

GEM SYSTEMS

UAV Solutions

Fixed-wing, Multicopter and Rotary-wing platforms
featuring ultra-light Potassium Magnetometer

NEW!

Celebrating 35 Years
Leading the World of Magnetics

GEM Systems is the number one global leader in the manufacture and sale of high precision magnetometers.

GEM is the only commercial manufacturer of Overhauser magnetometers, that are accepted and used at Magnetic Observatories over the world.

Our Potassium Magnetometers are the most precise magnetometers in the world.

Our Proton sensors are considered the most practical and robust magnetometers for general field use.

Proven reliability based on 35 years of R&D

We deliver fully integrated systems with GPS and additional survey capability with VLF-EM for convenience and high productivity

Today we are creating the absolute best in airborne sensors and are leading the way in Airborne sensors with smaller and lighter sensors for practical UAV applications. We are also making very large sensors with the best sensitivity (30-50 fT) for use in natural hazard research and global ionospheric studies.

Our Leadership and Success in the World of Magnetics is **Your key to success** in applications from Archeology, Volcanology and UXO detection to Exploration and Magnetic Observation **Globally.**



The GSMP-35U magnetometer has been installed on a multitude of unmanned platforms.

Surveying with UAV's

UAVs can be used to perform airborne geophysical surveys, in particular aeromagnetic surveys where mapping the spatial variations in the Earth's magnetic field can be used to further the understanding of the geology in areas where the mineral potential is being explored.

UAV borne magnetic surveys are less expensive than both airborne and ground surveys. They can be carried out in areas that are too dangerous, too remote, or too expensive to carry out with manned aircraft. UAV borne magnetic surveys can deliver better data quality in environments where topography and safety standards prohibit manned aircrafts from acquiring data at optimum terrain clearances.

Practical applications of UAVs are limited by several factors. Aviation regulations and flight restrictions must be adhered to when operating most fixed wing UAVs. In addition limitations are also imposed around the use of rotary-wing UAVs in and around built up areas. From a logistical point of view, one of the largest limiting factors with respect to UAVs is that they have limited payload. In order for UAVs to make practical survey flights, the survey equipment must be light. GEM has developed light weight geophysical instrumentation for UAVs.

Light Weight - High Sensitivity Potassium Magnetometer

Gem Systems developed the GSMP-35U to be the first lightweight, highly sensitive magnetometer for UAVs. It has been installed and successfully tested in the Monarch fixed wing Gradiometer UAV.

The GSMP-35U magnetometer with 0.3 pT sensitivity forms the core of GEM's UAV solutions. The sensors are based on GEM's popular optically pumped Potassium magnetometer sensor, that offers the highest sensitivity, absolute accuracy and gradient tolerance available in the industry.

The sensors stream RS-232 or RS-485 data which can be visualized for quality control purposes, if hardware is on board facilitating a down link of data. The GSMP-35U magnetometer is supplied complete with 128 Mb of on board data storage, suitable for long flights.

Advantages of Potassium Optically Pumped Technology

- Highest sensitivity, absolute accuracy and gradient tolerance optically pumped magnetometers available on the market
- Potassium narrow spectral line minimizes heading and orientation errors
- Low maintenance cost on sensors
- High quality results in areas of high gradients

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Our World is Magnetics.

Integration Options with UAV's

The light weight GSMP-35U magnetometer can be supplied as a stand alone magnetometer allowing the customer to complete integration into existing platforms. In addition, a variety of options exist.



UAV sensor head in wing tip pod

Option 1 - For UAVs operating with PIXhawk autopilots

This Option includes the lightweight GSMP-35U modified to facilitate recording the rich data stream from the 3DR Pixhawk autopilot found in so many UAVs. A full, multi-parameter database, which includes the mag data and all of the UAV's sensor data, such as altimeter and GPS is created onboard the Magnetometer's custom electronics module. Data is retrieved post flight.

