

Operations & Maintenance Cost Study for NASA Facilities

Final Report for Communications Buildings

March 3, 2014

Submitted to:

Peter Aitcheson
National Aeronautics and Space Administration
300 E Street, SW
Washington, DC 20546-0001

Submitted by:

CBRE | Whitestone
2050 Alameda Padre Serra, STE 200
Santa Barbara, CA 93103-1704

Contract NNC09BA14B

Operations & Maintenance Cost Study for NASA Facilities: Final Report for Communications Buildings

Overview

National Aeronautics and Space Administration (NASA) requires a credible method for estimating the operations and maintenance (O&M) requirements of its facilities.¹ The failure to anticipate future costs can lead to under-funding and diminished service life.

NASA has over 450 buildings totaling 12.6 million GSFT distributed at 24 sites in the selected inventory for this project. It is not cost effective to inspect all facilities, yet NASA needs detailed sustainment and operations estimates to support its budget planning. This project developed cost models for a sample of NASA assets with inventory details collected through site surveys. Estimates were extrapolated by facility type and size and adjusted for location to generate requirements for the selected NASA inventory.

The project employed the MARS Facility Cost Forecast System to provide cost information. Now in its eighth version, MARS is a facility cost modeling tool developed by CBRE | Whitestone and used by many federal and commercial agencies.

Phases 1 and 2 of this project called for inspections of four facility types: Administration Buildings, Propulsion Buildings, Communications Buildings, and Space Science (R&D and Test) Buildings. Eight sample buildings were chosen at two sites: the Goddard Space Flight Center (GSFC) and the Marshall Space Flight Center (MSFC). O&M estimates were generated for all buildings but the scope included formal reports for Administration and Propulsion Buildings only.

Site inspections were conducted by Jacobs Facilities, a long-time CBRE | Whitestone partner experienced in inspecting federal facilities and creating MARS component inventories. A team of three, consisting of an architect, and electrical and mechanical engineers, carried out the facility inspections.

Phase 3 of the project scope included individual reports on the two remaining facility types inspected in the previous phases, Communications and Space Science (R&D and Test) Buildings. This report describes the project methodology and presents final estimates for the Communications Buildings in the NASA inventory.

Project Methodology

Parametric Estimates for Buildings

The project methodology entailed estimating O&M requirements for the selected NASA inventory based on the inspection and modeling of a sample of facilities. The project included four key steps:

1. Validate the existing NASA inventory and develop a sample

¹ Operations include custodial (cleaning, pest control, and trash collection), utilities (energy, water, and sewer), grounds (landscape care, mowing, and snow removal), security, telecommunications, and management. Maintenance (also known as sustainment) includes preventative maintenance, minor repair, unscheduled maintenance, and renewal and replacement.

2. Perform on-site inspections of the sample buildings
3. Develop and calibrate MARS models
4. Generate per square foot estimates of sustainment and operations costs for the sample and extrapolate to the project inventory

Study Sample

NASA has over 450 buildings at 24 sites globally in the selected inventory. Complete inspection of each site to estimate O&M requirements is impractical and costly. This project generated sustainment and operations estimates for a sample of buildings and extrapolated the costs to a selected NASA inventory.

The Statement of Work called for a sample that included one small building (approximately 10,000 square feet) and one large building (approximately 100,000 square feet) from four Classification types. The sample included two buildings from Administration Buildings, Propulsion Buildings, Communications Buildings, and Space Science (R&D and Test) Buildings. Phases 1 and 2 of the project inventory excluded other Classification types in the NASA inventory, such as Warehouses and Wind Tunnels. CBRE | Whitestone proposed buildings at the Goddard Space Flight Center and the Marshall Space Flight Center to minimize travel costs.

Table 1 shows the building detail for the inspected Communications Buildings.

Table 1. Communications Buildings Inspection Sample						
Site	Classification	Property ID	Property Name	Year Built	Size	CRV
Goddard Space Flight Center	Communications Buildings	1019/51/17	B-RF SOC OPERATIONS BLDG	1997	1,200	\$475,173
Marshall Space Flight Center	Communications Buildings	1045/62/179	COMMUNICATIONS FACILITY	1962	61,648	\$18,633,603
Total					61,648	\$18,633,603

There are a number of variables that drive O&M costs. The project sampling plan only controls for size and Classification type. An alternative sample may control for current replacement value (CRV), age, and location.

The inspected sample was mapped to the remaining inventory by size and type. The 1,200 gross square foot (GSFT) building was mapped to the smaller half of the inventory, while the 62k GSFT building was mapped to the larger half. Square foot estimates were generated by MARS and then extrapolated to the inventory. All costs were indexed for location.

Communications Buildings represent 2.4 percent of the selected NASA inventory, totaling 304 thousand GSFT and 84 buildings with a \$129 million CRV. Table 2 shows the Communications Buildings inventory by Site.

Table 2. NASA Communications Buildings by Site			
Site	Count	Size	CRV
AMES Research Center	2	10,120	\$4,820,068
Dryden Flight Research Center	1	3,613	\$4,378,379
Ellington Field (JSC)	1	492	\$302,468
Glenn Research Center	2	3,440	\$1,773,016
Goddard Space Flight Center	4	6,589	\$2,496,531
Jet Propulsion Laboratory	7	1,574	\$361,065
Johnson Space Center	2	1,988	\$1,630,433
JPL/Spain - Madrid Deep Space Comm. Complex	2	30,199	\$8,457,897
JPL/Table Mtn Observatory	1	2,564	\$735,217
Kennedy Space Center	33	86,013	\$40,228,780
Langley Research Center	3	13,905	\$11,480,262
Marshall Space Flight Center	4	63,310	\$21,109,725
Moffett Federal Airfield	4	15,571	\$4,714,404
NASA JSC White Sands 1st TDRSS	1	26,500	\$5,667,082
NASA/JSC/White Sands Test Facility	1	143	\$77,548
NASA/JSC/WSTF Space Harbor	2	3,432	\$421,646
Stennis Space Center	3	20,789	\$14,505,994
Wallops Flight Facility	11	13,568	\$5,881,678
Total	84	303,810	\$129,042,193

Detailed cost models were developed for the two buildings using CBRE | Whitestone's MARS Facility Cost Forecast System.

Description of the MARS Model

CBRE | Whitestone used MARS to estimate preventative maintenance, unscheduled maintenance, repair, and renewal/replacement costs for this project. MARS is an asset management system that estimates both deferred maintenance and future requirements on the basis of asset components and their scheduled maintenance and repair. It also estimates costs for ten operations types in the typical commercial chart of accounts. MARS was originally developed in 1996, and is currently in its eighth version. It is used by many government agencies and commercial concerns.

Sustainment	Preventive Maintenance & Minor Repair Unscheduled Maintenance Renewal & Replacement
Operations	Custodial Energy Grounds Management Pest Control Refuse Road Clearance Security Telecom Water/Sewer

Note that the definition of future M&R requirements is the same as the “sustainment” requirements used for programming by DoD and an approach endorsed in a National Research Council (NRC) study of Department of Energy facility practices.² Among other agencies, the MARS Facility Cost Forecast System has been used to forecast budgets for the IRS, FAA, USDA, and CDC. It was recently used to benchmark costs for the Department of State Overseas Embassies. MARS is also the basis for the DoD Sustainment Model and a study for NNSA validating total life-cycle facility costs at eight nuclear weapons production and research sites.³ The model is used continuously to simulate alternative facility costs for the U.S. nuclear complex.

The MARS process begins with a component inventory of a building or structure. Derived from building plans, equipment inventory data, and on-site inspections, these components are organized into UNIFORMAT category level three elements and are identified specifically in terms of product characteristics, quantity, and output level; e.g. “Single-Ply Modified Bituminous/Thermoplastic Roof,” “Condenser, Air-Cooled, 60 Ton,” or “Pipe & Fittings, ¾” Copper.”

Once the component inventory is completed, the MARS system relates maintenance tasks from a pre-defined task library to each selected component. New components and related tasks are defined as necessary. The frequency of each task determines the forecast of future required maintenance. MARS estimates four types of maintenance: preventative maintenance, unscheduled maintenance (service calls), repair, and renewal/replacement tasks. Tasks and their labor and material requirements are pre-defined by CBRE | Whitestone, but are also editable.

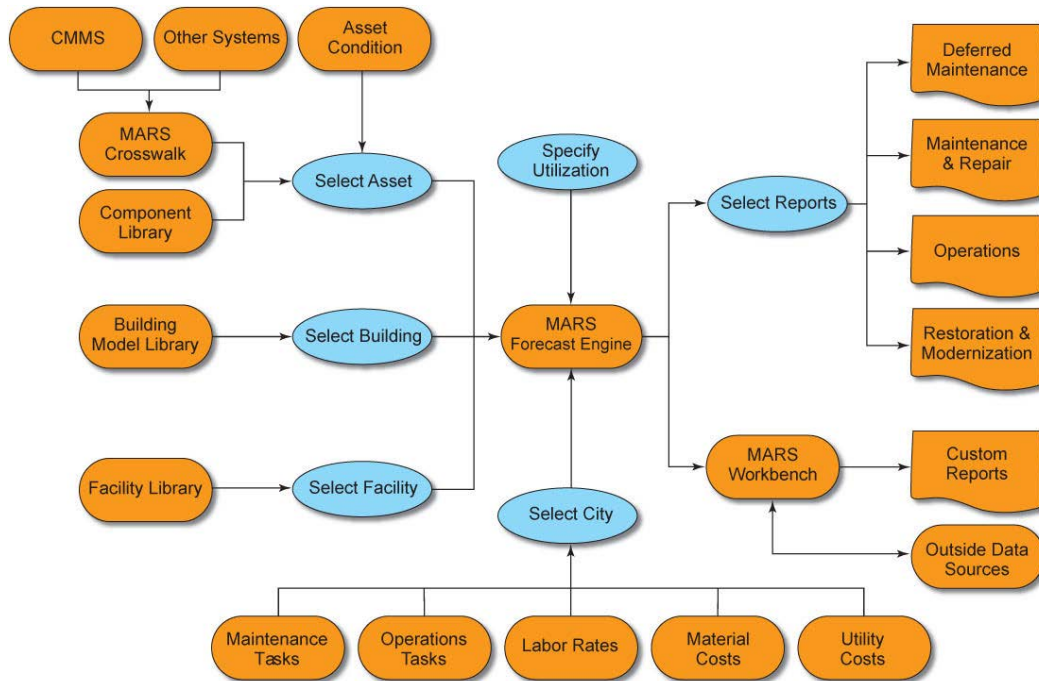
² National Research Council, *Intelligent Sustainment and Renewal of Department of Energy Facilities and Infrastructure*, 2004. P. 44.

³ Jacobs Facilities and Whitestone Research, *Implementation of the Department of Defense Sustainment Model, Final Report*, May 2002.

Other calibration steps include modifying default values for contract and in-house labor rates, specifying site-typical mark-up for contract expenditures, and identifying the utilization characteristics for each asset.

The sources for local wage rates and benefits are primarily the U.S. Department of Labor and Davis-Bacon Act labor agreements, and private sector employers. Both union and non-union wages are considered in determining prevailing rates by locality. State and local wage surveys are also used when available.

MARS Facility Cost Forecast System



MARS is also used to estimate operations costs other than maintenance and repair. These are based on the Facilities Operation Model developed jointly by the Department of Defense (DOD) and CBRE | Whitestone. This model provides costs for ten services, including those mentioned in the Federal Real Property Council (FRPC) guidance—utilities, cleaning and janitorial, and roads and grounds.⁴ Each operation type for an asset can be calibrated for a level of service (low, medium, high) to reflect the level of demand or frequency at which certain operations task are performed.

The CBRE | Whitestone operations cost models provides estimates for the following services:

Custodial. The custodial function represents the expense of cleaning offices, work areas, restrooms and common areas. Costs include local wage rates and benefits, task productivity, mark-ups for equipment, materials, supervision, and assumptions concerning the level of service. Trash removal costs are not included. Custodial service levels are defined by altering the combination and frequency of common tasks.

⁴ Federal Real Property Council. *Guidance for Real Property Inventory Reporting*. Washington, D.C. August, 2012.

Energy. Energy includes all expenses related to the purchase, generation, distribution, and conservation of energy and source fuels necessary to operate an asset. The main energy sources considered are electricity and natural gas. Not included are utilities maintenance and supervision, and utility tax rates. Service levels vary according to estimated commodity demand by asset use type.

Grounds. The grounds function includes any expense related to the maintenance of exterior landscaping. It does not include sweeping or the maintenance of signage, parking lots and roadways. Costs are estimated using local wage rates and benefits, task productivity, mark-ups for equipment, materials and supervision, and assumptions concerning the level of service. Service levels are defined by altering the combination and frequency of common tasks.

Management. The real property management function describes all costs associated with facility management, including: public works, contracts, material procurement, facility data, furnishings, real estate, and engineering services. Costs are expressed as a fixed percentage of Plant Replacement Value. Service levels are based on the distribution of costs found in institutional and commercial settings. For this project, the level of service for all NASA buildings was set to low to reflect economies of scale in a campus environment.

Pest Control. Pest control expenses cover indoor and outdoor pest control programs, separate from the grounds function. Costs are based on the frequency of common tasks for rodent and insect abatement and inspections. Costs include prevailing labor and material rates. Service levels are defined by altering the combination and frequency of common tasks.

Refuse. Refuse costs include all expenses related to trash collection and disposal, pick-up services, fees, recycling operations and administration, composting, etc. Costs exclude handling and disposal of HAZMAT materials. Service levels vary according to estimated demand by asset use type.

Road Clearance. The road clearance function includes all expenses related to sweeping paved areas including sidewalks, walkways, and parking lots. Costs include prevailing labor and material rates, and climatic variables. Service levels are defined by altering the combination and frequency of common tasks.

Security. Security expenses relate to the physical security of assets and occupants, and include personnel, operating and monitoring security equipment. Costs include relevant prevailing labor and material rates. Service levels are defined by altering the combination and frequency of common tasks and services.

Telecommunications. Telecommunication expenses cover the purchase of all the services ordinarily associated with commercial activities, such as voice and data equipment and service subscription. The level of telecommunications is defined by the combination of services selected.

Water and Sewer. Water and Sewer expenses include all costs related to providing the asset with potable water, irrigation water, and sewage service. Estimates include local commodity costs. Service levels vary according to estimated commodity demand by asset use type.

Data Collection and Calibration

MARS Model Development

The technical work for this task involved the definition of the component inventory for the two sample Communications Buildings. Goddard Space Flight Center and Marshall Space Flight Center staff supplied existing equipment inventories and construction design documents before the inspection. Jacobs Facilities inspected the buildings and created draft models in MARS. In total, 509 MARS components were defined for the two facilities.

Jacobs submitted the MARS database to CBRE | Whitestone for a detailed component-by-component review. Three areas of focus included:

- 1) Check for completeness. Review the wall finishes (exterior and interior), roofing, plumbing, HVAC, fire protection, and electrical data to ensure the building model contains the appropriate components in each category.
- 2) Check for consistency. Review the building gross square feet for accuracy. Ensure the square footage of structural components (exterior walls, roofing system, interior finishes) are reasonable compared to building GSFT. Verify the capacity of the following is consistent with the building type and size:
 - Heating, cooling, and air distribution
 - Electrical service, distribution, and lighting
 - Plumbing fixtures and water distribution
 - Fire protection
- 3) Forecast review. Run the following building-level MARS reports and look for extraordinary costs (high or low) illustrating an error in the building model:
 - Average M&R Costs
 - Most Costly M&R Tasks
 - Deferred Maintenance Detail
 - Operation Cost Summary

We also compared the costs with known resources (*The Whitestone Facility Maintenance and Repair* and *Operations Cost References*, comparable CBRE | Whitestone project work with federal agencies, and third party sources).

Attachment A and B provide detailed MARS component lists for the inspected Communications Buildings at GSFC and MSFC.

CBRE | Whitestone also collected information to calibrate the models for local site values.

Local Calibration of MARS

While the MARS system has pre-defined building models, labor and material costs, utility rates, and an extensive component library, all of these values can be changed or supplemented to reflect the actual site practices.

Calibration data was gathered to adjust MARS factors at both the site and the building level. Site-level information, such as labor and utility rates, was directly used to estimate O&M costs for the remaining non-inspected buildings at GSFC and MSFC.

Building-level calibration data was applied to the sample models and then extrapolated to the remaining NASA inventory by Classification type and size.

The following data was collected to calibrate the building models:

Maintenance and Repair. The sites provided contract labor rates and labor rate mark-ups. A default assumption in MARS assigns in-house labor to preventative maintenance, minor repair, and unscheduled maintenance, while contract labor performs major repair and replacement tasks. Goddard Space Flight Center and the Marshall Space Flight Center staff indicated all maintenance was performed by contract laborers. CBRE | Whitestone adjusted the MARS database accordingly.

NASA personnel specified laborers must be paid prevailing wages for the area. We used the default MARS wage rates for this study, and included a 30 percent mark-up for contract overhead.

Table 3 shows the source of the maintenance and repair factors for each site.

Table 3. Data Sources by Site, Maintenance & Repair					
Site	In-house Shop Rates	In-house Markup Rates	Contract Labor Rates	Contract Overhead Rates	Utilization
Goddard Space Flight Center	N/A	N/A	WST	WST	Site
Marshall Space Flight Center	N/A	N/A	WST	WST	Site
WST = Whitestone, Site = Respective NASA Site, N/A = Not applicable, no in-house maintenance staff					

MARS estimates also can be adjusted to reflect utilization factors that impact M&R. For example, many NASA facilities have special safety requirements which increase costs relative to conventional commercial practice. Other special requirements include high or low hours of operation and security. The two sites defined utilization factors for the eight building sample in Phases 1 & 2.

Table 4 displays the average utilization multipliers by site used to adjust for these requirements.

Table 4. Average Utilization Adjustment by Site ^A				
Site	Hours of Operation ^B	Security ^C	Safety & Permitting ^D	Sum ^E
Goddard Space Flight Center	1.37	1.05	1.04	1.45
Marshall Space Flight Center	1.07	1.01	1.03	1.11

^A Calculated from individual asset multipliers assigned by the sites.
^B Hours of Operation rates building use on a weekly basis and is defined as follow s: 0.80 = 40 hours, 1.00 = 41 to 80 hours, 1.37 = 80+ hours.
^C Security is defined as follow s: 1.00 = free access, 1.01 = contractor training & daily check-in, 1.15 = full contractor accompaniment.
^D Safety & Permitting is defined as follow s: 1.00 = typical commercial & service activity, 1.07 = non-specific laboratory, 1.75 = radiological or life science research, 3.00 = nuclear facility.
^E In combination the multipliers are additive such that the total multiplier = $1 + \sum (\beta - 1)$ w here β = the multiplier value.

Operations. MARS also estimates operations costs for ten services including: custodial, energy, grounds, management, pest control, refuse, road clearance, security, telecommunications, and water & sewer. We requested utility rates, operations labor rates, and mark-ups. In addition, individual building models are calibrated in terms of level of service (low, medium, high, or none).

Each site defined levels of service for all operation types and provided several utility rates. As with M&R, CBRE | Whitestone used the default MARS wage rates and a 30 percent mark-up for contract overhead.

The utility rates provided by the two sites were significantly lower than the default MARS commercial rates. These discounts are often provided to large federal property holders like NASA. CBRE | Whitestone applied the average discounts for the calibrated sites (GSFC and MSFC) to the remaining sites in the inventory.

Table 5 shows the source of the operations calibration data.

Table 5. Data Sources by Site, Operations											
Site	Level of Service	Custodial Wage	Refuse Rates	Energy Rates	Water/Sewer Rates	Groundskeeper Wage	Pest Control Wage	Road Clearance Wage	Security Rates	Property Management	Telecom Rates
Goddard Space Flight Center	Site	WST	Site	Site	Site	WST	WST	WST	WST	Site	WST
Marshall Space Flight Center	Site	WST	WST	Site	Site	WST	WST	WST	WST	Site	WST

WST=Whitestone, Site = Respective NASA Site

Cost Estimates for Communications Buildings

Sustainment Costs

The final sustainment estimate for the smaller GSFC Communications Building (Property ID 1019/51/17) is an average of \$31.55 per GSFT over a 50-year period. The larger MSFC building (Property ID 1045/62/179) is \$12.65 per GSFT over the same period.

The sample estimates were extrapolated to the population. Table 6 shows sustainment costs by site for all Communications Buildings. Sustainment estimates are expressed as 30, 40, and 50-year averages. While CBRE | Whitestone computes annual requirements, average costs are presented to smooth the annual oscillations. Overall, the sustainment requirements are an average of \$6.8 million per year over 50 years, or \$22.41 per GSFT. Expressed another way, this amounts to 5.3 percent of the \$129 million replacement value.

Table 6. Average Annual Estimates of Sustainment Requirements by Site, Communications Buildings

Site	GSFT	CRV	Sustainment ^A								
			30-Year Estimates			40-Year Estimates			50-Year Estimates		
			Avg. Annual Estimate	Per GSFT	Percent CRV	Avg. Annual Estimate	Per GSFT	Percent CRV	Avg. Annual Estimate	Per GSFT	Percent CRV
AMES Research Center	10,120	\$4,820,068	\$346,402	\$34.23	7.2%	\$324,623	\$32.08	6.7%	\$351,953	\$34.78	7.3%
Dryden Flight Research Center	3,613	\$4,378,379	\$111,760	\$30.93	2.6%	\$104,734	\$28.99	2.4%	\$113,551	\$31.43	2.6%
Ellington Field (JSC)	492	\$302,468	\$14,338	\$29.14	4.7%	\$13,437	\$27.31	4.4%	\$14,568	\$29.61	4.8%
Glenn Research Center	3,440	\$1,773,016	\$95,614	\$27.79	5.4%	\$89,603	\$26.05	5.1%	\$97,146	\$28.24	5.5%
Goddard Space Flight Center	6,589	\$2,496,531	\$204,614	\$31.05	8.2%	\$191,750	\$29.10	7.7%	\$207,893	\$31.55	8.3%
Jet Propulsion Laboratory	1,574	\$361,065	\$48,688	\$30.93	13.5%	\$45,627	\$28.99	12.6%	\$49,469	\$31.43	13.7%
Johnson Space Center	1,988	\$1,630,433	\$57,936	\$29.14	3.6%	\$54,294	\$27.31	3.3%	\$58,865	\$29.61	3.6%
JPL/Spain - Madrid Deep Space Comm. Complex	30,199	\$8,457,897	\$687,480	\$22.76	8.1%	\$644,258	\$21.33	7.6%	\$698,498	\$23.13	8.3%
JPL/Table Mtn Observatory	2,564	\$735,217	\$72,043	\$28.10	9.8%	\$67,514	\$26.33	9.2%	\$73,198	\$28.55	10.0%
Kennedy Space Center	86,013	\$40,228,780	\$1,804,332	\$20.98	4.5%	\$1,693,201	\$19.69	4.2%	\$1,815,129	\$21.10	4.5%
Langley Research Center	13,905	\$11,480,262	\$344,894	\$24.80	3.0%	\$323,210	\$23.24	2.8%	\$350,421	\$25.20	3.1%
Marshall Space Flight Center	63,310	\$21,109,725	\$838,330	\$13.24	4.0%	\$789,489	\$12.47	3.7%	\$821,413	\$12.97	3.9%
Moffett Federal Airfield	15,571	\$4,714,404	\$532,986	\$34.23	11.3%	\$499,478	\$32.08	10.6%	\$541,528	\$34.78	11.5%
NASA JSC White Sands 1st TDRSS	26,500	\$5,667,082	\$602,081	\$22.72	10.6%	\$564,229	\$21.29	10.0%	\$611,730	\$23.08	10.8%
NASA/JSC/White Sands Test Facility	143	\$77,548	\$3,249	\$22.72	4.2%	\$3,045	\$21.29	3.9%	\$3,301	\$23.08	4.3%
NASA/JSC/WSTF Space Harbor	3,432	\$421,646	\$77,975	\$22.72	18.5%	\$73,073	\$21.29	17.3%	\$79,225	\$23.08	18.8%
Stennis Space Center	20,789	\$14,505,994	\$569,334	\$27.39	3.9%	\$533,541	\$25.66	3.7%	\$578,459	\$27.83	4.0%
Wallops Flight Facility	13,568	\$5,881,678	\$336,535	\$24.80	5.7%	\$315,377	\$23.24	5.4%	\$341,928	\$25.20	5.8%
Total^B	303,810	\$129,042,193	\$6,748,592	\$22.21	5.2%	\$6,330,482	\$20.84	4.9%	\$6,808,273	\$22.41	5.3%

^A Sustainment is the average annual sum of preventative maintenance, unscheduled maintenance, and major repair and replacement tasks.

^B All costs expressed in \$2012.

Operation Costs

Final estimates of ten operation costs are shown in Table 7. In total, the operation requirements for the selected Communications Buildings are an annual average of \$6.1 million, or \$19.99 per GSFT and 4.7 percent of replacement value. Note that in commercial accounting M&R (sustainment) is often included as an operating cost, but is reported separately above.

Site	Operations Type ^A													Per GSFT	Percent CRV
	GSFT	CRV	Custodial	Energy	Grounds	Management	Pest Control	Refuse	Road Clearance	Security	Telecom	Water/Sewer	Total Costs		
AMES Research Center	10,120	\$4,820,068	\$23,774	\$77,291	\$1,769	\$12,050	\$645	\$368	\$0	\$105,547	\$7,590	\$2,002	\$231,035	\$22.83	4.8%
Dryden Flight Research Center	3,613	\$4,378,379	\$8,012	\$27,644	\$667	\$10,946	\$149	\$122	\$0	\$34,626	\$2,710	\$800	\$85,675	\$23.71	2.0%
Ellington Field (JSC)	492	\$302,468	\$828	\$4,435	\$60	\$756	\$20	\$47	\$0	\$4,410	\$369	\$157	\$11,082	\$22.52	3.7%
Glenn Research Center	3,440	\$1,773,016	\$7,050	\$23,295	\$366	\$4,433	\$116	\$31	\$276	\$33,430	\$2,580	\$885	\$72,459	\$21.06	4.1%
Goddard Space Flight Center	6,589	\$2,496,531	\$16,945	\$52,985	\$829	\$6,241	\$384	\$216	\$102	\$75,197	\$4,942	\$2,313	\$160,154	\$24.31	6.4%
Jet Propulsion Laboratory	1,574	\$361,065	\$3,490	\$12,043	\$291	\$903	\$65	\$53	\$0	\$15,085	\$1,181	\$348	\$33,458	\$21.26	9.3%
Johnson Space Center	1,988	\$1,630,433	\$3,346	\$12,918	\$242	\$4,076	\$80	\$60	\$0	\$17,821	\$1,491	\$438	\$40,473	\$20.36	2.5%
JPL/Spain - Madrid Deep Space Comm. Complex	30,199	\$8,457,897	\$83,431	\$740,671	\$3,841	\$21,145	\$1,117	\$3,658	\$224	\$324,141	\$23,860	\$8,411	\$1,210,499	\$40.08	14.3%
JPL/Table Mtn Observatory	2,564	\$735,217	\$4,331	\$30,973	\$349	\$1,838	\$86	\$206	\$0	\$24,065	\$1,923	\$588	\$64,358	\$25.10	8.8%
Kennedy Space Center	86,013	\$40,228,780	\$103,270	\$640,297	\$10,655	\$100,572	\$5,753	\$2,715	\$0	\$472,669	\$93,887	\$23,463	\$1,453,281	\$16.90	3.6%
Langley Research Center	13,905	\$11,480,262	\$24,899	\$81,709	\$1,528	\$28,701	\$616	\$434	\$84	\$129,162	\$10,429	\$2,289	\$279,851	\$20.13	2.4%
Marshall Space Flight Center	63,310	\$21,109,725	\$38,955	\$518,956	\$7,938	\$52,774	\$4,173	\$2,101	\$145	\$53,055	\$99,390	\$6,017	\$783,504	\$12.38	3.7%
Moffett Federal Airfield	15,571	\$4,714,404	\$36,579	\$118,922	\$2,722	\$11,786	\$992	\$566	\$0	\$162,398	\$11,678	\$3,080	\$348,724	\$22.40	7.4%
NASA JSC White Sands 1st TDRSS	26,500	\$5,667,082	\$47,227	\$168,675	\$2,544	\$14,168	\$1,128	\$417	\$190	\$240,616	\$19,875	\$1,542	\$496,382	\$18.73	8.8%
NASA/JSC/White Sands Test Facility	143	\$77,548	\$255	\$910	\$14	\$194	\$6	\$2	\$1	\$1,298	\$107	\$8	\$2,796	\$19.55	3.6%
NASA/JSC/WSTF Space Harbor	3,432	\$421,646	\$6,116	\$21,845	\$330	\$1,054	\$146	\$54	\$25	\$31,162	\$2,574	\$200	\$63,505	\$18.50	15.1%
Stennis Space Center	20,789	\$14,505,994	\$41,222	\$144,835	\$2,459	\$36,265	\$733	\$606	\$0	\$199,141	\$15,592	\$2,087	\$442,938	\$21.31	3.1%
Wallops Flight Facility	13,568	\$5,881,678	\$24,295	\$110,778	\$1,491	\$14,704	\$601	\$1,327	\$82	\$126,032	\$10,176	\$4,742	\$294,229	\$21.69	5.0%
Total^B	303,810	\$129,042,193	\$474,023	\$2,789,181	\$38,095	\$322,605	\$16,811	\$12,982	\$1,129	\$2,049,857	\$310,352	\$59,370	\$6,074,405	\$19.99	4.7%

^A Operations include custodial (cleaning, pest control, and trash collection), utilities (energy, water, and sewer), grounds (landscape care, mowing, and snow removal), security, telecommunications, and management.
^B All costs expressed in \$2012.

Total O&M Costs

Estimated total annual Communications Building costs are shown in Table 8. A combination of maintenance and repair (sustainment) and operations, these costs represent an annual average for the next 50 years. Total costs are an estimated \$12.9 million per year, or can also be expressed as \$42.40 per GSFT and 10.0 percent of CRV.

