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PROJECT FINAL REPORT

Grant Agreement number: 312768
Project acronym: SpacePLAN 2020
Project title: Space Research Road-mapping and Planning for Europe
Funding Scheme: FP7-CSA-CA
Date of latest version of Annex I against which the assessment will be made:
5th February 2015
Period covered: **from 01/01/2013 to 31/12/2015** (project end)
Name, title and organisation of the scientific representative of the project's coordinator[1]:

Dr Jason Forshaw, on behalf of Professor Phil Palmer
University of Surrey

Tel: +44 1483 68 6307

E-mail: **j.forshaw@surrey.ac.uk**

Project website[2] address:

http://www.spaceplan2020.com/

[1] Usually the contact person of the coordinator as specified in Art. 8.1. of the Grant Agreement.
[2] The home page of the website should contain the generic European flag and the FP7 logo which are available in electronic format at the Europa website (logo of the European flag: http://europa.eu/abc/symbols/emblem/index_en.htm logo of the 7th FP: http://ec.europa.eu/research/fp7/index_en.cfm?pg=logos). The area of activity of the project should also be mentioned.

Declaration by the scientific representative of the project coordinator

I, as scientific representative of the coordinator of this project and in line with the obligations as stated in Article II.2.3 of the Grant Agreement declare that:

- The attached periodic report represents an accurate description of the work carried out in this project for this reporting period;
- The project (tick as appropriate) [3]:
  - ☑ has fully achieved its objectives and technical goals for the period;
  - ☐ has achieved most of its objectives and technical goals for the period with relatively minor deviations.
  - ☐ has failed to achieve critical objectives and/or is not at all on schedule.
- The public website, if applicable
  - ☑ is up to date
  - ☐ is not up to date
- To my best knowledge, the financial statements which are being submitted as part of this report are in line with the actual work carried out and are consistent with the report on the resources used for the project (section 3.4) and if applicable with the certificate on financial statement.
- All beneficiaries, in particular non-profit public bodies, secondary and higher education establishments, research organisations and SMEs, have declared to have verified their legal status. Any changes have been reported under section 3.2.3 (Project Management) in accordance with Article II.3.f of the Grant Agreement.

Name of scientific representative of the Coordinator:

Dr Jason Forshaw, on behalf of Professor Phil Palmer

Date: 29 / 02 / 2015

For most of the projects, the signature of this declaration could be done directly via the IT reporting tool through an adapted IT mechanism and in that case, no signed paper form needs to be sent

[3] If either of these boxes below is ticked, the report should reflect these and any remedial actions taken.

3.1 Final publishable summary

3.1.1 Executive Summary

SpacePlan 2020 (SP2020) is a 3 year European Commission (EC) FP7 funded project that responds to the SPA.2012.3.5-02 theme of the FP7 Space 2012 call which request proposals for the definition of research agenda's and research activities for a European Research framework program.

The scope of SP2020 is to concentrate only on five key areas. The five core areas examined are:

1. Small Satellites
2a. Launch Vehicles (Propulsion)
2b. Launch Vehicles (Avionics & Systems)
2c. Launch Vehicles (Structures & Materials)
3. GNC
4. Propulsion
5a. Space Exploration
5b. Robotics

SP2020 Process

SP2020 has developed a technology assessment methodology that can be followed to assess the importance and development paths of different technologies. The process consists of 4 stages:

A. Technology Down-selection
B. Metric Selection
C. Dedicated Expert Workshops
D. Technology Assessment (technology strategy, themes and roadmaps)

A reduction of technologies to a manageable number is performed in A and then selection of the metrics to be used for assessment is done in B. In C, a series of expert workshops (one for each SP2020 area) are hosted, allowing a series of technologies to be scored and ranked. In each workshop, experts worked through a series of down-selected technologies and provided scoring and justification for each technology. A list of post-workshop technologies is then collated.

In the first part of the assessment process, D1, roadmaps throughout Europe and beyond were examined and to identify gaps in the roadmaps which could be filled with the technology developments identified in the expert workshops. The analysis includes: EC work programmes (H2020), the SRC calls, critical space technologies for European strategic non-dependence, ESA 2015 harmonisation (including European Space Technology Master Plan, ESA CleanSpace and ESA FLPP), NASA 2015 roadmap series and Technology Area Breakdown Structures. The analysis leads

to the categorisation of the technologies into a series of 'themes' and providing a final list of technologies for SP2020.

