Naval Network & Space Operations Command (NNSOC)

Naval Surface Warfare Center Dahlgren Division
Dahlgren, VA

Technical Assignment 2
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Executive Summary

This technical report will analyze the existing electrical system at the Naval Network & Space Command (NNSOC) located in Dahlgren, VA. Using the National Electric Code (NEC 2005), I was able to find the lighting, receptacle and equipment loads to sum the volt-amps (VA) to find the building power loads. Comparing these values to the single line diagram and panelboards, I was able to see if the equipment was sized correctly.

After analysis, the building electrical system seems to be sized correctly and allows room for growth as well. Having redundancy has made the system large, but being able to operate even when the power goes down is a must for a facility such as this. Lastly, a utility rate structure was supposed to be analyzed, but a few factors caused this to be unattainable.

Power Distribution System

The electrical system in the Naval Network & Space Operations Command is powered from an existing switchgear unit located outside the adjacent building. The utility service ends at two existing exterior 1750kVA transformers before entering the existing switchgear. This utility comes in parallel to these transformers that step-down the voltage from 13.8KV to 480V. These 480Y/277V feeders enter the existing double-ended switchgear that powers the adjacent building. Two secondary feeders are routed from here to the new building, where they enter double-ended 1600A switchgear located in the first floor electrical room. Each feeder and switchgear panel is designed to carry the entire load of the building. The switchgear's main tie breaker will automatically transfer on the loss of a power to a single feeder in order to keep the entire building powered.

Interior building power will be distributed at 480Y/277V, using a 3-phase and 4-wire system. Feeders from the switchgear go to distribution panels for lighting, receptacles and power panels, along with the UPS system and all other loads throughout the building. Step-down transformers are provided for those loads that run off of 208Y/120V service. Panels are located primarily in the first floor and second floor electrical rooms. Exceptions to this are the critical systems and workstation receptacle panels which are located in each specific office area. Locations of switchgear, battery rooms, and other equipment will be discussed later in the report.

Building Utilization Voltage

All the power entering the building comes from a 480Y/277V system. From the double-ended switchgear power is distributed throughout the building to the different loads. For all motors greater than 1/2hp and other heavy loads >5kW, power will be provided from 480Y/277V panels. The fluorescent and H.I.D. lighting is run off 277V, single-phase 2-wire plus ground system. A 120V, single-phase 2-wire plus ground system will power all receptacles, incandescent and low voltage lighting, motors less than 1/2hp, lab equipment, and all other small appliance loads. For computer receptacle and other sensitive loads an isolated ground wire is also present. Transient voltage surge suppression devices are installed on the main switchgear and all panels downstream to prevent damaging voltage excursions from equipment. Metering will be provided in the main switchgear on each main circuit breaker compartment.

Transformer Configuration

Two main transformers rated 1500kVA (ambient air)/1750kVA (forced air) step-down the utility voltage from 13.8kV to 480V via a delta/wie connection. These supply redundant service to each end of the existing double-ended switchgear that are located outside and provide power to the existing building as well as the new facility. These

transformers are not provided on the transformer schedule because they are existing units. The building transformers are all dry rated transformers. These step-down transformers are located ahead of all 208Y/120V panelboards and are rated for 150^{o}C (302^{o}F) rise over 40^{o}C (104^{o}F) ambient. All transformers serving non-linear loads are K-13 rated with electrostatic shielding and 200% neutrals that are rated for 115^{o}C (239^{o}F) rise over 40^{o}C (104^{o}F) ambient with sinusoidal load current.

