

# Robotic DS Raider All-Terrain Vehicle Project Proposal

To: Israel-U.S. Binational Industrial Research and Development Foundation

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Project Title: **Robotic DS Raider All-Terrain Vehicle**

Project Duration: **18 months**

Project Budget: **\$ 2,032,107.00** <sup>(1)</sup>

Submitted by:	<b>Israeli Company</b> <b>Authorized Company Official</b>	<b>U.S. Company</b> <b>Authorized Company Official</b>
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Date Submitted: 10/15/2019

\_\_\_\_\_  
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10/15/2019

<sup>(1)</sup> Project Budget – must be the same as the sum of the companies' budgets

**Preferred date (month / year) for start of project funding** <sup>(2)</sup> 1/1/2020 (Can only be 1st day of the month).

<sup>(2)</sup> Do not request a start date prior to the date of the final proposal submission.

## **A. Table of Contents**

<b>Section</b>	<b>Page</b>
A. Table of Contents	2
B. Executive Summary	3
C. The Innovation	5
D. Proposed R&D Program	10
E. Program Plan	12
F. The Market	13
G. Commercialization	15
H. Cooperation, Economic and Social Benefits	15
I. Organization and Management Plan	15
J. The Companies and Their Resources	16
K. Project Budget	16
L. Risk Analysis	17
M. Sundry Information	17

## B. Executive Summary

	Israeli Company	U.S. Company
Company name	<b>D.S RAIDER LTD</b>	<b>Mistral Inc.</b>
Company locations (headquarters and relevant division address, including full street address, state, city, zip code)	Calanit 81, Hagor, Israel 4587000	7910 Woodmont Avenue, Suite 820, Bethesda, Maryland 20814, USA
Company website	www.dsraider.com	www.mistralinc.com
Year established	2017	1988
Revenues: most recent fiscal year 2018	\$0.85 million	\$12.01 million
Increase / (Decrease) over previous year	0%	-6%
Number of employees	14	45
Ownership (Public / Private)	Private	Private
Percentage ownership of the company by the other company	0.00%	0.00%
Relationship of the companies – Parent/Subsidiary Common Ownership No common relationship Other	No common relationship	
Number of previous BIRD projects	0	0

Israeli Company Registration Number	515640894
U.S. Company DUNS Number	608561015

Expected project title	Robotic DS Raider All-Terrain Vehicle
Estimated project budget	\$1,990,870.78
Expected project duration	36 months

- Abstract:** Mistral Inc. teamed up with D.S. Raider Ltd. to develop and commercialize an innovative robotic remotely-controlled/optionally-supervised version of the popular EZRaider 4X4 All-Terrain Vehicle (ATV). The EZRaiderHD4R (DS Raider Heavy-Duty 4 Wheel Drive All-Terrain Vehicle – Robotic) could function either as an operator-driven or semi-autonomous ATV, will weigh approximately 100 kg, would support a payload of up to 170 Kg, and could be hooked-up to an electric cart to carry on additional payload of up to 250 kg. For the purposes of this proposal, the primary applications envisioned for the EZRaiderHD4R would be in the agriculture, public safety, and homeland security market segments. The EZRaiderHD4R is compact and light, easy to fold and store/transport, enables simple and precise steering, unique ground clearance and access angles, and features an exceptionally effective suspension system enabling it to travel in extreme weather through challenging terrains, including forests, boulders, sand dunes, and deep mud. The EZRaiderHD4R would be driven in person, remotely, or programmed to conduct optionally-supervised unmanned missions along a pre-planned route.

- 2. Company Background: DSRaider:** The company was launched in April 2017 and developed its patented suspension system, which grants incomparable off-road mobility. DSRaider had quickly established a niche for itself as a supplier to Public Safety and Homeland Security agencies, while also attracting ATV-sports fans and hunter communities. To date, DSRaider raised \$4.00M from private investors and has already made commercial sales and supplied orders to customers in Israel, the United States, New Zealand, Italy, Japan, Spain, Russia, and the Czech Republic. **Mistral:** With 30 years of experience and close working relationships with the end-user, system integrators, and technology developers, Mistral is an expert in providing ready, relevant, and reliable solutions to military, public safety, and homeland security agencies. Leveraging its extensive marketing, sales, program management, engineering, manufacturing, and customer support experience and capabilities, Mistral provides system solutions, such as tactical sensors and robotic vehicle borne IED tools to law enforcement SWAT and bomb squads allowing them to safely engage threats using robots at safe stand-off distances from the threat. Mistral also provides explosive storage containers and total containment vessels, drug and explosive detection, and identification field test kits to the department of defense, and federal, state and local law enforcement agencies. Mistral's Program Management Office resides in Bethesda, MD, whereas its production and operations office --- including the required development, integration, significant manufacturing, test, inspection, and storage equipment --- resides in the company's new manufacturing facility in White Marsh, MD. In this project, Mistral intends to conduct system integration and final assembly through its White Marsh facility.
- 3. The Innovation:** The EZRaiderHD4R (DS Raider Heavy-Duty 4 Wheel Drive All-Terrain Vehicle - Robotic), a robotic remotely-controlled/optionally-manned version of the popular EZRaider 4X4 All-Terrain Vehicle (EZRaiderHD4). The EZRaiderHD4R would function either as an operator-driven or tele-operated ATV, serving the agriculture, public safety, and homeland security markets by providing optionally-manned/unmanned mobility and transportation solutions not available today by existing platforms. The EZRaiderHD4R will enable farmers, law enforcement officers, border patrol agents, and emergency relief personnel to conduct manned or remotely-supervised tasks requiring a small footprint and ability to move heavy equipment through narrow paths and difficult terrains. This would enable safer and more efficient manned/unmanned rugged-terrain operations that cannot be met by existing platforms, such as the Ninebot Segway or T3 models.
- 4. Collaborative Relationship:** Throughout the design and integration phases, Mistral will function as the system integrator, program management, and commercialization planning office, while DSRaider will function as the platform original equipment manufacturer (OEM); each company will incur its own respective non-BIRD portion of the project cost using internal funding. The approximate development budget ratio breakdown is: (a) digital drive-by-wire conversion of the EZRaiderHD4 [DSRaider, 25%; Mistral, 5%], (b) integration of the DBW EZRaiderHD4 with semi-autonomous kit [Mistral, 25%; DSRaider 5%], (c) commercialization planning [Mistral, 10%], (d) testing and evaluation, incl. end-user demonstrations [Mistral 25%; DSRaider 5%]. During the commercialization phase (not part of this project), DSRaider will manufacture and sell to Mistral DBW EZRaiderHD4 platforms at mutually-agreed price that will be integrated, marketed, sold, and supported by Mistral. This proposal focuses on the design and integration phases only.
- 5. Commercial Potential:** The estimated relevant market segment sizes for the developed product and expected markets share after 1-3 years of commercialization are listed below.

