

# GravNav Discussion Points

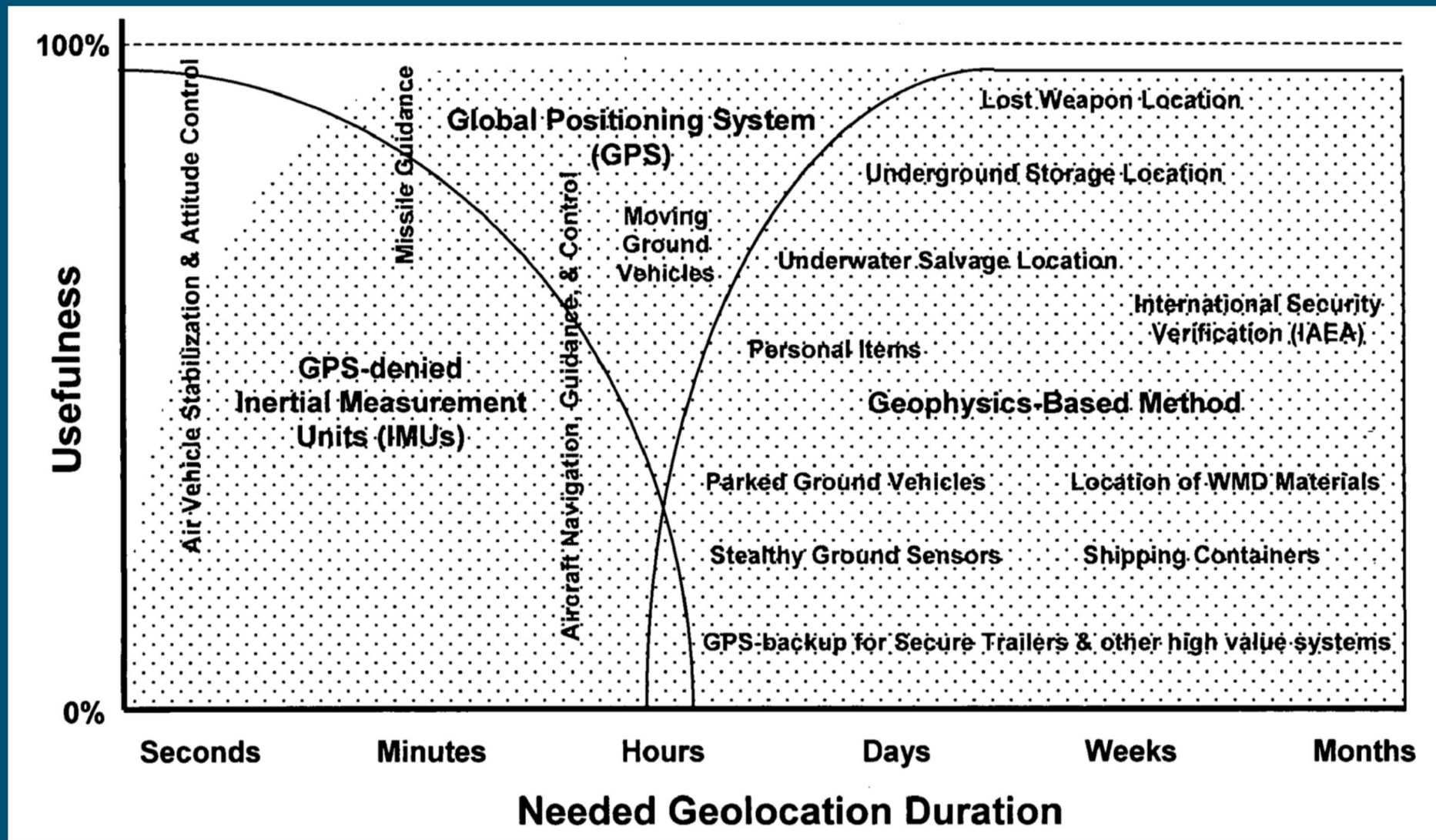
## February 26, 2020



*Presented By: Neil Claussen, 5447*

- LDRD plus-up opportunity for FY21
  - Seedling funds for initial GravNav study.
  - Subcontract negotiations underway.
  - Contract agreement by March?
  - Expenditure deadline September 30, 2020
  - Kick-off teleconference?

