ARTES 4.0 Technologies and Products

Agile + Full Proposal

Part 7

In-Orbit Experiment/Demonstration Proposal

Proposal title

Proposal Reference: reference number

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# Introduction

## Support is being requested for an in-orbit activity to be carried out in the Demonstration/Technology Phase. The in-orbit activity is an:

Embedded Case

Independent Case (hosted)

Independent Case (standalone).

# Business Justification

Provide a justification and mapping of the demonstration activities and the user requirements identified in the business for the commercial system.

The proposed demonstration mission will support the business case by…

# Technical Description

## Overview of the Flight Opportunity

## The table below provides an overview of the flight opportunity.

Table 7-1: Overview of the Flight Opportunity

|  |  |
| --- | --- |
|  | **Statement** |
| Item(s) proposed to be flown with ARTES 4.0 support: | … |
| Name of the spacecraft/mission: | … |
| Satellite operator(s): | … |
| Spacecraft manufacturer(s): | … |
| Type/make of spacecraft: | … |
| Proposed/Required Orbit | … |
| Duration of In-Orbit activities | … |
| Status of contractual arrangement with Satellite Manufacturer and Operator: | … |
| Launch provider: | Not applicable for Embedded Case |
| Status of contractual arrangement with Launch provider: | Not applicable for Embedded Case |
| Intended state of registration for the spacecraft (as per UN database): | Not applicable for Embedded Case |
| Company responsible for registering the spacecraft with the above state: | Not applicable for Embedded Case |
| The state through which any RF frequencies shall be licenced: | Not applicable for Embedded Case |
| The company responsible for filing the frequency licences: | Not applicable for Embedded Case |
| Legal owner of the items once in orbit:  The legal owner assumes liability for the flight item once in orbit. This may or may not be the same as the beneficial owner of the item. | Not applicable for Embedded Case |
| The company confirms that the spacecraft shall meet all space debris mitigation requirements as set out in ESSB-ST-U-007 DIR1 - ESA Space Debris Mitigation Requirements, as interpreted by the state of registration for the spacecraft: | yes/no |

## The following table indicates whether or not the parties identified in the table above have been informed that support is being sought from the Agency for an in-orbit activity.

Table 7-2:Notification of Parties Involved in the In-Orbit Activity

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Informed that support is being sought from the Agency for an in-orbit activity?** | **Performance data of the flight items is agreed to be provided and made visible to ESA** | **Provision of the performance data of the items(s) during integration testing is agreed to be provided and made visible to ESA** | **The entity who will assume ownership of the flight item(s) at the time of launch has been informed that all liability for the flight item(s) will reside with them:** |
| Satellite operator(s): | yes/no | yes/no | yes/no | yes/no |
| Spacecraft manufacturer(s) | yes/no | yes/no | yes/no | yes/no |

## We hereby confirm that:

* this is the first flight opportunity for the proposed flight item(s).
* the verification and validation approach (Part2 - Section 2.5) identifies which requirements will be demonstrated in-orbit.
* the duration of the in-orbit activities has been assessed to be adequate to achieve the objectives of the in-orbit activity in [provide reference to full proposal section].

## A statement from the satellite operator is attached as Annex 1 to this cover letter/will be provided prior to contract signature:

## A statement from the satellite manufacturer is attached as Annex 2 to this cover letter/will be provided prior to contract signature:

## Overall Mission Summary

The purpose of the in-orbit activity is to…

Please provide a top level set of objectives for the in-orbit activity and the success criteria for the mission.

The flight items will be installed and launched on [number of] spacecraft.

Include the following paragraph if more than one spacecraft is proposed.

The reason [number of] spacecraft are required is …

Please provide a detailed reason why more than one spacecraft is proposed, and describe the orbits/missions of each spacecraft.

Summary details of the spacecraft platform for this mission are provided below:

Please provide a top level description of the spacecraft platform to be used on this mission and the reasons for selecting this platform for this activity.

The following modifications to the standard platform are required to support this mission:

If any modifications/customisations are required to the standard version of the proposed platform to support the proposed flight item(s), then please provide a top level description of these modifications/customisations.

