Document Identifier	LUBGEAR_WP5_D5.1
Status	Final

LUBGEAR

Tribological behaviour under loss of LUBrication of new optimized GEARs for friction reduction in power gearboxes

H2020-CS2-CFP11-2020-01

Grant Agreement No **101007713**

Deliverable D5.1

Plan for Communication, Dissemination and Exploitation of project results

WP	5	Exploitation, Dissemination and Communication
Task	5.1	Technology Watch
Task	5.2	Knowledge protection and exploitation

Dissemination level[1]	PU
Nature[2]	R

Due delivery date	30/06/2021
Actual delivery date	08/10/2021

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Approved by the Topic Manager	
Date	**Signature**
13/10/2021	
	Lucia Azzini

[1] Dissemination level: **PU** = Public, **CO** = Confidential, only for members of the consortium

[2] Nature of the deliverable: **R** = Report, **E = Ethics** or, **O** = Other

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Deliverable summary (public version of the Deliverable if confidential)

2.1.1. This document is the first deliverable of WP5: Exploitation, Dissemination and Communication which objectives are to collect information about dissemination relevant project results and dissemination of knowledge, to create communication material for the project partners' use, to facilitate collaboration and information, to monitor and analyse the IPR positioning and based on this to define potential IPR strategies and to ensure the knowledge is effectively disseminated and exploited within the participant organizations articulating a route to commercial access, tailored to their requirements and the TM requirements.

This deliverable reports a preliminary plan for communication, dissemination, and exploitation activities for the next stages in the project. During the first months of the project, the main focus has been on setting up necessary online communication channels (i.e., visual identity, website, social media, brochures, etc.) for presenting the project. Scientific dissemination, industrial collaboration, and exploitation activities will be intensified in the end of the project as more concrete results are obtained. The present document, which has been elaborated based on the inputs collected from the project partners up to M6, is expected to act as a point of reference for current and foreseen communication, dissemination and exploitation activities and will be continuously monitored and updated throughout the project duration, being circulated to the consortium for updates, corrections and/or amendments. The final plan will be completed in M30 and will be included in deliverables D5.2: Report on Exploitation Activities and D5.4: Report on Communication and Dissemination Activities.

REVISION HISTORY			
Version	**Date**	**Comment**	**Author(s)**
v01	27/08/2021	First draft	Jaime Ochoa, Virginia Sáenz de Viteri (CIDETEC) Lorenz Braumann, Hanns Amri (ZOERKLER)

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Table of Content

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1. INTRODUCTION

The goals of reducing the CO_2-footprint of European aviation and advancing future competitiveness of the European Union in the context of advanced short to medium range large passenger aircrafts (LPA) necessitate the utilization of innovative and increasingly efficient engine technologies. Reduced specific fuel consumption and thus high efficiency, lower noise levels and decreased CO_2 emissions can be achieved by the ultra-high-bypass ratio (UHBP) geared turbofan engine. The UHBP turbofan uses a planetary gear stage to decouple the fan RPM from the RPM of the turbine. To enable the planetary gear stage to transmit the required high torque at a high RPM level a continuous supply with lubricant, for cooling and lubrication, has to be ensured. This is usually performed by the primary lubrication system. Nevertheless, during flight, several off-design conditions can take place where the oil supply of the primary lubrication system is insufficient. These events are called Loss of Lubrication (LOL) events. The corresponding results are damages inside the planetary gear stage, due to scoring and high temperatures. To prevent gearbox damages and ensure safety and operability, a secondary or auxiliary lubrication system is used. The drawback of this system is the weight increase and the complexity. To reach the goal of further CO_2 emission reduction it is necessary to decrease the weight of the engines and to increase the efficiency. Therefore, the goal of LUBGEAR is to develop an optimized gear design which can withstand the off-design conditions without additional means such as secondary or auxiliary lubrication system.

Summarizing, the aim of LUBGEAR project is to demonstrate gear design solutions for off-design conditions, going through the investigation of off-design conditions, the elaboration of design and technology solutions for off-design conditions, the validation of selected design and technology solutions for gears and the roadmap for design solutions for off-design conditions.

This document is the Plan for Communication, Dissemination and Exploitation of LUBGEAR project results. Its purpose is to present the approach of dissemination, communication and exploitation strategy of the project itself and its results. It introduces into dissemination, communication and exploitation activities that are planned to be carried out by the LUBGEAR Project partners. It provides the steps needed to be taken during and after the project to achieve maximum effect of the actions and how to reach the relevant target audience.

This document is the first deliverable of WP5: Exploitation, Dissemination and Communication which main objective is to effectively prepare and coordinate the use and dissemination, communication and exploitation of the foreground generated during the LUBGEAR project. The WP is divided in 4 tasks: T5.1: Technology Watch, T5.2: Knowledge protection and exploitation, T5.3: Technology transfer and dissemination, and T5.4: Roadmap of the line-of-sight solutions on macro level. This deliverable reports the activities performed in the first 6 months of the project in the first three tasks and defines a preliminary Plan for Communication, Dissemination and Exploitation of the results.

The strategy and plan of dissemination and exploitation will be continually monitored, updated and reported during the project.

2. DISSEMINATION ACTIVITIES

2.2. Dissemination Objectives

Through the dissemination and communication strategy the knowledge generated along the LUBGEAR project will be spread to the largest extent as possible. The strategy of dissemination includes the following objectives:

- To collect information about dissemination relevant project results and dissemination of knowledge
- To set up the information dissemination mechanisms and strategies
- To create a community composed by the project partners and interested stakeholders

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2.3. Dissemination Rules

There are some general rules that the dissemination activities must follow, according to the EU Regulations, the LUBGEAR Grant Agreement (article 29) and Implementation Agreement (article 8.2).

Language:

The dissemination of the project will be performed in English, as the official language of the project. Therefore, all dissemination actions, deliverables and documents will use this language. However, the official languages spoken at each of the partner's countries could be also used for dissemination activities with no international character.

Obligation to disseminate results:

According to art.29.1 of the Grant Agreement (GA), unless it goes against their legitimate interests, each beneficiary must (as soon as possible) 'disseminate' its results by disclosing them to the public by appropriate means (other than those resulting from protecting or exploiting the results), including in scientific publications (in any medium).

A beneficiary that intends to disseminate its results must give advance notice to the other beneficiaries and Topic Manager of (unless agreed otherwise) at least 45 days, together with sufficient information on the results it will disseminate.

Any other beneficiary or Topic Manager may object within (unless agreed otherwise) 30 days of receiving it can show that its legitimate interests in relation to the results or background would be significantly harmed. In such cases, the dissemination may not take place unless appropriate steps are taken to safeguard these legitimate interests.

If a beneficiary intends not to protect its results, it may (under certain conditions, see Article 26.4.1 of GA) need to formally notify the JU before dissemination takes place.

Open access to scientific publications:

According to art.29.2 of the GA each beneficiary must ensure open access (free of charge online access for any user) to all peer-reviewed scientific publications relating to its results.

