LLEINST 7700J
15 December 2016

Omega

LASER FACILITY

PROJECT MANAGEMENT PROCESS

MANUAL

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LLE INSTRUCTION 7700J

SUBJECT: Omega Laser Facility Project Management Process Manual

1. **Purpose:** To promulgate Revision J for the Omega Laser Facility Project Management Process Manual.

2. **Promulgation:** Revision J to the Omega Laser Facility Project Management Process Manual is hereby promulgated.

3. Approval:

Robert L. McCrory
Director, Laboratory for Laser Energetics

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Part I

Introduction to Project Process

1. Purpose [TOC]

This policy establishes the process and procedures for the initiation, administration, and completion of approved projects for new or changed equipment or systems within the Laboratory for Laser Energetics (LLE). This instruction includes guidance for all aspects of project administration, management, and execution to ensure that safety, reliability, and all other relevant factors are addressed during the project life cycle.

2. Scope [TOC]

This policy applies to all equipment or system projects conducted at LLE, which encompasses Omega and Multi-Terawatt (MTW) Laser Facilities, and all LLE research laboratories, including those proposed by outside organizations.

A full requalification in the context of this instruction is not required for minor modifications to previously qualified equipment or systems, as long as all of the following conditions are met:

- The proposed change is approved by the relevant Division Director(s).
- The Laser Development and Engineering Division Director approves in writing that the change is minor.
- The proposed modification is approved as part of the normal LLE Document Management System (DMS) design approval process.

3. Personnel and Equipment Safety [TOC]

Personnel safety is of paramount importance and will be addressed at every phase of every project *without exception*!

Student advisors are responsible for ensuring that students comply with all requirements of this instruction.

All projects require the same discipline and care to ensure that desired results are achieved and that safety risks to personnel and equipment are identified and mitigated. In general, projects with identified safety risks should employ engineering controls (e.g., interlocks, custom rigging, enclosed beam path, etc.) as the primary risk-mitigation technique. Procedures, training, and the use of personal protective

equipment are secondary risk-mitigation techniques and will be employed in conjunction with engineering controls.

During prototype evaluation and initial stages of development, administrative controls (e.g., temporary barriers, operation by expert or specially qualified personnel, procedural verification, etc.) can be used to mitigate safety risks. In such cases, redundant controls, e.g., a second operator, may be applied if deemed appropriate by the LLE Chief Safety Officer (CSO) to ensure that safety concerns are mitigated.

An up-to-date Personnel Safety Risk Assessment (SRA) must be presented at each design review. The Project Manager (PM) will complete these documents in collaboration with the project team and appropriate safety officers. The completed safety analysis will be approved by the PM and the CSO.

The final project design must ensure that all safety risks identified on the SRA are reduced to "minor or none" or else the project will not be deployed within any LLE facility.

4. Project Stakeholders [TOC]

The following is a brief summary of the roles and responsibilities of the project stakeholders. Detailed roles and responsibilities for all stakeholders are provided in **Part V** (Project Roles and Responsibilities) of this document.

a. Division Directors: [TOC] The Experimental Division Director, Omega Laser Facility Division Director, and the Laser Development and Engineering Division Director are responsible for reviewing, approving, and prioritizing all projects, including those proposed by external organizations consistent with LLE's established mission, objectives, and goals.

With the concurrence of the relevant Division Director(s), the Laser Development and Engineering Division Director may authorize that a project or modification to a previously completed project may bypass the requirements of this Instruction. The Project Management Administrator (PMA) will issue a record of decision notice to the Division Directors, Principal Investigator (PI), and Project Manager (PM) to document this approval.

b. Project Management Administrator (PMA): [TOC] The PMA administers the overall LLE project management administrative process to ensure projects proceed efficiently and safely. The PMA is responsible for training and assisting LLE personnel, especially the Project Manager, who will be executing the administrative controls defined in this instruction: the definition of project requirements, tailoring equipment qualification checklist requirements, and preparing for and documenting reviews.

c. Principal Investigator (PI): [TOC] The PI is the motivator and initiator of a project for achieving specific objectives. The PI is the scientific/technical expert responsible for establishing top-level requirements and to ensure that they are fulfilled, and is responsible for generating and submitting the initial Project Budget and Resource Request (PBRR).

d. Responsible Group Leader (RGL): [TOC] The Group Leader most closely associated with the primary goals/objectives of the project must be actively involved in the oversight and execution of the project.

e. Project Manager (PM): [TOC] The PM has overall responsibility for project execution. The PM is responsible for assembling the project team, working closely with the PI and PMA to execute the project, ensuring that all technical and administrative requirements are fulfilled, and ensuring that the project is completed on time and on budget. The PM is the principal point of contact for all concerned with the project throughout its life cycle. A PM must be assigned for all internal and external projects. A PM may be recommended in the PBRR by the project originator; however, the final selection/approval of a PM is determined by the RGL.

f. Project Team: [TOC] A team comprised of the appropriate disciplines required to achieve the goals and objectives of the project. It will be assembled by the PM in cooperation with the appropriate engineering, operations, experimental, and facilities Group Leaders.

g. Chief Safety Officer (CSO): [TOC] The term CSO will be used throughout this document specifically in reference to LLE's Chief Safety Officer. If it is necessary to refer to the Chemical Safety Officer that role will be fully spelled out as such.

The CSO is responsible for ensuring the completed project fulfills all applicable safety requirements. He will ensure that the Safety Risk Assessment (SRA) is completed and that all safety risks are mitigated. Additionally, he will, by participation in the final Operational Readiness Review (ORR), ensure that the project as installed meets all safety requirements.

h. Customer/End User: [TOC] The project's customer/end user is generally the PI and/or the Responsible Group Leader who receives and operates the completed equipment/system. Other customers/end users should be identified by the PM to ensure that their interests are identified and addressed.

5. Project Types [TOC]

The diversity of projects, their complexity, scope, objectives, and ultimate use does not lend itself to a one-size-fits-all process for managing projects. The following project types are those most commonly encountered at LLE.

a. Experimental Diagnostics Used at LLE [TOC]

All experimental diagnostics used on the OMEGA, OMEGA EP, and MTW Laser Systems are subject to all the qualification processes and procedures of this document.

All experimental diagnostic project requests are to be submitted via the LLE Experimental Support Group Leader.

Experimental diagnostic projects fall into two distinct categories:

Internally developed diagnostics are those instruments that are conceived and designed by LLE personnel or designated subcontractors with LLE oversight.

Externally developed diagnostics are those instruments that are conceived, designed, fabricated, assembled, and tested by external users for use within the LLE facility. All externally developed diagnostics are subject to the diagnostic qualification criterion established in this document.

At the request of the external user, and with approval and resource prioritization from the LLE Division Directors, LLE personnel may be involved in all or some subset of the external diagnostic development process.

b. Laser Facility [TOC]

Laser Facility projects modify the OMEGA, OMEGA EP, and/or the MTW Laser Systems. These projects are divided into two distinct subcategories:

Laser System projects are those that impact generating, amplifying, converting, steering, focusing, and diagnosing instrumentation of the laser beam(s) within the facilities cited above.

Experimental System projects are those that impact the laser facility target chamber and associated experimental support systems for the facilities cited above.

c. Research and Development [TOC]

The objective of a Research and Development (R&D) project is to explore promising technologies and ideas to demonstrate feasibility or proof of

principle. An R&D project will not produce a qualified piece of equipment that will support routine operations at LLE.

R&D projects are exploratory in nature and include graduate student research projects, development of new techniques/technologies in support of existing LLE laser and experimental systems and infrastructure, and development technologies in support of future LLE systems. A project is designated R&D by the cognizant Division Director with the approval of the Laser Development and Engineering Division Director.

The PMA will work with the PM to establish a tailored R&D project management plan to achieve the oversight and reporting requirements deemed appropriate by the Division Directors. R&D projects may use prototype hardware, software, controls, or other means to demonstrate feasibility or proof of principle for new equipment. This demonstration may require *in-situ* testing of prototype/developmental equipment in an LLE operational environment. As such, these projects have specific oversight and reporting requirements [see **Part III-2** (Project-Specific Guidance by Type)] to ensure personnel and system safety.

R&D projects requiring *in-situ* testing in an LLE operational environment must be operated in accordance with a specific operational test procedure approved by the cognizant Group Leader. Such projects have quantifiable goals and limited test duration, each specified by the cognizant Division Director and approved by the Laser Development and Engineering Director.

The dynamic nature and unpredictable outcome of R&D projects typically does not result in production-ready technology or equipment; therefore, the termination of an R&D project will result in one of the following recommendations:

- ***Close the project***. The project objectives have been met and no further work is necessary/required.
- ***Continue the R&D effort along alternate lines***. The results of the R&D effort indicated the original hypotheses were no longer valid and a new approach is required.
- ***Pursue qualification for production use***. The project has resulted in a new technology or piece of equipment that should become operational. The technology/equipment maturity will be assessed by the Laser Development and Engineering and the Omega Laser Facility Directors to determine if additional engineering is required, or if the technology/equipment may proceed directly to qualification through an ORR.