INDIVIDUAL TRANSFORMER SCHEDULE

TAG	PRIMARY VOLTAGE	SECONDARY VOLTAGE	SIZE	TYPE	TEMP. RISE	TAPS	MOUNTING	REMARKS
T30	480V,3PH,3W	208Y/120V,3PH,4W	30	DRY TYPE	150 DEGREE C	*(6) 2.5%	TRAPEZE MOUNTED	
T30	480V,3PH,3W.	208Y/120V,3PH,5W	30	DRY TYPE	115 DEGREE C	*(6) 2.5%	TRAPEZE MOUNTED	K-13 RATED
T45	480V,3PH,3W.	208Y/120V,3PH,4W	45	DRY TYPE	150 DEGREE C	*(6) 2.5%	PAD MOUNTED ON FLOOR	
T45	480V,3PH,3W.	208Y/120V,3PH,5W	45	DRY TYPE	115 DEGREE C	*(6) 2.5%	PAD MOUNTED ON FLOOR	K-13 RATED
T150	480V,3PH,3W.	208Y/120V,3PH,5W	150	DRY TYPE	115 DEGREE C	*(6) 2.5%	PAD MOUNTED ON FLOOR	K-13 RATED
T150	480V,3PH,3W.	208Y/120V,3PH,5W	150	DRY TYPE	115 DEGREE C	*(6) 2.5%	TRAPEZE MOUNTED	K-13 RATED

NOTES:
1. REFER TO SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS
* UNABLE TO FIND INFORMATION ON TAPS SO ASSUMED THESE

Emergency Power Systems

Two existing 1250kVA generators are outside and provide redundant standby power if the system goes down. These generators activate upon loss of normal power, and sense the maximum load to the double-ended switchboard (Panel MSBA and MSBB). If the building load is below maximum for the generators, the tie breaker in the generator switchgear stays open and does not activate any shunt trip breakers. If the maximum load is exceeded then the tie breaker stays open and shunt trips are activated on appropriate non-essential loads to maintain facility load. If a generator fails to start the tie breaker in the generator switchgear closes and the appropriate shunt trip breakers are activated to shed non-essential loads across the entire system. The generators are not rated to serve life safety loads so these are served by the standby power system (SPS).

The SPS system provides power for emergency egress lighting, non-egress lighting to maintain essential operations, and essential equipment. The egress lighting also has a 90-minute battery backup via an automatic transfer switch to ensure the emergency lights will stay on. Fire alarm and security systems, along with the UPS system are also run from this SPS.

The UPS system services critical loads in both facilities and has two 625kVA modules to provide N+1 reliability. Each system has a 30-minute battery plant to provide the necessary power to service the present critical loads and 25% spare capacity for future expansion. The UPS system is set up so if one system goes down, critical loads can be transferred to the other UPS module by closing the static transfer switch located between the UPS switchboards and UPS distribution panels.

A better understanding of the UPS system is as follows. Two UPS battery

modules are connected by two feeders to each side of the Main double-ended switchgear, which means if one side of the utility goes down both systems can still operate from the other side of the utility's service. From the UPS modules feeders go to two UPS switchboards, one for each module. Each UPS switchboard provides a feeder to two 600A static transfer switches. These transfer switches allow power to be delivered to either UPS distribution panel which in turn delivers power to the end panel and loads.

Overcurrent Protection Devices

The electrical system provides many different overcurrent protection devices. Most of them are circuit breakers on panels and the main switchgear. Drawout circuit breakers are located on the existing Exterior Switchgear that provides power to my building. All non-linear loads have K-13 rated transformers and an isolated ground wire. Transient Voltage Surge Suppression devices are placed on all downstream panels to prevent damage due to power surges. An automatic transfer switch is located at the life safety lighting panels which are connected to the emergency system. Static switches are also located between the UPS switchgear and UPS distribution panels to insure all the critical loads can receive power from either UPS battery source.

Distribution Equipment Locations

An existing Motor Control Center is located in the existing adjacent building and has one hot and two cold water pumps controlled from it. The main electrical room is on the first floor in the northwest corner of the building and houses the main switchgear, battery room, UPS modules, and 1st floor distribution panels. The second floor electrical room is located to the right of the first floor electrical room and shares a vertical conduit path. UPS and workstation receptacle panels are located at specific office areas of the building. All other distribution and normal panels are housed in the electrical rooms.

