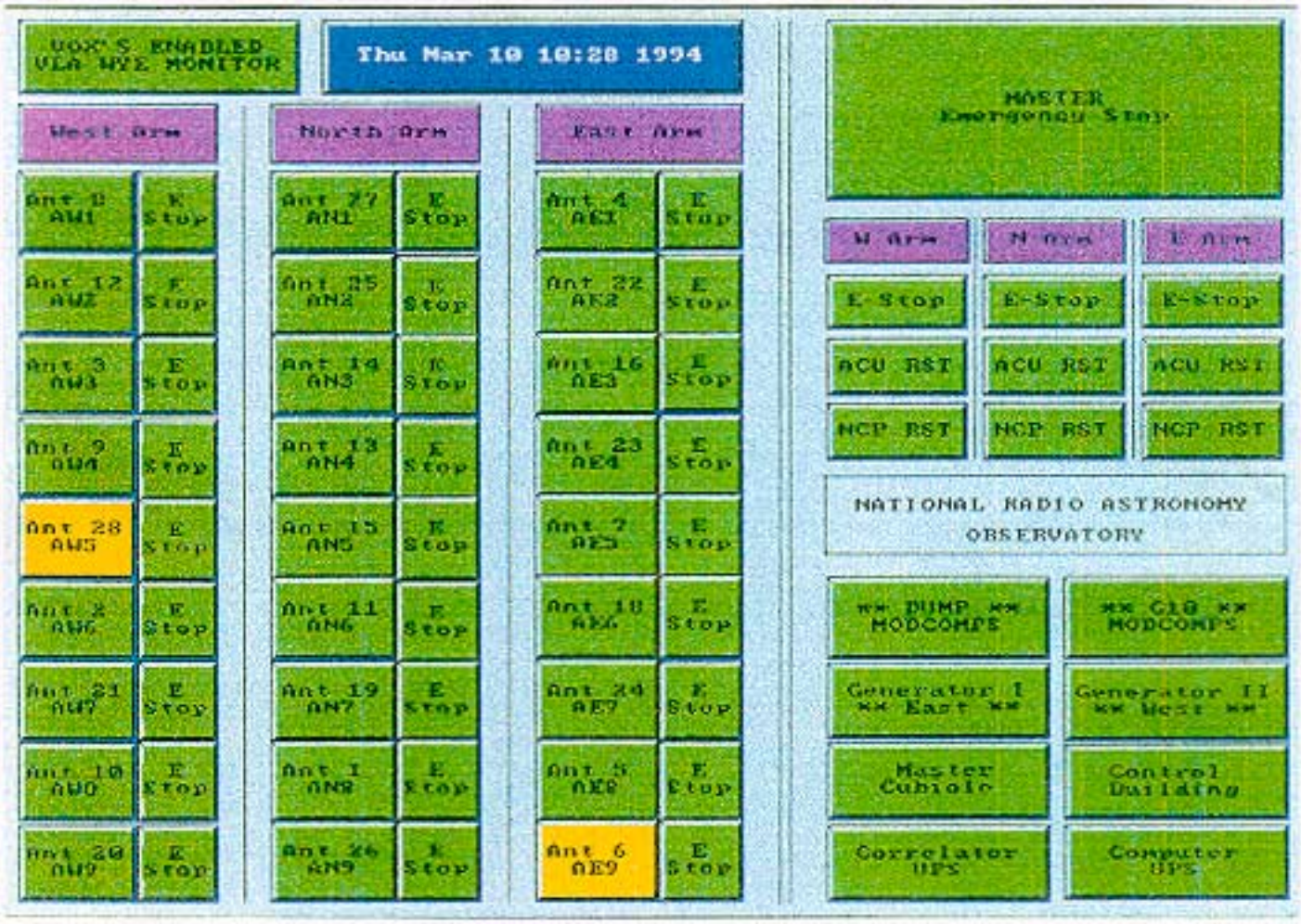

VLA Technical Report No. 79

A REVIEW OF THE VLA WYE MONITOR SYSTEM

by

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1.0 INTRODUCTION

The purpose of this document is to provide VLA operations with a clear and concise description of the functional aspects of each Wyemon screen. For readers unfamiliar with the VLA Wye Monitor System, it is used for monitor and control of antenna safety systems and provides for telescope operator control of major VLA facility support systems.

This report includes a section for each major monitor and control system, as well as a miscellaneous section to cover the various odds and ends not covered under each major system. Each section is described as best understood by the individuals who routinely work with each respective system.

Also included in this report is reference to support documentation and illustration of the VLA site power distribution, as well as preventive maintenance test procedures and a comprehensive breakdown of test results obtained from complete antenna testing during the VLA 2000 "D" configuration.

Many thanks to Bob Broilo, Tom Frost, Jim Nieri, Ken Sowinski, Mario Torres and Steve Troy for providing documentation and support for this project. Also thanks to the VLA telescope operators for their support and patience with all the testing needed to verify each functional component in the Wyemon system.

2.0 SUMMARY OF FUNCTIONAL DESCRIPTIONS

This section summarizes each major monitor and control system and the related screens of the Wyemon system. With the exception of the TO START GENERATORS WINDOW, each category can be seen on the touch-screen monitor. An in depth presentation of this system is explained in VLA Technical Report No. 71, *The VLA Wye Monitor System Hardware*. **A block diagram,** *Wye Monitor Touch-Screen Control/Monitor Menu Structure Block Diagram*, **Drawing No. D13900B11 also serves to define the touch-screen hierarchy. The VLA Site Power Conceptual Drawing graphically represents the power distribution network. Both are in the functional drawing section of this report.**

2.1 GENERATOR SCREENS

Generator CKT BRKR

OPEN (RED)-This generator is not connected to the Generator Bus.
CLOSED (GREEN)-This generator is connected to the Generator Bus.

Remote CKT BRKR

OPEN (RED)-This generator has either a serious electrical fault or has been removed from the bus manually for maintenance.
CLOSED (GREEN)-This generator is able to connect to the bus.

Engine Start

GREEN-This generator has had the Engine Start sequence initiated.
RED-There is no activity.

Engine Running

GREEN-This generator is running.
RED-This generator is not running.

Battery Failure

GREEN-The starting battery bank for this generator has sufficient voltage.
RED-The starting battery bank voltage dropped below the low limit. If this generator is not already running, it probably won't start.

Overcrank

GREEN-The previous start sequence was successful.
RED-The generator starter tried three times to crank for twenty seconds. The generator failed to start after the third attempt.

Fail to Synchronize

GREEN-The previous synchronization was successful.
RED-The generator could not synchronize speed to the Generator Bus.

Approach LO Lube Oil

GREEN-The generator has proper oil pressure. This may also be GREEN if the generator is not currently in operation.
RED-The generator is experiencing low oil pressure and may shut down soon.

Approach HI Water Temp

GREEN-The generator is at proper temperature.
RED-The generator is overheating and may shut down soon.

Approach LOAD Limit

GREEN-The generator is running within the load limit.
RED-The generator is near the load limit.

2.2 MASTER CUBICLE SCREEN

NCP RESET

ENABLE (GREEN)-The generator start-up delay sequence is allowing NCP (Non-Critical Power) to be reset.
DISABLE (RED)-The generator start-up delay has locked out NCP reset for a short time.

GEN Tie Breaker

CLOSED (GREEN)-The GEN circuit breaker (852a) is connecting the Generator Bus to the VLA power distribution. This should always be GREEN.
OPEN (RED)-The generator building is disconnected. The generators cannot power the site in this state.

SEC UTILITY Breaker

CLOSED (GREEN)-The UTIL circuit breaker (752a) is connecting utility power to VLA distribution.
OPEN (RED)-Utility power is disconnected from the VLA site power distribution.

AC CONTROL VOLT Fail

GREEN-The master cubicle has AC control voltage. This control voltage is for instrumentation in the master cubicle module.
RED-The master cubicle has lost AC control voltage. This does not interrupt operation of the Master Cubicle, it indicates a loss of instrumentation in the master cubicle module.

125V Battery Bank

GREEN-The DC battery bank that powers the circuit breakers has sufficient voltage.
RED-There is a problem with the battery bank, and breakers may not work.

#1 DAY TANK Lo Fuel

GREEN-Generator #1 has sufficient fuel.
RED-Generator #1 will run out of fuel soon.

#2 DAY TANK Lo Fuel

GREEN-Generator #2 has sufficient fuel.
RED-Generator #2 will run out of fuel soon.

VOLT/FREQ Fail

GREEN-The Generator Bus power is normal.
RED-The Generator Bus power is improper. This could be either a utility or generator malfunction.

LOAD SHED Activated

GREEN-The **entire VLA site is powered up.**
RED-The site load exceeded the capacity of the generators and specific non-essential areas of the site have been disconnected.

ALARM Horn

GREEN-The alarm horn in the generator building is silent.
RED-The alarm horn is sounding. The alarm horn sounds for any alarm and has to be manually reset.

PLAINS-On Utility

GREEN-The VLA site is connected to the power utility. Pressing the ACK button acknowledges this condition.

PLAINS-Interruption

RED-The VLA site is disconnected from the power utility. Pressing the ACK button acknowledges this condition.
(Note: This also means that for some reason the generator start sequence has been triggered. Some possible reasons: 1) An operator has pushed the "GENERATOR START" button on the touch-screen, 2) the utility company has triggered a remote start, and 3) Hatch (852a) has opened due to a fault or poor power.

