Mark Sanford
Governor

SOUTH CAROLINA
DEPARTMENT OF COMMERCE

Joe E. Taylor, Jr.
Secretary

August 11, 2009

Dr. John Kelly
Clemson University
Vice President, PSA
Executive Director, Clemson University Restoration Institute
360 Truxtun Avenue, Suite 300 B
North Charleston, SC 29405-2045

RE: DE-FOA-0000112, Large Wind Turbine Drivetrain Testing Facility

Dear Dr.Kelly,

The South Carolina Department of Commerce is writing in support of Clemson University's Large Wind Turbine Drivetrain Testing Facility grant proposal for the facility to be located on Clemson University's Restoration Institute site at the former Charleston Naval Shipyard. The scope of this project has the potential to create economic opportunities for our community, our state and the entire nation. We are encouraged by the opportunities for job creation that CURI's Renewable Energy Research Program brings to our state and we wholeheartedly support the project.

Should this grant be awarded, Secretary of Commerce Joe E. Taylor, Jr., Chairman of the South Carolina Coordinating Council for Economic Development, will recommend that the Council approve a $3 million grant to Charleston County for cost sharing on eligible expenditures associated with Clemson University's project.

The proposed Wind Turbine Drivetrain Test facility will serve as the catalyst to establish a wind energy manufacturing cluster in the Charleston area. This will provide a positive economic impact and keep South Carolina on the leading edge of the wind energy industry through Clemson University's advanced research and development.

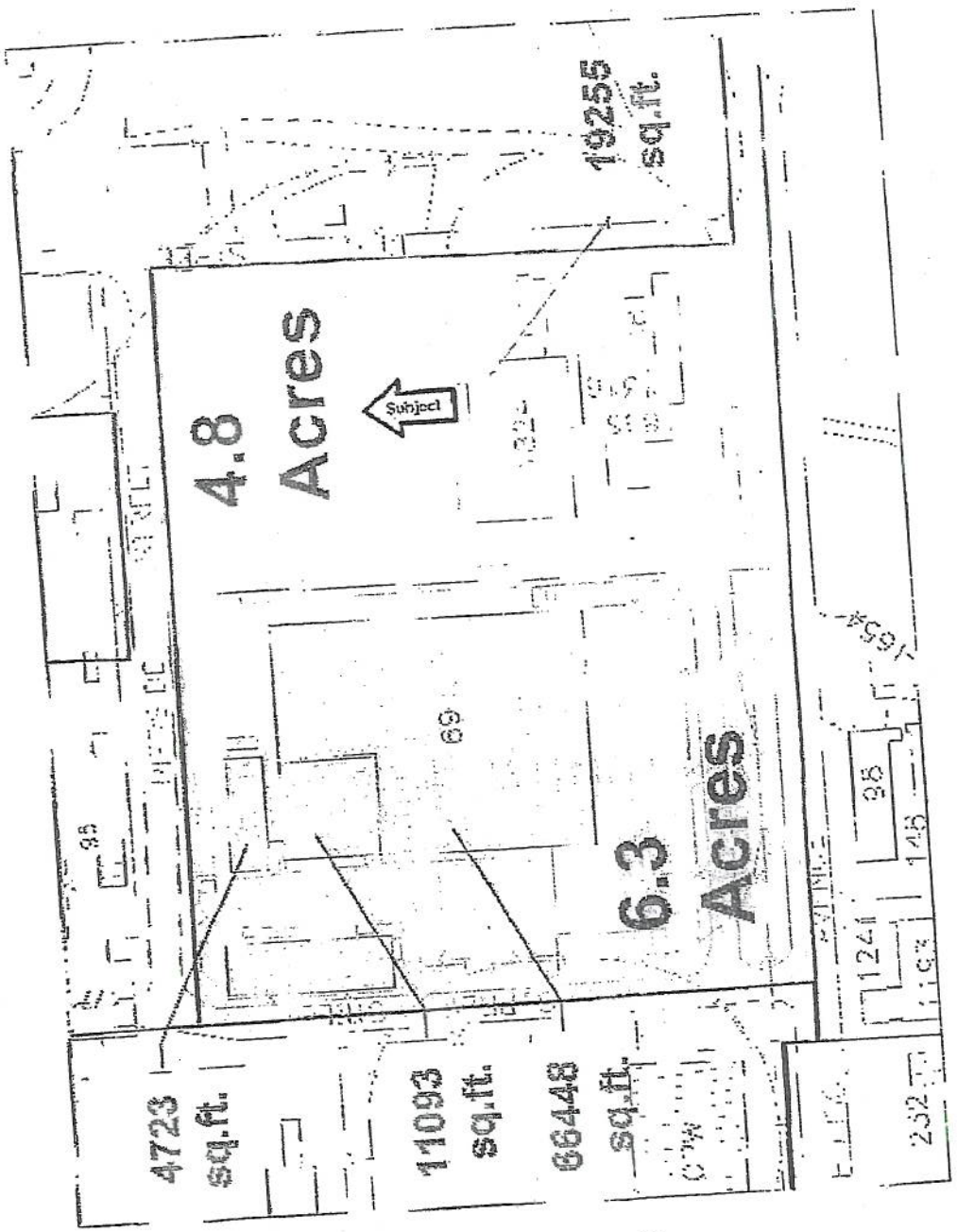
We look forward to supporting your efforts and the award announcement in October of 2009.

Sincerely,

Alan D. Young
Executive Director
South Carolina Coordinating
Council for Economic Development

cc: Secretary of Commerce Joe E. Taylor, Jr.

1201 Main Street, Suite 1600, Columbia, SC 29201
Tel: (803) 737-0400 • Fax: (803) 737-0418 • www.sccommerce.com



Map Showing Subject Sites

HARTNETT REALTY COMPANY
REALTORS AND APPRAISERS
COMMERCIAL – INDUSTRIAL - RESIDENTIAL
ESTABLISHED 1947
134 MEETING STREET, SUITE 120 – POST OFFICE BOX 221
CHARLESTON, SOUTH CAROLINA 29402

THOMAS F. HARTNETT, JR. CERTFIED APPRAISER

TELEPHONE:
(843)723-7222
FAX:
(843)723-9403

August 11, 2009

Mr. Alan M. Godfrey, Director of Real Estate and Financial Affairs
Clemson University Restoration Institute
1360 Truxtun Avenue, Suite 300B
North Charleston, South Carolina 29405-2005

Re: A Cost Approach Estimate of the Market Value of 6.3 Acres of Land and Improvements Located on Supply Street, Old Charleston Naval Base, North Charleston, South Carolina

Dear Mr. Godfrey:

Pursuant to your request, I have made an appraisal of the above captioned property. The purpose of the appraisal was to render an opinion of the market value of the property. The appraisal is to be used in conjunction with an application for a federal grant.

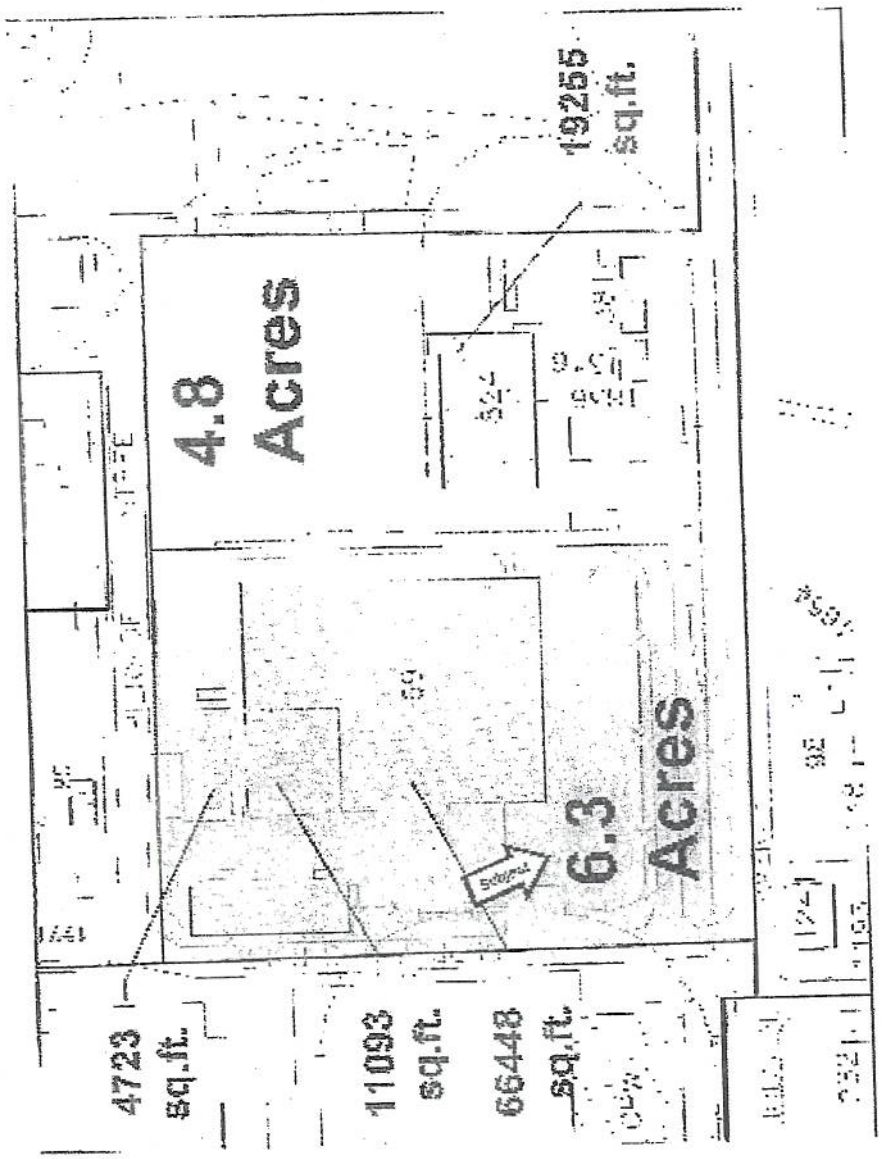
As a result of my appraisal and analysis, an opinion has been formed that the replacement values of the existing improvements, as per the attached Fagin Inc. estimate, plus estimated value of the subject site as of August 5, 2009, was:

Five Million Two Hundred Forty-One Thousand Dollars
($ 5,241,000)

As per your instructions I have employed only the Cost Approach to Value. It is my understanding that this is satisfactory to your needs at the present time.

Neither this assignment nor my compensation for making this report was based on a requested minimum valuation, a specific valuation, or the approval of a loan.

The appraisal has also been made in conformity with the Code of Ethics of the Appraisal Section of the National Association of Realtors and the Appraisal Institute.



Drawing of Subject Site Showing Site Size

Anthony E. Bakker
PO Box 1866
Charleston SC 29402
843-637-3395

August 21, 2009

Dr. John Kelly
Clemson University
Vice President, PSA
Executive Director, Clemson University Restoration Institute
360 Truxtun Avenue, Suite 300 B
North Charleston, SC 29405-2045

Dear Dr. Kelly:

I am writing in support of Clemson University's application for federal funding through the Large Wind Turbine Drivetrain Testing Facility program, made possible by the American Recovery and Reinvestment Act of 2009 (ARRA). Not only will this project have a direct impact on job creation and economic development for our local community and our state but, promotes and protects quality of life for our coastal community by delivering services of value to the community.

Should DE-FOA-0000112 grant for Large Turbine Drivetrain Testing Facility, made possible by the America Recovery and Reinvestment Act, be awarded to Clemson University, I commit to provide $ 500,000.00 to Clemson University for their work. I am excited to see the scope of this nearly 100 million dollar project and its potential of 650 jobs for our local community. We continue to be encouraged by the opportunities for job creation that CURI's Renewable Energy Research Program brings to our state.

The test facility will serve as the catalyst to establish a wind energy manufacturing cluster at the former Naval Base to bring economic development to the area. As the offshore wind market emerges along the East Coast of the United States and land-based turbines continue to grow in size, South Carolina is strategically positioned to serve as an industrial hub from this growing industry to meet the 20% Wind by 2030 Scenario.

I look forward to supporting your efforts and the award announcement in October of 2009.

Sincerely,

Anthony E. Bakker

Infrastructure

Robert Grimley
EED WSE, Technical Platform Engineering Mgr.

300 Garlington Road 3-3C-11
Greenville, SC 29615

T 864-254-2477
robert.grimley@ge.com

Aug 5, 2009

Dr. John Kelly
Director
Clemson University Restoration Institute
Clemson University
1360 Truxtun Avenue, Suite 300 B
North Charleston, SC 29405-2045

Subject: GE Commitment to Clemson Wind Turbine Drive-train Test Facility planned in response to DOE's solicitation DE-FOA-0000112

Dr. Kelly,

GE is a world leader in the production and assembly of utility scale wind turbines. As a company invested in the success of wind energy we endorse Clemson University's initiative to develop a Wind Drive-train Reliability Center in South Carolina. We believe that such a facility is critical to achieving the United States energy goals of generating 20% of the nation's electrical power from wind sources by the year 2030.

GE Energy (GEE) has a strong interest in the establishment of a Large Drive-Train Test Facility that is being funded under DOE's FOA DE-FOA-0000112. If Clemson's initiative is successful, GEE would plan to utilize this test center in the future provided it is operated according to the following requirements:

- Testing capabilities must meet the requirements of GE Energy for drive train testing
- Measures to protect intellectual property must be in place to the satisfaction of GEE
- The test facility must be suitable for future products of GE Wind Energy
- The test facility must have sufficient capacity and availability to meet GEE testing schedules
- The facility's equipment must be of high industrial standards and contain State-of-the-Art equipment
- Prices for the usage of the facility, or testing at the facility, must be at competitive market rates.

Assuming the requirements above are met, and the test facility is operational by 2012, GEE would expect to use the facility. The specific usage will be determined in time, according to the facility's capabilities/availability and GE's testing needs.

GEE will commit to serve on a Clemson Technical Advisory Board Committee with responsibilities limited to providing input to clarify capabilities, specifications and features of the dynamometer and testing facility to ensure it meets the needs of GE and other industry partners.

Sincerely

R P Grimley

Robert Grimley
EED WSE, Technology Platform Engineering Mgr.

Nordex USA, Inc. • 300 South Wacker Drive • Suite 1500
Chicago • Illinois 60606 / USA

Dr. John Kelly
Director
Clemson University Restoration Institute
Clemson University
1360 Truxtun Avenue, Suite 300 B
North Charleston, SC 29405-2045

Contact	Phone	Email	Date
Karsten Brüggemann	+1 (312) 386-4265	kbrueggemann@nordex-online.com	August 12, 2009

RE: Funding Announcement # DE-FOA-0000112: Large Wind Turbine Drivetrain Testing Facility

Dear Dr. Kelly,

We are writing this letter in support of Clemson University's application for federal funding through the Large Wind Turbine Drivetrain Testing Facility program, made possible by the American Recovery and Reinvestment Act. The wind industry is growing rapidly worldwide and there is a need for a state of the art drivetrain test facility that will assist in the rapid transfer of new technologies into the industry to reduce cost, increase reliability and meet the 20% Wind by 2030 Scenario. You have put together a strong team that includes Renk Test Systems, Fluor Corp. and the Savannah River National Laboratory in cooperation with City of Charleston, City of North Charleston, the State of South Carolina and other existing industry players at the North Charleston Naval Complex. The facility will be strategically positioned to service the wind industry through existing port and rail infrastructure.

We thank the US DOE Golden Field Office for being proactive in supporting the future growth of the industry in the United States and worldwide through the proposed facility that will lead to economic development and a more sustainable future.

I:\Dept\Sales_Project_Securing\International\Countries\US Various\Repenergy\Correspondence\Support letter drive train testing facility 12Aug2009.doc

Nordex USA, Inc.
300 South Wacker Drive
Suite 1500
Chicago, Illinois 60606
USA

Phone: +1-312-386-4100
Fax: +1-312-386-4101

nordexusa@nordex-online.com
www.nordex-online.com

Registered in Delaware
N° 3149241

Yours truly,

Nordex USA, Inc.

R. Sander
VP Engineering

K. Brüggemann
Sales Director

winergy

August 24, 2009

Dr. John Kelly

Vice President, Clemson University

Director, Clemson University Restoration Institute

1360 Truxtun Avenue, Suite 300 B

North Charleston, SC 29405

Subject: Drivetrain test center support letter

Dear Dr. Kelly,

Winergy, a Siemens affiliate, is the leading designer and manufacturer of wind turbine drivetrains (gearbox – coupling – generator) in the world. With over 50,000 wind turbine gear units installed globally, we are by-far the largest provider of utility scale wind turbine drivetrains to key OEM's in the wind industry like GE, Vestas, Siemens, Gamesa, Acciona, Suzlon, RePower, Nordex and others. Winergy maintains a global presence, including, but not limited to, the U.S. (Elgin, Illinois – two plants), Germany, China and India. In our brand new (LEED certified) state of the art U.S. facility, we manufacture, assemble and test a wide range of MW class gearboxes for the wind industry.

With over 20 years of experience designing and building wind drivetrains (in fact, we are the only complete wind turbine drivetrain manufacturer in the world), Winergy has been a key contributor in advancements within the wind industry. Approximately 15% of our workforce comprises engineering, research and development. Our developmental efforts have helped push the range expansion in the industry resulting in today's production and supply of gearboxes and generators up to 6 MW. We have three different size test stands (3.5 MW, 2.8 MW and 750 kW) in the U.S. and several test stands, with the largest one being 14 MW (believe to be the largest in the world for gearbox testing), in Germany. The above test stands incorporate Siemens state of the art products and technology. We are currently working closely with NREL in their gearbox reliability study. Our end customers, such as NER, Iberdrola, Horizon, Enxco, AEP, and others have a keen interest in increased reliability of the wind turbine drivetrain and we collaborate closely with them on issues related to reliability.

Given all of the above, we are extremely excited that the DOE has decided to help establish a globally leading Wind Industry Drivetrain Reliability and Test Center ("Test Center"). With our technical knowledge and expertise, large installed base in the US (and globally) and previous experience in designing and testing test stands, we believe that Winergy can contribute to the success of such a facility. Accordingly, Winergy hereby expresses its non-binding interest in collaborating with your consortium on a non-exclusive basis.

Objective: Winergy Commitment to Clemson University Wind Turbine Drivetrain Reliability and Test Center to support the growth of wind industry (20% by 2030 is national goal as stated by DOE) and develop next generation of highly reliable wind turbine drivetrains.

Scope: Help develop and utilize drivetrain test stands (gearbox to coupling to generator) in the 10-15 MW range.

Consortium: The proposed Test Center provides an opportunity for the full continuum of industry stakeholders to collaborate on reliable wind turbine powertrain solutions – from the national labs and industry R&D programs to component manufacturers and OEMs. The clear goal of this Test Center is to identify system integration issues before deployment in the field, thus improving reliability, while at the same time, increasing operational efficiency and reducing the total cost of ownership.

Further, by promoting collaboration among key industry stakeholders, the Test Center will help to accelerate the development and commercialization of new technologies, next generation powertrain systems and advanced manufacturing methods for critical turbine components. These technological advancements will become increasingly important as the industry moves to larger scale turbines – the technology for which is still in development. This new Test Center will ensure that the next-generation of wind turbines will be engineered with design goals that deliver a significant reduction of unplanned outages resulting from premature failure of drivetrain components.

Winergy's Commitment:

1. **Technical and Business Consultation**: Winergy will commit to serve on the Argonne Laboratories

Technical Advisory Board/Business Development Committee with responsibilities including:

- Providing input to clarify capabilities, specifications and features of the dynamometer and testing facility to ensure it meets the needs of Winergy, its OEM's and End-Users and other industry partners. Winergy, with its broad drivetrain experience and large gearbox and generator test facilities in the U.S., as well as in Europe, is best suited to help in an advisory role for design and specification of the Test Center.
- Supporting the design and specification of the Test Center with Siemens and Winergy products where appropriate. Given our previous test stand design experience with these products, we feel that that they are extremely suitable for such large scale applications.
- Dedicating technical, business development, research and engineering staff time equal to 50 hours/year to this effort for a 5 year period (Typical rate of US$300 per hour).

JOE WILSON
2ND DISTRICT, SOUTH CAROLINA

ASSISTANT REPUBLICAN WHIP

COMMITTEES:
ARMED SERVICES
RANKING, PERSONNEL SUBCOMMITTEE
FOREIGN AFFAIRS
EDUCATION AND LABOR
HOUSE POLICY

Congress of the United States
House of Representatives

August 3, 2009

COUNTIES:
AIKEN*
ALLENDALE
BARNWELL
BEAUFORT
CALHOUN*
HAMPTON
JASPER
LEXINGTON
ORANGEBURG*
RICHLAND*
(*PARTS OF)

W. ERIC DELL
CHIEF OF STAFF
AND COUNSEL

Mr. Steven Chalk
Principal Deputy Assistant Secretary
Energy Efficiency and Renewable Energy
Mail Stop EE-1
Department of Energy
Washington, DC 20585

RE: Funding Announcement # DE-FOA-0000112

Dear Mr. Chalk:

I am writing in support of Clemson University's application for federal funding through the Large Wind Turbine Drivetrain Testing Facility program, made possible by the American Recovery and Reinvestment Act of 2009 (ARRA). Not only will this project have a direct impact on job creation and economic development in the State of South Carolina, but South Carolina is an optimal choice to house such a project.

Specifically, Clemson University seeks to develop a large wind turbine drive train test facility located at the Clemson University Restoration Institute (CURI) campus on the former U.S. DOD Naval Base in North Charleston, SC. Clemson's experience and expertise at the Clemson University International Center for Automotive Research (CU-ICAR), where dynamometer test facilities have been designed, built, and operated for the automotive industry, makes it well-equipped to establish this test facility. Moreover, CURI operates materials testing facilities at the Naval Base that will provide analytical support for the test facility. The site will be designed to serve the wind industry's current and future needs in large wind turbine drive train testing. The facility will also serve as platform for research, education, and workforce training.