In the second part of the assessment process, D2, the 8 developed themes are explored:

1. Development of Exploration Technologies for Moon and Mars
2. Deep Space Missions with Microsatellites and Nanosatellites
3. Earth Observation (EO) and Applications Missions with Microsatellites and Nanosatellites
4. Development of Space Debris Removal and On-Orbit Servicing Technologies
5. More Affordable Launcher Architectures and Technologies
6. Cleaner Launcher Technologies
7. Higher Performance Launcher Technologies
8. Key Non-dependent or Critical Technologies for Europe

Each theme cuts across multiple technology domains and draws together several technologies. For each finally recommended technology a justification as to why the technology needs development, or what might be the current limitations of existing technology is provided. In addition, a roadmap for the technology showing the development path up to and sometime beyond 2020 is produced.

The approach to SP2020 throughout has been at a "technology level" using a "bottom-up" approach. The technology level approach means core recommendations can be directly made to select areas without consideration of exactly what mission the technology is being used on. SP2020 therefore does not intend to map any proposed in-flight demonstrations to current launch dates.

SP2020's scope does not include estimation of the finances required to develop any of the recommended technologies. Although the cost of developing a technology is dependent on various factors (e.g. background of the developer and timescales), these roadmaps are developed on the assumption of "what may be deemed a realistic timescale based on the current developmental progress in that area" and not on whether funding is likely to be available in that timeframe to fund the development, or who would provide such funding.

<u>Contributions to European Space Strategy</u>

SP2020 has tackled niche space technologies, researched existing roadmaps, engaged with experts and decision makers in the space domain, conducted space technology workshops, and developed a rapid and low cost complementary technology assessment approach.

It has helped to:

- Identify potential gaps in existing roadmaps from space agencies, in particular technologies which align with the outputs from the assessment workshops.

- Identify disruptive technologies and those which appear to currently receive less attention in the space community, but could have very large impact in the longer term.
- Identify technologies that make Europe dependent on other countries and entities and technologies which, if developed, could contribute to having a European in-house capability.
- Construct roadmaps for key technologies (37 in total, out of 41 technologies) in order to scope both vision and development paths for highlighted technologies.

SP2020 doesn't compare with ESA or NASA harmonisation programmes as the project is a one-shot effort for fixed time duration (not an on-going process) and is constrained by far fewer resources. By proposing the low cost assessment process, SP2020 aims to have a small, yet useful, contribution to roadmapping and technology development in Europe.

SP2020 tried to identify which promising technologies are maturated in FLPP, and which ones are missing, in order to help to determine how Europe maintains and strengthens its independent access to space into the long-term. The outputs from the SP2020 have so been harmonised with FLPP and thus complementary technologies are recommended overall in the launcher domain. The SP2020 results benefited from the on-going efforts of the FLPP. This increases the value of both FLPP and SP2020 from a launcher technology perspective.

In addition, the SP2020 outputs have been designed to feed into the H2020 space programme and to future call development.

3.1.2 Summary description of project context and objectives

Space is part of our everyday life. Without the use of space assets many applications which are integral to our lives (communications, meteorology, navigation, science and agriculture) would suffer. In order to successfully and sustainably exploit the benefits of space the available technologies need to be robust, reliable and low cost. The evolution and development of space technologies requires careful consideration and planning to ensure future needs are met with minimal strife.

SpacePlan 2020 (SP2020) is a 3 year European Commission (EC) FP7 funded project that responds to the SPA.2012.3.5-02 theme of the FP7 Space 2012 call which request proposals for the definition of research agenda's and research activities for a European Research framework program. SP2020 fills a gap which exists in the European community on providing research and technology roadmaps up to 2020 for key space technologies using inputs from multiple stakeholders in Europe and internationally while fostering dialogue and collaboration.

The SP2020 project will answer various questions towards the EU mandate to develop a robust and sustainable space research capability in Europe such as:

- What space technologies need to be further developed and how?
- What should be the space technology agenda in Europe towards 2020?
- Can technology roadmaps be drawn with strong European and complimentary international inputs?

