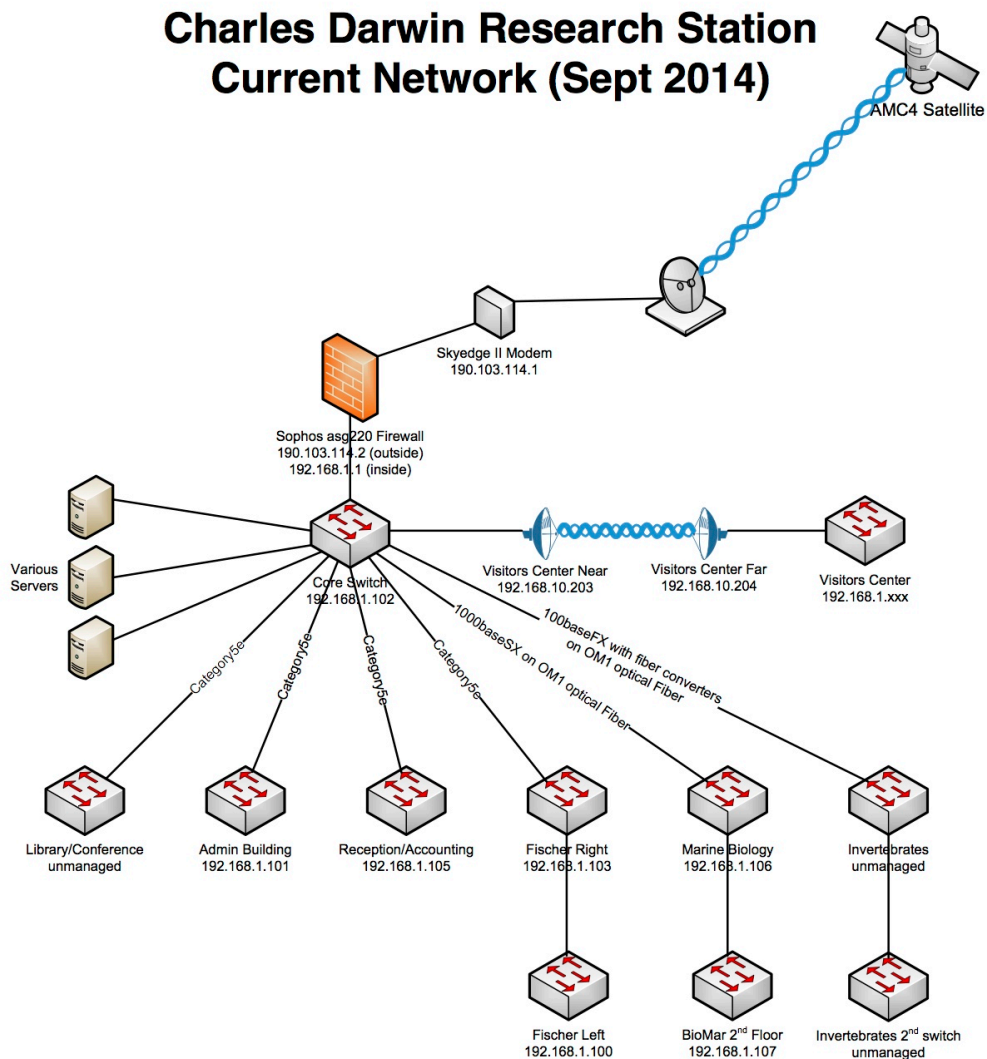# CDRS Equipment and DEA Plan

This document will outline the specific plan for a Direct Engineering Assistance (DEA) trip in 2015 to the Charles Darwin Research Station. This trip follows up a prior DEA activity that took place in September, 2014. Details of that trip can be found in the full DEA trip report.

The current network is documented below

Charles Darwin Research Station Current Network (Sept 2014)

The planned upcoming DEA activity will focus on three primary areas: repair of some cabling, replacement of the existing wireless network, and changing the architecture and replacing all switches.

