



**Warning and Mitigation Technologies for Travelling
Ionospheric Disturbances Effects**

TechTIDE

D7.1

**TechTIDE Dissemination, Exploitation & Communication
Strategy**

Version 1.1

Grant agreement no: 776011

The TechTIDE has received funding from the European Commission Horizon 2020
research and innovation programme (2017 – 2020)



Table of Contents

Document Information.....	4
Abstract	5
Document history.....	5
Disclaimer	5
Executive Summary.....	6
1. 1. Introduction	7
1.1. Purpose and scope of the document	7
1.2. Approach and Document structure	7
1.3. List of figures	8
1.4. List of tables	8
1.5. List of abbreviations and acronyms	9
2. Project Objectives	10
3. Dissemination, Exploitation and Communication Goals	11
3.1. Maximum take-up of the project outcome	11
3.2. Boosting of research and innovation	11
3.3. Benefit for the EU citizens.....	11
4. Target Audiences	12
4.1. Overview on the network of potential users and stakeholders	12
4.2. Users of TechTIDE end products	12
4.3. Users of scientific models for post processing	12
4.4. Model Developers.....	12
4.5. Service Providers / Operators/ Space Agencies.....	12
4.6. General public	13
5. Key Messages.....	14
5.1. Purpose of the TechTIDE warning system	14
5.2. State of the Art.....	14
5.3. Benefit of the warning system	14
6. Dissemination Partners.....	16
7. Dissemination activities, tools, timing and responsibilities.....	18
7.1. Participation to scientific conferences and workshops	18
7.2. Journal Publication and Initiation of a Topical Issue.....	19



7.3.	Operate the TechTIDE warning system.....	19
7.4.	Knowledge management and protection strategy for the Intellectual Property Rights	19
7.5.	Data Management Plan	20
7.6.	Dissemination schedule	21
8.	Exploitation activities, tools, timing and responsibilities	22
8.1.	User Network	22
8.2.	User Workshops	22
8.2.1.	TechTIDE first workshop	22
8.2.2.	TechTIDE second workshop.....	22
8.2.3.	Final TechTIDE meeting	23
8.3.	Sustainability and expandability study	23
8.4.	User Support Center	23
8.5.	Exploitation schedule	24
9.	Communication activities, tools, timing and responsibilities.....	25
9.1.	Communication events	25
9.2.	Virtual Visit	25
9.3.	TechTIDE Leaflets	25
9.4.	TechTIDE logo and brochure	25
9.5.	TechTIDE Public Web Site	26
9.6.	TechTIDE e-newsletters	26
9.7.	Communication Schedule	26
10.	Evaluation.....	29
10.1.	Maximum take-up of the project outcome.....	29
10.2.	Boosting of research and innovation	29
10.3.	Benefit for the EU citizens	29
11.	Work Plan summary and status	30
11.1.	Dissemination	30
11.2.	Exploitation.....	30
11.3.	Communication	31



Document Information

Deliverable number:	D7.1
Deliverable title:	TechTIDE Dissemination, Exploitation & Communication Strategy
Date of Delivery:	31.01.2019
Author(s):	C. Borries, K.D. Missling, A. Belehaki, D. Altadill
Work Package no.:	7
Work Package title:	Dissemination, exploitation and communication activities
Work Package leader:	C. Borries
Dissemination level:	Public
Nature:	Report



Abstract

In the frame of the Horizon 2020 (H2020) call of the European Commission (EC), the project “Warning and Mitigation Technologies for Travelling Ionospheric Disturbances Effects” (TechTIDE) develops a system for the mitigation for the detection and monitoring and alert for Travelling ionospheric disturbances (TIDs). Effective dissemination, exploitation and communication activities are organized in this document. Furthermore, this document reports about their implementation. The TechTIDE dissemination, exploitation and communication activities include the establishment of an active users’ network, the organization of user workshops and the provision of online support for the users. Additionally, an assessment of the TechTIDE services (i.e. the TID warnings and its implementation in the mitigation chain of the users’ operations), the discussion of service level agreements (SLAs), and the dissemination of results towards the scientific community (through papers and presentations in conferences) are coordinated within this document.

Document history

Version	Date	Edited by	Reason for modification / Remarks
0.1	08.12.2017	C. Borries	Initial version
0.2	13.12.2017	C. Borries	- adoption of TechTIDE template - feedback from WP7 members
1.0	15.12.2017	C. Borries	First distribution in WP7
1.1	25.01.2019	C. Borries	Update of the document with status information on the activities

Disclaimer

This document contains description of the TechTIDE project findings, work and products. Certain parts of it might be under partner Intellectual Property Right (IPR) rules so, prior to using its content please contact the Project Coordinator (Dr Anna Belehaki, belehaki@noa.gr) for approval.

In case you believe that this document harms in any way IPR held by you as a person or as a representative of an entity, please do notify us immediately.

The authors of this document have taken all reasonable measures in order for its content to be accurate, consistent and lawful. However, neither the project consortium as a whole nor the individual partners that implicitly or explicitly participated in the creation and publication of this document hold any sort of responsibility that might occur as a result of using its content.

This publication has been produced with the assistance of the European Union. The content of this publication is the sole responsibility of the ESPAS consortium and can in no way be taken to reflect the views of the European Union.



Executive Summary

In the frame of the Horizon 2020 (H2020) call of the European Commission (EC), the project “Warning and Mitigation Technologies for Travelling Ionospheric Disturbances Effects” (TechTIDE) develops a system for the mitigation for the detection and monitoring and alert for Travelling ionospheric disturbances (TIDs). Effective dissemination, exploitation and communication activities are organized in this document. They have been selected and planned as appropriate means to address users and the public based on a dedicated assessment of the TechTIDE objectives and targeted audience. The TechTIDE dissemination, exploitation and communication activities include the establishment of an active users’ network, the organization of user workshops and the provision of online support for the users.

