Introduction to Inertial Sensor and System Testing

Marius Gheorghe, PhD
Chief Engineer, Systems Solutions
Ideal Aerosmith, Inc.
Phoenix, AZ, USA
mgheorghe@idealaero.com

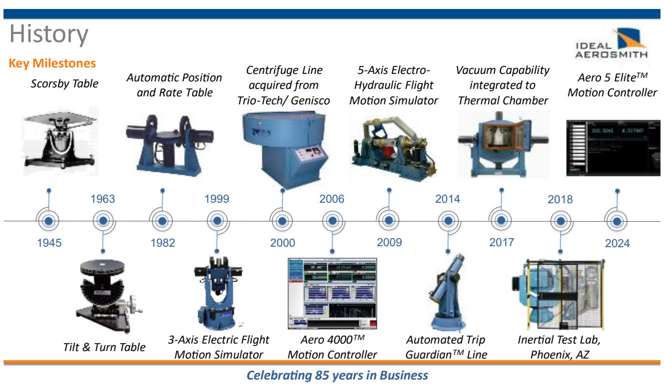
***Abstract*—The presentation aims to present the audience aspects related to the testing of inertial MEMS sensors and systems. A broad range of topics include an introduction to Ideal Aerosmith Inc., common MEMS inertial sensors and systems, testing techniques, and Fehlerkultur.**

I. Introduction to Ideal Aerosmith Inc.

I will briefly introduce my employer, Ideal Aerosmith, Inc., a premier manufacturer of inertial test equipment and provider of turnkey test solutions.

I will present in general lines the type of equipment, projects, and other offerings related to inertial MEMS sensors and systems.

Sample slides are included below:



II. MEMS Inertial Sensors and Systems

I will introduce the three main categories of MEMS inertial sensors and systems.

A. Accelerometers

I will present the main concepts behind MEMS accelerometers.

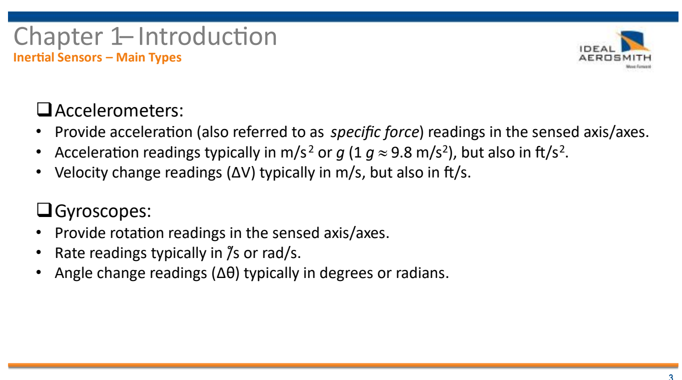
B. Gyroscopes (Gyros)

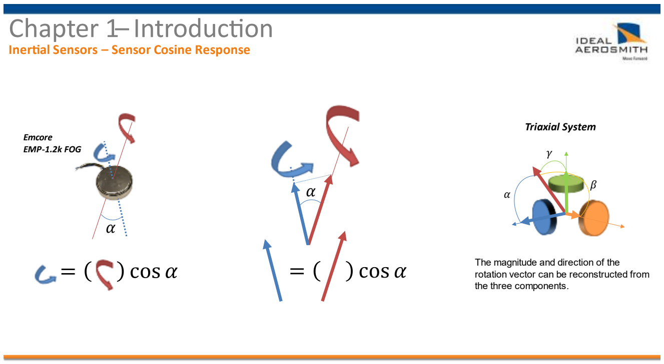
I will present the main concepts behind MEMS gyros.

C. Inertial Measurement Units (IMU)

I will present the main concepts behind MEMS IMUs.

Sampe slides are included below:

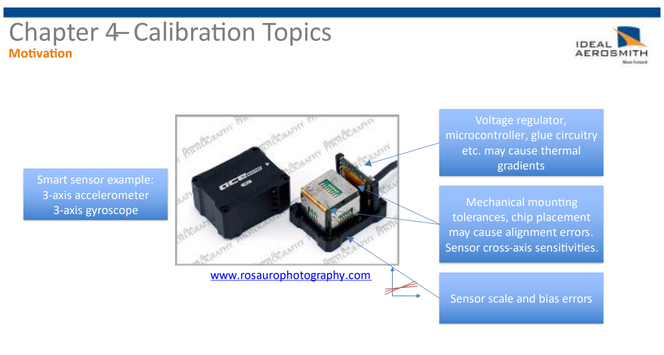


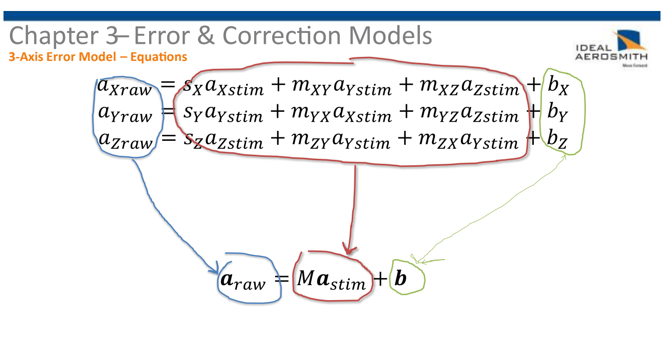


III. Rationale for Calibration and Testing

I will present the rationale for the calibration and testing of MEMS inertial sensors and systems, highlighting the typical error types. I will also introduce the linear error models.