Site	GSFT	CRV	O&M Estimates			Per GSFT	Percent CRV
			50-Year Avg. Sustainment ^A	Annual Operations ^B	Total Costs		
AMES Research Center	10,120	\$4,820,068	\$351,953	\$231,035	\$582,988	\$57.61	12.1%
Dryden Flight Research Center	3,613	\$4,378,379	\$113,551	\$85,675	\$199,227	\$55.14	4.6%
Ellington Field (JSC)	492	\$302,468	\$14,568	\$11,082	\$25,650	\$52.13	8.5%
Glenn Research Center	3,440	\$1,773,016	\$97,146	\$72,459	\$169,606	\$49.30	9.6%
Goddard Space Flight Center	6,589	\$2,496,531	\$207,893	\$160,154	\$368,048	\$55.86	14.7%
Jet Propulsion Laboratory	1,574	\$361,065	\$49,469	\$33,458	\$82,927	\$52.69	23.0%
Johnson Space Center	1,988	\$1,630,433	\$58,865	\$40,473	\$99,337	\$49.97	6.1%
JPL/Spain - Madrid Deep Space Comm. Complex	30,199	\$8,457,897	\$698,498	\$1,210,499	\$1,908,996	\$63.21	22.6%
JPL/Table Mtn Observatory	2,564	\$735,217	\$73,198	\$64,358	\$137,556	\$53.65	18.7%
Kennedy Space Center	86,013	\$40,228,780	\$1,815,129	\$1,453,281	\$3,268,410	\$38.00	8.1%
Langley Research Center	13,905	\$11,480,262	\$350,421	\$279,851	\$630,272	\$45.33	5.5%
Marshall Space Flight Center	63,310	\$21,109,725	\$821,413	\$783,504	\$1,604,916	\$25.35	7.6%
Moffett Federal Airfield	15,571	\$4,714,404	\$541,528	\$348,724	\$890,252	\$57.17	18.9%
NASA JSC White Sands 1st TDRSS	26,500	\$5,667,082	\$611,730	\$496,382	\$1,108,112	\$41.82	19.6%
NASA/JSC/White Sands Test Facility	143	\$77,548	\$3,301	\$2,796	\$6,097	\$42.64	7.9%
NASA/JSC/WSTF Space Harbor	3,432	\$421,646	\$79,225	\$63,505	\$142,730	\$41.59	33.9%
Stennis Space Center	20,789	\$14,505,994	\$578,459	\$442,938	\$1,021,397	\$49.13	7.0%
Wallops Flight Facility	13,568	\$5,881,678	\$341,928	\$294,229	\$636,157	\$46.89	10.8%
Total^C	303,810	\$129,042,193	\$6,808,273	\$6,074,405	\$12,882,678	\$42.40	10.0%

^A Sustainment is the average annual sum of preventative maintenance, unscheduled maintenance, and major repair and replacement tasks.
^B Operations include custodial (cleaning, pest control, and trash collection), utilities (energy, water, and sewer), grounds (landscape care, mowing, and snow removal), security, telecommunications, and management.
^C All costs expressed in \$2012.

Included in Attachment A and B are detailed MARS reports for the sample Goddard Space Flight Center and the Marshall Space Flight Center Communications Buildings.

**Attachment A: Detailed MARS Reports for GSFC Property ID
1019/51/17**

Building Component List

Whitestone Research

Building: B-RF SOC Operations Bldg

Year Built: 1997

Building Type: Communications Building

Facility: Goddard Space Flight Center

Original Cost: \$1

Building Num: 1019/51/17

City: Washington, D.C.

Replacement Value: \$475,173 **per SF:** \$396

Building Gsft: 1,200

Uniformat	Asset Description	Component	Date	Quantity	Location	Notes
B1010		Concrete Ramp	1997	80 Sq Ft		
B1010		Wood Decking	2012	70 Sq Ft		
B1010		Wood Decking	1997	130 Sq Ft		
B2010		Aluminum Siding, Painted, Exterior, 1st Floor	1997	2200 Sq Ft		
B2010		Concrete, Exterior, 1st Floor	1997	75 Sq Ft		
B2020		Aluminum Fixed Window, 24 sf, 1st Floor	1997	6 Each		
B2030		Steel, Painted, Exterior Door	1997	3 Each		
B2030		Steel, Painted, Exterior Double Door	1997	1 Each		
B3010		Aluminum Gutter, Downspouts, Fittings	1997	0.18 K Ln Ft		
B3010		Metal Roof	1997	1200 Sq Ft		
C1020		Steel, Painted, Interior Door	1997	3 Each		
C2010		Wood, Exterior Railing	2012	41 Ln Ft		
C2010		Wood, Exterior Railing	1997	34 Ln Ft		
C2010		Wood, Painted, Exterior Stairs	1997	20 Sq Ft		
C3010		Gypsum Board, Interior Wall Finish	1997	2100 Sq Ft		
C3020		Access Flooring w/ Carpet, Raised	1997	1130 Sq Ft		
C3020		Vinyl Tile Flooring	1997	70 Sq Ft		
C3030		Acoustical Tile, Dropped Ceiling	1997	1155 Sq Ft		
C3030		Acoustical Tile, Dropped Ceiling	1997	45 Sq Ft		
D2010		Drinking Fountain, Refrigerated	1997	1 Each		
D2010		Lavatory, Vitreous China	1997	1 Each		
D2010		Sink, Stainless Steel	1997	1 Each		
D2010		Tankless Water Closet	1997	1 Each		
D2020		Ball Valve, 1"	1997	2 Each		
D2020		Pipe & Fittings, 3/4" Copper, Cold Water	1997	0.1 K Ln Ft		
D2020		Pipe & Fittings, 3/4" Copper, Hot Water	1997	0.1 K Ln Ft		
D2020		Pipe Insulation, Fiberglass, Cold Water	1997	0.1 K Ln Ft		
D2020		Pipe Insulation, Fiberglass, Hot Water	1997	0.1 K Ln Ft		

§ Indicates Component set to have PM Tasks coincide with Replacement Task.

All costs expressed in (\$) 2012.

04-Dec-13

Uniformat	Asset Description	Component	Date	Quantity	Location	Notes
D2020		Water Heater, Electric, 20 Gal.	1997	1 Each		
D3020		Ball Valve, 1"	1997	2 Each		
D3020		Pipe & Fittings, 1" Steel	1997	0.05 K Ln Ft		
D3020		Pipe Insulation, Fiberglass, Heating Water/Steam	1997	0.05 K Ln Ft		
D3030		Condenser, Air Cooled, 5 Ton	1997	1 Each		
D3030		Condenser, Air-Cooled, 10 Ton	1997	1 Each		
D3040		Duct Insulation, Fiberglass Blanket	1997	15 Sq Ft		
D3040		Ductwork	1997	35 Lbs		
D3040		Exhaust Fan, Ceiling, 200-500 Cfm	1997	1 Each		
D3040		Humidifier, Electric, Duct w/ Controls	1997	1 Each		
D3050		Air Conditioner, DX Packaged, Air Cooled, 10 Ton	1997	1 Each		
D3050		Air Conditioner, DX Packaged, Air Cooled, 5 Ton	1997	1 Each		
D3050		Air Conditioner, Window, 1 Ton	1997	1 Each		
D3060		Thermostat	1997	2 Each		
D4010		Fire Alarm Control Panel	1997	1 Each		
D4010		Fire Department Connection, Siamese, 3"	1997	1 Each		
D4010		Fire Sprinkler Head	1997	8 Each		
D4010		Fire Sprinkler System	1997	1 Each		
D4010		Pipe & Fittings, 1" Steel	1997	0.2 K Ln Ft		
D4010		Pipe & Fittings, 2" Steel	1997	0.15 K Ln Ft		
D4010		Valves & Components, Sprinkler System, 3"	1997	1 Each		
D5010		Circuit Breaker, 600 V, 70-100 Amp., 3 Ph.	1997	1 Each		
D5010		Disconnect Switch, 100 Amp.	1997	3 Each		
D5010		Disconnect Switch, 60 Amp.	1997	2 Each		
D5010		Power Panel Board, 208 Y/120 V, 100 Amp.	1997	2 Each		
D5010		Power Panel Board, 208 Y/120 V, 225 Amp	1997	3 Each		
D5010		Power Panel Board, 480 V, 100 Amp.	1997	1 Each		
D5010		Power Panel Board, 480 V, 200 Amp.	1997	1 Each		
D5010		Primary Transformer, Oil Filled, 750 kVA	1997	2 Each		
D5020		Emergency Lighting Pack, 2 Light w/ Battery	1997	3 Each		
D5020		Exit Lighting Fixture, w/ Battery	1997	3 Each		
D5020		Fluorescent Lighting Fixture, T12, 2-60 w	1997	1 Each		
D5020		Fluorescent Lighting Fixture, T12, 4-60 w	1997	24 Each		
D5020		Grounded Fault Circuit Interruptor, 15 Amp.	1997	1 Each		
D5020		High Pressure Sodium Lighting Fixture, 250 w	1997	3 Each		
D5020		Incandescent Lighting Fixture, Basic, 100 w	1997	4 Each		

§ Indicates Component set to have PM Tasks coincide with Replacement Task.

All costs expressed in (\$) 2012.

04-Dec-13

Page 2

Uniformat	Asset Description	Component	Date	Quantity	Location	Notes
D5020		Occupancy Sensors, Indoor Lighting	1997	5 Each		
D5020		Receptacle, 120 V, 15 Amp.	1997	20 Each		
D5020		Wiring Device, Switch	1997	10 Each		
D5030		Card Reader	2005	3 Each		
D5030		Fire Alarm Bell, 6"	1997	2 Each		
D5030		Fire Alarm Strobe	1997	3 Each		
D5030		Magnetic Lock	2005	3 Each		
D5030		Manual Pull Station	1997	2 Each		
D5030		Smoke Detector	1997	7 Each		
D5090		Battery, UPS, Dry, 12 V, 75 Amp.	2009	6 Each		
D5090		Lightning Protection System	1997	0.228 K Ln Ft		
D5090		Uninterruptible Power Supply, 15 kVA	1997	1 Each		

§ Indicates Component set to have PM Tasks coincide with Replacement Task.

All costs expressed in (\$) 2012.

04-Dec-13

Page 3

Average M&R Costs

Whitestone Research

Building:	B-RF SOC Operations Bldg	GSFT:	1,200
Building Number:	1019/51/17	PRV:	\$475,173
Facility:	Goddard Space Flight Center	Built Date:	1997
City:	Washington, D.C.		

M&R Average Annual Cost Forecasts

	Current Year	5 Year	20 Year	50 Year
PM & Minor Repair:	\$9,484	\$8,830	\$9,078	\$9,030
Unscheduled Maintenance:	\$6,220	\$5,706	\$5,882	\$5,858
Renewal & Replacement:	\$258	\$24,514	\$23,239	\$22,973
Total M&R Costs:	\$15,962	\$39,050	\$38,199	\$37,861
Per GSFT:	\$13.30	\$32.54	\$31.83	\$31.55
As % of PRV:	3.36%	8.22%	8.04%	7.97%

M&R Costs by Task

Whitestone Research

04-Dec-13

Building: B-RF SOC Operations Bldg

Facility: Goddard Space Flight Center

Building Num: 1019/51/17

City: Washington, D.C.

Forecast Year:	2013	4	5	6	7	2018	9	0	1	2	2023	4	5	6	7	2028	9	0	1	2	2033	4	5	6	7
Replace Wood, Exterior Railing																									
Finish Replaced Wood, Painted, Exterior Stairs																29									
Replace Wood, Painted, Exterior Stairs																787									
Finish Repaired Wood, Painted, Exterior Stairs																									
Repair Wood, Painted, Exterior Stairs																									
Finish Replaced Wood, Exterior Railing																									
Finish Repaired Wood, Exterior Railing																3									
Repair Wood, Exterior Railing																30									
Refinish Wood, Exterior Railing	36			44	36			44	36			44	36			44	36			44	36			44	36
Refinish Wood, Painted, Exterior Stairs						29							29										29		

C30 Interior Finishes

Repair Vinyl Tile Flooring (2% of Floors)												4													
Replace Carpet on Access Flooring, Raised						10,625														10,625					
Replace Acoustical Tile, Dropped Ceiling																				4,733					
Repair Acoustic Tile, Dropped Ceiling (2% of Ceiling)			99								99										4				
Refinish Gypsum Board, Interior Wall Finish					3,010										3,010										3,010
Repair Access Flooring w/ Carpet, Raised (2% of Floors)																									747
Finish Repaired Gypsum Board, Interior Wall Finish					61																				61
Repair Gypsum Board, Interior Wall Finish (2% of Walls)					145																				145
Replace Access Flooring w/ Carpet, Raised											37,336														
Replace Vinyl Tile Flooring			294																				294		

D20 Plumbing

Replace Pipe Insulation, Fiberglass, Hot Water (20% of Insulation)											123														
Resolder Joint, Pipe & Fittings, 3/4" Copper, Cold Water					68															68					
Replace 10' Section, Pipe & Fittings, 3/4" Copper, Cold Water					33																				
Replace Pipe & Fittings, 3/4" Copper, Cold Water (20% of Pipe)											660														
Replace 10' Section, Pipe & Fittings, 3/4" Copper, Hot Water					33																				
Re-tape Pipe Insulation, Fiberglass, Cold Water					36										36					36					36
Replace Ball Valve, 1"			927																927						
Re-tape Pipe Insulation, Fiberglass, Hot Water					36										36					36					36
Resolder Joint, Pipe & Fittings, 3/4" Copper, Hot Water					68															68					
Check Operation, Water Heater, Electric, 20 Gal.			37				37				37							37			37				37
Drain & Flush Water Heater, Electric, 20 Gal.						305							305									305			
Replace Water Heater, Electric, 20 Gal.															1,777										
Replace Pipe Insulation, Fiberglass, Cold Water (20% of Insulation)											123														
Replace Washer & Spud Connection, Lavatory, Vitreous China					61										61										

M&R Costs by Task

Whitestone Research

04-Dec-13

Building: B-RF SOC Operations Bldg

Facility: Goddard Space Flight Center

Building Num: 1019/51/17

City: Washington, D.C.

Forecast Year:	2038	9	0	1	2	2043	4	5	6	7	2048	9	0	1	2	2053	4	5	6	7	2058	9	0	1	2
Replace Wood, Exterior Railing										495															598
Finish Replaced Wood, Painted, Exterior Stairs																					29				
Replace Wood, Painted, Exterior Stairs																					787				
Finish Repaired Wood, Painted, Exterior Stairs					1																				
Repair Wood, Painted, Exterior Stairs					17																				
Finish Replaced Wood, Exterior Railing										36															44
Finish Repaired Wood, Exterior Railing					3																1				1
Repair Wood, Exterior Railing					30																17				14
Refinish Wood, Exterior Railing		44	36			44	36				44		36	44				36	44			36	44		
Refinish Wood, Painted, Exterior Stairs				29							29								29						

C30 Interior Finishes

Repair Vinyl Tile Flooring (2% of Floors)					4																				4
Replace Carpet on Access Flooring, Raised					10,625																10,625				
Replace Acoustical Tile, Dropped Ceiling									185																
Repair Acoustic Tile, Dropped Ceiling (2% of Ceiling)			95	4									95					4				95			
Refinish Gypsum Board, Interior Wall Finish										3,010											3,010				
Repair Access Flooring w/ Carpet, Raised (2% of Floors)																									747
Finish Repaired Gypsum Board, Interior Wall Finish																					61				
Repair Gypsum Board, Interior Wall Finish (2% of Walls)																					145				
Replace Access Flooring w/ Carpet, Raised										37,336															
Replace Vinyl Tile Flooring															294										

D20 Plumbing

Replace Pipe Insulation, Fiberglass, Hot Water (20% of Insulati										123															
Resolder Joint, Pipe & Fittings, 3/4" Copper, Cold Water					68																68				
Replace 10' Section, Pipe & Fittings, 3/4" Copper, Cold Water					33																				
Replace Pipe & Fittings, 3/4" Copper, Cold Water (20% of Pipe										660															
Replace 10' Section, Pipe & Fittings, 3/4" Copper, Hot Water					33																				
Re-tape Pipe Insulation, Fiberglass, Cold Water					36										36						36				36
Replace Ball Valve, 1"											927														
Re-tape Pipe Insulation, Fiberglass, Hot Water					36										36						36				36
Resolder Joint, Pipe & Fittings, 3/4" Copper, Hot Water					68																68				
Check Operation, Water Heater, Electric, 20 Gal.		37						37			37			37										37	
Drain & Flush Water Heater, Electric, 20 Gal.					305										305									305	
Replace Water Heater, Electric, 20 Gal.					1,777																			1,777	
Replace Pipe Insulation, Fiberglass, Cold Water (20% of Insula										123															
Replace Washer & Spud Connection, Lavatory, Vitreous China		61								61														61	

M&R Costs by Task

Whitestone Research

04-Dec-13

Building: B-RF SOC Operations Bldg

Facility: Goddard Space Flight Center

Building Num: 1019/51/17

City: Washington, D.C.

	Forecast Year:																								
	2013	4	5	6	7	2018	9	0	1	2	2023	4	5	6	7	2028	9	0	1	2	2033	4	5	6	7
Replace Pipe & Fittings, 3/4" Copper, Hot Water (20% of Pipe)	660																								
Lubricate, Repack Gland, Ball Valve, 1"	108		108	108	108	108	108	108	108	108	108	108	108	108	108	108	108	108		108	108	108	108	108	108
Replace Coolant & Adjust Drinking Fountain, Refrigerated	44		44				44		44		44		44				44		44		44		44		
Replace Faucet Washer & Clean Trap, Lavatory, Vitreous China	39		39		39		39		39		39		39		39		39		39		39		39		
Replace Valve Set, Lavatory, Vitreous China					190										190										
Replace Lavatory, Vitreous China																					646				
Replace Faucet Washer & Clean Trap, Sink, Stainless Steel	39		39		39		39		39		39		39		39		39		39		39		39		
Repair Strainer, Sink, Stainless Steel	109								109								109								
Replace Valve Set, Sink, Stainless Steel					190										190										
Replace Sink, Stainless Steel																									1,391
Replace Flush Valve, Tankless Water Closet					37										37										
Replace Tankless Water Closet																					887				
Replace Drinking Fountain, Refrigerated						1,365									1,365										1,365

D30 HVAC

Maintain Fan & Motor, Exhaust Fan, Ceiling 200-500 Cfm	86	86	86	86		86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86
Replace Condenser, Air-Cooled, 5 Ton																6,928									
Replace Fan & Motor, Exhaust Fan, Ceiling 200-500 Cfm					1,114																				1,114
Replace Duct Insulation (20% of Insulation)																22									
Replace Condenser, Air-Cooled, 10 Ton																8,205									
Repair Condenser, Air-Cooled, 10 Ton					1,947																				1,947
Maintain Condenser, Air-Cooled, 10 Ton	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207
Repair Condenser, Air-Cooled, 5 Ton					1,318																				1,318
Maintain Condenser, Air-Cooled, 5 Ton	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207
Replace Pipe Insulation, Fiberglass, Heating Water/Steam (20%)										83															
Re-tape Pipe Insulation, Fiberglass, Heating Water/Steam					18										18						18				18
Install New Gasket & Bolts, Pipe & Fittings, 1" Steel										10															
Replace 10' Section, Pipe & Fittings, 1" Steel										12											12				
Lubricate, Repack Gland, Ball Valve, 1"	269	269	269	269		269	269	269	269	269	269	269	269	269	269	269	269	269	269	269	269	269	269	269	269
Replace Ball Valve, 1"					1,071																				1,071
Maintain Air Conditioner, Window, 1 Ton	192	192	192	192		192	192	192	192	192	192	192	192	192	192	192	192	192	192	192	192	192	192	192	192
Replace Existing Ductwork (20% of Ductwork)																104									
Replace Thermostat					1,038										1,038										1,038
Maintain Thermostat	76	76	76	76		76	76	76	76	76	76	76	76	76		76	76	76	76	76	76	76	76	76	76
Repair Air Conditioner, Window, 1 Ton																199									
Replace Air Conditioner, DX Packaged, Air Cooled, 10 Ton					22,665																				22,665
Repair Air Conditioner, DX Packaged, Air Cooled, 10 Ton																13,749									
Maintain Air Conditioner, DX Packaged, Air Cooled, 10 Ton	610	610	610	610		610	610	610	610	610	610	610	610	610	610	610	610	610	610	610	610	610	610	610	610

M&R Costs by Task

Whitestone Research

04-Dec-13

Building: B-RF SOC Operations Bldg

Facility: Goddard Space Flight Center

Building Num: 1019/51/17

City: Washington, D.C.

Forecast Year:	2038	9	0	1	2	2043	4	5	6	7	2048	9	0	1	2	2053	4	5	6	7	2058	9	0	1	2
Replace Pipe & Fittings, 3/4" Copper, Hot Water (20% of Pipe)										660															
Lubricate, Repack Gland, Ball Valve, 1"	108	108	108	108	108	108	108	108	108	108		108	108	108	108	108	108	108	108	108	108	108	108	108	108
Replace Coolant & Adjust Drinking Fountain, Refrigerated		44		44		44		44				44		44		44		44				44		44	
Replace Faucet Washer & Clean Trap, Lavatory, Vitreous Chin	39		39		39		39		39		39		39		39		39		39		39		39		39
Replace Valve Set, Lavatory, Vitreous China					190										190										190
Replace Lavatory, Vitreous China																									
Replace Faucet Washer & Clean Trap, Sink, Stainless Steel		39		39		39		39		39		39		39		39		39		39		39		39	
Repair Strainer, Sink, Stainless Steel								109								109									109
Replace Valve Set, Sink, Stainless Steel										190											190				
Replace Sink, Stainless Steel																									
Replace Flush Valve, Tankless Water Closet					37										37										37
Replace Tankless Water Closet																									
Replace Drinking Fountain, Refrigerated										1,365											1,365				

D30 HVAC

Maintain Fan & Motor, Exhaust Fan, Ceiling 200-500 Cfm	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86		86	86	86	86	86	
Replace Condenser, Air-Cooled, 5 Ton					6,928																6,928					
Replace Fan & Motor, Exhaust Fan, Ceiling 200-500 Cfm																									1,114	
Replace Duct Insulation (20% of Insulation)																									22	
Replace Condenser, Air-Cooled, 10 Ton					8,205																				8,205	
Repair Condenser, Air-Cooled, 10 Ton															1,947											
Maintain Condenser, Air-Cooled, 10 Ton	207	207	207	207		207	207	207	207	207	207	207	207	207	207	207	207	207	207	207		207	207	207	207	
Repair Condenser, Air-Cooled, 5 Ton																									1,318	
Maintain Condenser, Air-Cooled, 5 Ton	207	207	207	207		207	207	207	207	207	207	207	207	207	207	207	207	207	207	207		207	207	207	207	
Replace Pipe Insulation, Fiberglass, Heating Water/Steam (20															83											
Re-tape Pipe Insulation, Fiberglass, Heating Water/Steam					18											18									18	
Install New Gasket & Bolts, Pipe & Fittings, 1" Steel															10											
Replace 10' Section, Pipe & Fittings, 1" Steel															12										12	
Lubricate, Repack Gland, Ball Valve, 1"	269	269	269	269	269	269	269	269	269	269	269	269	269	269	269	269	269	269	269	269		269	269	269	269	
Replace Ball Valve, 1"																									1,071	
Maintain Air Conditioner, Window, 1 Ton	192	192	192	192	192	192	192	192	192	192	192	192	192	192	192	192	192	192	192	192		192	192	192	192	
Replace Existing Ductwork (20% of Ductwork)																									104	
Replace Thermostat															1,038											1,038
Maintain Thermostat	76	76	76	76	76	76	76	76	76		76	76	76	76	76	76	76	76	76	76		76	76	76	76	
Repair Air Conditioner, Window, 1 Ton															199											
Replace Air Conditioner, DX Packaged, Air Cooled, 10 Ton																									22,665	
Repair Air Conditioner, DX Packaged, Air Cooled, 10 Ton															13,749											
Maintain Air Conditioner, DX Packaged, Air Cooled, 10 Ton	610	610	610	610	610	610	610	610	610	610	610	610	610	610	610	610	610	610	610	610		610	610	610	610	

M&R Costs by Task

Whitestone Research

04-Dec-13

Building: B-RF SOC Operations Bldg

Facility: Goddard Space Flight Center

Building Num: 1019/51/17

City: Washington, D.C.

	Forecast Year:																								
	2013	4	5	6	7	2018	9	0	1	2	2023	4	5	6	7	2028	9	0	1	2	2033	4	5	6	7
Replace Air Conditioner, DX Packaged, Air Cooled, 5 Ton						8,241																			8,241
Repair Air Conditioner, DX Packaged, Air Cooled, 5 Ton																3,874									
Maintain Air Conditioner, DX Packaged, Air Cooled, 5 Ton	322	322	322	322		322	322	322	322	322	322	322	322	322	322	322	322	322	322	322	322	322	322	322	322
Replace Humidifier, Electric, Duct w/ Controls						3,732																			3,732
Maintain Humidifier, Electric, Duct w/ Controls	287	287	287	287		287	287	287	287	287	287	287	287	287	287	287	287	287	287	287	287	287	287	287	287
Replace Air Conditioner, Window, 1 Ton						2,167																			2,167

D40 Fire Protection

Test Fire Sprinkler Head						458										458									458
Replace Fire Sprinkler Head																									
Install New Gasket & Bolts, Pipe & Fittings, 2" Steel										30															
Replace 10' Section, Pipe & Fittings, 2" Steel										50												50			
Install New Gasket & Bolts, Pipe & Fittings, 1" Steel										40															
Replace 10' Section, Pipe & Fittings, 1" Steel										50												50			
Test Gages & Valves, Fire Sprinkler System	1,373	1,373	1,373	1,373	1,373	1,373	1,373	1,373	1,373	1,373	1,373	1,373	1,373	1,373	1,373	1,373	1,373	1,373	1,373	1,373	1,373	1,373	1,373	1,373	1,373
Inspect Fire Sprinkler Head	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Replace Fire Alarm Control Panel																4,729									
Repair Fire Alarm Control Panel						203				203											203				203
Inspect & Test Fire Alarm Control Panel	243	243	243	243	243	243	243	243	243	243	243	243	243	243		243	243	243	243	243	243	243	243	243	243
Inspect & Maintain Fire Department Connection, Siamese, 3"	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207	207
Replace Valves & Components, Sprinkler System						4,764																			4,764
Replace Fire Department Connection, Siamese, 3"																									
Maintain Fire Sprinkler System	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	

D50 Electrical

Replace Ballast & Lamp, HP Sodium Lighting Fixture, 250 w																1,493									
Maintain Card Reader	342	342		342	342	342	342	342	342	342	342	342		342	342	342	342	342	342	342	342	342		342	342
Replace Wiring Device, Switch																573									
Repair Wiring Device, Switch						609																			609
Replace Receptacle, 120 V, 15 Amp.						1,368																			1,368
Replace Occupancy Sensors, Indoor Lighting																7,862									
Replace Control Unit, Occupancy Sensors, Indoor Lighting						781				781											781				781
Inspect & Maintain Occupancy Sensor, Indoor Lighting	302	302	302	302	302	302	302	302	302	302	302	302	302	302		302	302	302	302	302	302	302	302	302	302
Replace Incandescent Lighting Fixture, Basic, 100 w						792																			792
Replace HP Sodium Lighting Fixture, 250 w						4,170																			4,170
Replace Uninterruptible Power Supply Battery, 15 kVA						418																			418
Replace Grounded Fault Circuit Interruptor, 15 Amp.						94																			94
Replace Fluorescent Lighting Fixture, T12, 4-60 w						5,927																			5,927

M&R Costs by Task

Whitestone Research

04-Dec-13

Building: B-RF SOC Operations Bldg

Facility: Goddard Space Flight Center

Building Num: 1019/51/17

City: Washington, D.C.

Forecast Year:	2038	9	0	1	2	2043	4	5	6	7	2048	9	0	1	2	2053	4	5	6	7	2058	9	0	1	2	
Replace Air Conditioner, DX Packaged, Air Cooled, 5 Ton																										8,241
Repair Air Conditioner, DX Packaged, Air Cooled, 5 Ton										3,874																
Maintain Air Conditioner, DX Packaged, Air Cooled, 5 Ton	322	322	322	322	322	322	322	322	322	322	322	322	322	322	322	322	322	322	322		322	322	322	322	322	
Replace Humidifier, Electric, Duct w/ Controls																										3,732
Maintain Humidifier, Electric, Duct w/ Controls	287	287	287	287	287	287	287	287	287	287	287	287	287	287	287	287	287	287	287		287	287	287	287	287	
Replace Air Conditioner, Window, 1 Ton																										2,167

D40 Fire Protection

Test Fire Sprinkler Head																										458
Replace Fire Sprinkler Head										969																
Install New Gasket & Bolts, Pipe & Fittings, 2" Steel										30																
Replace 10' Section, Pipe & Fittings, 2" Steel										50																50
Install New Gasket & Bolts, Pipe & Fittings, 1" Steel										40																
Replace 10' Section, Pipe & Fittings, 1" Steel										50																50
Test Gages & Valves, Fire Sprinkler System	1,373	1,373	1,373	1,373	1,373	1,373	1,373	1,373	1,373	1,373	1,373	1,373	1,373	1,373	1,373	1,373	1,373	1,373	1,373	1,373	1,373	1,373	1,373	1,373	1,373	
Inspect Fire Sprinkler Head	10	10	10	10	10	10	10	10	10		10	10	10	10	10	10	10	10	10		10	10	10	10	10	
Replace Fire Alarm Control Panel						4,729																				4,729
Repair Fire Alarm Control Panel										203						203										203
Inspect & Test Fire Alarm Control Panel	243	243	243	243		243	243	243	243	243	243	243	243	243	243	243	243	243	243		243	243	243	243	243	
Inspect & Maintain Fire Department Connection, Siamese, 3"	207	207	207	207	207	207	207	207	207		207	207	207	207	207	207	207	207	207		207	207	207	207	207	
Replace Valves & Components, Sprinkler System																										4,764
Replace Fire Department Connection, Siamese, 3"										1,702																
Maintain Fire Sprinkler System	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	1,490	

D50 Electrical

Replace Ballast & Lamp, HP Sodium Lighting Fixture, 250 w										1,493																
Maintain Card Reader	342	342	342	342	342	342	342		342	342	342	342	342	342	342	342	342		342	342	342	342	342	342	342	
Replace Wiring Device, Switch						573																				573
Repair Wiring Device, Switch															609											
Replace Receptacle, 120 V, 15 Amp.																										1,368
Replace Occupancy Sensors, Indoor Lighting						7,862																				7,862
Replace Control Unit, Occupancy Sensors, Indoor Lighting										781						781										781
Inspect & Maintain Occupancy Sensor, Indoor Lighting	302	302	302	302		302	302	302	302	302	302	302	302	302	302	302	302	302	302		302	302	302	302	302	
Replace Incandescent Lighting Fixture, Basic, 100 w																										792
Replace HP Sodium Lighting Fixture, 250 w																										4,170
Replace Uninterruptible Power Supply Battery, 15 kVA															418											
Replace Grounded Fault Circuit Interruptor, 15 Amp.																										94
Replace Fluorescent Lighting Fixture, T12, 4-60 w																										5,927

M&R Costs by Task

Whitestone Research

04-Dec-13

Building: B-RF SOC Operations Bldg

Facility: Goddard Space Flight Center

Building Num: 1019/51/17

City: Washington, D.C.

