

AIRBOTICS

2018 Global Automated Drone
New Product Innovation Award

FROST & SULLIVAN

2018 BEST PRACTICES AWARD

GLOBAL AUTOMATED DRONE
NEW PRODUCT INNOVATION AWARD

2018
BEST PRACTICES
AWARDS

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Background and Company Performance

Industry Challenges

The commercial drone industry has been growing rapidly with the emergence of many new participants. A major challenge, however, has been the inability to integrate a variety of sensors (payloads) into the drones.

Sensors have to be manually replaced, which expends valuable minutes during critical missions. With rapid advancements in sensor technologies such as LiDAR, radar, and thermal imaging, effective integration of multiple sensors can enhance drones' data collection capabilities.

Batteries pose an additional concern: although advancements have been made to improve battery life and charging technologies, time is of the essence during emergency-response flights or long-duration surveillance missions. Either a drone must land in a docking station to recharge, or maintenance personnel are needed to manually swap out a battery.

Many organizations do not have the resources to invest in and maintain the necessary hardware and software for an in-house drone system, obtain required civil aviation certifications, or hire or train licensed pilots to operate it. Piloted drones' surveillance and data gathering capabilities remain limited simply because of the potential for human error or the inherent dangers of operators working in proximity to hazardous environments. All captured data still must be analyzed and converted into actionable insights.

A completely automated drone, also known as an automated unmanned aerial vehicle, could help a company reduce its costs and improve the reliability of its data.

New Product Attributes and Customer Impact

Match To Needs

Israel-based Airobotics, founded in 2014, has developed an industry-first automated drone platform that includes an automated launch and docking station that allows for automatic payload and battery switching. Its Optimus pilotless drone, which can survey and collect abundant raw data, includes integrated software for mission planning and data analytics. Users can launch the drone from its airbase with a single click, harvest the raw data that it collects along a pre-programmed flight path, and automatically land it in the airbase.

Airobotics gained a competitive advantage in March 2017 when it met Civil Aviation Authority of Israel requirements for reliability and safety on pilotless, fully-automated, missions for beyond visual line of sight (BVLOS) commercial drone operations—a global first—after nearly 24 months of rigorous field testing and more than 10,000 flight hours. The company also received a commercial BVLOS license from the Civil Aviation Safety Authority of Australia and a Part 107 waiver from the Federal Aviation Administration for operation in the United States.

Unique Features and Durable Design

The Airobotics system is the first-of-its-kind drone platform that is completely automated

from end to end: launching, gathering data, payload and battery switching, and docking. Unlike competitors' simple launch/docking platforms, Airobotics' multipurpose station can swap out advanced, high-precision avionic sensors on the Optimus drone based on a customer's needs for a specific mission.

The innovative, swappable payload system helps users optimize surveying missions. A robotic arm in the docking station can switch sensor payloads and batteries in a few minutes. When the battery level becomes low, the drone is programmed to return to the airbase for a quick battery swap, and then automatically relaunch. This allows Airobotics drones to operate continually on critical missions while the Airbase is connected to 3-phase ground power. Airobotics prefers swappable batteries over rapid-charging technologies that could result in heating or overcharging and possibly reduce battery life and affect the drone's performance.

Airobotics has positioned itself as a provider of high-quality, multipurpose, industrial-grade drone platforms. At the outset, Airobotics designed its system specifically for extreme industrial conditions, with the ability to withstand winds of as high as 20 knots (as well as wind gusts of up to 30 knots), water and dust ingress (IP43 protection), and temperatures ranging from 0 to 50 degrees Celsius. The docking station frame is built of durable material to combat dust, rain, and corrosion. The Optimus drone's rugged exterior is designed with molded carbon fiber, an optimized propeller design to increase aerodynamics performance, and commercial-grade autopilot and controllers.