Power Factor Correction Devices

There no power factor correction devices located in the building, but the metering system on the main switchboard does monitor power factor.

ASHRAE 90.1/IESNA Shutoff Requirements

Occupancy sensors are provided in most spaces of the building. Switches are provided to override the occupancy sensor to the off position. An automated lighting control panel is also used in the building enabling remote monitoring and control of the facility's non-emergency lighting system. All spaces that don't have occupancy sensors

or are on the SCADA system have multiple switching to meet ASHRAE 90.1. The outdoor lighting is controlled by a photosensor mounted on the roof.

Important Design Requirements

Reliability is the greatest concern and has been addressed by redundant utility, emergency, and UPS systems. This much redundancy should enable the facility to run smoothly and to full capacity almost all of the time. Due to the square footage of the building (75,000s.f.), running at 480 volts and the fact that it's basically square, voltage drop considerations inside the building are not a factor. Voltage drop may be a concern when running feeders from the existing building to the new facility because of certain lengths of run (>350ft.). Security issues are a major concern, so placement of panels and what they power are important to make sure no secure panels are located in unsecured places. Also, care has to be taken to make sure the right connected loads are going to the correct systems panel (UPS, standby receptacles…) so the correct loads have generator and UPS power when needed.

Primary Lighting System

Almost all of the lighting is connected at 277V. The lighting is provided to the majority of the building using fluorescent or compact fluorescent fixtures. A combination of direct troffers and indirect pendants are the main fixture choice in most areas of the building. Specialty lighting such as LEDs and incandescent fixtures are used to accent certain areas where attention is required or pleasing to visitors and staff alike. These lighting fixtures are run from 120V panels.

NEC Building Design

The following building load design was built from the equipment and panelboard schedules, along with using the NEC 2005 code for demand factors. I based my motor calculations on the assumptions that 1HP=1KW and power factors were 0.9 for 3-phase and 0.85 for 1/10HP and lower. This assumption gave me a chance to error on the safer side of the load calculations. Calculations were pulled from the following tables in the NEC:

NEC 2005 Tables	Title	Description	Demand Factor
Table 220.12	General Lighting Loads by Occupancy	Office Building	3.5 VA/sq. ft.
Table 220.42	Lighting Load Demand Factors	All others	1.0
Table 220.44	Non-dwelling Receptacle Loads	First 10KVA	1.0
		Remaining KVA	0.5

From these loads, demand factors can be placed where appropriate and equipment and overcurrent devices can be sized accordingly. The following are the calculations for the total building load and all distribution panels.

