

# CASE STUDY

**USAF** Arnold Engineering Development Complex  
NFAC, Moffett Field, Mountain View, California,  
USA installs Beran's PlantProtech PCMS system



**BERAN**  
A CMTG COMPANY





USAF Arnold Engineering Development Complex large-scale wind tunnel test facility.

**National Full-Scale Aerodynamics Complex installs Beran PlantProtech Protection and Condition Monitoring System for critical rotating machinery monitoring.**

The National Full-Scale Aerodynamics Complex (NFAC), part of the Air Force Arnold Engineering Development Complex, located on the site of the NASA Ames Research Center at Moffett Field in Mountain View, California, is home to the two largest Wind Tunnels in the world. A high speed (up to ~300 kts) 40 ft by 80 ft (12 m by 24 m) wind tunnel circuit and a lower speed but larger 80 ft by 120 ft (24 m x 36 m) test section which is capable of testing a full-size Boeing 737 at velocities up to 100 knots.

The facility was originally built in 1944 and is used to conduct aerodynamic testing on a wide range of full and large-scale test articles, including airplanes, helicopters, tiltrotors, articulated lorry trailers, parachutes, planetary decelerators, wind turbines and more.

**The NFAC facility includes two motor generator units which are used to start up and control six large fan motors. The motor generators operate up to speeds of 600 RPM**

There are six fans, each measuring 40 ft (12 m) in diameter, and now consisting of twelve large wood laminate blades. Each fan blade measures 12 ft (3.6 m) long, weighs more than 800 lbs (360 kg), and has been carefully crafted.

Due to the difficulty in manufacturing new blades, the fans require continuous monitoring in order to detect the onset of any changes in operation which may cause damage.

The fans are variable speed, variable pitch and operate at speeds of up to 180 rpm – at full power, they move more than 60 tons of air per second and they consume up to 108 MW of power, supplied by the two motor generator units and supplemented by the local grid.

*“Support from Helitune and Beran Engineers, ensured that our testing capabilities were mission capable when required”*

–NAS Engineer





Motor Generator unit in use in the wind tunnel test facility.



NFAC wind tunnel test facility, largest in the world. Beran engineers are in front of the bottom left wind fan.

## What was the problem?

The originally-installed Vibration Monitoring System had reached end-of-life and required replacement. National Aerospace Solutions LLC (NAS), who operate and maintain the NFAC facilities, on behalf of the U.S. Air Force's Arnold Engineering Development Complex, tendered for supply of a replacement Protection and Condition Monitoring System, which was required by NFAC engineers to automate safe shutdown of fans and motor generator units in the event of excessive vibrations.

During operation, the fans within the Wind Tunnel are not accessible and need to be continuously monitored for safe operation. Vibration and temperature sensors are installed on all bearings, with an associated phase

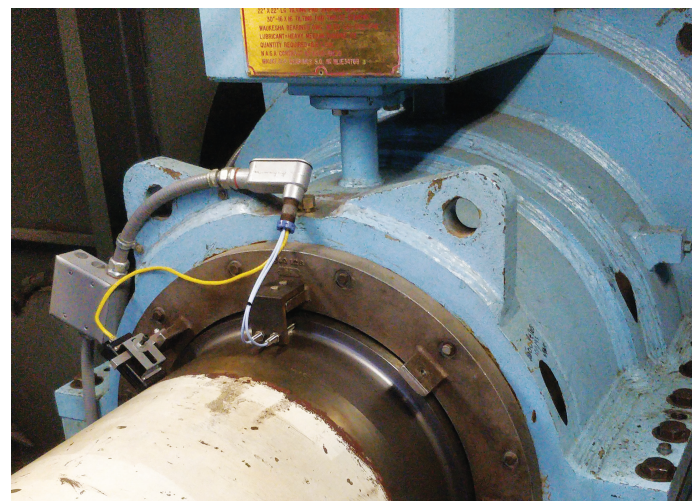
marker. Signals are wired back to a Central Control Room for monitoring, alarming and to control machine equipment safety. At the same time, NAS Engineers are required to perform assessments of machine condition to ensure that any issues are identified, diagnosed and resolved both safely and quickly.

As a result, a replacement Fan Drive Health Monitoring System was required, providing both Protection and Condition Monitoring capabilities, along with replacement of proximity probes and associated drivers for vibration, phase marker, and position monitoring.

## The solution

To meet the requirements of NFAC's replacement Fan Drive Health Monitoring System, Helitune USA (based in Wood Dale, Illinois), working with UK sister company Beran Instruments, proposed to install and commission Beran Instruments' flagship product, the PlantProtech Protection and Condition Monitoring System (PCMS). This is Beran's latest generation of turnkey high reliability Machinery Protection System with integrated Condition Monitoring functionality designed for critical plant. The Beran Instruments PCMS System expands upon the company's proven Condition Monitoring solutions which are in use around the world for monitoring industrial machinery.