ACK

This button is an acknowledgement for the utility connection and disconnection.

2.3 TO START GENERATORS WINDOW

(Note: Other than SEC Utility Breaker and GENERATOR Start/Stop Button, the indicators on this window are the same as each Generator Screen.)

SEC UTILITY Breaker

OPEN (RED)-The commercial electric power is not connected to the VLA site.
CLOSED (GREEN)-The commercial electric power is connected to the VLA site.

GEN #1 Engine Start

GREEN-Engine Start sequence initiated.
RED-Engine Start sequence not active.
(Note: For both GEN #1 & GEN #2, this is tied directly to a relay in the Generator cabinets.)

GEN #1 Engine Running

GREEN-The engine is running.
RED-The engine is not running.
(Note: For both GEN #1 & GEN #2, this is tied to a relay that is connected to the governor. It means that the rotation sensor on the generator is producing the proper signal that a running engine would.)

GEN #1 CKT Breaker

OPEN (RED)-This generator is not closed to the Generator Bus.
CLOSED (GREEN)-This generator is connected to the Generator Bus.

GEN #2 Engine Start

GREEN- Engine Start sequence initiated.
RED- Engine Start sequence not active.

GEN #2 Engine Running

GREEN-The engine is running.
RED-The engine is not running.

GEN #2 CKT Breaker

OPEN (RED)-**This generator is not closed to the Generator Bus.**
CLOSED (GREEN)-**This generator is connected to the Generator Bus.**

GENERATOR Start/Stop Button

This button will initiate the commands from the VLA control building that provide a relay closure for the Programmable Logic Controller inside the Master Cubicle that begins the generator start-up and stop sequences.

2.4 CORRELATOR AND COMPUTER UPS SCREENS

NORMAL (UPS AVAILABLE)

This is the normal condition. The UPS is providing clean power with battery backup available. Under normal conditions this is the only illuminated indicator, and the color will be GREEN.

(Note: During the normal condition, the remainder of the indicators will be gray. When the computer and correlator are on UPS, the indicators will be either GREEN or RED according to the status of the UPS.)

UPS on BYPASS

The UPS is in BYPASS mode, either because of maintenance, or an internal fault has shut down the inverter & the UPS no longer supplies clean power. Battery backup is not available. The load (correlator or computer) is on commercial power or generator power.

5 Min Till UPS SHUTDOWN

The UPS is on battery power because of an input power failure, and the batteries only have ~5 minutes of power left before the load will lose power. The loads should be shut-down at this point.

Summary ALARM

The UPS has detected an alarm condition & is reporting it. This can be either a minor or major alarm.

MINOR ALARM

The UPS has detected a minor alarm & is reporting it. The UPS is still providing clean power with battery backup available. This alarm can be caused when the VLA site is on generator power during a source change.

MAJOR ALARM

The UPS has detected a major alarm & is reporting it. This alarm can be caused by an input power failure, or an internal fault severe enough to cause the inverters to shut down. If the problem is an internal fault, the UPS will not provide clean power, and the battery backup or generator power is not available.

UPS INPUT FAILURE

Commercial power has failed or gone out of tolerance. The UPS will automatically switch to battery backup mode for the duration of the "glitch", or until commercial power comes back on-line, or until the generators come on-line and synchronize.

Battery Volts LOW

The UPS batteries have been discharged & are approaching the low battery voltage shut-down point, or the UPS batteries are not charging correctly. The UPS can still provide clean power with battery back-up, however the cause of the alarm needs investigation.

Battery NOT AVAILABLE

The batteries have discharged past the low battery voltage shut-down point & cannot furnish power to the load. The load will drop power at this point.

UPS Overload ALARM

The UPS load has exceeded 105% of rated capacity for more than a few seconds. Large inductive loads, for instance the chiller fan motors or pumps coming on-line can cause this alarm. If the overload continues for more than 15 minutes the UPS will automatically switch to the BYPASS mode without power conditioning or battery back-up available.

INLET AIR Over-temp ALARM

The UPS room ambient air temperature is too high. If the temperature continues to rise, the UPS will shut down.

Transfer NOT AVAILABLE

The UPS cannot transfer power to the static BYPASS switch because the commercial power has failed or is out of tolerance for voltage/frequency. The UPS will not go into maintenance BYPASS mode.

Retransfer NOT AVAILABLE

The UPS inverter has failed or is out of tolerance, and power cannot be transferred back from the static BYPASS switch. The load is on generator or commercial power only without any power conditioning or battery back-up available.

Generator/s STOPPED

The generators are not producing power to the VLA site power distribution.

2.5 ANTENNA STATUS SCREENS

POINTING

POINTING (GREEN)-The antenna is pointed at an astronomical source.
STOW/HI-EL (YELLOW)-The antenna is in the stow position, or in a high elevation between 85° and 95°. If there is cross-hatching, then the ACU is in the LOCAL mode.

E-STOP

OFF (GREEN)-There isn't an emergency stop set at the antenna.
ON/LOCAL (RED)-There is an emergency stop set at the antenna.

+28V

OK (GREEN)-There is +28V present at the antenna, generated by the ACU.
FAIL (RED)-There is an absence of +28V at the antenna.
E-STOP – ON/LOCAL (RED)-The ACU is in local mode at the antenna, and the emergency indicator is set. If +28V is absent, then the E-STOP will be activated.

PHASE

OK (GREEN)-This indicates the presence of three-phase power at the antenna.
LOSS (RED)-One or several of the power phases is missing at the antenna.

NCP

OK (GREEN)-The non-critical power is working properly at the antenna.
FAILURE (RED)-The non-critical power is malfunctioning at the antenna.
RESET (BLUE)-This command activates a reset of the non-critical power at the antenna. (Note: If the fire alarm has caused the loss of non-critical power, it will be necessary for someone to restore the power at the antenna by activating the fire alarm reset switch.)

ACU

REM/OK (GREEN)-This indicates that the ACU in the antenna is working properly.
FAULT (RED)-This means there is trouble with the ACU unit at the antenna.
RESET (BLUE)-This command activates a reset of the ACU unit at the antenna.

FIRE

OK (GREEN)-There is no fire or smoke conditions being detected by any one of three smoke detectors mounted inside the antenna.
ALARM (RED)-Fire or smoke has been detected at the antenna. Someone needs to go to the antenna and investigate, or to reset the fire alarm.

E-STOP

SET E-STOP

E-STOP (RED)-This command activates an emergency stop remotely from operations.

RESET E-STOP

E-STOP (GREEN)-This command clears the emergency stop remotely from operations.

2.6 CONTROL BUILDING

COMPUTER Air Flow or HI Temp

GREEN-This means that the airflow from the HVAC to the computer room is working properly.
RED-This means that the airflow from the HVAC to the computer room has stopped. (Note: at this time there is no HI temp sensor to provide an alarm, only a transducer to measure changes in airflow pressure for sensing whether or not cool air is being transported from the HVAC.)

CORRELATOR Air Flow or HI Temp

GREEN-This means that the airflow from the HVAC to the correlator room is working properly.
RED-This means that the airflow from the HVAC to the correlator room has stopped. (Note: at this time there is no HI temp sensor to provide an alarm, only a transducer to measure changes in airflow pressure for sensing whether or not cool air is being transported from the HVAC.)

AIR CONDITIONER HI Chiller Water Temp.

GREEN-The water temperature is within the proper limit set at the Chiller controller. Mean temperature is ~6.8°C.
RED-The water temperature is increasing above the limit set at the Chiller controller, and this condition will adversely affect temperatures in the correlator room, with potential for serious damage to the correlator. The RED indicator should come on when the temperature has risen above ~10.5°C, and ought to return to a GREEN condition when has gone below ~8.9°C.

AIR CONDITIONER LO Chiller Water Temp.

GREEN-The water temperature is within the proper limit set at the Chiller controller. Mean temperature is ~6.8°C.
RED-The water temperature is decreasing below the limit set at the Chiller controller, and this condition will adversely affect temperatures in the correlator room, with potential for serious damage to the correlator. The RED indicator should come on when the temperature has dropped below ~5.5°C, and is supposed to return to a GREEN condition when it has risen above ~6.6°C.

AIR CONDITIONER HI Condens. Water Temp.

GREEN-The water temperature is at the right temperature for the proper operation of the HVAC system. Mean temperature is ~36.0°C.
RED-The water temperature is either above or below the limits set for correct operation of the HVAC system, creating either heating or cooling malfunctions in the control building.

Condens. Water Temp.

This indicator is a read-out of the actual condenser water temperature. This is sampled in the HVAC room, and could be compared to the digital meter located at that location.

Chilled Water Temp.

This **indicator is a read-out of the actual chiller water temperature. This is sampled in the HVAC room, and could be compared to the digital meter located at that location.**

2.7 SERIAL HOLD-OFF SIGNALS

G10

GREEN-Verifies the chain from the WG cycle interrupt through to the task G10 which calculates all the geometry-related parameters for an observation once per ten seconds.
RED-The most likely cause for this alarm is that BOSS is no longer running. Almost always, if the G10 alarm sounds, the DUMP alarm will also sound.