If additional engineering is required, a new project request (PBRR) must be submitted to pursue full qualification before use.

When an R&D project is terminated all associated hardware will be removed from the operational environment and the affected system restored to its original state.

d. Cryogenic and Tritium Facilities [TOC]

Projects in this category are those that are specific to Room 157, the Tritium Laboratory (Room 2838), the Cryo-cart Maintenance room (Room 150A), or involve radiological materials in the Target Fabrication Facility/Laboratory.

e. Information Technology (IT) [TOC]

Major software and control jobs that involve one or more of the following may be determined to be a project. The Laser Development and Engineering Division Director will determine when a job must be made a project and be managed using this Instruction:

Software Development Projects are those jobs involving the development and deployment of major software applications and systems at LLE. These projects are principally executed by the Software Development Group. These projects are typically fielded to support laser facility operations.

Computer Support and Networking Projects are those jobs that support major maintenance, modification, and upgrade of all LLE computing systems from desktop deployment to servers and networking infrastructure.

Informatics Projects are those jobs involving major changes or upgrades to laser facility operations controls and data acquisition, handling, management, storage, and retrieval to support facility users and operational groups. Informatics projects include major upgrades, modifications, and installation of computers and network systems within the Omega Laser Facility.

High-Performance Computing Projects are those jobs that impact the Laser Computing Facility, its infrastructure, and computing systems.

While the general scope of projects within these four areas is defined above, the boundaries between these project types tend to be blurred. Many of these projects have strong interdependencies and require the expertise of multiple disciplines to successfully execute.

f. Facility Infrastructure [TOC]

Major laboratory improvement projects that involve significant conversion of existing laboratory space or construction of a new space may be determined to be a project. If so, an architectural firm and/or a professional engineering firm should normally be engaged. Additionally, the Administrative Division Facilities Group Leader should consult with the University Architect and River Campus Facility Maintenance Organization, as necessary, to ensure compliance with applicable building codes and regulations.

The Administrative Division Director will determine when a job must be a project and managed using this Instruction. In this case the Facilities Group Leader will be the PM and is responsible for tailoring the Equipment Qualification Checklist (EQC).

6. Project Scope Definition [TOC]

A project scope is generally developed by the PMA in consultation with the project PI and PM. The steps required to complete a project are detailed by completing the EQC using a tailored approach (also referred to as the project plan, elsewhere in this instruction).

a. Tailored Approach: All projects are unique and completion of all steps of an EQC, and/or Electrical and Controls Review Checklist (ECRC), and/or Software Review Checklist (SRC) may not be necessary or appropriate.

Tailoring is based on evaluating the scope of the project, the impact on LLE facilities and personnel, and the resources necessary to execute. Tailoring normally is completed at the preliminary meeting to review the project scope. Items of EQC, ECRC, or SRC, as appropriate, that are not mandatory are reviewed to determine whether or not they must be completed. The PM must initial any items that are determined to be not applicable.

b. Exempt Projects: Projects determined to be exempt are not subject to the requirements of this instruction. Exempt projects typically do not cross engineering disciplines. The Engineering and Laser Development Division Director must authorize a project exemption from this instruction.

7. Project Process Overview [TOC]

The LLE project process flow is as follows:

- Proposal and submission
- Project approval and prioritization
- Establishment of Project Team

- Project execution
- Project closure

The remaining sections of this document describe in greater detail these process fundamentals.

Part II

Project Process

1. Project Proposal and Submission [TOC]

a. LLE Internal Projects [TOC]

i. LLE internal projects are those projects requested by LLE personnel for use in the LLE facility, or those which alter or modify LLE facilities.

ii. Internal project requests are generally approved as part of the Laboratory's annual budget cycle; however, projects may be proposed and considered for approval whenever circumstances warrant.

iii. All LLE internal projects will be initiated by submitting a hard copy or an electronic Project Budget and Resources Request (PBRR) form [**Enclosure (1)**]. An updated PBRR must be submitted as part of the budget call for all open projects requiring additional funding or resources. The PBRR should be reviewed and endorsed by the cognizant Group Leader and Division Director prior to submission. A PBRR is required for all projects requiring engineering resources and the administrative controls of this instruction.

Note: *The PBRR must be completed in sufficient detail to allow the resource managers to estimate resource requirements preliminary to the Division Director budget review*.

b. External User Project Requests [TOC]

External user projects are those projects requested by non-LLE personnel for use in the LLE facility as defined in **Part I-5.a** (Experimental Diagnostics Used at LLE) of this document.

i. ***All externally developed*** experimental diagnostics or laser-facility development project requests are subject to the diagnostic qualification criterion established within this document prior to use within the LLE facility.

ii. External user ***experimental diagnostic project requests*** are to be made by the external Principal Investigator (PI) through the Experimental Support Group Leader (ESGL), who is the initial point of contact (POC) and liaison for all externally generated experimental diagnostic projects.

iii. All external experimental diagnostic requests must be accompanied by a Project Proposal Briefing (PPB) at least four months in advance of the scheduled experiment that it supports. It is recommended that these projects be requested with the yearly May–June campaign proposals of the year preceding the campaign the diagnostic is to support. Guidance on PPB

content and format is provided in **Part IV-2** (Design Review Guidance) of this document.

iv. The ESGL will assist the external user with completing a PPB, detailing the proposed project to be submitted to the LLE Division Directors for review and approval.

v. The ESGL will notify the Project Management Administrator (PMA) of a new external project request and provide the PMA with the PPB and any additional supporting information for the proposed project.

vi. If the project proposal is approved by the LLE Division Directors, the ESGL will coordinate its introduction into the Omega Laser Facility scheduling process and the LLE INST 7700 project process for execution.

vii. External user ***laser-facility development requests*** are to be made by the external PI through the cognizant Division Director. In the event an external request to modify the LLE laser facility is approved the project will be an LLE internal project owned and managed by LLE personnel.

c. Grants and Joint Ventures [TOC]

i. For the purposes of this document the term "grant(s)" will be used to describe projects that result from formal grant proposals submitted to external agencies by LLE PI's, or scientific joint ventures between internal and external PI's requiring the use of LLE facilities and/or personnel resources.

ii. The use of LLE facilities and/or personnel resources associated with these types of projects is subject to the same review, approval, and prioritization process as any other LLE internal project.

iii. LLE PI's considering grant applications requiring LLE engineering resources, use of laser facilities (OMEGA, OMEGA EP, or MTW), or any other LLE resource beyond their own level of effort must have the approval of their Division Director ***prior to applying for the grant or agreeing to a joint-venture project***.

d. Proposals for LLE Design and/or Fabrication of Equipment [TOC]

i. Projects in this category can result in contracts with external customers to provide equipment.

ii. This equipment will not be fielded at LLE beyond limited development and testing activities required to calibrate, align, and verify contractual performance requirements of the equipment in question prior to delivery to the customer.

iii. Projects in this category are typically not funded by LLE but may require significant LLE personnel resources, particularly from Engineering. For this reason, proposals ***for LLE design and fabrication of equipment must be presented to the Laser Development and Engineering Division Director for review and approval prior to entering into, or accepting, this type of contract with external customers.***

Laser Development and Engineering will assess the scope and resource requirements for the proposed project and submit a recommendation to the LLE Division Directors for approval and prioritization as described in **Part II-2** (Project Approval and Prioritization) of this document.

2. Project Approval and Prioritization [TOC]

To effectively manage LLE resources, all project requests will be approved and prioritized by the Division Directors and the Associate Director for Operations.

a. Projects will be prioritized first by criticality and then by ordinal ranking, 1...*n*, within each criticality level.

Project priority (criticality) levels are defined as:

Priority 1C: Critical

- To meet LLE mission milestones, or strategic goals
- Continue operations
- Ensure safety

Priority 1G: Graduate Student

- To support graduate student degree activities (student must have an LLE advisor)

Priority 2: Important

- To develop or support future needs
- To improve operational efficiency and effectiveness

Priority 3: Merited

- Pending funding and/or resource availability

b. LDE will facilitate the prioritization by providing rough order-of-magnitude resource estimates from Mechanical Engineering and Electrical and Controls Engineering.

c. Only projects for which budget and personnel resources are available will be recommended for approval to the Laboratory Director.

d. When a project is approved and prioritized, the LLE PM listed on the PBRR will be confirmed and the PMA will notify the PI, PM, and responsible Group Leader that the project is approved. For external projects, the ESGL will notify the PI of the final project disposition.

e. Project status will be reviewed monthly by the LLE Division Directors and Associate Director for Operations. If resource loading requires reprioritization, this will be accomplished as part of the monthly review. This meeting is also the forum for submitting new project proposals for consideration during the fiscal year.

f. An updated listing of approved projects and their priority will be maintained and posted on the LLE Engineering website.

