



## Radar test equipment for Sentinel-1

In the frame of the Global Monitoring for Environment and Security (GMES) programme, the European Space Agency is developing SENTINEL-1, a satellite carrying a C-Band Synthetic Aperture Radar, or SAR, designed and produced by EADS Astrium, to expand and enhance the data sets gathered by the successful ERS-1, ERS-2 and ENVISAT missions. This high resolution imaging radar depends not only on quality in design, but also stringent testing to ensure that it is successful in meeting its tight requirements.

As a result of the company's previous background in spacecraft test and in transponding systems, SEA has been awarded a contract to provide an Echo Simulator to test the SENTINEL-1 radar electronics as part of the overall Electrical Ground Support Equipment (EGSE), to be integrated by Siemens of Austria. This item is crucial in generating artificial targets to test the sensitive receivers of the radar instrument. Targets are generated by the Echo Simulator software and transmitted by a high quality Arbitrary Waveform Generator into the receiver directly, after the output of the Generator has been up-converted to the radar frequency of about 5400 megahertz. These targets can be synthetic simulations of the radar pulse repeated to form a line in the radar image, they can be more complex representations of a return from an area, or they can be generated from recordings of the pulses transmitted by the SENTINEL radar itself, made by the Radio Frequency Special Checkout Equipment (RF-SCOE).

The key aspect in testing spacecraft radar is the timing. Unlike conventional earth-based radars, one on a satellite operates at low power and long distances. To form an image the radar needs to sum the returns from a large number of pulses, more than could be received if the radar were to wait for the response from each pulse before transmitting the next. This radar operates ambiguously, that is several pulses are transmitted before the return from the first pulse is received. The Control Logic of the Echo Simulator must track the sequence of transmitted pulses so that the return is generated in correct timing relationship to the associated transmission, not the latest transmission received.