Clemson University has partnered with an engineering and design firm, redevelopment and ports authorities, local municipalities, private industry, and a national laboratory on this proposal, bringing together a qualified team with diverse skills and complementary strengths. Specifically, these partners include: Renk Labeco, Savannah River National Laboratory, Fluor Corp., SCANA, Charleston Naval Complex Redevelopment Authority (RDA), South Carolina State Ports Authority (SCSPA), CMMC LLC., City of North Charleston and City of Charleston. Additionally, the CURI campus represents an ideal site location equipped with existing crane infrastructure to facilitate the movement of large, heavy drive trains from rail or ships.

The test facility will serve as the catalyst to establish a wind energy manufacturing cluster at the former Naval Base to bring economic development to the area. As you know, South

MIDLANDS OFFICE:
1700 SUNSET BLVD. (US 378), SUITE 1
WEST COLUMBIA, SC 29169
(803) 939-0041
FAX: (803) 939-0078

212 CANNON HOUSE OFFICE BUILDING
WASHINGTON, DC 20515-4002
(202) 225-2452
FAX: (202) 225-2455
www.joewilson.house.gov

LOWCOUNTRY OFFICE:
903 PORT REPUBLIC STREET
P.O. BOX 1538
BEAUFORT, SC 29901
(843) 521-2530
FAX: (843) 521-2535

TOLL FREE 1-888-381-1442

Carolina's offshore wind potential has been documented by AWS Truewind and reported by the Department of Energy. Three of the most important cost drivers in developing an offshore wind farm include strong wind resources in shallow waters, access to good port facilities, and a large coastal demand center. According to your agency, South Carolina possesses excellent offshore wind resources close to its growing coastal demand centers in shallow waters near outstanding port facilities like Charleston and Georgetown. As the offshore wind market emerges along the East Coast of the United States and land-based turbines continue to grow in size, South Carolina is strategically positioned to serve as an industrial hub from this growing industry.

I hope you will give this project your serious consideration. Please do not hesitate to contact Matt Daack if we can be of further assistance in this matter.

Very truly yours,

Joe Wilson

JOE WILSON
Member of Congress

JW:ww

JIM DEMINT
SOUTH CAROLINA

CHAIRMAN
SENATE STEERING COMMITTEE

340 RUSSELL SENATE OFFICE BUILDING
WASHINGTON, DC 20510
(202) 224-6121
demint.senate.gov

United States Senate

COMMITTEES:
BANKING, HOUSING, AND URBAN AFFAIRS

COMMERCE, SCIENCE AND TRANSPORTATION

FOREIGN RELATIONS

JOINT ECONOMIC

August 3, 2009

Dr. John Kelly
Director, Clemson University Restoration Institute
Clemson University
1360 Truxtun Avenue, Suite 300 B
North Charleston, SC 29405-2045

Dear Dr. Kelly,

Thank you for taking the time to explain to my staff the projects you are currently working on at Clemson University. You have partnered with leading industry and academic institutions across the county to seek competitive funding solutions that will decrease our dependency on traditional fossil fuels, and I commend you on these efforts.

Developing a strong alternative energy portfolio is a goal that we must continue to pursue in the United States. The advancements that Clemson University is making in wind energy are to be applauded. By harnessing offshore wind potential, your project will move us toward developing clean sustainable domestic energy sources. I am encouraged by your innovative efforts and believe your contributions could help everyone take the next steps forward.

In the future, the United States will need a broad portfolio of energy sources to keep our economy growing. Thank you again for your diligent work in this area. It is an honor to serve you in the United States Senate. If I may be of any further assistance, please do not hesitate to let me know.

Sincerely,

Jim DeMint

Jim DeMint
United States Senator

CHARLESTON
112 CUSTOM HOUSE
200 EAST BAY STREET
CHARLESTON, SC 29401
(843) 727-4525

GREENVILLE
105 NORTH SPRING STREET
SUITE 109
GREENVILLE, SC 29601
(864) 233-5366

COLUMBIA
1901 MAIN STREET
SUITE 1475
COLUMBIA, SC 29201
(803) 771-6112

LINDSEY O. GRAHAM
SOUTH CAROLINA

290 RUSSELL SENATE OFFICE BUILDING
WASHINGTON, DC 20510
(202) 224-5972

UNITED STATES SENATE

August 17, 2009

Ms. Katy Bayless
Director of Federal Relations
Clemson University Governmental Affairs
PO Box 34754
Washington, DC 20043-4754

Dear Ms. Bayless:

Thank you for your correspondence requesting support for your *Large Wind Turbine Drivetrain Testing Facility Grant (DE-FOA-0000112)*. In order to express my interest in your project, I have contacted the appropriate officials at the United States Department of Energy (Mr. Steven Chalk, Deputy Asst. Secretary) on your behalf. Be assured that I will contact you when any additional information becomes available to me.

I wish you the best of luck with this project, and I am glad to assist you in this matter. If I may be of further service to you, please do not hesitate to contact me.

Sincerely,

Lindsey O. Graham
United States Senator

LOG/wm

508 HAMPTON STREET
SUITE 202
COLUMBIA, SC 29201
(803) 933-0112

401 WEST EVANS STREET
SUITE 226B
FLORENCE, SC 29501
(843) 669-1505

101 EAST WASHINGTON STREET
SUITE 220
GREENVILLE, SC 29601
(864) 250-1417

530 JOHNNIE DODDS BOULEVARD
SUITE 202
MOUNT PLEASANT, SC 29464
(843) 849-3887

140 EAST MAIN STREET
SUITE 110
ROCK HILL, SC 29730
(803) 366-2828

135 EAGLES NEST DRIVE
SUITE B
SENECA, SC 29678
(864) 888-3330

STATE OF SOUTH CAROLINA

State Budget and Control Board

SOUTH CAROLINA ENERGY OFFICE

1200 SENATE STREET
408 WADE HAMPTON BUILDING
COLUMBIA, SOUTH CAROLINA 29201
(803) 737-8030 Fax (803) 737-9846
www.energy.sc.gov

August 6, 2009

Dr. John Kelly
Director
Clemson University Restoration Institute
Clemson University
1360 Truxtun Avenue, Suite 300 B
North Charleston, SC 29405-2045

RE: Funding Announcement # DE-FOA-0000112: Large Wind Turbine Drivetrain Testing Facility

Dear Dr. Kelly:

The South Carolina Energy Office (SCEO) enthusiastically supports Clemson University's application for federal funding through the Large Wind Turbine Drivetrain Testing Facility program. Not only will this project have a direct impact on job creation and economic development in the State of South Carolina, but South Carolina is strategically positioned to host such a facility.

Clemson University has been an integral partner for many SCEO projects and initiatives, including recent offshore wind energy grants that have been funded by the US Department of Energy. Without the resources and expertise provided by Clemson University, these projects would have never come to fruition.

The SCEO understands the wind energy industry is an important manufacturing base in South Carolina and is expected to grow. A large wind turbine drivetrain test facility is vital to not only the wind energy industry in the United States, but also the economic well-being of our state. The SCEO is excited that this facility will be designed to serve the wind industry's current and future needs in large wind turbine drive train testing and will serve as platform for research, education, and workforce training, which is vital to building a green energy economy. With among the highest unemployment levels in the United States, South Carolina desperately needs jobs and this project would make a significant long-term impact, particularly to the former Naval Base area in North Charleston, which is in an economically depressed area.

South Carolina also possesses three of the most important cost drivers in developing an offshore wind farm including strong wind resources in shallow waters, access to good port facilities, and a large coastal demand center. According to studies performed by the SCEO, South Carolina possesses excellent offshore wind resources close to its growing coastal demand centers in shallow waters near outstanding port facilities like Charleston and Georgetown. As the offshore wind market emerges along the East Coast of the United States and land-based turbines continue to grow in size, South Carolina is strategically positioned to serve as an industrial hub from this growing industry to meet the 20% Wind by 2030 Scenario.

Please let me know if the SCEO can be of further assistance and we are happy to offer our full support for this project.

Sincerely,

John F. Clark
Director
South Carolina Energy Office

COUNTY COUNCIL OF BEAUFORT COUNTY

ADMINISTRATION BUILDING
100 RIBAUT ROAD
POST OFFICE DRAWER 1228
BEAUFORT, SOUTH CAROLINA 29901-1228
TELEPHONE: (843) 470-2800
FAX: (843) 470-2751
www.bcgov.net

August 10, 2009

Dr. John Kelly
Clemson University
Vice President, PSA
Executive Director, Clemson University Restoration Institute
360 Truxton Avenue, Suite 300 B
North Charleston, SC 29405-2045

Dear Dr. Kelly:

I am writing this letter on behalf of Beaufort County in support of Clemson University's application for federal funding through the Large Wind Turbine Drivetrain Testing Facility program, made possible by the American Recovery and Reinvestment Act of 2009 (ARRA). Not only will this project have a direct impact on job creation and economic development for Beaufort, but directly relates to our vision of growing the economy through a green sustainable economy.

Specifically, Clemson University seeks to develop a large wind turbine drivetrain test facility located at the Clemson University Restoration Institute (CURI) campus on the former U.S. DOD Naval Base in North Charleston, SC. Clemson's experience and expertise at the Clemson University International Center for Automotive Research (CU-ICAR), where dynamometer test facilities have been designed, built, and operated for the automotive industry, makes it well-equipped to establish this test facility. Moreover, CURI operates materials testing facilities at the Naval Base that will provide analytical support for the test facility. The site will be designed to serve the wind industry's current and future needs in large wind turbine drive train testing. The facility will also serve as platform for research, education, and workforce training.

Clemson University has partnered with an engineering and design firm, redevelopment and ports authorities, local municipalities, private industry, and a national laboratory on this proposal, bringing together a qualified team with diverse skills and complementary strengths.

Additionally, the CURI campus represents an ideal site location equipped with existing crane infrastructure to facilitate the movement of large, heavy drive trains from rail or ships.

The test facility will serve as the catalyst to establish a wind energy manufacturing cluster at the former Naval Base to bring economic development to the area. Three of the most important cost drivers in developing an offshore wind farm include strong wind resources in shallow waters, access to good port facilities, and a large coastal demand center. According to your agency, South Carolina possesses excellent offshore wind resources close to its growing coastal demand centers in shallow waters near outstanding port facilities like Charleston and Georgetown. As the offshore wind market emerges along the East Coast of the United States and land-based turbines continue to grow in size, South Carolina is strategically positioned to serve as an industrial hub from this growing industry to meet the 20% Wind by 2030 Scenario.

Very truly yours,

Bryan J. Hill
Deputy County Administrator

BJH/jh

lowcountry economic network

[illegible], suite 300, beaufort, sc 29902
phone 843.479.3576 fax 843.379.3576
lowcountryalliance.org

August 7, 2009

Dr. John Kelly
Clemson University
Vice President, PSA
Executive Director, Clemson University Restoration Institute
360 Truxtun Avenue, Suite 300 B
North Charleston, SC 29405-2045

Dear Dr. Kelly,

The Lowcountry Economic Network is the economic development entity for Beaufort County. Our mission is to enhance the economic prosperity of the Beaufort County region by retaining, creating and attracting quality jobs, expanding and recruiting business and fostering cooperative economic growth.

The Network understands the importance of sustainable energy both to the environment and the economy and has developed initiatives designed to promote the creation of green and related knowledge-intensive jobs in our community. Our organization is, therefore, strongly in favor of Clemson University's application for federal funding through the Large Wind Turbine Drivetrain Testing Facility program, made possible by the American Recovery and Reinvestment Act of 2009 (ARRA).

The coastal region of South Carolina's Lowcountry affords the perfect environmental and economic setting to develop a wind energy cluster: excellent port facilities; strong wind resources in shallow waters; an emerging offshore wind market, as well as an existing manufacturing base and nationally-recognized research facilities. These resources have been substantiated by the US Department of Energy and the US Department of the Environment, whose studies conclude that South Carolina's coastal, research and industrial environment position it to serve as an offshore wind energy hub able to serve both the US and global energy markets. According to the US Department of the Environment 'EERE 20 percent Wind Scenario by 2030', South Carolina could gain 10,000 to 20,000 new jobs related to the wind power industry over the next 20 years.

The work and testing conducted on this project at the Clemson University Restoration Institute will also serve as an example of the availability of advanced research opportunities close to home for our region's high school and college students as well as an excellent platform for workforce development.

The Lowcountry Economic Network is committed in its support of the Clemson University's application for federal funding to fund the Large Wind Turbine Drivetrain Testing Facility program. The program will support this region's environmental, research, education, economic and workforce development goals by reducing fossil fuel dependence and generating much needed opportunities for job creation in an emerging and sustainable industry.

Sincerely,

Kim Statler
Executive Director

CLEMSON UNIVERSITY
WIND TURBINE DRIVETRAIN TEST FACILITY:
PROJECT MANAGEMENT PLAN

Dr. John Kelly, Clemson University
Dr. Imtiaz Haque, Clemson University
Dr. Nicholas C Rigas, Clemson University
Dr. Michael Drews, Clemson University
JoAnn Williams, Clemson University
Alan Godfrey, Clemson University
Elizabeth Colbert-Busch, Clemson University

Joe Cordaro, Savannah River National Laboratory

George Trask, Consultant

Jorge Cordes, Renk Labeco Test Systems
Eric Floyd, Renk Labeco Test Systems

Dennis Hurt, Fluor Corp
Thomas Rishforth, Fluor Corp

Shawn Gaffney, EcoEnergy LLC
Edward Englert, EcoEnergy LLC

Brad Kerr, CMMC LLC

TABLE OF CONTENTS

LIST OF FIGURES

APPENDICES

LIST OF ACRONYMS

ARRA	American Recovery and Reinvestment Act
AMRL	Advanced Materials Research Laboratory
CCC	Clemson Conservation Center
CMMC	Charleston Marine Manufacturing Company
CUICAR	Clemson University International Center for Automotive Research
CU	Clemson University
CUWTDTF	Clemson University Wind Turbine Drivetrain Test Facility
DOE	U.S. Department of Energy
EH&S	Environmental, Health and Safety
EPA	U.S. Environmental Protection Agency
FOA	Funding Opportunity Announcement
HALT	Highly Accelerated Life Testing
LLC	Limited Liability Company
NEPA	National Environmental Policy Act
PEP	Project Execution Plan
PM	Project Manager
PMBOK	Project Management Body of Knowledge
PMP	Project Management Plan
SCDHEC	South Carolina Department of Health and Environmental Control
SCOCRM	South Carolina Office of Coastal Resource Management
SCPR	South Carolina Public Railways
SCSPA	South Carolina State Port Authority
SEMP	System Engineering Management Plan
SRNL	Savannah River National Laboratory
WBS	Work Breakdown Structure

1.0 OVERVIEW

1.1 Project Mission, Objectives and Success Criteria

The Clemson University Wind Turbine Drivetrain Test Facility ('Facility') has been developed to address the DOE Funding Opportunity Announcement (FOA) DE-FOA-0000112, "Recovery Act – Large Wind Turbine Drivetrain Testing Facility", which was issued by the U.S. Department of Energy Golden Field Office on June 23, 2009. The Project is led by Clemson University, in partnership with the Savannah River National Laboratory, City of North Charleston and the State of South Carolina through the Charleston Naval Complex Redevelopment Authority. Industrial contractors include Renk Labeco Test Systems, EcoEnergy LLC, Fluor Corporation, South Carolina Public Railways and Charleston Marine Manufacturing Corporation. The mission of the Project is to design, construct and operate a unique wind turbine drivetrain test facility that will provide high value/high quality test services at a competitive price to the wind industry.

The proposed Facility has been designed to meet the following objectives.

- To perform HALT of up to 15MW rated wind turbine drivetrains and generators with a 30% overload of the rated torque to the test article.
- To accommodate existing and future turbine designs including large direct drive generators.
- To be able to apply simultaneous dynamic and/or steady off-axis loads to the drivetrains through a blade force simulator.
- To permit the simultaneous, independent testing of two 7.5MW rated drivetrains.
- To permit interconnection of the test article at all common system operating voltages.
- To evaluate the test generator system response to grid anomalies and for grid code compliance.
- To obtain independent accreditation of the Facility to conduct certification testing in accordance with applicable wind turbine design standards.
- To have available preparation rooms for assembly, disassembly and instrumentation check-out of test articles as required.
- To be located near sea port and rail access.

This Project Management Plan has been developed to outline in detail the execution of the proposed Project. The plan includes a discussion of all facets that are important to making the Project Management Plan and in turn the Project successful. This includes but not limited to the Project Management Model, Environmental, Health and Safety Considerations, Fiscal Responsibility, Schedule Organization, Industrial Contractor Estimates, Work Packages, Change Control Process, Business Model assumptions and management of Intellectual Property.

1.2 Project Phases and Deliverables

The project management plan has been set up in five phases with four critical milestones to fulfill the Mission Requirements. A Phase-Gate Model for Management of the Project has been established that calls for five performance phases with entry into each phase conditioned upon Project Team acceptance of the milestone reviews. The phase-gate progression is shown in Figure 1. Fulfillment of all Mission Requirements will occur upon completion of Phase IV and sustainability of the facility will carry past the

proposal period in Phase V. The associated project costs have been broken down by Phase and can also be found on an annual basis in DOE Form 424 as well as the Business Pro forma in the Appendices.

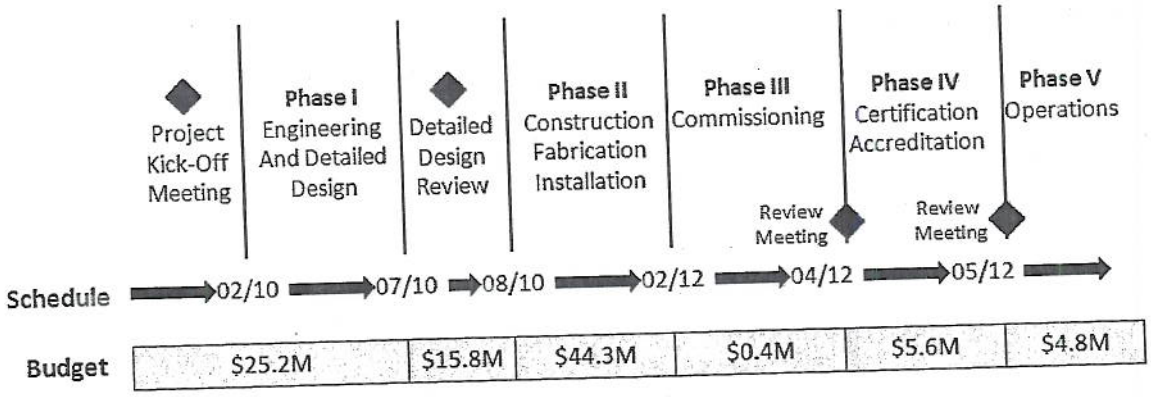


Figure 1. Project Management Phases

A detailed Gantt of the Project can be found in Appendix A. The key partners, contractors and stakeholders for the Project are shown below.

Project Team (Phases I – V)	Key Stakeholders (Phases I-V)
Clemson University Project Manager Project Safety Manager Savannah River National Laboratory Renk Labeco Test Systems Fluor Corporation SCE&G EcoEnergy LLC CMMC LLC SC Public Railways	Charleston Naval Complex RDA City of North Charleston City of Charleston SC DHEC SC OCRM State of South Carolina South Carolina State Port Authority

The following deliverables will be completed at each phase of the Project.

- Project Kick-off Meeting:
  - Introduction of project participants, partners and key stakeholders
  - Develop detailed scope of the project
  - Establish safety plan and safety culture
  - Identify key critical milestones and decision points
  - Develop individual contractor scope of work
  - Identify key Environmental, Safety and Permitting requirements
  - Establish communication links, sharing of data and key points of contacts
  - Establish periodic project review plan optimizing use of video conferencing to minimize travel costs

- Develop detailed project management plan
- Attendees:
  - Project Team
  - Key Stakeholders
  - Representative from NREL Wind Turbine Test Program
  - Key industry reps including GE Energy, Winergy and Nordex

- Phase IV – Certification and Accreditation
    - Test Rig #1
    - Test Rig #2
- **Milestone:** Accreditation Review
    - Attendees:
        - Project Team
        - Key Stakeholders
        - Representative from NREL Wind Turbine Test Program
        - IAB
        - TAB
- Phase V - Operations

1.3 Assumptions, Dependencies, and Constraints

The following high-level assumptions were made as the Project documents were being developed.

- Project will be funded by DOE at $45,000,000 with funds expended in first three years.
- A minimum 35% cost share from university/industrial partners must be obtained.
- At the completion of Phase IV, the Facility will remain operational, self-sufficient and will be owned by Clemson University and managed through the Vice President of Public Service Activities at Clemson University for a period of 20 years.

Successful management and execution of the Project is dependent upon a seamless transition from each of the Project Phases with key milestones and reviews in place to ensure Facility will meet customer needs. This requires coordination of activities between Clemson University, City of North Charleston and Charleston, Charleston Naval Complex Redevelopment Authority, Savannah River National Laboratory and industrial contractors (e.g., Renk Labeco Test Systems, Fluor Corporation, EcoEnergy LLC, SCPR, CMMC and DHEC). An external Project Manager (PM) with significant project management experience will be engaged as a temporary grant employee through the first four phases of the project to ensure a seamless, cost efficient project is executed to meet the targeted deadlines. Reporting to the PM will be a dedicated Project Controller to ensure fiscal responsibility of the project and the Project Safety Manager. The PM designated for the Project has extensive prior project management experience including the installation of the dynamometer facilities at the CUICAR (see G. Trask resume attached in narrative.) Key staff including PI (I. Haque), Facility Director (N. Rigas), Administrative Specialist (E. Arena), Business Development Manager (E. Colbert-Busch), Advisor (Dr. M. Drews), CUICAR Engineering Team, Project Manager (G. Trask), Project Safety Manager (TBD) and Project Controller (A. Godfrey) will be in place from the start of the Project. The CU WTDTF will be fully staffed by Phase III per the Organizational Chart.

