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Why a human-centered Aviation Maintenance approach is essential to Aviation Sustainability

CH. 3 EFFECTIVE LIFE CYCLE MANAGEMENT

The third pillar of Maintenance Sustainability

December 2022

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Effective Life Cycle Management

A SUSTAINABILITY PLATFORM

We believe sustainable aviation maintenance relies on three pillars.

With more effective oversight, planning, and communications, aviation can ensure that the three pillars of sustainable aviation maintenance are powerful enough to fuel optimal flight operations now and well into the future. The three chapters of our White Paper explore the three pillars of sustainability.

In this third Chapter, we review the third of these pillars: **EFFECTIVE LIFE CYCLE MANAGEMENT.**

FLY NET ZERO 2050

“SAFs (sustainable aviation fuels) account for the largest share of CO2 reduction potential, varying between 59% and 64% across scenarios.

Improvements in aircraft technical and operational efficiency contribute an additional one-third of CO2 mitigation.

Zero-emission planes powered by hydrogen account for up to 5% of emission reductions in 2050.”

—ICCT (The International Council on Clean Transportation)

1. EMPOWERED PEOPLE

In the first chapter of our White Paper on sustainability, we delved into factors in human resources currently impacting aviation maintenance and, more broadly, aviation operations and considered how a platform could resolve systemic issues.

2. EFFICIENT PROCESSES

In this Chapter of our White Paper, we explored how aviation could optimize maintenance processes to reduce waste and downtime, supporting aviation sustainability.

3. EFFECTIVE LIFE CYCLE MANAGEMENT

In the third chapter of this sustainability series, we will explore the life cycle management of aviation through the lens of the people who ensure and account for the extension of that life cycle. We will also look at the documentation required for accountability—an essential element to ensure that the sustainability actions taken in aviation are credible and provable.





*Why a **human-centered Aviation Maintenance approach** is essential to **Aviation Sustainability***

CH. 3 EFFICIENT LIFE CYCLE MANAGEMENT - the third pillar of
Maintenance Sustainability

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Effective Life Cycle Management

FOREWORD

*By Marco Cesarino
Head of Beacon*

We designed Beacon to “make the invisible visible.” We focus our platform’s “disruption” energy on breaking down silos and connecting people who can share resources.

We know a lot of organizations, primarily commercial or larger operators, have a lot of data and know-how stored in their digital and people systems. They lack an interface to reveal what matters most: the repeat maintenance events of aircraft in need of special attention, the aircraft’s history, and the overall health of the fleet.



Parts suppliers can offer valuable solutions and tools, but only a few know about them. Flight services, catering, ground services, and maintenance may have untapped knowledge to help airplanes take off sooner, avoiding service disruptions. They only need to talk to each other, share knowledge, and collaborate in a fluid—not fragmented—way. This dialogue and knowledge exchange becomes increasingly valuable to the aviation industry as previously siloed bits of information are connected and made relevant in context.

Knowing what you know is an important step toward organizational progress. As Knowledge Management professional, [Ekta Sachania writes for KMI](#):

“Knowledge that can be quantified and documented is explicit knowledge. It is tangible and can be conveyed through processes, documentation, books, videos, etc. However, this just forms only a fraction of any organization’s knowledge while the rest of the knowledge bound to peoples’ experiences, intuition, insights, expertise, and personal conclusions is the tacit knowledge.

Recognizing the importance of this tacit knowledge and capturing it in a methodical way to make it explicit is a challenge for most organizations.”



This is the challenge we set about to facilitate. Transitioning from tacit knowledge to explicit knowledge is at the heart of making the invisible visible. Once tacit knowledge becomes explicit, you can augment it and easily disseminate it throughout the organization, fostering more meaningful collaboration in which everyone feels valued and recognized for their knowledge.

Breaking down silos requires transparency and accountability across all communications, data sharing, and decision-making channels. In this sense, it becomes a sustainability endeavor, up-cycling knowledge, optimizing the use of human and data resources, and allowing people to collaborate more efficiently and effectively.

