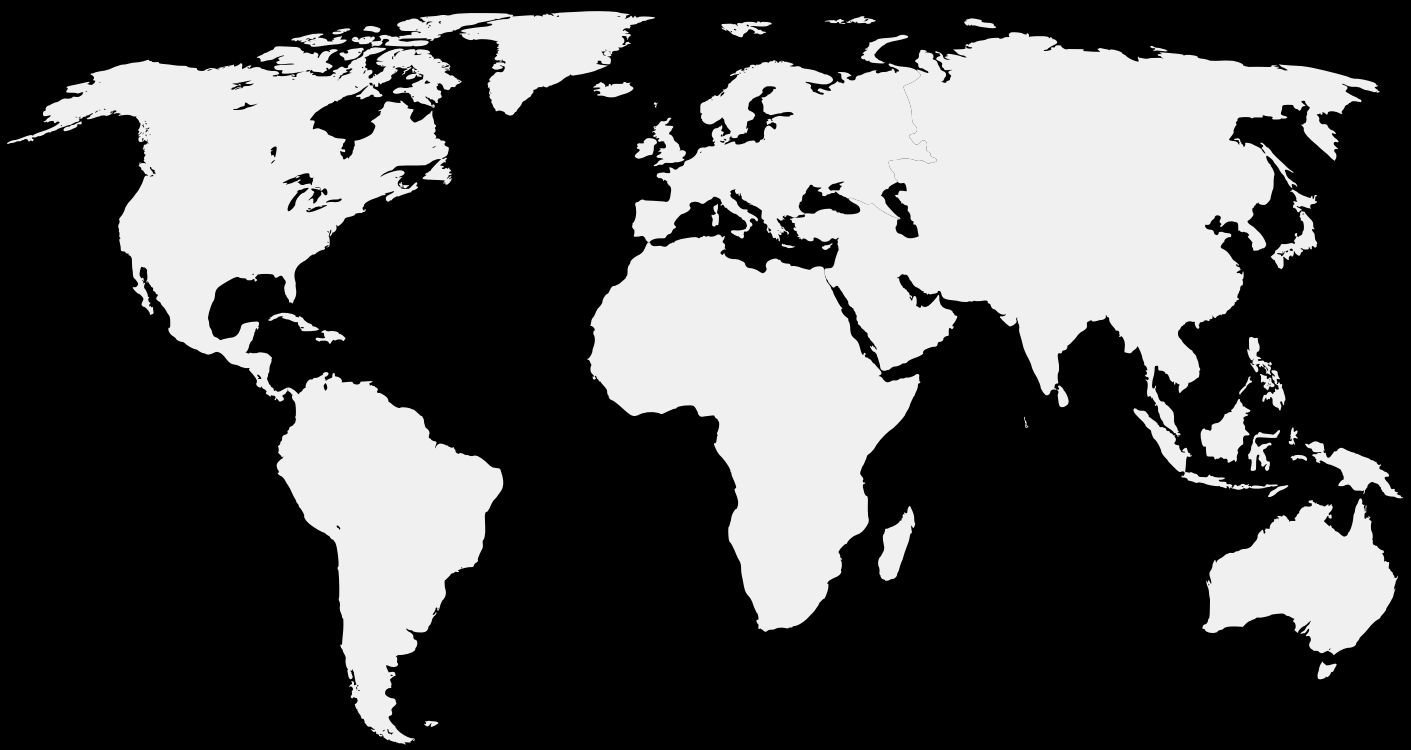
IDOM

ADA - ADVANCED
DESIGN & ANALYSIS

TEST SYSTEMS & SPECIAL MACHINERY

IDOM IS PRESENT IN 45 OFFICES DEVELOPING PROJECTS IN 125 COUNTRIES ACROSS 5 CONTINENTS

We are an association of independent professionals working in the fields of Consulting, Engineering and Architecture, sharing common objectives and work practices, at the service of our clients. IDOM operates globally in areas such as power generation, oil & gas, renewable and alternative energies, manufacturing industry, civil infrastructures, nuclear plants, large technological and scientific facilities, architecture and unique challenging engineering projects.



€290M ANUNUAL TURNOVER

65 YEARS

125 COUNTRIES

45 OFFICES

4300 PROFESSIONALS

920 PARTNERS

TEST SYSTEMS & SPECIAL MACHINERY

Within the Advanced Design & Analysis Department, Test Systems & Special Machinery Division designs and builds technological facilities designed to test a wide variety of prototypes of new products and advanced technologies.

We accompany the client from the initial conceptual stages to the final handover, developing the entire test facility as well as modern test benches for pioneering research centres and existing production facilities.

ADA - ADVANCED DESIGN & ANALYSIS DEPT.

YOUR SHORTCUT TO THE NEW ENGINEERING TECHNOLOGIES

We offer advanced engineering for challenging projects. With a broad expertise in different areas, such as applied mechanics, mechatronics, optics & optomechanics, structural design, electronics & control, we provide engineering solutions to a wide range of customers worldwide. The experience in diverse areas enables us to push our creative skills to the uttermost in a hybridizing and cross-innovation scheme. In this context we provide solutions within our division of Test Systems & Special Machinery.