Additionally, an assessment of the TechTIDE services (i.e. the TID warnings and its implementation in the mitigation chain of the users’ operations), the discussion of service level agreements (SLAs), and the dissemination of results towards the scientific community (through papers and presentations in conferences) are coordinated within this document.

Furthermore, this document reports about their implementation. A detailed plan, which covers the whole time of the project activity, lists all targeted activities, their timing and their status.

1. 1. Introduction

1.1. Purpose and scope of the document

In the frame of the Horizon 2020 (H2020) call of the European Commission (EC), the project “Warning and Mitigation Technologies for Travelling Ionospheric Disturbances Effects” (TechTIDE) develops a system for the mitigation for the detection and monitoring and alert for Travelling ionospheric disturbances (TIDs). TIDs constitute a threat for operational systems using HF or transionospheric propagation. TIDs can impose disturbances of an amplitude of 20% of the ambient electron density and a Doppler shift of the level of 0.5Hz. Consequently, the direct and timely identification of TIDs is a clear customer’s requirement for the Space Weather segment of the ESA SSA Programme. The objective of this proposal is to address this need with setting up an operational system for the identification and tracking of TIDs, the estimation of their effects in the bottomside and topside ionosphere and for the issuing warnings to the users with estimated parameters of TID characteristics. Based on the information released from this warning system, the users, depending on their applications, will develop mitigation procedures. Workpackage 7 addresses dissemination, exploitation and communication activities. This document is an output from this workpackage and provides the delivery D7.1.

This document has been prepared by C. Borries in the frame of EU project TechTIDE - DLV-776011 with contribution from A. Belehaki and H. Barkmann.

Dissemination activities in TechTIDE project refer to sharing research results with potential users - peers in the research field, organizations operating services for the citizen’s safety and security, other commercial players and policymakers. Exploitation activities concerns with the use of results in public policymaking and with the investigation of its future commercialization potential. In this context, dissemination activities feed into exploitation.

During the kick off meeting of TechTIDE, the consortium discusses the strategy proposed for the dissemination, exploitation & communication activities, given the latest developments in the field. The dissemination, exploitation and communication plan will be updated at least once during the project lifetime, at month 18.

1.2. Approach and Document structure

This document describes the generation of the dissemination, exploitation and communication plan and its final status. An overview of the used approach is presented in Figure 1.

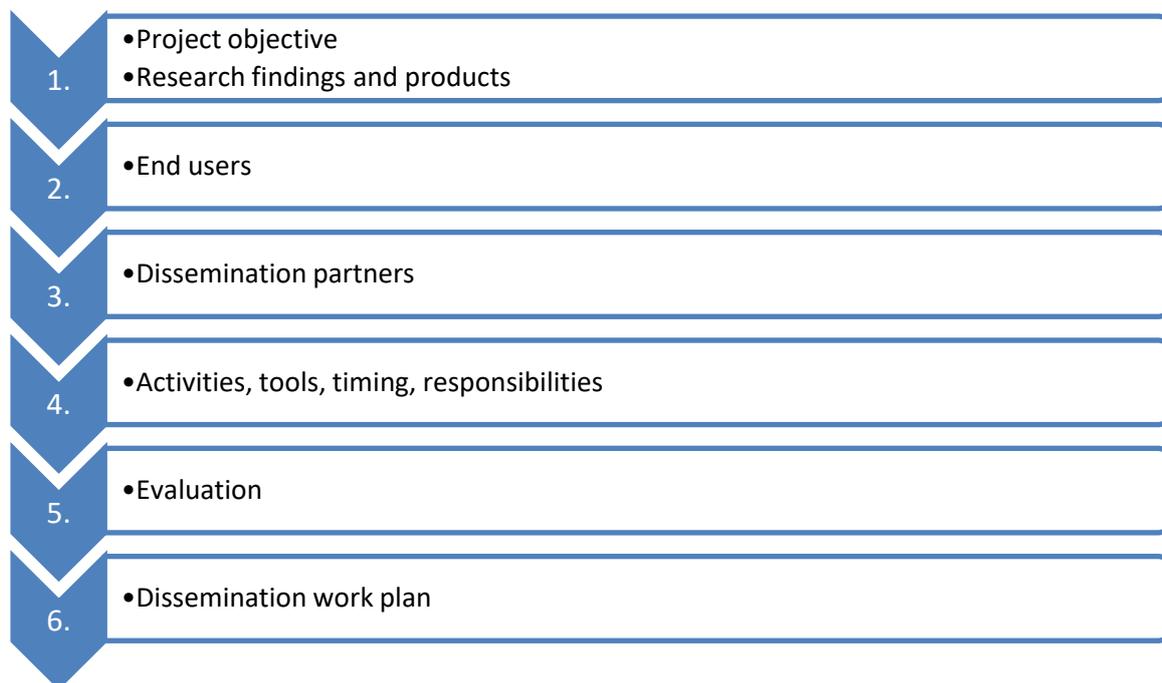


Figure 1 Scheme for the generation of the dissemination, exploitation and communication strategy.

At first, an assessment of the preconditions is presented. On the one hand, this includes the clear description of project objectives and research products, which are communicated. On the other hand, the targeted audience (end users) is described. Second, dissemination partners are identified. These are individuals, organizations or networks through whom we can reach end users. Third, the activities, tools, timing and responsibilities for dissemination, exploitation and communication are described. This forms the main part of this document. Finally, some methods for the evaluation of the results of the dissemination, exploitation and communication activities are described. Finally, a summary and clear work plan is described at the end of this document.

