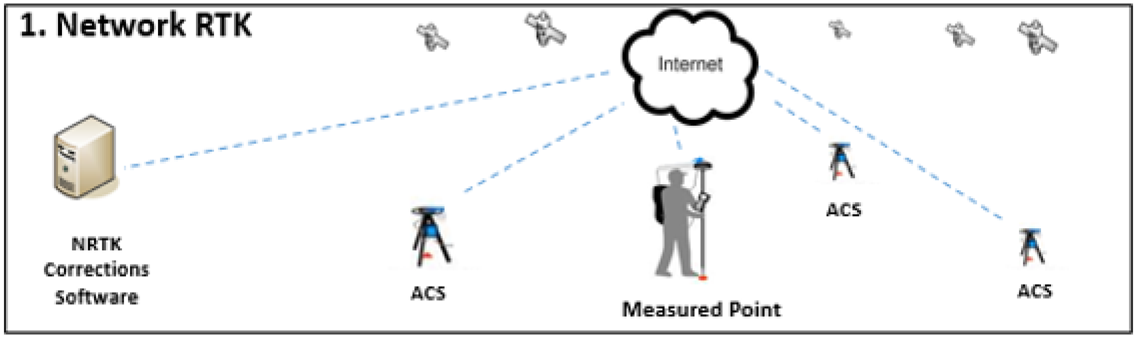
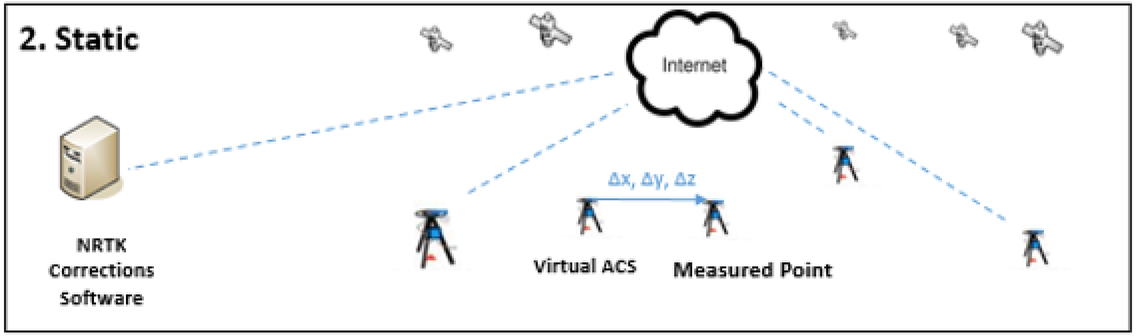
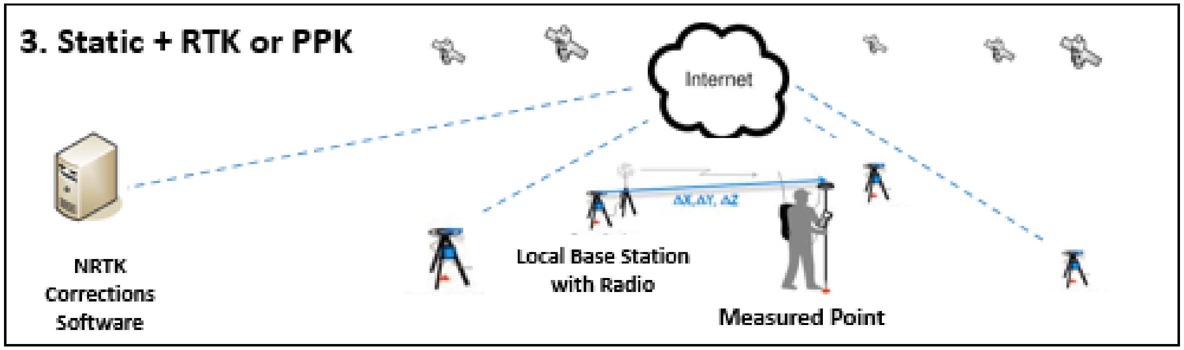
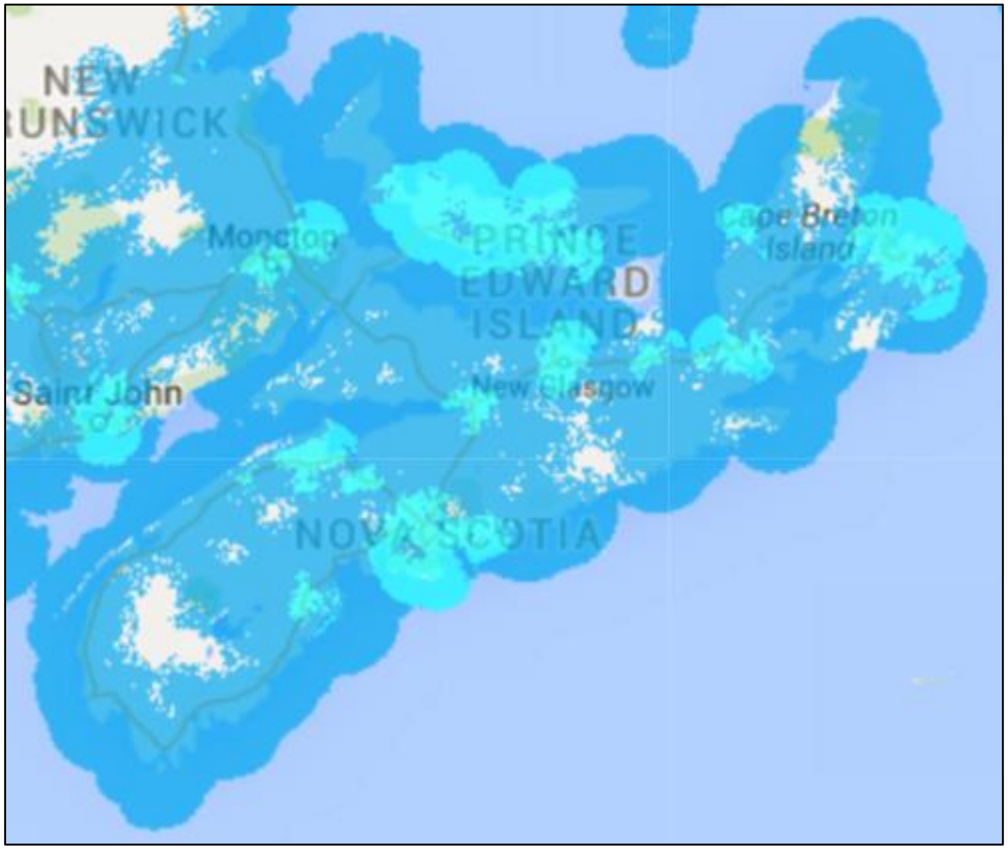
What is the Nova Scotia Active Control Stations (NSACS) network?	In 2012, a strategy was adopted to better address Nova Scotia's coordinate referencing mandates. At the core of the strategy were Global Navigation Satellite Systems (GNSS) and Active Control Stations (ACSs). This strategy lead to the installation of 40 permanent GNSS base stations across the province of Nova Scotia. This infrastructure was named the Nova Scotia Active Control Stations (NSACS) network. The 40 stations transmit data to a server which is then redistributed to service providers in Nova Scotia (see additional links). Based upon the real-time data and the location of a user in the field, the service providers can compute corrections which allow users to get centimeter level accuracy, positions in real-time. Corrections are distributed over the internet (e.g. cellular connection) through a service provider for a monthly fee. Post-processing data is also made available at no charge through NRCan (you must create an account and sign in to access data).