Scope

The scope of SP2020 is to concentrate only on five key areas. The five core areas examined are:

1. Small Satellites
2a. Launch Vehicles (Propulsion)
2b. Launch Vehicles (Avionics & Systems)
2c. Launch Vehicles (Structures & Materials)
3. GNC
4. Propulsion
5a. Space Exploration
5b. Robotics

3.1.3 Description of main S & T results/foregrounds

SP2020 Process

SP2020 has developed a technology assessment methodology that can be followed to assess the importance and development paths of different technologies. The process consists of 4 stages:

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In the first part of the assessment process, D1, roadmaps throughout Europe and beyond were examined and to identify gaps in the roadmaps which could be filled with the technology developments identified in the expert workshops. The analysis includes: EC work programmes (H2020), the SRC calls, critical space technologies for European strategic non-dependence, ESA 2015 harmonisation (including European Space Technology Master Plan, ESA CleanSpace and ESA FLPP), NASA 2015 roadmap series and Technology Area Breakdown Structures. The analysis leads

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SP2020's scope does not include estimation of the finances required to develop any of the recommended technologies. Although the cost of developing a technology is dependent on various factors (e.g. background of the developer and timescales), these roadmaps are developed on the assumption of "what may be deemed a realistic timescale based on the current developmental progress in that area" and not on whether funding is likely to be available in that timeframe to fund the development, or who would provide such funding.

3.1.4 Potential impact and main dissemination activities and exploitation results

Contributions to European Space Strategy

SP2020 has tackled niche space technologies, researched existing roadmaps, engaged with experts and decision makers in the space domain, conducted space technology workshops, and developed a rapid and low cost complementary technology assessment approach.

It has helped to:

- Identify potential gaps in existing roadmaps from space agencies, in particular technologies which align with the outputs from the assessment workshops.
- Identify disruptive technologies and those which appear to currently receive less attention in the space community, but could have very large impact in the longer term.
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In addition, the SP2020 outputs have been designed to feed into the H2020 space programme and to future call development.

<u>Post-Project Activities</u>

The SP2020 project ended on the 31st December 2015. In the interests of both consortium and the EC, some post-project activities were performed or are envisaged. The consortium considers:

1. Engaging with the EuroSpace organisation and briefing them on the final project results.

2. Continuing to progress development on the ESA FLPP from which SP2020 benefited from:
    a. The ESA launcher directorate were met as part of the ESA Launcher Day in Paris on 17th February 2016, where several themes were considered around Europe's low cost access to space. Themes included: FLPP results of technologies proposed for future development, the future of Vega C and Ariane 6, the LEE (launcher evolution element).
    b. It is proposed a meeting is organised with programme manager of the FLPP at the ESA Launcher Directorate, Paris in March for a full SP2020 briefing.

c. These activities and FLPP form part of the strategy of Airbus DS / Airbus Saffron Launchers in terms of future launcher projects.

3. Continuing on the survey journal paper in preparation for Acta Astronautica.

4. From an Athena SPU perspective, the recommendations made with respect to radiation hardened components form part of the key strategy for future work for Athena.

5. SP2020 will ideally provide inputs to the H2020 work programme.

3.1.5 Address of project public website and relevant contact details

More information on the SpacePlan-2020 project can be found at:

http://www.spaceplan2020.com/

The following are the contact details for the project:

1. Dr Jason Forshaw, Surrey Space Centre Project Manager, j.forshaw@surrey.ac.uk
2. Professor Guglielmo Aglietti, Director of Surrey Space Centre, g.aglietti@surrey.ac.uk

3.1.6 Publications

The conferences that were held during the course of the project include:

- Forshaw, J. L., Bamber, D., Turconi, A., Palmer, P., Gignac, D., Troyas, P., Sarris, E. and Margaronis, K. (2015), "SpacePlan 2020: Identification and Assessment of Key Space Technologies towards 2020", 66th International Astronautical Congress, Jerusalem, Israel. [Session: IAA Symposium on Visions and Strategies for the Future]

- 2016 International Astronautical Congress (Guadalajara, Mexico), abstract submission shortly to be undertaken: "Roadmapping for Europe: SpacePlan 2020 – Final Results".

3.1.7 Dissemination Activities

The following dissemination activities were undertaken:

- Symposium One, Full day event on the 27th February 2014, hosted at the Radisson Blu Edwardian, Guildford, UK, 118 delegates, 72% attendance rate, 16 international speakers.
- The ESA launcher directorate were met as part of the ESA Launcher Day in Paris on 17th February 2016, where several themes were considered around Europe's low cost access to space.

