REPLACING CANADA'S UPPER AIR OBSERVING NETWORK

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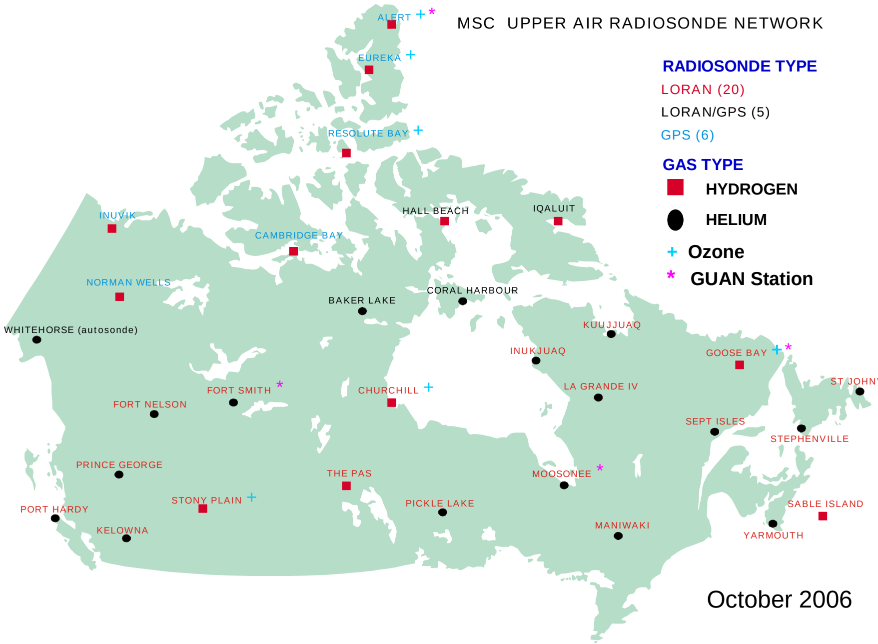
Abstract

Canada operates a network of 31 upper air observing stations. The equipment used at these sites is approaching the end of its operational life. Consequently, the Meteorological Service of Canada (MSC) is in the process of procuring replacement hydrogen generators, ground processing equipment and radiosondes to meet its operational needs for the next 10 or more years. This paper will describe MSC's existing aerological network, identify operational issues and discuss progress and plans to replace its obsolete equipment. The paper will also provide some information on other technologies being considered to obtain atmospheric soundings.

Background

The MSC presently operates a network of 31 upper air stations which use Vaisala MW15 DigiCORA II ground equipment and RS92 radiosondes. The equipment was installed in the early and mid 1990's and utilizes LORAN-C and GPS navaid wind finding techniques. Although the equipment was recently upgraded to permit use of RS92 radiosondes when it was learned that Vaisala was ceasing the manufacture of its RS80 radiosondes, major components are obsolete and for this reason, action is underway to replace the radiosonde network.

The following map shows the current operational sites in the Canadian upper air network and provides details on their configuration.



Procurement Strategy
MSC is in the process of establishing a ten-year contract for the supply of ground systems, radiosondes, and vendor support. While there are risks associated with budget uncertainty, technological change, and evolving user requirements, these are felt to be manageable through the use of options rather than firm commitments, particularly in the later years of the contract. Furthermore, this approach eliminates the need to carry out sole-source procurements of radiosondes when a normal 3-5 year contract would expire and will maximize the use of competition to get the best overall pricing. This especially applies to the costs of radiosondes which will account for most of the network life-cycle costs estimated to be in excess of forty million Canadian dollars during the 10 year period of the contract

Six Step Procurement Process

1. ***Requirements specification***

The overall radiosonde system performance specifications were determined in consultation with various users to ensure that operational requirements were not compromised. To a large extent these are consistent with the WMO (World Meteorological Organization) Guide to Instruments and Methods of Observation (see Table 1, below). Accuracy requirements for temperature, relative humidity, atmospheric pressure, and altitude are expressed at the 2-Sigma confidence level. Accuracy requirements for wind data are expressed as a vector Root Mean Square (RMS) value.

DATA PARAMETER	RANGE	QUALIFIER	ACCURACY	RESPONSE TIME
Temperature	+40C to -90C	Sfc to 100 hPa	0.5°C	0.5 s
		100 to 30 hPa	0.5°C	1.0 s
		30 to 3 hPa	0.7°C	3.0 s
Relative Humidity	0 to 100%	1000 hPa and +20.0°C	6%	2 s
		1000 hPa and -40.0°C	6%	20 s
Pressure (where measured)	1050 to 3 hPa	Sfc to 100 hPa	1.5 hPa	n/a
		100 to 3 hPa	0.6 hPa	n/a
Geopotential height (where measured)	n/a		30 m	n/a
Wind velocity	n/a	GPS derived	0.3 m/s	n/a
		Loran derived	0.7 m/s	n/a
		RDF derived	1.5 m/s	n/a
Ozonesonde interface	0 to 10 µA	Digital conversion of sensor data	.02 µA	10 s
	-10°C to +50°C	Internal temperature	0.2°C	n/a

Table 1 – Requirements for Accuracy, Range, and Response Time

2. ***Letter of Intent***

The above specifications along with other operational requirements unique to MSC, possible options and a proposed bid evaluation scheme were published on the PWGSC (Public Works and Government Services of Canada) MERX web site where potential suppliers were advised of our intent to procure upper air systems and details of how we proposed to conduct this procurement. This gave potential bidders a "heads up" notification of our plans and allowed them to review all the documentation and provide comments prior to our finalizing a formal Request for Proposals.

