



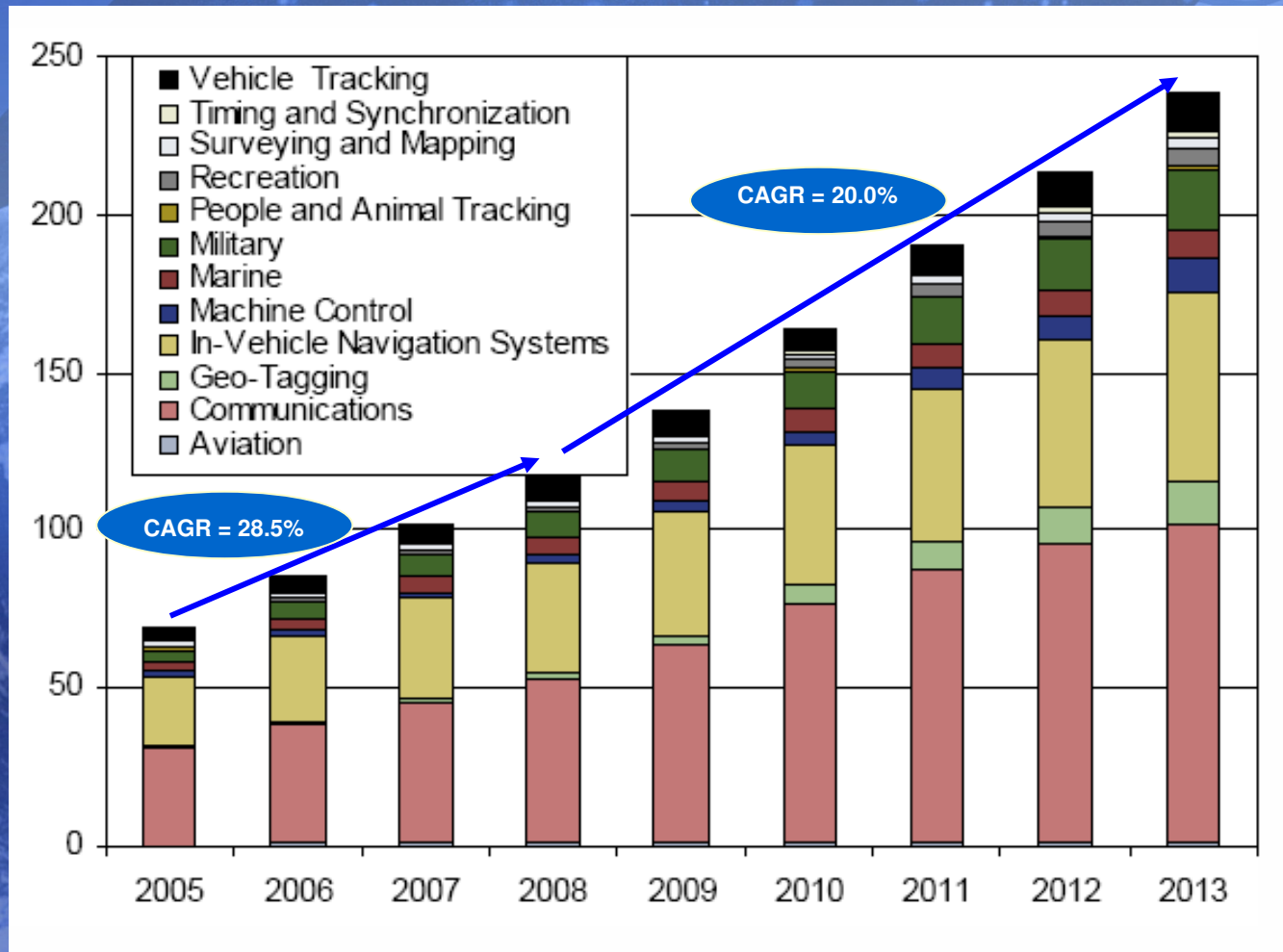
***Review of navigation systems
by Russian manufacturers,
trends and prospects***

