

# 4-4 WINDS Network Data Gathering System

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WINDS network data gathering system is received the several kinds of network data such as the telemetry from the satellite, the network configuration data, and so on. Those data are sent from the WINDS network management center in JAXA Tsukuba Space Center through the leased line. WINDS network data gathering system has several functions, such as a display function of the trend graph, data search function, and so on.

## *Keywords*

WINDS, Network Management Center, Telemetry, Network monitoring information

## 1 Introduction

The network data-gathering system is designed to receive and process telemetry, network monitoring information, and Network Management Center (NMC) information at the Kashima earth station in the Wideband Inter-Networking Engineering Test and Demonstration Satellite (WINDS) experiments.

In the WINDS project, the Japan Aerospace Exploration Agency (JAXA) has sole responsibility for command operations from the tracking and control station using the S-band; the National Institute of Information and Communications Technology (NICT) is not involved in this area. Satellite telemetry is also received at the tracking and control station via the S-band, and a portion of mission-related telemetry is transmitted to the WINDS NMC.

The WINDS satellite does not receive commands for IF switch settings for each time slot, reception rate settings, or Active Phased Array Antenna (APAA) settings. Instead, these items are set from the NMC via the network control link using the Ka-band. This network control link is also operated solely by JAXA. Status information for the devices set through the network monitoring link is down-

linked to the WINDS NMC via the Ka-band as in the context of network monitoring.

In addition, the Permanent Virtual Circuit (PVC) table of the onboard switch (ATM Baseband Switch, or ABS) is transmitted to the ABS via communication link in the Ka-band, while ABS maintenance and management information is downlinked to the WINDS NMC via the Ka-band communication link.

Accordingly, setting information related to the WINDS satellite communication network (including satellite telemetry, network monitoring information, the reference burst for regenerative mode, and ABS maintenance and management information) are gathered in the WINDS NMC by way of the tracking and control station, network monitoring link, or the communication link.

The network data-gathering system is designed to receive the diverse information gathered in the WINDS NMC at the Kashima Space Research Center (KSRC) via a leased line. This article describes the configuration and the functions of the network data-gathering system and the data collected by this system.

## 2 System configuration

The network data-gathering system is installed in the satellite communication experiment building at the KSRC, site of the WINDS Large-scale Earth Terminal. Figure 1 shows the configuration of the network data-gathering system.

The network data-gathering system receives a range of information via a leased line: satellite telemetry, network monitoring information, and NMC data gathered in the WINDS NMC at the JAXA Tsukuba Space Center.

The information collected in the WINDS NMC is stored in files classified according to the type of information and the time the information was generated. A file is also created to manage the information stored in each file.

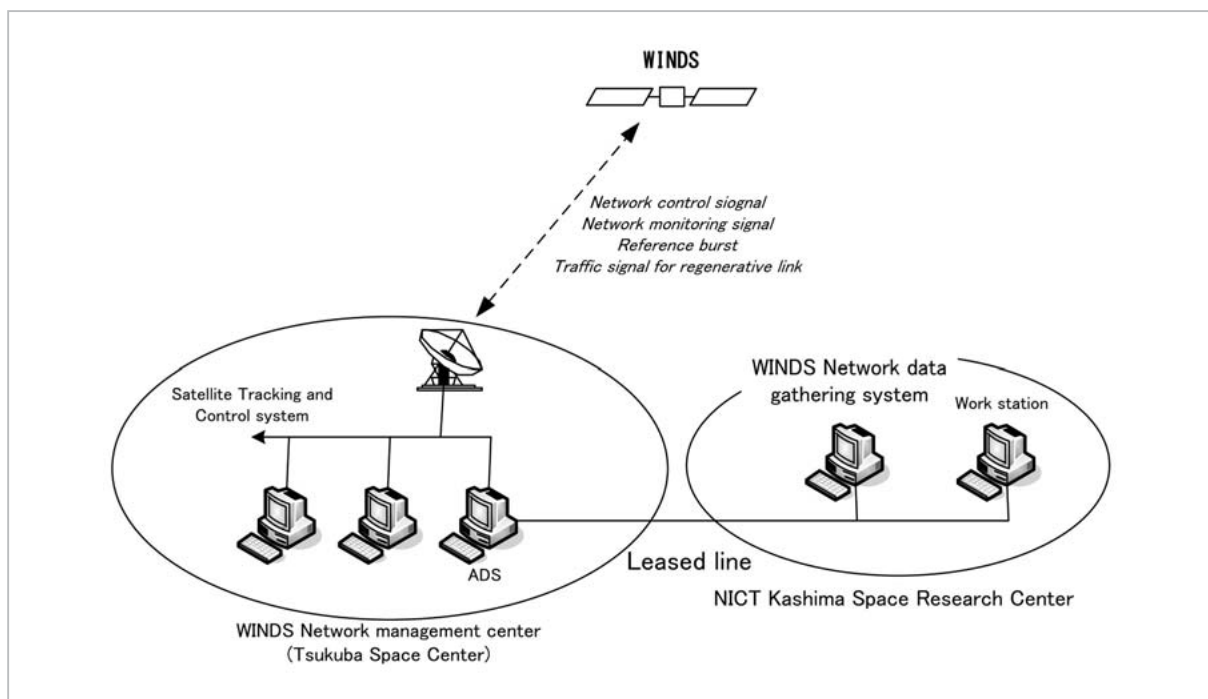
The network data-gathering system refers to this information management file to request the required data, which the system then receives. Thus, the data are not delivered in real time but instead incorporate a delay of several minutes at maximum.

