5.11A OUTLINE OF THE MU RADAR

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The MU radar is expected to be partly in operation in summer or fall 1983. The number of antennas in this partial operation is 57 or three groups, each of which consists of 19 Yagis. It is our idea that even such limited operation can work as an ST radar. In 1984 the rest of the antenna groups will be added, completing the total 25 groups, i.e. 475 (19 x 25) antennas. This complete system makes it possible for us to observe both the middle and upper atmosphere, probably up to 300 km.

Technical specifications are given in Table 1 and the system is shown in block diagram (Figure 1). Among other things, the MU radar has the following two outstanding features:

1. The antenna array consists of 25 groups each of which consists of 19 crossed-Yagis with three elements; each antenna has semiconductor transmitter and receiver, called a module, and each group of 19 antennas works as an independent small radar steering its radar beam under the control of a microcomputer. Thus, the total system consists of 25 small radars of this kind, enabling us to do various sophisticated operations with the system.

2. The system is controlled by two other computers, one for radar controlling (HP9835A) and the other for data taking and on-line analysis (VAX11/750). The computer-controlled system is simple in operation for users and reliable in observation. Very quick beam steering (as quick as in a msec) is also possible because of electronic phase-changing of each module output under control of the microcomputer which is further controlled by the radar controller.

Table 1. Basic parameters of the MU radar

Location:	Shigaraki, Shiga, Japan (34.85°N,136.10°E)
Frequency:	46.5 MHz
Antenna configuration:	circular array of 475 crossed Yagi antennas
Aperture:	8330 m^2 (103 m in diameter
Beam width	3.6°
On-axis gain:	34.0 dB
Polarizations:	linear or circular
Beam directions:	0-30° zenith angle
Transmitter:	
Power amplifier:	475 solid-state amplifiers
Peak power:	1 MW min
Average power:	50 kW min
Bandwidth:	1 MHz
TR switch:	PIN diodes with a directional coupler
Receiver:	
Bandwidth:	1 MHz
Dynamic range:	70 dB min
IF:	3 MHz
A/D converter:	12 bit x 4 channel

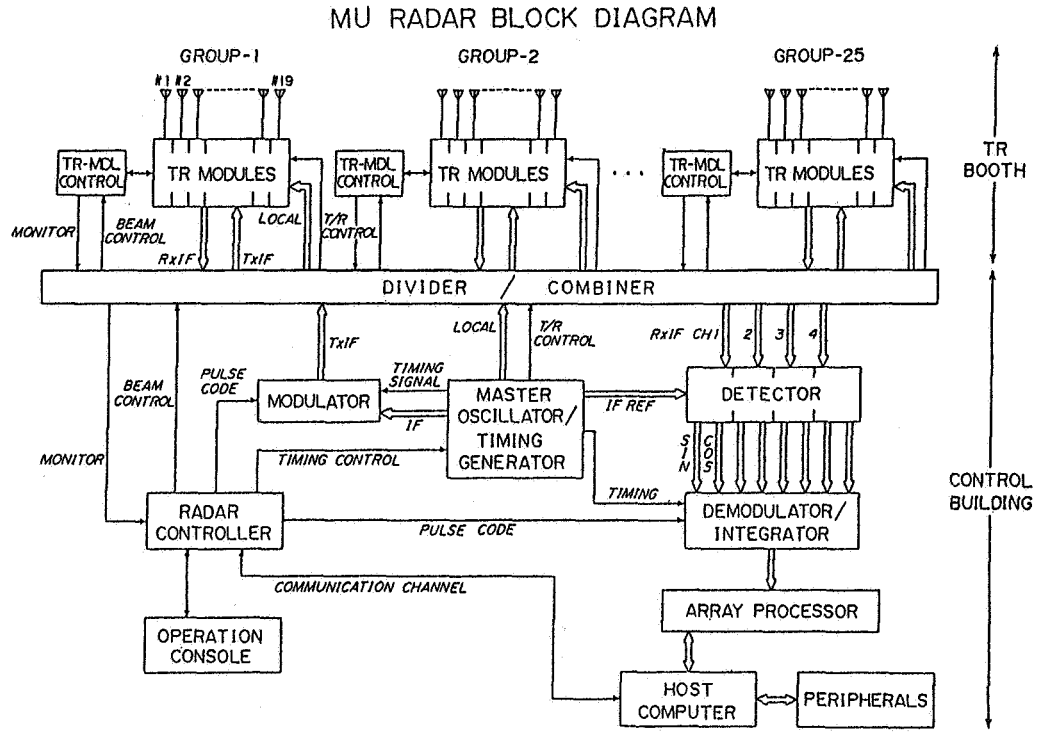
MU RADAR BLOCK DIAGRAM
GROUP-1
GROUP-2
GROUP-25
#1 #2
#19
TR-MDL CONTROL
TR MODULES
TR BOOTH
MONITOR
BEAM CONTROL
LOCAL
T/R CONTROL
RxIF
TxIF
DIVIDER / COMBINER
RxIF CH1 2 3 4
PULSE CODE
TIMING SIGNAL
MODULATOR
MASTER OSCILLATOR/ TIMING GENERATOR
IF REF
DETECTOR
IF
SIN
COS
TIMING CONTROL
TIMING
RADAR CONTROLLER
PULSE CODE
DEMODULATOR/ INTEGRATOR
CONTROL BUILDING
COMMUNICATION CHANNEL
ARRAY PROCESSOR
OPERATION CONSOLE
HOST COMPUTER
PERIPHERALS

Figure 1.