DUMP

GREEN-Verifies the chain from the correlator to INTAKE, DUMP, TAPE and the tape drive.
RED-Aside from hardware failures, the most likely cause for this alarm is the Spectre and the correlator do not agree with BOSS about the current observing configuration. Failures of Spectre, the correlator, the AP, or a tape drive will also cause this alarm. Running NEWCFG (/NEWCFG/E, , L32 in BOSS) can remedy this.

2.8 MISCELLANEOUS SCREENS AND FUNCTIONS

MASTER EMERGENCY STOP

E-STOP (GREEN)-The E-STOP for all antennas in the array is not set.
E-STOP (RED)-The E-STOP for all antennas in the array is set.

W-ARM

E-STOP (GREEN)-The E-STOP for all antennas in the west arm of the array is not set.
E-STOP (RED)-The E-STOP for all antennas in the west arm of the array is set.
ACU RST (ACU RESET)-This will activate a reset of all the ACU modules in the west arm of the array. A blue indicator will scroll down each pad location on the west arm.

N-ARM

E-STOP (GREEN)-The E-STOP for all antennas in the north arm of the array is not set.
E-STOP (RED)-The E-STOP for all antennas in the north arm of the array is set.
ACU RST (ACU RESET)-This will activate a reset of all the ACU modules in the north arm of the array. A blue indicator will scroll down each pad location on the north arm.

E-ARM

E-STOP (GREEN)-The E-STOP for all antennas in the east arm of the array is not set.
E-STOP (RED)-The E-STOP for all antennas in the east arm of the array is set.
ACU RST (ACU RESET)-This will activate a reset of all the ACU modules in the east arm of the array. A blue indicator will scroll down each pad location on the east arm.

WEST ARM

WEST ARM CONFIGURATOR-This sub-screen will allow the operator to configure a specific antenna to a specific pad location.
POSITION-This is the position of the antenna in the west arm.
ANTENNA NUMBER-This is the antenna number.
PAD LOCATION-This is the pad location for the west arm configuration.

NORTH ARM

NORTH ARM CONFIGURATOR-This sub-screen will allow the operator to configure a specific antenna to a specific pad location.
POSITION-This is the position of the antenna in the north arm.
ANTENNA NUMBER-This is the antenna number.
PAD LOCATION-This is the pad location for the north arm configuration.

EAST ARM

EAST ARM CONFIGURATOR-This sub-screen will allow the operator to configure a specific antenna to a specific pad location.
POSITION-This is the position of the antenna in the east arm.
ANTENNA NUMBER-This is the antenna number.
PAD LOCATION-This is the pad location for the east arm configuration.

DATE-TIME

SET DATE/TIME-This sub-screen will allow the operator to set the various time functions listed in this window.

VOX's ENABLED VLA WYE MONITOR

GREEN-The voice annunciation is active for the system.
RED-The voice annunciation is inactive for the system.
(Note: this button is a global function.)

K/VOICE

This button disables the voice annunciation for the current alarm condition.

TX LOG

This button will bring up a menu for the transmission, acknowledge, and no response record for the associated modules and screens, and is for troubleshooting purposes.

EXIT

Pressing this will exit the current menu.

3.0 PREVENTIVE MAINTENANCE TEST PROCEDURES

This section contains preventive maintenance procedures as developed in the course of a complete audit and checkout of the entire Wyemon system. These procedures are to be incorporated into a regular maintenance schedule that will facilitate system level testing. The goal is to maintain quality and identify any problems incurred during testing. Itemized check-out sheets are included in the maintenance procedures to define a standard for qualification and acceptance.

3.1 WYE MONITOR ARRAY SYSTEM

TEST ANTENNA STATUS IN THE ARRAY AT THE SYSTEM LEVEL

Summary:
VLA preventive maintenance procedures for the M26 Wye Monitor Modules

Personnel Required:
2 DCS technicians and a Servo technician

Tools Required:
2 hand-held radios, cans of smoke detector tester

Reference Drawing:
VLA Technical Report No. 71

Time Required:
~2 maintenance days when the VLA is in the D configuration

Procedure:
A. Antenna check-out
(NOTE: A Servo technician will be required to assist either in initiating fault conditions or monitoring the reporting status in the operations control room.)

1. Two technicians will be needed in the antenna for: 1) initiating and clearing fault conditions, and 2) good communications with the other technician while they are either sending commands or watching status conditions in the control room.

2. The antenna technicians can initiate multiple alarm conditions by spraying smoke detector tester on each smoke alarm. There are three smoke alarms in an antenna. They are located in the lower pedestal room, the upper pedestal room, and the vertex room.

3. After each smoke alarm has been activated it will be necessary for alarm status to be conveyed between operations and the antenna. Once the smoke alarm clears, a manual reset has to be performed inside the fire alarm control box located inside the lower pedestal room.

4. When the operations technician confirms that the fire alarm has cleared the Wyemon screen a timed relay resets the main power inside the antenna. When the communication technician in the antenna hears the relay set, they can request the operations technician to send a NCP reset command to restore non-critical power.

5. Once power has been restored, the communication technician can request commands to be sent for ACU reset and E-STOP. Upon confirming that each one has been activated and cleared, steps 2 & 3 can be repeated for testing the remaining two smoke alarms.

WYEMON ANTENNA STATUS CHECKLIST

ANTENNA NUMBER ☐

POINTING
POINTING (GREEN) ○ check
STOW/HI-EL (YELLOW) ○ check

E-STOP
OFF (GREEN) ○ check
ON/LOCAL (RED) ○ check

+28V
OK (GREEN) ○ check
FAIL (RED) ○ check
E-STOP – ON/LOCAL (RED) ○ check

PHASE
OK (GREEN) ○ check
LOSS (RED) ○ check

NCP
OK (GREEN) ○ check
FAILURE (RED) ○ check
RESET (BLUE) ○ check

ACU
REM/OK (GREEN) ○ check
FAULT (RED) ○ check
RESET (BLUE) ○ check

FIRE
OK (GREEN) ○ check ○ check ○ check
ALARM (RED) ○ check ○ check ○ check

E-STOP
SET E-STOP
E-STOP (RED) ○ check
RESET E-STOP
E-STOP (GREEN) ○ check

DATE COMPLETED: _____

TIME REQUIRED: _____

SIGNED: _____

3.2 WYE MONITOR SYSTEM (GENERATOR ROOM)

TEST GENERATOR AND MASTER CUBICLE SYSTEMS

Summary:
VLA preventive maintenance procedures for the M27 Auxiliary Monitor Modules

Personnel Required:
2 DCS technicians and a Servo technician

Tools Required:
Small flat-head screwdriver

Reference Drawings:
D13900S08
D13900W10
C9390028
VLA Technical Report No. 71

Time Required:
~1 hour

Procedure:
A. Generators 1 and 2
(NOTE: A Servo technician will be required to assist either in initiating fault conditions. The circuit-board that interfaces to the Wyemon system in the generator room is maintained by the Servo group.)

1. A DCS technician will be needed in the generator room and in operations. This is required in order to get good communications of the proper faults being set.

2. For the M27 to present a problem to the Wyemon system there needs to be +24V seen from the circuit-board to set each generator fault. The Servo technician must apply +24V across the relay switches, therefore initiating a fault condition.

B. Master Cubicle
(NOTE: A Servo technician will be required to simulate the fault conditions.)

1. A DCS technician will be needed in operations and in the generator room. This is needed in order to get good communication of the proper fault being set.

2. For the M27 to present a problem to the Wyemon system there needs to be +24V present on the circuit board to set each master cubicle fault. The Servo technician must apply +24V across the relay switches, therefore initiating a fault condition.

3. After each simulated fault, you must verify that each fault was received by the Wyemon system. This is done by going to the touch screen and opening up the Master Cubicle sub-screen and noting that the corresponding fault is flagged in red and that the voice alarm is sounding.

WYEMON GENERATOR ROOM CHECKLIST

	GENERATOR 1	GENERATOR 2
GENERATOR CIRCUIT BREAKER	○ check	○ check
REMOTE CIRCUIT BREAKER	○ check	○ check
ENGINE START	○ check	○ check
ENGINE RUNNING (no voice)	○ check	○ check
BATTERY FAILURE	○ check	○ check
OVER-CRANK	○ check	○ check
FAILURE TO SYNCHRONIZE	○ check	○ check
APPROACH TO LO LUBE OIL	○ check	○ check
APPROACH HI WATER TEMP	○ check	○ check
APPROACH LOAD LIMIT	○ check	○ check

DATE COMPLETED: _____

TIME REQUIRED: _____

SIGNED: _____

WYEMON MASTER CUBICLE CHECKLIST

NCP RESET	○ check
GEN. TIE BREAKER	○ check
SEC UTILITY BREAKER	○ check
AC CONTROL VOLT FAIL	○ check
125V BATTERY BANK	○ check
#1 DAY TANK LO-FUEL	○ check
#2 DAY TANK LO-FUEL	○ check
VOLT/FREQ FAIL	○ check
LOAD-SHED ACTIVATED	○ check
ALARM HORN	○ check

DATE COMPLETED: _____

TIME REQUIRED: _____

SIGNED: _____

3.3 WYE MONITOR SYSTEM (UPS ROOM)

TEST THE COMPUTER AND CORRELATOR ROOM UPS SYSTEMS

Summary:
VLA preventive maintenance procedure for the UPS room M27 Auxiliary Monitor Modules

Personnel required:
2 DCS technicians and a Servo technician

Tools required:
None

Reference Drawings:
D13900W09
D13900S08
C13900W05
VLA Technical Report No. 71

Time required:
~1.0 hour

Procedure:
A. Computer and Correlator UPS Systems
(NOTE: A Servo technician will be required to simulate the fault conditions.)