3.2 Core of the report for the period: Project objectives, work progress and achievements, project management

3.2.1 Project objectives for the period

Note: the summary in these sections represents the amended version of SP2020 from March *2015.*

Work Package 100

The objective of this work package is to establish the specific technical roadmap objectives of the project in terms of space technology, agency (EU, ESA, NASA, JAXA etc) roadmaps as well as a survey of planned space missions and applications. This work package will also include the general overview and TRL and IRL (Implementation readiness level) of space technologies and missions planned in Europe and Internationally. Furthermore a complete list of space technology and space mission conferences, workshops, symposia and other forums will be reviewed and surveyed.

Deliverables due for this period include:

- D100.1) Report on Technology Survey & Enabling Space Missions/Applications [month 12]
- D100.2) Report on Space Agencies Technology Roadmaps [month 12]
- D100.3) Report on 1st Symposium on Space technology road-mapping (emphasis on technology) [month 12]

Work Package 200

Having surveyed the European and International domain with respect to space technology capabilities/developments, missions, space applications and agency roadmaps, the objective of work package 200 is to establish an in depth understanding of five key space technology areas: (i) Guidance, Navigation and control (ii) Propulsion (iii) Launch vehicle technology (iv)small satellites and (v) space exploration. An in depth assessment will take place according to the IRL and TRL of the various technologies which will lead to the generation of a comprehensive 'white paper' on space technology development through a technology roadmap which has a European core but with international inputs, reflecting international collaboration in space technology and space missions.

Deliverables due for this period include:

- D200.1) GNC & Propulsion Technology Report [month 31]
- D200.2) Launch Vehicle, Small Satellites Report [month 31]
- D200.3) Space Exploration Report [month 31]
- D200.4/5/6) Report on 2nd Symposium on Space technology road-mapping (emphasis on space exploration and international collaboration) + Space Technology Roadmap White Paper (Report), 1st Version. Symposium 2 & 3 merged. Symposium report merged with roadmap draft report D200.7 [month 31]
- D200.7) Space Technology Roadmap White Paper (Report) - Final Version [month 36]

Work Package 300

The purpose of this work package is to gather, synthesise, and disseminate the project objectives, scientific advances, project data produced during this project to all parties within the consortium, the scientific community, and to the general public.

Deliverables due for this period include:

- D300.1) Dissemination and communication strategy document [month 6]
- D300.2) First year intermediate report on the dissemination of information via journal publications, conference and websites [month 12]
- D300.3) Second year intermediate report on the dissemination of information via journal publications, conference and websites [month 24]
- D300.4) Final report on the dissemination of information via journal publications, conferences and websites [month 36]

Work Package 400

The purpose of this work package is to manage all aspects of the project. This will include operations, administration, finances, and ensuring deliverables and milestones are achieved on schedule. Also, this work package will provide a communications link to the officers within the European Union commission.

Deliverables due for this period include:

- D400.1) Project handbook: Project handbook [month 2]
- D400.2) First year progress report Represented by M18 Periodic Report per PO [month 12]
- D400.3) Second year progress report Represented by M18 Periodic Report per PO [month 24]
- D400.4) Final progress report [month 36]

3.2.2 Work progress and achievements during the period

Note: the summary in these sections represents the amended version of SP2020 from March *2015.*

Work Progress Summary

The progress of each task for the defined period is detailed below.

Table 1. WORK PACKAGE DETAIL

WP no.	Task no.	Progress Summary	Significant Results	Deviations	Schedule	Resource Usage	Corrective Actions
100	T1.1	Space technology survey completed. Results submitted as part of D100.1.	Identified space technologies being used and under development in Europe and internationally in all key areas such as GNC, Propulsion, OBDH, communications, thermal, robotics, launch vehicles.	-	Export license issue occurred. A delay of 4 months was incurred.	See Section 3.4.	Delay was utilised to incorporate additional materials recently published.
	T1.2	Agency Roadmaps document completed and submitted as D100.2.	Major roadmaps across the globe have been reviewed, giving an overview of current technology developments and future objectives	-	A delay of 4 months was incurred.	See Section 3.4.	
	T1.3	Enabling Space Missions and Applications survey completed and submitted as part of D100.1.	Enabling space missions and applications surveyed	-	A delay of 4 months was incurred.	See Section 3.4.	
200	T2.1-T2.5	In depth assessment of technologies (GNC,	Series of dedicated workshops plus new assessment	Refocus of DoW towards small satellite missions was proposed	-	See Section 3.4.	Effect of delay from WP100 was