Forecast Year:	2013	4	5	6	7	2018	9	0	1	2	2023	4	5	6	7	2028	9	0	1	2	2033	4	5	6	7	
Replace Card Reader			3,832										3,832											3,832		
Replace Lamp, Incandescent Lighting Fixture, Basic, 100 w										62					62						62					
Repair Smoke Detector						529																			529	
Maintain Power Panel Board, 480 V, 100 Amp.	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
Maintain Uninterruptible Power Supply, 15 kVA	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57	57
Replace Fluorescent Lighting Fixture, T12, 2-60 w						247																			247	
Maintain & Repair General Wiring, Lightning Protection System	32	32	32	32	32	32	32	32	32		32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32
Replace Battery, UPS, Dry, 12 V, 75 Amp.		2,507					2,507					2,507					2,507							2,507		
Replace Lightning Protection General Wiring										3,302																
Replace Smoke Detector																1,568										
Replace Fire Alarm Bell, 6"						562																			562	
Replace Batteries & Check Operation, Smoke Detector	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210	210
Replace Manual Pull Station																384										
Check & Repair Manual Pull Station						163																			163	
Replace Magnetic Lock			3,084											3,084											3,084	
Maintain Magnetic Lock	342	342		342	342	342	342	342	342	342	342	342		342	342	342	342	342	342	342	342	342	342		342	342
Replace Fire Alarm Strobe						535																				535
Maintain Battery, UPS, Dry, 12 V, 75 Amp.	342		342	342	342	342		342	342	342	342		342	342	342	342	342		342	342	342	342		342	342	342
Replace Uninterruptible Power Supply, 15 kVA																28,799										
Maintain Circuit Breaker, 600 V, 70-100 Amp., 3 Ph.	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46
Repair Circuit Breaker, 600 V, 70-100 Amp., 3 Ph.						639																				639
Replace Circuit Breaker, 600 V, 70-100 Amp., 3 Ph.																										
Maintain Disconnect Switch, 60 Amp.	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76
Repair Disconnect Switch, 60 Amp.						479																				479
Replace Disconnect Switch, 60 Amp.																										
Maintain Disconnect Switch, 100 Amp.	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317	317
Repair Disconnect Switch, 100 Amp.						816																				816
Replace Disconnect Switch, 100 Amp.																										
Maintain Power Panel Board, 208 Y/120 V, 100 Amp.	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228
Repair Power Panel Board, 208 Y/120 V, 100 Amp.						359																				359
Replace Power Panel Board, 208 Y/120 V, 100 Amp.																										
Maintain Power Panel Board, 208 Y/120 V, 225 Amp.	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342
Replace Power Panel Board, 480 V, 100 Amp.																										
Repair Primary Transformer, Oil Filled, 750 kVA						10,604																				10,604
Replace Ballast & Lamps, Fluorescent Lighting Fixture, T12, 2-6																149										
Replace Exit Lighting Fixture, w/ Battery						1,457																				1,457
Replace Lamp, Exit Lighting Fixture, w/ Battery										304						304										

M&R Costs by Task

Whitestone Research

04-Dec-13

Building: B-RF SOC Operations Bldg

Facility: Goddard Space Flight Center

Building Num: 1019/51/17

City: Washington, D.C.

Forecast Year:	2038	9	0	1	2	2043	4	5	6	7	2048	9	0	1	2	2053	4	5	6	7	2058	9	0	1	2		
Replace Card Reader							3,832										3,832										
Replace Lamp, Incandescent Lighting Fixture, Basic, 100 w					62						62					62									62		
Repair Smoke Detector																529											
Maintain Power Panel Board, 480 V, 100 Amp.	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115		115	115	115	115		
Maintain Uninterruptible Power Supply, 15 kVA	57	57	57	57		57	57	57	57	57	57	57	57	57	57	57	57	57	57	57		57	57	57	57		
Replace Fluorescent Lighting Fixture, T12, 2-60 w																									247		
Maintain & Repair General Wiring, Lightning Protection System	32	32	32	32	32	32	32	32	32		32	32	32	32	32	32	32	32	32	32	32	32	32	32	32		
Replace Battery, UPS, Dry, 12 V, 75 Amp.		2,507				2,507					2,507					2,507					2,507						
Replace Lightning Protection General Wiring											3,302																
Replace Smoke Detector						1,568																1,568					
Replace Fire Alarm Bell, 6"																									562		
Replace Batteries & Check Operation, Smoke Detector	210	210	210	210		210	210	210	210	210	210	210	210	210	210	210	210	210	210	210		210	210	210	210		
Replace Manual Pull Station						384																				384	
Check & Repair Manual Pull Station																163											
Replace Magnetic Lock							3,084											3,084									
Maintain Magnetic Lock	342	342	342	342	342	342	342		342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342		
Replace Fire Alarm Strobe																									535		
Maintain Battery, UPS, Dry, 12 V, 75 Amp.	342		342	342	342	342		342	342	342	342		342	342	342	342		342	342	342	342		342	342	342		
Replace Uninterruptible Power Supply, 15 kVA						28,799												28,799									
Maintain Circuit Breaker, 600 V, 70-100 Amp., 3 Ph.	46	46	46	46	46	46	46	46	46		46	46	46	46	46	46	46	46	46	46	46	46	46	46	46		
Repair Circuit Breaker, 600 V, 70-100 Amp., 3 Ph.																									639		
Replace Circuit Breaker, 600 V, 70-100 Amp., 3 Ph.											2,015																
Maintain Disconnect Switch, 60 Amp.	76	76	76	76	76	76	76	76	76		76	76	76	76	76	76	76	76	76	76	76	76	76	76	76		
Repair Disconnect Switch, 60 Amp.																									479		
Replace Disconnect Switch, 60 Amp.											2,214																
Maintain Disconnect Switch, 100 Amp.	317	317	317	317	317	317	317	317	317		317	317	317	317	317	317	317	317	317	317	317	317	317	317	317		
Repair Disconnect Switch, 100 Amp.																									816		
Replace Disconnect Switch, 100 Amp.											5,626																
Maintain Power Panel Board, 208 Y/120 V, 100 Amp.	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228		228	228	228	228		
Repair Power Panel Board, 208 Y/120 V, 100 Amp.											359																
Replace Power Panel Board, 208 Y/120 V, 100 Amp.																									11,660		
Maintain Power Panel Board, 208 Y/120 V, 225 Amp.	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342	342		
Replace Power Panel Board, 480 V, 100 Amp.																									8,161		
Repair Primary Transformer, Oil Filled, 750 kVA											10,604																
Replace Ballast & Lamps, Fluorescent Lighting Fixture, T12, 2-											149																
Replace Exit Lighting Fixture, w/ Battery																									1,457		
Replace Lamp, Exit Lighting Fixture, w/ Battery					304						304					304									304		

M&R Costs by Task

Whitestone Research

04-Dec-13

Building: B-RF SOC Operations Bldg

Facility: Goddard Space Flight Center

Building Num: 1019/51/17

City: Washington, D.C.

Forecast Year:	2013	4	5	6	7	2018	9	0	1	2	2023	4	5	6	7	2028	9	0	1	2	2033	4	5	6	7	
Replace Emergency Lighting Pack, 2 Light w/ Battery					4,383																				4,383	
Replace Lens, Replace Emergency Lighting Pack, 2 Light w/ Bat															160											
Repair Power Panel Board, 208 Y/120 V, 225 Amp.					538																					538
Replace Primary Transformer, Oil Filled, 750 kVA															102,183											
Replace Power Panel Board, 208 Y/120 V, 225 Amp.															26,410											
Maintain Primary Transformer, Oil Filled, 750 kVA	228	228	228	228	228	228	228	228	228	228	228	228	228	228		228	228	228	228	228	228	228	228	228	228	228
Replace Power Panel Board, 480 V, 200 Amp.															11,217											
Repair Power Panel Board, 480 V, 200 Amp.					179																					179
Maintain Power Panel Board, 480 V, 200 Amp.	115	115	115	115	115	115	115	115	115	115	115	115	115	115		115	115	115	115	115	115	115	115	115	115	115
Repair Power Panel Board, 480 V, 100 Amp.					179																					179
Replace Ballast & Lamps, Fluorescent Lighting Fixture, T12, 4-6															3,594											
Replace Lamp, Replace Emergency Lighting Pack, 2 Light w/ Ba	302		302				302		302		302		302		302		302		302		302		302		302	

M&R Costs by Task

Whitestone Research

04-Dec-13

Building: B-RF SOC Operations Bldg

Facility: Goddard Space Flight Center

Building Num: 1019/51/17

City: Washington, D.C.

Forecast Year:	2038	9	0	1	2	2043	4	5	6	7	2048	9	0	1	2	2053	4	5	6	7	2058	9	0	1	2		
Replace Emergency Lighting Pack, 2 Light w/ Battery																										4,383	
Replace Lens, Replace Emergency Lighting Pack, 2 Light w/ B											160																
Repair Power Panel Board, 208 Y/120 V, 225 Amp.											538																
Replace Primary Transformer, Oil Filled, 750 kVA																										102,183	
Replace Power Panel Board, 208 Y/120 V, 225 Amp.																										26,410	
Maintain Primary Transformer, Oil Filled, 750 kVA	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228
Replace Power Panel Board, 480 V, 200 Amp.																										11,217	
Repair Power Panel Board, 480 V, 200 Amp.											179																
Maintain Power Panel Board, 480 V, 200 Amp.	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	
Repair Power Panel Board, 480 V, 100 Amp.											179																
Replace Ballast & Lamps, Fluorescent Lighting Fixture, T12, 4-											3,594																
Replace Lamp, Replace Emergency Lighting Pack, 2 Light w/		302		302		302		302		302		302		302		302		302		302		302		302		302	

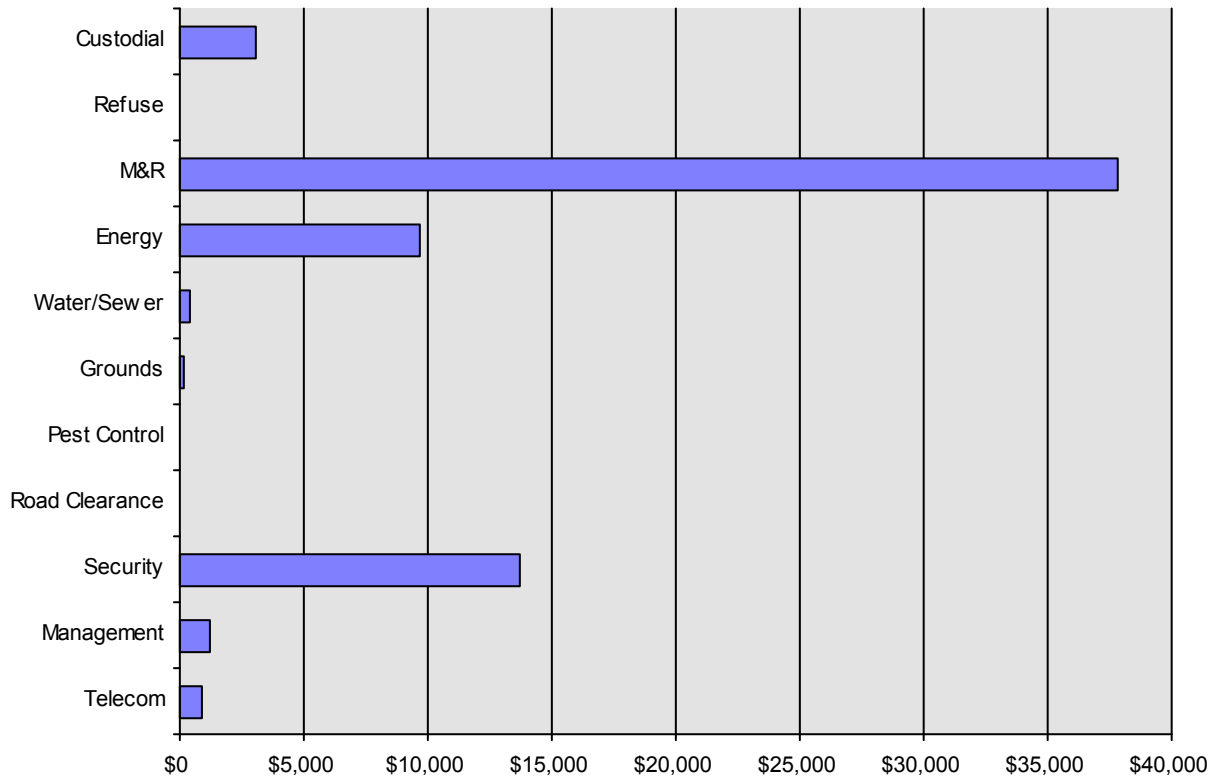
Operation Costs Summary

Whitestone Research

Building: B-RF SOC Operations Bldg
Building Number: 1019/51/17
Facility: Goddard Space Flight Center
City: Washington, D.C.
Built Date: 1997

GSFT: 1,200
Replacement Value: \$475,173
Building Use: Office
Building Type: Communications Building

Operation	Annual Cost/GSFT	Annual Total	Percent
Custodial	\$2.572	\$3,086	4.6%
Energy	\$8.041	\$9,650	14.4%
Grounds	\$0.126	\$151	0.2%
M&R	\$31.552	\$37,862	56.4%
Management	\$0.990	\$1,188	1.8%
Pest Control	\$0.059	\$70	0.1%
Refuse	\$0.033	\$39	0.1%
Road Clearance	\$0.015	\$19	0.0%
Security	\$11.412	\$13,695	20.4%
Telecom	\$0.750	\$900	1.3%
Water/Sewer	\$0.351	\$421	0.6%
Building Total	\$55.90	\$67,081	100.0%



Building Operations Task Details

Whitestone Research

Building: B-RF SOC Operations Bldg

Year Built: 1997

Building Type: Communications Building

Facility: Goddard Space Flight Center

Original Cost: \$1

Building Num: 1019/51/17

City: Washington, D.C.

Replacement Value: \$475,173

per SF: \$396

Building Gsft: 1,200

Functional Area	FA GSFT	Task	Labor Cost	Material Cost	Task Cost
Operation: Custodial		Level of Service: Medium			
Conference Room	960	Vacuum Carpet with 14" Upright Vacuum	\$1,449	\$236	\$1,685
Conference Room	960	Clean and Wipe Furniture with Trigger Sprayer & Cloth	\$551	\$89	\$640
Conference Room	960	Empty Trash; Wipe Clean & Re-line Basket	\$207	\$34	\$241
Office	120	Vacuum Carpet with 14" Upright Vacuum	\$181	\$29	\$211
Office	120	Empty Trash; Wipe Clean & Re-line Basket	\$26	\$4	\$30
Office	120	Clean and Wipe Furniture with Trigger Sprayer & Cloth	\$23	\$4	\$27
Office	120	Dust Surfaces with Duster	\$17	\$3	\$20
Office	120	Vacuum Upholstered Furniture with Tank or Canister Vacuum	\$9	\$1	\$10
Office	120	Dust Window Blinds	\$8	\$1	\$10
Common/Circulation Are	60	Vacuum Carpet with 14" Upright Vacuum	\$91	\$15	\$105
Common/Circulation Are	60	Vacuum Upholstered Furniture with Tank or Canister Vacuum	\$13	\$2	\$15
Common/Circulation Are	60	Empty Trash; Wipe Clean & Re-line Basket	\$13	\$2	\$15
Mechanical/Equipment R	48	Sweep Hard Floor with 48" Push Broom	\$2	\$0	\$2
Mechanical/Equipment R	48	Empty Trash; Wipe Clean & Re-line Basket	\$2	\$0	\$2
Restroom	12	Service Restroom: Empty Trash, Clean & Disinfect Fixtures, Wipe Mirrors, Replace Supplies, Wet M	\$54	\$9	\$63
Restroom	12	Service Restroom: Empty Trash, Replace Supplies & Touch Up as Needed	\$8	\$1	\$10
Total:			\$2,654	\$431	\$3,086
Operation: Grounds		Level of Service: Low			
Grounds, Improved	720	Mow Turfgrass with 21" Power Mower	\$27	\$11	\$39
Grounds, Improved	720	Aerate Improved Grounds	\$20	\$8	\$29
Grounds, Improved	720	Clear Shrubs	\$17	\$7	\$24
Grounds, Improved	720	Edge Clean & Trim Walks with Gas Powered Edger	\$11	\$5	\$16
Grounds, Improved	720	Overseed, Improved Grounds	\$10	\$4	\$14
Grounds, Improved	720	Vacuum with 30" Billy Goat	\$7	\$3	\$10
Grounds, Improved	720	Clear Crabgrass	\$5	\$2	\$7
Grounds, Improved	720	Clear Weeds with 15" Boom, Improved Grounds	\$3	\$1	\$4
Grounds, Improved	720	Trim Around Raised Objects with String Edger	\$2	\$1	\$3

All costs expressed in (\$) 2012.

04-Dec-13

Functional Area	FA GSFT	Task	Labor Cost	Material Cost	Task Cost
Grounds, Improved	720	Fertilize Improved Grounds	\$2	\$1	\$3
Grounds, Improved	720	Sweep with 30" Power Rake	\$1	\$1	\$2
Grounds, Improved	720	Fertilize Using Power Take Off Broadcast	\$0	\$0	\$0
Total:			\$107	\$44	\$151
Operation: Pest Control		Level of Service: Low			
Pest Controlled	1200	Install, or Check and Re-Bait 5 Rodent Boxes	\$19	\$8	\$27
Pest Controlled	1200	Inspect Building for Pests	\$24	\$0	\$24
Pest Controlled	1200	Perform Crawling Insect Abatement	\$14	\$6	\$20
Total:			\$57	\$14	\$70
Operation: Road Clearance		Level of Service: Medium			
Pavement NASA	960	Plow Paved Area	\$14	\$4	\$19
Total:			\$14	\$4	\$19
Operation: Security		Level of Service: High			
Secured Area	1200	Guard Lobby/Parking	\$1,764	\$287	\$2,050
Secured Area	1200	Patrol Building Perimeter	\$304	\$49	\$354
Total:			\$2,068	\$336	\$2,404

Building Operations Utility Details

Whitestone Research

Building: B-RF SOC Operations Bldg

Year Built: 1997

Building Type: Communications Building

Facility: Goddard Space Flight Center

Original Cost: \$1

Building Num: 1019/51/17

City: Washington, D.C.

Replacement Value: \$475,173

per SF: \$396

Building Gsft: 1,200

		Utility	GSFT	Demand	UM	Rate	Cost
Operation:	Energy	Level of Service:	High				
		Electricity	1200	95.781	kWh	\$0.0820	\$9,425
		Natural Gas	1200	0.360	Thm	\$0.5200	\$225
		Diesel	1200	0.000	Gal	\$3.3400	\$0
		Total:		96.142			\$9,650
Operation:	Refuse	Level of Service:	Medium				
		Municipal Solid Waste	1200	0.370	Lbs	\$0.0711	\$32
		Recycling	1200	0.180	Lbs	\$0.0367	\$8
		Total:		0.550			\$39
Operation:	Water/Sewer	Level of Service:	Medium				
		Sewer	1200	19.800	Gal	\$0.0092	\$219
		Water	1200	25.200	Gal	\$0.0067	\$203
		Total:		45.000			\$421

Building Operations Management Details

Whitestone Research

Building: B-RF SOC Operations Bldg

Year Built: 1997

Building Type: Communications Building

Facility: Goddard Space Flight Center

Original Cost: \$1

Building Num: 1019/51/17

City: Washington, D.C.

Replacement Value: \$475,173

per SF: \$396

Building Gsft: 1,200

	Service	Demand	UM	PRV	Cost
Operation: Management	Level of Service: Low				
	Management	0.3%	PRV	\$475,173	\$1,188
	Total:				\$1,188

Building Operations Service Details

Whitestone Research

Building: B-RF SOC Operations Bldg	Year Built: 1997	FTEs: 1	Building Type: Communications Building
Facility: Goddard Space Flight Center	Original Cost: \$1		Building Num: 1019/51/17
City: Washington, D.C.	Replacement Value: \$475,173	per SF: \$396	Building Gsft: 1,200

Service*		Quantity	Rate	Cost
Operation: Security	Level of Service: High			
	Intrusion Detection Systems	1	\$4,986	\$4,986
	System Monitoring	1	\$3,615	\$3,615
	Access Control	1	\$2,690	\$2,690
	Total:			\$11,291
Operation: Telecom	Level of Service: High			
	Local Telephone	1	\$468	\$468
	Data	1	\$3,588	\$240
	Long Distance Telephone	1	\$192	\$192
	Total:			\$900

All costs expressed in (\$) 2012.

* Security may be composed of service and task based cost. See Building Operations Task Details for Security Tasks.

**Attachment B: Detailed MARS Reports for MSFC Property ID
1045/62/179**

Building Component List

Whitestone Research

Building: Communications Facility

Year Built: 1962

Building Type: Communications Building

Facility: Marshall Space Flight Center

Original Cost: \$1

Building Num: 1045/62/179

City: Huntsville, AL

Replacement Value: \$18,633,603 **per SF:** \$302

Building Gsft: 61,648

Uniformat	Asset Description	Component	Date	Quantity	Location	Notes
B1010		Concrete Decking	1965	260 Sq Ft		
B1010		Concrete Decking	1962	46 Sq Ft		
B1020		Steel Roof Access Ladder	1990	20 Ln Ft		
B2010		Aluminum Louver, 1st Floor	1995	2 Each	150	
B2010		Aluminum Louver, 1st Floor	1962	2 Each		
B2010		Aluminum Louver, 1st Floor	1985	2 Each		
B2010		Aluminum Louver, 1st Floor	1970	4 Each		
B2010		Clay Brick, Exterior, 1st Floor	2010	4550 Sq Ft	4208	
B2010		Clay Brick, Exterior, 1st Floor	1995	3680 Sq Ft	150	
B2010		Clay Brick, Exterior, 1st Floor	1995	1450 Sq Ft	Cooling Towers	
B2010		Clay Brick, Exterior, 1st Floor	1962	6670 Sq Ft		
B2010		Clay Brick, Exterior, 1st Floor	1970	4615 Sq Ft		
B2010		Clay Brick, Exterior, 1st Floor	1985	6665 Sq Ft		
B2010		Clay Brick, Exterior, 1st Floor	1990	2990 Sq Ft		
B2010		Stucco, Painted, Exterior, 1st Floor	1995	600 Sq Ft		
B2010		Stucco, Painted, Exterior, 1st Floor	1985	325 Sq Ft		
B2020		Aluminum Fixed Window, 24 sf, 1st Floor	1962	25 Each		
B2020		Aluminum Fixed Window, 24 sf, 1st Floor	1970	15 Each		
B2020		Glass Curtain Wall	1985	20 Sq Ft		
B2030		Aluminum Frame, Fully Glazed, Exterior Door	1962	4 Each		
B2030		Aluminum Frame, Fully Glazed, Exterior Door	1985	2 Each		
B2030		Steel w/ Safety Glass, Painted, Exterior Door	1962	2 Each		
B2030		Steel w/ Safety Glass, Painted, Exterior Door	1985	1 Each		
B2030		Steel, 10'x8', Painted, Overhead Coiling Door, Motorized	1985	1 Each		
B2030		Steel, 14'x10', Painted, Overhead Coiling Door, Motorized	1995	2 Each		
B2030		Steel, Exterior Door	2010	1 Each	4208	
B2030		Steel, Painted, Exterior Door	1970	1 Each		
B2030		Steel, Painted, Exterior Door	1985	3 Each		

§ Indicates Component set to have PM Tasks coincide with Replacement Task.

All costs expressed in (\$) 2012.

04-Dec-13

Uniformat	Asset Description	Component	Date	Quantity	Location	Notes
B2030		Steel, Painted, Exterior Door	1995	1 Each		
B2030		Steel, Painted, Exterior Door	1990	1 Each		
B2030		Steel, Painted, Exterior Double Door	2010	1 Each	4208	
B2030		Steel, Painted, Exterior Double Door	1962	3 Each		
B2030		Steel, Painted, Exterior Double Door	1995	7 Each		
B2030		Steel, Painted, Exterior Double Door	1970	2 Each		
B3010		Aluminum Gutter, Downspouts, Fittings	2010	0.2 K Ln Ft	4208	
B3010		Aluminum Gutter, Downspouts, Fittings	1995	0.225 K Ln Ft	walkway	
B3010		Aluminum Gutter, Downspouts, Fittings	1995	1.65 K Ln Ft		
B3010		Built-up Roof	2010	3660 Sq Ft	4208	
B3010		Built-up Roof	1992	2975 Sq Ft	North	
B3010		Built-up Roof	1996	41400 Sq Ft		
B3010		Metal Canopy	1995	1250 Sq Ft	Walkway	
B3010		Metal Roof	1995	5615 Sq Ft	150	
C1010		Toilet Partitions, Painted Metal, Overhead Braced	1990	7 Each		
C1020		Aluminum Frame, Fully Glazed, Sliding Interior Door	1995	4 Each		
C1020		Aluminum, Fully Glazed, Interior Door	1962	4 Each		
C1020		Steel, Interior Door	2010	2 Each	4208	
C1020		Steel, Painted, Interior Door	1962	17 Each		
C1020		Steel, Painted, Interior Door	1965	6 Each		
C1020		Steel, Painted, Interior Door	1985	3 Each		
C1020		Steel, Painted, Interior Door	2000	4 Each		
C1020		Steel, Painted, Interior Double Door w/ Safety Glass	1962	3 Each		
C1020		Steel, Painted, Interior Double Door w/ Safety Glass	2000	1 Each		
C1020		Steel, Painted, Interior Double Door w/ Safety Glass	1985	1 Each		
C1020		Steel, Painted, w/ Safety Glass, Interior Door	1962	4 Each		
C1020		Steel, Painted, w/ Safety Glass, Interior Door	1965	11 Each		
C1020		Steel, Vault Security, Interior Door	1965	3 Each	B	
C1020		Wood, Solid Core w/ Safety Glass, Painted, Interior Door	1962	3 Each		
C1020		Wood, Solid Core w/ Safety Glass, Painted, Interior Door	1965	7 Each		
C1020		Wood, Solid Core w/ Safety Glass, Painted, Interior Door	1985	16 Each		
C1020		Wood, Solid Core w/ Safety Glass, Painted, Interior Door	1995	1 Each		
C1020		Wood, Solid Core, Painted, Interior Door	1962	3 Each		
C1020		Wood, Solid Core, Painted, Interior Door	1965	23 Each		
C1020		Wood, Solid Core, Painted, Interior Door	1985	12 Each		
C1020		Wood, Solid Core, Painted, Interior Door	1995	2 Each		

§ Indicates Component set to have PM Tasks coincide with Replacement Task.

All costs expressed in (\$) 2012.

04-Dec-13

Page 2

Uniformat	Asset Description	Component	Date	Quantity	Location	Notes
C2010		Concrete, Exterior Stairs	1995	30 Sq Ft		
C2010		Concrete, Exterior Stairs	1965	108 Sq Ft		
C2010		Concrete, Exterior Stairs	1962	84 Sq Ft		
C2010		Metal, Painted, Exterior Railing	1995	15 Ln Ft		
C2010		Metal, Painted, Exterior Railing	1965	0.1 Ln Ft		
C2010		Metal, Painted, Exterior Railing	1962	0.5 Ln Ft		
C2010		Metal, Painted, Interior Railing	1965	60 Ln Ft		
C2010		Metal, Painted, Interior Railing	1995	30 Ln Ft		
C2010		Metal, Painted, Interior Railing	1985	60 Ln Ft		
C2020		Rubber Interior Steps	1990	20 Sq Ft		
C2020		Rubber Interior Steps	1965	135 Sq Ft		
C3010		Acoustical Interior Wall Panels, Fabric Faced	1985	1338 Sq Ft		
C3010		Acoustical Interior Wall Panels, Fabric Faced	1990	506 Sq Ft		
C3010		Acoustical Interior Wall Panels, Fabric Faced	1995	3375 Sq Ft		
C3010		Acoustical Interior Wall Panels, Fabric Faced	2013	940 Sq Ft		
C3010		Ceramic Tile, 4"x4", Interior Wall Finish	1990	475 Sq Ft		
C3010		Clay Brick, Painted, Interior Wall Finish	1965	315 Sq Ft		
C3010		Clay Brick, Painted, Interior Wall Finish	1975	690 Sq Ft		
C3010		Concrete Block, Painted, Interior Wall Finish	2010	4900 Sq Ft	4208	
C3010		Concrete Block, Painted, Interior Wall Finish	1962	10556 Sq Ft		
C3010		Concrete Block, Painted, Interior Wall Finish	1965	6945 Sq Ft		
C3010		Concrete Block, Painted, Interior Wall Finish	1975	5770 Sq Ft		
C3010		Concrete Block, Painted, Interior Wall Finish	1985	7875 Sq Ft		
C3010		Concrete Block, Painted, Interior Wall Finish	1990	690 Sq Ft		
C3010		Concrete Block, Painted, Interior Wall Finish	1995	4185 Sq Ft		
C3010		Concrete, Painted, Interior Wall Finish	1965	1370 Sq Ft		
C3010		Gypsum Board, Interior Wall Finish	1962	140 Sq Ft		
C3010		Gypsum Board, Interior Wall Finish	1975	2000 Sq Ft		
C3010		Gypsum Board, Interior Wall Finish	1985	6915 Sq Ft		
C3010		Gypsum Board, Interior Wall Finish	1990	1870 Sq Ft		
C3010		Gypsum Board, Interior Wall Finish	1995	3560 Sq Ft		
C3010		Gypsum Board, Interior Wall Finish	2000	3925 Sq Ft		
C3010		Plate Glass Interior Wall	1995	230 Sq Ft		
C3010		Plate Glass Interior Wall	1985	100 Sq Ft		
C3010		Steel, Painted, Interior Wall Finish	1995	900 Sq Ft		
C3020		Access Flooring w/ Carpet, Raised	2005	1921 Sq Ft		

§ Indicates Component set to have PM Tasks coincide with Replacement Task.