***GLONASS/ GPS/ GALILEO
technologies and equipment***

Valery Babakov

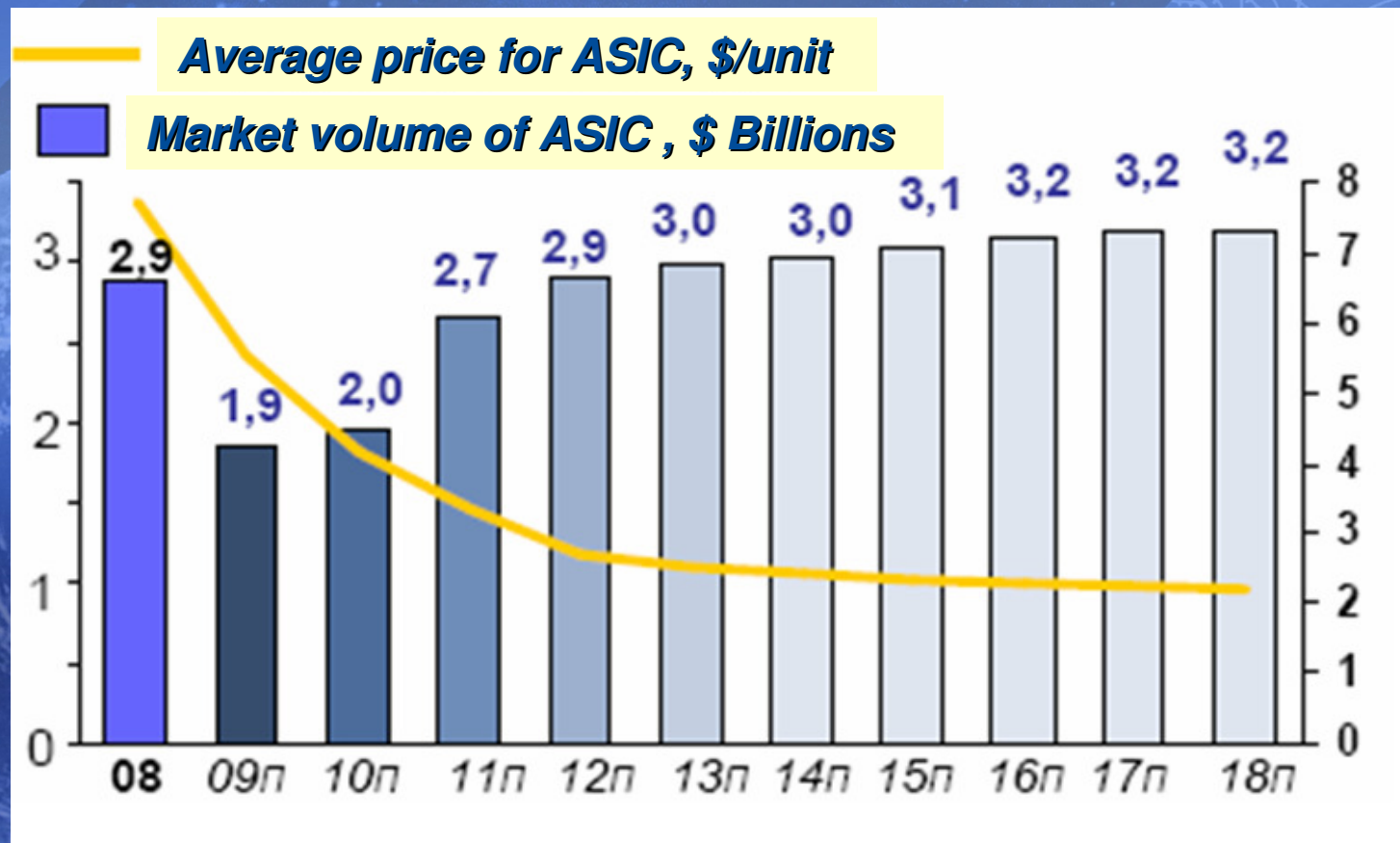
The global market of navigation equipment

