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Change Record

Issue	Date	Section(s) Affected	Description of Change/Change Request Reference/Remarks
0.1	21/10/02	All	New document
0.2	12/02/03	All	Major revision
0.3	21/08/03	All	Incorporates updates and comments from Camera team
0.4	03/10/03	All	Corrections and more comments incorporated
0.5	04/11/03	All	Final pre-issue draft
1.0	11/11/03	All	Issued document

Table of Contents

1 SCOPE

This document defines the tasks and deliverables to be provided by the IR Camera Consortium within the scope of the design, manufacture, testing, packing, transport and commissioning of the IR Camera of the Visible and Infrared Survey Telescope for Astronomy (VISTA). It also defines those items that are provided free issue to the Consortium by the VISTA Project Office (VPO) for incorporation within the IR Camera. The SOW has been prepared on the basis that a fully compliant Preliminary Design exists and has successfully passed the Preliminary Design Review (PDR). The SOW therefore only concerns work following the PDR and no requirements are placed on that Review.

2 ACRONYMS & ABBREVIATIONS

ADxx	Applicable Document No xx
DRDxx	Document Requirements Definitions No xx
CIDL	Configuration Items Data List
CFE	Customer Furnished Equipment (supplied free issue by the VPO)
CMM	Configuration Management Module
CoDR	Conceptual Design Review
COR	Commissioning Review
CRE	Change Request
DRD	Document Requirements Definition
DRL	Document Requirements List
ESO	European Southern Observatory
FAC	Final Acceptance
FE	Finite Element
FDR	Final Design Review
ICD	Interface Control Document
MIPx	Manufacturing Inspection Point No x
NCR	Non Conformance Report
PDR	Preliminary Design Review
PAC	Preliminary Acceptance Review
RAL	Rutherford Appleton Laboratory
RAMS	Reliability, Availability, Maintainability and Safety
SIPx	Software Inspection Point No x
SOW	Statement of Work
T/0	Start of activities covered by this SOW i.e. the date of the PDR
TCS	Telescope Control System
UKATC	United Kingdom Astronomy Technology Centre
UoD	University of Durham (Astronomical Instrumentation Group
VISTA	Visible & Infrared Survey Telescope for Astronomy
VPO	VISTA Project Office
WBS	Work Breakdown Structure
WP	Work Package

3 DEFINITIONS

3.1 Definitions

Consortium	The collective term used in this SOW to represent the IR Camera Consortium (RAL, UKATC and UoD).

3.2 System Definition

The following terms are used throughout this document with the meaning herein:

IR Camera Work Package	The object of this statement of work as defined in AD01; Comprising the IR Camera, Software, Control Hardware, Service and Test Equipment, Handling Equipment, Spares and all supporting documentation
Local Control Unit	VME/VxWorks based computer system which controls the IR Camera Hardware
Telescope Control System	The external control system that interfaces with the Local Control Unit described in this document. *(The Telescope Control System is not part of this WP).*
PDR Documentation	The technical and managerial documentation presented at the IR Camera Preliminary Design Review. This documentation will form the basis of the design development to the FDR but is not part of this SOW.
Free Issue	Items purchased outside the Consortium and supplied as Customer Furnished Equipment (CFE) to the Consortium. The VPO takes responsibility for the performance of these individual items, however the Consortium is responsible for maintaining their performance after integration within the IR Camera.
IR Detector Focal Plane	The free issue of the IR Camera focal plane mounting plate and IR detectors, including early-delivery Engineering Grade devices, subject of a contract between the VPO and Raytheon. Managed by the Consortium on behalf of the VPO.
IR Detector Controller	The free issue of the IR Detector controllers subject of an agreement between the VPO and ESO. Managed by the Consortium on behalf of the VPO.
TCCD Controller	The free issue of the TCCD Detector controllers subject of an agreement between the VPO and ESO. Managed by the Consortium on behalf of the VPO.

4 APPLICABLE & REFERENCE DOCUMENTS

The latest agreed issue of the following documents form part of this statement of work to the extent specified herein.

In the event of a conflict between the documents referenced herein and the contents of this statement of work, the contents of this statement of work shall be considered as superseding requirements.

	Title	Document Number & Current Issue
AD01	VISTA IR Camera Technical Specification	VIS-SPE-ATC-06000-0004 Issue: 2.0
AD02	Standard Procedure for Design Reviews	VLT-INS-ESO-00000-0251 Issue: 2
AD03	Definition of Preliminary Design Phase, PDR Data Package, Preliminary Design Review	VLT-TRE-ESO-00000-0280 Issue: 1
AD04	Definition of Detailed Design Phase; FDR Data Package; Final Design Review	VLT-TRE-ESO-00000-0397 Issue: 1
AD05	VISTA Project Safety Management Plan	VIS-PLA-ATC-00001-0019 Issue: 3.0

RD01	CMM (Configuration Management Module) User Manual	VLT-MAN-ESO-17200-0780 Issue 2.0

5 PROJECT DEFINITION

5.1 Project Overview

VISTA is a 4-metre class telescope with an “Alt-Az” mount and a Cassegrain instrument rotator. The Consortium entrusted with the work package is required to supply the IR Camera interfacing to the rotator.

Prior to the start of this SOW the Consortium shall have developed the design of the IR Camera to the level that a PDR has been successfully completed and a budget and schedule to completion agreed.

There are a number of free issue items supplied by the VPO to the Consortium which will be managed by the Consortium on behalf of the VPO.

The IR Camera Work Package Product Tree used by the Consortium during the System Design Phase leading up to PDR is shown in Figure 5.1. The same tree should be used for the succeeding phases unless there is a compelling reason not to do so.

The Consortium is responsible for the implementation and completion of the phases listed in Section 5.3. This includes the design, manufacture, test and delivery of the VISTA IR Camera Work Package in full compliance with the Technical Specification AD01 within the delivery date foreseen within this Statement of Work.

5.2 Compliance

Compliance with AD01 and its applicable documents are part of the criteria used when accepting the work package deliverables. Compliance covers, but is not limited to, equipment design, hardware component selection and system control.

Non-compliant options will be considered if there are significant apparent improvements with regards to system performance requirements (AD01), cost, maintainability, reliability and safety. The Consortium in proposing alternative strategies shall submit evidence of these option benefits.