The proposed/planned network is documented below:

Charles Darwin Research Station
Proposed Network (Feb 2015)
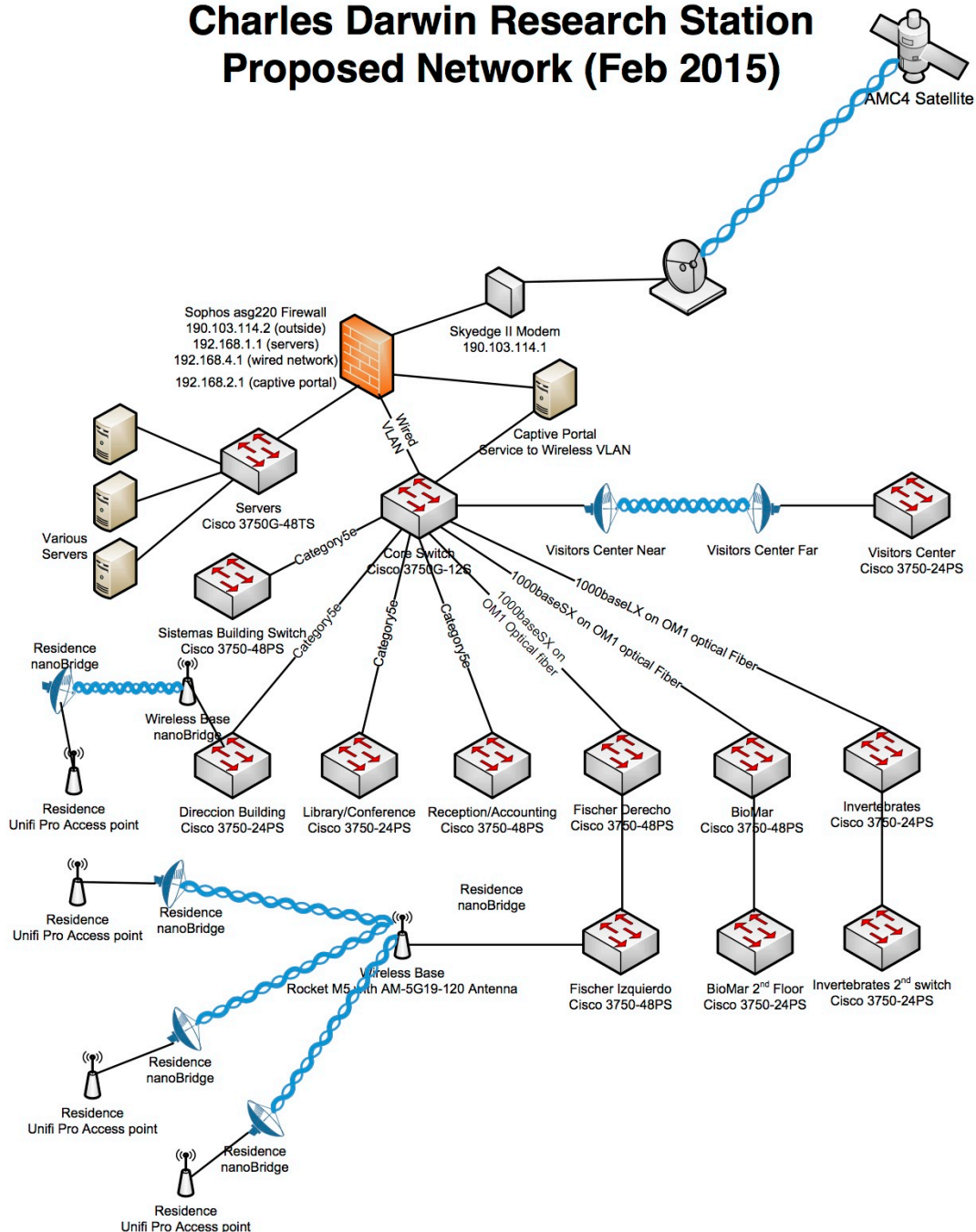
For clarity, the campus diagram below shows the relationships of the various buildings and how they are to be served. Note