

# Guidance, Navigation and Control Systems for Sounding Rockets

With more than 30 years of experience in sounding rocket guidance, navigation and control, RUAG Space provides systems for sounding rockets, with peak altitudes in the 100-1000 km range and more.



RUAG Space experience in sounding rockets and guidance dates back to 1968, and covers almost 280 successful rocket launches. The company's sounding rocket guidance systems are highly acclaimed and frequently used in several European and American programmes. We tailor our flight-proven systems to your application and provide accurate trajectories and small impact areas for your payload.

## Canard control

Our 5th generation of the S19 family of guidance systems, the S19E, takes the performance one step further by introducing electrical servos:

- Extendable guidance time by utilizing high-energy density power supplies.
- Lower system weight due to a more compact design of the servo system.
- Simplified ground operations and integrated automated tests.

As its predecessor the S19E Guidance uses the same constant attitude guidance, however it can also be extended to a true fire-and-forget system which takes your vehicle along an accurate trajectory to its preprogrammed impact point. By enabling this extended capability no wind-weighting is required when using the S19E.

Over the years, well over two hundred sounding rockets have been guided by S19 family canard control systems.



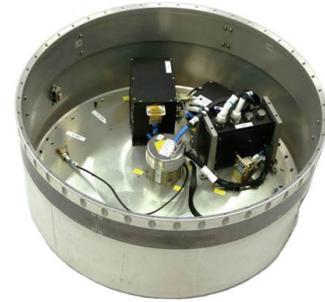
The S19E

Together  
ahead. **RUAG**

## Thrust vector control

Our GCS Guidance, Navigation and Control system has successfully provided accurate guidance for the ESA Maxus programme over a twenty year period. In that programme, the RUAG Space GCS uses a thrust vector control actuator to maintain Castor 4B rockets inside the range boundaries of Esrange in northern Sweden throughout its 700 km peak altitude flight.

The GCS uses the same sensor platform and electronics as the S19E. The Castor 4B rocket is launched vertically, and the GCS then guides it to follow a pre-programmed trajectory. Apart from its primary trajectory and impact point control task, it also provides the Range Safety Officer with excellent situational awareness data, as a complement to primary range safety systems.



The GCS



Fourth generation lightweight SPINRAC

## Control system features

- Very low impact dispersion
- High wind tolerance
- Self-Contained unit
- RCS/ACS software functions (SPINRAC, RACS) may be added
- Refurbishable
- Inertial trajectory or constant Attitude guidance
- Self-checking/ready to launch indicator
- Navigational and pointing data available for flight safety and scientific use.

## Cold gas thruster control

Our canard and thrust vector control systems also are designed with future expansion capabilities in mind. Thus, the control systems are flexible and additional sensors such as GPS and star sensors can be added, if your application so requires.

## Additional sensor input

RUAG Space has successfully built and flown stand-alone systems for control activities above the atmosphere, such as the RACS for payload attitude control and pointing, and the SPINRAC for impact point control of rockets with upper stages that burn outside the atmosphere. However, all of our canard and thrust vector control systems have data interfaces through which RACS and SPINRAC control commands may be channeled to a separate cold gas module. So, if an S19 or GCS type system is already part of your payload, a light weight - low cost addition of a cold gas module adds RACS and/or SPINRAC capabilities to your mission.

## Other Applications

Our flight proven systems can also fill the role of cost-effective solutions for Small Launch Vehicles and Military Target Applications.



An S19 family system with its electrical ground support equipment

## Technical support

RUAG Space also provides ground support equipment and services such as:

- Feasibility studies
- Preflight analysis
- Aerodynamic analysis
- Structural analysis
- Control analysis and design
- Test and integration support
- Launch support
- Postflight analysis
- Safety support systems

**Guidance systems from RUAG Space ensure high reliability and performance at low cost**