<b>Calendar year:</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>
Target market size for developed product (M\$):	79,386	79,386	79,386
Estimated market share (%):	0.05	0.5	1.0
Estimated sales quantity (units):	40	397	794
Estimated representative unit price (\$/unit):	30,000	30,000	30,000
Estimated sales revenue (K\$):	1,200	11,910	23,820
Estimated cumulative sales revenue (K\$):	1,200	13,110	36,930

## C. The Innovation

1. **Current Situation:** The agriculture, public safety, and homeland security markets have been utilizing for years a variety of off-road manned transportation solutions for their missions. And yet, missions such as, traversing undeveloped rugged farmlands, firefighting fast-spreading fires in hard-to-get wildlands, conducting silent movement and watch border patrol or search and rescue missions in rugged areas, and responding to emergency cases during natural and man-made disasters, necessitate fast-movement through extremely rough and difficult to maneuver terrains while carrying heavy loads cannot be conducted using existing equipment. While the market is gradually shifting toward optionally-manned/unmanned payload and transportation solutions, these solutions tend to focus on either specialty platform-payload combinations or commercial vehicles modified with add-on kits. As a result, the current market is lacking all-terrain narrow-width optionally-manned/unmanned solutions. The EZRaiderHD4R will enable farmers, law enforcement officers, border patrol agents, and emergency relief personnel to conduct manned or autonomous tasks requiring small footprint and ability to move heavy equipment through human-selected machine-driven narrow paths in difficult terrains. This would enable safer and more efficient manned/unmanned rugged-terrain operations that cannot be met by existing platforms. Given the limited scope of this proposal, the analysis will outline the agriculture market segment potential only; detailed analysis of this market segment as well as the others will be conducted during the commercialization planning activity.
2. **The Agriculture Market for EZRaiderHD4R:** The U.S. agricultural market is showing a clear trend of consolidation and productivity increase. As could be seen in figures 1.a. and 1.b. below, large-scale farms with annual gross cash income larger than \$1M constitute 2.8% of the US farm count (79,386 farms in the 2017 census<sup>1</sup>) and 39% of the overall production. The rate of technology insertion in support of productivity improvement increased due to the consequential cost savings and has been focused on global positioning system (GPS) guidance systems, GPS yield and soil monitoring and mapping, and variable-rate input application technologies<sup>2</sup>.

<sup>1</sup> U.S. Department of Agriculture, Economic Research Service Data

<sup>2</sup> Schimmelpfennig, D. Farm Profits and Adoption of Precision Agriculture, ERR-217, U.S. Department of Agriculture, Economic Research Service, October 2016

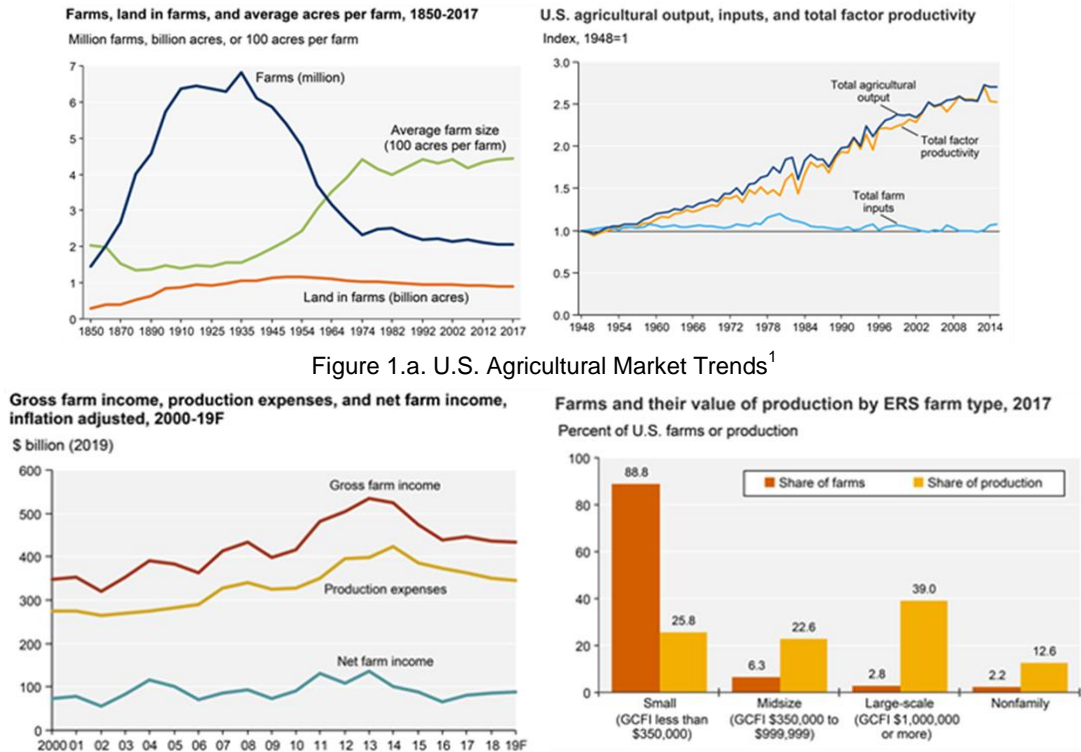


Figure 1. U.S. Agricultural Market Trends<sup>1</sup>

As USDA predicts, this rate of insertion is likely to grow further in custom applications, those that could yield gains or reducing environmental impacts of farming<sup>Error! Bookmark not defined.</sup> (see figure 2). In this respect, the unique functionality (i.e., small footprint and ability to move heavy equipment through human-selected machine-driven narrow paths in difficult terrains) of the EZRaiderHD4R is anticipated to open a new market at a greater size than forecasted in this proposal.

