

The Foundation Duits-Nederlandse Windtunnels / Deutsch-Niederländische Windkanäle (DNW) has been established by Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) and Stichting Nationaal Lucht- en Ruimtevaartlaboratorium (NLR) Chamber of Commerce Lelystad Reg. no. 41 022 363

Nadine Kramer-Kort
(Secretary)

Yours sincerely,

Please find enclosed two signed copies of the contract for countersignature.

Dear Ms Tomasini,

Gisella Tomasini
Politecnico di Milano
Via La Masa 34
20158 Milano
ITALY

German-Dutch Wind Tunnels



P.O. Box 175
8300 AD Emmeloord
THE NETHERLANDS
Phone +31 527 24-8555
E-mail info@dnw.aero
Website www.dnw.aero

Bank (NL)
IBAN NL84 ABNA 0427 7848 59
BIC ABNANL2A
VAT-ID NL 0038.05.864 B 01
Visitors
Voorsterweg 31
8316 PR Marknesse

Your contact N. Kramer-Kort

Direct dial +31 527 248522

E-mail nadine.kramer-kort@dnw.aero

Our reference 18060 SCR-NK

Your reference

Date 26 February 2018

At the end of the tests, all the test data shall be provided in electronic form as well as the corresponding descriptions and the associated data file photos, video and other information. Moreover a test report with the description of the experimental setup and the results shall be provided within the

- 1) The wind tunnel test should be compliant with the requirements of EN 14067-6: 2010.
- 2) Compliance of the wind tunnel to the EN 14067-6:2010 shall be demonstrated on the basis of the tests carried out on the 1:15 scaled model of ETR 500 train.
- 3) Force balance-model connection: Party B shall send the balance interface designs to Party A and Party A shall adapt the models to the specific interface.
- 4) At the end of the tests, all the test data shall be provided in electronic form as well as the

1.2 Requirements of the Technology Service

Production of the force/moment/pressure coefficients and presentation of the test setup and the results in a report. Description) and Annex 2 (Party B's offer No. 4717.1705).

Execution of wind tunnel tests with two 1:15 scaled models (CRRC train model and ETR500 train model) to measure forces and pressures, in the test configurations described in Annex 1 (Technical

1.1 Goal and contents of the Technology Service

1. Contents and Requirements

With respect to the commission Party B receives from Party A to perform wind tunnel tests on two 1:15 scaled CRRC train model (hereinafter referred to as "Technology Service"), the two Parties hereby sign the Contract after equal consultation for common compliance.

German-Dutch Wind Tunnels DNW (tax code 003805864B01, VAT No. NL003805864B01), with registered offices at Voorsterweg 31, 8316 PR Marknesse, The Netherlands (hereinafter Party B) represented by its Deputy Director Ir. Christophe Hermans authorised to conclude this contract.

And

The Politecnico di Milano - Department of Mechanical Engineering (tax code 80057930150, VAT No. 04376620151), with registered offices in Piazza Leonardo da Vinci 32 Postcode 20133 Milan, Italy (hereinafter Party A), represented by the Head of the Department of Mechanical Engineering Prof. Marco Francesco Boccione authorised to conclude this contract

Contract for Technology Service

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work indicates Party B shall make any correction/modification, Party B shall make the required Party A shall check and accept upon reception of such results. In case the inspection and acceptance while the test report shall be sent within 30 days after the completion of the wind tunnel tests.

6.1 The electronic test data shall be sent within 14 days of the completion of the wind tunnel tests

6. Delivery and Acceptance

regular invoice(s).

the name of the German-Dutch Wind Tunnels DNW, specifying the reason, upon presentation of a

427784859, IBAN: NL84ABNA0427784859, SWIFT CODE: ABNANL2A, at ABN-AMRO bank, in

5.2 The above mentioned amounts shall be paid by Party A to the Party B on Current Account no

report.

c) The final payment shall be paid within 30 days upon delivery of the final test data and the final

b) 50% of the total remuneration shall be paid within 30 days after completion of the test activities;

site;

a) 30% of the total remuneration shall be paid within 30 days after receipt of the models at Party B's

5.1 The total remuneration as stipulated in Article 4.1 above shall be paid by the Party A as follows:

5. Payment

reimbursement payments received from the insurance company to Party A.

process with the insurance company in case of damage to or loss of the model, and shall forward the

Party B shall be the insurant of this model insurance. Party B will be responsible for the claiming

damage the own risk (10% of the damage value and at least EUR 5,000.00) shall be borne by Party A.

above mentioned Contract Price includes model insurance during the wind tunnel test. In case of

work is: EUR 52290 (excluding VAT) (in words: fifty-two thousand two hundred ninety Euros). The

4.1 The total remuneration that Party A shall pay to Party B for the execution of the commissioned

4. Remuneration

3.1 The place where Party B will execute the wind tunnel test is: Cologne, Germany.

3. Place of Implementation

during the first half of 2018 depending on the availability of the model and the wind tunnel.

