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DOCUMENT

FAMOUS Statement of Work

FAct based MOdelling Unifying System Toward implementing solutions for ECSS-E-TM-10-23A

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1 INTRODUCTION

1.1 Scope of the Document

This document describes the activity to be executed and the deliverables required by the European Space Agency in relation to the Fact based Modelling Unifying System, i.e. FAMOUS.

It will be part of the purchase order and shall serve as an applicable document throughout the execution of the work.

1.2 Applicable and Reference Document

1.2.1 Applicable Documents

The following documents, listed in order of precedence, contain requirements applicable to the activity:

[ECSS-E-ST-40]	<i>Space Engineering – Software</i>
[FBM1002]	<i>Fact based Modelling exchange Schema specification</i>

1.2.2 Reference Documents

The following documents contain information of relevance for this activity:

[ECSS-E-TM-10-23]	<i>Space Engineering – Space system data repository</i>
[AO/1-5880/08/NL/ST]	<i>Monitoring and control data modelling Statement of Work</i>
[FAMOUS-1]	<i>Final Delivery data package containing all information related to Contract 22080/08/NL/ST</i>
[FBM1002WD06]	<i>FBM exchange schema specification, working draft 06 from November 2011</i>
[ECSS-E-TM-10-25/QUDV]	<i>Quantity, units, dimensions and values model of the ECSS-E-TM-10-23 Engineering design model data exchange</i>



1.3 Acronyms and Abbreviations

<i>Acronym</i>	<i>Description</i>
CogNIAM	<i>cognition enhanced natural language information analysis method</i>
COTS	<i>commercial off the shelf</i>
DOGMA	<i>developing ontology-grounded methods and applications</i>
ECSS	<i>European cooperation for space standardization</i>
FAMOUS	<i>fact based modelling unifying system</i>
FBM	<i>fact based modelling</i>
FCO-IM	<i>fully communication oriented information modelling</i>
ICD	<i>interface control document</i>
KOM	<i>kick-off meeting</i>
MMI	<i>man machine interface</i>
NORMA	<i>natural object-role modelling architect</i>
ORM	<i>object role modelling</i>
OWL	<i>ontology web language</i>
RDBMS	<i>relational database management system</i>
RDF	<i>Resource description framework</i>
SparQL	<i>SPARQL protocol and RDF query language</i>
SoW	<i>statement of work</i>
SQL	<i>structured query language</i>
TBC	<i>to be confirmed</i>
TRL	<i>technology readiness level</i>
TRP	<i>technology research program</i>
UML	<i>unified modelling language</i>
XMI	<i>XML metadata interchange</i>
XML	<i>Extensible markup language</i>



XSD	<i>XML schema definition</i>
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2 BACKGROUND AND OBJECTIVE(S)

2.1 Background

Developing space systems implies complex activities involving many parties who are widely distributed in location and time. Such development requires efficient and effective information exchange during the complete lifecycle of the space system. This can only be achieved by realizing semantic interoperability between all involved parties.

Within the 22080/08/NL/ST TRP contract, a first step has been performed in assessing how to solve the interoperability issue. A first prototype of the FAMOUS modelling tool, i.e. **FAMOUS-1**, has been produced that implements formal means to develop information systems.

FAMOUS-1 addresses the engineering specificity of modelling information during software developments. **FAMOUS-1** architecture is based on a 3-level (i.e. conceptual, logical and physical) hierarchy of data models as illustrated in Figure 1 below.