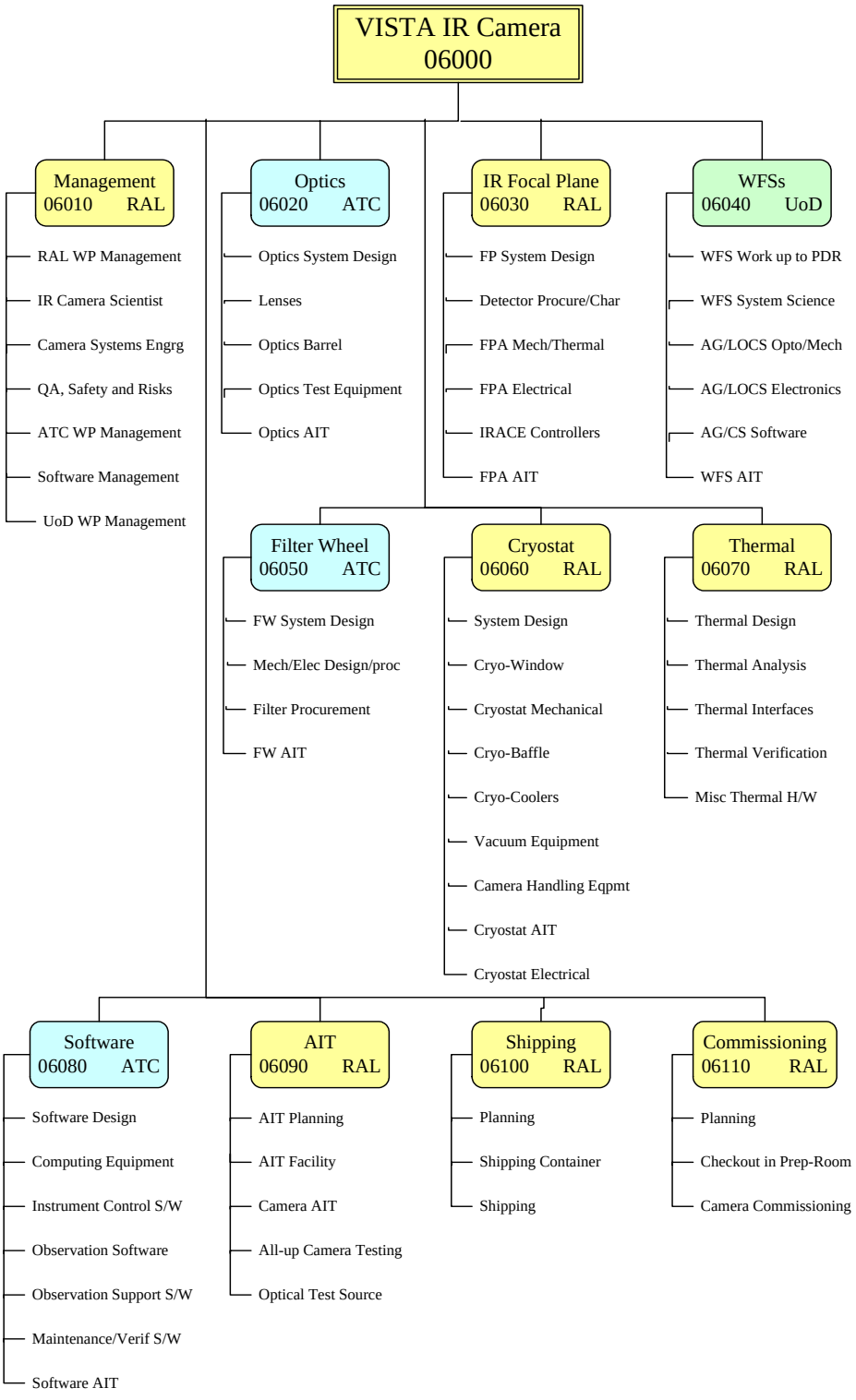

Figure 5.1 IR Camera Work Package Product Tree

5.3 Project Phases

This section defines the different phases of the VISTA IR Camera Work Package project as shown in outline in Figure 5.2.

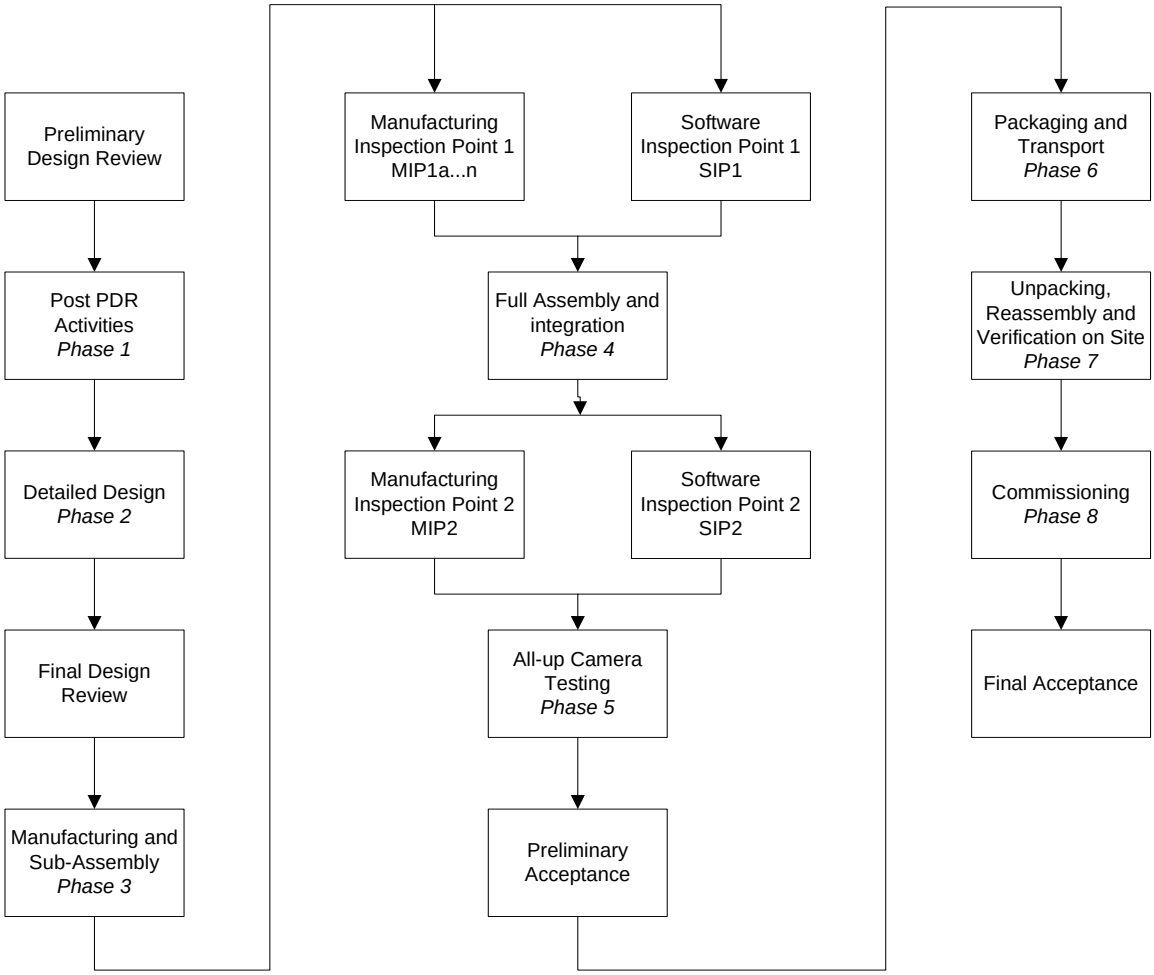

Figure 5.2 Project Phases and Key Reviews

5.3.1 Preliminary Design Review

This does not form part of this SOW but is an essential precursor to this work.

5.3.2 Post PDR Activities (Phase 1)

This Phase commences on completion of the Preliminary Design Review.

This phase ensures that all actions arising from the PDR are agreed and closed out, that the management plan is complete, the CIDL updated and any changes to the IR Camera Technical Specification agreed.

5.3.3 PDR Close-Out Review

The post-PDR activities conclude with a close-out review, sometimes referred to as the Delta-PDR, to verify all PDR actions completed to the satisfaction of the VPO.

5.3.4 Detailed Design Phase (Phase 2)

During this phase, the Consortium shall establish a detailed design of the IR Camera based on the preliminary design. The Detailed Design Phase is the period when the system and the items necessary for its support shall be designed in detail, including the preparation of manufacturing drawings and the design shall be verified analytically and/or by tests as required by AD01. Phase 2 ends with the Final Design Review (FDR), which may be split into several sub-reviews with the agreement of the VPO.

Long lead items that have been verified as fit for purpose may be procured in this phase of the project with agreement of the VPO.

5.3.5 Manufacturing and Sub-Assembly (Phase 3)

During this phase, the Consortium shall manufacture/procure/produce all parts of the IR Camera Work Package including the Camera Software. The hardware and software produced during this phase will be verified by Manufacturing Inspection Points (MIPs) and Software Inspection Points (SIPs) respectively. On completion of MIP 1 and SIP1, full assembly and integration testing (Phase 4) shall commence.

5.3.5.1 MIP 1

The Manufacturing and Sub-assembly Phase concludes with Manufacturing Inspection Point 1 (MIP 1) which shall be used to check that all of the components have been built/procured to specification. This MIP may be split into a number of sub-MIPs and may be conducted at more than one site of the Consortium. (Section 7.6.2.1).

5.3.5.2 SIP 1

During this phase, software produced by the Consortium shall be subject to assessment at the conclusion of incremental releases. The VPO inspection of one release is envisaged during this phase Software Inspection Point (SIP 1). (Section 7.6.2.2).

5.3.6 Full Assembly and Integration (Phase 4)

During this phase, the Consortium shall perform full assembly and integration of the IR Camera Work Package components, including software.

5.3.6.1 MIP 2

Full Assembly and Integration concludes with MIP 2 which shall check that the system has been built as designed (Section 7.6.2.1).

5.3.6.2 SIP 2

During this phase, software produced by the Consortium shall be subject to assessment at the conclusion of incremental releases. The VPO inspection is envisaged during this phase Software Inspection Point, SIP 2, (Section 7.6.2.2) of the final release prior to all-up camera testing (Section 5.3.7).

5.3.7 All-Up Camera Testing (Phase 5)

This phase involves tests on the final configuration of the camera.

5.3.8 Acceptance Testing

During the assembly and integration (phase 4) and all-up camera testing (phase 5), the Consortium shall perform all tests and any corrective action necessary to assure correct function of the IR Camera Work Package in accordance with the system requirements given in AD01 as far as may be verified off-telescope. The successful execution of this ends with the Preliminary Acceptance Review (PAC).

5.3.9 Preliminary Acceptance Review

The camera-level AIT and acceptance testing in the UK concludes with the preliminary acceptance review.