ONSHORE WIND TURBINE ROTOR TEST BENCH

CLIENT: **LM WIND POWER**
SCOPE: **EPC**
COUNTRY: **HOLLAND**

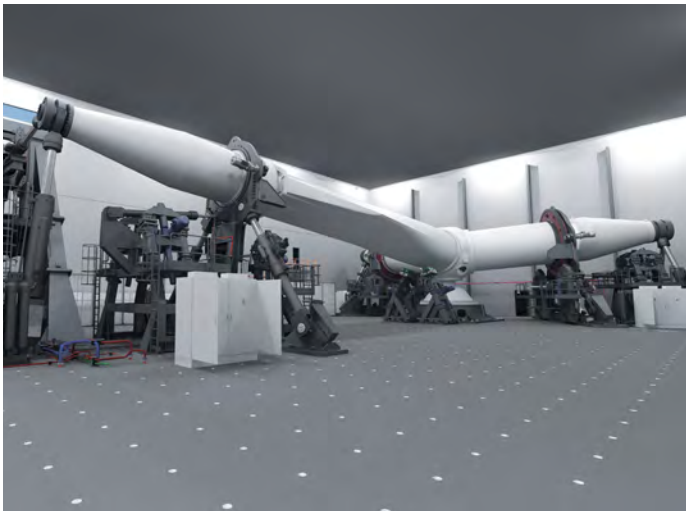
IDOM completed the construction of the Onshore Wind Turbines Rotor Rig for LM Wind Power at December 2020. The rig is hosted by the LM windpower's WMC Technology Centre at the Netherlands. The project was completed in a record time spanning over two years from inception to the commissioning tests. LM Wind Power entrusted IDOM to supply the rig as an EPC project involving the design, manufacturing, installation, and commissioning activities.

LM Onshore WT Rotor Rig is a unique worldwide test facility. Equipped with three load application systems installed at the end of three composite components, mimicking the stiffness of real WT blades, is able to replicate the forces and dynamics caused by the wind aerodynamics, centrifugal forces and gravity for WT up to 6 MW+. A counter-pitch system installed in the load application systems allows to apply a torque while the hub pitch oscillates to study the wear and fatigue failures in key WT components as the pitch bearings.

Reproducing realistically the stresses and deformation caused by the three blades in the rotor allows LM Wind Power to accurately analyse the lifetime of critical components as the hub, pitch bearings, gearboxes and gears rims, and bolted connections to the main shaft and blades under demanding fatigue, extreme and wear conditions.

"IDOM PERFORMANCE AND OUTSTANDING RESPONSIVENESS DURING AND AFTER THE PROJECT ALLOWED TO START THE ROTOR TEST RIG DESPITE THE IMPACT AND THE IMPLICATIONS IMPOSED BY THE COVID-19 PANDEMIC"
Alon Goldis, LM Wind Power

watch our project video



BEAT 6.1 BLADE BEARING TEST BENCH

CLIENT: **FRAUNHOFER IWES**
SCOPE: **EPC**
COUNTRY: **GERMANY**

The BEAT 6.1 is a test bench for large blade bearings of multimegawatt wind turbines of up to 12MW, designed and supplied by IDOM to Fraunhofer IWES and fully operational in Hamburg since 2019.

The innovative design developed by IDOM is based on an 8-meter-high Stewart Platform with an 11.5-meter diameter, powered by 6 hydraulic servo-actuators (each with a 350-ton capacity, and equipped with precise load cells) that are able to apply, both statically and dynamically, high loads and moments on a set of two bearings (specimens) simulating, in an accelerated way, the efforts to which they will be subjected during their lifetime.

The features of the test bench are complemented by an additional cylinder that simulates the pitch movement of the wind turbine blade and a series of adapters and steel and composite parts that emulate the stiffness of the hub and blade.

The turnkey project (design, manufacturing, assembly and commissioning) was awarded to IDOM. The mechanical, hydraulic and electrical assemblies were completed in record time and the acceptance tests by the client were successfully carried out.

"FROM THE COLLABORATION WITH IDOM, WE WOULD HIGHLIGHT THEIR FLEXIBILITY AND PROFESSIONALISM, THE CAPACITY OF TEAMING UP WITH US IN SEARCH OF THE MOST SUITABLE SOLUTIONS"
Christian Broer, Fraunhofer IWES

