

Table A1. National-level storage facilities

| Name | Other names | Military unit | Mobile unit | Coordinates |
|------------------------|-------------------------------|---------------|-------------|------------------------|
| Saratov-63 | Object 1050, Krasnoarmeyskoye | 25623 | 04197 | 51°25'28"N 46°15'35"E |
| Bryansk-18 | Object 365, Rzhanitsa | 42685 | 54056 | 53°33'39"N 33°58'17"E |
| Komsomolsk-na-Amure-31 | Object 1201, Selikhino | 52015 | 57381 | 50°17'43"N 137°28'6"E |
| Trekhgorny-1 | Object 936, Trekhgorny | 41013 | 24562 | 54°47'16"N 58°37'54"E |
| Lesnoy-4 | Object 917, Nizhnyaya Tura | 40274 | - | 58°36'57"N 59°38'8"E |
| Khabarovsk-47 | Object 1200, Korfovskiy | 25625 | 81385 | 48°10'58"N 135°1'35"E |
| Voronezh-45 | Object 387, Borisoglebsk | 14254 | 24552 | 51°21'47"N 41°55'38"E |
| Irkutsk-45 | Object 644, Zalari | 39995 | 25007 | 53°27'23"N 102°35'50"E |
| Belgorod-22 | Object 1150, Golovchino | 25624 | - | 50°33'47"N 35°44'9"E |
| Vologda-20 | Object 957, Chebsara | 25594 | 00494 | 59°5'59"N 38°36'41"E |
| Mozhaysk-10 | Object 714 | 52025 | 06031 | 55°25'35"N 35°46'8"E |
| Olenegorsk-2 | Object 956, Ramozero | 62834 | - | 68°14'56"N 33°51'39"E |