1. A DCS technician will be needed in the UPS room and in operations. This is required in order to get good communication of the proper fault being set.

2. In this test, the Servo tech will simulate real fault conditions in the computer UPS and correlator UPS, unlike the fake fault conditions required in the generator system.

3. After each simulated fault, you must verify that each fault was received by the Wyemon system. This is done by going to the touch screen and opening up the Computer UPS or Correlator UPS sub-screens and verifying that the corresponding fault is flagged and that the voice alarm is sounding.

WYEMON UPS ROOM CHECKLIST

	COMPUTER UPS	CORRELATOR UPS
(will not simulate) *		
NORMAL (UPS AVAILABLE)	○ check	○ check
UPS ON BYPASS	○ check	○ check
5 MIN TILL UPS SHUTDOWN*	○ check	○ check
SUMMARY ALARM	○ check	○ check
MINOR ALARM	○ check	○ check
MAJOR ALARM*	○ check	○ check
UPS INPUT FAILURE	○ check	○ check
BATTERY VOLTS LOW*	○ check	○ check
BATTERY NOT AVAILABLE	○ check	○ check
UPS OVERLOAD ALARM*	○ check	○ check
INLET AIR OVER-TEMP ALARM*	○ check	○ check
TRANSFER NOT AVAILABLE	○ check	○ check
RETRANSFER NOT AVAILABLE	○ check	○ check

DATE COMPLETED: _____

TIME REQUIRED: _____

SIGNED: _____

3.4 WYE MONITOR SYSTEM (M29 MODULE)

TEST HVAC SYSTEM, COMPUTER AND CORRELATOR ROOM AIRFLOW SENSORS, AND RS-232 SERIAL HOLD-OFF SIGNALS FROM THE MODCOMP COMPUTERS

Summary:
VLA preventive maintenance procedure for the M29 Auxiliary Utility Module

Personnel required:
2 DCS technicians, an HVAC technician, and Ken Sowinski

Tools Required:
None

Reference Drawings:
D13900S07
C13900W03
VLA Technical Report No. 71

Time Required:
~2 hours

Procedure:
A. HVAC System:
(NOTE: An HVAC technician will be needed to initiate fault conditions.)

1. You will need the HVAC technician to initiate chiller hot, chiller cold, and condenser hot fault conditions one at a time.

2. After each fault, you must verify that each one was received by the Wyemon system. This is done by going to the touch screen and opening up the control building sub-screen and noting that the corresponding fault is flagged in red and that the voice alarm is sounding.

	GOOD		BAD	
CHILLER HOT FAULT	○	check	○	check
CHILLER COLD FAULT	○	check	○	check
CONDENSER HOT FAULT	○	check	○	check

3. Verify the correct condenser and chilled water temperatures.

4. This is performed by looking at the Wyemon touch screen and monitoring the condenser and chilled water temperatures.

5. These temperatures are sampled in the HVAC room and compared to the digital meters that measure the actual temperatures. To find out where the digital meters are located, ask your local HVAC technician.

	WYEMON	ACTUAL
CONDENSER WATER TEMPERATURE	○ check	○ check
CHILLED WATER TEMPERATURE	○ check	○ check

B. Computer and Correlator airflow systems:
(NOTE: An HVAC technician will be needed to simulate fault conditions.)
Currently, the computer room low-pressure sensor is disconnected due to false alarms generated when doors are opened, but the following will still be included for the PM with this device.

1. You will need the HVAC technician to shut down the computer and correlator room airflow fans in order to simulate the fault conditions.

2. After each simulated fault, you must again verify that that each fault was received by the Wyemon system. This is done again by going to the touch screen and opening up the control building sub-screen and being assured that the proper air flow alarm is flagged and the voice alarm is sounding.

	GOOD	BAD
COMPUTER ROOM AIRFLOW FAULT	○ check	○ check
CORRELATOR ROOM AIRFLOW FAULT	○ check	○ check

C. Modcomp Hold-off Signals:
NOTE: Ken Sowinski will be needed to initiate fault conditions.

1. You will need Ken Sowinski to shut down the Dump and G10 programs one at a time in order to initiate the fault conditions.

2. You should then verify that the Wyemon system is responding to the missing DUMP and G10 hold-off signals by observing the flashing DUMP and G10 panels and listening for the Dump has stopped and G10 has stopped voice alarms.

	GOOD		BAD	
DUMP ALARM	○	check	○	check
G10 ALARM	○	check	○	check

DATE COMPLETED: _____

TIME REQUIRED: _____

SIGNED: _____

4.0 TEST RESULTS FROM VLA 2000 “D” CONFIGURATION

This section is the results of the antenna status testing, performed throughout the entire D-array configuration during 2000. There is a sheet for each arm of the array, with acceptance criteria for each antenna. Comments were made for any discrepancy or anomaly.

WYEMON ANTENNA STATUS SYSTEM TEST
VLA D CONFIGURATION 2000

NORTH ARM									
Antenna number	**5**	**27**	**19**	**3**	**18**	**25**	**4**	**8**	**1**
POINTING									
pointing (green)	x	x	x	x	x	x	x	x	x
stow/hi-el (yellow)	x	x	x	x	x	x	x	x	x
E-STOP									
off (green)	x	x	x	x	x	x	x	x	x
on/local (red)	x	x	x	x	x	x	x	x	x
28V									
ok (green)	x	x	x	x	x	x	x	x	x
fail (red)	x	x	x	x	x	x	x	x	x
e-stop - on/local (red)	x	x	x	x	x	x	x	x	x
PHASE									
ok (green)	x	x	x	x	x	x	x	x	x
loss (red)	x	x	x	x	x	x	x	x	x
NCP									
ok (green)	x	x	x	x	x	x	x	x	x
failure (red)	x	x	x	x	x	x	x	x	x
reset (blue)	x	x	x	x	x	x	x	x	x
ACU									
rem/ok (green)	x	x	x	x	x	x	x	x	x
fault (red)	x	x	x	x	x	x	x	x	x
reset (blue	x	x	x	x	x	x	x	x	x
FIRE									
ok (green)	x (all)	x (all)	x (all)	x (all)	x (all)	x (all)	x (all)	x (all)	x (all)
alarm (red)	x (all)	x (all)	x (all)	x (all)	x (all)	x (all)	x (all)	x (all)	x (all)
E-STOP									no chck
Set E-Stop									
e-stop (red)	x	x	x	x	x	x	x	x	
Reset E-Stop									
e-stop (green)	x	x	x	x	x	x	x	x	
comments:				replace fire alarm batt.				acu red in local	no check e-stop- people in vertex

WYEMON ANTENNA STATUS SYSTEM TEST
VLA D CONFIGURATION 2000

EAST ARM									
Antenna number	**15**	**28**	**9**	**20**	**17**	**7**	**12**	**6**	**14**
POINTING									
pointing (green)	x	x	x	x	x	x	x	x	x
stow/hi-el (yellow)	x	x	x	x	x	x	x	x	x
E-STOP									
off (green)	x	x	x	x	x	x	x	x	x
on/local (red)	x	x	x	x	x	x	x	x	x
28V									
ok (green)	x	x	x	x	x	x	x	x	x
fail (red)	x	x	x	x	x	x	x	x	x
e-stop - on/local (red)	x	x	x	x	x	x	x	x	x
PHASE									
ok (green)	x	x	x	x	x	x	x	x	x
loss (red)	x	x	x	x	x	x	x	x	x
NCP									
ok (green)	x	x	x	x	x	x	x	x	x
failure (red)	x	x	x	x	x	x	x	x	x
reset (blue)	x	x	x	x	x	x	x	x	x
ACU									
rem/ok (green)	x	x	x	x	x	x	x	x	x
fault (red)	x	x	x	x	x	x	x	x	x
reset (blue	x	x	x	x	x	x	x	x	x
FIRE									
ok (green)	x (all)	x (all)	x (all)	x (all)	x (all)	x (all)	x (all)	x (all)	x (all)
alarm (red)	x (all)	x (all)	x (all)	x (all)	x (all)	x (all)	x (all)	x (all)	x (all)
E-STOP									
Set E-Stop									
e-stop (red)	x	x	x	x	x	x	x	x	x
Reset E-Stop									
e-stop (green)	x	x	x	x	x	x	x	x	x
comments:	no response to fire alarm	no alarm lwr ped		up. ped alarm-no pwr. dump		no aud. alarm lw. Ped, no local ACU ind., no local crs. Hatch			fire alarm low batt.