When we make the invisible visible, we help our customers focus-in on issues that lead to chronic flight disruptions and quickly help identify spare capacity to improve operations, not by working harder but by working smarter, not by working harder but by working smarter.

By advancing the progress and the potential of each mechanic and the organization that mechanic works for, with healthy aircraft operating optimally, we can transform aviation and make it ecologically and economically sustainable.

Marco Cesarino
Head of Beacon

A blue handwritten signature in cursive script, appearing to read "Marco Cesarino".

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MAINTENANCE ACCOUNTABILITY

There is no sustainability without accountability. For aviation to demonstrate a credible sustainability strategy, it must account for more than just a reduction in carbon emissions. Tracking the parts and materials used and their context will also be essential.

Sustainable aircraft maintenance, regardless of the aircraft type, will require an efficient exchange of information to avoid loss and waste while accounting for the origins and use of parts throughout the life cycle. Aviation is well ahead of other industries in this sense since parts marking and tracking is already a well-established regulatory requirement. We have the processes in place to govern the practice.

FLY NET ZERO 2050

“Hovering consistently well above a 99% benchmark of aircraft technical availability implies a careful steering of the aircraft maintenance with a sharp focus on preserving the capabilities and performance of the asset close to its ‘as new condition’. Hence, the needed enabler for a 24/7 visibility on, awareness of, and action to maintaining the required level of aircraft health.”

— IATA MCTG



A platform model designed to support the life cycle of the fleet enhances the best practices of tracking and traceability for part checks, overhauls, repairs, and changes. Knowing the context of when maintenance technicians replaced a part or sent it out for repairs, how often, and under what circumstances is just as crucial to fleet life cycle management as keeping regulatory records. Analytics and search functionality refine accountability by allowing a more comprehensive view of maintenance events and making the context of these events visible. Finding commonalities in maintenance events enhances sustainability by highlighting recurring failure modes that might require process changes or re-engineering.

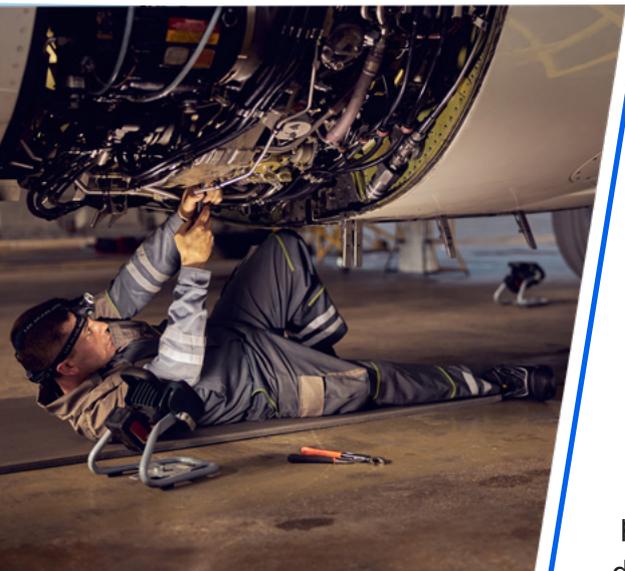
Operators can shift from airplane-centric to operations-centric planning and fleet management, in which the total operational capacity is optimized by digitizing the flow of aircraft through their lifecycle. When the invisible becomes visible, unscheduled MTX events are minimized and their duration is shortened.





With awareness of the context, operators can quickly share insights into their extended networks, reducing recurrent failures and increasing operational utility for the operator's fleet and the global fleet.

One of the challenges of information flow throughout the operational life cycle is the need to preserve data in order to retain asset value. The full documentation of work performed on aircraft and aircraft components, and the traceability of parts added or removed from service, are required by regulators around the world. Without that information, assets must be scrapped, resulting in material and financial losses. Some aircraft components, even something as seemingly innocuous as an aircraft seat cushion, require special handling at the end of their service life, which means the information flow and record-access must be continuous for the asset, from cradle to grave.



