SUMO: Operation and Maintenance Management web tool for astronomical observatories

Emma Mujica-Alvarez^a; Ana Pérez-Calpena^a and María Luisa García-Vargas^a ^aFRACTAL S.L.N.E, C/Tulipán 2, p13-1A, 28231 Las Rozas, Madrid, Spain

ABSTRACT

SUMO is an Operation and Maintenance Management web tool, which allows managing the operation and maintenance activities and resources required for the exploitation of a complex facility. SUMO main capabilities are: information repository, assets and stock control, tasks scheduler, executed tasks archive, configuration and anomalies control and notification and users management.

The information needed to operate and maintain the system must be initially stored at the tool database. SUMO shall automatically schedule the periodical tasks and facilitates the searching and programming of the non-periodical tasks. Tasks planning can be visualized in different formats and dynamically edited to be adjusted to the available resources, anomalies, dates and other constrains that can arise during daily operation. SUMO shall provide warnings to the users notifying potential conflicts related to the required personal availability or the spare stock for the scheduled tasks.

To conclude, SUMO has been designed as a tool to help during the operation management of a scientific facility, and in particular an astronomical observatory. This is done by controlling all operating parameters: personal, assets, spare and supply stocks, tasks and time constrains.

Keywords: Operation and maintenance management, software tool, scheduler, tasks, resources, equipment, facilities, spares, supplies, anomalies, configuration control.

1. INTRODUCTION

SUMO (System Use Management Tool) is an Operation and Maintenance Management web tool developed by FRACTAL. SUMO allows managing the operation and maintenance activities and resources required for the exploitation of a complex facility during the Operation phase.

SUMO main capabilities are to provide a) an operation and maintenance information repository, b) assets and stock control, c) tasks scheduler, d) executed tasks archive, e) configuration and anomalies control and f) notification and users' management.

The information collected at the Operation and Maintenance Plan must be initially stored at the tool database.

SUMO shall automatically schedule periodical tasks and facilitate the search and the programming of non-periodical tasks. Tasks planning can be visualized in different formats and dynamically edited to be adjusted to the available resources, anomalies, dates and other constrains that can arise during daily operation.

SUMO shall provide warnings to the users notifying potential conflicts such as the required personal is not available or the stock has run out of the spares needed for carrying out the scheduled tasks.

SUMO is part of the FRACTAL System and Project Suite, which includes also the tools GECO (System Engineering and Configuration Tool), DOCMA (Documentation Management Tool) and MANATEE (Project Management Tool). All these tools are being successfully applied to carry out international, complex and geographical distributed projects. An example is the project MEGARA; the future fiber fed optical spectrograph for the GTC 10-m telescope, for which FRACTAL is responsible of both Management and System Engineering Work Packages.

In the following sections, we first introduce FRACTAL System and Project Suite, to provide an overview of the set of applications that are used in combination with SUMO to track and manage projects during their whole life-cycle (i.e., from the design phases to the operational and disposal phases). Then, we describe in detail SUMO functionality.

2. FRACTAL SYSTEM AND PROJECT SUITE

Having computer-aided tools is particularly important when generated data increases (which occurs as the projects or organizations evolve). In such cases, the information can become unmanageable very fast and the need for a specific software tools to control it becomes essential.

This assessment is particularly important for companies or organizations where most of the involved people are geographically distributed (which is also the FRACTAL situation). In such a case, people located in different work centers (often in different cities or even different countries) need to access the project data in a controlled way.

FRACTAL is a company founded in 2005 and dedicated to carry out engineering and scientific projects mainly related with telescope and professional astronomical instrumentation. Our main customers are universities and research centers involved in large Consortia responsible for delivering cutting-edge developments for the ground-based professional observatories and/or Space missions. It is also important to mention that most of the people working or collaborating in our company and/or our customer's organizations, is geographically distributed, which makes the effective communication becomes a key tool for project success.

For this reason, we have developed several customized tools fully focused on solving the main problems found when participating in instrument projects. GECO, DOCMA and MANATEE, which are more focused in the development projects phase, share a common database. SUMO, to be used during the operation phase, has its own database. All these tools are focused to support the team by accessing and exchanging information, and to perform and coordinate the Management and/or System Engineering activities during the entire project life cycle.

• GECO - System engineering and configuration control.

System Engineering is defined as the interdisciplinary effort that governs the global technical effort done in a project framework to transform the initial requirements into the final system. Therefore, Systems Engineering provides the basis to establish a good organization during the technical development of a project, and will be essential to provide the needed help to Project Management to fulfill both the system requirements and the project schedule and budget. This discipline is always essential for the success of any project, especially the more complex ones, which include different professional skills and whose partners and working groups are often geographically distributed.

The System Engineering group must produce the System Engineering plan for the development of a system. During the implementation of such plan, the system configuration data are generated: Product Tree (PT) elements, requirements, interfaces, specification documents, verification matrix, configuration control records, non-conformities records, etc.

GECO is a Configuration Management Tool that provides the means to manage the configuration data generated in all phases of a project, i.e., not only during the design phases of a system but also during its integration, verification and, even later, when the system enters into operation.

The application has been developed with two objectives: firstly, to assist the System Engineering Group and Configuration Control Group to control and maintain the configuration items of a system and, secondly, to make this information available to other groups within the organization or the consortium in charge of developing and operating the system.

GECO helps to keep updated the configuration data, to establish the links among data (e.g. requirements traceability) and to manage configuration changes, non-conformities and anomalies. The final goal is to facilitate the configuration control process by tracking correctly the system development in order to ensure the successful system development and integration.

Finally, this tool can automatically generate the requirement section of the documents from the updated requirements stored in GECO database, which helps to keep a coherent set of requirements and to avoid maintaining duplicated information, reducing considerably at the same time the work needed to have the documents updated. Requirement Documents are an important view of the system and these documents have to be distributed to third parties, such as contractors and/or customers, and have to keep updated to comply with the intended project milestones and reviews.

Fig. 1 provides several view of the GECO graphical user interface.

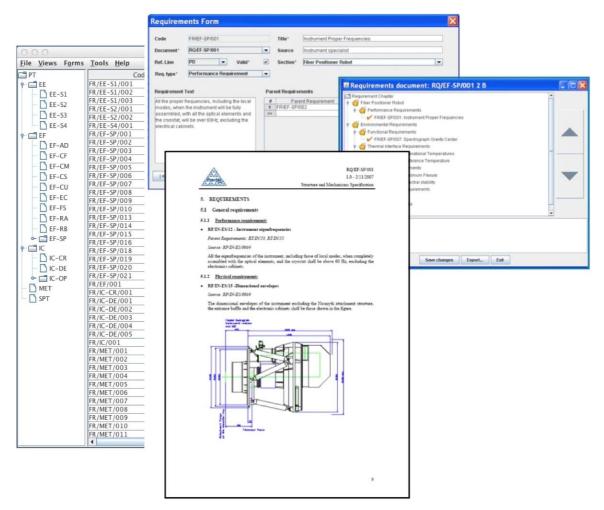


Fig. 1. GECO snapshots. Some views on documentation, requirements and configuration-change views are shown.