Wind tunnel test in KKK wind tunnel will be conducted in mutual agreement between the parties

2. Period of the Contract

5) Test configurations and measurement requirements of the Technology Service: see Annex 1.

prescribed period.

modification within 30 days of the reception of the check outcome.

6.2 Criteria of acceptance: wind tunnel tests and results shall be compliant with the EN 14067-6:2010.

6.3 After passing the acceptance, Party A shall provide Part B with a written documentation.

No matter which type of the acceptance is used, if the acceptance is failed at the first time, Party B shall finish modification of the work and resubmit to Party A, within 30 days of the day receiving the revision notice. The second acceptance shall be organized by Party A.

6.4 Party A has 1 year after the delivery of the results of the tests to request modifications or corrections; Party B shall make modifications without charge in case of any disagreement to the Contract or defects in the project accomplishments.

7. Intellectual Property

7.1 Party A owns the results of technology services delivered by Party B, as well as the intellectual properties (including but not limited to patents, copyrights, trademark, proprietary technology) acquired by Party A using the technology services of Party B. Within this Contract the proprietary technology and intellectual property rights acquired by Party B from the use of technical information and working conditions provided by Party A are owned by Party A.

7.2 After confirmed by Party A, Party B may use the research results for scientific publications.

8. Confidentiality

8.1 Unless otherwise specified by the Contract, each Party shall assume the obligation of confidentiality for any relevant information it may obtain or be aware of from the other Party for the purpose of signing and performing the Contract (whether on, before or after the effective date), including but not limited to terms of this Contract, relevant document and technical data, trade secrets of the other Party and other exclusive information or information of confidential nature, and it may not disclose such information to any third Party without the permission from the other Party.

8.2 The confidentiality period is 5 years since the effective date of the Contract, and the obligation of confidentiality shall be assumed by both Parties regardless of withdrawal, cancellation or termination of the Contract.

8.3 The usage in proper purposes like Contract performing, assessments, receiving inspection, participating in review, applying for patent and lawsuit shall not be covered in the range of violating the obligations of confidentiality.

9. Transfer of Work

9.1 Without the consent of Party A, Party B shall not transfer the entire or part of the commissioned work to any third Party.

9.2 Cooperation, affiliation, subcontracting, temporary employing employees of any third Party to participate in the commissioned work shall be deemed as transferring commission.

10. Guarantee of Right

10.1 Party B shall ensure that services provided under the Contract will not infringe any third Party's intellectual property, and Party B shall indemnify, defend and hold harmless Party A against any such infringement claims by any third Party and shall bear all the responsibilities and costs.

11. Breach of Contract and Compensation

11.1 Neither party shall have the right to terminate the Contract unilaterally without Contract stipulations or statutory reasons.

11.2 In the event of Party B's delay in delivery of the accomplishments of the Contract Object Project, Party B shall pay 1% of the total remuneration payable to Party A as penalty for each day of delay since the next day of the expiration of delivery up to a maximum amounting to 3% of the contract value. In the event of delay exceeding 30 days, Party A shall have the right to select to terminate the Contract in part or in whole.

11.3 In the event that Party B neglects or refuses to perform the technical guidance and service obligation as set in the Contract, or the obligation performance is not in compliance with the provisions of the Contract, Party B shall pay 2% of the total remuneration as penalty to Party A for each time of such situation occurs. And such penalty shall not be exempted as result of the Party B's rectification thereafter.

11.4 If Party B infringes intellectual property rights of any third Party due to its breach of this Contract, Party B shall indemnify and hold harmless Party A from third Party claims resulting from this infringement.

11.5 In case Party B transfers this commissioned work without Party A's permission, Party B shall pay a penalty of 2% of the total Contract remuneration to Party A for each time found by Party A. This penalty shall not be exempted for Party B's rectification thereafter.

11.6 Whether before or after delivering to Party A, Party B, without Party A's permission, shall not provide part or all of the Contract achievements to any third Party with or without compensatory payment in any form like transfer, donation, exchange, cooperation, affiliation, contributions, etc., nor use, implement, apply for patent or make public, otherwise, Party B shall indemnify Party A for 100% of the amount of this Contract remuneration. If Party B earns profits as a result and the profit amount is higher than the above penalty, the profit amount shall be taken as compensation. If continual performance of this Contract becomes unnecessary or meaningless due to the aforesaid reason, Party A shall have the right to terminate this Contract.

11.7 Either Party that breaches the confidentiality obligations under the Contract shall compensate all the caused damages to the other Party. If the losses are not able to determined, 100% of the total remuneration shall be compensated.

11.8 In case Party B breaks the Contract as written above with respect to the services to be provided and the Contract is not terminated, Party B shall pay the penalty and compensation to Party A, and Party A has the right to deduct directly from the unpaid remuneration of Party B. If the Contract is terminated for the breach of Party B, Party B shall return the remuneration paid by Party A within 7

days after the next day of termination.

12. Force Majeure

12.1 In case the performance of this Contract is influenced by force majeure, national laws, regulations and politics, or caused impossible to perform in part or wholly, neither Party shall be held responsible for breach of Contract to the other Party. And both Parties shall agree to solve, through consultation, the follow up issues against the principle of fairness.

