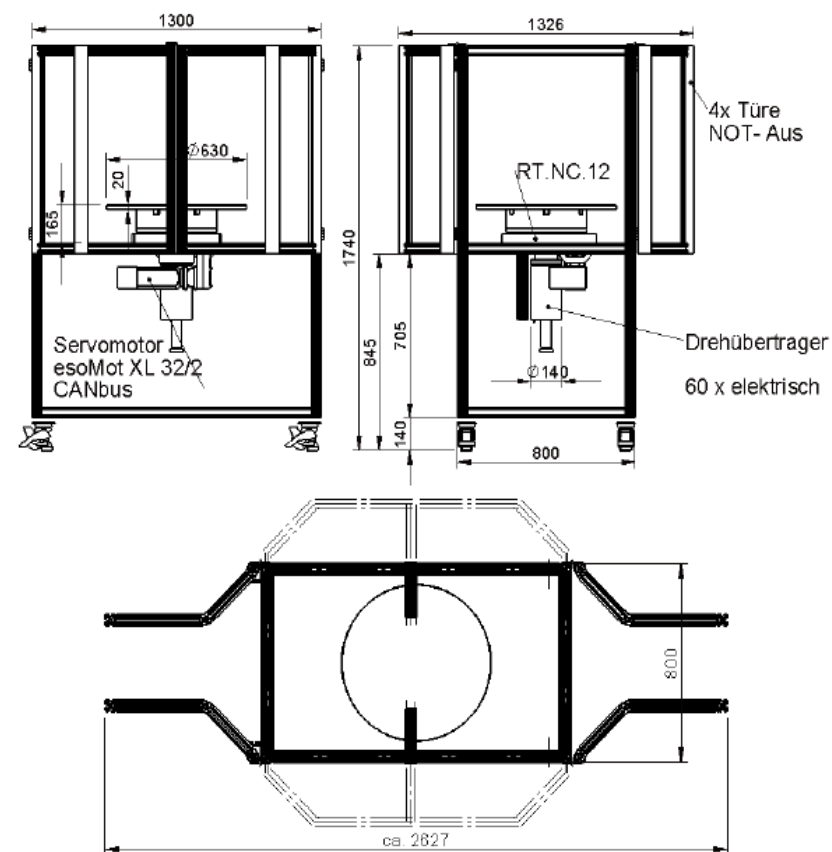
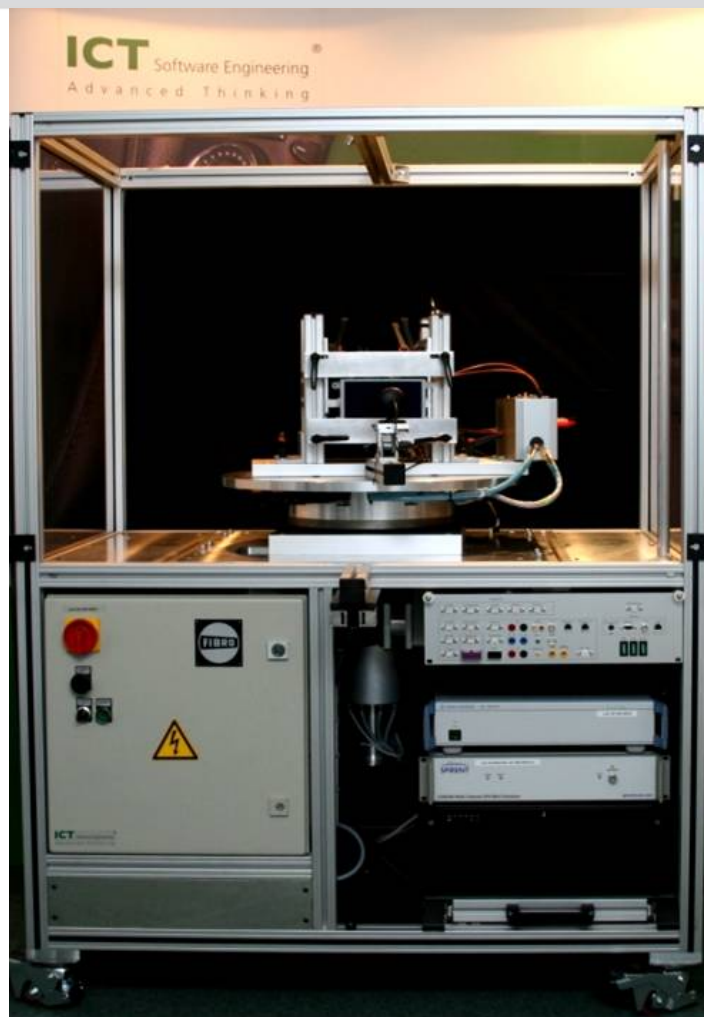


# Navi-Simulator

Robust & Reproducible Testing of Navigation Systems

**ICT** Software Engineering<sup>®</sup>  
Advanced Thinking



# Navi-Simulator

- What BENEFITS does Navi-Simulator bring to a company?
- What IS Navi-Simulator?
- What technological ADVANTAGES does Navi-Simulator bring?
- WHO can profit from having Navi-Simulator?
- What does Navi-Simulator COST?
- What FEATURES are on the Navi-Simulator Roadmap?