3. ***RFP***

Based on comments received, a final RFP (Request For Proposals) was prepared and again posted on MERX. This RFP included provision for a bidders conference where MSC and PWGSC representatives briefed interested bidders on what was expected and provided clarification where requested. This ensured that interested bidders fully understood what was expected before submitting their bids. It was emphasized that the requirements and specifications were from a functional perspective and that rather than carrying out an expensive pre-qualification process, MSC required vendors to provide documented proof that their system would meet the stated specifications. In addition to internal test results from the company, bidders were to provide additional results from independent third-party testing. Acceptable examples include the WMO radiosonde intercomparison carried out in Mauritius in 2005 (this is the most significant document being used) , qualification testing by the National Weather Service and testing carried out by other respected national meteorological services such as UK Met and Météo-France.

4. ***Technical Evaluation***

Bids received are then evaluated for technical compliance by an MSC committee of experts. It should be noted that the committee does not have access to any of the financial costing provided as this is removed from the bid packages by PWGSC to ensure that it does not bias the technical evaluation. This phase identifies bids as compliant or non-compliant based on technical merit only.

5. ***Life cycle costing***

A 10 year life-cycle cost is then calculated for the technically compliant bids using costs previously identified by the vendors and the bids ranked in order of lowest cost.

6. ***Proof of Performance***

The lowest cost bidder installs two ground systems and provides a quantity of radiosondes for MSC Proof of Performance (PoP) testing at its Stony Plain upper air station and training facility. This testing will last up to 30 days and involves dual flights with Vaisala RS92 radiosondes presently being used to assess operational comparability. An engineering design assessment is also included in this process. The final step in the PoP entails a full end-to-end test where output messages are communicated from the station through the MSC telecommunications network to end users within Environment Canada to ensure that there are no issues with existing processing and display software. If the equipment passes this proof of performance tests the vendor will be selected for contract award. If it fails, the process will be repeated with the next lowest technically qualified bidder.

Comments

1. Radiosonde radio direction finding systems were not considered due to:
    - Limiting angles (a climatological study indicated that too many flights would go over the horizon and consequently would not report data to the required altitude.
    - Accuracy (did not meet operational requirements)
    - Additional infrastructure, training and maintenance costs

2. The majority of MSC upper air stations (~75%) presently use LORAN-C for wind-finding. Because the cost of LORAN-C radiosondes is considerably lower than the present cost of GPS radiosondes MSC specified this as an option. However, recognizing the uncertainty of the long term viability of LORAN-C, bidders including this in their proposals were expected to cover the cost of upgrading ground equipment to GPS capability if necessary.
3. The RFP has flexibility to permit manufacturers to identify and cost different options; this also involves maintenance and sparing strategy for the expected life of their system.
4. The 10 year firm requirement is for 35 ground processing systems and 150,000 radiosondes.
5. An optional 20 additional ground systems and 100,000 radiosondes were specified and will be part of the costing evaluation.
6. Special contracting approval was required due to the ten year duration of the proposed contract and the potential overall cost (~ $40 Million Canadian).
7. For ease of comparison, all costing was to be provided in American dollars and the resulting contract will reflect payment in American dollars also.

Status of Procurement

At the time of writing this paper (October 2006), bids have been received and were being evaluated for technical compliance. A financial evaluation will follow with proof of performance testing expected to commence early in the 2007 calendar year. A contract award is anticipated by the summer of 2007 followed by implementation of the replacement systems within a two year period.

Other Upper Air Technologies

The MSC is also heavily involved in an expanding AMDAR program to obtain upper air soundings and meteorological information from aircraft and is also investigating the use of GPS Meteorology to obtain atmospheric profiles.

Hydrogen Generators

Hydrogen is used as the lifting gas at 12 of the 31 MSC radiosonde stations. This gas is presently being produced using electrolizers which are nearing the end of their operational life and which also pose some health and safety hazards. The Proton Energy System Limited, model Hogen 40 hydrogen generator has been identified to replace these electrolyzers. One unit has been installed at our Stony Plain upper air facility near Edmonton Alberta in order familiarize ourselves with its operation and to further develop installation and operator procedures. Electrolizer replacement is expected to be completed within the next three years. Issues presently being investigated involve a hydrogen storage tank suitable for use in the cold arctic environment and ensuring that the ventilation requirement for the Hogen generator is satisfied and resolving some Canadian building codes associated with explosive gases.

Acknowledgement

The MSC gratefully acknowledges the work of Dr. John Nash and his expert team which conducted the Intercomparison of High Quality Radiosondes in Mauritius in 2005. The results of this intercomparison and the advice provided by Dr. Nash were critical in the development of MSC's radiosonde replacement procurement initiative.