MAKING OPERATIONAL EFFICIENCIES REAL IN AVIATION
WHY FURTHER EFFICIENCY IS WORTHWHILE

While the aviation industry has always focused on efficiency, there is still opportunity for operators of all kinds to become more efficient and to reduce costs.

For the military, air ambulance and medevac organizations, efficiency can help stretch limited budgets while improving mission readiness and enabling organizations to fly more missions. Airlines and business jet operators can more efficiently use workers and assets to enhance service reliability and help keep passengers and pilots happy. For all operators, from the largest airline to the smallest general aviation owner, efficiency can help control variables in the cockpit and improve flight safety.

How can any discussion of efficiency apply to the diverse mission and business objectives that different operators face? By focusing on the tested principles built into efficiency frameworks like Lean Six Sigma, Agile and others.

Few industries are as susceptible to unknown variables, such as weather, as aviation. Nonetheless, progress is possible. This e-book examines how the aviation industry can put tested principles to work to control uncertainty and reduce time and costs.
Lean processes and efficiency programs are common in manufacturing, which is not surprising since the industry is the birthplace of the assembly line. Today, operational efficiency has expanded beyond the manufacturing lines and maintenance departments.

It matters just as much to the head of customer relations as it does to the chief of maintenance. Its importance is clear to mission commanders and aircraft owners. From ground handling to flight operations to equipment and procurement, operational efficiency is vital. Simply put, operational efficiency is at the core of your success.

With a strong appreciation and appetite for operational efficiency in place, the industry has reached a turning point to achieve it.
Data alone does not provide what’s needed for action. Often, data and data collection systems reach a point of being merely descriptive: They can tell you what happened. Diagnostic systems take it a step further by telling you why something happened.

To reach predictive systems, though, you need to analyze data and patterns from past events, make assumptions, and test them to provide probabilities about the future. And in the very best predictive systems, you can even receive prescriptions that can help you address the issues.

How you go from collections of data that are descriptive or diagnostic to those that are predictive and prescriptive relies on advanced data analysis, and increasingly on the power of artificial intelligence.

Descriptive and diagnostic systems are common throughout aviation. Most aviation operators are just beginning to take the journey to predictive or prescriptive. Doing so involves tying existing systems together and working with aviation vendors who understand software and data well enough to help operators take advantage of the advanced data analysis necessary for prediction.
Fuel is the single biggest expense in aviation. Fuel efficiency not only means financial savings, it also correlates directly to the distance an aircraft can fly, the amount of payload it can carry and better environmental performance.

The industry is exploring many different approaches to fuel efficiency to better control costs and to meet commitments on CO2 production, including:

- Alternative fuel sources
- Changes in aircraft design and componentry, including:
  - Influencing drag and weight through wings and shape
  - Reduced wiring for in-flight, wireless and control-surface management systems
  - Changes in auxiliary power units – from fuel-powered units to direct installation of electrical supplies
- Lighter composite materials and components such as brakes and wheels
- Different types of engines (turboprops, turbofans, hybrid-electric, open-rotor)
- Longer-lasting coatings
- Planning and management tools that offer:
  - The ability to understand prevailing wind conditions, calculate precise fuel loads and achieve the most aerodynamic and economic performance possible
  - Predictive models of future fuel requirements
  - Delay-prediction software
- Global changes in airspace practices for more efficient use of airspace
- New approaches to takeoffs and landings to task engines less
- Cooperative practices with airports, such as on-the-ground electrical power use

We’ll address the optimization of other critical resources, like crew, in the pages ahead.

Fuel may be an operator’s largest single expense, but time is unquestionably the most valuable resource. Aircraft maintenance, ground activities, communications and the logging of information and data are all tasks that take time. Inefficiencies in one area can negatively affect multiple other areas, decreasing productivity and efficiency overall and wasting resources.

Efficient communication and use of flight plan or flight management apps can eliminate time spent on the wrong tasks before, during or after a flight. Better communication also reduces pilot and crew workloads.

Related to communication is the need for current data. The ability to load data quickly on critical devices makes it possible to have information where it’s needed, when it’s needed.

