

## Pendulum Instruments Keeps The Galileo Project on Time



### Background

Pendulum Instruments has completed the first Factory Acceptance Test (FAT) of a Time and Frequency system for the European Galileo project. Completed successfully and two weeks earlier than originally promised, the system forms an essential part of the first Galileo Satellite Tracking, Telemetry and Control (TTCF) station.

The function of this station is to keep the Galileo satellites flying on the correct orbits and to enable engineers to control the navigation transmissions.

### The System Solution

The system supplied consists of two Pendulum 2804 GPS Master Clocks operating in a Master/Standby configuration. The 2804's are fitted with Rubidium atomic oscillators to give the time and frequency precision required for this application. To ensure that end user signals are ultra low noise, these are supplied by Pendulum Tracking oscillators TO-16, which are controlled by the super accurate Rubidium clocks. Many types of synchronization signals are needed by the mass of instruments and control systems in the TTCF station and these are provided by Pendulum 900 series modular distribution units. The station's computers are time synchronised by NTP time servers supplied as part of the T&F system.

### The Way to Success

The first TTCF station was installed by Indra Espacio S.A. of Madrid, Spain at the Galileo site in Kiruna, Sweden. Indra engineers came to our factory (former Rapco) to witness the successful FAT. Pendulum engineers had designed the system and specified the gruelling tests the system must pass before acceptance. Over two days the system was put through its paces before Indra announced their satisfaction.

A second system is already on order from Indra for another Galileo TTCF station to be installed at Kourou in French Guiana, and ultimately there will be three more stations required to give global coverage of satellites at all stages of their orbits.

### Why Pendulum Instruments?

The quality of the system proposal and the care and attention to questions from Indra showed Indra that Pendulum Instruments was the supplier to choose and made Pendulum Instruments win this important order.

This ability is recognised within Pendulum Instruments as very important in making our offers stand out from the competition, and will hopefully enable us to win more valuable order opportunities similar to these in the future.

*Success Story 13,  
 rev. 01 September 2008*

### Success Summary

- Based on the customer's requirements, Pendulum Instruments presented a full system solution
- The customer evaluated the system at Pendulum Instruments (former Rapco) factory in UK

### 2804 - GPS Master Clock

- A Precision Time and Frequency reference using the GPS satellite signals to discipline a high-stability, low-noise oscillator. Provides reference frequency, timing and time code outputs in a un-interrupted operation, even if GPS-signals are lost

### TO-16 - Tracking Oscillator

- A high quality Frequency Reference source that faithfully tracks the frequency accuracy of its reference input. Maintains excellent long-term and short-term stability

### 900-series - Modular Distribution System

- Distribution Amplifiers for local distribution of time code signals, 1-pps timing signals and sinewave reference frequency to multiple outputs, up to 30 per cabinet. Offers flexible configuration and mounting arrangements, ultra low noise and EMC profile