1.4 Evolution of the Project Management Plan

This Project Management Plan will be updated and revised at the start of each Project phase, and will be reviewed on a quarterly basis. Updates to the plan will also be made per the Project Change Control Process, described herein.

2.0 PROJECT MANAGEMENT

2.1 External Interfaces

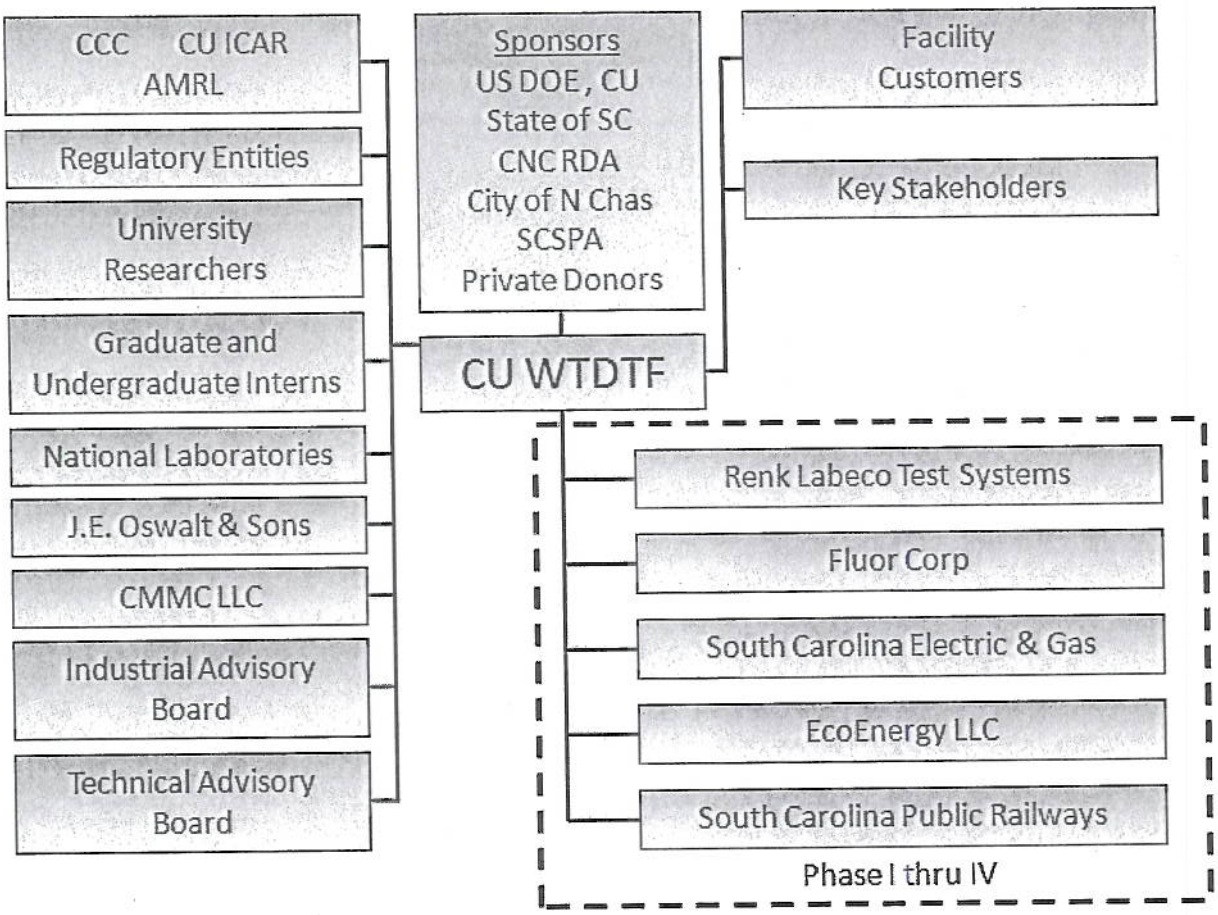


Figure 2. CU WTDTF External Interfaces

The Project will interact with a number of outside agencies, organizations, and individuals throughout Phases I through IV. The primary program sponsor is DOE, State of South Carolina, Charleston Naval Complex Redevelopment Authority, Clemson University, City of North Charleston and private donors. The primary customer for the project is the wind turbine manufacturers and drivetrain suppliers. Key Stakeholders were identified above. Regulating bodies will be engaged from Phase I through Phase V to ensure the Facility meets all local building, environmental and operations safety requirements. The Project will interact with other stakeholders who may only have an indirect link with the Project but are affected by it, including the home organizations of the people working on the Project, the Facility's neighbors and community and suppliers. The objective is to maximize local use of labor to reduce costs and support the mission of the ARRA.

2.2 Project Organization

The Project is managed by a Facility Director, who will be assisted by a Project Manager through Phase IV. The Facility Director and Project Manager oversee all aspects of the Project including designated specialist in EH&S, Cost Control, Administration, Design and Engineering, Construction, Commissioning, Accreditation, Certification and Operations. The Facility Director will be assisted by University Advisors,

Administrative Specialist, Project Controller, Project Safety Manager and other CU, CUICAR, CURI, and CCC resources as needed. The roles and responsibilities of the key personnel are further described below. A diagram of the overall Project Organization is shown in Figure 3.

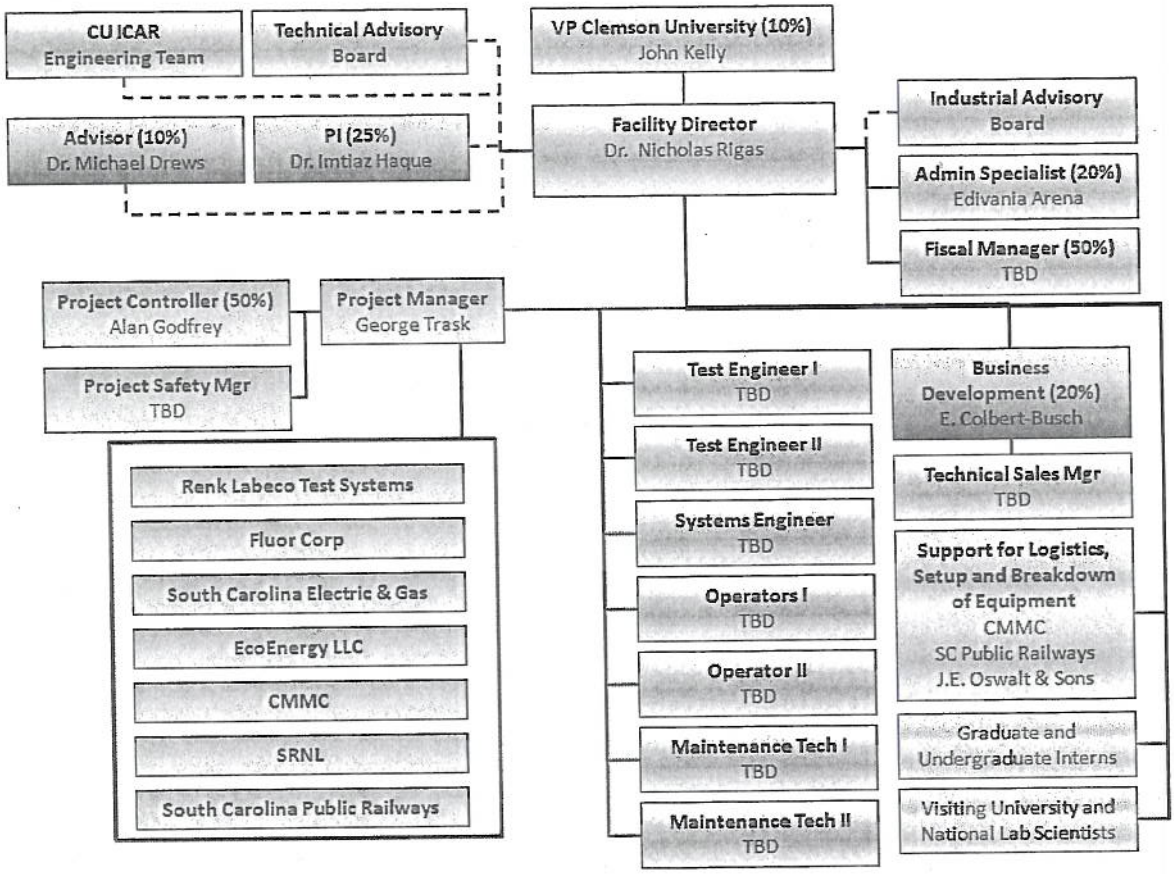


Figure 3. Project Organization Chart

Principal Investigator: Responsible for execution of DOE Grant and serving as Advisor for Facility Director throughout Phases 1 through V. This designated individual (see I. Haque resume) has extensive experience in the design, start-up, commissioning and operations of CUICAR as well as developing and managing Industry – University relationships and programs. The position will transition to the TAB post the proposal period.

Facility Director: Fiscal and operational responsibility of the Facility ensuring safety of employees, customers and community. This positions reports directly to the Vice President at Clemson University. Responsibilities include:

- Completion of Phases I through V with the assistance of Project Manager.
- Hiring and management of Facility personnel
- Development and management of annual budget, three year rolling budget and monthly reporting
- Establishment and liaison with Technical Advisory Board and Industrial Advisory Board

- Ensuring fair access to Facility to all end-users
- Establish customer relationships
- Organization of Annual Review Meeting the IAB and TAB
- Overseeing business development
- Review and approval of proposed test plans
- Liaison between Facility customers and support services including CMMC, SCSPA, SCPR, SCE&G and JE Oswalt & Sons as needed by the customer

Advisor: Serve as an advisor to Facility Director and Project Manager during Phases I through V utilizing experience and lessons-learned from the development, construction and operations of the CCC located at CURI.

CUICAR Engineering Team: Provide technical advice to Facility Director and Project Manager based on experience and knowledge in operating CUICAR test facilities. This team has extensive experience in automotive drivetrain testing, systems engineering and industry-university collaborative research and test services.

Technical Advisory Board: A seven member advisory board of key industry relevant Researchers from around the world with experience and knowledge of the wind industry, drive-train technology and operations of non-profit facilities serving industry. This would include representatives from NREL, Universities and DOE Laboratories. Mission of TAB is to provide technical advice on Facility operations to maximize utilization, ensure capabilities meet emerging technology test requirements, promote related private-public research and ensure educational and workforce development.

Industrial Advisory Board: A seven member board of representatives from the wind turbine manufactures, drivetrain manufacturers, technology end-users and Tier I component suppliers that will provide oversight to ensure Facility meets industry needs and direct future expansion of Facility to service changing or emerging technology.

Project Manager: (Consultant thru Phases I - IV) Reports directly to the Facility Director. Responsibilities include:

- Development of System Engineering Management Plan
- Project schedule
- Contract execution and management
- Liaison with industrial contractors
- Project oversight
- Quality assurance of services provided by contractors
- Environmental and Safety control of all related activities
- Development of Facility Acceptance Plan
- Development of Accreditation Plan
- Commissioning
- Project documentation archiving
- Project Reporting

Project Controller: Reports to Project Manager. This individual is responsible for ensuring fiscal responsibility of project, adhering to all State and Federal procurement procedures, and fiscal reporting to US DOE.

Fiscal Manager: Reports to Facility Director. Responsibilities include:

- Fiscal responsibility over long term Facility operations.
- Management of Facility accounts.
- Establishing Customer user accounts.
- Customer invoicing.
- Purchasing.
- Reporting of Facility monthly accounting statements to Clemson University.

Project Safety Manager: Reports directly to the Project Manager. Responsibilities include:

- Establishing a culture of safety from onset of the project.
- Develop Project Safety Plan
- Conduct Safety Training of all employees and contractors entering proposed work site.
- On-site safety observations and evaluations during construction period.
- Periodic safety review meetings with employees and contractors during Phases I -IV.
- Establishment of key safety procedures including Personal Protective Gear, Confined Space Entry, Lock-out / Tag-out, Hot Work Permit, Heavy equipment lifting, Evacuation and other OSHA related requirements.
- Develop Emergency First Respondent Plan and associated Training Program.
- Develop Safety Training Program for the Facility including certification.
- Develop Safety Incident Reporting and Root Cause Analysis Program.
- Develop Safety Observation Program.

Administrative Specialist: The Administration Specialist oversees documentation, records, and aids the Project Manager in the generation and submittal of reports and other Project documents.

Test Engineer I and II: The Test Engineers report to the Facility Director and oversees the safe day-to-day operations of the Facility during Phase V. Responsibilities include:

- Oversee operations and data collection of test rigs for customer during testing.
- Develop, update and maintain Facility operating procedures and policies.
- Develop, update and maintain preventative maintenance procedures.
- Develop, update and maintain training and certification program for Operator and Maintenance Technicians.
- Coordination with Project Manager in Phase IV and seamless transition of Facility to Phase V.
- Customer Test Plan Review in cooperation with the Systems Engineer and Facility Director.
- Liaison with Customer resources at site during testing.
- Managing testing programs on Test Rigs.
- Ensuring confidentiality of customers during multiple testing on both test rigs.
- Coordinating with CMMC and J.E. Oswalt & Sons for logistics, rigging, machining and additional Customer defined support needs.

Business Development Manager: To quickly establish a marketing strategy and build relationships within the industry. Elizabeth Colbert-Busch of the Clemson University Restoration Institute with extensive industrial experience in Business Development and Marketing will be assigned to develop and execute a marketing plan during the period of this proposal. She will work closely with the Technical Sales Manager to rapidly develop strong customer relationships, marketing tools, representation at trades

shows and customer visits to the Facility. Clemson University resources will be available to establish a website for the Facility and assist in developing marketing and trade-show materials.

Technical Sales Manager: The Technical Sales Manager reports to the Facility Director. During the period of this proposal, the Technical Sales Manager will report directly to the Business Development Manager to accelerate implementation of the Marketing Plan and establishment of business relationships within the industry. Responsibilities include:

- Development of Marketing Plan and materials.
- Establishment of Facility website.
- Planning for customer visits.
- Management of customer relations.
- Trade show representation.
- Building customer relationships.
- Conducting customer satisfaction reviews.

Systems Engineer: The Systems Engineer reports to the Facility Director and is responsible for review and implementation of data acquisition requirements outlined in Test Plans by Customers. Responsibilities include:

- Commissioning of data acquisition system with SRNL.
- Review of Test Plans.
- Coordination with Customers on Data Acquisition Requirements.
- Ensuring security of test data.
- Developing data acquisition protocol and plans for each test unit.
- Maintaining Facility data acquisition hardware and software.
- Customizing data acquisition system to meet customer needs.
- Testing of sensors before and after test cycles.

Operators I and II: Report to Facility Director. Responsible for:

- Safe operation of Test Rigs I and II.
- Coordinating with Customer resources on site.
- Ensuring Customer confidentiality.
- Overseeing test units during testing.
- Preparing units for testing and break-down post testing.
- Working with support personnel from CMMC and Oswalt to meet Customer needs.
- Maintaining Test Rigs.
- Modifying Test Rigs to meet Customer Test Plans.

Maintenance Technicians I and II: Report to Operations Manager. Responsible for:

- Safe maintenance of Test Rigs I and II.
- Scheduling of preventative maintenance and checks.
- Coordinating with Customer resources on site.
- Ensuring Customer confidentiality.
- Preparing units for testing and break-down post testing.
- Working with support personnel from CMMC and Oswalt to meet Customer needs.
- Maintaining Test Rigs.
- Modifying Test Rigs to meet Customer Test Plans.

CMMC and J.E. Oswalt & Sons:

- Provide contract services directly to Customers on equipment logistics, required rigging, machining, maintenance and other technical needs.

3.0 MANAGERIAL PROCESS PLANS

3.1 Design Process Model

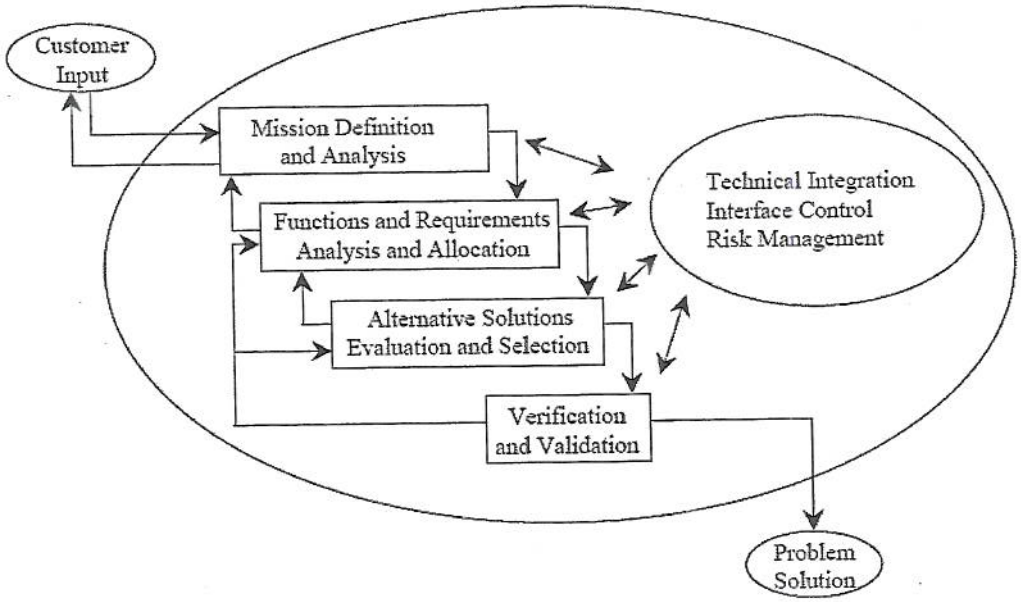


Figure 4. System Engineering Process Model

A Systems Engineering methodology will be applied to the facility design and engineering process. The System Engineering Process consists of a cyclic application of integrated design steps at higher levels (i.e. facility level) and then at lower more detailed levels (i.e. system level, component level) until a final detailed design is generated. Some steps are performed in sequential order – Mission Definition and Analysis, Functions and Requirements Analysis and Allocation, Alternative Solutions Evaluation and Selection, and Verification and Validation – and some steps are performed throughout the process – Technical Integration, Interface Control, and Risk Management. Feedback loops are presented in the process to ensure that the Problem Solution meets Mission expectations.

In the larger context of the Project, the System Engineering Methodology will be used in an iterative fashion in successive Project phases. Though more complicated than will be used for this project, the iterative scheme shown in Figure 4 helps illustrate how the System Engineering Methodology can be applied to complicated projects.

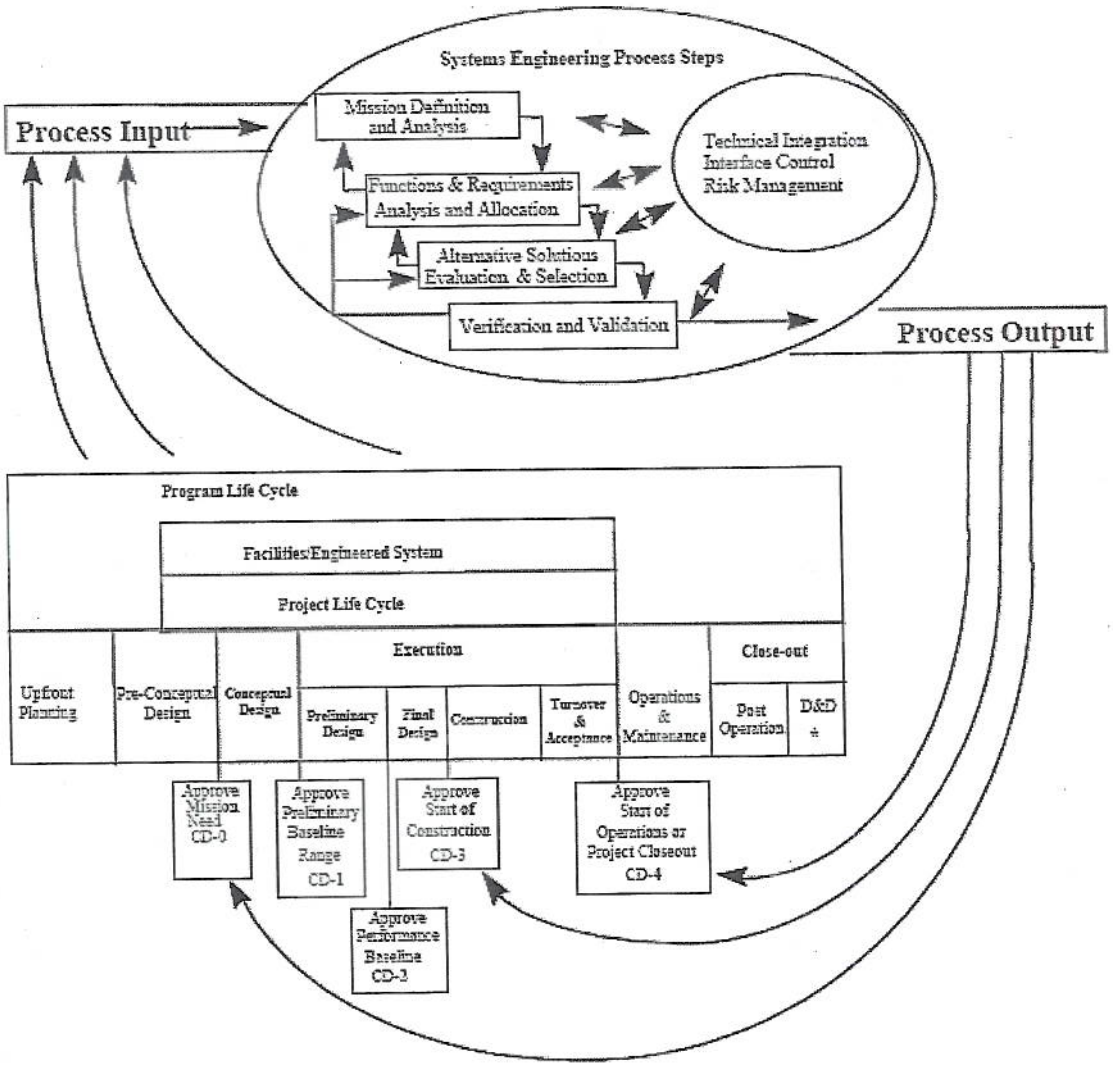


Figure 5. System Engineering Methodology

Although this project will not be progressing through a full DOE Critical Decision structure, the figure shows that the process output from one design iteration becomes the input to the next design iteration, and the information generated during the previous iteration is refined and updated in order to achieve a new or better process output. In this Project, the proposal generation process is analogous to the Pre-Conceptual and Conceptual Design stages; Phase I is analogous to the Preliminary Design phase and parts of the Final Design Phase; Phase II, III and IV is analogous to the Final Design Phase, Construction, and Turnover and Acceptance; and Phase V is analogous to the Operations and Maintenance Phase in Figure 5.