# Localization vs. Time Scale



Daily, Rohde, Novak US Patent 7,376,507 (2008).

# Global gravity models – satellite+terrestrial

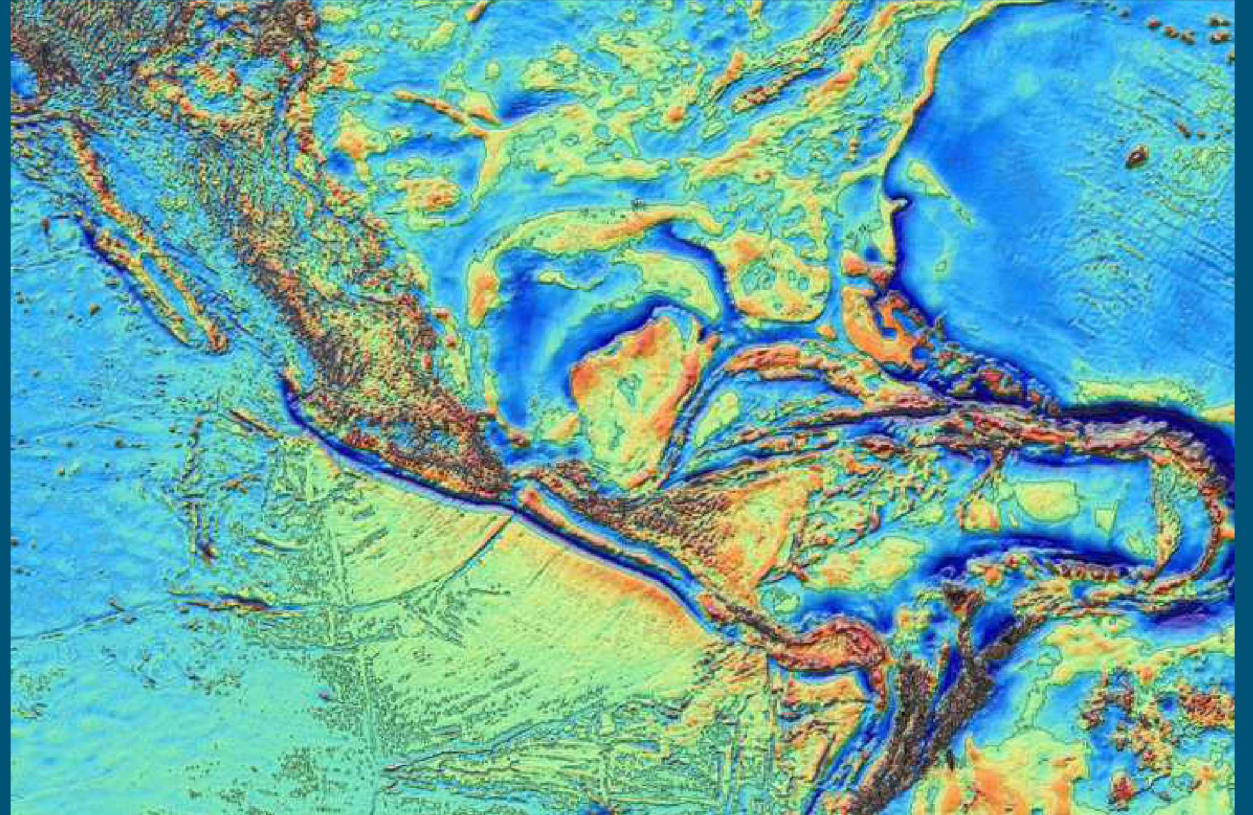
**Cryosat-2, Jason-1, GRACE missions**

**Spatial resolution limit?