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How Galileo Planning became automated

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Abstract

Galileo[1] is one of the four worldwide Global Navigation Satellite Systems (GNSS). Being a programme of the European Commission (EC)[2], the Galileo Service provision is under the responsibility of the GNSS Service Agency (GSA)[3], who in turn contracted the Galileo Service Operations (GSOp) to Spaceopal GmbH[4]. The Spaceopal Planning Team is in charge of coordinating all Galileo operations and infrastructure activities. In July 2018 the team took on the task to automate all GSOp internal planning processes. Galileo planning involves three timelines: a Short-Term plan (STP), two Mid-Term plans (MTP), one for the Operational (OPE) and one for the Validation (VAL) Chain, and a Long-Term plan (LTP). The activities in these timeframes cover all entities working on Galileo. The three planning levels are interlinked and dependent on each other. But the original set up had these four plans handled not only by different tools, but also by different teams, complicating or even preventing resolution of interdependencies between the planning processes and plans itself. This paper describes how the different plans and timelines were taken over by the Spaceopal Planning Team and moved into the Galileo Planning Tool (GPT). An interface to the GPT was developed to allow all MTP actors to provide inputs via a standard planning input sheet directly into the activities of the current timeline, which are then sent to the SPO Planning Team. These inputs are automatically imported into the GPT eliminating any human error or additional intervention. For this process, a transitioning period was necessary and new processes had to be set up and documented. The result is that now the plans are interlinked: not only via communication channels, but also via automatic linking of the activities within the tool. Also the processes and output from the weekly planning meetings are now identical every week. But these were only the first steps to fully complete the automation and this paper will also give an outlook of what else is to come.

Keywords: Galileo Programme, Navigation, Planning Process, Automation

Acronyms/Abbreviations

CW	–	Calendar Week
EC	–	European Commission
GfR	–	DLR Gesellschaft für Raumfahrtanwendungen (GfR) mbH
GPT	–	Galileo Planning Tool
GSA	–	The GNSS Service Agency
GSOC	–	German Space Operations Centre
GSOp	–	Galileo Service Operator
GNSS	–	Global Navigation Satellite System
LTP	–	Long-Term plan

[1] The Galileo contract (GSA/CD/14/14) is carried out under a programme funded by the European Union and. In any case, it is clarified that the opinions expressed herein are those of the authors of this only and do not represent the official position of the European Union or the GNSS Agency.
[2] https://ec.europa.eu/growth/sectors/space/galileo_en
[3] https://www.gsa.europa.eu/
[4] http://spaceopal.com/

MoM	–	Minutes of Meeting
MTP	–	Mid-Term
OPE	–	Galileo Operational Chain plan
Pinta	–	Program for Interactive Time Analysis
SDT	–	Support Desk Tool
SPO	–	Spaceopal GmbH
STP	–	Short-Term plan
TPZ	–	Telespazio
VAL	–	Galileo Validation Chain

1. Introduction

Galileo is one of the four worldwide Global Navigation Satellite Systems (GNSS). The programme in general is under the responsibility of the European Commission, who has commissioned the Galileo Service provision to the GNSS Service Agency (GSA). The Service provision includes different contracts, one of which is the Galileo Service Operations (GSOp) contract that was awarded to Spaceopal GmbH in 2016[5]. Spaceopal GmbH, with headquarters in Munich, is a joint venture founded in 2009 by the partners DLR Gesellschaft für Raumfahrtanwendungen (GfR) mbH [6] and Telespazio S.p.A. [7] (a Leonardo and Thales Company). As Service Operator of the Galileo system, Spaceopal GmbH provides high-quality navigation and timing for users worldwide.

The fully established constellation and infrastructure of Galileo consists of 30 satellites distributed over three orbital planes, approx. 20 sensor stations for monitoring the navigation signals, two satellite control centres – one each in Oberpfaffenhofen (Bavaria, Germany) and in Fucino (Abruzzo, Italy), the GNSS Service Center in Torrejón de Ardoz (Spain), several mission-uplink stations and S-Band stations for satellite monitoring and control.

The Spaceopal Planning Team is one of many teams within Spaceopal working with several subcontractors on ensuring the Service Operations for the Galileo fleet of spacecraft and all above mentioned infrastructures. Spaceopal ensures that operations and maintenance as well as evolutions of the system run smoothly and without interruptions at all times, so that the service to the user is continuously provided. Users around the world these days already utilize Galileo for single and dual frequency positioning down to the m-level. In order to ensure smoothly running operations and maintenance activities, the planning for these activities also needs to run smoothly, seamlessly, and without errors.