A graded approach will be used in the application of System Engineering Methodology in order to tailor specific System Engineering processes to the needs of the Project. At the start of the Project, a System Engineering Management Plan (SEMP) will be written by the Project Manager and approved by the

Facility Director that will describe the specific System Engineering processes that will be used during each design phase.

3.1.1 Budget

The total capital budget for the Clemson University Wind Turbine Drivetrain Testing Facility is shown in DOE Form 424 and in Appendix L (Business Project Pro forma). The DOE portion of the budget will be expended by Year 3 as outlined in DE-FOA-0000112. The Project Budget was developed using the following detailed cost estimates.

	Appendix
Building 69 and 6.3 Acres (Appraisal)	B
Test Rig Detailed Cost Estimates and Conceptual Drawings	C
Building 69 Detailed Cost Estimate	D
Facility Electrical Infrastructure Estimate and Drawing	E
Rail-spur Extension Estimates and Drawings	F
SRNL Data Acquisition System Estimate	G

During Phases I through III, the Project Manager may elect to hold up to 10% of the total funding for each phase as management reserve (unallocated) in order to cover unforeseen expenses as the work progresses. The shifting of funds from the management reserve to individual work activities will be done with the approval of the Project Manager using the Project's Change Control Process (Section 3.1.5).

3.1.2 Schedule

The Project will develop and maintain a resource-loaded schedule for each phase. All work activities will be included in the schedule and will be categorized and sub-categorized. Changes to the schedule, once it is finalized, may only be performed using the Project's Change Control Process (Section 3.1.5). Phases I through IV are limited to no more than 36 months duration.

The Detailed Project Gantt is shown in Appendix A. The Project Gantt will be reviewed and updated, as needed, at the start of each Project phase, quarterly and in response to approved Change Control requests.

3.1.3 Work Packages

Work performed by the Project will be organized into work packages. A work package is a document that describes a specific body of work that occurs within a particular tier of the WBS. A work package involves work that spans between approximately one month and one year in duration, and that may contain one or more tasks and sub-tasks. It covers work only in the current fiscal year or funding period. All work being performed that results in funds being expended must be captured in a work package, as work packages will be the means by which project work will be monitored and controlled.

The work package document contains the following items:

- Title
- Work Package Number

- Organization
- Total budget ($K).
- List of milestones and deliverables, and their required completion dates
- Detailed task and sub-task resource-loaded schedule with costs assigned to each task and/or sub-task.
- Estimated monthly budget outlay, assuming that the work is accomplished on schedule.
- Name of assigned principal investigator or work package manager
- Description of project risks
- Description of work package staffing plan
- Description of procurement activities.

An example of a work package document is provided in Appendix H. The total funding provided in the work package may consist of current period funding, and funding provided by carryover of unspent Project funds from the previous funding period.

Work packages will be organized into Control Accounts which will contain one or more work packages. Control account headings align with the sub-elements in Figure 1. The Project Controller will be responsible for managing the work packages under each control account. While a control account may contain one or more work packages, an individual work package may be associated with only one control account.

If a work activity involves more than one organization, then separate work packages will be written for each organization in order to capture the funding provided to each organization for the activity and to better track expenditures.

In the case of sub-contracts and other such agreements, the work packages do not serve as a substitute for more formal contracts. Work packages are internal to the Project, while more formal contracts govern work or the exchange of funds for services or goods that is generated or purchased outside of the Project.

Work packages will be generated for all planned work in the current funding period at the start of each Project phase, and on a periodic basis within each Project phase as funding is released from DOE or from cost-share partners. Work packages may be created at any time within a Project phase if new funding is provided, or management reserve is released. Work packages may be revised at any time in response to changes in scope, schedule, or budget using the Change Control Process (Section 3.1.5). A work package naming convention will be developed upon the start of Phase I.

Rolling wave planning will be used to economize the generation of work packages and to minimize work package re-work. Rolling wave planning involves the generation of work packages for current work, and the generation of less detailed "planning" packages for future work. Planning Packages are similar to work packages in that they must have the following information:

- Are assigned to a particular Control Account
- Are assigned a Planning Package number
- Have defined start and stop dates
- Have specific assigned budgets.

Planning packages tend to be less detailed than work packages and may have wider scope. Planning packages are used in part explicitly identify future work tasks and funding needs, so that funding for the

work planned is not used for other purposes. Planning packages are also helpful for updating the resource-loaded schedule. As time progresses, a planning package may become one or more work packages. Figure 6 illustrates rolling wave planning.

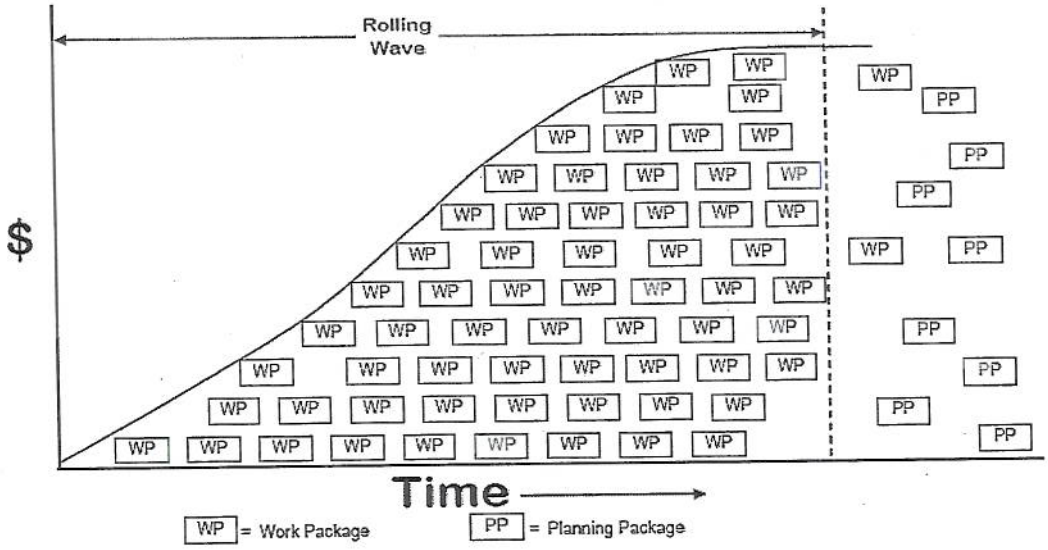


Figure 6. Rolling Wave Planning

3.1.4 Earned Value Management

The Project will employ Earned Value Management techniques utilizing ANSI 748 criteria in order to track the progress of individual work packages and to assess overall project performance. In an Earned Value system, tasks or sub-tasks in a work package are assigned a "dollar-equivalent" value and completion of each task or sub-task in the work package is counted towards the "value earned", and the value earned is assessed at the dollar-equivalent value assigned to each task or sub-task. The total potential earned value of a work package is set equal to the budget supplied for the work package, and it is necessary that the dollar-equivalent values of all tasks or sub-tasks in a work package sum to the total work package budget. For example, assume a particular work package has a total budget of $5,000, and contains five work tasks, each valued at $1,000 each. Completion of only one task constitutes an earned value of $1,000, completion of three tasks constitutes and earned value of $3,000, and completion of all five tasks constitutes an earned value of $5,000. Tracking earned value in dollar-equivalent numbers places every work package, regardless of the diversity of possible work, on the same scale (dollar-equivalents) and allows for comparison and management of multiple work packages using the same methods and performance measures.

Measuring only the earned value is insufficient as a work package performance measure, and it is important to know also how much money was actually spent in order to realize the value earned at any given point. In regard to the previous example, the amount of value earned by the accomplishment of a work task towards the total value of the work package is $1,000, while it may have cost $750 or $1,500 to accomplish the task. In the first instance, the task was accomplished under-budget, while in the second instance, the task was accomplished over-budget. Comparisons of earned value to the actual

amount spent at intermediate points along the way to work package completion therefore allow for assessments of whether the amount of money remaining in the work package budget is sufficient to accomplish the remaining tasks (under-budget or on target), or whether the work package may be over-budget at completion.

Another important piece of information to determine is whether the tasks in the work package are on-schedule, or if they are ahead or behind schedule, and this can be accomplished by comparing the value earned (work accomplished) at any given point in time with the value that was expected to have been earned by that moment in time. For example, the work package discussed previously has five tasks, each valued at $1,000. It is further assumed that the work would be accomplished at a completion rate of one task/month over a time span of five months. So, the expected schedule in earned value in Month 1 is $1,000, in Month 2 is $2,000, and so on up to Month 5, where the earned value is expected to be $5,000. If it is observed at the end of Month 3 that only two tasks have been accomplished ($2,000 in earned value) and that $1,500 of the total project budget have been spent, then the work is $500 under budget, which is good, but the work is $1,000 behind schedule, because it was expected that three tasks were to be accomplished ($3,000 in earned value) by Month 3 and only two tasks have been completed.

The Project will track work at the *control account* level unless otherwise specified by the Project Manager. Earned value statistics for the control account will be calculated as the sum of the contributions to each earned value statistic from the work packages contained within the control account, which will have an averaging effect on control account performance. Control account managers may choose to track individual work packages using the EVMS for their own use, but will not be required to report the earned value performance of individual work packages within a control account unless the control account contains only one active work package, and, by definition, the control account and the work package within it are one and the same.

3.1.4.1 Earned Value Statistics

Information concerning earned value, actual cost, and schedule is formalized by the Earned Value Management System (EVMS), and relevant statistics are calculated in order to assess project performance in relation to the budget and schedule. These are described below.

Budget at Completion (BAC): The BAC is the total amount of money provided to perform the tasks and sub-tasks in the work package.

Budgeted Cost Work Scheduled (BCWS): Each task or sub-task in a work package is assigned a dollar-equivalent value. The tasks or sub-tasks are scheduled by assigning starting and completion dates. The total span of the schedule is divided into equal intervals (weekly or monthly), and the cumulative amount of work to be accomplished by each time interval is calculated based on the assigned dollar-equivalent value of all of the tasks or sub-tasks that will have been completed by that point. The cumulative schedule expressed in dollar-equivalents is known as the BCWS. The BCWS is determined prior to starting work on the work package, and changes to the BCWS are not allowed when work on the work package is underway without going through the approved Change Control Process (See Section 3.1.5). At the terminal date of the work package, the BCWS equals the BAC, as it is assumed that the total earned value of a work package is equal to the amount of money budgeted to accomplish the work.

Budgeted Cost Work Performed (BCWP): BCWP is the earned value of the work accomplished at any given point in time, and is usually formally assessed at the same time intervals under which BCWS is evaluated (weekly or monthly).

Actual Cost Work Performed (ACWP): ACWP is the actual cost or dollars spent in order to achieve a given BCWP.

Cost Variance (CV): The CV is equal to the earned value minus the actual cost, or CV = BCWP – ACWP. A positive variance indicates that the work has been accomplished under budget, while a negative variance indicates the work has been accomplished over budget.

Cost Performance Index (CPI): The CPI is used to normalize the cost variance, so that projects differing widely in their budgets can be compared on an equal basis. The CPI is calculated by dividing earned value by the actual cost, or CPI=BCWP/ACWP. The CPI is above 1.0 if the work package is under budget, while a CPI less than 1.0 indicates that the work package is over budget.

Schedule Variance (SV): SV is calculated by subtracting BCWS from the BCWP, or SV=BCWP – BCWS. A negative SV indicates that the work is behind schedule, while a positive SV indicates that the work is ahead of schedule.

Schedule Performance Index (SPI): The SPI is used to normalize the schedule variance, so that projects differing widely in their budgets can be compared on an equal basis. The SPI is calculated by dividing the earned value by the planned value, or SPI = BCWP/BCWS. An SPI greater than 1.0 indicates that the project is ahead of schedule, while an SPI less than 1.0 indicates that the project is behind schedule.

Estimate to Completion (ETC): The ETC is calculated at intermediate points during the completion of a work package in order to determine how much money will be needed to accomplish task that remain to be completed. The ETC is not a precise measure, and there are two different ways of calculating it. The first method assumes that the cost variances experienced up to that point in time are not typical, and that there is no reliable information on future cost variances. In this case, ETC = BAC – BCWP. In another method, the cost variances experienced up to that point in time are assumed to be typical, and a better estimate can be determined. This is done by using the following formula: ETC = (BAC – BCWP)/CPI. The ETC is not fate, and calculating an ETC that exceeds the available remaining budget does not mean that the work package will necessarily be over-budget at completion, or that all of the work scheduled cannot be accomplished with the available budget, but it does mean that adjustments will need to be made in how future tasks are performed in order to conserve funds and reduce cost variances.

Estimate at Completion (EAC): The EAC is the total expenditure that is expected to be spent if all of the tasks in the work package are performed, based on data at some intermediate point in time, and is calculated by EAC = ACWP + ETC.

3.1.4.2 Significant Variance Levels

Cost and schedule variances are statistical, and are based on comparison of actual expenditures and work performed to estimated schedules, and estimates are rarely perfect. Cost and schedule variances will occur each month, and can be tolerated as long as they are randomly distributed around the $0

mark, do not exceed particular action thresholds, and long-term trends in the cumulative variances do not persist for three or more months (e.g., steadily increasing cost variance).

In a single month, a cumulative cost or schedule variance (positive or negative) in excess of 10% and greater than $10,000 requires an explanation and corrective action(s) in monthly performance reports. The explanation should describe the variance value, the cause of the variance, the proposed action(s) that will be taken to correct the variance, and the expected duration of the variance once the corrective action(s) are initiated.

Over a period of three months, a persistently increasing cost or schedule variance (either negative or positive) but that has not yet reached the 10% variance threshold also requires an explanation. The explanation should describe the variance trend, the cause of the deviating trend, the proposed corrective action(s) that will be taken to reverse the trend, and the expected time period the trend is expected to persist.

3.1.5 Change Control (Scope, Schedule, Budget)

Project scope, schedule and budget are interrelated and come together at the work package level. Therefore, the change control process is executed at the work package level. Change control is imposed in order to preserve work packages against arbitrary changes in regard to scope, schedule, and cost once work packages have been approved and put into action. A significant change is defined as any change that affects a work package's cost, schedule, or assigned scope and list of deliverables. Deviations from a work package's basic description, staffing management plan, procurement plan, and risk register may be performed without going through change control if there is no effect on cost, schedule, or assigned scope and list of deliverables. Work package change control will be managed by the Project Manager, Administration Specialist and Project Controller.

Changes to work packages that will affect a work package's cost, schedule, or scope (list of milestones and deliverables) are not permitted after the work packages are approved without submitting a formal request for changes to the Project Manager for approval. A formal request is a request made in a form suitable for storage in Project files as a record. Changes to work packages, once they are approved, are not made casually and are usually only made due to circumstances that occur during the execution of the work package that are beyond the control of the work package manager, including: increases or decreases in project funding; loss of key personnel; loss of use of facilities; unforeseen increases in the cost of equipment, materials or personnel; and other such causes. Otherwise, work package performance must be allowed to float in regard to estimated cost and schedule baselines, so that problems related to cost and schedule can be discovered and communicated in a timely manner, Also, it is important to allow for deviations from the baseline costs and schedules so that better estimates of cost and schedule can be crafted in future years.

Appendix I shows a draft work package change request form. This form, along with a draft modification of the work package, is submitted to the Project Manager and the Administration Manager in order to initiate a review of the proposed change(s). The Administration Manager will examine the change request and provide an evaluation to the Project Manager of the impact of the proposed changes on the Project's baseline cost, schedule, expected deliverables, and work scope. Based on this evaluation, the Project Manager may accept, accept with modification, or reject the proposed changes. If the change(s)

are accepted, the change(s) are incorporated into a modified work package, and the modification becomes part of the established baseline budget, schedule, and scope.

Work package change control is not imposed on the planning packages, and those can be changed continuously, as needed, by the Project Controller. Only when planning packages become work packages is work package change control imposed.

The integrated schedule in the current year is built up from detailed work package schedules, and so is subject to work package change control. Changes to the current-year integrated schedule should not be made by Project managers without also going through the work package change control process for the affected work packages in order to record the reasons for the changes in the Project records.

3.1.6 Communications

The Project Manager will develop a Communications Management Plan at the Project Kick-off Meeting. The Communications Management Plan will describe the processes required to ensure timely and appropriate generation, collection, distribution, archiving, retrieval, and ultimate disposition of Project information. In general, it is expected that the Communications Management Plan will take into account the communication processes and methods described in Chapter 10 of the PMBOK, 3rd Edition. The communication plan will maximize the use of secure document sharing through the web and video conferencing to reduce travels cost but maximize communication throughout all Phases of the project.

3.2 Procurement Management

Procurement of capital equipment for the Facility will be performed through Clemson University or a designated industrial contractor, and the procurement process will be prescribed by the procuring organization. In general, it is expected that the procurement process, regardless of which organization is performing the procurement will meet the requirements of the State of South Carolina and will resemble the procurement process described Chapter 12 of the PMBOK, 3rd Edition.

3.3 Risk Management/Mitigation

The Project Manager will develop a Risk Mitigation Plan during Phase I of the Project. As part of the Systems Engineering Methodology (see Section 3.1), risks associated with the Facility design will be identified, and risk management strategies will be developed. Risks associated with the performance of work activities are identified in the work packages, and are reviewed periodically as the work progresses.

The Project team will develop and maintain a risk register. The risk register will contain a list of identified project risks, potential impact of risks, a list of potential responses to each risk, and root causes of risks. Negative as well as positive risks will be identified. Feeding the risk register will be qualitative or quantitative risk analyses performed at a level that is appropriate for each risk. For example, high-impact high-probability risks may require thorough analyses and response plans, while low-impact low-probability risks may only require monitoring. Once developed, the risk register will be updated on a

monthly basis. The risk register is expected to be a living document, and risks or responses to risks may be added, subtracted, or changed as new information is collected and the project progresses in time.

In some cases, if a high-impact high-probability negative risk may occur in a future year, the best response may be to assume the risk will occur and to incorporate it into the Project planning baseline (i.e., budget, schedule, scope) using the Change Control Process. Then, if the risk does not occur as expected, additional resources may be freed or circumstances exploited that could accelerate the schedule or reduce the cost. The use of a risk register will be described more fully in the Risk Mitigation Plan that will be developed during Phase I.

3.4 Issues Reporting/Resolution

During the course of work, problems or issues may arise that may potentially affect the Project's scope, schedule, or budget, but have not yet been analyzed and assessed as a Project risk. On a periodic basis (weekly or monthly) the Project Manager will survey the Project Team for potential issues, so that an explicit response can be formulated. The Administration Manager will maintain an Issues/Issues Resolution Log that will record and track issues, and record issue responses.

3.5 Quality Management

The Project Manager is responsible for:

1) Identifying which quality standards are relevant to the Project and determine how to satisfy them.
2) Applying planned systematic quality activities to ensure that the Project employs all management processes needed to meet requirements,
3) Performing monitoring activities on Project activities to determine whether results conform to relevant quality standards.

Quality Assurance is applied to work processes and not to the work content, while Quality Control applies to the content of the work. Specific quality management activities will be identified by the Project Manager at the start of the Project, and will be recorded in a Project Quality Management Plan.

ENVIRONMENT, SAFETY, and HEALTH

3.6 NEPA Documentation

In accordance with the requirements of the proposal and subsequent grant, NEPA documentation will be generated during Phase I of the Project to support the Facility. In addition to the NEPA paperwork, the requirements for additional environmental permits will be identified during the generation of the Facility preliminary design. The US DOD Environmental Assessment Report on Building 69 is shown in Appendix J.

3.7 Environmental, Safety, and Health Plan

Ensuring the safety and health of all employees, contractors, subcontractors and the local community will be the highest priority throughout all Phases of the project. A culture of Safety will be implemented from the start of the project that will include incident investigation, safety procedures, training and a safety observation program. In addition, all activities related to all Phases of the Project will ensure no adverse impact to the environment through proper reviews and interface with SCDHEC and SCOCRM. This culture of Environmental, Safety and Health stewardship will be considered an integral part of the facility design process that will include safety eye washes, fire suppression, fire alarm, evacuation routes and other identified safety equipment and features in the Facility. Key ES&H activities will include the following:

- A Safety Review Plan of the proposed facility will be developed in Phase I to understand the safety and health characteristics of the facility and its operations.
- The Safety Review Plan will be updated during Phase II as the detailed design is generated.
- A Safety Training Program will be developed prior to Phase II. All employees and contractors will be trained to the Plan prior to the commencement of construction. The program will be developed to meet all OSHA guidelines and will include at a minimum:
    - Lock-out/Tag-out
    - Confined Space Entry
    - Hot work Permit
    - Heavy Overhead Lift
    - Safety Incident Reporting
    - Safety Observation
- A Project Safety Manager will be assigned directly to the Project Manager for Phases I through IV. The Facility Director and Test Engineers will be responsible for ensuring the safe operations of the facility through Phase V and beyond.
- Safety will be the responsibility of all employees and will be written into each job description.
- Each Facility worker, contractor, Customer representative or visiting scientist and students will be empowered with "Stop Work" or "Time Out" authority in the event a procedure is unclear or a worker feels a work situation is potentially unsafe.

