



Chilbolton Observatory



The Chilbolton Observatory 25m antenna

The Chilbolton Observatory in Hampshire is at the cutting-edge of world class atmospheric science, radar and radio research and astronomy.

Owned and operated by STFC, it is host to several facilities: the Chilbolton Facility for Atmospheric and Radio Research (CFARR), the Low Frequency Array Radio Telescope (LOFAR), the Met Office Upper Air Monitoring Facility, and the Space Monitoring Facility.

CFARR is one of the world's most advanced experimental meteorological remote sensing facilities. It is largely funded through the Natural Environment Research Council (NERC). The atmospheric research at Chilbolton helps scientists and meteorologists:

- understand how clouds form and develop into rain or storm clouds,
- understand the properties and impact of aerosols in the atmosphere.

- investigate the effects of cloud composition, such as ice particle shape and orientation, on the Earth's energy balance,

Scientists use CFARR's sophisticated RADAR (Radio Detection And Ranging), LIDAR (Light Detection And Ranging), and radiometer instruments to characterise the atmosphere by making detailed measurements of precipitation, cloud, aerosol particles and water vapour. These measurements are helping to improve the prediction of climate change and severe weather conditions. They also monitor how the atmosphere impacts upon radio communication systems.

One of the main research tools at the Observatory (and certainly the largest) is the 25m fully steerable antenna. The Chilbolton Advanced Meteorological Radar (CAMRa) is installed on this antenna and provides high resolution, long range measurements of all types of precipitation such as rain, snow and hail. Other research instruments on site include:

- cloud, rain and clear air radar systems
- Doppler lidar for measuring the boundary layer turbulence in the atmosphere
- high power UV lidar for measuring aerosol and water vapour profiles
- radiometers for profiling water vapour and atmospheric temperature
- disdrometers for measuring the drop size distribution of rain
- visible and infrared radiation sensors
- meteorological sensors

The Chilbolton Observatory provides a versatile site with excellent infrastructure for conducting field campaigns and hosting visiting instruments. Over recent years several such campaigns have been successfully based at the site.

The Space Monitoring Facility harnesses the power of the 25m antenna to track and characterize Earth orbiting satellites. It receives funding from various organisations including the UK Space Agency (UKSA), the European

The Science and Technology Facilities Council

Space Agency (ESA), and the International Space Innovation Centre (ISIC).

The 25m antenna is being used to conduct in orbit testing (IOT) of satellites. It can measure and evaluate transmissions from global navigation system satellites as they are tracked. It has been used for the in-orbit testing of ESA's GIOVE-A and GIOVE-B satellites. Engineers are tracking and collecting data necessary to assess the satellites' performance to ensure the success of Europe's first global satellite navigation system.

As part of ESA's Space Situational Awareness Preparatory Programme, the Chilbolton CAMRa system has been tasked as a space surveillance radar and has recently been used to track and characterise over 40 satellites in low-earth orbit out to 2500 km range. Targets with radar cross sections below 1 square metre have been successfully observed with the current system. Following these successful trials, modifications are planned to increase the radar's sensitivity by 100 fold – greatly extending its capability to track and detect micro-satellites and space-debris. This is essential information for satellite operators who need accurate orbit determination to predict collisions using conjunction analysis.

The Met Office Upper Air Monitoring Facility has been established on the site to make observations of rain, cloud and air turbulence at heights up to 10 km. They operate a wind profiling radar which transmits pulses of radio waves into the sky and analyzes the returned signals to calculate wind speed and direction profiles at different heights above the ground. This data is valuable for weather forecasting, especially of severe weather events and factors such as the dispersal of pollution.

LOFAR is a new radio telescope that was built on the observatory site in 2010. It uses a field of 192 static antennas, which can be combined to allow the telescope to look in several different directions at once and at frequencies between 30 and 240 MHz. It is operated on behalf of LOFAR-UK, a consortium of 22 UK academic institutions. In addition, it can be linked with other similar systems across Europe, as part of the International LOFAR Telescope, which is coordinated by the Dutch radio astronomy institute, ASTRON. Together this powerful facility will address fundamental questions like:

- What was the nature of the early Universe?
- When did the first stars start to burn?
- How does the Sun affect the Earth?
Can we find any transient or evolving radio objects?
- Are we alone in the Universe?



View of the LOFAR site at Chilbolton, with the Low Band Array (LBA) in the foreground

Contact: Darcy Ladd, Chilbolton Observatory Station Manager
T: +44 (0)1264 860391 E: darcy.ladd@stfc.ac.uk
<http://www.stfc.ac.uk/chilbolton>
For media enquiries please contact +44 (0)1235 445627