



WMM Program Overview

Mike Paniccia

SFN - Office of Geomatics

NATIONAL GEOSPATIAL **NGA** INTELLIGENCE AGENCY

Approved for Public Release #20-510

National Geospatial-Intelligence Agency

- The National Geospatial-Intelligence Agency (NGA) delivers world-class geospatial intelligence that provides a decisive advantage to policymakers, warfighters, intelligence professionals and first responders.
- NGA ensures safety of navigation in the air and on the seas by maintaining the most current information and highest quality services for U.S. military forces and global transport networks.
- NGA Office of Geomatics is the custodian of WGS 84, the best global geodetic reference system for the Earth available at this time for practical applications of mapping, charting, geopositioning, and navigation.
- WGS 84 includes the definition of the coordinate systems, the Earth Gravitational Model (EGM), the World Magnetic Model (WMM), and a current list of coordinate conversions/local datum transformations.
- NGA partners with NOAA (NCEI) and BGS to build and maintain the WMM.



NATIONAL GEOSPATIAL **NGA** INTELLIGENCE AGENCY

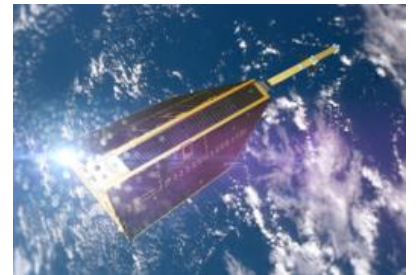
WMM Users

- Federal Aviation Administration (and other Aviation agencies around the globe)
- All the Ships at Sea (International Hydrographic Organization)
- United States Department of Defense / NATO
- You!



History of WMM

- **Non Magnetic Ships (1905-1929)** – The U. S. Department of Terrestrial Magnetism surveyed ~500,000 miles of ocean using 2 ships (Galilee and Carnegie).
- **Project Magnet (1951-1994)** – The U.S. Navy continuously collected data via aircraft to support WMM production by NIMA.
- **MAGSAT (1979-1980)** – Launched by NASA/USGS to map the Earth's magnetic field as part of the Explorer's program.
- **Ørsted/CHAMP Satellites (1999-2013)** – Launched by Denmark/Germany to measure the Earth's magnetic field.
- **SWARM Satellites (2013-2025?)** – Three (+1) satellites launched by the European Space Agency to measure the Earth's magnetic field; possible extension past 2021 if they remain funded/healthy.
- **TBD (2025 – at least 2048)** – Future system under investigation