What does an ACS look like?	Each station consists of a survey monument (usually an antenna mast with a bolt at the top), GNSS receiver, choke antenna, uninterruptible power supply, lightning protection and other communications equipment. All sites currently use Trimble NetR9 receivers which track GPS, GLONASS, Galileo, QZSS, and COMPASS satellite constellations. A typical location for an ACS is on the side of a building so that the antenna can extend above a building's roofline and benefit from optimal satellite visibility.

	 
What accuracy can I get from using the Nova Scotia Active Control Stations (NSACS) network?	The 40 ACSs enable real-time kinematic (RTK), cm level accuracy for GNSS users in the Province. If a user is inside the polygon formed by the outer perimeter of the 40 ACSs, Network RTK accuracy is possible (0.5 mm / km error introduced from nearest reference station). Outside of the polygon, accuracy is dependent upon a single ACS (1 mm / km error). Up to millimeter level accuracy can be obtained in post processing, depending upon session length and location in the Province.
What are the benefits of using the Nova Scotia Active Control Stations (NSACS) network?	There are several benefits that a user gains from using the NSACSs network. The distance dependent error from the nearest reference station is cut in half. Additionally, the time to select and setup a reference station in a traditional RTK survey is eliminated which provides a significant time savings (approximately 1 hour per day is saved). The ACSs provide excellent satellite visibility and state of the art technology. This means that differential corrections are of very high quality.

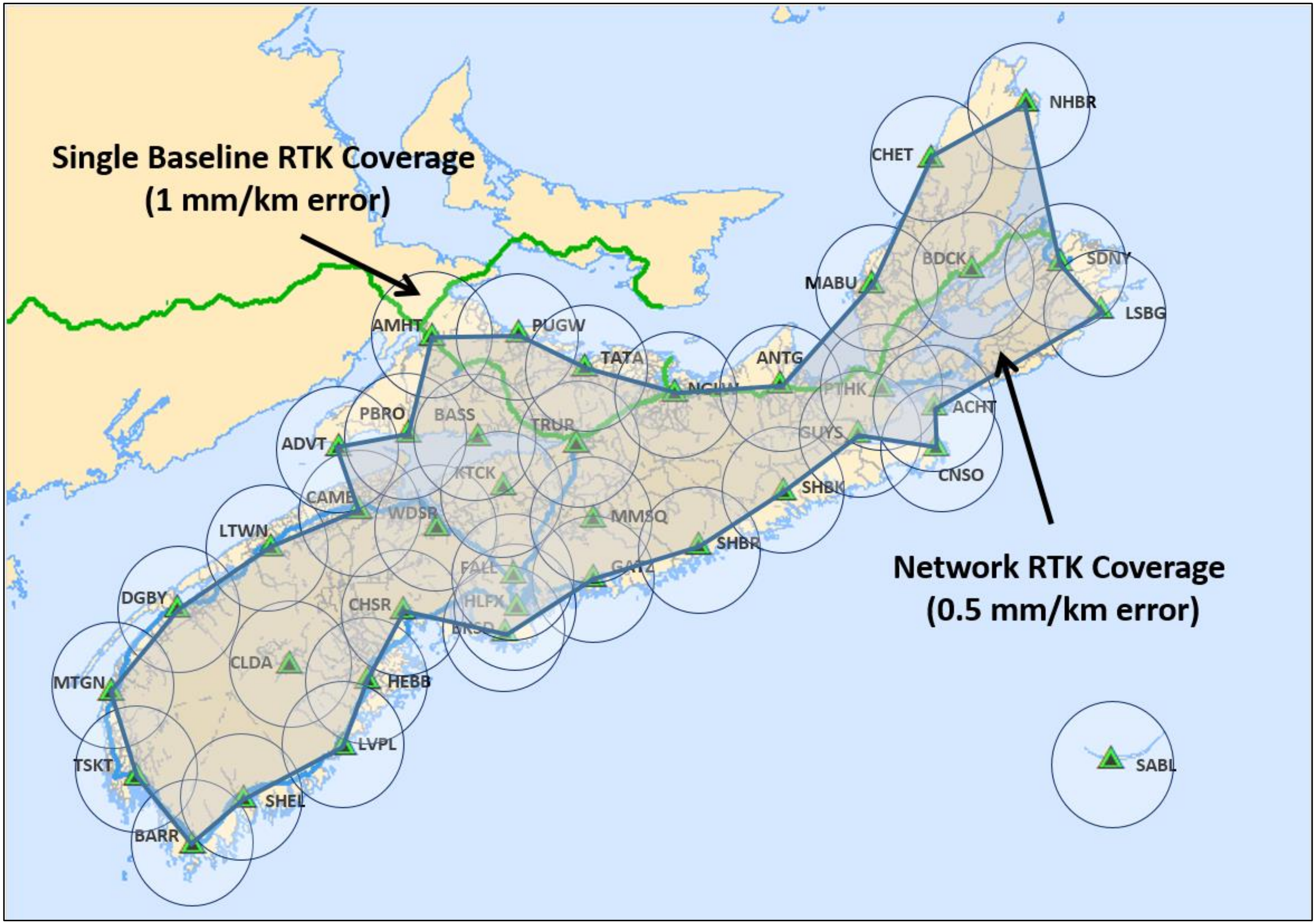
How can the Nova Scotia Active Control Stations (NSACS) network be used?	1. In the NRTK scenario, data from each ACS is streamed over the internet to a server which can calculate differential corrections. Users have a subscription which allows them to connect to the server while in the field. Based upon the user's position, a differential correction is calculated and transmitted to the user over the internet. If the user is not within the network polygon, the differential correction is based soley upon the nearest ACS. This method allows the user to operate with just a rover.  2. In the second scenario, the user is outside the cellular coverage region and cannot receive differential corrections in real-time. Data is logged in a static manner over a desired point which can be post-processed to calculate a single baseline solution. Alternatively, with a subscription to a service provider, the user can download data for a virtual reference station located at an arbitrary location near the measured point. The virtual reference station data is generated using the NSACS network data. The virtual reference station allows a high accuracy position to be calculated for the measured point with a short observation period (seconds to minutes) because baseline length is kept short. 