In particular, it must:

(a) as soon as possible and at the latest on publication, deposit a machine-readable electronic copy of the published version or final peer-reviewed manuscript accepted for publication in a repository for scientific publications; Moreover, the beneficiary must aim to deposit at the same time the research data needed to validate the results presented in the deposited scientific publications.

(b) ensure open access to the deposited publication — via the repository — at the latest:
- on publication, if an electronic version is available for free via the publisher, or
- within six months of publication (twelve months for publications in the social sciences and humanities) in any other case.

(c) ensure open access — via the repository — to the bibliographic metadata that identify the deposited publication.

The bibliographic metadata must be in a standard format and must include all of the following:
- the terms "Clean Sky 2 Joint Undertaking", "European Union (EU)" and "Horizon 2020";
- the name of the action, acronym and grant number;
- the publication date, and length of embargo period if applicable, and
- a persistent identifier.

Open access to research data:

It is not applicable for LUBGEAR.

Information needed to be included:

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Following art. 29.4: Unless the JU requests or agrees otherwise or unless it is impossible, any dissemination of results (in any form, including electronic) must:

1) display the Clean Sky 2 JU Logo

2) display the EU emblem, and

3) include the following text:

"This project has received funding from the Clean Sky 2 Joint Undertaking (JU) under grant agreement No 101007713. The JU receives support from the European Union's Horizon 2020 research and innovation programme and the Clean Sky 2 JU members other than the Union".

When displayed together with another logo, the JU logo and the EU emblem must have appropriate prominence. The beneficiaries may use the JU logo and the EU emblem without first obtaining approval from the JU or the Commission. This does not however give them the right to exclusive use.

Moreover, they may not appropriate the JU logo and the EU emblem or any similar trademark or logo, either by registration or by any other means.

Disclaimer excluding JU responsibility:

Any dissemination of results must indicate that it reflects only the author's view and that the JU is not responsible for any use that may be made of the information it contains.

2.4. Dissemination Activities

A two-level strategy has been defined, depending on whether targeting specific audiences or wider audiences (see table below to see what is meant by specific and wider audiences), in order to optimize the dissemination efforts and get the desired impact. Next table links the different audiences with the dissemination means and the timing (when the actions will be performed, during the first half or in the last part of LUBGEAR or after project).

Table 1: Dissemination and Communication Strategy overview

Target Audience	Dissemination instrument	Timing
Specific Audiences - Research community - Industrial associations - Surface treatment companies - Drivetrain manufacturers	Project deliverables and reports	D1 & D2
	Technical webinars for scientists	D1 & D2
	Articles in journals and conference papers	D2 & A
	Scientific technical reports	D1 & D2
	Project executive summary published via CORDIS-EU RTD	D1
	Briefing of relevant Industrial Associations (AIAS, CETS), Clusters (HEGAN) and excellence networks (EASN, CEAS)	D2 & A
	Meetings with users and stakeholders at EU/national/local level	D2 & A

- Policy makers - Educational institutions - National government organizations - Professional associations	Briefing of the project to relevant EU Technology Platforms (national level: PLATEA, PAE, EU level: EUMAT, ACARE)	D2
	Final Project Workshop (engaging dialog between researchers, EU & national policy makers and other stakeholders)	D2 & A
Wider Audiences - General public - Journalists - Media	Project Website	D1 & D2
	Press releases	D1 & D2
	Dissemination of experience through specific Blogs	D2 & A
	Exhibitions, trade fairs	D2
***Labels: D1** During the first half of the project; **D2** During the second half of the project; **A** After the project*		

2.5. Responsibilities

All members of the Consortium must contribute to public engagement and communicate the results of the project to society. The tasks associated with communication and dissemination actions are going to be distributed as follows:

- Coordinator (CID) and WP5 leader (ZOERKLER)

1) Managing and updating the shared point, intranet and social networks.
2) Collecting, evaluating and archiving press releases, communication and outreach activities.
3) WP5 deliverables preparation.
4) Informing consortium members about important aspects related to WP5.

- Other partners

1) To inform and send the coordinator and WP5 leader press releases, news, and social media communication actions managed by their institutions.
2) To keep a fluent communication with the project coordinator and WP5 leader and, whenever possible, provide information and graphic material (such as pictures, posters, leaflets, etc.) of any outreach or communication activities developed within the framework of the project.

In any case, all members of the consortium must follow the dissemination rules exposed in Section 2.2.

2.6. Reporting and data access

LUBGEAR opted out from the ORDP in proposal level so no open access to the research data is provided.

- **Storage**

The partners will store all dissemination materials used in the LUBGEAR project in a platform provided by AC2T partner dedicated to this purpose. It will enable the dissemination manager to collect these materials to update the annex of the annual report. Moreover, all partners will be responsible for keeping records of their own dissemination material produced by themselves (presentations, papers, press notes, etc.) and collect them in their own servers. According to Horizon H2020 rules, partners commit to archive and let accessible the disseminated information for re-use up to five years after the end of the project. Open access papers will be stored and accessible via ZENODO or via other means.

- **Dissemination report**

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The LUBGEAR dissemination report will be continuously updated by the ITD dissemination manager (ZOERKLER) and communicated to all partners and TM during the consortium meetings. The dissemination report will be updated each reporting period. It will list all the dissemination activities performed as well as the scientific publications according to peer-reviewed template tables provided by the EC.

- **Reporting to the JU**

Dissemination archives will be communicated on a regular basis to the JU by the Dissemination manager. The Exploitation Manager (ZOE), as dissemination and exploitation leader, will be in charge of uploading all dissemination activities to Funding & Tenders Portal. Every quarterly report time, a dissemination report shall be communicated to the JU.

Moreover, any dissemination activity will be reported in D5.4. *Report on Communication and Dissemination activities.*

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2.7. List of Dissemination activities

The next table summarises a provisional list of scientific (peer reviewed) publications and technical papers expected in the next years. Other potential journals in which scientific publications could be published are: Tribology International, Journal of Engineering Tribology and Surface and Coatings Technology. The list will be updated in each reporting period.

A1-**LIST OF SCIENTIFIC (PEER REVIEWED) PUBLICATIONS AND TECHNICAL PAPERS**										
No.	Title	Main author	Title of the periodical or the series or the event	Number, date or frequency (N/A for events)	Publisher or organiser	Place of publication or event venue	Year of publication or event	Relevant pages or event session	Permanent identifiers[3] (if available)	Is/Will open access[4] provided to this publication?
1	*Passive lubrication systems for gears in loss of lubrication conditions: A review*	*Join publication*	*Friction*	--	*Tsinghua University Press and Springer*	*N/A*	*2022*	*N/A*	N/A	YES
2	*Friction and Temperature of High Speed Gears under Loss of Lubrication*	*TUM*	*International Conference on Gears (ICG)* *Forschung im Ingenieurwesen*	--	*VDI / Engineering Research*	*Munich*	*2023*	*N/A*	*N/A*	YES
3	*Comparison of two-disc test rig and FZG gear test rig at high speeds.*	AC2T	*Tribology International*	--	Elsevier	N/A	2022	N/A	N/A	YES
4	*Influence of surface topography on friction power losses under extreme loading conditions.*	AC2T	*Tribology International*	--	Elsevier	N/A	2022	N/A	N/A	YES

[3] A permanent identifier should be a persistent link to the published version full text if open access or abstract if article is pay per view) or to the final manuscript accepted for publication (link to article in repository).