Safety requirements make aircraft inherently expensive to operate and maintain. Some components which might still have a useful service life cannot be repurposed or recycled merely because they lack the documentation to support that critical documentation to support their re-introduction to service. Digitization of the maintenance process can help ensure that documentation is available when it's needed.



Another way to look at it is that the preservation and more efficient exchange of information and asset records inherently adds value to the asset and retains utility. By adding stakeholders (suppliers and service providers) to the platform, operators have an opportunity to improve the financial and ecological sustainability of the organization by reducing process and material waste.

OPERATIONAL LIFE CYCLE KNOWLEDGE EXCHANGE



Through platform collaboration, sustainability gains magnify beyond the asset owner to the entire aviation supply chain, while ensuring that AHM (Aircraft Health Management) data helps improve product design, reducing AOG supply pressures, and supporting an after-market life for retired equipment.

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A DYNAMIC APPROACH TO MAINTENANCE

New Aircraft Life Cycles Require New Tools.

Aircraft maintenance will always require specialized knowledge to ensure safety. A platform more readily distributes that knowledge.

As we covered in Chapter 2 of our White Paper series on sustainability, the status quo of aviation maintenance is unsustainable, and it is not up to the challenge of traffic growth predicted over the next two decades.

It also falls short of what sustainable fleet management requires.

FLY NET ZERO 2050

“In 2020, the world fleet consisted of a total of 30,771 aircraft. This includes western built aircraft in commercial operations (Passenger, Cargo, Combi), with narrowbody, widebody and regional jets and turboprops (ATR42/72 and Q300/400 only). Thirty on percent (31%) of the fleet was parked or stored compared to 10% on average in the past decade.”

— IATA MCTG



As commercial aviation recovers from the impact of the COVID shutdown, maintenance operations face significant challenges. The fleet mix has shifted with the retirement of larger aircraft and next-generation narrowbody aircraft deployed on longer routes. Maintenance teams must restore grounded aircraft to flight-ready conditions as capacity demands increase.

The fleet shift will challenge the current processes in place for maintenance coordination.

A return to service of a large fleet of grounded aircraft will increase the maintenance teams' workload. They will need more effective collaboration tools to get the job done.



New aircraft technologies using alternative propulsion systems will require the rapid training of maintenance staff, requiring new methods of knowledge exchange.

A fleet of “smart aircraft,” generating oceans of aircraft health data on their components, will require a new approach to fleet maintenance planning.



As “smart aircraft” take to the skies, controllers and technicians must interpret and act on aircraft health reporting, exchange information, and ensure that predictive maintenance delivers the expected efficiency returns. The IATA MCTG has detailed the requirements in its detailed report on the shift from “passive” Aircraft Health Monitoring to “active” Aircraft Health Management (AHM).