5.3.10 Packing and Transport (Phase 6)

The Consortium shall pack the equipment in appropriate containers provided by the Consortium and shall deliver the containers to the ESO Paranal site in Chile.

5.3.11 Unpacking, Re-assembly and Re-testing on Site (Phase 7)

The Consortium shall unpack, reassemble and test all the parts in order to have a nominally working IR Camera on site.

5.3.12 Commissioning (phase 8)

The consortium shall perform all activities necessary to commission the instrument. The successful execution of this phase ends with the Commissioning Review (COR). Final Acceptance (FAC) will occur when any actions from the COR have been completed to the satisfaction of the VPO, nominally 1 month after the COR.

5.4 Milestones

The minimum set of milestones of the project are defined in Table 5.1 below (see Section 7.6 for details). The Consortium shall include in their schedule all milestones defined in this section

Milestone	Designation	Timescale
1. Preliminary Design Review	PDR	T/0
2. PDR Close-Out Review	Delta-PDR	T/0 + 6 months
3. Final Design Review	FDR	T/0 + 12-14 months
4. Software Inspection Point 1	SIP 1	T/0 + 16 months
5. Manufacturing Inspection Point 1	MIP 1	T/0 + 17-28 months
6. Software Inspection Point 2	SIP 2	T/0 + 30 months
7. Manufacturing Inspection Point 2	MIP 2	T/0 + 35 months
8. Preliminary Acceptance Review	PAC	T/0 + 37 months
9. Commissioning Review	COR	PAC+ 7 months
10.Final Acceptance	FAC	COR + 1 month

- ***Note 1**: In order to meet the milestone dates, the associated documentation and/or software shall be delivered to the VPO 3 weeks prior to the milestone due date.*
- ***Note 2**: The Commissioning Review milestone date is subject to the telescope being ready to support Camera integration 3 months after the Preliminary Acceptance Review.*

Table 5.1 Project Milestones

6 DEFINITION OF TASKS

The Consortium shall perform all technical tasks necessary for the delivery to the VPO of the IR Camera Work Package in accordance with the Technical Specification AD01. This section describes technical tasks, which the VPO considers indispensable for the realisation of the VISTA IR Camera Work Package. Deliverable documents for each of the phases are shown at Table 9.1.

6.1 Post PDR Activities (Phase 1)

It is assumed that the Consortium will have developed the concept to the PDR level as per AD03. In addition, any long-lead items that require early placement of orders prior to FDR will be identified. The Consortium shall undertake the following tasks as part of the Phase 1 activities:

1. Update the preliminary Project Plan (DRD02), initially provided with the PDR documentation.
2. Revise PDR Data Package in accordance with the findings of the review panel. The revised PDR Data Package shall include:
    a) PDR Design Report (DRD21);
    b) PDR Analysis Reports (DRD22) covering all analyses performed during Phase 1 with respect to:

- Design and Performance evaluation (including error budgets, tolerance analysis and modelling);
- RAMS aspects, specifically but not exclusively Preliminary Safety Case Document, Hazards Log and Spare Parts List;

Phase 1 ends when all issues identified during the PDR have been resolved and implemented.

6.2 Detailed Design (Phase 2)

During this phase the complete IR Camera Work Package including all test, transport, handling and maintenance tools and equipment shall be developed and designed in detail.

The following tasks shall be included in the Phase 2 activities:

1. Develop the Detailed Design for the IR Camera Work Package, including all workshop drawings and parts lists, required to manufacture the IR Camera. The compliance of the final design with the requirements defined in the technical specifications AD01 shall be demonstrated at FDR.
2. Generate preliminary versions of the On-site Assembly Instructions (DRD27), integration procedures (DRD42), Operation Manual (DRD40) and Maintenance Manual (DRD41) including safe handling procedures.
3. Establish current version of CIDL
4. Update Spare Parts List (DRD45).
5. Update Reliability, Availability, Maintainability and Safety (RAMS) documents.
6. Generate Manufacture Inspection Point Procedures (DRD52) for use at the end of assembly and integration (Phase 3 and 4).
7. Generate Software Inspection Point Test Plan (DRD51).
8. Generate preliminary Verification Test Plan (DRD51) and Verification Procedures (DRD52) for use during the Acceptance Testing (Phase 5). These procedures shall cover all the system requirements as given in AD01.
9. Define the Packing, Transport and Handling Concept and the necessary equipment required for safe handling.
10. Generate preliminary IR Camera Commissioning Plan and Commissioning procedures for use in the Commissioning Phase of the Work Package
11. Provide monthly updates of the Project Plan (DRD02).
12. Prepare a FDR Data Package in accordance with AD02 and AD04. The Consortium shall deliver the documents to the VPO three weeks before the review date. The FDR Data Package shall consist of all documents the Consortium needs to use to show compliance and as a minimum shall include:
    a) A FDR Design Report (DRD21);
    b) FDR Analysis Reports (DRD22) covering all analyses performed during Phase 2 with respect to:

        - Design and Performance evaluation (including error budgets, tolerance analysis and modelling)
        - Design and Performance evaluation
        - RAMS aspects, specifically but not exclusively Safety Case Document, Hazards Log and Spare Parts List;

c) A FDR Mass and Balance Budget (DRD202);
d) A FDR Drawing set (DRD23);
e) Manufacturing Test Point Procedures (DRD52) for use in the assembly and integration (Phase 3 and 4);
f) Software Test Point Procedures (DRD52) for use in the assembly and integration (Phase 3 and 4);
g) Verification Procedures (DRD52) for use in the Acceptance Testing (Phase 5);
h) IR Camera Commissioning procedures for use in the Commissioning Phase of the Work Package
i) Software Design Description (DRD 204);
j) Software User and Maintenance Manual, preliminary version (DRD 205);

Phase 2 ends when all issues identified during the Final Design Review (FDR) have been resolved and implemented.

6.3 Manufacturing and Sub-Assembly (Phase 3)

During Phase 3 the Consortium shall:

1. Manufacture and/or procure all components of the IR Camera Work Package, including the agreed spare parts, which shall be manufactured in parallel with the IR Camera Work Package.
2. Build up sub-assemblies.
3. Design and manufacture/procure the transport containers for IR Camera Work Package deliverables.
4. Procure Tools, Test Equipment and Test Stand for IR Camera Work Package.
5. Produce and test at least one incremental delivery of software (SIP1) that implements
   - the command interface from the TCS and
   - prototype engineering screens

   The software need not perform any information processing or interface with hardware, although this is not precluded if it is required by other camera WPs.

Phase 3 is completed with Manufacturing Inspection Point 1 (Section 7.6.2.1), which may be divided into several sub-MIP's. An Inspection report shall be provided by the Consortium detailing compliance of the parts and assemblies against the manufacturing drawings.

6.4 Full Assembly and Integration (Phase 4)

During Phase 4, the Consortium shall:

1. Assemble and integrate all the sub-assemblies completed in Phase 3 into the IR Camera Work Package.
2. Perform the mechanical alignment and carry out the required analyses to show how mechanical alignment is preserved after any disassembly, packing, transport, unpacking and re-assembly.

3. Update, if necessary, On-site Assembly Instructions (DRD27), Integration Procedure (DRD42), Operation Manual (DRD40) and Maintenance Manual (DRD41) provided at FDR.
4. Supply the as-built drawing sets (DRD23).
5. Complete the procurement of spares as agreed with the VPO at FDR
6. Produce and test at least one incremental delivery of software (SIP2) with full functionality, but which
   - need not meet performance requirements,
   - may contain bugs and
   - may simulate some hardware.

The TCS interface, including the status database, and engineering screens shall be fully implemented.

Phase 4 is completed with a Manufacturing Inspection Point (MIP 2) relating to the full IR Camera Work Package Assembly. The Consortium shall provide an Inspection report for MIP 2 following the format of DRD53.

6.5 Preliminary Acceptance (Phases 4 and 5)

The acceptance test phases require a set of Verification Procedures defined by the Consortium and agreed by the VPO at FDR.

The purpose of this phase is to perform all verification activities necessary for the Preliminary Acceptance Review of the related equipment before it leaves the Consortium's premises.