Table 1. WORK PACKAGE DETAIL							
WP no.	**Task no.**	**Progress Summary**	**Significant Results**	**Deviations**	**Schedule**	**Resource Usage**	**Corrective Actions**
		Propulsion, Launch vehicles, small satellites and space exploration) – This task is on-going with technologies identified in WP100 being down-selected and appropriate metrics determined.	process led to D200.1 to D200.4/5/6.	and rejected after M18. Move from single symposium to series of dedicated workshops.			minimised by use of additional resources
300	-	Dissemination and communication. D300.1 and D300.2 has been completed and submitted – This task is on-going.	Presentations and information from 1st symposium are available on the spaceplan2020 website		D300.2 was submitted prior to M18	See Section 3.4.	

Recommendations from M6

A number of recommendations were made following the M6 review. These recommendations along with the remedial actions taken are listed below.

ID	Work Package	Recommendation	Completed	Comment
1	WP100	**D100.1, D100.2** The work progress and achievements should be reported and documented in an appropriate fashion. In particular for WP 100 evidence of progress should include e.g. an annotated list of information gathered in the course of performing the WP tasks and samples of at least some of the information compiled.	Yes	Information available in draft and final reports. See D100.1, and D100.2.

2	WP100	**Symposium** Regarding Symposium 1 (emphasis on technology) there is a need for proper and timely planning to try to ensure success. By month 9 the Coordinator should provide detailed information on the agenda, participants (with special emphasis on day 2), other aspects, etc.	Yes	Structure, speaker information, agenda, etc. documented and provided prior to 1st Symposium event.
3	WP100	**Symposium** The documentation to be discussed on day 2 should be delivered to the relevant participants at least two weeks in advance.	Yes	Provided 2nd day reviewers with documentation. Feedback reported through telecon and questionnaires.
4	WP100	**Mid Term Review** It is recommended to perform an additional Mid Term Review right after completion of WP100, including Symposium 1, in order to review the achievements made, assess whether they form a proper basis for the execution of WP200 and make appropriate decisions as to how to proceed with it.	Yes	This is covered by the M18 review.
5	WP400	**Management Structure** It is recommended that the full organisational structure, including all project personnel, be put in place without further delay.	Yes	This is documented within the project handbook.
6	WP400	**Management Structure** It is further recommended that the Advisory Board should include members to cover the whole spectrum of knowledge of the different technology / programme areas and that it be put to work as soon as possible.	Yes	This is documented within the project handbook.
7	WP400	**Management Structure** A complete organisational structure including the identification of all project personnel and members of the Advisory Board should be available by month 9 at the latest, the fact that some names were mentioned at the Review Meeting notwithstanding.	Yes	This is documented within the project handbook.

8	WP300	**D300.1 - Dissemination and Communication Strategy Document** The quality of deliverables should be substantially improved. A meaningful, updated D 300.1 document should be available by month 9, which should describe the dissemination strategy, its focus, messages to be passed as applicable to target groups, dissemination tools, etc.	Yes	Updated document with relevant sections added.
9	WP400	**D400.1 - Project Handbook** Regarding D400.1, an updated, meaningful version of the Project Handbook should be available by month 9, and the document should provide, inter alia, information regarding the project tasks and its detailed timing, allocation of resources to the various project tasks including list of personnel undertaking those, the actual composition of the Advisory Board, an annotated list of information gathered in the course of performing the WP tasks, annotated tables of contents of the deliverables of the project, any other useful information for the carrying out of the project.	Yes	An updated version of the handbook has been submitted. This document is updated on a regular basis and available upon request.

Recommendations from M18

Various presentations were given by the participants on the different subjects pertinent to the review. Discussions on the different topics were undertaken allowing a proper understanding of the project progress and future activities. Overall, the project was deemed to have made relatively good progress. Requested amendments along with corrective actions are listed below.