The company has integrated several sensors and payloads to develop industry-best sensor technologies that increase the system's mission flexibility. Its industry-grade sensors and cameras for surveying and mapping, inspections, and security now include a 24-megapixel, high-resolution, high-definition camera for mapping; dual-vision cameras for simultaneously generating infrared and standard images; thermal imaging cameras; high-resolution, 8x optical zoom cameras, a night and day video camera with 20x optical zoom and 20x digital zoom; and multispectral imaging cameras (red, blue, green and infrared); LiDAR (300,000 points/second). A gas sensor—a laser spectrometer with a 30-metre range is in development. A Frost & Sullivan competitive analysis found that the dual-vision and 8x optical zoom cameras are offerings that competitors do not match.

Frost & Sullivan recognizes the potential for the platform to become the benchmark of the commercial drone industry because of its end-to-end automation and application versatility.

Furthermore, Airobotics has potential to become the app store for drone platforms. The company's developer program serves as an open ecosystem for the developer community to provide a wide selection of tools to accomplish the vital tasks clients need for their businesses. The dynamic, swappable payload mechanism design of Airobotics' system enables partners to create new payloads that integrate new sensors and other tools into the drone. Airobotics' software provides both a complete operating system and an open platform designed with scale in mind. Third parties can build and customize the payloads,

along with software apps to support and manage new missions.

Customer-Focused Business Model

Airobotics has chosen to lease its drone systems to customers rather than directly sell them, which Frost & Sullivan has identified as a best practice because of several tangible benefits: it alleviates concerns about capital expenditures and recurring maintenance and personnel costs, and customers will always have access to the latest product upgrades without significant additional expense. This value proposition is expected to make the company a formidable player in the commercial drone space in the next 2 to 3 years.

Airobotics' business model also frees the customer from regulatory burdens. Customers are not required to be certified by the regulator (aviation authority). Airobotics is liable for both the technology and its servicing and certification.

Maintenance and certifications are included in the rental cost. Sensors can be added to or removed from the docking station based on the site requirements. The annual leasing cost includes application-specific sensors and software, service, periodic maintenance, and certification. A customer always has the flexibility to upgrade to the latest off-the-shelf cameras and sensors available in the market.

Reliability with a Focus on Safety

Autonomous drones provide accurate, consistent results on pre-planned or day-to-day/routine missions—a feat that is difficult for drone operators to manually replicate. Airobotics drones are ideal for use in missions that would put human operators at risk, such as in sections of active blast sites in mining or oil and gas operations. The system, for example, provides post-blast digital elevation models for drill planning and assesses blast behavior. Traditionally, blast site monitoring and placement of drill holes involved the use of ground vehicles or helicopters for inspection, which is costly and may not provide accurate and repeatable results.

The drones also benefit surveying of stockpiles where ground surveying teams need to climb stockpiles (which can contain more or less friendly materials) and use GPS sticks to create a point cloud (which can be a risky and tedious job). The drones are also beneficial for visual inspection of slurry lines or pipelines with slurry that can be hot or toxic.

Geofencing software creates fly zone geographical boundaries using GPS. The drone has a built-in pyrotechnic parachute release for emergencies, a siren and strobe light to indicate its position, and a return-to-base feature that kicks in if it detects a malfunction or is activated by the user. Competitors' safety packages are not as comprehensive.

Rigorous Attention to Quality

Each Airobotics drone system is subjected to rigorous testing at the company headquarters for more than a month and must operate autonomously prior to shipping. Each component and system undergoes a simulation based on the operating conditions at the customer site.

The company has built its own testing equipment to ensure quality and to procure automated drone certifications. It has logged more than 30,000 automated flights—among the most in the industry.

Airobotics deploys engineers at customer sites to set up system operations and flight paths, provide training, and obtain certifications. The company provides around-the-clock customer support, and launched a remote operation center in Australia in 2017 for managing and monitoring its operations across its sites in the country.

Growth Plans with a Focus on Customer Experience

The company is targeting mining, oil and gas, port, energy, and homeland security customers. It tripled its customer base in 2017, with 6 major clients in Israel and Australia in the mining, seaport, homeland security, and fabrication fields. Airobotics ventured into the US market in 2017 and plans to briskly expand its base in the country; it expects to again double and even triple its base in the next 1 to 2 years. The company is also expanding into Chile, due to its massive potential in mining. The company's representation in Chile is through a distributor. If this model succeeds, it will be scaled to additional countries.

