APPLIED AERODYNAMICS RESEARCH PROJECT

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CONTENTS

- Application perspective:
  - high altitude surveillance;
  - rescue;
  - aerospace industries;
  - military / police application;
  - engineering training programs.

- Some of the key applications to show prospect include but are not limited to military and aerospace industries.

RESEARCH PERSPECTIVE

OUR RESEARCH

Research includes:

- Wind tunnel testing of
  - airfoils,
  - wings,
  - wind energy conversion systems.
- Computational fluid dynamic analysis of
  - airfoils,
  - wings,
  - aircraft,
  - turbines,
  - nozzles,
  - etc.
- Full-scale aerodynamic testing of various systems.

We work closely with engineers and researchers of various companies and institutions on the above problems.

WORLD TRENDS

WORLD TRENDS

- Major Trends:

- Stealth Technology;
- Hypersonic Technology;
- Jet-Powered Drones.

- Stealth technology, also termed low observable technology (LO technology), is a technology that encompasses a range of techniques used to make aircraft, missiles, and satellites less visible (ideally invisible) to radar, infrared, sonar, and other detection methods. Stealth technology corresponds to multispectral camouflage for these objects in electromagnetic spectrum.

- Hypersonic speed is a speed that is 5 times the speed of sound and is often stated to start at Mach 5 and above.

IRIS-T FCAAM
STEALTH MISSILE FOR 6TH GENERATION

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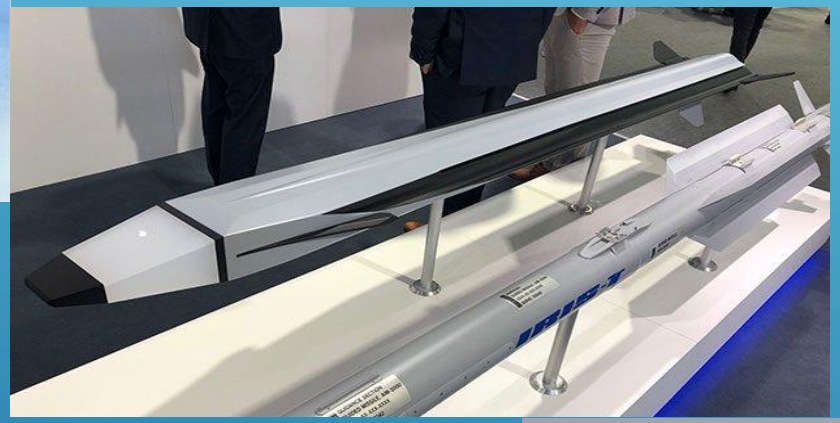
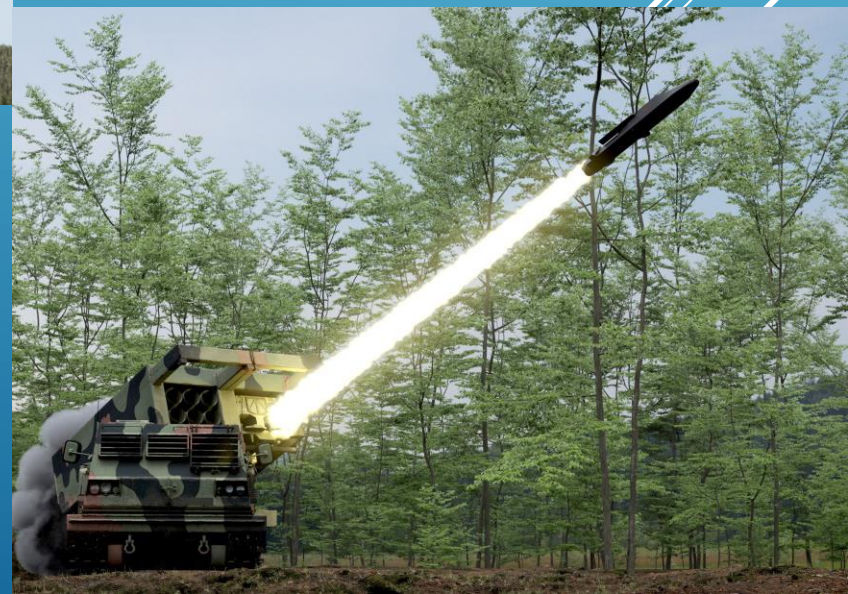


DIEHL BGT DEFENCE GMBH & KO KG GERMANY

JFS-M
(JOINT FIRE SUPPORT MISSILE)