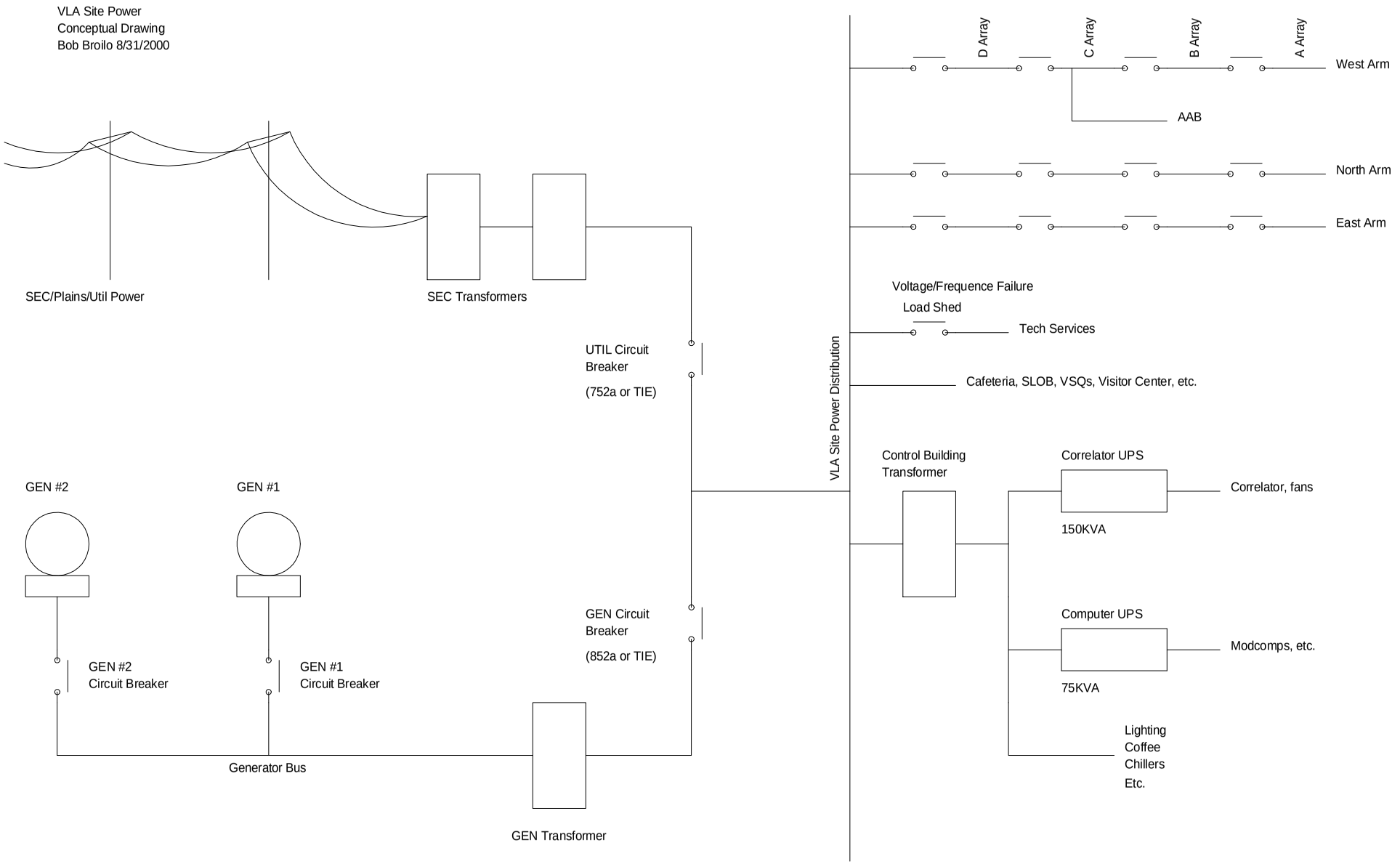
WYEMON ANTENNA STATUS SYSTEM TEST
VLA D CONFIGURATION 2000

WEST ARM									
Antenna number	**23**	**21**	**10**	**11**	**16**	**26**	**24**	**22**	**13**
POINTING									
pointing (green)	x	x	x	x	x	x	x	x	x
stow/hi-el (yellow)	x	x	x	x	x	x	x	x	x
E-STOP									
off (green)	x	x	x	x	x	x	x	x	x
on/local (red)	x	x	x	x	x	x	x	x	x
28V									
ok (green)	x	x	x	x	x	x	x	x	x
fail (red)	x	x	x	x	x	x	x	x	x
e-stop - on/local (red)	x	x	x	x	x	x	x	x	x
PHASE									
ok (green)	x	x	x	x	x	x	x	x	x
loss (red)	x	x	x	x	x	x	x	x	x
NCP									
ok (green)	x	x	x	x	x	x	x	x	x
failure (red)	x	x	x	x	x	x	x	x	x
reset (blue)	x	x	x	x	x	x	x	x	x
ACU									
rem/ok (green)	x	x	x	x	x	x	x	x	x
fault (red)	x	x	x	x	x	x	x	x	x
reset (blue	x	x	x	x	x	x	x	x	x
FIRE									
ok (green)	x (all)	x (all)	x (all)	x (all)	x (all)	x (all)	x (all)	x (all)	x (all)
alarm (red)	x (all)	x (all)	x (all)	x (all)	x (all)	x (all)	x (all)	x (all)	x (all)
E-STOP									
Set E-Stop									
e-stop (red)	x	x	x	x	x	x	x	x	x
Reset E-Stop									
e-stop (green)	x	x	x	x	x	x	x	x	x

comments:

5.0 WYEMON SYSTEM FUNCTIONAL DRAWINGS

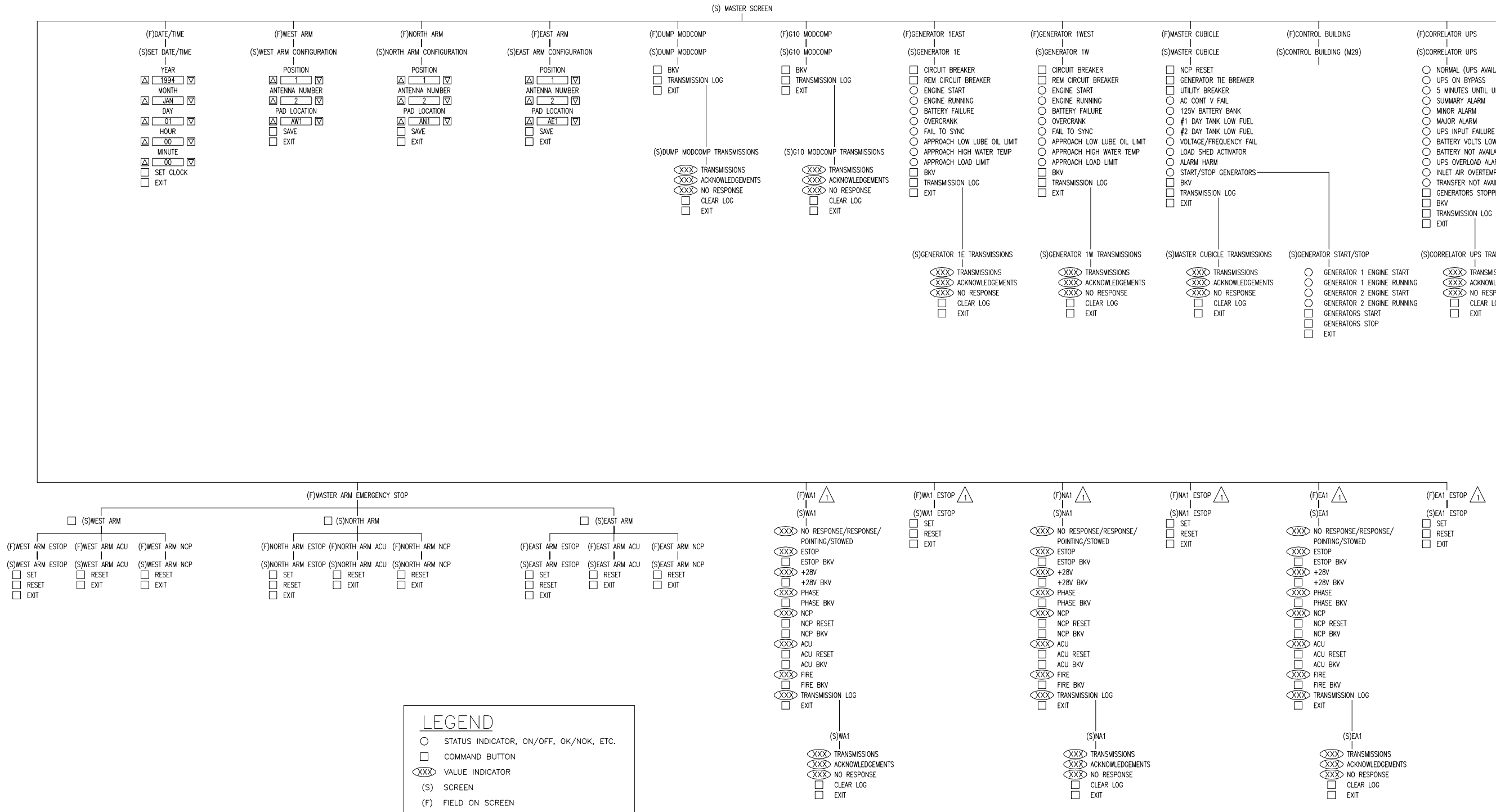
These are drawings that illustrate the VLA site power distribution and the Wyemon menu structure.