The company has raised a total of \$71 million in funding, including \$32.5 million in a Round C funding announced in September and an additional \$10 million for the company's extended Round C funding. It plans to use the money for business development and further expansion into the homeland security and defense arena. It also has begun a Safe Cities initiative to encourage the use of automated drones on critical missions, which is in line with Frost & Sullivan's Smart is the New Green Mega Trend in which smart technologies have a dramatic effect on daily life. Mega Trends are transformative, global forces that define the future world with their far-reaching impact on businesses, societies, economies, cultures, and personal lives.

The company has been working with Israel Chemicals Ltd. (ICL) to survey and map of all of its operating sites in Israel. ICL develops fertilizers, metals, and chemical products for industries including agriculture, food, and engineered materials. ICL deployed Airobotics drone systems at its Rotem Amfert mining site, which extracts phosphates. Before this, ICL used manual surveying methods such as real-time kinematic (RTK)-pole and laser scanners that required surveyors to climb stockpiles, which is time-consuming and dangerous and demands a full work stoppage for a complete survey. With the help of a third-party surveyor, ICL compared the surveying methodologies between ground-based methods and Airobotics' system, and found that the drone collected nearly 55 images

across various points from stockpiles across the site flying at an altitude of 75 meters. Using advanced software, a 3-D terrain model was created and compared with ground-based techniques for 16 ground control points. Airobotics' system offered a stockpile volume of 16,574.77 cubic metres compared with 16,347.4 cubic metres of RTK-pole measurement, which is 1.37% higher.

The Optimus drone offered elevation accuracy of 6.3 cm, 127% better than RTK-pole measurements of 8 cm. In addition, the Optimus drone sampled 9.5 million points versus 360 points sampled by ground-based surveyors. The drone's total mission time was 10 minutes versus 2 hours, and the processing time was half a day for the drone system versus 3.5 days for the ground surveyors.

Airobotics' systems also have been implemented by Australian mining company South32 for mud line and pipeline inspection, infrastructure inspections, and volumetric measurements of stockpiles. The company also works with an Intel semiconductor fabrication facility in Israel for security, surveillance, and emergency response flight missions.

Conclusion

Airobotics' completely autonomous drone platform has a first-mover advantage as competitors remain in the development stage, and has gained momentum through rigorous product testing, certifications, and reliable service. The multi-tool, payload-swapping docking station with the capacity to store batteries and sensor devices; built-in intuitive software for mission planning, control, and analytics; automatic battery swapping; and robust Optimus drone are unique value additions that give clients a versatile system.

Frost & Sullivan analysis concludes that Airobotics' innovative drone system is best positioned to meet the inspection, surveillance, emergency response, and surveying and mapping demands of customers in numerous industries. With its strong overall performance, Airobotics has earned Frost & Sullivan's 2018 New Product Innovation Award in the global automated drone industry.

Significance of New Product Innovation

Ultimately, growth in any organization depends upon continually introducing new products to the market and successfully commercializing those products. For these dual goals to occur, a company must be best-in-class in three key areas: understanding demand, nurturing the brand, and differentiating from the competition.



Understanding New Product Innovation

Innovation is about finding a productive outlet for creativity—for consistently translating ideas into high-quality products that have a profound impact on the customer.

Key Benchmarking Criteria

For the New Product Innovation Award, Frost & Sullivan analysts independently evaluated two key factors—New Product Attributes and Customer Impact—according to the criteria identified below.

