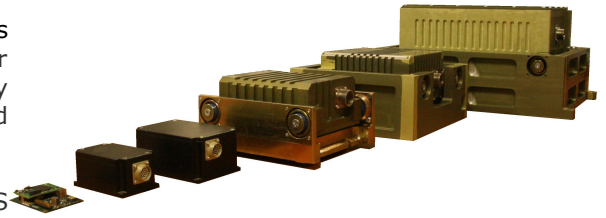


Complex of inertial & satellite navigation, monitoring, control and diagnosis

Besprovodka Engineering LLC represents the complexes of inertial and satellite navigation, monitoring and control. These complexes are developed with strapdown inertial navigation systems (SINS) on MEMS and fiber-optic gyroscopes by Gyrolab LLC.

The complex is used in navigation, monitoring, control and diagnosis complexes on ground transport for important application – passenger transporting, valuable and dangerous freights, construction and quarry equipment, as a part of pilotless vehicle or diagnostic road laboratories etc.



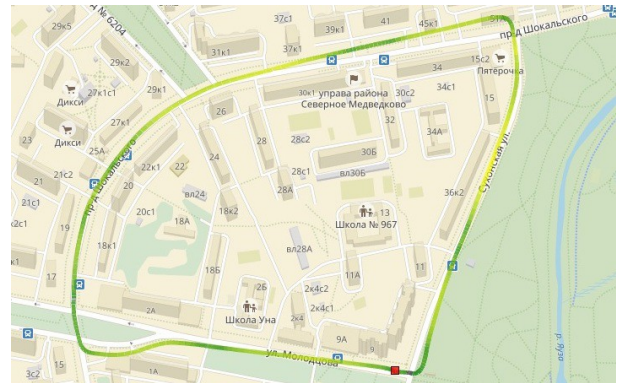
Demonstration video of testing "BSP-GL-VG109" complex GPS+BINS MEMS on Nissan Teana car with connection to the regular odometer by means of socket OBD-II (please turn on English subtitles): https://youtu.be/XDIOFN6_8io

Options of practical application:

- The car of MES (Ministry of Emergency Situations) is in burning wood. The signal of satellite navigation GLONASS/GPS doesn't catch. Clear visibility is absent because of smoke. People and equipment can be damaged. By means of the inertial block it is possible to leave the burning wood by means of inertial navigation.
- Valuable freights are often transported under control of escort cars on some distance. At entrance to a tunnel communication for navigation data transferring is carried out, but satellite navigation data are absent therefore a thief can send the car with valuable freight to another road passing over the escort cars. Thanks to inertial navigation, the location of a car with valuable freight is available constantly regardless of GLONASS/GPS availability.
- The quarry equipment (excavators, dump trucks, loaders, etc.) is very expensive, and for this reason it's cheaper to control it than repair it. The complex of inertial and satellite control can be used as a flight recorder and allows to control numerous important parameters (lists, pitches, blows, etc.) in on-line mode or in post-processing to restore an accident picture in exact location of an object.
- The same is relevant in dangerous freights transition (petrotransportation), for passenger transport, etc.
- As a part of indoor navigation complex for warehouse robots and so on.

The basis of the low-exact BSP-GL-VG109 complex is made by SINS MEMS block with a margin error of inertial navigation to 3% from the passable way allows to solve:

- **Navigation tasks:** to ensure continuity and to increase the reliability of the navigation decision in projects of navigation and monitoring of land transport during loss of information from GNSS (Global GLONASS/GPS/BeiDou Navigation satellite systems) for example in tunnels, the woods, garages, when jamming and entering mistakes into GNSS signal, to smooth information from GNSS, getting navigation information with a frequency up to 600 times per second.
- **Control & Diagnosis tasks:** the opportunity to record all the actions in case of emergency (before, in time, after) related to coordinates and angular sizes and to control numerous parameters and their excesses, such as rolls, pitches, vibrations, overturning, blows, to control all parameters, including overloads in the required range.



The complex is delivered in various options, depending on tasks and requirements of the customer:

1. Only SINS which can be connected to satellite navigation equipment which is already available on the object (GLONASS/GPS/BeiDou ...) and to setup/ to connect the regular odometer of the car: by means of socket OBD-II, via the CAN interface, etc.
2. The turnkey decision SINS including GLONASS / GPS equipment according to a customer needs and also installation and setup of additional sensors.