watch our project video

DYNALAB DRIVE TRAIN TEST BENCH

CLIENT: **FRAUNHOFER IWES**
SCOPE: **EPC – TEST BENCH & FACILITY**
COUNTRY: **GERMANY**

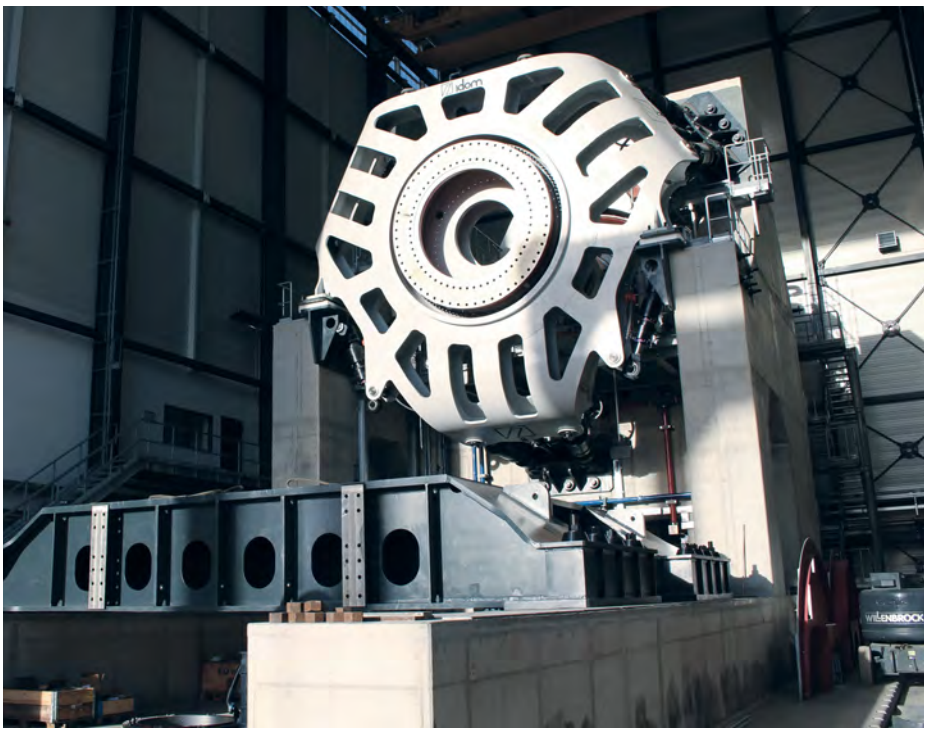
IDOM has provided the Fraunhofer Institute IWES with the first complete test stand for multi-megawatt wind turbines, known as the Dynamic Nacelle Laboratory. Since its inauguration in October 2015, DyNaLab is one of the most technologically advanced testing facilities in the world.

The Fraunhofer Institute IWES entrusted IDOM to carry out the design, and turnkey supply of the test stand, as well as the architectural, engineering and construction management works of the building to house the test laboratory. Design, manufacture, assembly, integration and implementation of the test stand was carried out in parallel to the construction of the facility under a fast-track scheme.

The innovative design developed by IDOM for DyNaLab consists of a rotary drive of up to 10 MW, and incorporates an innovative load application system and grid simulator, as well as an HIL simulator (Hardware-in-the-loop). The result is a facility that stands out for its high dynamic performance – permitting fluctuations and variations of torque to be simulated in an agile and very quick manner – and capacity for simulation of robust networks.

watch our project video

"IDOM PROPOSED FOR DYNALAB TEST FACILITY INNOVATIVE, TECHNICALLY COMPLIANT AND COST-EFFECTIVE SOLUTIONS WHICH CONTRIBUTED TO BUILD A WORLD-CLASS FACILITY"
Jan Wenske, Fraunhofer IWES



TRIPALA OFFSHORE WIND TURBINE ROTOR TEST BENCH

CLIENT: **WINDBOX**
SCOPE: **EPC**
COUNTRY: **SPAIN**

IDOM was in charge of carrying out the turnkey Project of the Test Bench for the Hub and Blade Bearing system of wind turbines. The test bench, conceived for the simultaneous testing of 3 blade bearings at almost real operation conditions, can reach a maximum moment capacity at the interface joining the bearing and hub of 35 MNm for fatigue tests, for which the three blades spin simultaneously, and of 55 MNm for extreme tests, in which blades remain static.

The innovative load application system designed by IDOM is based on the concept of a compact two-degree-of-freedom mechanisms, allowing the application of varying loads, continuously at 360º in any direction in the plane, not limited to discrete directions.

In addition to the design, manufacturing, assembly, commissioning and validation of the Hub and Blade Bearing Test Bench, IDOM was also responsible for the design and construction supervision of the civil works required on the plot of land, including test bench foundations and the integration of the mechanical and electrical installations required for the test bench operation.