**

**Track spacing ~ 2.5km**

**Map error estimation**

**Secular drift, tides – incl. in model?**

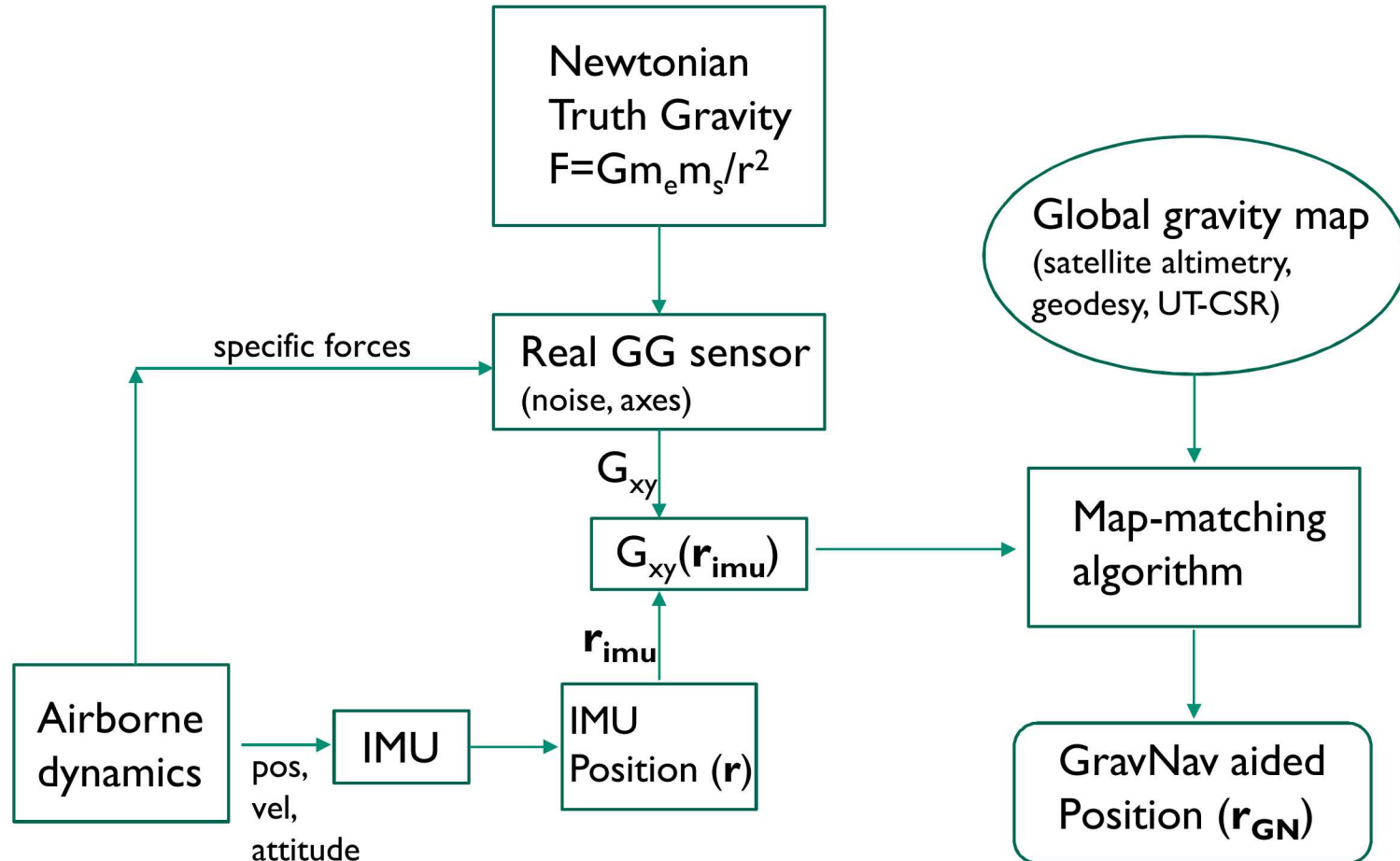


Sandwell et al. (2014) Science 346(6205), pp. 65-67.

