

Rolling Deck to Repository (R2R): Best Practices for Navigation Data Collection & Thresholds for Navigation Quality Assessment

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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:

Quality Test	Green	Yellow	Red
% completeness	>95%	75 - 95%	≤75%
Longest Gap	< 1 hr	1 - 24 hrs	≥ 24 hrs
% out of sequence	<5%	5 - 10%	≥10%
% with bad quality of fix	<5%	5 - 10%	≥10%
% unreasonable speeds	<5%	5 - 10%	≥10%
% unreasonable accelerations	<5%	5 - 10%	≥10%
Overall Fileset	If all results Green	Everything else	If one or more results Red



Navigation Quality Assessment

Example:

QA Summary Info

Cruise: [REDACTED]

Vessel: [REDACTED]

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 %**

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Thresholds for Navigation Quality Assessment

Are they appropriate?

Quality Test	Green	Yellow	Red
% completeness	>95%	75 - 95%	≤75%
Longest Gap	< 1 hr	1 - 24 hrs	≥ 24 hrs
% out of sequence	<5%	5 - 10%	≥10%
% with bad quality of fix	<5%	5 - 10%	≥10%
% unreasonable speeds	<5%	5 - 10%	≥10%
% unreasonable accelerations	<5%	5 - 10%	≥10%
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