situation on 17 July 2014 before the downing of MH17; Source: <http://www.rnbo.gov.ua>

<sup>7</sup> <http://kot-ivanov.livejournal.com>

<sup>8</sup> cf.: <http://www.novayagazeta.ru/inquests/68846.html> (last accessed: 26 June 2015).

<sup>9</sup> <http://www.rnbo.gov.ua>. A copy of the maps was found on <http://seo-top-news.com.ua> (last accessed: 26 June 2015). Some of the maps have a relatively low resolution, but they are nonetheless sufficient for the purposes of this report.



As seen in figure 5, comparing the situation on 17 July with the situation between 11 July and 16 July does not yield any relevant differences in the area between Shakhtarsk and Amvrosiivka. The 11 and 13 July maps show hostilities in the area of Savur-Mohyla, and the 15 July and 16 July maps show hostilities in the area around Amvrosiivka.

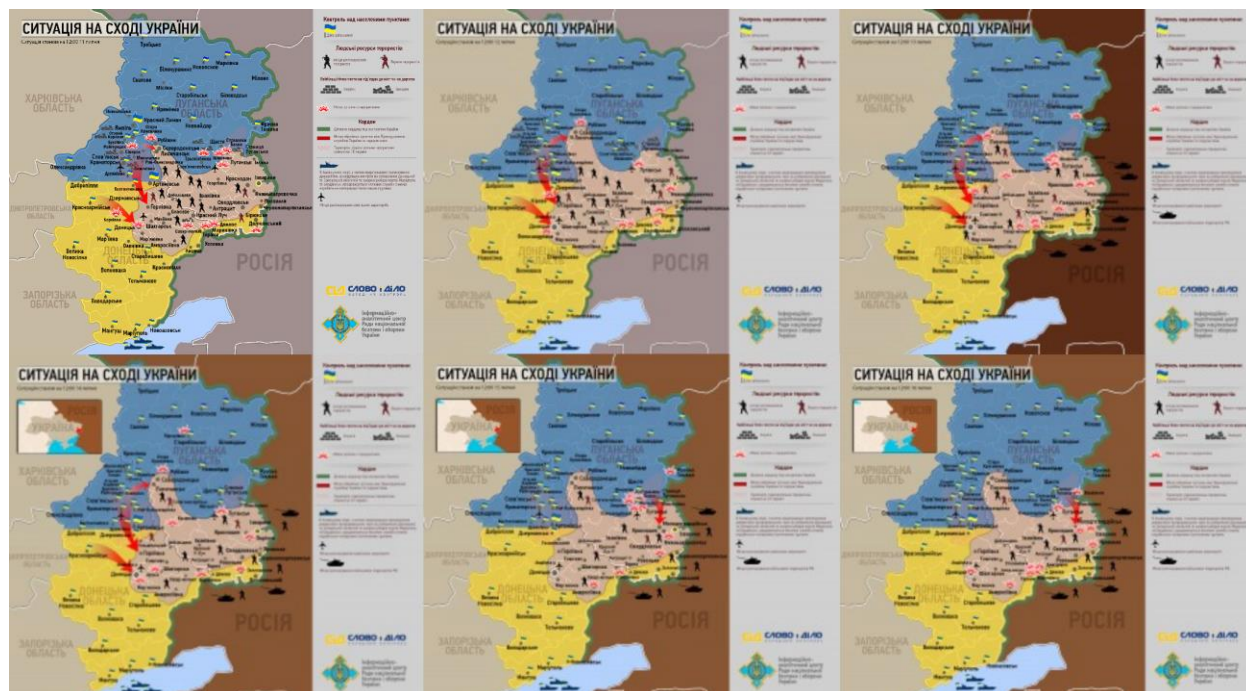


Figure 2: NSDC situation maps; Upper row: 11 July 2014, 12 July 2014, 13 July 2014 (left to right); Lower row: 14 July 2014, 15 July 2014, 16 July 2014 (left to right); Source: <http://seo-top-news.com.ua10>

Between 18 July and 23 July,<sup>11</sup> there are no observable changes in territorial control concerning the area between Shakhtarsk and Amvrosiivka. There are also no hostilities depicted in the area between Shakhtarsk and Amvrosiivka. The maps do, however, show hostilities near Kuteinykove on 18 July and the following day.

## LiveUAmap Situation Maps

LiveUAmap<sup>12</sup> uses public information to assess the situation in eastern Ukraine. The interactive map on their website, which is updated daily, depicts this information and can be seen as their best estimate of the situation on the ground. Current events are marked on the map using different symbols, and the sources are linked on their website. LiveUAmap also has an option to go back in time. Figure 6 shows LiveUAmap's description of the situation on 17 July 2014. The downing of MH17 and sightings of a Buk M1 TELAR are already included in the map. Similar to the NSDC maps, the complete area south of Shakhtarsk up to Amvrosiivka, is shown as not being under Ukrainian control.

<sup>10</sup> Note that there is a difference between the English and the Ukrainian version of the 11/12 July 2014 map. An area north of Luhansk is still claimed to be under Russian control in the English version, while the area is claimed to be under Ukrainian control in the Ukrainian version. However, there are no differences in the area between Shakhtarsk and Amvrosiivka. This report uses the Ukrainian version of the maps.

<sup>11</sup> Situation maps for these days are presented in the appendix.

<sup>12</sup> <http://liveuamap.com/>



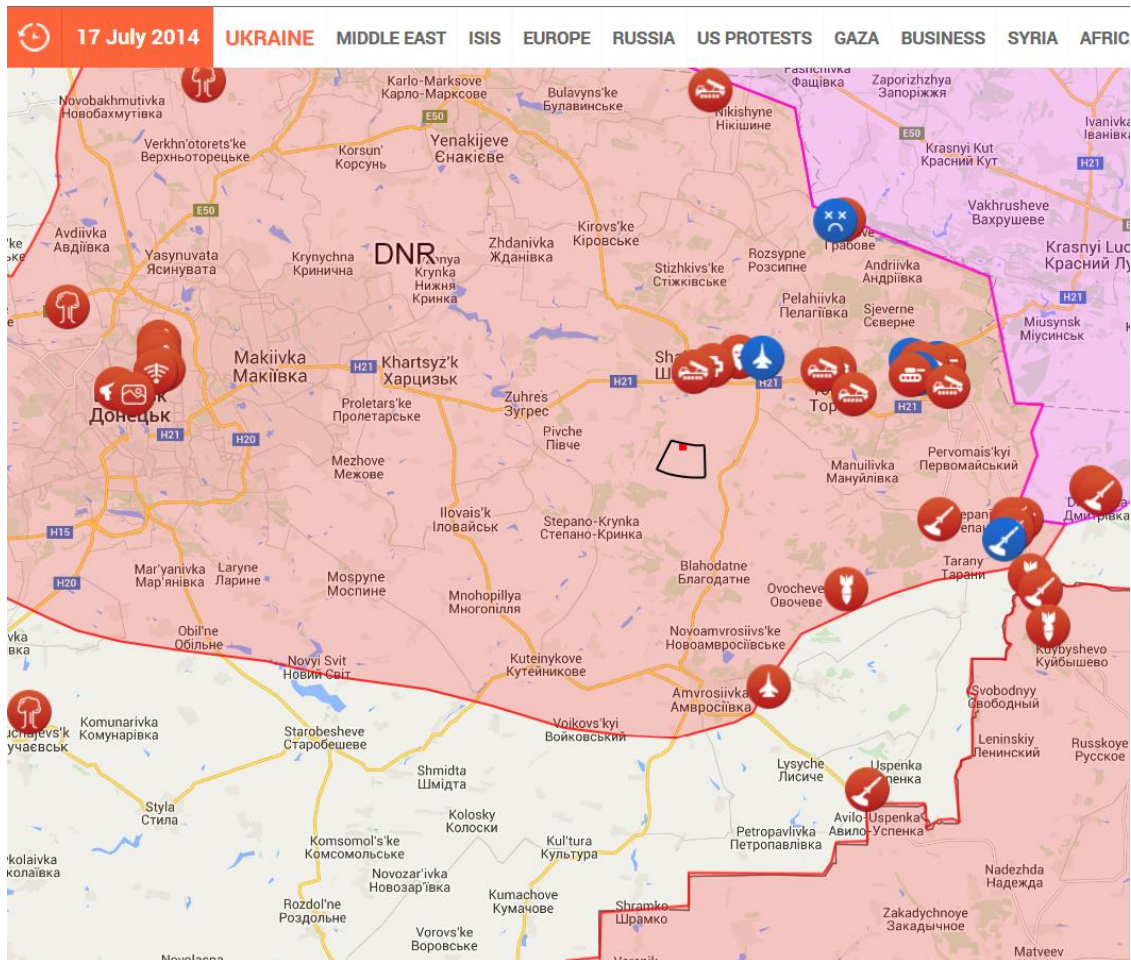


Figure 6: LiveUAmaph situation map, 17 July 2014; Area outlined in black: Almaz-Antey launch site; Red square: Russian MoD site; Source: <http://liveuamap.com/>

The situation maps from 12 July 2014 to 17 July 2014 show some Ukrainian territorial gains in the area around Amvrosiivka. However, in the area between Shakhtarsk and Amvrosiivka, neither hostilities nor territorial changes are depicted, aside from a Ukrainian air strike near Shakhtarsk and an attack near Amvrosiivka on 16 July. The entire area seems to be relatively quiet for the presented period.

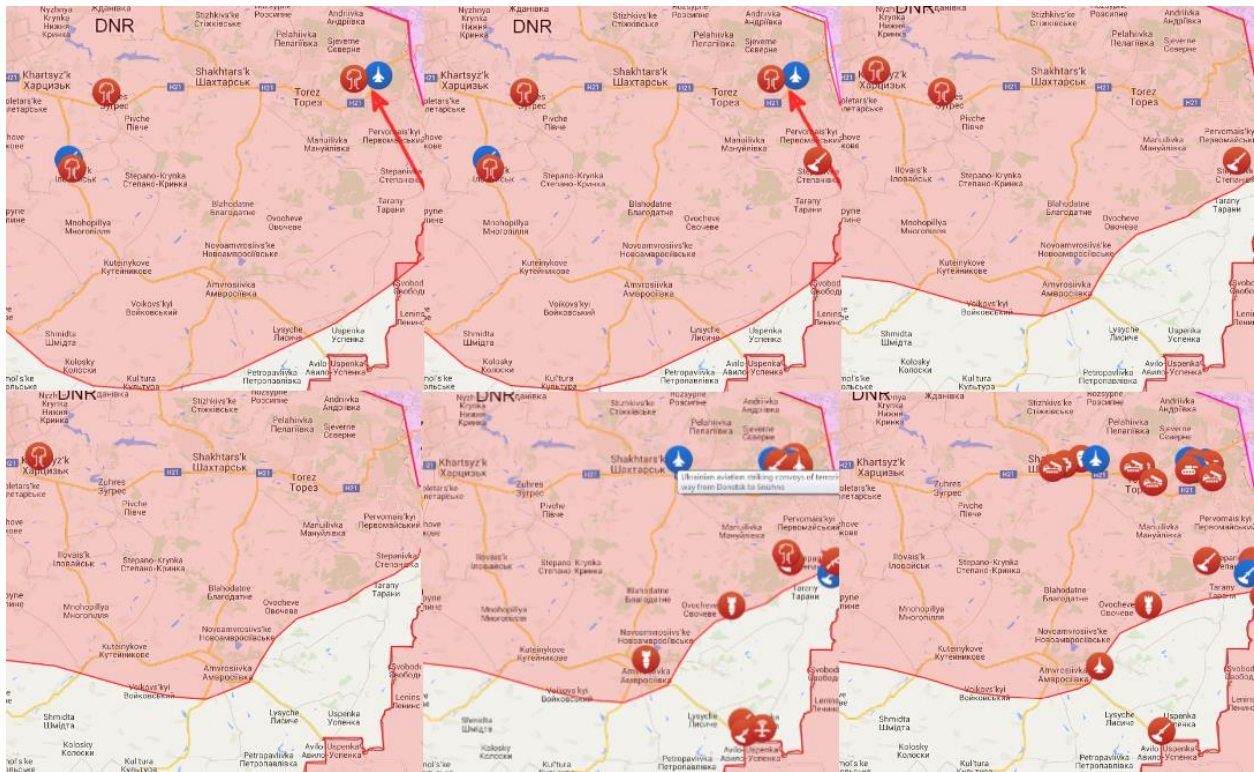


Figure 3: LiveUMap situation maps; Upper row: 12 July 2014, 13 July 2014, 14 July 2014 (left to right); Lower row: 15 July 2014, 16 July 2014, 17 July 2014 (left to right); Source: <http://liveuamap.com/>.

There are neither changes in the area under control nor any relevant events recorded for the area between Shakhtarsk and Amvrosiivka from 18 July to 23 July. The maps depicting the situation on these days can be found in the appendix.

