# HONEYWELL RADAR VELOCITY SYSTEM

Range and Velocity without GNSS

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Honeywell

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# RANGE AND VELOCITY WITHOUT GNSS

**The Honeywell Radar Velocity System (HRVS) is a low size, weight and power (SWaP), radar-based navigation aiding system. Combined with INS, it enables safe navigation during continuous GNSS disruptions.**


*Proven – Robust – Accurate*

**The Honeywell Radar Velocity System** is built upon mmWave sensing technology (60-64GHz or 76-81 GHz) providing the range and velocity of objects. It can provide cm level-range accuracy and is impervious to environmental conditions such as rain, fog, dust and snow.

**HRVS** is meant to be used as a body velocity aiding source for inertial navigation systems as well as airborne altimeter and depth mapping/ground avoidance sensor pack, ready for application in multiple market segments and use cases.

## KEY HONEYWELL ADVANTAGES

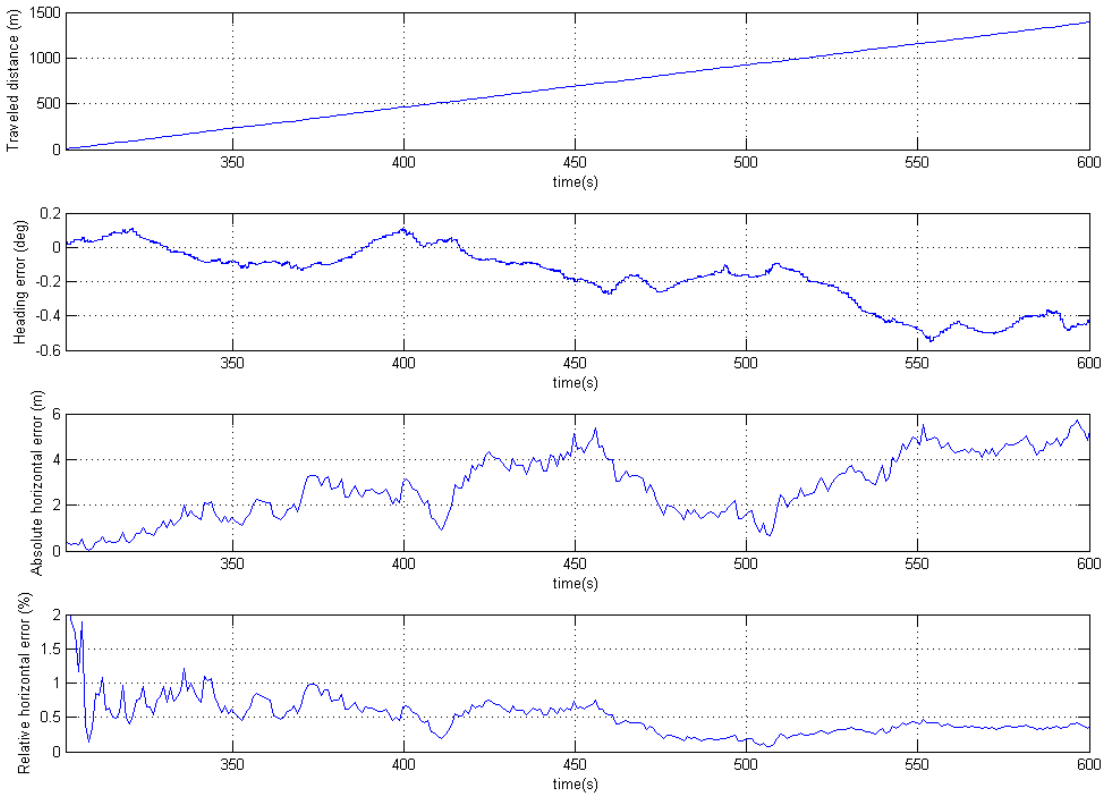
- Guaranteed functionality with chosen Honeywell product lines such as Honeywell Compact Inertial Navigation System (HCINS)
- Supports high velocity ranges (theoretical limit ~250m/s)
- Provides precise vertical velocity (e.g., for autoland)
- Range up to 170m above the ground
- Range measurement resolution down to 4cm
- Day/night operations
- Impervious to environmental conditions such as rain, fog, dust and snow
- Enables features:
  - Velocity aid
  - Altitude measurement
  - Depth mapping
  - Ground avoidance