Polar Movement

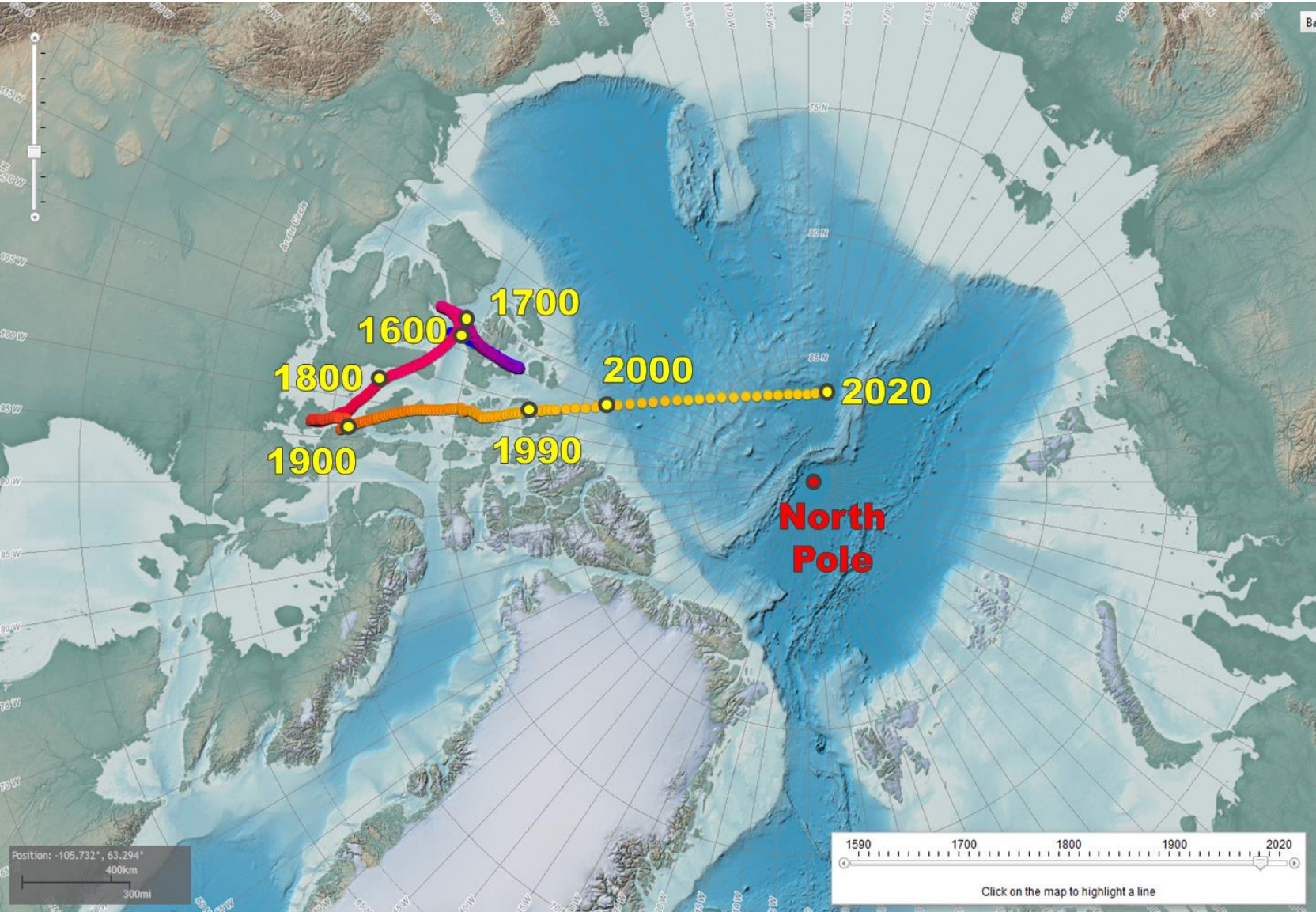


Image: NOAA.gov

Approved for Public Release #20-510

- NGA produces the World Magnetic Model (WMM) for DoD, NATO, civilian, and international users
- Mission Imperative 'Assured PNT: WGS-84 Modernization' enables navigation, precision targeting, satellite operations, and many other uses
- Production dependent on data from aging European Space Agency (ESA) Swarm satellites
- DoD issued JROC-M validating GGI ICD and designating NGA as lead agency to ensure DoD retains the ability to produce accurate WMM
- NGA initiated MagQuest and formal Analysis of Alternatives (AoA)