## Kot Ivanov Blog's Situation Maps

A third source for situation maps is Kot Ivanov's LiveJournal blog.<sup>13</sup> Instead of daily maps, the maps from this blog tend to cover larger periods of time. Figure 8 presents the situation during the period between 11 July 2014 and 15 July 2014 (left) as well as between 15 July and 18 July 2014 (right).<sup>14</sup> The territorial control in the area between Shakhtarsk and Amvrosiivka shown on the Kot Ivanov maps clearly differs from the maps of NSDC and LiveUMap. The Kot Ivanov maps depict the entire area around Amvrosiivka is being under Ukrainian control. In addition, the front line is positioned considerably higher north – nearly halfway between Shakhtarsk to Amvrosiivka. However, there are no changes to the frontline in the area under consideration between the two maps.

13 Kot Ivanov maps are frequently used by other pro-Russian sites. Some of the presented figures in this report are derived from <http://warday.su/> (last accessed: 10 June 2015). The authenticity of the figures in this source was verified using Kot Ivanov's blog.

14 There is also a situation map covering 15 July to 21 July, but there are no differences in the area under consideration between this map and the 15 July to 18 July 2014 situation map used in this report.





Figure 4: Left: Situation map 11 July - 15 July 2014; Right: situation map 15 July - 18 July 2014; Source: <http://warday.su/>

Comparing terrain features between the situation maps and Google Earth allows an approximation of the claimed front line. The front line can be defined by two villages in the area between Shakhtarsk to Amvrosiivka. Pokrovka, nine kilometers east of Ilovais'k, which is located south of two prominent areas of vegetation, and Mala Shyshivka, 20 kilometers east of Ilovais'k, which lies on T0517 road. A direct comparison between the maps and Google Earth is presented in figure 9.

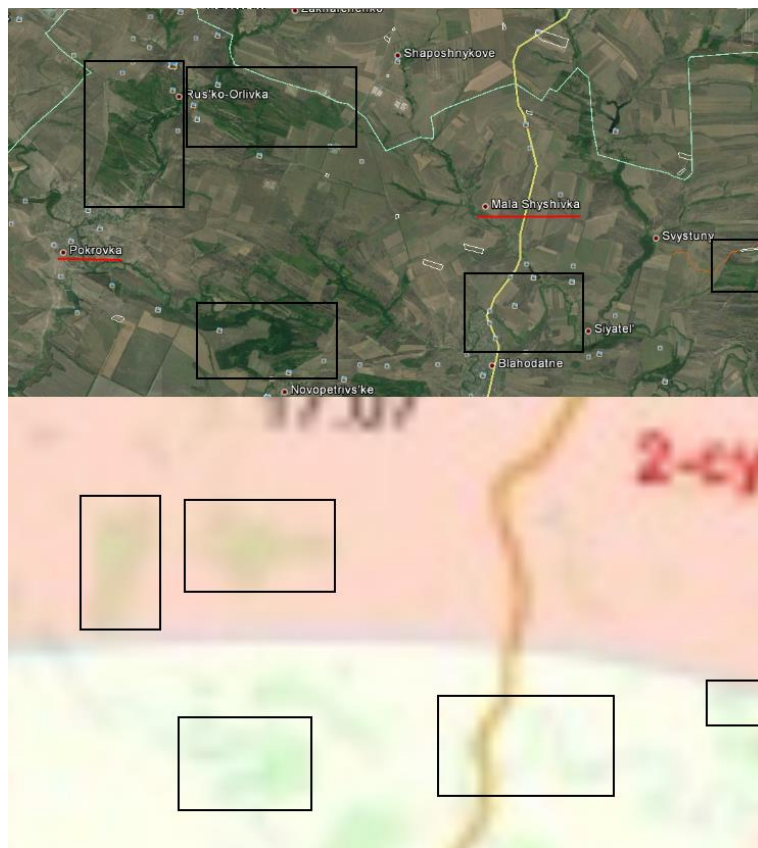


Figure 5: Comparison between Google Earth and Kot Ivanov's situation map: Black outlines are prominent terrain features; Red underlines are the two villages Pokrovka and Mala Shyshivka; Source: <http://warday.su/>

Both situation maps do not show any hostilities north of the contact line for the period between 11 July and 18 July 2014; however, two attacks on Ukrainian positions in the area west and south of Ilovais'k are noted. The attack on the Ukrainian position near Kuteinykove on 17 July may be identical to the claimed hostilities near this village in the Ukrainian NSDC maps from 18 July.

There are at least six situation maps also covering the days after 17 July 2014. There is, as has already been presented, a map covering the period from 15 July to 18 July. Another map shows the situation from 15 July to 21 July. Four other maps only cover the days after 17 July 2014. One of these maps covers the period between 18 July and 22 July. A second map covers the period between 18 July and 24 July.<sup>15</sup> There is a notable difference in the relevant area between both of these maps. The village of Blahodatne is not under Russian control in the first map, while the second map shows at least partial Russian control over the village and depicts a Ukrainian attack in the area near Blahodatne. A comparison of the relevant area between the two maps and an identification of the new front line near Blahodatne are presented in the appendix.

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<sup>15</sup> There are no differences in the relevant area between the 15 July and 18 July or 15 July and 21 July situation maps. The map covering 18 July through 23 July does not show notable differences in the relevant area compared with the map of 18 July to 22 July. The map covering the period between 18 July and 25 July does show the same area under Russian control compared with the map covering 18 July through 24 July. However, the military positions north of Amvrosiivka and the date of the purported Ukrainian attacks near Blahodatne slightly differ between the two maps.



## Military or Likely Military Positions

The following chapter provides an overview of military and likely military positions in the area between Shakhtarsk and Amvrosiivka. Only positions plausibly used on 16 July 2014 are included; those visible for the first time at a later date are excluded. This restriction is necessary because Google Earth does not provide imagery for large parts of the area between 16 July 2014 and 13 September 2014. This report's analysis is primarily based on Google Earth satellite imagery from 16 July 2014.<sup>16</sup> Yandex (a Russian internet company) and Bing have nearly the same satellite imagery of the area. Yandex imagery was used in some instances because of its higher resolution for the area under consideration.

### Amvrosiivka Area

Roughly four kilometers southeast of the city center of Amvrosiivka, a large Ukrainian military camp is clearly visible in Google Earth. Figure 10 shows the area in the center of the camp at three different dates.



Figure 6: Amvrosiivka field camp: Left: 18 July 2010; Middle: 16 July 2014; Right: 14 September 2014

Four years before the conflict, the layout of the terrain was similar, but the camp had yet to be established. On 16 July 2014, the camp is well established. In addition to military equipment and what are either permanent structures or tents, there are impact craters visible, meaning the camp was attacked before or on 16 July 2014. Trajectory analysis of crater fields using open source tools has shown that at least some of the craters are the result of cross border attacks originating from Russia.<sup>17</sup> The Google Earth image on the right was taken on 14 September 2014. The camp at this date is empty and seems to be abandoned. There are new craters around the camp that were not present on 16 July. Figure 11 presents a closer look at the camp on 16 July. Multiple vehicles can be identified, such as Grad multiple rocket launcher systems (MRLS) situated on the right side of the field.

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<sup>16</sup> The date was cross checked with the Digital Globe database. For the date comparison between Google Earth, yandex.ru and bing.com prominent features, like a harvester at work, were used.

<sup>17</sup> For further details, cf.: <https://www.bellingcat.com/news/uk-and-europe/2015/02/17/origin-of-artillery-attacks/> (last accessed: 26 June 2015).



Figure 7: Amvrosiivka field camp, 16 July 2014; Source: <https://maps.yandex.ru>

Other positions near the camp could also be identified in the area around Amvrosiivka; see figure 12 for an overview. Most positions seem to be checkpoints: northwest of Amvrosiivka there is a checkpoint located on T0517 road; a second checkpoint can be found on T0509 road near Zhukova Balka; and west of Kuteinykove there is a checkpoint with fortifications. A second camp is located southeast of Voikovs'kyi. Note that the position west of Kuteinykove corresponds with an attacked position on 17 July 2014 in the situation map from Kot Ivanov's blog and an area of hostilities in the NSDC maps from 18 and 19 July. The satellite imagery for the other identified positions at different dates is presented in the appendix.



Figure 8: Identified positions (red) near Amvrosiivka, 16 July 2014

## Shakhtarsk Area

Shakhtarsk marks the northern border of the area under consideration and was controlled by Russian forces on 17 July 2014. The town is 15 kilometers east of Zuhres and 12 kilometers west of Torez. The N21, connecting Donetsk and Luhansk, goes straight through the town. There are two identifiable checkpoints in the area near Shakhtarsk. Both are located on the N21, with one west of Zachativka and the other south of Hirne.

The checkpoint south of Hirne, east of Shakhtarsk, is presented in figure 13. In 2013, there is nothing of note visible at this location. Aside from the traffic, there are no differences visible between the 16 July 2014 and 21 July 2014 satellite imagery (or 20 July 2014 and 24 July 2014, which are not presented below), which show a checkpoint at the crossing. The road leading south is T0517, which is the shortest route between Shakhtarsk and Amvrosiivka. The checkpoint seems suitable for controlling the traffic from all three possible directions. What look to be fortifications are visible west of the crossing, south of the trees. On 04 August 2014 the situation has changed, as there are craters visible in the area around the checkpoint. It also seems that the position is at least partially destroyed. The situation visible on 04 August 2014 also proves that there were hostilities in the area between 24 July and 04 August 2014. Because of the damage already visible east of the checkpoint on 01 August 2014, it is highly likely that the hostilities in the area leading to the damage occurred between 24 July and 01 August 2014.





Figure 9: Checkpoint south of Hirne, east of Shakhtarsk: Upper row: Left: 22 March 2011; Right: 16 July 2014; Lower row: Left: 21 July 2014; Right: 04 August 2014

The situation around the western checkpoint near Zachativka is different (see figure 14). In 2013, there are again no traces of the checkpoint visible. On 16 July 2014, the checkpoint is present, controlling the traffic on the N21. Fortifications are clearly recognizable in the area south of the street. Two months later,<sup>18</sup> the checkpoint is still in use and the fortifications have in the meantime been strengthened. The southern fortification has been extended and a new fortification north of the street is visible. There are also traces of weapon usage visible in the area north of the checkpoint. While it seems that attacks were initiated from the area north of the checkpoint given the presence of scorch marks from Grad launches, there are, unlike with the eastern checkpoint, no observable craters nearby.

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<sup>18</sup> The area west of Shakhtarsk got fewer maps updates in Google Earth, therefore, the situation end of July – mid of August can not be shown. The earliest map update in Google Earth for this region after 16 July 2014 has the date 13 September 2014.





Figure 10: Checkpoint west of Zachativka, west of Shakhtarsk: Left: 22 August 2013; Middle: 16 July 2014; Right: 13 September 2014

Other positions near or in Shakhtarsk could not be identified using Google Earth. This could either indicate that there were no additional major military positions in and around the town, or, perhaps more likely, other positions were better camouflaged and thus more difficult to identify relying solely on satellite imagery.

### **Velyka Shyshivka Area**

Velyka Shyshivka is a village five kilometers south of Shakhtarsk and four kilometers east of Zaroshchens'ke. It lies directly on T0517 road connecting Shakhtarsk and Amvrosiivka. Following T0517 to the north leads to the eastern checkpoint near Shakhtarsk; to the south, the road leads to the villages Mala Shyshivka and Blahodatne. Velyka Shyshivka contains the most massive fortifications in the area. An overview of all identified positions near or in the village is presented in figure 15.<sup>19</sup> Three fortifications are south of Velyka Shyshivka, two being inside and one east of the village. The sheer amount of positions in this area indicates that the village had some local strategic importance at this time.

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<sup>19</sup> The easternmost position is not shown.



Figure 15: Positions in the Velyka Shyshivka area: 1 – 3: southern fortifications (1 west, 2 middle, 3 east); 4 – 6: northern positions (4 and 5 inside the village, 6 east)

The situations for the three southern positions are presented in figure 16. All fortifications are relatively new, or, to be more exact, were built after 22 March 2011.<sup>20</sup> The western position seems to be disbanded on 14 September 2014, while the middle position is unchanged and the eastern position is strengthened. The western and middle positions are most likely checkpoints. They are both located near or on roads and there are objects visible on the road, suggesting that they are obstacles to control the flow of traffic.

<sup>20</sup> Verification using old Google Earth satellite imagery is necessary to avoid the misidentification of old structures as new positions. It is possible to find old positions already visible in 2010 or even earlier in eastern Ukraine. However, these old positions are likely still visible traces of the World War II or (less likely) traces of former military training in the area that have no connection with the actual ongoing war in the region.





Figure 11: Southern fortifications near Velyka Shyshivka: Upper row: western fortification; Middle row: middle fortification; Lower row: eastern fortification; Left column: 22 March 2011; Middle column: 16 July 2014; Right column: 14 September 2014

The situations for the three northern positions already existing on 16 July 2014 are presented in the appendix. All of them are new, having been built after 2010 and 2011. The positions are clearly visible because of the existing fortifications on 16 July 2014. Some of the positions were fortified between 16 July 2014 and 14 September 2014. Also, a new position can be found at the northern entry on 14 September 2014.