For this, Galileo Planning is run via three different timelines (see Fig. 1): A Long-Term plan (LTP), covering the high level activities over the next 15 months, a Mid-Term plan (MTP), covering the next 12 weeks in rough detail of weekly activities, and a Short-Term plan, covering the next 10 days, providing slots for all activities down to minute precision (See Figure 1). Very obviously these plans depend on each other and all details need to be correct at all times. To make sure this is the case, ideally these plans need to be run with the same tool, that allows to connect the plans with each other, showing impacts, relationships, delays, approvals, cancellations, and the final completion of the tasks themselves. Also human error needs to be minimized - as we all know copy-paste actions can be highly erroneous and working with excel sheets for several hours can easily lead to unwanted mistakes due to fatigue or loss of concentration.

[5] https://www.gsa.europa.eu/galileo/services/initial-services
[6] http://www.dlr.de/gfr/en/
[7] https://www.telespazio.com

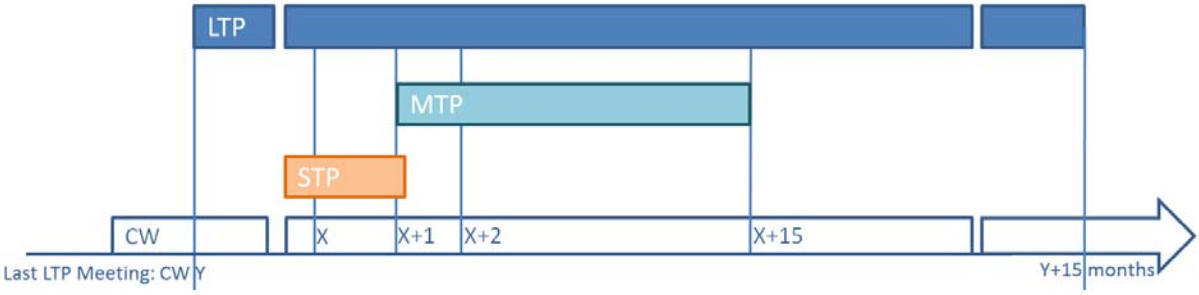

Fig.1. LTP-MTP-STP Timelines (not to scale)

Therefore, the GSOp Planning team took on the action in 2018 to join all these plans together, reduce sources of human error to an absolute minimum, and thus automate all internal planning processes as much as possible. This paper will first describe the old setup and its problems and why a change was absolutely unavoidable. Then we will describe the steps that need to be taken in order to automate the planning processes and give details on the steps that we have already taken and what the current state of the planning processes is. At the end, a brief summary will be provided about where problems still exist and how they can be solved. We will also give an outlook on the steps that still need to be taken to finalize the automation of our processes.

2. Galileo Planning processes of the past

Out of the three timelines LTP, MTP, and STP, the MTP is again split up into two plans – one for the Operational (OPE) Chain and one for the Validation (VAL) Chain. Both the OPE MTP and the VAL MTP are interdependent: e.g. if an activity changes something major in the overall system, it first needs to be validated on the VAL Chain to make sure it is correct, before it will receive the permission to be installed in the OPE Chain. As the Validation Chain is in its nature more linked to the evolution of engineering developments, whilst the OPE Chain is directly connected to the Service Operations side of Galileo, historically these two plans were handled by different teams. It is obvious that, in order for these two plans to be linked properly to each other, it is mandatory to have an excellent communication between these two teams. This communication can either be established via a technical interface between two tools or via verbal communication between two people, but one of the two at least has to be ensured. Unfortunately, again out of historical reasons, the OPE MTP and VAL MTP were originally handled not only by different teams, but also by different tools, making the interaction dependent on verbal communication. But as we all know, working under pressure with strict deadlines often makes this communication difficult, if not even sometimes impossible. Therefore merging VAL and OPE MTP both into the same team and the same tool was absolutely mandatory.

As for the LTP and the STP, they were handled by the same team, but this was again a different team than the two handling OPE and VAL MTP. And also LTP and STP were dealt with in different tools. So in summary we were originally talking about 4 plans across 3 timelines being handled by 3 different teams in 3 different tools. Communication was possible, but very difficult, complicating or sometimes even preventing resolution of interdependencies between the planning processes and the plans themselves.