All costs expressed in (\$) 2012.

Uniformat	Asset Description	Component	Date	Quantity	Location	Notes
C3020		Access Flooring w/ Carpet, Raised	2007	1633 Sq Ft		
C3020		Access Flooring w/ Carpet, Raised	2013	1222 Sq Ft		
C3020		Access Flooring w/ Laminate, Raised	1975	1903 Sq Ft		
C3020		Access Flooring w/ Laminate, Raised	1985	4857 Sq Ft		
C3020		Access Flooring w/ Laminate, Raised	1990	2150 Sq Ft		
C3020		Access Flooring w/ Laminate, Raised	1995	8310 Sq Ft		
C3020		Carpet, Nylon 20 oz., Low Traffic	1990	1486 Sq Ft		
C3020		Carpet, Nylon 20 oz., Low Traffic	1995	887 Sq Ft		
C3020		Carpet, Nylon 20 oz., Low Traffic	2000	4311 Sq Ft		
C3020		Ceramic Tile Flooring	1962	235 Sq Ft		
C3020		Concrete Flooring	2010	2435 Sq Ft	4208	
C3020		Concrete Flooring	1962	5081 Sq Ft		
C3020		Concrete Flooring	1965	1057 Sq Ft		
C3020		Concrete Flooring	1975	3601 Sq Ft		
C3020		Concrete Flooring	1985	535 Sq Ft		
C3020		Concrete Flooring	1995	617 Sq Ft		
C3020		Concrete, Painted Flooring	2010	1216 Sq Ft	4208	
C3020		Metal Floor Grating	2010	32 Sq Ft	4208	
C3020		Rubber Sheet Flooring, 1/4"	2010	480 Sq Ft	4208	
C3020		Vinyl Tile Flooring	1962	3906 Sq Ft		
C3020		Vinyl Tile Flooring	1975	7142 Sq Ft		
C3020		Vinyl Tile Flooring	1985	6149 Sq Ft		
C3020		Vinyl Tile Flooring	1990	482 Sq Ft		
C3030		Acoustical Tile, Dropped Ceiling	1975	8441 Sq Ft		
C3030		Acoustical Tile, Dropped Ceiling	1985	11586 Sq Ft		
C3030		Acoustical Tile, Dropped Ceiling	1990	9677 Sq Ft		
C3030		Acoustical Tile, Dropped Ceiling	1995	12046 Sq Ft		
C3030		Acoustical Tile, Dropped Ceiling	2000	3272 Sq Ft		
C3030		Acoustical Tile, Dropped Ceiling	2013	1254 Sq Ft		
C3030		Concrete, Painted Ceiling	1965	2381 Sq Ft		
C3030		Gypsum Board, Finished Ceiling	1975	552 Sq Ft		
C3030		Gypsum Board, Finished Ceiling	1985	598 Sq Ft		
C3030		Metal, Painted Ceiling	2010	3651 Sq Ft	4208	
C3030		Metal, Painted Ceiling	1962	989 Sq Ft		
C3030		Metal, Painted Ceiling	1965	6440 Sq Ft		
D2010		Drinking Fountain, Refrigerated	2000	2 Each		

§ Indicates Component set to have PM Tasks coincide with Replacement Task.

All costs expressed in (\$) 2012.

Uniformat	Asset Description	Component	Date	Quantity	Location	Notes
D2010		Emergency Eye Wash & Shower Station	2010	1 Each	4208	
D2010		Emergency Eye Wash & Shower Station	2010	2 Each		
D2010		Lavatory, Vitreous China	1990	4 Each		
D2010		Service Sink, Iron, Enamel	1990	1 Each		
D2010		Sink, Stainless Steel	2000	1 Each		
D2010		Tankless Water Closet	1990	6 Each		
D2010		Urinal, Vitreous China	1990	4 Each		
D2020	HWP1, 2	Booster Pump, 1 1/2 HP	1990	2 Each		
D2020	HWP-3, 4	Circulator Pump, 1/2 HP, Hot Water	1990	2 Each		
D2020		Expansion Tank, 10 Gal.	2010	1 Each	4208	
D2020		Hose Bib	2010	1 Each	4208	
D2020		Pipe & Fittings, 1" Steel	1990	0.35 K Ln Ft		
D2020		Pipe & Fittings, 2" Copper, Cold Water	1990	0.35 K Ln Ft		
D2020		Pipe & Fittings, 3/4" Copper, Cold Water	1990	0.57 K Ln Ft		
D2020		Pipe & Fittings, 3/4" Copper, Cold Water	1962	0.1 K Ln Ft		
D2020		Pipe & Fittings, 3/4" Copper, Hot Water	1990	0.45 K Ln Ft		
D2020		Pipe & Fittings, 3/4" Copper, Hot Water	1962	0.1 K Ln Ft		
D2020		Pipe & Fittings, 4" Copper, Cold Water	1990	0.4 K Ln Ft		
D2020		Pipe Insulation, Fiberglass, Cold Water	1990	0.4 K Ln Ft		
D2020		Pipe Insulation, Fiberglass, Hot Water	1990	0.5 K Ln Ft		
D2020		Water Heater, Electric, 120 Gal.	2010	1 Each	4208	
D2020		Water Heater, Electric, 65 Gal.	2006	1 Each		
D2030		Backflow Preventer, 1"	1990	1 Each		
D2030		Backflow Preventer, 1"	1962	1 Each		
D2030		Floor Drain	1962	4 Each		
D2030		Pipe & Fittings, 10" Cast Iron	1962	0.2 K Ln Ft		
D2030		Pipe & Fittings, 10" Cast Iron	1965	0.2 K Ln Ft		
D2030		Pipe & Fittings, 2" PVC	1990	0.35 K Ln Ft		
D2030		Pipe & Fittings, 3" Cast Iron	1985	0.45 K Ln Ft		
D2030		Pipe & Fittings, 4" Cast Iron	2010	0.1 K Ln Ft	4208	
D2030		Pipe & Fittings, 4" Cast Iron	1962	0.35 K Ln Ft		
D2030		Pipe & Fittings, 4" Cast Iron	1970	0.25 K Ln Ft		
D2030		Pipe & Fittings, 4" PVC	1970	0.1 K Ln Ft		
D2030		Pipe & Fittings, 6" Cast Iron	1985	0.1 K Ln Ft		
D2030		Pipe & Fittings, 6" Cast Iron	1962	0.125 K Ln Ft		
D2040		Pipe & Fittings, 2" PVC	1990	0.225 K Ln Ft		

§ Indicates Component set to have PM Tasks coincide with Replacement Task.

All costs expressed in (\$) 2012.

Uniformat	Asset Description	Component	Date	Quantity	Location	Notes
D2040		Pipe & Fittings, 4" PVC	1990	0.45 K Ln Ft		
D2040		Pipe & Fittings, 6" PVC	1990	0.25 K Ln Ft		
D2040		Roof Drain, 4-6"	1980	2 Each		
D2040		Sump Pump, 1 HP	1990	2 Each		
D2040		Sump Pump, 1 HP	1990	2 Each		
D2040		Sump Pump, 1/2 HP	1990	1 Each		
D2040		Sump Pump, 3 HP	1990	1 Each		
D2090		Air Compressor, 2 HP	2004	2 Each		
D2090		Compressed Air Dryer	2004	2 Each		
D3010		Fuel Storage Tank, 10,000 Gal.	2010	1 Each	4208	
D3010		Leak Detection, Panel & Float Assembly	2011	1 Each		
D3020		Ball Valve, 6"	1980	6 Each		
D3020		Boiler, Electric, 144 kW	1990	1 Each		
D3020		Expansion Tank, 10 Gal.	1990	1 Each		
D3020		Expansion Tank, 30 Gal.	1990	1 Each		
D3020		Expansion Tank, 60 Gal.	1990	1 Each		
D3020		Gate Valve, 6"	1995	3 Each		
D3020	HWC-1, 2	Heat Exchanger, Steam-to-Water, 20 Gpm	1990	2 Each		
D3020		Pipe & Fittings, 1" Steel	1990	0.55 K Ln Ft		
D3020		Pipe & Fittings, 1" Steel	2010	0.05 K Ln Ft		
D3020		Pipe & Fittings, 1" Steel	1970	0.2 K Ln Ft		
D3020		Pipe & Fittings, 2" Steel	1990	0.6 K Ln Ft		
D3020		Pipe & Fittings, 2" Steel	1970	0.125 K Ln Ft		
D3020		Pipe & Fittings, 2" Steel	2010	0.15 K Ln Ft		
D3020		Pipe & Fittings, 3" Steel	1990	0.2 K Ln Ft		
D3020		Pipe & Fittings, 3/4" Copper	1990	0.7 K Ln Ft		
D3020		Pipe & Fittings, 3/4" Copper	2010	0.1 K Ln Ft		
D3020		Pipe & Fittings, 4" Steel	1990	0.2 K Ln Ft		
D3020		Pipe & Fittings, 6" Steel	1990	0.2 K Ln Ft		
D3020		Pipe & Fittings, 6" Steel	1970	0.1 K Ln Ft		
D3020		Pipe Insulation, Fiberglass, Heating Water/Steam	1990	2.2 K Ln Ft		
D3020		Pipe Insulation, Fiberglass, Heating Water/Steam	1970	0.45 K Ln Ft		
D3020		Pipe Insulation, Fiberglass, Heating Water/Steam	2010	0.4 K Ln Ft		
D3030		Ball Valve, 4"	1980	4 Each		
D3030		Butterfly Valve, 3"	1962	6 Each		
D3030		Butterfly Valve, 6"	1995	6 Each		

§ Indicates Component set to have PM Tasks coincide with Replacement Task.

All costs expressed in (\$) 2012.

Uniformat	Asset Description	Component	Date	Quantity	Location	Notes
D3030		Check Valve, 3-4"	1995	6 Each		
D3030		Chiller, Centrifugal Hermetic, Bundled w/ Condenser, 900	2011	1 Each		700T
D3030		Circulation Pump, 25 HP, Chiller & Condenser Water	1995	3 Each		20HP
D3030		Circulation Pump, 50 HP, Chiller & Condenser Water	1995	2 Each		40HP
D3030		Condenser, Air Cooled, 5 Ton	2010	1 Each		
D3030		Condenser, Air-Cooled, 25 Ton	2010	2 Each	4208	
D3030		Condenser, Air-Cooled, 25 Ton	2010	6 Each		
D3030		Condenser, Air-Cooled, 30 Ton	2010	1 Each		
D3030		Flow Control Valve, Motorized, 2"	1990	2 Each		
D3030		Flow Control Valve, Motorized, 4"	2011	3 Each		
D3030		Flow Control Valve, Motorized, 6"	1980	4 Each		
D3030		Pipe & Fittings, 1" Copper	1990	0.5 K Ln Ft		
D3030		Pipe & Fittings, 1" Copper	2010	0.125 K Ln Ft		
D3030		Pipe & Fittings, 1" Steel	1990	0.75 K Ln Ft		
D3030		Pipe & Fittings, 1" Steel	2010	0.125 K Ln Ft		
D3030		Pipe & Fittings, 2" Steel	1990	0.7 K Ln Ft		
D3030		Pipe & Fittings, 2" Steel	1970	0.2 K Ln Ft		
D3030		Pipe & Fittings, 3" Steel	1990	0.125 K Ln Ft		
D3030		Pipe & Fittings, 3" Steel	1970	0.15 K Ln Ft		
D3030		Pipe & Fittings, 4" Steel	1990	0.25 K Ln Ft		
D3030		Pipe & Fittings, 4" Steel	2010	0.05 K Ln Ft		
D3030		Pipe Insulation, Fiberglass, Chilled Water	1990	2.1 K Ln Ft		
D3030		Pipe Insulation, Fiberglass, Chilled Water	1970	0.38 K Ln Ft		
D3030		Pipe Insulation, Fiberglass, Chilled Water	2010	0.4 K Ln Ft		
D3040	AH-2	Air Handler, Multizone, 5,200 Cfm	1962	1 Each		
D3040	AH-4	Air Handler, Single Zone, 10,000 Cfm	1990	1 Each		
D3040	AH-1	Air Handler, Single Zone, 10,000 Cfm	1990	1 Each		
D3040	AH-7	Air Handler, Single Zone, 2,500 Cfm	2011	1 Each		
D3040	AH-6	Air Handler, Single Zone, 2,500 Cfm	1990	1 Each		
D3040	AH-B2	Air Handler, Single Zone, 2,500 Cfm	1990	1 Each		
D3040	AH-3	Air Handler, Single Zone, 8,000 Cfm	1990	1 Each		
D3040	AH-8	Air Handler, Single Zone, 8,000 Cfm	1990	1 Each		
D3040	AH-5	Air Handler, Single Zone, 8,000 Cfm	1990	1 Each		
D3040	AH-B1	Air Handler, Single Zone, 8,000 Cfm	1990	1 Each		
D3040		Duct Insulation, Fiberglass Blanket	1990	26500 Sq Ft		
D3040		Duct Insulation, Fiberglass Blanket	1970	5000 Sq Ft		

§ Indicates Component set to have PM Tasks coincide with Replacement Task.

All costs expressed in (\$) 2012.

04-Dec-13

Page 7

Uniformat	Asset Description	Component	Date	Quantity	Location	Notes
D3040		Duct Insulation, Fiberglass Blanket	2010	3000 Sq Ft		
D3040		Ductwork	1990	33000 Lbs		
D3040		Ductwork	1970	7000 Lbs		
D3040		Ductwork	2010	4400 Lbs		
D3040	EF-3,4	Exhaust Fan, Centrifugal, 2,000 Cfm	1962	2 Each	4208	
D3040		Exhaust Fan, Centrifugal, 2,000 Cfm	2010	1 Each		
D3040	EF-1,2	Exhaust Fan, Centrifugal, 5,000 Cfm	2010	2 Each	4208	
D3040		Exhaust Fan, Roof Mounted, 10,000 Cfm	1990	4 Each		
D3040		Exhaust Fan, Roof Mounted, 5,000 Cfm	1990	3 Each		
D3040		Exhaust Fan, Roof Mounted, 8,500 Cfm	1990	5 Each		
D3040		Variable Air Volume Box, 1,300 Cfm	1990	5 Each		
D3040		Variable Air Volume Box, 2,500 Cfm	1990	2 Each		
D3040		Variable Air Volume Box, 400 Cfm	1990	3 Each		
D3040		Variable Air Volume Box, 800 Cfm	1990	6 Each		
D3050	CRU-DX6, 7	Air Conditioner, Computer Room, Air Cooled, 20 Ton	2010	2 Each	Annex	
D3050	CRU-DX02	Air Conditioner, Computer Room, Air Cooled, 20 Ton	2010	1 Each		
D3050	CRU-DX1	Air Conditioner, Computer Room, Air-Cooled, 25 Ton	2010	1 Each		
D3050	CRU-DX11, 12	Air Conditioner, Computer Room, Air-Cooled, 25 Ton	2010	2 Each	4208	
D3050	CRU-DX4, 5	Air Conditioner, Computer Room, Air-Cooled, 25 Ton	2010	2 Each		
D3050	CRU-DX8	Air Conditioner, Computer Room, Air-Cooled, 25 Ton	2010	1 Each		
D3050	CRU-DX04	Air Conditioner, Computer Room, Air-Cooled, 30 Ton	2010	1 Each		
D3050	CRU-12	Air Conditioner, Computer Room, Chilled Water, 10 Ton	1990	1 Each		
D3050	CRU-15, 16	Air Conditioner, Computer Room, Chilled Water, 10 Ton	1995	2 Each		
D3050	CRU-9	Air Conditioner, Computer Room, Chilled Water, 10 Ton	1990	1 Each		
D3050	CRU-06	Air Conditioner, Computer Room, Chilled Water, 15 Ton	1990	1 Each		
D3050	CRU-14	Air Conditioner, Computer Room, Chilled Water, 20 Ton	1990	1 Each		
D3050	CRU-08, 13	Air Conditioner, Computer Room, Chilled Water, 20 Ton	1990	2 Each		
D3050	CRU-17	Air Conditioner, Computer Room, Chilled Water, 25 Ton	1995	1 Each	Annex	
D3050	CRU-4, 10, 11	Air Conditioner, Computer Room, Chilled Water, 25 Ton	1990	3 Each		
D3050	CRU-7	Air Conditioner, Computer Room, Chilled Water, 25 Ton	1990	1 Each		
D3050	CRU-5	Air Conditioner, Computer Room, Chilled Water, 25 Ton	1990	1 Each		
D3050		Air Conditioner, DX Packaged, Air Cooled, 5 Ton	1990	1 Each		
D3050	MAU-1, 2	Air Conditioner, Rooftop, Multizone, 50 Ton	2010	2 Each	4208	
D3050		Air Conditioner, Window, 1 Ton	2010	1 Each		
D3050		Unit Heater, 36 Mbh	1990	1 Each		
D3050		Unit Heater, 480v, 5kW	2010	2 Each	4208	

§ Indicates Component set to have PM Tasks coincide with Replacement Task.

All costs expressed in (\$) 2012.

Uniformat	Asset Description	Component	Date	Quantity	Location	Notes
D3050		Unit Heater, 480v, 5kW	2010	3 Each		
D4010		Fire Alarm Control Panel	2010	1 Each	4208	
D4010		Fire Alarm Control Panel	2010	1 Each		
D4010		Fire Sprinkler Head	1962	75 Each		
D4010		Fire Sprinkler Head	1985	150 Each		
D4010		Fire Sprinkler Head	1990	100 Each		
D4010		Fire Sprinkler Head	1975	85 Each		
D4010		Fire Sprinkler System	1962	1 Each		
D4010		Pipe & Fittings, 1" Steel	1962	0.45 K Ln Ft		
D4010		Pipe & Fittings, 1" Steel	1985	0.35 K Ln Ft		
D4010		Pipe & Fittings, 2" Steel	1985	0.65 K Ln Ft		
D4010		Pipe & Fittings, 2" Steel	1962	0.35 K Ln Ft		
D4010		Pipe & Fittings, 3" Steel	1995	0.35 K Ln Ft		
D4010		Valves & Components, Sprinkler System, 3"	2010	8 Each		
D5010		Circuit Breaker, 600 V, 125-400 Amp., 3 Ph.	2010	2 Each		
D5010		Circuit Breaker, 600 V, 125-400 Amp., 3 Ph.	1995	3 Each		
D5010		Circuit Breaker, 600 V, 70-100 Amp., 3 Ph.	2012	1 Each		
D5010		Circuit Breaker, Main, 208 Y, 120 V, 600 Amp.	2012	1 Each		
D5010		Circuit Breaker, Main, 600 V, 3,000-4,000 Amp.	2010	2 Each	4208	
D5010		Disconnect Switch, 100 Amp.	2011	2 Each		
D5010		Disconnect Switch, 100 Amp.	1962	1 Each		
D5010		Disconnect Switch, 100 Amp.	1995	2 Each		
D5010		Disconnect Switch, 100 Amp.	2010	1 Each	4208	
D5010		Disconnect Switch, 200 Amp.	1995	4 Each		
D5010		Disconnect Switch, 30 Amp.	1996	3 Each		
D5010		Disconnect Switch, 30 Amp.	2010	2 Each	4208	
D5010		Disconnect Switch, 30 Amp.	1962	3 Each		
D5010		Disconnect Switch, 30 Amp.	2010	4 Each		
D5010		Disconnect Switch, 30 Amp.	1995	3 Each		
D5010		Disconnect Switch, 400 Amp.	1995	3 Each		
D5010		Disconnect Switch, 60 Amp.	1996	1 Each		
D5010		Disconnect Switch, 60 Amp.	2010	2 Each	4208	
D5010		Disconnect Switch, 60 Amp.	1995	5 Each		
D5010		Disconnect Switch, 60 Amp.	1962	2 Each		
D5010		Disconnect Switch, 600 Amp.	2011	1 Each		
D5010		Disconnect Switch, 600 Amp.	1996	2 Each		800A

§ Indicates Component set to have PM Tasks coincide with Replacement Task.

All costs expressed in (\$) 2012.

04-Dec-13

Uniformat	Asset Description	Component	Date	Quantity	Location	Notes
D5010		Motor Control Center w/ Main Breaker, 480 V, 1200 Amp.	1962	1 Each		
D5010		Motor Starter, <5HP, <600V	2010	2 Each	4208	
D5010		Motor Starter, <5HP, <600V	1996	2 Each		
D5010		Motor Starter, <5HP, <600V	2010	1 Each		
D5010		Motor Starter, <5HP, <600V	1995	6 Each		
D5010		Motor Starter, 5-20 HP, <600 V	1995	3 Each		
D5010		Motor Starter, 5-20 HP, <600 V	2010	1 Each		
D5010		Power Panel Board, 208 Y/120 V, 100 Amp.	2010	2 Each	4208	
D5010		Power Panel Board, 208 Y/120 V, 100 Amp.	2002	1 Each		
D5010		Power Panel Board, 208 Y/120 V, 100 Amp.	1962	4 Each		
D5010		Power Panel Board, 208 Y/120 V, 100 Amp.	1995	1 Each		
D5010		Power Panel Board, 208 Y/120 V, 100 Amp.	1995	1 Each		
D5010		Power Panel Board, 208 Y/120 V, 100 Amp.	2003	3 Each		
D5010		Power Panel Board, 208 Y/120 V, 100 Amp.	1990	12 Each		
D5010		Power Panel Board, 208 Y/120 V, 100 Amp.	2010	1 Each		
D5010		Power Panel Board, 208 Y/120 V, 100 Amp.	2005	3 Each		
D5010		Power Panel Board, 208 Y/120 V, 200 Amp.	1995	1 Each		
D5010		Power Panel Board, 208 Y/120 V, 200 Amp.	2010	2 Each		
D5010		Power Panel Board, 208 Y/120 V, 200 Amp.	1962	1 Each		
D5010		Power Panel Board, 208 Y/120 V, 200 Amp.	2010	2 Each		150A
D5010		Power Panel Board, 208 Y/120 V, 225 Amp	1962	7 Each		
D5010		Power Panel Board, 208 Y/120 V, 225 Amp	2010	1 Each		
D5010		Power Panel Board, 208 Y/120 V, 225 Amp	1989	1 Each		
D5010		Power Panel Board, 208 Y/120 V, 225 Amp	1998	3 Each		
D5010		Power Panel Board, 208 Y/120 V, 225 Amp	2010	3 Each		
D5010		Power Panel Board, 208 Y/120 V, 225 Amp	1990	1 Each		250A
D5010		Power Panel Board, 208 Y/120 V, 225 Amp	2002	1 Each		
D5010		Power Panel Board, 208 Y/120 V, 225 Amp	1992	12 Each		
D5010		Power Panel Board, 208 Y/120 V, 400 Amp.	1975	3 Each		
D5010		Power Panel Board, 208 Y/120 V, 400 Amp.	2010	1 Each		
D5010		Power Panel Board, 208 Y/120 V, 400 Amp.	2010	1 Each		48VDC
D5010		Power Panel Board, 480 V, 100 Amp.	1995	1 Each		
D5010		Power Panel Board, 480 V, 100 Amp.	2004	1 Each		
D5010		Power Panel Board, 480 V, 200 Amp.	2010	2 Each	4208	
D5010		Power Panel Board, 480 V, 200 Amp.	1990	1 Each		250A
D5010		Power Panel Board, 480 V, 4,000 Amp.	2010	5 Each	4208	3000A

§ Indicates Component set to have PM Tasks coincide with Replacement Task.

All costs expressed in (\$) 2012.

04-Dec-13

Page 10

Uniformat	Asset Description	Component	Date	Quantity	Location	Notes
D5010		Power Panel Board, 480 V, 400 Amp.	2010	2 Each		
D5010		Power Panel Board, 480 V, 400 Amp.	1995	1 Each		
D5010		Power Panel Board, 480 V, 400 Amp.	1996	1 Each		
D5010		Secondary Transformer, Dry, 30 kVA	2010	1 Each	4208	
D5010		Secondary Transformer, Dry, 45 kVA	2010	2 Each	4208	
D5010		Secondary Transformer, Dry, 45 kVA	1990	2 Each		
D5010		Secondary Transformer, Dry, 500 kVA	1990	1 Each		
D5010		Secondary Transformer, Dry, 500 kVA	1996	2 Each		
D5010		Secondary Transformer, Dry, 75 kVA	2010	4 Each		
D5010		Secondary Transformer, Dry, 75 kVA	1995	4 Each		
D5010		Secondary Transformer, Dry, 750 kVA	2010	2 Each	4208	660 kVA
D5010		Switchboard, 1600 Amp.	2010	2 Each	4208	
D5010		Switchboard, 1600 Amp.	1990	2 Each		
D5010		Switchboard, 1600 Amp.	1996	2 Each		
D5010		Switchboard, 800 Amp.	2010	5 Each	4208	
D5010		Switchboard, 800 Amp.	1995	1 Each		
D5010		Switchboard, 800 Amp.	2010	3 Each		
D5010		Switchboard, 800 Amp.	2010	1 Each		120V/600A
D5010		Switchboard, 800 Amp.	2010	1 Each		120V
D5010		Transient Voltage Surge Suppression Panel	2010	2 Each		
D5010		Variable Frequency Drive, <600 V	1995	4 Each		
D5010		Variable Frequency Drive, <600 V	2012	1 Each		
D5010		Variable Frequency Drive, <600 V	2010	1 Each		
D5020		Compact Fluorescent Lighting Fixture, 32 w	2007	20 Each		
D5020		Emergency Lighting Pack, 2 Light w/ Battery	2007	24 Each		
D5020		Emergency Lighting Pack, 2 Light w/ Battery	1995	8 Each		
D5020		Emergency Lighting Pack, 2 Light w/ Battery	1985	3 Each		
D5020		Exit Lighting Fixture, LED	2010	17 Each		
D5020		Fluorescent Lighting Fixture, T8, 2-32w	2010	60 Each	4208	
D5020		Fluorescent Lighting Fixture, T8, 2-32w	2007	179 Each		
D5020		Fluorescent Lighting Fixture, T8, 2-32w	1995	6 Each		
D5020		Fluorescent Lighting Fixture, T8, 4-32 w	2007	500 Each		
D5020		High Pressure Sodium Lighting Fixture, 250 w	2010	3 Each	4208	
D5020		Incandescent Lighting Fixture, Basic, 100 w	2007	88 Each		
D5020		LED Lighting Fixture, 100 w	2011	10 Each		
D5020		Light Dimming Panel	1998	1 Each		

§ Indicates Component set to have PM Tasks coincide with Replacement Task.

All costs expressed in (\$) 2012.

04-Dec-13

Page 11

Uniformat	Asset Description	Component	Date	Quantity	Location	Notes
D5020		Light Dimming Panel	1985	1 Each		
D5020		Light Dimming Panel	2007	1 Each		
D5020		Occupancy Sensors, Indoor Lighting	2007	27 Each		
D5020		Receptacle, 208 V, 3 phase	1995	8 Each		
D5020		Receptacle, 120 V, 15 Amp.	1962	250 Each		
D5020		Receptacle, 120 V, 15 Amp.	1975	350 Each		
D5020		Receptacle, 120 V, 15 Amp.	1985	500 Each		
D5020		Receptacle, 120 V, 15 Amp.	1995	150 Each		
D5020		Wiring Device, Switch	1985	150 Each		
D5020		Wiring Device, Switch	1962	100 Each		
D5020		Wiring Device, Switch	2005	50 Each		
D5030		Camera, Exterior, Closed Circuit, PTZ Color	2006	3 Each		
D5030		Camera, Interior, Closed Circuit, Fixed Color	2006	4 Each		
D5030		Camera, Interior, Closed Circuit, PTZ Color	2006	7 Each		
D5030		Card Reader	2010	2 Each	4208	
D5030		Card Reader	2006	21 Each		
D5030		Electric Lock	2006	25 Each		
D5030		EPO Button	2010	10 Each		
D5030		Fire Alarm Horn & Strobe	2010	4 Each	4208	
D5030		Fire Alarm Horn & Strobe	2010	26 Each		
D5030		Heat Detector	2010	2 Each	4208	
D5030		Heat Detector	2010	2 Each		
D5030		Intrusion Detection Motion Detector, Interior	2010	2 Each	4208	
D5030		Intrusion Detection Motion Detector, Interior	2006	21 Each		
D5030		Keypad	2006	2 Each		
D5030		Manual Pull Station	2010	4 Each	4208	
D5030		Manual Pull Station	2010	19 Each		
D5030		Public Address Speaker	2010	39 Each		
D5030		Public Address Speaker	1962	4 Each		
D5030		Public Address Speaker	1995	69 Each		
D5030		Smoke Detector	2010	16 Each	4208	
D5030		Smoke Detector	2010	180 Each		
D5030		Smoke Detector	1990	1 Each		
D5030		Smoke Detector, Duct	2010	11 Each		
D5090		Battery Charger	2010	2 Each	4208	
D5090		EMI/RF Filter	2006	1 Each		

§ Indicates Component set to have PM Tasks coincide with Replacement Task.