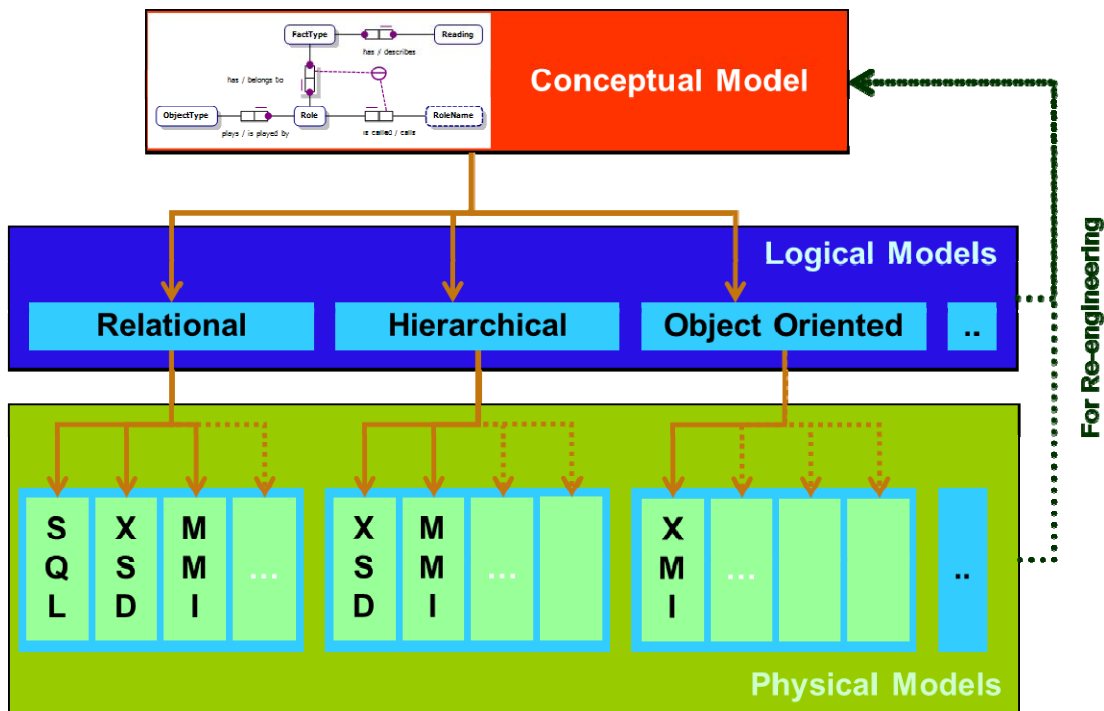


Figure 1 The FAMOUS 3-level data modelling architecture



Conceptual Modelling

Conceptual modelling is made using the so-called Fact Based Modelling (FBM) language. This language inherits from work performed over the last 40 years by research institutes and academicians. It encompasses the modelling capability of the CogNIAM, ORM, DOGMA and FCO-IM fact oriented dialects. The FBM language specification is specified by developers and users of the above mentioned fact oriented dialects¹.

Conceptual modelling using the FBM language provides the means to capture the knowledge of the domain experts in terms of the "what" (i.e. the user requirements).

FBM is conceptual, hence free of any software implementation bias. FBM adheres to the conceptualization and the 100% principle of ISO TR9007. It is based on logic and controlled natural language. The semantics of the domain of interest is captured by means of fact types and associated concept definitions, validation and derivation rules that apply to the associated fact type populations, i.e. the facts.

FBM is attribute-free. Unlike logical models (e.g. entity relationship models), FBM treats all elementary facts as relationships and so treats decisions for grouping facts into structures (e.g. attribute-based entity types, classes, relational schemes, XML schemas) as implementation concerns irrelevant to semantics.

Logical Modelling

Logical modelling refers to technology. It is the product of the software architecture. The conceptual data model, specified during the requirement analysis phase, is transformed into one or more logical models depending on the software needs, e.g. into a relational logical data for instantiation in a relational database management system (RDBMS), into a hierarchical logical model for exchange of information with external systems.

Using FBM, the formal specification of conceptual models allows (semi-) automating the production of logical models of different natures (e.g. relational, hierarchical, object oriented, network).

Physical Modelling

Physical modelling refers to implementation. It is the product of the software design. The logical data model is transformed into tool specific data models e.g. SQL for Oracle, XML schemas, XMI for specific UML tools.

¹ refer to www.factbasedmodelling.eu for additional information about the Fact Based Modelling language and associated notations and tools.