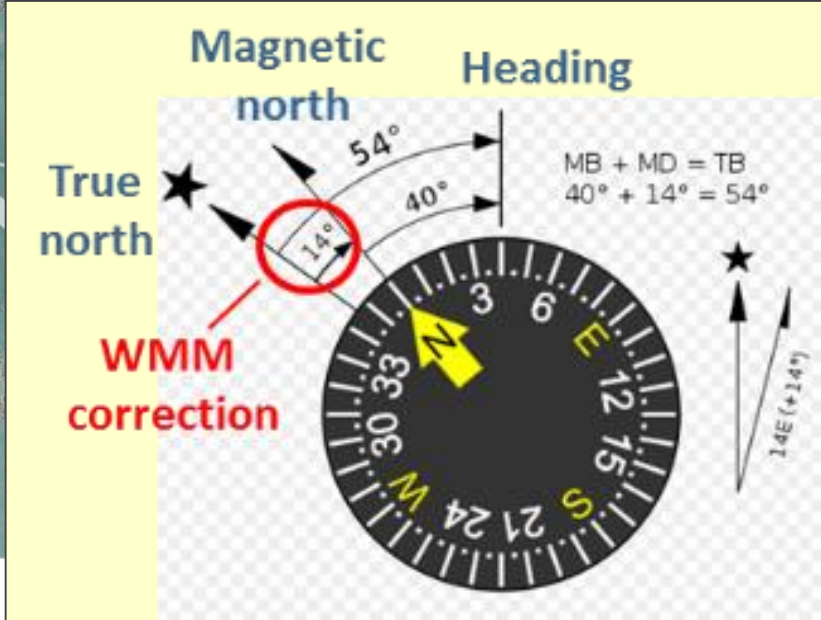
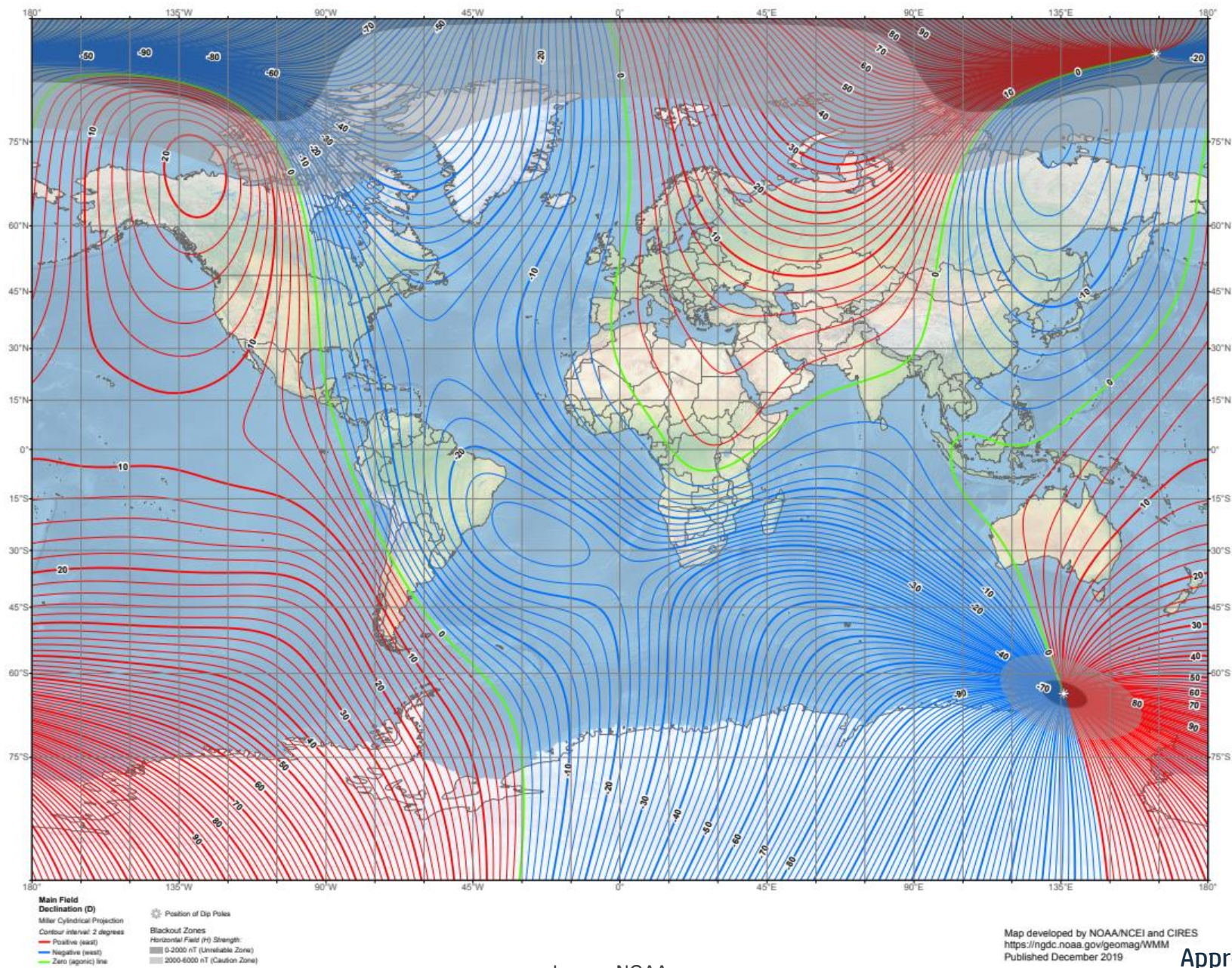


