Technology Website Article Template

# Introduction

The website “[shaping the future](http://www.esa.int/Our_Activities/Space_Engineering_Technology/Shaping_the_Future)” was created in 2016 to publish articles on a selection of closed TRP (including ITI and Startiger) & GSTP activities as a contribution to both the dissemination of technology achievements and the Knowledge Management of ESA. The purpose of these articles is to inform a semi-professional audience about the activities.

The structure of the article is oriented on the structure of the Technology Achievement Template (TAT) that needs to be provided for every closed TRP & GSTP activity. The TAT is available on the same website as this document:

<http://www.esa.int/Our_Activities/Space_Engineering_Technology/Shaping_the_Future/Download_Area>

Although the reuse of the TAT is strongly recommended, the article should provide more information than the TAT – as provided normally during an oral presentation of the TAT.

ESA will then review and publish the article.

# Guidelines for article preparation

1/ Use the template provided in the annexes 1 to 4 to prepare the website article by replacing all the text in **blue** based on the TAT and enriched with your own summary or that extracted from the TRP or GSTP deliverables provided by the contractor(s) for the specific activity.

2/ **Avoid** the use of **area specific acronyms** that are not known to a semi-professional audience. Moreover, avoid the use of **the future tense**, e.g. “The service will provide the following features…” or “The following tasks will be carried out…”. Instead use forms for the text such as “The following tasks are covered by the project activities…”.

3/ **Provide a minimum of 2 supporting images:** A reference picture that is representative for the entire activity (e.g., a picture of the manufactured Engineering Model or a generic picture setting the developed component in its technical context) and a further picture that is representative of a highly relevant part of the activity.The pictures need to be in GIF/JPG/JPEG/PNG format (no transparency) as well as of a good size and quality (about 1,000 x 1,000 pixels shall be targeted). The provision of (short) captions is mandatory – 8 to 10 words maximum. If a more detailed description is required, it shall be provided in the dedicated field.The pictures will be published on ESA websites and in print – accessible for the public. If someone shall be credited for these images, further details need to be provided. The **provision of videos** (e.g., via a YouTube link) or further types of media is encouraged.

4/ Once completed, send the article and the images to the Technology Programmes section (tecdms@esa.int) with the Activity Title, Programme reference number, and the contract number in the subject line.

# Annex 1 – Article Header Information

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| --- | --- |
| Official Activity Title: | Assessments to Prepare and De-Risk Technology Developments: SABRE Application -FTV |

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| --- | --- | --- | --- |
| Programme: | GSTP | Achieved TRL: | 2 |
| Reference: | G617-241TAec | Closure:  | 2020 |
| Contractor(s): | Cranfield Aerospace Solutions Ltd (GB), BAE Systems Plc (GB), Reaction Engines Ltd (GB), Frost & Sullivan Ltd (GB)  |

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| Contract Number: | 4000129097/19/NL/BJ/rk |
| Further TRL info: | Initial: | 1 | Target: | 9 |
| Budget (incl. CCNs): | ESA: | 198.986 k€ | Co-funded: | 0.000k€ |
| Competence Domain: | CD07 |
| Technology Domain: | TD19 |
| Service Domain: | ST |
| Technical Officer: Name, Establishment, and e-mail | Mr Mark Ford (TEC-MPC)Mark.ford@esa.int |
| Industry Point of Contact: Name, Establishment, and e-mail | Dr Robert Jones (Cranfield Aerospace Solutions Ltd)r.i.jones@cranfieldaerospace.com |

# Annex 2 – Article

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| **Article** |
| Background and justification*Max. 75 words* | The Synergetic Air-Breathing Rocket Engine (SABRE) has the potential to allow the development of space launch systems which provide a step change in reusability, reliability and cost-per-kg to orbit. Whilst ground based development of SABRE core engine and rocket elements is progressing, flight testing of the SABRE nacelle elements is seen as most appropriate approach to raising their TRL to allow acceptable risk flight testing of an entire SABRE propulsion unit. |
| Objectives*Max. 75 words* | The purpose of this activity was to develop a roadmap for the next phase of SABRE development, focused on flight testing of SABRE propulsion elements, leading to the potential to flight test an integrated SABRE engine, and to assess the potential competitive position of SABRE powered systems in the future transportation segment. |
| Achievements and status*Max. 150 words* | A range of concept options to provide a staged approach to flight testing of SABRE propulsion elements up to a target condition of Mach 5/25 km have been generated and their advantages/disadvantages defined with consideration of aspects including safety, reliability and control. Significant commonality in design, development and verification steps between options has been recognised and most options also allow for associated airframe technology advancement.An analysis of the future space transportation market 2030+ and potential for SABRE-based systems within this been performed. This has indicated that transportation to orbit of small satellites is likely to be the most significant sector to target with a SABRE-based system but there are opportunities in other sectors. |
| Benefits*Max. 50 words* | SABRE propulsion would allow the development of fully re-usable, horizontal take-off and landing, Single- or Two Stage To Orbit launch vehicles powered by a single engine, operating in air breathing mode up to 25 km/Mach 5 and only requiring an on-board oxidizer for operation in rocket mode beyond that point.  |
| Next steps*Max. 50 words* | A quantitative assessment of options for flight testing SABRE propulsion is being planned. This will allow concept selection and development to a stage where funding for flight testing to Mach 5/25 km can be sanctioned and allow target TRL achievement towards a SABRE-based space transportation system. |