12.2 The Party affected by the preceding clause shall notify the other Party of the detailed information together with relevant proof within 7 days after the affect.

12.3 Should either party be prevented from performing any of its obligations under this Contract due to event of Force Majeure, such as hurricane, earthquake, war, strike, facility breakdown, riot and government embargo which could not be expected, avoided and overcome, the affected party shall not be liable for any delay or failure in performing any or all of its obligations due to the event of Force Majeure.

12.4 The affected party shall advise the other parties immediately of the occurrence mentioned above and within fourteen days thereafter, the affected party shall send by airmail to the other parties for their acceptance a certificate of the accident (if possible) issued by the competent government authorities or the chamber of commerce where the accident occurs as evidence thereof. Under such circumstances Party B, however, is still under the obligation to take all necessary measures to hasten the delivery of the goods respectively services. In case the accident lasts for more than ten (10) weeks, the parties shall have the right to cancel this Contract.

13. Dispute Settlement

13.1 In case any dispute arose during the execution of this Contract fails to be settled through mutual negotiation, the case shall be submitted to The Court of Bern. The settlement of disputes shall be governed by the laws of Switzerland.

14. Notification and Delivery

14.1 Written notices and documentations given by either Party shall be sent to the address listed

below:

Party A

Contact:

Givella Tomassin

Address:

Via G. L. Naya, 1 - 20121 Milano

E-mail:

givella.tomassin@polim.it

Party B

Contact: Carsten Lenters

Address: Lilienthalplatz 7, 38108 Braunschweig, Germany

14.2 Unless otherwise specified in the notice, for any notice that requires a feedback, the Receiving Party shall reply the Sending Party in written form within 3 days after receiving the notice. Paper notice shall be signed and sealed by the relevant person of Sending Party.

15. Liability

15.1 Party B shall not be liable for personal, material or financial damage, irrespective of the legal basis, except in cases of willfulness or gross negligence. In case of gross negligence the liability is limited to 40% of the contract value. Any further liability of Party B, especially for restitution for indirect damage including loss of profit, is excluded.

15.2 Party B shall insure the model during the wind tunnel test. Party B warrants that this insurance covers model damages. The own risk in case of damage (10% of the damage value; at least EUR 5000.00 for a model value up to EUR 500,000.00) shall be borne by Party A.

16. Other Agreements

16.1 Annexes of this Contract shall be treated as part of the Contract. In case there is any inconsistency between the annexes and the Contract, the later shall prevail.

16.2 All issues not included in this Contract or parts to be changed shall be determined in forms of signing additional supplementary Contract or memorandum, etc. The unmodified content of the Contract shall remain effective.

16.3 Should any provision of this Contract be or become fully or partly legally invalid, the rest remains unaffected. The parties hereto shall undertake to replace retroactively an invalid by a valid provision which shall to the greatest possible extent comply with the meaning of the invalid provision and with the purposes of this Contract.

16.4 The Contract and all rights and obligations there under shall be governed, interpreted and construed in accordance with the laws of Switzerland.

17. Validation of the Contract

17.1 The Contract shall come into effect after signed and sealed by the representatives of both Parties. 17.2 The whole text of this Contract is printed, and each page shall be confirmed by both Parties with signature and paging seal. Waiver of the aforesaid confirmation method by either Party shall be regarded as agreeing with and accepting other Party's confirmation. In case any dispute should arise due to different Contract versions held by both Parties, the version confirmed by the other Party shall prevail.

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10-05-2018
Milano, (date of signature)

POLITECNICO DI MILANO

Department of Mechanical Engineering

The Head

(Prof. Marco Francesco Boccione)

[Handwritten signature of Prof. Marco Francesco Boccione]

The Heads of the Contract;

(Prof. Daniele Rocchi and prof. Gisella Tomasini)

[Handwritten signature of Prof. Daniele Rocchi and prof. Gisella Tomasini]

The Management Responsible

(Ing. Alessandro Tosi Giorcelli)

[Handwritten signature of Ing. Alessandro Tosi Giorcelli]

German-Dutch Wind Tunnels DNW

Deputy Director

Ir. Christophe Hermans

[Handwritten signature of Ir. Christophe Hermans]

Marknessse, 26-02-2018

Annex 1 : Technical Description

1. Research purposes

Based on the wind tunnels described in EN 14067:2010, the research purposes are to perform wind tunnel tests and data analysis with 1:15 scaled CRRC and ETR500 train models.

2. Standards

EN 14067-1: 2003. Railway applications – Aerodynamics-Part 1 : Symbols and units.
EN 14067-6: 2010. Railway applications – Aerodynamics- Part 6: Requirements and test procedures for cross wind assessment.

3. Test conditions

The wind tunnel tests will be done in KKK-DNW wind tunnel.
The cross section size of DNW test section is 2.4m×2.4m, the maximum wind speed is constrained by the balance range and wind tunnel fan load, but the steady wind speed is more than 80m/s.

