

700-00016-000
CabinAXe™
User's Manual



Astronics CSC
Inflight Entertainment and Connectivity Systems

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1 User Information

This User's Manual describes the features supported by Astronics CSC Wi-Fi 6E Cabin Wireless Access Point (CWAP), branded as *CabinAXe™* and provides detailed instructions for setting up and configuring the *CabinAXe™* wireless access point.

This guide is intended for administrators who configure and use CabinAXe™.

1.1 Support Documentation

In addition to this document, the following table describes Astronics CSC support documentation:

Table 1: Astronics CSC Support Documentation

Document Number	Description
700-00016-000-OL	Outline Drawing, Wi-Fi 6E CWAP (GbE)
PS-700-00016-000	Product Specification, Wi-Fi 6E CWAP (GbE)
CMM-44-20-53	Component Maintenance Manual (CMM), Wi-Fi 6E CWAP (GbE)
SRD-700-00016-000	Software Requirements Document for Wi-Fi 6E CWAP (GbE)
ATP-700-00016-000	Acceptance Test Procedure (ATP), Wi-Fi 6E CWAP (GbE)
FMEA-700-00016-000	Failure Modes and Effects Analysis (FMEA), CWAP, CabinAXe
QTR-700-00016-000ENV	Environmental (ENV) Qualification Test Report
QTR-700-00016-000EMC	Qualification Test Report, Electromagnetic Compatibility (EMC)

CabinAXe™ ships with Aruba Instant firmware. The following table describes the applicable Aruba support documentation for this firmware version. Aruba Instant 8.10 is the minimum version supported.

Table 2: Aruba Support Documentation

Document Name	Description
Aruba Instant User Guide	This User Guide describes the features supported by Aruba Instant and provides detailed instructions for setting up and configuring the Instant network.
Aruba Instant CLI Reference Guide	This document describes the Aruba Instant command syntax and provides information for each Command.
Aruba Instant Rest API Guide	This document describes the configuration procedures and monitoring functions that can be performed using REST APIs

1.2 Industry Standards

Table 3: Industry Standards

Industry Standard	Description
ARINC 628	Cabin Equipment Interfaces, Part 1, Interfaces, Cabin Management and Entertainment Systems - Peripherals
IEE 802.11	A set of media access control (MAC) and physical layer (PHY) specifications for implementing wireless local area network (WLAN) computer communication in the 900 MHz and 2.4, 3.6, 5.6, and 60 GHz frequency bands.
IEE 802.3	A set of media access control (MAC) and physical layer (PHY) specifications for implementing wired local area network (LAN) computer communication.
RTCA/DO-160G	Environmental Conditions and Test Procedures for Airborne Equipment RTCA/DO-178B Software Considerations in Airborne Systems and Equipment
802.11h	Spectrum and Transmit Power Management Extensions (TPC) is supported to ensure that the average power is less than the regulatory maximum to reduce interference to satellites.

1.3 Warranty

The CabinAXe™ is warranted against defects in materials and workmanship for the warranty period from the date of shipment. The warranty does not apply to defects resulting from improper or inadequate maintenance of handling by the buyer, unauthorized modification or misuse, operation outside of the product's environmental specification of improper installation or maintenance. Astronics CSC will not be responsible for any defects or damages to other products not supplied by Astronics CSC that are caused by a faulty Astronics CSC product.

1.4 Exclusion of Liability Notice

Should the user disregard the instructions (specifically the safety instructions) in this manual and possibly on the device, Astronics CSC shall be exempt from legal liability for accidents.

In the event of damage to the device, which is caused by a failure to observe the instructions (specifically the safety instructions) in this manual and possibly on the device, Astronics CSC shall not be required to honor the warranty, including during the warranty period, and shall be exempt from legal liability of accidents.

2 Important Safety Instructions

The following general instructions should always be followed in order to assure the proper operation of CabinAXe™, the safety of operators and the preservation of warranty coverage.



Warning!