3. Galileo Planning processes of the present

3.1 The move of the plans into one tool

The tool of choice for merging these four plans was already decided as part of the GSOp contract: GPT – the Galileo Planning Tool. A screenshot can be seen in Fig. 2. The associated colour coding is explained in Fig. 3. The GPT is a tool developed by the German Space Operations Center (GSOC). [8]It is based on its generic planning system and adapted to the needs of the Galileo Programme. The GPT consist of the following three components:

[8] https://www.dlr.de/rb/en/desktopdefault.aspx/tabid-6816/4256_read-6303/

- PINTA (Program for Interactive Timeline Analysis) – an interactive planning and visualization tool. PINTA is optimally suitable for performing the planning process, from its modelling including the definition of resources, tasks, and constraints up to automated time-based scheduling. With the aid of conflict indicators and resource usage visualization, furthermore an intuitive and straight-forward manual timeline modification is possible. Besides providing numerous generic information import and export functionalities and a plug-in mechanism for project-specific extensions, PINTA provides an interface to the mission planning database and the PLATO library.
- PLATO (PLAnning TOol) – an extremely fast and intelligent scheduling library. The strengths of PLATO are the flexible and descriptive modeling capabilities and the high-performant, multi-threaded engine with extensive support for creating custom algorithms. Generic algorithms are available, which can be combined and extended using a dedicated plug-in mechanism, and thus can be used to cover the common scheduling requirements.
- TimOnWeb (Timeline On Web) – a flexible visualization tool for the mission timeline, based on the PINTA and PLATO libraries.

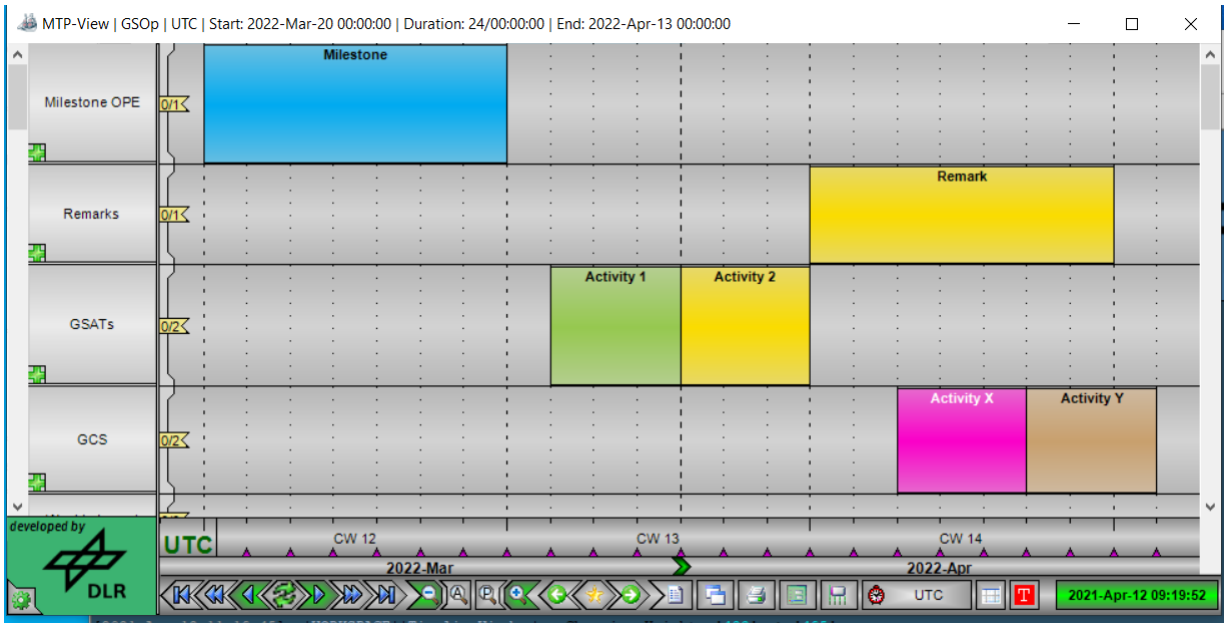

Fig.2. Screenshot of the GPT

Fig.3. GPT Colour Coding

The GPT was actually already in use – it was the tool used for the Long-Term plan. So the first transition necessary was to move the MTP into the GPT.