4. Instruments and equipment

4.1 Force measuring equipment
The aerodynamic force and moment of leading car should be measured.
Sampling frequency of the force measuring equipment should be more than 100 Hz, the conversion accuracy of the whole test system should be congruent with the requirements of EN 14067-6:2010.

4.2 Pressure measuring equipment

The range of pressure measuring equipment is about $\pm 500\text{Pa}$, the accuracy is about $\pm 0.08\%FS$.

5. Test models

5.1 Model type

1) CRRC train model: leading car + half middle car, scale size: 1:15

2) ETR500 train model: leading car + half middle car, scale size: 1:15

3) The force balance interfaces of CRRC train model and ETR500 model should be designed

experimental setup description.

test report should be delivered in the prescribed time. The test report should contain test results and
 4) All test results, their descriptions, pictures and videos should be delivered after the test. The

140.

3) Pressure measurements shall be performed for the CRRC model: the number of pressure taps is

the test results of ETR 500 1:15 with the standard ETR 500 model 1:15 in EN 14067-6: 2010.

2) Verification of compliance of the KKK-DNW wind tunnel will be carried out by comparison of

1) Wind tunnel tests shall be compliant with the EN 14067-6:2010.

7. Test Requirement

Track type	Test type	Model name	Test condition	
Single	Force Test	CRRC model	V=V2	$\beta=\beta1$
Track With		CRRC model	V=V1	$\beta=0^\circ$
Ballast and		ETR 500	V=V2	$\beta=\beta1$
Rail	Pressure Test	CRRC model	V=V2	$\beta=\beta1$
Angle	$\beta1 = -30^\circ \sim 30^\circ, \text{step}=5^\circ;$			
Velocity	V1=30m/s, 35m/s, 40m/s, 45m/s, 50m/s, 55m/s, 60m/s, 65m/s, 70m/s, 75m/s, 80m/s;			
	V2=20 m/s; 40 m/s; 60 m/s; 80 m/s			

Table 1 test conditions in DNW-KKK.

Test conditions are shown in table 1.

6. Test conditions

be well protected in the transportation process, to prevent the models from being damaged.

2) Party B will be responsible for the preparation of models after the tests. The models should

1) Party A is responsible for the transportation of models to the KKK and from the KKK.

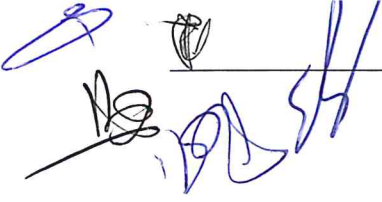
5.3 Transportation

provided by Party A.

4) The scenario Single Track With Ballast and Rail and the model support structure are

balance interfaces is provided by Party B.

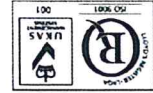
by Party A to be adopted also for the tests in KKK-DNW wind tunnel. The type of force



8. Expected results

Test data and reports for the two standard models.

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(Handwritten signatures and initials)

- Preparatory activities (outside of the wind tunnel)
- Drafting of a pre-test document
- Build-up of the model, including model instrumentation installation and checks prior to testing
- Execution of the wind tunnel tests according to a mutually agreed test matrix prior to the test and fitting into the number of offered wind tunnel occupation hours
- Removal of the model from the test section
- Production of a final set of test data in ASCII format
- Drafting of a final test report

The scope of work (further detailed in the Technical Proposal, Annex 1) will include the following activities:

1. Scope of work

With reference to your request and the above mentioned document, we hereby send you the proposal for the execution of a low-speed wind tunnel test in the DNW-KK.

Dear Ms Tomasinì,

1. Technical proposal
2. Compliance matrix
3. Modus operandi
4. General contract conditions

Enclosures:

1. Request for quotation as sent to H. Vos via Email on October 25th, 2017

Reference documents:

Our offer number: 4717.1705 (please use as reference in all correspondence)

G. Tomasinì
 Politecnico di Milano
 Via La Masa 34
 20158 Milano
 ITALY
 Email: gisella.tomasini@polimi.it

Your contact	C. Lenfers
Direct dial	+49 531 295 2452
E-mail	carsten.lenfers@dnw.aero
Our reference	17442 PAG-CL
Your reference	
Date	18 December 2017



Lilienthalplatz 7
 38108 Braunschweig
 GERMANY
 Phone +49 531 295-2450
 E-mail dnw-bgg@dnw.aero
 Website www.dnw.aero

Bank (NL)
 IBAN NL84 ABNA 0427 7848 59
 BIC ABNANL2A
 VAT-ID NL 0038.05.864 B 01
 Visitors Lilienthalplatz 7
 38108 Braunschweig

2. Deliverables

The on-line and preliminary wind tunnel data (obtained during the wind tunnel test) shall be made available to the CUSTOMER under the assumption that DNW received the advance payment as stipulated in Article 5 a. The final test data and the final test report shall be made available to the CUSTOMER on the condition that DNW has received the progress payment as stipulated in Article 5 b. and an irrevocable bank guarantee with a validity of 12 months opened in favour of DNW, by a First Class Bank, covering the final payment amount

3. Costs

The costs for the requested services, based on the scope of work, are as follows (all amounts in euros):

Cost breakdown test	
(Dis)mounting (hours)	10
Wind off (hours)	12
Wind on (hours)	2
Total time (hours)	24
Total cost	52,290.00
The costs comprise:	
Wind Tunnel rent	
Energy	
Model insurance	
Miscellaneous	
Option:	
Provision of "Single Track with Ballast and Rail"	8,000.00



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4. Price conditions

All costs are on firm fixed basis.