VLA Site Power
Conceptual Drawing
Bob Broilo 8/31/2000
SEC/Plains/Util Power
SEC Transformers
UTIL Circuit
Breaker
(752a or TIE)
GEN #2
GEN #1
GEN #2
Circuit Breaker
GEN #1
Circuit Breaker
GEN Circuit
Breaker
(852a or TIE)
Generator Bus
GEN Transformer
VLA Site Power Distribution
D Array
C Array
B Array
A Array
West Arm
AAB
North Arm
East Arm
Voltage/Frequence Failure
Load Shed
Tech Services
Cafeteria, SLOB, VSQs, Visitor Center, etc.
Control Building
Transformer
Correlator UPS
Correlator, fans
150KVA
Computer UPS
Modcomps, etc.
75KVA
Lighting
Coffee
Chillers
Etc.

REV	DATE	DRAWN BY	APPRV'D BY	DESCRIPTION

NOTES:

1. INDENTICAL SCREENS EXIST FOR ALL 27 ANTENNAS.
   ONLY ANTENNA 1 SCREENS ARE SHOWN FOR CLARITY



LEGEND

- ○ STATUS INDICATOR, ON/OFF, OK/NOK, ETC.
- □ COMMAND BUTTON
- (XXX) VALUE INDICATOR
- (S) SCREEN
- (F) FIELD ON SCREEN
- □ BKV – KILL VOICE MESSAGE

ACAD : 13900B11

PROPERTY OF NRAO

NEXT ASSEMBLY	DWG. TYPE

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES : ANGLES ±
3 PLACE DECIMALS (.XXX) ±
2 PLACE DECIMALS (.XX) ±
1 PLACE DECIMALS (.X) ±

MATERIAL :

FINISH :

PROJECT: VLA — WYE MONITOR

TITLE: WYE MONITOR TOUCH–SCREEN CONTROL/MONITOR MENU STRUCTURE BLOCK DIAGRAM

SHEET NUMBER 1 OF 1 | DRAWING NUMBER D13900B11 | REV. – | SCALE NONE

NATIONAL RADIO ASTRONOMY OBSERVATORY
SOCORRO, NEW MEXICO 87801

DRAWN BY K. TATE	DATE 5–94
DESIGNED BY P. DOOLEY	DATE 5–94
APPROVED BY P. DOOLEY	DATE 5–94

6.0 REFERENCES

Dooley, Philip *The VLA Wye Monitor System Hardware*. **VLA Technical Report No. 71, Volume 1. Aug. 1994**

Nieri, J. *Site Generator Initialization After SEC Utility Power Loss*. **July, 1993**

7.0 APPENDIX

This section is comprised of excepts from *The VLA Wye Monitor System Hardware*, **VLA Technical Report No. 71. For an in-depth discussion of the entire Wye Monitor System, please refer to this document.**

7.1 TELESCOPE OPERATOR INTERFACE

The telescope operator interface is both visual and audible. The visible portion of the interface is a Touch Screen CRT terminal that displays annotated control and display images that mimic conventional system control panels. The audible portion of the interface is an annunciator that pronounces voice messages that describe system states and alarm conditions.

The visual interface – the Touch Screen – is considered first. The Touch Screen images contain annotated pseudo-switches, pseudo-indicator lights and numeric displays grouped in labeled fields appropriate for the control function. The operator can enter a command by touching a fingertip to a pseudo control switch, just as is done on a conventional hardware control-display panel switch. Similarly, the pseudo-indicator lights and numeric displays show status and values, just as they would be displayed on a conventional hardware control-display panel. The control program assigns various solid and hatched colors to these switches, display and numeric indicator images and backgrounds as a function of the Wye Monitor system command and monitor states.

The color green in a switch or indicator signifies a non-fault or OK condition and red signifies an abnormal or fault condition. A blinking red color signifies an antenna fault. Antenna Emergency Stop is red. Yellow signifies a stowed antenna. A border-hatched (with a band of broad diagonal black hatching around the periphery) switch or indicator signifies local control of the function. A gray color signifies a no-response condition from the associated control interface. If a control function's voice alarm has been disabled, the switch's border is outlined in red. Some switches shift to a blue color for two seconds or so after actuation to show that the actuation caused a command to be sent to an antenna or some other device. Some switch activations request a different screen and may not send out commands.

The control program provides a number of Touch Screen images arranged in hierarchical sets that are accessed from the highest level (main) image, the VLA Wye Monitor Screen (Figure 1). Access to lower-level screens is accomplished by pressing any pseudo-switch. The accessed screen is inserted into the upper right corner of the VLA Wye Monitor Screen and replaces the Master Emergency Stop, W Arm, N Arm, etc. switches, and the "National Radio Astronomy Observatory" label. For example, Figure 2 shows the Correlator UPS sub-screen inserted into the VLA Wye Monitor Screen. Pseudo-switches on these sub-screens invoke commands or access lower level sub-screens. Figures 3, 4, and 5 show typical sub-screens for the antennas, generators, and other facility equipment. Note that these figures do no show every possible sub-screen; there are also similar sub-screens for identical equipment. Examples of such are sub-screens for other antennas, to other arm-wide antenna functions and multiple identical facility units (e.g. generators and UPS's).

These sub-screens are the telescope operator's control and monitor interfaces for the VLA antenna and facility systems equipment. There are thirteen types of level 2 sub-screens that can be accessed from the main screen and some systems have a third level sub-screen to provide an additional level of control expansion for complex systems. The other sub-screens are not described in detail, but the equipment's functions are suggested by the annotations on the screen switches, lights and indicators.

The VLA Wye Monitor Screen is the most complex screen, and its usage typifies the operation of the other screens. The left side of Figure 1 has 9 antenna pseudo-switches for each arm in observing pad order. These activate the antenna sub-screen (level 2) indicated by the antenna number. Emergency Stop pseudo-switches command the associated antenna Emergency Stop to be set. The antenna switches also show the antenna's observing location. At the top of these three columns are arm configuration switches labeled "West Arm", "North Arm", and "East Arm". These switches call up the Arm sub-screens described below. Please note that antenna E-Stop, ACU Reset and NCP Reset commands can be activated on a single antenna basis (via an antenna sub-screen) or on an arm-wide basis (via an Arm E-Stop, Arm ACU Reset or an Arm NCP Reset sub-screen). Additionally, the Emergency Stop command can also be activated on an array-wide basis via the Master E-Stop sub-screen. No other comparable cases exist for other VLA facility equipment.

The West, East and North Arm configurator sub-screens are activated when the operator touches the "West Arm", "North Arm", or "East Arm" switches above the antenna number-pad location columns on the top left side of the main screen. This Arm configurator screen enables the telescope operator to quickly re-assign antennas to the observing pad locations during array reconfigurations. The antenna number-observing pad data is shown in increasing pad number order in the three antenna columns.

Below the Arm associated switches described above are eight switches that activate level 2 screens for major VLA system components. These are: the ModComp control computers, the generators and switch gear (Master Cubicle), the computer and correlator UPS's and the control building HVAC system.

A Date-Time switch above the three-arm configuration switches show the day, month, date, time (local time) and year. Touching this switch activates the Set Date/Time screen to enable the operator to set in the appropriate values. This data appears in the upper left side of the main VLA Wye Monitor Screen.

A large Master Emergency Stop switch on the top right causes all antennas to be commanded to the Emergency Stop condition.

Below the Master Emergency Stop switch are three arm-associated switches: an Emergency Stop, ACU Reset and NCP reset. The Emergency Stop switch causes all antennas on an arm to be set to the Emergency Stop condition. Similarly, the ACU Reset and NCP Reset switches cause all the ACU's and the NCP breakers on the arm to be reset.

Additionally, level 2 and level 3 sub-screens have an Exit switch to return to the associated level 2 or main screens.

To relieve the operator from the necessity of checking the Touch Screen displays, the annunciator alerts the operator when there are antenna and/or system facility equipment alarm conditions and abnormal states. The annunciator can be enabled or silenced in two ways: 1) the main screen has a Clear Voice Alarms switch to reset all annunciator alarms, and 2) some of the level 2 and level 3 screens have K/Voice switches that cause the associated vocal alarms to be squelched.

The annunciator is a voice synthesizer that is driven by concatenated sets of vocal word synthesis files. The program formulates the voice file sets as a function of the program's abnormal state and alarm logic. A voice message start is signaled by a beep to alert the operator that a message is impending. A typical voice message might be "Fire Alarm, West Arm, Antenna 22". Annunciator messages roughly correspond to each type of command or monitor function implemented in the Wye Monitor System. Voice messages are repeated until either the alarm or abnormal condition is cleared or the operator actuates the associated K/Voice switch. If there are more than one voice message, they are repeated in a continuous sequence.