# GravNav Concept:

5

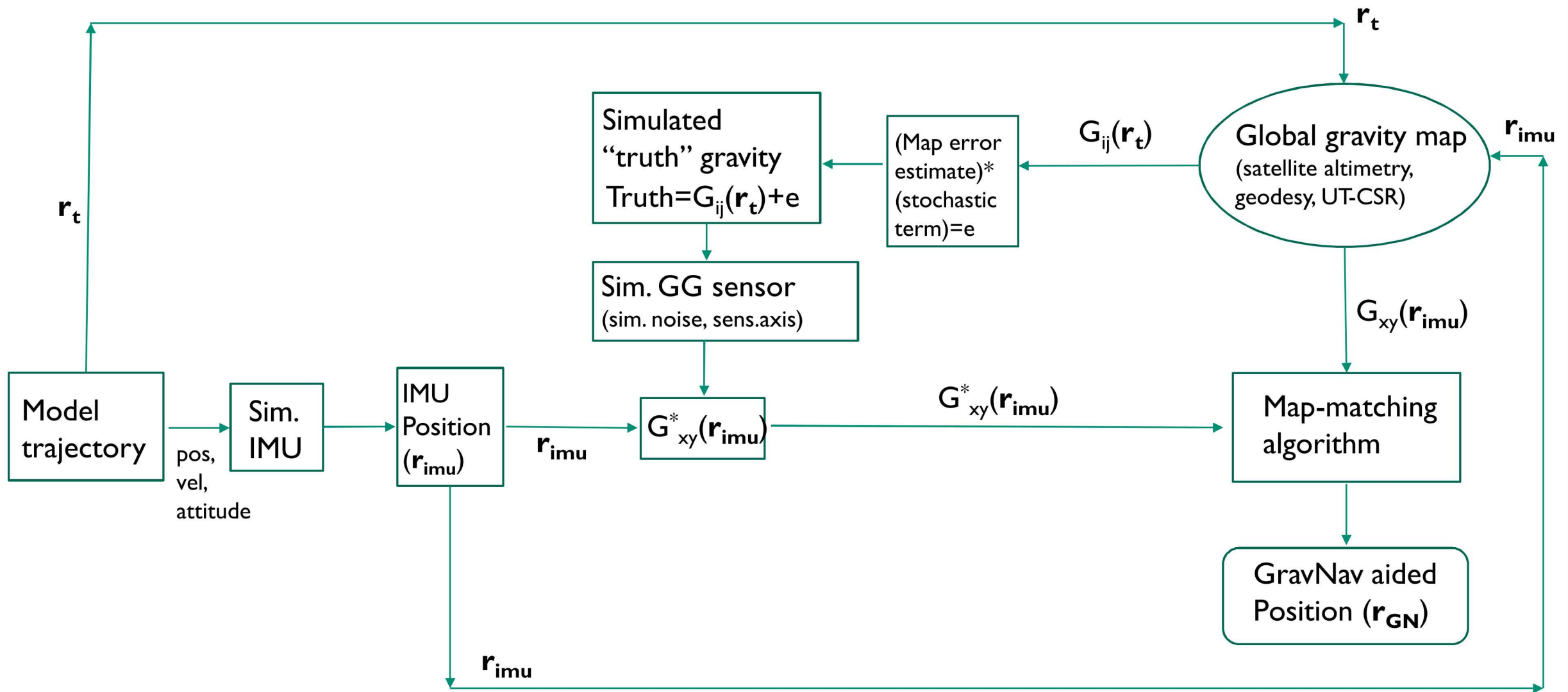
## Real-world gravity gradiometer (GG) aiding of IMU after GPS denial



- GG sensor measurement is independent of the global gravity map (by default).

