Renewal Plan of Computer System and Telecommunication Facilities at Meteorological Satellite Center*

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Abstract

The current computer system at DPC will be replaced by a new computer system in March 1987. The new computer system is being installed in order to be used for system check-out for six months before it begins routine operation. Hourly basis imaging in northern hemisphere will start at this time.

Following the computer replacement, the telecommunication facilities at CDAS and DPC will be replaced with new ones in March 1988. Stretched VISSR dissemination for all VISSR observations will start at this time, and HR-FAX transmission through satellite will be quit in a few month after March 1988.

The renewal plan of the DPC computer system, which is going on, and the coming renewal plan of the telecommunication ground facilities are described in this article with the following three chapters:

I. New computer system and products of Meteorological Satellite Center,

II. Renewal plan of the ground telecommunication facilities, and

III. Future schedule of VISSR observation and FAX dissemination.

Chapter I. New Computer System and Prpducts of Meteorological Satellite Center***

1. Introduction

The computer system being used at Meteorological Satellite Center (MSC) at present was established in April 1977. Fig. I-1 shows the general concept of the current computer system being used at MSC.

The new computer system is to be installed at MSC in September 1986, and then various kinds of check-out of the system are to be done to validate the performance of the new computer system with intermittence of VISSR observations, until full operation of the new computer system is started in March 1987. The conceptual illustration of the new computer system is shown in Fig. I-2.

2. New Computer System

The new computer system consists of four main frames. They are primary satellite

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** This article was edited by T. Hamada, System Engineering Division in cooperation with other staffs at System Engineering Division and Facilities Division, MSC, and Office of Meteorological Satellite Planning, JMA.

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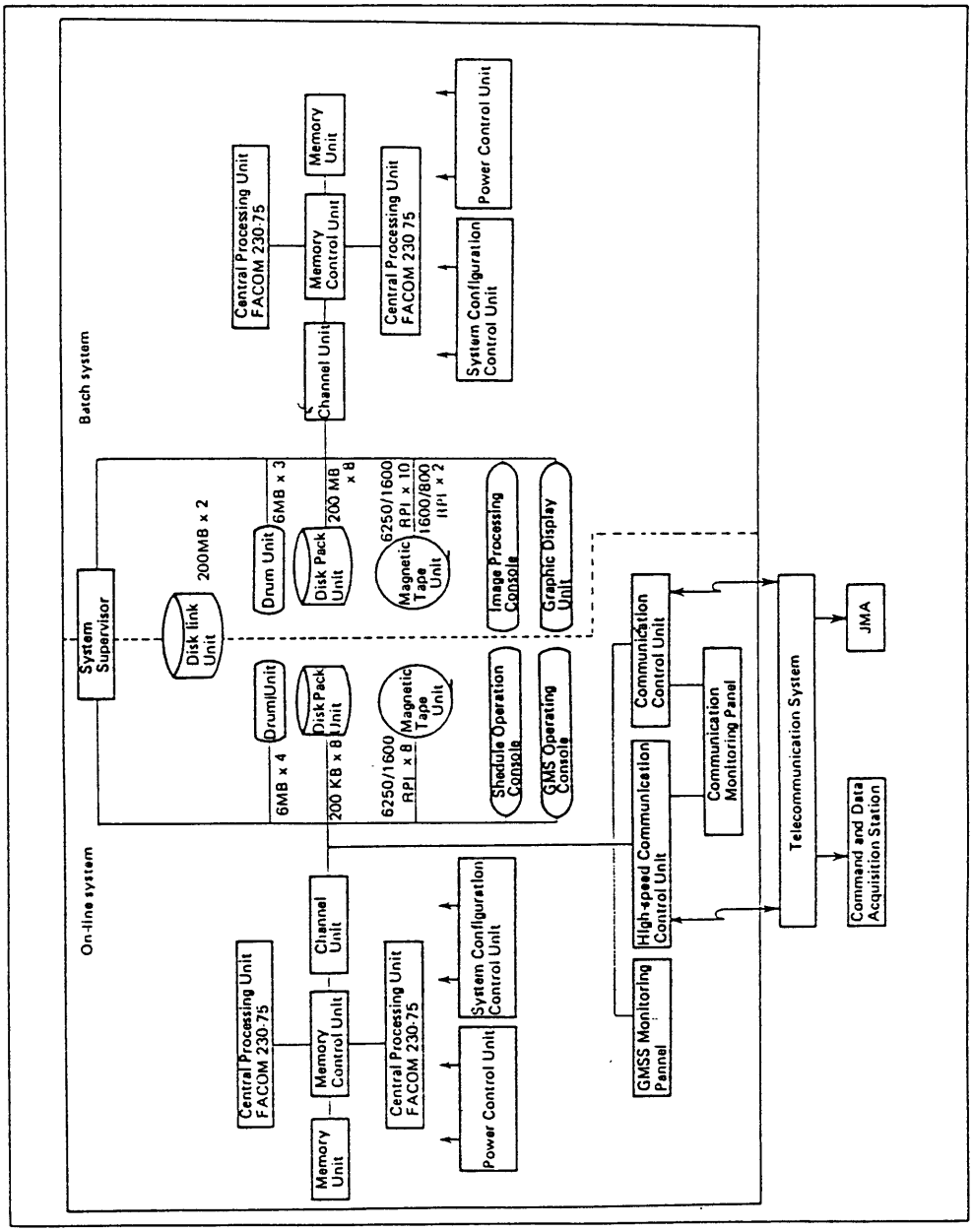

Fig. I-1 Conceptual scheme of the current computer system of MSC.

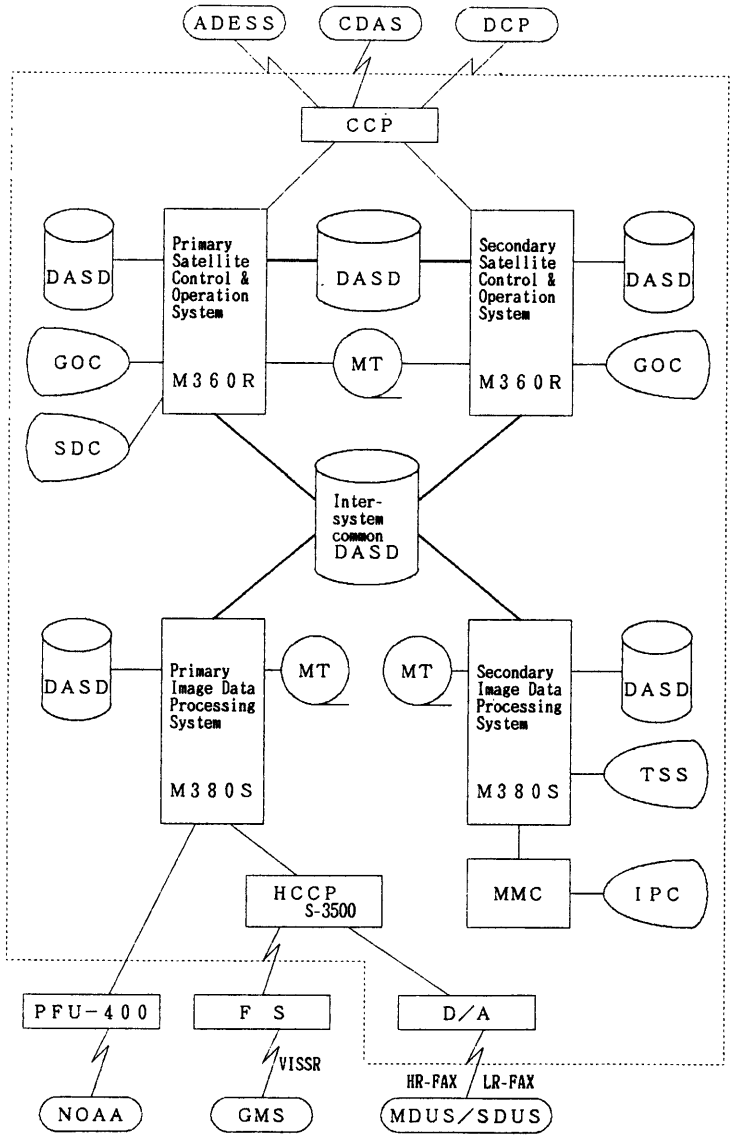

Fig. I-2 Conceptual scheme of the new computer system.