Sample slides are shown below:

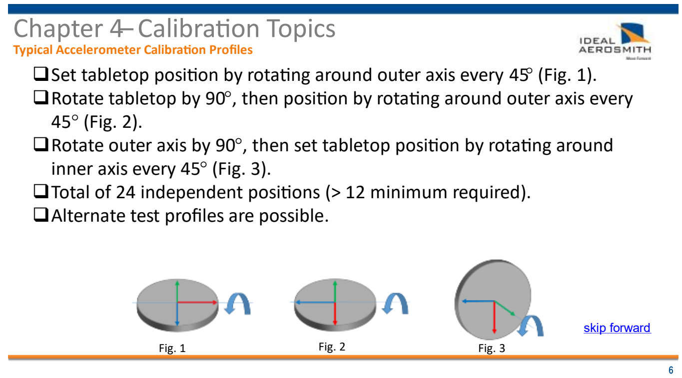


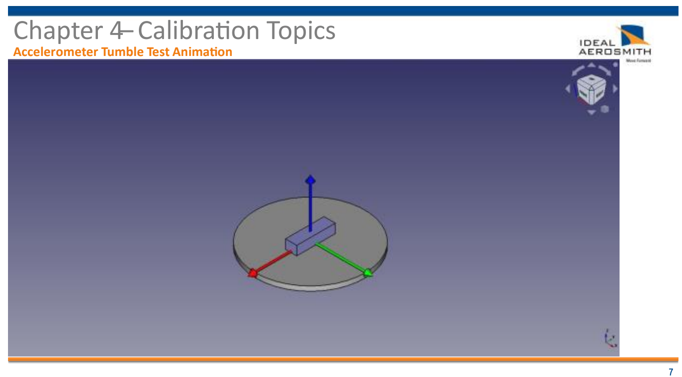


IV. Accelerometer Calibration and Test Profiles

I will present the typical calibration and test profiles used for MEMS accelerometers. I will cover the *tumble*, *centrifugal*, and *vibration* profiles.

Sample slides are shown below:

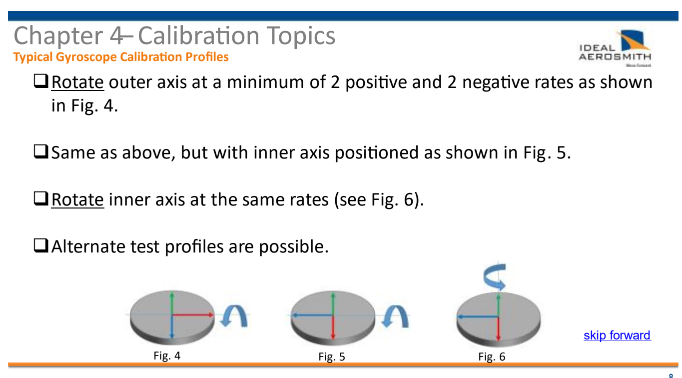




V. Gyro Calibration and Test Profiles

I will present the typical calibration and test profiles used for MEMS gyros. I will cover the *comb*, *canted*, and *g-sensitivity* profiles.

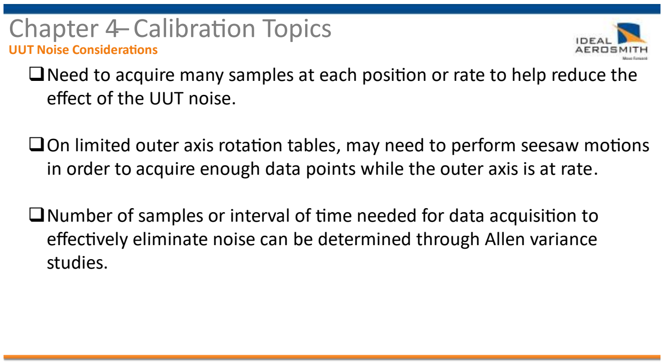
Sample slides are shown below:



VI. IMU Calibration and Test Profiles

Will briefly summarize the specifics of the IMU (i.e. system) versus accel and gyro (sensors) calibration and testing.