Total GNSS Revenue by Segment, \$ Billions



The global market of navigation equipment

GNSS ASIC/ChipSet Market forecast



Source: ABI Research, Semiconductor Applications Markets report, 2009

Major drivers of further development of GNSS equipment

- ***GPS system modernization and development of new navigation signals***
- ***The complete launch of GLONASS system and development of new navigation signals***
- ***The introduction of the European GALILEO and Chinese COMPASS systems***
- ***Implementing of the most advanced microelectronic technologies for new chip-sets, lower equipment prices even for improved performance***
- ***Continuous development of GNSS position and navigation based services and their introduction in various areas of human activities***
- ***The advantages of multi-system receivers over GPS only receivers***

The main advantages of GLONASS / GPS equipment

- ***higher accuracy of combined navigation solutions***
- ***higher availability of navigation signal in urban canyons and other areas with limited satellites visibility***
- ***increased noise immunity from industrial or intentional interference***
- ***free choice between GLONASS and GPS in case of limited availability of either system signals***

Russian navigation equipment market

Factors slowing down Russian navigation market development before 2008

- ***legislative restrictions until 2007 (restrictions of identifying coordinates with accuracy of less than 30m)***
- ***unsatisfactory cartography of most of the Russian territory***
- ***containment of GPS-only navigation in regulated market segments for security reasons until the complete launch of GLONASS***
- ***Insufficient public awareness of opportunities and advantages of navigation technologies***
- ***Absence of unified standards and certification methods for navigation receivers***
- ***Absence of state purchases stimulating market development***

Russian navigation equipment market

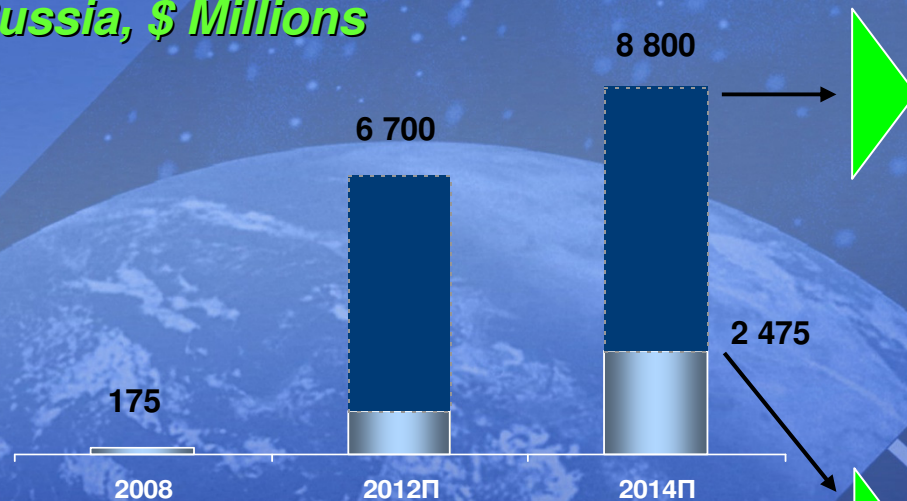
Major drivers of Russian navigation market in the next 3-5 years

- ***Federal program “GLONASS” activities:***
 - ***Complete restoration of the GLONASS constellation***
 - ***Cartography activities***
 - ***Development of regulations and rules for navigation equipment and services for public transportation***
- ***Increasing range of navigation equipment and services, resulting in increased application opportunities***
- ***Lower prices for GPS/GLONASS navigation receivers (competitive with GPS-only equipment)***
- ***State purchase programs for various ministries, departments and regions***
- ***Growing public awareness of advantages and opportunities***