All precautions, procedures, and safeguards to prevent damage due to ESD, and promote the safe handling of electrical components must be followed

1. Avoid removing any identification plates, serial numbers or warning labels unless specifically authorized by the manufacturer.
2. Please observe all specified dimensions required for mounting included in the Outline Drawing, Document 700-00016-000-OL.
3. When installing the CabinAXe™, there must be at least 1.00" free space to the left, right, top and rear of the unit to prevent the system overheating.
4. Leave at least 3.00" of free space to the front of the unit in order to have access to the connector interfaces to properly connect the peripherals.
5. Attach the CabinAXe™ firmly to a clean flat and solid mounting surface. Use proper fastening materials suitable for the mounting surface. Ensure that the mounting surface type and the mounting solution safely support the load of the CabinAXe™ and the attached components.
6. Follow the local/national regulations for grounding. A ground bonding measurement between the CabinAXe™ and the mounting surface should be conducted to ensure proper safety and EMI characteristics are maintained.
7. The voltage feeds must not be overloaded. Adjust the cabling and external overcharge protection to correspond with the electrical data indicated on the type label. For detailed interconnection of power and signal wiring, refer to the Section 4 (Starting Up) and Section 5 (Physical I/O).
8. Electrostatic Discharge (ESD)



Electrostatic boards and their components are sensitive to static electricity. Therefore, care must be taken during all handling operations and inspection of this product, in order to ensure product integrity at all times. Do not handle this product out of its protective enclosure while it is not used for operational purposes unless it is otherwise protected.



A sudden electrostatic discharge can destroy sensitive components. Proper packaging and grounding rules must be observed. Always take the following precautions.

- Keep electrostatically sensitive components in their containers, until they arrive at an electrostatically protected workplace.
- Only touch electrostatically sensitive components when you are properly earthed.
- Store electrostatically sensitive components in protective packaging or on anti-static mats.

3 Introduction

3.1 Product Description

The Cabin Wireless Access Point (CWAP) is a network distribution system specifically designed for commercial aircraft applications. The CWAP supports Wi-Fi 6E functionality and is backwards compatible with 802.11ac/a/b/g/n. The CWAP leverages the use of a COTS wireless access point to facilitate wireless communications to wireless client radios in the aircraft cabin, as well as other devices on the network. The CWAP provides a bridge between IEEE 802.3 wired Ethernet LANs and IEEE 802.11 compliant wireless networks.

The unit is provided with aircraft level discrete inputs and outputs to facilitate event notification to and from other aircraft systems, including remote management of the ON/OFF function. The unit is equipped with an airborne-type AC power supply capable of operating from 115VAC, 360 Hz – 800 Hz power, with a 200 msec hold-up capability for power interruptions. The CWAP does not require an active cooling system. The unit communicates to a host server by physical connection over a Gigabit Ethernet wired interface either in a “Daisy chain” or “Star” network topology environment.

The CWAP has integrated antennas supporting 2.4GHz, 5GHz, and 6GHz bands. Additionally, the CWAP includes a Bluetooth Low Energy (BLE 5.0) and 802.15.4 (Zigbee) radio for low-power connected devices, and onboard sensors and beacons.

This User Manual pertains to a CWAP with integrated antennas supporting 2.4GHz, 5GHz, and 6GHz bands.

This unit is identified as Astronics CSC part number 700-00016-000 and is branded as *CabinAXe™*.

3.2 Hardware Architecture

The CWAP leverages a state-of-the-art, commercial enterprise-class Wireless Access Point (AP). The AP selected for this application is manufactured by Aruba Networks, a Hewlett Packard Enterprise company. The Aruba model AP-635 has been ruggedized and repackaged to meet the operational requirements of commercial aircraft environment. The CWAP meets the electrical and mechanical requirements of ARINC 628.

The CabinAXe™ feature set includes:

- Architecture based on Wi-Fi 6E wireless standards (includes 1GHz of spectrum at 6GHz).
- Tri-band coverage across 2.4GHz, 5GHz, and 6GHz using three dedicated radios.
- IEEE 802.11ax, 2 x 2 MIMO, 2SS operation up to seven 160MHz channels.
- Peak data rates: 2.4Gbps (6GHz, HE160/2SS) + 1.2Gbps (5GHz, HE80/2SS) + 574Mbps (2.4GHz, HE40/2SS).
- 2x Integrated antennas omni-directional antennas with adaptive beam forming for enhanced throughput capabilities.
- OFDMA and Bi-Directional MU-MIMO for more active concurrent users.
- WPA-3 and Enhanced Open Security. WPA2-MPSK
- TPM 2.0 for secure key storage and credentials.
- Improved Client Roaming to optimize AP utilization.
- Hotspot 2.0.
- Dynamic Frequency Selection.
- Support for up to 512 associated client devices per radio.
- Fully Autonomous without Requiring a Separate Wireless Controller.
- Support for Worldwide (-WW) operation via the CLI which can automatically configure the CWAP

in accordance with location information (provided by the aircraft) to pre-set regulatory domains (country codes) stored within the CWAP.