Incidents and "near miss" events will be discussed at Project meetings in order to understand events and to develop "lessons learned." Changes to the scope, schedule, budget, or planned work activities may be initiated by a "lesson learned," and provide sufficient reason to trigger a Change Request.

4.0 BUILDING 69 MODIFICATION PLAN

Building 69 modifications were described in the Narrative of the Proposal. The following assumptions were used to build the cost estimates for the building modifications.

General Estimate Assumptions/Clarifications

- Test equipment will be furnished and installed outside the scope of this estimate (cost and scope will be by the equipment vendor – Renk Labeco Test Systems). Assumed this scope will be turn-key including all associated engineering, on site construction, on site construction management and commissioning.
- The cost for all required process automation will be the equipment vendor outside the scope of this estimate.

- Bridge crane pricing reflects budget price from American Crane.
- Cooling tower and air compressor are assumed to be small units. Equipment pricing reflects assumptions by the estimator.
- Mini piles were assumed to be 8 inch diameter, 70 feet deep piles based on conceptual pricing provided by a local contractor.
- Bridge crane columns and framing weights reflect an average weight per linear feet based on a historical norm.
- Bridge crane column foundations are estimated to be 8' x 8' x 4' pile caps with 4 piles each spaced 20 feet apart.
- The test bed foundations, one for each potential vendor, are sized based on preliminary equipment data sizing (10 meters wide by 34 meters long) and assumed to be 6 feet thick with approximately 70 piles under each foundation. Piling count reflects rough equipment loads and assumed pile loading provided by a local contractor.
- All excavated material was estimated to be tested for contamination and hauled off site for proper disposition. Material disposition rates reflect actual experience local to the site.
- Once the test bed and crane foundations are installed, the removed slab areas will be re-poured and patched along the new foundations.
- New conditioned building areas include restroom areas, control rooms, electrical rooms and some administration areas. Total combined area to be fitted out is approximately 7,000 square feet. This includes area architectural, self contained HVAC, plumbing and building electrical.
- New building restrooms are assumed to be located near existing sanitary and potable water services. Assumed only a small portion of the existing floor slab will be removed for this tie-in.
- Remaining areas aside from minor modifications are assumed to remain unchanged.
- Based on the information provided within the Facility summary report assumed no hazardous materials remediation will be required. Assumed no allowance for identification or remediation of hazardous materials.
- Aside from minor sanitary floor drainage additions required as a result of the new restrooms, assumed no new building floor drains or floor drain collection systems will be required as a result of this project.
- Aside from some minor modifications as a result of the traveling bridge crane, assumed the existing building shell will remain as is and will not be modified or upgraded as a result of this project.
- Construction general conditions estimate reflects a reduced historical norm. Assumed a portion of the existing building shell could be utilized as construction/project offices during the construction phase.
- Due to current market conditions and anticipated project schedule assumed no escalation will be required for this project.
- CM estimate reflects a percentage of the total direct construction.
- Project engineering estimate reflects a percentage of the total installed cost.
- Commissioning cost is excluded from this portion of the estimate and will be by others.
- Construction contingency has been included at 10% of the total cost.
- While no allowance has been included for internal owner's cost, line item allowances have been included for the following owner type items: area signage, client supported equipment, office equipment, publication/print room equipment and modification allowances for existing site fork-trucks.

Detailed cost estimates for Building 69 modifications are shown in Appendix D. Detailed schematics of Building 69 modifications are shown in Appendix K.

5.0 PROJECT BUSINESS PLAN

Three business models were developed to compare the 'dedicated' facility model versus the 'shared' business models. They include:

Case 1: CU WTDTF 'Shared Facility Model'

1. The facility will operate as a non-profit business.
2. A CPI of 2% was assumed.
3. Fringe and benefit was assumed at SC state rate of 34.4%.
4. On-stream time of facility is assumed at 50 weeks allowing two week annual shut down for preventative maintenance and repair.
5. Facility utilization is assumed at 50% during the first full year of operation.
6. Facility utilization is then projected at 75% for Years 4 through 20.
7. Charges for the use of the facility are based on the following:
    a. Facility director develops a three-year rolling budget for operation of facility.
    b. Electrical costs for testing will be passed directly through to the customer at the SCE&G Light Industrial Rate. The net electrical loss or use will be monitored on individual meters for each test rig. These costs are not included in the pro forma and will be dependent on the size of the equipment being tested and length of testing. These pass-through charges are not subject to the Test Surcharge detailed below.
    c. A Major Capital Reserve expense line item is included as part of the annual operating budget starting in Year 6. This will be based on 10% of the 20 year depreciation of Test Rig 1, Test Rig 2, Data Acquisition System and Electrical Infrastructure. The capital reserve fund will be used for unexpected equipment breakdown or improvements to the facility. Through guidance of the Industrial Advisory Board and Technical Advisory Board, any surplus reserves would be reinvested in the facility to improve its capability based on industry needs. Minor capital maintenance also occurs in year 5.
    d. A 12% Test Surcharge will be added on top of the base operating costs. This surcharge will serve as a cash reserve for facility operations through periods of non-utilization, training for personnel and building infrastructure maintenance and improvements.
    e. A cash reserve equivalent to one year of operation expenses will be set aside to weather fluctuations in facility usage. Excess cash reserves will be reinvested in the facility in Years 10 and 15.
    f. Logistic, machining and rigging services provided by CMMC LLC and J.E. Oswalt and Sons will be contracted with customer directly. There will be no Test Surcharge fee on these services.
    g. Facility services will be offered on a projected weekly rate shown in Appendix L. Test Rig #1 would be at a higher weekly rate than Test Rig #2. Scheduling of tests will be optimized to maximize test rig utilization.
8. Analytical and modeling support services will be available to customers through existing CU facilities (CU-ICAR, AMRL, CCC) with the same Test Surcharge.
9. Improvements to the facility such as expansion and technical upgrades will be financed through competitive proposals and private partnerships.

Two additional business cases were developed using the following assumptions (Appendix L).

Case 2: 'Dedicated' 15 MW HALT Facility ***with*** Blade Force Simulator

Case 3: 'Dedicated' 7.5 MW HALT Facility ***without*** Blade Force Simulator

The following assumptions were used to develop Case 2 and Case 3 business models.

1. Overhead for facility is leveraged through existing corporate structure.
2. A CPI of 2% was assumed.
3. Fringe and benefit was assumed at SC state rate of 34.4%.
4. On-stream time of facility is assumed at 50 weeks allowing two week annual shut down for preventative maintenance and repair.
5. Minimal staffing requirements of facility.
6. Capital cost of test rigs based on Renk Labeco Test Systems quote for proposal.
7. Cost of electricity for testing not included as in the case of the Project Business Pro forma.
8. Assumed upgrades to an existing building to accommodate test rig and overhead crane structures. Assumed all other building space needs were available.
9. Assumed logistic infrastructure in place to deliver drivetrains and turbines to the test facility.
10. Did not assume any cost related to 115 V supply line to test rig, substation or logistics upgrades.
11. Assumed 75% utilization of 'Dedicated' facilities.
12. Assumed a 6% cost of capital and 20 year depreciation of facility.

In all three models including the 'Shared' and 'Dedicated' facility cases, the weekly facility charge for each test rig was based on the estimated cost of capital and operating cost. In all cases, the cost for the electrical energy to run the test was not included since it is considered consistent amongst all business cases. When comparing the 'Shared' facility model (Case 1) and the 'Dedicated' facility models (Case 2 and Case 3), it is evident that 'Dedicated' facilities require a significant upfront cost to the turbine and drivetrain manufacturers. This upfront capital cost for a 'dedicated' test facility is significant enough that it could prove to be a barrier to entry for smaller new technology entrants into the market that do not have the financial resources of the major OEMs. The 'Shared' facility model provides equitable access to state-of-the-art test facilities to all industry players supporting development of novel technology to reduce the COE delivered by wind turbines. Comparing estimated weekly costs to operate the test rigs in Cases 1, 2 and 3; it becomes evident again that the lower cost option is for a 'Shared' facility versus a 'Dedicated' facility. The models for Cases 2 and 3 show the weekly operating costs ramping down in the out year as the facility is depreciated and the cost of financing is reduced.

The weekly charges for the 'Shared' Facility test rigs will be based on a three year rolling budget developed by the Facility Director. Adjustments will be made to the weekly charge schedule for each rig on an annual basis to reflect the past year budget performance and projected next year budget estimates. Given the significant capability differences between the proposed Test Rig #1 and Test Rig #2, weekly test charges for the large 15 MW rig with a blade-force simulator are set higher than the charges for the 7.5 MW test rig. The facility is being designed to allow for maximum utilization of the test rigs with three preparation and breakdown areas. Additional space is available near the Facility at CMMC to store or prepare test units. Scheduling of the facility will be on a first come first serve basis with a lottery system used if more than one customer is seeking the same time slot for testing.

6.0 INTELLECTUAL PROPERTY MANAGEMENT

Clemson University proposes to enter into a Master Services Agreement with customers for the delivery of testing services. Task orders will be issued under each Master Services Agreement identifying the testing services, deliverables, protocol and any unique requirements. CU proposes to allocate rights to intellectual property arising as a result of the testing conducted at the Facility in accordance with established terms and conditions which are documented in standard contracting templates developed to address both commercial and sponsored/non-commercial intellectual property resulting from the use of the Facility. The terms and conditions outlined in the templates may be altered to accommodate unique circumstances.

Commercial Testing Services:

a. The deliverables resulting from commercial testing are anticipated to be reports that will be provided to a Sponsor and which shall consist of technical data, measurements and any other quantitative and/or qualitative findings made during the performance of the testing services conducted at the Facility and/or resulting from the application of Sponsor's testing methodologies, standards, protocols, etc. to Sponsor's data, samples, information or other material(s) (the "Results").

b. Sponsor shall own the rights to all Results and any inventions conceived as a result of CU's access to Sponsor's confidential or proprietary information and materials provided in connection with and specifically for the testing services. All Sponsor or third party owned background intellectual property, materials and information provided to CU for the purpose of conducting the services will remain the property of Sponsor and/or third party. CU must request right to publish and use any Results for non-profit, academic and research purposes, subject to any confidentiality obligations/restrictions of Sponsor. Title to any "non-related" inventions conceived and first reduced to practice during the performance of the Services and not dependent upon Sponsor and/or third party's proprietary information will be allocated in accordance with CU's intellectual property policies. Under CU policies, Sponsor shall be granted the opportunity to license any "non-related" inventions for no additional cost, with royalties and other licensing terms to be mutually agreed but which will take into consideration, among other factors, Sponsor's contributions, patent prosecution and maintenance expenses, and commercialization plans.

c. Invention / Authorship shall be determined in accordance with United States federal regulations governing intellectual property. CU shall, in all cases and in accordance with the terms of a Master Service Agreement, require all principal investigators and staff involved in the delivery of testing services to transfer and assign all interests in any intellectual property arising from the services to CU.

Research Services (Fundamental, Applied, or Developmental):

a. The deliverables resulting from research services may include test results, technical data, periodic and final reports that detail the research findings. Any inventions will be reported to CU and CU shall report to Sponsor.
b. Research agreements must permit the free and open dissemination of research results. Sponsors shall have the opportunity to review any publications prior to submission in order to protect their documented interests and confidential information.
c. Intellectual property rights:

1) CU shall retain title to all intellectual property including supporting data for all discoveries and/or inventions made exclusively by University faculty, students, or employees of CU.
2) Sponsor shall retain title to all intellectual property including supporting data for all discoveries and/or inventions made exclusively by Sponsor's employees, officers or agents.
3) CU and Sponsor shall each share ownership of an undivided interest in any intellectual property including supporting data for all discoveries and/or inventions made jointly by any employee of Sponsor and by any faculty member, student, or employee of Clemson University or the service provider.
4) Sponsor will be entitled to 1) a no-cost, non-exclusive license, with royalties and other terms to be determined by mutual agreement, to use resulting CU property and CU's interest in jointly owned property and 2) a 90-day, first option to negotiate an exclusive, royalty-bearing license which shall take into consideration expenses, including prosecution and maintenance. The 90-day option shall start on the date of disclosure of intellectual property to Sponsor.
5) CU will retain a fully-paid, royalty-free, non-exclusive, irrevocable license to use all discoveries and inventions for non-profit, academic, and research programs and activities.

In general, non-CU/Facility personnel using the testing facilities must abide by the same policies as CU/Facility personnel. CU will require non-CU/Facility personnel to sign memoranda of understanding, equipment use, non-disclosure and other agreements that CU deems necessary to protect the safety of personnel and the security of proprietary information or activities of a Sponsor using CU testing facilities. Any modifications to the Facility shall become the property of the Facility.

APPENDIX C

TEST RIG DETAILED COST ESTIMATES AND CONCEPTUAL DRAWINGS

RENK LABECO Test Systems CORPORATION
156 East Harrison Street,
Mooresville, Indiana 46158-1625

Phone: 317-831-2990
Watts: 800-878-2990
Facsimile: 317-831-2978
Email: mail@labeco.com

Quotation-no. 29 000 110-1

Clemson University

Truxton Avenue
North Charlston, SC
USA

Our reference	Your contact	Phone	Telefax	E-Mail	Date
RL-JC	Eric Floyd	(+1) 317-831-2990	(+1) 317-831-2978	mail@labeco.com	12.August.2009

Clemson University Wind Turbine Testing Facility
RENK/LABECO-Quotation-No. 29 000 110-1

Dear Sirs,

thank you for your interest in our technology, we are pleased to submit our quotation as follows:

1. 15 MW Wind Turbine and components Test Stand

For the calculation of prices for start up and acceptance testing at the customer site, it is our understanding that the work involved can be carried out smoothly and without any unforeseen interruptions. Work can be performed by RENK as a not union organized company.
If the relevant work should be interrupted and is not related to a fault of RENK/LABECO, or if unionized personal is required, we reserve the right to charge the corresponding waiting period and/or additional travel expenses to customer at cost.

RENK LABECO Test Systems CORPORATION
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Facsimile: 317-831-2978
Email: mail@labeco.com

2. Pricing

2. 1 **Total price for the 15 MW test system**, containing one 7.5 MW motor and drive, one 15 MW@10 rpm gear box, a RDDS control and data acquisition system. Installed to a customer built base slab, and commissioned at site in Charleston

US$ 11,800,000

2. 2 **Total price for the dynamic rotor blade force load simulation**, containing hydraulic cylinder load application, servo valve operated, served by a hydraulic power plant located next to the test stand. RDDS control and data acquisition system. installed to a customer built base slab, and commissioned at site in Charleston.

US$ 16,700,000

2. 3 **Total price for the support structure to above mentioned Components**, containing frame work and support structure for the test stand. Installed at site in Charleston to a customer built base slab,. Specimen support frames and adapting parts are not included.

US$ 2,200,000

2. 4 **Total price for the 7.5 MW test system**, containing one 7.5 MW motor and drives, one 7.5 MW@12rpm gear box, a RDDS control and data acquisition system. installed to a customer built base slab, and commissioned at site in Charleston

US$ 10,600,000

2. 5 **Total price for the climatic chamber**, containing a modularly built chamber for temporary set up, 100kW cooling capacity -20°C max. low temp. at no heat load for cold start testing, +50°C max. high temp, heat generated by gas burner. Ventilation motors and drives and mixer chamber, a control system. installed to a customer built duct system, and commissioned at site in Charleston

US$ 2,600,000

2. 6 **Total price for sound separation system**, containing one sound cover for the 7.5 MW test stand gearbox and motor and one sound absorbing wall (barrier), approx. 20m x 15m between the test stand and specimen for the 15 MW test stand. Wall side sound absorbing panels in test room to be installed by customer

US$ 700,000

US$ 44,600,000

Educational discount to Clemson University **US$ 10,000,000**

Final Total System Price **US$ 34,600,000**

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Email: mail@labeco.com

2.5 Options

Option 1	7.5 MW Motor and drive for power boost to 15MW	**US$**	**4,300,000**
Option 2	Grid simulation	**US$**	**TBD**
Option 3	Transformer and power distribution panel	**US$**	**TBD**
Option 4	Cooling tower, and piping 3MW capacity **Price estimate**	**US$**	**370,000**
Option 5	Calibration equipment for torque measurement	**US$**	**TBD**
Option 6	Acoustic absorption panels for test room	**US$**	**TBD**
Option 7	Ventilation of test rooms, air conditioning of electrical and control room	**US$**	**TBD**
Option 8	Civil engineering and construction of Base slab and foundation.	**US$**	**TBD**
Option 9	Crane with a gross capacity of 300t	**US$**	**TBD**
Option 10	Vibration analyzer, Power electric analyzer **Price estimate**	**US$**	**350,000**
Option 11	Packaging, shipping, moving in **Price estimate**	**US$**	**380,000**
Option 12	3rd Party certification of test stand (e.g. Germanischer Lloyd, Tüv, UL) **Price estimate**	**US$**	**400,000**

2. 3 Pricing, General

The above prices are firm prices. Imported components are based on a exchange rate of $1.42 / €1.00, in case exchange rate shift more then 1% in any direction prices will be adjusted. Prices do not include any state or sales or import tax.

2. 4 Delivery terms

RENK LABECO Test Systems CORPORATION
156 East Harrison Street,
Mooresville, Indiana 46158-1625

Phone: 317-831-2990
Watts: 800-878-2990
Facsimile: 317-831-2978
Email: mail@labeco.com

Ex Works, Renk Labeco Test Systems Corp., Mooresville, IN,USA
Major components might be shipped in from international manufacturers, this shipping and packaging will be charged as per actual.

3. Delivery time

The delivery period will be approx.18 months, ex work Renk Labeco or its major suppliers, after receipt of your technically and commercially clear order and advance payment. Assembly, commissioning and start up will take about 6 to 9 additional month.

4. Payment terms

20% after close of contract

30% after critical design review (approx. 6 month after contract date)

20% 14 month after contract date (approx. 50% of construction is completed)

20% at shipment

10% after final acceptance test at customers site, not to exceed 360 days after receipt, if installation and/or final acceptance test is delayed for reasons beyond RENK/LABECO's responsibility.

Net without any deductions, payable within 30 days after date of invoice.

5. Warranty for new supplied parts

For 12 months from the date of acceptance, or 24 months from shipment if commissioning of the test stand is delayed for reasons beyond RENK/LABECO's responsibility, RENK/LABECO warrants the equipment to be free from defects in material, workmanship and title. This limited warranty is conditioned upon the equipment being properly cared for and operated under normal conditions and competent supervision. In addition, the warranty is conditional upon the equipment not being modified or altered in any manner.

The software is warranted to conform to RENK/LABECO's published functional specifications. If any persons other than RENK/LABECO alter the software, the warranty is terminated from the date of such alteration.

Warranty for reused or modified parts and components is excluded.

6. Protective remarks

Copying of any documents submitted, their disclosure, utilization and communication of the contents thereof are forbidden unless explicitly authorized in writing. All rights are reserved in the event of the granting of a patent or registration of a model or design.

All software developed by RENK/LABECO remains the property of RENK/LABECO and is subject to a Licensee Agreement. Any software supplied by RENK/LABECO or developed on its behalf may only be used for such systems or parts thereof

RENK LABECO Test Systems CORPORATION
156 East Harrison Street,
Mooresville, Indiana 46158-1625

Phone: 317-831-2990
Watts: 800-878-2990
Facsimile: 317-831-2978
Email: mail@labeco.com

delivered by RENK/LABECO and for which the software is intended according to the definition of the purchase order. Any other use or disclosure to third parties in whole or in part is not allowed.

For commercial software programs included in RENK/LABECO's scope of supply, the conditions of the relevant user licenses are valid.

7. Limitation of Liability

The parties expressly agree that under no circumstances shall RENK/LABECO be liable to the purchaser for any special, indirect, incidental or consequential damages as a result of any breach under this contract. In addition, the parties expressly agree that RENK/LABECO's total liability to the purchaser whether in contract, in tort, under any warranty or otherwise arising out of the transaction, shall not exceed the price of the product or part on which such liability is based.

The purchaser expressly agrees to indemnify and save harmless RENK/LABECO, its agents, employees, or representatives from and against all loss or expense (including costs and attorney's fees) incurred by reason of liability imposed by law for damages incurred for bodily injury and property damage, including loss of use thereof, arising out of or in consequence of the contract between the parties.

8. Conditions of contract

The remaining contractual conditions are in conformity with our "Standard Terms and Conditions of Sale of RENK/LABECO".

If any of the words or provisions of this contract shall be deemed to be invalid for any reason then this contract shall be read as if the invalid provisions had to that extent been deleted there from and the validity of the remaining provisions of this contract shall not be affected thereby.

9. Validity of the quotation

This quotation is valid for 90 days.

Should you have any questions please do not hesitate to contact us. We hope our quotation meets your requirements and are looking forward to receiving your order.