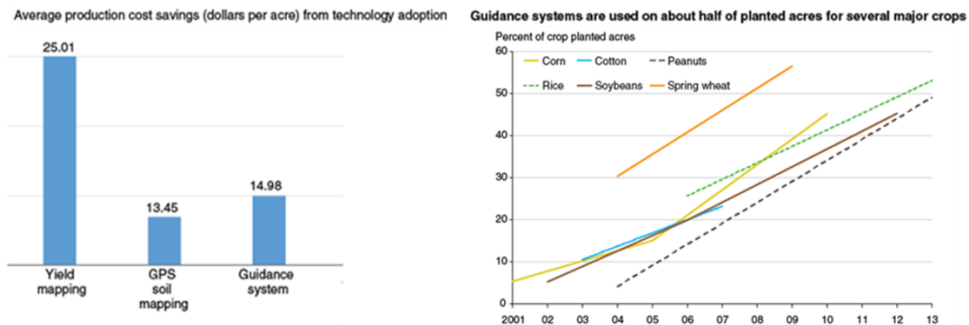


Figure 2. U.S. agricultural technology insertion trends<sup>1</sup>

At the end state, it is assumed that very large farms with annual market value of agricultural products sold higher than \$1M could procure at least one EZRaiderHD4R in support of their operations in rugged/undeveloped farmlands. Given that 37% and 54% of the agricultural income is generated in the top 5 and 10 states, respectively; the marketing effort could be easily focused and optimized during the penetration phase (see figures 3.a and 3.b).



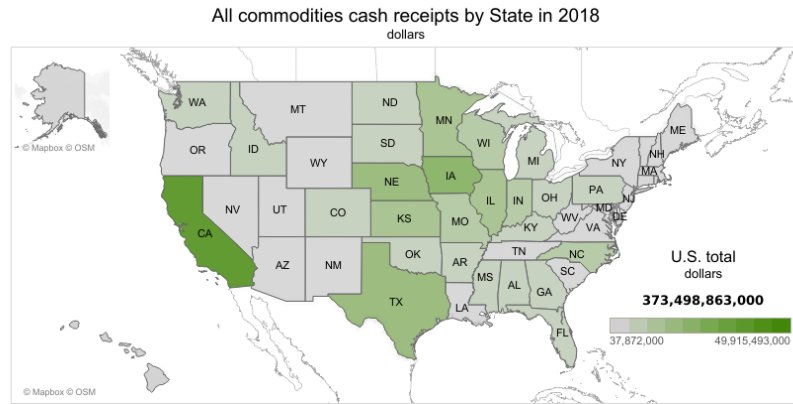


Figure 3a. Geographical distribution of U.S. Agricultural cash receipts

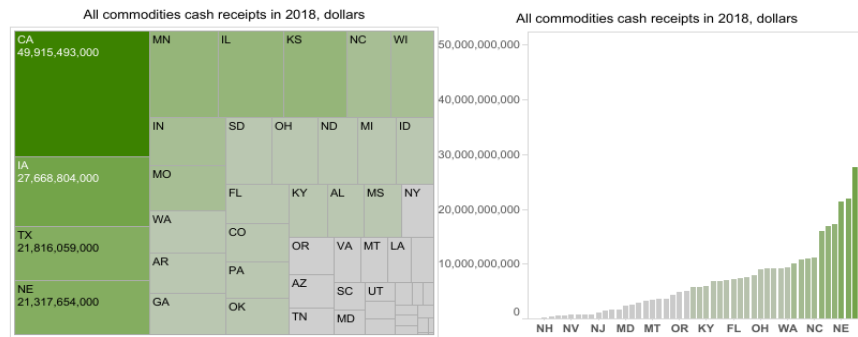


Figure 3b. Geographical distribution of U.S. Agricultural cash receipts

- Product Concept:** The existing EZRaider platform (see figures 4, 5, and 6) is driven by mechanical steering, analog acceleration/deceleration input, pushdown reverse button, and mechanical activation of hydraulic-operated disc brakes.