The positions do not show visible battle damage or other traces of hostilities on 14 September 2014. However, some craters can be found inside the village close to the buildings east of the village and south of the southwestern position. There is also 21 July 2014 satellite imagery available for the three northern positions; there are no traces of hostilities observable. On 01 August 2014, military vehicles are visible around five kilometers southeast of Velyka Shyshivka.

Figure 17 presents a closer look at the terrain around the southern positions with elevations of certain points stated in meters derived from Google Earth.<sup>21</sup> This information allows a rough assessment of the positions' elevations in relation to the surrounding area. In each measurement, an area of around 1600 by 1400 meters is covered.

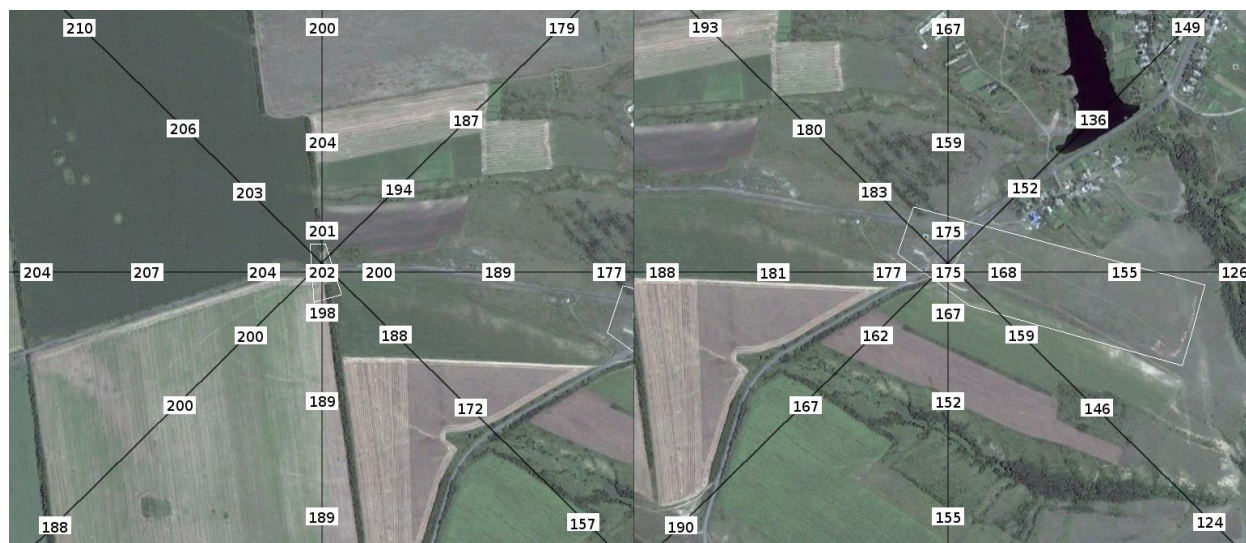


Figure 12: Southern fortifications near Velyka Shyshivka and elevation of selected places around the positions:  
Left: west fortification; Right: middle (and right) fortification

The western position exhibits declining elevation in the eastern region. A much smaller decline can be identified to the south and southwest. All other points have either a similar or greater elevation than that of the military position. The middle position exhibits a different elevation profile, where in almost all directions, the surrounding terrain lies below the position. Only towards the western position can similar elevations be found. Noteworthy again is the ascending terrain toward the northern position located in the village.

## Shaposhnykove Area

Shaposhnykove is a small village three kilometers south of Zaroshchens'ke and marks the southern border of the Almaz-Antey launch site. There are two positions located on the periphery of the village. One is located to the northwest of the village, while the second is located southwest. Both positions have fortifications.

<sup>21</sup> The measurement was carried out manually; the resulting error should be for most places below  $\pm 1$  meter or, for some areas with sharper declining or ascending terrain, within  $\pm 2$  meters. The premise behind determining the elevation of these areas is that military positions are more likely to be established on elevated terrain.



Figure 18 presents both positions. In 2011, no similar ground structures can be identified, meaning that the fortifications in the area are new. The northwestern position is located on a fork and seems to have gotten a minor extension between 16 July 2014 and 13 September 2014. The fortification itself is located between the two roads. There is a row of trees south of the position, and there are also trees north of the position near the fork. The southwestern position is clearly smaller than the northwestern position and located near a small road. Craters can be seen in the area around both positions on 13 September 2014.



Figure 13: Positions near Shaposhnykove: Upper row: northwestern position; Lower row: southwestern position; Left column: 22 March 2011; Middle column: 16 July 2014; Right column: 13 September 2014

Figure 19 presents some details of the northwestern position. The fortification in the southern area of the position is clearly visible. There are tracks and an object that may be a vehicle near the southern fortification. The tracks leading to the fortification came from the north, and the potential vehicle is parked in the middle of a number of tracks north of the fortification. In the northern part, near the trees and the fork, there are two dark objects visible. It is not possible to conclusively identify these objects. East of the trees, there are again tracks visible, some of which seem to end in or lead into the trees. The tracks and the potential vehicle in particular indicate that the position was in use on 16 July 2014.



Figure 14: Positions near Shaposhnykove: Details of the northwestern fortification; Source: <https://maps.yandex.ru>.

Figure 20 presents the elevation profile of both positions. The terrain south of the northwestern fortification is lower, while the terrain north of the position is at a similar or greater elevation. The area surrounding the southwestern position has a different elevation profile with the terrain from north to southwest (clockwise) being located at a lower elevation while exhibiting a more distinct decline in the southern areas. The elevation of the southwestern fortification is above the surrounding area, while the elevation of the northwestern fortification exhibits declining terrain only south of the position.



Figure 15: Positions near Shaposhnykove and height of selected places around the positions: Left: northwestern fortification; Right: southwestern fortification

## Other Positions

The positions discussed so far are among the more prominent and identifiable. There are, however, additional positions or likely positions that can be identified in the area between Shakhtarsk and Amvrosiivka. These places shall be briefly introduced in the following subsection. Figure 21 presents a map of the entire area with all identified or likely positions marked. The areas marked in red have been discussed in the preceding subsections. This subsection covers the positions marked in black.

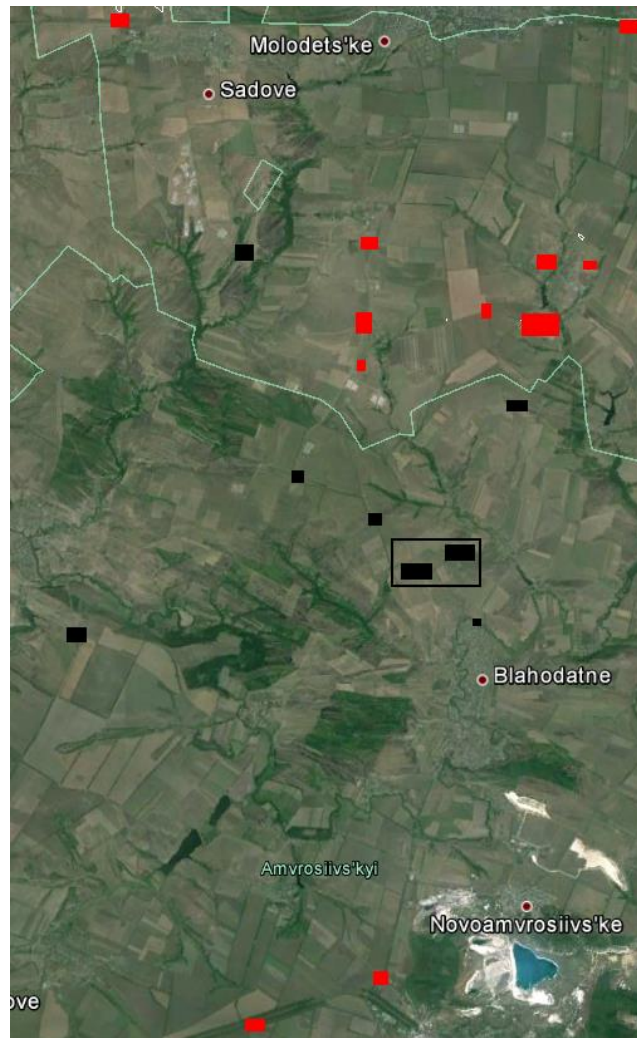


Figure 16: Identified or likely positions between Shakhtarsk and Amvrosiivka: Red-marked places are discussed in separate subsections; Black-marked positions are discussed in the subsection "Other Positions"

One likely position is 1.3 kilometers south of Dubove and 2.8 kilometers west of Zaroshchens'ke. Two likely positions are located south (3.7 and 4.3 kilometers, respectively) of Shaposhnykove, and another likely position is 2.3 kilometers south of Velyka Shyshivka. Possible checkpoints can be found south of Pokrovka and north of Blahodatne. The black-rimmed area southwest of Mala Shyshivka marks an area with craters visible on 16 July 2014.



Figure 22 presents these four likely positions. The Dubove position is presented in the top row. On 18 July 2010 and 22 March 2011 (not shown), nothing of note is visible in the area. A new structure is clearly visible on 16 July 2014, but a precise identification is not possible. It could be a fortification, an observation post, or perhaps something else. Roughly two months later, tracks and other traces can be found near the trees just south of the position. Farther south, additional traces can be identified, which indicate military usage or an operation in the area.



Figure 17: Other positions: Upper row: Dubove positions; Second row: western position south of Shaposhnykove; Third row: eastern position south of Shaposhnykove; Lower row: position south of Velyka Shyshivka; Left column: 18 July 2010; Middle column: 16 July 2014; Right column: 13/14 September 2014



The western position south of Shaposhnykove can be found in the second row. Nothing of note is visible on 18 July 2010. This has changed by 16 July 2014, when a new road leading south and an object similar to other entrenchments can be identified in the area. The situation is similar in September. Craters or new tracks are not visible in the area.

The third row presents the situation around the eastern position south of Shaposhnykove. A road leads through two tree rows which form an "X." The situation on 18 July 2010 and 16 July 2014 appears similar, though two small white objects can be seen on 16 July 2014. On 13 September 2014, craters and tracks are visible north of the position. Because of the elevation profile of the surrounding area (see the appendix) and the craters in September, it seems possible that this location was used as a military position or observation post.

The last row presents an area south of Velyka Shyshivka near a small crossroad. Comparing the 18 July 2010 and the 16 July 2014 satellite imagery shows a new object in the area. The situation is unchanged on 14 September 2014. The position is located on a small hill, the elevation profile of which is presented in the appendix. Mala Shyshivka, a small village three kilometers south of the position, has an elevation 100 meters lower than that of the likely position on the hill.

The satellite maps for the other marked places are presented in the appendix. The checkpoint south of Pokrovka can be clearly identified. The position was strengthened between 16 July 2014 and 13 September 2014 and craters are visible on 13 September as well. Toward the north, the terrain declines and the two northern villages, Pokrovka and Stepano-Krynka, have a considerable lower elevation. A tree row is south of the checkpoint. The second possible checkpoint is north of Blahodatne. There is a white object visible on the street that was not visible on 18 July 2010 possibly indicating the presence of a checkpoint. However, given the low resolution of the imagery, it is not possible to reach a definitive conclusion. On 14 September 2014, craters are visible in a field north of this position.

On 16 July 2014, almost no traces of hostilities are visible in the area between Shakhtarsk and Amvrosiivka. A notable exception is the black-rimmed area southwest of Mala Shyshivka, where two distinct crater fields are visible. The western crater field consists of at least 14 craters; the eastern crater field has at least 16. These two crater fields also prove that there were hostilities between Blahodatne and Mala Shyshivka before or on 16 July 2014. Later satellite imagery shows much more evidence of hostilities in the area as would be expected, for there were reportedly combat operations in the area in the meantime.

## Assessing the Russian Claims

In the first chapter, two Russian claims were presented. The first claim originates from the Russian MoD, which argued that there were Ukrainian Buk M1 TELARs south of Zaroshchens'ke on 17 July 2014. The second claim stems from Almaz-Antey, which estimated an area south of Zaroshchens'ke to be the launch site for the missile that downed MH17. If both claims are true, this would strongly support the hypothesis that the Ukrainian army is responsible for the downing of MH17.

In this chapter, the validity of both claims will be assessed. For this assessment, the information presented in chapter two, Situation Maps, and chapter three, Military or Likely Military Positions, will be used. Additional information is derived from press articles. Especially noteworthy are articles by Correctiv<sup>22</sup> and Novaya Gazeta<sup>23</sup> that contain interviews with locals from the area.

To assess the Russian claims, the validity of the following three hypothesis will be analyzed:

- H1: The alleged launch site south of Zaroshchens'ke was under Ukrainian control on 17 July 2014.
- H2: There were Ukrainian Buk M1 TELARs present in the alleged launch site south of Zaroshchens'ke on 17 July 2014.
- H3: There was a missile launch inside the estimated launch site on 17 July 2014.