Russian navigation equipment market

Possible scenarios

Total navigation equipment & services sales in Russia, \$ Millions



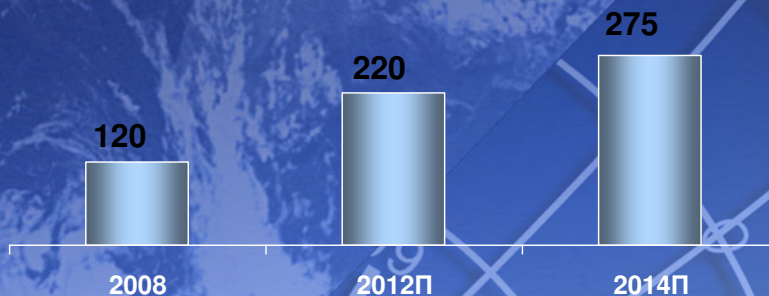
Probable scenario

Total navigation market in Russia in 2014 is likely to be of the same share of the global market as the Russia's GDP share in the world's GDP, that is 3.2%

Conservative scenario

Russian navigation market share only 0.9% of the global market

Total World navigation equipment & services sales, \$ Billions



Conclusion

Russian navigation market in 2014 will be \$ 2.5 – 9 Billion

Market development areas of navigation equipment

- ***Chip-sets and OEM modules for various applications, including consumer electronics***
- ***Navigation equipment for maritime, aviation, automotive and rail applications***
- ***Geodesic equipment***
- ***DGNSS equipment***
- ***Mass-market equipment (PND navigators, trackers, communicators)***
- ***Safety of Live and Military equipment***
- ***GPS/GLONASS/GALILEO signal simulators***



GLONASS State program

Sub-program 2

«Development and industrialization of navigation equipment for civil application»

State customers

Ministry of industries and trade of the Russian Federation,
the Federal Space Agency