watch our project video

LOAD APPLICATION SYSTEM FOR MAIN BEARING TEST BENCH

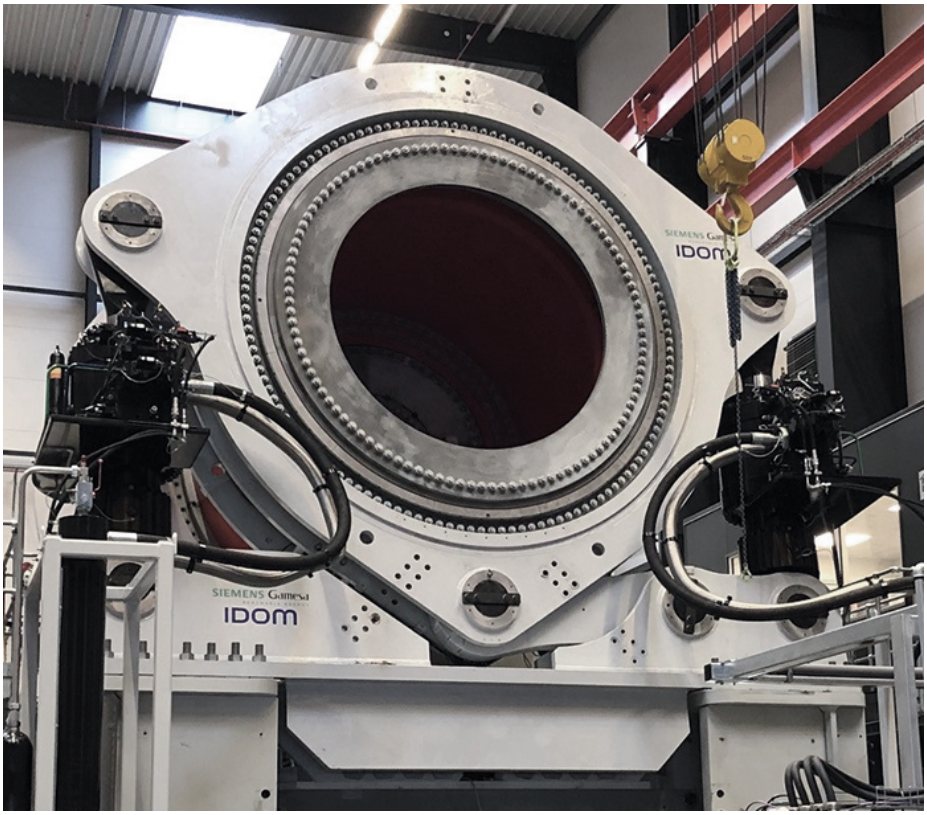
CLIENT: **SIEMENS GAMESA**
SCOPE: **EPC – LOAD APPLICATION SYSTEM**
COUNTRY: **DENMARK**

Siemens Gamesa entrusted IDOM with the design and turnkey supply of the Load Application System, including the assembly and commissioning of the mechanisms, Hydraulic System and Control and Safety systems.

The Load Application System for Wind Turbine Main Bearing consists of compact and robust mechanisms with high load capacity for Offshore Multimegawatts Turbines. The limited space for the large hydraulic actuators is solved by an optimized design and neat shape of mechanical components, avoiding any interference or collision, as well as the demanding service life requirements specially for the rotating elements.

The solution designed for the mechanisms decouples radial and axial loads, tailored for the application, resulting in a cost-effective product. In addition, a specific test mode for impact simulation is developed for this Load Application System, with dynamic outstanding capacity.

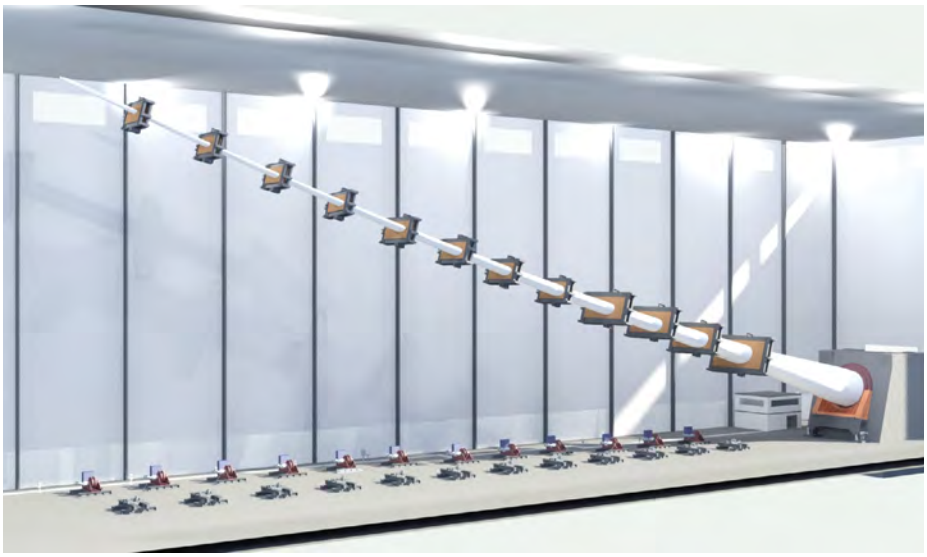
"IDOM TECHNICAL AND ECONOMICAL PROPOSAL WAS SCORED THE HIGHEST. CONSTRUCTION TIMELINE WAS MET SUCCESSFULLY ACHIEVING THE REQUIRED MILESTONES IN A VERY TIGHT SCHEDULE" Vicente García, SGRE