1.3. List of figures

Figure 1 Scheme for the generation of the dissemination, exploitation and communication strategy. 8
 Figure 2: Screen shot of the TechTIDE Knowledge Database. 20

1.4. List of tables

Table 7-1: Preliminary list of targeted scientific events to be used for dissemination of TechTIDE results 18
 Table 9-1 The schedule for the communication activities 26
 Table 11-1 Summary and status of dissemination actions..... 30
 Table 11-2 Summary and status of exploitation actions..... 30
 Table 11-3 Summary and status of communication actions 31

1.5. *List of abbreviations and acronyms*

BOM	Bureau Of Meteorology, Australia
COSPAR	Committee on Space Research
DLR	German Aerospace Center
EC	European Commission
EGNOS	European Geostationary Navigation Overlay Service
ESA	European Space Agency
ESSP	European Satellite Service Provider
EU	European Union
GA	General Assembly
GFP	German Federal Police
HF	High Frequency
IAP	Institute for Atmospheric Physics, Prague, Czech Republic
L-IAP	Leibnitz Institute for Atmospheric Physics, Kühlungsborn, Germany
NICT	National Institute of Information and Communications Technology, Japan
NOA	National Observatory of Athens
N-RTK	Network real-time kinematic
OE	Observatorio del Ebro Fundacion, Spain
RTD	Research Technology Development
SANSA	South African National Space Agency
SLA	Service Level Agreement
SME	Small and Medium size Enterprise
SSA	Space Situation Awareness
TID	Travelling Ionospheric Disturbance
UHF	Ultra High Frequency
UPC	Universitat Politecnica de Catalunya
US	United States
VHF	Very High Frequency



2. Project Objectives

The overarching objective of TechTIDE is to design and test new viable TID impact mitigation strategies for the technologies affected and in close collaboration with operators of these technologies, to demonstrate the added value of the proposed mitigation techniques which are based on TechTIDE products. To achieve this main goal, it is necessary to address the following specific objectives:

Improve understanding regarding the physical processes resulting in the formation of TIDs, and consequently to identify the drivers in the interplanetary medium, the magnetosphere and the atmosphere

1. Identify the impact of the TIDs on the space based navigation systems (mainly European Geostationary Navigation Overlay Service, EGNOS, services and Network Real-Time Kinematic, N-RTK) and on ground-based high frequency (HF) operations
2. Develop improved methodologies, suitable to support for the first time the direct, real-time identification and tracking of TIDs over wide world regions
3. Establish an operational system to issue warnings of the occurrence of TIDs over the region of Europe and South Africa, to estimate the parameters that specify the TID characteristics and the inferred perturbation, and provide all additional geophysical information to the users to help them assess the risks and to develop mitigation techniques, tailored to their applications;
4. Work systematically with potential users to assess the functionality, reliability and efficiency of the TechTIDE services paving the way to its systematic exploitation from users and to its sustainable operation

3. Dissemination, Exploitation and Communication Goals

Three goals for the TechTIDE dissemination and exploitation activities have been described in the proposal, which will be elaborated here.

3.1. Maximum take-up of the project outcome

The take-up of the project outcome shall be maximized for use by both the academic and operational sectors and for policy making including future commercialization potential

3.2. Boosting of research and innovation

With the dissemination activities, research & innovation shall be boosted not only among participants in TechTIDE but also amongst others who could benefit from the research conducted.

3.3. Benefit for the EU citizens

TechTIDE shall communicate its research results and disseminate its generated products to make sure that the funding received by the H2020 has been invested for the benefit of the EU citizens.

The results of the TechTIDE project to be applied in dissemination and exploitation activities are:

- Direct
 - TechTIDE warning products and services;
 - Metrics for the TID impact definition;
 - Mitigation plans for specific operations.
- Indirect
 - Better understanding of the TID triggering mechanisms;
 - Improved performance of EGNOS, N-RTK and HF operations leading to improved safety;
 - Awareness of users for Space Weather effects on their systems, better trained users, and better trained scientists/model developers.

4. Target Audiences

4.1. Overview on the network of potential users and stakeholders

The engagement with potential users and stakeholders is necessary in all phases of the project development in order to achieve the ambitious goals of the project. TechTIDE partners already work with industrial users and operators (especially DLR, IAP, SANSA, L-IAP and UPC). In addition, the two partners GFP and ESSP are direct users of TechTIDE products as they operate and provide public services. This gives a strong evidence for a solid connection between the TechTIDE consortium and potential users and stakeholders.

In the following subsections, we present potential TechTIDE users, which are grouped, based on their profile and expected benefits from TechTIDE products.

4.2. Users of TechTIDE end products

This type of users is interested only in TechTIDE results. They want to browse the warning system for a quick look on current TID activity in specific areas. TechTIDE offers the possibility to get TID characteristics for current and past conditions. These users are not interested in models or data.

4.3. Users of scientific models for post processing

Users of scientific models for post processing are for example air-traffic managers, or HF geolocation operators. They are interested in retrieving results for past periods and they are interested in finding TID activity results under similar geophysical conditions. TechTIDE offers them the possibility to use domain specific applications developed to serve pre-specified domains (for example navigation and air traffic control). Additionally, TechTIDE offers the possibility to query results using specific filters.

4.4. Model Developers

Model Developers are interested in applying the TechTIDE identification and warning methodologies for Research Technology Development (RTD) projects implementation (academic users, Small and Medium size Enterprises - SMEs, operators). Furthermore, they are interested in improving and validating models and post-event analysis. Therefore, TechTIDE will provide the possibilities for model developers to improve, validate and easily use TechTIDE scientific models. These models are available with open access through the TechTIDE repository. Furthermore, TechTIDE offers the possibility to work with the TechTIDE consortium to derive products useful for operations and mitigation activities and to prepare models for operational use. Also the possibility to execute and compare models outputs is provided by TechTIDE.

