

6 Critical implementation risks and mitigation actions

• Foreseen Risks

Risk Number	Description of Risk	Work Packages Concerned	Proposed risk-mitigation measures
1	Project governance does not work	WP1	The partners forming the consortium (see section 3.3) have extensive experience in working on EC funded projects and understand the requirements they demand, also with respect to reporting and financial administration.
2	Project coordinator does not work	WP1	Governance structure in place to monitor and act.
3	Project management does not work	WP1	Project coordinator and Governance structure in place to monitor and act.
4	MPE Infrastructure not ready	WP2	MPE Infrastructure will be built based on existing infrastructure, so no critical design components. Content progress will be monitored.
5	No participants for MPE Operation	WP2	Participation will be beneficial for ESFRI facilities participating in the project, so there will be enough pressure to participate.
6	Dissemination and outreach does not reach far enough	WP2	ASTRON (lead) has a good record on outreach and dissemination and has an interest in making the project well known to everyone.
7	Lack of ICT infrastructures and skills in computing	WP3	Direct involvement of major Computing Centres owned by ASTERICS partners and supporting the ESFRI projects is formally defined through D3.1. This would minimize the risk and allow to look for international "relay-mode" cooperation among centres, e.g. EU-T0 collaboration framework will support the WP3 management and to guarantee the execution of the project plan.
8	Activities diverging from the cooperative framework and lack of cross-fertilization	WP3	All proposed tasks are selected on the basis of common prior interest with at least two or more ESFRI projects standing to benefit. Funded human

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			resources are allocated exclusively for federated efforts. Mid-term deliverables will help to gather interest and cooperation from more partners and allow monitoring that the path followed path is consistent with the expected objectives. The AEB together with the AMST will monitor this closely.
9	Scale of WP3 leads to fragmentation of effort and disengagement from the main project. Limited coherence with similar efforts and developments in other domains	WP3	Task MAUD will bring sufficient management resources to ensure OBELICS does not diverge - data dissemination through co-located thematic but multi-disciplinary events; cooperation of well-established and transversal ICT and e-initiatives etc.
10	VO framework does not meet the needs of the ESFRI infrastructures.	WP4	ASTERICS is designed to collect requirements and feedback from ESFRI projects on implementation of the VO framework (Task 4.1). ASTERICS partners have significant experience with implementation of the framework, and will use the requirements and feedback to make any necessary customisations. ASTERICS partners hold leadership roles in IVOA and will integrate priorities and requirements for the updates of the framework into the IVOA process.
11	Pathfinder/ESFRI projects do not implement the VO framework	WP4	ASTERICS is designed to provide support from experienced VO teams (Task 4.1): direct support, helpdesk, and the provision of data publication software libraries. Global emphasis on Science 2.0 principle will force European scale projects to comply with VO goals.
12	The data framework does not meet the needs of the scientific community	WP4	ASTERICS Task 4.2 uses training combined with the gathering of requirements and feedback to ensure the relevance of VO tools and framework. High-level guidance is provided by the AEAB.
13	Divergence of priorities between ASTERICS and IVOA	WP4	ASTERICS partners include leading actors in the IVOA, and Task 4.3 will ensure representation of European priorities within IVOA.
14	Wavelength-stabilized OSC-band transmitters not commercially available (D5.1.1)	WP5	In-house design of transmitters is possible.

Risk Number	Description of Risk	Work Packages Concerned	Proposed risk-mitigation measures
15	Impact of environmental site factors on timing precision underestimated (D5.1.5)	WP5	Partners have realistic lab simulators that can recreate these conditions. Combine lab tests with actual field test campaign at CTA site
16	Divergent scientific and operational requirements and goals	WP5	Invoke task coordination meetings and identify primary objectives early on.
17	No budgeted operational/ investment cost for pilot	WP5	Review impact at design milestone
18	CTA and SKA scheduling software applications are not ready to integrate both projects in the simulation	WP5	Involve CTA and SKA development teams from the beginning to discuss the maturity of the software and jointly define the base requirements to build the simulation infrastructure.

• **Unforeseen Risks**

Risk Number	Description of Risk	Work Packages Concerned	Proposed risk-mitigation measures
U1	Difficulties in hiring of new expert personnel with project partner. First year hiring has advanced quite good despite of some unforeseen delays. The hiring process has been challenging for some of the partners. Recruitment process at the partner institutes UCAM, CNRS-APC, CNRS-IAP, has not been fully implemented. Hiring technical engineers proved to be a very difficult task due to the shortage of people willing to leave industry for public projects. This led to another challenge, which is to train non-specialists to the issues at hand in ASTERICS in general. It has also caused over commitment of leads at partner institutions. This issue has been discussed under risk management in the WP meetings, AEB meetings, and in the last AGA meeting.	WP2,WP1,WP4,WP3,WP5	<ul style="list-style-type: none"> • Pick up tasks by existing staff at partner. • Train non-specialists for the tasks where hiring experts is difficult. • Shift task to other partner.

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U2	New ESFRI facility wants to join the project. No budget reserved for new partners.	WP1	Repeatedly ask partners to plan and forecast in detail the cost at completion and urge them to free budget to allow a necessary new partner to access the project consortium. For future projects, budget a management reserve (a provision for the unknown unknowns) for diverging activities at the end of the project.