# Navi-Simulator

## What BENEFITS does Navi-Simulator bring to a company?

- **100%** Reproducibility for Testing of Navigation Systems
  - Absolute reproducibility for trouble shooting and closure of Bug Tickets
  - Automated overnight trials based on Libraries of Route Data (Regression Testing)
- **100%** Compatibility with the ‘*ICT - Infotainment HIL / SIL Simulator*’
- **Cost Reduction** with Regards to Testing
  - Typical Testing Scenario (as measured by our alpha customers)
    - 1 to 2 Weeks On-Site (Trouble Location) Testing per Release
      - (Example) China : €10k (Travel Costs, Daily Allowance, etc.)
    - 2 to 3 times On-Site Re-Testing for Critical Errors
      - €1k per Week (because of the need for highly trained and qualified developers on-site)
  - Typical Measured Improvements : **1/3 Test Cost Reduction**
- **Reduction** in Overall Development and Test Times
  - Reduced Test Track/Course Time due to accelerated and more productive Lab Tests
    - (Example) Artificial increase in the vehicle speed with the same test track coverage
  - More comfortable development / test cycle with a reduction in unproductive travel time between the laboratory and proving grounds / open field trials
  - Typical Measured Improvements (as measured by our alpha customers) :  
**12x in regards to Testing Times and  
2x by Development Times**

# Navi-Simulator

## What IS Navi-Simulator?

To enable the **reproducible testing** of **navigation systems**, is the reason why **Navi-Simulator** was developed. A tool that **plays back** in NMEA or SiRF formatted (or thru a flexible interface other formats) routes and can thereby test the complete navigation system from the convenience of the lab.

Of paramount importance was to create an **easily expandable** and **open interface concept** (data sources and 3rd Party Tools) to enable the potential use of Navi-Simulator for all vehicle and equipment generations and suppliers.

**Patent Pending** - Mechanical Table and GPS Satellite Data combined with CAN Signalling

**EXPANDABILITY / MODULARITY !!!**

# Navi-Simulator

## What IS Navi-Simulator?

To this effect a system and software architecture was developed, which pulls data from satellite signals (and later generates local signals) in a **synchronized simulation** for a device under test which is mounted on a rotary table. Thereby stimulating internal gyros in coordination with GPS signal data. The system is currently able to read **route data** from data sources (data formats **SiRF, NMEA**) and **3rd Party** systems (such as **GoogleEarth** route data). The scanned data is then processed and sent to different system elements. Currently, an HF generator to generate the GPS signals, a rotary table for rotational movement and a connection to CANoe to generate CAN messages are used.