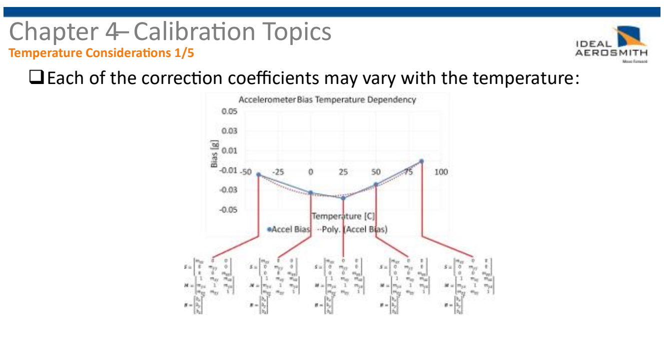
Sample slides are shown below:

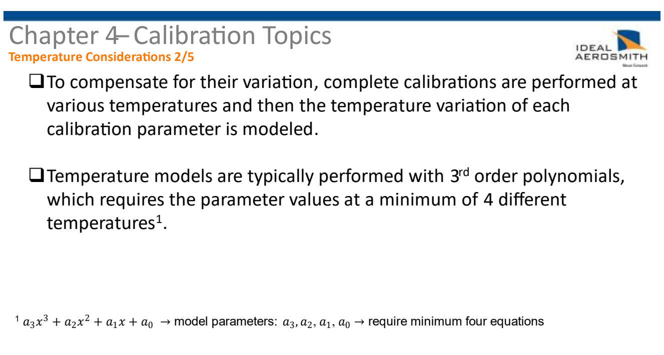


VII. Thermal Profiles

I will present the thermal dependence of various error model coefficients, thermal profiles and modeling.

Sample slides are shown below:



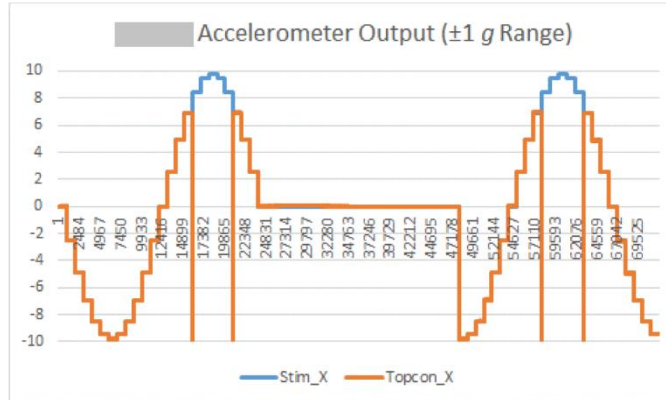


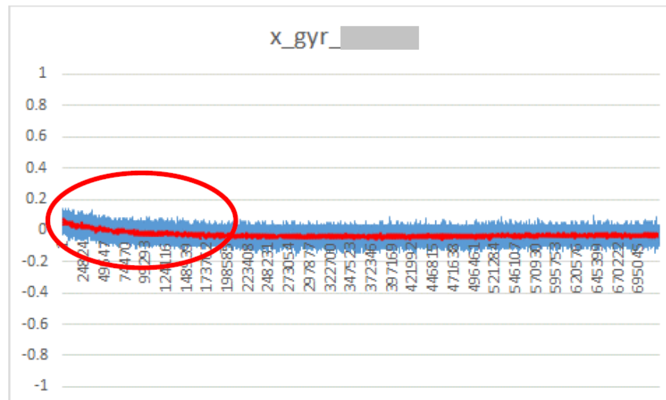
VIII. Fehlerkultur (Culture of Learning from Failures)

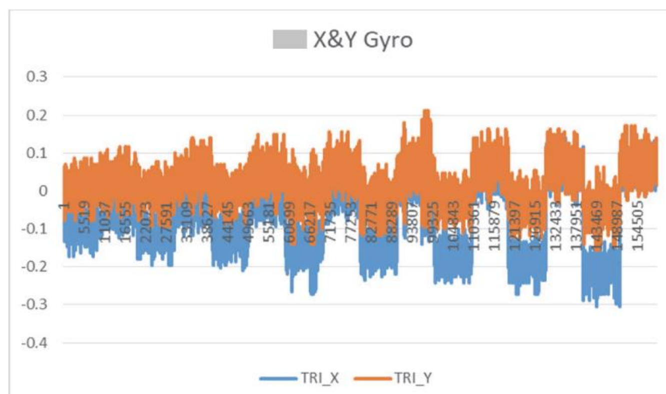
I will present a number of interesting cases from the vast experience accumulated at the Inertial Test Laboratory (ITL) located at Ideal Aerosmith's Phoenix facility.

Almost every project executed at the ITL discovered unexpected phenomena, deviations from the intended behavior, or other types of anomalies.

Sample graphs showing anomalies are shown below:







IX. Questions and Answers

The attendees will have the opportunity to ask questions during the last 10 minutes of the presentation.

References

References will be presented on the last slide(s) of the presentation using IEEE-style citations.