# Simulated gravity gradiometer (GG) aiding

6



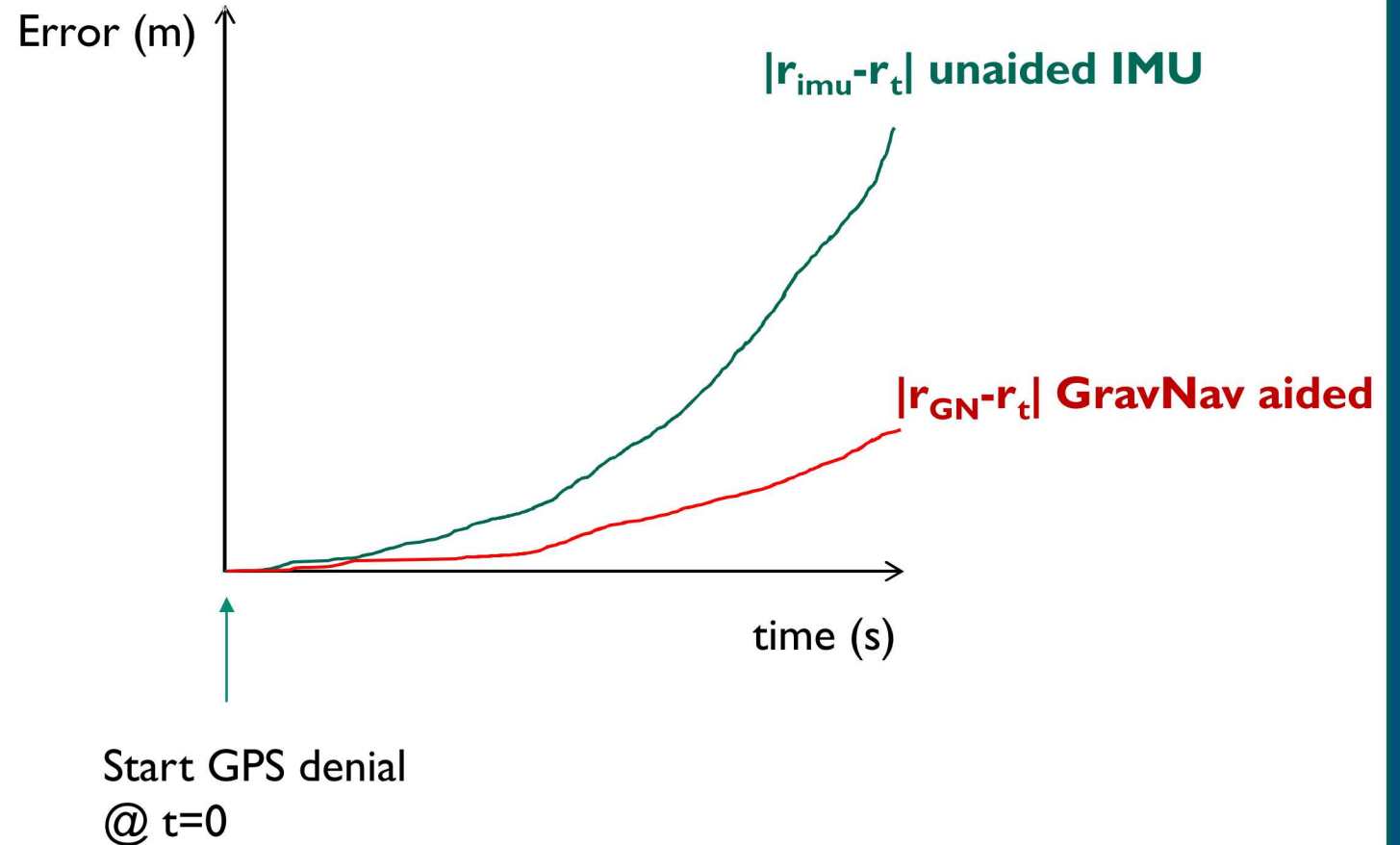
- Sim. truth gravity is made independent of the global gravity map by map error stochastic term.
- Sim. GG sensor measurement has additional sensor noise.

