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WORKPLAN OF WORKPACKAGE 4

“Helium Leaktightness Rotating Seal”

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WORKPLAN OF WP4

"Helium Leaktightness Rotating Seal"

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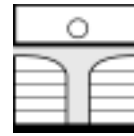
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1. Objectives of the Work Package

The helium rotating seal is associated with a rotor of the turbo-machine penetrating through the primary vessel. In this case the generator is located outside the primary circuit that simplifies the maintenance operations and that allows to use mechanical bearings for the support. So this concept can be considered as an alternative of a fully immersed rotor in primary helium and consequently fully supported by magnetic bearings. The feasibility of such a seal is a key issue to increase the competitiveness of a modern HTR by reducing the maintenance campaign duration.

The main objective of this WP is to identify the best promising design for such a rotating seal.

2. Description of the task

The contractual objective of the work package is to produce six documents which are identified D30, D31, D32, D33, D34 and D35.

2.1 Deliverable D30

The title of the document is “State-of-the-art and specifications”.

It is first of all necessary to evaluate the State-of-the-art of Dry Gas Systems and Canned Magnetic Bearings.

In a second step the requirements for rotating seals will be defined for two turbomachine configurations (GT-MHR resp. PBMR). If necessary, input data from GT-MHR and PBMR can requested on the basis of HTR-TN agreements.

The particular case of the rotating seal will be developed as a feasibility study for this system. Different available concepts are already tentatively identified and will be analysed taking into account the state-of-the-art and feedback experience on similar systems used in industry.

2.2 Deliverable D31

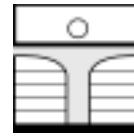
The title of the document is “Canned Magnetic Bearing”.

With help of a single effect analysis on basis of theoretical investigations for Canned Magnetic Bearings it is planned to find an innovative technical solution for helium leak-tightness rotating systems. AMB, materials, loads and controller algorithms for such a system will be investigated.

2.3 Deliverable D32

The title of the document is “Dry System”.

In connection with the analysis of the existing devices, a suitable concept of a dry system as regards the HTR conditions will be defined, and justified by theoretical analysis.



2.4 Deliverable D33

The title of the document is “Liquid, gas, ferro-fluid barrier”.

A justification of liquid film (cinematic effect), gas film, controlled leak rate, liquid film with electromagnetic confinement will be performed by theoretical analysis. Then a suitable concept of the system as regards the HTR conditions (GT-MHR and PBMR) will be defined.

2.5 Deliverable D34

The title of the document is “Dry gas system stability and leakage analysis”.

The objective of this task is to determine whether the selected dry seal designs meets the requirements for functionality and structure integrity. CFD analyses (STAR CD code) will be performed on the recommended concept of the task “Dry System”.

2.6 Deliverable D35

The title of the document is “Experimental tests program definition ”.

The experimental tests program required for the best promising concept will be defined. It will be also analysed the capability to carry out these tests on HTTR and HTR 10 test loops.

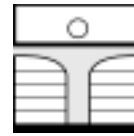
A first proposal for test facilities with rotating seals and canned magnetic bearings will be defined.

At the end of this feasibility study, the best promising concept will be identified. The manufacturing of a mock-up and the experimental tests campaign will be possible, after the 5th FWP, on a large scale facility or in international collaboration (e.g. test loop at HTTR/HTR10).

3. Definition of the task of each partner

The partners involved in the work package are:

- Framatome ANP SAS - FRA (1)
- University of Applied Sciences Zittau/Goerlitz - Uni Zittau (3)
- Nuclear Research and Consultancy Group - NRG (4)
- Forschungszentrum Juelich GmbH - FZJ (5)
- Jeumont Industrie - JT (8)
- Société de mécanique magnétique - S2M (9)



The proposal of the repartition of the budget by document and partner is the following:

	D29	D30	D31	D32	D33	D34	D35	Total
FRA (1)	-	1.0	-	-	2.8	-	2.0	5.8
Uni Zittau (3)	1.0	-	8.7	-	-	-	-	9.7
NRG (4)	-	-	-	-	-	4.9	-	4.9
FZJ (5)	-	1.0	-	-	-	-	-	1.0
JT (8)	-	-	-	4.0	-	-	-	4.0
S2M (9)	-	-	1.0	-	-	-	-	1.0

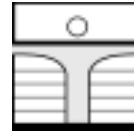
TABLE 1: Budget repartition

Remark:

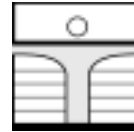
- The numbers in the columns are person month.

4. Future meetings

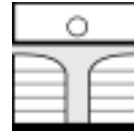
The next meeting will be held at the beginning of the 4th quarter of 2002. The location will be in Zittau. The precise date of the meeting will be proposed by the work package leader in accordance with the WP 3 meeting.