Acronym

ADESS : Automatic Data Editing and Switching System
CCP : Communication Control Processor
CDAS : Command and Data Aquisition Station
D/A : Digital to Analogue
DCP : Data Collection Platform
FS : Frame Synchronizer
GOC : GMS Operating Console
HCCP : High speed Communication Control Processor
IPC : Image Processing Console
MMC : Mass Memory Controller
SDC : ScheDule operation Console
TSS : Time Sharing System

control and operation system, a secondary satellite control and operation system, a primary image data processing system, and a secondary image data processing system.

The new computer system has a very large mass storage equipment which can be accessed commonly from any of the four systems and enables inter-system communication and data exchange.

The state of resource assignments and job prosecutions of all four computer systems can be monitored and controlled by the Schedule and DCP Operating Console (SDC) which consists of 4 character displays and so on.

A. Satellite Control and Operation System

The host computer of the primary satellite control and operation system is FACOM M-360R. Principal peripheral equipments of the system are a magnetic tape unit with 2 tape drivers, 4 color graphic displays (GDs), a color hard copy unit, a line printer, a communication control processor (CCP), etc.

Main duties of the primary satellite control and operation system are;

a. Reception of GMS telemetry data and CDAS telemetry data,
b. Generation and transmission of telecommands signal for GMS operation,
c. Support of satellite housekeeping and analysis,
d. Reception of tri-lateral range and ranging rate data to be used for the satellite orbit determination,
e. Transmission of S/DB information,
f. Transmission of various kinds of retrieved meteorological information to ADESS system in JMA, etc.

Whenever the primary satellite control and operation system gets down due to some failure, the secondary satellite control and operation system is to take its place as a new primary system as soon as possible and to succeed the primary system's jobs.

B. Primary Image Data Processing System

The host computer of the primary image data processing system is FACOM M-380S. Principal peripheral equipments of the system are a magnetic tape unit with 2 tape drivers, a line printer and a high-speed communication control processor (HCCP), etc.

Main duties of the primary image data processing system are;

a. Reception of GMS VISSR data and HRPT data of polar orbiting satellites,
b. Calculation of calibration parameters such as temperature and albedo,
c. Generation and transmission of LR-FAX (low resolution facsimile) and HR-FAX (high resolution facsimile) data,
d. Preparation of pre-processed image data set of VISSR and HRPT the purpose of which is to transform the original raw data into a more feasible form for direct access in the secondary image data processing system, etc.

In the primary image data processing system, almost all jobs are carried out automatically according to a schedule. Whenever some failure happens in the system or the system gets down, the secondary image data processing system is to succeed the jobs of the primary system as a new primary system to make the discontinuity of jobs in the primary image data processing system as short as possible.

C. Secondary Image Data Processing System

The host computer of the system is another FACOM M-380S. Main peripheral equipments are a magnetic tape unit with 4 tape drivers, two GDs, 2 sets of man-machine interactive image data processing equipments called IPC (Image Processing Console), a cassette magnetic tape unit which controls and drives TV video type cassette magnetic tape up to 10 at one time, a line printer, etc.

Main jobs performed in the secondary image data processing system are;

a. Cloud motion wind derivation,
b. Cloud amount distribution retrieval,
c. Clear radiation field retrieval,
d. Surface temperature field retrieval,
e. Vertical profile retrieval of temperature and water vapor using TOVS data of NOAA series satellites,
f. Typhoon center location and intensity estimation analysis based on the Dvorak's method,
g. Determination and prediction of the satellite's orbit and attitude, and so on.

By means of IPC, various kinds of image data processing such as cloud motion wind derivation, center location and intensity analysis of typhoons, nephanalysis, etc. are to be performed operationally. Making use of refresh memory equipment called MMC (Mass Memory Controller) animation of cloud images from up to 24 images can be provided on the high resolution color display screen (1024×1024 dots) of IPC. IPC is also to be

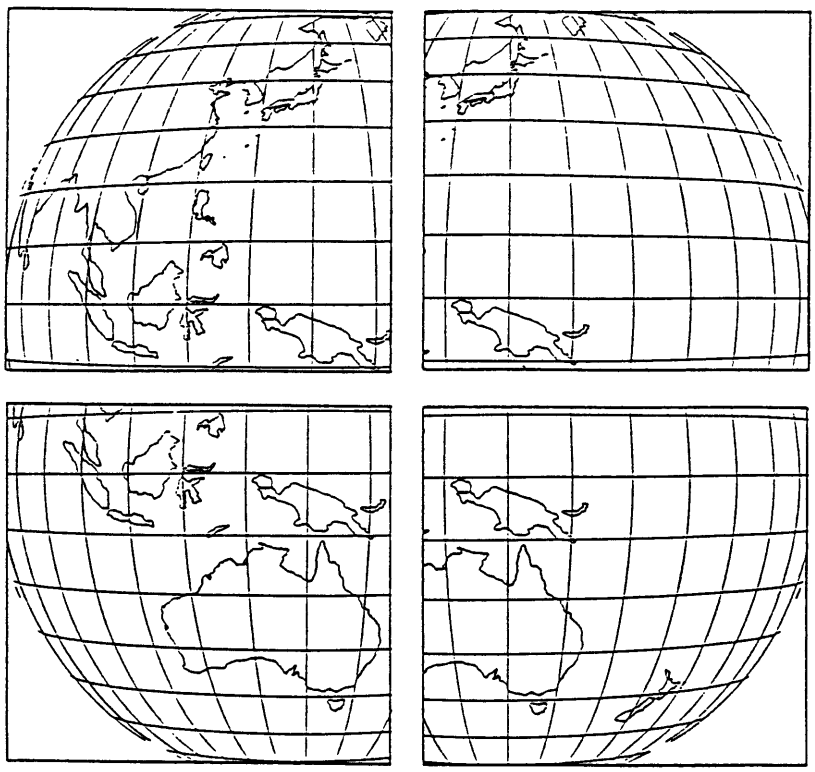

Fig. I-3 Format of four-sectorized LR-FAX picture

used for non-operational works such as research and development works.

3. Principal product changes on the new computer system

A. Primary Image Data Processing System

Principal changes in the new primary image data processing system are as follows.

(1) LR-FAX image

The formats of FAX image are changed as follows.

a. Current seven-sectorized pictures for LR-FAX are replaced by four-sectorized pictures. The format of four-sectorized pictures is shown in Fig. I-3.

b. Partial pictures, H(infrared), I(visible) and J(enhanced infrared), will be changed: These images are currently only sectorized images covering Japan and contiguous sea area. They are changed to the images with polar-stereographic projection covering Far East area including Japan and contiguous sea. The format of polar-stereographic pictures is shown in Fig. I-4.