## 3 Delivered information

In WINDS, the tracking and control system controls items related to controlling and monitoring the satellite (including on/off operation of the devices, temperature, and control and monitoring of waveguide switches). Among these items, telemetry related to mission devices (with some exceptions) is transmitted from the tracking and control system to the NMC.

Further, the NMC controls items related to the communications network settings (including IF switching in the TDMA time slot, gain control, and transmission rate) via the network control link using the Ka band. The NMC then directly receives status details (i.e., network monitoring information).

In addition, the association messages and the  $C/N_0$  margin notification from user stations are transmitted and received to and from WINDS via the communication link. These items of information are gathered in the NMC. Table 1 lists some of the types of data the network data-gathering system is designed to receive. Items 1 through 5 in Table 1 are received in quasi-real time as soon as the cor-



**Fig. 1** Configuration of network data-gathering system

**Table 1** Data delivered from WINDS NMC

	Information	description
1	Telemetry	Status of satellite transponder
2	Satellite network information	Setting information of satellite network
3	Referene burst information for regenerative link	ABS mode, congestion standing of ABS, carrier / unique word detection status at ABS, orbit information
4	Communication data between NMC and ABS	Association data from user terminal, answer of association, PVC connection data
5	ATMS statistics data	Number of pass cells, number of rejection cells
6	Command history	Commnad history for satellite transponder
7	Netrowk control history	Control history of satellite network
8	ABS management data	Memory dump, SEU data, fault notification
9	NMC status	Equipment status of NMC

responding files are generated in the WINDS NMC. These items mainly concern telemetry, including items relating to the onboard ABS developed by NICT and general network monitoring information. Items 6 through 9 are acquired later as required upon request. We expect that the leased link connecting the WINDS NMC and the network data-gathering system will require a capacity of approximately 10 Mbps.

## 4 Functions

The network data-gathering system is designed to receive a variety of data delivered from the WINDS NMC and is equipped with the functions listed below.

(1) Reception of the required data delivered from WINDS NMC

(2) Conversion of raw data for engineering-value compatibility

To limit the volume of data delivered from the WINDS NMC, several types of data are received as raw data, and the network data-gathering system performs conversion to an engineering-value format. We use the same conversion table as that employed by the WINDS NMC to enable us to manage any upgrades or modifications.

(3) Display of trend graph from the acquired data

To facilitate the understanding of satellite

conditions, the specified items are displayed as trend graphs.

(4) Acquisition, promptly after recovery, of data that failed to be gathered during failures in the link between the WINDS NMC and the network data-gathering system

Even when the leased line between the WINDS NMC and the network data-gathering system is disconnected due to link failures or other causes, the uncollected data are acquired from the WINDS NMC promptly after recovery of the link, to ensure that required data are not lost.

(5) Temporary data storage

The network data-gathering system is not intended for storing data. However, data is stored for a period to enable use in data analyses.

The period during which the data are stored differs among the items in Table 1. This period extends for approximately one month for items 1, 2, 7, and 9 and the receiving C/N<sub>0</sub> margin transmitted from the user station (listed within Item 4), and for eight days with respect to remaining items.

(6) Data retrieval according to time period and item; display of results as a graph or in other form

(7) Storage of specified data in CSV format

The operator can store data for a specified item and period in CSV format to allow the data to be processed using software prepared by the user.

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## 5 Conclusions

This article describes the WINDS network data-gathering system. This system is designed to receive data concerning the WINDS communication network from the WINDS NMC.



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