



Realization of high-precision navigation mode

Sergey Silin

Krasnoyarsk, May 18-22, 2015



COMPANY "NAVIS GROUP"



Headquarter - in Moscow

NAVIS company operates in the market of satellite navigation

GLONASS/GPS since 1996

Company "NAVIS Group" includes:

- NAVIS Inc. - Moscow & St. Petersburg, Russia www.navis.ru
- NVS Navigation Technologies Ltd. - Moscow, Russia www.nvs-gnss.ru
- NVS Technologies AG - Montlingen, Switzerland www.nvs-gnss.com
- NVS Telematic Systems Ltd. - Moscow, Russia www.nvs-ts.ru
- NAVIS Ukraine Ltd. - Smela, Ukraine www.navis-ukraine.com.ua



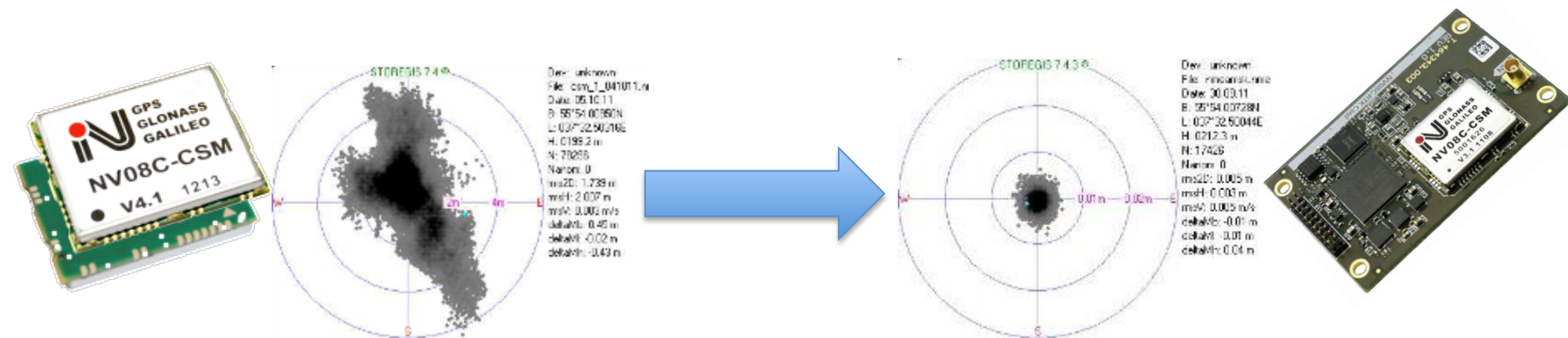


Main problems for quick determination of the object location:

- Low GNSS signal level at the time of start of the equipment (conditions of measurements)
- Limited number of "visible" satellites (conditions of measurements)
- Time for allocation of navigation information from a satellite board of 30 seconds (features of system creation)

Main problems of exact determination of the object location:

- Mistakes due to ephemeris and time providing (control segment)
- Signal ionosphere and troposphere delays (distribution environment)
- Multipath errors – reception of the reflected signals (conditions of measurements)
- Radio noise from sending devices of space and land infrastructure (conditions of measurements)
- Non compensated group delay errors for GLONASS signals (features of system creation)