	3. In the third scenario, the user does not have access to NRTK services and employs a traditional reference station and rover station setup. In this case, the reference station can be deployed in a convenient location near the work site to perform an RTK survey. The reference station should be configured to log data so that its position can be precisely calculated relative to the nearest ACS. If accurate, real-time coordinates are required (e.g., for a stakeout survey), then the position of the base will need to be calculated relative to the nearest ACS using static post processing prior to conducting the RTK survey. This becomes a two-step process and, depending upon the situation, it may be preferable to find a nearby NSHPN to leverage existing coordinate values. If accurate coordinates are not immediately required (e.g., for a topographic survey), then data collection can occur without a radio and the entire survey can be post processed using appropriate software in post-processed kinematic (PPK) mode. A variant on this technique is to conduct a RTK survey using a radio and approximate coordinates at the local reference station. The survey can be later shifted by assigning accurate coordinates for the reference station once they are calculated. The advantage of using a radio is that there is less chance of not being aware of unresolved ambiguities on points observed in kinematic mode which would only otherwise show up in post processing. The local reference station helps to ensure that distances to the roving station are kept short so that ambiguities can be resolved. If the work site is within a few kilometers of an ACS and a radio is not in use, it may not be advantageous to establish a local reference station since the kinematic data can be post processed relative to the ACS directly. 
Related Technical Support Documents:	

Useful Links:	Data Service Providers - https://geonova.novascotia.ca/sites/default/files/GNSS-NRTK-Service-Providers.pdf Canadian Active Control System - http://www.nrcan.gc.ca/earth-sciences/geomatics/geodetic-reference-systems/9052#cacs
Illustrations:	



Example cellular coverage in Nova Scotia through Bell



Location of NSACS and NRTK Coverage (Circles are 25 km in radius and represent the region for Single Baseline RTK)