iSWACO-M200

Precise MEMS Based Inertial Navigation System with Integrated Vehicle Controller and Dedicated Interfaces for Swarm Control Applications

Swarm Control is a most important application for highly autonomous operating vehicles. All controlled vehicles have to operate within a shared space, a joined task has to be fulfilled and therefore the trajectory control of each swarm member (e.g. autonomous marine vessels, unmanned airborne vehicles, highly automated road vehicles etc.) is as mandatory as communication is between every member and - if desired - also with a dedicated control center.

The iSWACO-M200 is a device with an integrated navigation solution based on inertial sensors and a highly sophisticated data fusion by incorporating information from GNSS, wheel sensors, RADAR or stereo cameras for precise positioning as well as environmental survey and collosion avoidance.

Additionally iSWACO contains a powerful communication module for LTE, GSM and – on request also secured - WLAN, to be able to interact with all other swarm members in the neighborhood as well as with an upper level control center.

- INS/GNSS with up to L1L2 GPS/GLONASS RTK and dual-antenna capability
- Accurate roll, pitch, heading, WGS84 or UTM position & velocity, rates and acceleration
- Integrated odometer input
- Integrated vehicle control output
- lowest data latency (< 3 ms) and data jitter (< 1 ms) makes it also the best choice for real-time vehicle control applications
- Integrated communication I/F for LTE, GSM, WLAN
- CAN (OBD) / UART RS-232 & RS-422 / Ethernet / WLAN / GP-I/O / USB interfaces
- PPS output for synchronization
- L1L2 GNSS antennas with ground plane and vacuum fixation for vehicle roof mounting

Due to today's missing interface standardization, nearly each autonomous operating platform comes with it's individual actuator interface. Therefore, iSWACO provides a dedicated ARM based processor, which can perform the application specific platform control (vehicle's kinematic model) to achieve best trajectory performance with smallest errors in position, speed or regarding dynamic behaviour, depending on the user's priorities.

The iSWACO series is one of the smallest powerful MEMS based INS/GNSS inertial navigation, measurement, surveying and control systems on the market, in a modular design for swarm control applications on the surface (land/sea) and in the air. It provides all kinematic measurements like acceleration, angular rate, attitude, true heading, velocity and position of the target vehicle in real-time as well as the actuator control outputs (engine's torque, steering and bra-

king information etc.) with an data update rate of up to 500 Hz.

The iSWACO-M200 is a robust and easy to handle ensemble of an INS/GNSS solution (iNAT-M200) together with a WLAN
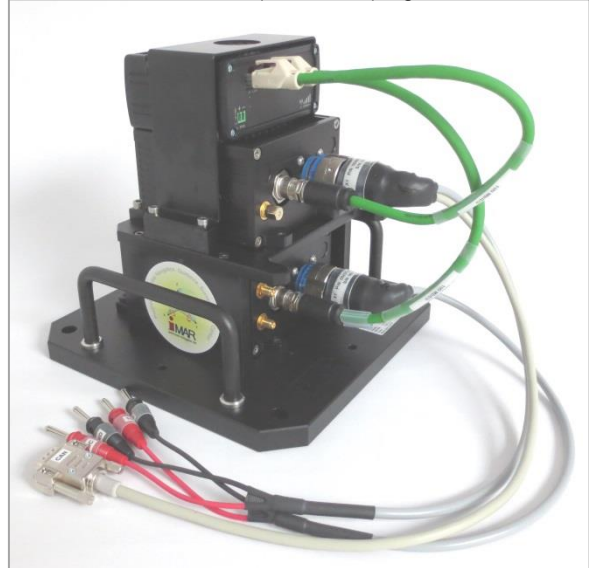
managed router and a LTE / UMTS / GSM modem, all mounted together on a single carrier. This light weight small carrier contains also mounting brackets and grasps for easy handling. As an option, an integrated rechargeable battery can be made available to bridge power interrupts of up to several minutes. The size of the carrier base is approx. 230 mm x 230 mm.

The technical data of the iNAT-M200 are given in the dedicated product datasheet (DOC141218097). To meet higher performance requirements as well, the modular architecture of iSWACO also allows to connect any other of iMAR's higher performance iNAT INS/GNSS systems (MEMS / fiber optic / ring laser / or hemispherical resonator gyro based).

The key technical data of the communication interface are as follows (additionally a dynamic mesh network is available as option):

- LTE up to 100 Mbps DL and 50 Mbps UL
- DC-HSPA+ up to 42 Mbps DL and 5.73 Mbps UL
- Multiple LTE FDD bands
- Quadband UMTS and GSM
- IEEE 802.11b/g/n WiFi with 2x2 MIMO up to 300 Mbps
- IEEE 802.3 and IEEE 802.3u standards
- Four Ethernet ports (3 x LAN, 1 x WAN)
- External antennas
- Dual SIM
- Temperature range -40… +75 °C operating

Contact iMAR sales team for further information or customized solutions.