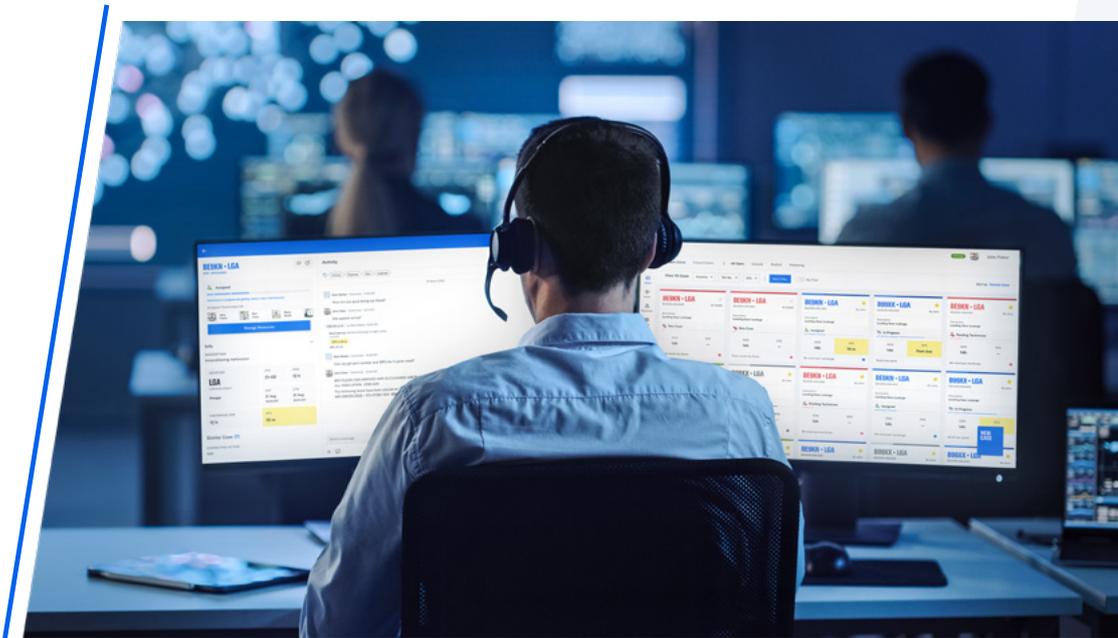
AHM could revolutionize aircraft life cycle management, but it requires active knowledge exchange among the people who keep aircraft flying to streamline workflows matching the speed of aircraft data flow.

“The AHM (Aircraft Health Management) means using aircraft and fleet generated data to promptly identify the individual aircraft’s needs for maintenance work and trigger an effective and efficient maintenance action,’ authors of the [IATA MCTG AHM report](#) write. “This is an end-to-end comprehensive process, which encompasses aircraft systems, data transfer and electronic processing, data analysis, and subsequent informed decision on improved, re-defined, or alternative methods to maintenance tasks. Such a process includes both ‘on-board’ and ‘off-board’ sequences, and its results are highly relevant to planning and executing the aircraft scheduled maintenance program or the ad-hoc required maintenance action. It is a dynamic action-oriented approach and a consequential evolution of the already acknowledged albeit more ‘passive witnessing’ field of Aircraft Health Monitoring.”



A platform fosters this “dynamic action-oriented approach” with an efficient exchange of information on an aircraft requiring maintenance. The platform provides a single point of truth for all the complexities that arise in the maintenance process. The network ensures that actions required based on critical AHM data are captured and shared effectively.

There are no efficiency gains from managing a fleet of “smart aircraft” via fax machine correspondence, phone, or e-mail. New tools are required to ensure the timely exchange of notifications from ‘on-board systems’ to the ‘off-board’ human team who will manage issues revealed by that data.





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AIRCRAFT MAINTENANCE EXTENSIONS

Aviation developed advanced reservation and GDS systems to manage the complexities of airline bookings and flight schedules. These have benefited all travel sectors through API integrations with multiple other solutions. Beacon works with carriers to capture data from GDSs in aid of maintenance planning.



As discussed in Chapter 2, Simone Cicero, inventor of the [Platform Design Toolkit](#) refers to these growing and robust platform connections and collaborations between parties with a common interest as ‘extensions.’ The benefit of these extensions is substantial. They do not require a re-design of proprietary information systems. They are designed solely to enhance collaboration and co-exist as complementary tools for the organization to optimize its processes.

Managing the life cycle of current and future aircraft, transmitting data from multiple systems and various hardware—from engines to seat-back IFE and galley equipment—will require such extensions, delivered by a fleet-agnostic platform, to ensure the effectiveness of AHM. As every stakeholder has access to the right information, at the right time, coordination of a response to complex AHM data is simplified.

More effective AHM will be critical to ensure a sustainable future for aviation.