[4] Open Access is defined as free of charge access for anyone via Internet. Please answer "yes" if the open access to the publication is already established and also if the embargo period for open access is not yet over but you intend to establish open access afterwards.

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The table below lists the dissemination activities.

A2- LIST OF CONFERENCES AND OTHER DISSEMINATION ACTIVITIES									
No.	Type of activities[5]	Main leader	Title	Date/Period	Place	Type of audience[6]	Size of audience	Permanent identifiers ISBN	Countries addressed
1	*Oral presentation*	*AC2T*	*Influence of surface topography on friction power losses under extreme loading conditions*	*Nov. 2022*	*ICTIE001 2022:16. International Conference on Tribology and Interface Engineering*	*Scientific community*	*100-1000 attendees*		*International level*
2	*Poster presentation*	*ZOE*	*LUBGEAR: Surface design for aviation gears under extreme conditions*	*Sept. 2022*	*DLRK*	*Scientific community & industry*	*100-1000 attendees*		*International level*
3	*Oral presentation*	*FZG*	*Friction and Temperature of High Speed Gears under Loss of Lubrication*	*2023*	*10th International Conference on Gears*	*Scientific community & industry leaders*	*500-600 attendees*		*International level*
4	*Poster presentation*	*CID*	*Passive lubrication systems for gears in loss of lubrication conditions: A review*	*2023*	*24th International conference on Wear of Materials (WOM)*	*Scientific community*	*100-1000 attendees*		*International*
5									
6									

[5] Choose the dissemination activity: Conference publications, workshops presentations, conference presentations, conference exhibitions, conference posters, Other.

[6] Choose the type of public: Scientific Community (higher education, Research), Industry, Civil Society, Policy makers, Medias, Other ('multiple choices' is possible).

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3. COMMUNICATION ACTIONS

3.1. Communication Objectives

Through the dissemination and communication strategy the knowledge generated along the LUBGEAR project will be spread to the largest extent as possible. The strategy of communication includes the following objectives:

- To create communication material for the project partners' use
- To facilitate collaboration and information
- To perform targeted communication activities for different stakeholders

3.2. Communication Rules

There are some general rules that the dissemination activities must follow, according to the EU Regulations, the LUBGEAR Grant Agreement (article 38 – Promoting the action) and Implementation Agreement (article 11.3).

- **Obligation to promote the action and its results (article 38.1.1 of GA):**

  The beneficiaries must promote the action and its results, by providing targeted information to multiple audiences (including the media and the public) in a strategic and effective manner.

  This does not change the dissemination obligations in Article 29, the confidentiality obligations in Article 36 or the security obligations in Article 37, all of which still apply.

  Before engaging in a communication activity expected to have a major media impact, the beneficiaries must inform the JU (see Article 52).

- **Information needed to be included (article 38.1.2 of GA):**

  Unless the JU requests or agrees otherwise or unless it is impossible, any communication activity related to the action (including in electronic form, via social media, etc.) and any infrastructure, equipment and major results funded by the grant must:

  1) display the Clean Sky 2 JU Logo

  2) display the EU emblem, and

  3) include the following text:

  "This project has received funding from the Clean Sky 2 Joint Undertaking (JU) under grant agreement No 101007713. The JU receives support from the European Union's Horizon 2020 research and innovation programme and the Clean Sky 2 JU members other than the Union".

  When displayed together with another logo, the JU logo and the EU emblem must have appropriate prominence. The beneficiaries may use the JU logo and the EU emblem without first obtaining approval from the JU or the Commission. This does not however give them the right to exclusive use.

  Moreover, they may not appropriate the JU logo and the EU emblem or any similar trademark or logo, either by registration or by any other means.

- **Disclaimer excluding JU responsibility (article 38.1.3 of GA):**
  Any communication activity related to the action must indicate that it reflects only the author's view and that the JU is not responsible for any use that may be made of the information it contains.

3.3. Communication Strategy

Communication activities of LUBGEAR project aim to establish critical mass and commitment from all project partners (including the Topic Manager) and different stakeholders. Results from project activities will have to be efficiently communicated both within consortium, Topic Manager and Project Officer (internal communication) and to the widest possible community through various channels and instruments (external communication).

3.3.1. Internal Communication

Internal communication is focused to the channels of communication between the project partners (including the coordinator) and the topic manager. The primary, quickest and easiest means for being in contact with all partners in the LUBGEAR project will be:

- email,
- phone calls, and
- audio/videoconferences.

Project Officer will be contacted through the Portal communication/notifications. This will be used in parallel with the email (in case for example it is necessary to formally record a notification for a delay in reporting).

Personal communication will take place also in face-to-face meetings during the project, when circumstances so permit.

To make communication easier, a mailing and contact list is available, and a SharePoint is available to allow access to necessary documents and files. AC2T partner has habilitated access to their SharePoint to share documents with the coordinator. The TM has also access to this SharePoint.

3.3.2. External Communication

In the first 6 months of the project efforts have been directed to communicate project activities and the existence of the project itself to the European public, both general and specialised. LUBGEAR will use diverse communication channels to ensure maximum visibility for project activities and results.

All communications will be developed by dedicated communication experts within the consortium, skilled at translating the information of scientist and technicians into a language that is relevant for the aimed public.

The communication activities planned during the project are summarised in table A3 and below some additional information is shown.

Website:

Internet is one of the most effective tools for disseminating project results and serves as the central public showcase of the Project.

The partner´s websites will act as dissemination hubs, and news broadcast channel for all public information. CIDETEC, project coordinator, will host a website, which will contain documents and dissemination material produced as a part of the LUBGEAR project, such as press releases, newsletters, project brochures/flyers, conferences