Hypothesis 2 speaks to the claim made by the Russian MoD. If the hypothesis can be rejected, the Russian claim is wrong. Hypothesis 1 serves as an auxiliary hypothesis for this question and will thus be evaluated first.

Hypothesis 3 only evaluates the probability of the claimed missile launch from the area in question on 17 July 2014. Even if hypothesis 2 is rejected, the area south of Zaroshchens'ke could be still the launch site. However, in this case, it must have been a Russian Buk M1.

In general, the validity of the hypotheses will be assessed by estimating the likelihood of the observed information assuming the considered hypothesis is true. It is not possible, however, to objectively quantify this probability. Therefore, the following subsections primarily contain a qualitative analysis of the situation and are more subjective in nature. If the likelihood of the information is judged to be too low assuming the tested hypothesis' accuracy, the hypothesis will be rejected and its antithesis will be considered true.

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22 cf.: <https://mh17.correctiv.org/> (last accessed: 10 June 2015).

23 cf.: <http://www.novayagazeta.ru/inquests/68728.html> (last accessed: 10 June 2015), for an English translation of the interviews, cf.: <http://www.interpretermag.com/there-was-no-buk-in-our-field/> (last accessed: 26 June 2015).

## Hypothesis 1 “Ukrainian Control”

H1: The alleged launch site south of Zaroshchens'ke was under Ukrainian control on 17 July 2014.

To evaluate this hypothesis, the plausibility of the information provided in the situation maps shall be verified first. None of the aforementioned maps show the area in question as being under Ukrainian control. The official Ukrainian NSDC map and LiveUAmap claim that the Russian controlled territory reaches as far as Amvrosiivka. The conflict line estimated in Kot Ivanov's blog's situation maps is noticeably farther north. However, even this estimated conflict line is 6.7 kilometers<sup>24</sup> south of Zaroshchens'ke and four kilometers south of the southern boundary of the Almaz-Antey launch site.

That being said, the official Ukrainian maps did not capture the entire truth. The field camp near Amvrosiivka, an area claimed to be under Russian control, can be clearly identified as a Ukrainian position. Also, it is quite common for the Ukrainian maps to show hostilities deep inside Russian-controlled areas. LiveUAmap has a similar flaw. In both maps, "Russian controlled" must rather be seen as "not under strict Ukrainian control or under Russian control." The maps from Kot Ivanov's blog do not have such issues, but the author of the maps claims that they may not necessarily represent the actual situation in the area between Shakhtarsk and Amvrosiivka.<sup>25</sup>

This claim is part of a response to a Novaya Gazeta article assessing the conflict line using the maps from his blog. In his reply to the article, the author of the maps provided some insight into how he assessed the conflict line. Novaya Gazeta added his comment at the end of the article. The author states that the conflict line is often an interpolation using known positions and the public available reports from both sides. For the estimated conflict line in the area, he says that he had used the known Ukrainian military field camp near Amvrosiivka and the fact that N21 was under Russian control. Furthermore, he provides his thoughts about the situation near Zaroshchens'ke. He assesses that the Russian main defense line was close to N21 and that the area south of the road had only local defense positions. Therefore, he believes that Ukrainian forces should have been able to travel quite freely in the area while avoiding the settlements. He also adds that Zaroshchens'ke was not an important stronghold.<sup>26</sup>

Analyzing the identified positions should allow for a more complete picture of the situation on the ground. It seems certain that all positions in the proximity of Amvrosiivka were under Ukrainian control. The position near Kuteinykove, west of Amvrosiivka, was very likely also

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24 Novaya Gazeta also uses the situation maps from Kot Ivanov's blog to assess the terrain under control and comes to a similar conclusion. Instead of the approach used in this report (i.e., estimating the conflict line using prominent terrain features), they use a more technical approach. Using certain key features such as major road crossings, they calculate the exact map coordinates. Using the coordinates, they calculated a distance of six to seven kilometers from Zaroshchens'ke to the conflict line. cf.: <http://www.novayagazeta.ru/inquests/68846.html> (last accessed: 26 June 2015). Another analysis is provided by The Interpreter, which draws upon the official Ukrainian NSDC map from 11 July 2014 and the situation map from Kot Ivanov's blog. Using this information, The Interpreter concludes that the area in question was under Russian control on 17 July 2014. cf.: <http://www.interpretermag.com/russia-update-challenges-to-engineers-report-in-novaya-gazeta-on-downing-of-mh17/#8201> (last accessed: 26 June 2015).

25 cf.: <http://www.novayagazeta.ru/inquests/68846.html> (last accessed: 26 June 2015).

26 He supports his claims by pointing to an alleged attack south of Velyka Shyshivka on 16 July 2014 and later Ukrainian movements in the area. He also express his belief that there was a plausible reason for a Ukrainian Buk M1 SAM system to be in the area. cf.: <http://www.novayagazeta.ru/inquests/68846.html> (last accessed: 26 June 2015).



under Ukrainian control. The main fortifications face northwestward, in the direction of Ilovais'k and Russian controlled territory. On the other side, Shakhtarsk and the two checkpoints near Shakhtarsk can safely be seen as being Russian controlled.

Russian control over Velyka Shyshivka and the positions near the village can also be safely assumed. The main fortifications face southward; the northern positions seem to be a second line of defense. There are checkpoints controlling the traffic coming from the south and the west. Overall, the entire area generates the impression of a major defense position designed to protect against attacks coming from the south and controlling the traffic on T0517, the only road of its class in the area between Shakhtarsk and Amvrosiivka. Velyka Shyshivka is very likely one of the main defense installments used by Russian forces to guard the south of Shakhtarsk.

The likely military position south of Velyka Shyshivka was also likely to have been under Russian control. The hill south of Velyka Shyshivka, where the position is located, would hinder the early detection of approaching enemies from positions close to Velyka Shyshivka. Because this village can be seen as a major defensive position on 16 July 2014, it is likely that there was a monitoring position overseeing the southern area to ensure early detection of approaching enemies. The position south of Velyka Shyshivka seems suitable for just such a task. While the hill seems to have a flat top, the area around Mala Shyshivka has a much lower elevation and should be viewable from the hilltop. Though it is sensible for a position to be located here, it is unclear whether object identified really indicates a position.

It is also plausible to assume Russian control over the two positions near Shaposhnykove. The northwestern position on the fork is higher than the southern area. However, the tree row in the south likely hinders the visibility in this direction. But because there is a track leading to the fortifications coming from the north as well as tracks leading into a tree row in the northern part of the position, it is highly likely that the installment has a general southern orientation. The southwestern position, being elevated, is thus more suitable for controlling and overseeing the southern area. Russian control of nearby Velyka Shyshivka and a complete lack of evidence of hostilities between the two villages, together with the complete absence of a defensive position north of these two positions, also bolsters the assumption of Russian control over this area.

The possible checkpoint north of Blahodatne is likely under loose Ukrainian control. The placement would allow the protection of the village from incursions coming from the north and control of the road in the direction of Amvrosiivka. There are also reports that the northern bridge of Blahodatne was damaged in the middle of June by Russian forces and afterward closed for traffic.<sup>27</sup> While this does not completely preclude Ukrainian movements in the area (Google Earth shows clear signs of troop movements west of Blahodatne on 13 and 14 September 2014), the blast provides evidence that the village itself was most likely not under Russian control at this time. Contradicting Ukrainian control is the situation map from Kot Ivanov's blog for 18 July to 24 July 2014, which shows parts of Blahodatne under Russian control. Because this map presents an altered conflict line, it indicates that there

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27 A longer discussion of the report can be found in the appendix. For the article reporting the attempted blasting of the bridge, cf.: <http://amvrosievka.dn.ua/news/a-1064.html> (last accessed: 26 June 2015).

were reports of Russian troops in the area.<sup>28</sup> There were also social media reports from Ukrainian sources that surfaced on 18 July 2014 claiming that the village was captured by Ukraine.<sup>29</sup> In summary, it seems more likely that Blahodatne was under loose Ukrainian control on 16 July 2014.<sup>30</sup> However, this assessment is quite uncertain. Moreover, even the existence of the position cannot be viewed with certainty. What was initially identified as a checkpoint may well be a result of the bridge blast.<sup>31</sup>

The assessment of the checkpoint south of Pokrovka is similarly difficult. The position of the checkpoint is suitable for overlooking the lower area north of the position. There are also no other checkpoints or positions visible between Pokrovka and Kuteynkove, and the latter was surely under Ukrainian control on 16 July 2014. This would indicate Ukrainian control over the area. However, to guard the two villages north of the checkpoint, a defensive position would seem logical at that location. The situation map from Kot Ivanov's blog for 22 July to 28 July 2014 also shows a Russian position in the area. However, the exact placement of this position best corresponds with a position in the village and not with the identified position south of Pokrovka. Although it is not guaranteed that the following assessment is correct, it seems more likely that it was a Ukrainian position, not Russian.

The position south of Dubove was likely Russian. The elevation of the terrain is decreasing from north to south, making the location more suitable to oversee the southern area. Other positions close to this area are also identified as Russian, further bolstering this assessment. Because there is a dearth of visual evidence, it is unclear whether the object identified really indicates a position. Control over the remaining two likely positions between Shaposhnykove and Blahodatne cannot be clearly determined. The two positions, if they existed and were used on 16 July, seem to be more suitable as Russian outposts. They may have been used to overlook the lower terrain in the south. The craters south of the positions on 16 July 2014 and the visible tracks north of one of the positions on 13 September 2014 would support such an assessment. Therefore, Russian control is perhaps the more likely scenario, but there is not enough evidence available for a well-grounded conclusion.

Figure 23 shows the estimated situation on 16 July 2014 using Google Earth satellite imagery. The area under control was estimated starting with the identified position. The area around each position, covering from 2.5 km up to 3.5 km depending on the terrain, is considered to be under the control of the party controlling the position. The area between the positions is filled if it is reasonably considered to form a cohesive, controlled area. The situation resembles that which is seen in the maps from Kot Ivanov's blog (see figure 9 for the period of 15 July to 18 July 2014). However, an estimation based on the Google Earth imagery from 16 July 2014 leads to an area without decisive control between Shaposhnykove and Blahodatne. But even so, neither the place of the Russian MoD photo nor the Almaz-Antey launch site were under Ukrainian control. Moreover, they were clearly inside Russian-controlled territory and the access to this area from the south was guarded

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<sup>28</sup> There are reports dated 23 July 2014 in which Strelkov is cited claiming that Blahodatne was captured by Russian troops. The territorial change in the maps may be based on these reports. cf.: <http://vz.ru/news/2014/7/23/696947.html> (last accessed: 09 July 2015).

<sup>29</sup> cf.: <https://twitter.com/WowihaY/status/490228448208883712> (last accessed: 09 July 2015).

<sup>30</sup> The formulation "loose Ukrainian control" does not necessarily imply that Ukrainian troops were in the area on 16 July 2014. However, it seems more likely that Blahodatne was within range of Ukrainian troops rather than Russian troops. Therefore, it can be assumed that Ukraine had at least the opportunity to exercise some kind of control over the area.

<sup>31</sup> See the brief discussion in the appendix. The area identified as a checkpoint matches the damaged area of the bridge.

by defense positions. This latter point also illustrates that the author of the maps from Kot Ivanov's blog assessed the situation near Zaroshchens'ke erroneously in his reply to the Novaya Gazeta article.