Vibration, speed, position, and temperature sensors are connected to the PlantProtech PCMS system. A prime requirement was the need to interface into the existing control and shutdown system. The PCMS System is continuously monitoring machine health, allowing NAS engineers to review data both in real-time and perform analysis on historical data determining overall machine health and maintenance requirements.



One of the fan bearings with installed vibration, temperature and 1/rpm sensors installed.

The intuitive vibration analysis software – PlantProtech Vision – is complemented by a summary Machine Dashboard, customized to ensure real-time levels and alarm states are immediately available to engineers.

The PlantProtech PCMS System was originally supplied with inclusion of on-site engineering support by Beran's highly experienced and qualified engineers. Due to the impact of the COVID-19 pandemic, on-site commissioning support was not possible; however, through excellent teamwork between NAS, Helitune and Beran Engineers, the system was successfully installed by NAS, with remote commissioning support being provided by Beran.

## The results

NFAC now has a state-of-the-art Machinery Health Monitoring system using Beran's high-reliability PlantProtech PCMS, integrated by Helitune out of Wood Dale, Illinois, providing Protection and Condition Monitoring of the Fan Drive System.

The PCMS unit delivers advanced machine monitoring of the fan and blades, including fast and safe machine shut down in an emergency scenario, should it be required.

The Beran PlantProtech™ Vision application provides engineers with the tools they need to rapidly configure hardware, analyze data, share results, and identify problems. With Beran's PlantProtech PCMS installed the Fan Drive System and Motor Generators will be continuously protected and monitored for many years to come.

## How have we helped you since implementation/introduction?

NAS "Helitune / Beran technical support has been top notch, especially when considering time zone variation between the US and UK and the current global constraints due to COVID-19. Enquiries such as adding additional recording states in which data is collected for analysis or modifying the Mimic software have been handled quickly and professionally, allowing for uninterrupted performance of system operation. Furthermore, during the recent on-site checkout of the PCMS system, Beran Engineers discovered that our fan drive thrust bearing displacement limits were incorrectly modified by our in house Engineering team, preventing the alarm from shutting down our fan drive system in the presence of excessive movement. After isolating the issue, we were able to set the correct

displacement limits, ensuring that our fan drive system is sufficiently protected against the known failure mode."



Installed Beran PlantProtech PCMS System configured to monitor NFAC's Fans and Motor Generators.

## What kind of success did you enjoy with our product? (Results)

NAS "The Beran PCMS System has been very successful in providing a hedge between potential and functional failure of our most critical asset. Alarm and warning limits greatly minimize the probability of vibrational induced failures, while the ability to trend data has highlighted potential areas of concern such as harmonics of one of our shaft running frequencies, indicating the possibility of looseness or misalignment. By continually monitoring and collecting machine data, the PCMS provides our facility with the information required to control when corrective maintenance is performed, which is crucial in preventing catastrophic asset failure while minimizing maintenance costs."

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-NAS Engineer





NAS and Beran Engineers performing commissioning test works at NFAC.

Our PlantProtech 7600 PCMS system is designed to meet the requirements of ISO7919, API670 and IEC61508.

By means of continuous online vibration monitoring, changes in the health of the plant can be detected early.

Powerful analysis tools allow the root cause of the problem to be identified, enabling operators to make crucial decisions, and in many cases, plant can be run with confidence through to planned outage or scheduled maintenance.

The PlantProtech range of integrated hardware and software products provides our users with a solid foundation, which can be expanded as required, ensuring the safe and efficient continued operation of your assets.

## Beran Instruments

Decrease risk and increase your revenues with our proven PlantProtech™ protection and condition monitoring solutions.

PlantProtech™ is Beran's platform for condition monitoring and protection of rotating machinery, built on nearly forty years of industrial experience and innovation.

The PlantProtech hardware and software is in use around the world installed on nuclear, fossil, hydro, CCGT, combined cycle and renewables sites.

Originally designed to meet the requirements for monitoring of critical rotating machinery, our customers PlantProtech systems have been proven to pay for themselves many times over.

As user requirements have increased, the PlantProtech range has developed accordingly.

## About CMTG

Condition Monitoring Technology Group (CMTG) brings quality, innovation and service to a range of precision markets.

CMTG specialises in vibration and acoustic analysis, vibration condition monitoring, and the science of structural and rotating machinery in aerospace, defence, power generation, automotive and manufacturing industries.

CMTG provides technologies and services to optimise complex systems, identify potential failures and help our customers to plot solutions, reduce costs and improve safety.

The Condition Monitoring Technology Group is made up of Helitune, Semia, SEI, Beran, Prosig and DJB and has local sales and support facilities in UK, France, Germany, Italy and USA.

This document is not contractual. Beran Instruments maintains a policy of continuous product development and improvement. This specification may change without notice.

Beran Instruments is an ISO 9001:2015 and AS/EN 9100:2018 company.

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