WIND TURBINE BLADE STATIC TEST BENCHES

CLIENT: **CEPRI**
SCOPE: **ENGINEERING**
COUNTRY: **CHINA**

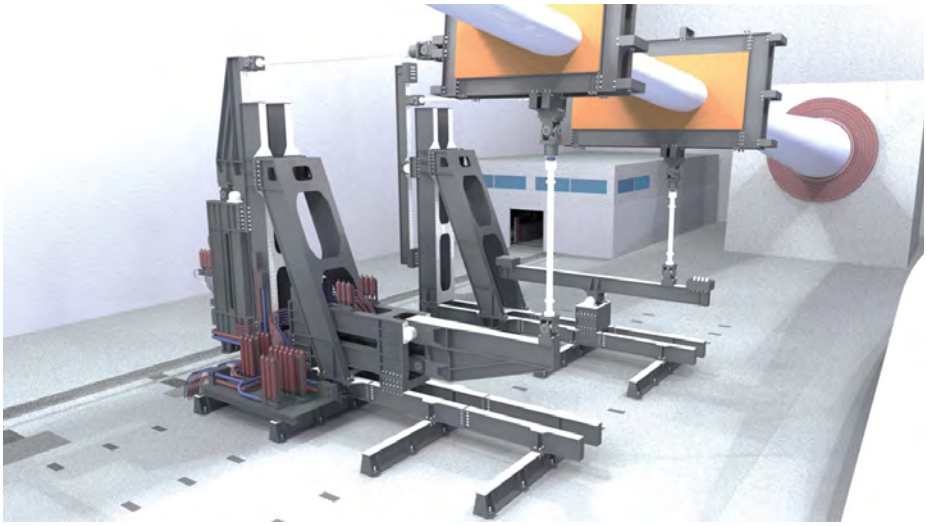
IDOM was contracted by CEPRI in a project funded by the World Bank to design a test bench for the static testing of multimegawatt scale blades of up to 150m in length.
The load application system is based on a set of pulling points attached along the blade. The pulling loads are applied through cables directed with pulley systems to winches.
The winch systems are able to apply the desired loads by means of an electric motor, a gearbox and a drum. On the blade root side the test bench design includes a reinforced concrete reaction wall that withstands the reaction forces generated in the pulling points.



WIND TURBINE BLADE DYNAMIC TEST BENCHES

CLIENT: **CEPRI**
SCOPE: **ENGINEERING**
COUNTRY: **CHINA**

IDOM was contracted by CEPRI in a project funded by the World Bank to design two test benches for the fatigue testing of multi-megawatt scale blades of up to 150m in length.
The load application system is a ground resonant exciter, with a hydraulic actuator with the fixed end connected to the foundation and the rod end to a bell crank mechanism that uses the mechanical advantage of the lever arm to cope with the large deflections.
On the blade root side the test bench design includes a reinforced concrete reaction wall that withstands the dynamic reaction forces generated by the load application system.



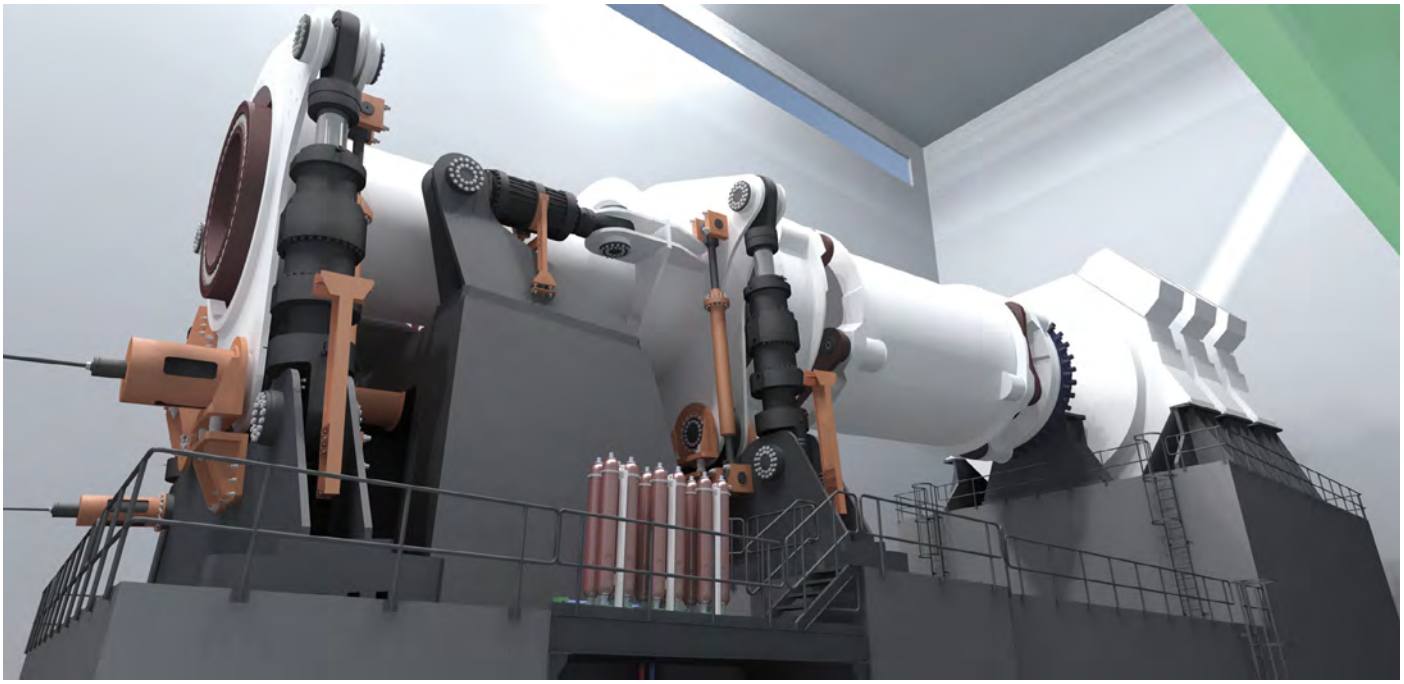
WIND TURBINE DRIVETRAIN TEST BENCH

CLIENT: **CEPRI**
SCOPE: **ENGINEERING**
COUNTRY: **CHINA**

IDOM was contracted by CEPRI in a project funded by the World Bank to design a test bench for the testing of multimegawatt scale nacelles of up to 20MW.