# GravNav – simulated performance

7

Look at performance dependence on:

- Trajectory (dynamics)
- Map error
- Sensor error
- Tensor components



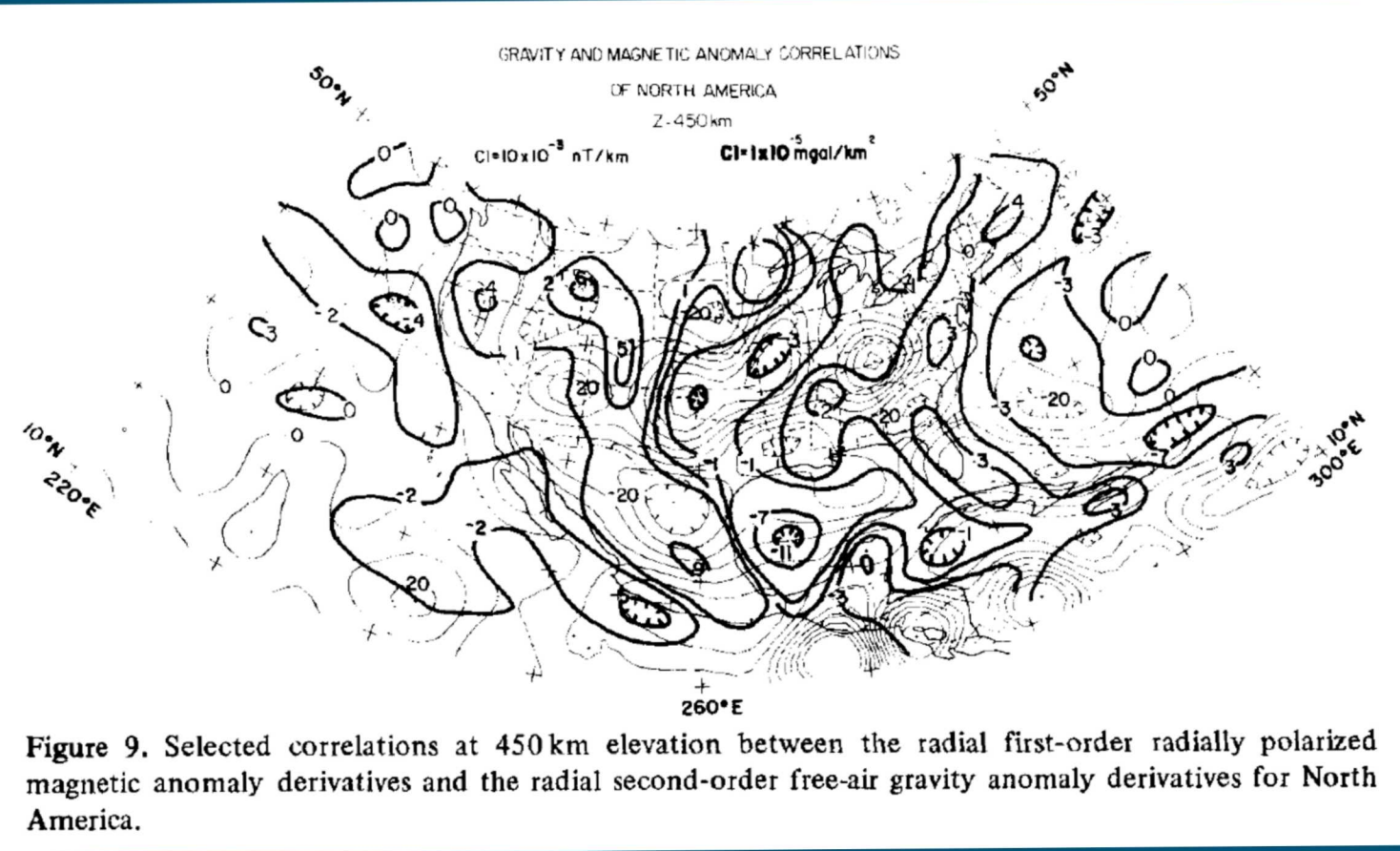
# Gravity/Magnetic Fusion

Correlations between gravity & magnetic anomalies

Inverse correlation over continents

Positive correlation over oceans