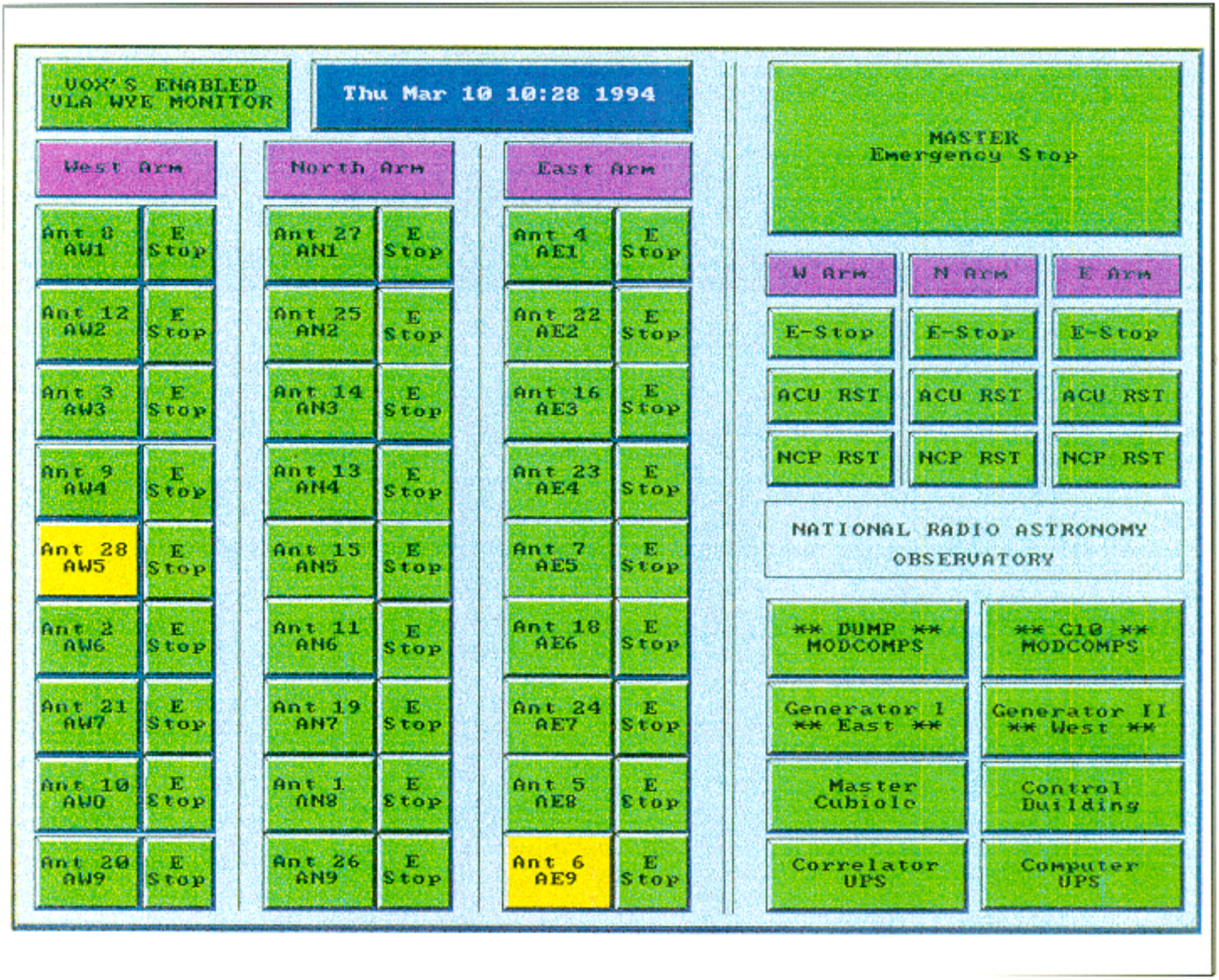


Figure 1 VLA WYE Monitor Screen

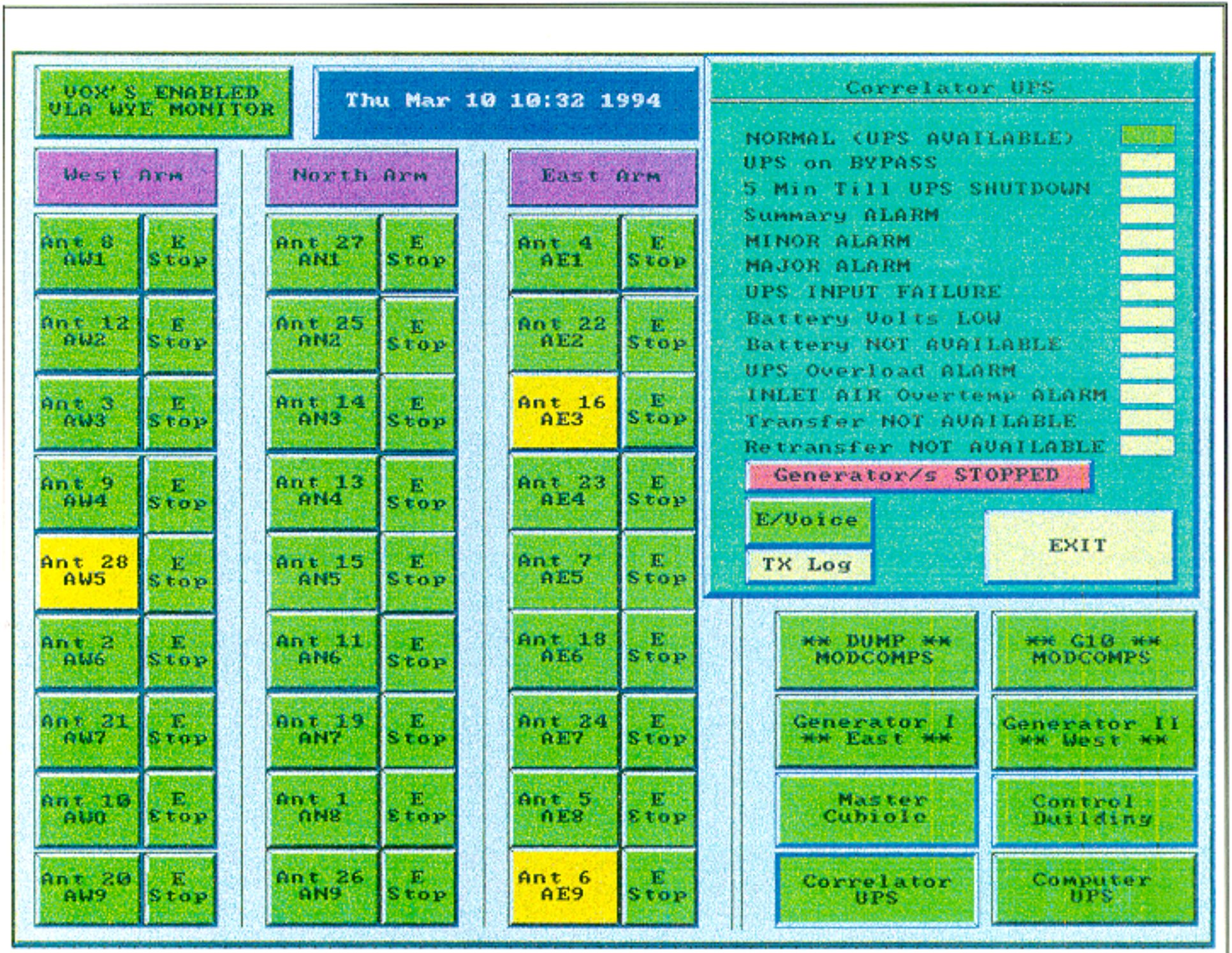


Figure 2 Correlator UPS Screen

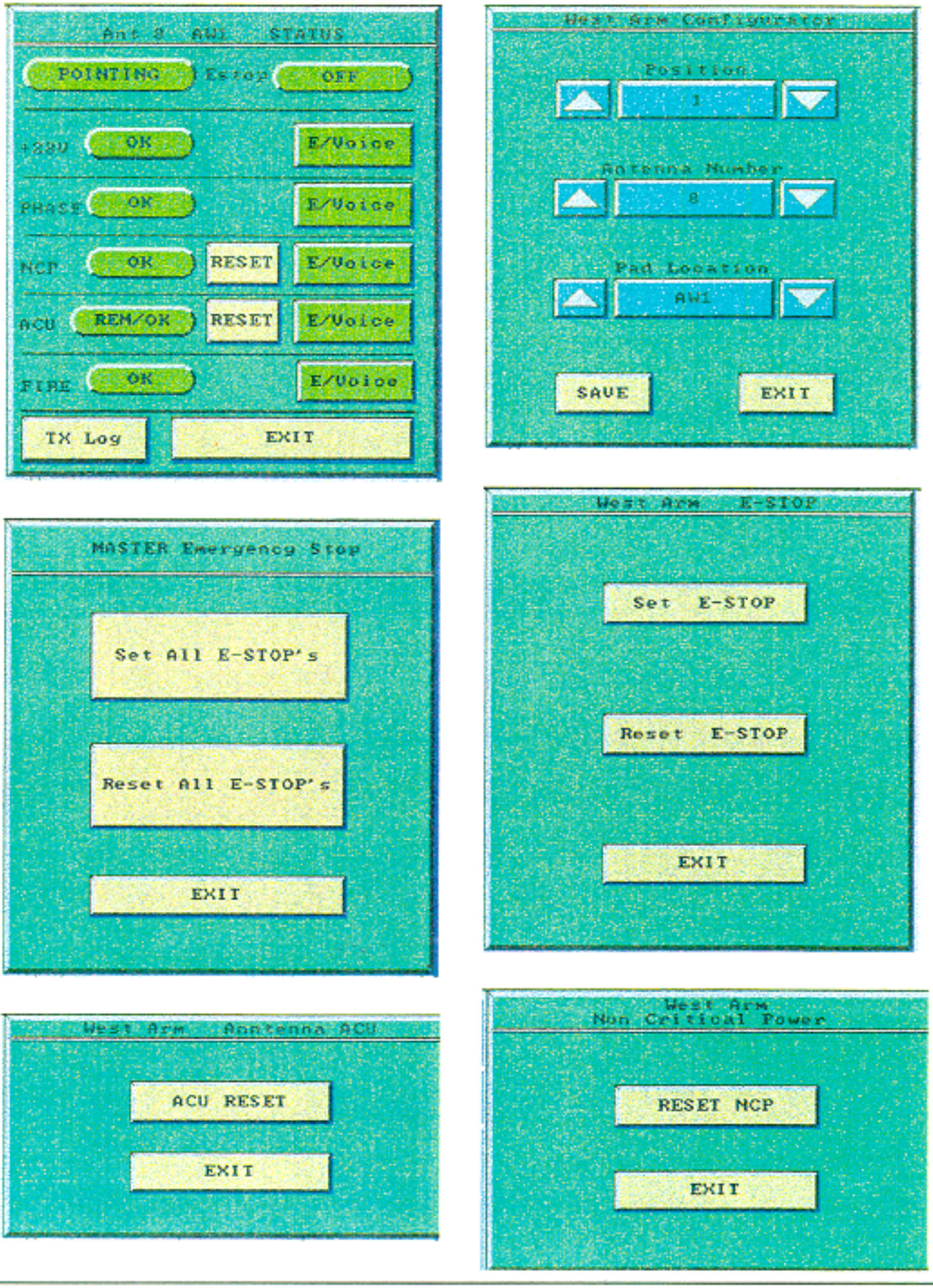


