

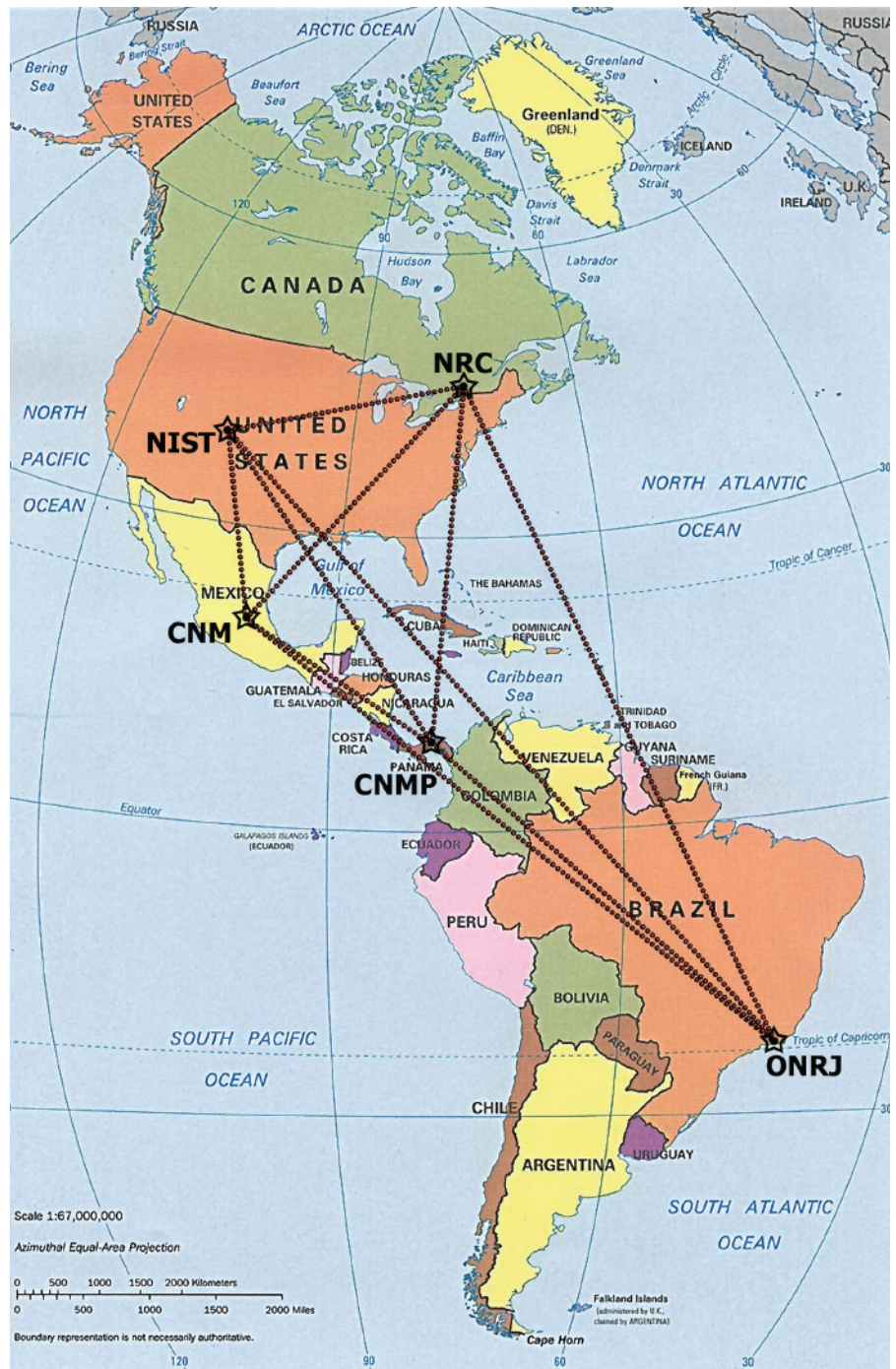
SIM Network Improves Time Coordination

International time coordination is improving throughout the Americas thanks to a low-cost network relying on Global Positioning System (GPS) satellites and the Internet, which enables much faster time comparisons and gives small countries the opportunity to easily evaluate their measurements in relation to others and to world standards.

The time and frequency network of the Sistema Interamericano de Metrologia (SIM), began operation in 2005. SIM consists of national metrology institutes located in member nations of the Organization of American States (OAS). The SIM network currently has seven members, including the national metrology institute (NMIs) of Brazil, Canada, Colombia, Costa Rica, Mexico, Panama and the United States. Other NMIs from countries including Argentina, Guatemala, Jamaica, Paraguay, Peru, and Uruguay, have expressed interest in joining the network, and are expected to be added soon. As shown in the illustration, SIM covers a large geographic region, and the distance between some NMIs exceeds 9000 km. Even so, time standards can still be nearly instantaneously compared through the use of GPS and the Internet.

As the U.S. civilian timekeeper, the National Institute of Standards and Technology (NIST) participates in the SIM network and also calibrates other members' equipment, which consists of a computer-based measurement system and a GPS receiver provided by OAS. Institutes simultaneously compare their time scales to clocks on the same GPS satellites, and then automatically compare their results over the Internet. Time differences can be viewed on the Web by all laboratories in the network, with updates every 10 minutes. A recent report on the SIM network showed that the NMIs of Canada, Mexico, and the United States kept time within 50 nanoseconds of each other for an eight-month period in 2006.² The measurement uncertainty of the network is estimated at 15 nanoseconds ($k = 2$).

²M.A. Lombardi, A.N. Novick, J.M. Lopez, J. Boulanger and C. Donado, "Time coordination throughout the Americas via the SIM common-view GPS network," *30th Annual Precise Time and Time Interval Meeting*, Reston, VA, Dec. 5-7, 2006.



The SIM time and frequency network spans a large geographical area. The baseline from NIST to the Brazilian NMI is about 9500 km.

The SIM network boosts the stature and capabilities of small national metrology institutes, which cannot establish traceability to fundamental measurement units until they make international comparisons. Larger laboratories also benefit because they can see their comparison results in near real-time, instead of waiting several weeks or more for data to be processed, as they were often required to do in the past.

For more information, contact Michael Lombardi, NIST, lombardi@nist.gov.