External projects and internal zero-budget (resource only) project requests

Upon notification from the ESGL of the request for an external project, the PMA will work with the ESGL and any applicable supporting organizations to assess the impact to LLE facilities and personnel resources of the project request and generate a project summary and recommendation memorandum to the LLE Division Directors for disposition.

The LLE Division Directors will review the proposed project based on the project summary, recommendation memorandum from the PMA, and the PBRR (internal requests) or PPB (external requests). If approved, the project will be supported and other project priorities adjusted as required.

Experimental diagnostic projects associated with a scheduled experiment (shot day):

- If the approved project can be supported without displacing existing higher-priority projects, the ESGL will coordinate the introduction of these projects into the Omega Laser Facility scheduling process and the LLE INST 7700 project process for execution per **Part II-3** (Project Execution and Phases) of this document.

- If the project cannot be supported without displacing existing higher-priority projects, the ESGL will work with the PI and the Omega Facility Scheduling Committee to attempt to reschedule the experiment.

3. Project Execution and Phases [TOC]

Project execution describes the activities that occur after a project has been approved as described in **Part II-2** (Project Approval and Prioritization) of this document.

Project execution typically occurs in phases, as described below; however, the structure and execution of every project is unique. The following is provided to be used as guidance during the project-tailoring process.

Project phases can overlap, particularly in the case of procuring and fabricating long-lead items that may be concurrent with the design phase. Concurrent execution of project phases inherently adds risk (inefficient resource use, redesign, schedule, and budget overruns) to the project and must be undertaken with due consideration of those risks.

The nominal phases of a project are

- Kickoff
- Concept of Requirements Development (C&RD)
- Design
- Procurement, Fabrication, and Assembly (PF&A)
- Qualification

Personnel safety is of paramount importance and will be addressed at every phase of every project *without exception*!

Student advisors are responsible for ensuring that students comply with all requirements of this instruction.

a. Kickoff [TOC]

The initial phase of project execution—project kickoff—provides the foundation for successful completion of the project.

During this phase of the project the PM

- Consults with the PI to develop a comprehensive understanding of the project: its motivation, goals, principal requirements; initial concepts for achieving the project objectives; and schedule constraints.
- Consults with the PMA and the appropriate Group Leaders to assemble a project team and identify all potential project stakeholders.

Projects requiring modification to any LLE facility infrastructure [**Part I-5.f** (Facility Infrastructure)] must have a Laboratory Improvement Budget and the laboratory requirements must be given to the Administrative Division Facilities Group Leader. He will manage the laboratory improvement project.

- Holds a project kickoff meeting with the project team to lay out the project: its motivation, goals, principal requirements, and schedule constraints, and to establish team member roles and responsibilities.

- Works with the PMA to set up the project database, also known as the WEBEQC (web-based Equipment Qualification Checklist), Electronics/ Controls Review Checklist (ECRC), and/or Software Review Checklist (SRC) as appropriate.

- Works with the PMA to establish an appropriate project work space on the LLE computing network.

- Prepares a draft-tailored EQC, ECRC, or SRC as applicable.

b. Concept and Requirements Development (C&RD) [TOC]

The goal of the Concept and Requirements Development phase is to

- Define the principal project requirements.

  Principal requirements are the underlying scientific or system requirements necessary to achieve the project objectives.

  Principal requirements are ***not*** engineering requirements. Principal requirements support the development of relevant engineering requirements.

  If specific engineering requirements are known or implied at this phase of the project, they should be documented and validated during the project design phase.

- Develop and explore concepts that will satisfy the project objectives and principal requirements.

- Develop a preliminary Concept of Operations for the project equipment/system.

- Prepare and present a Conceptual Design Review (CDR), (**Part IV-2.c**) to the relevant project stakeholders and other interested parties.

- At the conclusion of the project CDR, funds may be authorized to procure low-risk, long-lead items required to maintain the project schedule, or for "seed" capital to initiate an R&D project.

At the concluding C&RD phase, the draft EQC will be reviewed/updated and approved by the PMA and Laser Development and Engineering.

c. Design Phase [TOC]

The goal of the Design Phase is to finalize the engineering requirements for the project and to initiate and complete the formal design process to achieve those requirements. The Design Phase should be guided by the principle of "***sufficiency***" of a given design to fulfill the project requirements without over-engineering a solution.

The Design Phase may require a Preliminary Design Review (PDR), (**Part IV-2.d**) as well as a Final Design Review (FDR), (**Part IV-2.g**) to demonstrate the project requirements are satisfied. The decision to hold a PDR is at the discretion of the appropriate Division Director(s) and the PMA. This determination is typically made at the conclusion of the CDR.

Readiness of a project to proceed to an FDR is based upon having achieved a "final design" that satisfies all of the following criteria:

- all science, engineering, and operational requirements are finalized and satisfied by the design,
- a comparison (analytical, functional, or some combination) of the design against the system requirements is complete,
- all system interfaces—hardware, software, network, and human—are finalized and satisfied by the design,
- the system Concept of Operations is updated and supported by the design, and
- system integration, implementation, and PF&A issues are identified and understood, and there are plans in place to address them with no known "show stoppers" identified.

A "final design" does not imply that detailed drawings are complete. It is strongly recommended that detailed drawings and early procurement/fabrication activities be limited to low-risk system components prior to the FDR. Final, detailed drawings must be completed and released post FDR to support PF&A activities.

d. Procurement, Fabrication, and Assembly (PF&A) [TOC]

The goal of the PF&A phase of the project is to physically realize the design developed during the Design phase in hardware. Typically, component procurement and fabrication may proceed in earnest at the conclusion of the design phase.

i. Long-Lead Procurements

Long-lead procurements include

- purchased equipment
- vendor-fabricated components
- LLE-fabricated components

To facilitate the acquisition of long-lead items that could impact the ability to meet the project schedule milestones, the PF&A phase may be coincident with the Design phase and, in some cases, the C&RD phase of a project.

Initiating long-lead procurements ahead of a completed design should be considered only where the risk is low relative to the benefit or, in the case of R&D projects, where procurements are required to begin the activity.

A request for long-lead procurements, regardless of project type, must include

- specific item(s) to be acquired
- risk assessment of procuring/not procuring the item(s), and
- cost estimate and basis of estimate for each item requested.

The request for long-lead procurements may be made at any project review and must be documented in the review meeting minutes.

All long-lead procurements must be approved by the stakeholders and cognizant Division Director.

ii. Component Fabrication

- Fabrication of hardware may be executed using only revision-controlled, released documents from the LLE Document Management System.
- If any discrepancies are identified between hardware, approved drawings, and specifications during fabrication and/or assembly, the work in progress will be stopped and the discrepancy will be brought to the attention of the appropriate engineer for resolution.
- The engineer responsible for the assembly in question will notify the PM of any fabricated component discrepancies and provide an assessment of the severity of the problem, impact to project schedule, and a resolution plan.

- Discrepant components will be brought into compliance with the drawing or the drawing will be updated to reflect the approved as-fabricated design. Fabrication and/or assembly will be continued only after the discrepancy is resolved and properly documented.

iii. Assembly

- Assembly activities are to be performed only by qualified personnel using approved (i.e., released) assembly drawings from the Document Management System. Qualified personnel are defined as those individuals assigned by the cognizant Group Leader with the appropriate safety and functional training required to complete the required assembly.

- After assembly is complete, a fit and function test will be conducted off-line if possible. This includes testing any control systems and software to the fullest extent possible.

- In the event that fit and function testing must occur within the Omega Laser Facility, the PM will review this need with the PMA who will determine the need for a Preliminary Qualification Review (PQR) in **Part IV-2.h** of this document.

- If a PQR is required prior to executing the fit and function test, the PM will follow the guidance for a PQR in **Part IV-2.h** of this document. If a PQR is not required, the PM will coordinate this effort with the appropriate representatives from operations and the LLE Safety Officer(s).

e. Qualification Phase [TOC]

The goal of the Qualification Phase of a project is to verify that the project meets its specified performance, operational, and safety requirements prior to acceptance for routine operational use.

The qualification process may include installing, testing, and validating equipment and its associated procedures, as well as training personnel involved in the routine operation of the equipment.

In general, qualification is performed off-line prior to installation; however, this is not always possible or desirable. In these cases the project may be required to present a PQR to obtain permission for the restricted use of non-qualified equipment in the Omega Laser Facility as described in **Part IV-2.h** (Preliminary Qualification Review) of this document.

The Qualification Phase of a project typically culminates in an Operational Readiness Review (ORR), a post-ORR review of the project documentation by

the Division Directors and, in the case of experimental diagnostics, the issuance of an EQC completion memorandum from the Omega Laser Facility.

In-situ Qualification: Projects requiring *in-situ* development, assembly, integration, and qualification will typically require either an Installation Readiness Review (IRR) (**Part IV-2.i**) to allow for the equipment/system installation, or a PQR to complete development/integration activities. These types of projects often have extended qualification periods within the operational system prior to having their requirements and procedures fully validated.

