Paper presented at the 22nd Asian Conference on Remote Sensing, 5 - 9 November 2001, Singapore.

EXPERIENCES IN REMOTE SENSING DATA PROCESSING SYSTEMS

Sanondh Brahmaphalin[1] and Somkid Chotchuang[2]
[1]Scientist, [2]Specialist, Thailand Ground Receiving Station, Space Technology Center
Geo-Informatics and Space Technology Development Agency
165 Chalongkrung Rd., Ladkrabang, Bangkok 10520
THAILAND

KEY WORDS: Remote Sensing, Data Processing, GISTDA, Ground Receiving Station

ABSTRACT: The trend of sensor development in terms of spatial resolution is currently of interest to the remote sensing professionals. It is expected that more information is likely to be extracted from high resolution images. Based on current standard, imageries received from LANDSAT, IRS, and RADARSAT in some specific product-levels can be considered as medium-to-high resolution satellite data. It has been known that precision of satellite imageries highly depends on the data processing quality. It would then be beneficial for users to understand data processing procedures. This article describes the data processing and production systems of the ground receiving station of Thailand. This station is recently capable to acquire and process data from several major earth observation satellites such as LANDSAT, RADARSAT, and IRS. Experience in handling Microimage Quicklook Subsystem and Geocoded Image Correction Subsystem, including some trouble shooting techniques will be discussed. Microimage Quicklook Subsystem typically is the front-end data handling and pre-processing system for images from individual satellites. It provides a quick-look display and generates browse images from sensors. On the other hand, the Geocoded Image Correction Subsystem is responsible for effectively generating products obtained from Remote Sensing Satellites. With these facilities and other high technology equipment, this station can deliver a wide range of digital and photographic image products from the downlink data to the users in various disciplines. This sophisticated station is being managed and operated entirely by GISTDA scientists, engineers, and technicians. The end products generated by this station are therefore have a high geometric and radiometric quality. Current status and the future plans of the Ground Station will also be included in the paper.

1. INTRODUCTION

Geo-Informatics and Space Technology Development Agency (GISTDA) is the only public organization in Thailand which is responsible for geo-informatics and all space technology development activities. At present GISTDA receives the archived data from Earth Observation Satellites such as LANDSAT, IRS, and RADARSAT by the use of Remote sensing systems. The system is expected to be used extensively, in the future, for transferring information across the country. Therefore recognizes the development of these technology and manipulate of their applications are very beneficial. Also for users, understanding data processing procedures is necessary, as the precision of satellite imageries product highly depends on the data processing quality. This article describes and discusses mainly about the data processing and production systems of Thailand Ground Receiving Station, including experiences in handling the quick-look browsing systems, Data Processing Systems, and some trouble shooting techniques.

2. BACKGROUND OF THE ORGANIZATION AND GROUND STATION

Thailand National Remote Sensing Program anticipated United States NASA LANDSAT Program since July 1972. In May 1979, Remote Sensing Division under National Research Council of Thailand (NRCT) has been established and internationally known as Thailand Remote Sensing Center (TRSC). Subsequently, the LANDSAT data was first acquired in 1982 by the Ground Receiving Station, which was also upgraded to receive high resolution data from several satellites in 1987. In November 2000, a new public organization, Geo-Informatics and Space Technology Development Agency (GISTDA) was officially established by combining TRSC and GIS Coordinating and Promotion Section. GISTDA enhances all functions in remote sensing and GIS services, and responses to geo-informatics and all space technology development activities of the country. At this point in time, Thailand Ground Receiving Station under GISTDA, acquires data from Radarsat-1, IRS-1C, IRS-1D, Landsat 5-TM, and in the near future it is going to acquire the data from Landsat 7-ETM.

3. SYSTEM OVERVIEW

Overview of Thailand Ground Receiving Station system is illustrated in Figure 1, Data Acquisition System (DAS) acquired high resolution downlink archive data, which was transmitted through 9 meters antenna from the satellites. This output bit-synchronized data has to be process through the Recording System and Playback System using

electromagnetic induction principal. After that the formatted data is required to process through the Data Processing System before distributed to the users.