(2) Basic histogram image data

This is a new product. Basic histogram data are calculated three hourly from VISSR infrared or visible data in 0.25°-latitude by 0.25°-longitude boxes. Processed area is from 60°N to 60°S and from 80°E to 160°W. The histogram data are to be used as a basic source data for cloud amount retrieval,

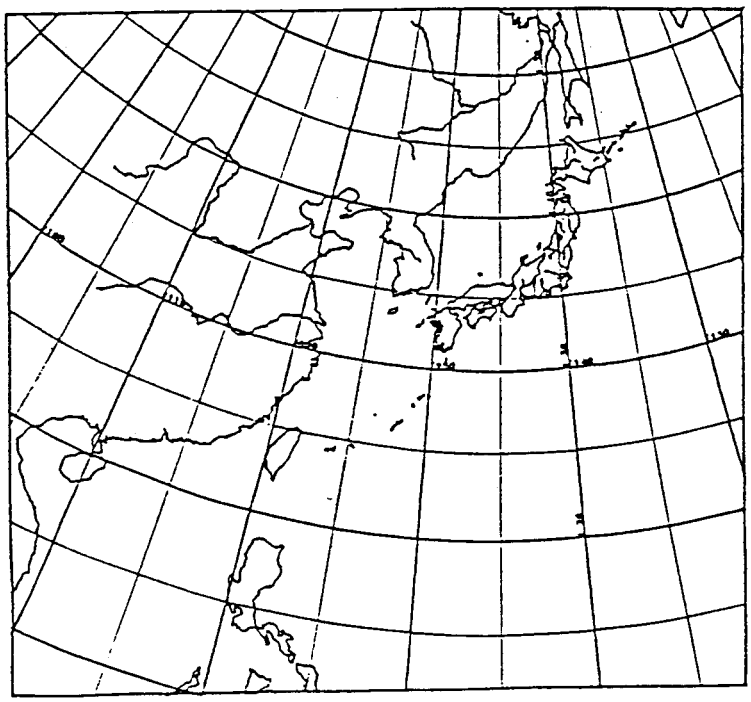

Fig. I-4 Format of polar-stereographic picture over the Far East area surrounding Japan.
Scale: 1/30-million

clear radiance retrieval, surface temperature retrieval, etc. in the secondary image data processing system.

B. Secondary Image Data Processing System

Primary changes in the secondary data processing system are as follows.

(1) Cloud Motion Wind Estimation (CWES)

Basically the method for low-level cloud motion wind derivation is not changed, that is, the calculation is carried out automatically. In the new system the LF (Loop Film) method is no longer used for the calculation of high-level wind. The high-level cloud motion wind calculation will be done by the method shown as follows;

a. Automatical procedure: almost the same method as the current method used in the low-level cloud motion wind calculation with change of parameters to choose cirrus level cloud targets.
b. Man-machine interactive procedure: just like LF method by man but by means of IPC.

Currently cloud motion wind estimation is being carried out twice a day. In the new system it is to be carried out 4 times per day; at 00Z and 12Z in whole coverage, and at 06z and 18z in the northern hemisphere. Steering level assignment method is not changed, that is, the low-level cloud motion winds are assigned to fixed level, 850 mb, and the high-level cloud motion winds to 200, 250, 300, or 400 mb depending upon the season and the latitudes.

(2) Surface Temperature Estimation

In the new computer system, at first clear radiance field data are retrieved by analyzing the basic histogram data for each 0.25°-latitude by 0.25°-longitude box. And then surface temperature data are retrieved from the clear radiance data with new air mass correction method which incorporates radiative transfer model using objectively analyzed vertical temperature and humidity profile data received from numerical prediction division of JMA. Thus more accurate surface temperature retrieval is expected.

(3) Cloud Amount Distribution Retrieval

High-level, low-level and total cloud amounts are produced in the same way as currently used, but threshold values between the levels are determined using the clear radiance data and vertical profile data described above.

(4) Typhoon Center Location and Intensity Analysis

In the new computer system it is carried out making use of IPC on both infrared and visible images (infrared data are to be main to make daytime and nighttime analyses compatible). The results will be distributed within 30 minutes for center location and 50 minutes for intensity after the observation time.

(5) Satellite Clond Information Chart (Advanced TBB Contour Chart)

This products are new one improved from the present nephanalysis chart and the TBB contour chart, and are disseminated in quasi-real-time. This chart will contain the cloud area information which is added automatically and/or man-machine interactively. There are two kinds of products; one covers vicinity of Japan area, and the other Far East area including Western Pacific area,

which are called "Vicinity of Japan (VJ) Area Chart" and "Far East (FE) Area Chart" respectively.

The VJ area chart designed to support the local field forecaster is disseminated within 45 minutes after each 3-hourly map time to JMA local stations by using land line (Fig. I-5).

The FE area chart designed to support the aviation field forecaster is disseminated within 50 minutes after each 3-hourly map time. The analysis area covers from the