An IRR is used to demonstrate that the equipment/system installation, operation, and safety has been appropriately addressed ***prior to installation*** of equipment/systems requiring *in-situ* development/qualification, and to present the final qualification plans to achieve an operational system.

An IRR differs from a PQR in that a PQR will typically be associated with ***transitory equipment*** (e.g., diagnostics) while an IRR will typically be associated with changes intended to permanently alter the configuration of the laser facility (e.g., a new support structure) in some way.

Experimental Diagnostics [Part I-5.a]

Per the Omega Laser Facility Organization and Regulation Manual (LFORM) **Part I, Sec. 4.3.1.2** "*All new diagnostics must be fully qualified two full weeks before the date of the experiment.*" The two-week rule ***applies only to diagnostics on OMEGA***. Experimental diagnostic qualification is complete when the Omega Laser Facility issues the EQC completion memorandum.

Laser Systems or Experimental Systems (Part I-5.b)

Projects in this category typically are built and tested *in situ* and final qualification often requires extended operational use before they are completely characterized and their performance verified.

Once these activities are complete to the satisfaction of the project PI, PM, Laser Facility Manager, and the Omega Laser Facility, the PI and PM will issue a final project report.

The content of the final report will be substantially the same as for an ORR, as described in **Part IV-2.j** (Operational Readiness Review) of this document.

Research and Development Projects (Part I-5.c)

R&D projects, by earlier definition, are not qualified for routine use. If, in the course of an R&D project, it is determined the outcome will be a functional system for routine use, the project will be reclassified accordingly and a project plan will be tailored to achieve the required qualification.

Cryogenic and Tritium Facility Projects (Part I-5.d)

Qualification of projects in this category will depend on the nature of the equipment being deployed.

In the case of stand-alone equipment, the qualification process will be same as for Experimental Diagnostics, except qualification two weeks prior to first use in not required.

In the case of systems that must be built and tested *in situ*, the qualification process will be the same as for Laser and Experimental Systems.

All Cryogenic and Tritium Facility project qualifications that involve tritium require the approval of the LLE Radiation Safety Officer.

Information Technology Projects (Part I-5.e)

Qualification of projects in this category will depend on the nature of the project (Software, Equipment, and Informatics). The end product of these projects must be tested and debugged to the greatest extent possible prior to deploying *in situ*.

Any required *in-situ* testing must be conducted under the same guidance as for a PQR and must include a reversion plan to allow for the system under test to be restored to its pre-test operational condition.

Facility Infrastructure (Part I-5.f)

No formal qualification is required.

4. Project Closure [TOC]

A project is not closed, and the project team discharged, until the following items have been completed:

- All project documentation has been updated and appropriately archived. For documentation with Document Management System (DMS) numbers, this means the updated documents will be released in DMS.
- All project action items have been closed.
- The project database (WEBEQC) has been updated by the PM.
- The project electronic "blue binder" [**Part VI-7** (Directors Approval Package)] has been completed and the Project Approval Cover Sheet [**Part VIII Enclosure (9)**] scanned and filed.

- For budgeted projects, the PM must notify the LLE Administrative Division Director
  - of project completion and request that the project account be closed and
  - request that the final equipment/system be tagged per LLE INST 8520–Property Management.

The PMA will review these items with the PM to validate project completion. Once complete, the PMA will generate a project-closure memorandum to close the project. The project-closure memorandum will be distributed to the project team and the LLE Division Directors.

Part III

Project Execution Guidance

1. Baseline Project Administration Requirements [TOC]

Regardless of project type, the basic project administration requirements described below must be followed during the execution of projects.

a. Project Process Tailoring [TOC]

The diversity of project types, including complexity, concept of operations, and operational environments does not support a one-size-fits-all process for projects.

While the fundamental deliverables to complete a project do not vary significantly, the project plan (review cycle, oversight, and formality) for achieving qualification can vary substantially from project to project.

A custom-tailored project plan will be developed to facilitate the efficient use of LLE resources and to streamline the qualification process.

i. The Project Manager (PM) will work with the Project Management Administrator (PMA) to develop a tailored project plan to ensure the objectives of the project are fulfilled, while ensuring safety and the efficient use of LLE resources (personnel, equipment, facility, and funding).

ii. The tailored project plan must be reviewed and approved by the appropriate Division Director(s) prior to implementing the project plan.

iii. Any proposed revision to the approved project plan must be reviewed by the PM, Responsible Group Leader, and the PMA. The PM must review the updated plan with the appropriate Division Director(s) for approval prior to implementing the revised project plan.

iv. Process tailoring is specific to, and approved for, individual projects and may not be applied to any other project, including future iterations of a previously approved project, future modifications of previously approved projects, or spin-offs of previously approved projects.

b. Project Network Share Folder [TOC]

i. To facilitate project team communication, visibility to LLE management, project closure, and archiving for future reference, ***all approved projects,*** internal or external, will establish a project folder on **\\Sequoia\Project_Files**, hereafter referred to as "Sequoia." A basic project folder structure/hierarchy is defined in **Part VI-2** (Project Folder Structure) of this document.

ii. Project team members will maintain and archive all relevant project documentation in this shared project folder.

iii. Exceptions to this rule will be evaluated on a case-by-case basis and must be approved by the PMA.

The principal exception to this rule is for Mechanical Engineering, working in the Team Center-NX environment for Computer-Aided Design (CAD). The project Mechanical Engineer is required to maintain a drawing hierarchy identifying the principal project drawings in the project folder on Sequoia. All other non-CAD Mechanical Engineering work should be maintained and archived in the established project folder on Sequoia.

iv. It is the PM's responsibility to ensure all relevant project documentation is maintained in the project folder on Sequoia.

c. Project Database [TOC]

The LLE project database is a summary of project milestones, documents, and other significant project-related information. The database may be accessed from either the OMEGA or the OMEGA EP Operations pages or from the following link **https://omegaops.lle.rochester.edu/ceqcReport**.

It is the PM's responsibility to keep this database up to date. The PM is responsible for completing the project database and having it verified by the PMA before the project is closed.

d. Meeting Minutes (TOC)

Meeting minutes serve to document the decisions and their rationale to maintain an unambiguous record of the project evolution and to promote effective communication among team members. The archival record of a project is useful where modification to equipment is requested at a later date or similar projects are proposed in the future.

Meeting minutes must be kept for all project team working group meetings and all project reviews.

- The PM is responsible for ensuring that meeting minutes are published to all team members, attendees, and stakeholders in a timely manner (less than one week).
- A copy of the meeting minutes must be kept in the project folder on Sequoia.
- Project review meeting minutes must be included with the release of presentation slides during submission to DMS.

e. Project Kickoff Meeting [TOC] [Meeting Listing]

After a project team has been assembled, the PM will hold a project kickoff meeting [**Part IV-2.b** (Project Kickoff Meeting)] with all relevant parties (engineering, operations, Principal Investigator (PI), other stakeholders).

2. Project-Specific Guidance by Type [TOC]

All projects will follow their individually tailored project plans to completion per this document.

Approval for operational use of equipment/systems is requested by the PM at the conclusion of the project ORR/electronic Operational Readiness Review (eORR) and documented in the review meeting minutes.

a. Experimental Diagnostics Used at LLE [TOC] **(Part I-5.a)**

The phasing of the tailored Equipment Qualification Checklist (EQC), Electrical and Controls Review checklist (ECRC), Software Review Checklist (SRC) deliverables as applicable [**Enclosure (2)**] for experimental diagnostics may be restructured to accommodate the dynamics of each project with the caveat that all applicable deliverables, with the exception of those listed under "Project Closure," are required to be completed ***prior to the diagnostic being qualified for use in an LLE facility***.

Mandatory Project Team Members

Regardless of the project origination (LLE internal or external user developed), one or more operations representatives, typically from Experimental Operations, are mandatory team members of any experimental diagnostic project and are final approvers for operational readiness of the system. The PM should request that the Experimental Operations Group Leader recommend the operations representatives required to support the project.

Approval for Use

Final approval for using an experimental diagnostic must generally be given by all of the following individuals. Required approvers will be specified on the EQC, ECRC, and/or SRC as applicable:

- Omega Laser Facility
- Experimental Division Director
- Laser Development and Engineering
- Laser Facility Manager
- Experimental Operations Group Leader

- Experimental Support Group Leader
- Chief Safety Officer
- Any other relevant operations personnel required by the project.

i. External-User–Developed Diagnostics [TOC]

- Experimental diagnostics developed by external users for use at LLE are subject to the diagnostic qualification criterion established within this document as per **Part II-1.b** (External User Project Requests) and **Part III-2.a** (Experimental Diagnostics Used at LLE) above.
- External-User–Developed diagnostics will be assigned an LLE PM to coordinate the activities required to complete qualification for use within the LLE facility.
- Project initiation begins with the PM meeting with the external user PI and discussing the LLE-approved project plan; thereafter, **Part III-2.a** (Experimental Diagnostics Used at LLE) above, will be followed for the remainder of the qualification process.
- External diagnostics that remain in the custody of the LLE facility after use do not require recertification prior to each new use, as long as they have not been modified.

ii. Recertification of External Diagnostics that Leave the LLE Facility [TOC]

External-user diagnostics that leave the LLE facility must be recertified upon their return prior to being allowed to be used within the facility **Part III-2.a** (Experimental Diagnostics Used at LLE) above.