DOCMA - Project documentation.

All organizations produce and store a good amount of documents. The number of documents is usually high enough to make a documentation management tool always a need. When several companies and/or institutions collaborate in a multi-discipline, complex project in a geographically distributed environment, a documentation tool starts to be even more important. In such a case, the number of documents generated and stored in the diverse work centers, with different versions, written and reviewed by several individuals can become a communication problem in the project, being unmanageable very fast. Then, a specific computer-aided tool becomes essential.

DOCMA is a Documentation Management Tool that provides the means to manage the documents generated in a company or organization during the whole document life-cycle and according to the permission granted to the users. This allows us to keep and organize documents and to improve the internal communication among the different members involved in a project.

0.0	1 0	OCMA Main	n page	+													
() a m	tps://www.fr	actal-es.c	om/docr	na/private/s	ervfets/main?	option-do	cuments&	suboption	-documen	search	- C	Coog	e		Q \$	₫ ‡ 1	ft
1 Cmall	Coogle		TAL -		MANATEE		TT MECH	-	DOCMA MED	-			Coogle Maps	word	telerence		lemo
A	A.	FRACT		NF									aperez 1 g	sout			
Fra	ctal	C/ Tulpår E-28231 U	n n*2, por Las Rozas 9163796-	tal 13, 1* A de Madrid 40 / 6307379	61								DOCMAH	tetiz.			
atificatio	a data	Projects	Docum	ents Users	Notifications	Backupe	Tools										
proj-prop	2014-05-09	Document	ta Lint Ne	w Document	Search Documen	14											
qorq-jorq	2014-05-09	-															
doc-appr	2013-11-20		Project	Code	T		Oete	1000	Official Draft				Contra Contra			2	
farb-oob	2013-11-20	1 10			WENTOS	Team		1		president and a second s	modify	providence and the	add	Januaria	pression and	phone in the second second	
fierb-ool	2013-11-20		VIENTOS	VIENTOBICVS	C.V.'s		2011-04-12	Approved	1.8	modify	status	commenta	comments	send	history	delete	
soc-appr	2013-11-20	1 1	Internet St	10000000	LAFATTOR.	Partners 1		(in the second	interiment.					1	-	-	
farb-col	2013-11-20 2013-11-20		VIENTOS	VIENTOGIRPT	1001 NENTOS. Report 201	10	2011-04-12	Approved	1.6	medity	modify status	commenta	add comments	send	history	delete	
toc-draft	2013-11-20 2013-11-13			-					and a state		-			1			
too-appr too-appr	2013-11-13		VIENTOS	VIENTOGRPT	Report 201	Progress	2012-03-23	Approved	1.6	modify	modify	comments.	add	send	history	delete	
furb-ook	2013-11-13				resport 201			111111	22		etatus	Contraction of the local division of the loc	commente	1.200	Constant of		
furb-ool	2013-11-13	1 1	LARACTOR.	VIENTOS/RPT	VIENTOS	Progress	2013-02-01			Constant of	modify	(and the second	add		In the second second	Contraction of the	
doc-appr	2013-11-13		100	THE REAL PROPERTY.	Report 201	2	BURGE 01	-seconds	10	modify	status	commenta	comments	send	history	delete	
farb-oot	2013-11-13				NENTOS	Project					modify		edd				
farb-cob	2013-11-13		VIENTOS	VIENTOS/SCI	001 Scientific *	écoda	2013-02-01	Approved	72	modify	status	commants	conversante	send	history	delete	
doc-appr	2013-11-13	1.10	_					-	-								
doc-appr	2013-11-13		VIENTOS	VENTOS/TEC	Managem	Post Ran	2013-02-01	Approved	1.9	modify	modify status	comments	add comments	send	history	delete	
doc-appr	2013-11-13	1 1				Transment of					The second second						
farb-oob	2013-11-13		VIENTOS	VENTOS/TEC	HENTOS		2015-02-01	Approved	1.6	modify	modify	commenta	bbe	and	history	defete	
fanb-oob	2013-11-13				Lighten	grian			77	Concerning of the	status		commenta	- Internet and	Construction of the	harry prophysical	
farb-cob	2013-11-13				Market An	alysis.					The rolling		State Street				
doc-appr	2013-11-13		VIENTOS	VENTOS/TEC	0000 at large tel	escopes .	2011-04-12	Approved	1.A	modify	modify	comments]	204	send	history	delete	
fierb-oot	2013-11-13				that could	books seu					status		comments				
Parity-col	2013-11-12				bribit Gates			-									
doc-appr doc-appr	2013-11-07		VIENTOS	VENTOS/TEC	E-ELT inst 2004 in the cont	rumentation ext of	2011-04-12	Approved	1.4	modify	modify	commants	bhe	send	history	delete	
loc-appr	2013-10-14		201022		VIENTOS.	project		1000	-		status	Longer Lange	comments		Summer Street Street		
doc-appr	2013-10-14	1 1				lors Market							1			1000	
doc-draft	2013-10-14		VIENTOS	VIENTOS/TEC	1005 Analysis in		2011-04-12	Approved	2.8	modity	modify status	commenta	add	send	history	deleta	
doc-appr	2013-06-21	11 14			and large 1						second .					Concernance of	
doc-appr	2013-06-21								6 1 2	3	3 39						
flarb-oob	2013-06-21																
doc-appr	2013-06-15														Contra and	The second second	
doc-appr	2013-06-15														print list	print list	(ata)
doc-appr	2013-06-11																

Fig. 2. DOCMA web interface view (document list).

MANATEE – Project Management.

All projects must be defined in terms of their managerial parameters: Scope (Performance), Schedule (calendar and time relationships among tasks) and Price (overall budget and cash-flow along the project). These three parameters must be planned from the beginning of a project, but the real difficulty appears when trying to control them and their inter-relationships as far as the project progresses. The core management activities are usually a huge amount of day-to-day tasks related to making decisions, managing and coordinating the team that could lead to a provisional abandon of the crucial project control task. MANATEE has been designed to help in the optimization of the project achievement, acting as an electronic project controller able to be fed by the team members and to inform them and the managers of the project progress, generating also warning when important deviation from the planned goal are detected.

The set of tasks managed by the same overall responsible, oriented to produce a single deliverable or to offer certain kind of services to the project are called Work Packages. The WPs are usually divided by the nature of the tasks to do (usually due to the skills of the people that have to carry out the work) or by organizational needs. Each Work Package has an associated deliverable (or set of deliverables) in such a way that the sum of the Work Packages is the system to be delivered. Each WP is divided in sub-work packages and these into smaller pieces of work, tasks, and all together constitutes the Work Breakdown Structure, WBS. The Project Manager has to propose the Work Breakdown Structure at the time of designing a project plan. The WBS is a deliverable-oriented grouping of project elements, which organizes and defines the total scope of the project via the needed tasks to complete all the deliverables. The WBS technique uses a hierarchical tree structure. Each task is an activity and it is an element of work with clear assigned project parameters.

