

## The Final Frontier in **Facilities Management**

When running the campus where America's space program was pioneered, a facilities contractor must be on the cutting edge of its own industry to produce top results and operate under intense pressures. Through its close working relationship with JPL and its utilization of new

technology, energy management, Reliability Centered Maintenance (RCM), condition-based maintenance, and root cause analysis, EMCOR Government Services is helping propel better solutions at the campus.

### Introduction

The value EMCOR Government Services (EGS) delivers at the Jet Propulsion Laboratory (JPL) in Pasadena, Calif., is integral to the success of numerous NASA programs, including the exploratory journey of the Mars Rover and other space flight operations that probe the universe. The Mars Yard, the Space Flight Operations Facility (SFOF), the Flight Projects Center, and the infamous NASA Control Room are just a few of the unique and challenging spaces EGS oversees on the 177-acre campus of more than 200 buildings and 2.8 million square feet.

EMCOR Government Services' role at JPL is to provide base operations support, which involves facilities management, operations and maintenance, repairs, improvements, and oversight of all facilities-related equipment, systems and structures. Service also includes grounds maintenance, pest control, janitorial services, and fire suppression; energy, environmental, and disaster management; and 24/7 operation of critical facilities like the SFOF.

### Wireless Technology & Process Integration

Due to JPL's location, Internet access used to be intermittent, depending on where technicians were working on the campus. In a collaborative effort in 2014, JPL and EGS identified difficult areas and activated hotspots to enable heightened Wi-Fi connectivity for tablets and handheld technologies. Technicians can therefore receive service calls, perform data entry, and take and upload photos in the field with real-time capability through a Computerized Maintenance Management System (CMMS).

Handhelds and tablets are also equipped with an application that ties to JPL's Energy Management System, so if any adjustments need to be made, they can be done immediately—the technician in the field does not have to rely on someone in the control room to turn equipment on or off. This feature has also enhanced EGS' response times to trouble calls.

With immediate electronic access to O&M manuals for each asset, technicians can reference parts diagrams, warranty information, troubleshooting matrices, electrical distribution one-line diagrams, and other critical information while working on a specific piece of equipment. They can also pull up Standard and Local Operating Procedures and JPL's power distribution

system, which allows them to see in real-time how the electrical load is distributed throughout the campus.

If a technician needs to search for parts, prices and lead times, or if he or she wants to perform a material requisition through the CMMS, this functionality is at his or her fingertips. When parts arrive at the JPL warehouse, the techs are notified on their handhelds that their order is ready for pickup. All of these operational conveniences save time and money.

EGS also equipped technicians with smartphones, enabling them to access the internet to help in troubleshooting as well as increase the resolution of photos techs take for relevant documentation.



## Staying Ahead with RCM

A proactive approach to facilities management is critical, especially in a high-stakes environment like JPL. Through EGS' Reliability Centered Maintenance (RCM) program, the staff gets ahead of problems before they start, which makes their solutions much less reactive.

For example, JPL's campus contains miles and miles of piping, some of which transports natural gas and compressed air. If one of these lines springs a leak, it could easily go undetected, posing major safety hazards, like a potential explosion. Compressed air, which is used in many of the Lab's machine shops, is also one of the most expensive utilities, making a leak very costly. Through its RCM program, EGS performs routine ultrasonic leak testing on these lines to reduce safety hazards and keep money from vanishing into thin air.

Infrared thermography (which detects roof leaks and electrical heat signatures) and equipment vibration analysis (which looks for mechanical imbalances) are two other forms of RCM that EGS uses regularly. Their tools include an infrared camera and a high-end vibration data collector with multi-channel inputs that enable the technician to detect vibration and fix the imbalance.



The RCM program resulted in 62 proactive discoveries last year that averted serious problems in a scheduled manner, rather than in a panic. One such find was a chilled water supply pump that serves a critical building. Through predictive testing, EGS found it was exhibiting a high-amplitude vibration, indicating defects that could cause the chilled water supply to fail.