The load application system is based on a double yoke mechanism that can apply axial forces, shear forces and bending moments so as to reproduce the loads generated by the wind on field. Besides, an electric motor introduces the drive torque and motion present in the wind turbine rotor star.

The nacelle can also be connected to a grid simulator that can reproduce the real grid behavior and events.

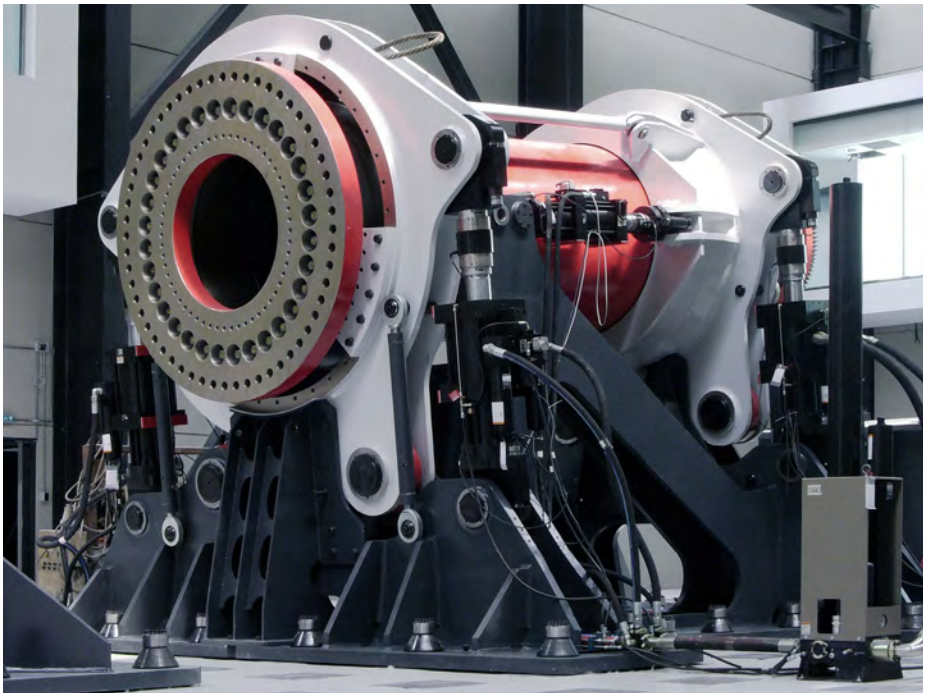


WIND TURBINE DRIVETRAIN TEST BENCH

CLIENT: **CENER**
SCOPE: **EPCM – TEST BENCH & FACILITY**
COUNTRY: **SPAIN**

IDOM performed the design, complete engineering, construction and commissioning of the Test Systems, Auxiliary Installations and Building of the DriveTrain and Generator Test Centre of Spain's National Renewable Energy Centre (CENER).

This test centre is dedicated to Functional and Highly Accelerated Life Testing (HALT) of full-scale multi-megawatt wind turbine drive trains and generators.



WIND TURBINE DRIVETRAIN TEST FACILITY

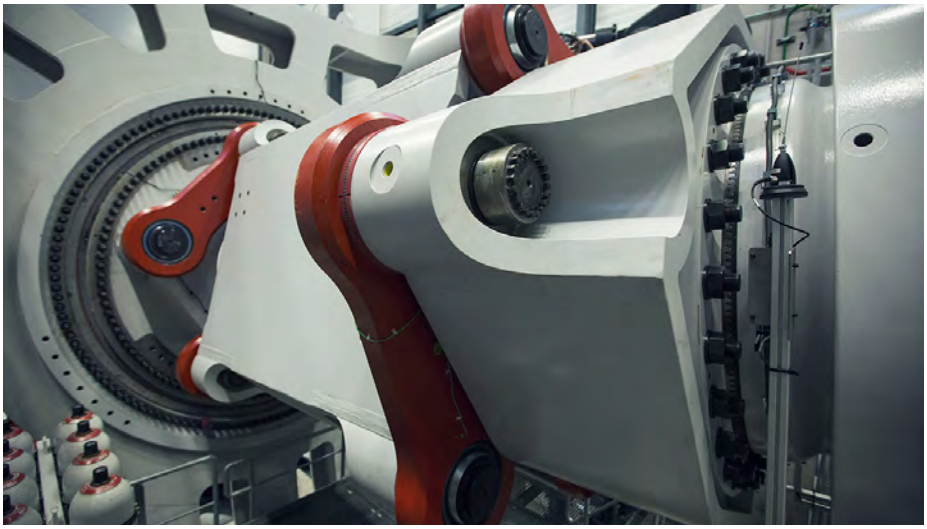
CLIENT: **CLEMSON**
SCOPE: **ENGINEERING & ARCHITECTURE – TEST BENCH FOUNDATION, STRONG WALL & FACILITY**
COUNTRY: **USA**

CLEMSON SCE&G Energy Innovation Centre is a world-class leading research facility conceived to conduct tests on the next generation offshore wind turbines. The facility is capable of full-scale, highly accelerated mechanical and electrical testing of advanced drivetrain systems for wind turbines.