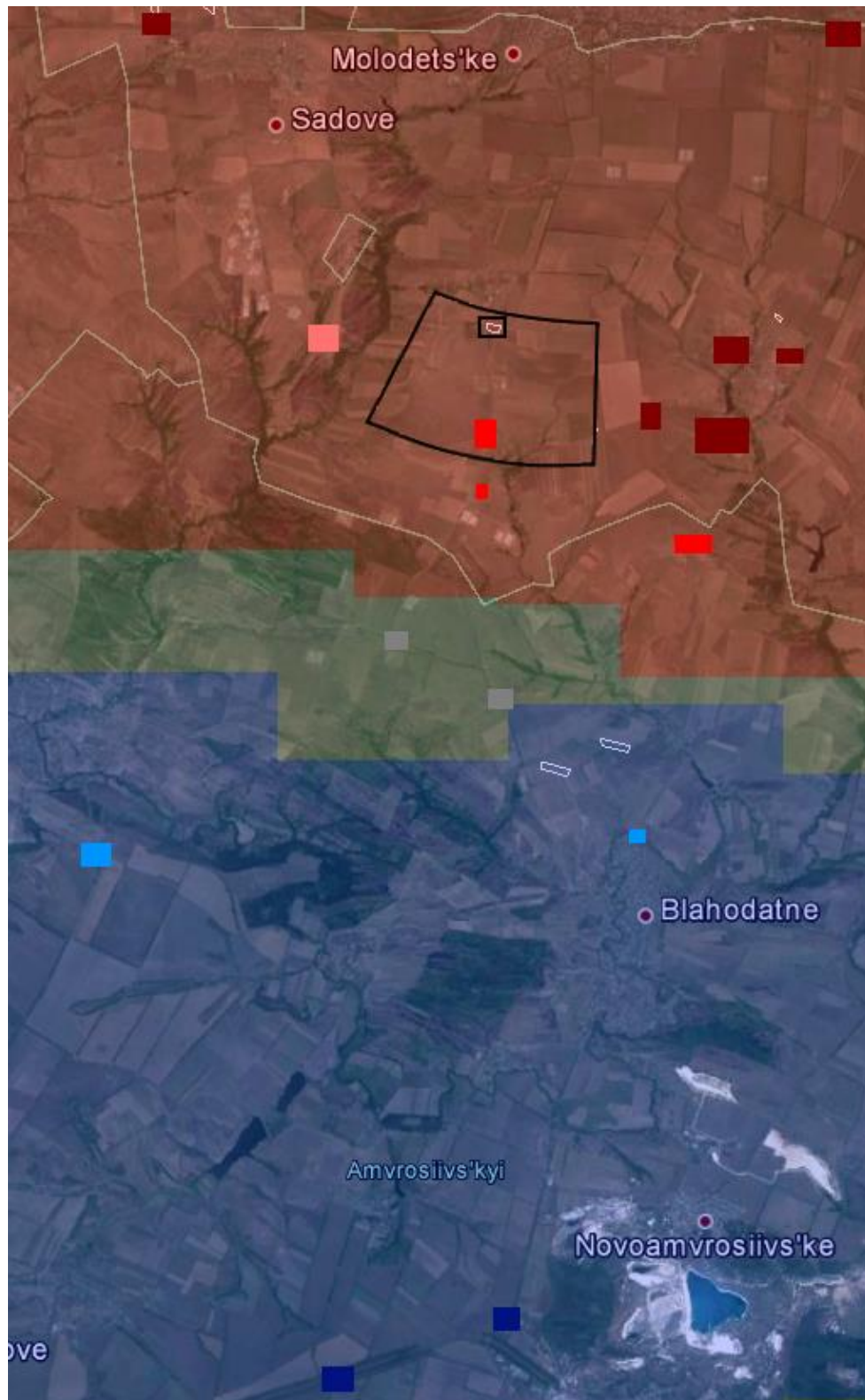




Figure 23: Estimated situation on 16 July 2014; Black square marks the Russian MoD picture area; Estimated ownership of identified positions is specified by the color, where blue stands for Ukrainian control, red for Russian control and grey for undetermined.; The intensity of the color symbolizes the likelihood of the assessment; The estimated area under control is indicated using the same color scheme

In any case, the assessed contact line and control based on Google Earth is estimated using data from 16 July 2014. Control could theoretically have changed hands on 17 July 2014. However, the situation map from Kot Ivanov's blog as well as the NSDC and LiveUAmapi maps indicate that such a change did not take place, as the maps show no hostilities in the area around Zaroshchens'ke. Furthermore, neither the Correctiv report<sup>32</sup> nor the Novaya Gazeta article<sup>33</sup> describe any hostilities in the area on 17 July 2014. Indeed, the area in question is stated to be under Russian control in both reports. The Correctiv report cites one inhabitant who claims that the Ukrainian army should have been too afraid to enter the area, and Novaya Gazeta cites a local who states that there was a Russian checkpoint in the area.

While the satellite imagery for most of the area south of Zaroshchens'ke is not updated again until 13 September 2014, Zaroshchens'ke and the area north of the village have updates for 20 July and 21 July 2014. Analysis of this area provides additional evidence. If there was temporary Ukrainian control over the area south of Zaroshchens'ke, the conflict line would have shifted; Zaroshchens'ke would have been a frontline village. It is also highly unlikely that an advance to these positions would have gone undetected or unanswered, as the western position in Velyka Shyshivka is merely three kilometers east of the area, and there were also two positions south of the area near Shaposhnykove. However, the updated area does not show any signs of hostilities. New craters are not visible in either Zaroshchens'ke or north of the village. Additionally, positions in Velyka Shyshivka that are visible in the imagery updates exhibit no signs of hostilities. Because a Ukrainian army south of Zaroshchens'ke would have meant a direct threat to Shakhtarsk and could have led to a collapse of the existing front line, at least a new line of defense south of Shakhtarsk would be expected. There is no sign of such an installment.

An additional indication is provided by the civilians in the area. On 16 July 2014, farmers can already be seen working in their fields. This would be very unlikely if the Ukrainian army had entered the area and hostilities were expected. Instead, there is clear progress visible in the updated area, where large parts of fields were worked between 16 July and 20 July 2014. A comparison between the situations is presented in figure 24.

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32 cf.: <https://mh17.correctiv.org/> (last accessed: 10 June 2015).

33 cf.: <http://www.novayagazeta.ru/inquests/68728.html> (last accessed: 10 June 2015).



Figure 18: Comparison of fields northeast of Zaroshchens'ke; Left: 16 July 2014; Right: 20. July 2014

In summary, it is highly unlikely to observe the information derived from the situation maps, Google Earth imagery, and content of the interviews if the area south of Zaroshchens'ke had been under Ukrainian control on 17 July 2014. Further, there is no evidence indicating hostilities in the area on 17 July or unclear control over the alleged launch site. Therefore, the hypothesis that the area was under Ukrainian control can be rejected. It follows that the area was likely under Russian control.<sup>34</sup>

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<sup>34</sup> Only likely because the rejection of hypothesis 1 only proves that there was no *Ukrainian* control over the area. Control by neither part is also a possible, albeit highly unlikely, alternative.

## **Hypothesis 2 “Ukrainian Buk M1 TELAR”**

H2: There were Ukrainian Buk M1 TELARs present in the alleged launch site south of Zaroshchens'ke on 17 July 2014.

This hypothesis is a direct test of the Russian MoD claim and picture. If the hypothesis is rejected, picture 5 of the Russian MoD briefing (see figure 1) can be considered to be false, meaning the picture is either a fabrication or deliberately misinterpreted so as to mislead or confuse the public. Rejecting the hypothesis also means that no Ukrainian Buk could have fired a missile from this position.

The discussion and subsequent rejection of hypothesis 1 already indicates that it is highly unlikely that there were Ukrainian Buks in the area, as the area was not under Ukrainian control. Even more damning, the discussion of the likelihood of a change of control on 17 July 2014 also shows that is highly unlikely that there were Ukrainian troops in the area at this date.

However, to assess the validity of the hypothesis, another angle will be considered as well, namely, the tactical advantage a Ukrainian Buk would have in the area in question compared to further south. Figure 25 shows two possible positions: one position is the center of the Almaz-Antey launch site; the second is the Amvroziivka field camp. Around both positions four circles are drawn at approximately 20, 25, 30, and 35 kilometers, illustrating the possible engagement zone of a Buk M1. The east-to-west coverage of both positions is almost identical. A Buk M1 positioned near Amvroziivka would cover a larger area over the territory of Russia. Positioned at the Zaroshchens'ke launch site allows for a larger area to the north that can be covered.



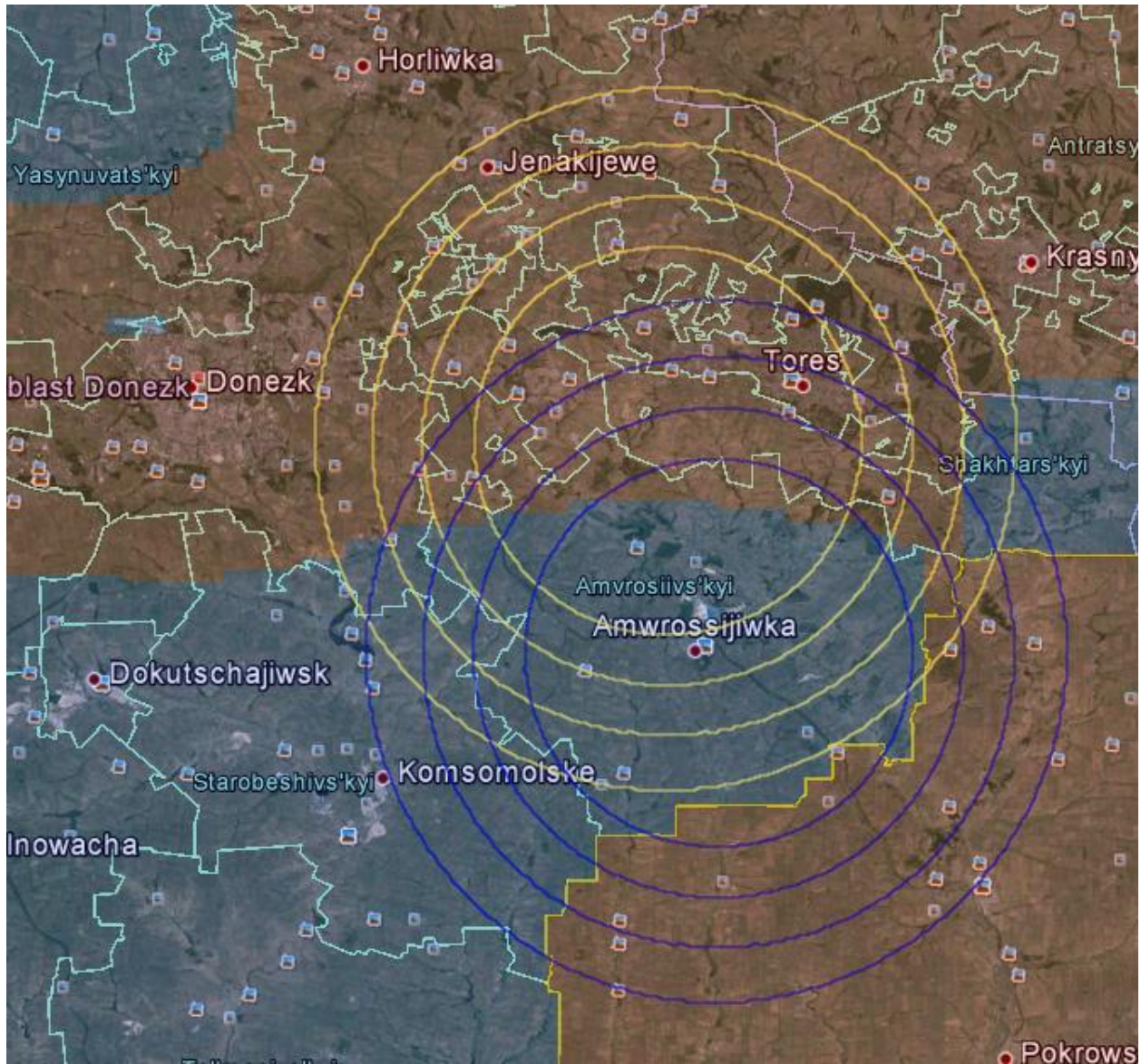


Figure 19: Engagement zone of a Buk M1; Circles are at approximately 20, 25, 30, and 35 kilometers from the Buk M1 position; Yellow: Center of Almaz-Antey launch site; Blue: Amvrosiivka field camp; Situation map from Kot Ivanov's blog from 15 to 18 July 2014 was used for an estimation of the area under control; Blue area: Ukrainian control; Red area: Russian control; The western and northern areas are only a rough approximation

To judge the situation on the ground, the map from Kot Ivanov's blog is used. For the area between Shakhtarsk and Amvrosiivka, the Kot Ivanov maps had a higher reliability than the LiveUAmaps or NSDC maps when compared with Google Earth imagery. It is clear that the Amvrosiivka position has higher coverage (i.e., the area falling within the range of a Buk M1) over Ukrainian-controlled territory; better coverage for the Almaz-Antey launch site could only be identified near Mospyne and east of Snizhne. However, both areas are close to the maximum range of a Buk M1. A position near Amvrosiivka would clearly allow air cover for the field camps and the positions in the area and would also be automatically guarded by the Ukrainian troops in the area.

The Almaz-Antey launch site would be more sensible if the intention of the positions was to control the airspace over the Russian-controlled territory in Ukraine or if a moving army in

the area of Shakhtarsk needed protection.<sup>35</sup> The former is implausible, given the complete absence of air operations by the Russian troops inside eastern Ukraine. The Ukrainian army would also have other options to control the airspace efficiently without risking valuable air defense equipment by positioning a SAM system inside Russian-controlled territory. The latter was already partially discussed in the context of hypothesis 1. However, so far only the existence of Ukrainian troops has been discussed. The presence of a Buk M1 south of Zaroshchens'ke provides another avenue for analysis. The Buk M1 is designed to provide air cover, not to act as an offensive weapon for ground operations. Given the presence of Russian troops and positions in the area, Ukrainian ground forces must have accompanied the Buk M1, and these forces must have advanced farther north, meaning that at least Zaroshchens'ke would have been under Ukrainian control. Furthermore, a Buk M1 would most likely only accompany a larger military unit.<sup>36</sup> In contrast, the interviewees in the Correctiv report<sup>37</sup> and the Novaya Gazeta article<sup>38</sup> deny a Ukrainian presence near and in Zaroshchens'ke on 17 July 2014. In addition, there are neither tracks nor other traces north of Zaroshchens'ke that would indicate a (larger) Ukrainian military unit in the area. As was discussed before, there are also no new craters indicating hostilities between 16 July 2014 and 20/21 July 2014 in the area north of Zaroshchens'ke.

