

The Canadian Spatial Reference System (CSRS)

The primary role of the Geodetic Survey Division (GSD) today is to maintain, continuously improve and facilitate efficient access to what is now known as the **Canadian Spatial Reference System (CSRS)**. The CSRS is a three-dimensional grid on which positions (latitude, longitude and height) of any object or feature can be precisely pinpointed. Grids are fundamental for mapping, marine charting, navigation, boundary demarcation, crustal deformation study and other georeferencing applications. The infrastructure that underlies a grid consists of a network of points whose coordinates are determined with the highest precision.

Geodetic networks traditionally consisted of control **monuments** distributed across our landmass for surveyors to occupy to access the geodetic grid and control their surveys. In the early 1980's, with the advent of the **Global Positioning System (GPS)**, geodetic control became accessible from **space** with great accuracy. GSD established the **Canadian Active Control System (CACS)** to continuously track GPS satellites and compute their precise orbits.

Left: GPS antenna on concrete pillar at ACP (Active Control Point)
Right: Typical ACP equipment (GPS receiver, atomic clock, computer and communication equipment).



The extension of the geodetic reference frame into space also brought along the requirement for monitoring the **Earth's orientation in space** which is provided by observations of quasars with **Very Long Baseline Interferometry (VLBI)**.



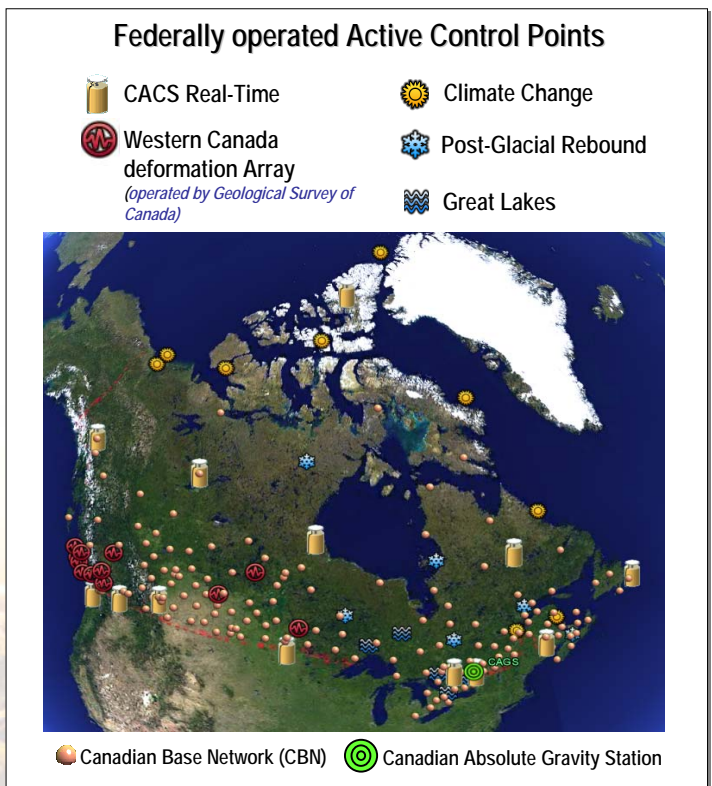
Algonquin Park radio-telescope

These activities marked GSD's entry into the space-age of precise geodetic positioning.

In the mid-1990's, a program to install and observe stable monuments, known as the **Canadian Base Network (CBN)**, was initiated. The CBN was deployed at 200 km spacing in southern Canada and 500 km up north, for multi-epoch high-accuracy GPS positioning.

Initial observations of the CBN revealed the presence of distortions of up to 2 metres in the original realisation of our national grid, the North-American Datum of 1983 (**NAD83**). Over the past decade, re-observation of the CBN network also confirmed that crustal motion of the order of a few millimetres per year horizontally and up to a couple of centimetres vertically is occurring Canada-wide. The CBN network also provides anchor points for the integration of denser **provincial high-precision networks**.

Several networks of Active Control Points have been added across Canada for various monitoring purposes. The CSRS is tied to the world gravity network with an Active Control Point (ACP) at the Canadian Absolute Gravity Station (CAGS)



Today, GSD supports users of space-based technologies, with a stable, although sparse ground infrastructure, precise orbit products, gravimetric geoid models and the tools to facilitate access to the Canadian Spatial Reference System.