To do that, one has to first consider the amount of entries that need to be moved – round about 150 for OPE and 50 for the VAL. Luckily an import function was available to import the content of the OPE MTP from its old tool to the new tool. The VAL MTP had to be transferred manually from Excel to the GPT. It is mandatory that these entries are being moved absolutely correctly, no details may get lost or skipped.

Once the actual data is transferred and the tool is set up, it has to be considered that we are not only talking about a tool change, but also of a team change, meaning neither OPE nor VAL MTP were so far lead by SPO Planning, only the LTP and STP were. So, in addition to the tool, technology, and associated process change a knowledge transfer was necessary.

Additionally we are not talking about static plans, but plans in motion that are being updated regularly, e.g. the MTP is updated weekly. Meaning any data transfer that needs to include a knowledge transfer has to be accompanied by a continuous weekly update of two plans in parallel. In short, also training of the new team by the old team has to happen before any handover of the meeting may take place.

And even if all of this works well, then it cannot be forgotten that the participation to both meetings includes between 25 and 50 people with distribution lists of up to 300 email addresses, including not only individuals, but also team email addresses. This means that a change has to also include people change management in order for everyone to feel picked up and comfortable with the change. The change of a tool and team can only be successful if the participants know what is going on and what is expected of them.

Last, but not least, as the tool was so far never before used for the Mid-Term plan meeting, it proved to be complicated and clumsy at the beginning. The programming and set up of the GPT was quite challenging and it took several iterations to set it up to work properly for the meeting. For a general update of the tool to improve the performance during the meeting a cooperation with GSOC was necessary. For this we started three week development sprints [1] in order to make the necessary changes to adapt the GPT to the MTP requirements and make it work smoother and easier.

These are the challenges that had to be tackled for the change to be possible:

- Data Transfer from OPE Tool PME to GPT
- Data Transfer from VAL Tool Excel to GPT
- Setup and programming of GPT
- Knowledge transfer / Training from OPE Team to SPO Planning Team
- Knowledge transfer / Training from VAL Team to SPO Planning Team
- Planning process changes
- People Change Management
- GPT Sprints to adapt the tool to the meeting requirements

In order to do all this we went through the following motions:

1. Transfer the OPE MTP from the old tool (PME) to the new tool (GPT)
2. Run the OPE MTP parallel for several weeks, ensuring that all entries are complete, and allowing on-the-job training to take place
3. Only once the OPE MTP was successfully established in GPT, it was possible to move the VAL MTP to GPT as well
4. For the VAL MTP also parallel running of the tools was necessary to allow training and proper tool setup to take place
5. Once the tools were set up and it was clear a change of team would be manageable, the participants needed to be informed
6. The tool was introduced to the participants of the MTP and the Minutes of Meeting (MoMs) were updated to a common content structure and layout
7. For a few meetings the old and new output were provided together with the MoMs, giving everyone time to adapt
8. The change from the old tool to the new tool was completed

For a detailed schedule of this transition, please refer to Table 1.

CW	OPE MTP	VAL MTP
17/2018	PME	Excel
18/2018	PME – Parallel Start of GPT	Excel
22/2018	PME	Excel – Parallel Start of GPT
30/2018	PME – GPT was introduced to the OPE Community	Excel
31/2018	PME used, GPT sent out as reference	Excel – GPT was introduced to the VAL Community
32/2018	GPT used for the first time for the OPE MTP	Excel used, GPT sent out as reference
37/2018	GPT	GPT used for the first time for the VAL MTP
38/2018	GPT	GPT

Table 1. Transition of OPE and VAL MTP to the GPT – Tools used

3.2 The first step of automation

At this point, three out of four plans (OPE MTP, VAL MTP, LTP) were merged into one tool. Also all four plans were by now handled by one team only - the SPO Planning Team. Thus it was time for us to look at the inputs we received - because all inputs so far still had to be inserted manually. The amount of inputs varied greatly, depending on the week, between a few and several dozen and manual implementation is very time intense and error prone. Therefore we came up with a solution that would enable everyone to work on the original timeline, meaning actually edit the current entries, provide the inputs to us, and then allow us to import these via the click of a button.