Using FBM, having formal captured the conceptual models and automating the transformation into logical models, retaining links to the conceptual origin of any elements of the logical models, allows automating the production of physical data models and part of the software that uses these models (e.g. man machine interfaces, import/export functions).

Reverse engineering from physical and logical data models toward conceptual models

Reverse engineering from physical and logical models consists in removing from physical and logical models the how. Due to the implementation focusing interest of most logical and physical modeling languages, reverse engineering from physical and/or logical to conceptual can only be partially done. Manual interaction is required to remove implementation specifics and inject conceptual knowledge to fully reproduce valid conceptual data model.

Looking for compliance to the conceptualization and the 100% principle of ISO TR9007, developing software implies validation at conceptual level. Figure 2 below presents a tailoring version of ECSS-E-ST-40C software engineering standard that complies to this approach.

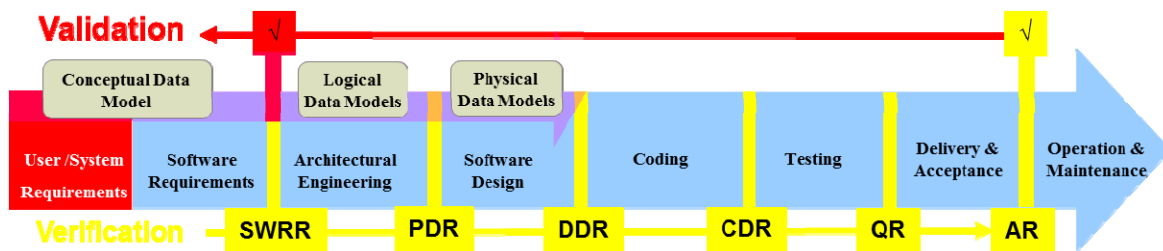


Figure 2 Software Engineering, data modelling and validation

During FAMOUS-1, a draft of the FBM language (refer to [FBM1002WD06]) has been prototyped. FAMOUS-1 implements the capability to formally model information using asserted and derived fact types of any arity. Fact type forms are used to verbalise the fact types. A number of validation rules (i.e. those specified in [FBM1002WD06]) has been implemented.

Using the knowledge captured at conceptual level, FAMOUS-1 automates the production of :

- Relational logical models and related:
 - SQL physical models for Oracle RDBMS, Microsoft SQL Server,
 - XML schema,
 - MMI specification;



- *Object Oriented logical models UML 2.4.1 and related XMI physical models.*

Reverse engineering from XMI models compliant with UML 2.4.1 has also been implemented.

Refer to [FAMOUS-1] for additional information about the capability offered by this first prototype.

2.2 Objectives of the Activity

The objectives of this activity are:

- *to further assess and prototype the full capability of the FAMOUS modelling tool, extending the capability of the FAMOUS-1 prototype:*
 - *developing a controlled natural language view of the conceptual data models,*
 - *developing a language for specifying derivation rules, together with its graphical and controlled natural language views,*
 - *developing means to transform conceptual data models into hierarchical logical and physical (i.e. XML schemas) models,*
 - *developing additional means to reverse engineers from physical to conceptual models;*
- *to verify and consolidate the capability of FAMOUS-1 to support the automatic generation of database software;*
- *to consolidate the prototyped functionality of the FAMOUS modelling tool producing a formal specification of the FBM methodology and the compliant FAMOUS modelling tool and performing, together with the Agency, a full validation of the resulting data and process models, for the purpose of having a fully validated requirement specification of the FAMOUS modelling tool able to fully support:*
 - *the development of conceptual, logical and physical data model for the purpose of developing new information systems;*
 - *reverse-engineering existing systems;*
 - *the production of an ontology specification tool as specified in ECSS-E-TM-10-23A able to develop federations of information systems for the purpose of achieving semantic interoperability.*



3 WORK TO BE PERFORMED

3.1 Work Logic

This activity consists of consolidating the outputs of the 22080/08/NL/ST TRP contract, assessing and prototyping new modelling concepts and fully specifying the FBM methodology and the system capabilities of the associated FAMOUS modelling tool.