- Bluetooth Low Energy (BLE 5.0) and 802.15.4 (Zigbee) radio for low-power connected devices, and onboard sensors and beacons.
- Dual Gigabit Ethernet interfaces.
- Discrete inputs to control Remote ON/OFF and RF Enable.
 - o The RF Enable/Disable discrete input state is read by the SIB and can be queried via the Manufacturing Data Server. The SIB firmware does not take any direct action when a state change is detected.
- Discrete output for PSU and AP status.
- IP address strapping bits.
- Support for input power pass thru to downstream CWAPs.
- Aircraft-grade AC power supply unit with 200 msec of hold-up capacity.
- Support for pass-thru Ethernet to downstream CWAPs (per ARINC 763).
- Redundant power supply to support Ethernet bypass in the event of a CWAP primary power supply failure.
- Connectors:
 - o EN4165 style connectors for all I/O (per ARINC 628).
 - o Micro USB for serial console connection.

3.3 Key Hardware Components

The CWAP key hardware components include:

- Commercial AP with integrated antennas for Wi-Fi, BLE, and Zigbee radios.
- PSU: Includes primary AC/DC, and secondary AC/DC power supplies.
- Signal Interface Board (SIB).
- External connectors Interface for Power, Ethernet, Discrete I/O (per ARINC 628).
- Mechanical housing; meets mounting requirements of ARINC 628.

Figure 1 shows the CWAP System Block Diagram.

(Intentionally Left Blank)