• **States of the Play for Risk Mitigation**

Risk Number	Period	Did you apply risk mitigation measures?	Did your risk materialise?	Comments
1	1	Yes	No	
	2	Yes	No	
	3	Yes	No	
2	1	Yes	Yes	The general director of ASTRON, personally involved as coordinator of the project, moved to another institute. In consultation with the project Consortium and the Project Officer in Brussels, the ASTRON managing director accepted the coordinating position. There were no changes in the project management team or the support team, so the continuation of the project management was guaranteed.
	2	Yes	Yes	The ASTRON managing director, who accepted the coordinating position after the general director of ASTRON moved to another institute, handed over the coordinating task to the new general director of ASTRON in the fall of 2017. As the project management team and the support team

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				had been enlarged with two persons during his coordination period, the continuation of the project management was guaranteed.
	3	Yes	No	
3	1	Yes	No	
	2	Yes	No	
	3	Yes	No	
4	1	Yes	No	Since the project beginning, the Zooniverse platform has been released as open-source software, and is very well tested. We therefore believe this risk to be negligible.
	2	Yes	No	
	3	Yes	No	
5	1	Yes	No	Indeed, three ESFRI facilities have already sent representatives to our mass participation workshop and project ideas are already in development.
	2	Yes	No	
	3	Yes	No	
6	1	Yes	No	As the project is still in its relatively early stages, it is too soon to measure the impact and reach of our dissemination and outreach.

Risk Number	Period	Did you apply risk mitigation measures?	Did your risk materialise?	Comments
	2	Yes	No	
	3	Yes	No	
7	1	Yes	No	
	2	Yes	No	
	3	Yes	No	
8	1	Yes	No	
	2	Yes	No	There is cross-fertilization between the ESFRI facilities. To increase the cross-fertilization between the work packages, we organised a all-hands meeting in March 2018 Amsterdam.
	3	Yes	No	
9	1	Yes	No	
	2	Yes	No	
	3	Yes	No	
10	1	Yes	No	<ul style="list-style-type: none"> • Sustained Workshop activity to build the WP4 team at the beginning of the project • Discussion on requirements in particular in D4.3 and checks during all the meetings • Collaborations established

Risk Number	Period	Did you apply risk mitigation measures?	Did your risk materialise?	Comments
				between VO and ESFRI teams on specific topics (data publication, standards, tools)
	2	Yes	No	
	3	Yes	No	
11	1	Yes	No	<ul style="list-style-type: none"> • Sustained Workshop activity to build the WP4 team at the beginning of the project • Discussion on requirements in particular in D4.3 and checks during all the meetings • Collaborations established between VO and ESFRI teams on specific topics (data publication, standards, tools) • Additional meetings when useful (Provenance, Gravitational Waves) • Additional collection of large project requirements in the IVOA ("focus sessions", survey)
	2	Yes	No	
	3	Yes	No	
12	1	Yes	No	<ul style="list-style-type: none"> • Sustained Workshop activity to build the WP4 team at the beginning of the project • Discussion on requirements in particular in D4.3 and checks during all the meetings • Collaborations established between VO and ESFRI teams on specific topics (data publication, standards, tools) • Additional meetings when useful (Provenance, Gravitational Waves) • Additional collection of large project requirements in the IVOA ("focus sessions", survey) • Good alignment of IVOA and DADI initial priority areas • Standards relevant

Risk Number	Period	Did you apply risk mitigation measures?	Did your risk materialise?	Comments
				to multi-dimensional data near completion in IVOA • New start of the IVOA work in the time domain using DADI momentum
	2	Yes	No	
	3	Yes	No	
13	1	Yes	No	• Additional collection of large project requirements in the IVOA (“focus sessions”, survey) • Good alignment of IVOA and DADI initial priority areas • Standards relevant to multi-dimensional data near completion in IVOA • New start of the IVOA work in the time domain using DADI momentum
	2	Yes	No	
	3	Yes	No	
14	1	Yes	No	
	2	Yes	No	
	3	Yes	No	
15	1	Yes	No	
	2	Yes	No	
	3	Yes	No	

Risk Number	Period	Did you apply risk mitigation measures?	Did your risk materialise?	Comments
16	1	Yes	No	
	2	Yes	No	
	3	Yes	No	
17	1	Yes	No	
	2	Yes	No	
	3	Yes	No	
18	1	Yes	No	
	2	Yes	No	
	3	Yes	No	
U 1	2	Yes	Yes	In the second period less partners suffered from difficulties in hiring new experts. Still some partners had trouble replacing persons that left the institute.
	3	Yes	No	
U 2	2	Yes	Yes	At the January 2018 meeting, the General Assembly accepted the proposal of the European Solar Telescope (EST) consortium to join development work in the ASTERICS WP3 and WP4 activities. The collective partners could not find the budget needed for this proposal. It took

Risk Number	Period	Did you apply risk mitigation measures?	Did your risk materialise?	Comments
				six months before the budget was made available and could be allocated to EST.
	3	Yes	No	