“Fact based modelling” is “compliance to the conceptualization and the 100% principle of ISO TR9007”. The development logic for that activity shall apply what fact based modelling “preaches”, that is first fully formally specifying the system requirements and fully formally validating these system requirements, prior to any software development. The work logic shall reflect this principle.

In compliance with the tailored version of ECSS-E-ST-40C as depicted in Figure 2, the work to be performed during this activity is limited to:

- *A complete and validated specification of the FBM methodology including both the structural and the structuring parts of the methodology*
 - *The structural part of the methodology shall be fully compliant with the standardization work performed by the FBM working group extended to support the ontology modelling concepts derived from the ECSS-E-TM-10-23A;*
 - *The structuring part of the methodology shall comply with the modelling procedures described by the FBM working group, extended to support the global modelling concept and associated local solutions introduced in the ECSS-E-TM-10-23A.*
- *A complete and validated user/system specification of the FAMOUS modelling tool that implementing that methodology, permit:*
 - *to develop local conceptual models and derive from those models logical and physical data models used to produce formal specifications of future information systems;*
 - *to develop global conceptual models for the purpose of supporting the development and integration of new information systems and of integrating (after reverse engineering) existing information systems to achieve interoperability at semantic level.*
- *A complete and validated software specification of the FAMOUS modelling tool.*

These specification works shall be accompanied by examples and prototypes that support the verification and validation activities.



The work is organised in 2 phases as follows:

- Phase 1: FBM methodology and FAMOUS modelling tool user/system specification
- Phase 2: FAMOUS modelling tool software specification

3.2 Phase 1 Tasks

The purpose of Phase 1 is:

- the development of the specification of the FBM methodology (task 1), and
- the user/system specification of the FAMOUS modelling tool (task 2).

3.2.1 Task 1 Fact based modelling methodology

3.2.1.1 Scope

The development of the FBM specification shall be performed in an incremental manner assessing, modelling and verifying every concept of the methodology including modelling:

- 1) the structural part of the methodology, meaning modelling:
 - a) The concepts introduced by the FBM working group, including:
 - elementary fact,
 - asserted, derived and semi-derived elementary fact type,
 - object type,
 - fact type reading,
 - objectification (i.e. nominalisation),
 - subtyping,
 - validation rules including uniqueness, mandatory, frequency, value, value comparison, equality, exclusion, subset, cardinality, ring constraints,
 - fact type derivation (TBC),
 - data type (TBC);
 - b) Additional concepts required for achieving the 100% principle required for modelling local solutions, including:
 - concept definition,
 - fact type, object type and constraint derivations,



- *time and event based constraint applicability,*
 - *fact type and object type existential dependency, part of,*
 - *exchange rule,*
 - *event rule,*
 - *permitted and non-permitted fact*
 - *semantic data type²;*
- c) *Additional concepts required for modelling at global level, i.e. implementing the ontology modelling concept derived from ECSS-E-TM-10-23A, including:*
- *community (e.g. synonym, homonym),*
 - *atomic and compound conceptual definition (e.g. concept definition, fact type, derivation rule, validation rule),*
 - *folding,*
 - *atomic relativity nature of value types,*
 - *conceptual definitions equivalence,*
 - *integrability of conceptual definition,*
 - *conceptual definition context dependency, including especially context dependent validation and derivation rules,*
 - *assembly and integration rule;*
- 2) *The structuring part of the methodology, by specifying all related processes:*
- a) *for modelling local solutions, specifying, for example:*
- *the process for producing a conceptual data model from scratch, i.e. starting with examples including e.g. modelling derivations;*
 - *the process for determining fact type and object type existential dependency, more generally for determining the part of nature of fact types and object types;*
 - *the processes for creating different views on a conceptual data model including:*

² For the purpose of modelling data types within FAMOUS, the Agency intends to reuse the Quantities, Units, Dimensions and Values (QUDV) specification of ECSS-E-TM-10-25. Within ECSS-E-TM-10-23A, this specification is expressed in UML. The Agency intends to produce a formal representation in FBM of this specification. Conditioned by the successful validation of the output of this Agency undertaking, the Contractor is requested to include the results in this FAMOUS activity.