The wind tunnel occupation time is based upon the estimated time for the execution of the test matrix of reference 1. The occupation time includes time for installation and changes of the model and the test setup. The assumed times for model configuration changes are listed in article 3 of Annex 1.

Customer representatives at the test will have the right to adjust the test matrix under such circumstances that tunnel occupation time, energy and test cost remain unchanged. Adjustments have to be made in mutual agreement with DNW.

The offer is based on the DNW tariffs for 2018 and is only valid for execution of the test in 2018.

All prices are exclusive VAT.

5. Payment conditions

The following payment schedule shall apply:

- a. Advance Payment (30%)
A down payment of thirty percent (30%) of the total price shall be made by T/T (telegraphic transfer) within 30 days after contract signature and ultimately at the start of the wind tunnel test, under the condition that the CUSTOMER has received from the SELLER:

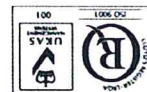
- The commercial invoice for 30% of the contract value sent by email to the CUSTOMER
- b. Progress Payment (65%)
65% of the total price shall be paid by T/T (telegraphic transfer) within 30 days under the condition that the CUSTOMER has received from the SELLER:

- (1) the commercial invoice for 65% of the contract value sent by email to the CUSTOMER
- (2) the on-line and preliminary wind tunnel data, obtained during the wind tunnel test
- c. Final Payment (5%)

5% of the total price shall be paid by T/T (telegraphic transfer) within 30 days under the condition that the CUSTOMER has received from the SELLER:

- (1) The final data and final test report.
- (2) The commercial invoice for 5% of the contract value sent by email to the CUSTOMER.

Payments are due 30 net days after invoice date.



Chamber of Commerce Leijstad Reg. no. 41 022 363

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6. Period of work

The wind tunnel test is tentatively scheduled in the first quarter of 2018. The duration is estimated on 1 week in the wind tunnel.

The exact wind tunnel entry date will be defined in mutual agreement amongst others depending on the availability of required wind tunnel model, equipment and resources.

The wind tunnel slot can only be made firm after receipt of a formal order or upon the conclusion of the contract, respectively.

7. Place of performance

DNW-KKK
Linder Höhe
51147 Köln
Germany

8. Point of contact

Technical matters
C. Lenfers
Telephone: +49 531 295 2452
E-mail: carsten.lenfers@dnw.aero

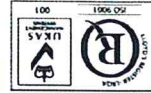
Commercial matters
Henri Vos (Business Development)
Telephone: +31 527 248505
E-mail: henri.vos@dnw.aero

Contractual and legal matters
Oliver Fries (Head of Administration)
Telephone: +31 527 248561
E-mail: oliver.fries@dnw.aero

9. Other conditions

The CUSTOMER shall provide an irrevocable bank guarantee with a validity of 12 months opened in favour of Supplier, by a First Class Bank, covering the final payment amount.

DNW shall not be liable for personal, material or financial damage, irrespective of the legal basis, except in cases of willfulness or gross negligence. In case of gross negligence the liability is limited to 20% of the contract value. Any further liability of DNW, especially for restitution for indirect damage including loss of profit, is excluded.



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Model insurance is included in this offer. In case of an insurance claim the own risk in case of damage is 10% of the damage value:

- At least EUR 5,000.00 for a model value up to EUR 500,000.00
- At least EUR 75,000.00 for a model value of EUR 500,000.00 and above

The own risk has to be borne by the customer.

The customer shall provide a model stress report at least four weeks before the start of the test. Model requirements will be made available after contract award.

The execution of the test program will take place in line with the conditions of the DNW Quality Management System certified according to ISO-9001:2008.

Any costs related to model transport such as transport costs, insurances, taxes and duties have to be borne by the customer unless otherwise specified. After the wind tunnel test the model is EXW available at DNW site.

In case assumptions for this offer are no longer valid (e.g. unexpected high loads during the test or change of specifications after contract award) DNW will have the right to re-evaluate the offer and determine the technical, costs and time consequences. These consequences will be communicated and mutually agreed with the Customer and documented before proceeding with the activities.


Furthermore the enclosed General Contract Conditions of DNW apply (Annex 4).

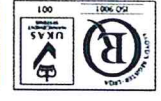
10. Additional remarks

Please note that DNW's tariff structure is based on facility rental costs. Therefore a cost breakdown in man hours is not possible and not given.