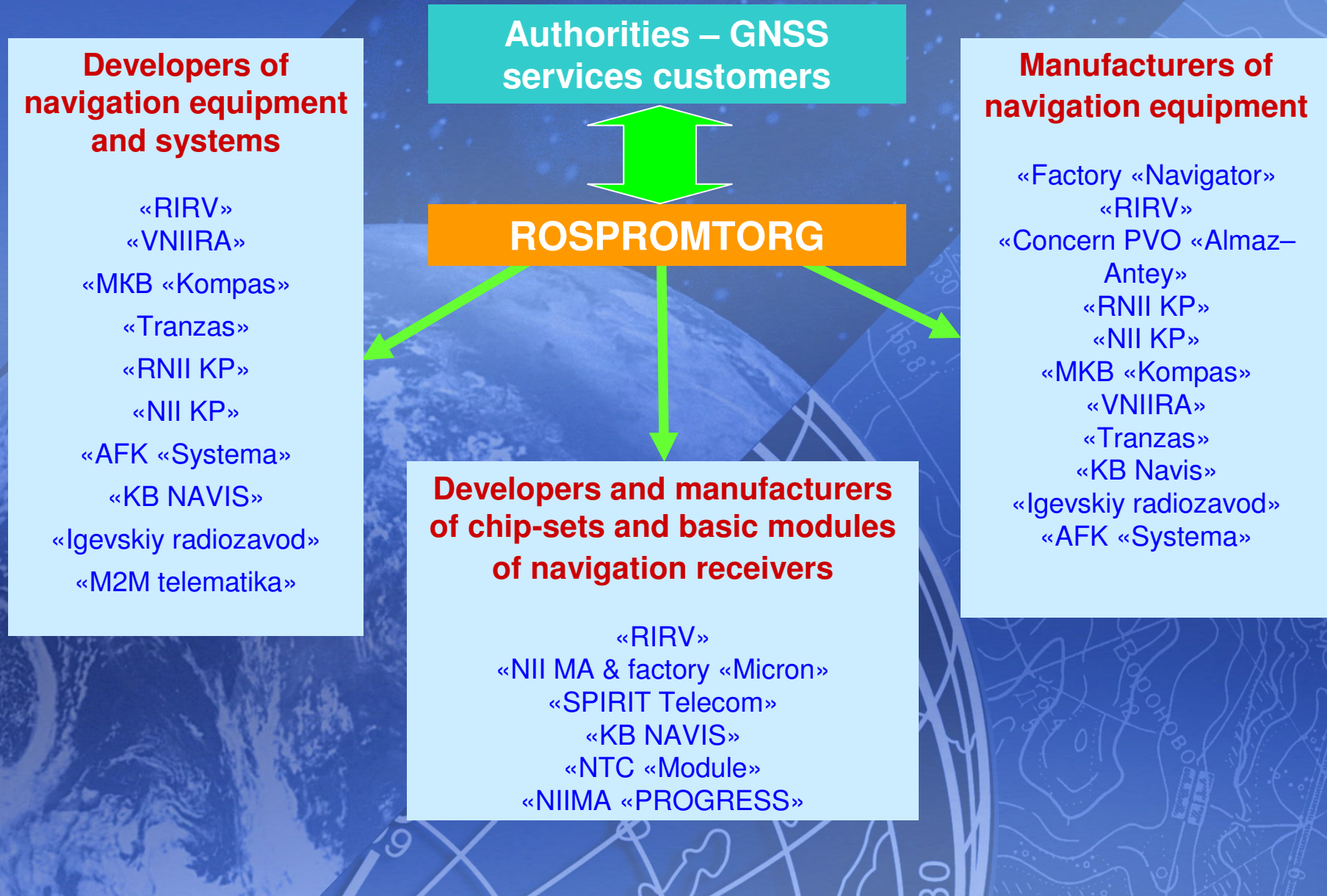
Aims of the sub-program

Development and industrialization of modern navigation equipment for public customers, as well as development and production of basic electronic components for mass-market navigation equipment

The main tasks of the sub-program

1. Development of state-of-the-art electronic components
2. Development of competitive navigation equipment and systems
3. Introduction of modern mass production technologies
4. Modernization of navigation equipment production facilities

The main companies participating in the GLONASS program



OEM-receiver modules



OEM receiver for military equipment

RNPI (14C850)

Highly dynamical objects, special purpose navigation receiver

«KB NAVIS»

OEM modules for civil application



GNSS OEM receiver

for civil aircrafts

«KB NAVIS»



CH-4706

the small-sized navigation receiver

«KB NAVIS»



NAVIOR-24

the precision navigation receiver for time synchronization

«KB NAVIS»



MNP-M3

the small-sized navigation receiver

«IRZ»

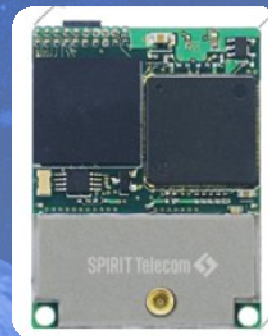
OEM-receiver modules

OEM modules for civil application



1K-161

«RIRV»



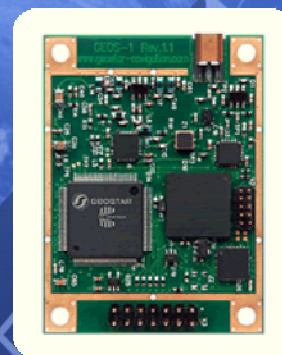
DuoStar-2000

«SPIRIT Telecom»



1K-181

«RIRV»



GeoC-1

«GeoStar Navigation»

Maritime equipment



Aqua-Board-12
«RIRV»



Integration
«RIRV»



UAIS T103
«Tranzas»



Farvater
«Radio Complex»



Aviation equipment



BPSN-2
«KB NAVIS»



A-737
MKB «Kompas»



BPSN-2-01
«KB NAVIS»

BMC
«VNIIRA Navigator»



CH-4312
«KB NAVIS»



ABRIS
«Tranzas»

In-car navigation and fleet management equipment

Over 40 manufacturers of autotrackers and mobile terminals



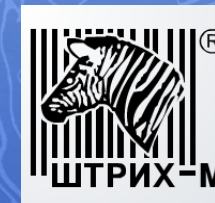
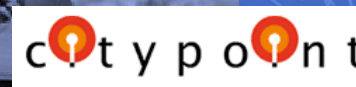
Avto-K
«RIRV»



Glospace SGK-70
«NII KP»



CH-4711
«KB NAVIS»



Equipment for Rail application

Satellite communication and navigation equipment «Airokosmicheskyy Technology»



Emergency warnings to train crew, in train communication. The equipment increases train security and service levels.