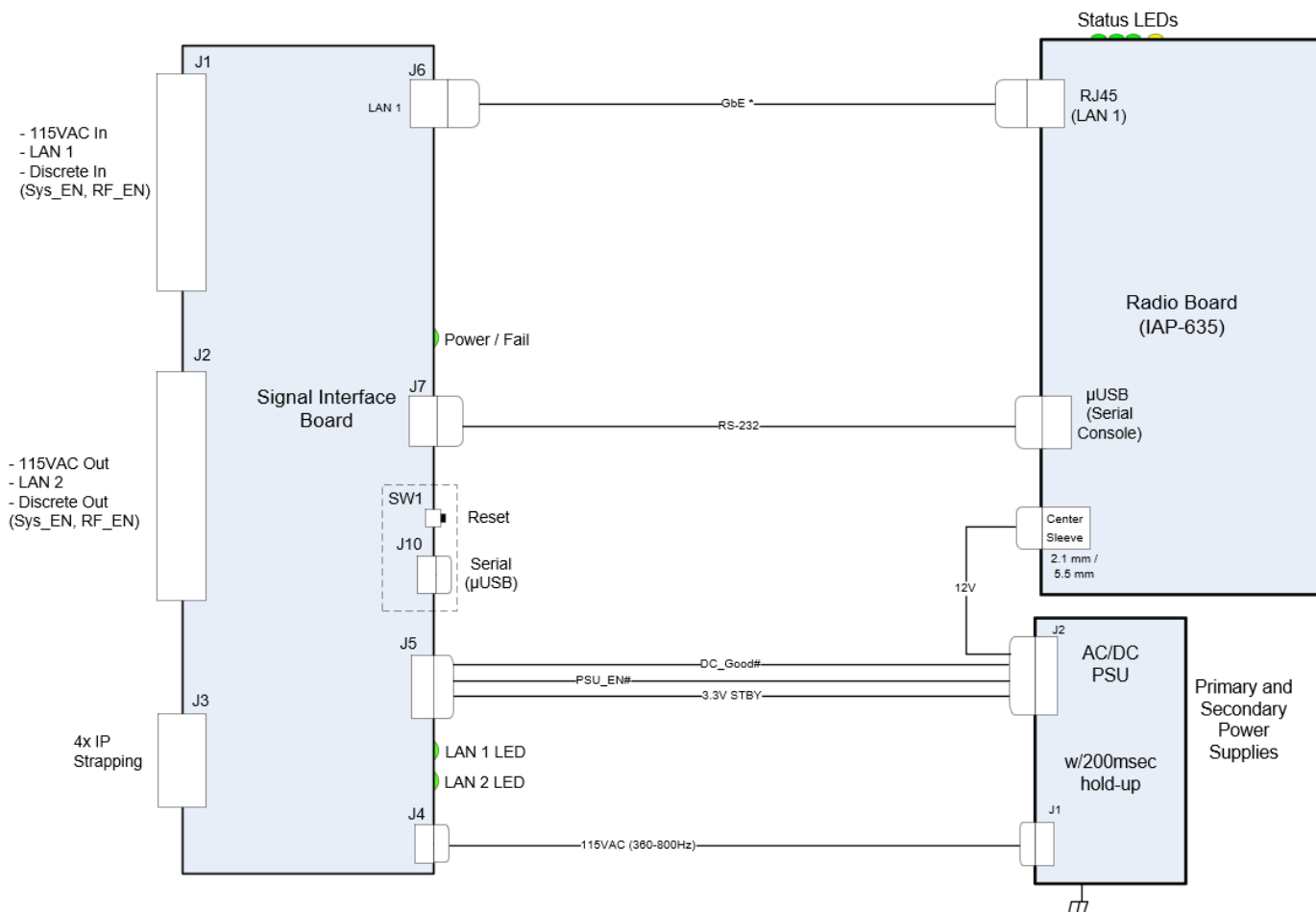
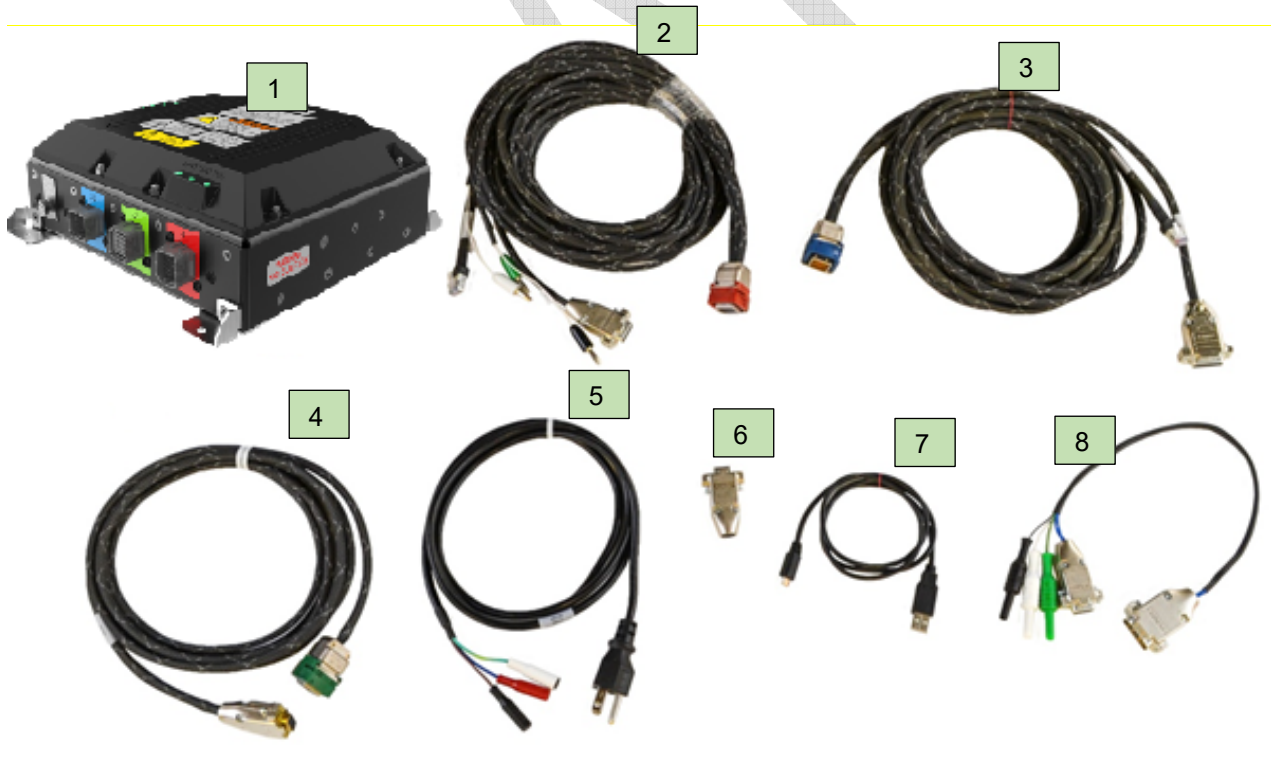