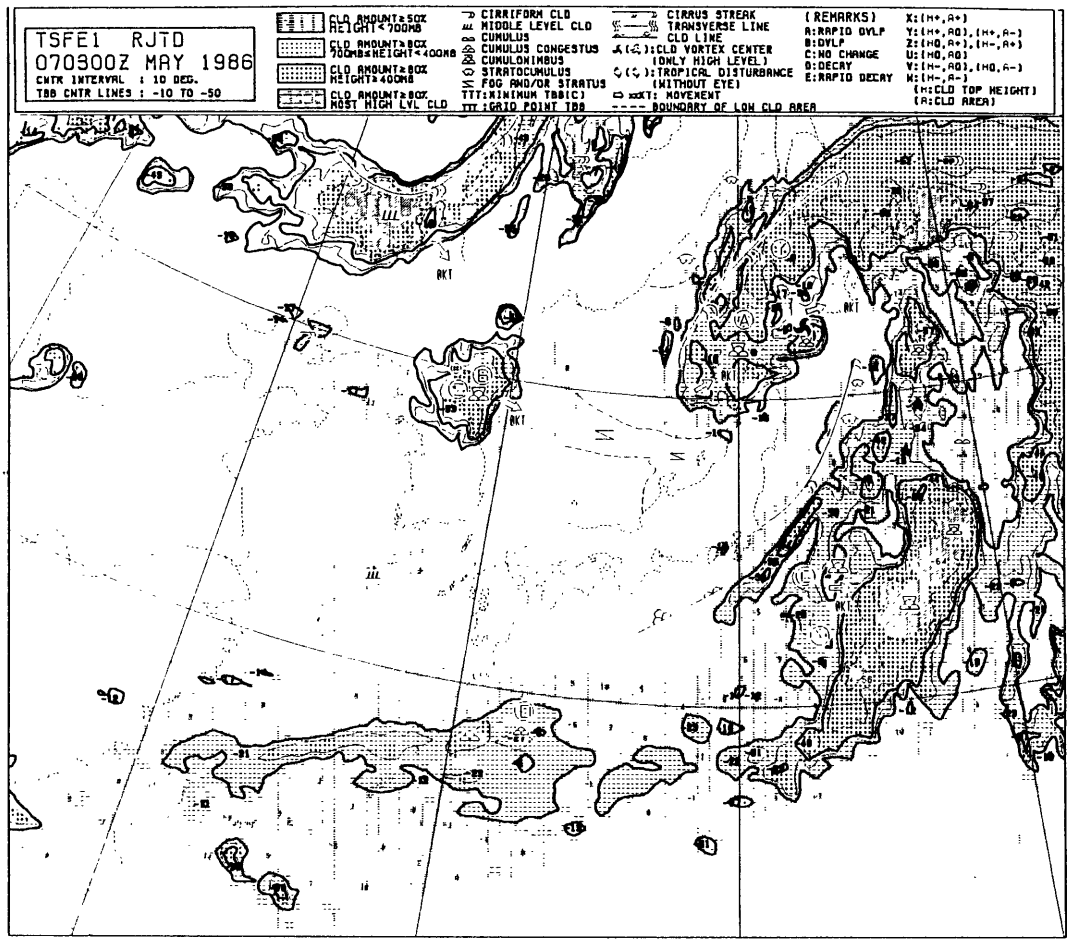

Fig. I-5 An example of Satellite Cloud Information Chart for vicinity of Japan area (VJ chart). Observation time is 0300Z 7 May, 1986. TBB contour interval is 10 degrees from −10°C to −50°C. Contour lines of −10°C and −30°C are presented by thick full line, and those of −20°C and −40°C by thin full line. Areas surrounded by tick mark lines are those colder than −50°C. Categorized cloud top levels are presented by the shading with thin short line, thin long line, thick short line, and oblique line. Minimum/maximum TBBs within contours are shown in numerics. Grid point TBBs in the cloud area without contours are also presented by numerics with equal interval. Letters A, B, and C indicate the developing/decaying features of cloud systems. Cloud shapes and cloud line/streaks in the significant cloud portions are indicated by several kinds of symbols. Fog areas which are detected by man-machine interaction are presented by the dashed line.

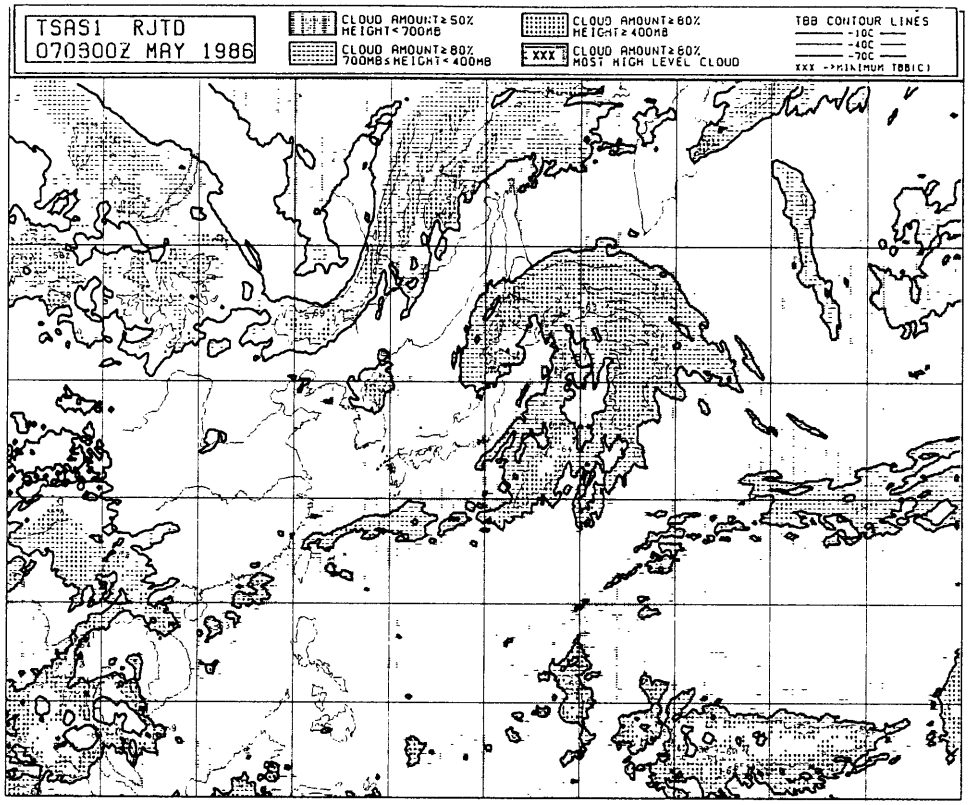

Fig. I-6 An example of Satellite cloud Information Chart for Far East area (FE chart). Observation time is 0300Z 7 May, 1986. TBB contour intervals are 30 degrees from −10°C to −70°C. Categorized cloud cloud top levels are given by the same shaded patterns as shown in Fig. 1. Minimum TBB are presented on each Most-high level cloud area.

equator to 60°N and from 90°E to 170°W. This product will be disseminated to local aviation stations of JMA by using land line (Fig. I-6).

Chapter II. Renewal Plan of the Ground telecommunication Facilities*

Following the replacement of the computer system of Meteorological Satellite Center (MSC) in March, 1987, the GMS ground telecommunication system will be partially renewed in March, 1988. The renewal schedule of the ground facilities at present is shown in Fig. II-1. The figure also includes the renewal plan of DPC computer system already described in the Chapter I. This paper explains the renewal plan of the ground telecommunication facilities.

1. Ground telecommunication facilities

GMS ground telecommunication facilities of JMA consist of the CDAS system and

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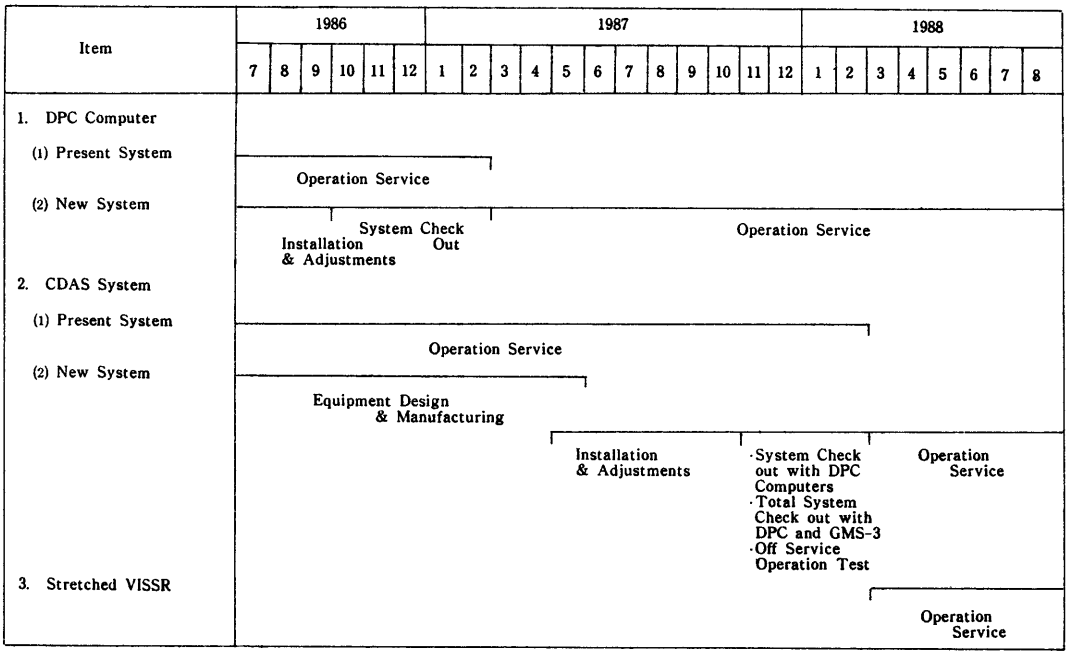

Fig. II-1 Renewal schedule of telecommunication ground facilities.

DPC (MSC) system as shown in Fig. II-2. The new system will be improved in the present system and enable it to perform following functions:

a. to transmit digital formed Stretched VISSR signal to MDUS's via GMS-3 instead of current HR-FAX transmission,
b. to be operated almost automatically using computer system, and
c. to record FAX images on film for archiving.

The concept of the new computer controlled telecommunication system is shown in Figs. II-3 and II-4.