Methods of solving problems for quick and accurate positioning on GNSS

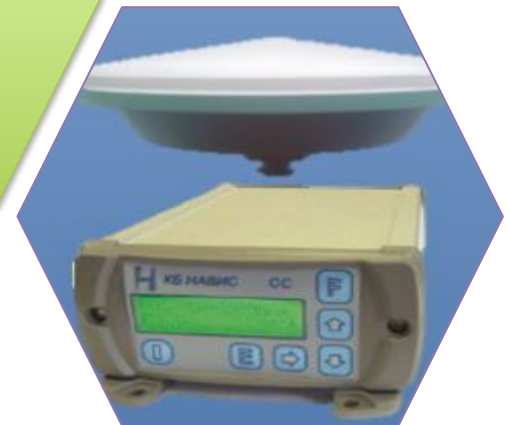


Assisted



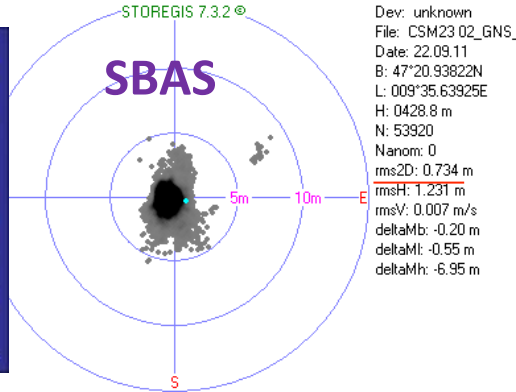
RTK

SBAS/
DGSS





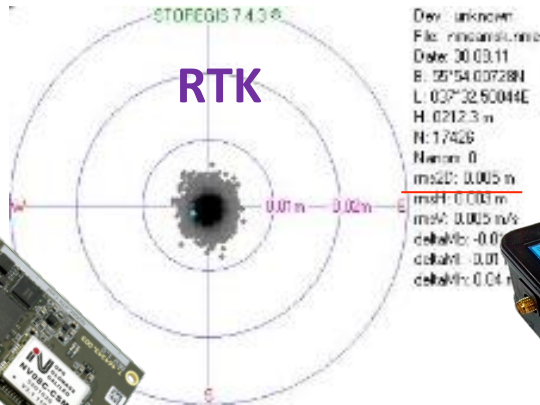
Methods of wide area differential correction



Base station



Methods of relative navigation



Methods of local differential correction



Relative navigation

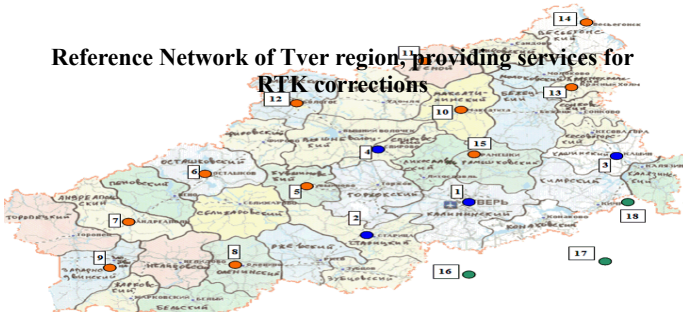
Network base stations of precise positioning (SPP) on the territory of the Russian Federation