| KEY CHARACTERISTICS | |
|---|---|
| **Supply Voltage** | +5VDC |
| **Power Consumption** | 1.7W nominal |
| **Weight** | 24g (OEM version)<br>68g (Enclosed version) |
| **Size** | 113mm x 60mm x 10mm (OEM version)<br>118mm x 66mm x 13mm (Enclosed version) |
| **Operating Frequency** | 62.0±0.5GHz |
| **Field of View** | 5.5° H x 5.5° V (-3dB) |
| **Operating Temperature Range** | -40 to +85°C |

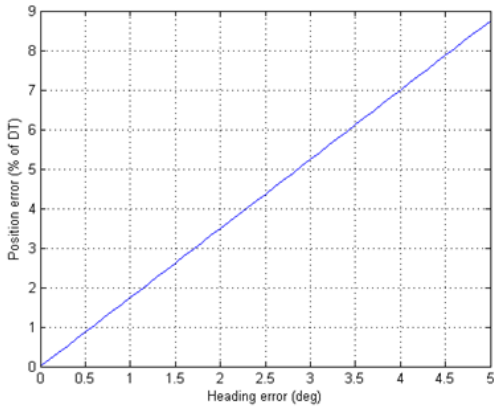
| HRVS (4 BOARDS) PERFORMANCE DATA – AIRBORNE (NO GNSS) | | |
|---|---|---|
| **Used INS** | HCINS (MEMS based low-cost navigator – tactical grade - gyro bias instability 1 deg/h | |
| **Typical Performance** | *1% of Distance Travelled (Typical Performance) | |
| **2-sigma Performance** | *3% of Distance Travelled (2-sigma Performance) | |
| **Maximum Measurement Range** | 170m | |
| **Key Performance Variables** | Heading error, trajectory shape (open vs closed) | |
| **Typical Heading Error with HCINS** | 5 minutes < 1° (for outages > 15 minutes mag. heading aiding is recommended) | |
| **Tested Surfaces** | Asphalt, grass, concrete, forest/trees, greenfield, snow | |
| **Surfaces with Limitations** | Lake (i.e. still water) | |
| **Velocity errors X/Y/Z axes 3m/s** | 0.20/0.20/0.04 RMS | 0.02/0.02/0.003 Mean |
| **Velocity errors X/Y/Z axes 6m/s** | 0.35/0.35/0.07 RMS | 0.06/0.02/0.02 Mean |
| **Velocity errors X/Y/Z axes 9m/s** | 0.45/0.45/0.10 RMS | 0.09/0.04/0.03 Mean |

*Performance between 1-3% of DT is achievable till the heading error starts to be a dominant error source which is typical for GNSS outages shorter than 10 minutes. For longer outages, it's recommended to use some heading-aiding source if it is possible, like a magnetometer for example.

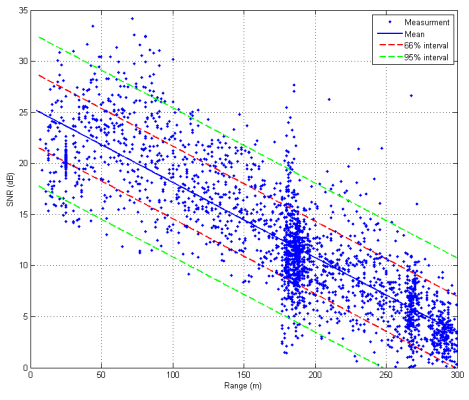
Example of flight test results with the tactical grade INS (HCINS) on closed trajectory