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MBDA GMBH GERMANY

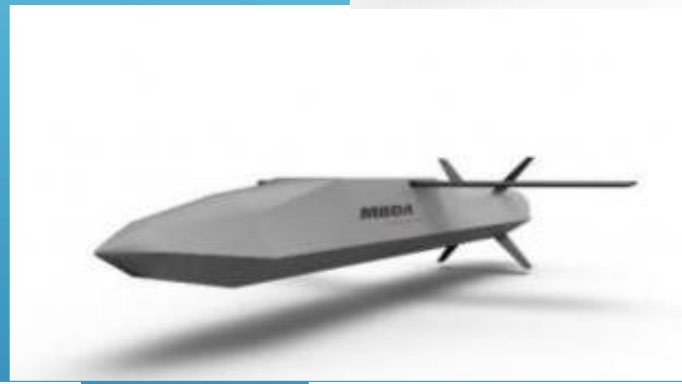
FUTURE AIR SYSTEMS
MBDA GMBH GERMANY

Smart Cruiser

Smart Glider

Remote Carrier 100

Remote Carrier 200



Supersonic Cruise Missile

Hard Kill Anti-Missile System

Subsonic Cruise Missile

LOW OBSERVABLE UAV TESTBED (LOUT) PROGRAM

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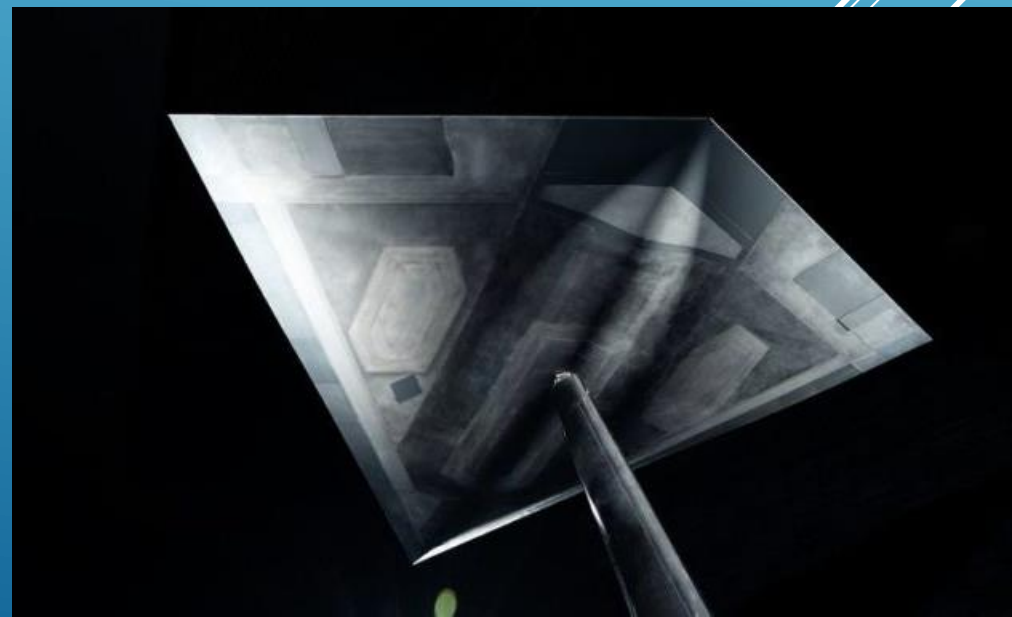
AIRBUS DEFENCE AND SPACE GERMANY GMBH



JET-POWERED DRONES

MQ-20 Avenger
General Atomics

5GAT Drone
The Sierra Technical Services

Kızılelma
Baykar Bayraktar

INTERNATIONAL EXPERIENCE

STEALTH TECHNOLOGY EXPERIENCE

- Stealth aircraft use a tail-tilt pattern to reduce angular reflections.
- The design of the flying wing is closest to the ideal form of stealth, as it will not have angles to deflect back radar waves (vertical control surfaces increase Radar Cross-Section).
- A low observable shape must be devoid of complex bumps.
- S-duct engine air intake will conceal engine from probing radar waves.
- By stealth technology, baffles are applied to install in the air intakes, so that the compressor blades are not visible to radar.
- Parallel alignment of edges or even surfaces is also often used in stealth designs. The technique involves using a small number of edge orientations in the shape of the structure. The leading edges of the wing and the tail planes are set at the same angle and other smaller structures also use the same angles. The effect is to return a narrow radar signal in a very specific direction away from the radar emitter rather than returning a diffuse signal detectable at many angles (the "glitter" effect).
- Stealth airframes sometimes display distinctive serrations on some exposed edges, such as the engine ports. This is a method of the parallel alignment of features on the external airframe.
- The shaping requirements detracted greatly from the aircraft aerodynamic properties. The stealth aircraft can be inherently unstable, and cannot be flown without a fly-by-wire control system.