## The following items are proposed to be developed and flown as part of an in-orbit activity.

Table 7-3: Items to be developed and flown

| **Flight Item** | **Total Number of Units in Spacecraft** | **Number of Units Supported by ARTES 4.0** | **Function/Usage Within the Mission***\** | **Fully Representative of Recurrent Flight Product** |
| --- | --- | --- | --- | --- |
| Item 1 | … | … | … | Yes/No |
| Item 2 | … | … | … | Yes/No |
| Item 3 | … | … | … | Yes/No |
| … | … | … | … | Yes/No |

\* Explain how the proposed architecture will support the mission objectives, including how the supported items will be utilised in the mission and how they will be used in the context of the payload or platform architecture. For example, for an embedded case, a redundant unit within a redundancy ring, with the rest of the hardware being standard hardware.

The table below contains further information on the innovative nature of the proposed flight item(s) and, in cases where more than one unit of the same item is proposed to be flown, why it is necessary to fly more than one unit.

Table 7-4: Flight Item Details

| **Flight Item** | **Innovative Nature of the Flight Item***1* | **Rationale for More than One Flight Item of the Same Type***2* |
| --- | --- | --- |
| Item … | … | … / not applicable |
| Item … | … | … |
| Item .. | … | … |
| … | … | … |

1 Nature of the innovation that justifies the need for ARTES 4.0 support for this particular item (e.g. first flight heritage of a new product or product variant).

2 What function(s) would not be adequately demonstrated by flying only one item of the same type and how would these function(s) be adequately demonstrated by flying the proposed number of units?

Include the following statement and table if any of the above flight items are not fully representative of the recurrent flight product.

Some of the flight items identified above are not fully representative of the recurrent flight product. The following table explains the differences in each case and provides a justification for why a fully recurrent product is not proposed to be flown.

Table 7-5: Rationale for flying items not fully representative of the recurrent flight product

| **Item** | **Differences with Respect to the Recurrent Flight Product** | **Rationale for not Flying a Representative Example of the Recurrent Flight Product** |
| --- | --- | --- |
| Item … | … | … |
| Item … | … | … |
| Item .. | … | … |
| … | … | … |

## Accommodation of the Flight Items

No activities associated with the accommodation of the supported flight items on board the spacecraft are included in the proposed in-orbit activity.

or

(delete the inapplicable paragraph)

The following table indicates the activities associated with the accommodation of the supported flight items on board the spacecraft, to be carried out by the spacecraft manufacturer.

Table 7-6: Activities associated with accommodating the flight items on board the spacecraft

| **Activity** | **Description** | **Performed By** | **Funding is sort for this element** |
| --- | --- | --- | --- |
| Accommodation Studies | … | contractor/spacecraft manufacturer | Yes/No |
| Accommodation in the Spacecraft | … | … | … |
| ... | … | … | … |
| … | … | … | … |

The nature of any work foreseen to be carried out by the spacecraft manufacturer shall be identified. For example, accommodation studies, design modifications performed to accommodate the innovative item(s), hardware specifically required for accommodation purposes, satellite level assembly, integration and test (AIT) and specific activities related to the innovative item(s) during the AIT and launch campaigns.

## Concept of Operations

Include this section if an Independent Case is proposed.

The baseline concept for operating the payload/spacecraft/ground elements of the mission is…..

No activities associated with developing the concept for operations of the payload/spacecraft/ground elements are included as part of the proposed in-orbit activity because … (include a justification for selecting this text).

or

(delete the inapplicable paragraph)

The following activities associated with developing the concept for operations of the payload/spacecraft/ground elements are included in the proposed in-orbit activity.

….(provide details of the baseline concept of operations for the payload/spacecraft/ground elements of the mission, and the associated developments which will take place during the activity).

## Launch Activities and In-Orbit Test

Include this section if an Independent Case is proposed.

No activities associated with the launch campaign and in orbit testing of the supported flight item(s) are included in this development phase.

or

(delete the inapplicable paragraph)

The following table describes the activities associated with the launch campaign, in orbit testing to verify performance and function and end-of-life operations of the supported flight item(s).