- (1) *positive and negative, fact and rule verbalisations,*
 - (2) *switching between semantically equivalent representation of specific conceptual definition;*
 - *the process for transforming into relational model, (subsets of) the conceptual data model to be populated;*
 - *the processes for transforming conceptual data models into logical and physical data models;*
- b) *for modelling global solutions, specifying, for example:*
- *the process to select consistent subsets of a global conceptual data model for producing local conceptual views of that model;*
 - *the process to assemble and integrate local conceptual data models into global conceptual models.*

The above lists are not exhaustive. The FBM methodology shall be fully specified. The FBM methodology specification shall be declarative.

Task 1 is conceptual modelling, the FBM methodology shall be specified using the proposed FBM methodology. To succeed in this exercise, it is of prime importance to ensure that every methodology concept is verified by the Agency Technical Officer as soon as available. It is of the responsibility of the Contractor to plan the development work and organise all verification events to avoid lengthy redo.

Acknowledging that the scope of FAMOUS-1 was limited to data modelling, some research shall be performed on how to model, at conceptual level, business and algorithmic processes in a way that is fully consistent with FBM, i.e. being formal, being based on logic and controlled natural language. The conceptual process model shall be specified using a process and algorithmic modelling language that is considered by the Contractor best for that purpose. For each process, the related view of the conceptual data model shall be produced.

3.2.1.2 Input

The input to this task shall include:

- *the output of the FBM working group activities,*
- *the output of the 22080/08/NL/ST TRP contract,*
- *ECSS-E-TM-10-23A.*



3.2.1.3 Task description

Performing this task, specific attention shall be put on:

- *assessing the modelling capabilities offered by the different FBM dialects, including CogNIAM, DOGMA, FCO-IM, ORM;*
- *assessing research findings on matters related to FBM, e.g. assessing the part-of characteristics of fact based models for the purpose of e.g. identifying compound conceptual definitions, creating valid hierarchical logical models;*
- *assessing research and development activities related to logic (e.g. ISO/IEC 24707);*
- *assessing the data modelling capabilities of other than FBM methodologies/notations e.g. RDF/OWL2, SPARQL and relational logical modelling e.g. ISO-IEC 9075-112011 SQL 2011.*
- *Implementing additional concepts required from the lessons learned using FAMOUS-1 in R&D projects, including the on-going Avionic Test Bench Database contract number 4000105909 and this still to be contracted “Automatic Generation of MMI from a domain ontology” TRP.*

Taking into account the large scope of this activity and the mandatory needs to verify and validate any concept meetings and reviews shall be organised for discussing and verifying the adequacy of each proposed concept.

Taking into account the possibility to develop tools that only implement the part of the FAMOUS methodology required to develop local solutions, the local view(s) of the FAMOUS conceptual data model required for modelling these local solutions shall also be produced.

3.2.1.4 Output

The output of this task shall include:

- *the complete and validated specification of the FBM methodology including both the structural and the structuring parts of the methodology,*
- *a compliance matrix to the FBM working group exchange schema.*

3.2.2 Task 2 FAMOUS modelling tool user/system specification

3.2.2.1 Scope

The development of the user/system specification of the FAMOUS modelling tool shall be performed in an incremental manner, addressing the system needs for:

- 1) *modelling at conceptual level in full compliance with the FBM methodology specified in Task 1 of Phase 1 with for example, the capability to graphically visualise the conceptual data model*