11. Validity

This offer is valid until 28 February 2018.

Yours sincerely,

 Ir. C. Hermans
 (Deputy Director)




Annex 1 Technical Proposal

1. Ground simulation measurements with splitter plate.

- Test section is the 2.4 x 2.4 m² closed test section of DNW-KKK
- Test section floor is the standard floor with turntable
- Splitter plate is installed onto the turntable
- Maximum speed might be restricted due to balance limits and/or maximum fan loads
- Maximum yaw angle for Leading car + Half middle car is $\pm 30^\circ$
- For the test setup consisting of Leading car + Half middle car only the leading car will be equipped with an internal wind tunnel balance

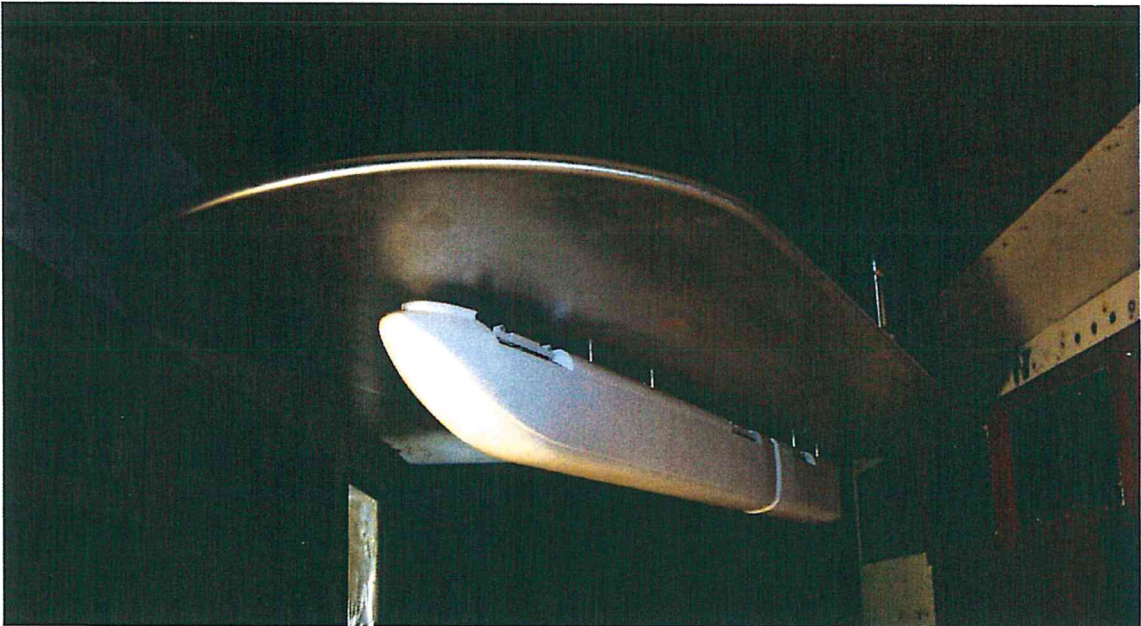
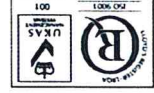


Figure 1 ICE3 Model on splitterplate in the closed test section of DNW-KKK at maximum yaw angle of $\beta = 30^\circ$

2. Measuring Techniques

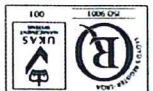
In all set-ups and moment measurements as well as pressure measurements can be conducted synchronously. The chosen model – balance set-ups avoid force short cuts due to tube bundles crossing the balance. Just the balance cable and the cables to connect three pressure scanners have to cross the balance. According to DNW's experience their influence on the balance measurements is negligible.




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For the above given assumption of configuration change time it was taken as given that the pressure taps are connected to connectors of type Scanivalve 55F700.

Configuration change of:	Time [h]
Mounting splitter plate	4
Installation CRRC model	4
Model change from CRRC model to ETR 500	6
De-installation of ETR 500 and splitter plate	4

DNW has assumed the following configuration change times:

3. Configuration change assumptions



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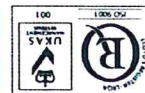
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Annex 2 Compliance Matrix

SOW Document Reference 1		Level of compliance ¹		Remarks & references to DNW	
p					
Track type	Test type	Model name	Test condition	Suitable hardware to be mounted on the DNW-KKK owned splitter plate to simulate the "single track with ballast and rail" shall be delivered by the customer or could be optionally purchased by DNW	
Single Track With Ballast and Rail	Force Test	CRRC model	V=V2		β=β1
		CRRC model	V=V1		β=0°
		ETR 500	V=V2		β=β1
Rail	Pressure Test	CRRC model	V=V2		β=β1
		CRRC model	V=V2		β=β1
Angle	β1 = -30°~30°, step=5°				the "single track with ballast and rail" shall be delivered by the customer or could be optionally purchased by DNW
Velocity	V1 = 30m/s, 35m/s, 40m/s, 45m/s, 50m/s, 55m/s, 60m/s, 65m/s, 70m/s, 75m/s, 80m/s; V2=20 m/s; 40 m/s; 60 m/s; 80 m/s				

¹ Legend: Y fully compliant, P: partial compliance, N: not compliant



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Annex 3 Modus operandi for wind tunnel testing

1. Introduction

This document describes the way in which wind tunnel testing (baseline service level and as such covered by the cost of the wind tunnel occupation) is conducted in the facility KKK of DNW in terms of responsibilities, communication and interactions with the customer.
 Deviations from the baseline service level shall be explicitly defined in the DNW offer, including the related compensation, or negotiated separately as the need arises during the project.