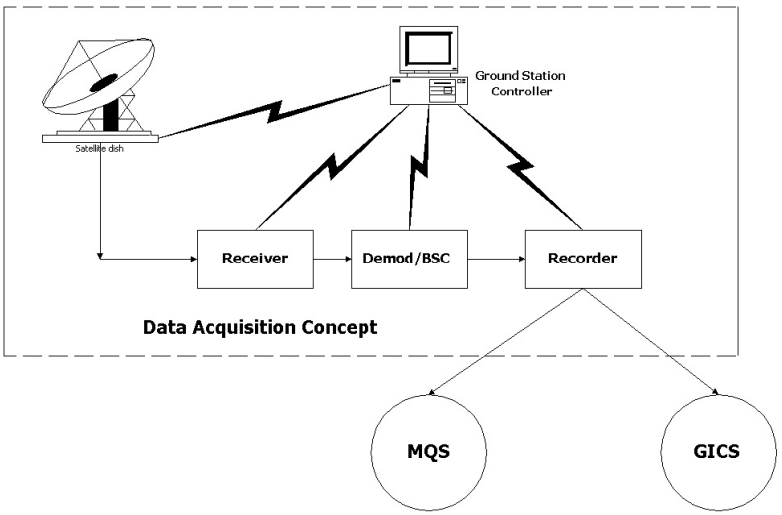

Figure 1: Thailand Ground Receiving Station system

In general, different levels of data products quality may require various processes. Many problems may possibly occur along the way of processing because the quality of the products depends on several factors such as quality of satellites signal, connectors, cables, software and hardware components. However this article only concentrates in the Data Processing System, which consists of two main parts. Those are Microimage Quicklook Subsystem and Geocoded Image Correction Subsystem.

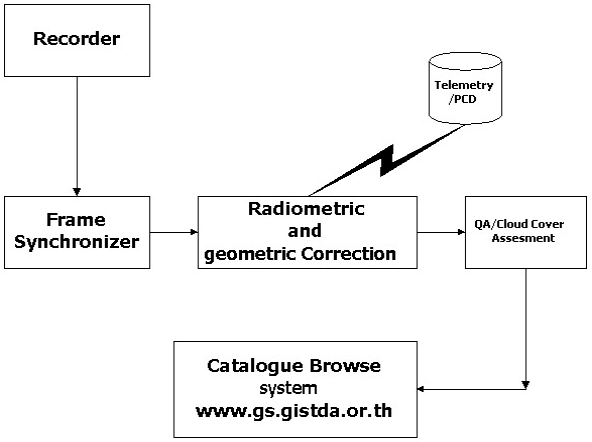

Figure 2: Microimage Quicklook Subsystem

3.1 Microimage Quicklook Subsystem

It is typically the preprocessing system which is simply known as Quicklook image QA Catalogue. Such example images can be viewed in our Catalogue browse system at www.gs.gistda.or.th. This subsystem presents the diminish version, sub-sampling of the formatted data. It also allows for Data ingest, reformatting, Cloud Cover Assessment, radiometric and geometric to be corrected before the selected image from this Catalogue could be process by Geocoded Image Correction Subsystem.

Figure 3: Examples of the images from the Catalogue Browse System.

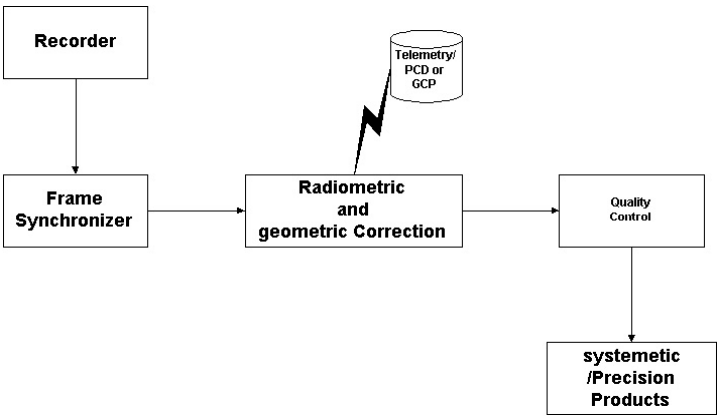

Figure 4: Geocoded Image Correction Subsystem

3.2 Geocoded Image Correction Subsystem

It is separated into two levels of accuracy, which is known as Systematic Correction and Precision Correction. In case that high level of accuracy is required, Precision Correction may be used instead of Systematic Correction. That is Ground Control Point or Payload Correction Data may be required, depending upon which level of accuracy is requested. Payload Correction Data is required to perform Systematic Correction for normal level of accuracy. It is necessary for all data products to be processed through these Correction Subsystems in order to meet its standard quality.

In Thailand Ground receiving Station during playback period on Data Processing System, some sync loss sometimes occurs. In such a case, the random red light would show on HDDR (based on Model HD96 Honeywell). This signal indicates that some data channel on HDDT is missing. In fact, there are many possible reasons which cause the problem, including the data channel is blocked, data cannot be transferred to the processor effectively, noise interference, data dropout or even low quality data.