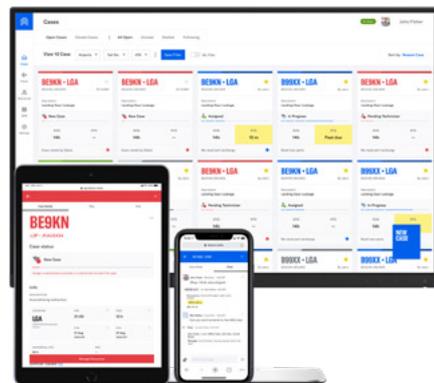
COLLABORATE SMARTER

Beacon is an agnostic platform designed for the aviation industry that fosters collaboration at scale and enables all people involved in resolving unscheduled maintenance to find, coordinate and synchronize the people and resources they need to solve problems more quickly.

Reduce OOS
Time by
20%

Increase
Productivity by
10%

Reduce Overall
Delays by
5%



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Effective Life Cycle Management

THE NETWORK EFFECT: AN ENGINE FOR A SUSTAINABLE FUTURE

Platforms are more than tools. They can be a power-source for enterprise, and are particularly helpful in developing better economies of scale and optimal use of resources. As the authors of *Platform Revolution: How Networked Markets Are Transforming the Economy and How to Make Them Work for You* write, their power is defined as the “Network Effect.”

“Network effects refers to the impact that the number of users of a platform has on the value created for each user. Positive network effects refers to the ability of a large, well-managed platform community to produce significant value for each user of the platform.”¹

Their effectiveness is virtue of optimal use of modern connectivity and the open exchange of resources and knowledge that platforms foster. Platforms are the cure for leaky pipeline models that waste energy and resources through inefficiencies.



“In the world of platforms, the Internet no longer acts merely as a distribution channel (a pipeline). It also acts as a creation infrastructure and a coordination mechanism. Platforms are leveraging this new capability to create entirely new business models. In addition, the physical and the digital are rapidly converging, enabling the Internet to connect and coordinate objects in the real world—for example, through smartphone apps that allow you to control your home appliances at long distance. Simultaneously, organizational boundaries are being redefined as platform companies leverage external ecosystems to create value in new ways. In this new stage of disruption, platforms enjoy two significant economic advantages over pipelines. One of these advantages is superior marginal economics of production and distribution.”



“A platform’s ability to scale rapidly is further enhanced by network effects. When positive network effects kick in, higher production leads to higher consumption, and vice versa.”

“A virtuous feedback loop is set in motion, fueling the growth of the platform at minimal cost. Leveraging network effects, platforms are able to build open electronic ecosystems embracing hundreds, thousands, or millions of remote participants. Such ecosystems can be larger than most pipeline-based organizations and can have access to more resources than a traditional pipeline company can command. As a result, the value created in such an ecosystem can be much larger than the value created in a comparable traditional organization. Therefore, firms that continue to compete on the basis of resources that are owned internally are increasingly finding it difficult to compete with platforms.”²

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As aviation moves toward intelligent assets—smart aircraft—creating a framework for open collaboration and communication between stakeholders of the fleet and its equipment will be essential. The economies of scale in maintenance, repairs, spare parts distribution, and labor allocation—all made possible by platform collaboration—will make aviation more sustainable economically and environmentally.

¹ Parker, Geoffrey G.; Van Alstyne, Marshall W.; Choudary, Sangeet Paul. Platform Revolution: How Networked Markets Are Transforming the Economy and How to Make Them Work for You (p. 17). W. W. Norton & Company.

² Parker, Geoffrey G.; Van Alstyne, Marshall W.; Choudary, Sangeet Paul. Platform Revolution: How Networked Markets Are Transforming the Economy and How to Make Them Work for You (pp. 64-65). W. W. Norton & Company.

³ Parker, Geoffrey G.; Van Alstyne, Marshall W.; Choudary, Sangeet Paul. Platform Revolution: How Networked Markets Are Transforming the Economy and How to Make Them Work for You (p. 65). W. W. Norton & Company.