4.5. Service Providers / Operators/ Space Agencies

Service providers, operators and space agencies are interested in TechTIDE products and services for their own use and for sharing. TechTIDE offers them to test potential



improvements applying TechTIDE products in their production chain to mitigate Space Weather risks. This activity is planned in the framework of the three users' workshops.

4.6. General public

The impact of Space Weather in aerospace and ground systems has an enormous potential to generate a strong public interest and to attract and introduce young people to science topics. NOAA visitor's center hosts every year 8000 school students and 7000 visitors from the general public. Similar activities are developed in other partner organizations. This audience can be easily involved in activities that feature outreach talks, and even actual observations and data taking. Participants can directly experience how the research process and technology work.

5. Key Messages

5.1. *Purpose of the TechTIDE warning system*

TIDs are plasma density fluctuations that propagate as waves through the ionosphere at a wide range of velocities and frequencies. TIDs constitute a threat for operational systems using predictable ionospheric characteristics as they can impose significant disturbances in the ambient electron density and Doppler frequency shifts on HF signals. It is clearly demonstrated that TIDs can have multiple effects in the operation of aerospace and ground-based infrastructures and especially in the EGNOS and N-RTK services, in HF communications, in radio reconnaissance operations and in Very High Frequency – Ultra High Frequency (VHF-UHF) radiowave propagation. TIDs constitute a specific type of space weather phenomenon that can be solar-driven and/ or be driven by other processes acting below the ionosphere. Independent of their source, the effects imposed by TIDs at ionospheric altitudes are very important and for the user needs the source of TIDs is information of secondary importance.

5.2. *State of the Art*

Because of the high occurrence frequency of TIDs (almost daily), and the variety of their characteristics regarding their velocity, propagation direction and amplitude, their identification and tracking is very complicated and has not been achieved in operational service mode.

5.3. *Benefit of the warning system*

The following achievements, which are expected at the end of the TechTIDE activity, shall be communicated to the users.

TID identification

TechTIDE will deliver a comprehensive system for TID identification, with an activity metrics report and recommended mitigation strategies for aerospace and ground-based operations.

TID in real-time

TechTIDE will provide for the first time direct identification of TIDs in real-time based on 8 different and complementary detection techniques.

Novel methods

Data from Digisondes, GNSS receivers and Doppler stations collected simultaneously from experiments operated in the European and South African regions will support novel studies on the TID triggering mechanisms including their intensification due to interhemispheric circulation. In addition TechTIDE provides an open access model repository, which provides



the basic codes of TechTIDE TID identification methodology. This is an interesting resource that can be used by users of scientific models.

Fill the gap

TechTIDE will fill in the gap in the current SSA ensemble of federated services, satisfying the requests of Trans-ionospheric domain for accurate ionospheric specification and especially for TIDs nowcasting.

Compliance to ESA SSA

TechTIDE will be compliant to the ESA SSA technical specifications and will use as much as possible data from other SSA services. Consequently, TechTIDE can be easily integrated to the SSA services.

6. Dissemination Partners

Dissemination partners are individuals, organizations or networks, who are not part of the TechTIDE consortium, through whom TechTIDE can reach end users. Following dissemination partners have been identified:

- "Real Time Ionosphere Monitoring - Working Group (RTIM-WG)" which is within the International Association of Geodesy (IAG).
- "International Reference Ionosphere - Working Group (IRI) which is within URSI and COSPAR."
 - IAG Commission 4: Positioning and Applications, Subcommittee 4.3
Atmosphere remote sensing
 - WG 4.3.1 Real-time Ionosphere Monitoring Chair: Alberto Garcia-Rigo (Spain)
Vice-Chair: David Roma Dollase (Spain)
 - WG 4.3.2 Ionosphere Predictions Chair: Mainul Hoque (Germany)
- "The Spanish General Directorate of Civil Protection and Emergencies".
- Air navigation service providers (ANSPs). ESSP maintains contact to Spanish and French ANSPs.
- Journal „Mycoordinates“ (a GNSS magazine). Publication on TechTIDE features
- Space weather websites such as <http://spaceweather.com/> . Distribution of information on the project
- Journal for Space Weather and Space Science. Scientific publication of project results.
- Projects linked with TechTIDE:
 - ESA SSA: Space Weather Expert Service Centre Definition and Development, A. Glover, F. Da Dalt
 - H2020: LOFAR4SW, Mark Bentum, ASTRON,
 - H2020: TREASURE, L. Alfonsi, INGV
 - H2020 ARISE2, Project Coordinator, Prof. Elisabeth Blanc
- Interested Institutes and partners:
 - Spanish Directorate of Civil Protection and Emergencies, Álvaro de la Peña Cuesta
 - NVIS Researcher, Telecommunication Engineering, University of Twente, The Netherlands, Dr. Ing. B. A. Witvliet
 - Department of Geodesy and Geodynamics, RIGTC, Prof. Pavel Novak
 - Lowell Digisonde International, LLC, Prof. Bodo Reinisch



- SEPLA, Ariel Shocrón Croitoru
- Radio Communication Agency of Netherlands, B.T.
- GEW Technologies South Africa, Hannes Coetzee
- Airborne Operations & Geodesy, ICGC, Spain, Ernest Bosch Llopart
- Coordinated Community Modelling Center (CCMC), M. Kusnezova