ID	Work Package	Recommendation	Completed	Comment
1	WP100	**D100.1** The document is acceptable regarding the technology survey; the chapter devoted to Enabling Space Missions and Applications is very meagre (2 pages out of 175) and it should include an adequate if succint discussion of the projects listed, at least from their technology perspective; it is also incomplete	Yes	D100.1 was updated with extra material and an expanded Mission and Applications section. This was re-submitted in M22 and later

		(e.g. MSR is not even mentioned). The document shall be updated.		accepted.
2	WP100	**D100.2** The document should be completed with at least a discussion on the substance of which technologies are addressed by which agency, not only by the formal aspects of how do they prepare these roadmaps. Some conclusions should be also drawn especially in view of the transition work to WP200.	Yes	D100.2 was updated with additional roadmaps and analysis. This was submitted in M22 and later accepted
3	WP100	**D100.3** Requires update addressing the substantial conclusions of the symposium in terms of technologies, not only of the organisational aspects. The chapter on metrics shall be completed upon receipt of the distributed questionnaires.	Yes	D100.3 was updated and submitted in M22 and later accepted.

Final Work to Completion

Significant progress has been made in performing efforts to complete the project on time and to budget.

In the project the following have been achieved:

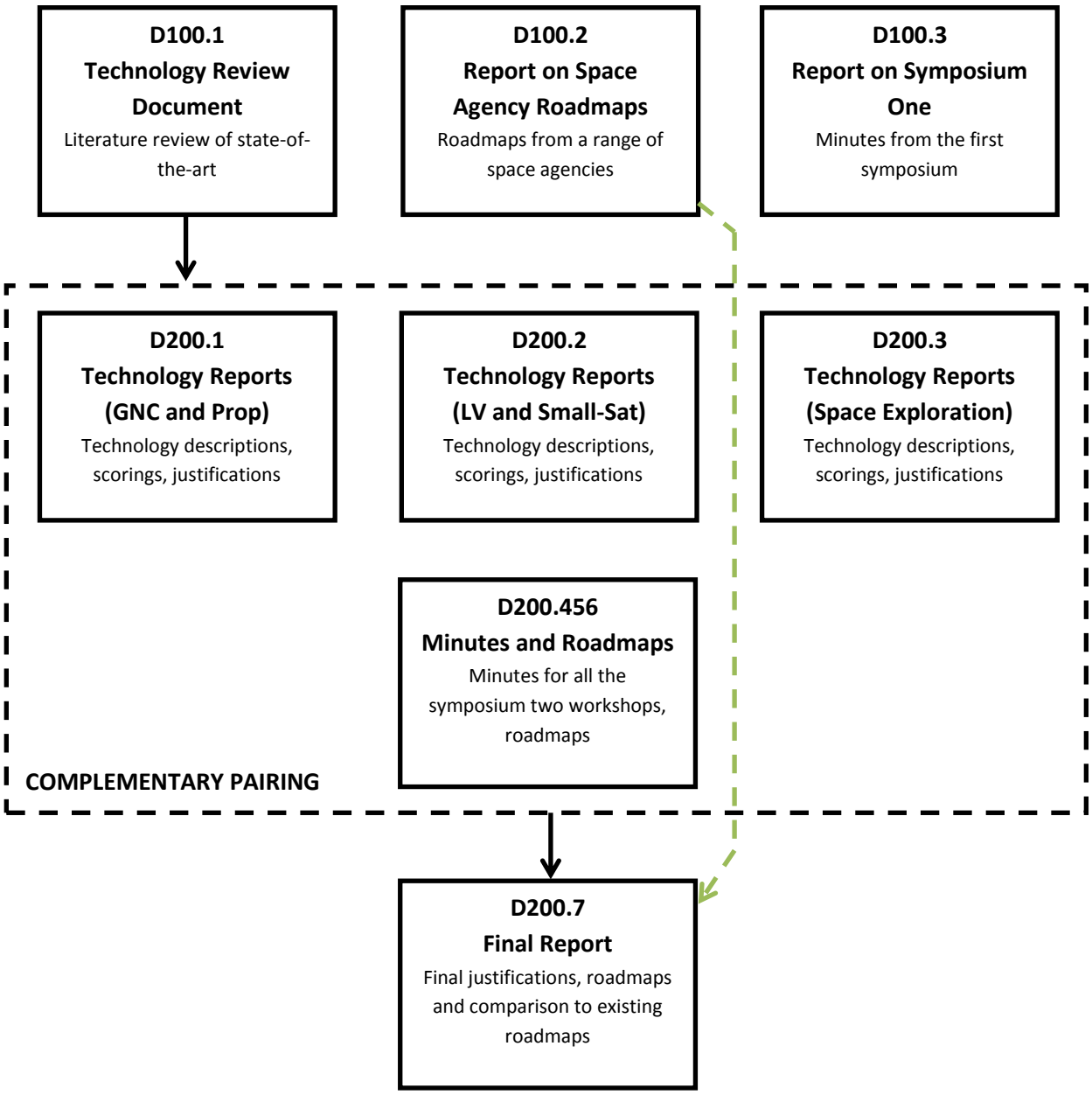
• Established an in depth understanding of five key space technology areas: (i) guidance, navigation and control, (ii) propulsion, (iii) launch vehicle technology, (iv) small satellites, and (v) space exploration.