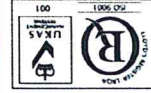
2. Definition

Customer Supplied Systems (CSS²) are non-DNW systems that are used in a wind tunnel test on request of the customer.
 The DNW project aerodynamicist (PA) is the central point of contact for the customer.

3. Responsibilities

- DNW personnel are responsible for the operation of the wind tunnel (e.g. setting the wind speed, model height, angle of attack, slip angle and positioning of the inflow traverse).
- The DNW project aerodynamicist is responsible for:
 - health and safety of personnel on-site
 - integrity of DNW systems, model support or associated equipment during operations
 - validity of test results
 - test schedule
- The lead test engineer of the customer is responsible for and in charge of the operation of all CSS.
 - On request of the customer, DNW staff can operate CSS provided that the customer accepts sole responsibility.
 - Possible delay or loss time to the test program caused by technical problems with the operation of CSS will not be compensated.
 - The DNW retains authority over the conditions of use of CSS within its own premises/infrastructure.
- The lead test engineer of the customer is responsible for customer personnel on-site to obey DNW health and safety regulations.
- Wind tunnel model assembly and configuration changes shall be performed by the customer, unless otherwise agreed upon.

² CSS shall be explicitly listed in an offer.



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- Workshops and tools of DNW-BGK may be used by trained customer personnel after instruction by and surveillance of DNW personnel.

4. Test execution

- In case of delays during operations due to technical failures or unavailability of equipment under responsibility of DNW, related wind tunnel occupation time will be compensated for by DNW.
- On request the DNW project aerodynamicist will provide the customer with the accumulated wind tunnel occupation time and a LN2 consumption estimation on ROM-basis after each shift (for cost reimbursement contracts only).

- The wind tunnel test preparation and operations are conducted on regular working days (German official holidays excluded). One regular shift includes one 8 hrs working period and a lunch break of 0:30 hrs. On project or customer needs begin and end of a shift as well as the lunch break might be shifted within 07:30 hours and 18:00 hours. During cryogenic test section conditions the DNW-KKK is operated in double-shift-mode. The morning shift lasts from 06:00 to 14:00 hours while late shift lasts from 14:00 to 22:00 hours. Working hours during cryogenic operation are fixed and cannot be adapted on customer requirements.

- On request, the customer is allowed to carry out wind tunnel model configuration changes or maintenance work under DNW supervision but without DNW support.

- In consultation with the customer a working day can either be extended until 21:00 hours or work can be conducted in double shifts from 07:00 – 23:00 hours.

- DNW will make, as a standard, available working places for a maximum of three customer representatives in the control area and three in the customer area.

- Wi-Fi is available in the public areas with access to the internet.

- All visitors and / or customer attendees to testing activities must be announced to the DNW project manager by the customer at least 24 hours in advance. The name, date of birth, nationality, ID number and the affiliation of the visitors have to be provided in written form to DNW project manager.

5. Accounting

- Wind tunnel occupation time is offered as multiples of full shifts for KKK.
- Actual test execution starts after successful completion of the test readiness review.
- Wind tunnel occupation time to be charged and round-up to the next full shift (8 hours) for accounting purposes (cost reimbursement contracts).





Annex 4 General Contract Conditions of DNW

GENERAL CONTRACT CONDITIONS GERMAN-DUTCH WIND TUNNELS (DNW)

The following General Contract Conditions shall apply to all contracts for deliveries, services, etc. rendered by the German-Dutch Wind Tunnels (hereinafter referred to as "DNW").