Yours faithfully,

RENK LABRCO Test system CORPORATION

Mathias Karrer
Board Member

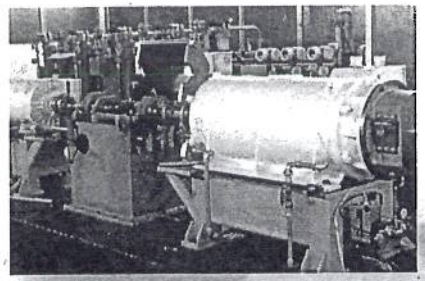
Jörg Cordes
President

CLEMSON UNIVERSITY

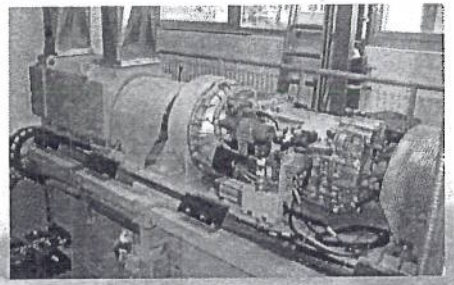
Test Systems for Wind Turbine Drivetrains

RENK LABECO – Product Division Automotive

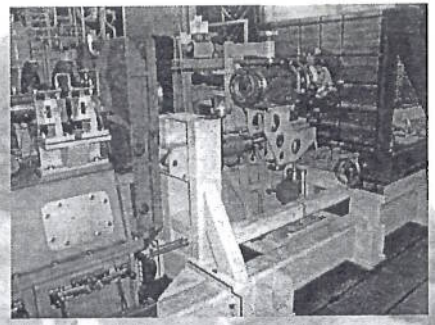
RENK TEST SYSTEMS LABECO



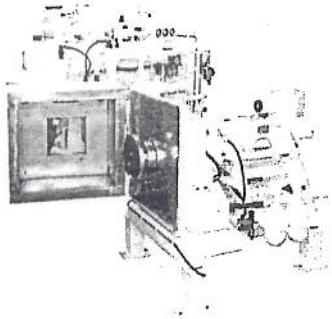
Torque Converter Test Rig



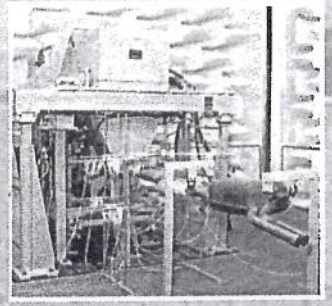
Transmission Test Rig



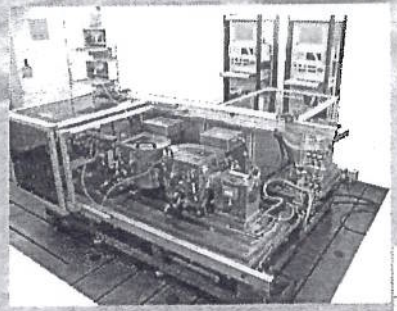
Wheel-bearing Test Rig



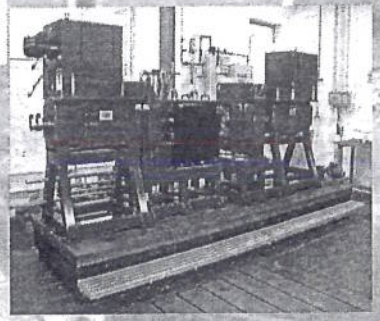
Dual-mass Flywheel Test Rig



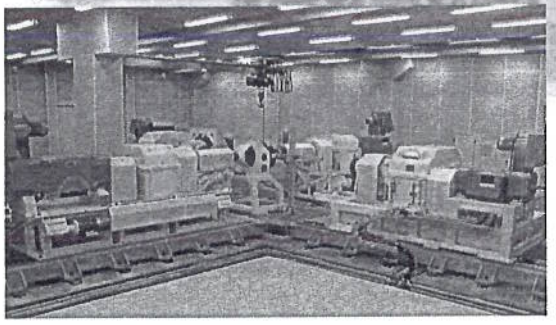
Engine Test Rig



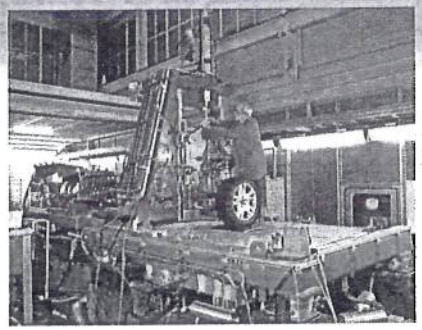
Boot Test Rig



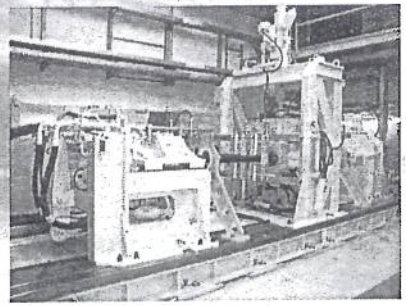
Coupling Test Rig



Drive Train Test Rig



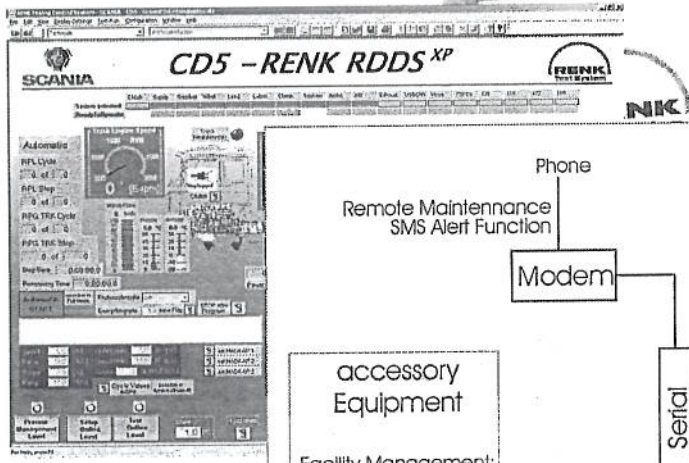
Brake/Semiaxle Test Rig

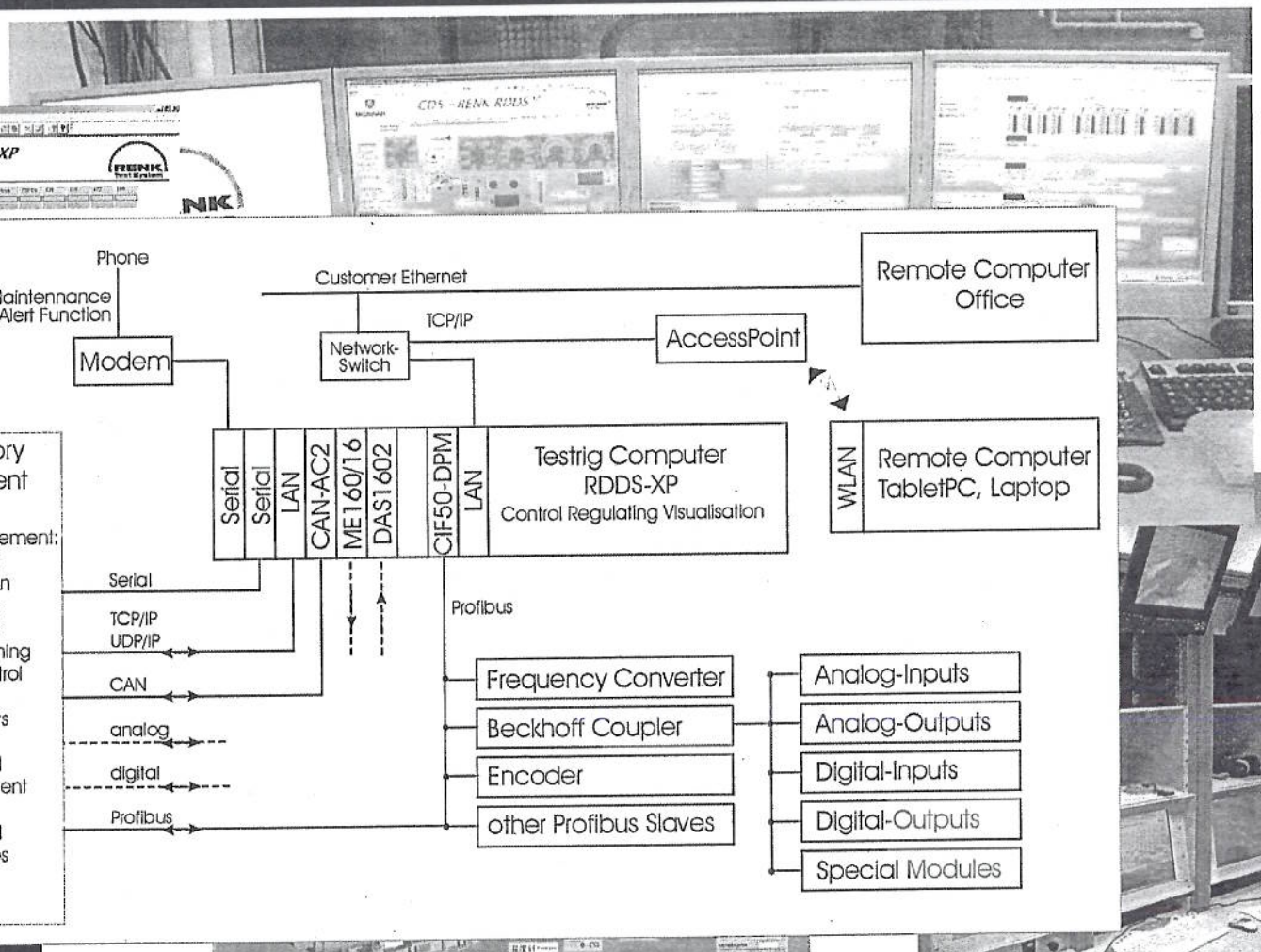


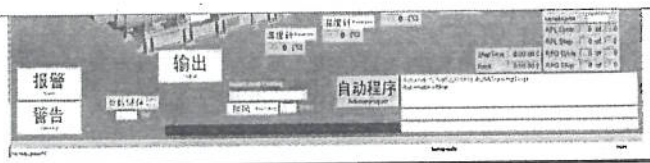
Drive Shaft Test Rig

Test Systems for Wind Turbine Drivetrains

RENK Dynamic Data System (RDDS XP)







CLEMSON UNIVERSITY

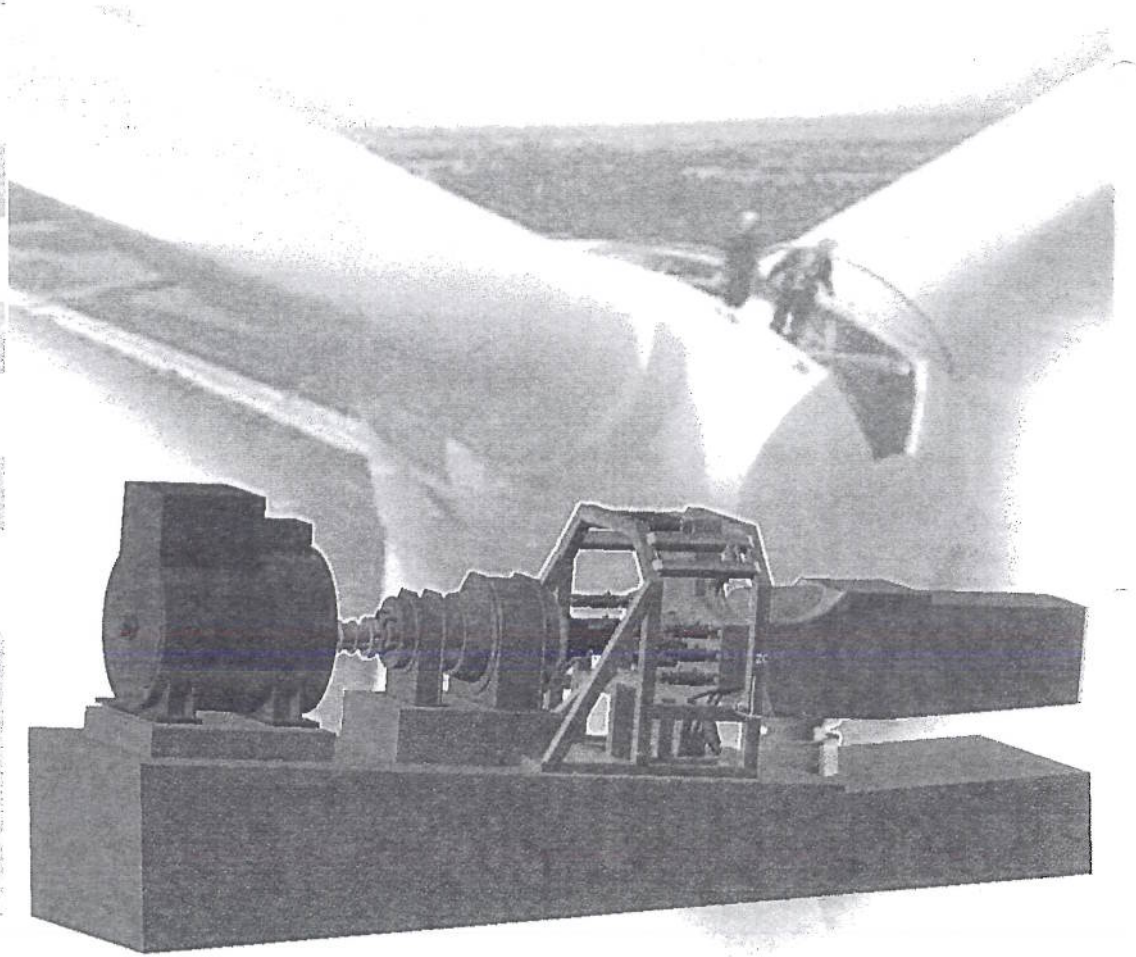
Test Systems for Wind Turbine Drivetrains

RENK LABECO - Product Division Wind Energy

RENK TEST SYSTEMS LABECO

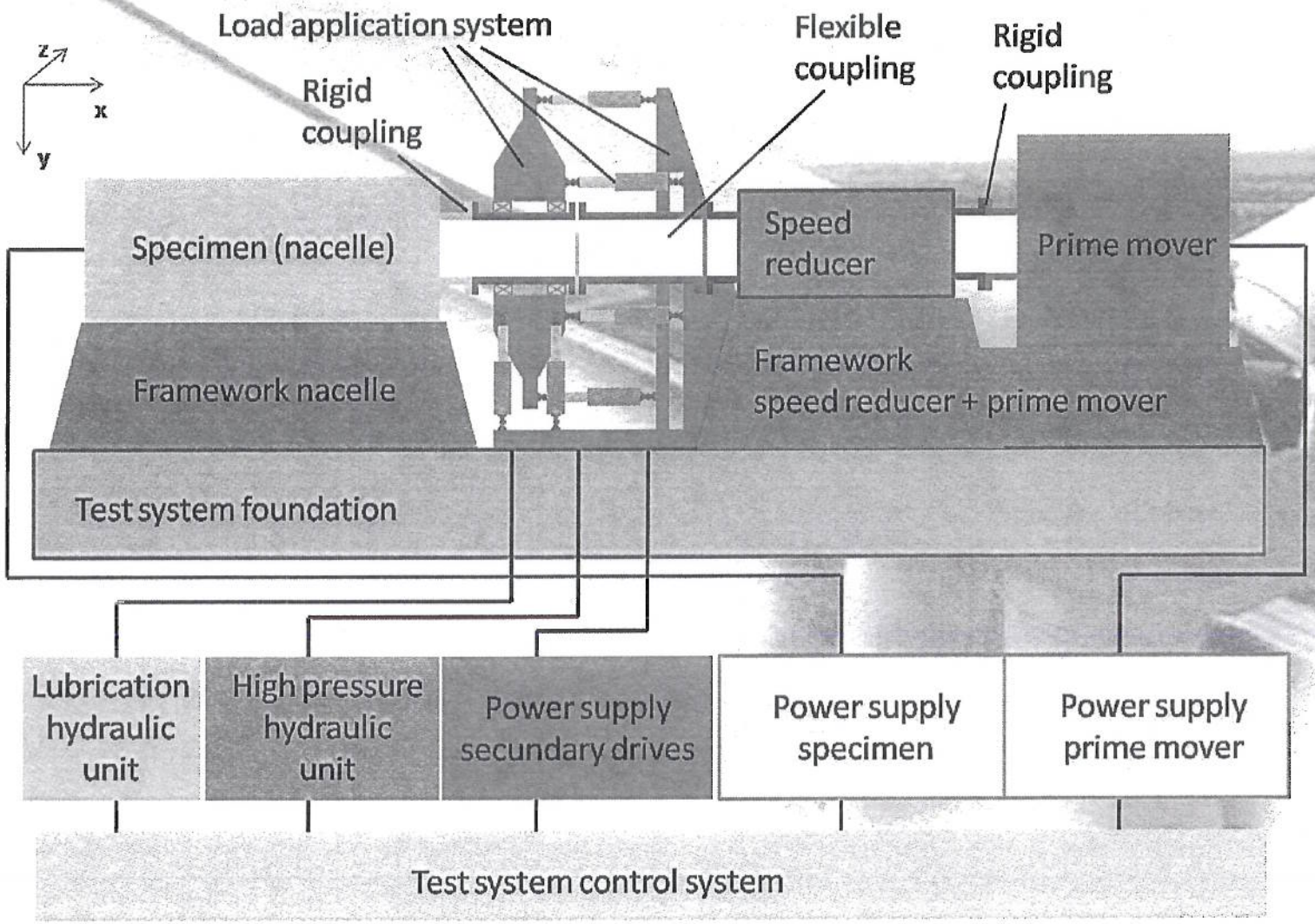
Drive train and nacelle test rigs

Installations at	Wind turbine manufacturers and public and state controlled institutions
Power range	Up to 15 MW
Speed range	Up to 30 rpm
Axial load	Up to 4 MN
Radial load	Up to 8 MN
Bending moments	Up to 70 MNm
Design	Direct drive with adaption gearbox
Testing capabilities	+ Complete drivetrain + Full rated speed and torque + Overload + Bending moments, axial and radial loads + Power system simulation + Fault ride through (FRT)



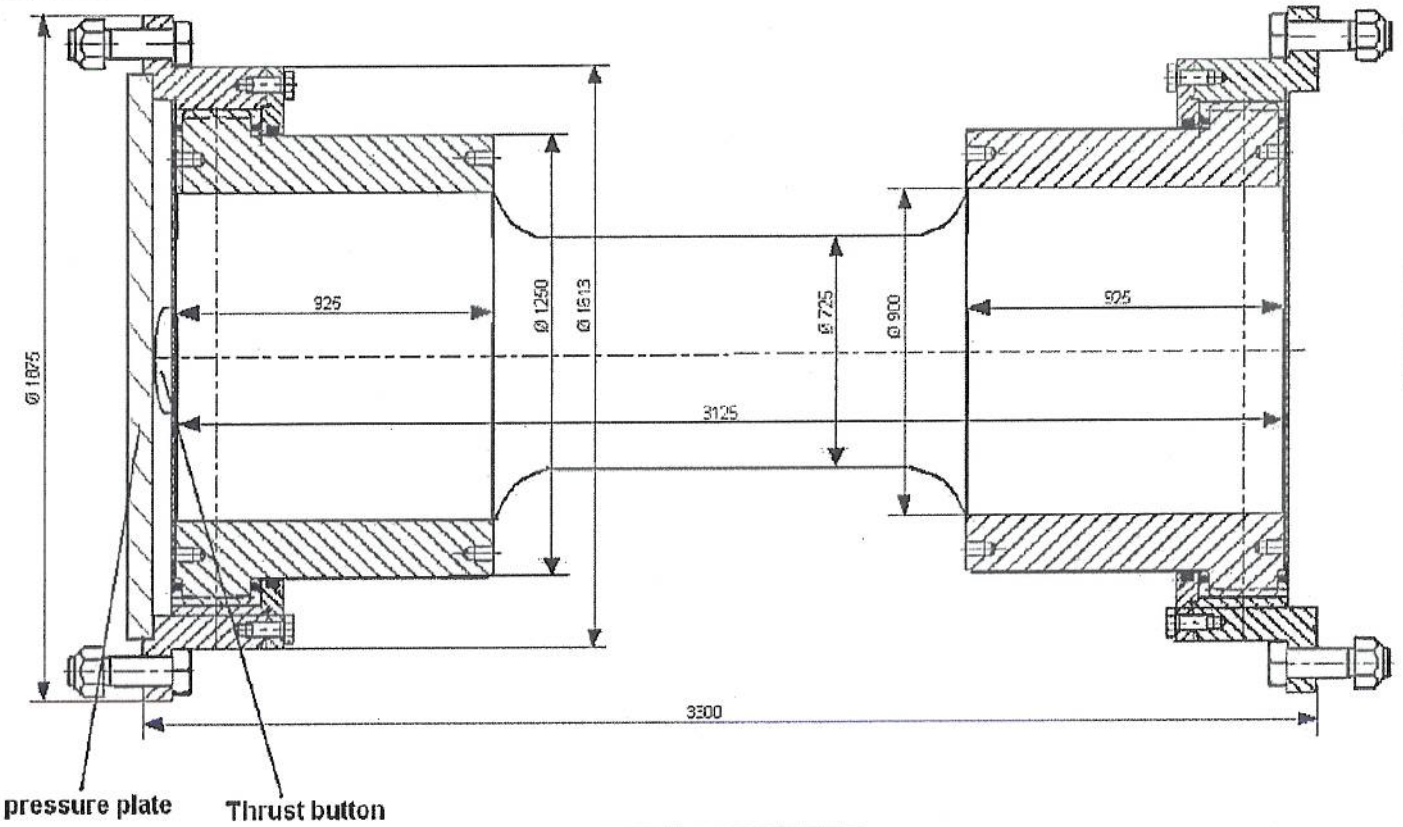
Test Systems for Wind Turbine Drivetrains