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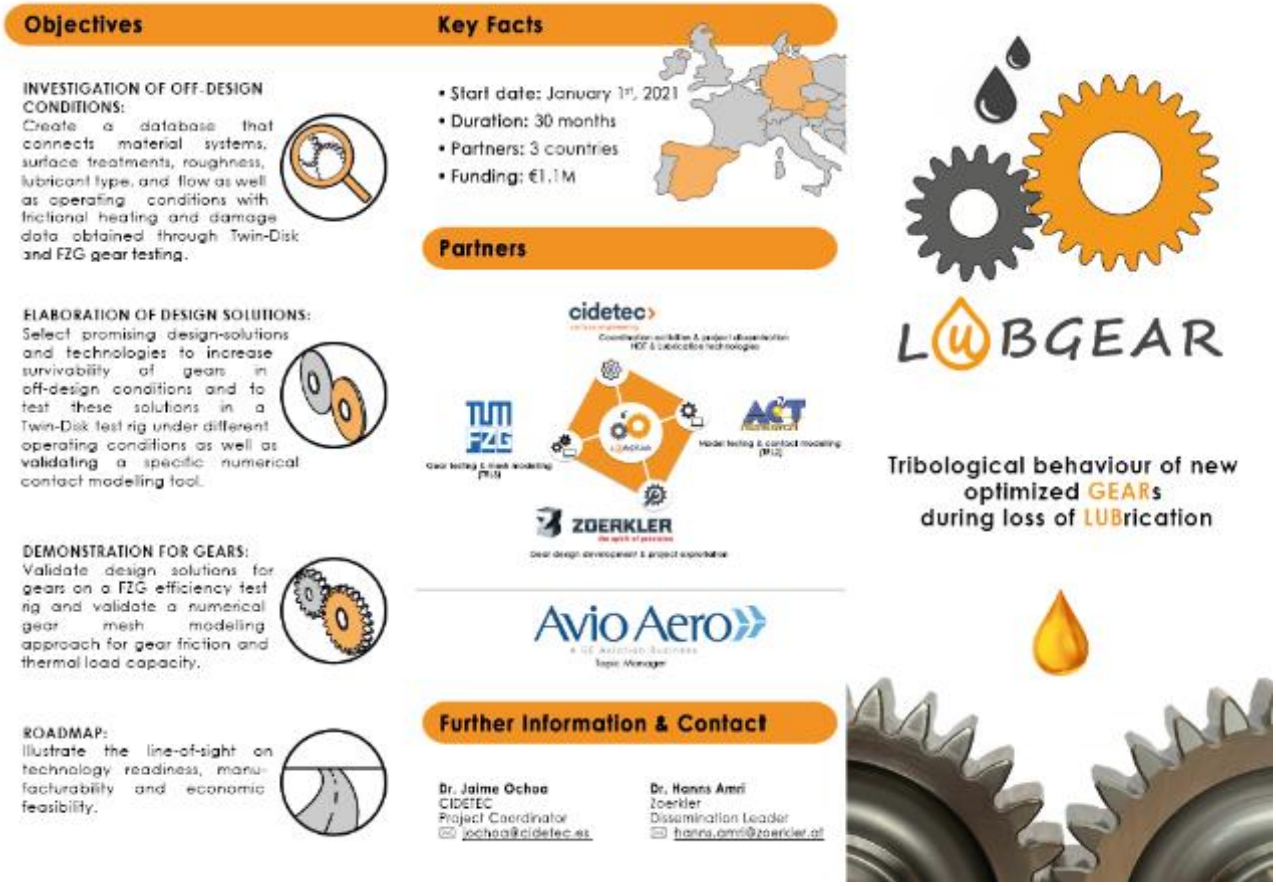
presentations, etc. It will be continuously updated throughout the project and will be a constant updated source of information for the interested stakeholders. CID and ZOE have already published first information about the LUBGEAR project at their websites.

The website is available since the beginning of 2021. The link for the website is below:

https://www.cidetec.es/en/projects/surface-engineering-6/lubgear-3

Flyer/brochure/poster:

The flyer is being created to inform a wide range of audience of the LUBGEAR project and enhance its visibility, ranging from the general public to scientific or industrial stakeholders. It is including the project logo, a brief description of the project, easy-to-understand graphics and the list of the partners. In the following figure, (Figure 1) the flyer is shown.



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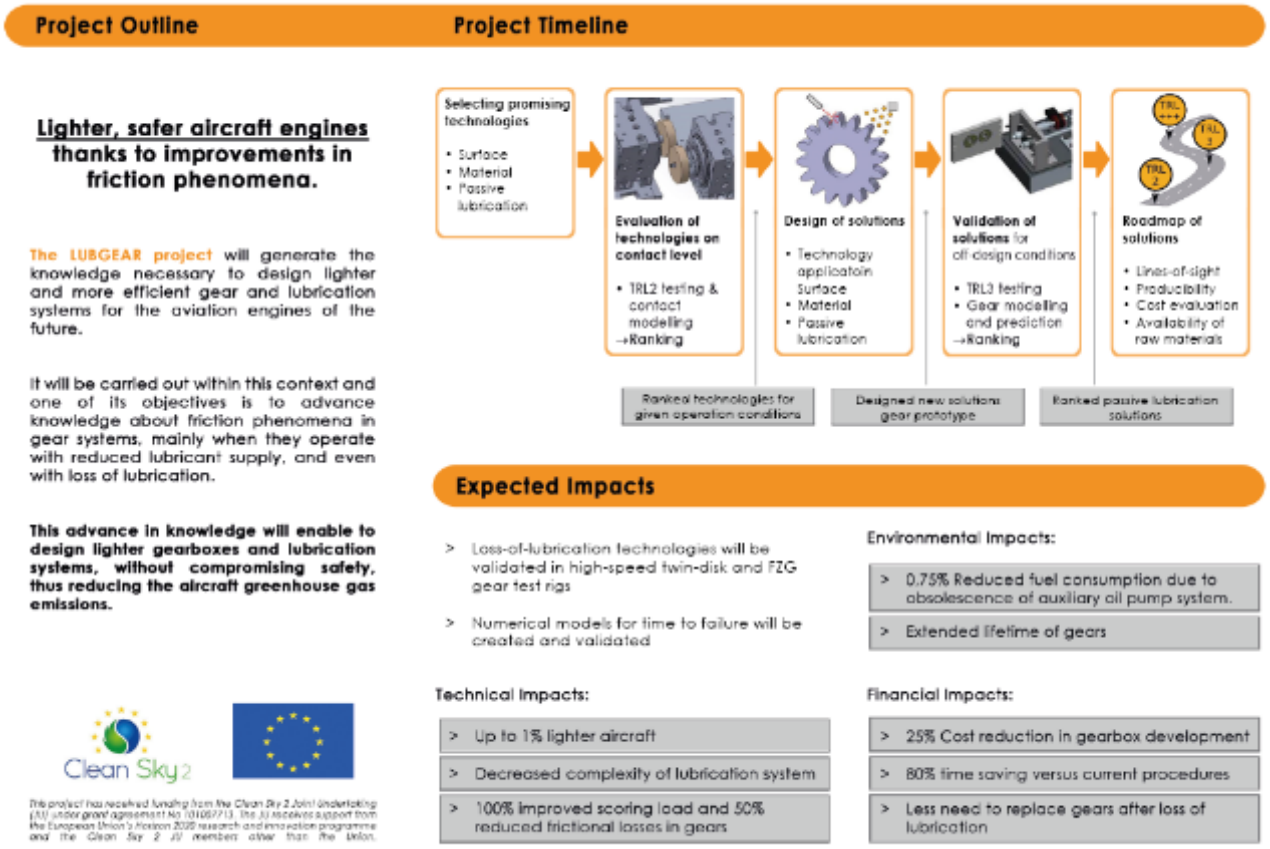

Figure 1. Flyer of the project

It will be published on the website and will be available for download by the end of 2021. It will be also distributed at the events attended by the partners in order to increase the visibility of the project and extend our network and contacts.