Examples for Swarm Control Applications:

a) Naval Vessel Control with Airborne Support

LTE / WLAN / GSM

Vehicle Control Interface
(iMAR iVCI HW&SW)

Inertial Navigation
(iMAR iNAT-M200 HW&SW)

Rover 1

GNSS Data
(option: also correction data)

Rover 2

Rover n

ALL Data with RTK accuracy *
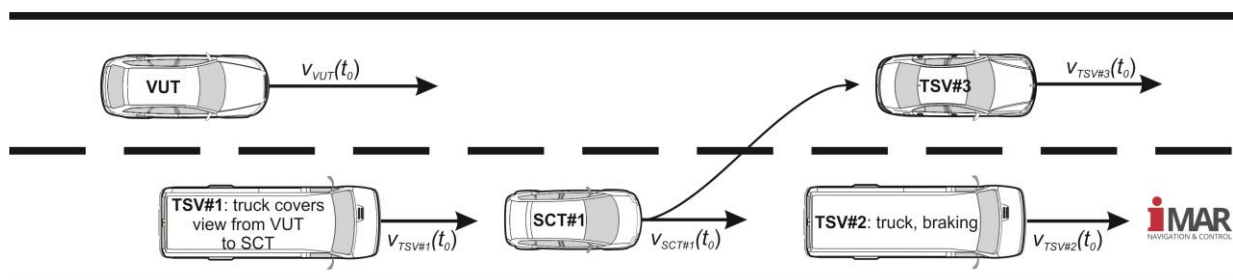
Master **)
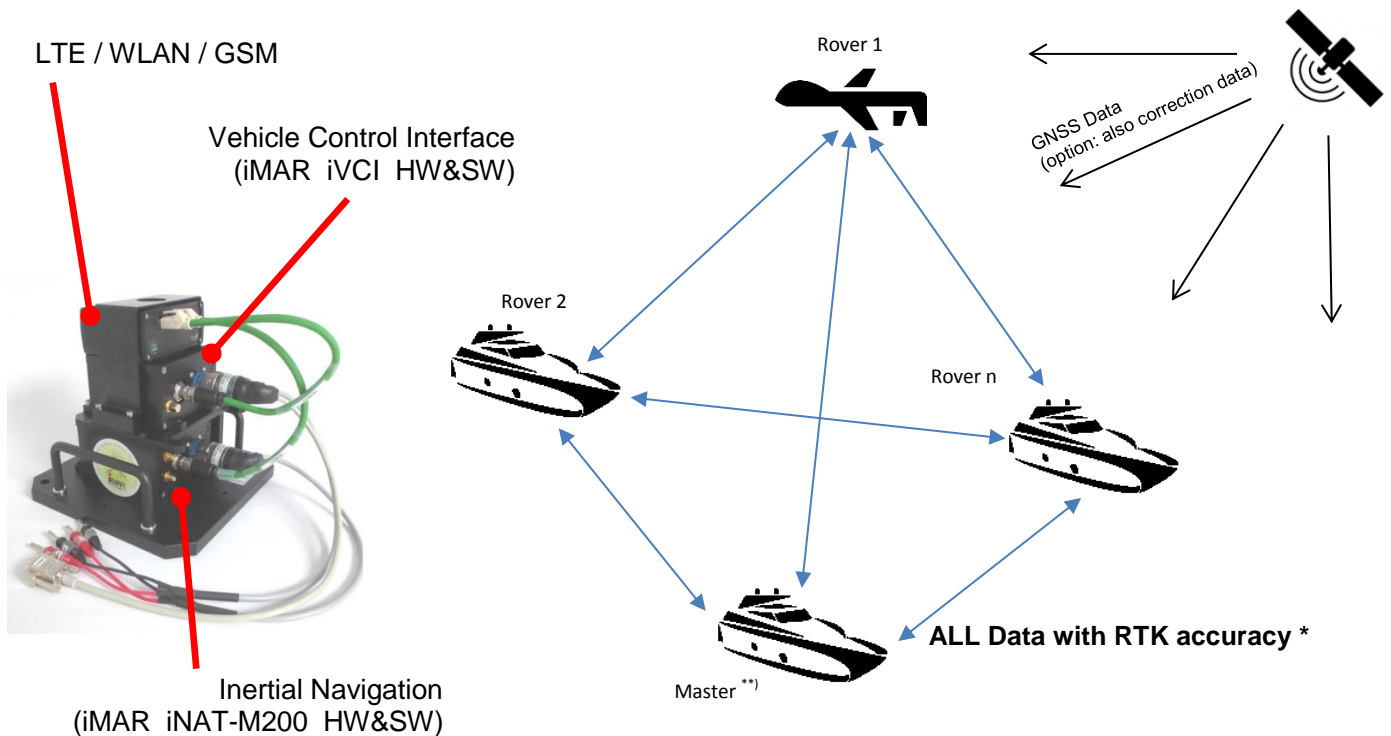
Explanations:

For each vehicle the GUI software **iARGUS-CMD** (under Linux and MS Windows and as SDK available) assists the on-board or remote working operatorby providing visualization, communication, trajectory planning, monitoring, health reporting and optionally also remote access capability, on request via a secured communication channel.

*) Absolute sub-decimeter accuracy with external GNSS Correction Data,
but **relative sub-decimteter accuracy also without any availability of GNSS correction data**!

**) The "Master" role can be moved via command from one object to another object, e.g. in case of a loss of one object

b) Automotive Testing of highly automated driving (HAD) vehicles within a real emulated traffic scenario on a proving ground (see also iSWACO-ARGUS)

VUT $v_{VUT}(t_0)$

TSV#3 $v_{TSV\#3}(t_0)$

TSV#1: truck covers view from VUT to SCT $v_{TSV\#1}(t_0)$

SCT#1 $v_{SCT\#1}(t_0)$

TSV#2: truck, braking $v_{TSV\#2}(t_0)$

(same explanations as given above)