6.5.1 Preliminary Acceptance Testing

During Phase 5, the Consortium shall:

1. Inform the VPO about the test schedule three weeks in advance.
2. Perform all verification activities according to the Verification Procedures approved by the VPO.
3. Maintain a test logbook.
4. The IR Camera Operation Manual (DRD40) and the IR Camera Maintenance Manual (DRD41) shall be complete by this stage.
5. Evaluate the results of the tests and perform all necessary analyses or assessments.
6. Provide the Preliminary Acceptance Data Package according to DRD56, along with the As-Built CIDL and the As-Built Drawing Sets.
7. Provide the final versions of:
   a) Software Design Description (DRD 204);
   b) Software User and Maintenance Manual (DRD 205);
   c) Software Test Procedure comprising Test Plan and Test Design Specification (DRD 206)
   d) Commissioning Plan and procedures

6.5.2 Preliminary Acceptance Review

The Preliminary Acceptance Review shall provide evidence that the related equipment fulfils all requirements as defined in AD01 and be chaired by the VPO. The Review Board shall be composed of:

- VPO representatives
- The Test Manager responsible for the complete programme
- The Product Assurance Representative
- Specialists as required

Phase 5 ends when all issues identified during the Preliminary Acceptance Review have been resolved and implemented and that evidence is given that the corresponding equipment meets the specified requirements.

6.6 Packing and Transport (Phase 6)

During phase 6, the Consortium shall:

1. Prepare the IR Camera for transportation.
2. Pack the equipment in the transport container(s).
3. Prepare the Packing List (DRD81).
4. Transport the Camera Hardware to Chile.

6.7 Unpacking, Re-assembly and Re-testing On Site in Prep Lab (Phase 7)

The Consortium shall:

1. Unpack the various transport containers.
2. Assemble as required all the IR Camera parts.
3. Perform all verification activities according to the Verification Procedures agreed with the VPO.
4. Keep a test logbook.
5. Evaluate the results of the tests and perform the necessary analyses or assessments.

Phase 7 ends when all issues identified during the Provisional Acceptance have been resolved and implemented and that evidence is given that the corresponding equipment meets the specified requirements.

6.8 IR Camera Commissioning On-Telescope (Phase 8)

During Phase 8, the Consortium shall:

1. Inform the VPO about the commissioning test schedule three weeks in advance.
2. Perform all verification activities according to the Commissioning Procedures approved by the VPO.

3. Maintain a test logbook.
4. The IR Camera Operation Manual (DRD40) and the IR Camera Maintenance Manual (DRD41) shall be updated to reflect commissioning reality.
5. Evaluate the results of the tests and perform all necessary analyses or assessments.

6.8.1 Commissioning Review

The Commissioning Review shall provide evidence that the related equipment fulfils all requirements as defined in AD01 and be chaired by the VPO. The Review Board shall be composed of:

- VPO representatives
- The Test Manager responsible for the complete programme
- The Product Assurance Representative
- Specialists as required

6.8.2 Final Acceptance

Final acceptance shall occur nominally one month following the Commissioning Review provided that the following criteria are met:

- All issues identified during the Commissioning Review have been resolved to the satisfaction of the VPO;
- Full compliance with all technical and contractual requirements has been demonstrated.

Provided that the above criteria are achieved, a Final Acceptance Certificate will be issued by the VPO. The issue of the Final Acceptance Certificate shall have the effect of formal final acceptance by the VPO.

7 PROJECT ORGANISATION & CONTROL

7.1 Project Organisation and Requirements

The Consortium shall establish and maintain an effective project organisation to accomplish the objectives of this contract. This project organisation and its management shall be separated from other projects and operations to the extent necessary to prevent interference with the effective and timely completion of the project. This organisation shall have effective control and support from appropriate senior institute management.

The Consortium's project management office shall co-ordinate and control all technical and commercial activities, project resources and manage all disciplines required to successfully complete the project.

The key personnel of the project shall consist of experienced personnel. Exchange of the key personnel during the execution of the contract shall be notified to and agreed with the VPO in due time. The project organisation shall ensure on all levels of the project the implementation, enforcement and control of the methods and procedures covering the schedule control, configuration control, product assurance including the safety and reliability aspects and the design implementation.

The Consortium shall assign a Project Manager with full authority over all personnel and resources of the project organisation throughout the Consortium. The Project Manager shall be assigned full authority to negotiate and conclude with the VPO and any Sub-Contractors/suppliers all issues related to the Work Package. He shall be the formal point of contact to the VPO for all technical and contractual matters. The VPO Project Manager will be the formal point of contact to the Consortium. Notwithstanding the formal points of contact, technical liaison and interaction between the engineering and scientific teams of the Consortium and the VPO shall be encouraged.

If events occur which may cause an impact on the critical schedules, for example technical problems, or changes requested by the VPO or initiated by the Consortium, the Consortium shall evaluate every possible way to avoid a negative schedule impact, including the utilisation of additional manpower and facilities.

7.2 Project Plan

As a deliverable of the Post PDR activities, the Consortium shall submit to the VPO an updated version of the Project Plan (DRD02). It will serve as a Project Control document for the VPO. Modifications and updates of the Plan shall be made available on a regular basis and at least once every three months.

7.3 Project Safety

The Consortium shall establish and maintain effective safety management to accomplish the objectives of this contract with respect to AD05. This safety management shall be separated from other projects and operations to the extent necessary to prevent interference with the safe completion of this project. Effective control and support from appropriate senior Company management shall be provided to ensure that a safety case for the Project is produced. The detailed requirements for the safety case are given in DRD200.

The Consortium shall be responsible for providing a safe working environment for any VPO personnel whilst they are on their premises.

7.4 Project Risk

The Consortium shall submit to the VPO an updated version of the Project Risk Register. The Consortium shall maintain this risk register and shall submit updates to the VPO on a regular basis.

7.5 Reporting

The Consortium shall submit to the VPO monthly progress reports (DRD03). Independently and in addition to the regular Progress Reports, the Consortium shall report any event with potential

implications on the schedule of over a month or on the technical specifications of the IR Camera as specified in AD01.

A "Red Flag Report" shall be issued by the Consortium within one day of occurrence of major problems which might jeopardise the timely delivery of deliverable items, the achievement of the contract milestones, the achievement of the technical performance and which requires the immediate attention of the VPO.

7.6 Reviews, Inspections and Meetings

7.6.1 Reviews

The Consortium shall plan and prepare project reviews in consultation with the VPO, particularly with regard to the agenda, participants and contents of the reviews. In general:

- Completion of reviews is defined as the VPO agreed completion of all action items arising from the review meeting.
- The Consortium shall prepare the various data packages as defined in the DRL and submit them for comments to the VPO.
- These data packages shall be delivered to the VPO three weeks prior to the review meeting. The Review Panel will prepare Review Item Discrepancies, Requests for Clarifications or Observations and will submit these to the Consortium one week prior to the review meeting.
- When test reports are submitted, the VPO require a 3-week period to approve the report.

The following major project reviews shall be held:

7.6.1.1 Final Design Review

The Final Design Review (FDR) is a scrutiny down to detailed drawings of the final design. The objective of this review is to verify the conformance of the final design of the IR Camera Work Package with the technical performance specifications. The review will consider the design, detailed analyses and development tests down to the subsystem level. It shall be performed according to the review procedure defined in AD02. The FDR will take place at the Consortium's premises. A dedicated data package shall be produced.

At the VPO's discretion, the FDR may be divided into two or more sub-reviews. In such an event, the Consortium must demonstrate how system engineering and in particular configuration control is maintained through these staggered reviews.

7.6.1.2 Preliminary Acceptance Review

The Preliminary Acceptance Review (PAC) is the review on completion of the Verification Activities during Acceptance Testing (Phase 5). The PAC shall verify that all interface, sub-system and system requirements defined in the technical specifications are met. The PAC is held at the Consortium's premises. The Consortium shall produce a Preliminary Acceptance data package (DRD56).

7.6.1.3 Commissioning Review

The Commissioning Review (COR) is the review on completion of the Commissioning Activities on site (Phase 8). The COR shall verify that all system requirements defined in the technical specifications are met. The COR is held at the Consortium's premises unless otherwise agreed by the VPO. The Consortium shall produce a Commissioning acceptance data package (DRD56).

7.6.2 Inspections

The Consortium shall plan and prepare inspections in consultation with the VPO, particularly with regard to the agenda, participants and contents of the inspection.

In addition to any Inspections the Consortium may recommend, the following major inspections shall be held:

7.6.2.1 Manufacturing Inspection Point (MIP)

There are Two Manufacturing Inspection Points, designated MIP 1 and MIP 2 that have been identified by the VPO. Additional inspection points may be required by the VPO or recommended by the Consortium. Test Plans for MIPs shall be delivered with the FDR Data Package.

The MIP shall check

- the equipment is in accordance with the prescribed configuration;
- the equipment is free from material and workmanship defects;
- any assembly and integration tasks relating to that Phase are completed;
- all the testing hardware and software is available and operational;
- all test/inspection procedures (DRD52) are available and approved by the VPO.