Voice recognition tools are one example of a tool that can eliminate bottlenecks. Maintenance crews can easily record serial numbers or parts lists while staying on task. These tools can also reduce data entry errors, so crews make fewer mistakes that can cause operational disruption.

Tracking tasks digitally, in visually clear ways, can help crews stay on task and help management or command foresee bottlenecks such as supply or staffing levels. As the aviation industry uses data-based tracking and assessment tools more broadly, it will reduce delays and improve arrival and departure times, as well as mission readiness.

Connected helicopter solutions enable operators to tap into an aircraft’s systems through the electrical data buses. Information like oil levels, engine temperature, torque and more can be recorded and plotted so it is immediately available to ground crews. This can save those crews valuable time.
While storms affect every industry, few companies have to respond by cancelling hundreds or thousands of orders, shifting orders to new facilities, and still completing them within a few days. Yet this is exactly what is expected of airlines when major storms cause flight cancellations.

For helicopter rescue, storms can not only increase demand – by causing accidents that require medevac, for instance – but also increase the danger of those missions. Storms can lead to business jets not being able to serve important clients, to mission commanders being unable to support forward operations, and to increased danger for pilots of all aircraft. In short, weather is by far the most challenging variable for the aviation industry. It can ground aircraft or missions, disrupt flight paths or even cause equipment damage. The wear and tear on aircraft due to weather events is variable and hard to predict.

When other operators change their flight patterns to avoid weather and/or other aircraft, these shifts can ripple throughout an airspace, requiring further changes from all. As airspace expands and becomes more crowded, this complexity will only increase.

However, storms and the other variables are not entirely unpredictable. To better prepare for and control these variables, forward-thinking operators in aviation are using:

- Data and predictive insights – to see where storms are going so they can plan ahead
- Improved communications – to ensure smooth operations within airspaces and between aircraft
- Enhanced situational awareness – to enable pilots to adjust flight plans themselves, reducing the future impact of changes
- Greater precision in takeoffs and landings – to enable aircraft to operate safely in conditions that would otherwise ground them
Higher-quality materials and systems often carry higher prices initially, leading to pressure on operators to get by with “good-enough” solutions. The truth, however, is that higher-quality components can save money in the long run.

More reliable parts and components, actuators that provide better control, and systems that prevent damage or loss are all examples of higher-quality elements that save organizations money over time. Even a simple element – such as highly durable paint that requires less reapplication – can save money in both the reduced maintenance costs and the costs of the paint itself.

Being diligent about upgrades can also lead to operational efficiencies. Retrofit, modification and upgrade (RMU) solutions can cost-effectively enhance operational capabilities, improve aircraft efficiencies and extend platform life.

Avionics upgrades can enable business jets to support Required Navigation Performance Authorization Required (RNP AR) approach procedures, which can save both time and fuel.2

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### QUALITY COMPONENTS THAT MAKE A DIFFERENCE

#### ACTUATORS
Depending on the type of actuation system, valuable hours can be lost on tests, maintenance and repairs between every flight. Thus the quality of the actuator strongly influences the efficiency of turnaround operations.

#### APUS
Improved auxiliary power units (APUs) not only save fuel directly, but can be lighter or easier to maintain, leading to additional efficiencies in multiple parts of the organization.

#### ENGINES
Issues with engines endanger crews and passengers and can lead to lengthy maintenance downtime. Engine innovations can allow pilots to fly farther, faster and more efficiently.

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As a heavily regulated industry that's reliant on advanced technologies, changes occur rapidly in aviation. Achieving operational excellence in this context requires organizations to remain agile.

The aviation industry has approached the goal of adaptability from two primary angles:

- **Engineering.** The industry is studying new kinds of motors and engines, such as turbofans, hybrid-electric and open-rotor systems, and new wing shapes and body designs.

- **Data analytics.** Aviation organizations can study the past, predict possible futures and invest in systems that will help them remain flexible.

To stay up to date on this innovation, operators should consider operational efficiency an ongoing goal. There will always be opportunities to improve.

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“In sensors, micro-electrical-mechanical systems (MEMS) and nanotechnologies will bring a revolution, while connectivity and machine learning are taking avionics toward new disruptions. Avionics hardware also is going through phenomenal change, and gradually will be replaced by software functionality and new processors like systems on a chip (SoCs).”