In order to control the project parameters (scope, schedule and budget), it is essential to follow in detail the tasks execution and project milestones or, in other words, to have close access to the relevant tasks data that allow understanding the status of the project. This includes the possibility of making lists and/or figures such as the level of task complexion, the hours assigned and spent in each task, milestones lists, critical path and milestone dependence, etc. Project managers need to receive (or to access) these data (fully updated) in order to make decisions and to anticipate any risk or problem. At the same time, the people participating in the project need to have the means to record the information relative to the tasks under their responsibility.

In addition to the above items, when the project office is geographically distributed and/or when the project is too complex, in terms of number of disciplines, number of resources, funding sources, etc. a web-based software tool allows people being more active in the project and keep them fully informed on the project status. A tool such MANATEE also makes the relevant information available to everybody.

et Visited + Getting Sta	rted Lat		EE darma FRACTAL Portal de Estadi	das Po	rtal HIFT Con	ail MANATI	E DOCMA	Apple Google I	Maps YouTube	20											P	eriod: 2009	-07-01 - 2009	12-01
MANATEE Main	page.	+								Cede		Preject TST project				Period start	Date	Period 2005.	end Date		Hanuel	ST Real Spen	t Hours Distril	oution
									aperez I logout	n		Trys proces				12009-00.00		Taxas 1	231		Maldonado			
Fractal	C/ T	ACTAL SLNE ulipán n°2, portal 13, 1 1231 Las Rozas de Madi							MANATEE Help	WBS C		Title	Users Spen	Planned hears	Total up Manper Biodge		Total spetd other tressurces Budget	Total planed other reconstroor Biologi	Total Spont Budget	Planed Biolpt	(36.59%)			Cesar Ga
- ne	Telé	feno: 916379640 / 630 838829107							MANALEE Help	WRS TYL O	01.02	Ecology Hady	Users Speed Plasmed Hours Sciences			36(33.5	- 10	1754.20	28.1	30783.84				(8.701
stification date		iniert Hanssement	Human Resources Quality Co	(budge	Tools 11	ALC: NO	adistration				_		Manual Muld-made	.0.0 4	.52	_	_			-	Pedro Gomez	2		
bsr-crea 2009-09-	18 Pr		BS Reports Milestones Cash Fi		1005	inter l'este	in the state of the			WHO THE	^{m.e.}	Finishity study system marring	Evens Muna	Spend Ph Hours S 31.0	MC1	2681.8	200001.0	2080-0	1459.0	12981-9	(20.29%)			/
oj-prop 2009-07- bs-mod 2009-06-		ojects List Search Pro	ects							WED-TET-	02 0	hime Courted drips	Manul Middaude	101.0		1003.6	7000.0		17941-0	1001.0			7	Enma M. (34.42
ibs-mod 2009-06-	16	Code	Title	Status)]								Cover Gietalia Podra Gietalia	Hours B 21.0 2 54.0 2	101									
ubs-resp 2009-06-		ESO 18366 GWIE	Pipelines Development for VLT /	active	modify	finish	change	summary	track	W30-1374	15-11	Management Conceptual	Carr	Speed Ph.	and in a	34(34.9	2000.01	7.000.04	2001	4.761.76	· Ernna Mult	ca • Pedro Gom	ez @ Matual Maldo	uido 🕂 Cesar Ga
bs-manp 2009-06-			230				dates	Common 1	000000				Cross Ganila Linea Marica	6n 3 6.0 3	4.0								Hours Distrib	
bs-crea 2009-06-	16	EST	Proyecto Estalidos IAC	active	show	finish	view dates	summary	track		-		1	I ma I a	•.01 L 1.000		10000							Emma M
bs-manp 2009-06- sil-crea 2009-06-	16	F101	z-shifted Filters for Elmer	active	show	finish	view dates	summary	track	-											(32.15			
nil-del 2009-06- nil-del 2009-06- isk-del 2009-06-	7	FISIR	Filtro Sintonizable en Infrarrojo para CIRCE	active	show	finish	view dates	summary	track								2				Manuel Maldonado	4		
c-del 2009-06- c-crea 2009-06-		FRACPUB	FRACTAL Company Public Information	active	modify	finish	define dates	summary	track					TS	T (TST	project	Gantt	Chart			(36.20%)		A .	Center Ga
isk-mod 2009-06- isk-crea 2009-06- ibs-mod 2009-06-	7	GECO	Gestión de Configuración Fractal Suite	active	modify	finish	change dates	summary	track				01-34-2009	01-349-3	0.09 01-10	nv-2009	TST p		-2010	11-May-221	Pedro Gomez (8.80%)		- 19	(22.85
bs-mod 2009-05- bs-mod 2009-05-	11	GEN	Miscellaneous	active	show	finish	view dates	summary	track	3		T-001: FEASIBILI - TST-001-0	-				9.01							
bs-resp 2009-05-	109-05-21 HIFI HIPSHerscher DAN active show finish dates summary track				track	1		- TST-001-1: Feasibili iT-002: CONCEPTU		_		-	25.8%		-		Cesar Garci	Pedro Gome	z Hanuel Maldon	ido: 🤤 Emma Mu				
il-del 2009-05- p-man 2009-05-	10	IACAT	Atmosphere and Telescope Simulator for AO systems	active	show	finish	view dates	summary	track		was-	-TST-002: Scienc -TST-002-0		-				10 25				-		
p-crea 2009-05- p-man 2009-05-		MASD I+D: Creación: Proyectos. Ayudas: Subvenciones active modify finish change dates summary track							ST-002: Prelimina ST-003: Syst			•												

Fig. 3. MANATEE web interface view (project list and some results charts).

An additional feature, common to all the applications of the suite, is that they have been developed to run on different environments and at different locations. This is important taking into account the geographical distribution of the personnel in the organizations involved in these kinds of projects. Besides, in order to minimize the maintenance costs and complexity, we have chosen a platform-independent technology; providing simple ways to install the software in a distributed environment and implement a user access policy and encryption features to protect the project's data.

GECO is developed in Java, while DOCMA, MANATEE and SUMO provide a graphical user interface based on WEB forms. The four tools allow accessing the full functionality and the project data remotely from any place. More information about the suite can be found in FRACTAL webpage <u>http://www.fractal-es.com/en/Suite.html</u>.

3. SUMO

3.1 Overview

SUMO allows managing the operation and maintenance tasks and all type of resources required for the exploitation of a complex facility during the Operation phase.