By the end of the project, a poster will be also made summarising the most relevant results obtained during the project.

Press media, and newsletters:

In order to promote and enhance the visibility of the project, periodic press release will be prepared and sent to different general public media and to specialised media like EASN (EASN newsletter), IntAirCoat (IntAirCoat newsletter), EFC (e)-Newsletter (CIDETEC is member of EFC), Clean Sky2 website (CS2 newsletter) or CORDIS Press Office. Technical notes will be used to present the main project results to a more specific industry audience. Till now a press release template (in English) has been prepared by CID and sent to all partners and the launch of the project has been announced by a technical note (in Spanish) in six national technical journals (Metalia.es, Estrategia Empresarial, Interempresas.net, Actualidad Aerospacial, Noticias-Aero.info and Red de Parques de Euskadi).

https://www.metalia.es/noticia.asp?id=4716

https://www.interempresas.net/Aeronautica/Articulos/325178-Motores-de-avion-mas-ligeros-y-seguros-gracias-a-las-mejoras-de-los-fenomenos-de-friccion.html

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https://actualidadaeroespacial.com/proyecto-lubgear-la-apuesta-por-los-motores-de-avion-mas-ligeros-y-seguros/

http://www.noticias-aero.info/2021/02/clean-sky-el-proyecto-lugbear-busca.html

https://parke.eus/es/motores-de-avion-mas-ligeros-y-seguros-gracias-a-las-mejoras-de-los-fenomenos-de-friccion/

During 2022 and 2023, at least 3 publications per year will be launched in English (to reach a wider audience).

Social media and viral micro-campaign:

Social media (LinkedIn, Facebook, Twitter, blogs, etc.) will be used for relevant news in short statements with a link to more detailed information on the LUBGEAR webpage. A viral micro-campaign with industry-dedicated webinars will also be used for creating awareness of alternative solutions, reporting project progress, untaken paths, benefits gained, collaborations created and/or test performance.

The launch of the project has been already announced in LinkedIn (see screenshots of Figure 2) and in future announcement the hashtag #H2020 will be used.

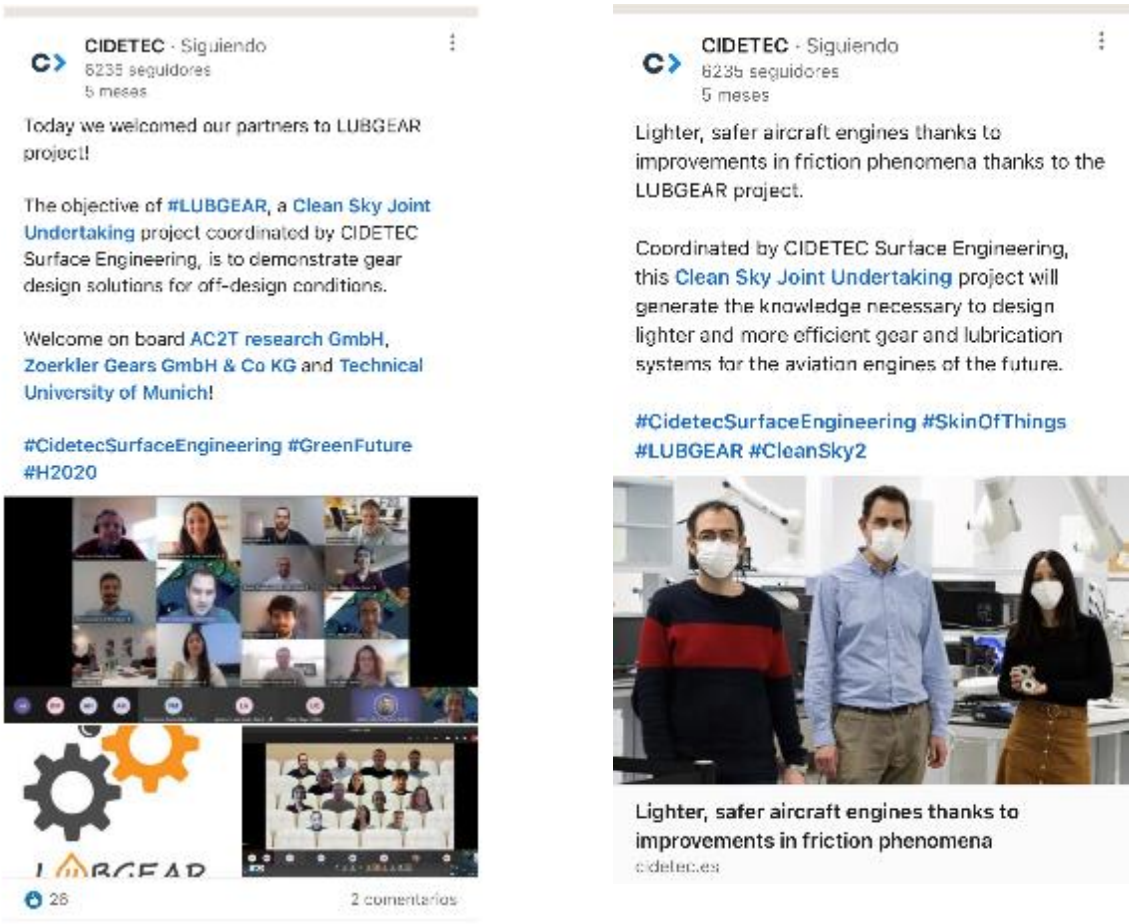

Figure 2: Announcement of the project launch in LinkedIn

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3.4. List of Communication activities

A3- LIST OF COMMUNICATION ACTIVITIES								
No.	Type of activities[7]	Main leader	Title/Subject	Date/Period	Place	Type of audience[8]	Size of audience	Countries addressed
1	Partners website	CID	N/A	During 2021	Partners website	General Public, Scientific Community, Industry, Policy makers, Media	1,000-10,000	International level
2	Press releases	CID/ZOE	To be defined	2 per year	Not yet established	Industry, Policy makers, Media, General Public,	1,000	National (ES, DE, AT) and international level
3	Flyers / Posters	ZOE/CID	Project title	First version almost finished	To be used in trade fairs / exhibitions / conferences / meetups	Scientific Community, Industry, Policy makers	1,000-10,000	International level
4	Newsletters	CID	To be defined	2 per year from 2022	EASN newsletter, IntAirCoat newsletter, EFC (e)-Newsletter, Clean Sky2 website (CS2 newsletter) or CORDIS Press Office	Scientific Community, Industry, Policy makers	1,000-10,000	International level
5	Social media	CID/ZOE	N/A	1 update every quarter	Mainly LinkedIn, Instragram	General Public, Scientific Community, Industry, Policy makers, Media	1,000-10,000	International level

[7] Choose the communication activity: web, press releases, flyers, articles published in the popular press, videos, media briefings, exhibitions, interviews, films, TV clips, posters, Other.