— George Koilpillai, Engineer Chief, Honeywell Aerospace

Unmanned flight has enormous potential – particularly for the role it will play in urban air mobility – but will also bring operational efficiency challenges. The industry is already working on ways to get the most from unmanned aerial vehicles (UAVs).

Some of the same technologies that go into ground proximity warning and collision avoidance systems are being adapted for use in UAVs, along with several other innovative ways to improve their ability to detect and avoid obstacles.

Manufacturers of UAVs are also focusing on building models with electric motors and other components that are lower maintenance than large engines or that can be serviced with readily available parts.

Keeping all the future UAVs connected to their operators and running safely will be crucial. Many of the advances in connectivity that have changed traditional aviation are being applied to UAVs, as well as advances in cellular networks and other communication technologies.

Overall, as unmanned flight continues to develop, manufacturers and operators will make advances in situational awareness, emissions control and precision in all aspects of flight. These developments will result in greater operational efficiency and safety.
The Connected Aircraft is the world of connected machines and Internet of Things (IoT) capabilities brought to aviation. It includes data and communications capabilities, sensors, and tracking from nose to tail and from aircraft to ground. The Connected Aircraft can have an enormous impact on operational efficiency.

Integrated systems enable you to benefit from data and streaming communications so that flight crews, commanders and maintenance chiefs can all perform their jobs more efficiently and effectively.

- Connected communications provide communication in real time, wherever needed, greatly improving decision making.
- Tracking solutions provide an understanding of turnaround tasks, maintenance activities and efficient flight planning.
- Connected diagnostics can reduce operational disruptions by as much as 35%. Operators can avoid issues with preventive or predictive maintenance. They can also minimize time on the ground and cut troubleshooting costs by sending maintenance crews directly to the part of the aircraft that needs attention, armed with the tools and parts they need.
- Connected flight bags and situational information helps pilots and other flight crew select the best flight paths and avoid adverse weather, leading to more efficient flights.

The Connected Aircraft also makes it much easier to monitor fuel use and gain insights on how flights individually and collectively can be more efficient.
We're committed to helping the aviation industry drive efficiency and control costs with solutions designed to save time and reduce waste. We offer a variety of planning and management tools, as well as a full suite of Connected Aircraft solutions. Together these tools can decrease time and workload through intelligent use of data and monitoring, and through allowing for faster turnaround time with less possibility of operational disruptions.

JETWAVE AND ASPIRE

Satellite communication systems that can help you synchronize flights and operations:
- **Aspire**
  Our Aspire 350 satellite communication system enables pilots to stay connected with data and voice services throughout their flight path, anywhere in the world.
- **JetWave**
  Improve the passenger experience while helping make the crew more productive with hardware that enables fast, consistent, reliable global connectivity.