7. Dissemination activities, tools, timing and responsibilities

Dissemination activities in TechTIDE project refer to sharing research results with potential users - peers in the research field, organizations operating services for the citizens' safety and security, other commercial players and policymakers. The dissemination plan includes organization of TechTIDE special sessions in the frames of some of the major conferences, i.e. EGU GA, URSI GASS, COSPAR, ESWW, IES, ION GNSS, CHAPMAN/AGU, with scientific and technical presentations of TechTIDE key outcomes. The purpose of the presentations in workshops will be the dissemination of the project results to scientific communities about the possibilities that TechTIDE offers with its Open Science policy (open access to codes, to methodologies to data). Special action will be taken for presenting the results of the project to events organized by the ESA Space Situational Awareness Programme. The leader of WP7 (DLR) is the coordinator of the Ionospheric Weather Expert Service Centre of the ESA SSA Programme and therefore good links between TechTIDE and ESA SSA will be established since the early phases of the project with dedicated presentations in ESA relevant meetings.

All dissemination activities and results will be summarized by DLR and provided in month M30.

7.1. *Participation to scientific conferences and workshops*

TechTIDE outcomes will be regularly disseminated through presentations/feature articles and research papers in peer review journals, posters, demonstrations and tutorials at key events. The consortium has already identified a preliminary list of targeted events in the Table 7-1.

Table 7-1: Preliminary list of targeted scientific events to be used for dissemination of TechTIDE results

Venue/ Channel	Impact
European Geosciences Union General Assembly.	Aware the research community of the TechTIDE developments with the aim to receive updates on the latest achievements and feedback.
European Space Weather Week Organize splinter session and participate in the fair	Making people aware of the TechTIDE developments with the aim to promote opportunities of using TechTIDE services and applications in critical operations, especially targeting to European Space Agency operations; aware service developers about the TechTIDE tools to support RTD projects.
ION International Technical Meetings	Promotion of the TechTIDE products and mitigation solutions, discussing opportunities for improvement and enhancement.



Venue/ Channel		Impact
International Symposium	Ionospheric Effects	Promotion of the TechTIDE products and mitigation solutions, discussing opportunities for improvement and enhancement.
COSPAR GA and URSI GA and Atlantic Radio Science meeting		Promotion of TechTIDE as a main system that supports excellence in Space Weather impacts in the ionosphere.

7.2. *Journal Publication and Initiation of a Topical Issue*

The TechTIDE team, together with two parallel running H2020 projects related to space weather and upper atmosphere, initiated the publication of a topical issue in the Journal for Space Weather and Space Climate (JSWSC). In this topical issue, JSWSC will publish relevant and mature project results from these three H2020 activities.

7.3. *Operate the TechTIDE warning system*

Operate the TechTIDE warning system through which the main results will be distributed. The warning system will reach a TRL 5 by the end of the project. Its robust operation should allow users to perform experiments and in the final phase of the project, to negotiate with the consortium on Service Level Agreements (SLAs). The purpose of the SLAs is to systematically assess the reliability and performance of the TechTIDE services. This activity will allow the initiation of discussions with large organizations and space agencies for the future integration of TechTIDE services in their operations. For example, a gap identified by the European Space Agency (ESA) in the Space Situation Awareness (SSA) Programme's Space Weather Services is the identification and tracking of TIDs. TechTIDE will be in the position to provide a robust solution and fill in this gap.

7.4. *Knowledge management and protection strategy for the Intellectual Property Rights*

The consortium commits to the Horizon2020 Open Access mandates and intends to embrace all possible Open Access roads known today. These include Gold Open Access, Green Open Access and self-archiving for publications. With this objective, the consortium partners will privilege Open Access journals or non-Open Access journals that support the Green road. They will rely on dedicated funding from their research projects and/or institutions and store originals or pre-prints of their publications into their organization's repository or, in absence of such repositories, into OpenAIRE's Zenodo for publications. Similar strategies will be adopted for research data, using thematic data repositories and alternatively OpenAIRE's Zenodo. The basic principles that the TechTIDE consortium will adopt for knowledge management are already agreed in the Consortium Agreement (already signed by the TechTIDE partners) and include the following elements based on the DESCA H2020 Model CA:

- Background IP (data, models, computer codes, products etc.) must be provided to other project partners, if needed for the project.
- Foreground IP (data, models, computer codes, products etc.) is owned by the partner who generated the IP.
- Foreground IP will be openly available during the project for use within the project, but its wider dissemination should be reasonably protected (e.g. CCBYNCSA) and can be widely disseminated with the Executive Board permission.
- If possible and reasonable, commercially exploitable Foreground IP will be protected through registration and patenting.
- The consortium members are expected to disseminate their project results, subject to protection of the IP, and to do so in open access journals.

A dedicated Knowledge Database has been established by DLR in month M3 and is maintained and updated as necessary throughout the project. A screen shot of the TechTIDE Knowledge Database, which is located in the TechTIDE Wiki, is shown in Figure 2.