It is therefore impossible to identify a sensible reason for a Ukrainian Buk to be deployed in the area in question. There were no Russian air activities in the Ukrainian airspace, neither over Ukrainian nor Russian-controlled territory, and there were no Ukrainian troops in the area that would require air cover. The alternative position near Amvrosiivka presented above would be more sensible, as a Buk M1 positioned there could provide air cover for a large part of the territory controlled by the Ukrainian army. Still, given the lack of air activities by Russian forces, the rationality of this alternative position is dubious at best.<sup>39</sup>

In summary, the alleged launch site was not controlled by Ukrainian forces and was instead in close proximity to Russian positions. Furthermore, there were no Russian air activities over Ukraine that would indicate the necessity of a Buk M1. There is also no evidence visible in Google Earth satellite imagery or provided by interviews with locals that would indicate Ukrainian troops were present in the area on 17 July 2014, much less accompanied by a Buk M1.

The likelihood that even one Ukrainian Buk M1 was in the area in question is extremely low given the evidence provided by the situation maps, Google Earth satellite imagery, and interviews with locals. Indeed, all available information indicates the opposite. Therefore, hypothesis 2 can be rejected. This means that there was no Ukrainian Buk M1 in the area south of Zaroshchens'ke. An implication of this assessment is that the Russian MoD provided false information in their 21 July 2014 briefing. This finding is buttressed by the lack of visible tracks near the claimed positions of the two Buk M1s west of the trees in the 21 July 2014 satellite imagery.

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35 Such an argument is used by the author of the situation map from Kot Ivanovs blog, who claims that a Ukrainian Buk M1 was likely positioned in the area to provide air cover.cf.:<http://www.novayagazeta.ru/inquests/68846.html> (last accessed: 26 June 2015).

36 cf.: <https://mh17.correctiv.org/> (last accessed: 10 June 2015).

37 cf.: <https://mh17.correctiv.org/> (last accessed: 10 June 2015).

38 cf.: <http://www.novayagazeta.ru/inquests/68728.html> (last accessed: 10 June 2015).

39 It should be noted that there were reports of Ukrainian Bucs in eastern Ukraine. The presented assessment only covers the two discussed positions.

## Hypothesis 3 “Almaz-Antey Launch Site”

H3: There was a missile launch inside the estimated launch site on 17 July 2014.

Almaz-Antey claims that they were able to identify the launch site of the missile that downed MH17 (see figure 2) using the damage visible on the wreckage. They used the available pictures for their assessment. The estimated launch site can be described as being an area south of Zaroshchens'ke ranging from Zaroshchens'ke to Shaposhnykove. The Russian MoD's Buk M1 picture area is part of the Almaz-Antey launch site.<sup>40</sup> The veracity of the claim that the missile that downed MH17 was fired from this area will be analyzed with hypothesis 3.

The rejection of hypothesis 2 has shown that there was no *Ukrainian* Buk in the area in question. However, this does not necessarily mean that there was no Buk M1 in the area at all. The area was most likely under Russian control and it is feasible that a Russian Buk M1 may have been positioned there to provide air cover, as there are reports of Ukrainian air activities and air strikes in the area.

Satellite imagery is available for only 16 July 2014 and 13 September 2014 for most of the Almaz-Antey launch site. (Only a small part of the area south of Zaroshchens'ke was more frequently updated.) Between these two dates, there were hostilities in the area, and some fields seem to have been burned. While the Google Earth satellite imagery is inconclusive, it can still be used to describe the area in question.

The Almaz-Antey launch site is south of Zaroshchens'ke and between six and eight kilometers south of Shakhtarsk. Nearby villages are Zaroshchens'ke, Zakharchenko, Shaposhnykove, Velyka Shyshivka, and Dubove. The distance to Torez is between 13 and 16 kilometers. The last known position of MH17 would be within the range of a Buk M1 positioned in the area.

Theoretically, the missile that downed MH17 could have been launched from this area. However, all interviewees in the Correctiv report<sup>41</sup> and the Novaya Gazeta article<sup>42</sup> claim that there was no missile launch south of Zaroshchens'ke on 17 July 2014. Some interviewees, however, do confirm that they had heard the crash of MH17. Because a nearby missile launch would have undoubtedly attracted their attention, they either lied deliberately or both reports must have presented fake interviews. Moreover, Shakhtarsk is close to the claimed launch site, suggesting that there ought to have been claims that the missile was launched south of Shakhtarsk on 17 July 2014. Either such claims were widely ignored and not reported at all, or such claim simply did not exist.

Recycling an argument originally posed against the Snizhne launch site, there have been no pictures taken of the missile launch. While such an argument is in general nonsensical, in this case it is at least partially applicable. There was a photographer in Torez who recognized the launch and the crash. The Torez missile launch picture was taken at a distance of approximately 12 kilometers from the launch site east of Snizhne. The distance

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40 cf.: <http://tass.ru/boeing-presentation/vvedenie> (last accessed: 26 June 2015).

41 cf.: <https://mh17.correctiv.org/> (last accessed: 10 June 2015).

42 cf.: <http://www.novayagazeta.ru/inquests/68728.html> (last accessed: 10 June 2015).



from the building in Torez to the Almaz-Antey launch site, at 15-16 kilometers, is only slightly greater. Nonetheless, the photographer only recorded the Snizhne launch and the MH17 crash site 10 kilometers northwest of his position.

If the hypothesis of a missile launch south of Zaroshchens'ke was true, at least some prompt reports covering the launch would have been expected. However, such reports did not occur or are at least not widely known. Also, a satisfying answer for the interviews in Zaroshchens'ke would be necessary. Both are possible but also highly unlikely. In summary, it is highly unlikely that the missile that downed MH17 was fired from the Almaz-Antey launch site. The main argument against the launch site are the interviews and the lack of other evidence. However, because a lack of evidence is in general a weaker argument than evidence supporting or opposing a hypothesis, some minor uncertainty remains in this case. It may still be conceivable that a Russian Buk launched a missile from this area, but this scenario can also be considered to be highly unlikely.<sup>43</sup>

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43 It should be noted that this assessment is only based on the presented information. Additional reports, for example analyzing the technical assumption of the Almaz-Antey assessment leading to this launch site, are not considered. Inclusion of this information may lead to a more definitive conclusion and a rejection of the hypothesis.

## Discussion

The objective of this report was to assess two specific Russian claims about the downing of MH17. One claim was made by the Russian MoD in their 21 July 2014 briefing, namely, that Ukrainian Buk M1s were positioned south of Zaroshchens'ke and therefore in range of MH17. This claim was supported by a satellite picture. Although the implication was clear, the Russian MoD briefing only claimed the presence of Ukrainian Buk M1s in the area, not that the missile that downed MH17 was fired from this position. The second claim originates from Almaz-Antey, the successor firm of the Buk M1 producer. They claim to have identified an area south of Zaroshchens'ke as the likely launch site. They also claim that because the missile used was no longer in use in Russia<sup>44</sup> but still used by the Ukraine armed forces, it was most likely a Ukrainian Buk that downed MH17.

For the presented analysis, different sources of information were used. One resource was situation maps from three different sources. These maps were created close to the actual date and rely upon information available at the time. The second source of information was satellite imagery, primarily that of Google Earth. These maps were used to identify potential military positions and checkpoints and to assess which parties controlled them on 17 July 2014. The final source of information were various press reports, especially noteworthy interviews conducted in Zaroshchens'ke by the German Correctiv<sup>45</sup> and the Russian Novaya Gazeta.<sup>46</sup> While these sources of information describe to a certain degree the same events, the processes that lead to their creation can be seen as independent.

The assessment was performed using an approach that can be described as qualitative hypothesis testing. This approach assessed the probability of the evidence provided by the resources mentioned above assuming the hypotheses were true. A qualitative approach was applied because it was considered to be impossible to quantify the probabilities under consideration in a sensible manner. The established information was discussed and assessed and, in the final step, evaluated assuming the tested hypothesis would be true. A drawback of this approach is the more subjective character compared to a more quantitative analysis.

If the observed situation was considered to be highly unlikely assuming that the tested hypothesis is true, the hypothesis is rejected. For the presented assessment, a hypothesis was only rejected if all of the different sources speak against it. The evaluation was therefore performed using quite conservative criteria. This should guarantee that the general conclusions are valid even if some elements of the presented assessment are proven to be not completely true or even false. However, if major assessments are shown to be wrong or important information was missed, a reevaluation will be necessary. An additional reason for the conservative criteria was to compensate for the more subjective character of the approach.

Using this principle and the presented information, it is possible to clearly reject two hypotheses. It can be concluded that the area in questions was not under Ukrainian control

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44 For an assessment discussing this claim, cf.: <https://www.bellingcat.com/news/uk-and-europe/2015/06/03/evidence-the-russian-military-supplied-the-type-of-missile-used-to-shoot-down-mh17/> (last accessed: 27.06.2015).

45 cf.: <https://mh17.correctiv.org/> (last accessed: 10 June 2015).

46 cf.: <http://www.novayagazeta.ru/inquests/68728.html> (last accessed: 10 June 2015).

on 17 July 2014 and that there was no Ukrainian Buk M1 in the area at this date. For the assessment, the area under control was estimated using Google Earth satellite maps and situation maps. To assess the area under control, positions and likely positions in the area were identified first and subsequently evaluated. Most positions could be affiliated with one of the two sides; however, the estimated reliability of this assessment strongly differs among the positions. It can be demonstrated that the pro-Russian map from Kot Ivanov's blog had the most accurate representation of the situation in the area, even if the author claims that his analysis was the result of presumptions. His new assessment in response to a Novaya Gazeta article, however, could be refuted. Additional factors supporting the conclusions are the interviews performed in Zaroshchens'ke, the lack of other positions, the missing traces of tracks and hostilities in the area, and the lack of a sensible scenarios supporting the claim of Ukrainian Buk M1s in the area.

The assessment that no Ukrainian Buk M1 was in the area south of Zaroshchens'ke on 17 July 2014 has one additional important implication. It proves that the Russian MoD presented patently false information in their 21 July 2014 briefing. Figure 5 presented by the Russian MoD must then be either a fabrication or a deliberate misinterpretation in order to mislead or confuse the public.

The hypotheses positing a missile launch from the Almaz-Antey launch site could not be rejected given the included information. It can, however, be clearly stated that no Ukrainian Buk M1 launched a missile from the area. There is also a clear lack of evidence supporting the hypothesis that the missile was launched from the position at all and, furthermore, there are interviews plainly contradicting the hypothesis. Nevertheless, under the conservative criteria employed for the purposes of this report, the available evidence is considered to be too weak to reject the hypothesis of a missile launch from the area. However, it can be stated that a missile launch from the area seems highly unlikely.



