

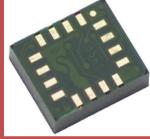
Miniaturized Magnetometers for SmallSat Missions

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Summary

The Goddard magnetometry group has over 70 magnetometers that have returned science measurements from space. Some of these instruments were designed for resource constrained missions so we are able to directly adapt our heritage designs for modern SmallSat missions including planetary and heliospheric CubeSat missions. Additionally, we are continuing to investigate the possibilities for new technologies to allow truly tiny sensors to deliver science-grade results. We welcome interest in collaborations to place magnetometers on a variety of future missions.

	Standard mag 	Mini-mag 	Micro-mag 
Heritage	MAVEN, Juno, Parker, Solar Probe	Polar Orbiting Geomagnetic Survey	Cellphones
Sensor Technology	Fluxgate (1" ringcore)	Fluxgate (5/8" ringcore)	Magnetoresistive
Sensor: Mass	400g	40g	~1g
Volume	400cm ³	60cm ³	~1cm ³
Electronics: Mass	700g	200g	TBD
Volume	700cm ³	200cm ³	TBD
Power	~1 W	<1 W	<<1 W
Radiation Tolerance	50 krad TID	50 krad TID	???
Instrument Noise	<< 1 nT	< nT	~1-10nT?
Future Applications	Goes Future New Frontiers Future Discovery Europa Lander?	Planetary SmallSats Heliospheric SmallSats Mars Airplane? Europa Lander?	NanoSat swarms Spacecraft navigation
Current Development	Calibrate for use at ~80K (e.g. European nightside surface without heaters)	Keep functional design of the MAVEN electronics but adapt the layout to match the CubeSat form factor and pair with existing 5/8" sensor	Test noise performance of commercial product for science usage

Example Application

This diagram shows a design for a 6U CubeSat to study the martian magnetosphere, ionosphere, and crustal magnetic fields. A putative Europa lander where a magnetometer could make measurements about subsurface water (local aquifers and the ocean). Note the deployed mini-mag which in total (sensor, electronics, and pre-deployed boom) is approximately 0.5 U.

