Driving sustainable aviation through software

By Airspace Intelligence, OpenAirlines, Signol

The importance of safe and operational technology systems cannot be understated for the aviation sector. Advancements from the simple compass to satellite guidance systems over the past century have not only ensured safe passage to global destinations, but also have increased operational efficiencies in the areas of safety and environmental protection.

But for some time, many players in the aviation industry have built new hardware on top of outdated, legacy software systems that have not kept up with advances in technology. For example, until recently the software for routing aircraft through our skies was far less advanced than consumer road navigation applications like Google Maps or Waze. Simply put, this means that the industry has given up gains in a number of core areas including operational efficiency, safety, sustainability, and passenger experience.

However, that void has created a great opportunity. This has been successfully demonstrated by three companies—Airspace Intelligence, OpenAirlines and Signol—who are driving innovation in the aviation industry through software solutions.

Each company has taken its own approach to add new and unique value to the aviation sector, in particular regarding driving fuel use and emissions reductions. Using pure software products as their basis, they have innovated and deployed solutions in a much faster way than traditional industry players. This results in faster value delivery to their customers through software solutions versus hardware products, and the results speak for themselves.

Airspace Intelligence — Artificial Intelligence (AI) for Air Operations

Airspace Intelligence is on a mission to help the world's most complex air operations succeed. Airspace Intelligence has developed an AI-enabled operating system for modern airlines that already optimizes routes for thousands of commercial flights in the U.S. everyday—saving fuel, time and emissions while improving passenger experiences. The self-learning platform moves the aviation industry away from manual processes and dated technologies that use hard-coded rules to route aircraft with a single-flight focus towards a predictive software solution that enables network-wide optimization. From the operations control center to the flight deck, Airspace Intelligence empowers human decision makers with the information and applications needed in order to make safer, smarter, and more efficient decisions.

In just over three years of development and one year since the commercial launch with Alaska Airlines, Airspace Intelligence is completely changing the way of thinking in the industry and driving substantial impact. Airspace Intelligence has optimized more than 38,000 flights with an average per flight savings of approximately 5 minutes. This has led to an estimated fuel savings of 21 million pounds or nearly 34,000 tons of carbon emissions reductions.

As the company expands over the next 3-5 years, Airspace Intelligence could drive savings of over 200,000 hours of flight time, 1 billion pounds of fuel, and 1.8 million tons of CO_2 emissions per year by serving all U.S. airlines, assuming pre-COVID passenger demand. Although time and fuel savings are more easily quantifiable, Airspace Intelligence's impact on flight safety and passenger satisfaction should also be highlighted. By providing future-state, predictive

situational awareness that was previously not possible, decision makers in the air and on the ground can more accurately route flights around bad weather or rough turbulence, or around inefficient traffic flow restrictions to help minimize airborne holding, diversions, and delays. Passenger satisfaction is also improved due to often landing 5 minutes or earlier than expected due to the platform's optimization recommendations.

As Airspace Intelligence continues to advance, the software will optimize across more dimensions such as airspeed and altitude, which will further expand the operational and sustainability benefits that the company provides to their airline partners. Airspace Intelligence's goal is to not only have the software fundamentally improve airline operations across the industry, but also to positively impact the world through fuel and emissions reductions.

OpenAirlines — SkyBreathe® 360° eco-flying Platform

Over the past decade, OpenAirlines led the first Clean Sky project, the largest European research program developing innovative and cutting-edge technology to reduce CO_2 gas emissions, and noise levels produced by civil aviation. As an outcome of this research project the SkyBreathe® is developed which is the first eco-flying solution for airlines. SkyBreathe® is a software that collects all the data from the black boxes, weather, air traffic control, and maintenance. Through big data algorithms and artificial intelligence, it produces recommendations for airlines and pilots that has allowed them to reduce their fuel consumption by up to 5% without any aircraft modifications.

These recommendations, concern the aircraft preparation with aircraft performance monitoring or engine wash optimization. They may also concern the flight preparation by dispatchers by proposing the best routes based on weather and traffic, or the execution of the flight.

Fuel consumption depends not only on all phases of flights (taxi, climb, cruise, and descent) but also on dispatch, maintenance, ground activity, commercial services. It also affects legal aspects such as the European Union Emissions Trading System (EU ETS) or CORSIA (Carbon Offsetting and Reduction Scheme for International Aviation).

Factor in the threat of climate change on the industry, fuel efficiency at an airline must be a team effort whereby every department contributes to a safe and efficient fuel culture. SkyBreathe® offers an all-in-one platform that connects all airline workers in order that airlines can control the whole loop of their fuel program.

For example, pilots are critical players in a fuel efficiency project as many fuel initiatives are related to flight operations. SkyBreathe® empowers pilots with a mobile application that acts as a virtual coach at their side. It gives them a deeper insight into their individual performance by showing how much fuel they saved, and where they could have saved more. The maintenance and dispatch teams are also engaged and can analyze the fleet's actual performance, act on its degradation, and be more precise in fuel planning.

