

APPENDIX A – TG 2 ASSESSMENT OF PHASE 1 FOR INSTRUMENT PROJECTS BY MCAG

1. Introduction

MCAG are required to co-ordinate, manage and ensure integration of motion components into the ESS facility control system. The nature of the ESS project, with various in-kind partners providing complete instruments, provides many challenges in regards to integration and standardisation of components. It is imperative for the maintenance of the facility, that systems are designed and engineered in a consistent manor, therefore MCAG is always working to align the work of MCA or electrical engineering support teams across ESS partners.

2. Purpose

Phase 1 for each ESS Instrument Project is a planning phase for the subsequent phases 2 - 6. During Phase 1 each instrument should decide what is going to be built, formulate the associated budget and identify resources needed to build it. This Appendix is a review, completed by ESS MCAG, of the Preliminary Design (Phase 1) work performed by instrument teams and their MCA support teams and forms part of the Tollgate 2 assessment. In order to proceed till the next phase a project must receive an overall approval.

To avoid any confusion, this Appendix is part of document "*ESS-0049514 - Motion Control & Automation on ESS Neutron Instruments - Introduction, Definitions and Guidelines for Phase 1*". However the Appendix can be considered a separate document itself and used as a template that shall be completed for each instrument project. The remainder of this Appendix will refer to sections from ESS-0049514, so be aware that this is not necessarily a different document. It is actually only important to keep this in mind if the Appendix is being used on it's own.

Only motion control and automation aspects of the instrument design have been considered, except where it is considered they will significantly influence or interact with the motion control and automation system. The information required in the following sections should be included in the Instrument Team's documentation submitted for the TG2 review.

Although the instruments teams and the partners MCA support teams are in principle free in choosing the form to collect the appropriated information for TG2 documentation, ESS MCAG strongly recommends to follow the order and definitions given in ESS-0049514. They will match with the review criteria below and ensure enough information is available for ESS MCAG to smoothly review the instrument project for TG2.

3. Grading system

The assessment consists of a simple traffic light grading system. A number of criteria or sub-categories are considered and given an individual grading; which will then form an overall



GREEN: All aspects of the criterion in question have been addressed satisfactorily to permit endorsement by the MCAG to the detailed design phase.



ORANGE: Some aspects of the criterion in question have not been addressed satisfactorily. However, if additional information is supplied, MCAG endorsement of the instrument to the detailed design phase may be possible.



RED: Some aspects of the criterion in question are in serious doubt. Additional information and serious consideration by the NSS management is necessary to continue commencement to the detailed design phase



WHITE: Not applicable

grade for the complete MCA aspects of the project. The following sections aim to reduce the subjectivity of the assessment. It will list the specific tasks that MCAG feel should be completed during Phase 1. The traffic light colours have the following interpretations:

Each of the following criteria will be assessed and given a traffic light colour. The criteria that will be assessed are summarised at the end of the document in table form and consist of the following:

- **Technical Feasibility:** The technical feasibility of the proposal will primarily stem from the Table of Motion for the generic motion control axes but also from the description of the special purpose motion solutions (if any).
- **Budget Completeness:** The budget will be checked to ensure that nothing has been omitted. For this reason it is important to present the budget (at least to MCAG) so that it is broken down to an adequate level to allow this.
- **Schedule:** Schedule will be most important in projects where development is required. The schedule of the whole project will be considered and if there are unrealistic timelines MCAG will flag this.
- **Risks Analysis:** A risk analysis should be conducted to where deemed necessary.

4. Review of ESTIA

4.1 Technical Feasibility - Table of Motion

The MCA Table of Motion is an important component of the planning for Phase 1. The Table (in the form of an Excel spread sheet and supplied as template by ESS MCAG) must be completed as accurately as possible. Refer to section 4.2.1.1 for full details on how to complete the "Table of Motion", definition of parameters etc.

All sections of ESS MCA Table of Motion Excel spread sheet have been completed for each axis.








All safety shutters have been included in the table as an axis.	
Other pneumatic actuators have been included in the table (if applicable)	
Special environmental conditions have been identified for each axis (if applicable)	
Special relationship between axes (gear ratio, synchronisation etc.) have been identified (if applicable)	
Similar or identical multiple axes have been identified (if applicable)	

Table 4 Checklist for ESTIA Axis Table

Comments:

- Just one shutter is included, however other applications were specified that could be used as shutters for redundancy. The need of other pneumatic actuators will be assessed in phase 2, the detailed design of some applications.