The Operation and Maintenance Plan of a scientific facility must be developed to optimize the use of the observing time while keeping a cost effective maintenance program. This is worth mentioning that the total budget for the operational phase can be eventually larger than the development one. Therefore, it is important to take into account the operation and maintenance constrains at the system design to ensure that the facility shall provide the expected performance while optimizing the Operation and Maintenance Plan costs during its execution.

To design a system for being easily and economically supportable, the reliability, availability, maintainability and safety requirements must be defined and considered from the beginning of the project. Reliability, Availability, Maintainability and Safety (RAMS) analyses must be performed since the early design phases and draft versions of the Operation and Maintenance plan must be produced. The RAMS analyses will provide the input for identifying preventive, predictive and corrective activities. The maintenance tasks must include accessibility issues, safety measures, task duration and frequency, manpower, support test equipment and facilities required, manpower skills and training needed, and the spares and supplies availability to carry out the tasks.

The level of definition of the Operation and Maintenance Plan shall evolve during the system development. The detailed definition of the tasks and the support elements (test and support equipment, staff, facilities, technical manuals, training, external services, spares and supplies) must be ready before the system enters into operation. For complex facilities, the volume of this data would make advisable to have a software tool that facilitates the management.

A software tool like SUMO shall allow organizing and accessing in a controlled manner the operation and maintenance data and facilitate the planning of the tasks. SUMO is a user-friendly tool that will record not only the activity description but also the information related with the support elements.

SUMO capabilities can be summarized as follows:

- Operation and maintenance information repository
- Assets and stock control
- Tasks scheduler
- Executed tasks archive
- Anomalies control
- Notification and users management

3.2 Operation and maintenance tasks

The operation and maintenance information includes the detailed definition of the operation and maintenance tasks and the resources that are required to carry them out.

The definition of the operation and maintenance tasks shall include:

- The detailed description of the task (step by step) or the link to an operation or maintenance procedure, where the task is defined.
- The tasks periodicity (whenever applicable).
- The links among tasks (if any). It means, for those tasks that must be scheduled when a condition is met instead of each certain period.
- The task estimated duration.
- The task estimated priority.
- The resources that are needed to carry out the task, which must be selected from the ones stored in the tool.

A bard Gold Image: Construction Image: Construct	enu	Home 💑 Tasks 🛄										
P P Benerix P Denerix P	Asset Control					Add si Schedu	de Tasks de s					11-IN-SP-CR/00001
Promotion Produce Code Tak karm Type Ref © Domethis © Domethis The Scatt Produce Code Tak karm Produce Value <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>This section describe it</td><td>he general procedure for fille</td><td>the spectrometh crycelat</td><td>from a liquid nilrogen storage dever (</td></td<>									This section describe it	he general procedure for fille	the spectrometh crycelat	from a liquid nilrogen storage dever (
Series Series Solution Solution Solution Solution Solution Solution Solution Solution Solution Solution <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Description</td> <td>TP00, TP100 and/or P following alogs must be</td> <td>V1203. In order to maintain to a followed carefully by aklied</td> <td>w operation temperature of personnel.</td> <td>the system. To perform this activity th</td>								Description	TP00, TP100 and/or P following alogs must be	V1203. In order to maintain to a followed carefully by aklied	w operation temperature of personnel.	the system. To perform this activity th
Expired is in the last if is a special is a			TEL1-IN-SP-CR	TA/TEL1-IN-SP-CR/00001	Cryostat LN2 filing	Preventive	191	Parkd (in days) :	2		Condition :	
Reconstruction Sequence Sequence Sequence Processe Orders Proce			TEL1-IN-SP-CR	TATEL1-IN-SP-CR/00002	Cryostat maintenance of vacuum	Preventive	12			-		
Seconds Produce Outers Prod	Toupments		TEL1-OPT-M1	TA/TEL1-OPT-M1/00001	Replacement of primary mirror segments	Preventive	123	Duration (in hours) :	1.5		IV Ad	àn .
Process Coders Process Cod			TEL1-OPT-M1	TA/TEL1-OPT-M1/00002	Costing of the primary mirror segments	Preventive		Converts :				
Witchase Over		Primary Mirror	TEL1-ST-AZ	TATEL1-ST-A2/00001	Azimuth mechanism visual inspection	Preventive		Inter limbe				
Watchards	Purchase Order	- 🔛 Secondary mirror	TRILLET.D	TATELL ST. EL MONAL	Elecation mechanism visual inspection	Benetice	128					Time between tasks (in hours)
* Uvers * Sala * Paring * Tring Gis * Tring Gis * Tring Gis * Paring * Paring <td< td=""><td>🙀 Workshops</td><td>Tertiary mirror</td><td>TLL POPULL</td><td>ON THE MOTHER SHOWS</td><td>Certain nectain read hapecan</td><td>Fieroare</td><td>1923</td><td></td><td></td><td>No ferra</td><td>io show.</td><td></td></td<>	🙀 Workshops	Tertiary mirror	TLL POPULL	ON THE MOTHER SHOWS	Certain nectain read hapecan	Fieroare	1923			No ferra	io show.	
i Unit i i i i i i i i i i i i i i i i i i i	External Services	E C Telescope structure										
Image: Solid Soli	tusers	- Azimuth structure and mechnik										
Image: Proving Image	-	Elevation structure and mecha	6									add rese rose
Image: market		E 💋 Instrumentation										
Image: State Stat		😑 🥩 Spectrograph										
	💑 Time Slots	Cryostat										
is ithebair is ithebair	💑 Tasks	Support element										
is ithebair is ithebair	Record Tasks	A CONTRACTOR OF A CONTRACTOR						_				add new one
Schedul Veerr Revent task Tro Re Proben Management Schedul Veerr Re Proben Actor T Image Management Image Management Image Management Re Proben Actor T Image Management Image Management Image Management								Equeranta			Relative documentation	
Image: Produm Management Image: Produm Management Image: Produm Management Image: Produm Management Image: Produm Action T Image: Produm Action T Image: Produm Action T Image: Produm Action T Image: Produm Action T Image: Produm Action T Image: Produm Action T Image: Produm Action T Image: Produm Action T Image: Produm Action T Image: Produm Action T Image: Produm Action T Image: Produm Action T Image: Produm Action T Image: Produm Action T Image: Produm Action T Image: Produm Action T Image: Produm Action T Image: Produm Action T Image: Produm Action T Image: Produm Action T Image: Produm Action T Image: Produm Action T Image: Produm Action T Image: Produm Action T Image: Produm Action T Image: Produm Action T Image: Produm Action T Image: Produm Action T Image: Produm Action T Image: Produm Action T Image: Produm Action T Image: Produm Action T Image: Produm Action T Image: Produm Action T Image: Produm Action T Image: Produm Action T Image: Produm Action T Image: Produm Action T Image: Produm Action T												
Proben Management Image: Comparison of the comparison	d Schedule Viewer							Scissors platform	EGPID.	1 😐	Crystal LN2 filing proced	100 PNO_TEL1-IN-SP-CR
	🛃 Planned task Tim											
	A Problem Management											
Reg Problem Action T Image: I												
Np PrODBINACIOI F No text to show So te												1
Image: Constraint of the second of	Problem Action T							Spare	the same in the same			
store or m Line of the store o									THE ENTIRE LE LINE			
Edward services Technique		(m) ()										
Edward services Technique								51			and some one	
								External services				
The America Source										Tolla		
									No farms to show		N	o Barra to shaw.