All costs expressed in (\$) 2012.

Uniformat	Asset Description	Component	Date	Quantity	Location	Notes
D5090		EMI/RF Filter	2010	1 Each		
D5090		Generator, Diesel, 2,000 kw	2010	1 Each	4208	
D5090		Inverter	2010	2 Each		
D5090		Lightning Protection System	2010	0.38 K Ln Ft	4208	
D5090		Power Supply/Conditioner	2010	4 Each		
D5090		Power Supply/Conditioner	1995	6 Each		
D5090		Uninterruptible Power Supply, 450 kVA	2010	1 Each	4208	
D5090		UPS Battery, Wet	2010	480 Each	4208	
D5090		UPS Battery, Wet	1997	48 Each		

§ Indicates Component set to have PM Tasks coincide with Replacement Task.

All costs expressed in (\$) 2012.

Average M&R Costs

Whitestone Research

Building:	Communications Facility	GSFT:	61,648
Building Number:	1045/62/179	PRV:	\$18,633,603
Facility:	Marshall Space Flight Center	Built Date:	1962
City:	Huntsville, AL		

M&R Average Annual Cost Forecasts

	Current Year	5 Year	20 Year	50 Year
PM & Minor Repair:	\$126,489	\$129,156	\$127,109	\$126,308
Unscheduled Maintenance:	\$89,591	\$94,213	\$92,686	\$91,945
Renewal & Replacement:	\$93,530	\$244,271	\$439,353	\$561,562
Total M&R Costs:	\$309,610	\$467,640	\$659,148	\$779,815
Per GSFT:	\$5.02	\$7.59	\$10.69	\$12.65
As % of PRV:	1.66%	2.51%	3.54%	4.18%

M&R Costs by Task

Whitestone Research

04-Dec-13

Building: Communications Facility

Facility: Marshall Space Flight Center

Building Num: 1045/62/179

City: Huntsville, AL

Forecast Year: 2013 4 5 6 7 2018 9 0 1 2 2023 4 5 6 7 2028 9 0 1 2 2033 4 5 6 7

C10 Interior Construction

Refinish Wood, Solid Core w/ Safety Glass, Painted, Interior Doc	730	95	32		730	95	32		730	95	32		222	95	32		730	95	32		730	95		730
Replace Steel, Painted, Interior Double Door w/ Safety Glass																								10,580
Finish Replaced Steel, Painted, Interior Double Door w/ Safety G																								356
Refinish Steel, Painted, w/ Safety Glass Interior Door	349	127			349	127			349	127				349	127			349	127			349	127	349
Maintain Steel, Painted, w/ Safety Glass Interior Door Locks			335		121				335	121				335	121			335	121			335	121	335
Replace Steel, Painted, w/ Safety Glass Interior Door Locks			4,713						1,714					4,713				1,714				4,713		4,713
Replace Steel, Painted, w/ Safety Glass Interior Door																								6,395
Finish Replaced Steel, Painted, w/ Safety Glass Interior Door																								127
Refinish Wood, Solid Core, Painted, Interior Door	1,112	95	63		1,112	95	63		1,112	95	63		731	95	63		1,112	95	63		1,112	95		1,112
Maintain Wood, Solid Core, Painted, Interior Door Locks			1,126		91				1,126	91				760	91			1,126	91			1,065	91	91
Replace Wood, Solid Core, Painted, Interior Door Locks			15,851						1,285					10,710				1,285				14,994		14,994
Finish Replaced Wood, Solid Core, Painted, Interior Door														381								63		63
Maintain Wood, Solid Core w/ Safety Glass, Painted, Interior Doc			730		91				730	91				243	91			730	91			700	91	91
Replace Wood, Solid Core w/ Safety Glass, Painted, Interior Doc			10,281						1,285					3,427				1,285				9,853		9,853
Replace Wood, Solid Core w/ Safety Glass, Painted, Interior Doc														28,845								1,802		1,802
Finish Replaced Wood, Solid Core w/ Safety Glass, Painted, Inte														508								32		32
Maintain Aluminum, Fully Glazed, Interior Door Locks					121					121					121						121			121
Replace Steel, Painted, Interior Double Door w/ Safety Glass Lo			428						428						428			428			1,285	428		428
Replace Wood, Solid Core, Painted, Interior Door														21,633								3,606		3,606
Replace Aluminum, Fully Glazed, Interior Door																								
Maintain Steel, Painted, Interior Double Door w/ Safety Glass Lo			97		146				97	146				97	146			97	146			97	146	97
Replace Toilet Partitions, Painted Metal, Overhead Braced																								7,562
Maintain Aluminum Frame, Fully Glazed, Sliding Interior Door			121						121						121							121		121
Replace Door Locks Aluminum Frame, Fully Glazed, Sliding Inte			1,780											1,780								1,780		1,780
Repair Aluminum Frame, Fully Glazed, Sliding Interior Door						1,253															1,253			1,253
Replace Aluminum Frame, Fully Glazed, Sliding Interior Door																								
Replace Aluminum, Fully Glazed, Interior Door Locks										1,714												1,714		1,714
Maintain Steel, Interior Door Locks			61						61						61						61		61	61
Replace Steel, Painted, Interior Door																								19,245
Refinish Steel, Painted, Interior Double Door w/ Safety Glass	119	356		119	119	356		119	119	356		119	119	356		119	119	356		119	119	356	119	119
Refinish Toilet Partitions, Painted Metal, Overhead Braced			222			222				222					222							222		222
Finish Replaced Steel, Painted, Interior Door																								540
Replace Steel, Interior Door Locks									857												857			857
Replace Steel, Painted, Interior Door Locks			5,141			1,714			7,284					5,141				1,714			7,284		5,141	5,141
Maintain Steel, Painted, Interior Door Locks			486		518				486	518				486	518			486	518			486	518	486
Refinish Steel, Vault Security, Interior Door	95				95				95					95				95			95		95	95

M&R Costs by Task

Whitestone Research

04-Dec-13

Building: Communications Facility

Facility: Marshall Space Flight Center

Building Num: 1045/62/179

City: Huntsville, AL

Forecast Year: 2038 9 0 1 2 2043 4 5 6 7 2048 9 0 1 2 2053 4 5 6 7 2058 9 0 1 2

C10 Interior Construction

Refinish Wood, Solid Core w/ Safety Glass, Painted, Interior Dc	95	32	730	32	508	95	32	730	95	32	730	95	32	730	95	32	730	95	32	730	95	
Replace Steel, Painted, Interior Double Door w/ Safety Glass																					3,527	
Finish Replaced Steel, Painted, Interior Double Door w/ Safety																						119
Refinish Steel, Painted, w/ Safety Glass Interior Door			127		349	127		349	127		349	127		349	127		349	127		349	127	
Maintain Steel, Painted, w/ Safety Glass Interior Door Locks				121		335		121		335		121		335		121		335		121		335
Replace Steel, Painted, w/ Safety Glass Interior Door Locks								1,714		4,713				1,714		4,713				1,714		4,713
Replace Steel, Painted, w/ Safety Glass Interior Door			17,585																			
Finish Replaced Steel, Painted, w/ Safety Glass Interior Door			349																			
Refinish Wood, Solid Core, Painted, Interior Door	95	63	1,112	63	381	95	63	1,112	95	63	1,112	95	63	1,112	95	63	1,112	95	63	1,112	95	
Maintain Wood, Solid Core, Painted, Interior Door Locks			1,126		426		91		1,126		91		1,126		91		1,126		91		1,126	91
Replace Wood, Solid Core, Painted, Interior Door Locks					5,997						1,285		15,851									1,285
Finish Replaced Wood, Solid Core, Painted, Interior Door				95	731																	
Maintain Wood, Solid Core w/ Safety Glass, Painted, Interior D			730		518		91		730		91		730		91		730		91		730	91
Replace Wood, Solid Core w/ Safety Glass, Painted, Interior Dc					7,282						1,285		10,281									1,285
Replace Wood, Solid Core w/ Safety Glass, Painted, Interior Dc				5,408	12,620																	
Finish Replaced Wood, Solid Core w/ Safety Glass, Painted, Int				95	222																	
Maintain Aluminum, Fully Glazed, Interior Door Locks				121				121				121				121						
Replace Steel, Painted, Interior Double Door w/ Safety Glass L			428		428			1,285		428			428		1,285		428				428	
Replace Wood, Solid Core, Painted, Interior Door				5,408	41,463																	
Replace Aluminum, Fully Glazed, Interior Door																						10,858
Maintain Steel, Painted, Interior Double Door w/ Safety Glass L			97	146	97	146		97	146		97	146		97	146		97	146		48	146	
Replace Toilet Partitions, Painted Metal, Overhead Braced											7,562											
Maintain Aluminum Frame, Fully Glazed, Sliding Interior Door			121							121					121						121	
Replace Door Locks Aluminum Frame, Fully Glazed, Sliding Int														1,780								
Repair Aluminum Frame, Fully Glazed, Sliding Interior Door					1,253											1,253						
Replace Aluminum Frame, Fully Glazed, Sliding Interior Door						11,032																
Replace Aluminum, Fully Glazed, Interior Door Locks				1,714							1,714											
Maintain Steel, Interior Door Locks			61		61					61				61							61	
Replace Steel, Painted, Interior Door			30,760																			3,396
Refinish Steel, Painted, Interior Double Door w/ Safety Glass			119	475	119	475		119	475		119	475		119	475		119	475		119	356	
Refinish Toilet Partitions, Painted Metal, Overhead Braced	222			222			222					222				222						222
Finish Replaced Steel, Painted, Interior Door			286																			95
Replace Steel, Interior Door Locks			857							857												857
Replace Steel, Painted, Interior Door Locks			1,714		1,285	7,284		5,570				1,285	7,284		5,570							5,570
Maintain Steel, Painted, Interior Door Locks			213	518	486	518		486	518		486	518		486	518		486	518		395	518	
Refinish Steel, Vault Security, Interior Door					95			95				95			95							95

M&R Costs by Task

Whitestone Research

04-Dec-13

Building: Communications Facility

Facility: Marshall Space Flight Center

Building Num: 1045/62/179

City: Huntsville, AL

Forecast Year:	2013	4	5	6	7	2018	9	0	1	2	2023	4	5	6	7	2028	9	0	1	2	2033	4	5	6	7
Refinish Steel, Painted, Interior Door	286	540		127	286	540		127	286	540		127	286	540		127	286	540		127	286	540		127	286
Repair Steel, Vault Security, Interior Door													756												

C20 Stairs

Refinish Metal, Painted, Interior Railing	138		35		69		104		69		104		69		104		69		104		69		104		
Repair Metal, Painted, Exterior Railing																									1
Finish Replaced Metal, Painted, Interior Railing			69																					69	
Replace Metal, Painted, Interior Railing			2,128																					2,128	
Finish Repaired Metal, Painted, Interior Railing			1										1											3	
Repair Metal, Painted, Interior Railing			102										51											204	
Finish Repaired Metal, Painted, Exterior Railing																									0
Replace Rubber Interior Steps						1,348							200												1,348
Refinish Metal, Painted, Exterior Railing			19																	0				19	
Replace Concrete, Exterior Stairs			4,332																						
Repair Concrete, Exterior Stairs										251			90											323	251
Finish Replaced Metal, Painted, Exterior Railing										0			18												
Replace Metal, Painted, Exterior Railing										30			923												

C30 Interior Finishes

Repair Concrete Flooring (2% of Floors)			95				643		908				734				95							643	
Replace Vinyl Tile Flooring			22,606						35,587				2,789				41,334							22,606	
Repair Vinyl Tile Flooring (2% of Floors)					40		600						328				518							40	
Replace Rubber Sheet Flooring, 1/4"																13,001									
Repair Rubber Sheet Flooring, 1/4" (2% of Floors)							259																		259
Replace Metal Floor Grating																									
Repair Metal Floor Grating (2% of Grating)									23															23	
Finish Repaired Concrete, Painted Flooring													23												
Repair Concrete, Painted Flooring (2% of Floors)													217												
Replace Concrete Flooring																									45,383
Replace Ceramic Tile Flooring																									
Repair Carpet, Nylon 20 oz., Low Traffic (2% of Carpet)			468					1,024					1,141				468							1,024	
Repair Ceramic Tile Flooring (2% of Floors)											113														113
Repair Acoustic Tile, Dropped Ceiling (2% of Ceiling)	865				696	235	606		955						235	1,438		90					696		
Refinish Concrete, Painted Flooring							1,144										1,144								
Finish Repaired Gypsum Board, Finished Ceiling													17											18	
Replace Access Flooring w/ Laminate, Raised			78,395					303,007					69,389											177,100	
Replace Carpet on Access Flooring, Raised			16,185		13,759						10,296		16,185		13,759									10,296	
Finish Replaced Metal, Painted Ceiling																									1,528

M&R Costs by Task

Whitestone Research

04-Dec-13

Building: Communications Facility

Facility: Marshall Space Flight Center

Building Num: 1045/62/179

City: Huntsville, AL

Forecast Year:	2038	9	0	1	2	2043	4	5	6	7	2048	9	0	1	2	2053	4	5	6	7	2058	9	0	1	2
Refinish Steel, Painted, Interior Door			127	635			317	635			317	635				317	635			317	635			317	540
Repair Steel, Vault Security, Interior Door																			756						

C20 Stairs

Refinish Metal, Painted, Interior Railing		173				173				138		35		138		35		138		35		138		35	
Repair Metal, Painted, Exterior Railing			25																						
Finish Replaced Metal, Painted, Interior Railing								35																	
Replace Metal, Painted, Interior Railing								1,064																	
Finish Repaired Metal, Painted, Interior Railing			1						1															3	
Repair Metal, Painted, Interior Railing			51						102															153	
Finish Repaired Metal, Painted, Exterior Railing			0																						
Replace Rubber Interior Steps							200											1,348						200	
Refinish Metal, Painted, Exterior Railing						0			19															0	
Replace Concrete, Exterior Stairs										1,203															3,370
Repair Concrete, Exterior Stairs			90						323							251								413	
Finish Replaced Metal, Painted, Exterior Railing																0								18	
Replace Metal, Painted, Exterior Railing																30								923	

C30 Interior Finishes

Repair Concrete Flooring (2% of Floors)			545					95								908								734		
Replace Vinyl Tile Flooring			35,587					2,789								41,334								22,606	35,587	2,789
Repair Vinyl Tile Flooring (2% of Floors)			600					328								518								40	600	328
Replace Rubber Sheet Flooring, 1/4"																13,001										
Repair Rubber Sheet Flooring, 1/4" (2% of Floors)																									259	
Replace Metal Floor Grating			606																							
Repair Metal Floor Grating (2% of Grating)																									23	
Finish Repaired Concrete, Painted Flooring																									23	
Repair Concrete, Painted Flooring (2% of Floors)																									217	
Replace Concrete Flooring																									9,441	
Replace Ceramic Tile Flooring																									3,841	
Repair Carpet, Nylon 20 oz., Low Traffic (2% of Carpet)																									1,141	
Repair Ceramic Tile Flooring (2% of Floors)																									113	
Repair Acoustic Tile, Dropped Ceiling (2% of Ceiling)	1,438	865	90				696	235				832	865					696	235	606				955	235	
Refinish Concrete, Painted Flooring																									1,144	
Finish Repaired Gypsum Board, Finished Ceiling																									1,144	
Replace Access Flooring w/ Laminate, Raised																									78,395	
Replace Carpet on Access Flooring, Raised																									303,007	
Finish Replaced Metal, Painted Ceiling																									16,185	
																									13,759	
																									10,296	
																									16,185	
																									13,759	
																									10,296	
																									9,948	

M&R Costs by Task

Whitestone Research

04-Dec-13

Building: Communications Facility

Facility: Marshall Space Flight Center

Building Num: 1045/62/179

City: Huntsville, AL

Forecast Year:	2013	4	5	6	7	2018	9	0	1	2	2023	4	5	6	7	2028	9	0	1	2	2033	4	5	6	7
Finish Repaired Metal, Painted Ceiling			199																						113
Repair Metal, Painted Ceiling (2% of Ceiling)			3,952																						2,241
Refinish Metal, Painted Ceiling			9,948					5,640		1,528			9,948					5,640		1,528					9,948
Replace Metal, Painted Ceiling																									30,592
Replace Gypsum Board, Finished Ceiling																									
Replace Acoustical Tile, Dropped Ceiling								41,675					34,808					43,329							11,770
Repair Gypsum Board, Finished Ceiling (2% of Ceiling)																									66
Refinish Gypsum Board, Finished Ceiling			1,776										1,776												1,776
Finish Replaced Concrete, Painted Ceiling																									
Replace Concrete, Painted Ceiling																									
Finish Repaired Concrete, Painted Ceiling			75																						
Repair Concrete, Painted Ceiling (2% of Ceiling)			1,325																						
Refinish Concrete, Painted Ceiling			3,756										3,756												3,756
Finish Replaced Gypsum Board, Finished Ceiling																									
Repoint (50% of surface) Clay Brick, Interior Wall Finish			1,475										3,231												
Finish Replaced Concrete Block, Painted, Interior Wall Finish																									12,482
Replace Concrete Block, Painted, Interior Wall Finish																									135,203
Finish Repaired Concrete Block, Painted, Interior Wall Finish			181					99					137												302
Repoint (50% surface) Concrete Block, Painted, Interior Wall Fin			20,666					11,328					15,619												34,580
Repair Concrete Block, Painted, Interior Wall Finish (2% of Wall			1,955					1,072					1,478												3,273
Refinish Concrete Block, Painted, Interior Wall Finish			29,295					6,609		12,482			29,295					6,609		12,482					29,295
Refinish Concrete, Painted, Interior Wall Finish			1,620										1,620												1,620
Replace Clay Brick, Interior Wall Finish																									
Finish Repaired Clay Brick, Painted, Interior Wall Finish			7										17												
Refinish Clay Brick, Painted, Interior Wall Finish			1,188										1,188												1,188
Repair Ceramic Tile, 4"x4", Interior Wall Finish (2% of Walls)								130										130							
Replace Acoustical Wall Panels, Fabric Faced								22,513					8,515					56,790							
Repair Acoustical Tile, Interior Wall Finish (2% of Walls)			294					1,965																	548
Replace Carpet, Nylon 20 oz., Low Traffic			42,428					14,625					8,730					42,428							14,625
Replace Access Flooring w/ Carpet, Raised																		70,045		59,544					
Finish Replaced Clay Brick, Painted, Interior Wall Finish																									
Refinish Steel, Painted, Interior Wall Finish			1,141										1,141												1,141
Repair Clay Brick, Interior Wall Finish (2% of Walls)			132										290												
Repair Concrete, Painted, Interior Wall Finish (2% of Walls)			696																						
Repair Access Flooring w/ Laminate, Raised (2% of Floors)			3,541					1,388										5,109							6,060
Repair Access Flooring w/ Carpet, Raised (2% of Floors)								1,401		1,191								891							
Repair Steel, Painted, Interior Wall Finish (2% of Walls)								573																	

M&R Costs by Task

Whitestone Research

04-Dec-13

Building: Communications Facility

Facility: Marshall Space Flight Center

Building Num: 1045/62/179

City: Huntsville, AL

Forecast Year:	2038					9					0					1					2				
	2038	9	0	1	2	2043	4	5	6	7	2048	9	0	1	2	2053	4	5	6	7	2058	9	0	1	2
Finish Repaired Metal, Painted Ceiling																						113			30
Repair Metal, Painted Ceiling (2% of Ceiling)																							2,241		607
Refinish Metal, Painted Ceiling		5,640							1,528			15,588					1,528						15,588		
Replace Metal, Painted Ceiling		199,203																							
Replace Gypsum Board, Finished Ceiling												3,030												3,283	
Replace Acoustical Tile, Dropped Ceiling							30,363			4,511						41,675								34,808	
Repair Gypsum Board, Finished Ceiling (2% of Ceiling)																									
Refinish Gypsum Board, Finished Ceiling								1,776							923									853	
Finish Replaced Concrete, Painted Ceiling		3,756																							
Replace Concrete, Painted Ceiling		67,250																							
Finish Repaired Concrete, Painted Ceiling																									
Repair Concrete, Painted Ceiling (2% of Ceiling)																									
Refinish Concrete, Painted Ceiling												3,756											3,756		
Finish Replaced Gypsum Board, Finished Ceiling												853											923		
Repoint (50% of surface) Clay Brick, Interior Wall Finish																									
Finish Replaced Concrete Block, Painted, Interior Wall Finish		8,212										6,823											9,311		
Replace Concrete Block, Painted, Interior Wall Finish		88,953										73,903											100,864		
Finish Repaired Concrete Block, Painted, Interior Wall Finish		17						99															116	250	
Repoint (50% surface) Concrete Block, Painted, Interior Wall Fi		1,867						11,328															13,263	28,573	
Repair Concrete Block, Painted, Interior Wall Finish (2% of Wal		177						1,072															1,256	2,703	
Refinish Concrete Block, Painted, Interior Wall Finish		6,609						21,082		12,482		14,821				14,260		12,482					21,644		
Refinish Concrete, Painted, Interior Wall Finish												1,620											1,620		
Replace Clay Brick, Interior Wall Finish		6,607										14,473													
Finish Repaired Clay Brick, Painted, Interior Wall Finish																									
Refinish Clay Brick, Painted, Interior Wall Finish								816				373											1,188		
Repair Ceramic Tile, 4"x4", Interior Wall Finish (2% of Walls)		130										130											130		
Replace Acoustical Wall Panels, Fabric Faced										15,818						22,513							8,515		
Repair Acoustical Tile, Interior Wall Finish (2% of Walls)						780					294				1,965										
Replace Carpet, Nylon 20 oz., Low Traffic		8,730				42,428					14,625				8,730								42,428		
Replace Access Flooring w/ Carpet, Raised	44,557														70,045		59,544								
Finish Replaced Clay Brick, Painted, Interior Wall Finish		373										816													
Refinish Steel, Painted, Interior Wall Finish							1,141									1,141									
Repair Clay Brick, Interior Wall Finish (2% of Walls)																									
Repair Concrete, Painted, Interior Wall Finish (2% of Walls)																									
Repair Access Flooring w/ Laminate, Raised (2% of Floors)		1,388									3,541					1,568							6,060		
Repair Access Flooring w/ Carpet, Raised (2% of Floors)							1,401		1,191					891											
Repair Steel, Painted, Interior Wall Finish (2% of Walls)							573																		

M&R Costs by Task

Building: Communications Facility

Facility: Marshall Space Flight Center

Building Num: 1045/62/179

City: Huntsville, AL

Forecast Year:	2013	4	5	6	7	2018	9	0	1	2	2023	4	5	6	7	2028	9	0	1	2	2033	4	5	6	7		
Replace Plate Glass Interior Wall																										13,401	
Repair Plate Glass Interior Wall								522																			
Finish Replaced Concrete, Painted, Interior Wall Finish																											
Finish Repaired Concrete, Painted, Interior Wall Finish				33																							
Finish Repaired Steel, Painted, Interior Wall Finish									23																		
Replace Concrete, Painted, Interior Wall Finish																											
Finish Replaced Gypsum Board, Interior Wall Finish																											161
Refinish Gypsum Board, Interior Wall Finish			14,341					6,663		161			14,341					6,663		161					14,341		
Repair Gypsum Board, Interior Wall Finish (2% of Walls)			295					208		7			367					99							295		
Finish Repaired Gypsum Board, Interior Wall Finish			127					90		3			159					43							127		
Replace Gypsum Board, Interior Wall Finish																										373	

D20 Plumbing

Install New Gasket & Bolts, Pipe & Fittings, 4" Cast Iron									57																		23
Check Operation, Water Heater, Electric, 120 Gal.	26				26			26			26						26			26						26	26
Replace 10' Section, Pipe & Fittings, 2" DWV PVC																			123								
Replace Pipe & Fittings, 2" DWV PVC (20% of Pipe)									2,444																		
Install New Gasket & Bolts, Pipe & Fittings, 10" Cast Iron					48																						
Replace 10' Section, Pipe & Fittings, 10" Cast Iron	385										385		385										385			385	
Replace Pipe & Fittings, 6" Cast Iron (20% of Pipe)																											2,507
Install New Gasket & Bolts, Pipe & Fittings, 6" Cast Iron																											23
Replace 10' Section, Pipe & Fittings, 6" Cast Iron										101	126									101	126						
Replace Pipe & Fittings, 4" Cast Iron (20% of Pipe)																											5,421
Replace Pipe & Fittings, 10" Cast Iron (20% of Pipe)																											7,691
Replace 10' Section, Pipe & Fittings, 4" Cast Iron						193					348									193				348			
Replace Pipe & Fittings, 3" Cast Iron (20% of Pipe)																											
Install New Gasket & Bolts, Pipe & Fittings, 3" Cast Iron																											73
Replace 10' Section, Pipe & Fittings, 3" Cast Iron											207												207				
Replace Floor Drain																											
Maintain Floor Drain	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126
Replace Backflow Preventer, 1"									1,355		1,355								1,355		1,355						
Replace Water Heater, Electric, 120 Gal.																											13,356
Drain & Flush Water Heater, Electric, 120 Gal.							323						323									323					
Replace 10' Section, Pipe & Fittings, 4" DWV PVC											44																
Replace Pump & Motor Assembly, Sump Pump, 3 HP																											1,925
Maintain Backflow Preventer, 1"	127	127	127	127	127	127	127	63	127	63	127	127	127	127	127	127	127	63	127	63	127	127	127	127	127	127	
Inspect & Lubricate Sump Pump, 1 HP	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127		127	127	127	127	127	127	127	127
Replace Compressed Air Dryer								11,593																			11,593

M&R Costs by Task

Whitestone Research

04-Dec-13

Building: Communications Facility

Facility: Marshall Space Flight Center

Building Num: 1045/62/179

City: Huntsville, AL

	Forecast Year:	2038	9	0	1	2	2043	4	5	6	7	2048	9	0	1	2	2053	4	5	6	7	2058	9	0	1	2
Replace Plate Glass Interior Wall								30,824																		
Repair Plate Glass Interior Wall																										226
Finish Replaced Concrete, Painted, Interior Wall Finish			1,620																							
Finish Repaired Concrete, Painted, Interior Wall Finish																										
Finish Repaired Steel, Painted, Interior Wall Finish									23																	
Replace Concrete, Painted, Interior Wall Finish			35,360																							
Finish Replaced Gypsum Board, Interior Wall Finish														2,299											7,949	
Refinish Gypsum Board, Interior Wall Finish			6,663					14,341		161			6,663				12,042		161					8,962		
Repair Gypsum Board, Interior Wall Finish (2% of Walls)			208					367					99				189		7				208			
Finish Repaired Gypsum Board, Interior Wall Finish			90					159					43				81		3				90			
Replace Gypsum Board, Interior Wall Finish														5,321									18,400			

D20 Plumbing

Install New Gasket & Bolts, Pipe & Fittings, 4" Cast Iron																									23	80	
Check Operation, Water Heater, Electric, 120 Gal.						26			26								26						26		26		
Replace 10' Section, Pipe & Fittings, 2" DWV PVC			123																						123		
Replace Pipe & Fittings, 2" DWV PVC (20% of Pipe)																	2,444										
Install New Gasket & Bolts, Pipe & Fittings, 10" Cast Iron																										48	
Replace 10' Section, Pipe & Fittings, 10" Cast Iron																	385		385						385		
Replace Pipe & Fittings, 6" Cast Iron (20% of Pipe)																									2,005		
Install New Gasket & Bolts, Pipe & Fittings, 6" Cast Iron																										29	
Replace 10' Section, Pipe & Fittings, 6" Cast Iron									101								126					101			126		
Replace Pipe & Fittings, 4" Cast Iron (20% of Pipe)																	3,872										
Replace Pipe & Fittings, 10" Cast Iron (20% of Pipe)			7,691																								
Replace 10' Section, Pipe & Fittings, 4" Cast Iron						193				77							270					193	77		270		
Replace Pipe & Fittings, 3" Cast Iron (20% of Pipe)																									4,137		
Install New Gasket & Bolts, Pipe & Fittings, 3" Cast Iron																											
Replace 10' Section, Pipe & Fittings, 3" Cast Iron																	207						207				
Replace Floor Drain																											
Maintain Floor Drain	126	126	126	126		126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126
Replace Backflow Preventer, 1"			1,355			1,355											1,355		1,355						1,355	1,355	
Replace Water Heater, Electric, 120 Gal.			13,356																						13,356		
Drain & Flush Water Heater, Electric, 120 Gal.			323									323										323				323	
Replace 10' Section, Pipe & Fittings, 4" DWV PVC			44																						44		
Replace Pump & Motor Assembly, Sump Pump, 3 HP																										1,925	
Maintain Backflow Preventer, 1"	127	127	63	127	63	127	127	127	127	127	127	127	127	63	127	63	127	127	127	127	127	127	127	127	63	127	63
Inspect & Lubricate Sump Pump, 1 HP	127	127	127	127	127	127	127	127	127	127	127	127	127		127	127	127	127	127	127	127	127	127	127	127	127	127
Replace Compressed Air Dryer																										11,593	