The import process is the following:

1. The MTP exports a weekly Excel sheet (see Fig. 4) with all activities in the relevant timeframe and all necessary details of the activities
2. A tool was created that can read in this Excel file (see Fig. 5)
3. Once the Excel file is loaded, the user can choose his or her activity and change, duplicate, cancel, or also create a new entry.
4. Once all inputs for the next week are created, the user can then use the Export function, which will open an email, already addressed to the correct email address and with the correct attachment. All that is left to do is hit Send.
5. Once the SPO Planning Team receives the message, we can then again import the input by the user into the same tool. As administrators, we have 2 extra functions:
    a. Input Groups (The Import of the User inputs into the MTP Tool)
    b. Export to GPT (The Preparation of the inputs from the MTP tool to the GPT)
6. Through the click of these 2 buttons a file is generated that can be read by the GPT.

MTP Output for CW09

#

Start CW	Start Date	End CW	End Date	Resource	Activity Name	SDT Ticket	Description	Status
CW01	30.12.2019	CW12	19.03.2020	GSMC/FR				To Be Re-Planned
CW08	16.02.2020	CW17	19.04.2020	Ground Stations/GSS/FUC_GSS KIR_GSS				Approved for Planning
~~CW08~~	~~17.02.2020~~	~~CW11~~	~~08.03.2020~~	~~GSAT / 0220~~				~~Canceled~~
CW09	23.02.2020	CW11	08.03.2020	GMS/GMS_D & GSMC/FR				Approved for Planning
CW09	24.02.2020	CW10	02.03.2020	GSAT / 0216				Approved for Planning
CW10	02.03.2020	CW10	02.03.2020	Ground Stations/ULS/KOU_ULS				Approved for Planning
CW10	02.03.2020	CW10	04.03.2020	GSAT / 0204				Approved for Planning
CW10	02.03.2020	CW10	04.03.2020	GCS/GCS_D / FDF_D				Approved for Planning
CW10	02.03.2020	CW11	08.03.2020	GSAT / 0205 0206 0210				Approved for Planning
CW10	02.03.2020	CW11	08.03.2020	GMS/GMS_I/GACF_I MGF_I MUCF_I				Approved for Planning
CW10	02.03.2020	CW11	08.03.2020	GSAT / 0102 0103				Approved for Planning
CW10	02.03.2020	CW11	08.03.2020	GSAT / 0201 0202 0214 0216 0218 0222				Approved for Planning
CW10	02.03.2020	CW11	08.03.2020	GSAT / 0207 0212				Approved for Planning
CW10	02.03.2020	CW14	29.03.2020	Remarks				Pending Approval
CW10	02.03.2020	CW19	03.05.2020	Remarks				Approved for Planning
CW10	03.03.2020	CW10	03.03.2020	Ground Stations/ULS/KOU_ULS				Approved for Planning
CW10	03.03.2020	CW10	03.03.2020	GMS/GMS_D/TSP_D				Approved for Planning
CW10	03.03.2020	CW10	05.03.2020	Ground Stations/ULS/PAP_ULS				Approved for Planning
CW10	03.03.2020	CW10	06.03.2020	GMS/GMS_D/OSPF_D				Approved for Planning
CW10	04.03.2020	CW10	04.03.2020	Ground Stations/ULS/KOU_ULS				Approved for Planning
CW10	05.03.2020	CW10	05.03.2020	Ground Stations/TTCF/NOU_TTCF				Open

Fig.4. MTP Weekly Export

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New | Change | Import PINTA | Export | Settings | Export to PINTA | Input Groups

File Used: LTP#36-MTP_OPE_GPT_CW44_v1.0-Annex-1.xlsx

CW	Start Date	End Date	Duration	MTP Branches	Name of Activity	SDT	ARTS
3	13.01.2020	19.01.2020	6 Days	Ground Stations/ULS/RED_GSS		-	-
3	13.01.2020	19.01.2020	6 Days	GMS / GMS_I			
3	13.01.2020	19.01.2020	6 Days	GSAT / 0203 0204 0219 0220 0221			
3	13.01.2020	19.01.2020	6 Days	Ground Stations/ULS/AZO_GSS		-	-
3	13.01.2020	19.01.2020	6 Days	Milestone			
3	13.01.2020	19.01.2020	6 Days	Ground Stations/ULS/FUC_GSS		-	-
3	13.01.2020	19.01.2020	6 Days	Ground Stations/ULS/KIR_GSS		-	-
4	20.01.2020	26.01.2020	6 Days	GSAT / 0203 0204			
4	20.01.2020	09.02.2020	2 Weeks	GSAT / 0209			

Fig.5. MTP Tool

Together with GSOC, a plug-in was created, that allows one to select the correct Import File. GPT then reads in the file and creates the activities in the right calendar week and in the right location in the tool.