The recertification process will consist of at least the following reviews/inspections at the discretion of the Experimental Support Group Leader (ESGL) with the concurrence of the Omega Laser Facility:

- external PI disclosure of all changes, modifications, or upgrades to the diagnostic or its operation since its last fielding at LLE prior to the two-week PI Brief; if changes are discovered at the two-week PI Brief, operation of the diagnostic may not be possible on the upcoming campaign;
- external PI disclosure of all changes to the Concept of Operations for the diagnostic since its last fielding at LLE prior to the two-week PI Brief; if changes are discovered at the two week PI Brief, operation of the diagnostic may not be possible on the upcoming campaign;

- a physical inspection of the external diagnostic by the LLE Instrument Specialist or ESGL for changes since the last use at LLE;
- whenever pressure vessels have been removed from LLE; conduct an LLE safety inspection of the external diagnostic by the Chief Safety Officer (CSO) or designee;
- a review of the diagnostic operations procedures, Shot Request Form (SRF) and auditor; and
- a review of mechanical and beam interference checks.

The ESGL will summarize the findings of the above process in an entry on the Diagnostic Status Page prior to restoring the diagnostic to available status. If any concerns are noted during the inspections that cannot be resolved, the diagnostic will not be permitted to be used.

In rare cases where significant modifications have been made without approval, the diagnostic equipment may be disqualified and require a new project to requalify (i.e., external envelope increased on a ten-inch manipulator-deployed diagnostic.

b. Laser Facility Projects (OMEGA, OMEGA EP, MTW) [TOC] **Part I-5.b**

i. OMEGA and OMEGA EP Laser Systems [TOC]

Mandatory Project Team Members

For projects that affect the propagation or conditioning of a laser beam, a Laser System Science representative must be a team member and must approve the final operational readiness of the project. The PM should request the Senior System Scientist for the appropriate laser facility to appoint this representative to the project team.

Approval for Use

Final approval for use of a new laser system implementation must generally be given by all of the following individuals. Required approvers will be specified on the EQC, ECRC, and/or SRC as applicable.

- Omega Laser Facility
- Laser Development and Engineering
- Laser Facility Manager
- System Scientist
- Chief Safety Officer

- Any other relevant operations functional group representative required by the project.

ii. OMEGA and OMEGA EP Experimental Systems [TOC]

Mandatory Project Team Members

An Experimental Operations representative must be a team member and must approve the final operational readiness of the project. The PM will request the Experimental Operations Group Leader to appoint this representative.

Approval for Use

Experimental system projects will follow their individually tailored project plans to completion per this document.

Final approval for use of a new experimental system must generally be given by all of the following individuals. Required approvers will be specified on the EQC, ECRC, and/or SRC as applicable.

- Omega Laser Facility
- Laser Development and Engineering
- Laser Facility Manager
- Experimental Operations Group Leader
- Chief Safety Officer
- Any other relevant operations functional group representative required by the project.

iii. Multi-Terawatt (MTW) Laser Facility [TOC]

MTW is a significant research, laser, and diagnostic-development facility available to graduate students, University of Rochester faculty, LLE staff, and scientists both internal and external. The ability to rapidly develop and deploy various experiments, diagnostics, and laser-development technologies within MTW is a significant asset to LLE and highly prized by its users.

The application of the LLE project process to projects intended for MTW must be balanced with the benefits and advantages users' value in the facility.

Projects slated for MTW must generally be completed using all the requirements of this instruction. Projects will be evaluated to be R&D or Exempt on a case-by-case basis. MTW projects other than Exempt will be tailored as described in **Part III -1.a** (Project Process Tailoring).

Mandatory Project Team Members

The Laser Development Group Leader is a mandatory member of any project team involving MTW and will appoint shot operations and diagnostic support personnel to the project team as appropriate.

Approval for Use

Final approval for using new experimental systems must generally be given by all of the following individuals. Required approvers will be specified on the EQC, ECRC, and/or SRC as applicable:

- Laser Development Group Leader
- Laser Development and Engineering
- Chief Safety Officer
- Any other relevant operations functional group representative required by the project.

c. Research and Development Projects [TOC] **(Part I-5.c)**

R&D projects follow the project process through the Conceptual Design Review (CDR). At that point, they may be executed at the PI and PM's discretion, unless the project team is required by the Division Director(s) to develop a more comprehensive tailored project plan.

The PMA is responsible for monitoring R&D project progress and providing guidance to the PM with respect to project reviews and recommended steps to close the project or to pursue qualification for production use per **Part I-5.c** (Research and Development) of this document.

Equipment to be developed and/or deployed in the LLE Target Fabrication Area falls under the R&D project classification. For these projects, the Target Fabrication Group Leader will be a mandatory team member and final approver for any project deployed within the boundaries of the LLE Target Fabrication Area. The Radiation Safety Officer will have final approval if radiological materials are to be used with this equipment.

Safety and Approval for Use

- The PM and PI are responsible for ensuring the design, implementation, and operational plan are in compliance with all LLE personnel and equipment safety requirements by everyone involved in an R&D project.
- A safety inspection must be completed and approved by the CSO for all R&D projects prior to installing, testing, or operating any piece of development equipment at LLE.

R&D Project Reviews

Project Status Reviews (PSR's) are the vehicle for reporting project progress post CDR. A PSR may be scheduled at any time by the PM, or at the request of an LLE Division Director. A PSR is indicated and should be considered for one or more of the following reasons:

- significant progress has been made to achieve project goals,
- the development effort indicates that an alternate approach, or change in scope of the original project is warranted, or
- the development activity is complete.

Suggested PSR content may be found in **Part IV-2.m** (Project Status Review) of this document.

d. Cryogenic and Tritium Facility (C&TF) [TOC] **(Part I-5.d)**

Mandatory Project Team Members

The LLE Radiation Safety Officer (RSO) is a mandatory team member for any equipment/system project involving radiological materials ***anywhere*** within the LLE facility. The RSO is a mandatory approver for ***all project reviews*** related to equipment/systems involving the use/handling of radiological materials.

Approval for Use

Final approval for use of a Cryogenic and Tritium Facility system must generally be given by all of the following individuals. Required approvers will be specified on the EQC, ECRC, and/or SRC as applicable.

- Radiation Safety Officer
- Omega Laser Facility
- Laser Development and Engineering
- Cryogenic and Tritium Facility Group Leader for projects or projects destined for Room 157
- Chief Safety Officer
- Any other relevant operations functional group representative required by the project.

e. Information Technology (IT) Projects [TOC] **(Part I-5.e)**

IT projects identified by Laser Development and Engineering and/or the Omega Laser Facility to be major will follow the project process through the CDR. At

that point they may be executed at the PI and PM's discretion, unless the project team is required by the Division Director(s) to develop a more comprehensive tailored project plan.

All project-impacted stakeholders must be identified as part of the project tailoring process.

The PMA is responsible for monitoring IT project progress and providing guidance to the PM with respect to project reviews and closure.

Mandatory Project Team Members

A representative from each of the project-impacted stakeholders is required on the project team. Additionally, a representative from each of the IT disciplines (Software Development Group, Computer Support Group, and Informatics) is initially required on projects of this type until such time as the scope of the project no longer warrants membership.

Approval for Use

Final approval for use of an IT project must generally be given by all of the following individuals. Required approvers will be specified on the EQC, ECRC, and/or SRC as applicable.

- Omega Laser Facility
- Laser Development and Engineering
- Experimental Division Director
- Any other relevant operations functional group representative required by the project or major stakeholder may be appointed as an approver if necessary.

f. Facility Infrastructure Projects [TOC] **(Part I-5.f)**

The Administrative Division Director will determine when a job must be a project and managed using this Instruction. In this case, the Functional Group Leader will be the PM and is responsible for working with the PMA to tailor the EQC.

Part IV

Project Reviews and Meetings

1. Introduction and Common Requirements for Project Reviews [TOC]

Project reviews are the primary mechanism for maintaining oversight of a project, updating interested parties on the status of a project, and evaluating the readiness of a project to advance to its next Execution Phase [**Part II-3** (Project Execution and Phases)].

The LLE Coliseum meeting room is generally reserved Wednesday mornings between 0900 and 1200 hours for project reviews, but reviews may be scheduled at other times to support the needs of the project and the availability of required attendees.

A review is deemed successful once it is approved by the individuals specified in the project plan and listed on the Project Approval Cover Sheet.