IDOM was responsible for the Architecture design, complete Engineering, and Owner's Engineering during all phases of the project. It is equipped with two dynamometric test benches with capacity for testing wind turbines up to 15 MW.

DRIVE TRAIN COUPLINGS

CLIENT: **VARIOUS**
SCOPE: **ENGINEERING/ EPC/EPCM**
COUNTRY: **VARIOUS**



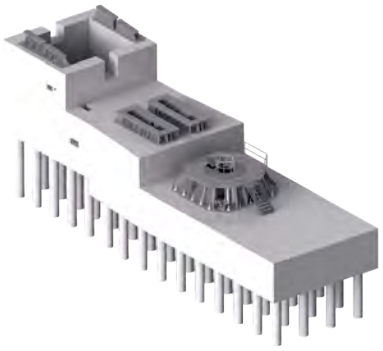
IDOM has experience in mechanisms design and procurement, owning various patents for specific mechanisms designs. IDOM can develop ad-hoc mechanisms upon the client's needs.

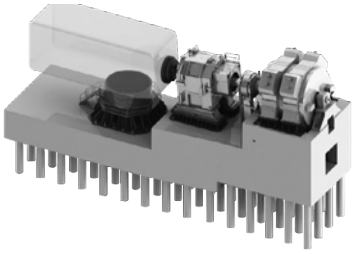
One of IDOM's designs is the rod-based flexible coupling that can be used as coupling element in drive trains. This coupling design can be adapted to the specific client's needs so to provide an optimized solution.

NAREC WIND TURBINE DRIVE TRAIN TEST FACILITY

CLIENT: **NAREC**
SCOPE: **ENGINEERING**
COUNTRY: **UK**

The UK National Renewable Energy Centre (NAREC) has been the driving force behind the creation of an offshore wind drive train test facility rated at 15 MW.
IDOM's engineering services comprised the design of the pile foundation, concrete superstructure, strengthened floor & anchoring systems, as well as the design of steel supports for the test piece, force application system and motor.
These services were completed by a vibration transmission control analysis. On-site technical assistance was also provided during the whole fabrication, construction and assembly stages.





LIFTING & HANDLING EQUIPMENT

CLIENT: **VARIOUS**
SCOPE: **ENGINEERING/ EPC/EPCM**
COUNTRY: **VARIOUS**

IDOM has experience in the design and procurement of lifting and handling equipment for the wind industry.

This experience is boosted by the know-how acquired in the design and performance of assembly procedures of very large Test Systems for wind turbine components.

The figure shows a lifting device for assembly and disassembly of large blade bearings of up to 6m and 18t.

BEAT 1.1 TEST BENCH FOR SCALED BEARINGS

CLIENT: **FRAUNHOFER IWES**
SCOPE: **EPC**
COUNTRY: **GERMANY**

The BEAT 1.1 (Bearing Endurance and Acceptance Test) is a test bench for scaled wind turbine bearings, designed and supplied by IDOM to Fraunhofer IWES already fully operational in Hamburg. The BEAT 1.1 is based on the innovative design developed by IDOM for the BEAT 6.1, a similar test rig conceived for large bearing testing.

This includes a Stewart Platform powered by 6 hydraulic servo-actuators that are able to apply loads up to 250 KNm and 1 MN. The test bench is able to apply dynamic loads with a frequency of 2 Hz, thus enabling the performance of highly accelerated life tests.

The features of the bench are complemented by an additional electric pitch system, based on a pinion and crown mechanism powered by an electric motor, that simulates the pitch movement of the wind turbine blade.

TEST BENCHES & SPECIAL MACHINERY IN OTHER SECTORS

CLIENT: **VARIOUS**
SCOPE: **ENGINEERING/EPC/EPCM**
COUNTRY: **VARIOUS**

IDOM has also experience in test systems for other sectors. One of these examples is CTAER Parabolic Trough Test Bench.
IDOM was awarded with a turnkey project for the concept design, detail engineering and construction of a solar parabolic trough test bench for CTAER (Centro Tecnológico Avanzado de Energías Renovables de Andalucía). The objective of the new facility, which has been in operation since March 2015, is to test innovative collector designs with improved efficiency and performance for the solar energy industry.