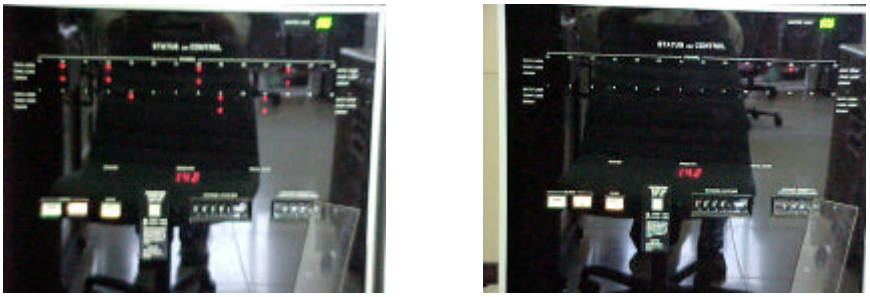

Figure 5: Data Processing System/HDDR (Left: Red Light shows Sync Loss, Right: Normal scenario)

Sync loss which is previously discussed can be detected by connecting the oscilloscope to the test point on the reproduction board (Figure 6). In the left figure, with no noise interference, the symmetric eye-shape pattern can be clearly seen. While in the right figure, the shape is not as symmetric as the left one and the split of the signals can be seen.

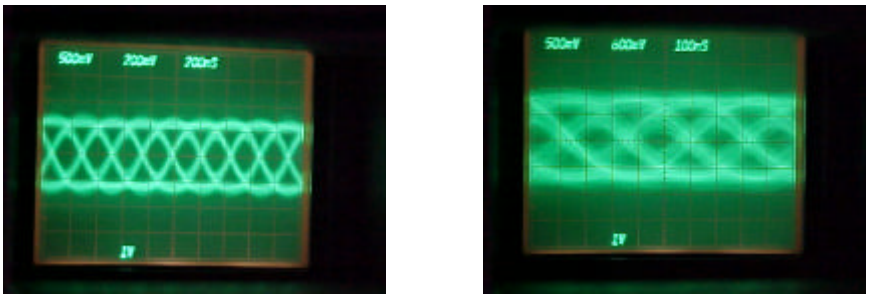

Figure 6: Eye Pattems (Left: Normal Scenario, Right: Sync Loss Scenario)

After the Record Head, Reproduce Head is cleaned. And all the components on the reproduce board are checked if it is in the working condition. At this point the adjustment of the gain and frequency is applied to improve the data quality. Notice that these parameters may be adjusted only in the case of the signal from the head of HDDR produced by the reproduction amplifier on the reproduction board is not in the suitable level of specification or contains bad compensation. In other case, further investigation may follow the system diagram (Figure 7) step by step.

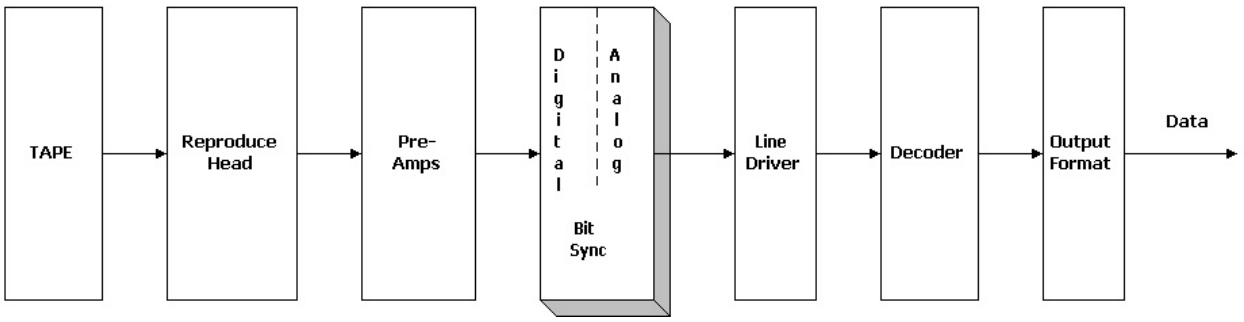

Figure 7: Reproduction System

Notice that the high quality of the data on HDDT or ½ inches Data Cartridge (DLT) itself are necessary in order to produce high quality data products. The quality of data products which already pass the Data Processing System is unlikely to have any error, as it previously been examine and confirm by GISTDA and user themselves before the order have been place.

4. CONCLUSION

Data Processing System is a very important step for effectively data production, which obtained from Remote Sensing Satellites. Facilities and technique that Thailand Ground Receiving Station operates can support the delivery of high quality and wide range of digital and photographic products to the users in various disciplines.

5. REFERENCES

Honeywell, 1986. Technical Manual. Colorado, USA.