Other video is here: https://www.youtube.com/channel/UCHBhZP6-8OOFSh8eNB92d9g/videos?shelf_id=0&view=0&sort=dd

Civil developments of Gyrolab LLC for

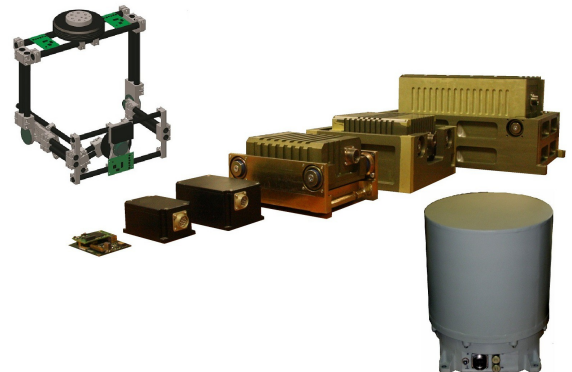
• Navigation • Stabilization • Orientation



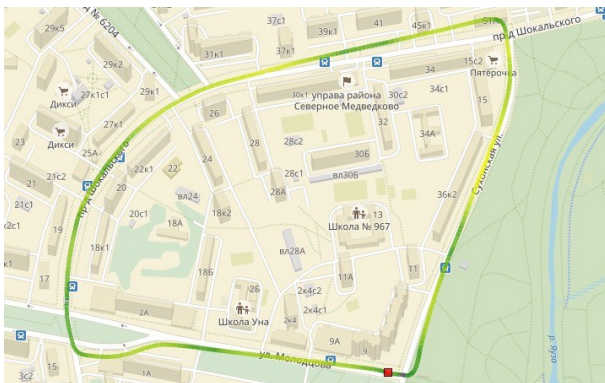
Gyrolab LLC is the Russian private development laboratory which develops and produces a wide range of equipment for high-accuracy autonomous navigation (even without Global Navigation Satellite Systems (GNSS)), for stabilization, orientation (and many other derivant functions) for land, naval, aerospace applications.

We can suggest different variants of cooperation:

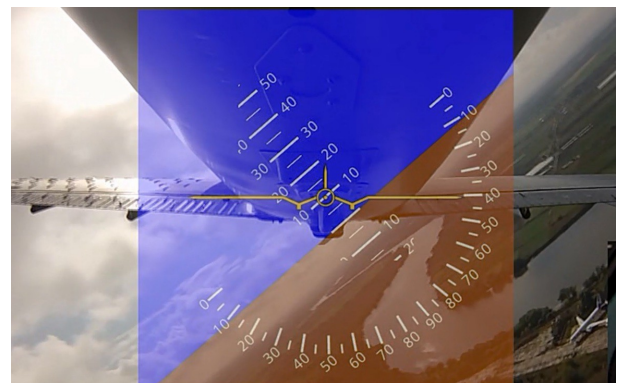
- Finished products / systems supply (possible with third-party brand name)
- Partnership according to license agreement when we help you to put into production our developments and then we receive payments for every sold unit. In this case we can continue our development of this product and support with new options
- Sale of know how



Strapdown Inertial Navigation Systems (SINS) on MEMS and fiber-optic gyroscopes. This is our main competence. Target audience are developers and integrators who work with navigation / stabilization / orientation tasks. Different options of execution, accuracy characteristics and reasonable prices let the customers choose optimal equipment according to their tasks: from 10-50 °/hour up to gyro compasses 0,04°/hour.



Car track with only SINS MEMS "GL-VG109"
(without GNSS)



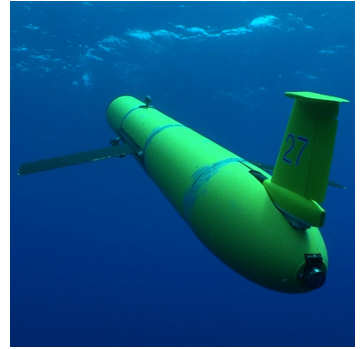
SINS MEMS "GL-VG109" as a gyrovertical on the plane (video is here: <http://www.gyrolab.ru/en/>)

Applications:

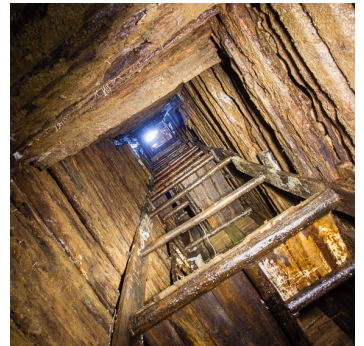
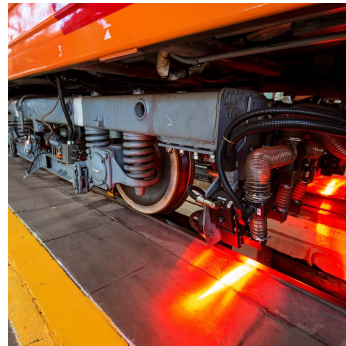
- integration SINS with already installed GNSS equipment for increased continuous autonomous navigation accuracy, roll / pitch / shock / flip / accident control. For transportation of expensive (including encashment) and dangerous goods and passengers; for special (for example, career) and rescue vehicles (for fire trucks navigation even without GNSS in a burning forest); for permanent binding to the railway line and so on:



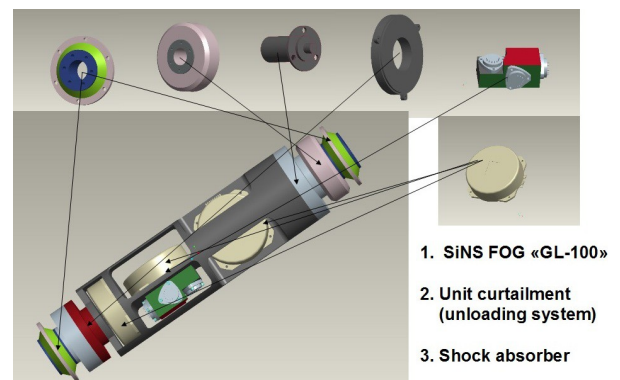
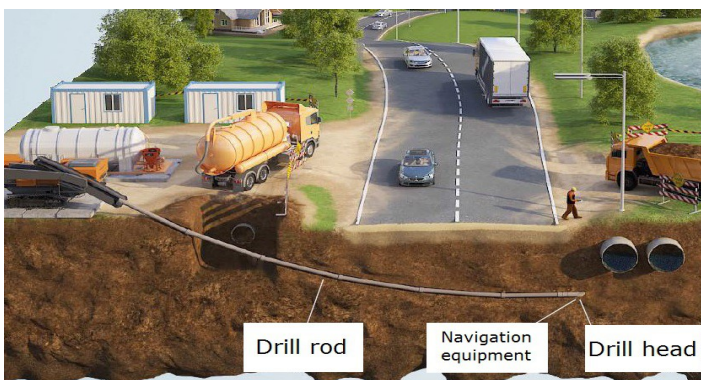
- SINS is one of the most important parts in unmanned vehicle systems and complexes:



- SINS for developers of diagnostic systems for road and railway / shaft diagnostics. Besides, for railway and shafts we can propose complete solution with our Russian partner



- SINS for high-precision directional horizontal and inclined drilling – for developers of drilling complexes:



- SINS as Gyrocompass for ships;
- SINS as Gyrovertical for planes;
- SINS for developers of robotics (medicine, service, industrial...);
- SINS for communication equipment (stabilization and orientation of satellite antennas and radar stations),
- SINS for medicine (complexes for remote surgical operations; horizontalizing and stabilization of medical trolley to avoid blood-strokes of patients)
- SINS for many other applications for navigation, stabilization, orientation

Drivers / Brushless direct drive motors

Developing gyrostabilized platforms we didn't find motors with suitable price / quality ratio. So, we developed our own brushless direct drive motors which are up to 1,5 times cheaper than any others with the same characteristics.

We are ready to put into production customized motors according to clients' requests. Besides, we develop drivers only or drivers&motors with the following characteristics:



| | |
|---|--------------------|
| Rated speed of rotation, turnover per minute: | Up to 3000 |
| Rating moment: | Up to 10000 |
| Ampere rating, A, not much | 70 |
| Rated watts, watt: | 20000 |
| Efficiency, not less than: | 0,75 |
| Operating temperature, °C: | -50 ... +55 |
| Positioning accuracy, angle: | Not more than 0.04 |

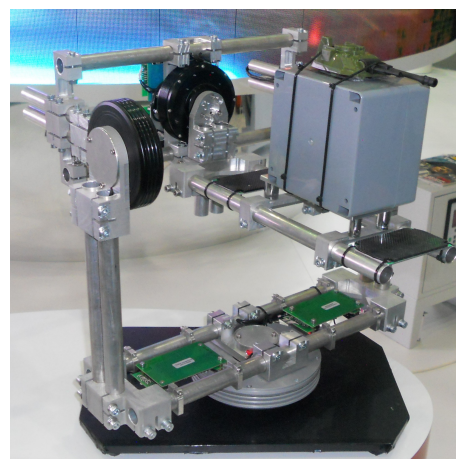
Applications: from small robotics to big radar stations.

Gyrostabilized platforms with remote control

Using all the elements of our development we can produce various Gyrostabilized platforms with remote control functions according to client's requests: different accuracy, different loads (up to 200 kg), different quantity of axis...

Applications:

- stabilization of filming and TV shooting (including small for drones);
- horizontalizing and stabilization of medical trolley to avoid blood-strokes of patients;
- robotics;
- stabilization and orientation of satellite antennas and radar stations;
- diagnostics;
- many others



<http://www.gyrolab.ru/en/> - here is more detailed information in English, including characteristics, prices, videos, documentation



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