that prior to the DEA described here, Fischer Right is served by category 5e cable, but this DEA will repair the fiber and re-establish this building on a direct fiber link.
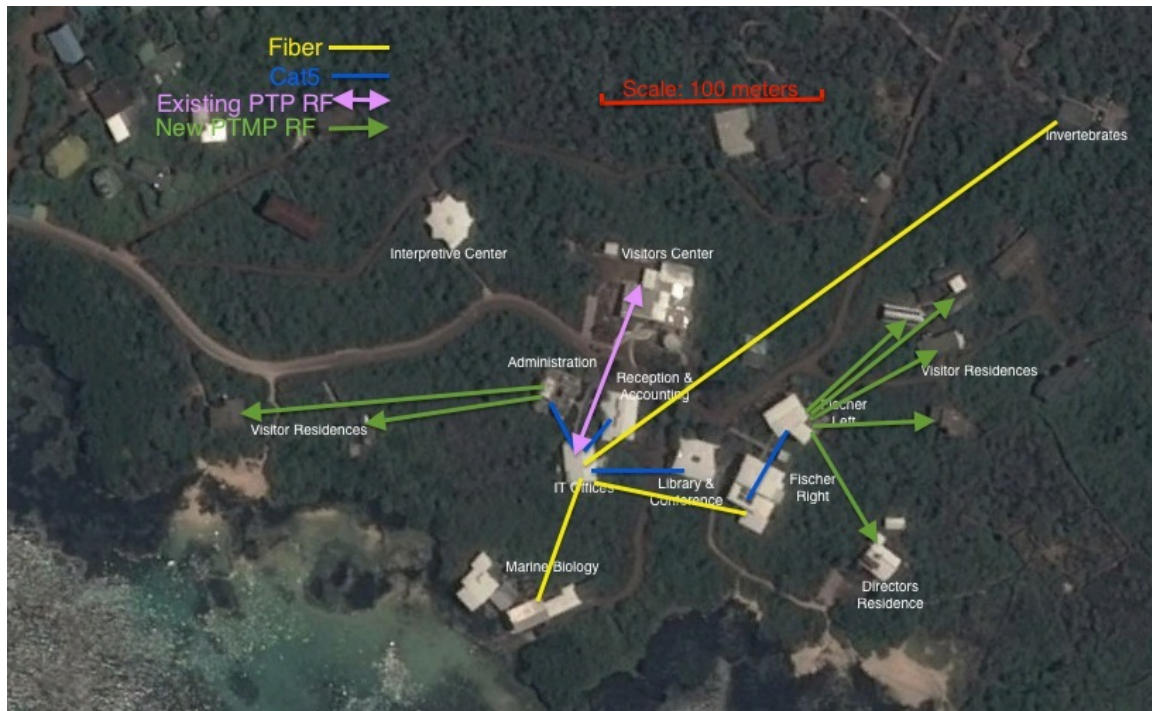
Task: Repair of Cabling Problems, installation of new cable