Figure 1: Wi-Fi 6E CWAP (GbE) System Block Diagram

3.4 Orderable Part Numbers

Table 4: Wi-Fi 6E CWAP (GbE) Orderable Part Numbers

ID	Astronics CSC P/N	Description
1	700-00016-000	LRU, Wi-Fi 6E CWAP (GbE)
2	E54-331	Cable Assy, Power/Signal/GbE, CWAP (J1)
3	E54-332	Cable Assy, Power/Signal/GbE, CWAP (J2)
4	E54-333	Cable Assy, Discretes, CWAP (J3)
5	E54-319	Cable Assy, AC Power Disconnect
6	E54-345	DB-9 Loop-back Test Connector (J1)
7	COTS part	USB Type A Male to Micro-USB Type B Male Cable
8	E54-352	Cable Assy, Daisy chain



Note: Items 2 – 8 are available for test purposes and are not intended to be used in flight.

Figure 2: CabinAXe™ Equipment

4 Starting Up

4.1 Power Up

The J1 power cable assembly, Astronics CSC P/N E54-331, and DB-9 loop-back connector, Astronics CSC P/N E54-345, are required to be connected to the CabinAXe™ to activate the unit when power is applied.

	WARNING! The specified voltage input range is 97 to 134 VAC, 60 – 800 Hz, single-phase power. DO NOT connect to 220 VAC. The power source must supply a minimum of 20W. The power source must be switched off via AC power disconnect, P/N E54-319, and must be easily accessible. Ambient temperature must be above -20 °C for the CWAP to turn on. Power is not switched internally and the unit will boot up as soon as power is applied.
---	--

Properly connect Astronics CSC P/N E54-331 to the CWAP J1 connector. The power source must be switched off via AC Power disconnect, Astronics CSC P/N E54-319, to make sure that no voltage is present at the terminal during the connecting procedure. Plug the DB-9 loopback connector, Astronics CSC P/N E54-345, to the mating connector of J1, E54-331 cable assembly.

Connect the other end of the power cord to the power source (not provided). Switch on the power source via the AC power disconnect.

4.2 Startup process

The CWAP needs two IP addresses for network connectivity, one for the access point and one for the Signal Interface Board (SIB). The four discrete IP strapping pins in the J3 connector are set to HIGH (+5v DC) by pull up resistors, and can be grounded to set static IP addresses. By default the CWAP is configured as a DHCP client, and will request two IP addresses from the network DHCP server. If no DHCP server responds to the request then auto configuration will assign an address to the AP on the 169.254.0.0 255.255.0.0 network (the SIB will continue to send DHCP requests).

Note: The IP strapping bits are read by the CWAP at power up and will over-write any static IP assignment made in the Aruba GUI. This behavior persists even when interface J3 is not connected.

4.2.1 Boot Up

4.2.1.1 SIB Boot Up

The SIB runs the bootloader application which provides the functionality to perform firmware updates on power up. The bootloader waits for up to two (2) seconds for a firmware update to start over the console port. If no firmware update occurs, then after that two second delay the application firmware is loaded, and begins execution.

Upon starting the application firmware, a Power on Self-Test (POST) is performed. The power on self test reads SIB configuration and manufacturing data from EEPROM and confirms the EEPROM integrity by checking the stored CRC. It also queries the discrete pins, verifies the Ethernet Switch, Temperature Sensor, Wiznet interface and the Aruba console to SIB communication path. If POST completes successfully the configuration of the Aruba is verified. At this point the console communication with the Aruba is password protected. To access the console you must enter the default password of **#0211** followed by a return key, after you see the Aruba Communications message that is shown at the bottom of Figure 3. Additional information on SIB firmware features can be found in the Software Requirements Document SRD-700-00016-000.

```
SIB: Booting firmware [part number]: 900-00071-001 [version]: 1.0.0BL1

SIB: SW Build date: May 18 2022 11:43:00

SIB: EEPROM Version: 1
SIB: Initializing EEPROM Cache
SIB: EEPROM Manufacturing Data: VALID
SIB: SIB Serial Number    DEF_SIB_SN
SIB: MFG Date             05/2022
SIB: CWAP Serial Number   000002
SIB: CWAP Part Number     700-00016-000
SIB: FW Part num          900-00071-001
SIB: FW Revision          1.0.0BL1
SIB: Cust Part Number     N/A
SIB: HW Rev               2
SIB: CWAP Rev             A
SIB: CWAP Mod             0
SIB: ATP Test Pattern     csc
SIB: Aruba Serial Number  PHMBKYJ04V
SIB: Last ATP Date        2022-06-29

SIB: Aruba communications are secured. Please enter password to unlock communication to the Aruba
```