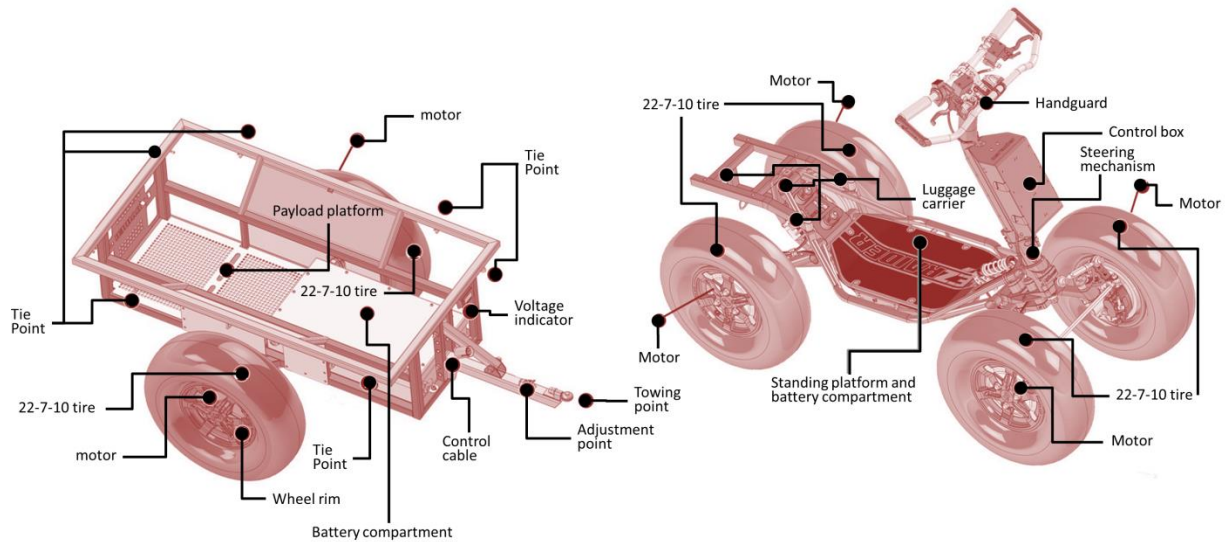


Figure 4. The EZRaider Baseline Configuration

Sub-System	Property	Value	Sub-System	Property	Value
<b>General</b>	Max Useful Payload	374.8 lbs.	<b>Suspension</b>	Front/ Rear Suspension Travel	19.7 in.
	Max Speed	28.1 mph		Suspension Type	Tri-axial Suspension; Adjustable rubber and gas/oil damper combo
	Max Range	46.9 mi	<b>Driveline</b>	Motor Type	Type 205; 8.3kg; Hub Motor; DC Brushless
	Motorized Trailer Towing Capacity	705.5 lbs.		No. Of Motors	4
	Max Climbing Capacity	30°		Output - Continuous	4 x 1,200 W
	Max Side Slope	45°		Output - Peak	4 x 2,200 W
	Approach Angle	90°		Torque	4 x 80 Nm
	Departure Angle	90°	<b>Braking</b>	Front/Rear	2 x disc
<b>Dimensions and weights</b>	Ground Clearance	9.4 in.		Parking Brake	Integrated with Discs
	Curb Weight	286.6 lbs.		Discs Diameter	6.7 in.
	Overall Length	66.9 in.		Caliper - Dual Piston	1.1 in.
	Overall Height	53.1 in.	<b>Water Fording</b>	Battery Compartment	Waterproof
	Overall Width	29.1 in.		Controllers	Partially Sealed
<b>Power</b>	Wheel Diameter	22.0 in.		Buoyancy	Buoyant; without payload
	Type	Sony BT6 - 240 Li-Ion	<b>Additional modules and options</b>	Prompt Fording (<20 sec)	7.9 in.
	Total Voltage	60.0 V		Luggage Carrier	Included
	Capacity	3.0 kWh		Skid Plate	Included
	Working Temp	-4°F to 176°F		Hand Guard	Included
	Charge Cycles	800.0 Cycles		Tow Hook	Included
	Current/ Max Continuous Current	50.0 A/240.0 A		Rider Seat	Optional
	Charger	HSS-P630A Li-ion 360W 230VAC 67.2V 5A Ea.		Co-rider Seat	Optional
	Max Continuous Charging Current	15.0 A		Control Harness For Trailer	Included

Figure 5. EZRaider Baseline Specification

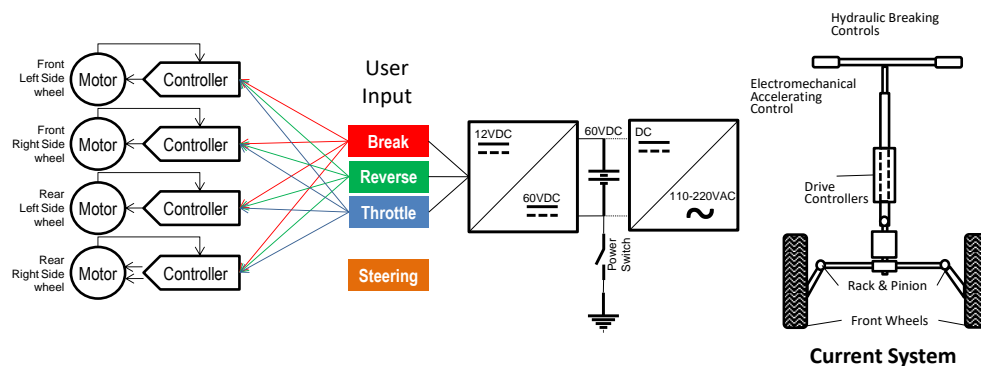


Figure 6. EZRaider Baseline Block Diagram

The EZRaiderHD4R, the proposed autonomous modification of the EZRaider, will focus on human-decided machine-learned modified commercially-available track-repeating automatic driving system solution. This practical low-risk approach will use proven modules, standard architectures and interfaces, and would avoid unnecessary challenges with experimental solutions, such as build-from-scratch robotic developments, large area teleoperation networks in non-permissive terrains, and over-generalized automatic navigation and route planning systems. This way, the proposed platform would enable system integrators,



payload sub-system manufactures, and robotic behavior and autonomy developers to easily design and integrate their solutions and technologies all while reducing development costs and market prices.

Notionally, the EZRaiderHD4R upgrade (see figure 7) will be based on two integrated kits: (a) the drive-by-wire (DBW) kit, which includes a DBW processor, tactile user interface, and break and steering actuators; and (b) the auto driver (AD) kit, which includes an AD processor and user interface. The DBW kit provides the following functions: monitoring of user inputs, activation of the driving functions, and provision of user feedback by the DBW processor. The AD kit provides the following functions: recording of traveled routes, execution of versed/reversed recorded routes, environmental monitoring, and watchdog safety procedures.

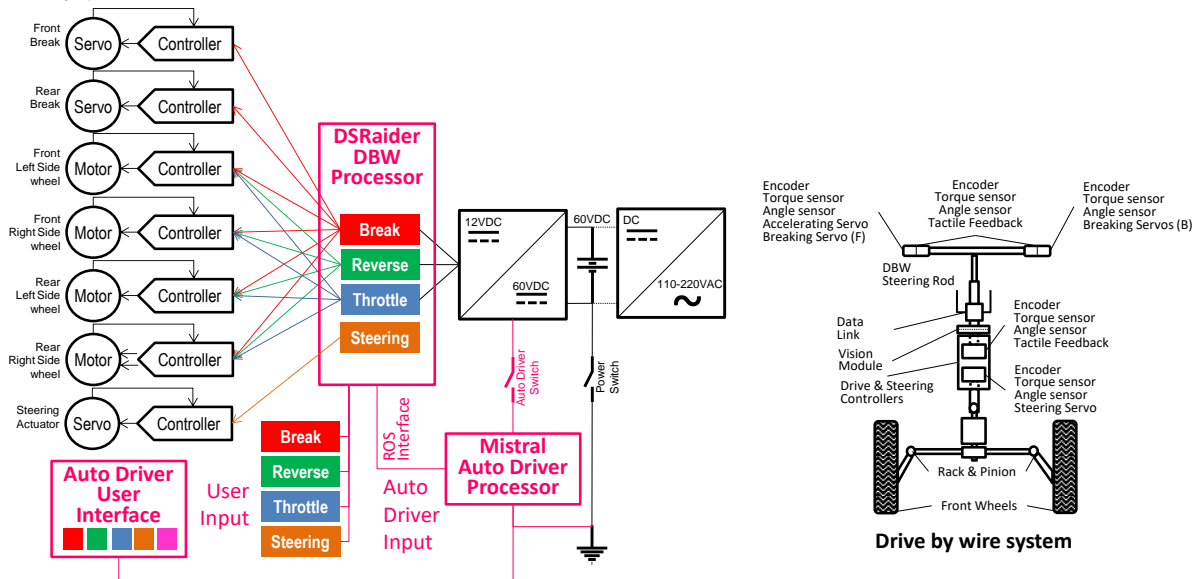


Figure 7. EZRaiderHD4R Notional Block Diagram

4. **Differentiation and competitiveness:** The existing EZRaider platform (see figures 4, 5, and 6) was designed for handling the most extreme terrains at both high, and extreme low speeds. With a patented 19.6"-long travel suspension, 25" width, 63" length, and a 441 lbs./1,102 lbs. (1:2.5) weight/payload ratio, the EZRaider is able to maneuver and haul substantial loads through extremely rugged terrain on narrow trails. The proposed development will yield a unique manned/unmanned all-terrain ultra-compact heavy-duty platform extending current capabilities in the precise farming, wildland firefighting, search and rescue, disaster relief, and border security market segments.
5. **Patent Situation:** The existing EZRaider platform and, essentially, the baseline configuration of the EZRaiderHD4R are protected by United States Design Patent USOOD8451775 dated 4/9/2019. The potential for applying for new patents resulting from the development of the EZRaiderHD4R will be evaluated by DSRaider and Mistral throughout the project's period of performance and the commercialization phase.
6. **Regulatory and Standards Compliance:** As indicated earlier, this project intends to use mature standard components and interfaces to the maximum possible extent in order to minimize development and commercialization risks. As such, it is envisioned that the

EZRaiderHD4R will utilize commercial automotive components, industry interface protocols such as the Robot Operating System (ROS) meta-operating system, and applicable standards such as SAE J3088, J3016, J2958, J1583, National Highway Traffic Safety Administration regulations, and any applicable state-level enacted legislation related to autonomous vehicles.