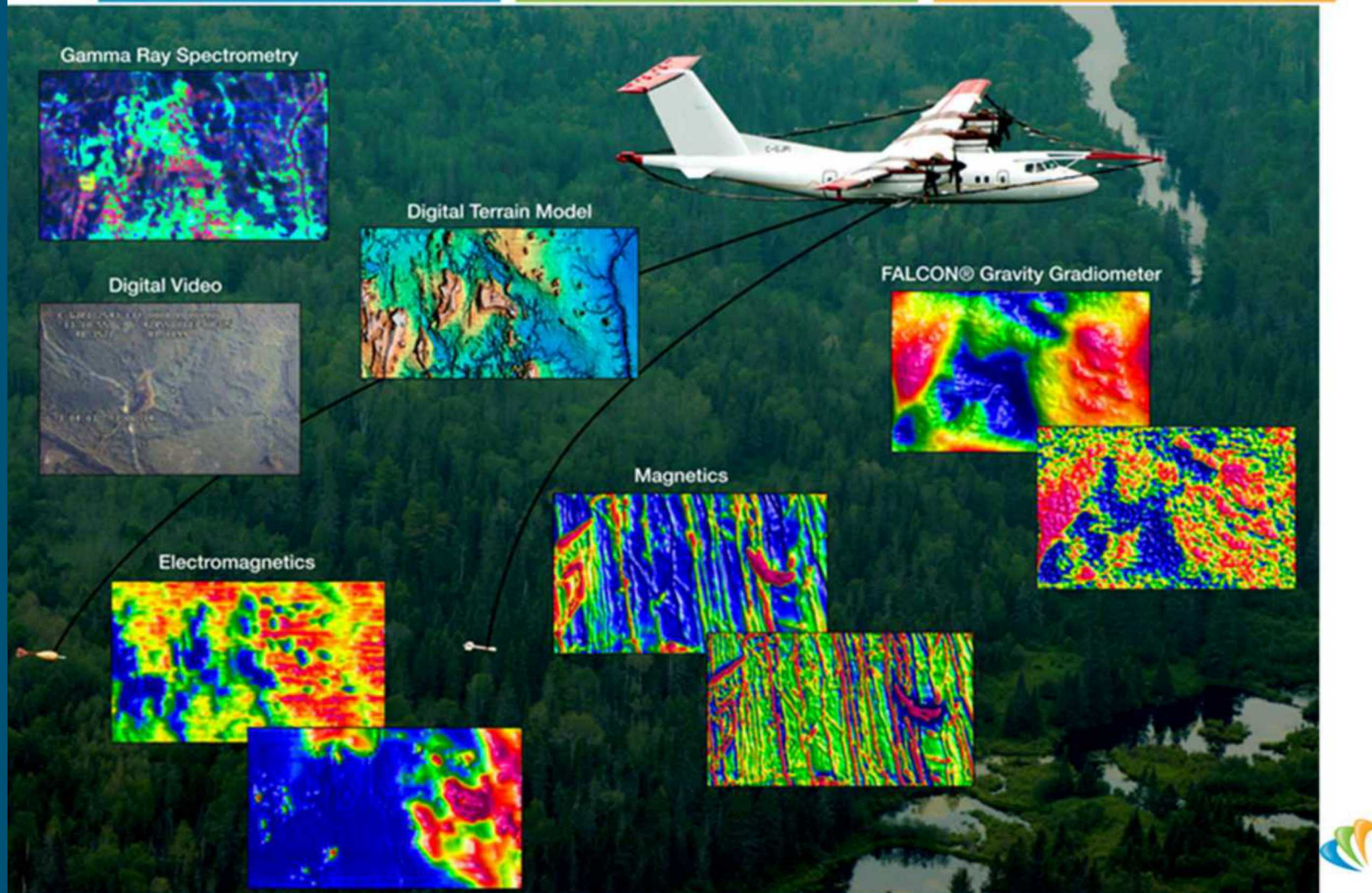
Possible fusion for improved nav?



Von Frese, Hinze, Braile (1982) Geophys. J.R. astr. Soc. 69, pp. 745-761.

# Oil & Gas Industry Gravity Gradiometer

GRYPHON™ unique multi-physics



“Acquisition with FALCON” (CGG online short course). Retrieved from the Internet on 10/15/2019: <URL:<https://www.cgg.com/multi-physics>>