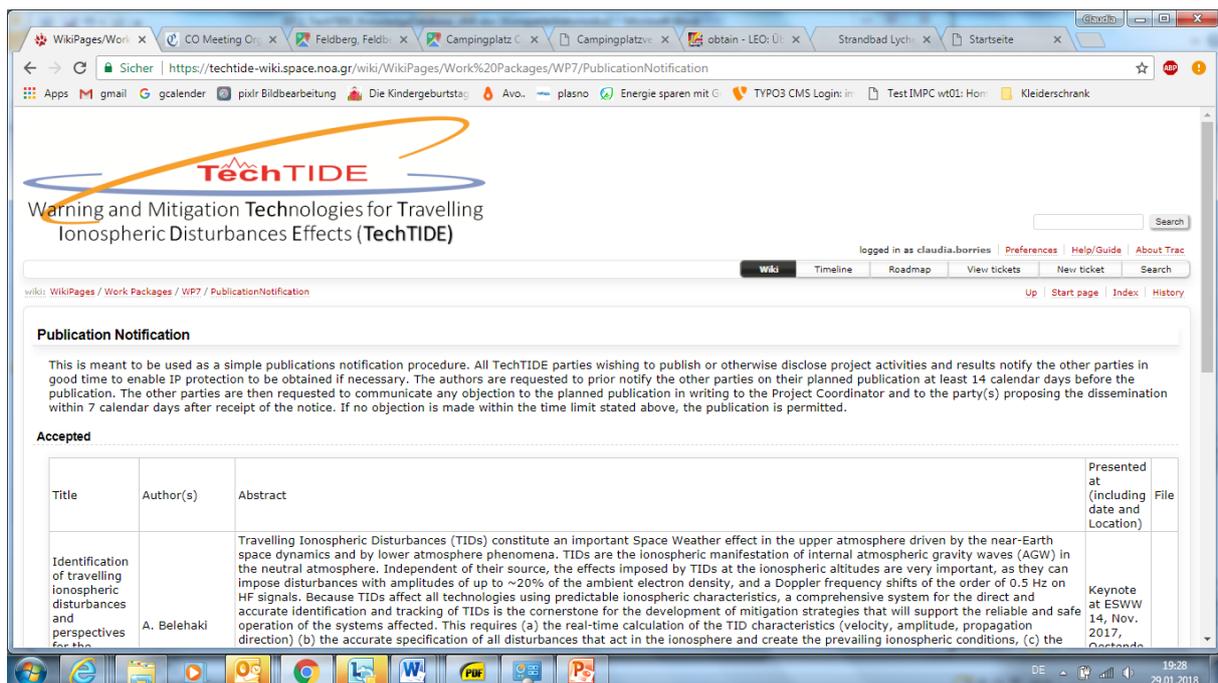


Figure 2: Screen shot of the TechTIDE Knowledge Database.

The establishment and maintenance of the TechTIDE Knowledge Database has been described in the TechTIDE deliverable D7.2.

7.5. Data Management Plan

In order to comply with Horizon2020's Data Pilot, TechTIDE will elaborate and implement a project strategy and operational model concerning publishing of data manipulated by the TechTIDE consortium. Specifically, aspects of representation standards for primary content

and data, as well as their metadata, data sharing, metadata-based documentation of services and workflows, data provenance, attribution and citation, archiving and preservation will be dealt with, in order to ensure discoverability, accessibility, measurability, intelligibility, standardization and interoperability via the production of a data management plan.

The TechTIDE data management plan has been provided by DLR in month M6.

7.6. Dissemination schedule

Action	Timing	Responsibility
Dissemination results	M30	DLR
Knowledge Management Database	M3	DLR
Data Management Plan	M6	DLR
7 th IAGA/ICMA/SCOSTEP Workshop	Jul 2018	IAP
ION GNSS+ 2018	Sep 2018	-
ESWW15	Nov 2018	NOA, DLR
EGU 2019	April 2019	IAP et al.
16 th IES	-	-
COSPAR 2018	July 2018	OE et al.
URSI GA	2019	NOA et al.
Topical Issue JSWSC	2019	NOA, DLR
ESWW16	Nov 2019	NOA et al.

8. Exploitation activities, tools, timing and responsibilities

Exploitation activities concerns with the use of results in public policymaking and with the investigation of its future commercialization potential. In this context, dissemination activities feed into exploitation.

All exploitation results will be summarized in a report by ESSP and provided in month M30.

8.1. User Network

A user network is going to be established. The TechTIDE team chose the TechTIDE Forum, which is linked on the TechTIDE website, as appropriate means for networking. It allows the registration of users (without publishing user details), communications between users and scientists/ developers and the announcement of events and TechTIDE activities.

8.2. User Workshops

As soon as the network is established, the following meetings will be organized.

8.2.1. TechTIDE first workshop

The first user workshop will follow very soon after the first release of the TechTIDE prototype which is in April. This workshop is organised on the 15th May 2019 at the premises of DLR in Neustrelitz Germany. DLR provides a website with information on the workshop, its objectives, the organization and the venue. Users can register via this website and submit abstracts for presentations. The workshop has been advertised with flyers and presentations at the European Space Weather Week 2018. Additionally, it has been announced in the third TechTIDE Newsletter. Next, mailing lists of radio amateurs and navigation users are explored and are intended to be used to spread further the information about the workshop.

Training sessions are going to be organized, having as primary objective to aware the potential users about the impacts of TIDs on their systems, about the basic prediction principles and about the basic functionalities of the TechTIDE warning system. Users are encouraged to present their applications and requirements for the provision of TID information. A discussion is going to be organized on how to report problems, questions, recommendations for improvements.

8.2.2. TechTIDE second workshop

This workshop will be linked with the second release of the TechTIDE prototype. The goal is (a) to receive feedback from groups from their experience in using the first Release, (b) to introduce the updates and functionalities of the second release. Based on this, efforts will be made to further adjust the TechTIDE functionalities to meet user needs, as long as this does not introduce risks for the Technology Readiness Level of the TechTIDE services. Participants will be asked to propose experiments in order to develop mitigation technologies and procedures. A discussion with the most systematic users will be initiated on the potential of TechTIDE to cover their operational needs and consequently the consortium will discuss the

possibility to sign with some users a Service Level Agreement (SLA) that maybe a shadow SLA (penalty free).

This workshop is going to be organized by IAP in Prague at Villa Lanna. It will take place in October 2019.