	SAE LEVEL 0	SAE LEVEL 1	SAE LEVEL 2	SAE LEVEL 3	SAE LEVEL 4	SAE LEVEL 5
What does the human in the driver's seat have to do?	You <b>are</b> driving whenever these driver support features are engaged - even if your feet are off the pedals and you are not steering			You <b>are not</b> driving when these automated driving features are engaged - even if you are seated in "the driver's seat"		
	You must constantly supervise these support features; you must steer, brake or accelerate as needed to maintain safety			When the feature requests, you must drive	These automated driving features will not require you to take over driving	
	These are driver support features			These are automated driving features		
What do these features do?	These features are limited to providing warnings and momentary assistance	These features provide steering <b>OR</b> brake/acceleration support to the driver	These features provide steering <b>AND</b> brake/acceleration support to the driver	These features can drive the vehicle under limited conditions and will not operate unless all required conditions are met		This feature can drive the vehicle under all conditions
Example Features	• automatic emergency braking • blind spot warning • lane departure warning	• lane centering <b>OR</b> adaptive cruise control	• lane centering <b>AND</b> adaptive cruise control at the same time	• traffic jam chauffeur	• local driverless taxi • pedals/steering wheel may or may not be installed	• same as level 4, but feature can drive everywhere in all conditions

Figure 8. SAE J3016 Levels of Driving Automation

7. **Obligations to other government agencies:** To both companies' best knowledge, there are no outstanding obligations to other government agencies associated with this proposed project.

## D. Proposed R&D Program

### D.1. Analysis of the Problem

1. **The problem:** Modern farms utilize automation to the maximum extent in order to improve their performance (see section C.2.). Currently, agriculture automation is used mostly for performing precise farming functions by specialty platforms and payloads. As evident from the emerging market of autonomous upgrade kits for commercial standard trucks and vehicles, there is a demand for autonomous transportation of goods between points, but current solutions still require the establishment of routes for full sized vehicles and do not support necessarily off-road cross-country transportation.
2. **Properties and functions:** The market input that contributed to formulating the end product characteristics provided in section C.3. is based on the review of the state of the market as described in sections C.1.-C.2. and applicable experience with the military market. See section C for more details.

3. **Challenges:** In order to realize the required properties and function described in section C.3., D.S. Raider and Mistral anticipate the following challenges: (a) upgrading the EZRaider to enable DBW functionality would require adaptation of existing kits to the baseline configuration, which may pose a development risk due to the smaller size of the platform, (b) adding the automated driver capability and adjusting it to accommodate off-road cross-country driving may pose additional set of risks due to the unstructured nature of this application, and (c) meeting current and future regulations and standards may induce additional layer of complexity adding to development risk even further. To mitigate these risks D.S. Raider and Mistral are planning to hire a subcontractor specializing in the development and integration of autonomous driving kits in order to get the state of the art available in the market and leverage its experience.

## D.2. Proposed Approach

The proposed approach for this project is the trusted waterfall model augmented with the agile model testing-while-developing for risk reduction. Due to the parallel work on the DBW and AD kits in D.S. Raider and Mistral and the consequent integration of the EZRaiderHD4R it deemed necessary to divide the project into two phases – design and integration. The first phase will be devoted to consecutive reviews of the requirements, DTW and AD design, and system integration design, culminating with the system design approval. Once the design was approved, the integration phase would commence in parallel with the implementation and testing of the DBW upgrade of the EZRaider platform and the adaptation of the AD robotic kit. Platform integration would begin once subsystem testing was completed and will be followed by indoors, outdoors, and end-use representing environment testing.

### 1. Phase 1 - Design

- a. **System Requirements Review.** Objective: Approved project requirements; Contents: Complete review of all functional, interface, interoperability, standard, and regulatory requirements; Resources: System engineering; Primary responsibility: D.S. Raider and Mistral (50%-50%).
- b. **Platform Drive by Wire Design Review.** Objective: Approved DBW upgrade design; Contents: Complete review of all functional, interface, interoperability, standard, and regulatory design aspects of the DBW upgrade of the EZRaider; Resources: System and specialty engineering and subcontractor technical support; Primary responsibility: D.S. Raider.
- c. **Robotic Kit Design Review.** Objective: Approved AD robotic kit design; Contents: Complete review of all functional, interface, interoperability, standard, and regulatory design aspects of the robotic kit; Resources: System and specialty engineering and subcontractor technical support; Primary responsibility: Mistral.
- d. **System Design Review.** Objective: System Design Approval; Contents: Complete review of all functional, interface, interoperability, standard, and regulatory aspects of the system and, if needed, revision of the requirements; Resources: System engineering; Primary responsibility: D.S. Raider and Mistral (50%-50%).

### 2. Phase 2 - Integration

- a. **Drive-by-Wire Sub-system Integration.** Objective: Implementation of the DBW upgrade design per system requirements; Contents: Complete implementation and testing of all functional, interface, interoperability, standard, and regulatory design aspects of the DBW upgrade of the EZRaider; Resources: System and specialty engineering and subcontractor technical support; Primary responsibility: D.S. Raider.