Complex locomotive equipment «IRZ»



Insures higher security for trains, prevention of accidents and pre-accident emergency situations on the railway

Geodesic equipment



GEO 161
«RIRV»



*Geodesic control
and correction
station*
«RIRV»



RESEARCH
«RIRV»



Briz-GP
«KB NAVIS»



Briz-KM-GS
«KB NAVIS»

Differential service equipment



CH-3500MK

Differential GLONASS/GPS reference station

«KB NAVIS»



CH-4901

Beacon receiver

«KB NAVIS»



CH-3500MKA

Differential GLONASS/GPS reference station

«KB NAVIS»

Military and special purpose equipment

Maritime receivers



14C812

Navigation receiver for submarine

«Briz-PL»

«KB NAVIS»



14C815

DGPS/DGLONASS Navigation receiver «Briz-KD»

«KB NAVIS»



14C852

Maritime Navigation receiver with electronic map «Briz-KM-K»

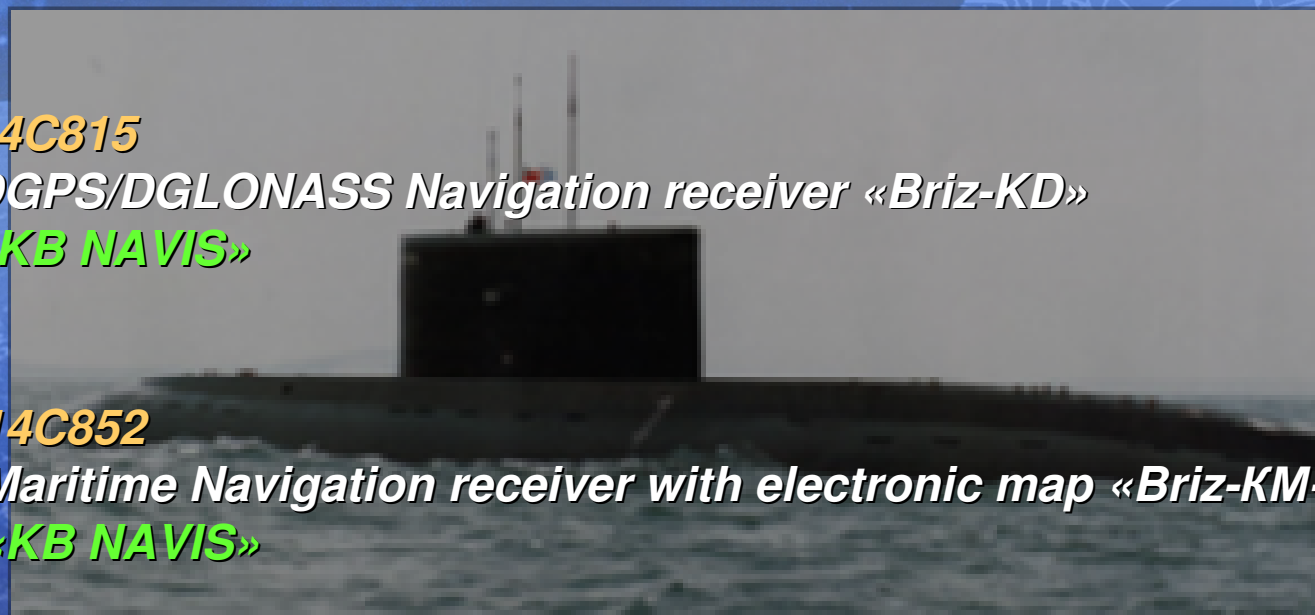
«KB NAVIS»