Table A2. Base-level 12th Main Directorate units and storage facilities

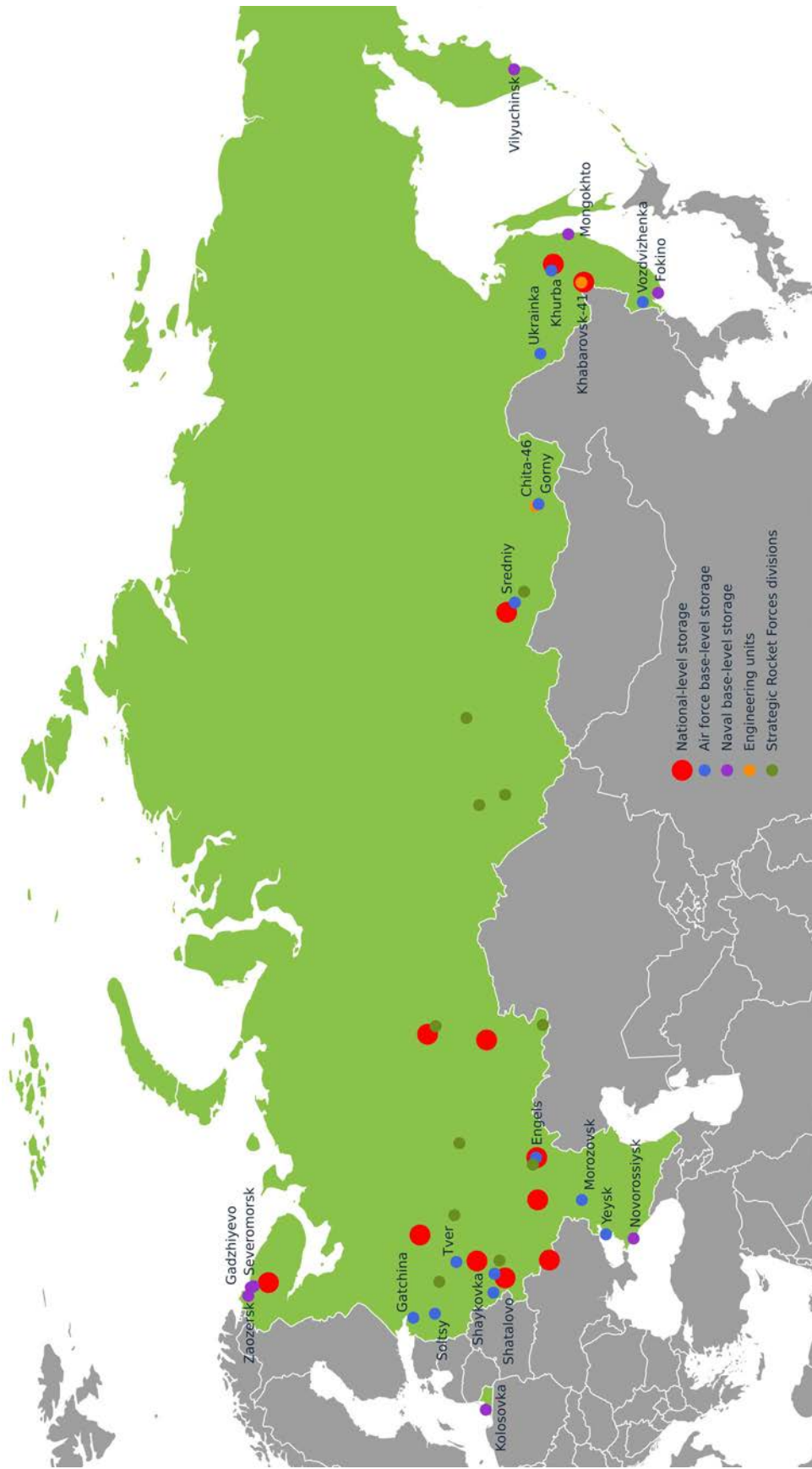
| Branch | Name of base | Unit | HQ or Potential Storage Location | Comments |
|--------------------------------|--------------|-------|----------------------------------|--|
| <i>Air Force</i> | Ukrainka | 27835 | 51°10'36"N 128°34'37"E | Long-range aviation, Tu-95MS strategic bombers |
| | Gatchina | 44086 | 59°31'20"N 29°55'6"E | Tactical aviation, possibly air defence |
| | Vozdvizhenka | 23477 | 44°00'13"N 131°54'52"E | Tactical aviation |
| | Morozovsk | 55796 | 48°19'11"N 41°47'35"E | Tactical aviation |
| | Tver | 19089 | 56°45'40"N 35°42'18"E | Airfield not located |
| | Engels | 77910 | 51°25'23"N 46°15'39"E | Long-range aviation, Tu-160, Tu-95MS strategic bombers |
| | Shatalovo | 23476 | 54°19'57"N 32°27'31"E | Tactical aviation |
| | Sredniy | 26221 | 52°54'11"N 103°28'39"E | Long-range aviation, Tu-22M3 |
| | Khurba | 77944 | 50°25'35"N 136°51'3"E | Tactical aviation |
| | Soltsy | 75365 | 58°8'50"N 30°19'53"E | Long-range aviation, Tu-22M3 |
| | Yeysk | 32161 | 46°37'43"N 38°15'2"E | Naval aviation training centre |
| | Gornyy | 54160 | 51°31'0"N 113° 1'60"E | Tactical aviation |
| <i>Navy</i> | Novorossiysk | 52522 | 44°39'56"N 37°46'34"E | Black Sea Fleet |
| | Gadzhyevo | 69273 | 69°15'13"N 33°21'33"E | Northern Fleet, naval weapons, SLBMs |
| | Kolosovka | 20336 | 54°50'12"N 20°21'11"E | Kaliningrad region |
| | Fokino | 36199 | 42°53'41"N 132°33'46"E | Pacific Fleet |
| | Mongokhto | 40689 | 49°15'39"N 140°12'23"E | Naval aviation, Tu-142 |
| | Vilyuchinsk | 31268 | 52°57'20"N 158°22'24"E | Pacific Fleet, naval weapons, SLBMs |
| | Zaozersk | 22931 | 69°23'51"N 32°27'5"E | Northern Fleet, naval weapons, SLBMs |
| | Severomorsk | 81265 | 69° 5'39"N 33°28'48"E | Naval aviation |
| <i>Strategic Rocket Forces</i> | Solnechny | 25996 | 56° 7'0"N 92°14'60"E | R-36M2/SS-18 silo ICBMs |
| | Yushkar-Ola | 54200 | 56°34'0"N 48° 4'0"E | Topol/SS-25 mobile ICBMs |
| | Bologoye | 33787 | 57°52'0"N 33°40'0"E | Topol/SS-25 mobile ICBMs |
| | Novosibirsk | 54245 | 55°16'0"N 83° 1'60"E | RS-24 Yars mobile ICBMs |
| | Sibirskiy | 08326 | 43°54'20"N 44°41'10"E | Topol/SS-25 mobile ICBMs |
| | Teykovo | 54175 | 56°53'60"N 40°35'0"E | Topol/SS-25, RS-24 Yars mobile ICBMs |
| | Yasny | 93766 | 51°1'0"N 59°49'0"E | R-36M2/SS-18 silo ICBMs |
| | Kozelsk | 44240 | 53°56'5.60"N 35°46'19"E | UR-100NUTTH/SS-19 and RS-24 Yars silo ICBMs |