- b. **Robotic Kit Sub-system Integration.** Objective: Implementation of the AD robotic kit design per system requirements; Contents: Complete implementation and testing of all functional, interface, interoperability, standard, and regulatory design aspects of the robotic kit; Resources: System and specialty engineering and subcontractor technical support; Primary responsibility: Mistral.
- c. **Drive-by-Wire and Robotic Kit Lab Integration.** Objective: Integration of the DBW and AD robotic kit; Contents: Complete integration and testing of the DBW and AD robotic kit in a desktop setting (without the platform yet) for functional and safety verifications; Resources: System and specialty engineering and subcontractor technical support; Primary responsibility: D.S. Raider and Mistral (50%-50%).
- d. **System Lab Integration.** Objective: EZRaiderHD4R system integration; Contents: Complete integration of all EZRaiderHD4R system components focusing on functional, interface, and interoperability aspects of the integration; Resources: System and specialty engineering and subcontractor technical support; Primary responsibility: D.S. Raider and Mistral (50%-50%).
- e. **Lab Integration Tests.** Objective: Verify that all functional, interface, interoperability requirements are met; Contents: Verify by testing that all functional, interface, interoperability requirements are met; Resources: System engineering; Primary responsibility: D.S. Raider and Mistral (50%-50%).
- f. **Test results and improvement.** Objective: Fully integrated EZRaiderHD4R prototype; Contents: Complete integration of an EZRaiderHD4R prototype focusing on testing readiness, standard and regulatory compliance, and compilation of the system user manual; Resources: System and specialty engineering and subcontractor technical support; Primary responsibility: D.S. Raider and Mistral (50%-50%).
- g. **Additional lab test after improvement.** Objective: Prototype ready for end-user evaluation; Contents: Verify by testing that all functional, interface, interoperability, standard, and regulatory aspects of the system were met; verify the applicability of the user manual; Resources: System and specialty engineering and subcontractor technical support; Primary responsibility: D.S. Raider and Mistral (50%-50%).
- h. **End-User Evaluations and Tests.** Objective: EZRaiderHD4R is ready for pre-sale marketing and demonstrations; Contents: Testing of the EZRaiderHD4R in end-user representative environment – tests will include all use cases defined in the system requirements across all system functions; Resources: System engineering; Primary responsibility: D.S. Raider and Mistral (50%-50%).

## E. Program Plan

The proposed 18-months program plan covers the design and integration phases up to the completion of a fully-functional prototype, which concluded tests and user evaluations and is ready for the commercialization phase. The design phase includes all research, development, and design activities, which are concluded by design review and formal design approval. The integration phase includes all implementation activities at the sub-system and system levels, as well as developer tests and user evaluations at the laboratory and representative environments. Until revisited during the project reviews, all combined tasks, which both companies are responsible for their execution, are considered at this point as if approximately 50% of the overall responsibility is assigned to each company.

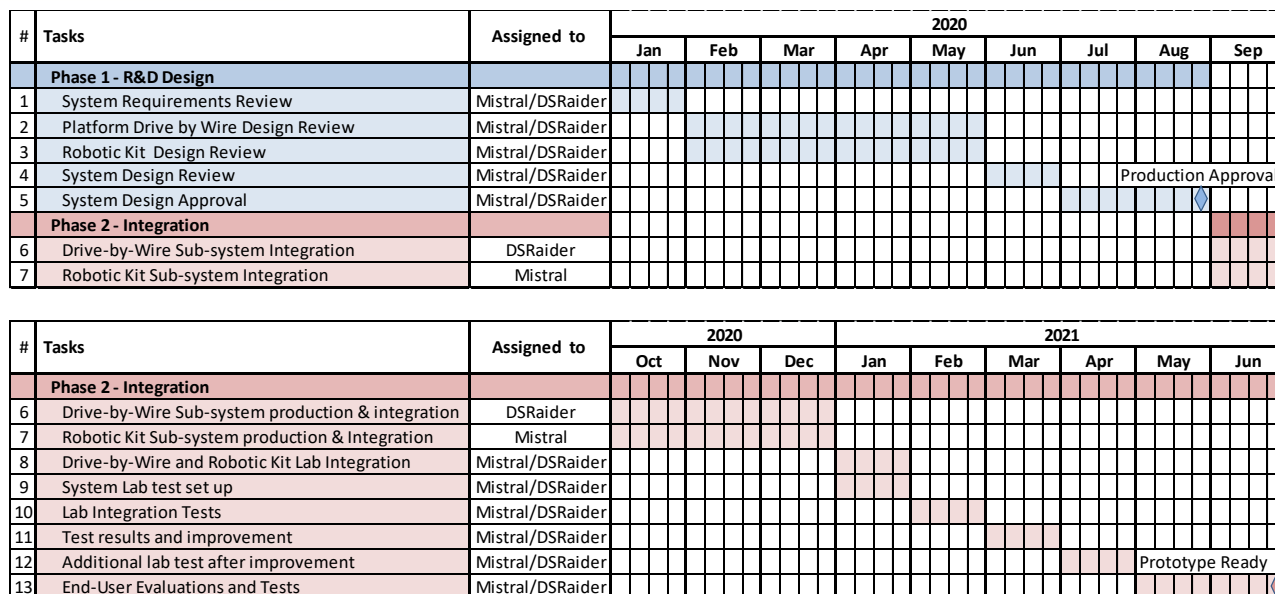


Figure 9. Program Plan

## F. The Market

1. As indicated in section C.3., while the proposed product could be applicable to additional market segments, this proposal focuses on the agricultural market; detailed market analysis will be conducted once the product completed its development and testing and is ready for pre-sale marketing. Both D.S. Raider and Mistral are currently active in developing, manufacturing, and selling similar types of this product in similar markets (military, homeland security, law enforcement, and public safety). The basis for the stated agriculture market needs was derived from market trends research by the U.S. Department of Agriculture (USDA)<sup>2</sup> and the academia<sup>3,4</sup>.

2. As indicated in section C.3., taking a conservative estimate that only large-scale farms with annual gross cash income larger than \$1M would be buying the EZRaiderHD4R at an average rate of 1 platform per farm, the estimated total available market (TAM) for the product is 79,386 physical units and \$2,381M. Given the recreational potential of the EZRaiderHD4R and the conservative approach taken, this estimate could plausibly grow further to an average of 2 platforms per farm leading to a twice-large TAM.

3. Taking a conservative approach, the companies estimate capturing market share of 0.05%, 0.5%, and 1% in the first, second and third commercialization years, in that order. See figure 10 for more details on the assumptions taken in this estimate. The unit selling price is assumed \$30,000 per platform and is not anticipated at this point to change from the year of the product launch to subsequent years.

<sup>3</sup> Shamshiri et al. (2018) Research and development in agricultural robotics: A perspective of digital farming. International Journal of Agricultural and Biological Engineering, 11(4): 1–14.

<sup>4</sup> UK-Robotics and Autonomous Systems Network. (2018) Agricultural Robotics: The Future of Robotic Agriculture.