Additional Reference: Pipelines, Platforms, and the New Rules of Strategy : <https://hbr.org/2016/04/pipelines-platforms-and-the-new-rules-of-strategy>





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BEACON SHINES A LIGHT ON SUSTAINABLE AIRCRAFT MAINTENANCE THROUGHOUT THE LIFE CYCLE OF THE FLEET

Beacon exists to keep airplanes flying by dramatically cutting the single biggest pain points in the industry: costs related to delays, cancellations, and reduced availability time.

We believe in an agnostic and collaborative approach to streamline operations, starting with the end-to-end unscheduled maintenance process.

LIFE OF AN ISSUE

Life Cycle management is essential to the sustainability of an enterprise. In an industry as complex as aviation—relying on thousands of parts to operate a fleet of aircraft—there are additional complications and burdensome requirements for documentation. Reducing those complications by streamlining communications with automatic accountability—record keeping and traceability of every issue for every aircraft—can make aviation maintenance sustainable.

A platform system follows the flow of aircraft maintenance of the issue from first creating a maintenance event alert to its resolution, maintaining a record of communications, facilitating collaboration between departments, ensuring accountability for tasks, and simplifying workflow with notifications and status updates from people with the right expertise for the job. Along the line, everyone shares knowledge. There are no silos, lost connections, or organizational blind spots.

LIFE OF AN AIRFRAME

The cumulative digital record of each issue becomes a reliable, easy-to-reference aircraft history. This digital record complements maintenance documentation and logbook records with a more valuable and actionable real-time view of the fix for previous issues. This knowledge enhances the information available in standard manuals.





LIFE OF THE FLEET AND ORGANIZATION

The fleet record produced through the platform grants visibility into all cases.

Users can sort by status, priority, and urgency with past and real-time analytics to make better decisions.

An eagle-eyed perspective on the status of all aircraft in maintenance, enhances fleet management, helping to identify recurring issues and promoting faster return to service. Less down time results in revenue optimization and reputation management. As passengers keep flying, with fewer service disruptions, they spread positive sentiment about the airline brand.

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Empowered People

A SUSTAINABLE FUTURE OF AVIATION MAINTENANCE

In this White Paper series, we have reviewed the three pillars of maintenance sustainability: Empowered People, Efficient Processes, and Effective Life Cycle Management.

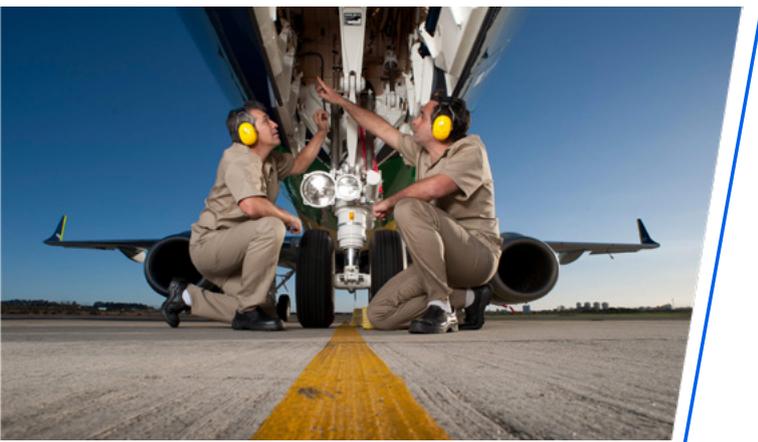
To attract tomorrow's workforce and transfer the knowledge of the current workforce, we need digital tools that are accessible and intuitive. As more digital-natives enter the workforce, a maintenance platform designed around eliminating unnecessary frictions in the process will also keep a record of maintenance events to shorten the learning curve.



Every efficiency gain at an airline radiates through aviation's Interaction Fields making the global economy more sustainable, as passengers, industries and communities benefit.