| Branch | Name of base | Unit | HQ or Potential Storage Location | Comments |
|--------------------------|---------------|-------|----------------------------------|------------------------------|
| | Svobodny | 54203 | 58°5'59"N 60°25' 43"E | RS-24 Yars mobile ICBMs |
| | Tatischchevo | 68886 | 51°41'60"N 45°32'60"E | Topol-M/SS-27 silo ICBMs |
| | Irkutsk | 73752 | 52°16'60"N 104°27'0"E | Topol/SS-25 mobile ICBMs |
| | Shaykovka | 26219 | 54°15'53"N 34°25'15"E | Long-range aviation, Tu-22M3 |
| <i>Engineering units</i> | Khabarovsk-41 | 23227 | 48°21'15"N 135°01'31"E | |
| | Chita-46 | 23233 | 51°31'5"N 113°2'28"E | |

Figure A1. Organization of 12th Main Directorate units

| | Engineering units | Air Force | Navy | Rocket Forces |
|------------------------|---------------------------|-----------------------|---------------------------------------|--|
| Belgorod-22 | | Morozovsk | Novorossiysk | |
| Bryansk-18 | | Shatalovo | | Kozelsk Shaykovka |
| Irkutsk-45 | | Sredniy | | Solnechny Novosibirsk Sibirskiy Irkutsk |
| Khabarovsk-47 | Khabarovsk-41 Chita-46 | Gorny Vozdvizhenka | | |
| Komsomolsk-na-Amure-31 | | Seryshevo Khurba | Fokino Mongokhto Vilyuchinsk | |
| Lesnoy-4 | | | | Svobodny |
| Mozhaisk-10 | | Tver | | |
| Olenegorsk-2 | | | Gadzhiyevo Severomorsk Zaozersk | |
| Saratov-63 | | Engels | | Tatishchevo |
| Vologda-20 | | Gatchina Soltsy | Kolosovka | Bologoye Teykovo |
| Voronezh-45 | | Yeysk | | |
| Zlatoust-30 | | | | Yoshkar-Ola Yasny |

Figure A2. 12th Main Directorate national storage sites and base-level storage facilities



Examples of storage facilities

Once the location of 12th Directorate units has been established, satellite imagery of the various storage facilities across Russia's territory allows the identification of the potential storage facilities, national-level and base-level. Because these facilities would be expected to host nuclear weapons, a heightened level of security around them can be expected. In identifying potential storage facilities, several observables can be useful. These include:

- Overall size of the site
- Presence of covered bunkers
- Size and number of structures and bunkers within the site
- Presence of ventilators for the bunkers
- Presence of heightened security features
- Proximity of 12th Directorate military unit

National-level facilities

The image below shows the Bryansk-18 national-level storage site of the 12th Main Directorate (Figure A3). It gives a clear example of some of the indicators of nuclear weapons storage facilities in Russia. The perimeter of the site is about 9500m, which falls within the normal range for national-level sites identified in this study. Within the site, we can distinguish six areas for weapons storage, further suggested by the presence of ventilation outlets. This type of configuration is similar across sites surveyed through satellite imagery.

Base-level facilities

Base-level facilities identified through satellite imagery and open sources typically share some of the basic features identified at national-level storage sites like Bryansk-18. These features include distinct bunker areas, ventilation outlets, and heavy security with a fortified outer perimeter. This type of facility can be smaller than the national-level sites.