M&R Costs by Task

Building: Communications Facility

Facility: Marshall Space Flight Center

Building Num: 1045/62/179

City: Huntsville, AL

Forecast Year:	2013	4	5	6	7	2018	9	0	1	2	2023	4	5	6	7	2028	9	0	1	2	2033	4	5	6	7		
Replace Compressor, Compressed Air Dryer		3,919																								3,919	
Recharge Compressed Air Dryer		160										160															160
Check & Adjust Compressed Air Dryer	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
Replace Air Compressor, 2 HP																											19,437
Repair Air Compressor, 2 HP				1,769				1,769				1,769				1,769					1,769					1,769	
Check & Adjust, Air Compressor, 2 HP	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179		179	179	179	179	179	179	179	179	179	179
Re-tape Pipe Insulation, Fiberglass, Cold Water								142					142					142								142	
Overhaul Sump Pump, 3 HP			63					63					63													63	
Replace Water Heater, Electric, 65 Gal.									2,866																	2,866	
Inspect & Lubricate Sump Pump, 3 HP	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32		32	32	32	32	32	32	32	32	
Overhaul Sump Pump, 1 HP			254					254					254													254	
Replace Pipe & Fittings, 4" DWV PVC (20% of Pipe)																										850	
Replace Pump & Motor Assembly, Sump Pump, 1/2 HP																										506	
Overhaul Sump Pump, 1/2 HP			63					63					63													63	
Inspect & Lubricate Sump Pump, 1/2 HP	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32			32	32	32	32	32	32	32	32	
Replace Roof Drain, 4-6"									1,292																		
Maintain Roof Drain, 4-6"	65	65	65	65	65	65	65		65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	
Replace Pipe & Fittings, 6" DWV PVC (20% of Pipe)									2,772																		
Replace 10' Section, Pipe & Fittings, 6" DWV PVC																										149	
Replace Pipe & Fittings, 4" DWV PVC (20% of Pipe)									3,823																		
Replace 10' Section, Pipe & Fittings, 4" DWV PVC																										201	
Replace Pipe & Fittings, 2" DWV PVC (20% of Pipe)									1,570																		
Replace 10' Section, Pipe & Fittings, 2" DWV PVC																										79	
Replace Pump & Motor Assembly, Sump Pump, 1 HP																										3,966	
Repair Strainer, Sink, Iron, Enamel		80									80											80					
Maintain Expansion Tank, 10 Gal.	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	
Replace Urinal, Vitreous China													4,013														
Replace Flush Valve, Urinal, Vitreous China						709																709					
Replace Tankless Water Closet													5,008														
Replace Flush Valve, Tankless Water Closet								160																	160		
Replace Sink, Stainless Steel																											
Replace Valve Set, Sink, Stainless Steel									170																	170	
Repair Strainer, Sink, Stainless Steel			79									79										79					
Replace Faucet Washer & Clean Trap, Sink, Stainless Steel		28		28		28		28		28		28		28		28		28		28		28		28		28	
Replace Expansion Tank, 10 Gal.																											
Drain & Flush Water Heater, Electric, 65 Gal.	323							323								323										323	
Replace Valve Set, Service Sink, Iron, Enamel									170																	170	

M&R Costs by Task

Whitestone Research

04-Dec-13

Building: Communications Facility

Facility: Marshall Space Flight Center

Building Num: 1045/62/179

City: Huntsville, AL

Forecast Year:	2038	9	0	1	2	2043	4	5	6	7	2048	9	0	1	2	2053	4	5	6	7	2058	9	0	1	2	
Replace Compressor, Compressed Air Dryer							3,919																		3,919	
Recharge Compressed Air Dryer		160					160										160								160	
Check & Adjust Compressed Air Dryer	80	80	80	80	80	80	80	80	80	80	80		80	80	80	80	80	80	80	80	80	80	80	80	80	80
Replace Air Compressor, 2 HP																	19,437									
Repair Air Compressor, 2 HP						1,769		1,769					1,769				1,769				1,769				1,769	
Check & Adjust, Air Compressor, 2 HP	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179	179		179	179	179	179	179	179	179	179	
Re-tape Pipe Insulation, Fiberglass, Cold Water									142									142							142	
Overhaul Sump Pump, 3 HP			63					63										63							63	
Replace Water Heater, Electric, 65 Gal.																		2,866								
Inspect & Lubricate Sump Pump, 3 HP	32	32	32	32	32	32	32	32	32	32	32	32		32	32	32	32	32	32	32	32	32	32	32	32	
Overhaul Sump Pump, 1 HP			254					254										254							254	
Replace Pipe & Fittings, 4" DWV PVC (20% of Pipe)																									850	
Replace Pump & Motor Assembly, Sump Pump, 1/2 HP																	506									
Overhaul Sump Pump, 1/2 HP			63					63										63							63	
Inspect & Lubricate Sump Pump, 1/2 HP	32	32	32	32	32	32	32	32	32	32	32	32		32	32	32	32	32	32	32	32	32	32	32	32	
Replace Roof Drain, 4-6"																									1,292	
Maintain Roof Drain, 4-6"	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	
Replace Pipe & Fittings, 6" DWV PVC (20% of Pipe)																	2,772									
Replace 10' Section, Pipe & Fittings, 6" DWV PVC			149																						149	
Replace Pipe & Fittings, 4" DWV PVC (20% of Pipe)																		3,823								
Replace 10' Section, Pipe & Fittings, 4" DWV PVC			201																						201	
Replace Pipe & Fittings, 2" DWV PVC (20% of Pipe)																		1,570								
Replace 10' Section, Pipe & Fittings, 2" DWV PVC			79																						79	
Replace Pump & Motor Assembly, Sump Pump, 1 HP																	3,966									
Repair Strainer, Sink, Iron, Enamel						80							80								80					
Maintain Expansion Tank, 10 Gal.	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	
Replace Urinal, Vitreous China																									4,013	
Replace Flush Valve, Urinal, Vitreous China			709						709								709									
Replace Tankless Water Closet																									5,008	
Replace Flush Valve, Tankless Water Closet									160									160								
Replace Sink, Stainless Steel			1,288																							
Replace Valve Set, Sink, Stainless Steel																		170							170	
Repair Strainer, Sink, Stainless Steel																									79	
Replace Faucet Washer & Clean Trap, Sink, Stainless Steel	28			28		28		28		28		28		28		28		28		28		28		28	28	
Replace Expansion Tank, 10 Gal.																									1,035	
Drain & Flush Water Heater, Electric, 65 Gal.						323							323								323					
Replace Valve Set, Service Sink, Iron, Enamel									170									170								

M&R Costs by Task

Whitestone Research

04-Dec-13

Building: Communications Facility

Facility: Marshall Space Flight Center

Building Num: 1045/62/179

City: Huntsville, AL

Forecast Year:	2013	4	5	6	7	2018	9	0	1	2	2023	4	5	6	7	2028	9	0	1	2	2033	4	5	6	7
Re-tape Pipe Insulation, Fiberglass, Hot Water								177					177					177						177	
Replace Lavatory, Vitreous China													2,375												
Replace Valve Set, Lavatory, Vitreous China								676																676	
Replace Washer & Spud Connection, Lavatory, Vitreous China						199														199					
Replace Faucet Washer & Clean Trap, Lavatory, Vitreous China		109		109		109		109		109		109			109		109		109		109		109		109
Replace Emergency Eye Wash & Shower Station																								5,222	
Repack Valve Glands, Emergency Eye Wash & Shower Station								195												195					
Inspect & Clean Emergency Eye Wash & Shower Station	160			160		160		160		160		160			160		160		160		160		160		160
Replace Drinking Fountain, Refrigerated								2,586												2,586					
Replace Coolant & Adjust Drinking Fountain, Refrigerated		66		66		66				66		66		66		66				66		66		66	66
Replace Service Sink, Iron, Enamel													1,317												
Replace Pipe & Fittings, 4" Copper, Cold Water (20% of Pipe)			14,363																						
Replace Faucet Washer & Clean Trap, Sink, Iron, Enamel		28		28		28		28		28		28			28		28		28		28		28		28
Inspect & Lubricate Booster Pump, 1 1/2 HP	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63		63	63	63	63	63	63	63
Check Operation, Water Heater, Electric, 65 Gal.			26			26						26			26					26		26			
Replace Pipe Insulation, Fiberglass, Hot Water (20% of Insulation)			537																						
Replace Pipe Insulation, Fiberglass, Cold Water (20% of Insulation)			429																						
Replace 10' Section, Pipe & Fittings, 1" Steel		65												65											
Replace 10' Section, Pipe & Fittings, 4" Copper, Cold Water																								718	
Resolder Joint, Pipe & Fittings, 4" Copper, Cold Water													190											190	
Replace Pipe & Fittings, 2" Copper, Cold Water (20% of Pipe)			4,246																						
Replace 10' Section, Pipe & Fittings, 2" Copper, Cold Water																								213	
Resolder Joint, Pipe & Fittings, 2" Copper, Cold Water													167											167	
Replace Assembly, Booster Pump, 1 1/2 HP																					16,753				
Install New Gasket & Bolts, Pipe & Fittings, 1" Steel			50																						
Overhaul Booster Pump, 1 1/2 HP			298					298					298											298	
Replace Pipe & Fittings, 3/4" Copper, Hot Water (20% of Pipe)			2,329																						518
Inspect & Lubricate Circulator Pump, 1/2 HP, Hot Water	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63		63	63	63	63	63	63	63
Overhaul Circulator Pump, 1/2 HP, Hot Water			126					126					126											126	
Replace Circulator Pump, 1/2 HP, Hot Water																				7,825					
Resolder Joint, Pipe & Fittings, 3/4" Copper, Cold Water										48			272								48			272	
Replace 10' Section, Pipe & Fittings, 3/4" Copper, Cold Water										26														148	
Replace Pipe & Fittings, 3/4" Copper, Cold Water (20% of Pipe)			2,950																						518
Resolder Joint, Pipe & Fittings, 3/4" Copper, Hot Water										48			215								48			215	
Replace 10' Section, Pipe & Fittings, 3/4" Copper, Hot Water										26														116	
Replace Valve, Hose Bib								72													72				

D30 HVAC

M&R Costs by Task

Building: Communications Facility

Facility: Marshall Space Flight Center

Building Num: 1045/62/179

City: Huntsville, AL

Forecast Year:	2038	9	0	1	2	2043	4	5	6	7	2048	9	0	1	2	2053	4	5	6	7	2058	9	0	1	2
Re-tape Pipe Insulation, Fiberglass, Hot Water								177				177						177							177
Replace Lavatory, Vitreous China																									2,375
Replace Valve Set, Lavatory, Vitreous China								676										676							
Replace Washer & Spud Connection, Lavatory, Vitreous China		199							199							199									
Replace Faucet Washer & Clean Trap, Lavatory, Vitreous Chin		109		109		109		109		109		109		109		109		109		109		109		109	
Replace Emergency Eye Wash & Shower Station																									5,222
Repack Valve Glands, Emergency Eye Wash & Shower Station								195										195							
Inspect & Clean Emergency Eye Wash & Shower Station		160		160		160			160			160			160			160			160				
Replace Drinking Fountain, Refrigerated			2,586										2,586												2,586
Replace Coolant & Adjust Drinking Fountain, Refrigerated		66			66		66		66		66			66		66		66		66		66			66
Replace Service Sink, Iron, Enamel																									1,317
Replace Pipe & Fittings, 4" Copper, Cold Water (20% of Pipe)			14,363																						
Replace Faucet Washer & Clean Trap, Sink, Iron, Enamel		28		28		28		28		28		28		28		28		28		28		28			28
Inspect & Lubricate Booster Pump, 1 1/2 HP		63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63
Check Operation, Water Heater, Electric, 65 Gal.		26			26			26			26				26			26			26				26
Replace Pipe Insulation, Fiberglass, Hot Water (20% of Insulati			537																						
Replace Pipe Insulation, Fiberglass, Cold Water (20% of Insula			429																						
Replace 10' Section, Pipe & Fittings, 1" Steel		65											65												65
Replace 10' Section, Pipe & Fittings, 4" Copper, Cold Water																									718
Resolder Joint, Pipe & Fittings, 4" Copper, Cold Water																	190								190
Replace Pipe & Fittings, 2" Copper, Cold Water (20% of Pipe)			4,246																						
Replace 10' Section, Pipe & Fittings, 2" Copper, Cold Water																									213
Resolder Joint, Pipe & Fittings, 2" Copper, Cold Water																		167							167
Replace Assembly, Booster Pump, 1 1/2 HP																16,753									
Install New Gasket & Bolts, Pipe & Fittings, 1" Steel			50																						
Overhaul Booster Pump, 1 1/2 HP			298					298										298							298
Replace Pipe & Fittings, 3/4" Copper, Hot Water (20% of Pipe)			2,329																						518
Inspect & Lubricate Circulator Pump, 1/2 HP, Hot Water		63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63
Overhaul Circulator Pump, 1/2 HP, Hot Water			126					126										126							126
Replace Circulator Pump, 1/2 HP, Hot Water																7,825									
Resolder Joint, Pipe & Fittings, 3/4" Copper, Cold Water									48											48					272
Replace 10' Section, Pipe & Fittings, 3/4" Copper, Cold Water																				26					148
Replace Pipe & Fittings, 3/4" Copper, Cold Water (20% of Pipe)			2,950																						518
Resolder Joint, Pipe & Fittings, 3/4" Copper, Hot Water									48											48					215
Replace 10' Section, Pipe & Fittings, 3/4" Copper, Hot Water																					26				116
Replace Valve, Hose Bib			72																		72				72

D30 HVAC

M&R Costs by Task

Building: Communications Facility

Facility: Marshall Space Flight Center

Building Num: 1045/62/179

City: Huntsville, AL

	Forecast Year: 2013		4	5	6	7	2018	9	0	1	2	2023		4	5	6	7	2028		9	0	1	2	2033		4	5	6	7																			
Replace Gate Valve, 6"			8,886																																													
Replace 10' Section, Pipe & Fittings, 2" Steel	153																				32				39													153				32						39
Install New Gasket & Bolts, Pipe & Fittings, 2" Steel					87															18																						22						
Replace Pipe & Fittings, 2" Steel (20% of Pipe)																																																
Replace 10' Section, Pipe & Fittings, 3" Steel													80																80																			
Install New Gasket & Bolts, Pipe & Fittings, 3" Steel					33																																											
Replace 10' Section, Pipe & Fittings, 6" Steel	138							69											138					69																								
Install New Gasket & Bolts, Pipe & Fittings, 6" Steel					62															30																												
Maintain Heat Exchanger, Steam-to-Water, 20 Gpm	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193																			
Repack Gland, Gate Valve, 6"																											199																					
Resolder Joint, Pipe & Fittings, 3/4" Copper									48									335					48									335																
Replace Expansion Tank, 60 Gal.																																																
Replace Pipe & Fittings, 6" Steel (20% of Pipe)																																																
Maintain Expansion Tank, 60 Gal.	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26																		
Replace Expansion Tank, 30 Gal.																																																
Maintain Expansion Tank, 30 Gal.	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26																		
Replace Expansion Tank, 10 Gal.																																																
Maintain Expansion Tank, 10 Gal.	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26																		
Replace Boiler, Electric, 144 kW																19,125																																
Repair Boiler, Electric, 144 kW																																																
Maintain Boiler, Electric, 144 kW	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687																		
Replace Ball Valve, 6"																	14,073																															
Lubricate, Repack Gland, Ball Valve, 6"	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571																		
Replace Fuel Storage Tank, 10,000 Gal.																																																
Replace Leak Detection, Panel & Float Assembly																																																
Maintain Fuel Storage Tank, 10,000 Gal.	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319	319																		
Maintain Variable Air Volume Box, 1,300 Cfm	2,429	2,429	2,429	2,429	2,429	2,429	2,429	2,429	2,429	2,429	2,429	2,429	2,429	2,429	2,429	2,429	2,429	2,429	2,429	2,429	2,429	2,429	2,429	2,429	2,429	2,429	2,429	2,429	2,429	2,429																		
Maintain Air Handler, Single Zone, 10,000 Cfm	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098																		
Replace Exhaust Fan, Roof Mounted, 10,000 Cfm	19,241																																															
Maintain Variable Air Volume Box, 400 Cfm	1,372	1,372	1,372	1,372	1,372	1,372	1,372	1,372	1,372	1,372	1,372	1,372	1,372	1,372	1,372	1,372	1,372	1,372	1,372	1,372	1,372	1,372	1,372	1,372	1,372	1,372	1,372	1,372	1,372	1,372																		
Repair Variable Air Volume Box, 400 Cfm	2,082																																															
Replace Variable Air Volume Box, 400 Cfm							12,725										12,725																															
Maintain Variable Air Volume Box, 800 Cfm	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797																		
Maintain Exhaust Fan, Roof Mounted, 10,000 Cfm	829	829	829	829	829	829	829	829	829	829	829	829	829	829	829	829	829	829	829	829	829	829	829	829	829	829	829	829	829	829																		
Replace Variable Air Volume Box, 800 Cfm													31,696																																			
Replace Exhaust Fan, Roof Mounted, 8,500 Cfm	22,113																																															
Repair Variable Air Volume Box, 1,300 Cfm													4,114																																			

M&R Costs by Task

Whitestone Research

04-Dec-13

Building: Communications Facility

Facility: Marshall Space Flight Center

Building Num: 1045/62/179

City: Huntsville, AL

Forecast Year:	2038	9	0	1	2	2043	4	5	6	7	2048	9	0	1	2	2053	4	5	6	7	2058	9	0	1	2
Replace Gate Valve, 6"						8,886																			
Replace 10' Section, Pipe & Fittings, 2" Steel	153				32					39						153					32	39			153
Install New Gasket & Bolts, Pipe & Fittings, 2" Steel			87																					22	
Replace Pipe & Fittings, 2" Steel (20% of Pipe)									639																
Replace 10' Section, Pipe & Fittings, 3" Steel	80															80									80
Install New Gasket & Bolts, Pipe & Fittings, 3" Steel			33																						
Replace 10' Section, Pipe & Fittings, 6" Steel	138				69											138						69			138
Install New Gasket & Bolts, Pipe & Fittings, 6" Steel			62																						
Maintain Heat Exchanger, Steam-to-Water, 20 Gpm	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193	193
Repack Gland, Gate Valve, 6"																									199
Resolder Joint, Pipe & Fittings, 3/4" Copper									48							335									335
Replace Expansion Tank, 60 Gal.			2,800																						
Replace Pipe & Fittings, 6" Steel (20% of Pipe)									1,394																
Maintain Expansion Tank, 60 Gal.	26	26		26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
Replace Expansion Tank, 30 Gal.			2,329																						
Maintain Expansion Tank, 30 Gal.	26	26		26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
Replace Expansion Tank, 10 Gal.			1,035																						
Maintain Expansion Tank, 10 Gal.	26	26		26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
Replace Boiler, Electric, 144 kW																									19,125
Repair Boiler, Electric, 144 kW						4,681																			
Maintain Boiler, Electric, 144 kW	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687	687
Replace Ball Valve, 6"																14,073									
Lubricate, Repack Gland, Ball Valve, 6"	571	571	571	571	571	571	571	571	571	571	571	571	571	571	571		571	571	571	571	571	571	571	571	571
Replace Fuel Storage Tank, 10,000 Gal.																30,930									
Replace Leak Detection, Panel & Float Assembly			6,676																						
Maintain Fuel Storage Tank, 10,000 Gal.	319	319	319	319	319	319	319	319	319	319	319	319		319	319	319	319	319	319	319	319	319	319	319	319
Maintain Variable Air Volume Box, 1,300 Cfm	2,429	2,429	2,429	2,429		2,429	2,429	2,429	2,429	2,429	2,429	2,429	2,429	2,429	2,429	2,429	2,429	2,429	2,429	2,429	2,429	2,429	2,429	2,429	2,429
Maintain Air Handler, Single Zone, 10,000 Cfm	2,098	2,098	2,098	2,098		2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098
Replace Exhaust Fan, Roof Mounted, 10,000 Cfm	19,241																								19,241
Maintain Variable Air Volume Box, 400 Cfm	1,372	1,372	1,372	1,372		1,372	1,372	1,372	1,372	1,372	1,372	1,372	1,372	1,372	1,372	1,372	1,372	1,372	1,372	1,372	1,372	1,372	1,372	1,372	1,372
Repair Variable Air Volume Box, 400 Cfm	2,082															2,082									
Replace Variable Air Volume Box, 400 Cfm					12,725														12,725						
Maintain Variable Air Volume Box, 800 Cfm	2,797	2,797	2,797	2,797		2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797	2,797
Maintain Exhaust Fan, Roof Mounted, 10,000 Cfm		829	829	829	829	829	829	829	829	829	829	829	829	829	829	829	829	829	829	829	829	829	829	829	829
Replace Variable Air Volume Box, 800 Cfm					31,696														31,696						
Replace Exhaust Fan, Roof Mounted, 8,500 Cfm	22,113																								22,113
Repair Variable Air Volume Box, 1,300 Cfm	4,114															4,114									

M&R Costs by Task

Whitestone Research

04-Dec-13

Building: Communications Facility

Facility: Marshall Space Flight Center

Building Num: 1045/62/179

City: Huntsville, AL

Forecast Year:	2013	4	5	6	7	2018	9	0	1	2	2023	4	5	6	7	2028	9	0	1	2	2033	4	5	6	7		
Replace Variable Air Volume Box, 1,300 Cfm				32,930													32,930										
Maintain Variable Air Volume Box, 2,500 Cfm	1,007	1,007	1,007			1,007	1,007	1,007	1,007	1,007	1,007	1,007	1,007	1,007	1,007	1,007		1,007	1,007	1,007	1,007	1,007	1,007	1,007	1,007		
Repair Variable Air Volume Box, 2,500 Cfm													1,426														
Replace Variable Air Volume Box, 2,500 Cfm				19,425													19,425										
Maintain Air Conditioner, Computer Room, Air Cooled, 20 Ton	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066		
Repair Variable Air Volume Box, 800 Cfm													4,187														
Repair Exhaust Fan, Centrifugal, 5,000 Cfm											524																
Repair Air Handler, Single Zone, 10,000 Cfm													4,736														
Replace Air Handler, Single Zone, 10,000 Cfm				62,859													62,859										
Replace Duct Insulation (20% of Insulation)																											
Replace Existing Ductwork (20% of Ductwork)																											
Maintain Exhaust Fan, Centrifugal, 2,000 Cfm	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380		380	380	380		
Repair Exhaust Fan, Centrifugal, 2,000 Cfm		524													262												
Repair Exhaust Fan, Roof Mounted, 10,000 Cfm																											
Maintain Exhaust Fan, Centrifugal, 5,000 Cfm	253	253	253	253	253	253	253	253	253	253	253	253	253	253	253	253	253	253	253	253	253		253	253	253		
Maintain Air Conditioner, Computer Room, Air-Cooled, 25 Ton	4,132	4,132	4,132	4,132	4,132	4,132	4,132	4,132	4,132	4,132	4,132	4,132	4,132	4,132	4,132	4,132	4,132	4,132	4,132	4,132	4,132	4,132	4,132	4,132	4,132		
Replace Exhaust Fan, Centrifugal, 5,000 Cfm																								8,704			
Maintain Exhaust Fan, Roof Mounted, 5,000 Cfm	380		380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380		
Repair Exhaust Fan, Roof Mounted, 5,000 Cfm																											
Replace Exhaust Fan, Roof Mounted, 5,000 Cfm		7,609																									
Maintain Exhaust Fan, Roof Mounted, 8,500 Cfm	632		632	632	632	632	632	632	632	632	632	632	632	632	632	632	632	632	632	632	632	632	632	632	632		
Repair Exhaust Fan, Roof Mounted, 8,500 Cfm																											
Replace Exhaust Fan, Centrifugal, 2,000 Cfm																								6,886			
Repair Unit Heater, 480v, 5kW																											
Replace Air Conditioner, DX Packaged, Air Cooled, 5 Ton																											
Maintain Air Conditioner, Rooftop, Multizone, 50 Ton	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960		1,960	1,960	1,960		
Repair Air Conditioner, Rooftop, Multizone, 50 Ton													68,565														
Replace Air Conditioner, Rooftop, Multizone, 50 Ton																											
Maintain Air Conditioner, Window, 1 Ton	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148		
Repair Air Conditioner, Window, 1 Ton																											
Repair Air Conditioner, Computer Room, Air Cooled, 20 Ton																											
Maintain Unit Heater, 480v, 5kW	813	813	813	813	813	813	813	813	813	813	813	813	813	813	813	813	813	813	813	813	813		813	813	813		
Replace Air Conditioner, Computer Room, Chilled Water, 25 To																											
Replace Unit Heater, 480v, 5kW																											
Maintain Unit Heater, 36 Mbh		163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163		163		
Repair Unit Heater, 36 Mbh																											
Replace Unit Heater, 36 Mbh	1,493																								1,493		

Tasks ordered by UNIFORMAT II Classifications. Unscheduled Maintenance Costs are not included.
Based on a 50-Year Forecast.

All costs expressed in (\$) 2012.

M&R Costs by Task

Whitestone Research

04-Dec-13

Building: Communications Facility

Facility: Marshall Space Flight Center

Building Num: 1045/62/179

City: Huntsville, AL

Forecast Year:	2038	9	0	1	2	2043	4	5	6	7	2048	9	0	1	2	2053	4	5	6	7	2058	9	0	1	2
Replace Variable Air Volume Box, 1,300 Cfm	32,930											32,930													
Maintain Variable Air Volume Box, 2,500 Cfm	1,007	1,007	1,007	1,007		1,007	1,007	1,007	1,007	1,007	1,007	1,007	1,007	1,007	1,007	1,007		1,007	1,007	1,007	1,007	1,007	1,007	1,007	1,007
Repair Variable Air Volume Box, 2,500 Cfm	1,426											1,426													
Replace Variable Air Volume Box, 2,500 Cfm	19,425											19,425													
Maintain Air Conditioner, Computer Room, Air Cooled, 20 Ton	2,066	2,066		2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066
Repair Variable Air Volume Box, 800 Cfm	4,187											4,187													
Repair Exhaust Fan, Centrifugal, 5,000 Cfm												524													
Repair Air Handler, Single Zone, 10,000 Cfm	4,736											4,736													
Replace Air Handler, Single Zone, 10,000 Cfm	62,859											62,859													
Replace Duct Insulation (20% of Insulation)												9,017													
Replace Existing Ductwork (20% of Ductwork)												25,000													
Maintain Exhaust Fan, Centrifugal, 2,000 Cfm	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
Repair Exhaust Fan, Centrifugal, 2,000 Cfm												787													
Repair Exhaust Fan, Roof Mounted, 10,000 Cfm												1,566													
Maintain Exhaust Fan, Centrifugal, 5,000 Cfm	253	253	253	253	253	253	253	253	253	253	253	253	253	253	253	253	253	253	253	253	253	253	253	253	253
Maintain Air Conditioner, Computer Room, Air-Cooled, 25 Ton	4,132	4,132		4,132	4,132	4,132	4,132	4,132	4,132	4,132	4,132	4,132	4,132	4,132	4,132	4,132	4,132	4,132	4,132	4,132	4,132	4,132	4,132	4,132	4,132
Replace Exhaust Fan, Centrifugal, 5,000 Cfm												8,704													
Maintain Exhaust Fan, Roof Mounted, 5,000 Cfm	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380
Repair Exhaust Fan, Roof Mounted, 5,000 Cfm												1,174													
Replace Exhaust Fan, Roof Mounted, 5,000 Cfm	7,609											7,609													
Maintain Exhaust Fan, Roof Mounted, 8,500 Cfm	632	632	632	632	632	632	632	632	632	632	632	632	632	632	632	632	632	632	632	632	632	632	632	632	632
Repair Exhaust Fan, Roof Mounted, 8,500 Cfm												1,957													
Replace Exhaust Fan, Centrifugal, 2,000 Cfm												6,886													
Repair Unit Heater, 480v, 5kW												901													
Replace Air Conditioner, DX Packaged, Air Cooled, 5 Ton												7,954													
Maintain Air Conditioner, Rooftop, Multizone, 50 Ton	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960	
Repair Air Conditioner, Rooftop, Multizone, 50 Ton												68,565													
Replace Air Conditioner, Rooftop, Multizone, 50 Ton												203,317													
Maintain Air Conditioner, Window, 1 Ton	148	148		148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
Repair Air Conditioner, Window, 1 Ton												141													
Repair Air Conditioner, Computer Room, Air Cooled, 20 Ton												111,439													
Maintain Unit Heater, 480v, 5kW	813	813	813	813	813	813	813	813	813	813	813	813	813	813	813	813	813	813	813	813	813	813	813	813	813
Replace Air Conditioner, Computer Room, Chilled Water, 25 T												221,698													
Replace Unit Heater, 480v, 5kW												44,339													
Maintain Unit Heater, 36 Mbh	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163	163
Repair Unit Heater, 36 Mbh												765													
Replace Unit Heater, 36 Mbh												1,493													