- including the part-of characteristic of fact types and object types, the capability to transform instantiated representation of definitions into fully equivalent other sets of representations;*
- 2) *transforming to logical models for relational, hierarchical and object oriented solutions with explicitly organising the output models in part-of compliant hierarchies;*
 - 3) *transforming to physical relational models (including SQL for Oracle Relational Database Management Systems), to physical hierarchical models (including XML schema), to physical UML models for the purpose on instantiating both the information systems and their data sharing interfaces;*
 - 4) *reverse engineering from SQL (including Oracle based SQL models), from XML schema, from XMI UML compliant models;*
 - 5) *modelling at global conceptual level;*
 - 6) *mapping (tailoring) and extracting local conceptual models from global conceptual models;*
 - 7) *assembling and integrating local conceptual models into global conceptual models;*
 - 8) *populating conceptual data models by use of editors based on the automated logical representation of a conceptual data model (or part of it) for permitting manual generation of permitted and non-permitted facts;*
 - 9) *automatically generating permitted and non-permitted facts;*
 - 10) *producing documentation for the ontologies developed using the tool;*
 - 11) *producing documentation for the conceptual, logical and physical data;*
 - 12) *producing, in compliance with the produced data models, the external views of the data models for use in specifications of local solutions, including man-machine interfaces, import/export interfaces, together with associated test cases;*
 - 13) *implementing version control.*

3.2.2.2 Input

The input to this task shall include:

- *The output of the Fact Based Modelling working group activities,*
- *The output of the 22080/08/NL/ST TRP contract,*
- *ECSS-E-TM-10-23A.*



3.2.2.3 Task description

Taking into account the large scope of this activity and the mandatory needs to verify and validate any concept:

- 1) meetings and reviews shall be organised for discussing and verifying the adequacy of each proposed concept,*
- 2) prototypes shall be developed to support the demonstration and the verification of the newly introduced concepts.*

It is recognised that using a FBM tool compliant with the capability required in this Statement of Work would augment the quality of the work.

*Taking into account that currently **FAMOUS-1** is not implementing all functionality that is required to formally specify the FBM methodology and the user/system specification of the FAMOUS modelling tool, updating the **FAMOUS-1** software shall be considered. If the required functionality is not made available in **FAMOUS-1** or not made available on time for the production of the data packages to be reviewed by the Agency, when the **NORMA** tool implements the needed capability, the **NORMA** tool shall be used.*

*Produced conceptual data models and conceptual views shall graphically report the existential dependency of each fact type. Updating the **FAMOUS-1** software to include this capability is required.*

In line with the subject of this activity, modelling the conceptual data model of FAMOUS is:

- modelling a global model for use to model ontologies/global models, and*
- modelling local models for developing local solutions, meaning creating the FAMOUS solution conceptual modelling view and its related logical and physical modelling views.*

All system requirements shall be flagged according to their applicability to the FAMOUS global model and any of its local views.

3.2.2.4 Output

The output of this task shall include:

- the complete and validated user/system specification of the FAMOUS modelling tool that implements the FBM methodology and associated ECSS-E-ST-40C deliverables,*
- the prototypes,*
- the updated **FAMOUS-1** and associated delta documentation,*
- the Phase 1 Tasks 1 & 2 data models for use by the updated **FAMOUS-1** and/or **NORMA**.*



3.3 Phase 2 Tasks

The purpose of Phase 2 task is:

- *the development of the software specification of the FAMOUS modelling tool (task 3), and*
- *the overall consolidation, verification and validation of all outputs of this activity (task 4).*

3.3.1 Task 3 FAMOUS modelling tool software specification

The development of the software specification of the FAMOUS modelling tool shall be performed for full compliance with any requirement specified during Phase 1.

3.3.1.1 Scope

The development of the software specification of the FAMOUS modelling tool shall be performed in an incremental manner, in full compliance with the requirements specified during Phase 1 and ECSS-E-ST-40C.

A formal specification of all required algorithms shall be produced together with examples.

The test cases shall be produced including the test procedures and associated test data.