[8] Choose the type of public: Scientific Community (higher education, Research), Industry, Civil Society, Policy makers, Medias, Other ('multiple choices' is possible).

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4. EXPLOITATION PLAN

4.1. Introduction

The Exploitation Plan, included in the PEDR, is designed in order to multiply the impact of the proposed solutions and prepare the transition towards industrial and commercial uptake in order to fully achieve the expected impact. The Exploitation Plan will describe the activities to be undertaken (how and by whom) in order to ensure the exploitation beyond the project itself. The exploitation strategy will reflect and will be built-up as a result of sound analysis of the market trends, potential users, and financial sustainability. The target users will be precisely identified and analyzed in terms of specific needs and objectives.

Consortium partners will work as a driving force, boosting industry (SME and large companies) in its surrounding due to the consequences that each customer will have in their value-chain. Material suppliers, technology suppliers, end-user's value-chain and all involved entities around each customer of project partners will receive some impact. Drivetrain manufacturers will have the most direct impact, but the rest will also receive some benefits (financial or not).

4.1.1. Exploitation objectives

As a start point of the project, the following Key Exploitable Results have been identified, which include the use of background of the partners involved:

- **ER 1: Advance in knowledge about frictional behaviour** of different materials and designs in different lubrication conditions.
    - **ER 1.1: State of the Art review** on approaches of gear design solutions for the lubrication system will be offered (passive lubrication by tribo-active surfaces or self-lubricated coatings) as well as material, surface and geometric alternatives.
    - **ER 1.2: Adapted TRL2 test rig** and conclusions (D2.2).
    - **ER 1.3: Contact model to estimate frictional contact conditions and heating** (D2.3) validated at the end of WP2.
- **ER 2: Optimized gears** containing a passive lubrication solution for off-design conditions (preliminary designs plus selected ones based on numerical validation, and the hardware). Based on this knowledge, a roadmap for line-of-site solutions will be developed which will form the basis for new solutions which can be exploited by the TM.
    - **ER 2.1: Optimized gear (geometry)**.
    - **ER 2.2: Passive lubrication technologies** that work better in off-design conditions (self-lubricating materials, lubricants with additives).
- **ER 3: TRL3 testing and conclusions** (D4.4). It will enable faster new product development as the performance and **proof of concept will be easier to achieve.**
- **ER 4: Gear mesh model for friction and thermal load limit (**D4.5). **It will enable faster new product development** as the friction and thermal load limit can be estimated for gears operating at a lack of oil supply.

It is still the intention of the consortium to protect any commercially exploitable and innovative result by patent application or by the publication of project results (to convert them in state-of-the-art and avoid any limitation by partners), subject to case-by-case decision by the partners, together with the Topic Manager.

4.2. Exploitation strategy plan

The overall objective of the LUBGEAR exploitation plan is to identify and target stakeholders, including end-users and the public, in order to raise their awareness regarding the activities performed and the results

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achieved by the partners and by the consortium (as whole). At the same time, encourage stakeholders to support and adopt the consortium's recommendations regarding the access to research data.

The exploitation plan will also define the ownership so as to optimize the utilization and protection of the results.

Results generated under the project include both tangible and intangible outputs. Some of the results may be protectable, while business information or valuable know-how can be protected via contractual mechanisms, like non-disclosure agreements or as trade secrets.

According to the Grant Agreement (Article 28), measures aiming to ensure exploitation of results and technology transfer include:

- Using them in further research activities (outside LUBGEAR)
- Developing, creating or marketing a product or process
- Creating or providing a service
- Using them in standardization activities

Each partner may grant licenses to its results. Moreover, each partner must give each other, under fair and reasonable conditions, access to results needed for exploiting their own results.

All partners will ensure adequate transfer of the generated results to industry, researchers, academy and/or society to widespread the outcomes and knowledge upon protection of the foreground whenever necessary.

Stakeholders will play a double role, so their involvement in the exploitation plan will be fundamental. In the beginning of the project, stakeholders will contribute to acquire feedback on several aspects for the benefit on the exploitation of the results, such as market needs, barriers, potential demands, etc. After the first reporting period, when the exploitable results could be better defined, stakeholders' involvement will be more related to the generated results and the need to make them aware of the outcomes.

During and just after the end of the project, the partners will have a proactive attitude to contact stakeholders, associations, lobby groups and multiplier organizations during dissemination events (conferences, workshops, fairs, etc.) to reach as many stakeholders as possible.

Beyond the end of the project, an expansion phase could be considered if any of the exploitable results is launched into the market. In that case, the exploitation phase would include a business plan with a profit&loss account, long-term marketing measures, marketing approach (aeronautic sector or others), geographical scope, etc.

4.2.1. Exploitation audiences

The following list provides the audiences identified so far:

- Industry: CEOs, CTOs, R&D Managers
- Research institutions: senior researchers, group leaders, research project managers
- Academia: group leaders, research project managers
- Policy makers: staff of funding bodies, staff of regulation bodies

4.2.2. Exploitation Content

To this stage of the project no further exploitation content can be defined except from the identification of the Key Exploitable Results reported in 4.4.1. The exploitation content will be updated in the periodic reports and reported in D5

.2 Report on exploitation activities.

4.2.3. Exploitation activities

The exploitation activities which will be performed from each partner will be defined once the exploitable content will be fully defined. In the start phase of the project the partners have performed and will continue performing during the whole project duration a systematic observation, tracking, filtering out and assessment of any scientific or technical innovation with potential to create opportunities/synergies or avoid threats. For

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this purpose, technology watch web based tools are used to check for relevant patents, scientific publications or other funded projects.

- **Patent search results**

A patent analysis has been performed at proposal level in order to define the freedom to operate and was repeated in the first 6 months of the project to check if new patents have been released. *Espacenet, SciFinder, Semantic Scholar ResearchGate* and *Google patents* were used for the patents search and analysis using the keywords listed in Table 2.

Table 2. List of key words used for the patent search and results.

Key words used	Results found	Relevant for the project
Gearbox + aircraft	48	0
Gearbox + passive lubrication	25	0
Gearbox + scuffing	190	0
Gearbox + low-loss gears	18	1
Gearbox + scuffing + low-loss gears	1	1
Gearbox + aircraft	48	0

The search results have been analysed in two steps:

1) Tittles and summaries of the entire search results have been reviewed and, based on the provided information, a first selection of documents of interest has been carried out.
2) The full tests of the selected documents in step 1 have been revised and the documents closest to the project have been selected.

The most relevant results identified both at proposal level and during the first months of the projects are reported in Table 3.