Dependency of position error on heading error in case of straight-line trajectory

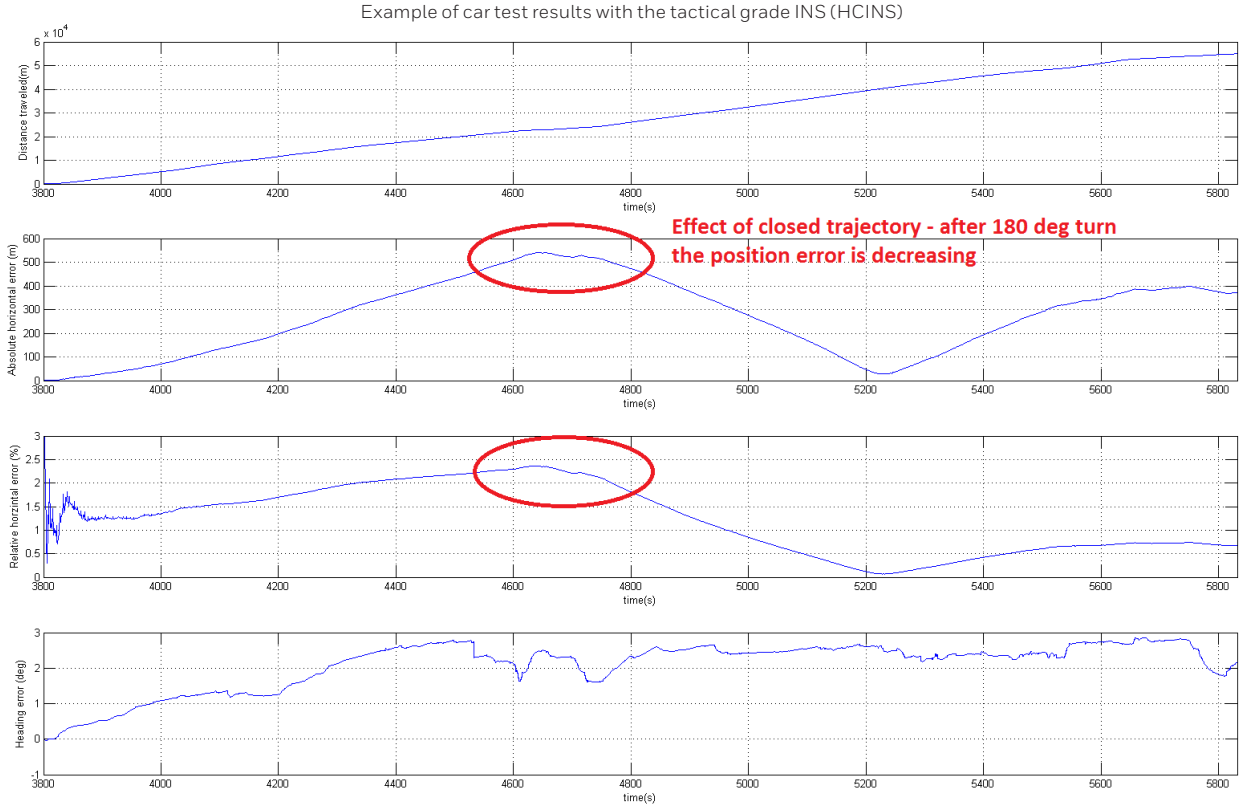


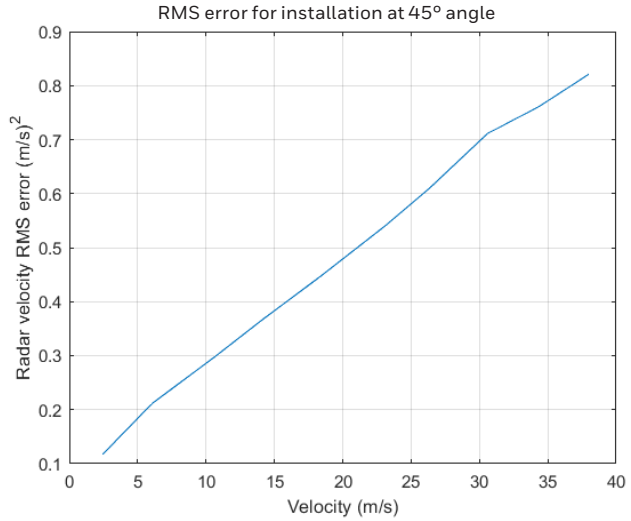

Dependency of signal to noise measurement range

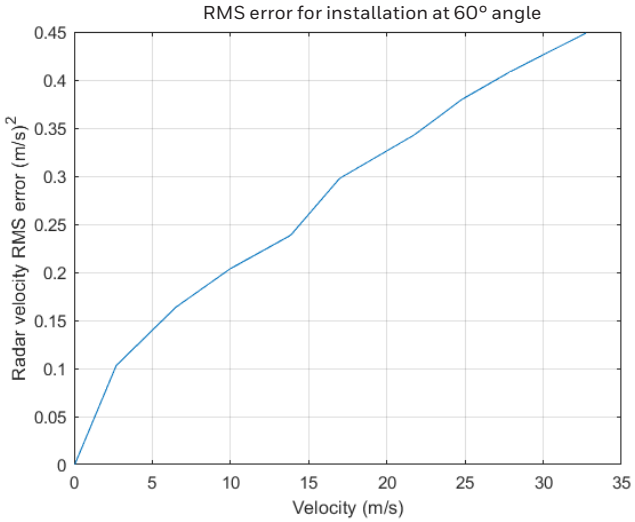


| HRVS (1 BOARD) PERFORMANCE DATA – SURFACE (NO GNSS) | | | |
|---|---|---|---|
| **Used INS** | HCINS (MEMS based low-cost navigator - tactical grade - gyro bias instability 1 deg/h) and Laseref VI (navigation grade) | | |
| **Performance with tactical grade INS** | >0.15% of distance travelled, max error is determined by heading error which is the dominant error source (depends on INS gyro quality) and typically grows in time | | |
| **Performance with navigation grade INS** | ~0.1% of distance travelled | | |
| **Minimum tested installation height** | 0.6 m | | |
| **Key Performance Variables** | Heading error, trajectory shape (open vs closed) | | |
| **Typical Heading Error with HCINS** | 5 minutes < 1° (for outages > 15 minutes mag. heading aiding is recommended) | | |
| **Tested Surfaces** | Asphalt | | |
| **Velocity error X axis** | 0.14 RMS | 0.02 Mean | @ speed 5 m/s and angle 60° |
| | 0.26 RMS | 0.02 Mean | @ speed 15 m/s and angle 60° |
| | 0.37 RMS | 0.02 Mean | @ speed 25 m/s and angle 60° |