- Advantages:
- potentially ideal aerodynamics (usually free of obtrusive tail surfaces and fuselage components);
- all of the structure provides lift.
- Disadvantages:
- dynamically unstable in pitch, unless sharply swept with resulting transverse flow and effectively reduced aspect ratio (loss of lift efficiency);
- dynamically unstable in yaw, partially ameliorated by sharply swept wing and / or includes wing-tip vertical stabilizers, with accompanying drag and / or reduced aspect ratio;
- requirement for software-driven flight controls;
- small cargo capacity that can only be offset by transverse load distribution (increasing polar moment in yaw and resistance to yaw / spin recovery);
- very high probability of unrecoverable spin behavior.

FLYING WING CONCEPT EXPERIENCE

STEALTH TECHNOLOGY AIRCRAFT

Avro Vulcan
Avro and
Hawker Siddeley Aviation

The British Avro Vulcan appears small on radar despite its large size, and sometimes disappears from radar screens altogether.

Avro Vulcan has a stealthy shape, except for the vertical element of the tail.

B-2 Spirit
Northrop Grumman

At U.S. Air Force's B-2 Spirit, the stealth is achieved through a combination of reduced: acoustic, infrared, visual and radar signatures (multispectral camouflage) to evade various detection systems.

B-2 Spirit is a flying wing concept.

Draken

The Draken is equipped with a distinctive double delta wing. According to Flight International, it is difficult to differentiate between the fuselage and the wing (blended wing-body). The fuselage has a circular section, and the inboard portion of the wing is a large-chord surface which extended almost to the engine intakes. The design allows possibility to dispense with a tailplane, resulting in a clean, simple overall design. The leading edge of the inner wing was swept back 80° for high-speed performance, and the outer wing 60° for good performance at low speeds. The design also allowed the plane to enter a «super stalls» (uncontrollable stall affecting aircraft with specific wing configurations when experiencing high alpha numbers).

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SAAB AB
SWEDEN

Viggen

The wing of Viggen has the shape of a double delta with a dogtooth added to improve longitudinal stability at high incidence angles.

A consequence of a tailless delta design is that the elevons, which replace more conventional control surfaces, operate with a small effective moment arm; their use adds substantial weight to the aircraft at takeoff and landing.

The lifting canard surfaces act as a vortex generator for the main wing and therefore provide more lift. The canard surfaces also improve roll stability in the transonic region.

OUR DEVELOPMENTS AND CONCEPTS OF DRONES

OUR JET DRONE DESIGN CONCEPTS

- We are developing two jet drone design concepts called:
  - Mjöllnir;
  - Shuriken.

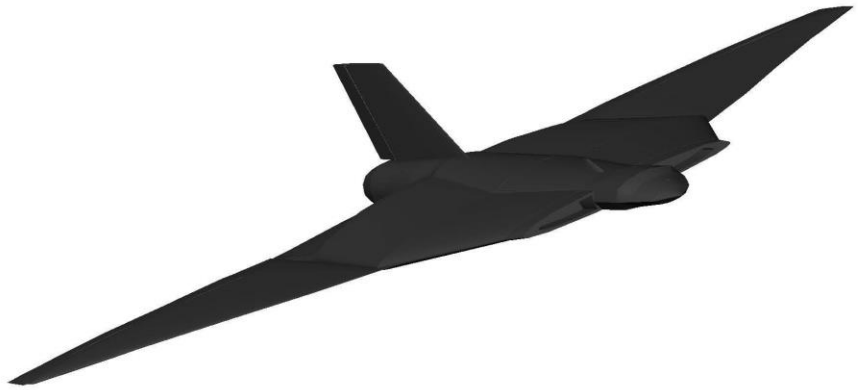
- The Mjöllnir and Shuriken jet drone design concepts include:
  - low observable shape;
  - rapidity drive systems of control surfaces;
  - powerful engines.

- We are at the stage of engineering design and improvement of aerodynamic characteristics through computational analysis.

- We are preparing for wind tunnel testing.

- We are at the stage of flight control system development and creation of hardware implementation of control system to ensure of stability for low observable shape drones.

MJÖLLNIR



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JET-POWERED DRONE

SHURIKEN

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JET-POWERED DRONE

- The Mjöllnir and Shuriken jet drone design concepts include blended wing-body concept.

It provides:

- Significant payload benefits in strategic airlift;
- Increased fuel efficiency;
- Lower noise.

- The blended wing-body concept is closest to the ideal form of stealth too.