In the event a project review receives a ***conditional approval*** by a required approver, a project memorandum that satisfactorily resolves the conditional approval must be subsequently issued to all meeting attendees prior to first use.

a. Delegation of Review Approval Authority [TOC]

- Project reviews are assigned specific individuals to approve the review and allow the project to proceed to its next phase.
- *In the event review approvers are unable to attend a review, they must delegate their approval responsibility to an appropriate individual who can attend, evaluate, and approve/reject the review on their behalf.*

b. Project Review Meeting Minutes [TOC]

- Meeting minutes for formal project reviews must list all required approvers by name (those specified in the project plan) and indicate their decision (approve/reject/conditional approval)
  - If a conditional approval is given, the conditions of the approval must be explicitly stated.
  - If the review is rejected, the rationale and corrective actions must be explicitly stated.
- Project review delegated approvals will be explicitly noted in the meeting minutes as "*Review approved by <DELEGATENAME and TITLE> on behalf of <DESIGNATED APPROVER and TITLE>*"

Example:

Review approved by John Q. Public, PMA, on behalf of J. K. Anyname, Laser Development and Engineering Division Director.

c. Types of Project Reviews and Meetings [TOC]

A listing of all review types is given below in the order they would typically appear for a project.

The specific reviews a project is subject to is specified on the Equipment Qualification Checklist (EQC), Electrical and Controls Review Checklist (ECRC), and/or Software Review Checklist (SRC), as applicable, and is determined as part of the project-tailoring process described in **Part III-1.a**; accordingly, a typical project would not include all of the reviews listed below.

- Project Proposal Briefing (PPB) [External Projects Only]
- Project Kickoff Meeting
- Conceptual Design Review (CDR)
- Preliminary Design Review (PDR)
- Electrical and Controls Review (ECR)
- Software Design Review (SDR)
- Final Design Review (FDR)
- Preliminary Qualification Review (PQR)
- Installation Readiness Review (IRR)
- Operational Readiness Review (ORR)
- Electronic Operational Readiness Review (eORR)
- Post-Commissioning Review (PCR)
- Project Status Review (PSR)

d. Common Requirements of Project Reviews [TOC]

i. A request to modify the reviews specified on the tailored EQC will typically be presented at a scheduled project review and reflect future reviews; however, the EQC, ECRC, and/or SRC as applicable that specifies required reviews may be modified at any time during the project life cycle with the approval of Laser Development and Engineering, Omega Laser Facility, and Project Management Administrator (PMA).

ii. If a project review is not successful, the Project Manager (PM) will take appropriate corrective actions and the review must be repeated.

iii. All project reviews, with the exception of PSR's and PCR's, must be forwarded to the PMA for review prior to the proposed review date. The PMA will assess the review against the review criterion, project history (action item closure), and any other project-specific information prior to approving the review to proceed as scheduled. If the PMA determines the project review is not sufficiently mature to proceed, the review will be rescheduled.

iv. With the exception of the PPB, PSR, PCR, and eORR, the PM must distribute all review materials to the meeting invitees at least one full working day prior to the meeting.

v. **Project Review Approvals**

Successful completion of a project review requires the approval of all the individuals specified on the tailored EQC, ECRC, and/or SRC as applicable. This will generally, but not always, include the following individuals or their delegates:

Approvers	Reviews											
	Principal Reviews					Ancillary Reviews						
Division Directors and Management	**PPB**	**CDR**	**FDR**	**ORR**	**eORR**	**PDR**	**ECR**	**SDR**	**PQR**	**IRR**	**PCR**	**PSR**
Omega Laser Facility	X	X	X	X	X	X	X	X	X	X	n/a	n/a
Experimental Division Director	X	X	P	P	P	P	P	P	P	P	n/a	n/a
Laser Development and Engineering	X	X	X	X	X	X	X	X	X	X	n/a	n/a
Laser Development Group Leader	n/a	P	P	P	P	P	P	P	P	P	n/a	n/a
Experimental Support Group Leader	n/a	P	P	P	P	P	P	P	P	P	n/a	n/a
LLE Project Management Administrator	pre	pre	pre	pre	pre	pre	pre	pre	pre	pre	n/a	n/a
Cryogenic and Tritium Facility Group Leader	n/a	P	P	P	P	P	P	P	P	P	n/a	n/a
Target Fabrication Group Leader	n/a	P	P	P	P	P	P	P	P	P	n/a	n/a

Safety Officers	**PPB**	**CDR**	**FDR**	**ORR**	**eORR**	**PDR**	**ECR**	**SDR**	**PQR**	**IRR**	**PCR**	**PSR**
LLE Chief Safety Officer	n/a	X	X	X	X	X	X	X	X	X	n/a	n/a
Safety Officers(s)	n/a	P	P	P	P	P	P	P	P	P	n/a	n/a

Operations Personnel	**PPB**	**CDR**	**FDR**	**ORR**	**eORR**	**PDR**	**ECR**	**SDR**	**PQR**	**IRR**	**PCR**	**PSR**
Laser Facility Manager	n/a	P	P	P	P	P	P	P	P	P	n/a	n/a
Experimental Operations Group Leader	n/a	P	P	P	P	P	P	P	P	P	n/a	n/a
Operations Representative(s)	n/a	P	P	P	P	P	P	P	P	P	n/a	n/a
System Scientist	n/a	P	P	P	P	P	P	P	P	P	n/a	n/a

Key: X = Approval normally required P = Approval required based on project type/scope n/a = Approval is not required pre = Pre-approval required prior to holding review

vi. The following review types are informational and, therefore, do not have successful completion criterion or require approval:

- Project Proposal Briefing
- Project Kickoff Meeting
- Post-Commissioning Review
- Project Status Review

These reviews may, however, result in a change in the project direction, classification, and/or tailoring plan. In this case, approval of the individuals originally listed on the EQC, ECRC, and/or SRC, as applicable (Project Plan), as approvers is required.

vii. Specific approvals are required for individual project types before they are qualified for routine operations. These projects also require a Pre-Operational Safety Inspection Checklist [**Enclosure (6)**] to be completed before approval for operation is given.

viii. Approval for use requires the approval of all individuals listed on the EQC, ECRC, and/or SRC, as applicable, and the Project Approval Cover Sheet. This will generally, but not always, include the individuals listed in the following matrix:

Approval for Use (Qualification) in the LLE Facility							
Approvers	**Project Types**						
	Experimental Diagnostics	**Laser Systems**	**Experimental Systems**	**C&TF**	**MTW**	**R&D**	**IT**
Chief Safety Officer	X	X	X	X	X	X	
Cryogenic and Tritium Facility Manager				X			
Experimental Division Director	X						X
Experimental Operations Group Leader	X		X				
Experimental Support Group Leader	X						
Laser Development and Engineering	X	X	X	X	X		X
Laser Development Group Leader					X		
Laser Facility Manger	X	X	X				
System Scientist		X					
Omega Laser Facility	X	X	X	X			X
Radiation Safety Officer				X			
Target Fabrication Group Leader				X			

Key: C&TF = Cryogenic Tritium Facility MTW = Multi-Terawatt R&D = Research and Development IT = Information Technology

e. Project Review Closure Activities [TOC]

i. PM writes/edits and distributes the review meeting minutes including:

- action items listing the responsible individual to close item,
- identification of approvers and their approval decision, and
- if conditional approval is given, the condition(s) to be satisfied and when they must be identified.

ii. PM submits the review presentation with the meeting minutes as an attachment to the Document Management System (DMS). DMS approvers must include the approvers specified on the project plan (EQC)

iii. PM updates the project database in WEBEQC.

iv. In the event the project is reclassified, the PM will work with the PMA to establish a revised project plan (EQC, ECRC, and/or SRC as applicable) to proceed.

2. Design Review Guidance [TOC]

a. Project Proposal Briefing [TOC] [Meeting Listing]

A PPB is required for all external project requests. The PPB provides the detail used to inform the LLE project approval and prioritization process and must be submitted at least four months prior to the scheduled experiment that it supports. It is recommended that these projects be requested with the yearly campaign proposals in May–June of the year preceding the campaign the diagnostic is to support.

PPB Minimum Requirements

At a minimum, the PPB will include the following items:

- Motivation for proposal
- Principal physics/system requirements
- Relationship to LLE mission and goals
- Description of proposed equipment or system modifications
- A preliminary equipment/system Concept of Operations
- LLE personnel support (engineering and operations) required

- Facility requirements (power, cooling, special gases, triggers, data capture, and storage, etc.)
- Identification of key external personnel, Principal Investigator (PI), PM, Mechanical Engineering, etc., and their contact information
- Consumables to be provided by LLE

b. Project Kickoff Meeting [TOC] [Meeting Listing]

After a project team has been assembled, the PM should hold a project kickoff meeting with all relevant parties (engineering, operations, PI, other stakeholders).

The project kickoff meeting should normally cover the following topics and the meeting minutes must be published including the completed project plan (EQC, ECRC, or SRC as applicable) to all individuals specified as approvers:.