Also in this step, the change management was essential, both for the process to function, as well as for the development of the MTP tool. The participants of the MTP meeting needed to be aware of why they were forced to change tools, and thus often also internal processes, in order to be able to provide inputs to the MTP.

We therefore started off by first informing people that we would be changing the form of inputs while the programming was ongoing. The information was received with mixed feelings. In the early CWs of 2019, we released a first version for user testing. We also performed trainings via Webex with as many parties as we could get a hold of. So, once the tool, again OPE first, was sufficiently stable and functional, we sent it out to all participants and decided on a one month transition period, asking users to switch to the new tool, but still allowing them to provide their inputs in the old fashioned way. Once the four weeks grace period was over, we drew a line, rejecting all old inputs, with some exceptions, where databases were used for inputs and a change to our format was impossible. The switch to the MTP tool for the VAL plan was performed roughly 6 weeks after OPE. It took another six months and updates to databases as well as our tool that a level was reached of roughly 90% of inputs received via our tool, with only very few exceptions. By the time of writing of this paper, all inputs are received by the MTP Tool. Only one team, which uses a database incompatible with the MTP tool remained in their old format, but even parts of their inputs are by now being processed by our tool. The process reduced the implementation time by about three-quarters - from roughly 1 day per MTP plan to max 4 hours for both plans together.

3.2 The second step of automation

At this point, we had started to think bigger. In collaboration with both TPZ and GfR we had started thinking about how to automate the overall process: not only planning, but removing as much manual labor out of the process - from the start of the raising of the ticket, via the approval, execution, report of completion, to the reporting at the end. We want to create a complete and closed lifecycle. For details, please refer to [2]. Between the writing of this abstract for Spaceops 2020 and the writing of this paper for Spaceops 2021, we have managed to complete Step 1 of this automation.

Many of the inputs to planning, primarily to VAL and OPE MTP, come from a tool called SDT. The SDT contains pretty much all activities that are done in Galileo, any type of support, resource bookings, system changes, maintenances, etc. The majority of MTP entries require at least one SDT ticket to be raised, in order to be approved. Up until now, it is necessary to complete two steps to get an activity approved – (1) raise an SDT ticket and (2) provide the content of the ticket to the MTP via the MTP tool. Wouldn't it be much easier to just import the SDT tickets into the GPT automatically and remove the manual input altogether? That is exactly what Step 1 did.

With the time that was freed up from the reduction of the implementation time for the MTP, a team of a handful of people sat together to create a new plan. Several interfaces were investigated and the SDT-GPT interface was the one we were able to implement until now. In December 2019 finally the new version of SDT was rolled out and since then the GPT is receiving weekly imports directly from SDT. So in Jan 2020, the transitioning phase started – the GPT import functionality was only partially ready and users currently still need to provide both MTP tool inputs and raise SDT requests. But as in the steps before, a transition phase is always good in order to allow the user to get accustomed to the new logic. Unfortunately due to COVID-19 this transition phase, that was only supposed to last a few weeks, is still ongoing. But that will change very soon.

Only during the last week of March 2021 the transition to an updated version of GPT was completed. This now finally completes the automated import of SDT tickets into GPT. Fig. 3 shows a simplified graphic of the SDT-MTP process and one can see that 2 steps need to be completed in order to get from the SDT Export to the MTP Meeting. Up until March 2021 only step 1 was automated, and step 2 was still manual, which is why we required both SDT and MTP tool inputs from our users. With the transition to the new version, now step 2 has also become automated, which will allow us to enter a new transition phase very soon and reduce the usage of the MTP tool. The MTP tool will never go away completely though, because not every team has the possibility to create their SDT tickets early. Therefore the MTP tool can continue to be used in order to provide inputs where either no SDT ticket is required or the ticket can only be raised at a later point in time.

For the connection between SDT and GPT some new rules had to be established to create the connection:
A specific flag in SDT needs to be set correctly in order to make sure it is being exported to the MTP. Due to this transition phase, users have had time to adapt to setting this flag correctly. Meanwhile, the SPO Planning team can compare the inputs received via SDT to the inputs received via the MTP tool and check the setting of the flag, because only a correct flag will ensure a correct MTP feedback.