Table 7-7: Activities associated with the launch campaign and in orbit testing

| **Activity Type** | **Activity** | **Performed By** | **Funding is sort for this element** |
| --- | --- | --- | --- |
| Launch Campaign | … | … | Yes/No |
| … | … | … | … |
| In-Orbit Testing | … | … | … |
| … | … | … | … |

Launch campaign activities could include the part of the testing and early operation phase specific to the item(s), for verification of function and performance or monitoring.

## End-of-Life

Include this section if an Independent Case (standalone) is proposed.

No activities associated with end-of-life and clean space requirements are included in this development phase because … (include a justification for selecting this text).

or

(delete the inapplicable paragraph)

The following activities associated with meeting end-of-life and clean space requirements are included in the in-orbit activity.

(include text setting out the activities to be undertaken to demonstrate compliance to end-of-life and clean space requirements. For example, Space Sustainability: Adoption Notice of ISO 24113: Space systems - Space debris mitigation requirements: ECSS-U-AS-10C Rev 1.)

# Implementation Proposal

## Work Breakdown Structure and Work Package Descriptions

The work breakdown structure, associated work package descriptions and associated schedule in Part 5 includes the following work packages related to the proposed in-orbit activity:

|  |  |
| --- | --- |
| * A dedicated work package for studies relating to accommodation of the flight item(s) on the spacecraft (work package reference). |  |
| * A dedicated work package for accommodation of the flight item(s) on the spacecraft, including assembly, integration and test (work package reference). |  |
| * A work package/work packages addressing the period of time from the delivery of the flight item(s) (completion of the Acceptance Review) up to the launch of the host satellite (work package reference(s)). |  |
| * A work package/work packages addressing the period of time from the launch of the host satellite to the completion of the Commissioning Results Review (work package reference(s)). |  |
| * A work package/work packages addressing the period of time from the completion of the Commissioning Results Review to the Final Review (work package reference(s)). |  |

## Review Meeting Plan

## The review meeting plan in Part 5 includes the following reviews and statements:

|  |  |
| --- | --- |
| - An Acceptance Review has been included in the review plan presented in Part 5 for the demonstration phase. It will include an additional objective:   * It is acknowledged that the success of the Acceptance Review shall be conditional upon the acceptance of the flight item(s) by the satellite prime manufacturer.   Include the paragraph below if this Part of the Proposal includes an in-orbit activity Independent Case (standalone) where the flight item(s) constitute the main purpose of the mission.   * It is acknowledged that the success of the Flight Acceptance Review shall be conditional upon the acceptance of the spacecraft by the Launch Service Provider for launch. |  |
| * A Commissioning Results Review has been included in the review plan presented in Part 5 for the demonstration phase. |  |
| * The final review described in the Review meetings table presented in Part 5 for the demonstration phase, includes the additional objectives: * Present the operational data gathered during the first year of operation of the flight item(s). * Compare the operational data with performance predictions, including a trend analysis. * List and assess any anomaly observed during operation. |  |

## Common ESA and Flight Programme Reviews

Include this section if this Part of the Proposal includes an in-orbit activity Embedded Case or Independent Case (hosted).

It is not planned to hold reviews with the Agency in common with flight programme reviews because …

or

(delete the inapplicable paragraph)

The review meeting plan for the Agency has, to the extent practicable, been aligned with that of the flight programme. The table below summarises the reviews with the Agency that, in view of the commonality between the review objectives, are planned to be held in common with flight programme reviews.

Table 7-8: Common ESA and Flight Programme Reviews

|  |  |
| --- | --- |
| **Agency Review Title** | **Flight Programme Review** |
| … | … |
| … | … |
| … | … |
| … | … |

The following principles will apply for ESA reviews held in common with flight programme reviews:

Identify policies regarding document delivery, distribution & disposition of review comments and close-out of the review

## Deliverable Documents

Include the following statement in Part 5 of the Proposal if it addresses an in-orbit activity Embedded Case or Independent Case (hosted).

The End Item Data Package will be the same as that supplied to the customer of the host flight programme. Any request for waiver (RFW) or request for deviation (RFD) raised at any time during the development will be delivered to the Agency.

Include the following statement in Part 5 of the Proposal if it addresses an in-orbit activity and support is requested for activities undertaken by the spacecraft manufacturer.

The documentation delivery plan includes reports detailing the work performed by the spacecraft manufacturer (insert document references).