## Acknowledgments

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# Appendix

## Additional Situation Maps

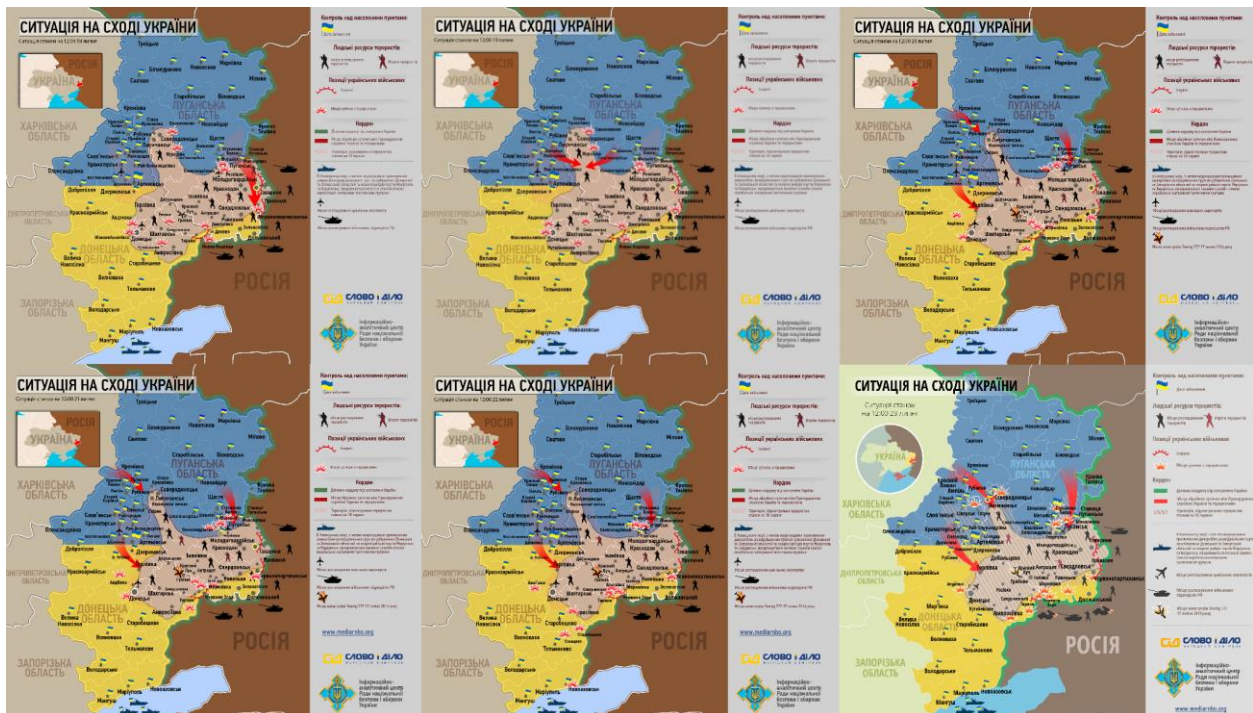


Figure 20: NSDC situation maps: Upper row: 18 July 2014, 19 July 2014, 20 July 2014 (left to right); Lower row: 21 July 2014, 22 July 2014, 23 July 2014 (left to right); Sources: <http://www.segodayna.ua/> (18 July 2014), <http://sender.rub.org.ua> (19 July 2014), <http://www.rnbo.gov.ua> (23 July 2014), <http://www.rnbo.gov.ua> (all other maps)

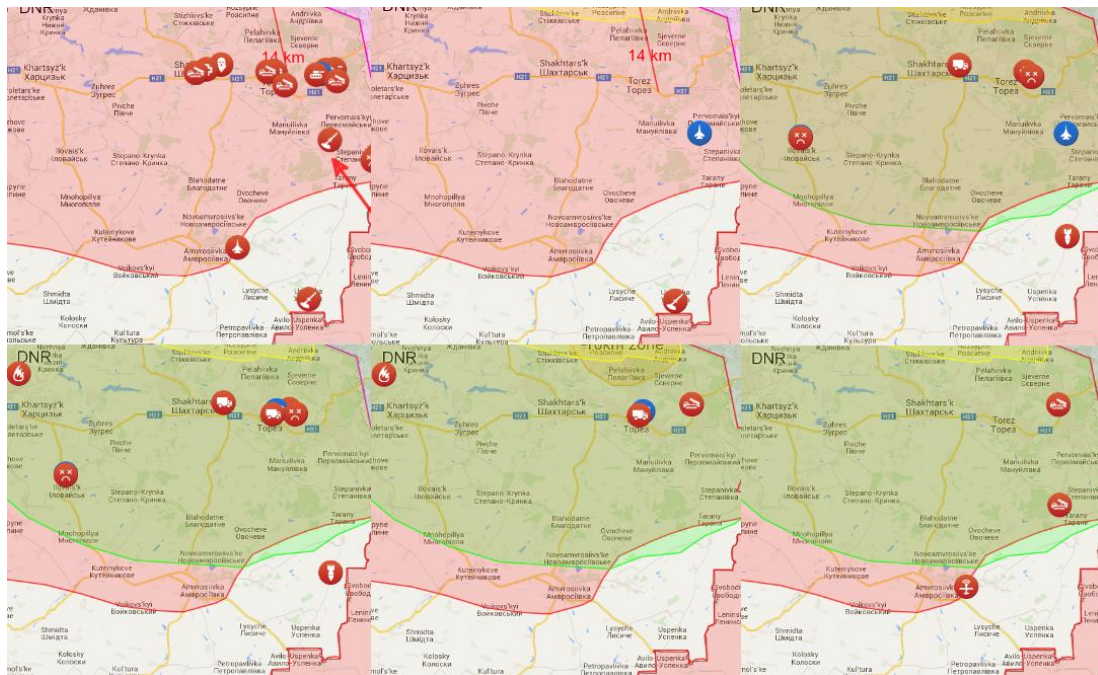


Figure 21: LiveUAmap situation maps: Upper row: 18 July 2014, 19 July 2014, 20 July 2014 (left to right); Lower row: 21 July 2014, 22 July 2014, 23 July 2014 (left to right); Source: <http://liveuamap.com/>



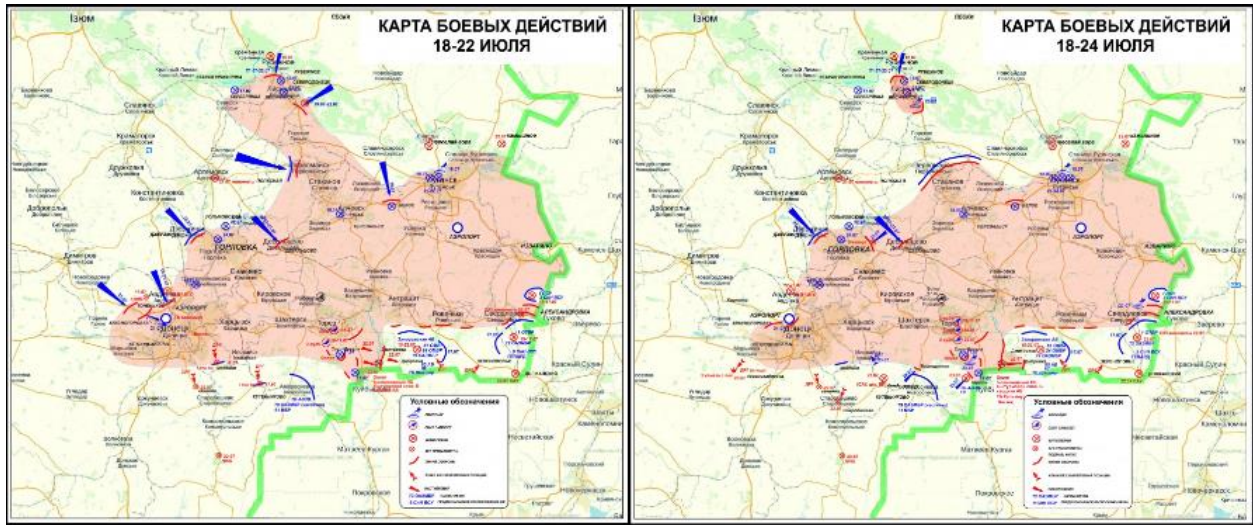


Figure 28: Left: situation map 18 July - 22 July 2014; Right: situation map 18 July - 24 July 2014;  
Source: <http://kot-ivanov.livejournal.com>

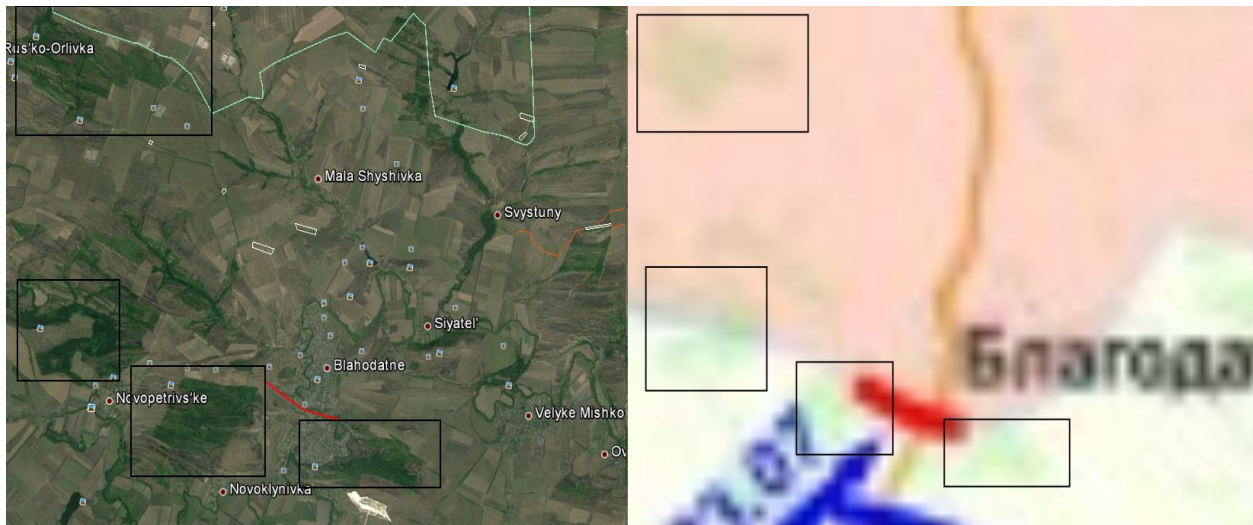


Figure 29: Comparison between GoogleEarth and Kot Ivanov's situation map 18 July - 24 July 2014; Black outlines are prominent terrain features; Red line is the claimed Russian position in Blahodatne; Source: <http://kot-ivanov.livejournal.com>



## Additional Maps for Military or Likely Military Positions



Figure 22: Kuteinykove position near Amvrosiivka: Left: 08 August 2013; Middle: 16 July 2014; Right: 13 September 2014



Figure 23: Zhukova Balka checkpoint near Amvrosiivka: Left: 22 March 2011; Middle: 16 July 2014; Right: 14 September 2014



Figure 24: Amvrosiivka checkpoint: Left: 18 July 2010; Middle: 16 July 2014; Right: 13 September 2014



Figure 25: Voikovs'kyi field camp near Amvrosiivka: Left: 25 September 2011; Middle: 16 July 2014; Right: 14 September 2014



Figure 34: Northwestern fortifications near Velyka Shyshivka; Upper row: Left: 18 July 2010; Right: 16 July 2014; Lower row: Left: 21 July 2014; Right: 14 September 2014

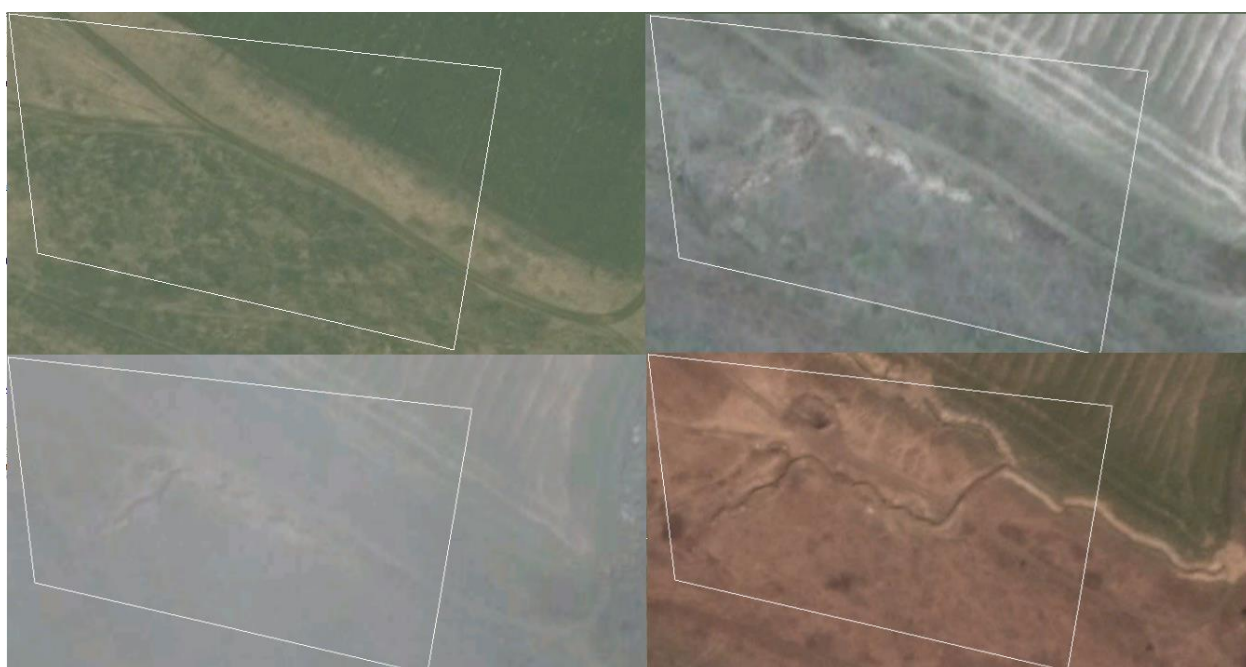


Figure 35: Northeastern fortifications near Velyka Shyshivka; Upper row: Left: 22 March 2011; Right: 16 July 2014; Lower row: Left: 21 July 2014; Right: 14 September 2014