The SDT tickets and MTP entries depend on each other:
- Most MTP activities need an SDT ticket in order to be approved
- An SDT ticket may not be given an SDT slot without MTP approval for planning

The cycle is the following (see Fig. 3):
- Mon at noon: SDT export to GPT
- Mon afternoon. MTP implementation of all inputs received
- Wed morning: MTP meeting
- Wed afternoon: MTP Export from GPT to SDT
- Wed night: GPT export is automatically imported into SDT
- Thu morning: Assignment of STP slots to MTP approved SDT tickets

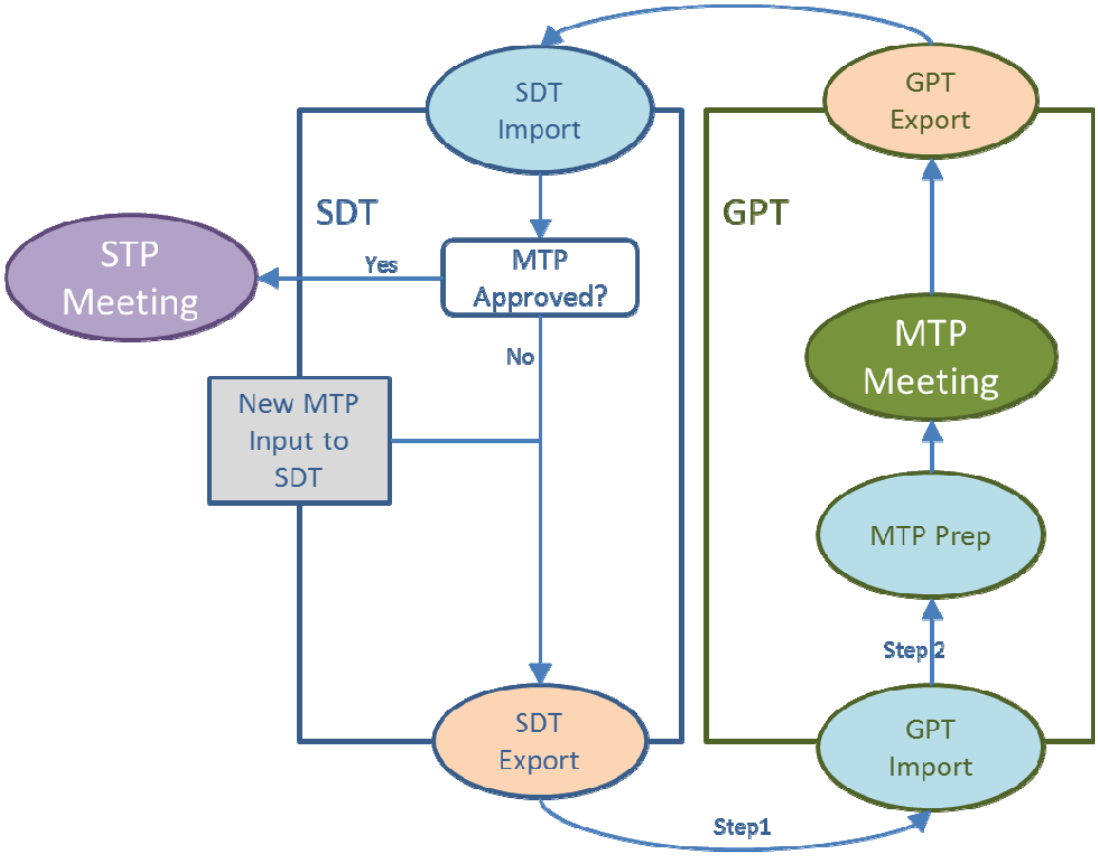

Fig.3. Simplified graphic of the SDT-GPT cycle

Now that SDT and the MTP are linked, SDT has received an extra field with MTP inputs, making sure that only approved SDT tickets are allowed to be assigned slots and finally executed. The circle has been closed.

Please note that the MTP only approves activities for planning, not for execution. Only in the STP cycle, where the final slots are assigned, the decision is made if the activity can be really planned and approval for execution can be given. An activity that cannot be assigned a proper slot during the STP process will need to move back into the planning cycle and will be rescheduled for a different day.