Conduct of a MIP:

1. The Consortium shall inform the VPO at least four weeks in advance about the foreseen test schedule.
2. The Consortium shall implement the agreed MIP test plan.
3. The MIP shall be witnessed by
    - The Consortium's Test Manager responsible for the complete test programme.
    - The Consortium's Product Assurance representative.
    - Specialists as required.
    - VPO representative(s), at VPO's sole discretion.
4. The above witnesses shall review the test data, decide to pass the system or sub-system or to repeat the inspection/test.
5. In the event of any non-conformity being discovered during inspection or testing the Consortium shall make every effort to rectify the non-conformity by remedial action.

If a non-conformity cannot be corrected the Consortium shall submit a repair scheme to the VPO explaining how the Technical Specification (AD01) will be maintained.

6. If any variance from the Technical Specification is anticipated, then the Consortium shall make an application for a waiver in accordance with DRD15 and submit a non-conformance report (NCR) in accordance with DRD16.
7. The Consortium shall produce Test/Inspection reports in accordance with DRD53.
8. Completion of the MIP shall be defined as acceptance of the test/inspection reports and correction of any non-compliance or issue of a waiver.

9. The successful completion of the MIP allows the Consortium to proceed to the next phase of the project.

The successful completion of the MIP allows the Consortium to include the results in the Provisional Acceptance Data Package in accordance with DRD56.

7.6.2.2 Software Inspection point (SIP)

There are two Software Inspection Points, designated SIP 1 and SIP 2 that have been identified by the VPO. Additional inspection points may be required by the VPO or recommended by the Consortium. Test Plans for SIPs shall be delivered with the FDR Data Package.

The SIP shall check that:

- the software release is in accordance with the prescribed configuration;
- the software release is sufficient to allow the Consortium to proceed to the next phase of the Project;
- all necessary test software and, if applicable, test hardware, is available and operational.

Conduct of a SIP:

1. The Consortium shall inform the VPO at least four weeks in advance about the foreseen test schedule.
2. The Consortium shall implement the agreed SIP test plan.
3. The SIP shall be witnessed by
    - The Consortium's Software Manager
    - The Consortium's Systems Engineer
    - The Consortium's Product Assurance representative
    - Specialists as required
    - VPO representative(s), at VPO's sole discretion.
4. The above witnesses shall review the test data, decide to pass the software release or to repeat some or all of the inspection/test.
5. In the event of any non-conformity being discovered during inspection or testing the Consortium shall make every effort to rectify the non-conformity by remedial action.
6. The Consortium shall produce Test/Inspection reports in accordance with DRD53.
7. The successful completion of the SIP allows the Consortium to proceed to the next phase of the project.

7.6.3 Meetings

The Consortium shall plan and prepare project meetings in consultation with the VPO, particularly with regard to the agenda, participants and contents of the meeting.

The VPO reserves the right to attend progress meetings held between the Consortium and their sub-contractors. The Consortium shall inform the VPO of all formal meetings of this nature in the monthly progress report.

Meetings may, at the discretion of the VPO, involve other participants upon agreement by the Consortium.

If not otherwise agreed, the Consortium shall write the minutes for all formal meetings between the Consortium and VPO. The minutes shall include an Action Item Record. Both parties shall sign the minutes. The signature of such minutes indicates solely that the wording is correct and properly reflects the outcome. The signature shall not be construed as a formal, contractual agreement. The following major project meetings shall be held:

7.6.3.1 Progress Meetings

In general, Monthly Progress Meetings will be held using tele/video conferencing facilities. Face-to-face Progress Meetings shall be held at the Consortium's premises. The purpose is to review the progress of work and to highlight and discuss problems or issues in need of special consideration and to determine, as appropriate, the corrective measures to be taken. The progress meeting will cover the entire scope of the contract, including programmatic, contractual and technical aspects.

7.6.3.2 Special Progress Meeting

The VPO reserves the right to ask for a Special Progress Meeting, one week in advance.

7.7 Configuration Management

The Consortium shall apply effective Configuration Management to assure that:

- The manufacturing documentation is in line with the FDR documentation;
- The product is in line with the manufacturing documentation;
- The activities performed in verifying the product (analyses, tests) have been performed against the configuration of the delivered product;
- Changes to technical specifications and statement of work are not implemented without prior approval by the VPO (see section 7.7.3. Change Procedures, below);
- The design as agreed upon at the FDR is not changed without prior approval by the VPO (see section 7.7.3. Change Procedures, below);
- Deviations from the requirements of the specifications are properly documented and submitted to the VPO for approval by means of Request for Waiver (see 7.7.4.).

7.7.1 Software Configuration Management

The Consortium shall apply software configuration management using either ESO's Configuration Management Module (RD01) or other recognised tools and procedures as agreed with the VPO. Software configuration management shall track all significant changes to source code and configuration, allowing software releases to be fully defined and previous release to be rebuilt.

7.7.2 Configuration Item Data List

The Consortium shall establish and maintain a Configuration Item Data List (CIDL) which reflects the edition/revision status of documents under configuration control. The purpose of the CIDL is to ensure that the Consortium and VPO agree upon the status of the documentation under configuration control. The required content of the CIDL is defined in DRD11. The Consortium shall deliver the initial version of the CIDL together with the Project Plan as part of the Phase 1 documentation. Updates shall be delivered monthly.

7.7.3 Change Procedures

Each party (Consortium and VPO) may propose at any time a change to be introduced into the contract and/or related documentation. Such a Change REquest (CRE) may affect:

- Contractual conditions (delivery, payment, schedule, etc);
- Technical specifications;
- Baseline documentation;
- Interfaces;
- Other written agreements between Consortium and VPO.

All CREs shall be prepared and forwarded to the VPO by the Consortium. Changes initiated by VPO shall be completed by the Consortium as CREs with a reasonable and justified price, schedule and shall be forwarded to the VPO within four weeks.

The Consortium is obliged to perform the work upon agreement of the change. If the Consortium wants to introduce third parties to complete the work proposed in the CRE, such parties shall be identified in the CRE. The VPO reserves the right to involve any third party for the implementation of a change if no satisfactory agreement can be achieved by negotiations with the Consortium.

The necessary preparatory work and requested content of a CRE is listed in DRD14.

7.7.4 Request for Waiver

The Consortium may submit to the VPO a Request for Waiver (RFW) in order to obtain relief from specifications, test procedures, integration requirements, etc. The RFW shall not be used to request changes to contractual requirements. The RFW can cover only a determined number of already produced materials.

The decision, which is a VPO responsibility, will be given after assessment of the supporting information to the RFW. Approval of a RFW shall not establish a precedent for the submission of RFWs concerning similar non-conformities. Whether the VPO decides to approve or to reject a RFW, the Consortium shall be informed about the decision within 4 weeks.

For detailed information about required contents of an RFW, see Request for Waiver (DRD15).

7.7.5 Action Item Control

The aim of the Action Item Initiation and Reporting Procedure is to provide a simple system to ensure that actions are raised and cleared effectively. Actions will normally originate from meetings and reviews or may be raised at the VPO's request.
Actions shall proceed immediately on the basis of acceptance. This acceptance can be reached during the meeting or, if requested by the actionee, after confirmation by their management. The change procedure defined above shall be applied for all actions, which may have an impact on the scope of the contracted work.

The Consortium shall keep an Action Item List and provide the VPO with an update of the list regularly together with the Progress Reports (DRD03) or upon request.

7.8 Documentation

The Consortium shall operate a centralised documentation system to fulfil the information requirements of the project. This system shall be capable of providing up-to-date information on all aspects of the project at all times including those relating to the Sub-Contractors.

7.9 Accommodation and Services for VPO Personnel on Consortium's Premises

During the project the Consortium shall provide, at no extra cost, desk space and communication facilities as may be required for VPO personnel (maximum 2 persons) who visit the Consortium's premises for reviews and inspections.

8 PRODUCT ASSURANCE

The Consortium shall follow the guidelines/processes of ISO 9001. Their general approach concerning the fulfilment of all specified quality assurance requirements shall be reflected in the Project Management Plan. The detailed tasks to be performed during individual phases of the project shall be included in the Project Plan (DRD02).

9 DELIVERABLES

9.1 Hardware

The Consortium shall deliver to the VPO all hardware items necessary for the fulfilment of the technical specifications defined in AD01 and this Statement of Work including the items listed below:

- One IR Camera
- All necessary handling equipment
- One set of tools comprising:
  - All special tools necessary for alignment of the IR Camera;
  - All special tools necessary for integration (on site) and maintenance of the IR Camera.
- Agreed Spares
- Transport containers as required for the safe delivery to Paranal for the IR Camera, Tools, Spares and handling equipment.