Motor Load Calculation

FAN POWERED TERMINAL UNIT SCHEDULE		MOTOR						
	EQUIP #	HP	VOLTS/PH	PF	Amps	VA	# Units	Total VA
	FPB1	0.5	277/1	0.85	2.12	587.2	3	1761.6
	FPB2	0.5	277/1	0.85	2.12	587.2	3	1761.6
	FPB3	0.5	277/1	0.85	2.12	587.2	3	1761.6
	FPB4	0.75	277/1	0.85	3.19	883.6	5	4418
FAN COIL UNIT SCHEDULE								
	FCU-1	0.5	460/3	0.9	0.7	557.7	1	557.7
	FCU-2	0.5	460/3	0.9	0.7	557.7	1	557.7
	FCU-3	0.25	120/1	0.85	2.45	294	1	294
	FCU-4	0.25	120/1	0.85	2.45	294	1	294
	FCU-5	0.5	460/3	0.9	0.7	557.7	1	557.7
	FCU-6	0.5	460/3	0.9	0.7	557.7	1	557.7
	FCU-7	0.5	460/3	0.9	0.7	557.7	1	557.7
	FCU-8	0.75	460/3	0.9	1.05	836.6	1	836.6
	FCU-9	0.5	460/3	0.9	0.7	557.7	1	557.7
	FCU-10	0.5	460/3	0.9	0.7	557.7	1	557.7
	FCU-11	0.5	460/3	0.9	0.7	557.7	1	557.7
	FCU-12	0.5	460/3	0.9	0.7	557.7	1	557.7
FAN SCHEDULE								
	EF-1	0.25	120/1	0.85	2.45	294	1	294
	EF-2	350W	120/1	0.85	3.43	411.6	1	411.6
	EF-3	350W	120/1	0.85	3.43	411.6	1	411.6
	EF-4	0.75	460/3	0.9	1.05	836.6	1	836.6
	EF-5	0.75	460/3	0.9	1.05	836.6	1	836.6
	EF-6	48W	120/1	0.85	0.47	56.4	1	56.4
	EF-7	48W	120/1	0.85	0.47	56.4	1	56.4
	EF-8	48W	120/1	0.85	0.47	56.4	1	56.4
	EF-9	48W	120/1	0.85	0.47	56.4	1	56.4
	EF-10	48W	120/1	0.85	0.47	56.4	1	56.4
	EF-11	48W	120/1	0.85	0.47	56.4	1	56.4
	EF-12	135W	120/1	0.85	1.32	158.4	1	158.4
	EF-13	48W	120/1	0.85	0.47	56.4	1	56.4
	EF-14	81W	120/1	0.85	0.79	94.8	1	94.8
	EF-15	48W	120/1	0.85	0.47	56.4	1	56.4
	SF-4	0.25	120/1	0.85	2.45	294	1	294
	SF-5	48W	120/1	0.85	0.47	56.4	1	56.4
UNIT HEATER AND CABINET UNIT HEATER-HOT WATER-SCHEDULE								
	UH-1	FRAC	120/1	0.85	1.04	125	1	125
	UH-2	FRAC	120/1	0.85	1.04	125	1	125
	UH-3	FRAC	120/1	0.85	1.04	125	1	125
	CUH-1	FRAC	120/1	0.85	1.04	125	1	125
	CUH-2	FRAC	120/1	0.85	1.04	125	1	125
	CUH-3	FRAC	120/1	0.85	1.04	125	1	125
	CUH-4	FRAC	120/1	0.85	1.04	125	1	125

Motor Load Calculation (Continued)

PUMP SCHEDULE		**MOTOR**				
	EQUIP #	**HP**	**VOLTS/PH**	**PF**	**Amps**	**VA**
	P-1	15	460/3	0.9	20.9	16651.9
	P-3	15	460/3	0.9	20.9	16651.9
	P-6	5	460/3	0.9	7	5577.2
	P-9	3	460/3	0.9	4.2	3346.3
	P-10	50	460/3	0.9	69.7	55533
	P-11	50	460/3	0.9	69.7	55533
	P-12	7.5	460/3	0.9	10.5	8365.8
	P-13	3	460/3	0.9	4.2	3346.3
	P-14	10	460/3	0.9	13.9	11074.7
	P-15	10	460/3	0.9	13.9	11074.7
	FOP-1	0.33	120/1	0.85	3.2	384
COOLING TOWER SCHEDULE						
	CT-3	20	460/3	0.9	27.9	22229.1
ELECTRIC STEAM HUMIDIFIER SCHEDULE						
	H-1	64A	480/3	0.9	64	53208.6
	H-2	96A	480/3	0.9	96	79812.9
	H-3	64A	480/3	0.9	64	53208.6
BOILER SCHEDULE						
BLOWER	B-2	1.5	460/3	0.9	2.1	1673.2
OIL PUMP	B-2	IN BLOWER	460/3	0.9	0	0
CHILLER-WATER COOLED, SCHEDULE						
COMPRESSORS	CH-3	96A	460/3	0.9	96	79812.9
AIR HANDLING UNIT SCHEDULE						
SUPPLY FAN MOTOR	AHU-1	40	460/3	0.9	55.8	44458.3
RETURN FAN MOTOR	AHU-1	20	460/3	0.9	27.9	22229.1
SUPPLY FAN MOTOR	AHU-2	60	460/3	0.9	83.7	66687.4
RETURN FAN MOTOR	AHU-2	25	460/3	0.9	34.9	27806.3
SUPPLY FAN MOTOR	AHU-3	10	460/3	0.9	13.9	11074.7
RETURN FAN MOTOR	AHU-3	5	460/3	0.9	7	5577.2
PLUMBING PUMP SCHEDULE						
	PP-1	7.5	480/3	0.9	10	8313.8
	PP-2	7.5	480/3	0.9	10	8313.8
	PP-3	0.05	115/1	0.85	0.005	0.6
	SP-1	0.5	115/1	0.85	0.005	0.6
	DHWG-1	0.142857143	120/1	0.85	0.005	0.6
	DHWG-1	0.142857143	120/1	0.85	0.005	0.6
	APP-1	5	460/3	0.9	7	5577.2

