

MRU Test Certificate

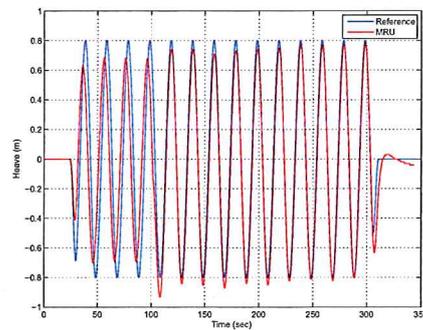
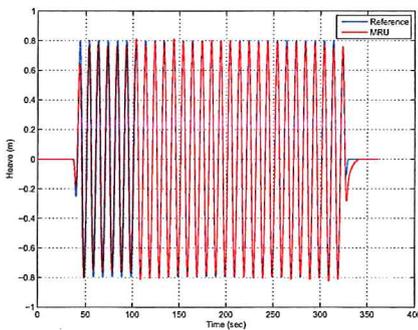
The following MRU from Inertial Labs was tested in the Motion Laboratory on June 7, 2016:

Integrated device s/n	M1650001
Firmware version	A2IMU v2.2.1.4 11.05.16
IMU1M s/n	20812
Firmware version	IMM1 R.1.0.4 03.21.2016

Pure sinusoidal motion was tested in three degrees of freedom (Heave, Pitch and Roll) with two cycle periods (10 and 20 seconds) using a hexapod E-Motion 8000 from Bosch Rexroth. The results are summarized in the table below.

Motion Type	Amplitude	Period	Std	Std+	Std-	Error
Heave	0.8m	10s	0.0107	0.0094	0.0128	1.6%
Heave	0.8m	20s	0.0324	0.0311	0.0338	4.2%
Pitch	5°	10s	0.0252	0.0284	0.0382	0.8%
Pitch	5°	20s	0.0110	0.0093	0.0200	0.4%
Roll	5°	10s	0.0137	0.0230	0.0289	0.6%
Roll	5°	20s	0.0107	0.0177	0.0127	0.4%

Data from both the MRU and the hexapod were sampled at 10ms (frequency 100Hz) and length 300s. The first 100s were used by the MRU for initial internal calculations. Std in the table above shows the standard deviation calculated from time 150s to 250s between the MRU measurement and measurement from the hexapod. Std+ is the standard deviation when the MRU time series is shifted by +10ms (one sample), while Std- is the same when the time series is shifted by -10ms (one sample). The error was calculated as the worst-case percentage value of Std, Std+ and Std- compared to the hexapod's motion profile. The errors varied from 0.4% (best-case) to 4.2% (worst-case). The pictures below show the MRU mounted on the hexapod and the measurement series for Heave (10s and 20s).



Signature: Geir Houk-el

Place and Date: Grimstad, June 22 2016