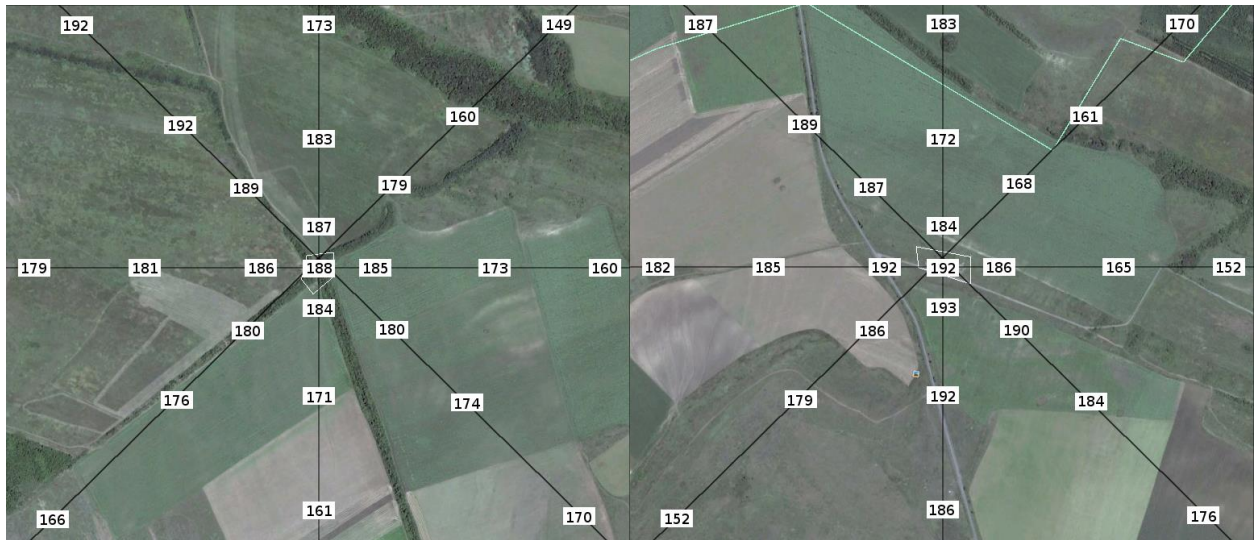


Figure 36: Other positions and elevation of selected places around the position: Left: eastern other position south of Shaposhnykove; Right: other position south of Velyka Shyshivka

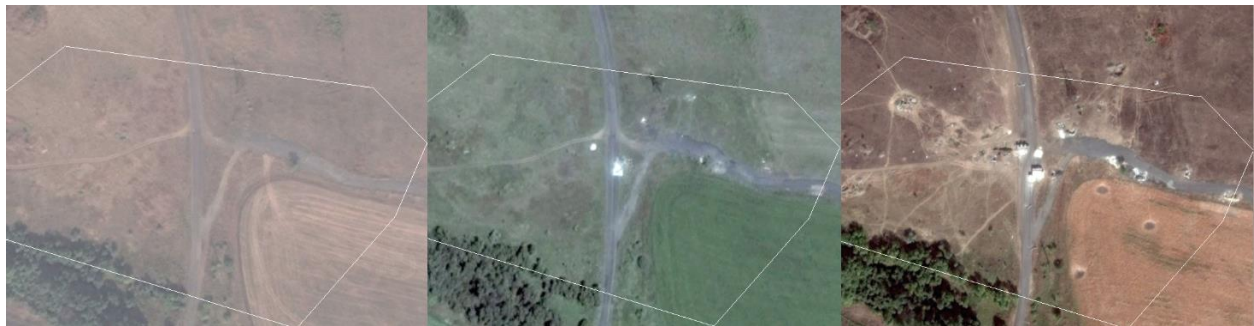


Figure 37: Checkpoint south of Pokrovka: Left: 13 September 2011; Middle: 16 July 2014; Right: 13 September 2014



Figure 38: Checkpoint north of Blahodatne: Left: 18 October 2010; Middle: 16 July 2014; Right: 14 September 2014



Figure 39: Crater fields near Mala Shyshivka: Both: 16 July 2014



## Blahodatne Bridge



Figure 40: Photos from the blasted bridge north of Blahodatne; The alleged date of the incident is the 18 June 2014;  
Source: <http://amvrosievka.dn.ua/news/a-1064.html>.

The following subsection briefly discusses the alleged attack on the northern Blahodatne bridge. The attack on the bridge was reported by the website<sup>47</sup> of the nearby town of Amvrosiivka on 18 June 2014. In the report, it is claimed that Russian forces (DPR) are responsible for the attempted destruction of the bridge, which resulted in it being closed to traffic.<sup>48</sup> A social media post on 20 July 2014 shows a much more damaged bridge. A larger part of the bridge had collapsed and only a small lane not wide enough for cars remained.<sup>49</sup>

The 18 June 2014 report also stated the exact position (T0517, kilometers 58 + 594) of the bridge and provides pictures from the scene.<sup>50</sup> While the provided position only helps to narrow down the area and the road, the pictures in the report make it possible to geolocate the bridge.

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<sup>47</sup> <http://amvrosievka.dn.ua/>

<sup>48</sup> cf.: <http://amvrosievka.dn.ua/news/a-1064.html> (last accessed: 26 June 2015).

<sup>49</sup> c.f.: [https://vk.com/wall-72822035\\_27](https://vk.com/wall-72822035_27) (last accessed: 09 July 2015).

<sup>50</sup> cf.: <http://amvrosievka.dn.ua/news/a-1064.html> (last accessed: 26 June 2015).



Figure 41: Panoramio picture of the northern bridge of Blahodatne; The photo was taken from a northern position looking toward the south; Source: <http://static.panoramio.com/photos/original/109711580.jpg>

There are four bridges in Blahodatne, two of which are on T0517. One crosses the river north of Blahodatne and the other in the middle of the town. The two other bridges are northwest and south of Blahodatne, respectively.

A comparison between the pictures from the scene (see figure 40) and the Google Earth satellite map from the area excludes three of the bridges; the northern bridge is the only viable candidate. The pictures clearly show a straight road that makes a sharp turn, marked by a traffic sign. This course of the road is unique to the northern bridge of Blahodatne. There are also other sources allowing a verification of the position of the photos. One Panoramio picture (see figure 41) shows the bridge from a vantage point to the north. A comparison of this picture with photos from the report allows for the identification of a number of similarities. For instance, the Panoramio photo was taken from a higher position, and the road slopes slightly downward to the bridge. A photo included in the report taken from the opposite direction shows the road inclining after the bridge. A picture from the report also shows a traffic sign in the background, the same sign that can be seen in the Panoramio picture. Furthermore, the wall of the bridge has a similar structure and color in both images. The pictures in the 20 July 2014 social media post also showed the same bridge. The general layout of the area is identical, with the road sign marking the sharp turn again visible along with the vegetation near and on the road. An especially noteworthy similarity is an area of small plants on the bridge near the guardrail.

Comparing the 16 July 2014 Google Earth satellite imagery (see figure 42) with the pictures from the report provides additional evidence. South of the bridge is a white strip visible on the road. In the picture showing the bridge from the south, gravel is clearly visible on the road at this location. In the background, directly in line with the road, a tree is visible. The same tree can be found in Google Earth. The area on the bridge identified as a likely checkpoint also matches quite well the area of the bridge that has visibly collapsed in the later social media post. In summary, it can be considered confirmed that the bridge north of Blahodatne was attacked and damaged in the middle of June.

The closing of the bridge interrupted the most direct connection between Amvrosiivka and Shakhtarsk. The two alternative routes provided in the report both lead through Kuteinykove and Zuhres. This would indicate that there was no longer a direct connection to the areas north of Blahodatne coming from Amvrosiivka. However, this may be only true for vehicles needing a road like T0517. There are other possible routes that would allow vehicles to bypass the damaged bridge. Vehicles not needing to rely on roads would have had additional options. Indications of this latter scenario are traces of military movements and craters on 13 September 2014 in the area northwest of Blahodatne.

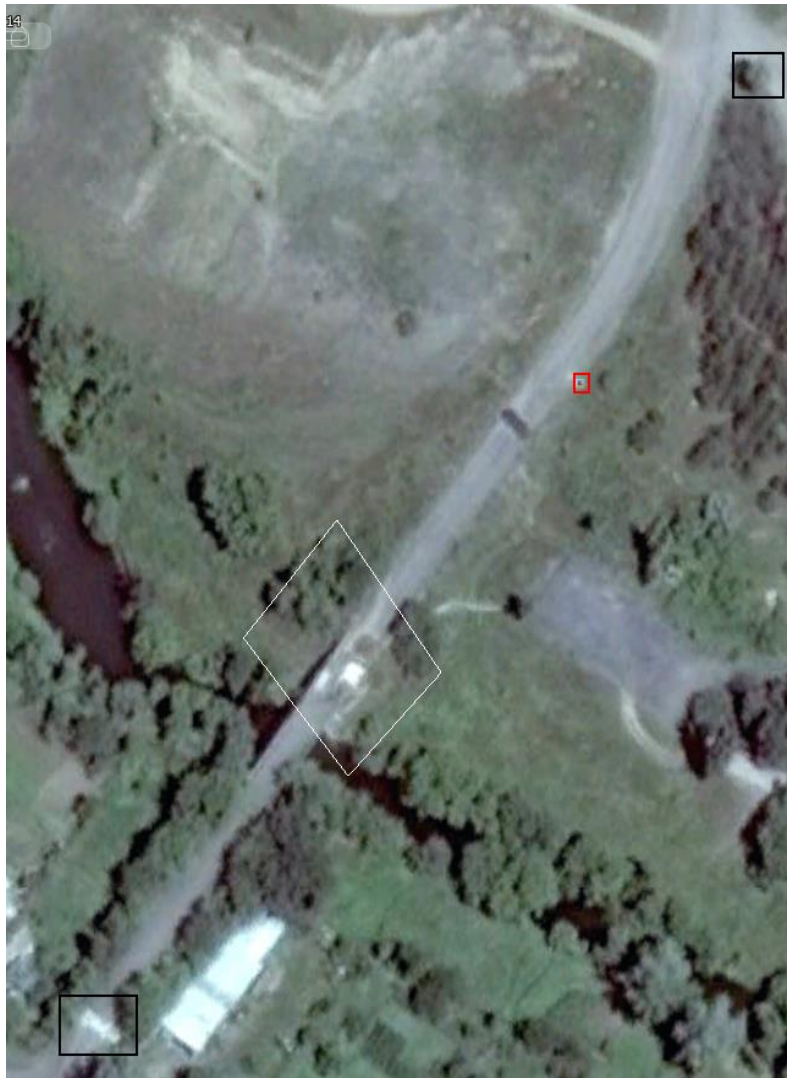


Figure 42: The northern Blahodatne bridge in Google Earth on 16 July 2014: Black outlines are two points of interest; Red outlines are the positions of the Panoramio picture in Google Earth; White outline is the potential position in the area

## List of Places and Their Coordinates

Amvrosiivka	47.783507 38.482628
Amvrosiivka checkpoint	47.816130 38.451987
Amvrosiivka field camp	47.763622 38.510084
Kuteinykove	47.810726 38.291210
Kuteinykove position	47.817009 38.275408
Voikovs'kyi	47.759435 38.336639
Voikovs'kyi field camp	47.742985 38.367967
Zhukova Balka	47.798317 38.401634
Zhukova Balka checkpoint	47.805243 38.409338
Blahodatne	47.882952 38.487832
Blahodatne checkpoint/bridge	47.896768 38.486249
Dubove	47.993893 38.410647
Dubove position	47.981257 38.408659
Mala Shyshivka	47.922918 38.484921
Mala Shyshivka crater field (west)	47.908897 38.464988
Mala Shyshivka crater field (east)	47.912676 38.480078
Pokrovka	47.910877 38.330514
Pokrovka checkpoint	47.895108 38.349777
Shakhtarsk	48.046535 38.468285
Hirne	48.036466 38.550161
Hirne checkpoint	48.031679 38.540007
Zachativka	48.030297 38.375372
Zachativka checkpoint	48.034124 38.367267
Shaposhnykove	47.960194 38.451998
Shaposhnykove northwest position	47.964737 38.449158
Shaposhnykove southwest position	47.955078 38.448249
Stepano-Krynka	47.919024 38.343827
Zuhres	48.014839 38.265857
Torez	48.022938 38.625967
Position of launch photo	48.048158 38.639026
Velyka Shyshivka	47.974925 38.513975
Velyka Shyshivka west-southern position	47.967407 38.491015
Velyka Shyshivka middle-southern position	47.964915 38.503958
Velyka Shyshivka east-southern position	47.962935 38.513039
Velyka Shyshivka eastern position	47.977530 38.525741
Velyka Shyshivka western positions	47.978280 38.510526
Zakharchenko	47.970940 38.414483
Zaroshchens'ke	47.988493 38.446697
Zaroshchens'ke Russian MoD position	47.982962 38.450892
Other positions	
South of Shaposhnykove eastern position	47.920623 38.452239
South of Shaposhnykove western position	47.930549 38.426428
South of Velyka Shyshivka position	47.946240 38.500324