2. CDAS System

Major function of the improved CDAS system are as follows.

a. S-VISSR signal generation

Received VISSR signals are demodulated, decoded and sent to the processor. The data are calibrated, resampled and then stored in the line buffer memories. The raw VISSR data are reformatted and two types of stretched VISSR data are produced. One is for direct broadcasting via satellite, and the other for transmission to DPC.

b. Monitor and Control

The ground system is controlled and monitored on CRT displays and keyboards interfaced with the computer system.

3. DPC System

Major functions of the improved DPC telecommunication system are as follows.

a. VISSR Interface

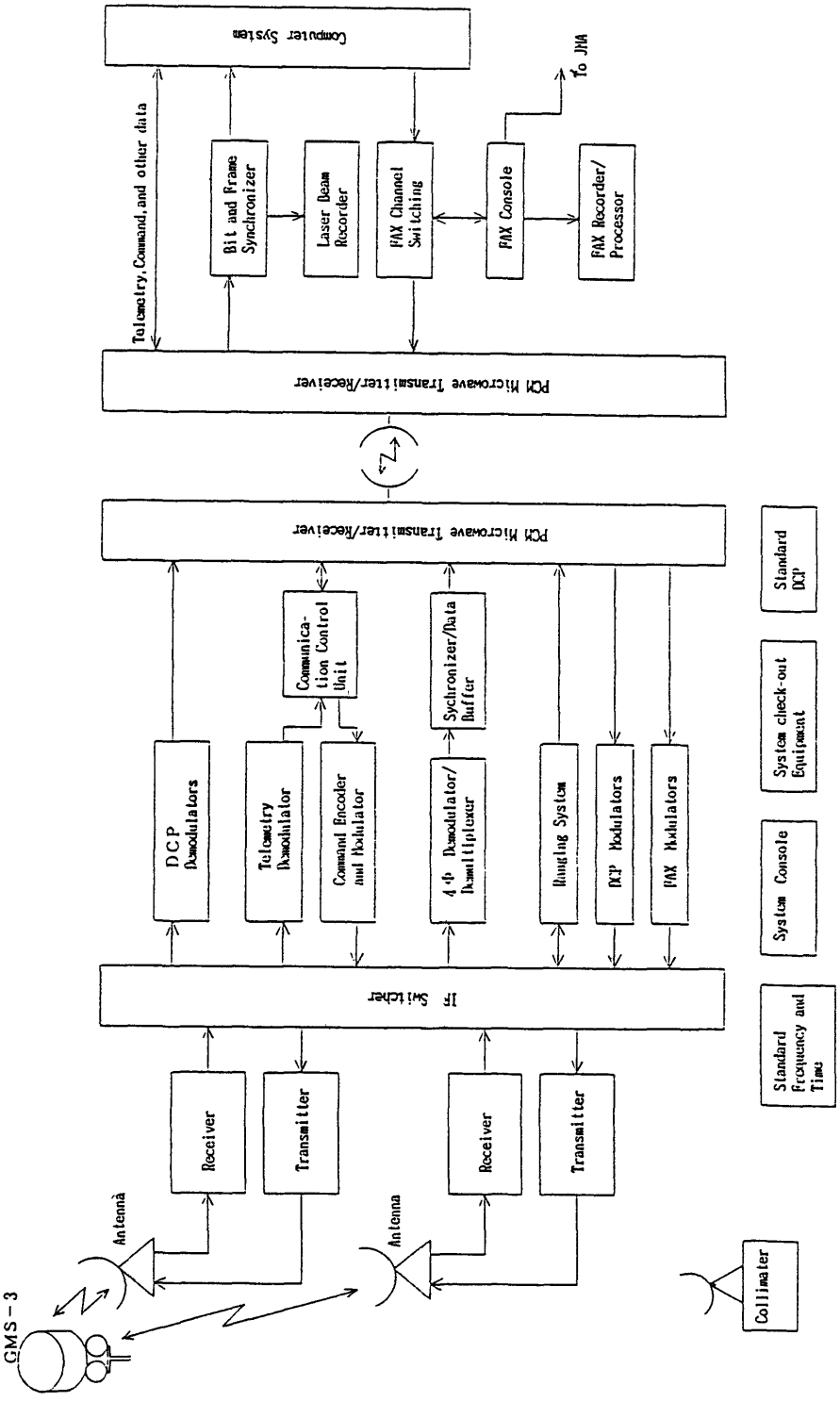

Fig. II-2 Diagram of present telecommunication system at CDAS and DPC.

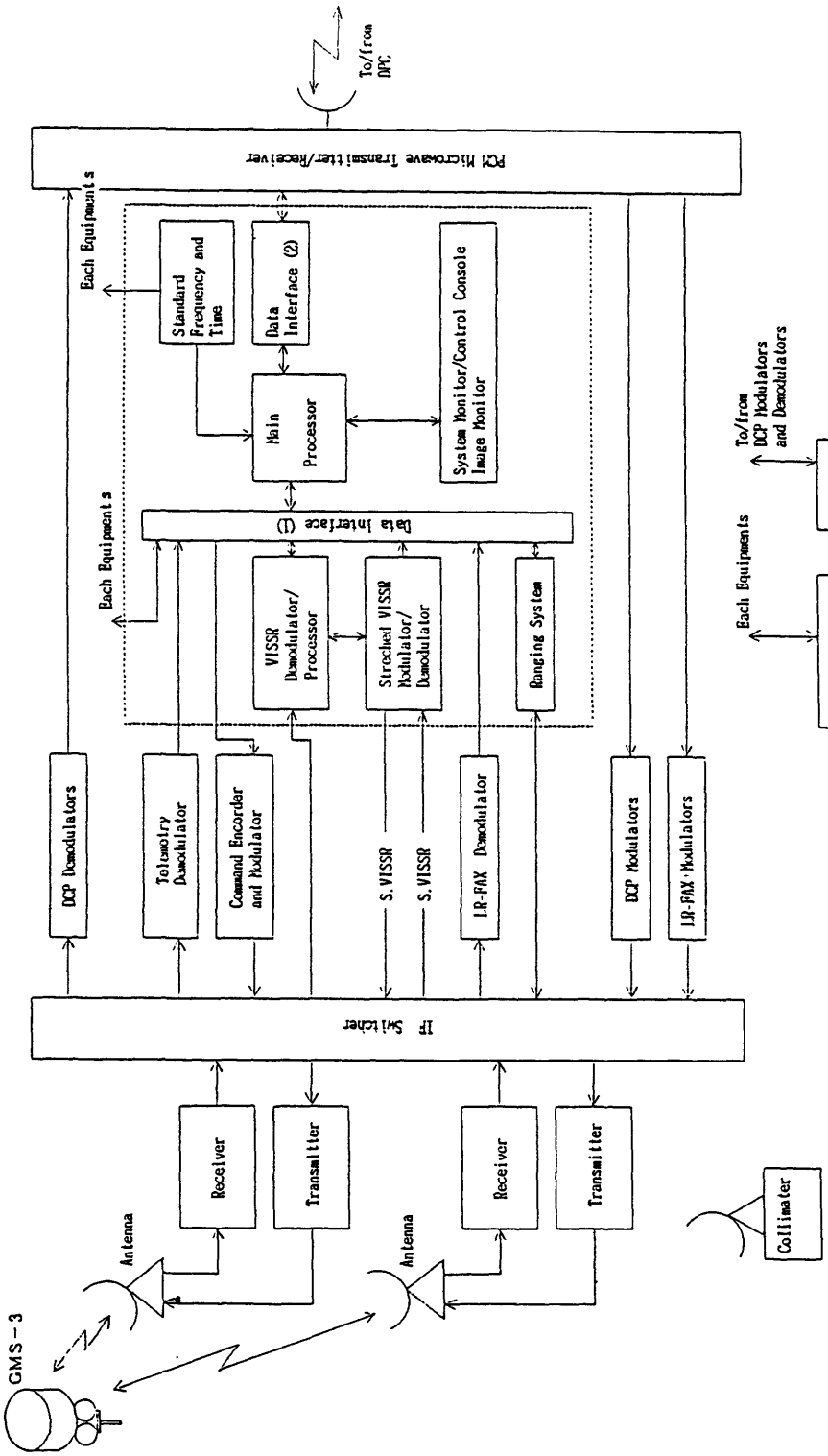

Fig. II-3 Diagram of new telecommunication system at CDAS.