9.2 Hardware Retention

Any equipment required for the completion of this project, that is not a deliverable, must be retained by the Consortium until Final Acceptance (see Section 6.8.2) as a minimum. This equipment shall include, but not be limited to:

1. Verification test equipment
2. Software test equipment
3. Previous versions of software

9.3 Documentation

The Consortium shall deliver to the VPO all documentation as specified in the Documentation Requirements List (DRL) given in Table 9.1.

The documentation shall comply with the Documentation Requirements Definitions (DRDs) given in Appendix 1 and the documentation numbering system defined in Appendix 2.

All documents shall be prepared in A4 format and written in English. Paper copies of drawings shall be folded to A4 format. All deliverable documentation shall be delivered in MSWord, MSExcel or .pdf format unless otherwise agreed between the VPO and Consortium.

Documentation shall be delivered to the VPO (UK) unless otherwise agreed by the VPO.

Other technical documents issued by the Consortium within the scope of the project and not listed in Table 9.1 shall be made accessible to the VPO on request. This includes, for example, lower level specifications, incoming inspection reports, design specifications, test logbook extracts, etc.

9.4 VPO Supply

Major procurements that exceed the applicable OJEC threshold, £154k, will be undertaken through the UKATC procurement section unless otherwise agreed with the VPO. Some items will be procured through the VPO and free issued to the Consortium.

9.4.1 List of Free Issue Equipment

1. Detector focal plane
2. CCD Technical controllers
3. IR Detector controllers

9.4.2 Acceptance of Free Issue Equipment

The VPO will supply free issue equipment with the following stipulations:

1. Equipment free issued by the VPO will be deemed accepted as fit for purpose by the Consortium following an inspection period of 50 working days following its receipt
2. The Consortium shall be responsible for the performance, maintenance and reliability of any equipment supplied following the inspection period.

DRD No	Title	Category	Quantity	Delivery Date/Weeks	Remarks
DRD02	Project Plan	R	4	T/0 + 4 w	To be updated monthly
DRD11	Configuration Item Data List	A	3	T/0 + 4 w	Prelim. version to be updated at FDR and as necessary
DRD03	Progress Reports	R	1	monthly	
DRD14	Change Request	A	1	As needed	
DRD15	Request for Waiver	A	1	As needed	
DRD16	Non-conformance Report	A	1	As needed	
DRD21	Post PDR Design Report	R	3	T/0 + 30 w	
DRD22	Post PDR Analysis Reports	R	3	T/0 + 30 w	covering analyses performed during the preliminary design phase
DRD21	FDR Design Report	R	3	FDR- 3wks	
DRD22	FDR Analysis Reports	A	3	FDR- 3wks	covering all analyses performed during the detailed design phase
DRD23	FDR Drawing Sets	R	3	FDR- 3wks	
DRD52	Manufacturing Test Point Procedures	R	3	FDR- 3wks	
DRD52	Verification Procedures	A	3	FDR- 3wks	
DRD27	On-site Assembly Instructions	R	3	FDR- 3wks	
DRD40	Operations Manual	R	3	FDR- 3wks	
DRD41	Maintenance Manual	R	3	FDR- 3wks	
DRD42	Integration Procedure	R	3	FDR- 3wks	
DRD 204	Software Design Description	R	3	FDR- 3wks	
DRD 205	Software User & Maintenance Manual	R	3	FDR- 3wks	
DRD 52	Software Test Procedure	R	3	FDR- 3wks	
DRD45	Spare Part List	A	3	FDR- 3wks	
DRD53	MIP 1 and 2 Test/Inspection Report	R	3	Test/insp. + 3 w	
DRD53	Software Test Report	R	3	Test/insp. + 3 w	
DRD11	As-Built CIDL	R	5	PAC- 3wks	
DRD23	As-built Drawing Sets	R	5	PAC- 3wks	
DRD56	Preliminary Acceptance Data package	A	5	PAC- 3wks	
DRD81	Packing List	R	3	PAC- 3wks	

Table 9.1: Documentation Requirement List (DRL)

Abbreviations for Table 9.1

A Document submitted to VPO for approval
R Document submitted to VPO for review

9.5 Spare Parts

A provisional cost of spare parts will be established. The list of spare parts shall be reviewed by the Consortium during Phase 1 based on the preliminary design and in accordance with the reliability requirements. An update of the spare parts list shall be made during Phase 2. Up to the date of the FDR+ 2 weeks, the VPO reserves the right to determine the quantity and type of spare parts.

Appendix 1: Document Requirement Definitions (DRDs)

This appendix defines the document requirements applicable to the VISTA IR Camera Work Package.

PROJECT PLAN (DRD02)

The Project Plan is the major Project Control document for the VPO and the Consortium.

The Project Plan shall include:

a) A Project Management Plan describing:
- the management approach implemented by the Consortium to control the project
- the organisational structure of the project
- the responsibilities and the authority of each function in the organigram, including key personal identification and their position
- the project planning and organisation relative to software activities
- the interrelation among the different functions in the organisation
- where and how the control of any lower tier Consortiums is established in the project organisation.

b) A Work Breakdown Structure (WBS).

c) A Work Package Description (WPD) derived from the WBS and containing:
- a reference number
- the title of the WPD
- the input to the WP
- the description of the tasks to be performed
- the output to the WP
- the estimated start date and duration of the task
- the person responsible.

d) Planning and Scheduling Data containing:
- A master network displaying logic and time characteristics of the Programme's major activities and a master bar chart directly based on it (Single A4 sheet)
- Detailed networks
- Detailed bar charts

The planning shall be constructed on the basis of a detailed task analysis and the proper logic and sequence of activities. The planning takes into account resource planning:
- to provide adequate resources and facilities to each activity
- to identify potential resource shortages and conflicts
- to resolve or improve technical/schedule criticality

The planning shall include, as appropriate, the following items:

- design and development activities
- significant procurement activities
- software items, including documentation
- production or construction of the individual units, assemblies, etc.
- testing, acceptance and delivery of major products
- assembly and integration of product
- higher level test activities
- support equipment and tools
- packing, logistics and transport
- technical milestones (reviews, key inspection points)
- payment milestones (as appropriate, as a separate list)
- any other major event

The following instructions are emphasised:

- The description of each activity shall be clear and concise.
- The duration of activities shall reflect the expected elapsed time from start to finish under normal working conditions, taking into account a project calendar, which defines working and non-working periods.
- Critical path must be highlighted.
- Calculated buffer time must be indicated with an appropriate symbol.

e) Risk Register

The Risk Register shall contain the list of the major risks associated with the production and delivery of the IR Camera Work Package, their expected probability, their anticipated effect and the measures planned and implemented to mitigate them.

The VPO may ask for detailed plans for critical areas.

PROGRESS REPORT (DRD03)

The Progress Report summarises on a monthly basis the progress of the project.

It shall summarise the achievements of the project during the reporting period and show them against the planned date contained in the Project Schedule (DRD-02) putting in evidence of any deviations, description of critical schedule and technical issues in the reporting period or anticipated for the future.

It shall discuss problems detected during the reporting period that could impact schedule or performance and shall address the planned remedial activities.

The progress report shall state the current Issue Number of the CIDL.

The progress report shall include an up-to-date Action Item List.

The Action Item List shall list all the actions agreed between the Consortium and VPO. It shall contain:

- the subject of the action
- the originator
- the actionee(s)
- the due date and the closure date
- the reference to the document(s) containing the basis for the closure of the action.

The Action Item List shall identify:

- All open actions
- All late actions
- All actions closed in reporting period

This list will be reviewed at each progress meeting.

CONFIGURATION ITEM DATA LIST (DRD11)

This shall describe the status of the product configuration for each configuration item, by means of listing the relevant requirements, design/development, manufacturing and operational documentation which is relevant for a configuration item:

It shall contain:

- list of the valid versions of the specifications
- list of valid drawings
- list of parts
- list of valid plans and procedures
- list of valid software

All documents shall be recorded in the CIDL with the:

- document title
- identification number
- issue/revision number
- date of status
- approval status (Consortium and/or VPO if required)

CHANGE REQUEST (DRD14)

When preparing a Change Request (CRE), the Consortium shall investigate the proposed change and provide all information required for the VPO to take a decision, including, but not limited to:

a) the reason for the change
b) assessment of the technical feasibility
c) assessment of the technical and performance impacts on the total system/other subsystems

d) the affected documents. The necessary modifications of the contractual documents (Technical Specification, Statement of Work, Interface Control Documents, etc.) shall be clearly indicated by quoting the OLD and the NEW version of the text or drawing
e) schedule impact on the key milestones including detailed schedule of the change implication
f) total cost impact giving detailed information on the manpower, material, cost, etc, and reflecting the differential cost for changes in work packages
g) other related factors such as reliability, safety/integrity, maintenance, etc.
h) additional documents in order to justify the change.