There are a number of cabling activities, including:
1. Re-termination and testing of category 5e cable running between IT Offices and Reception/Accounting
2. Testing and repair of fiber cable running between IT Offices and Fischer Right.
3. Assistance with installing replacement building switches.
4. Assistance with wireless upgrades and installations. This work will be in conjunction with the task of replacing all existing access points and will be focused on enhancing coverage in areas that don't currently have good coverage. New cabling will need to be installed for installing new indoor access points as well as outdoor point-to-multipoint units.
5. Exploration of the possibility of re-routing the existing 24-core single mode fiber cable to the visitors center. It is not anticipated that this DEA will be able to provide the re-routing of this cable, however, as time permits, exploration as to whether this is possible or not would provide information that could be used in a future DEA.

The equipment needed for the cabling work include:
- Category 5e cable (1000ft)
- Category 5e jacks
- Multimode ST connectors + epoxy
- Category 5e patch cables of various lengths, including short ones

Tooling that will be required includes:
- Cat5e testers and punch tools
- RJ45 Crimp Tool (for Toughcable connectors)
- Fiber termination kit
- Visual Fault Locator laser
- ST-ST fiber jumper for easy testing of fiber

Task: Installation of new wireless hardware

This involves two separate activities:
1. Replacing all existing wireless LAN devices that provide direct service to end users laptops, phones, etc. We will be installing Unifi Pro dual radio access points.   As part of this activity, we will be broadcasting only one SSID (versus the multiple SSIDs currently) and grooming all wireless traffic to a captive portal.
2. Installing some point-to-point equipment to provide service to un-served buildings (mostly residences). This will involve installing two "base stations" and then a nanoBridge and at least one Unifi Access point at each residence.

The previous DEA activity in 2014 did not do a survey of the existing wireless LAN hardware, so we do not have a complete inventory of wireless access points required to replace the existing set of access points. The intent of this DEA will be to provide enough wireless access points to provide complete coverage throughout all of the active buildings. This will certainly provide more access points than are currently in operation.

Initially, all existing access points should be replaced with Unifi Pro units and then work should be done to enhance coverage. Particular attention should be paid to locations where there is significant research activity. From our previous visit, it appears that one location that could use more coverage is Fischer Izquierdo, which will probably require the installation of new cabling to support additional access points.

Site	# of Unifi Pro
Sistemas Building (IT Offices)	2
Library/Conference	2
Direccion (Admin) Building	2
Reception/Accounting	2

Fischer Derecho (Right)	2
Fischer Izquierdo (Left)	3
Marine Biology	3
Invertebrates	2
Visitor Center	1
Residence and other out-buildings	10
Spares	2
Total	**23**

The existing service to the various outlying residence buildings is not good. There is currently an access point on the roof of Fischer Izquierdo that provides some coverage to the visitor and director residences to the East. There is no service to the house and education community center to the west.

After we have replaced all of the existing wireless access points, the focuse of the wireless portion of the DEA will be to improve the service to the residences to the east. To do this, we will replace the existing access point on the roof of Fischer Izquierdo with a Ubiquiti Rocket M5 that is equipped with a 120 degree directional antenna (part number AM-5G19-120). This will provide a wireless base station that will be used to provide service to each served building. At each served building, we will provide a Ubiquiti nanoBridge 5G-22 to provide service back to the Rocket M5 and at least one Unifi Pro access point to provide wireless LAN services inside the residence.

To allow mounting of nanoBridges and possibly the Rocket on existing walls where there are no other mounting options, we will provide a number of wall-mount tubes. See:
 http://www.l-com.com/wireless-antenna-universal-tube-antenna-mount

Note that all edge switches that are provided to replace all existing switches will provide 802.3af power over Ethernet, so most of the Unifi Pro access points will be able to be driven directly off of the POE switches.   However, the Rocket M5 on Fischer Izquierdo and the nanoBridge at the Direccion building are both 24 volt units that cannot be directly operated from the 48 volt POE switches. We will provide Ubiquiti 802.3af adapters for 24 volt (part number INS-8023AF-I) for these devices. For the remote buildings with nanoBridge and Unifi Pro units, we will need to provide POE injectors to power these units.

For any outdoor cable runs, we will install Ubiquiti outdoor Toughcable.

Task: Changing the architecture and replacing all existing switches

This is a fairly complex set of activities and must be carefully planned to avoid significant downtime for the campus users. The following is a suggested set of activities

- Reconfigure the firewall to have multiple interfaces: the existing interface that will be used in the future only for the servers, one for the wired workstations, and one for the wireless users.
- Install new server switch and migrate all servers to the new server switch, preserving their IP addresses.
- Install new core switch and move all buildings switches onto the new core switch. Users will need to reboot to get a new IP address.
- Replace switches in each building with the provided switches (see table below). I would not worry at this point about wireless VLANs – just stick everyone on the wired network. If CDRS staff is worried about open access to the CRDS wireless network, the firewall config for DHCP can be migrated from the old interface that is now dedicated to servers.
- Build up and get the wireless captive portal up and running. Configure firewall interface and build VLANs on core switch and Sistemas building switch. You can test the captive portal either with a laptop or an access point plugged into an untagged access port on the Sistemas building switch.
- Migrate the wireless stuff off of the wired network onto a wireless VLAN that is groomed toward the captive portal.