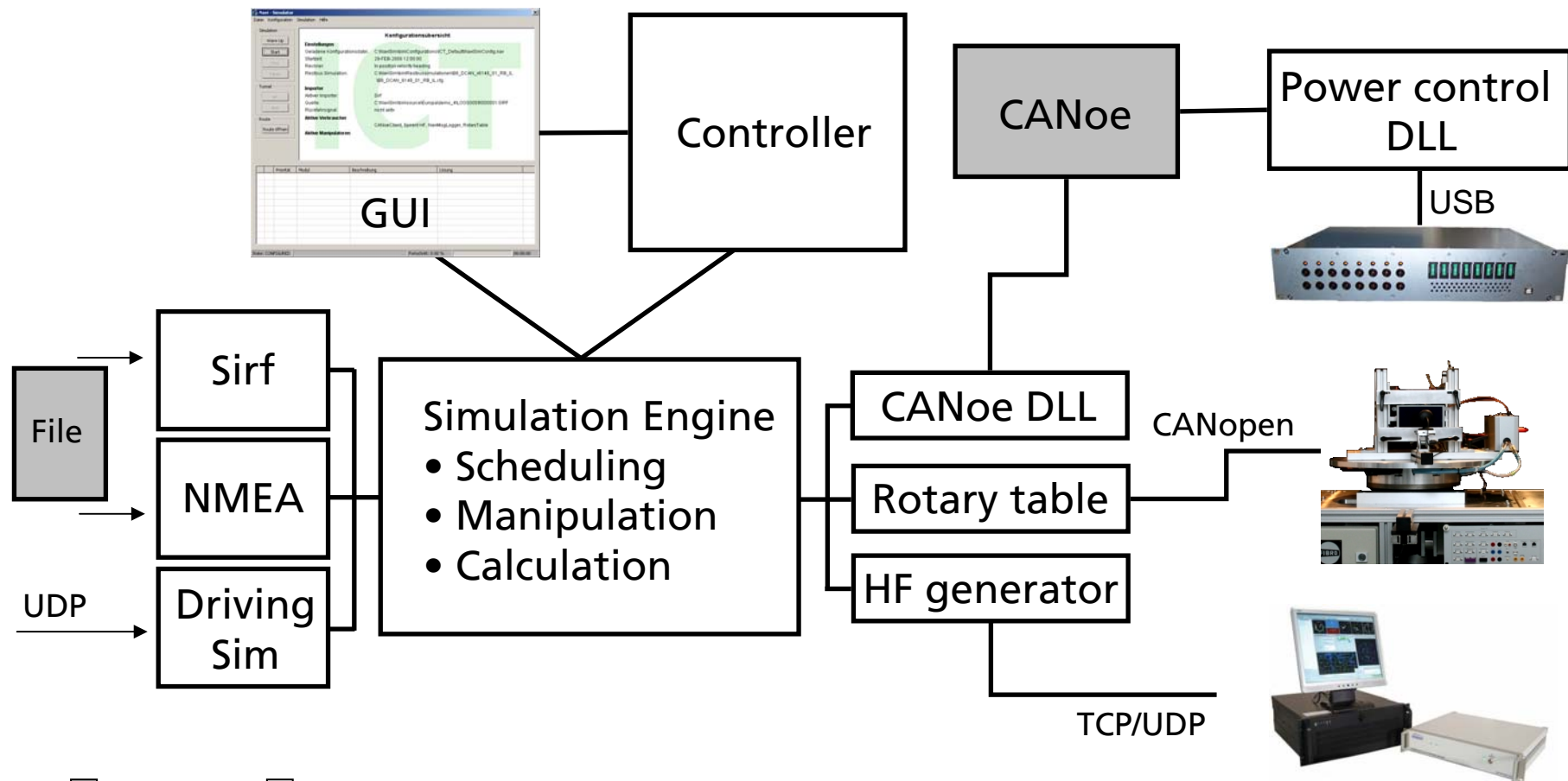


The **plug-in concept** allows for an easy extensibility to **new data formats** and **hardware**. Another important aspect is the **hard real-time capability**, both for reading of data from the 3rd Party Systems and the synchronous control of the hardware and message traffic.

The ability to create various **error scenarios** completes the functionality of the system.

# Navi-Simulator

## What technological ADVANTAGES does Navi-Simulator bring?



Extern
  ICT Software

# Navi-Simulator

## What technological ADVANTAGES does Navi-Simulator bring?

- High Availability and Reliability
- Easy to Use with an Intuitive GUI
- Modularity and Expandability (Supports all vehicle and equipment versions)
- Hard Real Time Connectivity with 3rd Party Systems (100 ms clock granularity)
- Predefined and Dynamic Test Routes (thru Use of Route Libraries, Routing Tools, and Real Time Interactive Driving)
- Simulator-Software
  - Creation of Test Routes out of Tools such as Google Earth or other Sources seamlessly supported
  - Ability to Artificially Modify Test Routes ( Ex: create a tunnel, etc.)
- Logging-Software – Real Time and 100% Repeatable with Results Digitally Stored and Visually Presented to the End User
- System Test and Systems Integration Support (Improvement in Supplier Management)
- **ONLY** Navigation Test Framework that supports simultaneous GPS, Gyro, CAN Testing with **REAL DATA** (SIL/HIL) while still supports simulated data input
- C++, Java, UML, CAN(oe), SiRF, NMEA, UDP

# Navi-Simulator

## WHO can profit from having Navi-Simulator?

- Automotive Manufacturer
  - Audi, Skoda, VW, Porsche, Mercedes, BMW, etc.
- Tier1 Suppliers
  - Continental, Alpine, Bosch, Harman, etc..
- Navigation Developers
  - Navigon, Elektrobit, etc.
- Navigation End User Devices
  - Tom Tom, Garmin, etc.

# Navi-Simulator

## What does Navi-Simulator COST?

- 50 - 150k HW (Modularity and Cost Reduction Features)
- 40k SW
- (Option : *ICT - Infotainment HIL / SIL Simulator*)
- (Option : On-site Installation and Training)
- (Option : Client Specific Functional Enhancements)
- (Option : SLA for Maintenance and Corrective Actions)

# Navi-Simulator

## What FEATURES are on the Navi-Simulator Roadmap?

- Automatic Test Report Generation - Camera (Navigation Unit & Combi Unit), Voice Guidance, Automatic Pin based Logging (Time Stamp)
- External Navigation Display connected via CAN
- GLONASS Support
- Telematics & Comprehensive Infotainment Networking Interface
- Bi-Directional Communications Interface
- Instrument Cluster Interface (incl. Touch Screen, Displays, and Controls)
- Position Data - Import / Export / Manipulation
- Expanded Logging Software
- MOST / Ethernet / Flexray Hardware Support
- Cooperative Driver Assistance Interface
- Car to Car Communication Interface
- Elektromobility and Energy Efficiency Simulation Interface
- Sensor Data Fusion for Environment Recognition