New Product Attributes

- Criterion 1: Match to Needs
- Criterion 2: Reliability
- Criterion 3: Quality
- Criterion 4: Positioning
- Criterion 5: Design

Customer Impact

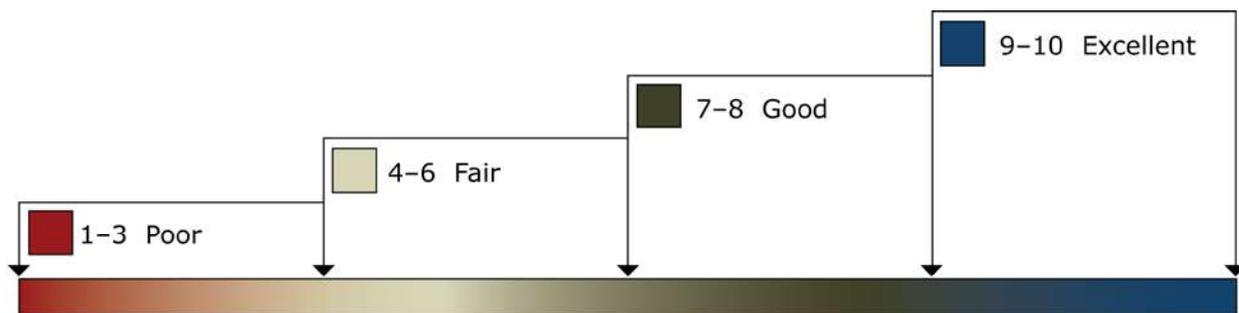
- Criterion 1: Price/Performance Value
- Criterion 2: Customer Purchase Experience
- Criterion 3: Customer Ownership Experience
- Criterion 4: Customer Service Experience
- Criterion 5: Brand Equity

Best Practices Award Analysis for Airobotics

Decision Support Scorecard

To support its evaluation of best practices across multiple business performance categories, Frost & Sullivan employs a customized Decision Support Scorecard. This tool allows our research and consulting teams to objectively analyze performance, according to the key benchmarking criteria listed in the previous section, and to assign ratings on that basis. The tool follows a 10-point scale that allows for nuances in performance evaluation. Ratings guidelines are illustrated below.

RATINGS GUIDELINES



The Decision Support Scorecard is organized by New Product Attributes and Customer Impact (i.e., these are the overarching categories for all 10 benchmarking criteria; the definitions for each criterion are provided beneath the scorecard.). The research team confirms the veracity of this weighted scorecard through sensitivity analysis, which confirms that small changes to the ratings for a specific criterion do not lead to a significant change in the overall relative rankings of the companies.

The results of this analysis are shown below. To remain unbiased and to protect the interests of all organizations reviewed, we have chosen to refer to the other key participants as Competitor 2 and Competitor 3.

<i>Measurement of 1-10 (1 = poor; 10 = excellent)</i>			
New Product Innovation	New Product Attributes	Customer Impact	Average Rating
Airobotics	10	10	10
Competitor 2	8	7	7.5
Competitor 3	7	7	7.0

New Product Attributes

Criterion 1: Match to Needs

Requirement: Customer needs directly influence and inspire the product’s design and positioning.

Criterion 2: Reliability

Requirement: The product consistently meets or exceeds customer expectations for consistent performance during its entire life cycle.

Criterion 3: Quality

Requirement: Product offers best-in-class quality, with a full complement of features and functionalities.

Criterion 4: Positioning

Requirement: The product serves a unique, unmet need that competitors cannot easily replicate.

Criterion 5: Design

Requirement: The product features an innovative design, enhancing both visual appeal and ease of use.

Customer Impact

Criterion 1: Price/Performance Value

Requirement: Products or services offer the best value for the price, compared to similar offerings in the market.

Criterion 2: Customer Purchase Experience

Requirement: Customers feel they are buying the most optimal solution that addresses both their unique needs and their unique constraints.

Criterion 3: Customer Ownership Experience

Requirement: Customers are proud to own the company’s product or service and have a positive experience throughout the life of the product or service.

Criterion 4: Customer Service Experience

Requirement: Customer service is accessible, fast, stress-free, and of high quality.

Criterion 5: Brand Equity

Requirement: Customers have a positive view of the brand and exhibit high brand loyalty.

Decision Support Matrix

Once all companies have been evaluated according to the Decision Support Scorecard, analysts then position the candidates on the matrix shown below, enabling them to visualize which companies are truly breakthrough and which ones are not yet operating at best-in-class levels.