M&R Costs by Task

Whitestone Research

04-Dec-13

Building: Communications Facility

Facility: Marshall Space Flight Center

Building Num: 1045/62/179

City: Huntsville, AL

Forecast Year:	2013	4	5	6	7	2018	9	0	1	2	2023	4	5	6	7	2028	9	0	1	2	2033	4	5	6	7	
Replace Heat Exchanger, Steam-to-Water, 20 Gpm														8,269												
Repair Heat Exchanger, Steam-to-Water, 20 Gpm		1,366									1,366															1,366
Replace Air Conditioner, Window, 1 Ton																										
Replace Air Conditioner, Computer Room, Chilled Water, 10 To										78,942				78,942												
Replace Air Conditioner, Computer Room, Chilled Water, 15 To										42,594																
Maintain Air Conditioner, Computer Room, Air-Cooled, 30 Ton	689	689	689	689	689	689	689	689	689	689	689	689	689	689	689	689	689	689	689	689	689	689	689	689	689	689
Repair Air Conditioner, Computer Room, Air-Cooled, 25 Ton																										270,930
Repair Air Conditioner, Computer Room, Air-Cooled, 30 Ton																										53,163
Replace Air Conditioner, Computer Room, Air-Cooled, 25 Ton																										
Replace Air Conditioner, Computer Room, Air-Cooled, 30 Ton																										
Repair Air Conditioner, DX Packaged, Air Cooled, 5 Ton																										3,734
Repair Air Conditioner, Computer Room, Chilled Water, 10 Ton																										20,590
Maintain Air Conditioner, DX Packaged, Air Cooled, 5 Ton	226	226	226	226	226	226	226	226	226	226	226	226	226	226	226	226	226	226	226	226	226	226	226	226	226	226
Maintain Air Conditioner, Computer Room, Chilled Water, 15 To	665	665	665	665	665	665	665	665	665	665	665	665	665	665	665	665	665	665	665	665	665	665	665	665	665	665
Repair Air Conditioner, Computer Room, Chilled Water, 15 Ton																										13,434
Maintain Air Conditioner, Computer Room, Chilled Water, 20 To	2,062	2,062	2,062	2,062	2,062	2,062	2,062		2,062	2,062	2,062	2,062	2,062	2,062	2,062	2,062	2,062	2,062	2,062	2,062	2,062	2,062	2,062	2,062	2,062	2,062
Replace Air Conditioner, Computer Room, Chilled Water, 20 To																										116,827
Maintain Air Conditioner, Computer Room, Chilled Water, 25 To	4,123	4,123	4,123	4,123	4,123	4,123	4,123	687	4,123	4,123	4,123	4,123	3,436	4,123	4,123	4,123	4,123	4,123	4,123	4,123	4,123	4,123	4,123	4,123	4,123	
Repair Air Conditioner, Computer Room, Chilled Water, 25 Ton																										109,729
Replace Air Conditioner, Computer Room, Air Cooled, 20 Ton																										
Maintain Air Conditioner, Computer Room, Chilled Water, 10 To	2,661	2,661	2,661	2,661	2,661	2,661	2,661	1,330	2,661	2,661	2,661	2,661	1,330	2,661	2,661	2,661	2,661	2,661	2,661	2,661	2,661	2,661	2,661	2,661	2,661	
Maintain Circulation Pump, 50 HP, Chiller & Condenser Water	137	137	137	137	137		137	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137	
Maintain Condenser, Air-Cooled, 30 Ton	203	203	203	203	203	203	203	203	203	203	203	203	203	203	203	203	203	203	203	203		203	203	203	203	
Maintain Chiller, Centrifugal Hermetic, Bnd'd w/ Condenser, 900 T	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	
Repair Chiller, Centrifugal Hermetic, Bnd'd w/ Condenser, 900 T																										289,597
Replace Chiller, Centrifugal Hermetic, Bnd'd w/ Condenser, 900 T																										
Maintain Circulation Pump, 25 HP, Chiller & Condenser Water	171	171	171	171	171		171	171	171	171	171	171	171	171	171	171	171	171	171	171	171	171	171	171	171	
Replace 10' Section, Pipe & Fittings, 3/4" Copper																										26
Inspect, Clean, & Verify Opening/Closing, Check Valve, 3-4"	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	
Replace Circulation Pump, 25 HP, Chiller & Condenser Water																										37,761
Replace Butterfly Valve, 6"																										10,518
Repair Circulation Pump, 50 HP, Chiller & Condenser Water																										531
Replace Circulation Pump, 50 HP, Chiller & Condenser Water																										48,461
Maintain Condenser, Air-Cooled, 5 Ton	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	
Repair Condenser, Air-Cooled, 5 Ton																										1,147
Maintain Condenser, Air-Cooled, 25 Ton	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	
Replace Condenser, Air-Cooled, 25 Ton																										132,804

M&R Costs by Task

Whitestone Research

04-Dec-13

Building: Communications Facility

Facility: Marshall Space Flight Center

Building Num: 1045/62/179

City: Huntsville, AL

Forecast Year:	2038	9	0	1	2	2043	4	5	6	7	2048	9	0	1	2	2053	4	5	6	7	2058	9	0	1	2		
Replace Heat Exchanger, Steam-to-Water, 20 Gpm																									8,269		
Repair Heat Exchanger, Steam-to-Water, 20 Gpm						1,366										1,366										1,366	
Replace Air Conditioner, Window, 1 Ton						1,962																					
Replace Air Conditioner, Computer Room, Chilled Water, 10 T																78,942										78,942	
Replace Air Conditioner, Computer Room, Chilled Water, 15 T																42,594											
Maintain Air Conditioner, Computer Room, Air-Cooled, 30 Ton	689	689		689	689	689	689	689	689	689	689	689	689	689	689	689	689	689	689	689	689	689	689	689	689	689	
Repair Air Conditioner, Computer Room, Air-Cooled, 25 Ton																										270,930	
Repair Air Conditioner, Computer Room, Air-Cooled, 30 Ton																										53,163	
Replace Air Conditioner, Computer Room, Air-Cooled, 25 Ton						557,338																					
Replace Air Conditioner, Computer Room, Air-Cooled, 30 Ton						105,680																					
Repair Air Conditioner, DX Packaged, Air Cooled, 5 Ton																											
Repair Air Conditioner, Computer Room, Chilled Water, 10 Ton						20,591																					
Maintain Air Conditioner, DX Packaged, Air Cooled, 5 Ton	226	226	226	226	226	226	226	226	226	226	226	226				226	226	226	226	226	226	226	226	226	226	226	226
Maintain Air Conditioner, Computer Room, Chilled Water, 15 T	665	665	665	665	665	665	665	665	665	665	665	665				665	665	665	665	665	665	665	665	665	665	665	665
Repair Air Conditioner, Computer Room, Chilled Water, 15 Ton																											
Maintain Air Conditioner, Computer Room, Chilled Water, 20 T	2,062	2,062	2,062	2,062	2,062	2,062	2,062	2,062	2,062	2,062	2,062					2,062	2,062	2,062	2,062	2,062	2,062	2,062	2,062	2,062	2,062	2,062	
Replace Air Conditioner, Computer Room, Chilled Water, 20 T																116,827											
Maintain Air Conditioner, Computer Room, Chilled Water, 25 T	4,123	4,123	4,123	4,123	4,123	4,123	4,123	4,123	4,123	4,123	4,123	4,123	687	4,123	4,123	4,123	4,123	4,123	3,436	4,123	4,123	4,123	4,123	4,123	4,123	4,123	
Repair Air Conditioner, Computer Room, Chilled Water, 25 Ton						21,946																					
Replace Air Conditioner, Computer Room, Air Cooled, 20 Ton						240,295																					
Maintain Air Conditioner, Computer Room, Chilled Water, 10 T	2,661	2,661	2,661	2,661	2,661	2,661	2,661	2,661	2,661	2,661	2,661	2,661	1,330	2,661	2,661	2,661	2,661	2,661	1,330	2,661	2,661	2,661	2,661	2,661	2,661	2,661	
Maintain Circulation Pump, 50 HP, Chiller & Condenser Water	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137	137	
Maintain Condenser, Air-Cooled, 30 Ton	203	203	203	203	203	203	203	203	203	203	203	203	203	203	203	203	203	203			203	203	203	203	203	203	
Maintain Chiller, Centrifugal Hermetic, Bnd'd w/ Condenser, 90	2,835	2,835	2,835		2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	
Repair Chiller, Centrifugal Hermetic, Bnd'd w/ Condenser, 900																										289,597	
Replace Chiller, Centrifugal Hermetic, Bnd'd w/ Condenser, 90						777,597																					
Maintain Circulation Pump, 25 HP, Chiller & Condenser Water	171	171	171		171	171	171	171	171	171	171	171	171	171	171	171	171	171	171	171	171	171	171	171	171	171	
Replace 10' Section, Pipe & Fittings, 3/4" Copper																										26	
Inspect, Clean, & Verify Opening/Closing, Check Valve, 3-4"	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160			160	160	160	160	160	160	
Replace Circulation Pump, 25 HP, Chiller & Condenser Water						37,761																					
Replace Butterfly Valve, 6"																										10,518	
Repair Circulation Pump, 50 HP, Chiller & Condenser Water																531										531	
Replace Circulation Pump, 50 HP, Chiller & Condenser Water						48,461																					
Maintain Condenser, Air-Cooled, 5 Ton	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146	146			146	146	146	146	146	146	
Repair Condenser, Air-Cooled, 5 Ton																1,147											
Maintain Condenser, Air-Cooled, 25 Ton	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224	1,224			1,224	1,224	1,224	1,224	1,224	1,224	
Replace Condenser, Air-Cooled, 25 Ton																										132,804	

Tasks ordered by UNIFORMAT II Classifications. Unscheduled Maintenance Costs are not included.

All costs expressed in (\$) 2012.

Page 11, Year 26-50

Based on a 50-Year Forecast.

M&R Costs by Task

Whitestone Research

04-Dec-13

Building: Communications Facility

Facility: Marshall Space Flight Center

Building Num: 1045/62/179

City: Huntsville, AL

Forecast Year:	2013	4	5	6	7	2018	9	0	1	2	2023	4	5	6	7	2028	9	0	1	2	2033	4	5	6	7	
Repair Circulation Pump, 25 HP, Chiller & Condenser Water														796									796			
Re-tape Pipe Insulation, Fiberglass, Heating Water/Steam			301					922						1,081				1,081							938	
Replace Air Handler, Single Zone, 8,000 Cfm				105,084														105,084								
Repair Air Conditioner, Computer Room, Chilled Water, 20 Ton																									57,495	
Replace Pipe & Fittings, 3/4" Copper (20% of Pipe)			3,632																							519
Replace 10' Section, Pipe & Fittings, 1" Steel		102				37				10				102				37							10	
Install New Gasket & Bolts, Pipe & Fittings, 1" Steel			79					29																		7
Replace Pipe & Fittings, 1" Steel (20% of Pipe)																										
Replace Check Valve, 3-4"														14,807												
Install New Gasket & Bolts, Pipe & Fittings, 4" Steel			46																							
Repair Condenser, Air-Cooled, 25 Ton														17,894												
Replace Pipe Insulation, Fiberglass, Heating Water/Steam (20%			3,293					673																		599
Lubricate, Repack Gland, Butterfly Valve, 3"	399	399	399	399	399	399	399	399	399		399	399	399	399	399	399	399	399	399	399	399	399	399	399	399	399
Replace Butterfly Valve, 3"										2,502																
Lubricate, Repack Gland, Ball Valve, 4"	381	381	381	381	381	381	381	381	381	2,502	381	381	381	381	381		381	381	381	381	381	381	381	381	381	381
Lubricate, Repack Gland, Butterfly Valve, 6"	399	399	399	399	399	399	399	399	399	399	399	399		399	399	399	399	399	399	399	399	399	399	399	399	399
Replace Ball Valve, 4"																5,248										
Replace 10' Section, Pipe & Fittings, 4" Steel		109												109												
Maintain Air Handler, Multizone, 5,200 Cfm	570		570	570	570	570	570	570	570	570	570	570	570	570	570		570	570	570	570	570	570	570	570	570	570
Repair Condenser, Air-Cooled, 30 Ton														2,821												
Replace Pipe & Fittings, 2" Steel (20% of Pipe)																										
Replace Condenser, Air-Cooled, 5 Ton																									6,425	
Install New Gasket & Bolts, Pipe & Fittings, 3" Steel			21					25																		
Replace Pipe & Fittings, 3" Steel (20% of Pipe)																										
Replace 10' Section, Pipe & Fittings, 4" Steel		135								28				135												28
Install New Gasket & Bolts, Pipe & Fittings, 4" Steel			58																							11
Replace 10' Section, Pipe & Fittings, 2" Steel		179				51								179				51								
Replace Pipe Insulation, Fiberglass, Chilled Water (20% of Insul			2,256					408																		429
Install New Gasket & Bolts, Pipe & Fittings, 2" Steel			101					29																		
Repair Air Handler, Multizone, 5,200 Cfm											2,632															2,632
Replace Air Handler, Multizone, 5,200 Cfm		20,628													20,628											
Maintain Air Handler, Single Zone, 2,500 Cfm	1,478	1,478	1,478	493	1,478	1,478	1,478	1,478	1,478	1,478	1,478	985	1,478	1,478	1,478	1,478	1,478	493	1,478	1,478	1,478	1,478	1,478	1,478	1,478	985
Repair Air Handler, Single Zone, 2,500 Cfm								2,055						4,110												2,055
Replace Air Handler, Single Zone, 2,500 Cfm														11,570												11,570
Maintain Air Handler, Single Zone, 8,000 Cfm	2,616	2,616	2,616		2,616	2,616	2,616	2,616	2,616	2,616	2,616	2,616	2,616	2,616	2,616	2,616		2,616	2,616	2,616	2,616	2,616	2,616	2,616	2,616	
Repair Air Handler, Single Zone, 8,000 Cfm														8,562												
Re-tape Pipe Insulation, Fiberglass, Chilled Water			277					886						1,021				1,021								879

M&R Costs by Task

Building: Communications Facility

Facility: Marshall Space Flight Center

Building Num: 1045/62/179

City: Huntsville, AL

Forecast Year:	2013	4	5	6	7	2018	9	0	1	2	2023	4	5	6	7	2028	9	0	1	2	2033	4	5	6	7
Maintain Flow Control Valve & Actuator, 4"	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320
Replace Condenser, Air-Cooled, 30 Ton																					19,403				
Maintain Flow Control Valve & Actuator, 2"	214	214	214		214	214	214	214	214	214	214	214	214	214	214	214	214	214	214	214	214	214	214	214	214
Replace Valve Actuator, 2"	2,894																								
Replace 10' Section, Pipe & Fittings, 3" Steel		50				59								50				59							
Replace Flow Control Valve, Motorized, 2"				4,292																					
Install New Gasket & Bolts, Pipe & Fittings, 1" Steel			108																					18	
Replace Valve Actuator, 4"																						6,751			
Replace Flow Control Valve, Motorized, 4"																									12,104
Maintain Flow Control Valve & Actuator, 6"	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426
Replace Valve Actuator, 6"														23,141											
Replace Flow Control Valve, Motorized, 6"																					23,966				
Resolder Joint, Pipe & Fittings, 1" Copper								59					240					59					240		
Replace 10' Section, Pipe & Fittings, 1" Copper																		37					148		
Replace Pipe & Fittings, 1" Copper (20% of Pipe)			2,957																				740		
Replace 10' Section, Pipe & Fittings, 1" Steel		139								23				139									23		

D40 Fire Protection

Install New Gasket & Bolts, Pipe & Fittings, 3" Steel								57																	
Replace 10' Section, Pipe & Fittings, 2" Steel									166	90											166	90			
Replace 10' Section, Pipe & Fittings, 3" Steel									139													139			
Install New Gasket & Bolts, Pipe & Fittings, 2" Steel																								94	
Replace Pipe & Fittings, 1" Steel (20% of Pipe)																									1,662
Install New Gasket & Bolts, Pipe & Fittings, 1" Steel																									50
Replace 10' Section, Pipe & Fittings, 1" Steel								65	83												65	83			
Test Gages & Valves, Fire Sprinkler System	967	967	967	967	967	967	967	967	967	967	967	967	967	967	967	967	967	967	967	967	967	967	967	967	967
Replace Pipe & Fittings, 2" Steel (20% of Pipe)																									1,784
Replace Fire Sprinkler Head													7,474												13,189
Test Fire Sprinkler Head			9,470					4,030		3,022			6,044						4,030		3,022				3,425
Inspect Fire Sprinkler Head	331	331	331	331	331	331	331	331	331	331	331	331	262	331	331	331	331	331	331	331	331	331	331	210	331
Replace Fire Alarm Control Panel													8,228												
Repair Fire Alarm Control Panel			312						312												312				312
Inspect & Test Fire Alarm Control Panel	334	334	334	334	334	334	334	334	334	334	334	334		334	334	334	334	334	334	334	334	334	334	334	334
Replace Valves & Components, Sprinkler System																									35,194
Maintain Fire Sprinkler System	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049

D50 Electrical

Replace Occupancy Sensors, Indoor Lighting										32,994															32,994
--	--	--	--	--	--	--	--	--	--	--------	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--------

M&R Costs by Task

Building: Communications Facility

Facility: Marshall Space Flight Center

Building Num: 1045/62/179

City: Huntsville, AL

Forecast Year:	2038	9	0	1	2	2043	4	5	6	7	2048	9	0	1	2	2053	4	5	6	7	2058	9	0	1	2			
Maintain Flow Control Valve & Actuator, 4"	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320		
Replace Condenser, Air-Cooled, 30 Ton																				19,403								
Maintain Flow Control Valve & Actuator, 2"	214	214	214	214		214	214	214	214	214	214	214	214	214	214	214	214	214	214	214	214	214	214	214	214	214		
Replace Valve Actuator, 2"	2,894																											
Replace 10' Section, Pipe & Fittings, 3" Steel	50				59												50					59						50
Replace Flow Control Valve, Motorized, 2"				4,292																								
Install New Gasket & Bolts, Pipe & Fittings, 1" Steel				108																		18						
Replace Valve Actuator, 4"																						6,751						
Replace Flow Control Valve, Motorized, 4"																							23,966					
Maintain Flow Control Valve & Actuator, 6"	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426	426		426	426	426	426		
Replace Valve Actuator, 6"																		23,141										
Replace Flow Control Valve, Motorized, 6"																					23,966							
Resolder Joint, Pipe & Fittings, 1" Copper								59					240					59					240					
Replace 10' Section, Pipe & Fittings, 1" Copper																		37					148					
Replace Pipe & Fittings, 1" Copper (20% of Pipe)	2,957																								740			
Replace 10' Section, Pipe & Fittings, 1" Steel	139								23					139					23						139			

D40 Fire Protection

Install New Gasket & Bolts, Pipe & Fittings, 3" Steel									57																				
Replace 10' Section, Pipe & Fittings, 2" Steel							166					90							166					90					
Replace 10' Section, Pipe & Fittings, 3" Steel						139											139												
Install New Gasket & Bolts, Pipe & Fittings, 2" Steel																						50							
Replace Pipe & Fittings, 1" Steel (20% of Pipe)																						1,292							
Install New Gasket & Bolts, Pipe & Fittings, 1" Steel																						65							
Replace 10' Section, Pipe & Fittings, 1" Steel								65					83					65					83						
Test Gages & Valves, Fire Sprinkler System	967	967	967	967	967	967	967	967	967	967	967	967	967	967	967	967	967	967	967	967	967	967	967	967	967	967			
Replace Pipe & Fittings, 2" Steel (20% of Pipe)																						3,313							
Replace Fire Sprinkler Head	8,793																									6,595			
Test Fire Sprinkler Head				3,022					9,470					4,030					3,022					9,470					4,030
Inspect Fire Sprinkler Head	331	331	251	331	331	331	331	331	331	331	331	331	331	331	331	331	331	331	331	331	331	331	331	331	331	270			
Replace Fire Alarm Control Panel				8,228																		8,228							
Repair Fire Alarm Control Panel									312					312					312										
Inspect & Test Fire Alarm Control Panel	334	334		334	334	334	334	334	334	334	334	334	334	334	334	334	334		334	334	334	334	334	334	334	334			
Replace Valves & Components, Sprinkler System																35,194													
Maintain Fire Sprinkler System	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049				

D50 Electrical

Replace Occupancy Sensors, Indoor Lighting																								32,994
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--------

Building: Communications Facility

Facility: Marshall Space Flight Center

Building Num: 1045/62/179

City: Huntsville, AL

Table with columns: Forecast Year, 2013, 4, 5, 6, 7, 2018, 9, 0, 1, 2, 2023, 4, 5, 6, 7, 2028, 9, 0, 1, 2, 2033, 4, 5, 6, 7. Rows list various tasks like 'Replace Control Unit, Occupancy Sensors, Indoor Lighting' with associated cost values.

M&R Costs by Task

Building: Communications Facility

Facility: Marshall Space Flight Center

Building Num: 1045/62/179

City: Huntsville, AL

	Forecast Year: 2038						2043						2048						2053						2058					
	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2						
Replace Control Unit, Occupancy Sensors, Indoor Lighting						3,773					3,773									3,773				3,773						
Inspect & Maintain Occupancy Sensor, Indoor Lighting	1,118	1,118	1,118	1,118	1,118	1,118	1,118	1,118	1,118	1,118	1,118	1,118	1,118	1,118	1,118	1,118	1,118	1,118	1,118	1,118	1,118	1,118	1,118	1,118						
Replace Light Dimming Panel						1,405		1,405							1,405					1,405		1,405		1,405						
Replace Dimmer Switch, Light Dimming Panel	139		139		139					139	139		139			139		139		139				139						
Replace Receptacle, 120 V, 15 Amp.					13,960			27,920										27,919						13,960						
Replace Incandescent Lighting Fixture, Basic, 100 w															16,364															
Maintain Camera, Interior, Closed Circuit, Fixed Color	312	312	312	312	312	312	312	312		312	312	312	312	312	312	312	312		312	312	312	312	312	312						
Inspect & Maintain Light Dimming Panel	124	124	124	124	124	83	124	83	124	124	124	124	124	124	83	124	124	124	124	124	83	124	83	124						
Replace Receptacle, 208 V, 3 phase																				1,236										
Repair Wiring Device, Switch			6,431				2,143		4,286									6,431			2,143		4,286							
Replace Wiring Device, Switch							6,765							2,255	4,510						6,765									
Replace Lamp, Incandescent Lighting Fixture, Basic, 100 w					1,083									1,083					1,083					1,083						
Replace Camera, Exterior, Closed Circuit, PTZ Color									18,743										18,743											
Replace Fluorescent Lighting Fixture, T8, 4-32 w														113,248																
Replace Camera, Interior, Closed Circuit, Fixed Color								9,592										9,592												
Maintain Camera, Interior, Closed Circuit, PTZ Color	546	546	546	546	546	546	546	546		546	546	546	546	546	546	546	546		546	546	546	546	546	546						
Maintain Camera, Exterior, Closed Circuit, PTZ Color	235	235	235	235	235	235	235	235		235	235	235	235	235	235	235	235		235	235	235	235	235	235						
Replace Emergency Lighting Pack, 2 Light w/ Battery								4,122		32,978								10,993												
Maintain Switchboard, 800 Amp.	284	284	26	284	284	284	284	284	284	284	284	284	284	284	284	284	258	284	284	284	284	284	284	284						
Replace Switchboard, 1600 Amp.			76,023												76,023					76,023										
Replace Switchboard, 800 Amp.			302,513															30,251												
Inspect & Clean Variable Frequency Drive, <600 V	469	469	469	469	469	469	469	469	391	469	391	157	469	469	469	469	469	469	469	469	469	469	469	469						
Replace Coil, Variable Frequency Drive, <600V	182		182	727		182		182	727					182		182	727		182		182	727		182						
Replace Variable Frequency Drive, <600V								18,698		18,698	74,792																			
Replace Ballast & Lamps, Compact Fluorescent Lighting Fixture																					2,136									
Replace Compact Fluorescent Lighting Fixture, 32 w											2,409																			
Replace LED Lighting Fixture, 100 w															3,008															
Replace Lens, Replace Emergency Lighting Pack, 2 Light w/ B								339									127		1,020											
Replace HP Sodium Lighting Fixture, 250 w															4,086															
Replace Exit Lighting Fixture, LED														6,474																
Replace Ballast & Lamps, Fluorescent Lighting Fixture, T8, 2-3			8,499					850												25,358			8,499							
Replace Ballast & Lamps, Fluorescent Lighting Fixture, T8, 4-3																							70,830							
Replace Fluorescent Lighting Fixture, T8, 2-32 w										40,543			13,590				1,359													
Replace Fire Alarm Horn & Strobe																					5,675									
Replace Lamp, LED Lighting Fixture, 100 w			1,039						1,039										1,039					1,039						
Replace Camera, Interior, Closed Circuit, PTZ Color									27,971										27,971											
Replace Ballast & Lamp, HP Sodium Lighting Fixture, 250 w				1,442																				1,442						

M&R Costs by Task

Whitestone Research

04-Dec-13

Building: Communications Facility

Facility: Marshall Space Flight Center

Building Num: 1045/62/179

City: Huntsville, AL

	Forecast Year:																											
	2013	4	5	6	7	2018	9	0	1	2	2023	4	5	6	7	2028	9	0	1	2	2033	4	5	6	7			
Replace Lamp, Replace Emergency Lighting Pack, 2 Light w/ Ba	3,018		2,328			3,018		3,018			3,018			2,760		948			3,018		3,018			3,018		2,328		3,018
Replace UPS Battery, Wet						59,362		593,615								59,362			593,615								59,362	
Replace EPO Button								11,065											11,065									
Replace Battery Charger																												3,108
Annual PM, Clean and Maintain Wet Cell Battery	35,873	35,873	35,873	35,873	32,612	35,873	35,873	3,261	35,873	35,873	35,873	35,873	35,873	35,873	32,612	35,873	35,873	3,261	35,873	35,873	35,873	35,873	35,873	35,873	35,873	32,612		
Annual PM, EMI/RF Filter	39	39	39	19	39	39	39	19	39	39	39	39	39	19	39	39	19	39	39	39	39	39	39	39	19	39		
Annual PM, Inverter	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853		1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853		
Annual PM, Power Supply/Conditioner	6,254	6,254	6,254	6,254	6,254	6,254	6,254	6,254	6,254	6,254	6,254	6,254	6,254	6,254	6,254	6,254	6,254	6,254	6,254	6,254	6,254	6,254	6,254	6,254	6,254	6,254		
Replace EMI/RF Filter				1,714				1,714						1,714				1,714								1,714		
Replace Smoke Detector, Duct																											7,195	
Replace Power Supply/Conditioner																											375,487	
Replace Smoke Detector								200																			200	
Electrical Testing, Generator, Diesel, 2,000 kw	937	937	937	937	937	937	937	937	937	937	937	937	937	937	937	937	937	937	937	937	937	937	937	937	937	937		
Replace Generator, Diesel, 2,000 kw																											837,098	
Maintain & Repair General Wiring, Lightning Protection System	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40		
Replace Lightning Protection General Wiring																											4,658	
Replace Uninterruptible Power Supply Battery, 450 kVA								406																			406	
Maintain Uninterruptible Power Supply, 450 kVA	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39		
Replace TVSS Panel																												
Maintain Switchboard, 1600 Amp.	153	153	153	153	153	153	153	102	153	153	153	153	153	102	153	153	153	153	153	153	153	153	153	153	153	153		
Replace Inverter																											8,386	
Replace Access Keypad					1,346																						1,346	
Replace Card Reader					24,939				2,375																		24,939	
Maintain EPO Button	258	258	258	258	258	258	258		258	258	258	258	258	258	258	258	258		258	258	258	258	258	258	258	258		
Replace Electric Lock					8,568																						8,568	
Check Operation, Heat Detector	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102		
Repair Heat Detector								226																			226	
Replace Heat Detector																											687	
Maintain Intrusion Detection Motion Detector, Interior	898	898	898	79	898	898	898	820	898	898	898	898	898	79	898	898	898	820	898	898	898	898	898	898	79	898		
Repair Battery Charger					609			609																			609	
Maintain Keypad	156	156	156		156	156	156	156	156	156	156	156	156		156	156	156	156	156	156	156	156	156	156	156	156		
Maintain Card Reader	1,795	1,795	1,795	156	1,795	1,795	1,795	1,639	1,795	1,795	1,795	1,795	1,795	1,795	156	1,795	1,795	1,795	1,639	1,795	1,795	1,795	1,795	1,795	156	1,795		
Check & Repair Manual Pull Station								1,541																			1,541	
Replace Manual Pull Station																											3,562	
Maintain Public Address Speaker	2,887	2,887	2,887	2,887	2,887	2,887	2,887	2,887	2,887	2,783	2,887	2,887	104	2,887	2,887	2,887	2,887	2,887	2,887	2,887	2,887	2,887	2,887	2,887	2,887	2,783		
Replace Public Address Speaker													1,496														1,496	
Replace Batteries & Check Operation, Smoke Detector	4,831	4,831	4,831	4,831	4,831	4,831	4,831	4,807	4,831	4,831	4,831	4,831	25	4,831	4,831	4,831	4,831	4,831	4,831	4,831	4,831	4,831	4,831	4,807	4,831	4,831		

M&R Costs by Task

Whitestone Research

04-Dec-13

Building: Communications Facility

Facility: Marshall Space Flight Center

Building Num: 1045/62/179

City: Huntsville, AL

	Forecast Year:																								
	2038	9	0	1	2	2043	4	5	6	7	2048	9	0	1	2	2053	4	5	6	7	2058	9	0	1	2
Replace Lamp, Replace Emergency Lighting Pack, 2 Light w/	3,018		3,018			3,018		2,760		948		3,018		3,018		3,018		2,328		3,018		3,018		3,018	
Replace UPS Battery, Wet		593,615								59,362		593,615								59,362		593,615			
Replace EPO Button		11,065										11,065										11,065			
Replace Battery Charger												3,108													
Annual PM, Clean and Maintain Wet Cell Battery	35,873	35,873	3,261	35,873	35,873	35,873	35,873	35,873	35,873	32,612	35,873	35,873	3,261	35,873	35,873	35,873	35,873	35,873	35,873	32,612	35,873	35,873	3,261	35,873	35,873
Annual PM, EMI/RF Filter	39	39	19	39	39	39	39	39	19	39	39	39	19	39	39	39	39	39	19	39	39	39	19	39	39
Annual PM, Inverter	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853		1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853
Annual PM, Power Supply/Conditioner	6,254	6,254		6,254	6,254	6,254	6,254	6,254	6,254	6,254	6,254	6,254	6,254	6,254	6,254	6,254	6,254		6,254	6,254	6,254	6,254	6,254	6,254	6,254
Replace EMI/RF Filter			1,714						1,714				1,714							1,714				1,714	
Replace Smoke Detector, Duct			7,195																7,195						
Replace Power Supply/Conditioner			375,487																375,487						
Replace Smoke Detector			39,309										200						39,309						
Electrical Testing, Generator, Diesel, 2,000 kw	937	937	937	937	937	937	937	937	937	937	937	937	937	937	937	937	937	937	937	937	937	937			937
Replace Generator, Diesel, 2,000 kw																								837,098	
Maintain & Repair General Wiring, Lightning Protection System	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
Replace Lightning Protection General Wiring																								4,658	
Replace Uninterruptible Power Supply Battery, 450 kVA																			406						
Maintain Uninterruptible Power Supply, 450 kVA	39	39		39	39	39	39	39	39	39	39	39	39	39	39	39	39		39	39	39	39	39	39	39
Replace TVSS Panel			1,750																						
Maintain Switchboard, 1600 Amp.	153	153	102	153	153	153	153	153	153	153	153	153	102	153	153	153	153	153	102	153	153	153	153	153	153
Replace Inverter																			8,386						
Replace Access Keypad									1,346										1,346						
Replace Card Reader			2,375						24,939				2,375						24,939						2,375
Maintain EPO Button	258	258		258	258	258	258	258	258	258	258	258		258	258	258	258	258	258	258	258	258	258	258	258
Replace Electric Lock									8,568										8,568						
Check Operation, Heat Detector	102	102		102	102	102	102	102	102	102	102	102	102	102	102	102	102		102	102	102	102	102	102	102
Repair Heat Detector																			226						
Replace Heat Detector			687																687						
Maintain Intrusion Detection Motion Detector, Interior	898	898	820	898	898	898	898	898	79	898	898	898	820	898	898	898	898	898	79	898	898	898	820	898	898
Repair Battery Charger	609		609		609		609		609		609			609		609		609		609		609		609	
Maintain Keypad	156	156	156	156	156	156	156	156		156	156	156	156	156	156	156	156		156	156	156	156	156	156	156
Maintain Card Reader	1,795	1,795	1,639	1,795	1,795	1,795	1,795	1,795	156	1,795	1,795	1,795	1,639	1,795	1,795	1,795	1,795	1,795	156	1,795	1,795	1,795	1,639	1,795	1,795
Check & Repair Manual Pull Station																			1,541						
Replace Manual Pull Station			3,562																3,562						
Maintain Public Address Speaker	2,887	2,887	104	2,887	2,887	2,887	2,887	2,887	2,887	2,887	2,887	2,887	2,887	2,887	2,783	2,887	2,887	104	2,887	2,887	2,887	2,887	2,887	2,887	2,887
Replace Public Address Speaker			40,394												1,496			40,394							
Replace Batteries & Check Operation, Smoke Detector	4,831	4,831	25	4,831	4,831	4,831	4,831	4,831	4,831	4,831	4,831	4,831	4,807	4,831	4,831	4,831	4,831	25	4,831	4,831	4,831	4,831	4,831	4,831	4,831