Each CRE must be identified by an individual and unique number, which shall be used by all subsequent correspondence. Implementation of the requested change shall not commence prior to written authorisation or approval of the CRE.

The Consortium shall maintain a change status list, which shall include all initiated CRE's with their status (approved, rejected, pending) and provide an update together with the regular reports.

REQUEST FOR WAIVER (DRD15)

The RFW shall include at least the following information:

- description of and reason for the discrepancy and the need for waiver
- the cost and schedule impact of the discrepancy
- the consequence of the discrepancy on the user personnel and on the interchangeability, reliability and performance of the material concerned and of the higher assemblies into which it is to be incorporated
- the number of items to be covered by the waiver
- the price impact of the waiver
- the corrective actions taken by the Consortium to prevent recurrence
- the need for, the urgency, the economy and the possibility of retrofit.

Each RFW must be identified by an individual and unique number, which shall be used by all subsequent correspondence.

NON-CONFORMANCE REPORT - NCR (DRD16)

The NCR shall report non-conformities, which occurred during the manufacture, assembly, testing and which are authorised by the VPO. The NCR forms are part of the "as built" drawing set. It shall:

- Identify the item in which the non-conformity occurs;
- Identify the originator;
- Describe the non-conformity in detail;
- List the documents, the software and the hardware affected;
- Describe the impact at any level of the project;
- Recommendations for further procedure.

The NCR is usually initiated by a Failure Report, which is forwarded to a Material Review Board (MRB) which in many cases require VPO participation. The MRB decides on the further use of the faulty item (re-work, use as is, scrap) and issues in accordance with this decision the NCR for VPO approval.

DESIGN REPORT (DRD21)

The Design Report summarises the design features of all contract items subject of this contract. The Design Report shall address every applicable requirement specified in the technical specification to the item that is the subject of the Design Report. In particular the Design Report shall contain the following information:

1. Scope of the Design
In this section a general description of the contents of the Design Report shall be given.

2. Applicable Documents
In this section all the documents referred to in the Design Report shall be listed.

3. Assumptions
The assumptions used in the design shall be listed. In particular:
- design constraints
- environmental conditions other than specified in technical specifications
- calculation methods (if applicable)
- maintenance constraints (if applicable)
- access constraints (if applicable)

4. Materials
All the materials used in the design and their physical and mechanical properties as well as their chemical behaviour - when applicable - shall be given. Applicable treatments and their purposes shall be described.

5. Design Description
In this section a complete description of the design shall be given. Starting from the assembly level, the design of subsystems shall be described down to the level of detail required to verify the compliance with the technical specifications. Every requirement specified in the technical specifications that is applicable to the described item shall be addressed. Properly referenced figures and sketches shall support the design description. The design solution shall be supported by calculations. (refer to section 6 or to an Analysis Report.)

6. Calculations
In this section all the calculations supporting the design, other than those included in the Analysis Report shall be given in detail, including a discussion of the results.

7. Conclusions
In this section a statement concerning the compliance of the design with the requirements shall be given. Non-conformities shall be discussed.

ANALYSIS REPORT (DRD22)

The Analysis Report summarises all the calculations that support the design (for example F.E. calculations, etc.).

The Analysis Report shall identify against which issue of the specification and against which design/manufacturing configuration the analysis has been performed.

An Analysis Report shall be produced every time a verification by analysis is required in the verification matrix.

The Analysis Report shall contain the following information:

1. Scope of the Analysis
In this section the purpose of the analysis shall be given as well as a general description of the contents of the Analysis Report.

2. Applicable Documents
In this section all the documents referred to in the Analysis Report shall be listed.

3. Assumptions
In this section all the assumptions used in the analysis shall be listed and discussed. In particular:
- assumptions used in the definition of the model
- assumptions used in defining the boundary conditions (if applicable)
- assumptions used in defining the material properties (if applicable)
- assumptions used in defining loads and loading cases (if applicable)
- assumptions used in processing the results (if applicable)
- analysis methods.

4. Model
In this section the model used in the analysis shall be described in detail.
In particular:
- the geometry
- the sectional properties (if applicable)
- boundary conditions
- loads topology
- type of elements used (if applicable)
- type of components used (if applicable)
- correspondence between the model and the actual modelled component.

Plots and sketches illustrating the model shall be included and shall be readable in all details.
The detail of the description shall allow reproduction of the model.

5. Loading Cases
In this section the loading cases shall be identified.
The loading applied to the model shall be given and illustrated in plots and/or sketches.
A list of the loaded nodes shall be given (if applicable).

6. Results
In this section the results shall be summarised and discussed.
The results of the analysis shall be processed in such a way that they are directly comparable with the verification items verified.
A comparison table shall summarise the calculated values with the values of the verification items.

7. Conclusions
In this section a statement concerning the compliance of the results with the performance requirements shall be given. Non-conformities shall be discussed (refer to DRD16).

DRAWING SETS (DRD23)

They shall define at **all levels** of the project the as-designed and as-built product.

Drawing Sets are engineering drawings that provide all necessary design, engineering, manufacturing and quality support information necessary to permit a competent manufacturer to produce an interchangeable item which duplicates the physical and performance characteristics of the original design without additional design engineering or recourse to the original manufacturer.

Drawing sets shall be prepared in accordance with DIN standards or equivalent and approved by the VPO.

The drawings shall be provided, on the centralised document store, in .pdf format.

ON-SITE ASSEMBLY INSTRUCTIONS (DRD27)

The On-Site Assembly Instructions shall describe the necessary sequence of the assembly and integration procedures for the on-site assembly in Chile.

The instructions shall clearly indicate all the inspections, checks and tests as well as all critical operations performed during the assembly process.

These instructions shall furthermore identify and specify the requirements for the On-Site Assembly:

- Handling equipment;
- Special assembly tools;
- Machine and hand tools;
- Measuring and alignment equipment;
- Electric power requirements;

In addition, an estimated manpower (number, qualifications and categories) and an estimated schedule of the on-site assembly work shall be provided.

OPERATIONS MANUAL (DRD40)

The Operations Manual shall describe in detail all the procedures needed to operate the IR Camera correctly and safely.

It shall at least:

- Describe the start-up and shut-down procedures - whenever applicable;
- Describe the procedures to operate the IR Camera systems;
- Describe the operational error conditions and the necessary remedial action;
- Describe the safety procedures to operate the unit;
- List the operational limits of the system;
- Contain the user manuals of the operational software - whenever applicable;
- List the emergency cases which can occur during operations;
- Describe emergency procedures;
- Describe trouble-shooting;

MAINTENANCE MANUAL (DRD41)

The maintenance manual shall contain the detailed maintenance procedures with drawings. It shall contain the maintenance requirements and scheduling for all items included in the supplies of this contract. It shall provide a maintenance checklist or matrix including information about:

- item to be maintained
- reference to maintenance manuals
- type of maintenance, inspection, etc.
- dates (intervals) for maintenance
- duration of maintenance action
- effect on other systems, functions of the VISTA telescope
- effect on other VISTA infrastructure
- required parts and consumable and tools
- required major equipment
- required personnel
- estimated man-hours and skill level required for each maintenance task

A maintenance manual and a computer readable list of maintenance actions shall also be delivered, to be used later for the implementation of a centralised preventive maintenance software for the whole VISTA system. The list format will be specified by the VPO.

INTEGRATION PROCEDURES (DRD42)

This shall list and describe the integration procedures at **all levels** of the project. It shall:

- identify the component(s) to which the procedures shall be applied
- identify the tools required to perform the procedures
- describe the procedures
- identify the originator.

In particular, for the IR Camera Work Package, integration procedures shall address (but not necessarily be limited to) the integration with the telescope including alignment of the axes.

SPARE PART LIST (DRD45)

This Spare Part List shall contain all relevant information concerning the required spare parts such as:

- number quantity
- make
- addresses of manufacturers or representatives
- name
- type designation
- dimensions
- specifications
- delivery times
- expected lifetime
- storage conditions

In the Spare Part List a subdivision shall be made with the following categories:

- consumable
- fragile and/or critical parts
- components or parts with very long delivery time or which are custom-made
- off-the-shelf/custom-made products

TEST/VERIFICATION PLAN (DRD51)

It shall list all the verification activities to prove the conformity of the product with the technical specification at all levels of the project.
It shall:

1. List all verifications to be performed and give reference to the requirements of the technical specification and the corresponding inspection/test procedure (if applicable)
2. List the closing document where the results will be documented
3. Indicate the milestones where these verifications have to be performed.