Fig. 4. SUMO web interface view and task form.

3.3 Operation and maintenance resources

SUMO keeps the following operation and maintenance resources:

• Product tree elements.

The product tree (PT, Product Tree) describes the hierarchical break-down structure of a complex system in the necessary levels to completely define the system.

All subsystems, components and parts that constitute the system to be operated and maintained must be introduced with a unique identifier, which will be used to link part of the archived information.

Name :	Spectrograph	
Code :	TEL1-IN-SP	
Parent PT element :	TEL1-IN	•
Status :	DD	*
Date :	May v 22 v 2014 v	
Description :	This instrument is composed by an optical fibers robot (which is rotating with the telescope). This robot feed a static spectrograph (non-rotating) placed on the Nasmyth platform.	((()))

Fig. 5. PT element form view

• Documents.

All operation and maintenance documents (procedures, user manuals, technical data sheets, reports, etc.) must be accessible at the tool. SUMO provides documentation version control capabilities.

• Spares

The spares that are needed for fulfilling the system availability budget must be kept at the tool. SUMO also facilitates the control of the stock (consumed and purchased spares must be also registered).

Supplies

The supplies that are needed for fulfilling the system availability budget must be kept at the tool. SUMO also facilitates the control of the stock (consumed and purchased supplies must be also registered).

Version : 1 Authors : Paul	ID/TEL1-IN-SP-CR/00001	Type 1 PHG Telle : Or, Issue : A Status : Ag Charge file : I Date : Ma	2 Posodent v v Repeip Form Supply code : SUPPOSOSO1 Annyzi : 34 Location : Supply code : SUPPOSOSO1 Particular Supply purchases Parthase other Parthase othe	Minimal and B	I Daak ninogen (542) aver From Spare code : 5PA-000001 Annuat: 3 Issatton	Spare name Mennel amout Communes	: Devision drive
Vention : 1 Authors : Paul Link : PRO Location : Comments :	al Gales 	Title : Cry Insue : A Station : App Charge file : Date : Me	Buggly code: SUP0000001 Amourt: 34 Location: Supply partneres	Minimal and B	Explain reforgen (542) prere Form Spare oode : SPA:000001 Annuet: 3	Meanal amount	u] 1
Authors : Paul Link : PRO Lookon : Comments :	D_TEL 1 HL S.P. C.R., DOD1 HA., JOHTTOOM 411	Eteles : Ap Charge file : Date : Ma	Amoyal 34 Location	Minimal and B	Spare code : SPA:00001 Anourt 3	Meanal amount	u] 1
Link : PRO, Location : Comments :	D_TEL 1 HL S.P. C.R., DOD1 HA., JOHTTOOM 411	Charge file :	Amoyal 34 Location	Minimal and B	Spare code : SPA:00001 Anourt 3	Meanal amount	u] 1
Location :		Charge file :	Location : Supply purchases	Comm	Spare code : SPA/00001 Anount: 3	Meanal amount	u] 1
Location :		Date : Ma	Supply purchases		Anourt: 3	Meanal amount	u] 1
Comments :				1.57			
Associated equipments		Associated spares			Location	-	
Associated equipments		Associated spares			(and the second s		
	•==	Associated spines	Purchase order				
	•	Associated spares		Date	2 Critical		Repairable
			Liquid retrogen (LN2) supply January 2014 6	2014/01/27			
Edulation		Barry	Liquid nitrogen (LN2) supply February 2014 7	2014/02/20	Spare purchases		
		oper			Purchase order	Date	Amuel
	No terms to show				Elevation drive purchase March 2013 1	2013/09/27	1 🔾
					Elevation drive purchase April 2014 3	2013/09/18	2 🥥
			Consumed supplies				
	add new row	add new row	Task	Date			
	add new row		2014-06-23 Cryostat UN2 filling 42	2014/05/23	-2010 N 1999 N 47		add new row
Associated supplies		Historic document status			Consumed sparse	15	
Supply		Status Issue			Tank	Date	Anourt
Liquid nitrogen (LN2) SUF	JP/0000001 1	Checkedin 1.A				is items to show	
		Approved 1.A					
			Associated documents				
			Document File	1.226			add new row
	add new row		RPT/TEL1-IN-SP-CR/00001 LN2 handing sa doc/RPT_T	EL1 IN SP	Associated PT elements	Associated docume	
	cancel	update	PR0/TELS-IN-SP-CR00001 Cryostat UN2 N. dou/PR0_1	TEL1-IN-SP	PT sharrant	Document	Fia
						2	
			4		TEL1-OPT Telescope Optics 3		No items to show.
				ncel update		0	
				down			
					add mine role		
					uncel	update	

Fig. 6. Document form, supply form and spare form view

• Equipment

The equipments needed to accomplish the operation and maintenance tasks must be also stored at the tool. As for the spares and supplies, SUMO facilitates assets control keeping all the information related with the acquisition of the components.

• Workshops

The workshops that are available at each maintenance level and are required to carry out a certain task must be identified in order to allow SUMO checking work shop availability conflicts when generating schedules.

External services

Some tasks could be carried out by external services. SUMO allows tracking these contracts in order to ensure that they are available whenever required.

• Skills (operation and maintenance manpower profiles)

Operation and maintenance profiles presents at the organization must be introduced at the tool. This allows defining at each task the profiles required to carry it out and, afterwards, to identify manpower conflicts at the schedule generation.

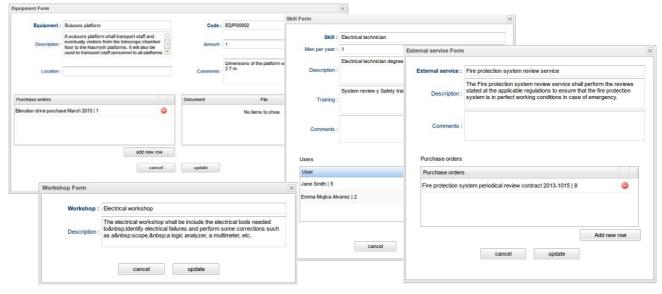


Fig. 7. Equipment form, external service form, skill and workshop form view

In addition, the purchase orders that are generated to acquire new assets shall be also registered. A purchase order must be generated each time that an item (spares, supplies, equipments or external services) is acquired or contracted in order to keep the purchase information for budget control.