Note: for simplicity, I do not recommend that we try to build a management VLAN for the management IP traffic to switches and wireless infrastructure. My recommendation is that all management traffic simply run on the wired network/VLAN. Note: there appears to be some limitation with the Unifi Pro units that always carries the management traffic to/from the Unifi Pro as untagged traffic, so you'll have to play some games on the POE switches to carry this traffic untagged and the wireless client traffic tagged onto the wireless VLAN.

Site	Switch Hardware	Notes
Core Switch @ Sistemas building	Cisco 3750G-12S	Will need 7 copper SFP and 3 1000baseSX SFP
Server Switch @ Sistemas building	Cisco 3750G-48TS	48-port gigabit switch for servers
Switch for users @ Sistemas building	Cisco 3750-48PS	48-port POE switch with one Copper SFP
Library/Conference	Cisco 3750-24PS	24-port POE switch with one Copper SFP
Direccion (Admin) Building	Cisco 3750-24PS	24-port POE switch with one Copper SFP
Reception/Accounting	Cisco 3750-48PS	48-port POE switch with one Copper SFP
Fischer Derecho (Right)	Cisco 3750-48PS	48-port POE switch with one Copper SFP and one 1000baseSX SFP
Fischer Izquierdo (Left)	Cisco 3750-48PS	48-port POE switch with

		one Copper SFP
Marine Biology	Cisco 3750-48PS	48-port POE switch with one Copper SFP and one 1000baseSX SFP
Marine Biology 2nd Floor	Cisco 3750-24PS	24-port POE switch with one Copper SFP
Invertebrates	Cisco 3750-24PS	24-port POE switch with one Copper SFP and one 1000baseSX SFP
Invertebrates 2nd switch	Cisco 3750-24PS	24-port POE switch with one Copper SFP
Visitor Center	Cisco 3750-24PS	24-port POE switch with one Copper SFP

For spares, we will ship one each of Cisco 3750G-12S, Cisco 3750G-48TS and Cisco 3750-48PS. We will also ship several extra SFP modules (two extra GLC-SX-MM 1000baseT and three extra GLC-T copper SFP). Note that this sparing strategy means that the 24-port POE switch will be spared by a 48-port POE switch.

Appendix: List of Materials to be Shipped

Hardware	Quantity	On Hand	On order	Contact
Cisco 3750G-12S	2	2	0	HK
Cisco 3750G-48TS	2	2	0	HK
Cisco 3750-48PS	6	6	0	HK
Cisco 3750-24PS	6	6	0	HK
Cisco GLC-SX-MM	8	8	0	HK
Cisco GLC-T	20	14	0	HK
1M ST-LC duplex MM fiber patch cords	2	0	2	HK
2M ST-LC duplex MM fiber patch cords	2	2	0	HK
Ubiquiti Unifi Pro	23	0	24	HK
Ubiquiti Rocket M5	2	2	0	HK
Ubiquiti nanoBridge 5G-22	8	8	0	HK
Ubiquiti INS-8023AF-I 802.3af/24v adapter	3	0	5	HK
Ubiquiti Toughcable TC-Pro, 1000ft	1	0	1	HK
Ubiquiti Toughcable TC-CON-100 (100 pieces)	1	0	1	HK
L-COM HGX-UMOUNT	8			DS
Category 5e Cable (1000ft)	1			JH
Category 5e Jacks	25			JH
Category 5e patch cables (assorted length)	80			JH
Multimode ST connectors	25			JH
Epoxy and catalyst	1			JH
Outdoor UV rated tie wraps (a bunch)	1			JH
Captive Portal (Supermicro box?)	1			DS

HK=Hans Kuhn
DS=Dale Smith
JH=Jeff Hite