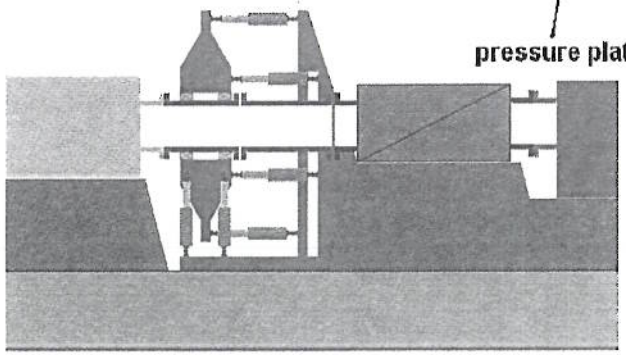
Rough Layout Nacelle Test Rig



Test Systems for Wind Turbine Drivetrains

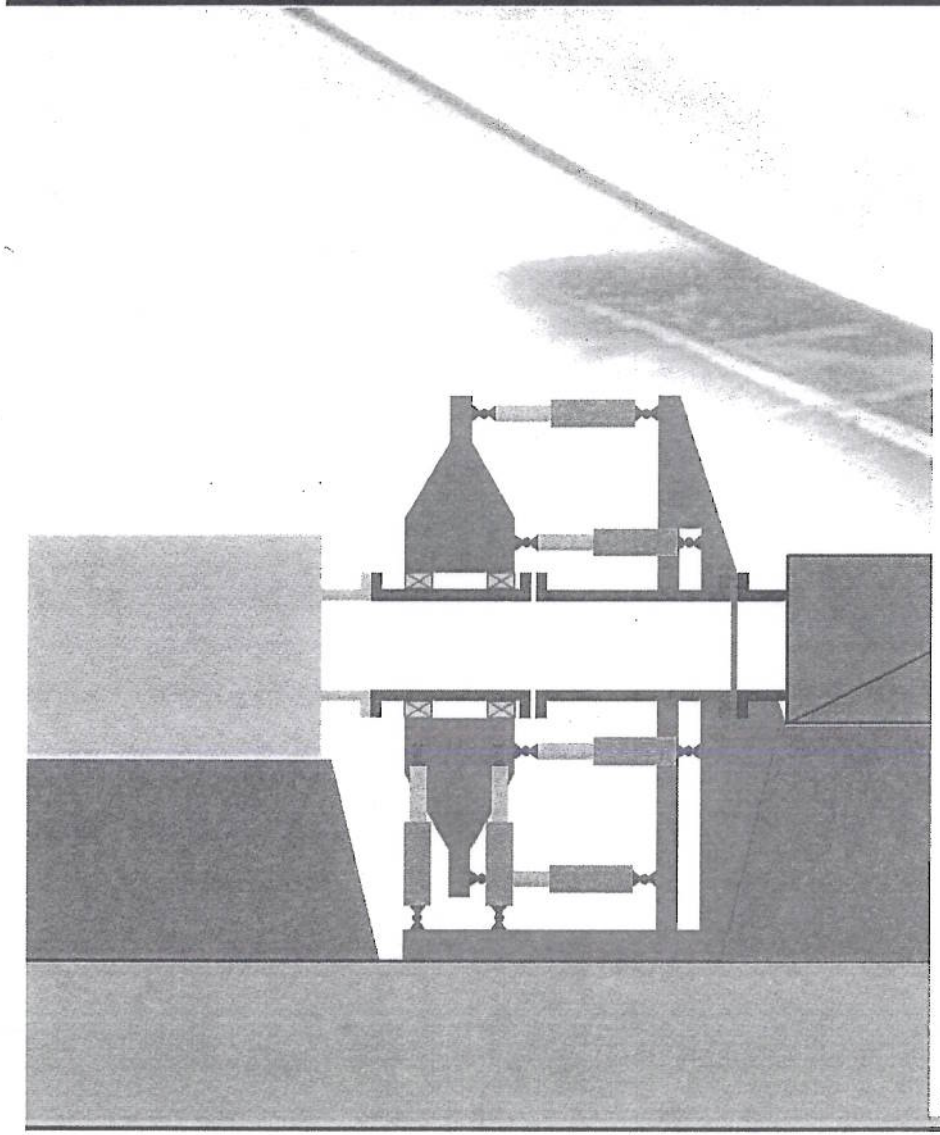
Possible 15MW Curved Tooth Coupling

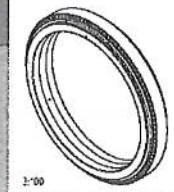


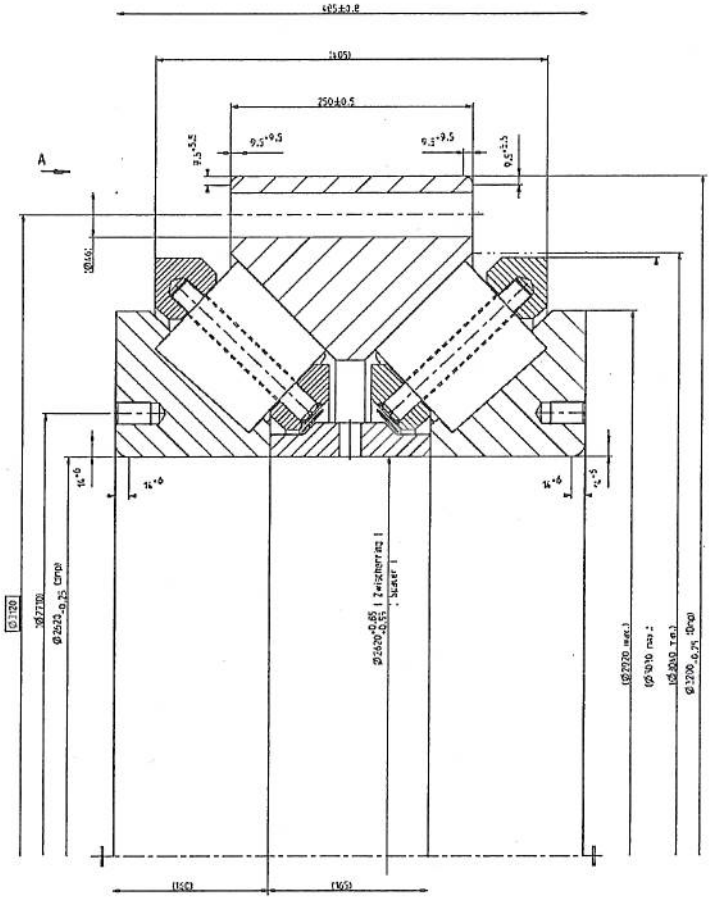


Test Systems for Wind Turbine Drivetrains

Possible Bearing for Load Application System







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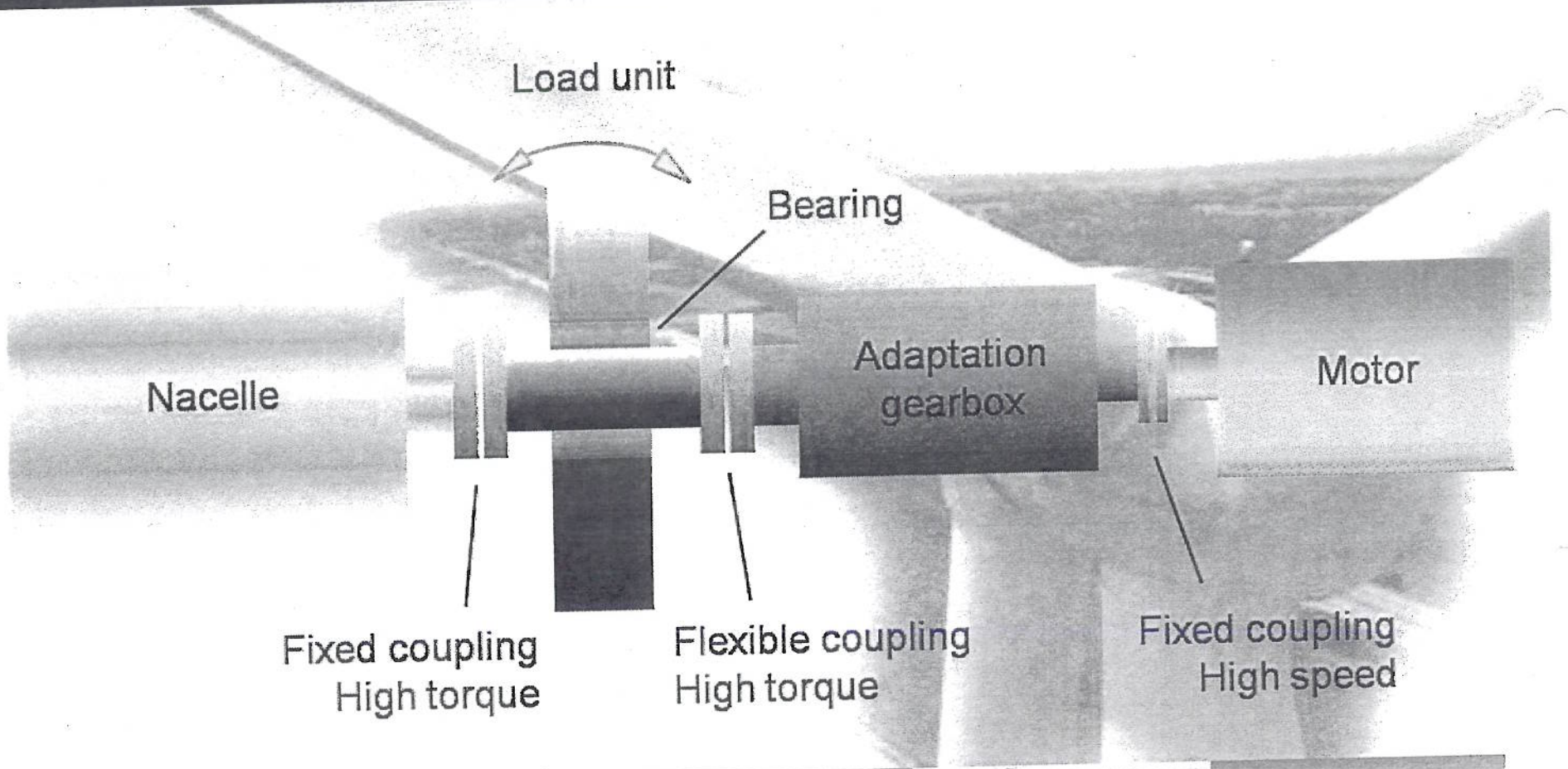
Test Systems for Wind Turbine Drivetrains

Rotor Blade Simulation inside the RENK Group

RENK TEST SYSTEMS LABECO



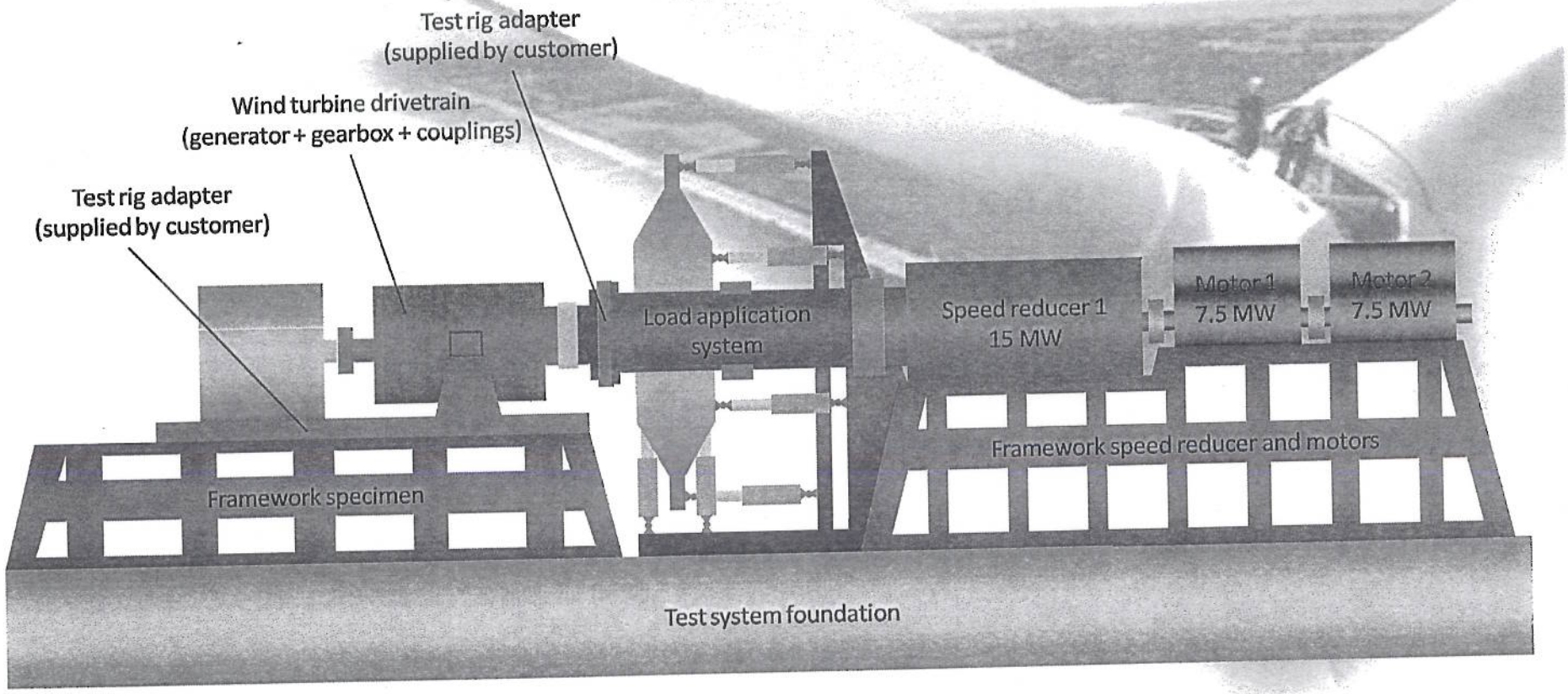
RENK LABECO

RTS Augsburg	RENK AG Augsburg	RENK AG Hannover	RENK AG Rheine	various manufacturers

Test Systems for Wind Turbine Drivetrains

Test Rigs for Drivetrain Testing Facility

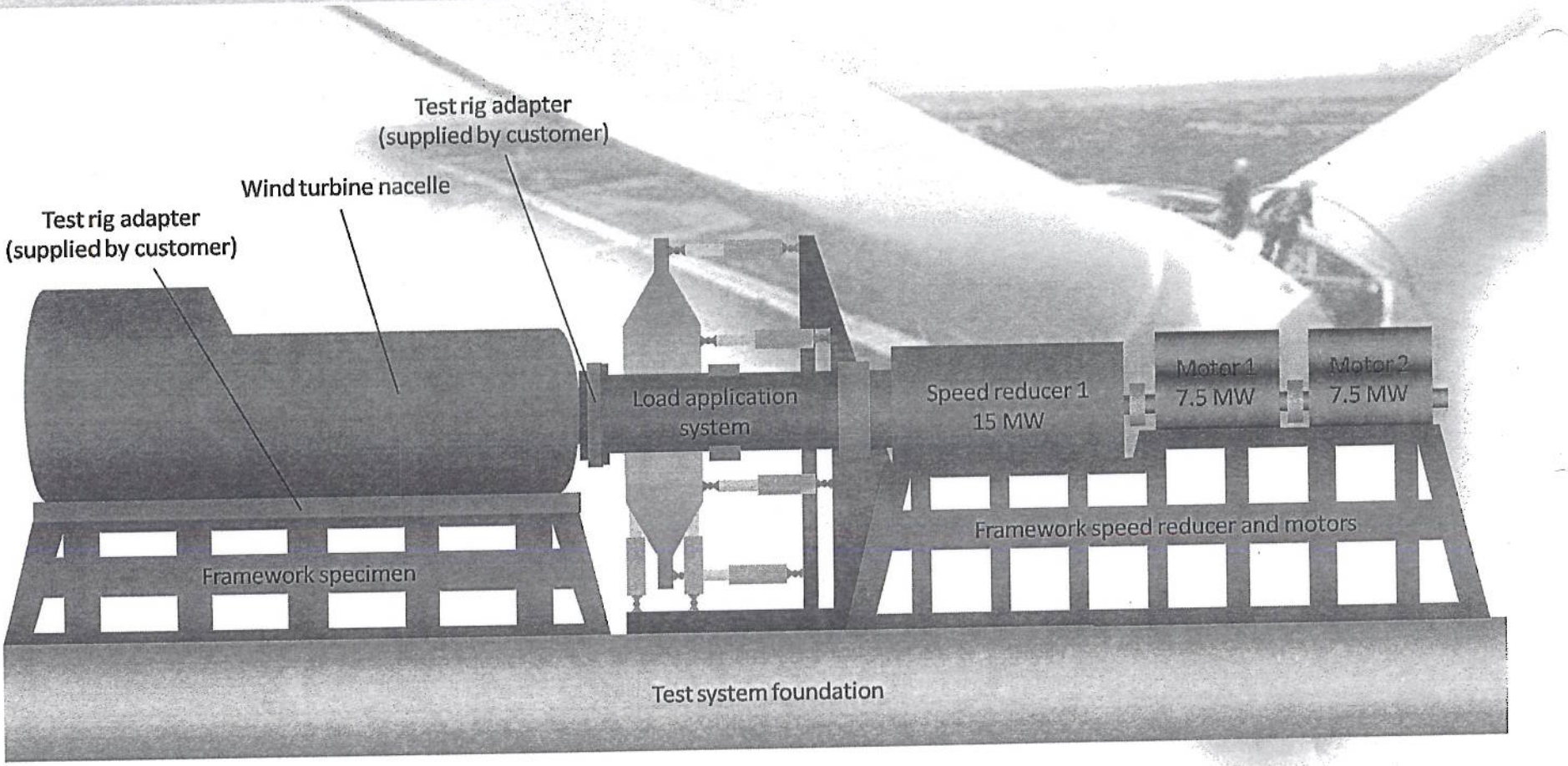
Test Rig 1: Drivetrain Test Rig (Testing of complete drivetrains)



Test Systems for Wind Turbine Drivetrains

Test Rigs for Drivetrain Testing Facility

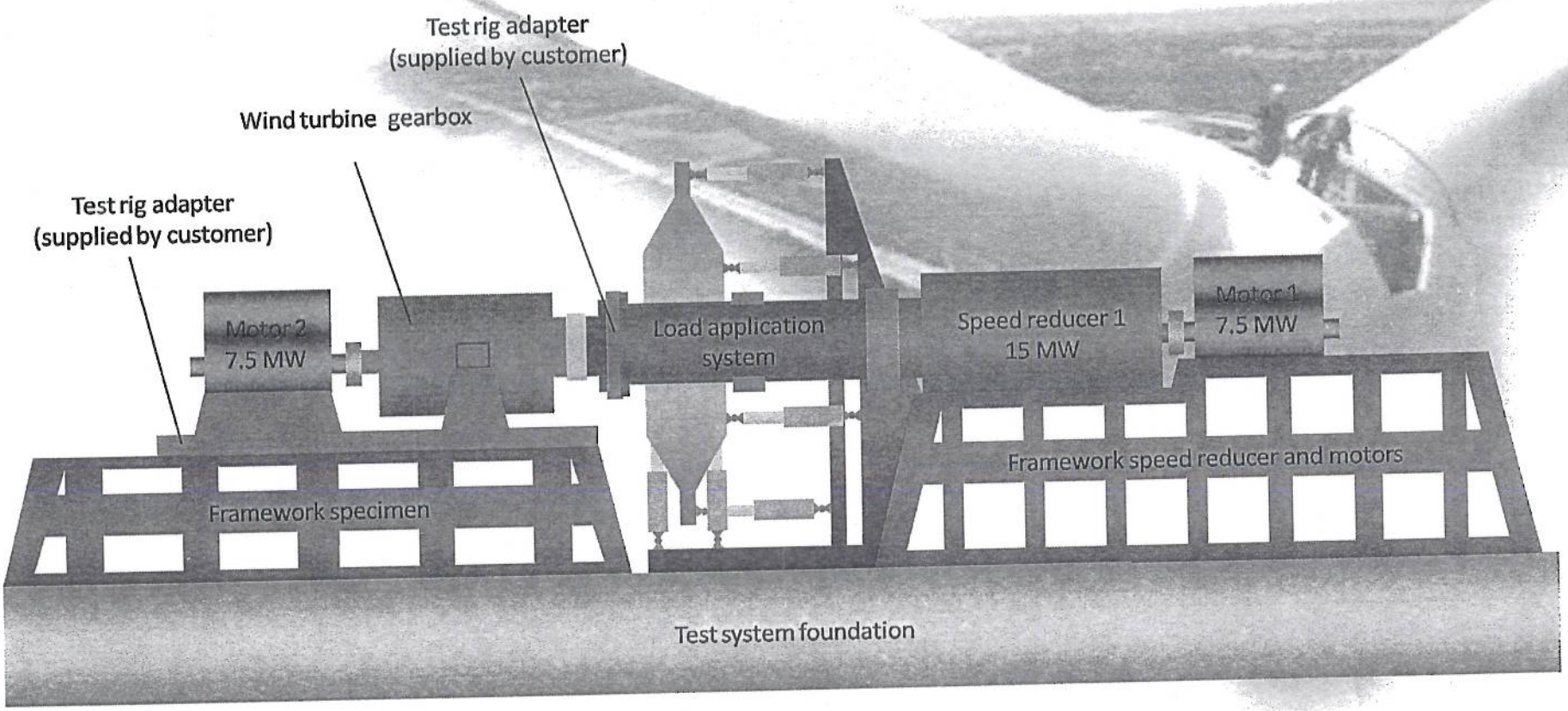
Test Rig 1: Drivetrain Test Rig (Testing of complete nacelles)