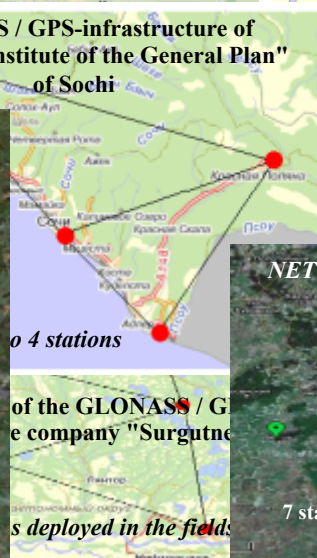
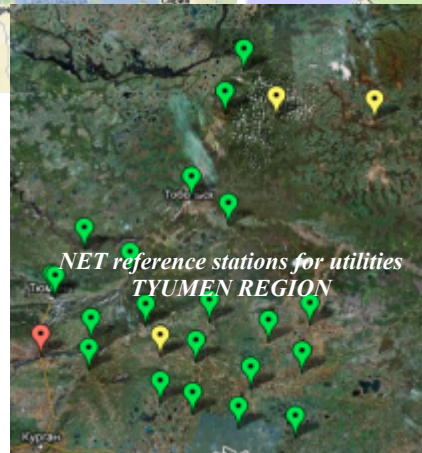
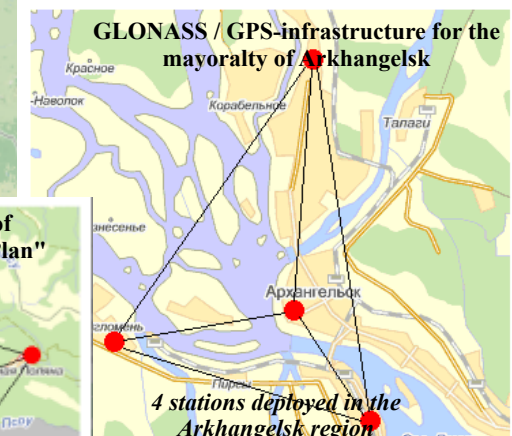
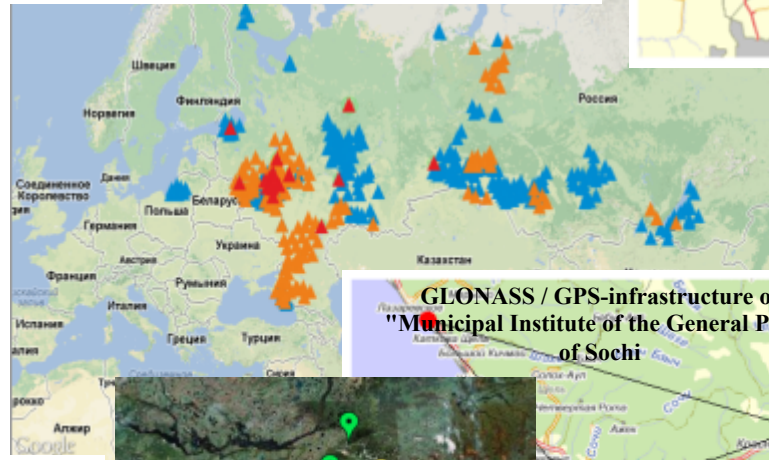
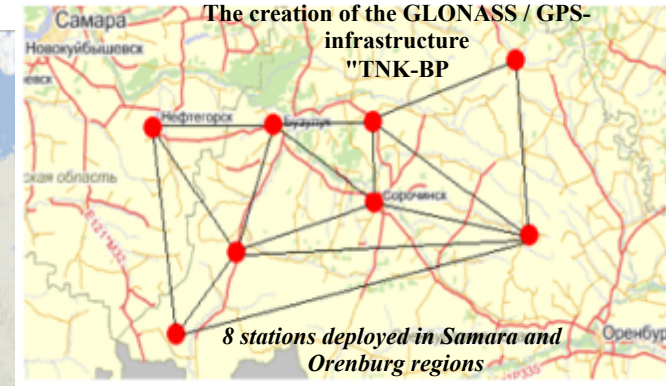
Reference station precise positioning



Reference Network of Tver region, providing services for RTK corrections



- - Действующие референсные станции СТП ТО (1 этап)
- - Планируемые референсные станции СТП ТО (2 этап)
- - Действующие референсные станции ССП МО



Scopes of application



**Transport - monitoring,
improving of security**



Agriculture sector



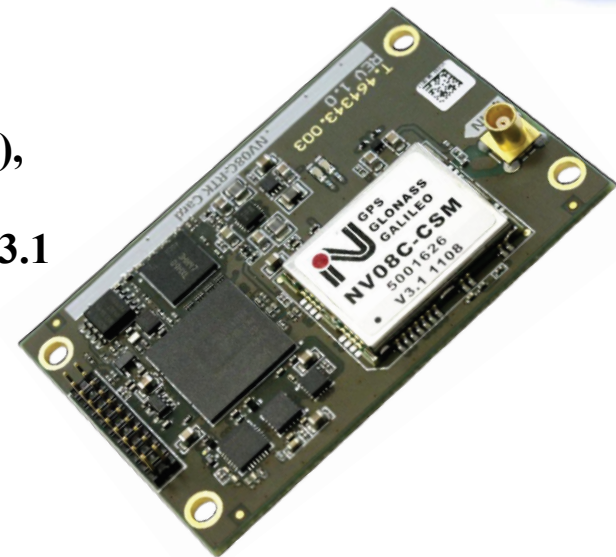
**Cartography,
construction**





Characteristics:

- Built-in RTK mode (Base and Rover)
- 32 channel GLONASS tracking (in the range L1 1602.0 MHz), GPS and SBAS (within the range L1 1575.42 MHz)
- Exchange protocols NMEA 0183, BINR, RTCM SC-104 v 3.0, 3.1
- Positioning accuracy in respect of (MSD)*:
 - Autonomous mode 2.5 m
 - RTK-condition (2D) **0.01+ 1ppm**
- The accuracy of speed determination (MSD)*: 0.05 m/s
- Sensitivity :
 - The tracking mode -160 dBm
 - Cold start -143 dBm
- Coordinate system: WGS-84, PZ-90, SC-42, SC-95
- The frequency of the decision issue 1, 2, 5, 10 Hz
- Individual calibration of group time delays of GLONASS path
- Three-level signal filtering to improve noise immunity
- Autonomous integrity monitoring receiver (RAIM control)
- Monitoring of antenna-feeder path condition
- Support of Assisted GNSS (A-GNSS) Technology



Telematic terminal mode support

L1 RTK SN-5707



- The telematic SN-5707 terminal with support of the RTK mode on the basis of the NV08C-RTK receiver providing high-precision on-line monitoring of object on GSM communication networks, and also possibility of receiving coordinates/course/speed and angles of heel and pitch through the built-in RS232 under the NMEA 0183 protocol with speed to 5 Hz.
 - Determination of location of object with high precision, about 0.01 m, in the RTK mode
 - Monitoring of a condition of the vehicle (V), control of its situation and movement, and also run and fuel consumption
 - The emergency notification about assault on the driver or on passengers and other emergency situations
 - Remote control connected devices and systems of the HARDWARE
 - Voice communication with the driver of the HARDWARE
 - Accumulation of information in non-volatile memory not less than 200 000 events in the absence of a communication channel
 - The built-in function of "the virtual odometer" according to GNSS and the accelerometer
- Full compliance to the Order No. 285 of Ministry of Transport of the Russian Federation "About the approval of requirements to the means of navigation functioning with use of navigation signals of GLONASS system or GLONASS/GPS and intended for obligatory equipment of the vehicles of category M used for commercial transportations of passengers, and the categories N used for transportation of dangerous freights"



The results of comparative testing of receivers **SN-5707** and **Leica GS10**



- Geodetic satellite receiver GPS/GLONASS/GAL/COMP L1+L2+L5 **Leica GS10**
- Telematic terminal **SN-5707**
- The receivers work with a single source of corrections (RTCM v3, the base station Ramenskoye)



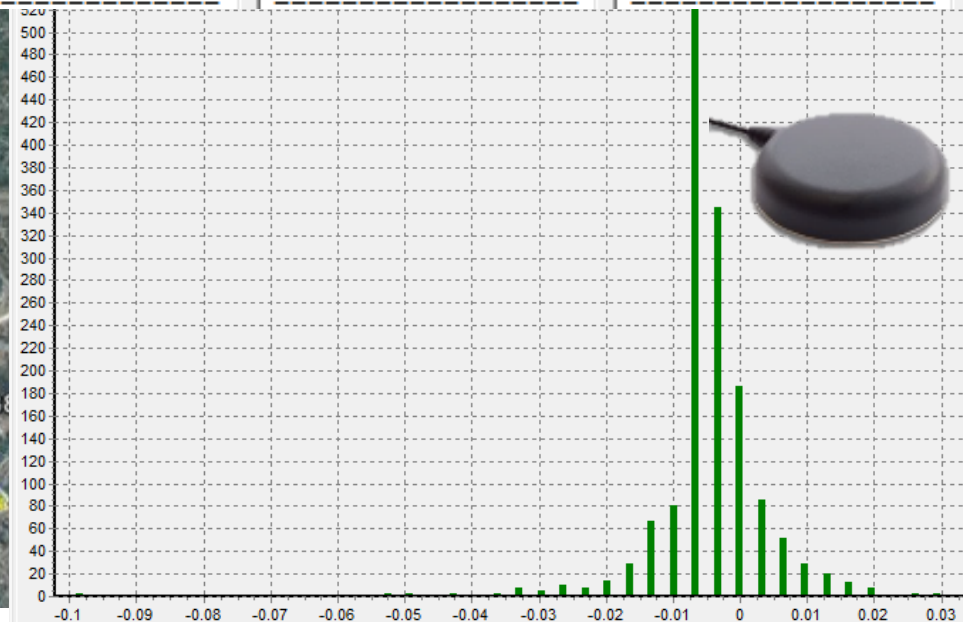
The results of travel with the antenna **NV2410** with a distance of 3 km from the base