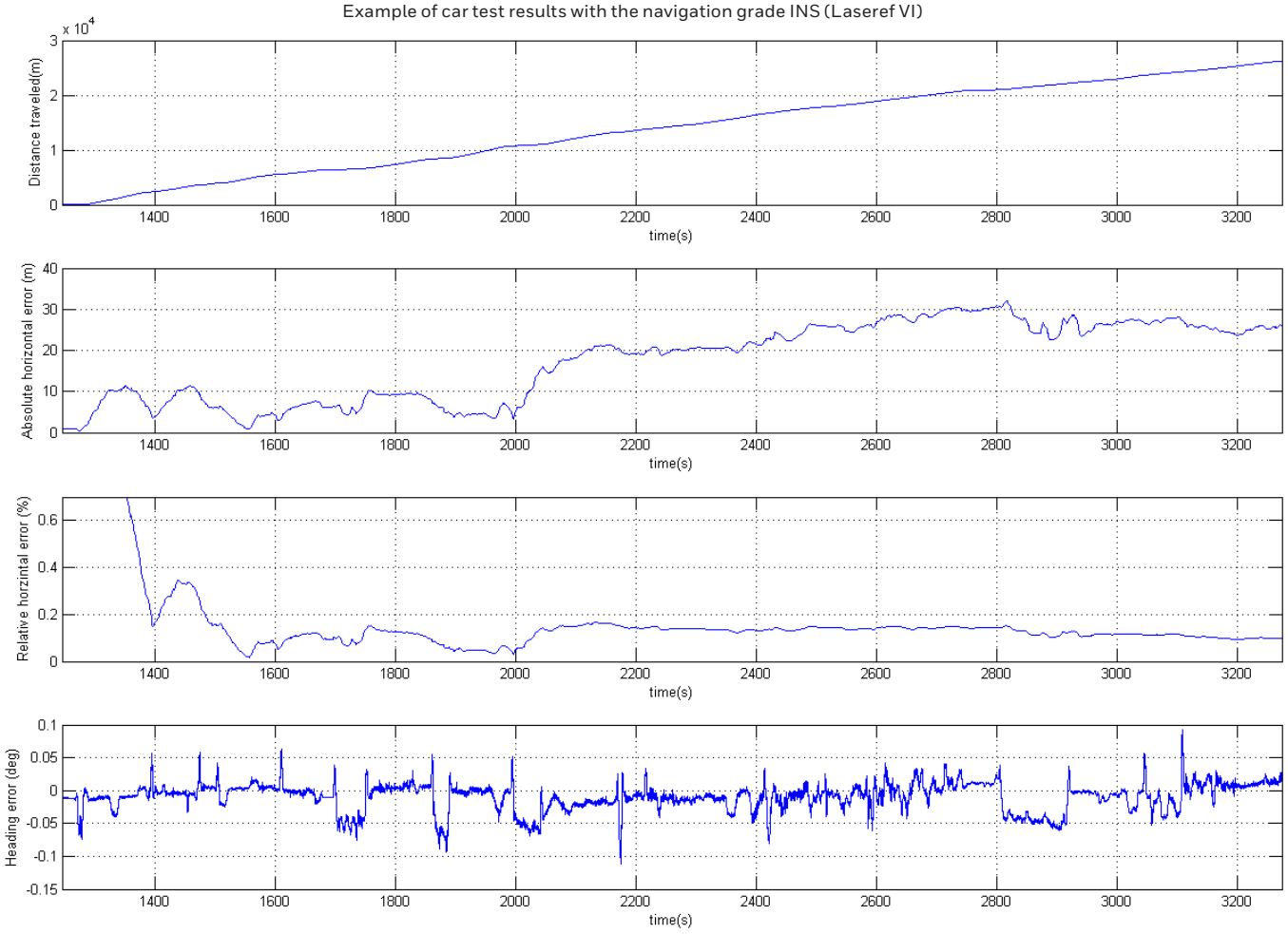
Example of car test results with the tactical grade INS (HCINS)



Example of car test results with the navigation grade INS (Laseref VI)




## HRVS APPLICATIONS PER SEGMENT

### Airborne (UAS)

**Setup:** *4 x HRVS board + INS (HCINS, etc.).*

**Tested Range:** *Up to 170m.*

**Features:** *Velocity aid, altimeter, depth mapping, ground avoidance sensing.*

### Surface (Commercial)

**Setup:** *1 x HRVS board (1.5m/0.6m above the ground) + INS (HCINS etc.).*

**Features:** *Velocity aid for no GNSS operations.*

### Surface (Defense)

**Setup:** *1 x HRVS board (1.5m/0.6m above the ground) + INS (HCINS etc.).*

**Features:** *Velocity aid for no GNSS operations.*

**Emission analysis available upon request.**

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