						📄 Save Pu	rchase Orders Ch	nange 🃸 Search 🔓	Print	
PT Code	Title	Action title	Responsible		Order date	Delivery date	Arrival date	Status		
	Fire protection system peri	Western States Fire Protec	Jane Smith 5		12/22/2012	2013/01/01	2013/01/04	Received	~	
TEL1	Elevation drive purchase M	. Elevation drive TL	Pedro García	Purchase Order	Form				minandi.	
TEL1	Elevation drive purchase A	Elevation drive TL	Pedro García	· · · · · · · · · · · · · · · · · · ·						
EL1-IN-SP-CR	Liquid nitrogen (LN2) suppl	Linde	Jane Smith 5	v Purchase	e order information					
EL1-IN-SP-CR	Liquid nitrogen (LN2) suppl	LESS	William Gates		PT element code :	TEL1-IN-SP-CR		Code	ORD/TEL1-	-IN-SP-CR/000001
					Title :	Liquid nitrogen (LN2) supply	January 2014	Description	LN2 supply	
					Responsible :	Jane Smith	~	Company purchase order code		
					Status :	Received	~	Purchase order file	Browse.	
				✓ Provider	/ Company information	n				
					Provider name :	Linde		VAT Code		
					Address :	Bailén, 105 - 08009 BARCE	LONA	Contact person name		
				Cont	act person e-mail :	linde@linde.com				
				✓ Quotatio	n information					
					Quotation reference :		1	Quotation file		
				, in the second se	200tation reference .			Upload quotation file	Browse.	No file selected.
				В	aseline total price :	1295		Coin (baseline total price)	€	2
					Other expenses :	151.86		Coin (other expenses)	¢	3
					Reception place :	Telescope		Remarks		
				✓ Dates						
					Submission date :	Dec v 22 v 2013	×	Order date	Dec 🗸	27 🗸 2013 🖌 🎆
				Link de	livery date to order	Yes	~	Time in	week	~
					date :		1000	Time in value		
					Delivery date :	Jan Y 17 Y 2014	×	Arrival date	Jan 🗡	21 🛛 2014 🗳 🋄
				✓ Payment	t plan					
					Payment plan :			Budget chapter		
							cancel	update		

Fig. 8. Purchase order form and purchase order tracking view

3.4 Operation and maintenance scheduler

SUMO generates an operation and maintenance schedule for a given period of time taken into account all tasks that can be automatically programmed. The schedule generation includes several utilities as described in the following lines:

- The tool generates the schedule automatically, including the periodical tasks and the corresponding linked tasks. Periodical tasks shall be scheduled taken into account the latest programming dates.
- The tool allows to introduce non-periodical tasks manually (i.e., non-foreseen tasks as corrective ones)
- The schedule can be edited manually. The task execution date automatically suggested can be changed by hand.
- The tool provides the means to analyze that the generated schedule can be performed with the available resources. Warning are displayed to identify potential resource conflicts.

In the short term (i.e., in a weekly or daily basis), SUMO allows editing the schedule manually to assign all the details (responsible, task hours, etc.) to the scheduled tasks.