Motor Load Results	**KVA**
Total Connected Load	**698.3912**

The lighting and receptacle loads were separated by panels and made the calculations much easier to compare to the panel schedules. The lighting calculation is based off Table 220.12, Occupancy load of 3.5W/sqft for an office space. The calculation meets code.

NEC Lighting Calculations			
	Area	VA/sq ft	Allowable KVA
1st Floor	37473	3.5	131.2
2nd Floor	36208	3.5	126.7
		Total	**257.9**

Lighting Load Calculations		
Panel	**Connected Load (KVA)**	**Amps**
"1HL"	58.7	70.6
"2HL"	34.7	41.8
Total Connected	**93.4**	

The receptacle calculation was based on the different panels that receptacles were powered from. Receptacles that went to normal housekeeping receptacle panels were able to use the demand factor of 0.5 for loads over 10,000KVA. Workstation and emergency receptacles were assumed to be fully loaded all the time so no demand factors were used.

Receptacle Load Calculations					
	Panel	Connected Load (KVA)	Amps	Demand Factor	Demand Load (KVA)
Workstation Recepts	"1LWS1"	2.44	6.78	1	2.44
	"1LWS2"	17.34	48.17	1	17.34
	"1LWS3"	7.08	19.67	1	7.08
	"1LWS4"	21.42	59.5	1	21.42
	"2LWS1"	22.82	63.39	1	22.82
	"2LWS2"	25.74	71.5	1	25.74
	"2LWS3"	19.44	54	1	19.44
	"2LWS4"	10.34	28.72	1	10.34
	"2LWS5"	13.24	36.78	1	13.24
Critical Recepts	"1LUPS"	8.38	23.28	1	8.38
	"1LUPS1"	0.72	2	1	0.72
	"1LUPS2"	10.08	28	1	10.08
	"1LUPS3"	2.88	8	1	2.88
	"1LUPS4"	13.68	38	1	13.68
	"2LUPS"	5.76	16	1	5.76
	"2LUPS1"	15.12	42	1	15.12
	"2LUPS2"	19.8	55	1	19.8
	"2LUPS3"	7.7	21.5	1	7.7
	"2LUPS4"	6.5	18	1	6.5
	"2LUPS5"	9	25	1	9
Housekeeping Recepts	"1LHR(1)"	33.2	92.3	1.0<10000KVA	10
				0.5>10000KVA	11.6
	"1LHR(2)"	19.1	53.1	1.0<10000KVA	10
				0.5>10000KVA	4.55
	"2LHR"	18.2	50.5	1.0<10000KVA	10
				0.5>10000KVA	4.1
Standby Recepts	"1LSB"	3.6	10	1	3.6
	"2LSB"	6	16.65	1	6

TOTALS (KVA)	Connected	319.58
	Demand	299.33

Adding up the KVA on all receptacle, lighting, and motor loads gives the size needed for the main distribution switchgear.