Note: *the following listing does not imply that all items are relevant to a given project, but that they should be discussed and team consensus reached on which item(s) are not relevant and that decision justified.*

- Project motivation, goals, and objectives
- Principal science/system requirements
- Known Engineering requirements
- Project team roles and responsibilities
- Project plan (EQC, ECRC, and/or SRC as applicable) including a listing of all individuals who must approve project reviews and completion <REQUIRED>
- Preliminary schedule and milestones with preliminary assessment of any "critical path" item(s)
- Project budget
- Preliminary project risk assessment (PRA) (schedule, budget, technology, personnel, or facility resources)
- Preliminary safety risk assessment (SRA)
- Working Group Meeting frequency/schedule

At the conclusion of the project kickoff meeting, all project team members should be aware of the projects' goals, principal requirements, and their specific responsibilities to advance the project to the next phase of the approved project plan (EQC, ECRC, and/or SRC as applicable), typically the CDR.

c. Conceptual Design Review [TOC] [Meeting Listing]

The project Concept and Requirements Development (C&RD) phase culminates with a CDR to present viable concepts to meet the projects objectives, and to lay out a credible plan for executing the project to achieve those objectives.

There should be no known "show stoppers" (i.e., don't know how to do it, or "violates the laws of physics") at CDR.

Additionally, a CDR will demonstrate that the principal physics and system requirements are understood, and that potential personnel, equipment, and facility safety issues have been identified in order to inform the design.

Multiple concepts should be presented at a CDR and compared against the principal requirements, budget, and proposed schedule. If a favored approach cannot be determined during the CDR, or significant technical challenges are identified, a PDR will be required.

The CDR is not intended to be a complete engineering solution for the project. In the case of projects requiring minor modification to previously qualified equipment, or minor documentation modifications (e.g. diagnostic cross qualifications), where the design is substantially complete or significantly mature, the PM may request a modification to the project plan (EQC, ECRC, and/or SRC as applicable).

CDR requirements are generally common across all project types; however, the PM should work with the PMA to tailor these requirements in cases where the project does not fit into the requirements given below.

CDR Presentation Requirements

i. Project Definition and Concept

- Project motivation and goals
- Principal physics/system requirements
- Known engineering requirements
- Concept(s) that can satisfy project goals/requirements
- Summary comparison of concepts with recommendation(s) of project team
- Preliminary Concept of Operations
- Preliminary space request (port allocation, floor space, etc.)

ii. Project Management

- Project team, roles, and responsibilities
- Action Items; review of Action Items generated in Working Group Meetings prior to the CDR
- Project Risk Assessment
- Safety Risk Assessment, preliminary
- Project schedule, preliminary
- Project budget

Supplementary CDR Presentation Items

- Failure Modes and Effects Analysis
- Recommendations/requests for redefinition of project categorization, project review cycle, or project plan (EQC, ECRC, and/or SRC as applicable).

CDR Approvals - see Part IV-1.d.v (Common Requirements of Project Reviews)

CDR Closure - see Part IV-1.e (Project Review Closure Activities)

d. Preliminary Design Review [TOC] [Meeting Listing]

The purpose of the PDR (if required) is to

- Present the recommended design concept, if multiple concepts were presented at the CDR.
- Demonstrate that all technical challenges for the project have been solved.
- Present the final principal physics/systems requirements for the project. Changes after this point are discouraged due to impacts to project schedule, resources, and cost.
- Present the principal extended requirements for the system. These are the engineering (Mechanical Engineering, Electrical and Controls Engineering, Software Development Group, etc.), functional, operational, maintenance, and computing requirements of the system.
- Present the initial system design based on the selected concept and requirements.

PDR Presentation Requirements

i. Project Definition and Concept

- Project motivation and goals, review
- Principal physics/system requirements, review, and changes from the CDR
- Final concept selection with rationale and expected performance against principal requirements
- Extended requirements, internal and external interfaces

ii. Design Status

- Preliminary design to support selected concept and anticipated requirements compliance, CAD, and relevant supporting analysis
- Concept of Operations, update from the CDR based on the selected concept
- Preliminary space claim (preliminary full CAD interference for target diagnostics)

iii. Project Management

- Update/review of project team roles and responsibilities
- Review of all open action items, and those closed since last review
- Project Risk Assessment, update
- Safety Risk Assessment, finalized
- Project schedule, update
- Project budget, update

Supplementary PDR Presentation Items

- Failure Modes and Effects Analysis
- Recommendations/requests for redefinition of project categorization, project review cycle, or project plan (EQC, ECRC, and/or SRC as applicable).

PDR Approvals - see Part IV-1.d.v (Common Requirements of Project Reviews)

PDR Closure - see Part IV-1.e (Project Review Closure Activities)

e. Electrical and Controls Design Review [TOC] [Meeting Listing]

For all projects where controls are a required component, the appropriate topics to be covered in specific reviews are outlined in the ECRC [Part VIII Enclosure (3)**]** of this document.

In the event it is determined a project requires an independent Controls review, the "FDR" portion of the ECRC provides complete guidance on the elements to be covered at the review. A summary outline is given below.

ECR Presentation Requirements

i. A review of the project definition and concept

- Principal physics/system requirements, review and changes from the CDR

ii. Controls Requirements Review

- High-level summary
- Concept of operations
- Interfaces (human/software/hardware)
- Control points

iii. Controls Architecture and Design

- Controls system high-level block diagrams
- Detailed design
  - Principal components
  - Interfaces
  - Software
  - Drawings
- Testing Plan
- Safety
- Documentation Status

iv. Project Management

- Update/review of project team roles and responsibilities
- Action Items; review of all open and closed project Action Items since last review
- Project Risk Assessment, update
- Project schedule, update

ECR Approvals - see Part IV-1.d.v (Common Requirements of Project Reviews)

ECR Closure - see Part IV-1.e (Project Review Closure Activities)

f. Software Design Review [TOC] [Meeting Listing]

The specific review cycle for a purely software-development project will be determined during the project tailoring phase of the project. The Software Review Checklist [**Part VIII** Enclosure (4)] provides guidance on the items to be covered at every stage of a pure software-development project.

For all other projects where software is a required component of a larger project, the following items are required:

SDR Presentation Requirements

i. A review of the project definition and concept

- Principal physics/system requirements, review and changes from the CDR

ii. Software Requirements

- High-level summary
- Expected and potential users
- Shot-cycle sequence
- Performance
- File requirements
- Data reduction and storage

iii. Design Status

- Software/system architecture
- Design approach

- Software design
  - Interfaces
    - User/hardware/operational systems/Omega Interface Protocol (OIP)/other
  - Database considerations
- Testing plan
- Safety
- Documentation status

iv. Project Management

- Update/review of project team roles and responsibilities
- Action Items; review of all open and closed project Action Items since last review
- Project Risk Assessment, update
- Project schedule, update

SDR Approvals - see Part IV-1.d.v (Common Requirements of Project Reviews)

SDR Closure - see Part IV-1.e (Project Review Closure Activities)

g. Final Design Review [TOC] [Meeting Listing]

The design phase of a project culminates in an FDR, the purpose of which is to present the final system design demonstrating that all system requirements are achievable and all technical challenges for the project have been resolved in order to satisfy the defined objectives of the project.

A "final design" is defined in **Part II-3.c** (Design Phase) of this document for reference.

FDR Presentation Requirements

i. Project Design and Status

- Project motivation and goals, review
- Principal physics/system requirements, review and changes from the last review

- Update of principal extended requirements, and internal and external interfaces
- Final system design for all applicable engineering disciplines (mechanical, electrical, optical, controls, and software)
- Detail drawing completion and release schedule with identification of "critical-path" items
- Procurement, Fabrication, and Assembly plan including "critical-path" item management
- Final space claim vetted and approved (final full CAD interference for target diagnostics)

ii. Operations Design

- Concept of Operations, update from the last review
- Identification of operations systems impacted
  - e.g., Experimental Operations (XOps)/B-lines/Amps/Power Conditioning/etc.
  - e.g., Shot Request Form (SRF)/auditor
- Identification of procedures to be developed, modified, or updated
- Identification of personnel and training requirements
- Identification of alignment, calibration, and preventive maintenance activities required to support new equipment/system
- Identification of consumables required to operate new equipment/system
- Qualification plan, preliminary

iii. Project Management

- Update/review of project team roles and responsibilities
- Action Items; review of all open and closed project Action Items since the last review
- Project Risk Assessment, update

- Safety
  - Safety Risk Assessment, update
    - e.g., new laser(s) have been added to LLE laser inventory and tagged
    - e.g., external user safety note(s) are completed and approved by ME
- Project schedule, update
- Project budget, update

Supplementary FDR Presentation Items

- Failure Modes and Effects Analysis
- Recommendations/requests for redefinition of project categorization, project review cycle, or project plan (EQC, ECRC, and/or SRC as applicable).