Figure 3 Typical Antenna Screens

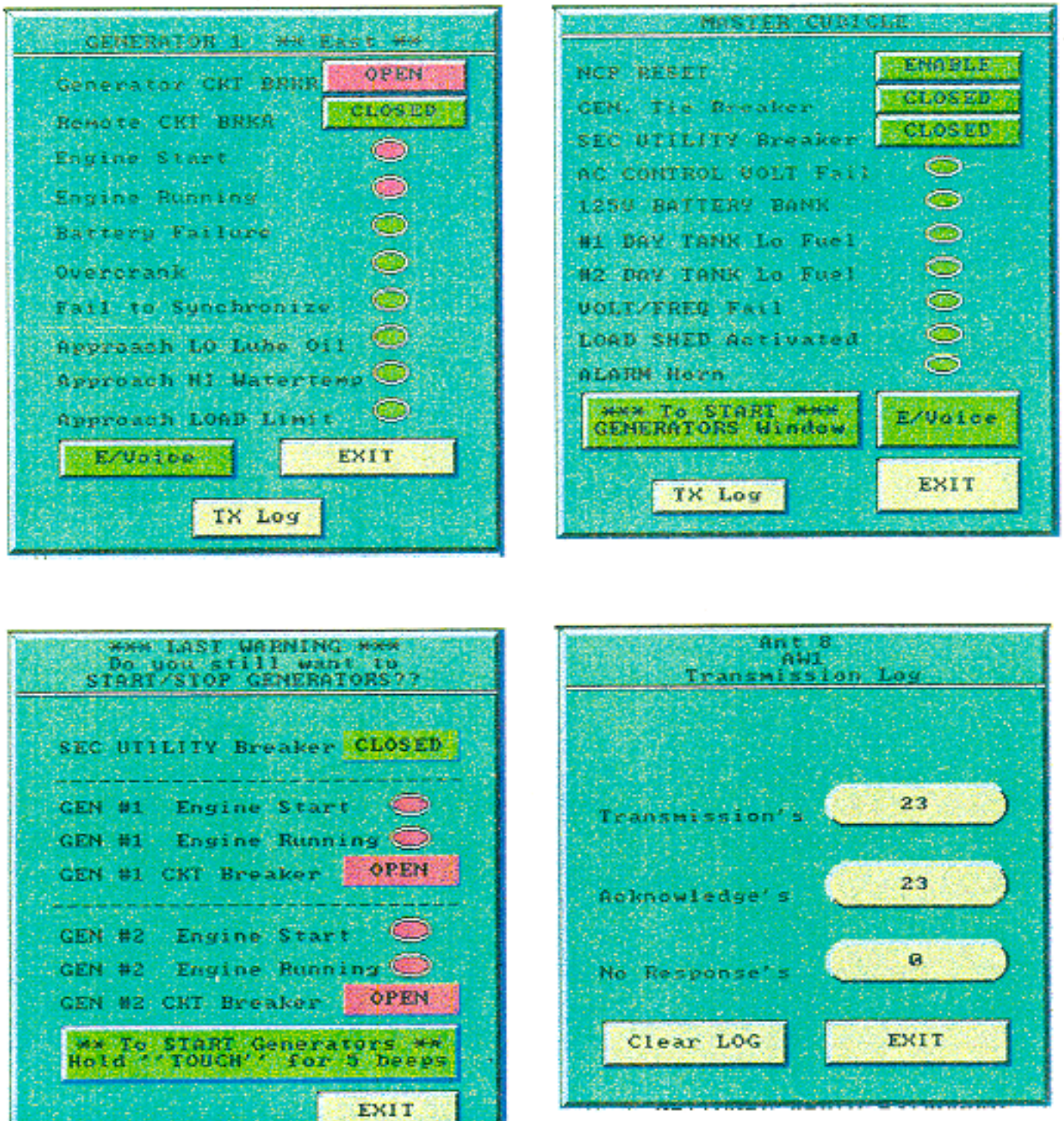


Figure 4 Typical Generator Screens

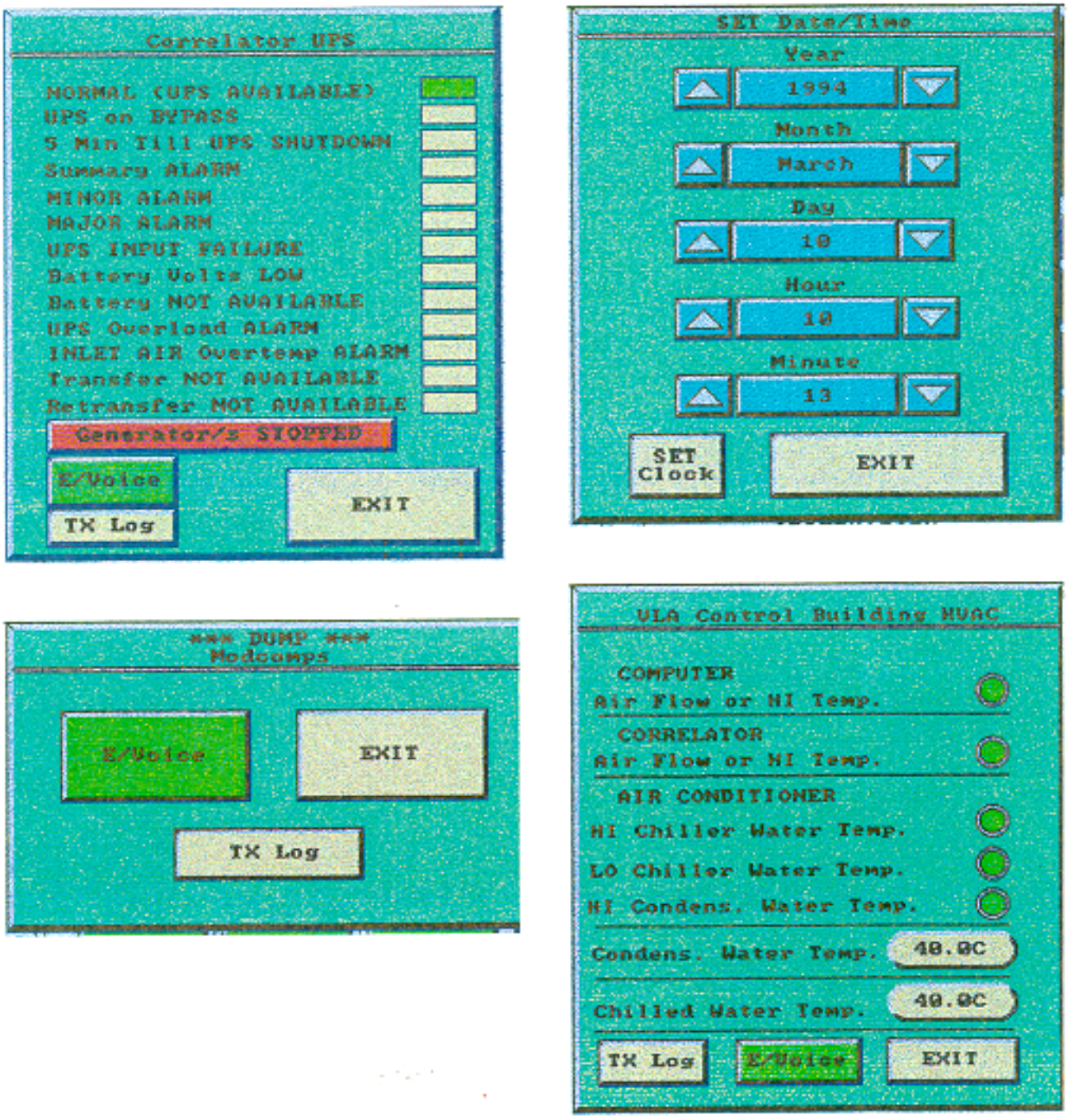


Figure 5 Typical Facility Screens