8.2.3. Final TechTIDE meeting

This workshop will be connected with the final release: The members of the TechTIDE network, the consortium participants and all stakeholders will be invited. The meeting will address technical, policy, organizational and sustainability issues. Selected users will be invited to present their experience on the improvements reached with the application of the mitigation techniques designed based on TechTIDE results. This workshop will be organized by NOA in month M30.

8.3. Sustainability and expandability study

TechTIDE will release open access services (data and products). Its sustainable operation will be based on the demonstration of the usefulness of these services for the operations sector and for researchers. In TechTIDE consortium two partners GFP and ESSP operate services (HF and EGNOS operations). Starting with these two partners we will assess the suitability of the final products. In addition we will analyze and position TechTIDE within a value chain that would fulfil requirements of the users of current structures and attracts new ones who need the specific services. It is important to note that TechTIDE will deliver unique services as no other system worldwide provides specification of TechTIDE activity in real-time.

The assessment of the results from the SLA negotiations in WP7 and the technological maturity of the warning system together with the assessment satisfaction of the partners who are using the system routinely, will provide an indication for the potential of the commercialization of the services that should be the objective of a follow up activity, after the end of the EU funding project. This possibility will be analyzed in the final report of the project.

TechTIDE products will cover the European and African regions. An expansion of international collaborations will be pursued. TechTIDE partners have good contacts with NICT in Japan and with BOM in Australia in collaboration framework of research projects that are under implementation. Also collaboration exists with US and European research organizations. The purpose is the expansion of the TechTIDE geographic coverage with the accommodation of data from other world regions.

8.4. User Support Center

To keep an active dialogue with the users, the TechTIDE users support center has been developed in form of a discussion forum for users' support and contact. NOA is taking charge of the management and administration of the TechTIDE forum. Information about the TechTIDE forum has been spread via the TechTIDE newsletter.



8.5. Exploitation schedule

Action	Timing	Responsibility
Thematic Workshop of the ESA SSA Space Weather Network	Oct 2018	NOA, DLR
Discussion Forum	M18	NOA
1st User Workshop	M18	DLR
2nd User Workshop	M24	IAP
3rd User Workshop/ Final TechTIDE Meeting	M30	NOA
Exploitation results	M30	ESSP
Report on TechTIDE workshops and the final meeting	M30	DLR

9. Communication activities, tools, timing and responsibilities

Communication activities are a set of events targeted to the awareness of the public about the impacts of Space Weather on systems using the ionosphere for its operations (release of leaflets for the public and for schools, organize presentations in the visitors center of NOA and use of electronic media such as the virtual visit). Specific events will be organized for the schools and for radio amateurs. The communication plan is analytically presented in section 3.2. As part of the communication plan, the project will participate at national and European outreach events (Athens science festival, EU Researchers' Night, etc.). All communication activities will be summarized by NOA in a communication results final report and provided in month 30.

9.1. *Communication events*

Public outreach presentations for:

- School students,
- Radio amateurs and
- General public

Targeted communication events will be organized for radio-amateurs who follow closely the activities of NOA (are systematic users of the DIAS services) and are interested in real-time ionospheric specification data for reliable communications. These events will be organized by NOA after the first release of the TechTIDE system.

NOA will take care of organizing the contributions to the European Researchers Night in September 2019. Additionally, NOA will organize presentations at the Athens Science Festival in March 2019 and March 2020 (dates TBC). FU will contribute to the science festival in Cyprus.

9.2. *Virtual Visit*

A virtual visit to the monitoring the equipment of the TechTIDE network in Europe and South Africa and to the working places where the models are developed can be provided by online 360° panoramas and virtual reality techniques/ headsets that are becoming increasingly affordable to anyone recently. The TechTIDE virtual visit will be prepared by ESSP.

9.3. *TechTIDE Leaflets*

TechTIDE leaflets have been prepared and published for the general public. The leaflets are provided in Greek, English, Spain and German. OE provided the leaflet for the general public in month May 2018. Another leaflet for the schools is going to be provided by NOA in the first half of 2019.

9.4. *TechTIDE logo and brochure*

The logo and brochure and were designed soon after the project was approved for funding. The TechTIDE logo and brochure were provided by NOA in month M2.

9.5. *TechTIDE Public Web Site*

The TechTIDE portal is central to the dissemination strategy, acting as a multi-functional gateway to a range of resources and materials (i.e., manuals and guidelines, publications, workshops presentations and proceedings, repository for the TechTIDE detection codes and relevant documentation) and to the TechTIDE services. All communication activities will be featured on the public TechTIDE web site to increase the overall visibility of the TechTIDE EU project. The TechTIDE website has been developed and is maintained by NOA. The initial website was provided in month M2.

9.6. *TechTIDE e-newsletters*

The TechTIDE newsletters are distributed electronically to the members of the TechTIDE network. A new issue is released every 3 months, highlighting key achievements, community news, events organized by the project and other relevant activities. DLR generated a template and procedures for the generation of the newsletter and compiles the newsletters regularly based on information received from the TechTIDE consortium. An archive of the newsletters will be provided by NOA in month M30.