In many cases, a base-level site would include a bunker with two entrances, as illustrated on Figure A4, which shows the base-level facility at the Engels air force base. The drawing on Figure A5, which is based on one of the former Soviet storage facilities in Eastern Europe, shows the internal layout of such a bunker.

In most cases, the base-level storage site is located some distance away from the operational base it is assigned to. In Engels, the nuclear weapon storage is about 7 km away from the airfield (Figure A6). However, in some cases, a unit that services a base-level facility can deploy weapons at an operational base (such as airfield) as far as 100 km away from the storage site. In other cases, the storage facility can be located in the immediate vicinity of the airfield. One example is the Soltsy air base, where the storage area is connected to the airfield (Figure A7).

Although most sites were constructed during the Soviet period, satellite imagery shows that Russia has recently upgraded a number of suspected base-level storage facilities or built new ones. One example is the possible bunker at Morozovsk air base. As shown on Figure A8, the bunker that appears to be used as weapon storage was built after 2005.

Figure A3. National-level storage site at Bryansk-18



Figure A4. Base-level storage facility at Engels air base



Figure A5. Schematic of the inside of a Soviet-era base-level storage site.
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Figure A6. Engels airbase and the nuclear weapon storage site



Figure A7. Soltsy airfield and the nearby storage site

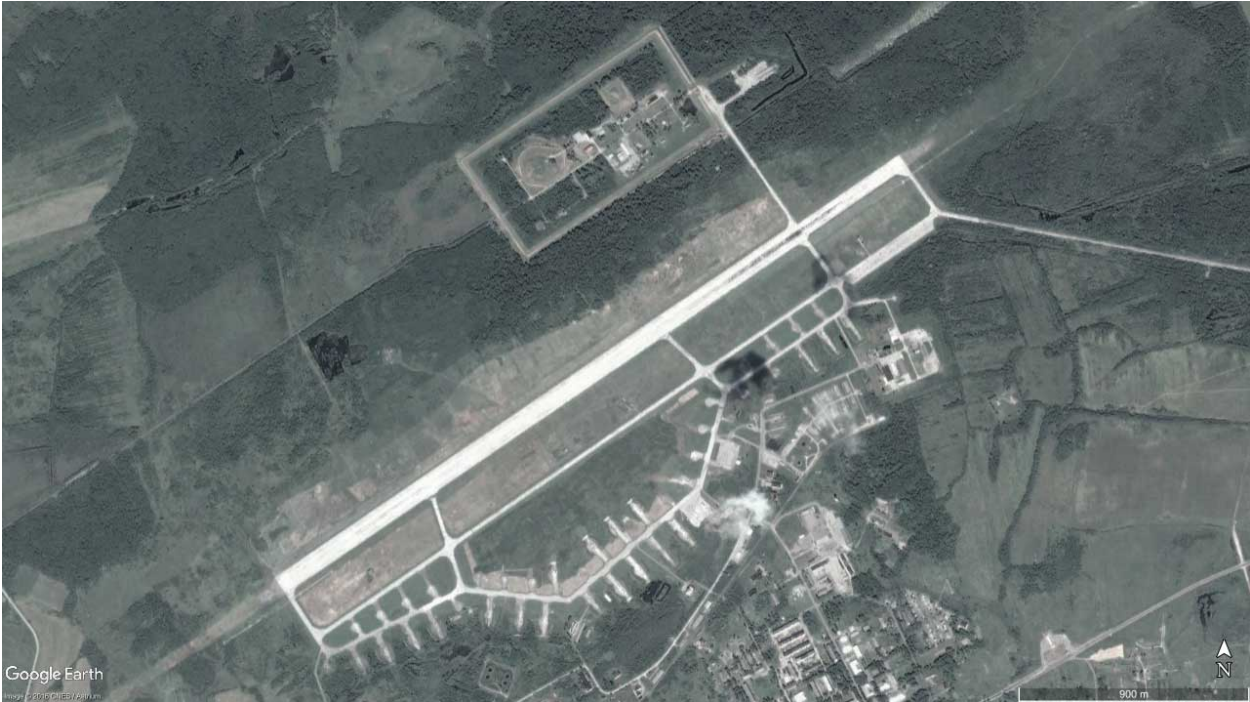


Figure A8. Comparison of 2005 and 2014 satellite images of storage area at Morozovsk Air Force Base, which shows new storage facility