Implementing semantic interoperability also implies the need to exchange conceptual data models produced with the FAMOUS software tool either between different instances of FAMOUS or between different data modelling tools, fact based or not. The following applies

- *Exchanging between different instances of the FAMOUS modelling tools should be performed in compliance with an XML schema based ICD generated from the FAMOUS conceptual data model populated in FAMOUS. The existing FAMOUS-1 import/export facility shall be updated to allow exchange of data between 2 instances of the updated FAMOUS-1 software tool (i.e. as resulting from the work done in this activity).*
- *At the time of writing this Statement of Work, the FBM working group is producing an ICD for exchanging conceptual data models between tools implementing dialects of the FBM. A FAMOUS-1 import/export function compliant with this ICD shall be developed.*
- *Exchanging with other modelling tools (i.e. non fact based) is currently being assessed by the OMG Semantic Information Modelling for Federation (SIMF) working group.*

3.3.1.2 Input

The input to this task shall include:

- *all deliverables of Phase 1, and*



- *the output of the 22080/08/NL/ST TRP contract.*
- *ECSS-E-ST-40C*

3.3.1.3 Task description

Taking into account the large scope of this activity and the mandatory needs to verify and validate any concept:

- 1) *meetings and reviews shall be organised for discussing and verifying the adequacy of each proposed concept,*
- 2) *prototype of the algorithms.*

Similar to what has been required in Phase 1 task 2, in case the required functionality to produce the software specification of the FAMOUS software tool, is not made available in FAMOUS-1, the NORMA tool shall be used.

Similar to what has been required in Phase 1 task 2, system requirements shall be flagged according to their applicability to the FAMOUS global model and any of its local views.

3.3.1.4 Output

The output of this task shall include:

- *the complete and validated software specification of the FAMOUS modelling tool and associated ECSS-E-ST-40C deliverables,*
- *the prototypes,*
- *the updated FAMOUS-1,*
- *the Phase 1 Tasks 1 data models for use by the updated FAMOUS-1 and/or NORMA.*

3.3.2 Task 4 Consolidation, Delivery and Acceptance

The purpose of this task is:

- *to consolidate all documents produced during this activity, ensuring their overall consistency,*
- *to produce a summary report and a paper for publication,*
- *to produce an abstract that follows the template enclosed in Appendix A which purpose is to demonstrate this TRP activity achievements for possible publication in the ESA TRP achievements brochure;*
- *to develop/populate the FAMOUS website for the purpose of presenting what the FBM methodology is, its relation with the existing FBM working group website, what FAMOUS is*



and what FBM and FAMOUS can bring to the problematic of developing large systems and having to interoperate in a multi supplier/customer development and operations network.

A final review of all deliverables shall be organised.

The full set of documentation implementing the output of the final review shall be delivered to the Agency.



4 REQUIREMENTS FOR MANAGEMENT, REPORTING, MEETINGS AND DELIVERABLES

The standard requirements for management, reporting, meetings and deliverables (appendix 3 to the Contract) shall apply, taking account of the following specific requirements for the present activity, which shall prevail in case of conflict.

- 1. All documents, including minutes of meetings, progress reports shall be delivered in Microsoft Word and PDF.*
- 2. All documents shall be stored within the ESA TEC-SW eRoom.*

4.1 MANAGEMENT

Section 1 applies.

4.2 REPORTING

Section 2 applies with the following modifications:

- Section 2.1 only electronic versions are requested, both in Microsoft word and PDF.*
- Section 2.6. The progress reports shall be delivered to the Agency not later than the 4th of each month. A teleconference with the technical officer to discuss the open issues of the progress reports shall be organised within 5 days following the distribution of the progress report.*

4.3 MEETINGS

Section 3 applies.

4.4 DELIVERABLES

Section 4 applies with the following modifications:

- 1. The following documentation shall be delivered.*

ID	Title	Versions
<i>D1</i>	<i>FBM Methodology</i>	<i>Phase 1 Task 1: Draft(s) and Issue 1 resulting from the successful FBM methodology review.</i> <i>Phase 2 Task 4: Draft and Issue 2 resulting from the successful Overall documentation consistency review. In</i>