4.2 Technical Feasibility - Special Purpose Motion Control

In some circumstances a special purpose control solution may be desired over the generic motion control solution. Instead of completing the Table of Motion a more detailed description of the technical solution is required. Refer to section 4.2.2 "Technical Solution for Special Purpose MC".





Justification is provided stating why the special purpose motion is necessary or desired.	
The proposed special purpose motion solution has been described in adequate technical detail including interfaces to other technical systems.	
At least one alternative has been proposed and reason is given as to why this not as desirable.	
A proposal how to integrate the control system into EPICS has been given.	

Table 5 Checklist for ESTIA Special Purpose Motion

Comments:

- No comments

4.3 Budget

A budget must be provided as part of the TG2 submission for the Instrument Project. MCAAG will assess this budget with regards to motion and automation in particular making sure the following points are satisfied. Refer to section 4.3 "Tasks List for Phase 1 – Budget" for additional information on how to form the budget, what should be included, definitions etc.









Instrument budget for MCA is broken down into the three MCAAG deliverables: Generic Motion, Special Purpose Motion Control and Electronics and Control Racks.	
Figures are given for labour and non-labour for each of the three deliverables.	
Each of the figures is broken down in a similar manner to that described section 4.3.3 from ESS-0049514.	
Special purpose motion control (if any) e.g. robots, hexapod, piezo motors control have been identified and included in the budget.	
Sufficient budget is allocated for electrical drawings.	
An estimate for the number of electrical cabinets and/or racks is given for budget purposes.	
Instruments components that require a SAT/FAT have been identified and included in budget (either MCA specific or Instrument budget).	
All development costs for motion control (if any) been included in the budget.	

Table 6 Checklist for ESTIA MCA Budget

Comments:

- No comments

4.4 Schedule

A schedule as described in section 4.3.8 "Schedule", should be included in the documentation. MCAAG will assess the documents and flag any unrealistic timelines according to the next criteria.




Sufficient information exists in the Toll Gate 2 instrument documents for the schedule of the MCA work units.	
Milestones are identified throughout all stages of the project in regards to MCA.	
Important schedule links between MCA work units and other parts of the instrument projects are identified.	

Table 7 Checklist for ESTIA Special Purpose Motion Control

Comments:

- The prototype of the mirror alignment of the Selene guides might delay parts of the MCA related stages of the project.

4.5 Risk analysis

Refer to section 4.4 "Risk Analysis" of ESS-0049514 for complete guidelines on what should be considered for a risk analysis.




Axes that may be difficult to implement with the generic solution have been identified e.g. high speeds/accuracy/repeatability/stability/demanding environment.	
Technical risk analysis of special purpose motion has been performed and the risks and mitigations identified.	
All moderate technical risks (if any) are addressed or an alternate solution stated.	

Table 8 Checklist for ESTIA Special Purpose Motion Control

Comments:

- The highest risk is the 360 axes use for the mirror segment alignment of the Selene guides. A R&D project to develop a prototype for this application is being done. Until the prototype is built and test, many of the risks are hard to assess. In terms of design all the risks have been taken into account.

4.6 Other

Each instrument project is different, for this reason sometimes more information will be required than that which is listed in the previous sections. Some of the things that MCA may require further information include:

- Information on any special shutters e.g. where they need to act as a dual device for safety and beam conditioning, or if they need some kind of special control or synchronisation.
- Information on axes that may be linked to choppers e.g. if a chopper is mounted to a motion stage and should in and out of the beam.
- Any special maintenance that may be required during operations period.
- Procurement strategy for any long lead-time components.
- Potential for training for personnel at ESS.
- Identify resources available for EPICS integration for motion control.
- Plan for production and delivery of E-Plan electrical schematics.

5. Conclusions and Recommendations

Example comments:

ESTIA is given a green light for the overall proposal with regards to MCA aspects. Please check the comments above regarding the risk of the mirror alignment system of the Selene guides.

Category of Criteria	Grade
Technical Feasibility	●
Budget completeness	●
Schedule	●
Risk Analysis	▲
Overall	●

Table 9 Grading for ESTIA

Assessment performed by Federico Rojas Givaudan on behalf of MCAG.

Signature: Federico Rojas Givaudan



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