RESEARCH AND DEVELOPMENT ON SYNTHETIC APERTURE RADAR

Yasuyuki ITOH Yasumasa HISADA
Equipment and Parts Development Department
Tsukuba Space Center
National Space Development Agency of Japan

ABSTRACT

A synthetic aperture radar (SAR) is one of the promising microwave sensors for earth observation. National Space Development Agency of Japan (NASDA) started 'phase A' study (preliminaly analysis) in FY 1978, recognizing the importance of active microwave remote-sensing. The research and development proceeded to 'phase B/C' (definition/design) after the heated discussion on the Earth Relources Satellite -1 (ERS-1) at the Space Activities Commission in August 1980.

The fundamental policy in the research and development on SAR is to make the system design simple for test operation, and to get better image data than those of SEASAT SAR. Under the above requirements, the specifications of the SAR system during the research and development phase were determined as follows :

Frequency	:	L-band
Polarization	:	H-H linear
Orbit	:	570 km
Off-nadir angle	:	33 deg.
Swath width	:	75 km
Resolution	:	25 m x 25 m
Multi-look number	:	4 (azimuth)
Signal-to-Noise Ratio	:	7 dB
Signal-to-Ambiguity Ratio	:	20 dB

In order to realize the system which satisfies these specifications, we started the trial manufacturing on the following critical technologies :

1) to keep the antenna panels flat after deployment in the space environment.
2) to obtain high power by solid-state amplifiers,
3) to get a large time-bandwidth-product (TBP) device for the pulse extention.
4) to achieve high frequency stability with a crystal oscillator.

Recently, the technically critical components listed above have been developed and the basic tests completed, to proceed to a final stage of the phase.

The antenna is the subsystem that we are making an effort in developing. Our steps of the research and develoment of SAR antenna are shown in Fig. 1. Through these steps, we are confirming electrical, structural, and thermal design of the antenna. The major successful data that we acquired during the test are the radiation characteristics of the 128-element microstrip array antenna (one panel of the eight) , the deployment characteristics of the full-scale mechanical model, and the thermal deformation data of the thermal deformation test model of the antenna panel.

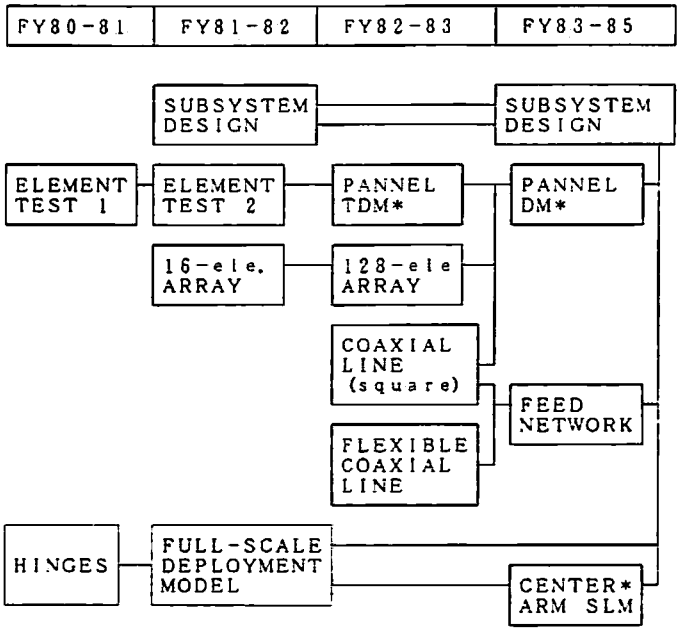
At present, the manufacturing of the development model of the antenna panel and the feed network are almost finished.

We are also making an effort to develope the electrical components. Fig. 2 shows the steps of the research and development of the SAR transmitter and receiver subsystem. The electrical tests of critical components such as a chirp modulator with a surface acoustic wave (SAW) despersive delay line (DDL) , the solid-state high power amplifier, and the oven-controlled stable crystal oscillator have been successfully completed. The space simulation test and the vibration test were executed on the oscillator and the exclusive power supply for amplifier. The test results proved

that the structural and thermal design were also good.

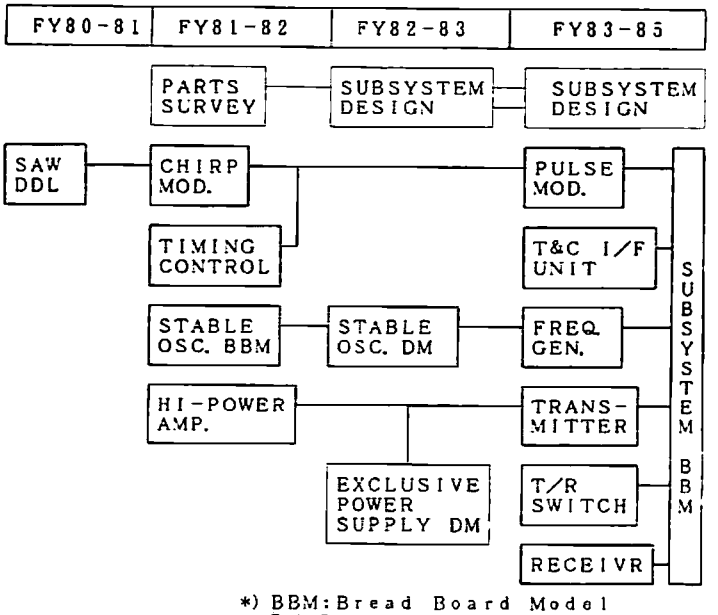
The bread board model of the SAR transmitter and receiver subsystem will be completed by March 1985. The system test and evaluation will be completed by September 1985.

The development of ERS-1 is to be task-shared between NASDA and Ministry of International Trade and Industry (MITI). The final results of the research and development phase will be succeeded to MITI, which is to be responsible for the development (phase D) of the mission instruments from FY 1985.



*) TDM:Thermal Deformation Test Model
DM:Development Model
SLM:Static Load Model

Fig. 1 The steps of R&D on SAR Antenna



*) BBM:Bread Board Model
DM:Development Model

Fig. 2 The steps of R&D on SAR TRX.