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Best Practices for Navigation Data Collection

Why do we need them?

• Did you record it?

• Can others easily re-use it?
Best Practices for Navigation Data Collection

• What do you record?

• How often do you record it?

• Where do you record it?
Recommendations

• What do you record?

**NMEA Strings:** The GGA, ZDA, and DTM strings are the minimum required sentences specified by the International Electrotechnical Commission in IEC Publication 61162-1.
Recommendations

• How often do you record it?

The following NMEA strings should be recorded:

At least once per file, preferably at the start:
   DTM (geodetic reference datum)

*At once-per-second or better resolution:*
   GGA (position and quality) – has important quality info
   ZDA (date-time) – holds date info
   VTG (course and speed) – used to correct gravity

Optional – daily:
   RMC (date-time/position) – for UNOLS/R2R Vessel Tracker
Recommendations

• Where do you record it?

Apart from any multiplexing or merging one might do between position time-series and other sensor data, **GPS data should also be recorded in navigation-specific files.**
What’s current practice?

Out of 22 vessels evaluated thus far:

• 15 record raw GGA strings.
• 10 record at the best time resolution of the GPS receiver
• 15 record GPS data in navigation-specific files
Navigation Quality Assessment

R2R runs these tests:

• % completeness of fileset
• Longest gap in recording
• % of records out of sequence
  (duplicates and time-reversals)
• % of records with bad GPS quality of fix
• % unreasonable speeds
• % unreasonable accelerations
# Navigation Quality Assessment

Apply Green, Yellow, Red thresholds:

<table>
<thead>
<tr>
<th>Quality Test</th>
<th>Green</th>
<th>Yellow</th>
<th>Red</th>
</tr>
</thead>
<tbody>
<tr>
<td>% completeness</td>
<td>&gt;95%</td>
<td>75 - 95%</td>
<td>≤75%</td>
</tr>
<tr>
<td>Longest Gap</td>
<td>&lt; 1 hr</td>
<td>1 - 24 hrs</td>
<td>≥ 24 hrs</td>
</tr>
<tr>
<td>% out of sequence</td>
<td>&lt;5%</td>
<td>5 - 10%</td>
<td>≥10%</td>
</tr>
<tr>
<td>% with bad quality of fix</td>
<td>&lt;5%</td>
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</tr>
<tr>
<td>% unreasonable speeds</td>
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</tr>
<tr>
<td>% unreasonable accelerations</td>
<td>&lt;5%</td>
<td>5 - 10%</td>
<td>≥10%</td>
</tr>
<tr>
<td>Overall Fileset</td>
<td>If all results Green</td>
<td>Everything else</td>
<td>If one or more results Red</td>
</tr>
</tbody>
</table>
**Navigation Quality Assessment**

**Example:**

### QA Summary Info

**Cruise:**

**Vessel:**

**Device Info:** gnss (Furuno GP-90D)

### QA Tests

- **Percent completeness:** 98.19 percent
- **Longest epoch gap:** 52109 s > 3600 s
- **Percent records out of sequence:** 0.00 percent
- **Percent records with bad gps quality indicator:** 0.01 percent
- **Percent unreasonable speeds:** 0.68 percent
- **Percent unreasonable accelerations:** 5.66 percent > 5 %

Webpage design by John Morton
Thresholds for Navigation Quality Assessment

Are they appropriate?

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