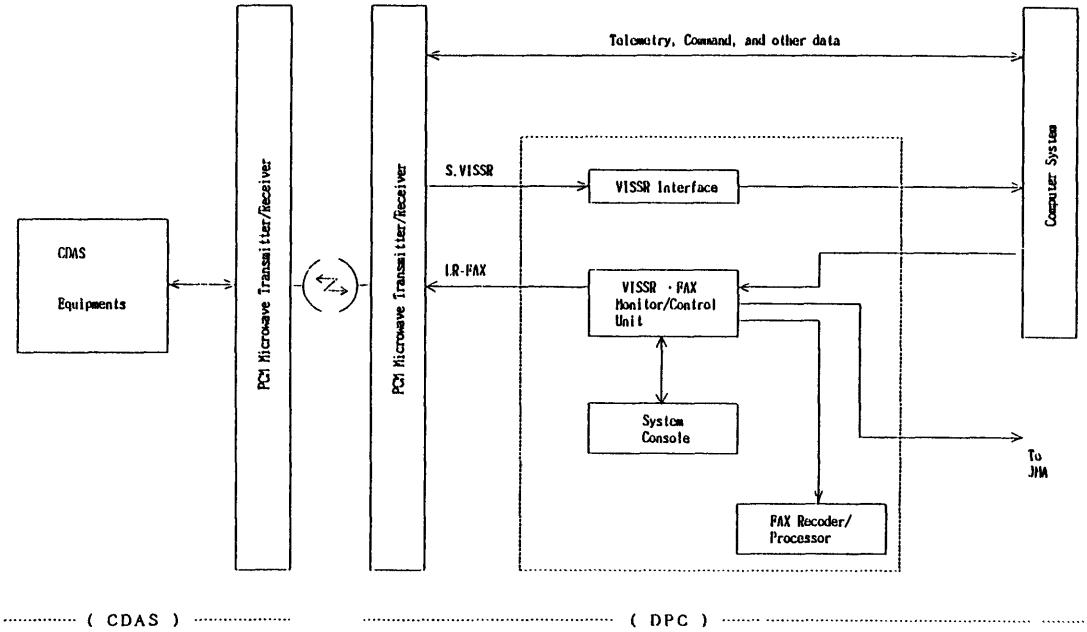

Fig. II-4 Diagram of new telecommunication system at DPC.

S-VISSR data from CDAS are bit-synchronized, decoded and transferred to the main computer system of DPC.

b. Centralized control and monitor console

The equipments have the following functions:

(1) The signals to/from CDAS and the DPC main computer system are monitored and switched as necessary,

(2) The signals to JMA head office are monitored and controlled, and

(3) The system equipments are controlled and monitored.

c. Image recorders

HR-FAX to be used in DPC and JMA HQ and LR-FAX images are automatically recorded on films for archiving.

Chapter III. Present and Future Schedule of VISSR observation and FAX Dissemination*

The computer system operated at the Data Processing Center (DPC), Meteorological Satellite Center, will be replaced by a new computer system in March 1987. Furthermore, the new telecommunication ground facilities will be introduced in March 1988 and Stretched VISSR (S. V.) dissemination will begin at this time. The transition of the VISSR observation and dissemination schedule is briefly summarized in Table III-1.

After introduction of the new system, FAX dissemination schedule will be changed according to three phases, I, II and III. After

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Table III-1 Summary of VISSR observation and dissemination schedule.

Period	Current -Feb. 1987	Phase I March 1978-Feb. 1988	Phase II March-May 1988(**)	Phase III May 1988(**)-
General		New DPC Computer	New ground facilities	
Observation Regular obs.	Full disk 8 times 3 wind full disks 2 times	Full disk 8 times 2 wind full disks 2 times 2 wind half disks 2 times	Same as Phase I	Full disk 8 times 2 wind full disks 4 times
Semi-regular obs.*	——	Hourly half disk (N. H.)		Hourly half disk (N. H.)
Special obs.	Special hourly obs. (N. H. or S. H.)	Special hourly obs. (S. H.)		Special hourly obs. (S. H.)
Stretched VISSR (S. V.)	None	None	S. V. dissemination for all observations including wind and special observations	
HR FAX	Full disk (IR) 8 times (VIS) 3 times Mercator proj. (IR) 4 times	Full disk (IR) 8 times (VIS) 3 times Mercator proj. (IR) 4 times	Same as Phase I	None
LR FAX	7 sectors and H, I/J	4 sectors and H, I/J (Polar stereographic projection)	Same as Phase I	Same as Phase I
Figure showing daily observation schedule	Fig. III-1	Fig. III-2	Fig. III-2	Fig. III-3
Comment * Sometimes missing due to system maintenance, etc.			** As for the beginning of Phase III, JMA would like to ask for the opinion of the users.	

Phase II, all VISSR observation data will be transmitted in the form of Stretched VISSR (S. V.) on real time basis.

1. Present schedule

The VISSR observation has been currently performed on three hourly basis. Three images are additionally taken at around 00z and 12z each for cloud motion wind derivation. The current observation and transmission schedule is shown in Fig. III-1.

2. Phase I

After the new computer system is introduced the three hourly basis will be still kept for full disk observation. Additionally hourly observation for the northern hemisphere will be performed, but sometimes it will be missing due to system maintenance, etc. (Fig. III-2).

2.1. VISSR observation

The VISSR observation times are as follows. The observation starting times are at about 30 minutes before the observation times.

(1) Regular observation
—Full disk image
3 hourly basis; 00, 03, ··· & 21Z.
Additional observation
for VIS calibration; 16Z
For wind derivation (12, 00Z);
1100, 1130, 2300 & 2330Z.
—Half disk image covering northern hemisphere
For wind derivation (06, 18Z);
0500, 0530, 1700 & 1730Z.

(2) Semi-regular observation
—Half disk image covering northern hemisphere
Hourly basis; at each hour except for regular observation.

(3) Special observation
—Limited area around Australia
Hourly basis; at each hour except for regular observation.