In the three years that followed SkyBreathe® implementation, several airlines have demonstrated success in improving fuel efficiency. Volotea, a fast-growing low-cost airline in Europe, managed to reduce its fuel consumption by more than 3%. Norwegian, have saved more than 27 M USD in 2019 using SkyBreathe®, representing 140,000 tons of CO_2. By putting MyFuelCoach™, the briefing and debriefing app dedicated to pilots, at every pilot's fingertip, Transavia has saved 3,200 tons of fuel in 2019, representing between 4 and 5 % of their total fuel consumption. On another example, after implementing MyFuelCoach™, Ukraine International Airlines pilots increased their application rate of Reduced Acceleration Altitude (another popular green operating procedure) from an already excellent 76% level to an almost perfect 95% level.

Today, SkyBreathe® is the most widely used eco-flying solution in the world. Its active community federates more than 50 airlines across the globe, including Air France, easyJet, DHL, Norwegian, IndiGo, flydubai, and Atlas Air. In 2019, its customers saved more than 590,000 tons of CO_2 and 150 million USD. In 2022, they will save more than 1 million tons of CO_2, equivalent to planting 125 million trees.

In 2022 OperAirlines added SkyBreathe® OnBoard to the platform, an EFB app, connected in the cockpit, that gives real-time eco-flying advice such as direct route recommendations, taxi assistant, etc. The work on an adaptation of SkyBreathe® designed for Air Navigation

Service Providers is ongoing. It has been seen that using SkyBreathe® data and analyses, some of the customer airlines have engaged in fascinating discussions with their local Air Traffic Control authorities leading to more fuel-efficient approaches in Iceland and Dubai. This results in all airlines flying in and out of these destinations benefiting from the improvement.

Signol — "Nudging Captains to Save Carbon"

Airline pilots are highly skilled, trained professionals who continuously digest information to complete their flights safely, on time, and ideally, in a carbon-efficient manner. While external variables may hamper a pilot's ability to implement carbon-saving practices, Signol's analyses suggest that individual pilot decision-making still plays a significant role in fuel burn and carbon emissions, even after statistically accounting for factors such as time of day, aircraft type, temperature, and destination. Thus, how can researchers encourage each pilot to reduce their carbon emissions? Behavioral science holds the key.
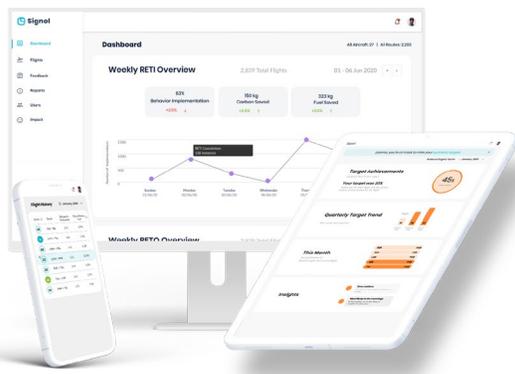

FIGURE 1: Signol software dashboard

Signol is a software application and communication service that delivers carbon and fuel savings using cutting-edge behavioral and data science. Signol motivates pilots to consistently implement carbon-saving operational best practices, including routine practices such as Reduced Engine Taxi, Idle Reverse Thrust, Continuous Descent, and Discretionary Fuel Weight Calculations, as well as custom practices developed in collaboration with each airline. Signol processes operational data from airlines and their third-party data providers to deliver personalized targets

and feedback to pilots. Pilots gain access to user-friendly, bite-sized updates on the direct social and environmental impact of their actions - empowering them to consistently cut emissions for their airlines.

By "nudging" 335 Virgin Atlantic Airlines captains via postal letters, Signol has already saved over 24,000 tons of CO_2 emissions and 6.1 million USD (1% of fuel costs) in an eight-month trial. Signol's feedback and incentives also significantly improved captain job satisfaction. The study results were published in the top-ranked Journal of Political Economy (Gosnell et al, 2020).

Signol complements powerful fuel analytics platforms by focusing on the final mile of user engagement. From dynamically updating positive reinforcement and memorable visual designs in our dashboard to proactive communications sent to pilots across multiple channels, Signol applies the latest behavior change research in every touchpoint with pilots. Moreover, Signol continuously experiments with and optimizes the timing, content, and design of the feedback for different groups of pilots. Not all pilots are the same, and Signol is built to offer a unique experience for each pilot.

In the next three years, Signol will integrate with existing third-party fuel analytics providers in the aviation industry – allowing a quicker setup for airlines who are keen to realize carbon savings. Moreover, Signol will refine the platform's predictive models of pilot decision-making – ensuring that the company's "nudges" remain engaging and relevant for each pilot.

Together, the three companies provide unique examples of how a software-first approach can drive significant operational and sustainability improvements in aviation. Moving forward from here, these industry players hope to see the sector continue to embrace the power of software to create positive change.