• Developed a technology assessment methodology that can be followed to assess the importance and development paths of different technologies.

• Hosted a series of expert workshops (collectively Symposium Two) – one for each SP2020 area, allowing a series of technologies to be scored and ranked.

• Established final conclusions on technology development and provide roadmaps for selected technologies.

• Performed dissemination of the SP2020 outputs to various stakeholders including within publications and as recommendations to space agencies.


D100.1
Technology Review Document
Literature review of state-of-the-art
D100.2
Report on Space Agency Roadmaps
Roadmaps from a range of space agencies
D100.3
Report on Symposium One
Minutes from the first symposium
D200.1
Technology Reports (GNC and Prop)
Technology descriptions, scorings, justifications
D200.2
Technology Reports (LV and Small-Sat)
Technology descriptions, scorings, justifications
D200.3
Technology Reports (Space Exploration)
Technology descriptions, scorings, justifications
D200.456
Minutes and Roadmaps
Minutes for all the symposium two workshops, roadmaps
COMPLEMENTARY PAIRING
D200.7
Final Report
Final justifications, roadmaps and comparison to existing roadmaps

3.2.3 Project management during the period

Consortium Management Tasks and Achievements

Amendment

An amendment to SP2020 was made in March 2015 and was accepted. The most important changes include:

- Adjustment of original D200.4 and original D200.6, both focusing on the conference session on space technology road-mapping, to D200.4/5/6 focusing on the workshops from symposium 2.
- Adjustment of original D200.5 and original D200.7, both focusing on a space technology roadmap white paper (draft and full forms), to D200.7, a single final report on the project.

Changes in Consortium

As of January 2015, the principal investigator Prof Phil Palmer replaces Prof Vaios Lappas.

As of October 2015, the consortium project manager Dr Jason Forshaw replaces Dr David Bamber.

List of Project Meetings

Table 2. MEETINGS

Month	Meeting Name	Location	Date/Proposed Date	Already Held?
M0	Kickoff Meeting	REA, Brussels	25/01/2013	Yes
M6	M6 Review Meeting	REA, Brussels	28/06/2013	Yes
M15	Progress Meeting	Teleconference	12/03/2014	Yes
M17	NASA Roadmap Discussions	Surrey Space Centre	16/05/2014	Yes
M18	Progress Meeting	Teleconference	07/07/2014	Yes
M18	M18 Review Meeting	Surrey Space Centre	30/07/2014	Yes
M22	Progress and planning meeting	Surrey Space Centre	23/10/2014	Yes

Table 2. MEETINGS				
Month	**Meeting Name**	**Location**	**Date/Proposed Date**	**Already Held?**
M30	M30 Review Meeting (Pre-Final)	Brussels, Belgium	11/11/2015	Yes
M36	M36 Review Meeting (Final + Presentation to EC Panel)	Brussels, Belgium	10/02/2016	Yes

Project Planning and Status

In this final period there were no delays with all deliverables submitted on time:

- Delivery of D200.1 and D200.2 by 30th September 2015
- Delivery of D200.3 and D200.456 by 31st October 2015
- Delivery of D200.7 by 21st January 2016, final after last EC meeting submitted 29th February 2016
- Completion of D300.4 (dissemination) by 29th February 2016
- Completion of D400.4 (management) by 29th February 2016

Changes to the Beneficiary Legal Status

As of the first periodic report and reported in D400.3, Astrium is now part of Airbus Defence and Space; submitted deliverables reflected the rebranding.