Image: WikiCommons

US/UK World Magnetic Model - Epoch 2020.0

Main Field Declination (D)



Map developed by NOAA/NCES and CIRES
<https://ngdc.noaa.gov/geomag/WMM>
 Published December 2019

Approved for Public Release #20-510

Image: NOAA.gov

Error From Continual Use of WMM2015

Seattle	
Latitude:	47.443546° N
Longitude:	122.301659° W
Year	Declination
2015	16.08° E
2020	15.55° E
2025	15.10° E
Difference	0.98°

Saint Louis	
Latitude:	38.7467° N
Longitude:	90.3654° W
Year	Declination
2015	1.15° W
2020	1.50° W
2025	1.85° W
Difference	0.7°

Quebec	
Latitude:	46.8139° N
Longitude:	71.2080° W
Year	Declination
2015	16.20° W
2020	15.60° W
2025	15.00° W
Difference	1.2°

Los Angeles	
Latitude:	33.942791° N
Longitude:	118.410042° W
Year	Declination
2015	12.27° E
2020	11.87° E
2025	11.43° E
Difference	0.84°

Orlando	
Latitude:	28.538336° N
Longitude:	81.379234° W
Year	Declination
2015	6.10° W
2020	6.48° W
2025	6.82° W
Difference	0.72°



WMM 2020 Blackout Zone

- WMM2020 released including new Black out Zones for better Safety of Navigation
- Documented in the latest WGS edition, MIL-PRF-89500B, and WMM Technical Reports