To meet Net Zero 2050, the aviation fleet will go through a dramatic change, with a mix of next-generation "smart" aircraft and new technology aircraft using new propulsion systems. Between today and tomorrow, aviation maintenance processes will need to get up to speed to ensure more effective life cycle management.

We believe that aviation can become sustainable by 2050, reducing its carbon footprint, improving its products and processes to keep aircraft flying.



THE SKY HAS NO LIMIT.



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Empowered People

WHAT LIFTS US?



GROWTH MINDSET

We embrace a growth mindset no matter how hard the challenge is ahead and inspire partners by approaching unprecedented ideas with creativity, humanity and grit.

CO-CREATION

Our superpower lies in the depth of our diversity and our desire to understand and constantly learn from alternative perspectives.

PEOPLE-FIRST

We always put people first and are passionate about enhancing people's lives - from our partners to our network of Beacon community members.

ALWAYS ON

We're responsive and adaptive. We listen deeply to the community and are unafraid to change course to accelerate our mission.

Beacon is a trailblazer with the tenacity to open new opportunities to allow its users to benefit from a new way of aviation maintenance. We bring together nonconformists, audacious adventurers, and those who dare to change the status quo and contribute to building a sustainable future for the aviation industry. Beacon leads the ecosystem with optimism, simplicity and expertise into a new era of collaboration and smarter ways of creating value.



WHAT LIFTS YOU?

We want to hear your thoughts! Share your views on the future of aviation maintenance sustainability with Beacon by following us on LinkedIn.

[Sign up](#) to get the full insights from our “light paper series” shining a better light on the future of aviation maintenance sustainability.**



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CH. 3 EFFICIENT LIFE CYCLE MANAGEMENT - the third pillar of
Maintenance Sustainability

ABOUT

BEACON

Beacon challenges current MTX systems and brings 21st-century solutions to improve maintenance services. Beacon applies a human-centric and ecosystemic approach to the use of technology to industry challenges. Beacon is a fleet agnostic platform that works alongside existing in-house systems to facilitate the interaction among stakeholders in aviation maintenance while ingesting data to bring actionable insights which enable optimal aircraft operations. Beacon cuts through complexity and provides a simple-to-use solution to maintenance event tracking. We are designing a new era of maintenance with faster return-to-service, better communication, and smarter collaboration so you can keep flying.

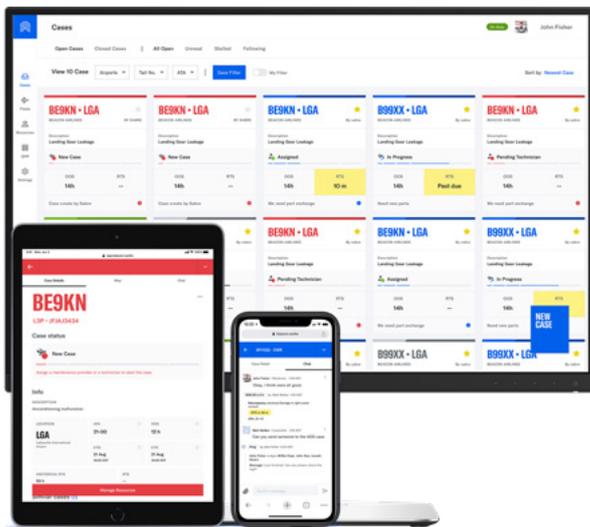
EMBRAER-X

Embraer-X is a venture builder and Embraer's innovation agent that transforms ideas into innovative businesses, transcending the aviation market and igniting the Innovation Ecosystem. We are crafting the path to make a positive impact in the world by developing solutions that inspire our partners to spread true grit to make changes people crave, based on our three pillars: Sustainable by Design, Integrated Mobility and Airborne Info-Systems. Learn more at embraerx.embraer.com



LEAD THE CHANGE

We want to hear your thoughts! Share your views on the future of aviation maintenance sustainability with Beacon by following us on [LinkedIn](#).



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THE BEACON PLATFORM**

Request a Demo