14C854

Radionavigation goniometric complex for maritime application «Briz-KM-RNK MP»

«KB NAVIS»



Military and special purpose equipment



Information-navigation system

«Termotech»

14C851

Universal navigation receiver «Briz-KM-U»

«KB NAVIS»



14C857

Radionavigation goniometric complex for artillery

«Briz-KM-RNK BRAV&MP»

«KB NAVIS»

Military and special purpose equipment

Individual navigation receivers



14C853

Personal navigation receiver.
Can be used individually and as part of in vehicle navigation system «Briz-KM-I»

«KB NAVIS»

14C858

Personal navigation receiver «Briz-KM-RV»

«KB NAVIS»



NPI2

Personal navigation receiver

«Kompas»

Grot-M

Personal navigation receiver

«RNII KP»



GNSS signal simulators

«KB NAVIS»

GPS/GLONASS/GALILEO/SBAS signal simulator CH-3803M

Designed in 2005

Navigation signals:

GLONASS L1, L2 (C/A, P)
GPS L1, L2, L5 (C/A, CM+CL, I5+Q5)
SBAS L1 (C/A)
GALILEO E1-L1-E2 (OS, SoL)

Number of simulation channels:

32 multi-system universal channel

Modeled objects – carriers of navigation receivers

The number of objects: 1...3

Modeled object movements – any with 6 degrees of freedom

The object dynamics: 0...12 000 m/s, 0...500 m/s²

Certified as measuring instrument for navigation receivers



GNSS signal simulators

«KB NAVIS»

Signal simulator system CH-3805

Designed in 2007 (development project «Simulator» within Program «GLONASS»)

Navigation signals:

GLONASS L1, L2 (C/A, P)

GPS L1, L2, L5 (C/A, CM+CL, I5+Q5)

SBAS L1 (C/A)

GALILEO E1-L1-E2, E5a, E5b (OS, SoL)

Number of simulation channels:

48 multi-system universal channel

Modeled objects – carriers of navigation receivers

The number of objects: 1...3

Modeled object movements – any with 6 degrees of freedom

The object dynamics: 0...12 000 m/s, 0...500 m/s²

Special shielded chamber for receiver sensitivity measurements



GNSS signal simulators

«KB NAVIS»

GPS/GALILEO Signal simulator CH-3806

Developed in 2006 within «GIRASOL» project (ESA)

Navigation signals:

GPS L1, L2, L5 (C/A, CM+CL, I5+Q5)

SBAS L1 (C/A)

GALILEO E1-L1-E2, E5a, E5b
(OS, SoL, AltBoc)

Number of simulation channels:

48 multi-system universal channel

Modeled objects – carriers of navigation receivers

The number of objects: 1...3

Modeled object movements – any with 6 degrees of freedom

The object dynamic: 0...12 000 m/s, 0...500 m/s²



The main tasks of Russian industries in GLONASS introduction

- ***Support of complete GLONASS satellite constellation***
- ***Providing of GLONASS metrological parameters in terms of accuracy, integrity and reliability***
- ***Developing of new GLONASS/GPS chip-sets and OEM receivers using the most advanced microelectronic technologies***
- ***Developing of mass-market equipment competitive with GPS-only systems in terms of price and performance***
- ***Mass production of GLONASS/GPS equipment for different consumer applications***