As of November 2015, the Airbus DS entity split its launcher division off into Airbus Saffron Launchers, which is responsible for all the launcher work in deliverables D200. As this change was phased to happen over several months (would not be complete by project completion) and the project official end date was December 2015, no action was taken. There was no impact to the work due to this change.

Development of the Project website

The project website was kept up to date throughout the project. See D300.4 for full information on content.

3.3 Deliverables and milestones tables

Deliverables

TABLE 1. DELIVERABLES										
Del. no.	**Deliverable name**	**Version**	**WP no.**	**Lead beneficiary**	***Nature***	**Dissemination level[4]**	**Delivery date from Annex I (proj month)**	**Actual / Forecast delivery date** **Dd/mm/yyyy**	**Status** **No submitted/** **Submitted**	**Comments**
D100.1	Report on Technology Survey & Enabling Space Missions/	1	100	2	R	PU	12	16	Submitted	

[4] **PU** = Public

PP = Restricted to other programme participants (including the Commission Services).

RE = Restricted to a group specified by the consortium (including the Commission Services).

CO = Confidential, only for members of the consortium (including the Commission Services).

Make sure that you are using the correct following label when your project has classified deliverables.

EU restricted = Classified with the mention of the classification level restricted "EU Restricted"

EU confidential = Classified with the mention of the classification level confidential " EU Confidential "

EU secret = Classified with the mention of the classification level secret "EU Secret "

	Applications									
D100.2	Report on Space Agencies Technology Roadmaps	1	100	1	R	PU	12	16	Submitted	
D100.3	Report on 1st Symposium on Space technology road-mapping (emphasis on technology)	1	100	3	R	PU	12	17	Submitted	
D200.1	GNC & Propulsion Technology Report	1	200	1	R	PU	24	33	Submitted	
D200.2	Launch Vehicle, Small Satellites Report	1	200	2	R	PU	24	33	Submitted	
D200.3	Space Exploration Report	1	200	1	R	PU	24	34	Submitted	
D200.456	Report on 2nd Symposium on Space technology road-mapping	1	200	1	R	PU	24	34	Submitted	

	(emphasis on space exploration)									
D200.7	Space Technology Roadmap White Paper (Report)- Final Version	1	200	1	R	PU	36	36	Submitted	Latest version v3.1
D300.1	Dissemination and communication strategy document	1	300	3	R	PU	6	6	Submitted	
D300.2	First year intermediate report on the dissemination of information via journal publications, confere	1	300	1	R	PU	12	18	Submitted	
D300.3	Second year intermediate report on the dissemination of information via journal publication	1	300	1	R	PU	24	24	Submitted	

	s, confer									
D300.4	Final report on the disseminati on of information via journal publication s, conferences and websites	1	300	3	R	PU	36	36	Submitted	Latest version v2.0
D400.1	Project handbo ok	1	400	1	R	PU	2	2	Submitted	
D400.2	First year progress report	1	400	1	R	PU	12	18	Submitted	Represente d by M06 Report per PO
D400.3	Second year progress report	1	400	1	R	PU	24	24	Submitted	Represente d by extended M18 Periodic report per PO
D400.4	Final progress report	1	400	1	R	PU	36	36	Submitted	

Milestones

TABLE 2. MILESTONES							
Milestone no.	**Milestone name**	**Work package no**	**Lead beneficiary**	**Delivery date from Annex I dd/mm/yyyy**	**Achieved Yes/No**	**Actual / Forecast achievement date dd/mm/yyyy**	**Comments**
MS1	Technology Survey	WP100	AST	12	Yes	16	
MS2	Space Agencies Technology Roadmaps Survey	WP100	SUR	12	Yes	16	
MS3	1st Symposium on Space technology road-mapping (emphasis on technology)	WP100	ATH	12	Yes	14	
MS4	GNC & Propulsion Technology Assessment	WP200	SUR	31	Yes	30	Combined into series of workshop (7 in total)
MS5	Launch Vehicle, Small Satellites Technology Assessment	WP200	AST	31	Yes	30	
MS6	Space Exploration Technology Assessment	WP200	SUR	31	Yes	30	

MS7	2nd Symposium on Space technology road-mapping (emphasis on space exploration)	WP200	SUR	31	Yes	30	
MS10	Space Technology Roadmap White Paper (Report)-Final Version	WP200	SUR	36	Yes	36(+)	Combined into final D200.7 deliverable