Figure 3: Aruba Communications Message

After the boot process completes there is a five (5) second window in which you may be asked to enter SIB command mode by your technical service representative. The console output of the SIB boot process is shown in Figure 4, the **[Boot Complete]** prompt indicates the beginning of the five (5) second delay. (Note if the operator unlocks the console communications and send a 'return' to the Aruba the boot delay counter is extended to 60 seconds. This delay will be reset for each new character sent, so the 60 seconds is from the last character received.)

```
SIB: PSU_EN#           : 0
SIB: RF_EN#           : 0
SIB: RESET#           : 1
SIB: TEMP_GOOD#       : 0
SIB: DC_GOOD#         : 0
SIB: ARUBA_POWER_EN#  : 0
SIB: ADDR_0           : 1
SIB: ADDR_1           : 1
SIB: ADDR_2           : 1
SIB: ADDR_3           : 1
SIB: BOARDREV_0       : 0
SIB: BOARDREV_1       : 1
SIB: BOARDREV_2       : 0

SIB: [Boot Complete]
```

Figure 4: SIB Boot Complete

4.2.1.2 Access Point (AP) Boot

Following SIB boot, the firmware boots the Aruba AP. During startup, the AP provides an auto-boot countdown prompt that allows you to interrupt the normal startup process and access **apboot** mode. The SIB firmware uses this mode to set the IP address configuration as defined by the IP strapping pins, then starts a ten (10) second inactivity counter to allow user access to apboot. If the user has 'unlocked' communications with the Aruba console as detailed above and the operator sends a 'return' to the console the ten second initial delay before fully booting is extended to sixty (60) seconds to permit the operator to enter commands in the Aruba apboot utility without needing to rush. If no characters are received within those 60 seconds, the AP will automatically boot.

The console output of the AP boot process is shown in Figure 5; the **apboot>** prompt indicates the beginning of the ten (10) second counter (Note if the operator unlocks the console communications and send a 'return' to the Aruba the boot delay counter is extended to 60 seconds).


```
SIB: [Boot Complete]
SIB: Aruba communications enabled
SIB: PSU EN# - Power ON
SIB: Aruba monitor initialized
SIB: IP Config Mode is: [Set Addr mode - Reverse Pin Map]
SIB: Address pins: 0xf offset: 0xf
SIB: Using DHCP for IP port configuration
SIB: Checking Aruba User Config ...
SIB: User config check complete.

APBoot 2.6.2.3 (build 80087)
Built: 2021-04-29 at 10:04:03

Model: AP-635
DRAM: 2 GiB
Flash: Detected MX25U6435F: total 8 MiB
MMC: 0 (eMMC)
PCIE: link up
Power: DC
Radio: qcn9072#0, ipq6010#1, ipq6010#2
Reset: cold
FIPS: passed

Hit <Enter> to stop autoboot: 0
SIB: Set Aruba Provisional SSID Broadcast to Disabled
printenv disable_prov_ssid
disable_prov_ssid=1
apboot> SIB: Provisional SSID Broadcast already Disabled
SIB: Current pins: 0x0f
SIB: Setting Aruba for DHCP mode

printenv ipaddr
## Error: "ipaddr" not defined
apboot>
SIB: Aruba ipaddr previously cleared

printenv netmask
## Error: "netmask" not defined
apboot>
SIB: Aruba netmask previously cleared

printenv gatewayip
## Error: "gatewayip" not defined
apboot>
SIB: Aruba gatewayip previously cleared

SIB: Aruba previous configuration correct. Update not required

SIB: APBOOT Configuration Complete
SIB: PT is enabled
SIB: DHCP: IP Assigned:
SIB: IP : 192.168.1.101
SIB: Net Mask : 255.255.255.0
SIB: Gateway : 192.168.1.1
SIB: SIB IP Valid - Starting MDS Server
SIB: Socket open OK: mode: 0x02 status: 0x22

apboot> :
```

Figure 5: Example Console Output of the AP Boot Process

While in **apboot** mode you have access to the following commands:

?	- alias for 'help'
boot	- boot the OS image
clear	- clear the OS image or other information
dhcp	- invoke DHCP client to obtain IP/boot params
factory_reset	- reset to factory defaults
help	- print command description/usage
mfginfo	- show manufacturing info
osinfo	- show the OS image version(s)
ping	- send ICMP ECHO_REQUEST to network host
printenv	- print environment variables
purgeenv	- restore default environment variables
reset	- Perform RESET of the CPU
saveenv	- save environment variables to persistent storage
setenv	- set environment variables
tftpboot	- boot image via network using TFTP protocol
upgrade	- upgrade the APBoot or OS image
version	- display version

The **setenv** command can be used to set the environment variables listed below. Enter commands one per line, replacing the equal sign with a space. To clear an environment variable, enter the variable name followed by <CR>.

```
os_partition=0
ipaddr=192.168.1.101
gatewayip=192.168.1.1
netmask=255.255.255.0
dnsip=8.8.8.8
name=IAP308
domainname=arubanetworks.com
```

4.3 IP Strapping Table

In IP Strapping mode the Cabin AXe™ will get two IP addresses assigned on the 192.168.10.0/24 network with the default gateway address 192.168.10.1.

The IP addresses that will be assigned are shown in Table 5.

Table 5: IP Strapping Table

ADDR3	ADDR2	ADDR1	ADDR0	Hostname Strapping		IP Strapping	
				Hostname	IP Offset	Standard Map	Reverse Map
Open	Open	Open	Open	WAP01	DHCP	DHCP	DHCP
Open	Open	Open	GND	WAP02	DHCP	192.168.10.24	192.168.10.10
Open	Open	GND	Open	WAP03	DHCP	192.168.10.23	192.168.10.11
Open	Open	GND	GND	WAP04	DHCP	192.168.10.22	192.168.10.12
Open	GND	Open	Open	WAP05	DHCP	192.168.10.21	192.168.10.13
Open	GND	Open	GND	WAP06	DHCP	192.168.10.20	192.168.10.14
Open	GND	GND	Open	WAP07	DHCP	192.168.10.19	192.168.10.15
Open	GND	GND	GND	WAP08	DHCP	192.168.10.18	192.168.10.16
GND	Open	Open	Open	WAP09	DHCP	192.168.10.17	192.168.10.17
GND	Open	Open	GND	WAP10	DHCP	192.168.10.16	192.168.10.18
GND	Open	GND	Open	WAP11	DHCP	192.168.10.15	192.168.10.19
GND	Open	GND	GND	WAP12	DHCP	192.168.10.14	192.168.10.20
GND	GND	Open	Open	WAP13	DHCP	192.168.10.13	192.168.10.21
GND	GND	Open	GND	WAP14	DHCP	192.168.10.12	192.168.10.22
GND	GND	GND	Open	WAP15	DHCP	192.168.10.11	192.168.10.23
GND	GND	GND	GND	WAP16	DHCP	192.168.10.10	192.168.10.24

Default mode is: IP Strapping, Reverse Map

4.4 Connecting using the Console Port

The integrated USB to UART provides console access via the micro USB port that is located behind the maintenance door. Use these settings to connect to the console:

Port	COM*
Baud rate	9600
Data	8 bit
Parity	None
Stop	1 bit
Flow Control	None

* Select the newly added USB Serial Port

Connecting to the console port gives you access to SIB boot, AP boot, SIB command mode, and the Aruba Instant Access Point (IAP) Command Line Interface (CLI).

The IAP CLI becomes available after completion of the startup process, and requires administrator credentials to start a session. The default credentials are:

User: admin

Password: admin

After login, the privileged command mode is enabled which provides access to **show**, **clear**, **ping**, **traceroute**, and **commit** commands. The configuration commands are available in the configuration (config) mode. To move from privileged mode to the configuration mode, enter the following command at the command prompt:

```
(Cabin AXe) # configure terminal
```

The configure terminal command allows you to enter the basic configuration mode and the command prompt is displayed as follows:

```
(Cabin AXe) (config) #
```

Some commands in configuration mode allow you to enter into a sub-mode to configure the commands specific to that mode. When you are in a configuration sub-mode, the command prompt changes to indicate the current sub-mode.

You can exit a sub-command mode and return to the basic configuration mode or the privileged Exec (enable) mode at any time by executing the **exit** or **end** command.

You can use the question mark (?) to view the commands available for your current mode.

Refer to the *Aruba Instant CLI Reference Guide*, for additional information on the IAP CLI.