Areas of development

Multifunctional small-size computers



PND



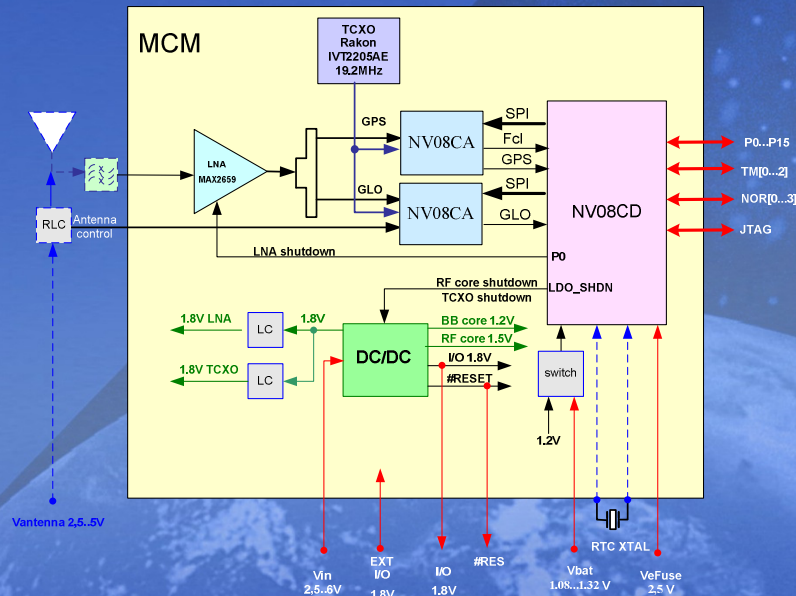
Personal trackers



Communicators and smart-phones



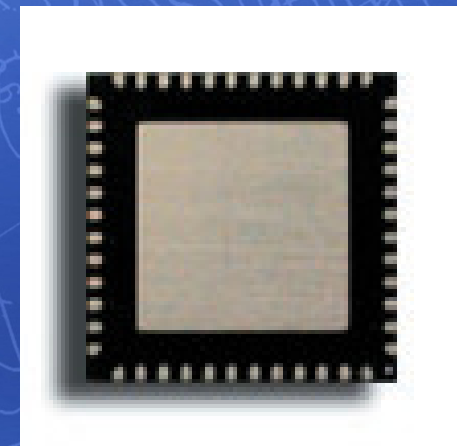
New NAVIS NV08C GPS/GLONASS/GALILEO receiver «KB NAVIS»



For various mobile navigation and communication devices

Applications:

- *mobile telecommunication devices*
- *mobile telecommunication systems*
- *personal navigation systems*
- *security and monitoring systems*
- *fleet management systems*
- *portable telecommunicators and media players*



Experimental samples are under production

New NAVIS NV08C GPS/GLONASS/GALILEO receiver ***«KB NAVIS»***

<i>Supported GNSS</i>	<i>GPS/GLONASS/GALILEO/SBAS</i>
<i>Number of tracking channels</i>	<i>32</i>
<i>Chipset</i>	<i>NV08CA, NV08CD (0.13 μm RF CMOS, 90 nm CMOS)</i>
<i>Accuracy</i>	<i>Position – 2.5 m, Height - 3 m Time – 50 ns</i>
<i>Max. update rate</i>	<i>10 Hz</i>
<i>Sensitivity</i>	<i>-189 dBW (A-GNSS)</i>
<i>Acquisition, average</i>	<i>cold start - 30 s hot start - 1 s</i>
<i>Power consumption</i>	<i>20 mW time-to-time fix @ 1s <150 mW tracking and navigation</i>
<i>Interfaces</i>	<i>USB 2.0, UART, SPI, GPIO, 1 PPS</i>
<i>Communication protocols</i>	<i>NMEA-0183, BINR, RTCM SC-104 V2.2</i>
<i>Dimensions</i>	<i>9*11*2 mm</i>
<i>Weight</i>	<i>1 g</i>
<i>Operating temperature range</i>	<i>-30...+70</i>
<i>Unite price @ mass production</i>	<i>< 15 \$</i>

New NAVIS NV08C GPS/GLONASS/GALILEO receiver «KB NAVIS»

The main development stages and milestones

- ***MPW lots of chipset ASICs NV08CA, NV08CD – October, 2009***
- ***Qualification test of NV08C MCM and OEM receiver – March, 2010***
- ***Series production start – first lot of 500K pcs – June, 2010***

Contact information:

Association «**GLONASS/GNSS-FORUM**»

<http://www.aggf.ru/catalog/razdel/sod.php>

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