4. Galileo Planning processes of the future

The SPO Planning Team is very proud to have come so far in only a year and a half. We have undergone one major planning process change and a few tool changes, including several updates of the GPT tool itself. At this point, the Long-Term plan is fully integrated into the MTP plans, and the interconnection between OPE and VAL MTP has been provided. The result is that now the plans are interlinked: not only via communication channels, but also via automatic linking of the activities within the tool. Inputs are mostly being received either via the automated MTP tool (for activities without SDT tickets) or directly via SDT. One team is responsible for all four plans, making communication easy and short. The processes have been clearly documented and provided to all participants and have been made as easy as possible for everyone with the goal to reduce the overall work load for planning an activity. The output from the weekly planning meeting is now identical every week. This enables us to follow all the activities from the Long-Term plan over the Mid-Term plan down to the Short-Term plan and all the way back up.

Of course there is still space for improvement. For example the Short-Term plan is currently still being handled via a simple Word File. The problem is that the Spaceopal STP is dependent on both the GCS STP activities (run by GfR Planning), as well as the GMS STP activities (run by TPZ Planning). Therefore, in order to move the STP into

GPT, a connection between the planning of these three Planning Teams would be necessary. A way forward is already in sight, but will take more time to come to fruition.

In the future, inputs for Planning will only be imported automatically. An LTP tool is also under discussion, with the same functionality as the MTP tool, which will allow easier changing of the plan and faster and error-free import of the LTP activities into the GPT. The connection between LTP and MTP today already makes sure that all activities that are planned in a high level manner in the Long-Term plan will also find their way into the Mid-Term and Short-Term plans. The fact that VAL and OPE MTP are connected enables us to provide the security that no activity is ever implemented in Galileo's operational environment as long as the validation has not been successfully completed. Once the STP is also in the GPT, a full circle will be able to provide LTP-MTP-STP both on the way down for activity planning, as well as on the way up for confirmation of activity completion.

Another step, that the GPT might enable us to take, is the usage of their resource capabilities. In theory it is possible to read in e.g. station availability data and directly provide the user with a feasible slot to perform their activity while a specific station is available. Due to the fact though, that this is Short-Term planning, this will be a step that will need to be taken together with the other two STP Planning teams by GfR and TPZ.

5. Discussion and Conclusion

Planning is a very precise activity. Without a proper Long-Term high level plan, which is then broken down into the appropriate smaller pieces, a complex activity of e.g. a system upgrade taking several weeks, may never be properly completed. Depending on the size of the activity that needs to be planned, at times it may prove to be difficult to think of all the little details that will need to be organized once the planning has reached a more detailed phase. Also the impact of one activity on another, especially in such a complex system as Galileo, may not always be obvious immediately.

Therefore, especially the more complex the activity is, it is very important to transmit planning information correctly and without errors. The more often information is passed from one hand to the other, the more likely it is that important details may get lost or changed, or do not get passed on to the right entity. A logical solution for this problem is for one to cut short the path of communication and secondly to automate as much as possible the transmission of the planning information from start to end. On the other hand it is always good to also stick to functioning processes and not change a set up that is working well. Thus, any change of a process needs to be well thought through.

For Galileo the Pros of a process change have well outweighed the Cons. To the Con side one could count a well-established process, where everyone knew how it worked, all internal processes were adapted to the current scheme and uprooting this setup could have very well unsettled all existing mechanisms. On the other hand there were many more Pro arguments to go with the planning process change as it was executed for Galileo Planning:

- Inter-tool communication was missing and needed to be established
- Inter-team communication was difficult and had to be improved
- Manual input implementation was time intense and error prone
- SDT tickets and MTP inputs were not linked, and not always matching as necessary

On the basis of these arguments, the decision was clear that an improvement was absolutely mandatory. Many different brainstorming sessions and meetings have been completed over the timeframe of a year and a half with different people in different teams and functions, in order to make sure that the result of this automation would be the best of the best we could come up with.

As a conclusion it can be clearly said that our process change has been successful. Both the changes of the plans to the GPT, as well as the change of several different input formats to the common MTP tool, have progressed in a very positive manner. Also the latest implementation of the linking of SDT with GPT is finally completed. As the SPO Planning team, we can only say that the changes have, in the end, been accepted very positively by all participants to the meetings, and we hope that all customers and subcontractors have been able to see the positive influence the planning changes have had on the overall process and the quality of the plans in general.

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