The Global Communications Infrastructure

The Global Communications Infrastructure has two principal functions. First, it is designed to transport raw data from the 337 facilities of the International Monitoring System in near real time to the International Data Centre in Vienna for processing and analysis. It then distributes the analysed data to States Signatories along with reports relevant to verification of compliance with the Treaty. Increasingly, the GCI is also being used as a means for the Commission and station operators to monitor and control IMS stations remotely.

Operation of the current, second generation GCI began in 2007, under a new contractor. This replaced the first generation GCI, which began provisional operation in mid-1999. Using a combination of satellite and terrestrial communication links, this global network enables the exchange of data by IMS facilities and States around the world with the Commission. The satellite communication links of the GCI are required to operate with 99.5% availability and its terrestrial communication links with 99.95% availability. The GCI is required to send data from transmitter to receiver within seconds. It uses digital signatures and keys to ensure that the transmitted data are authentic and have not been tampered with.

Highlights in 2014

GCI availability maintained above 99.5%

Nearly 39 gigabytes of data and products transmitted per day

Teleports and terrestrial circuits migrated and consolidated
IMS facilities and States Signatories can exchange data through one of six geostationary satellites via their local earth stations fitted with a very small aperture terminal (VSAT). The six satellites cover all parts of the world other than those near the North and South Poles: three cover the Pacific, Atlantic and Indian Oceans and three focus on the North Pacific (Japan), North and Central America, and Europe and the Middle East. The satellites route the transmissions to hubs on the ground and the data are then sent to the IDC by terrestrial links. Complementing this network, independent subnetworks employ a variety of communications technologies to carry data from IMS facilities to a communications node connected to the GCI, from where the data are routed to the IDC.

A virtual private network (VPN) uses existing telecommunications networks to transmit data privately. Most of the VPNs for the GCI use the basic public infrastructure of the Internet together with a variety of specialized protocols to support secure encrypted communications. In situations where VSATs are still not in use or not operational, VPNs provide an alternative means of communication. VPNs are also used at some sites to provide a backup communication

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**Technology**

Top: The footprints of the six geostationary satellites of the GCI
Middle: Communications equipment at infrasound station IS49, Tristan da Cunha, United Kingdom.
Bottom: Communications equipment at auxiliary seismic station AS110, Kodiak Island, Alaska, United States of America
link in case of failure of a VSAT or terrestrial link. For National Data Centres (NDCs) with a viable Internet infrastructure, a VPN is the recommended medium for receiving data and products from the IDC.

At the end of 2014 the GCI network included 217 VSAT stations (of which 26 had backup VPN links), 32 stand-alone VPN links, 5 independent subnetworks on terrestrial links using multiprotocol label switching (MPLS), a terrestrial MPLS link for US stations located in Antarctica, 3 satellite teleports (in Denmark, Norway and the USA) for the 6 geostationary satellites, and a network operations centre in Maryland, USA. All of these are managed by the GCI contractor. In addition, a total of 68 independent subnetwork links and 6 Antarctic communication links are operated by 10 States Signatories to carry IMS data to a GCI connection point. In all, the combined networks have nearly 330 different communication links to transport data to and from the IDC.

Expanding the Infrastructure

The use of the Internet in a secure manner to transport IMS data and IDC products continued in 2014. NDCs typically receive data and products in this way. While the installations slowed down somewhat due to a lack of personnel, it was still possible to deliver equipment to six NDC sites. The installations will be completed in 2015.

Operations

The Commission measures the compliance of the GCI contractor against the operational target of 99.5% availability in one year using a rolling 12 month adjusted availability figure. In 2014 this was above 99.5% in each month until November. The rolling 12 month actual availability, which is a measure of the raw uptime of each GCI link over one year, was about 1.8% lower than the adjusted availability. Over the year, there was a slight increase in the traffic transported over the GCI from IMS facilities to the IDC and from the IDC to NDCs to an aggregate of 29 gigabytes per day. In addition, data sent to NDCs that are directly connected to the IDC increased by 12%, to 9.8 gigabytes per day.

In 2014 the Commission made preparations to restore the communications for station AS112 on the island of Shemya, USA. In order to speed up the process, the initial solution will use an encrypted link over the Internet. A VSAT will subsequently be added to the site in a dual path mode. The GCI antennas (dual VSAT site) on Tristan da Cunha, which suffered damage to its radome in 2013, were replaced by high wind antennae.

The 2014 Integrated Field Exercise (IFE) used a primary telecommunications service known as GCI II. During the exercise, the light antenna GATR terminal provided the main link between the base of operations in Jordan and the Operations Support Centre (OSC) in Austria, for both data and voice communication.
Part of the VSAT service moved to a new teleport in 2014 in conjunction with an extensive modernization of the terrestrial backbone infrastructure link to the IDC. The satellites covering Europe and the Middle East and the Atlantic Ocean were migrated to a teleport at Blåvand, Denmark, from teleports in Norway and the USA, respectively. This major restructuring of the GCI network is intended to improve the reliability of GCI services at no cost to the PTS. The restructuring will be completed in 2015.