Mon 06/23 A/TEL1-IN-SP-CR/0	Tue 06/24						Da	y Week	Month
THE A BUILD ON THE		Wed 06/25	Thu 06/26		Fri 06/27		Sat 06/28		Sun 06/29
1781 1 10 CD 10									
		2							
ntenance of					~				
	8:00 (Yes) TA/TEL1-OPT-M1/000 Coating of the primary mirror	6:00 (No) TA/TEL1- Cryostat LN2	8:00 (Yes) TA/TEL1-OPT-M1/000 Replacement of primary mirror	6:00 (No) TA/TEL1 Cryostat LN2				6:00 (No) TA/TEL1-IN Cryostat LN2 filling	I-SP-CR/00001
-	segments	9:00 (Yes) TA/T	segments	tiling	9:15 (Yes) TA/1				-11
		Elevation mechanism visual			Azimuth mechanism	Schedule tasks			
		Inspection			visual Inspection	-			
						Date		om :	2014/05/22
H					-	-		To :	2014/07/30
						PT Code	: Cho	ose a value	
		- 				Туре	:		
						Time slot	:		
							_		
		S						cancel	accept
	Schedule tasks		-				×		
TA/TEL1-IN-SP-CR/I filing							Ĩ		
-	validation has detected	the following warnings:							
	Warning 6:								
	2014-06-23								
		8-23 Cryostat LN2 filling TA/							
	The planned task '2014-0. The planned task '2014-0	5-23 Cryostat maintenance of	TEL1-IN-SP-CR/00001' is as vacuum TA/TEL1-IN-SP-CI	signed outside t R/00002' is assi	he time slot de gned outside ti	fined in the task. he time slot defined in			1
	The planned task '2014-00 the task.	6-23 Cryostat maintenance of	TEL1-IN-SP-CR/00001' is as vacuum TA/TEL1-IN-SP-Ci	signed outside t ⊽/00002′ is assi	he time slot de gned outside ti	fined in the task. he time slot defined in			
	The planned task '2014-0 the task. 2014-06-24 The planned task '2014-0	6-23 Cryostat maintenance of	vacuum TA/TEL1-IN-SP-CI	7/00002' is assi	gned outside ti	he time slot defined in			1
	The planned task '2014-00 the task. 2014-06-24 The planned task '2014-00 in the task. 2014-06-26	6-23 Cryostat maintenance of 6-24 Coating of the primary m	vacuum TA/TEL1-IN-SP-Ci iirror segments TA/TEL1-OP	7/00002' is assi T-M1/00002' is	gned outside ti assigned outsi	he time slot defined in de the time slot defined			
	The planned task '2014-00 the task. 2014-06-24 The planned task '2014-00 in the task. 2014-06-26	6-23 Cryostat maintenance of 6-24 Coating of the primary m	vacuum TA/TEL1-IN-SP-Ci iirror segments TA/TEL1-OP	7/00002' is assi T-M1/00002' is	gned outside ti assigned outsi	he time slot defined in de the time slot defined			13
	The planned task '2014-0 the task. 2014-06-24 The planned task '2014-0 in the task. 2014-06-26 The planned task '2014-0	6-23 Cryostat maintenance of 6-24 Coating of the primary m	vacuum TA/TEL1-IN-SP-Ci iirror segments TA/TEL1-OP	7/00002' is assi T-M1/00002' is	gned outside ti assigned outsi	he time slot defined in de the time slot defined	Ш		
	The planned task '2014-0 the task. 2014-06-24 The planned task '2014-0 in the task. 2014-06-26 The planned task. '2014-0 defined in the task.	6-23 Cryostat maintenance of 6-24 Coating of the primary m 6-26 Replacement of primary .	vacuum TA/TEL1-IN-SP-Ci iirror segments TA/TEL1-OP	7/00002' is assi T-M1/00002' is	gned outside ti assigned outsi	he time slot defined in de the time slot defined	E.		
	The planned task '2014-0 the task. 2014-06-24 The planned task '2014-0 in the task. 2014-06-26 The planned task. '2014-0 defined in the task.	6-23 Cryostat maintenance of 6-24 Coating of the primary m 6-26 Replacement of primary .	vacuum TA/TEL1-IN-SP-Ci iirror segments TA/TEL1-OP	7/00002' is assi T-M1/00002' is	gned outside ti assigned outsi	he time slot defined in de the time slot defined	E.		13
	The planned task '2014-0 the task. 2014-06-24 The planned task '2014-00 in the task. 2014-06-26 The planned task '2014-00 defined in the task. Work time users report	6-23 Cryostat maintenance of 6-24 Coating of the primary m 6-26 Replacement of primary	vacuum TA/TEL1-IN-SP-Cl irror segments TA/TEL1-OP mirror segments TA/TEL1-O	₹/00002' is assi T-M1/00002' is PT-M1/00001' it	gned outside ti assigned outsi	he time slot defined in de the time slot defined side the time slot	E.		13
	The planned task '2014-00 the task. 2014-06-24 The planned task '2014-00 in the task. 2014-06-26 The planned task '2014-00 defined in the task. Work time users report	6-23 Cryostat maintenance of 6-24 Coating of the primary m 6-26 Replacement of primary : :	vacuum TA/TEL1-IN-SP-Ci irror segments TA/TEL1-OP mirror segments TA/TEL1-O Planned task	7/00002' is assi T-M1/00002' is PT-M1/00001' is	gned outside ti assigned outsi s assigned out	e time slot defined in de the time slot defined side the time slot Hours	E.		13
	The planned task 2014-0 the task. 2014-06-24 The planned task 2014-0 in the task. 2014-06-24 The planned task 2014-0 defined in the task. Work time users report Date User 2014-06-23 Pedro Ga	6-23 Cryostat maintenance of 6-24 Coating of the primary m 6-26 Replacement of primary c rcia	vacuum TA/TEL1-IN-SP-CI inor segments TA/TEL1-OP minor segments TA/TEL1-O Planned task 2014-06-23 Cryostat LN2	7/00002' is assi T-M1/00002' is . PT-M1/00001' is illing enance of vacu	gned outside ti assigned outsi s assigned out	the time slot defined in de the time slot defined is slot defined is slot the time slot defined the time slot defined the time slot defined to the	E.		15
	The planned task 2014-0 the task. 2014-06-24 The planned task 2014-0 in the task. 2014-06-24 The planned task 2014-0 defined in the task. Work time users report Date User 2014-06-23 Pectro Ga 2014-06-23 Erman Mit	5-23 Cryostat maintenance of 6-24 Coating of the primary m 6-26 Replacement of primary : : rcla rcla kharez th	vacuum TA/TEL1-IN-SP-CI irror segments TA/TEL1-OP minor segments TA/TEL1-O Planned task 2014-05-23 Cryositat LN2/ 2014-05-23 Cryositat LN2/	7/00022 is assi T-M1/000022 is . PT-M1/000011 is PT-M1/000011 is enance of vacu	gned outside ti assigned outsi s assigned out um um	the time slot defined in defined in the slot defined in slot defined in slot efficient slot slot the time slot slot slot slot slot slot slot slot	an a		15
	The planned task 2014-0 the task. 2014-06-24 The planned task 2014-0 in the task. 2014-06-24 task 2014-0 defined in the task. Work time users report Date User 2014-06-23 Pecto Ga 2014-06-23 Emma Mi 2014-06-23 Jane Smit	5-23 Cryostat maintenance of 6-24 Coating of the primary m 6-26 Replacement of primary c c c c c c c c c a Alvarez t th c c c a	vacuum TA/TEL1-IN-SP-CI iiror segments TA/TEL1-OP minor segments TA/TEL1-O Planned task 2014-06-23 Cryositat LN2+ 2014-06-23 Cryositat main 2014-06-23 Cryositat main	V00022 is assi T-M1/00022 is PT-M1/00007 is PT-M1/00007 is PT-M1/00007 is enance of vacu enance of vacu	gned outside ti assigned outsi s assigned outsi s assigned out num num r segments	de the time slot defined in de the time slot defined side the time slot Hours 1.5 5 5	E.		15
	The planned task 2014-0 the task. 2014-06-24 The planned task 2014-0 in the task. 2014-06-20 task 2014-0 defined in the task. Work time users report Date User 2014-06-23 Pedro Ga 2014-06-23 Jane Smil 2014-06-23 Pedro Ga	5-23 Cryostat maintenance of 6-24 Coating of the primary m 6-26 Replacement of primary cla recla recla digica Alvarez th th tercla alvarez	vacuum TA/TEL1-IN-SP-CI irror segments TA/TEL1-OP minor segments TA/TEL1-OP Planned task 2014-06-23 Cryostat LN2/ 2014-06-23 Cryostat LN2/ 2014-06-23 Cryostat main 2014-06-26 Replacement of	200002' is assi T-M1/00002' is ' PT-M1/00001' is anance of vacu enance of vacu of primary mirror	gned outside ti assigned outsi s assigned out s assigned out s assigned out s assigned out s assigned out s assigned outsi s assigned s assigned s assigned s assigned s assigned s assigned s assigned s assigned	Hours Hours 3			19
		The planned task 2014-00 the task. 2014-06-24 The planned task 2014-00 in the task. 2014-06-26 The planned task 2014-00 defined in the task. Work time users report	The planned task: 2014-06-23 [Cryostal maintenance of the task. 2014-06-24 The planned task: 2014-06-24 [Coating of the primary m in the task. 2014-06-28 The planned task: 2014-06-26 [Replacement of primary defined in the task. Work time users report:	The planned task '2014-06-23 [Cryostat LN2 filling] TA/TEL1-IN-SP-CR00000* is as: The planned task '2014-06-23 Cryostat maintenance of vacuum TA/TEL1-IN-SP-CI the task. 2014-06-24 The planned task '2014-06-24 Coating of the primary minor segments TA/TEL1-OP in the task. 2014-06-26 The planned task '2014-06-26 Replacement of primary minor segments TA/TEL1-O defined in the task.	The planned task: 2014-06-23 [Cryostat UN2 filing TA/TEL1-IN-SP-CR/00007 is assigned outside t The planned task: 2014-06-23 [Cryostat maintenance of vacuum TA/TEL1-IN-SP-CR/00007 is assi the task. 2014-06-24 The planned task: 2014-06-24 Coating of the primary mirror segments TA/TEL1-0PT-M1/00007 is in the task. 2014-06-26 The planned task: 2014-06-26 Replacement of primary mirror segments TA/TEL1-0PT-M1/00007 is defined in the task. Work time users report:	The planned task. 2014-06-23 [Oryostat IN2 filling TA/TEL1-IN-SP-CRV0007 is assigned outside the time slot de The planned task. 2014-06-23 [Oryostat maintenance of vacuum] TA/TEL1-IN-SP-CRV0002 is assigned outside th the task. 2014-06-24 The planned task. 2014-06-24 Coating of the primary mirror segments TA/TEL1-OPT-M1/00002' is assigned outside in the task. 2014-06-26 The planned task. 2014-06-26 Replacement of primary mirror segments TA/TEL1-OPT-M1/00001' is assigned out- defined in the task. Work time users report:	2014-06-24 The planned task: '2014-06-24 Coating of the primary mirror segments TA/TEL1-OPT-M1/00002' is assigned outside the time slot defined in the task. 2014-06-26 The planned task: '2014-06-26 Replacement of primary mirror segments TA/TEL1-OPT-M1/00001' is assigned outside the time slot defined in the task. Work time users report:	The planned task. '2014-06-23 Cryostat maintenance of vacuum TA/TEL1-IN-SP-CR/00002 is assigned outside the time slot defined in the task. 2014-06-24 The planned task '2014-06-24 Coating of the primary mirror segments TA/TEL1-OPT-M1/00002 is assigned outside the time slot defined in the task. 2014-06-26 The planned task '2014-06-26 Replacement of primary mirror segments TA/TEL1-OPT-M1/000001' is assigned outside the time slot defined defined in the task.	The planned task: 2014-06-23 [Cryostat maintenance of vacuum TA/TEL1-IN-SP-CR/00002' is assigned outside the time slot defined in the task. 2014-06-24 [Coating of the primary mirror segments TA/TEL1-OPT-M1/00002' is assigned outside the time slot defined in the task. 2014-06-26 [Replacement of primary mirror segments TA/TEL1-OPT-M1/00007' is assigned outside the time slot defined in the task. 2014-06-26 [Replacement of primary mirror segments TA/TEL1-OPT-M1/00007' is assigned outside the time slot defined in the task.

