# QUASI REAL-TIME POSITIONING OF SPACECRAFTS USING THE INTERNET VLBI SYSTEM

T. Kondo, Y. Koyama, R. Ichikawa, M. Sekido , and H. Osaki
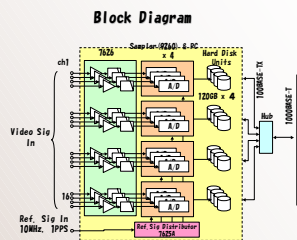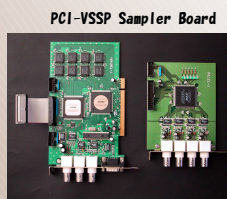### Communications Research Laboratory

CRL

We started the development of technique to determine spacecraft's position in quasi real-time using the Internet-VLBI system in collaboration with the Institute of Space and Astronautical Science (ISAS). A series of VLBI observations receiving Japanese spacecraft GEOTAIL and NOZOMI have been carried out since June 2002 to establish an observation method and to evaluate the measurement accuracy. At present it is possible to obtain the delay time which is a VLBI observable to use for satellite positioning within several hours after observations. Orbital determination software is under development in parallel to the improvement of observation data processing software. Phase delay measurements are also tried to increase the accuracy of measurement.

Delta VLBI Observation   Real-time or quasi Real-time correlation   Positioning
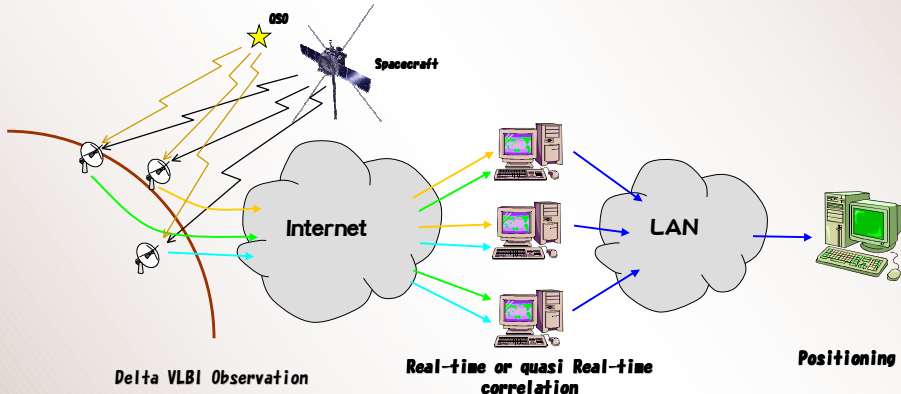
"NOZOMI" VLBI Observation Antennas in Japan

Tomakomai, Mizusawa, Usuda, Gifu, Yamaguchi, Koganei, Kashima

Internet VLBI System
K5-VSSP(Versatile Scientific Sampling Processor)

Block Diagram

PCI-VSSP Sampler Board

Characteristics of K5-VSSP

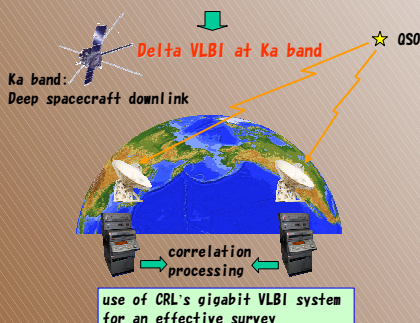| Item	Characteristic
Reference signals	10MHz (+10dBm), 1PPS
Number of input channels	16
Low pass filter	4MHz / 8MHz (in a video amp)
Sampling frequency	40kHz, 100kHz, 200kHz, 500kHz 1MHz, 2MHz, 4MHz, 8MHz, 16MHz
A/D resolution (bit)	1, 2, 4, 8
Hard disk drives	120GB (minimum)/ch total > 1.92TB
Maximum sampled data rate	256Mbps
Real-time VLBI	will be supported
Typical sampling mode	16ch x 4Mbps 16ch x 8Mbps 16ch x 16Mbps
Cost	42,000 US$ (without video amp)
VSI out	will be supported in the future

Prototype

Fringes for Various Kinds of Telemetry Mode
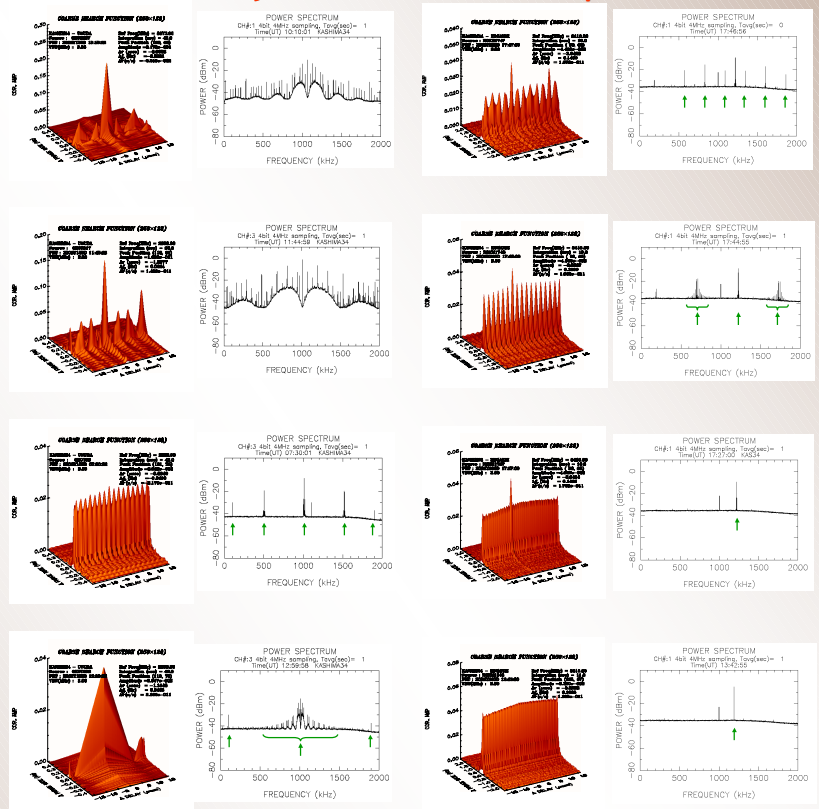
Near Future Plan (soon this year)

Refference Source Survey at Ka (32GHz) band with JPL

Delta VLBI at Ka band

Ka band:
Deep spacecraft downlink

QSO

correlation processing

use of CRL's gigabit VLBI system for an effective survey

An Evaluation of Measurement Accuracy

Fringes for QSO

Closure Test

CRL