Total Points:
 RTK Float:
 RTK Fixed (INT):
 RTK Fixed Validated / VALID:

1728 **GS10**
 0 (0.00%)
 1594 (92.25%)
 1594 / 1594 (100.00%)

1728 **SN5707**
 48 (2.78%)
 1680 (97.22%)
 1546 / 1539 (99.55%)



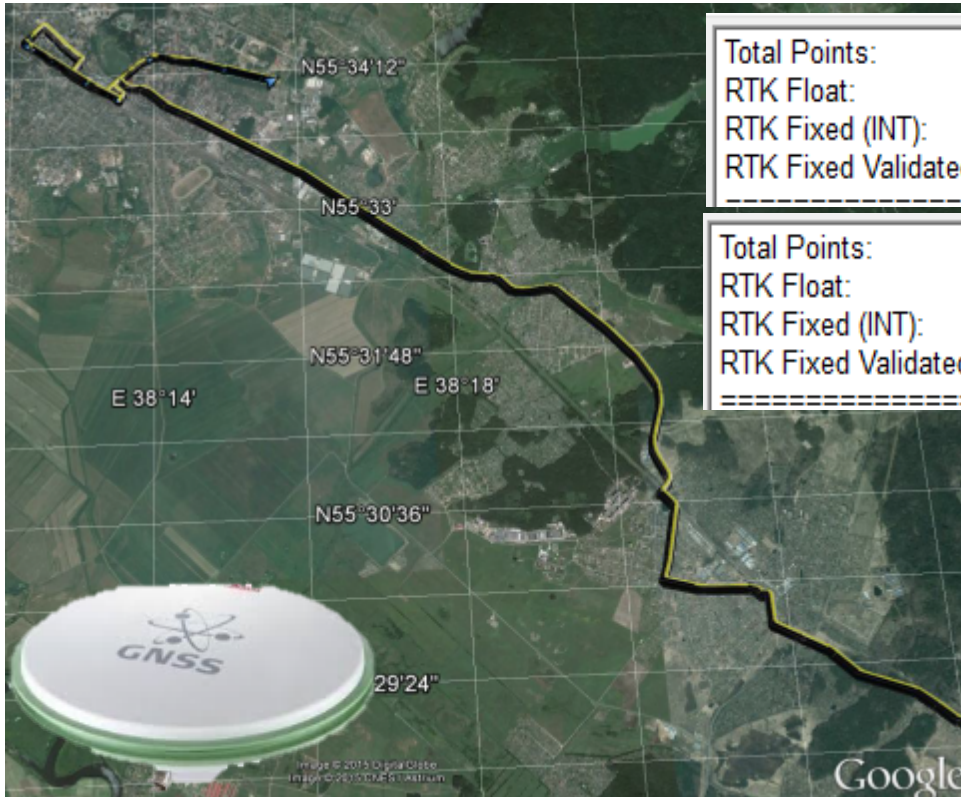
The results of comparative testing of receivers **SN-5707** and **Leica GS10**