Market Segment	Farms >\$1M/yr	Total
Estimated Agencies	79,386	
Final Average Units/Agency	1	
Market size Product (Qty)	79,386	<b>79,386</b>
Market size Developed Product (\$M)	2,381.58	<b>2,381.58</b>
<b>2021</b>		
Estimated sales Qty	40	<b>40</b>
Assumed Penetration	0.05%	<b>0.05%</b>
Y1 Average Units/Agency	1	
Estimated Sales (\$M)	1.2	<b>1.2</b>
<b>2022</b>		
Estimated sales Qty	397	<b>397</b>
Assumed Penetration	0.50%	<b>0.50%</b>
Y2 Average Units/Agency	1	
Estimated Sales (\$M)	11.91	<b>11.91</b>
<b>2023</b>		
Estimated sales Qty	794	<b>794</b>
Assumed Penetration	1.00%	<b>1.00%</b>
Y3 Average Units/Agency	1	
Estimated Sales (\$M)	23.82	<b>23.82</b>

Figure 10. Sales Forecast

4. Due to the less-restrictive nature of the agricultural market for autonomous platforms, compared to the commercial automotive market – which is progressing nicely on the regulatory plane – D.S. Raider and Mistral do not anticipate much regulatory barriers. Yet, the companies will continue to monitor the regulatory landscape at the federal and state levels and will plan accordingly. The utilization of commercial components should mitigate much of the risk in this aspect of the project.

5. There are virtually no comparable products to the EZRaiderHD4R in the market. While there is a variety of trucks and All-Terrain Vehicles (ATV) with farming attachments available in this market, neither one of them is as narrow and maneuverable as the EZRaider. While there are multiple farming robots in the agricultural market, they are mostly very specialized functionality. D.S. Raider and Mistral estimated the sale price of the EZRaiderHD4R to be \$30,000 in quantities, and comparing it to the \$85,000 cost of a typical autonomous kit for commercial trucks, this price seems to be competitive.

Calendar year:	2020	2021	2022
Target market size for developed product (M\$):	79,386	79,386	79,386
Estimated market share (%):	0.05	0.5	1.0
Estimated sales quantity (units):	40	397	794
Estimated representative unit price (\$/unit):	30,000	30,000	30,000
Estimated sales revenue (K\$):	1,200	11,910	23,820
Estimated cumulative sales revenue (K\$):	1,200	13,110	36,930



## **G. Commercialization – Plans and Prospects**

### **G.1. Product Manufacturing, Marketing and Sales Activities**

Both companies will be engaged in production: D.S. Raider would produce the DBW upgraded platform, while Mistral will integrate the AD robotic kit onto the upgraded platform. Mistral operates two manufacturing facilities in White Marsh, MD, and Curtis Bay, MD whereas the proposed product manufacturing could be incorporated. Mistral will be responsible for marketing, sales, and sales support of the developed product covering the U.S. across all potential markets for the product. The company has a suitable sales and service network addressing the homeland security, public safety, and law enforcement and will leverage it to the maximum extent possible. D.S. Raider and Mistral anticipate that the necessary financial resources would be available within the companies.

### **G.2. Cash Flow Analysis**

See attached worksheet

## **H. Cooperation, Economic and Social Benefits**

Throughout the design and integration phases, Mistral will function as the system integrator, program management, and commercialization planning office, while DSRaider will function as the platform original equipment manufacturer (OEM); each company will incur its own respective non-BIRD portion of the project cost using internal funding. The approximate development budget ratio breakdown is: (a) digital drive-by-wire conversion of the EZRaiderHD4 [DSRaider, 25%; Mistral, 5%], (b) integration of the DBW EZRaiderHD4 with semi-autonomous kit [Mistral, 25%; DSRaider 5%], (c) commercialization planning [Mistral, 10%], (d) testing and evaluation, incl. end-user demonstrations [Mistral 25%; DSRaider 5%]. During the commercialization phase (not part of this project), DSRaider will manufacture and sell to Mistral DBW EZRaiderHD4 platforms at mutually-agreed price that will be integrated, marketed, sold, and supported by Mistral. This proposal focuses on the design and integration phases only.

## **I. Organization and Management Plan**

1. As indicated in the program plan, D.S. Raider and Mistral will conduct a series of design reviews during the design phase and weekly program management teleconferences along the project's period of performance in order to maintain timely communications between each company's project team. For more details see sections D.2. and E.

## 2. Project organization chart



## 3. Program's Key Project Personnel

Personnel	Ad hoc role	Formal role
Ronnen Paytan	Program Manager	Mistral Business Development Director
Gadi Binyamini	Program Manager	DS Raider Chief Operating Officer
Yoav Tilan	Technical Manager	Mistral Program Manager
Erez Abramov	System Engineer	DS Raider Chief Technology Officer
Chris Weller	System Engineer	Mistral Business Development Director

## J. The Companies and Their Resources

**DSRaider:** The company was launched in April 2017 and developed its patented suspension system, which grants incomparable off-road mobility. DSRaider had quickly established a niche for itself as a supplier to Public Safety and Homeland Security agencies, while also attracting ATV-sports fans and hunter communities. To date, DSRaider raised \$4.00M from private investors and has already made commercial sales and supplied orders to customers in Israel, the United States, New Zealand, Italy, Japan, Spain, Russia, and the Czech Republic.

**Mistral:** With 30 years of experience and close working relationships with the end-user, system integrators, and technology developers, Mistral is an expert in providing ready, relevant, and reliable solutions to military, public safety, and homeland security agencies. Leveraging its extensive marketing, sales, program management, engineering, manufacturing, and customer support experience and capabilities, Mistral provides system solutions, such as tactical sensors and robotic vehicle borne IED tools to law enforcement SWAT and bomb squads allowing them to safely engage threats using robots at safe stand-off distances from the threat. Mistral also provides explosive storage containers and total containment vessels, drug and explosive detection, and identification field test kits to the department of defense, and federal, state and local law enforcement agencies. Mistral's Program Management Office resides in Bethesda, MD, whereas its production and operations office --- including the required development, integration, significant manufacturing, test, inspection, and storage equipment --- resides in the company's new manufacturing facility in White Marsh, MD. In this project, Mistral intends to conduct system integration and final assembly through its White Marsh facility.