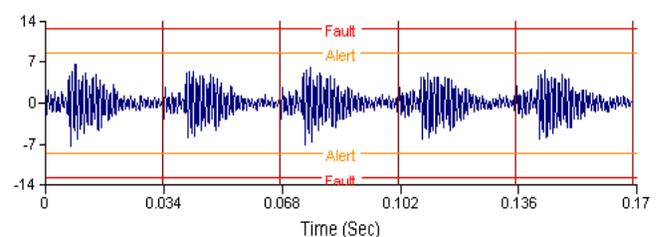
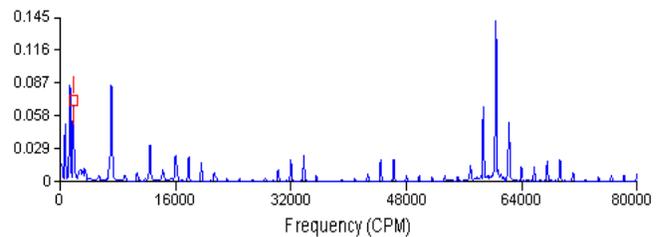
RCM also adds up financially. In a formal evaluation, JPL documented that EGS achieved a total cost avoidance of \$159,050 and a total cost savings of \$127,704 in 2014 alone. Over the course of its six-year tenure at JPL, EMCOR has calculated a \$909,588 total cost avoidance and a \$764,226 total cost savings.

Electrostatic testing is the latest RCM concept EGS introduced at JPL. Many buildings in the U.S. operate with Variable Frequency Drives (VFDs) on electric motors, which regulate motor speed and torque and ultimately economize the use of electric consumption during peak and nonpeak hours. The use of VFDs at JPL has saved significantly on electricity and related costs over the past four years since they were installed.



However, VFDs come with a consequence: they create an electrical discharge that causes premature pitting and motor failure. Having to replace a motor years early can quickly cut into electric savings. EGS therefore performs electrostatic testing to identify the problem, then installs shorting rings to give the electricity a non-damaging path out of the motor.

Through this method, EGS has reduced the failure rate for motor bearings from three months to a projected seven or more years, which bodes very well for JPL. If a motor were to fail in the SFOF or an area housing deep space hardware like the Mars Rover, it could mean for NASA the loss of mission-critical equipment and data or a multimillion dollar program.





## Condition-Based Maintenance

When EGS suggested moving from calendar-based to condition-based maintenance, it was able to show JPL the cost savings, efficiencies, and environmental impact for the campus. Filter changes are one of the biggest cost saving opportunities typically overlooked. Oftentimes filters are changed because an arbitrary time period has elapsed, or because they appear dirty. In reality, there could be a much longer lifespan on that filter.

Years ago, EGS' contract at JPL required filter changes every six months, regardless of their condition. Since JPL approved condition-based maintenance, the campus has some filters that are four years old and still supplying excellent indoor air quality, where previously they could have already been changed out eight times. This program has saved significant labor and materials costs while also keeping good filters out of landfills.

## Asset-Specific Job Plans

Though most facilities implement a preventative maintenance program, it is only as good as the level of detail it provides. At JPL, EGS has built a library of 2,213 asset-specific job plans over the course of five years, all of which are written by the site-based staff. These job plans are updated as necessary to reflect changes and additions in the field.

## Root Cause Analysis

In the event of a higher than normal failure rate on any given asset, EGS performs a root cause analysis to determine the best course of action, as opposed to one that may only target the symptoms. JPL's end users benefit from less downtime in labs and less facilities-driven inconveniences, like a space being too hot or too cold.

In January through September of 2014, EGS completed 8,159 trouble calls, which equated to a 13 percent reduction from the same period a year prior. It also achieved a 97.15 percent overall customer satisfaction rating based upon surveys that are generated and sent to end users after every service call.

## Conclusion

Through its results-oriented solutions and the metrics to back it up, EMCOR Government Services has gained the trust and reliance of JPL on a broad spectrum of critical and highly secure facilities operations. EMCOR's work at JPL is not a special case nor an anomaly; rather, it showcases the value and far-ranging capabilities EGS delivers to every one of its customers across the country.