TEST/INSPECTION PROCEDURE (DRD52)

The Test/Inspection Procedure shall describe in detail all the necessary operations to perform a verification by test/inspection. A Test/Inspection Procedure shall be produced for every verification by test/inspection. It shall contain the following information:

1. Scope of the Test/Inspection

In this section the scope of the test/inspection shall be described and the verification item shall be identified.

2. Applicable Documents

In this section all the documents referred to in the test/inspection procedure shall be listed.

3. Test/Inspection Conditions

In this section all applicable requirements needed to perform the test/inspection correctly shall be listed and discussed (for instance special environmental conditions, dedicated tools, test/inspection rigs, special requirements on the tested/inspected items, calibration requirements, etc.).

4. Test/Inspection Procedure

In this section all the operations required to perform the test/inspection shall be described in detail.

5. Test/Inspection Result Presentation

In this section the procedures used to process the raw data for the final presentation of the test/inspection results shall be described.

TEST/INSPECTION REPORT (DRD53)

The Test/Inspection Report shall summarise the findings of the tests/inspections. The Report shall contain the following information:

1. Scope of the Test/Inspection

In this section scope of the test/inspection and the verification item shall be identified.

2. Applicable Documents

In this section all the documents referred to in the Report shall be listed.

3. Test/Inspection Procedure

In this section reference shall be made to the applicable Test/Inspection Procedure.

4. Test/Inspection Results

In this section the findings of the test/inspection shall be given. The results shall be processed in such a way that they are directly comparable with the verification items verified. A comparative table shall summarise the actual findings compared with the verification item.

5. Conclusions

In this section a statement concerning the conformance of the test results or inspected item with the requirements specified shall be given. Non-conformities and changes shall be discussed as far as applicable.

ACCEPTANCE DATA PACKAGE (DRD56)

The Acceptance Data Package is the collection of documentation and drawings that shall be the base for the acceptance of the as-built product.

It shall include

- The list of data package documents (as far as not already delivered);
- The drawing set identifying the as-built product configuration;
- All certificates documenting the proper application of the critical manufacturing, assembly, test, inspection procedures;
- The inspection/test reports;
- All non-conformances/waivers and changes;
- Safety assessment;
- Analysis/design reports;
- Operation, maintenance manuals.

PACKING LIST (DRD81)

The Packing List shall provide for each box/container:

- its content
- its dimension
- its weight

SAFETY CASE (DRD200)

The Safety Case shall describe:

- The system under assessment including interfaces with other systems from the safety perspective.
- The requirements for safety and how they are to be achieved.
- The safety risk analysis including risk hazard assessment according to the As Low As Reasonably Practicable (ALARP) concept.
- The safety management system including the organisations involved, their role and the arrangements for accident/incident reporting and auditing.
- The emergency and contingency procedures.

- The safety case report that includes safety features of the system under assessment and includes the safety management system and emergency/contingency documents.
- The safety organisational chart which summarises the organisation and the lines of authority (organisation diagram) including any sub-contractor.
- The key safety personal identification and experience.

MASS AND BALANCE BUDGET (DRD202)

The Mass and Balance Budget shall be used to monitor the IR Camera with respect to the Mass limitations, the Balance requirements and Inertia linked performance requirements as given in the IR Camera Technical Specification.

The document shall contain the following information:

1. Scope of the document

In this section a general description of the contents of the Mass and Balance Budget document shall be given.

2. Applicable documents

In this section all the documents referred to in the Mass and Balance Budget shall be listed.

3. Definition and Convention

In this section all definitions and conventions used in the document shall be given.

4. General Assumptions

In this section all general assumptions used in elaborating the Mass and Balance budget shall be given.

5. Mass Budget

The mass budget shall be presented with reference to the budget requirements stated in the IR Camera Technical Specification. As part of the mass budget all component masses used in the IR Camera shall be given. Also the combined component masses to form sub-assemblies and then final assembly shall be given. The information shall be presented in a spreadsheet format that is clear in showing the build up of component masses into sub-assembly masses into final full assembly.

6. Balance Budget

In this section the balance budget shall be presented in spreadsheet format with reference to the balance requirements given in the IR Camera Technical Specification. Additional mass

requirements to meet the technical specification balance limitations shall be given with respect to placement on the IR Camera, mass type and mass quantity.

7. Inertial Budget

In this section an inertial budget shall be presented in spreadsheet format with reference to the performance requirements linked to inertia given in the IR Camera Technical Specification.

SOFTWARE FUNCTIONAL SPECIFICATION (DRD 203)

The Software Functional Specification shall describe how the software will meet the requirements, how it will be operated and maintained and what facilities and services will be offered.

It shall include:
(a) overview description
(b) external interfaces
(c) hierarchical breakdown
(d) functions, both operational and malfunction/maintenance
(e) data, e.g. type of storage, location, extent, availability
(f) control and supervision: equipment and procedures
(g) safety implications
(h) security, e.g. access control
(i) means of ensuring the required level of availability
(j) maintenance philosophy, facilities and procedures
(k) design factors
(l) development environment
(m) test factors

SOFTWARE DESIGN DESCRIPTION (DRD 204)

The Software Design Document shall describe the design in detail. It shall include:

(a) the design documented using an approved design methodology, e.g. Ward Mellor or UML. The design shall include the essential model and the implementation model.
(b) the complete definition of the software interfaces, referring to Interface Control Documents as appropriate, e.g.
- Command Definition Tables
- Command Interpretation Tables
- the interface header file (function prototypes, type definitions, etc.)
- for each routine the descriptive header of the source file
- error file, if applicable

(c) the complete definition of hardware interfaces, referring to Interface Control Documents as appropriate
(d) preliminary layout of user interface screens and their dependencies
(e) detailed documentation on any prototypes used to assess feasibility, performance etc.

SOFTWARE USER AND MAINTENANCE MANUAL (DRD 205)

The Software User and Maintenance Manual shall be complementary to the package Operations Manual (DRD40) and Maintenance Manual (DRD41), providing information related to software and computer hardware aspects.

It shall include

(a) Operator's Guide, containing information about
- start up and shut down, through the user interface
- operation through the user interface, including normal operations, test and maintenance
- location of files, including calibration data and logs
- configuration of the workstation and LCU

(b) Programmer's Guide, contain information about:
- operational modes and states
- programmatic start up and shut down
- include files
- command interfaces
- public data, e.g. C++ classes
- interface definitions or references
- data dictionary
- configuration files
- set up files
- calibration files
- log files

(c) Installation Guide, including
- hardware configuration
- software installation procedures

(d) Trouble Shooting Guide, including
- description of problems that may be encountered with solutions
- general and specific procedures

(e) Error Messages and their meaning

(f) Reference, including
- man pages of functions
- listings or examples of files described in other sections, e.g. header files, scripts, set up files, log files, error files.

Appendix 2: Document Numbering

The following numbering scheme shall be used by the Consortium for all documents related to the IR Camera Work Package.

Correspondence
Codification for correspondence with the VPO, which is applicable to letters and facsimiles concerning the IR Camera Work Package shall be as follows:

VIS-CCC-yy/EEEE

where:

CCC	is the code for the Firm or Organisation issuing the document (see list below)
yy	is the year code (for example 02 for 2002)
EEEE	is a sequential identification number (including preceding zeros)

Documents & Drawings
Other documents and drawings shall use the following numbering scheme:

VIS-BBB-CCC-DDDDD-GGGG

where:

BBB	identifies the type of document (see list below)
CCC	is the code for the Firm or Organisation issuing the document (see list below)
DDDDD	is the product code number (given in Figure 5.1 above)
GGGG	is a sequential identification number (including preceding zeros)

The document type codes (BBB) are defined as follows:

AMD:	Format of Amendments	RFW:	Request for Waiver
CRE:	Change Request	SOW:	Statement of Work
SCH	Schematic/Layout/Diagram	SPE:	Specification
DNO	Discrepancy Notice	TRE:	Technical Report
MAN:	Manual	DWG:	Drawings
MIN:	Minutes of Meetings	ICD	Interface Control Document
MEM	Memo	INS	Instruction
PLA:	Plans	ANA:	Analysis
LST:	List	REG	Register
DES:	Design	CID:	Configuration item data list
BDG:	Budget		

The Organisation codes (CCC) are defined as follows:

ATC:	Astronomy Technology Centre	UOD	University of Durham
RAL:	Rutherford Appleton Laboratory		

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