M&R Costs by Task

Whitestone Research

04-Dec-13

Building: Communications Facility

Facility: Marshall Space Flight Center

Building Num: 1045/62/179

City: Huntsville, AL

	Forecast Year:																								
	2013	4	5	6	7	2018	9	0	1	2	2023	4	5	6	7	2028	9	0	1	2	2033	4	5	6	7
Replace Batteries & Check Operation, Smoke Detector, Duct	269	269	269	269	269	269	269	269	269	269	269	269	269	269	269	269	269	269	269	269	269	269	269	269	269
Repair Smoke Detector								10,597										54						10,597	
Repair Smoke Detector, Duct								595																595	
Replace Intrusion Detection Motion Detector, Interior				17,511				1,667						17,511				1,667						17,511	
Replace Disconnect Switch, 600 Amp.																									
Replace Disconnect Switch, 100 Amp.																									
Maintain Disconnect Switch, 200 Amp.	291	291	291	291	291	291	291	291	291	291	291	291	291	291	291	291	291	291	291	291	291	291	291	291	291
Repair Disconnect Switch, 200 Amp.			795										795										795		
Replace Disconnect Switch, 200 Amp.																									
Maintain Disconnect Switch, 400 Amp.	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218
Repair Disconnect Switch, 400 Amp.			900										900										900		
Replace Disconnect Switch, 400 Amp.																									
Repair Circuit Breaker, 600 V, 70-100 Amp., 3 Ph.										563										563					
Repair Disconnect Switch, 600 Amp.				599					299					599					299					599	
Replace Disconnect Switch, 60 Amp.																									
Maintain Motor Control Center w/ Main Breaker, 480 V, 1200 Am	117	117	117	117	117	117	117	117	117		117	117	117	117	117	117	117	117	117	117	117	117	117	117	117
Repair Motor Control Center w/ Main Breaker, 480 V, 1200 Amp.																					1,265				
Replace Motor Control Center w/ Main Breaker, 480 V, 1200 Am										31,733															
Inspect & Clean Motor Starter, <5HP, <600V	262	471	575	575	575	575	575	575	575	575	575	575	575	575	418	575	575	262	471	575	575	575	575	575	
Replace Coil, Motor Starter, <5HP, <600V	770			2,312	513		2,312	513		2,312	513		2,312	513	1,541	513		770			2,312	513		2,312	
Replace Motor Starter, <5HP, <600V	4,361	1,453													2,180			4,361	1,453						
Inspect & Clean Motor Starter, 5-20 HP, <600 V	52	210	210	210	210	210	210	210	210	210	210	210	210	210	157	210	210	52	210	210	210	210	210	210	
Maintain Disconnect Switch, 600 Amp.	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218	218
Maintain Circuit Breaker, Main, 600 V, 3,000-4,000 Amp.	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145
Replace Uninterruptible Power Supply Motor Generator, 450 kV														72,427											
Maintain Circuit Breaker, 600 V, 70-100 Amp., 3 Ph.	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32
Replace Circuit Breaker, 600 V, 70-100 Amp., 3 Ph.																									
Maintain Circuit Breaker, Main, 208 Y, 120 V, 600 Amp.	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32
Repair Circuit Breaker, Main, 208 Y, 120 V, 600 Amp.										882										882					
Replace Circuit Breaker, Main, 208 Y, 120 V, 600 Amp.																									
Maintain Circuit Breaker, 600 V, 125-400 Amp., 3 Ph.	156	156	156	156	156	156	156	156	156	156	156	156	156	156	156	156	156	156	156	156	156	156	156	156	156
Repair Disconnect Switch, 100 Amp.			386					193	386	193			386					193	386	193			386		
Replace Circuit Breaker, 600 V, 125-400 Amp., 3 Ph.																									
Maintain Disconnect Switch, 100 Amp.	436	436	436	436	436	436	436	436	436	436	436	436	436	436	436	436	436	436	436	436	436	436	436	436	436
Repair Circuit Breaker, Main, 600 V, 3,000-4,000 Amp.								1,764										1,764							
Replace Circuit Breaker, Main, 600 V, 3,000-4,000 Amp.																									
Maintain Disconnect Switch, 30 Amp.	386	386	386	386	386	386	386	386	386	386	386	386	386	386	386	386	386	386	386	386	386	386	386	386	386

M&R Costs by Task

Building: Communications Facility

Facility: Marshall Space Flight Center

Building Num: 1045/62/179

City: Huntsville, AL

Forecast Year:	2013	4	5	6	7	2018	9	0	1	2	2023	4	5	6	7	2028	9	0	1	2	2033	4	5	6	7
Repair Disconnect Switch, 30 Amp.			490	490				978		490			490	490				978		490			490	490	
Replace Disconnect Switch, 30 Amp.																									
Maintain Disconnect Switch, 60 Amp.	257	257	257	257	257	257	257	257	257	257	257	257	257	257	257	257	257	257	257	257	257	257	257	257	257
Repair Disconnect Switch, 60 Amp.			838	167				335		335			838	167				335		335			838	167	
Maintain Power Panel Board, 208 Y/120 V, 100 Amp.	2,189	2,189	2,189	2,189	2,189	2,189	2,189	1,252	2,189	1,877	2,189	2,189	2,031	2,189	2,189	2,189	2,189	2,189	2,189	2,110	1,954	2,189	1,954	2,189	2,189
Repair Circuit Breaker, 600 V, 125-400 Amp., 3 Ph.			1,689					1,126					1,689					1,126					1,689		
Replace Secondary Transformer, Dry, 45 kVA								14,115																	
Replace Coil, Motor Starter, 5-20 HP, <600 V	257			1,028			1,028			1,028				1,028		771				257			1,028		1,028
Maintain Power Panel Board, 480 V, 4,000 Amp.	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391
Repair Power Panel Board, 480 V, 4,000 Amp.								4,623										4,623							
Replace Power Panel Board, 480 V, 4,000 Amp.																									
Maintain Secondary Transformer, Dry, 30 kVA	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79
Repair Secondary Transformer, Dry, 30 kVA								362										362							
Replace Secondary Transformer, Dry, 30 kVA																									
Repair Power Panel Board, 480 V, 400 Amp.			174	174																			174	174	
Repair Secondary Transformer, Dry, 45 kVA								723													1,446				
Maintain Power Panel Board, 480 V, 400 Amp.	313	313	313	313	313	313	313	313	313	313	313	313	235	235	313	313	313	313	313	313	313	313	313	313	313
Maintain Secondary Transformer, Dry, 75 kVA	624	624	624	624	624	624	624	624	624	624	624	624	312	624	624	624	624	624	624	624	624	624	624	624	624
Repair Secondary Transformer, Dry, 75 kVA			1,448					1,448										1,448					1,448		
Replace Secondary Transformer, Dry, 75 kVA													34,586												
Maintain Secondary Transformer, Dry, 500 kVA	235	235	235	235	235	235	235	156	235	235	235	235	235	79	235	235	235	235	235	235	235	235	235	235	235
Repair Secondary Transformer, Dry, 500 kVA				1,036																				1,036	
Replace Secondary Transformer, Dry, 500 kVA								39,897						79,793											
Maintain Secondary Transformer, Dry, 750 kVA	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312
Repair Secondary Transformer, Dry, 750 kVA								2,002													2,002				
Maintain Secondary Transformer, Dry, 45 kVA	312	312	312	312	312	312	312	156	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312
Maintain Power Panel Board, 208 Y/120 V, 400 Amp.	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392
Replace Secondary Transformer, Dry, 750 kVA																									
Repair Power Panel Board, 208 Y/120 V, 100 Amp.	375		627					377		126	375		375					1,880			501			251	
Replace Power Panel Board, 208 Y/120 V, 100 Amp.								63,929		21,310			10,654								5,327	15,982		15,982	
Maintain Power Panel Board, 208 Y/120 V, 200 Amp.	469	469	469	469	469	469	469	469	469	391	469	469	391	469	469	469	469	469	469	469	469	469	469	469	469
Repair Power Panel Board, 208 Y/120 V, 200 Amp.			126					502													502		126		
Replace Power Panel Board, 208 Y/120 V, 200 Amp.										7,667			7,667												
Maintain Power Panel Board, 208 Y/120 V, 225 Amp.	2,267	2,267	2,267	2,267	2,267	2,267	2,189	2,189	2,267	784	2,267	2,267	2,267	2,267	2,267	2,033	2,267	2,267	2,267	2,267	2,189	2,267	2,267	2,267	2,267
Replace Power Panel Board, 480 V, 400 Amp.													12,176	12,176											
Replace Power Panel Board, 208 Y/120 V, 225 Amp.							8,159	8,159		155,000						24,474					8,159				
Replace Motor Starter, 5-20 HP, <600 V	2,782																								

M&R Costs by Task

Whitestone Research

04-Dec-13

Building: Communications Facility

Facility: Marshall Space Flight Center

Building Num: 1045/62/179

City: Huntsville, AL

Forecast Year:	2038	9	0	1	2	2043	4	5	6	7	2048	9	0	1	2	2053	4	5	6	7	2058	9	0	1	2
Repair Disconnect Switch, 30 Amp.			978		490								978		490				490	490					
Replace Disconnect Switch, 30 Amp.								1,336	1,336													2,672		1,336	
Maintain Disconnect Switch, 60 Amp.	257	257	257	257	257	257	257	128	230	257	257	257	257	257	257	257	257	257	257	257	257	206	257	206	
Repair Disconnect Switch, 60 Amp.			335		335								335		335				838	167					
Maintain Power Panel Board, 208 Y/120 V, 100 Amp.	2,189	2,189	1,954	2,189	2,189	2,189	2,189	2,189	2,189	2,189	2,189	2,189	1,252	2,189	1,877	2,189	2,189	2,031	2,189	2,189	2,189	2,189	2,189	2,189	2,110
Repair Circuit Breaker, 600 V, 125-400 Amp., 3 Ph.			1,126										1,126					1,689							
Replace Secondary Transformer, Dry, 45 kVA			14,115										14,115												
Replace Coil, Motor Starter, 5-20 HP, <600 V			1,028		1,028			771		257		1,028				1,028		1,028		1,028			1,028		1,028
Maintain Power Panel Board, 480 V, 4,000 Amp.	391	391		391	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391
Repair Power Panel Board, 480 V, 4,000 Amp.													4,623									4,623			
Replace Power Panel Board, 480 V, 4,000 Amp.			225,662																						
Maintain Secondary Transformer, Dry, 30 kVA	79	79		79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79	79
Repair Secondary Transformer, Dry, 30 kVA																				362			362		
Replace Secondary Transformer, Dry, 30 kVA			6,089																						
Repair Power Panel Board, 480 V, 400 Amp.								174	174							348								348	
Repair Secondary Transformer, Dry, 45 kVA			723													723								1,446	
Maintain Power Panel Board, 480 V, 400 Amp.	313	313	157	313	313	313	313	313	313	313	313	313	313	313	313	313	313	235	235	313	313	313	313	313	313
Maintain Secondary Transformer, Dry, 75 kVA	624	624	312	624	624	624	624	624	624	624	624	624	624	624	624	624	624	312	624	624	624	624	624	624	624
Repair Secondary Transformer, Dry, 75 kVA								1,448								1,448								1,448	
Replace Secondary Transformer, Dry, 75 kVA			34,586																34,586						
Maintain Secondary Transformer, Dry, 500 kVA	235	235	235	235	235	235	235	235	235	235	235	235	156	235	235	235	235	235	79	235	235	235	235	235	235
Repair Secondary Transformer, Dry, 500 kVA			518					1,036															518		
Replace Secondary Transformer, Dry, 500 kVA													39,897							79,793					
Maintain Secondary Transformer, Dry, 750 kVA	312	312		312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312
Repair Secondary Transformer, Dry, 750 kVA																							2,002		2,002
Maintain Secondary Transformer, Dry, 45 kVA	312	312	156	312	312	312	312	312	312	312	312	156	312	312	312	312	312	312	312	312	312	312	312	312	312
Maintain Power Panel Board, 208 Y/120 V, 400 Amp.	392	392	235	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392	392
Replace Secondary Transformer, Dry, 750 kVA			94,317																						
Repair Power Panel Board, 208 Y/120 V, 100 Amp.			1,503		627	375		627								377	126	375		375			1,880		501
Replace Power Panel Board, 208 Y/120 V, 100 Amp.			15,982										63,929		21,310				10,654						5,327
Maintain Power Panel Board, 208 Y/120 V, 200 Amp.	469	469	157	469	469	469	469	469	469	469	469	469	469	469	391	469	469	391	469	469	469	469	469	469	469
Repair Power Panel Board, 208 Y/120 V, 200 Amp.						126		126								502							502		126
Replace Power Panel Board, 208 Y/120 V, 200 Amp.			30,669																	7,667					7,667
Maintain Power Panel Board, 208 Y/120 V, 225 Amp.	2,267	2,267	1,954	2,267	2,267	2,267	2,267	2,267	2,267	2,267	2,267	2,189	2,189	2,267	784	2,267	2,267	2,267	2,267	2,267	2,267	2,033	2,267	2,267	2,189
Replace Power Panel Board, 480 V, 400 Amp.			24,353																	12,176	12,176				
Replace Power Panel Board, 208 Y/120 V, 225 Amp.			32,633											8,159	8,159	155,000							24,474		8,159
Replace Motor Starter, 5-20 HP, <600 V									927							2,782									

M&R Costs by Task

Whitestone Research

04-Dec-13

Building: Communications Facility

Facility: Marshall Space Flight Center

Building Num: 1045/62/179

City: Huntsville, AL

Forecast Year:	2013	4	5	6	7	2018	9	0	1	2	2023	4	5	6	7	2028	9	0	1	2	2033	4	5	6	7	
Repair Power Panel Board, 208 Y/120 V, 400 Amp.			375					251					375					251								
Replace Power Panel Board, 208 Y/120 V, 400 Amp.																								29,101		
Maintain Power Panel Board, 480 V, 100 Amp.	157	157	157	157	157	157	157	157	157	157	157	157	79	157	157	157	157	157	157	157	157	157	79	157	157	157
Repair Power Panel Board, 480 V, 100 Amp.		126	126										126												126	
Replace Power Panel Board, 480 V, 100 Amp.													7,515											7,515		
Maintain Power Panel Board, 480 V, 200 Amp.	235	235	235	235	235	235	235	156	235	235	235	235	235	235	235	235	235	235	235	235	235	235	235	235	235	
Repair Power Panel Board, 480 V, 200 Amp.								251																	377	
Replace Power Panel Board, 480 V, 200 Amp.								10,427																		
Repair Power Panel Board, 208 Y/120 V, 225 Amp.							375	501		126							126	627		2,379						

M&R Costs by Task

Whitestone Research

04-Dec-13

Building: Communications Facility

Facility: Marshall Space Flight Center

Building Num: 1045/62/179

City: Huntsville, AL

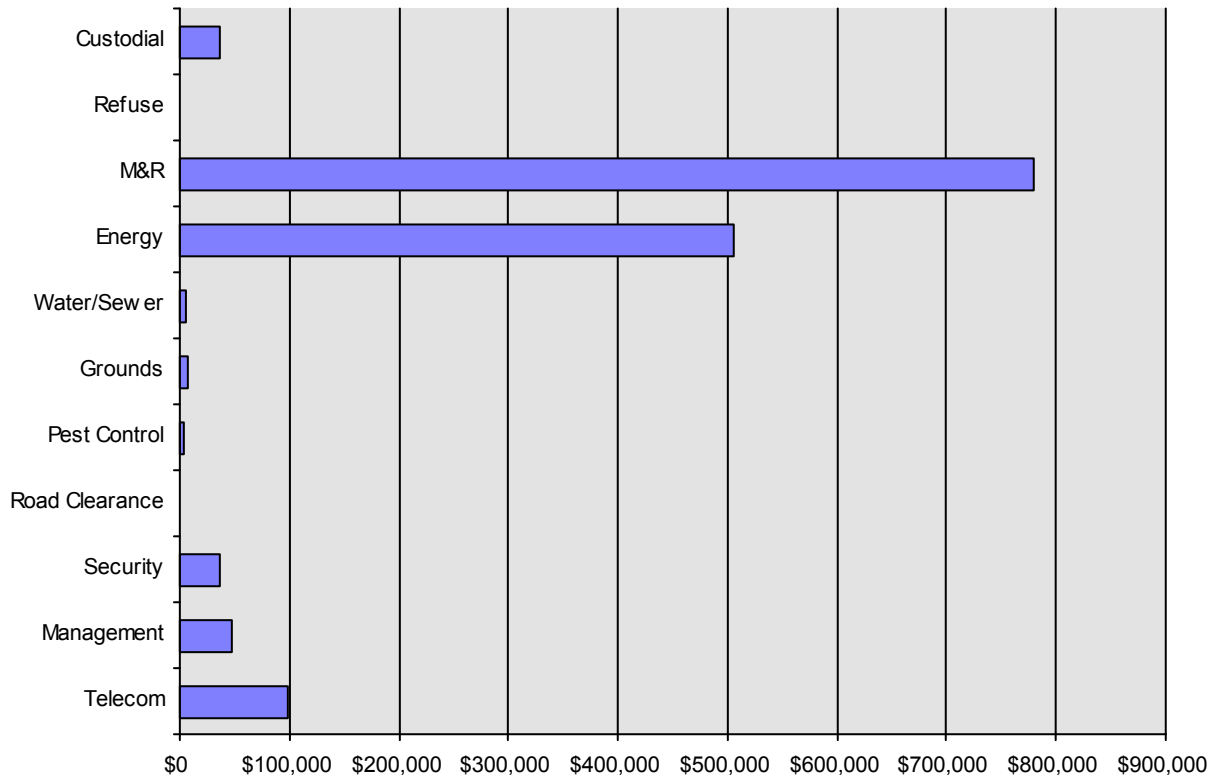
Forecast Year:	2038	9	0	1	2	2043	4	5	6	7	2048	9	0	1	2	2053	4	5	6	7	2058	9	0	1	2
Repair Power Panel Board, 208 Y/120 V, 400 Amp.								375					251					375						251	
Replace Power Panel Board, 208 Y/120 V, 400 Amp.								19,400																	
Maintain Power Panel Board, 480 V, 100 Amp.	157	157	157	157	157	157	157	157	157	157	157	157	157	157	157	157	157	79	157	157	157	157	157	157	157
Repair Power Panel Board, 480 V, 100 Amp.								126	126									126							
Replace Power Panel Board, 480 V, 100 Amp.																			7,515						
Maintain Power Panel Board, 480 V, 200 Amp.	235	235	79	235	235	235	235	235	235	235	235	235	156	235	235	235	235	235	235	235	235	235	235	235	235
Repair Power Panel Board, 480 V, 200 Amp.																									377
Replace Power Panel Board, 480 V, 200 Amp.																									10,427
Repair Power Panel Board, 208 Y/120 V, 225 Amp.	375	126	126			2,505							375	501		126							126	627	2,379

Operation Costs Summary

Whitestone Research

Building: Communications Facility **GSFT:** 61,648
Building Number: 1045/62/179 **Replacement Value:** \$18,633,603
Facility: Marshall Space Flight Center **Building Use:** Office
City: Huntsville, AL **Building Type:** Communications Building
Built Date: 1962

Operation	Annual Cost/GSFT	Annual Total	Percent
Custodial	\$0.584	\$35,987	2.4%
Energy	\$8.197	\$505,332	33.2%
Grounds	\$0.125	\$7,730	0.5%
M&R	\$12.649	\$779,810	51.2%
Management	\$0.756	\$46,584	3.1%
Pest Control	\$0.067	\$4,125	0.3%
Refuse	\$0.033	\$2,046	0.1%
Road Clearance	\$0.002	\$141	0.0%
Security	\$0.587	\$36,204	2.4%
Telecom	\$1.592	\$98,143	6.4%
Water/Sewer	\$0.095	\$5,859	0.4%
Building Total	\$24.69	\$1,521,962	100.0%



Building Operations Task Details

Whitestone Research

Building: Communications Facility

Year Built: 1962

Building Type: Communications Building

Facility: Marshall Space Flight Center

Original Cost: \$1

Building Num: 1045/62/179

City: Huntsville, AL

Replacement Value: \$18,633,603 **per SF:** \$302

Building Gsft: 61,648

Functional Area	FA GSFT	Task	Labor Cost	Material Cost	Task Cost
Operation: Custodial		Level of Service: Low			
Computer Room	25892	Damp Wipe Surfaces with Trigger Sprayer & Cloth	\$3,818	\$620	\$4,439
Computer Room	25892	Wet Mop & Rinse Hard Floor with 32 oz. Mop Using Double Bucket & Wringer	\$2,983	\$485	\$3,468
Computer Room	25892	Sweep Hard Floor with 36" Push Broom	\$2,183	\$355	\$2,538
Computer Room	25892	Empty Trash; Wipe Clean & Re-line Basket	\$1,293	\$210	\$1,503
Office	15412	Vacuum Carpet with 14" Upright Vacuum	\$5,386	\$875	\$6,261
Office	15412	Empty Trash; Wipe Clean & Re-line Basket	\$1,539	\$250	\$1,789
Office	15412	Clean and Wipe Furniture with Trigger Sprayer & Cloth	\$945	\$153	\$1,098
Office	15412	Dust Surfaces with Duster	\$710	\$115	\$826
Office	15412	Vacuum Upholstered Furniture with Tank or Canister Vacuum	\$591	\$96	\$687
Office	15412	Dust Window Blinds	\$341	\$55	\$396
Conference Room	12329	Vacuum Carpet with 14" Upright Vacuum	\$4,308	\$700	\$5,009
Conference Room	12329	Clean and Wipe Furniture with Trigger Sprayer & Cloth	\$1,637	\$266	\$1,903
Conference Room	12329	Empty Trash; Wipe Clean & Re-line Basket	\$615	\$100	\$716
Mechanical/Equipment R	3698	Sweep Hard Floor with 48" Push Broom	\$66	\$11	\$77
Mechanical/Equipment R	3698	Empty Trash; Wipe Clean & Re-line Basket	\$43	\$7	\$50
Common/Circulation Are	3082	Vacuum Carpet with 14" Upright Vacuum	\$2,154	\$350	\$2,504
Common/Circulation Are	3082	Empty Trash; Wipe Clean & Re-line Basket	\$308	\$50	\$358
Common/Circulation Are	3082	Vacuum Upholstered Furniture with Tank or Canister Vacuum	\$236	\$38	\$275
Restroom	616	Service Restroom: Empty Trash, Clean & Disinfect Fixtures, Wipe Mirrors, Replace Supplies, Wet M	\$1,292	\$210	\$1,501
Restroom	616	Service Restroom: Empty Trash, Replace Supplies & Touch Up as Needed	\$198	\$32	\$230
Break Room	616	Empty, Clean and Disinfect Refrigerator	\$118	\$19	\$137
Break Room	616	Damp Wipe Interior and Exterior Cupboard	\$76	\$12	\$88
Break Room	616	Scrub and Damp Wipe Sinks	\$38	\$6	\$44
Break Room	616	Wet Mop & Rinse Hard Floor with 32 oz. Mop Using Double Bucket & Wringer	\$35	\$6	\$41
Break Room	616	Clean and Polish Metal Surfaces with Trigger Sprayer & Cloth	\$28	\$5	\$33
Break Room	616	Empty Trash; Wipe Clean & Re-line Basket	\$14	\$2	\$16
Total:			\$30,957	\$5,030	\$35,987

All costs expressed in (\$) 2012.

04-Dec-13

Page 1

Functional Area	FA GSFT	Task	Labor Cost	Material Cost	Task Cost
Operation: Grounds		Level of Service: Low			
Grounds, Improved	36988	Mow Turfgrass with 21" Power Mower	\$1,366	\$568	\$1,934
Grounds, Improved	36988	Aerate Improved Grounds	\$1,060	\$441	\$1,501
Grounds, Improved	36988	Clear Shrubs	\$885	\$368	\$1,253
Grounds, Improved	36988	Edge Clean & Trim Walks with Gas Powered Edger	\$567	\$236	\$803
Grounds, Improved	36988	Overseed, Improved Grounds	\$530	\$220	\$750
Grounds, Improved	36988	Vacuum with 30" Billy Goat	\$354	\$147	\$501
Grounds, Improved	36988	Clear Crabgrass	\$265	\$110	\$375
Grounds, Improved	36988	Clear Weeds with 15" Boom, Improved Grounds	\$141	\$59	\$200
Grounds, Improved	36988	Trim Around Raised Objects with String Edger	\$116	\$48	\$164
Grounds, Improved	36988	Fertilize Improved Grounds	\$106	\$44	\$150
Grounds, Improved	36988	Sweep with 30" Power Rake	\$70	\$29	\$99
Grounds, Improved	36988	Fertilize Using Power Take Off Broadcast	\$0	\$0	\$0
Total:			\$5,459	\$2,271	\$7,730
Operation: Pest Control		Level of Service: Medium			
Pest Controlled	61648	Install, or Check and Re-Bait 5 Rodent Boxes	\$1,424	\$593	\$2,017
Pest Controlled	61648	Perform Crawling Insect Abatement	\$1,069	\$445	\$1,514
Pest Controlled	61648	Inspect Building for Pests	\$595	\$0	\$595
Total:			\$3,088	\$1,037	\$4,125
Operation: Road Clearance		Level of Service: Medium			
Pavement NASA	49318	Plow Paved Area	\$108	\$33	\$141
Total:			\$108	\$33	\$141
Operation: Security		Level of Service: Medium			
Secured Area	61648	Patrol Building Perimeter	\$11,718	\$1,904	\$13,622
Secured Area	61648	Guard Lobby/Parking	\$0	\$0	\$0
Total:			\$11,718	\$1,904	\$13,622

Building Operations Utility Details

Whitestone Research

Building: Communications Facility

Year Built: 1962

Building Type: Communications Building

Facility: Marshall Space Flight Center

Original Cost: \$1

Building Num: 1045/62/179

City: Huntsville, AL

Replacement Value: \$18,633,603 **per SF:** \$302

Building Gsft: 61,648

	Utility	GSFT	Demand	UM	Rate	Cost
Operation:	Energy	Level of Service: High				
	Electricity	61648	95.015	kWh	\$0.0833	\$487,929
	Natural Gas	61648	0.357	Thm	\$0.7900	\$17,403
	Diesel	61648	0.000	Gal	\$3.2100	\$0
	Total:		95.372			\$505,332
Operation:	Refuse	Level of Service: Medium				
	Municipal Solid Waste	61648	0.370	Lbs	\$0.0717	\$1,635
	Recycling	61648	0.180	Lbs	\$0.0370	\$411
	Total:		0.550			\$2,046
Operation:	Water/Sewer	Level of Service: Medium				
	Sewer	61648	19.800	Gal	\$0.0034	\$4,150
	Water	61648	25.200	Gal	\$0.0011	\$1,709
	Total:		45.000			\$5,859

Building Operations Management Details

Whitestone Research

Building: Communications Facility

Year Built: 1962

Building Type: Communications Building

Facility: Marshall Space Flight Center

Original Cost: \$1

Building Num: 1045/62/179

City: Huntsville, AL

Replacement Value: \$18,633,603 **per SF:** \$302

Building Gsft: 61,648

	Service	Demand	UM	PRV	Cost
Operation: Management	Level of Service: Low				
	Management	0.3%	PRV	\$18,633,603	\$46,584
	Total:				\$46,584

Building Operations Service Details

Whitestone Research

Building: Communications Facility **Year Built:** 1962 **FTEs:** 109 **Building Type:** Communications Building
Facility: Marshall Space Flight Center **Original Cost:** \$1 **Building Num:** 1045/62/179
City: Huntsville, AL **Replacement Value:** \$18,633,603 **per SF:** \$302 **Building Gsft:** 61,648

		Service*	Quantity	Rate	Cost
Operation:	Security	Level of Service: Medium			
		Intrusion Detection Systems	2	\$4,986	\$9,972
		System Monitoring	2	\$3,615	\$7,230
		Access Control	2	\$2,690	\$5,380
		Total:			\$22,582
Operation:	Telecom	Level of Service: High			
		Local Telephone	109	\$468	\$51,012
		Data	109	\$3,588	\$26,203
		Long Distance Telephone	109	\$192	\$20,928
		Total:			\$98,143