**TABLE 2: Detailed Workplan regarding D29 to D35**

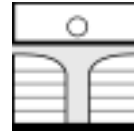
ID	Task of WP4	Start	End	Responsible	Input Results	Target date	needed from	Output Results	Target date	deliver to	Deliv. No.
1.0	WORKPLAN REPORT	01/02	03/02	Uni Zittau	Deliveries of all Partners	02/02	all	Workplan	03/02	Coordinator	D29
1.1	STATE OF THE ART AND SPECIFICATIONS	01/02	07/02	FRA				Results of the State-of-the-Art analysis and specifications	07/02	Uni Zittau	D30
	State-of-the-art of Dry Gas System	01/02	06/02	FRA							
	State-of-the-art of Canned Magnetic Bearings	01/02	06/02	FZJ, S2M							
	Definition of requirements for Turbomachines GT-MHR and PBMR	01/02	06/02	FRA	Input data from GT-MHR and PBMR projects brought HTR-TN agreements			1st version draft (requirements)	04/02	all partners	
	Definition of requirements for rotating seals in blowers	01/02	06/02	FZJ							



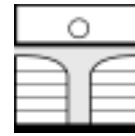
1.2	FEASIBILITY STUDY OF A ROTATING SEAL SYSTEM										
1.2.1	Canned Magnetic Bearing	04/02	12/03	Uni Zittau	1st version draft (requirements) Results of the State-of-the-Art analysis and specifications	04/02 07/02	FRA FRA	Feasibility Study	12/03	Uni Zittau	D31
	Consulting on Canned Magnetic Bearings	04/02	12/03	S2M, FZJ							
	Single effect analysis (theoretical investigations) (AMB, materials, loads, controller)	04/02	12/03	Uni Zittau				Status report (incl. questions)	01/03	S2M, FZJ	
1.2.2	Dry System	04/02	03/03	JT	1st version draft (requirements) Results of the State-of-the-Art analysis and specifications	04/02 07/02	FRA FRA	Feasibility Study	03/03	Uni Zittau	D32
	Analysis of existing devices	04/02	03/03	JT							
	Definition of a concept of dry system as regards the HTR conditions (GT-MHR and PBMR)	04/02	03/03	JT							
	Justification by theoretical analysis	04/02	03/03	JT							
	Exchange of information with NRG (task 1.2.4) including influent geometrical parameters	07/02	03/03	JT							



1.2.3	Liquid, Gas, Ferro-fluid Barrier	04/02	03/03	FRA	1st version draft (requirements) Results of the State-of-the-Art analysis and specifications	04/02	FRA	Feasibility Study	03/03	Uni Zittau	D33
						07/02	FRA				
	Justification of liquid film (cinematic effect), gas film, controlled leak rate, liquid film with electromagnetic confinement by theoretical analysis	04/02	03/03	FRA							
	Definition of a suitable concept of the system as regards the HTR conditions (GT-MHR and PBMR)	04/02	03/03	FRA							
1.2.4	Dry System - Stability and Leakage Analysis	01/03	12/03	NRG	1st version draft (requirements) Results of the State-of-the-Art analysis and specifications	04/02	FRA	Feasibility Study	12/03	Uni Zittau	D34
						07/02	FRA				
	Stability and leakage analysis	01/03	12/03	NRG							
	Determination of the selected dry seal designs (functionality and structure integrity)	01/03	12/03	NRG							
	CFD analyses (STAR CD code) for the recommended concept of the task 1.2.2.	01/03	12/03	NRG							
	Exchange of information with JT (task 1.2.4) including influent geometrical parameters	07/02	12/03	NRG							



1.2.5	Experimental Tests Program Definiton	01/03	12/03	FRA	1st version draft (requirements) Results of the State-of-the-Art analysis and specifications	04/02	FRA	Program Definition	12/03	Uni Zittau	D35
	Program Definition	01/03	12/03	FRA		07/02	FRA				
	Analysis of the test realization capability on HTTR and HTR 10 test loops	01/03	12/03	FRA							
	First proposal for test facilities (rotating seals, canned magnetic bearing)		10/02	FRA					10/02		
								Proposal		all Partners	

**TABLE 3: Manpower per year**

	2002	2003	2004	2005	Total
FRA (1)	2.9	2.9	-	-	5.8
Uni Zittau (3)	4.0	5.7	-	-	9.7
NRG (4)	0.1	4.8	-	-	4.9
FZJ (5)	1.0	-	-	-	1.0
JT (8)	4.0	-	-	-	4.0
S2M (9)	0.5	0.5	-	-	1.0

This work share may be revised taking into account the actual progress of the studies with the others partners.



TABLE 4: Schedule

		2002												2003												2004												2005											
ID	Name	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
	WP 4 : Helium leaktightness rotating seal																																																
1.0	Workplan report																																																
1.1	State of the art and specifications																																																
1.2	Feasability study (rotating leaktightness)																																																
1.2.1	Canned Magnetic Bearing																																																
1.2.2	Dry system,																																																
1.2.3	Liquid, gas, ferro-fluid barrier																																																
1.2.4	Dry system-Stability and leakage analysis																																																
1.2.5	Experimental tests program definition																																																

Milestone:
M1: Concept Proposals for Seals and AMB