Test Systems for Wind Turbine Drivetrains

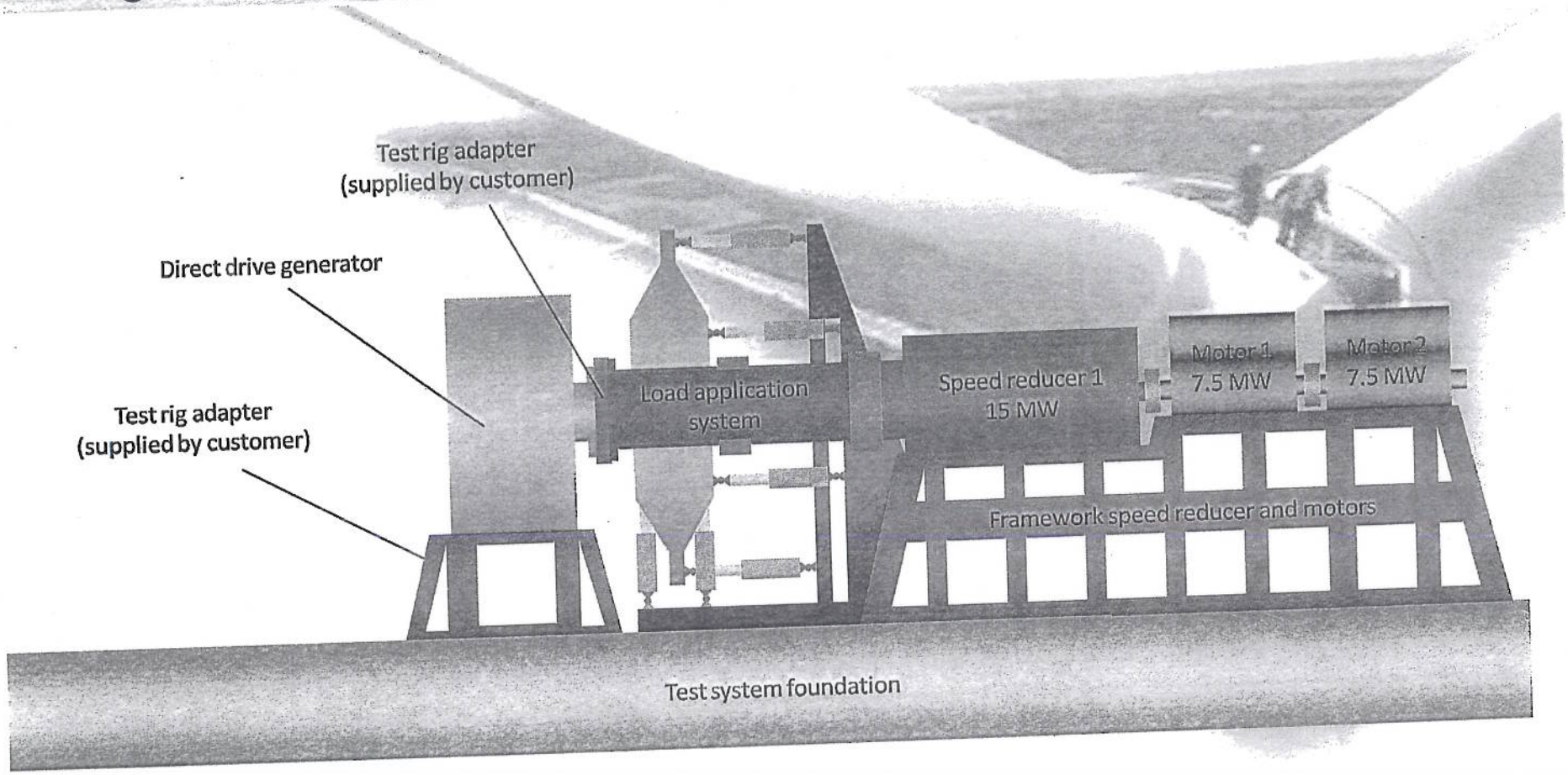
Test Rigs for Drivetrain Testing Facility

Test Rig 1: Drivetrain Test Rig (Testing of gearboxes)



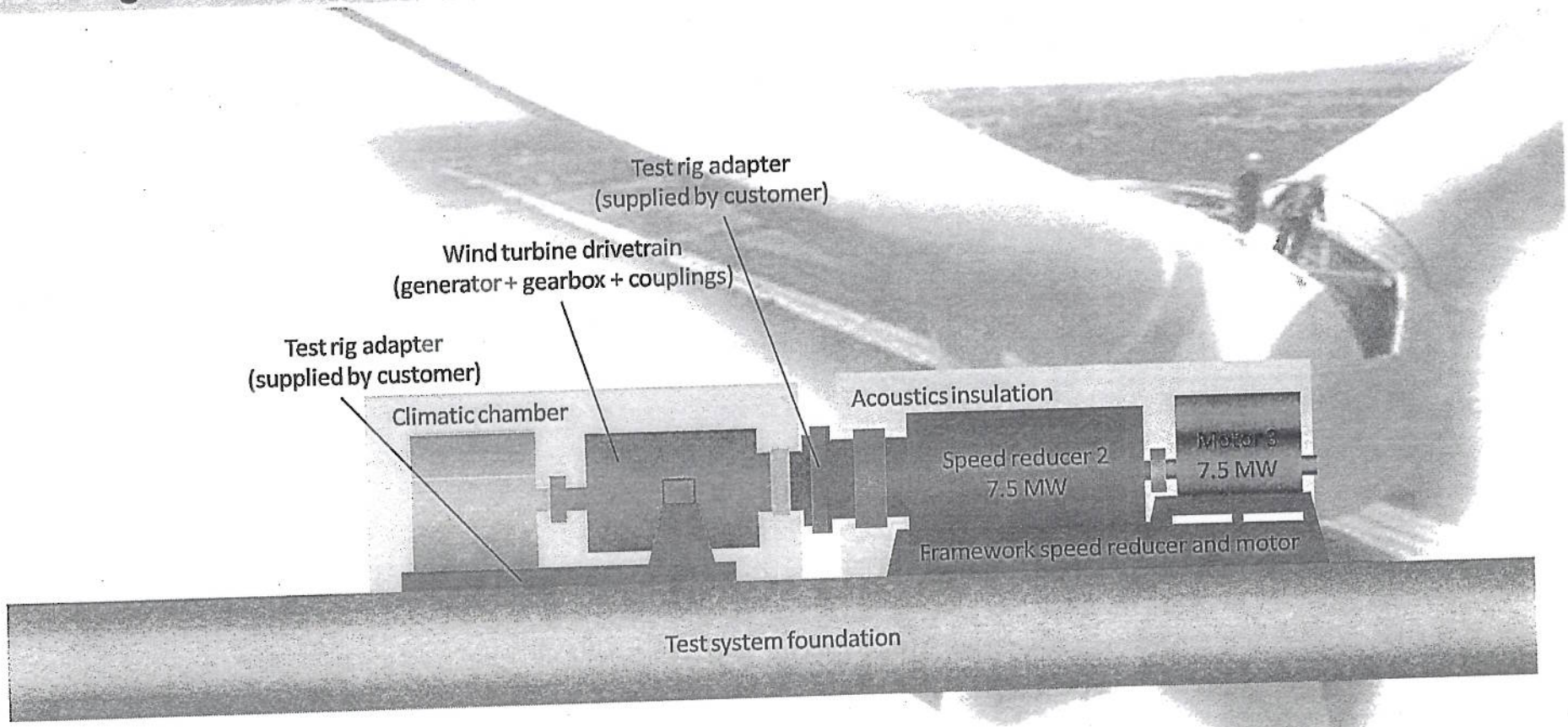
Test Systems for Wind Turbine Drivetrains

Test Rig 1: Drivetrain Test Rig (Testing of direct drive generators)



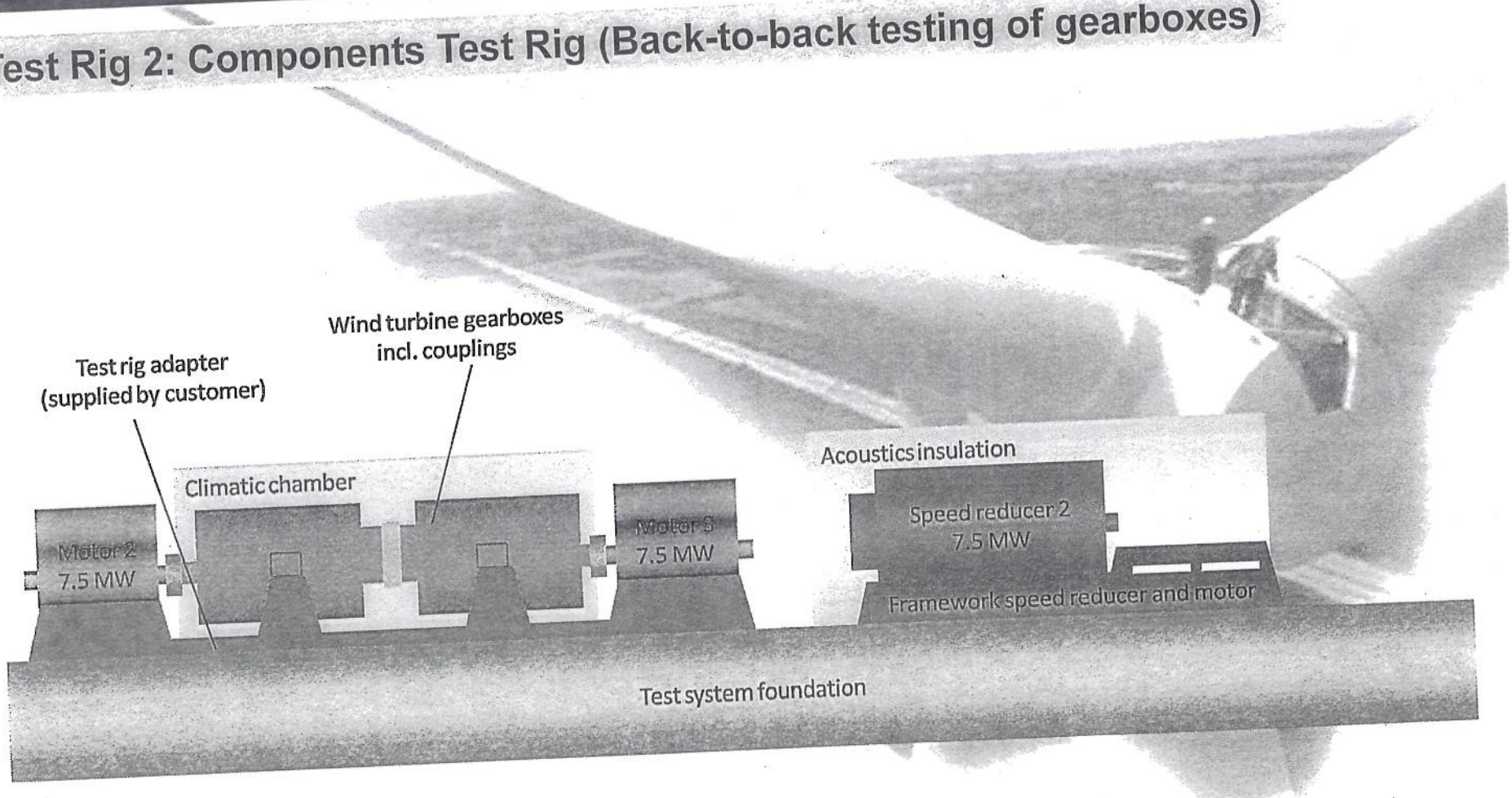
Test Systems for Wind Turbine Drivetrains

Test Rig 2: Components Test Rig (Testing of complete drivetrains)

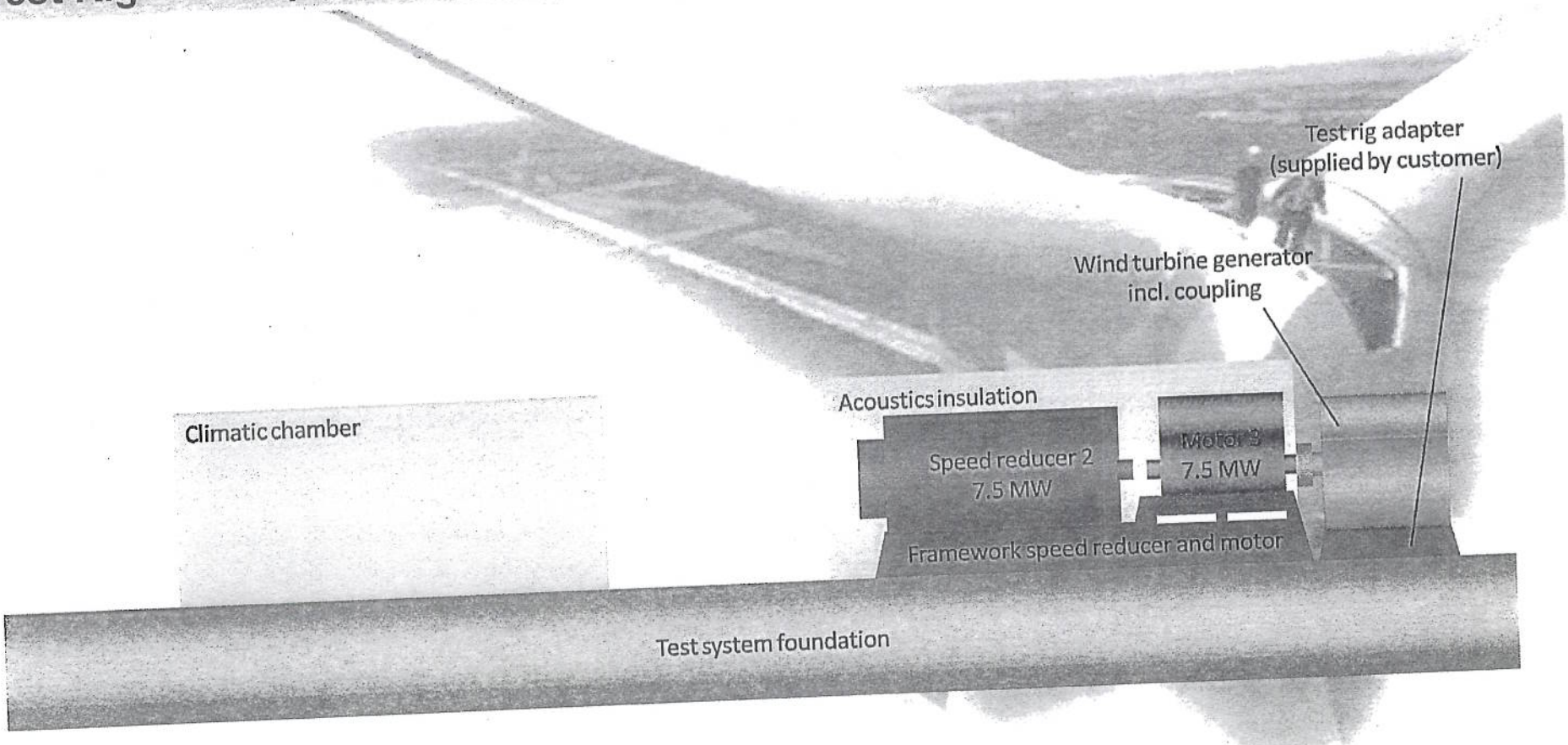


Test Systems for Wind Turbine Drivetrains

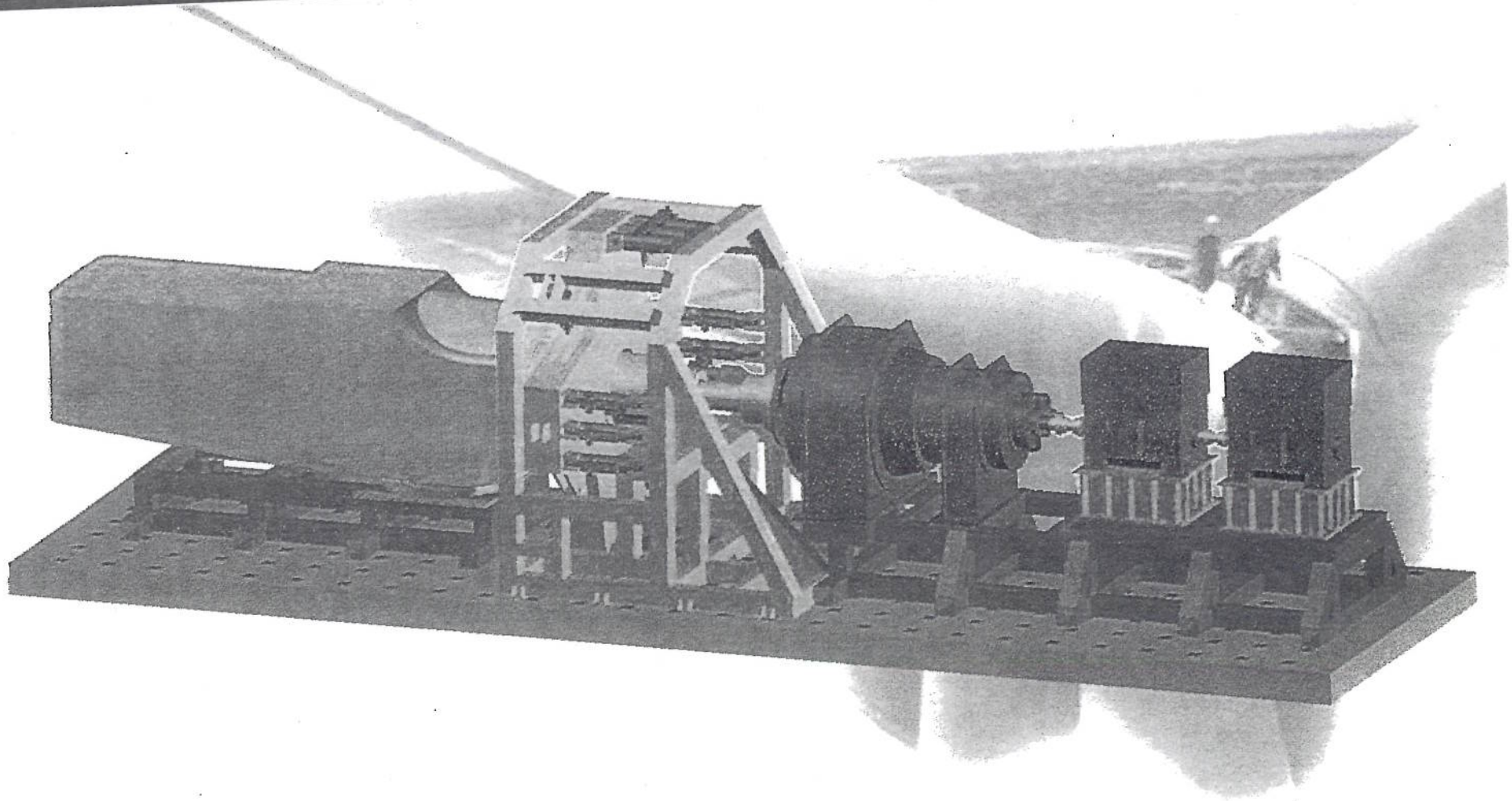
Test Rig 2: Components Test Rig (Back-to-back testing of gearboxes)

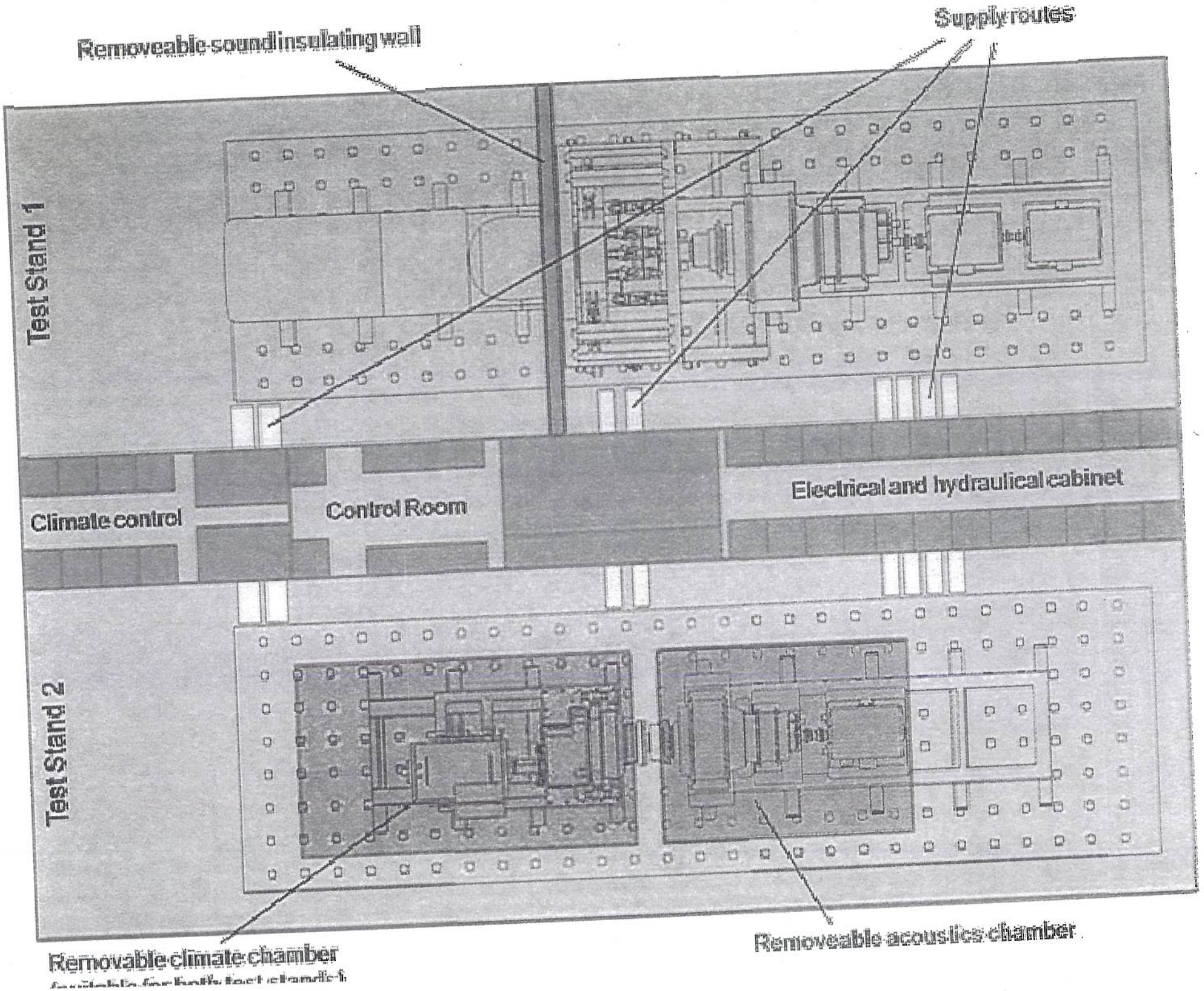


Test Rig 2: Components Test Rig (Testing of generators)



Test Systems for Wind Turbine Drivetrains




Removeable sound insulating wall
Supply routes
Test Stand 1
Climate control
Control Room
Electrical and hydraulical cabinet
Test Stand 2
Removable climate chamber
Removeable acoustics chamber