GODIRECT CONNECTED MAINTENANCE

A nose-to-tail solution that analyzes aircraft data and delivers diagnostics as well as predictive and prescriptive alerts. It:
- Provides notifications with prescribed maintenance actions to help maintenance crews pinpoint the fault down to the subcomponent level
- Ingests fault data, system performance reports, flight schedules, unscheduled disruptions, flight data, maintenance data, shop data and weather data
- Goes well beyond the capabilities of current-generation solutions, which focus on system health monitoring and trend analysis
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<tr>
<th>Service Type</th>
<th>Description</th>
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<tbody>
<tr>
<td>GODIRECT FLIGHT SERVICES</td>
<td>Designed to help operators make flight operation decisions by collecting all flight data (flight plans, fuel usage, navigation charts, weather, aircraft performance and more) into one easy-to-access dashboard.</td>
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<tr>
<td>GODIRECT GROUND HANDLING</td>
<td>Gives ground crews the tools they need to manage turnarounds and get aircraft back where they belong – in the air – quickly and efficiently. The software solution uses mobile devices to manage turnarounds, reduce flight delays by 22% and improve on-time performance by 30%.</td>
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<tr>
<td>HEALTH AND USAGE MONITORING SYSTEMS (HUMS)</td>
<td>Provides diagnostic information required for optimum performance. HUMS sensors and embedded diagnostic software help monitor and communicate the health and maintenance needs of critical components. HUMS increases aircraft availability, reduces maintenance costs, optimizes parts inventory management, enhances safety and more.</td>
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<td>INTUVUE RDR-4000 3D WEATHER RADAR SYSTEM</td>
<td>3-D volumetric scanning and pulse compression technologies provide a complete view of the weather from 0 to 60,000 feet across a 320 nm detection range. IntuVue has demonstrated a 26% improvement in weather hazard detection over conventional radar systems.</td>
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<tr>
<td>WEATHER INFORMATION SERVICE</td>
<td>An electronic flight bag app to assist the flight crew in making strategic in-flight decisions with respect to weather information by providing up-to-date weather data.</td>
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<td>TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM (TCAS)</td>
<td>We pioneered TCAS for military and commercial aircraft more than a half-century ago and have delivered more collision avoidance systems (CASes) than anyone else. Today, our SmartTraffic® CAS 100 system offers three models of commercial TCAS.</td>
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<td>ENHANCED GROUND PROXIMITY WARNING SYSTEM</td>
<td>Honeywell developed the first ground proximity warning system (GPWS) in the 1970s and introduced the enhanced ground proximity warning system (EGPWS) in 1996. Our Mark V EGPWS exceeds Class A terrain awareness and warning system (TAWS) requirements and provides protection against controlled flight into terrain (CFIT) and wind shear.</td>
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<td>LANDING SOLUTIONS</td>
<td>Our Surface Indications and Alert System (SURF IA) is the first system to visually show pilots whether their aircraft will come into contact with dangerous wake turbulence from other aircraft. SmartRunway and SmartLanding improve flight safety and help reduce the risk of runway excursions by alerting crew members if the aircraft is going too fast, is too high or is going to incur a long landing. The SmartView synthetic vision system synthesizes flight information from multiple onboard databases, GPSes and inertial reference systems into a complete, easy-to-understand 3-D rendering of the forward terrain.</td>
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<td>HONEYWELL VOCOLLECT</td>
<td>Honeywell's voice recognition solutions can improve data-entry accuracy and help technicians record information without putting down their tools. They helped a leading aerospace manufacturer reduce production-data-entry cycle time by 30%, while making significant gains in accuracy.</td>
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Our products are made with the highest quality materials, rigor and testing you’d expect from a company that has focused on the aviation industry for 100 years. Our retrofits, modifications and upgrades (RMUs) are designed to help your aviation investments deliver the highest performance possible. Additionally, our protection plans and warranties are designed to keep your aircraft in the best possible condition.

| RMUs | We have upgrades for a large range of platforms, including business jets, airliners and cargo planes, helicopters, defense aircraft, and general aviation aircraft. We also offer multiple upgrades to bring platforms into compliance with mandates. |
| PROTECTION PLANS | We offer our GoDirect maintenance and service plans to help you control the costs of your avionics, engines and mechanical components. These plans help your maintenance teams budget, plan more efficiently and take the uncertainty out of maintenance. |
| PROTECTIVE COATINGS | We offer a range of coatings designed to protect various components of aircraft. Our antioxidant coating technologies have proven to be best-in-class against carbon oxidation caused by deicing fluids and contaminants. |
| ENGINES AND ACTUATORS | Our engines have been at the forefront of aircraft propulsion since 1953. Today our continuous improvement has led to engines that provide more uptime and more power with less fuel. Our actuators deliver precision load management and motion control for an array of uses, including engine control, thrust reverse, space missions, missile steering and numerous marine applications. |
From our experience in space technologies to our pioneering work in urban air mobility (UAM), we’re constantly working on the future – and on bringing those innovations to all branches of aviation. You can see that in the advances we are making in engines, in situational awareness tools, in predictive and prescriptive insights, and in the Inertial Measurement Units (IMUs) we’ve designed for greater precision in unmanned flights.

When you buy from Honeywell, you can be certain that we are thinking about the needs of all those in the industry and its next steps.
THE FUTURE IS WHAT WE MAKE IT.