		<i>addition to the electronic copies, this document shall be provided in 5 paper copies.</i>
<i>D2</i>	<i>FBM Methodology versus FBM Exchange Schema compliance matrix</i>	<i>Phase 1 Task 1: Draft(s) and Issue 1 resulting from the successful FBM methodology review Phase 2 Task 4: Draft and issue 2 resulting from the successful Overall documentation consistency review.</i>
<i>D3</i>	<i>ECSS-E-ST-40C SRR data package</i>	<i>Phase 1 Task 2: Draft(s) and Issue 1 resulting from the successful SRR Phase 2 Task 4: Draft and issue 2 resulting from the successful Overall documentation consistency review.</i>
<i>D4</i>	<i>Phase 1 Tasks 1 & 2 FAMOUS-1 and/or NORMA data models</i>	<i>Phase 1 Task 2: Draft(s) and Issue 1 resulting from the successful SRR Phase 2 Task 4: Draft and issue 2 resulting from the successful Overall documentation consistency review.</i>
<i>D5</i>	<i>Delta FAMOUS-1 documentation</i>	<i>Phase 1 Tasks 1 and 2: Issue 1</i>
<i>D6</i>	<i>ECSS-E-ST-40C SWRR data package</i>	<i>Phase 1 Task 2: Draft(s) and Issue 1 resulting from the successful SWRR Phase 2 Task 4: Draft and issue 2 resulting from the successful Overall documentation consistency review.</i>
<i>D7</i>	<i>Phase 2 Task 3 FAMOUS-1 and/or NORMA data models</i>	<i>Phase 1 Task 2: Draft(s) and Issue 1 resulting from the successful SWRR Phase 2 Task 4: Draft and issue 2 resulting from the successful Overall documentation consistency review.</i>
<i>D8</i>	<i>Summary Report</i>	<i>Phase 2 Task 4: Draft and issue 1 resulting from the successful Overall documentation consistency review.</i>
<i>D9</i>	<i>Abstract (see template in Appendix A)</i>	<i>Phase 2 Task 4: Draft and issue 1 resulting from the successful Overall documentation consistency review.</i>
<i>D10</i>	<i>Contract Closure Documentation</i>	<i>End of Phase 2 Task 4: Draft and issue 1 resulting from activity software development.</i>

2. *The following software (source and object code) shall be delivered.*



Title	Versions
<i>Updated FAMOUS-1</i>	<i>Phase 1 Task 2</i> <i>Phase 2 Task 3</i>
<i>All prototypes developed during this activity</i>	<i>Phase 1 Task 2</i> <i>Phase 2 Task 3</i>
<i>The FAMOUS website</i>	<i>Phase 2 Task 4</i>

4.5 Commercial Evaluation

Section 5 applies with the following modifications:

- *The Commercial Evaluation shall also include an analysis and evaluation of the potential of reuse outside the space market of the output of the Contract.*



5 SCHEDULE AND MILESTONES

5.1 Duration

The duration of the work shall not exceed 24 months from kick-off to end of the activity (delivery of final report or hardware or software).

5.2 Milestones

The following major milestones applies:

- 1. End of Phase 1*
- 2. End of Phase 2 Task 3*
- 3. End of Phase 2*

5.3 Reviews

The main reviews are:

- 1. During the Phase 1 task 1, the FBM Review;*
- 2. During the Phase 1 task 2, the System Requirement Review;*
- 3. During the Phase 2 task 3, the Software Requirement Review;*
- 4. During the Phase 2 task 4, the overall final review of all deliverables.*



APPENDIX A. TRP ACHIEVEMENTS TEMPLATE

Estimated Start TRL	Title
Target TRL Achieved TRL	SDx TDx

Introduction

Insert here a brief paragraph related to the background of the activity.

- **Where it originates...**
- **Why it is important?**

Objectives

Statement of activity objectives, covering the key points

Achievements

General description of method, results and conclusion.

Technology design specification

Statement clearly showing whether objectives were met.

Add key results figures, plots, experiment setup.

Application

Mission

Technology

Equipment

Further Activities

Future work to be done...

Title and reference of follow on activities...

Non Space Application

Optional Description of any terrestrial application and how...

Publications

One or two journal articles

Source Reference Report

Final report reference



Company
(Country Acronym)

Mail Code
Technical Officer

TRP – Ref (eg, T604-07EP)
Contract: xxxxx
Closed: Month/Year
(April/2012)