Building Loads	(KVA)
Receptacles	300
Lighting	258
Motors	700
Total	**1258**

Main Double-Ended Switchgear rated at 3200A.
3200A*1.732*0.480V=2660KVA > 1258KVA so OK.

Quantifying the actual load going to the individual distribution panels was a confusing task considering all the redundancy and parallel services. The hard part was the fact that wire sizes were oversized in order to handle the other loads if a failure occurred. I think that the following is close for how the system will act when running

under normal conditions. Please refer to the single line diagrams at the end of the document to follow the distribution system.

Distribution Panels

Distribution Panel "2LUPSDP"	Load (KVA)
Panel 2LUPS1	15.12
Panel 2LUPS2	19.8
Panel 2LUPS3	7.7
Panel 2LUPS4	6.5
Panel 2LUPS5	9
Total Load	**58.12**

Dist. Panel 2ULUPSDP rated at 500A
500A*1.732*0.208V=180KVA > 58.12KVA so OK.

UPS Panel-B "1HUPSSBB"	Load (KVA)
Panel 2LUPSDP	58.12
Panel 2LUPS	5.76
Existing Panel MDP3B	200
Total Load	**263.88**

Dist. Panel 1HUPSSBB rated at 600A
600A*1.732*0.480=498.8KVA > 264KVA so OK.

UPS Switchboard "1HUPSDPB"	Load (KVA)
Panel 1HUPSSBA	0
Panel 1HUPSSBB	263.88
Total Load	**263.88**

Dist. Panel 1HUPSDPB rated at 1200A
1200A*1.732*0.480V=998KVA > 264KVA so OK.

Distribution Panel "1LUPSDP"	Load (KVA)
Panel 1LUPS1	0.72
Panel 1LUPS2	10.08
Panel 1LUPS3	2.88
Panel 1LUPS4	13.68
Total Load	**27.36**

Dist. Panel 1LUPSDP rated at 500A
500A*1.732*0.208V=180KVA > 27KVA so OK.

UPS Panel-A "1HUPSSBA"	Load (KVA)
Panel 1LUPSDP	27.36
Panel 1LUPS	8.38
Existing Panel MDP3A	200
Total Load	**235.74**

Dist. Panel 1HUPSSBA rated at 600A
600A*1.732*0.480=498.8KVA > 236KVA so OK.

UPS Switchboard "1HUPSDPA"	Load (KVA)
Panel 1HUPSSBA	235.74
Panel 1HUPSSBB	0
Total Load	**235.74**

Dist. Panel 1HUPSDPA rated at 1200A
1200A*1.732*0.480V=998KVA > 236KVA so OK.

Distribution Panel "2HDP"	Load (KVA)
H-2	79.8
Panel 2HL	34.7
Panel 2HM	29.7
Total Load	**144.2**

Dist. Panel 2HDP rated at 400A
400A*1.732*0.480V=333KVA > 144KVA so OK.

Distribution Panel "2LDP"	Load (KVA)
Panel 2LWS1	22.82
Panel 2LWS2	25.74
Panel 2LWS3	19.44
Panel 2LWS4	10.34
Panel 2LWS5	13.24
Total Load	**91.58**

Dist. Panel 2LDP rated at 500A
500A*1.732*0.208V=180KVA > 92KVA so OK.

Panel "2HSB"	Load (KVA)
RF-2	27.8
SF-2	66.7
EF-5	0.9
Panel "2LSB"	6
FCU-5	0.6
FCU-6	0.6
FCU-7	0.6
Total	**103.2**

Dist. Panel 2HSB rated at 300A
300A*1.732*0.480V=250KVA > 103KVA so OK.