Fig. 9. Weekly schedule view and weekly validation report

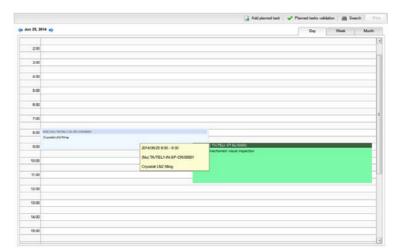


Fig. 10. Daily schedule view

3.5 SUMO users access rights

All persons that must have access to the tool must be registered as a user. User rights (according to the predefined user profiles) are granted to each user.

SUMO provides the following predefined profiles to be assigned to the users:

• Viewer

Viewer users can visualize all the data but cannot modify/add/delete any data.

• Doer

Doer users can visualize all the data; add/modify/delete documents, equipments, supplies; add and modify problems; and modify the tasks, planned tasks and spares.

• System Engineer

System Engineer users have doer's permissions and besides can modify/add/delete the users, PT elements, tasks, planned tasks, spares, purchase orders, workshops, external services, skills, time slots and problems.

• Scheduler

Scheduler users have all system engineer's permissions and in addition they can generate/modify the maintenance and operation plan.

• Administrator

The administrator has all rights in the tool.

Name	Organization		e-mail		Telephone	Actions
Administrator	Fractal	_	admin@fractal.es		911234567	7
Pedro García	Fractal	User Form			×) تي ج
Villiam Gates	Fractal		Name :	Pedro		7
imma Mujica Alvarez	Fractal		Surname 1 :	García		1
lane Smith	Fractal		Surname 2 :) ي ج
		∨ User	account data			
			User :	pedro		
			Password :			
			Confirmation Password :			
			e-mail :	pgarcia@fractal.es		
			Rights :	System Engineer	~	
				Active		
		✓ Conta	act data			
			Organization :	Fractal		
			Team :			
			Location :			
			Telephone :	966999692		
			Mobile :	265984763		

Fig. 11. User list and user form view

3.6 Additional features

To finalize SUMO functionality overview, just to mention that SUMO provides additional features to the ones described before:

• Notification manager

Different warnings shall be sent if a non-desired situation arises (e.g. if the due date of a pending task is reached, if the spare stock has been consumed, etc.).

• Anomaly manager

Any problem found during the operation and maintenance of the system can be reported through SUMO problems form, which will allow tracking the anomaly troubleshooting and program the actions to analyze it.

							📄 Save	ACTIONS	Change	Bearch) F
on title		Problem	Ad	ction st	Action due date	A	ction Responsible		Action sta	atus	
ommended a	ctions	Focusing problem		05/03/2013	05/20/2013	# M	Villiam Gates 7	~	Close		•
em Form							Nistrator 1		Open		
PT Element :	TEL: MARP		Code :	PROB/TEL1-IN-SP/0	00001		Smith 5		Close		
Tibe :	Focusing problem		Initiator :	Emma Mujica Alvare	52	*	Simurio		Cluse		
Starting Date :		05/01/2013	Problem Date :		04/25/2013						
Due Date :			Status :	Started		*					
Severity :	Medium	~	Criticality :	Medium		w/					
File :			Upload file :	Browse No t	file selected.						
Description :		, in which the focusing mechanist obtain the best focus, it was be no									
Analysis :	The detector has not bee passively to put it far aw	n correctly mounted on the OCD H ay from the last camera lens.	ead. The solution will	be to use shims to con	rect the detector position						
Impact :	It is not possible to ficur	the instrument so that it is not po	ssible to take correct a	stronomical images.							
Action to close the problem :	The number and sizes o	the shims have been calculated.									
Recommended actions :	To manufacture the shim	s and to use them to mount the de	tector in the corrected	position.							
Comments :							A				
Actions											
Responsible	Title	Description	Status	Starting Da	ate Due Date						
William Gates 7	Recommended act	ons Problem solved as sugg.	Close	05/03	3/2013 05/20/2013 🤤						
					add new row						
Assigned to			Members affected								
User			User								
Pedro Garcia 4		9	Pedro Garcia 4								
			William Gates 7								
2											

Fig. 12. Problem action tracking and problem form view

4. CONCLUSIONS

This paper describes SUMO, the Operation and Maintenance Management tool developed by FRACTAL to facilitate the management of the operation and maintenance tasks and resources and the tasks planning of a scientific facility during the operational phase.

SUMO is one of the four tools of the FRACTAL System & Project Suite, which is composed also by GECO (System Engineering Tool), DOCMA (Documentation Management Tool) and MANATEE (Project Management Tool). These tools are especially suited for those consortia and teams collaborating in a multi-discipline, complex project in a geographically distributed environment.

REFERENCES

- ^[1] Pérez-Calpena, A.; Mujica-Alvarez, E.; Osinde-Lopez, J. &, "FRACTAL System & Project suite: engineering tools for improving development and operation of the systems" Proc. SPIE 7017 (2008).
- ^[2] García-Vargas, M.; Mujica-Alvarez, E. & Pérez-Calpena, A. "Astronomical large projects managed with MANATEE: MANAgement Tool for Effective Engineering" Proc. SPIE 8449 (2012).