Best Practices Recognition: 10 Steps to Researching, Identifying, and Recognizing Best Practices

Frost & Sullivan analysts follow a 10-step process to evaluate Award candidates and assess their fit with select best practice criteria. The reputation and integrity of the Awards are based on close adherence to this process.

STEP	OBJECTIVE	KEY ACTIVITIES	OUTPUT
1 Monitor, target, and screen	Identify Award recipient candidates from around the globe	<ul style="list-style-type: none"> • Conduct in-depth industry research • Identify emerging sectors • Scan multiple geographies 	Pipeline of candidates who potentially meet all best-practice criteria
2 Perform 360-degree research	Perform comprehensive, 360-degree research on all candidates in the pipeline	<ul style="list-style-type: none"> • Interview thought leaders and industry practitioners • Assess candidates' fit with best-practice criteria • Rank all candidates 	Matrix positioning of all candidates' performance relative to one another
3 Invite thought leadership in best practices	Perform in-depth examination of all candidates	<ul style="list-style-type: none"> • Confirm best-practice criteria • Examine eligibility of all candidates • Identify any information gaps 	Detailed profiles of all ranked candidates
4 Initiate research director review	Conduct an unbiased evaluation of all candidate profiles	<ul style="list-style-type: none"> • Brainstorm ranking options • Invite multiple perspectives on candidates' performance • Update candidate profiles 	Final prioritization of all eligible candidates and companion best-practice positioning paper
5 Assemble panel of industry experts	Present findings to an expert panel of industry thought leaders	<ul style="list-style-type: none"> • Share findings • Strengthen cases for candidate eligibility • Prioritize candidates 	Refined list of prioritized Award candidates
6 Conduct global industry review	Build consensus on Award candidates' eligibility	<ul style="list-style-type: none"> • Hold global team meeting to review all candidates • Pressure-test fit with criteria • Confirm inclusion of all eligible candidates 	Final list of eligible Award candidates, representing success stories worldwide
7 Perform quality check	Develop official Award consideration materials	<ul style="list-style-type: none"> • Perform final performance benchmarking activities • Write nominations • Perform quality review 	High-quality, accurate, and creative presentation of nominees' successes
8 Reconnect with panel of industry experts	Finalize the selection of the best-practice Award recipient	<ul style="list-style-type: none"> • Review analysis with panel • Build consensus • Select recipient 	Decision on which company performs best against all best-practice criteria
9 Communicate recognition	Inform Award recipient of Award recognition	<ul style="list-style-type: none"> • Present Award to the CEO • Inspire the organization for continued success • Celebrate the recipient's performance 	Announcement of Award and plan for how recipient can use the Award to enhance the brand
10 Take strategic action	Upon licensing, company is able to share Award news with stakeholders and customers	<ul style="list-style-type: none"> • Coordinate media outreach • Design a marketing plan • Assess Award's role in future strategic planning 	Widespread awareness of recipient's Award status among investors, media personnel, and employees

The Intersection between 360-Degree Research and Best Practices Awards

Research Methodology

Frost & Sullivan's 360-degree research methodology represents the analytical rigor of our research process. It offers a 360-degree-view of industry challenges, trends, and issues by integrating all 7 of Frost & Sullivan's research methodologies. Too often companies make important growth decisions based on a narrow understanding of their environment, leading to errors of both omission and commission. Successful growth strategies are founded on a thorough understanding of market, technical, economic, financial, customer, best practices, and demographic analyses. The integration of these research disciplines into the 360-degree research methodology provides an evaluation platform for benchmarking industry participants and for identifying those performing at best-in-class levels.



About Frost & Sullivan

Frost & Sullivan, the Growth Partnership Company, enables clients to accelerate growth and achieve best-in-class positions in growth, innovation and leadership. The company's Growth Partnership Service provides the CEO and the CEO's Growth Team with disciplined research and best practice models to drive the generation, evaluation, and implementation of powerful growth strategies. Frost & Sullivan leverages more than 50 years of experience in partnering with Global 1000 companies, emerging businesses, and the investment community from 45 offices on six continents. To join our Growth Partnership, please visit <http://www.frost.com>.