Distribution Panel "1HDP"	Load (KVA)
Panel 1HL	58.7
H-1	53.2
H-3	53.2
PP-1	8.3
PP-2	8.3
Elevator	0
Panel 1HM	21
Total Load	**202.7**

Dist. Panel 1HDP rated at 400A
400A*1.732*0.480V=333KVA > 203KVA so OK.

Panel "1HSB"	Load (KVA)
SF-1	44.5
P-15	11.1
P-14	11.1
RF-1	22.2
P-11	55.5
SF-3	11.1
RF-3	5.6
P-10	55.5
PANEL 1LSB	3.6
EF-4	0.9
P-9	33.5
P-12	8.4
SF-4	0.294
P-13	3.3
B-2	1.7
CH-3	80
CT-3	22.2
Total	**370.494**

Dist. Panel 1HSB rated at 450A
450A*1.732*0.480V=374KVA > 370KVA so OK.
Providing my calculations were correct, a larger sized breaker should be used.

Distribution Panel "1LDP"	Load (KVA)
Panel 1LWS1	2.44
Panel 1LWS2	17.34
Panel 1LWS3	7.08
Panel 1LWS4	21.42
Total Load	**48.28**

Dist. Panel 1LDP rated at 500A
500A*1.732*0.208V=180KVA > 48KVA so OK.

Main Double-Ended Switchgear "MSBA"	Load (KVA)
UPS Switchboard 1HUPSDPA	235.74
UPS Switchboard 1HUPSDPB	0
Panel 1HSB	370.5
Panel 1HDP	202.7
Panel 1LDP	48.3
Total Load	**857.24**

Dist. Panel MSBA rated at 1600A
1600A*1.732*0.480V=1330KVA > 857KVA so OK.

Main Double-Ended Switchgear "MSBB"	Load (KVA)
UPS Switchboard 1HUPSDPB	263.88
UPS Switchboard 1HUPSDPA	0
Panel 2HSB	103.2
Panel 2HDP	144.2
Panel 2LDP	91.6
Total	**602.88**

Dist. Panel MSBB rated at 1600A
1600A*1.732*0.480V=1330KVA > 603KVA so OK.

All distribution panels are correctly sized except for Panel “1HSB”. There could be a variety of different reasons for this including my error, draftsman error, or wrong assumptions. It is highly unlikely that the load is actually that close to the breaker trip.

Communication Systems

For security:

The security system for this facility includes an Access Control system, Closed Circuit Television System (CCTV), an Intrusion Detection System (IDS), and an Electronic Security System (ESS). Electric card readers, door monitor switches, roof hatch monitors, cameras, duress switches, and emergency push buttons are all devices that are used in these systems. These devices are used in just about every single space in the building so having a detailed security system is a must.

Communication:

The communication part of this facility was basically left untouched due to the Government providing their own equipment and needs. Basic devices were placed in the building and those include data and voice outlets, multi-outlet raceways with data/telephone outlets, and cable TV connection boxes. The cable tray for voice and video cabling are also shown running through the hallways. Data cabling will be routed in a separate cable tray. All other information is unknown for the communication systems of this building.

Fire Alarm:

A fire alarm system is required and provided for the new facility. The main equipment used for the fire alarm system includes a fire alarm control panel, which is located in the 1st floor electrical room, and a remote annunciator panel that is housed the lobby for the fire department. Some components to the alarm system include smoke detectors, heat detectors, smoke dampers, manual pull stations, speakers, strobes and horns. Sprinkler system devices include water flow switches, valve tamper switches, and water flow pressure switches.

Utility Rate Information

This facility is located on a Naval Base, so utility rates are somewhat unknown. The meter that is located on the main double-ended switchgear keeps track of the amount of power allocated to this particular building. All buildings on the base have this type of metering. The individual building occupants all over the base then pay their share toward the overall base's utility bill. The Naval Base purchases the electricity from Va Power, but due to the base being a federal installation, there are some special considerations in the price. My building of study will not be completed until March 2007 (instead of the projected October 2006), so utility information can not be obtained at this point.