2.2. Facsimile dissemination through satellite

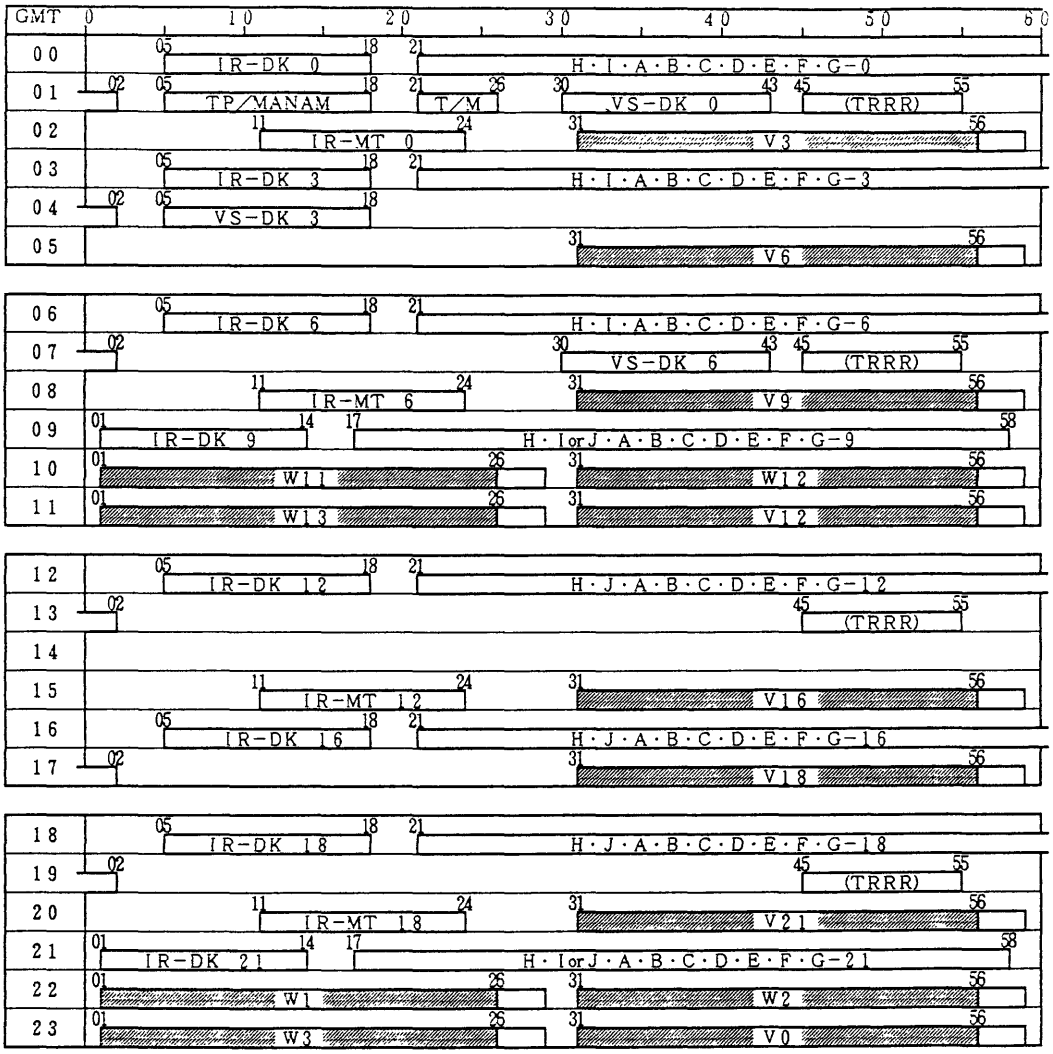
The following facsimile images are disseminated during the Phase I period.

(1) HR-FAX
—Full disk image
(IR); 00, 03, ··· & 21Z.
(VIS); 00, 03 & 06Z.
—Mercator's projection around equator (IR); 00, 06, 12 & 18Z.

(2) LR-FAX
—4-sectorized full disk
(IR); 00, 03, ··· & 21Z.
Polar stereographic projection
Image H (IR); Hourly
Image I (VIS) or J (enhanced IR); Hourly except for 05, 11, 17 & 23Z.

3. Phase II

After the introduction of the new telecommunication ground facilities, the stretched VISSR digital data disseminations for all observations will be started, still keeping analogue HR-FAX dissemination. During the Phase II period, the VISSR observation and FAX dissemination schedule will be the same as during the Phase I period (Fig. III-2). During the Phase II period, MDUS receiving facilities have to be replaced by stretched VISSR receiving ones.



ABBREVIATIONS

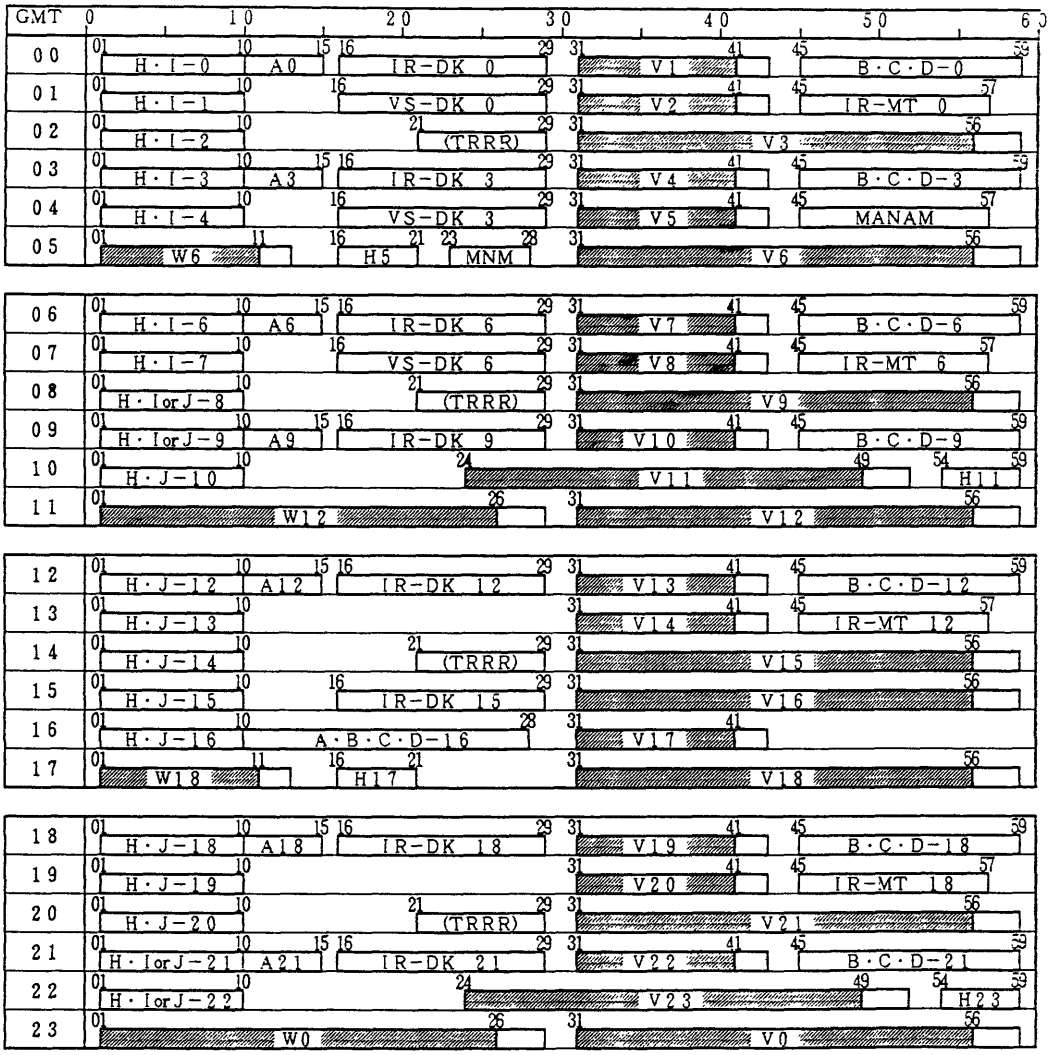
VISSR OBSERVATION
- Vnn: VISSR OBSERVATION OF nnZ
- Wnn: VISSR WIND OBSERVATION

HR-FAX DISSEMINATION
- IR-DK : INFRARED FULL-DISK
- VS-DK : VISIBLE FULL-DISK
- IR-MT : INFRARED MERCATOR
- TP/MANAM: TEST PATTERN OR MANUAL AMENDMENT

LR-FAX DISSEMINATION
- A~G: 7-SECTORIZED INFRARED FULL-DISK
- H : INFRARED SECTOR OF JAPAN
- I : VISIBLE SECTOR OF JAPAN
- J : ENHANCED INFRARED SECTOR OF JAPAN
- T/M: TEST PATTERN/ MANUAL AMENDMENT

TRRR: TRILATERATION RANGE AND RANGE RATE

Fig. III-1 Current VISSR/FAX schedule.