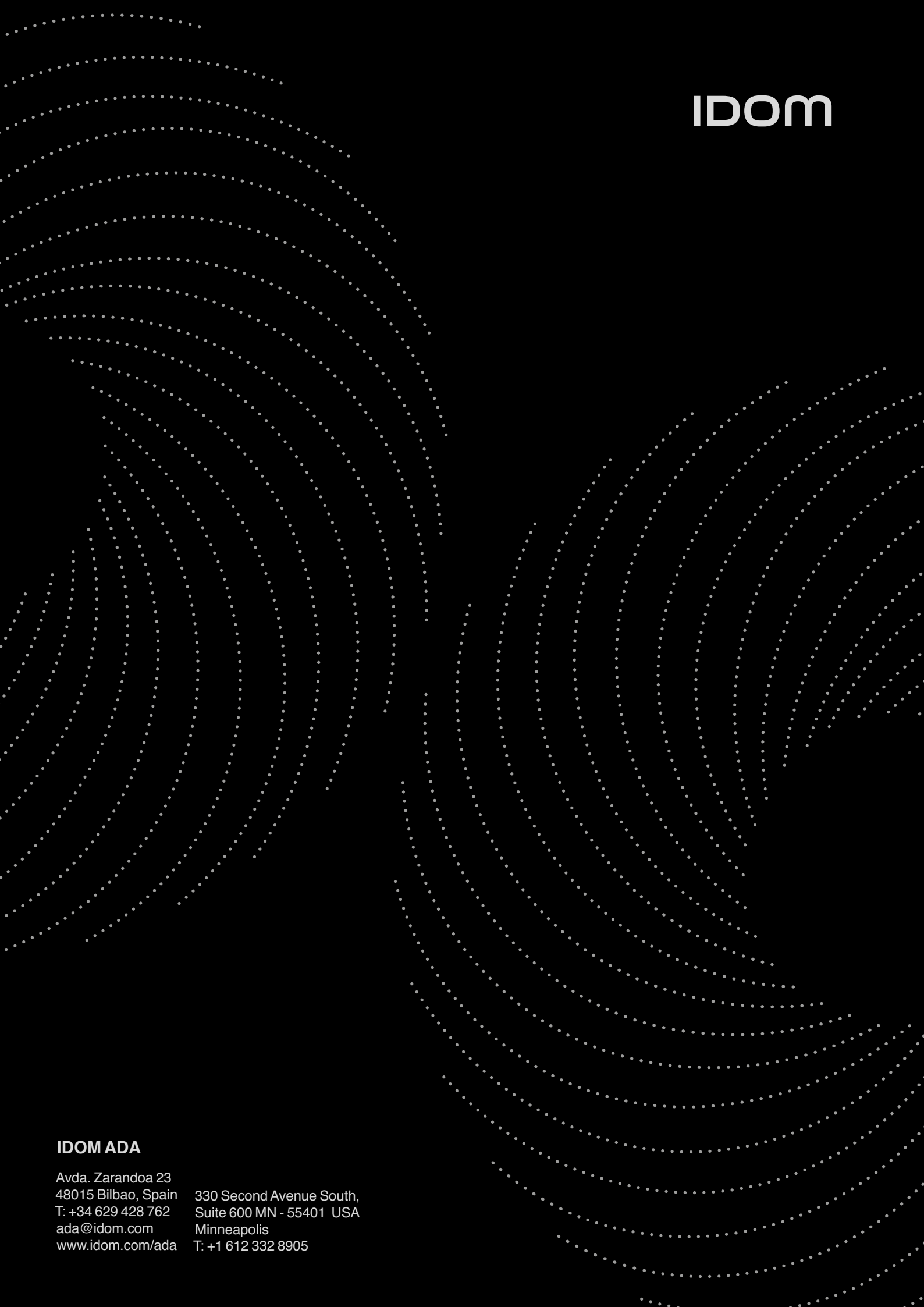
CLIENT: **VARIOUS**
SCOPE: **ENGINEERING/EPC/EPCM**
COUNTRY: **VARIOUS**

IDOM EXPERIENCE IN OTHER SECTORS

IDOM's Advanced Design & Analysis Dept. has a broad expertise in a wide range of sectors grouped in several divisions Astronomy, Marine Energy, Nuclear Technology & Particle Physics, Precision Instruments, Product Design & Development, Singular Structure, Technological Facilities and Test Systems & Special Machinery. This provides us a privileged background to provide ad-hoc solutions in a wide sort of special machinery.

MARINE ENERGY WAVE ENERGY CONVERTER PROTOTYPE

The MARMOK-A-5 is a prototype of a low power wave energy converter (WEC). It is a floating device, based on Oscillating Water Column technology, with two 15-kW turbines. The prototype – the result of public pre-commercial procurement by the EVE (Basque Energy Agency – has a length of 42m (36m draft and 6m freeboard), is 5m in diameter, with a displacement of 162Tm. It was installed on the BiMEP marine energy platform, the first WEC connected to the Spanish state electricity grid, and one of the first devices connected in the world.



IDOM ADA

Avda. Zarandoa 23
48015 Bilbao, Spain
T: +34 629 428 762
ada@idom.com
www.idom.com/ada

330 Second Avenue South,
Suite 600 MN - 55401 USA
Minneapolis
T: +1 612 332 8905