## K. Project Budget

See attached worksheets for DSRaider and Mistral

## L. Risk Analysis

TABLE 1A

Risk #	Name/Description	Ranking	Impact		
			Duration <sup>1</sup>	Budget <sup>2</sup>	Commercialization Potential <sup>3</sup>
1	<b>Main competition</b>	Medium	<3 months	<+10%	30% to 50%
2	<b>Fit for target markets</b>	Medium	3-6 months	+10 to 20%	30% to 50%
3	<b>Conversion to DBW</b>	Medium	3-6 months	+10 to 20%	30% to 50%
4	<b>Autonomous mode</b>	Medium	3-6 months	+10 to 20%	30% to 50%
5	<b>Continuing Resolution</b>	Low	<3 months	<+10%	1% to 29%

TABLE 1B

Risk #	Name/Description	Type*
1	<b>Main competition</b> (Ninebot Segway and/or T3) target similar markets	E
2	DSRaider HD4 platform <b>Fit for target markets</b> not optimal	T/M/E
3	DSRaider HD4 <b>Conversion to DBW</b> more complicated than envisioned	T/M
4	DSRaider HD4 <b>Autonomous mode</b> more complicated than envisioned	T/M
5	<b>Continuing Resolution</b> affects governmental spending	E

\*Type: Technical (T), Project Management/Resources (M), External to the Project (E)

Ranking	Probability of Risk Occurring	Impact	Duration <sup>1</sup>
High	Above 50%	High	Above 6 months
Medium	30 – 49%	Medium	3 to 6 months
Low	10 – 29%	Low	Below 3 months
Impact	Budget <sup>2</sup>	Impact	Commercialization Potential <sup>3</sup>
High	Above 20% increase	High	Above 50%
Medium	10% to 20% increase	Medium	30% to 50%
Low	Below 10% increase	Low	1% to 29%

1. Duration of project extended by the given amount
2. Cost of project increases by the given percentage
3. Forecasted sales in the next 3 or 5 years reduced by the given percentage

## M. Sundry Information – Mandatory

**Israeli Company - Company name as appears on the Certificate of Incorporation**

**Project Manager -**

Full name and title: Gadi Binyamini

Position in company: Chief Operating Officer

Email address: gadi@ezraider.com

Direct number: +972-72-2559880

Mobile number: +972-54-4580706

**Fiscal Information Official -**

Full name and title: Chaim Eldar

Position in company: Chief Financial Officer

Email address: chaim@ezraider.com

Direct number: +972-72-2559880

Mobile number: +972-54-8085330

**U.S. Company - Company name as appears on the Certificate of Incorporation**

**Project Manager -**

Full name and title: Ronnen Paytan

Position in company: Business Development Director

Email address: rpaytan@mistralgroup.com

Direct number: +1-301-913-9366

Mobile number: +1-301-529-4051

**Fiscal Information Official -**

Full name and title: Jeff Davis

Position in company: Chief Financial Officer

Email address: jdavis@mistralgroup.com

Direct number: +1-301-913-9366

Mobile number: +1-301-529-4043

**Details of bank accounts to enable the Foundation to transfer the payments to the companies.**



**Israeli Company**

- Name of Account: D.S RAIDER LTD
- Account Number: 12-626-12270
- Name of Bank: Bank Hapoalim
- Branch name: Hod Hasharon
- Complete bank address: Derech Ramataim 69-71 , Hod Hasharon , Israel
- IBAN number: IL510126260000000012270

**U.S. Company**

- Name of Account: Mistral, Inc.
- Account Number: 209053402
- Name of Bank: SunTrust Bank
- Complete bank address: 7535 Old Georgetown Road, Bethesda, Maryland 20814
- ABA Routing number: 061000104
- SWIFT number: SNTRUS3A

**Certificates of Incorporation – D.S. Raider Ltd.**

 <p>רשות התאגידים רשם החברות והשותפויות</p>	<p>מדינת ישראל</p> <p>משרד המשפטים – רשות התאגידים</p> <p>רשם החברות והשותפויות</p>	
<h2 style="margin: 0;">תעודת התאגדות חברה</h2> <p style="margin: 10px 0 0 0;">וזאת לתעודה כי החברה :</p> <div style="border: 1px solid black; padding: 20px; margin: 10px auto; width: 80%;"> <p style="text-align: center; font-size: 1.2em; margin: 0;"><b>ד.י.אס ריידר בע"מ</b></p> <p style="text-align: center; font-size: 1.5em; margin: 10px 0 0 0;"><b>D.S RAIDER LTD</b></p> <p style="text-align: center; margin: 10px 0 0 0;"><b>שםספרה 515640894</b></p> </div> <p style="text-align: center; margin-top: 20px;">נתאגדה ונרשמה ביום 05/04/2017 ט' ניסן תשע"ז על פי חוק החברות, התשנ"ט-1999, כחברה בערבון מוגבל.</p>		
<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="width: 30%;">  </div> <div style="width: 65%;"> <p style="text-align: right; font-weight: bold;">ניתנה בירושלים ביום:</p> <p style="text-align: right; margin-top: 20px;">05/04/2017</p> <p style="text-align: right;">ט' ניסן תשע"ז</p> </div> </div>		
<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="width: 30%;">  </div> <div style="width: 65%;"> <p style="text-align: right;">אייל גלוביס, עו"ד</p> <p style="text-align: right;">רשם החברות והשותפויות</p> <p style="text-align: right;">ראש רשות התאגידים</p> </div> </div>		

אישור שמסמך זה החתום אלקטרונית, מהווה העתק של מסמך מקור או העתק חיצוני. כיום החתימה בעזרת התאגיד ברשת התאגידים.



**Certificates of Incorporation – Mistral Inc.**

# *Delaware*

PAGE 1

## *The First State*

I, HARRIET SMITH WINDSOR, SECRETARY OF STATE OF THE STATE OF DELAWARE, DO HEREBY CERTIFY "MISTRAL, INC." IS DULY INCORPORATED UNDER THE LAWS OF THE STATE OF DELAWARE AND IS IN GOOD STANDING AND HAS A LEGAL CORPORATE EXISTENCE SO FAR AS THE RECORDS OF THIS OFFICE SHOW, AS OF THE TWENTY-THIRD DAY OF JULY, A.D. 2007.

AND I DO HEREBY FURTHER CERTIFY THAT THE SAID "MISTRAL, INC." WAS INCORPORATED ON THE TWENTY-SECOND DAY OF SEPTEMBER, A.D. 1988.

AND I DO HEREBY FURTHER CERTIFY THAT THE FRANCHISE TAXES HAVE BEEN PAID TO DATE.

AND I DO HEREBY FURTHER CERTIFY THAT THE ANNUAL REPORTS HAVE BEEN FILED TO DATE.

2173317 8300

070941627



*Harriet Smith Windsor*

Harriet Smith Windsor, Secretary of State

AUTHENTICATION: 5863639

DATE: 07-23-07