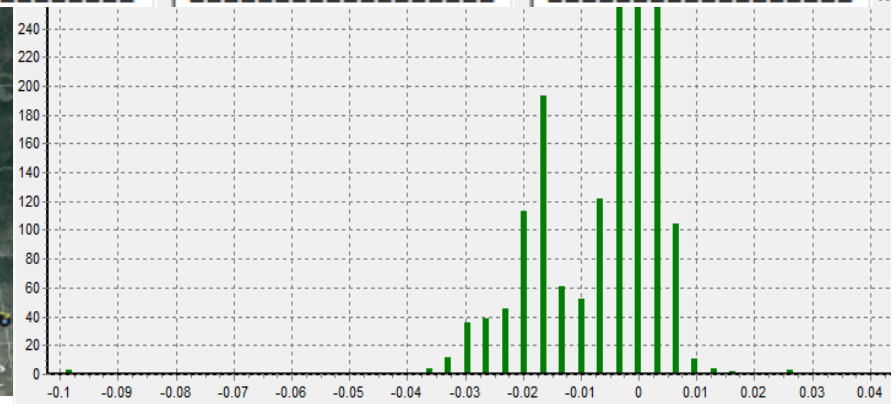
- Geodetic satellite receiver GPS/GLONASS/GAL/COMP L1+L2+L5 **Leica GS10**
- Telematic terminal **SN-5707**
- The receivers work with a single source of corrections (RTCM v3, the base station Ramenskoye)



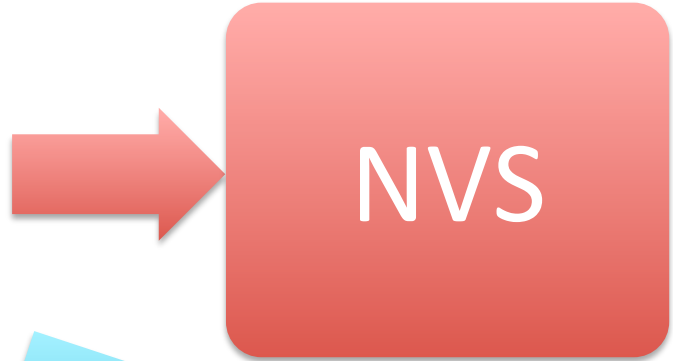
The results of travel with the antenna **Leica AS10** with the removal of 15 km from the base



Total Points: RTK Float: RTK Fixed (INT): RTK Fixed Validated / VALID:	1968 GS10 0 (0.00%) 1877 (95.38%) 1877 / 1877 (100.00%)	1968 SN5707 97 (4.93%) 1871 (95.07%) 1827 / 1823 (99.78%)
Total Points: RTK Float: RTK Fixed (INT): RTK Fixed Validated / VALID:	2334 GS10 0 (0.00%) 2264 (97.00%) 2264 / 2264 (100.00%)	2334 SN5707 85 (3.64%) 2247 (96.27%) 2196 / 2179 (99.23%)



SN-5707 as the Rover works with base stations (BS)



NVS



BS «SN-3500»



Trimble



Leica



NovAtel

NV08C-RTK supports BS SN-3500, NVS-BS01, own production, and BS third party, due to the adjustment of the phase characteristic



Station the Exact Positioning
of the production of "NAVIS"

The equipment manufactured by "NAVIS" received positive reviews from the largest state-owned Companies, has been certified and recommended for installation on the vehicle for critical applications.



The equipment -based modules **NV08C** series has a "Certificate of type approval of measuring instruments, which allows the use of data obtained with its help as a legitimate evidence base.



Thank you for your attention!

NAVIS

Russia, 121170, Moscow, Kulneva
st., 3, bld. 1

Tel: +7 (495) 661-40-85

Fax: +7 (495) 661-40-86

E-mail: navis@navis.ru

Web: www.navis.ru