9.7. *Communication Schedule*

Table 9-1 The schedule for the communication activities

Activity	Timing	Responsibility
Leaflet for the general public	M3	OE
Leaflet for the school students	M19	NOA
European Researchers Night	September 2018	NOA
European Researchers Night	September 2019	NOA
Athens Science Festival	March 2019 (dates TBC)	NOA
Athens Science Festival	March 2020 (dates TBC)	NOA
Cyprus Science Festival	Tbd	FU
Conference in the framework of the International Women's Day	M28	OE
Social media events using social networks, digital videos.	Starting M2	OE
Local and regional press release	M16	OE
Conference in the framework of a divulgative project called	M8	OE

Activity	Timing	Responsibility
Ciènciaprop (projecte devoted to the dissemination of science, technology and its applications since 2013)		
Conference in the framework of the Spanish Week of Science Festival	M25	OE
Conference "10th Anniversary of CZ in ESA",	-	IAP
Presentation for schools on the web	M19	NOA
Presentation for the public on the web	M19	NOA
Virtual visit	M19	ESSP
Event organized for the public in NOA	M19	NOA
Event organized for the public in NOA	M26	NOA
Event organized for radio amateurs in NOA	M19	NOA
Event organized for radio amateurs in NOA	M28	NOA
E-newsletter	M8	DLR
E-newsletter	M11	DLR
E-newsletter	M14	DLR
E-newsletter	M17	DLR
E-newsletter	M20	DLR
E-newsletter	M23	DLR
E-newsletter	M26	DLR
E-newsletter	M29	DLR
Newsletter archive	M30	NOA
TechTIDE website	M2	NOA



Activity	Timing	Responsibility
TechTIDE brochure	M2	NOA
TechTIDE logo	M2	NOA
Communication results final report	M30	NOA

10. Evaluation

With the evaluation of the success of the TechTIDE's dissemination, exploitation and communication efforts, we want to show how well we met the dissemination, exploitation and communication goals.

10.1. Maximum take-up of the project outcome

Following parameters are capable to indicate the take-up of the project outcome:

- Number of posts in the discussion forum
- Number of registered users
- Number of website visits
- Number of participants in the outreach and dissemination events
- Number of participants in the users' workshops

10.2. Boosting of research and innovation

Following parameters are capable to indicate the boosting of research and innovation:

- Number of journal papers
- Number of conference and workshop presentations
- Number of downloads of the TechTIDE open access codes

10.3. Benefit for the EU citizens

Following parameters are capable to indicate benefit for the EU citizens:

- Number requirements expressed by users during TechTIDE which could be integrated into the final requirements document
- Number of public events performed by TechTIDE
- Number of TechTIDE users discussing with the consortium about the use of TechTIDE data and products to support their mitigation technologies

11. Work Plan summary and status

11.1. Dissemination

Table 11-1 Summary and status of dissemination actions

Action	Timing	Responsibility	Status
Dissemination results	M30	DLR	open
Knowledge Management Database	M3	DLR	completed
Data Management Plan	M6	DLR	completed
EGU 2018	April 2018	IAP et al.	completed
7th IAGA/ICMA/SCOSTEP Workshop	Jul 2018	IAP	completed
ION GNSS+ 2018	Sep 2018	-	skipped
ESWW15	Nov 2018	NOA, DLR	completed
EGU 2019	April 2019	IAP et al.	In preparation
16 th IES	-	-	-
COSPAR 2018	July 2018	OE	completed
URSI GA	May 2018	NOA et al.	completed
Topical Issue JSWSC	2019	NOA, DLR	In preparation
ESWW16	November 2019	NOA et al.	In preparation

11.2. Exploitation

Table 11-2 Summary and status of exploitation actions

Action	Timing	Responsibility	Status
Thematic Workshop of the ESA SSA Space Weather Network	Oct 2018	NOA, DLR	completed
TechTIDE Discussion Forum	M19	NOA	in progress

1st User Workshop	M18		DLR	In preparation
2nd User Workshop	M24		IAP	In preparation
3rd User Workshop/ Final TechTIDE Meeting	M30		NOA	open
Exploitation results	M30		ESSP	open
Report on TechTIDE workshops and the final meeting	M30		DLR	open

11.3. Communication

Table 11-3 Summary and status of communication actions

Activity	Timing	Responsibility	Status
Leaflet for the general public	M3	OE	completed
Leaflet for the school students	M19	NOA	open
European Researchers Night	September 2018	NOA	completed
European Researchers Night	September 2019	Tbd	open
Athens Science Festival	March 2019 (dates TBC)	NOA	open
Athens Science Festival	March 2020 (dates TBC)	NOA	open
Cyprus Science Festival	Tbd	FU	open
Conference in the framework of the International Day of Women and Girls in Science, 11 February 2020	M28	OE	open
Social media events using social networks, digital videos.	starting M2	OE	completed

Activity	Timing	Responsibility	Status
Local and regional press release	M16	OE	open
Conference in the framework of a divulgative project called Ciènciaprop (projecte devoted to the dissemination of science, technology and its applications since 2013)	M8	OE	completed
Conference in the framework of the Spanish Week of Science Festival	M25	OE	open
Conference "10th Anniversary of CZ in ESA",	Nov 2018	IAP	completed
Presentation for schools on the web	M19	NOA	open
Presentation for the public on the web	M19	NOA	open
Virtual visit	M19	ESSP	open
Event for the public in NOA	M19	NOA	open
Event organized for the public in NOA	M19	NOA	open
Event organized for radio amateurs in NOA	M26	NOA	open
Event organized for radio amateurs in NOA	M28	NOA	open
E-newsletter	M8	DLR	Completed
E-newsletter	M11	DLR	completed
E-newsletter	M14	DLR	completed
E-newsletter	M17	DLR	open



Activity	Timing	Responsibility	Status
E-newsletter	M20	DLR	open
E-newsletter	M23	DLR	open
E-newsletter	M26	DLR	open
E-newsletter	M29	DLR	open
Newsletter archive	M30	NOA	open
TechTIDE website	M2	NOA	completed
TechTIDE brochure	M2	NOA	competed
TechTIDE logo	M2	NOA	completed
Communication results final report	M30	NOA	open