Table 3: List of most relevant patents related LUBGEAR developments

Patent ref	Title	Inventor / Applicant	Pub Year	Relevance to the project	Comments/ updated information
CA2772754A1	Gearbox with passive lubrication system	Bell Helicopter Textron Inc (CA)	2012	MEDIUM (lubrication system with a reserve housing to retain a lubrication fluid even when the supply line no provides pressurized lubrication fluid to the reserve housing)	Active in US, CA, CN, EP, IN
US8602166B2	Secondary lubrication system with injectable additive	Sikorsky Aircraft Corp (US)	2006	MEDIUM (lubrication system with an additive and a delivery system that inject and mix it with lubricating oil in the	Active in US, WO

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Patent ref	Title	Inventor / Applicant	Pub Year	Relevance to the project	Comments/ updated information
				secondary oil reservoir and dispensed to the gearbox when oil-out condition is detected)	
US7174997B2	Failure tolerant passive lubrication system	United Technologies Corp (US)	2003	MEDIUM (auxiliary system to provide lubrication when the primary system fails)	Active in US, EP
EP1918564A2	Rotor brake and windmilling lubrication system for geared turbofan engine	United Technologies Corp (EP)	2006	MEDIUM (primary oil provides oil during driven operation of the fan and a secondary oil pump provides oil during windmilling operation of the fan)	Active in US, EP, JP
US9683652B2	Method for the delivery of lubricant to a rotorcraft gearbox	Bell Helicopter Textron Inc (US)	2015	LOW (rotorcraft to transmit the flow rate to a lubrication system)	Active in US, EP
US9765875B2	Lubrication systems for gearbox assemblies	Sikorsky Aircraft Corp	2016	LOW	
EP2855859A2 WO 2014/031194 A2	Direct feed auxiliary oil system for geared turbofan engine	United Technologies Corporation (US)	2019	LOW (auxiliary lubrication system including a pump and reservoir)	EP, WO
US8511435B2	Lubrication system with extended emergency operability	Raytheon Technologies Corp	2013	LOW (auxiliary lubrication system with separate lubricant reservoir)	US, EP
US9341115B2	Valve for controlling flow of a turbomachine fluid	Raytheon Technologies Corp	2013	LOW (Flow control valves restricts lubricant flow for negative G maneuvers)	US, WO, EP
US10578017B2	Windmill and negative-G oil system for geared turbofan engines	Raytheon Technologies Corp	2016	LOW (pump draws lubricant from two different	US, EP

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Patent ref	Title	Inventor / Applicant	Pub Year	Relevance to the project	Comments/ updated information
				sumps depending on positive- or negative-G maneuver)	
CA1118370A	Emergency oil/mist system	Avco Corp	1982	LOW (Pressurized lubricant tank is emptied in emergency situation)	CA (Expired)
EP3530887A1	Passive lubrication system for gas turbine engine gearbox during wind milling	General Electric Co	2019	LOW (scavenge port is closed during loss of lubrication, trapping lubricant)	US, JP, CN, EP
US 2019/0338847	Planetary gear carrier with hardened posts	Bell Helicopter Textron Inc.	2019	LOW (specialized hardened planetary gear carrier posts)	Low relevance but mentions several measures against LOL for rotorcraft: Gear design for minimized sliding, use of coarse pitch power gears, high-hot-hardness materials

As it was described in the LUBGEAR project proposal and in the DoA (Annex of GA), a patent analysis was performed before the proposal submission in order to identify if there was freedom to operate. In this first technology watch, it was observed that most of the found patents were focused on the efficiency and the secondary lubrication system of the gearbox mainly with new mechanisms, in contrast to the LUBGEAR project, which goes beyond, because it is focused on optimizing the surface and material design as well as the geometry of gears for operation in off-design conditions. **This situation is still the same at this moment (1 year after proposal submission)** (**Error! Reference source not found.**4). **No relevant patents for the p roject have been identified**.

The situation is still the same as confirmed by a new search performed during the first moths of the project.

- **Analysis of scientific publications**

SciFinder has been used to search for relevant scientific publications at proposal level. The search has been repeated during the first 6 months of the project using Scopus and focusing in recent publications (2020-2021) regarding the following topics:

- Gearbox AND Aircraft
- Gearbox AND coatings
- Gearbox AND passive lubrication
- Gearbox AND scuffing
- Gearbox AND low-loss gears

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The state of the art described in the DoA and the related references show a good analysis of the current status. Only three more recent publications relevant for the project have been identified (2020-2021):

- Bobzin, Kirsten; Brögelmann, Tobias; Kalscheuer, Christian; Thiex, Matthias; Schwarz, Andreas; Ebner, Martin; Lohner, Thomas; Stahl, Karsten. DLC coated spur gears–Part II: coating properties and potential for industrial use. *Industrial Lubrication and Tribology* (2021), 73(4), 621-634.
- Radil, Kevin; Berkebile, Steven. Failure Progression of Spur Gears during a Simulated Loss-of-Lubrication Event in a Rotorcraft Drive System. Tribology Transactions (2020), 63(4), 718-725.
- Riggs, Mark R.; Murthy, Nikhil K.; Berkebile, Stephen P.; Korenyi-Both, Andras L. Scuffing Resistance and Starved Lubrication Behavior in Helicopter Gear Steels Coated with Nanocomposite Surface Coatings with and without a Hard Sublayer. Tribology Transaction (2020), 63(4), 610-620.

Regarding scientific publications, during last years, different studies have been identified related to the use of several coatings, materials, heat treatments and lubricants with different additives to improve the friction reduction and power losses in gears. Some of these studies were carried out in lubricated conditions and at lower TRL (TRL1) and with FZG test rig. However, no studies were detected, that consider all alternatives and parameter combinations that will be take into account in LUBGEAR. Also, passive lubrication systems have been identified and some simulation studies for the failure progression of gears were found. **Focusing on the last year (after proposal submission), no new publications have been identified related to the study of the tribological behavior of gears, specifically in power gearboxes, that could help to optimize gears design for operation in off design conditions.** So, the state-of-the-art described and the references included in the DoA show a good analysis of the current status of those technologies.

After this analysis update, no new barrier or restriction has been identified, that could affect to the project itself, as significant differences in concept and the application fields have been found.

This technology watch exercise will continue during the rest of the project. If any publication or patent (even if it is a patent application) will be identified during the project by any partner, it will be communicated to consortium and Topic Manager to analyse its impact in the future exploitation of project results.

4.2.4. Responsibilities

ZOE will lead the dissemination and exploitation of results activities. As exploitation manager, he will ensure that IPR are protected and exploitation of results are always sought. His main duties will be the following:

- Update exploitable results and promote contacts with potential end users
- Provide regular feedback on the adequacy of research efforts towards the exploitation of related results
- Coordinating the exploitation activities and related IP management
- Addressing potential conflicts of interest between dissemination and exploitation including IPR issues

4.2.5. Approval/rejection process

Any partner that generates an exploitable result has to communicate it to the exploitation manager (ZOE), who will communicate to the rest of the partners, to identify if there is any disagreement or conflict. In this meeting, it will be discussed any possible joint ownerships of the foreground, protection method and possible exploitation route.