- The blended wing-body concept will allow future modifications of the Mjöllnir and Shuriken jet drones to dispense with a tailplane.

LOW OBSERVABLE SHAPE

RAPIDITY DRIVE SYSTEMS OF CONTROL SURFACES

- The control surfaces of aircraft are set in motion by a drive systems.
- The improving of jet drone dynamics requires improving drive systems of jet drone.
- The Mjöllnir and Shuriken jet drone design concepts include patented magnetorheological control surface drive systems (PATENTS: WO 2016/028180, WO 2016/028181, WO 2016/028182, RU 192674, RU 2634163, RU 2634166).
- Magnetorheological drive systems significantly exceed the existing hydraulic analogue and electrical drive systems in the accuracy and rapidity. The use of magnetorheological drive systems makes the control of actuated mechanical elements easier and magnetorheological drive systems can be applied in the upper control flow paths of the multistage hydraulic amplifiers.
- The magnetorheological fluid control flow paths improve the dynamics and precision of control surface drive systems.
- The magnetorheological fluid control flow paths simplify also the regulation of control surface drive system, because the magnetorheological fluid systems do not require a transformation of the input electrical signals to others forms of energy, which increases the speed of response of drive system to control signals.

- The Mjöllnir and Shuriken drone design concepts include the possibility of installing jet and rocket engines.

- The use of jet and rocket engines allows drones to reach supersonic and hypersonic speeds.

POWERFUL ENGINES

OUR TEAM

Katharina Naigert Ph.D., Head of Project Management Office

Dr. Katharina Naigert specializes in the systems for aircraft and orbiter. Dr. Katharina Naigert was developing New Generation Magnetorheological, Magnetodynamic, and Ferrofluid Control Devices with Nonstationary Electromagnetic Fields. Dr. Katharina Naigert is also concerned with the research on hydro-, gas- and plasma dynamics.

Emil Rudyak Ph.D., Senior Developer

Dr. Emil Rudyak is activity from 1963 up to date, was concerned with the research on plasma technologies.
In particular, Dr. Rudyak was developing plasma generators with increasing Volt-Ampere characteristics, high enthalpy plasma stream and other types of plasma generators. Those plasma generators are applied for treatment on metals and raw materials in machining, metallurgy, plasma chemistry and plasma cutting.

Johnatan Brodsky, COO

M.Sc. Technology and Systems Management. Operation / Production and project manager, with extensive experience in the chemical process industry, John is highly Experienced in leading production processes, implementing engineering improvements for cost reduction, output efficiency, and improving product quality. Before he joined Plasmatron, he served as the Director of Operations at Dor Chemicals in Haifa.

Pinhas Uzan, Business Development Consultant

Pinhas is a highly decorated Ex military / police veteran. He has worked in Mexico for an international diamond company as a sales manager and for a multi-million dollar branch of the company as a store manager. Pinhas is a Microsoft Certified Desktop Technician and has worked in support of F1 computer systems. The field of metallurgy is his current area of interest along with natural remedies.

Elliott Silcoff Ph.D., in-house consultant

Graduate of the Hebrew University of Jerusalem and a postdoctoral fellow at the Weizmann Institute and Stanford University. 20+ years of experience in R&D with a number of released products and over 30 patents. Dr. Silcoff was a leading scientist and a head of research groups in many fields including electrochemistry, materials engineering and analysis.

Steve Daren Ph.D., in-house consultant

Ph.D. & M.Sc. in Chemistry, Weizmann Institute, B.Sc. (Honors) in Chemistry and Physics, Kings College, UK. 30+ years of experience in the chemical industry and academia. World renown expert and consultant for the chemical, pharmaceutical, polymer and plastics industries. Numerous patents in the field of agriculture, battery electrolytes.

Ariel Artur Mosheev, Business Development Consultant

Co-Founder of Plasmatron Waste Solution Ltd.
Ariel has a practical understanding of the technological needs of the enterprise and a remarkable ability to find the right people for different tasks. Ariel will be in charge of procurement management and contacts and work with key partners and subcontractors.

Berta Bracha Mosheev, CEO

Berta has a Certificate in accounting and Degree of Business manager specializing in Human Resources.

Rashmil Mamiev, Business Development Consultant

Entrepreneur. Co-Founder of Plasmatron Waste Solution Ltd.
Founder & Director of Brothers Mamiev Metal Industries and Construction Ltd.

Ofer Daren, Co-Founder of Plasmatron Waste Solution Ltd

Graduate of the College of Management. Founder of the Daren Innovation Center, a unique accelerator for technological start-ups. 10+ years of experience with working daily and closely with numerous start-ups and a deep understanding of the various needs and challenges of early-stage ventures.