- 5.1 CONCLUSION OF THE CONTRACT
 - (1) The contract is concluded upon DNW's written confirmation of the order.
 - (2) Agreements on amendments respectively additions to the contract shall be made in writing to become legally effective.
- 5.2 PRICES
 - (1) Unless agreed upon otherwise, all DNW activities are executed on cost reimbursement basis, which means that the actually incurred costs shall be charged to the customer.
 - (2) The man-hour rates as well as the wind tunnel charges are settled by the Board of DNW and are subject to revision by the Board.
 - (3) All prices are exclusive of taxes and duties (e.g. Value Added Tax).
- 5.3 PAYMENTS
 - (1) Unless agreed upon otherwise, payment is due according to the following payment schedule and shall be made within 30 days after order confirmation:
 - 30% after order confirmation
 - 60% after contract of the test
 - Remaining payment after supply of final test data and/or the final test report
 - (2) The customer shall not retain any payment or set-off payments against any claims if not explicitly admitted by DNW.
 - (3) If the customer fails to comply with his payment obligations in whole or in part, DNW shall be entitled to suspend the execution of the work. If the payment has not been received within the terms of payment stipulated in the contract, DNW is entitled to charge interest on the amount of default.
 - (4) All amounts are due in Euros (EUR).
 - (5) The last version of the offer made by DNW shall prevail over the scope of the written order from the customer unless explicitly mentioned in DNW's written order confirmation.
 - (6) Any change of the content of work is only legally effective if DNW has approved it in writing.
 - (7) DNW's employees or external staff do not constitute warrantors, shall not be relied upon by the customer and are not part of the contract unless confirmed in writing by DNW.
 - (8) DNW, any third party and copyright therein remain liable with DNW.
- 5.4 CONTENT OF THE WORK
 - (1) The customer is obliged to accept the contractually agreed service immediately once this has been performed by DNW. This also applies in respect to the final test data and the final report prepared by DNW and handed over to the customer.
 - (2) The contractually agreed services shall be deemed to have been carried out and accepted when the customer has not raised any objections against it towards DNW within a period of four weeks following submission of the final test data and/or the final test report.
- 5.5 ACCEPTANCE OF THE WORK
 - (1) The customer is obliged to accept the contractually agreed service immediately once this has been performed by DNW. This also applies in respect to the final test data and the final report prepared by DNW and handed over to the customer.
 - (2) The contractually agreed services shall be deemed to have been carried out and accepted when the customer has not raised any objections against it towards DNW within a period of four weeks following submission of the final test data and/or the final test report.
- 5.6 PASSING OF RISK
 - (1) Risk of theft, pilferage and non-delivery of the test object shall pass to DNW upon arrival at the DNW site. The risk shall remain to the customer as soon as the test object has left the DNW site.
 - (2) If the return of the test object is delayed as a result of circumstances beyond the control of DNW, risk of theft, pilferage and non-delivery of the test object shall pass to the customer from the day of dispatch to the customer as expressed by DNW.
- 5.7 WARRANTY
 - (1) DNW shall perform the work in strict adherence to the acknowledged rules and application of scientific discipline.
 - (2) If within six (6) months following the submission of the test data attributable to a fault in a test and/or a test data evaluation has been ascertained by the customer by immediate notice, DNW shall, if necessary, repeat this test or the test data evaluation at no cost.
- 5.8 LIABILITY
 - (1) DNW shall not be liable for material or financial damage, irrespective of the legal basis, except in cases of willfulness or gross negligence. In case of gross negligence, the liability is limited to the typical, foreseeable damage.
 - (2) DNW shall not be liable for damages of the test object during storage, preparation or testing, excluding in events of gross negligence or intent by DNW-personnel.
 - (3) In cases of claims arising from death or injury to body or health, DNW's liability is determined by the statutory provisions.
 - (4) Any further liability of DNW, especially restitution for indirect damage including loss of profit, is excluded.
 - (5) The customer is liable for personal, material or financial damages, irrespective of the legal basis, caused by him or his subcontractors. No liability of third parties shall be established by the conclusion of the contract.
- 5.9 SECURITY REGULATIONS
 - (1) The customer and his employees as well as third parties acting under his authority are obliged to adhere to the applicable DNW security regulations.
- 5.10 CANCELLATION
 - (1) The customer may cancel the contract, any further right and claim being excluded, if DNW is definitively unable to render services.
 - (2) If the inability to render services is due to reasons outside the control of DNW, DNW shall be entitled to claim the part of the price corresponding to the work performed. Furthermore the costs and commitments incurred until cancellation date, which are not covered by this price shall be reimbursed by the customer.
 - (3) DNW shall have the right to cancel the contract in whole or in part in the event of force majeure (including but not limited to public measures, seizures, riots and labor disputes of any kind, operational troubles). The customer shall not be entitled to claim damages because of such termination.
 - (4) In case of customer's cancellation for convenience up to 10 weeks before the mutually agreed start date of the test, DNW may charge the customer the costs incurred at cancellation date.
 - (5) In case of customer's cancellation for convenience after the cancellation period as stipulated in § 10 (4) or termination during the test due to technical reasons not attributable to DNW, DNW may charge in addition to the costs incurred at cancellation/termination date the remaining wind tunnel occupation time as ordered.
- 5.11 MISCELLANEOUS
 - (1) The customer has to provide DNW with a model stress report in due time before the start of the testing period, which has to meet the DNW wind tunnel model safety requirements.
 - (2) Place of Performance shall be the agreed wind tunnel site of DNW.
 - (3) DNW shall apply to the contractual relationship to the exclusion of the United Nations Convention on Contracts for the International Sale of Goods (CISG). Place of jurisdiction shall be Amsterdam, the Netherlands.
 - (4) Even if individual provisions of the contract are invalid, all other parts of the contract shall continue to be binding.
 - (5) The above conditions shall be applicable unless otherwise agreed in writing between the contracting parties.

01 August 2015

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