Option 2 - For customers with their own UAV that wish to add a complete geophysical system along with specialised ancillary equipment

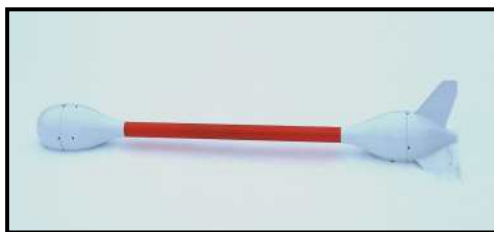
GEM will supply and integrate GPS, Laser altimeter, IMU and data radio link. The system runs completely independent of the onboard autopilot. The electronics box for the magnetometer system is modified to include a multiplexor (**GEMDAS**) to handle data acquisition and storage for a variety of parameters. The data can be retrieved at the end of the flight or it can be delivered in realtime to the ground via radio link. (a separate DAS system can also be provided)

Option 3 - Standalone light weight towed bird for VTOL UAVs (Turnkey System)

GEM Systems' stand-alone magnetometer **Airbird** for Vertical Take Off and Landing (VTOL) UAVs, comes complete with 1 GSMP-35U Potassium Magnetometer, laser altimeter for terrain clearance control, IMU, GPS navigation, battery, radio link and tow cable. The magnetometer performs all of the functions of a data acquisition unit.

AirBird

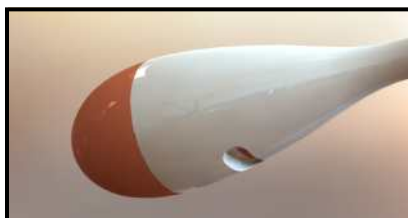
The self contained, self powered stand alone system does not require any integration with the UAV's navigation or electrical systems.



AirBird - Lightweight complete towable system to house; Magnetometer, GPS, Laser Altimeter, IMU and GEMDAS data acquisition module.

AirBird Specifications

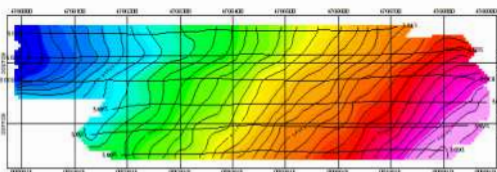
The overall length of the **Airbird** is 2.2 metres with the GSMP-35U sensor, installed on a gimbal in the tail to allow for +/- 45 degree rotation of the sensor. The housing shell weighs only 1.6 kg. With all components added, including power, the bird weighs just under 3.3 kg. The battery allows for 1 hour of equipment operation.



The nose of the Airbird houses all of the navigation and ancillary instruments, complete with a window for the laser range finder

Customer provided UAV's

Before deciding on a particular UAV aircraft with adequate range and payload for the geophysical instruments, it is recommended that the magnetic interference generated by the vehicle be assessed with a high sensitivity portable magnetic gradiometer, operated by an experienced geophysicist. The UAV vehicles should have a payload capacity of at least 1.5 kg for minimum requirements. But before purchasing a UAV contact GEM to discuss your plans.



Magnetic data collected with the GSMP-35U during a test flight of the Monarch UAV in southern Ontario.

Magnetometer Specifications

Performance

Sensitivity: 0.0003 nT @ 1 Hz
Resolution: 0.0001 nT
Absolute Accuracy: +/- 0.1 nT
Dynamic Range: 20,000nT to 120,000 nT
Gradient Tolerance: 50,000 nT/m
Sampling Rate: 1, 5, 10, 20 Hz

Orientation

Sensor Angle: optimum angle 30° between sensor head axis & field vector.
Orientation: 10° to 80° & 100° to 170°
Heading Error: +/- 0.05 nT between 10° to 80° and 360° full rotation about axis.

Environmental

Operating Temperature: -20°C to +55°C ***
Storage Temperature: -70°C to +55°C
Humidity: 0 to 100%, splashproof
*** Optional to -40°C

Dimensions & Weights

Sensor: 161mm x 64mm (external dia) with 2m cabling ; 0.43 kg
Electronics Box: 236mm x 56mm x 39mm; 0.46 kg
Option 1 cabling; .125kg
Option 3 light weight battery; .250kg

Power

Power Supply: 18 to 32 V DC
Power Requirements: approx. 50 W at start up, dropping to 12 W after warm-up
Power Consumption: 12 W typical at 20°C
Warm-up Time: <15 minutes at -40°C

Outputs

20 Hz RS-232 output with comprehensive Windows Personal Computer (PC) software for data acquisition and display.
Outputs UTC time, magnetic field, lock indication, heater, field reversal, GPS position (latitude, longitude altitude, number of satellites)

Components

Sensor, pre-amplifier box, 2m sensor / pre-amplifier cable,(optional cable 3-5m) manual & ship case.

GEM Systems provide an industry leading 3 year Warranty

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