# Annex 3 – Pictures

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| **Pictures** |
| **Reference Picture** |
| Picture reference: | Picture 1\_GSTP\_G617-241TAec |
| Short caption: | Concept with single test nacelle and rocket additional propulsion |
| More detailed description: |  |
| Credits: |  |
| **Further Picture** |
| Picture reference: | Picture 2\_GSTP\_G617-241TAec |
| Short caption: | Concept with two test nacelles and no additional propulsion |
| More detailed description: |  |
| Credits: |  |

If videos are provided, the template for the mandatory pictures needs to be applied.

# Annex 4 – Related Content

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| **Related Content** |
| **Related links:** | Enter below any links related to this project, e.g. links to web pages outside the ESA portal. A short title for the hyperlink needs to be provided. |
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# Annex 5 – Supportive Information

## Annex 5.1 – ISO Country Codes

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| --- | --- |
| **Country** | **ISO Country Code** |
| Austria | AT |
| Belgium | BE |
| Canada | CA |
| Czech Republic | CZ |
| Denmark | DK |
| Estonia | EE |
| Finland | FI |
| France | FR |
| Germany | DE |
| Greece | GR |
| Hungary | HU |
| Ireland | IE |
| Italy  | IT |
| Luxembourg | LU |
| Netherlands | NL |
| Norway | NO |
| Poland | PL |
| Portugal | PT |
| Romania | RO |
| Slovenia | SI |
| Spain | ES |
| Sweden | SE |
| Switzerland | CH |
| United Kingdom | GB |

## Annex 5.2 – Competence Domains

|  |  |
| --- | --- |
| **CD #** | **Full name of CD** |
| CD01 | EEE / Components / Photonics / MEMS |
| CD02 | Structures / Mechanisms / Materials / Thermal |
| CD03 | Avionic Architecture / DHS / OnBoard S/W / FDIR / GNC / AOCS / TT&C (E2E) |
| CD04 | Electric Architecture / Power & Energy / EMC |
| CD05 | End-to-end RF & Optical Systems and Products for Navigation, Communication & Remote Sensing |
| CD06 | Life / Physical Science Payloads / Life Support / Robotics and Automation |
| CD07 | Propulsion, Space Transportation and Re-entry Vehicles |
| CD08 | Ground Data Systems / Mission Operations |
| CD09 | Information Technology and data fusion and analytics |
| CD10 | Astrodynamics / Space Debris / Space Environment |

Systems Engineering, tools and PA/QA/Safety are transversal and represented in all Competence Domains.

## Annex 5.3 – Technology Domains

|  |  |
| --- | --- |
| **TD #** | **Full name of TD** |
| TD01 | On-board Data Systems |
| TD02 | Space System Software |
| TD03 | Spacecraft Power |
| TD04 | Spacecraft Environment & Effects |
| TD05 | Space System Control |
| TD06 | RF Payload Systems |
| TD07 | Electromagnetics Technology |
| TD08 | System Design & Verification |
| TD09 | Mission operation / Ground Data Systems |
| TD10 | Flight Dynamics & GNSS |
| TD11 | Space Debris |
| TD12 | Ground Station Systems / Networks |
| TD13 | Automation / Telepresence / Robotics |
| TD14 | Life / Physical Science |
| TD15 | Mechanisms |
| TD16 | Optics |
| TD17 | Opto-Electronics |
| TD18 | Aerothermodynamics |
| TD19 | Propulsion |
| TD20 | Structures & Pyrotechnics |
| TD21 | Thermal |
| TD22 | ECLS & ISRU |
| TD23 | EEE Components |
| TD24 | Materials & Processes |
| TD25 | Quality, Dependability and Safety |
| TD26 | Other |

## Annex 5.4 – Service Domains

|  |  |
| --- | --- |
| EO | Earth Observation |
| SCI | Space Science |
| EXP | Exploration (former Human Spaceflight and Robotic Exploration) |
| ST | Space Transportation |
| TEL | Telecommunication |
| NAV | Navigation |
| GEN | Generic Technologies |