## Non-Conformance Reviews

Include this section if this Part of the Proposal includes an in-orbit activity Embedded Case or Independent Case (hosted).

The contractor confirms that the Agency will be invited to any non-conformance reviews related to the flight item(s) that involve the flight programme customer and may adversely impact their requirements. In the case of a failure occurring during the testing of an item under development, the Agency’s Technical Officer will be informed within two (2) working days in order to agree on the corrective action to be taken.

# Financial Proposal

## Support for launch costs

## We hereby confirm that the flight items will only be used to support in-orbit demonstration and validation activities during and after the completion of the proposed activity, and the company is seeking support for the launch costs.

or

We intend to additionally use the flight items for commercial use. We hereby confirm that:

* the commercial activities will not interfere with the planned in-orbit demonstration activities.
* the company is not seeking support for the launch costs

or

The company is not seeking support for the launch costs.

## Cost Sharing (for Independent Case)

Include and complete this section only if an in-orbit activity Independent Case is being proposed.

Our flight item is an independent case. The following table details our financial contributions to the costs of resources shared between the flight item and the other payloads on the spacecraft:

Table 7-9: Shared Costs

|  |  |  |  |
| --- | --- | --- | --- |
| **Shared Cost Element** | **Total Share of the Costs for the Proposed Activity** | **Payable To** | **Basis for Calculating this Financial Contribution to the Shared Costs** |
| Launch Costs | €…… | …… | …… |
| Host Spacecraft Resources | €…… | …… | …… |

Add supplementary text as necessary to properly explain how these financial contributions to the shared costs have been calculated (e.g. flat rate, based on estimated mass, usage, etc.)

## Milestone Payment Plan

For an in-orbit activity please replace the Milestone Payment Plan in Part 6 with the below table:

Table 7-10: Milestone payment plan

|  |  |  |  |
| --- | --- | --- | --- |
| **Milestone Description** | **Schedule Date** | **Payments from ESA to Contractor (in Euro)** | **Country (ISO Code)** |
| Progress (MS 1): Upon successful completion of WP … and/or successful [review and] the Agency’s acceptance of all related deliverables. | T0 + … months | €…,… | … |
| Progress (MS 2): Upon successful completion of WP xxx and/or Acceptance of the Flight item design for flight (EQSR) and/or successful [review] and the Agency’s acceptance of all related deliverables. | T0 + … months | €…,… |
| Progress (MS 3): Upon the Agency’s certification of successful Acceptance Review and acceptance of the end item data package. | T0 + … months | €…,…  (min. 10%) |
| Progress (MS 4): Upon the Agency’s certification of successful Commissioning Results Review | T0 + … months | €…,…  (min. 10%) |
| Final Settlement (MS 5): Upon the Agency’s certification of successful Final Review, the Agency’s acceptance of all deliverable items due under the Contract and the Contractor’s fulfilment of all other contractual obligations, including submission of the Contract Closure Documentation | T0 + … months | €…,…  (min. 10%) |
|  | **Total** | **€…,…** |  |

**Annex** 1

**Statement from the Satellite Operator**

* Indicating the reasons for his interest in flying and using the proposed flight item(s).
* Agreeing to provide in orbit data on the performance of the flight item(s) to the Tenderer and ESA, should an ESA contract be awarded to the Tenderer.
* Agreeing to inform the Tenderer and ESA of any anomalies related to the flight item(s) and to provide visibility thereof (e.g. participation in non-conformance review board meetings), should an ESA contract be awarded to the Tenderer.
* Confirming that the flight item(s) is/are included in the procured satellite.
* Confirming that the resources needed for operation during the in-orbit demonstration will be available to the flight item(s).

**Annex** 2

**Statement from the Satellite Prime/Spacecraft Manufacturer**

* Agreeing to provide data relating to the performance of the flight item(s) during spacecraft assembly, integration and testing to the Tenderer and ESA, should an ESA contract be awarded to the Tenderer.
* Agreeing to inform the Tenderer and ESA of any anomalies relating to the flight item(s) and to provide visibility thereof to both parties (e.g. participation in non-conformance review board meetings), should an ESA contract be awarded to the Tenderer.