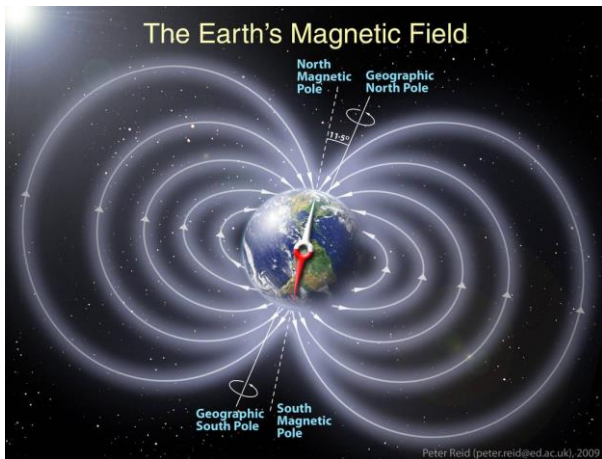
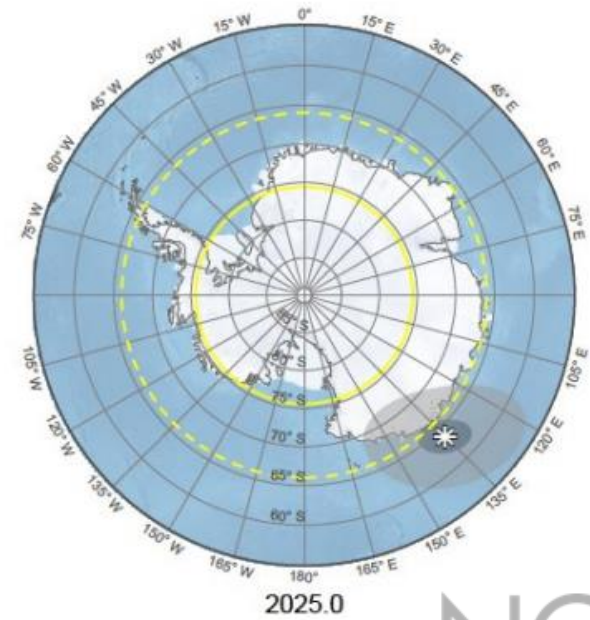
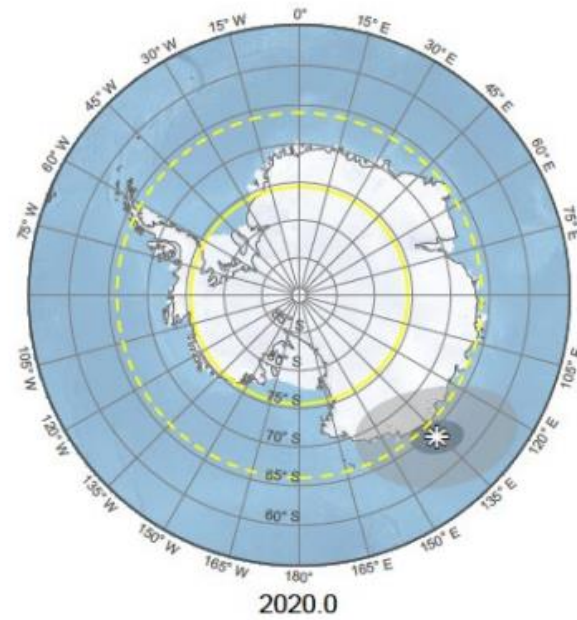
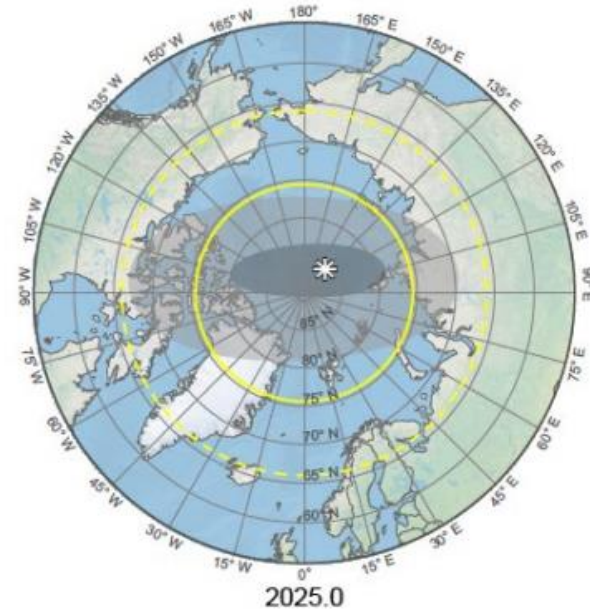
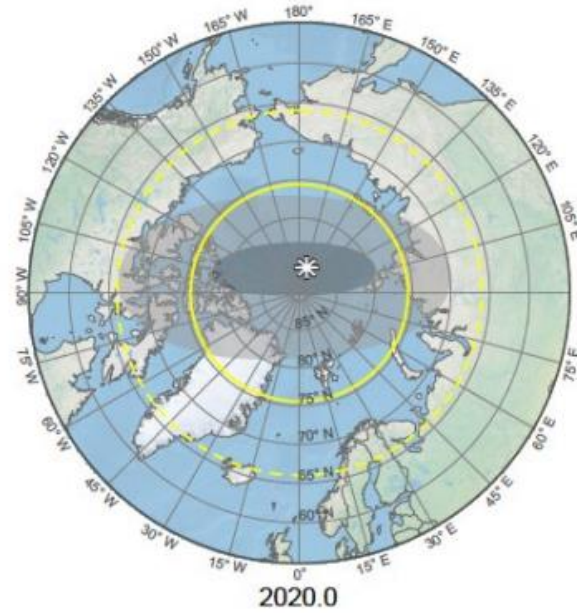


Image: Nasa.gov








	WMM2020 Blackout Zone (BoZ)		Legacy Unreliable Zone
	WMM2020 Caution Zone		Legacy Caution Zone
	WMM2020 Dip Poles		



Image: NOAA.gov