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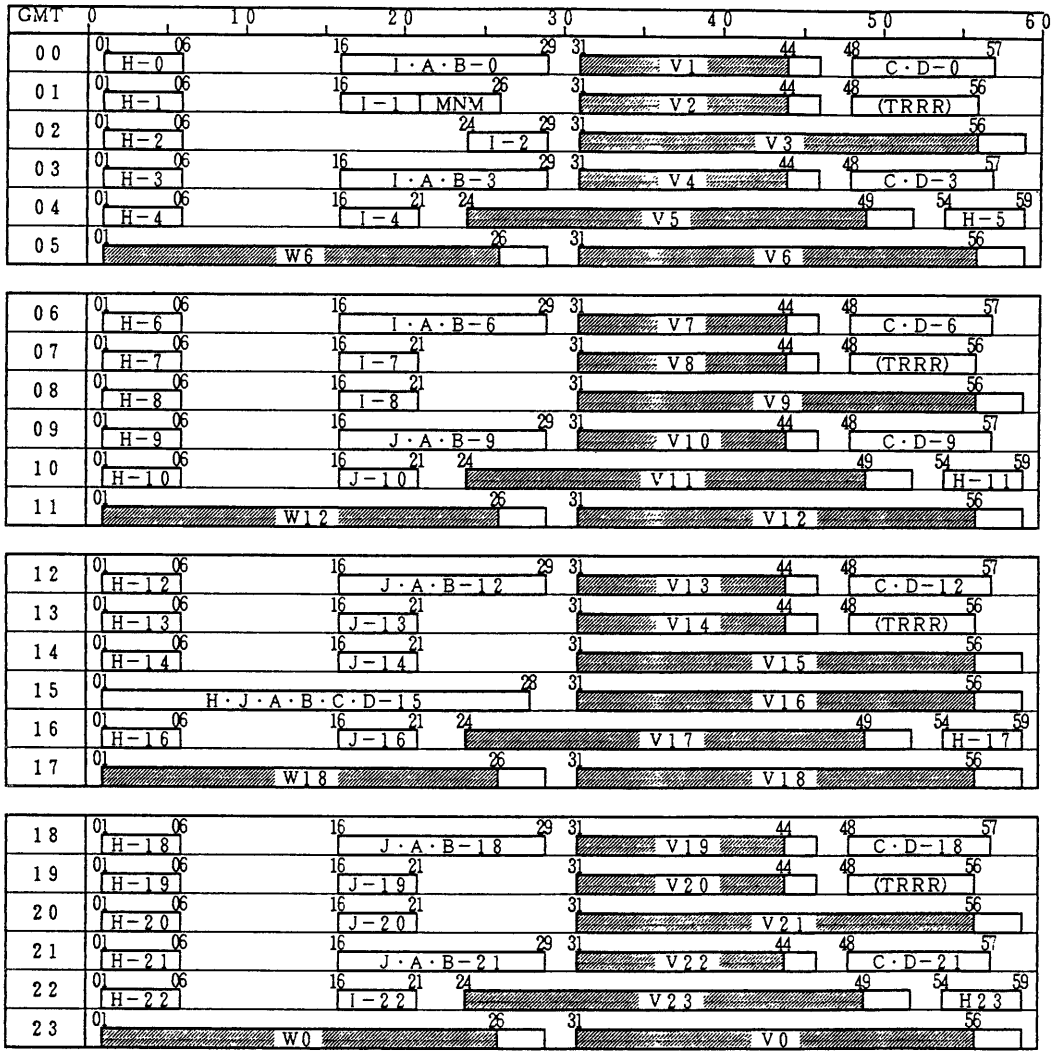
- VS-DK : VISIBLE FULL-DISK
- IR-MT : INFRARED MERCATOR
- MANAM : MANUAL AMENDMENT WITH TEST PATTERN

LR-FAX DISSEMINATION
- A~D: 4-SECTORIZED INFRARED FULL-DISK
- H~J: IR, VIS AND ENHANCED IR POLAR-STEREOGRAPHIC COVER THE FAR EAST AREA
- MNM: MANUAL AMENDMENT WITH TEST PATTERN

TRRR: TRILATERATION RANGE AND RANGE RATE

Fig. III-2 VISSR/FAX schedule during Phases I and II.



ABBREVIATIONS

VISSR OBSERVATION
Vnn:VISSR OBSERVATION OF nnZ
Wnn:VISSR WIND OBSERVATION

TRRR:TRILATERATION RANGE AND RANGE RATE

LR-FAX DISSEMINATION
A~D:4-SECTORIZED INFRARED FULL-DISK
H~J:IR, VIS AND ENHANCED IR POLAR-STEREOGRAPHIC COVER THE FAR EAST AREA
MNM:MANUAL AMENDMENT WITH TEST PATTERN

Fig. III-3 VISSR/FAX schedule during Phase III.

4. Phase III

In Phase III, the analogue HR-FAX will no longer be disseminated through the satellite. Full disk VISSR observation for wind derivation around at 06Z and 18Z will start in the Phase III (Fig. III-3) instead of half disk observation in the Phase II. The stretched VISSR digital data dissemination will be performed for all observations on.

4.1. VISSR observation

The VISSR observation schedule during the Phase III is a almost the same as during Phase I and II. The only difference is that full disk VISSR observation will be carried out at 0500, 0530, 1700 and 1730Z instead of the half disk observation.

4.2. Facsimile dissemination through satellite

The only LR-FAX will be disseminated in the Phase III.

気象衛星センター資料処理局用計算機と通信系地上機器の更新計画*

気象衛星センター　システム管理課

現在気象衛星センター資料処理局（DPC）で稼働しているデータ処理用計算機システム（F230−75×4台）は1987年3月に新計算機システム（富士通M360R×2台，M380S×2台）に置換られる予定で準備がすすめられている。新システムでは，準定常運用として毎時観測が行なわれることになっている。

1988年3月には，気象衛星通信所（CDAS）とDPCの通信系地上機器の更新が予定されている。この更新によって，すべての観測画像についてストレッチドVISSR (S. V.) データのリアルタイムの配信が行なわれるようになる。S. V.データ配信開始の数ヵ月後からは，現在配信している高分解能ファクシミリ（HR-FAX）の配信は行なわない。

これらの機器の更新に伴なって，一部のプロダクトの内容の変更，機能の向上，新規プロダクトの作成等を予定している。これらについての詳細な報告は，本技術報告その他気象衛星センターの出版物として印刷されるものと考えられるが，今回は速報として次の3章に分けて簡単な報告を行なう。

第1章　気象衛星センター資料処理局の新計算機システムとプロダクト

第2章　地上通信機器の更新計画

第3章　VISSR観測とファクシミリ配信スケジュール

＊　本稿の執筆は，（第1章）長谷川秀行，大島隆，浜田忠昭，（第2章）鈴木孝雄，上田真也（第3章）浜田忠昭，長谷川秀行による。全体を浜田忠昭がまとめた。