If approved, it will be included in the exploitable result list. This list will include all the exploitable results of the partners and will be included in the Periodic reports.

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4.3. Exploitation Means

4.3.1. Exploitation channels

The project will use channels to maximize the exploitation of the results aiming reaching the maximum number of stakeholders relevant for the exploitation of the project. The following exploitation channels have been selected:

- Project website hosted by CID and partners websites: Besides the general objectives of the project, it will include the main outcomes and results as well as contact to the project coordinator to facilitate engagement to the project.
- Presentations at conferences, seminars and workshops: Partners will participate in several events together with experts in the fields of LUBGEAR. The identified stakeholders will be present in these events, so the aim of attending these events is double: presenting the project results as dissemination activities but also engaging those stakeholders in the project to promote the exploitation activities.
- Fairs: To attract industry as stakeholders in the project, which could be valuable for exploitation of the project.
- Social media: To engage mainly standardization bodies and policy makers that can play a role during exploitation of results.

4.3.2. IPR & Exploitation instruments

Main exploitation activities will be performed by partners mainly in the last year of the project (when results are more visible) and will include:

i. IPR protection measures and management;
ii. Investigation of the project results technological and economic potential for use and exploitation;
iii. Identifying market barriers;
iv. Contact with potential users.

The Consortium Agreement (CA) and the Implementation Agreement (IA), signed within the first months of the project have clarified the pre-existing know-how of all the partners related to the research and development work planning during the project and the foreground knowledge ownership and access rights.

4.3.3. Business Plan

Not applicable at this stage of the project

4.3.4. Exploitation Risk analysis

Not applicable at this stage of the project

4.3.5. Policy for exploitation Material

Applications for protection of results (including patent applications) filed by or on behalf of a partner must include the following statement:

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4.3.6. Public Web Site

The partner´s websites will act as dissemination hubs, and news broadcast channel for all public information. CIDETEC, project coordinator, will host a website, which will contain documents and dissemination material produced as a part of the LUBGEAR project, such as press releases, newsletters, project brochures/flyers,

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conferences presentations, etc. It will be continuously updated throughout the project and will be a constant updated source of information for the interested stakeholders.

4.4. Reporting and data access

4.4.1. Storage

The partners will store all exploitation related material of the LUBGEAR project in the Share Point created by AC2T also to this purpose. It will enable the exploitation manager to collect these materials to update the annex of the annual report. Moreover, all partners will be responsible for keeping records of their own exploitation material produced by themselves and collect them in their own servers. According to Horizon H2020 rules, partners commit to archive and let accessible the information for re-use up to five years after the end of the project.

The LUBGEAR report on exploitation activities will be continuously updated by the ITD dissemination manager (ZOERKLER) and communicated to all partners and TM during the consortium meetings. The dissemination report will be updated each reporting period. It will list all the dissemination activities performed as well as the scientific publications according to peer-reviewed template tables provided by the EC.

4.4.2. Exploitation report

According to the H2020 rules, an update of the exploitation plan has to be provided at least at every periodic reporting time. I could be added to the project reporting documents. The consortium has to establish some indicators to measure the success of the exploitation activities, such as

- Expected number of stakeholder representatives involved in project's exploitation activities
- Number of conferences / international fairs / other events that partners will attend and will have participated in
- Circulation of information at local level in single countries
- Circulation of information on other websites and networks
- Feedback received over any dissemination or exploitation Number of scientific publications
- Number of coverages in specialised and general media
- Patent
- Utility model
- Trade Marks
- Industrial Design
- Copyright
- Confidentiality

These will be collected on an annual base by the exploitation Manager. The Exploitation Manager (ZOE), as dissemination and exploitation leader, will be in charge of uploading all exploitation activities to Funding & Tenders Portal. Every quarterly report time (Periodic Report), the progress performed in the dissemination shall be communicated to the JU.

4.4.3. Reporting to the JU

Quarterly reports (QR) delivered to the JU collect the exploitation activities carried out in each quarterly. Thus, regular feedback is provided to the JU delivering the QRs. Moreover, any exploitation activity will be reported in D5.2. *Report on Exploitation Activities.*

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4.5. List of potential exploitation

In this stage of the project no applications for patents, trademarks, registered designs, etc. have been performed nor are still planned.

TEMPLATE B1: LIST OF APPLICATIONS FOR PATENTS, TRADEMARKS, REGISTERED DESIGNS, ETC.						
No.	Type of IP Rights[9]:	Confidential YES/NO	Foreseen embargo date dd/mm/yyyy	Application reference(s) (e.g. EP123456)	Subject or title of application	Applicant (s) (as on the application)
1						

[9] Choose the type of IP rights: Patents, Trademarks, Registered designs, Utility models, Others.

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Part B2. At this stage of the project this table is not applicable. It will be completed forD6.2 Report on exploitation activities.

No.	Type of Exploitable Foreground[10]	Nature of Exploitable Foreground[8a]	Description of exploitable foreground	Confidential YES/NO	Foreseen embargo date dd/mm/yyyy	Exploitable product(s) or measure(s)	Sector(s) of application[11]	Timetable, commercial or any other use	Patents or other IPR exploitation (licences)	Owner & Other Beneficiary(s) involved

For each record in the above table is possible to further explain the exploitable foreground, in particular by addressing the following points:

Record No. 1:

a. Purpose of exploitable foreground
b. Achieved TRL at the end of period (where applicable)
c. How the foreground might be exploited, when and by whom
d. IPR exploitable measures taken so far or intended
e. Business case aspects considered (i.e. market study, opportunities, …)
f. Further research necessary, if any
g. Potential/expected impact (quantify where possible)
h. Role of ITD members towards potential commercialization of results
i. Relation to technical standards, EU/international regulations, directives

Record No. x:

10 Choose type of foreground: General advancement of knowledge, Commercial exploitation of R&D results, Exploitation of R&D results via standards, exploitation of results through EU policies, exploitation of results through (social) innovation.

8a Choose nature of foreground: Product innovation, Process innovation, New method, Scientific breakthrough

11 Choose the type sector (NACE nomenclature) : http://ec.europa.eu/competition/mergers/cases/index/nace_all.html

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5. CONCLUSIONS

This deliverable report is a preliminary plan for communication, dissemination, and exploitation activities for the next stages in the project. During the first months of the project, the main focus has been on setting up necessary online communication channels (i.e. visual identity, website, social media, brochures etc.) for presenting the project. Scientific dissemination, industrial collaboration, and exploitation activities will be intensified in the end of the project as more concrete results are obtained. The present document, which has been elaborated based on the inputs collected from the project partners up to M6, is expected to act as a point of reference for current and foreseen communication, dissemination and exploitation activities and will be continuously monitored and updated throughout the project duration, being circulated to the consortium for updates, corrections and/or amendments. The final plan will be completed in M30 and will be included in deliverables D5.2: Report on Exploitation Activities and D5.4: Report on Communication and Dissemination Activities.

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