FDR Approvals - see Part IV-1.d.v (Common Requirements of Project Reviews)

FDR Closure - see Part IV-1.e (Project Review Closure Activities)

h. Preliminary Qualification Review [TOC] [Meeting Listing]

A PQR is required in cases where off-line testing cannot replicate the relevant operational environment required to qualify a system or piece of equipment prior to deployment, or when *in-situ* testing (i.e., in the Omega Facility, including on-shot testing) may be needed to demonstrate proof of principle prior to advancing the project design to completion.

A PQR differs from an IRR [**Part IV-2.i** (Installation Readiness Review)] in that a PQR will typically be associated with transitory equipment; i.e., experimental diagnostics, while an IRR will typically be associated with permanent changes to fixed equipment in the laser facility.

i. Prior to introducing project hardware into an Omega operational environment the following must be completed:
   - CDR including resolution of action items
   - PQR detailing the proposed *in-situ* activities and approval to proceed

ii. The request for a PQR will typically be made at the project CDR but may be made at any time with the concurrence of the PMA.

iii. The PQR may be conducted as a formal review or during a working group meeting at the discretion of Laser Development and Engineering, Omega Laser Facility, and PMA as long as all individuals who must approve are in attendance.

iv. Upon successful completion of the PQR, *in-situ* test activities will be granted on a ***restricted, temporary basis*** and scheduled to occur consistent with laboratory objectives and priorities.

v. PQR approval is for the specific test conditions and hardware configurations identified in the review. All PQR's will be accompanied by a Work Authorization Procedure (WAP – *refer to LLEINST3000 LFORM Section 4003A*). Any changes to the proposed test conditions or the hardware under test require a new PQR and WAP. The Omega Laser Facility may approve minor changes requested by the PM to the test conditions and/or hardware under test without a new PQR.

vi. If the preliminary qualification objectives are not completed as planned (e.g., data not acquired, change to shot schedule or system availability), the *in-situ* test activities may be rescheduled at the discretion of the Omega Laser Facility.

PQR Presentation Requirements

i. Project Design and Status (as appropriate)

- Project motivation and goals, review
- Design (mechanical, optical, electrical and controls, facility infrastructure, software maturity)
- Component procurement and fabrication
- Equipment assembly
- Results of preliminary testing

ii. *In-situ* Test Plan

- A written test plan with clearly defined, quantifiable goals and performance expectations is required. The PQR presentation that includes a WAP may serve as the written test plan with the approval of Laser Development and Engineering, Omega Laser Facility, and PMA. Otherwise the test plan must be released to the DMS. Specific requirements of the test plan include
  - required system configuration and operating conditions, details regarding shot types, energies, beam paths, and beam terminations required for the test, as well as shot request forms as appropriate

- required support personnel and their responsibilities
- a test procedure with sufficient supporting detail such that it may be safely executed by the requisite personnel
- a review of any changes to the equipment, test plan, procedures, SRA, FMEA, or other relevant information from any previous iteration of preliminary qualification testing

iii. Project Management

- Update/review of project team roles and responsibilities
- Review of all open action items and those closed since the last review
- Safety
  - Safety Risk Assessment, update
    - e.g., new laser(s) have been added to LLE laser inventory and tagged
    - e.g., external user safety note(s) are completed and approved by the Mechanical Engineer
- Project Risk Assessment, update
- Project schedule, update
- Project budget, update

PQR Approvals - see Part IV-1.d.v (Common Requirements of Project Reviews)

Post PQR, Pre-Use Requirements

i. A final *in-situ* safety inspection is required prior to executing the equipment/system testing granted by the PQR acceptance.

ii. A WAP (see LFORM - LLEINST 3000, Section 4003A).

iii. An operational procedure for the hardware/system under test. This is not required to be released in DMS, but must be dated and approved by the LFM for use during the testing period granted by the PQR. This procedure may be combined with the WAP.

iv. Review of operational procedure and test plans with all relevant operations personnel.

PQR Closure - see Part IV-1.e (Project Review Closure Activities)

i. Installation Readiness Review [TOC] [Meeting Listing]

- An IRR is indicated for projects whose nature requires installation into LLE operational systems in order to complete the assembly and/or qualification phases of a project. Laser Facility projects [**Part I-5.b** (Laser Facility) typically fall into this category.
- An IRR differs from a PQR in that a PQR will typically be associated with transitory equipment; i.e., experimental diagnostics, while an IRR will typically be associated with permanent changes to fixed equipment in the laser facility.
- Projects requiring an IRR will be noted in the project plan (EQC).
- A definition of activities to be successfully conducted *in situ* to declare operational readiness and project closure will be presented at the IRR. An ORR conducted, or a final qualification report will be issued by the PM, after these activities have been completed.

IRR Presentation Requirements

i. Project Design and Status (as appropriate)

- Project motivation and goals, review
- Design (mechanical, optical, electrical, and controls, facility infrastructure, software maturity)
- Component procurement and fabrication
- Equipment assembly
- Results of preliminary testing

ii. Installation Plan presentation including

- Sequence of operations
- Required support personnel (engineering, operations, other), responsibilities and duration of need
- Detailed installation schedule based on sequence of operations
- Operational requirements to support installation
- Identification and status of operational procedures impacted by, or required, to support, the installation and post-installation operations

iii. Qualification Plan

- presentation of the post-installation equipment qualification plan

iv. Project Management

- Update/review of project team roles and responsibilities
- Review of all open action items and those closed since the last review
- Safety
  - Safety Risk Assessment, update
    - e.g., new laser(s) have been added to LLE laser inventory and tagged
    - e.g., external user safety note(s) are completed and approved by Mechanical Engineering
- Project Risk Assessment, update
- Project schedule, update
- Project budget, update

IRR Approvals - see Part IV-1.d.v (Common Requirements of Project Reviews)

IRR Closure - see Part IV-1.e (Project Review Closure Activities)

j. Operational Readiness Review [TOC] [Meeting Listing]

The purpose of the ORR is to verify the design meets the specified requirements to satisfy the objectives of the project and that the project has passed the appropriate tests, checks, and readiness for routine operations.

Prior to an ORR

i. All design work must be complete and released.

ii. All component/equipment/system fabrication, assembly, and checkout must be completed.

iii. All system integration, implementation, safety, and operational concerns must be resolved.

iv. Preliminary operational procedures (First Revision) must be complete, reviewed by the appropriate operations personnel, and approved for use by the relevant operations group leaders, Laser Facility Manager, and Omega Laser Facility.

v. The relevant operations personnel must be trained using approved operations procedures.

vi. Diagnostics [fixed, ten-inch manipulator (TIM)-based, or free-standing] and any other equipment not directly integrated into an operational system must have had a successful fit and function test and passed a pre-operational safety inspection [**Part VIII Enclosure (6)**].

ORR Presentation Requirements

i. Project Overview and Requirements Compliance

- Project motivation, goals, and requirements review
- Demonstration of compliance to principal requirements
- Status of design, design changes from previous review, fabrication, assembly, and testing

ii. Operational Readiness

- Equipment/System status

  – Results of preliminary/bench testing, calibrations, alignments,

  – Results of fit and function tests

- Verification of approved and published operating procedures
- Verification of personnel trained (by name) using approved operating procedures
- Status of software implementation, including

  – Shot Request Form updates

  – Auditor updates

  – Shot Executive updates

- Safety inspections review
- Maintenance, spares, and consumables

iii. Project Management

- Update/review of project team roles and responsibilities
- Verification that action items have been completed

- Safety

  – Safety Risk Assessment, update

    - e.g., new laser(s) have been added to LLE laser inventory and tagged
    - e.g., external user safety note(s) are completed and approved by Mechanical Engineering

- Project Risk Assessment, update
- Project schedule, update
- Project budget, update

ORR Approvals - see Part IV-1.d.v (Common Requirements of Project Reviews)

This listing is to be augmented by the specific pre-operational use approvals required by specific project types as given in Part IV-1.d.viii of this document.

ORR Closure - see Part IV-1.e (Project Review Closure Activities)

First-Use Follow-up

i. Revision, approval, and release of operational procedure updates

ii. Release of maintenance procedures

iii. Update of Preventive Maintenance System with project-relevant maintenance items

iv. A PCR is recommended to review the equipment/system performance against expectations and identify opportunities for improvement to the equipment, operations, or both

k. Electronic Operational Readiness Review [TOC] [Meeting Listing]

An eORR may be used in lieu of a formal ORR for projects with the pre-approval of the appropriate Division Director(s).

The request to complete a project with an eORR should be made as early in the project life cycle as possible, preferably with the approval of the tailored project plan [**Part III-1.a** (Project Process Tailoring)]. The recommendation for an eORR must be pre-approved by the PMA prior to submission to the appropriate LLE Division Director(s) for approval.

All preparation, presentation, closure, and follow-up requirements for an eORR are identical to an ORR as described in Part IV-2.i (Installation Readiness Review) above.

Conducting an eORR

i. The PM and project team assemble an ORR presentation.

ii. Centered at the top of the presentation title page labeled in Bold font, 18 pt, Red text must be the following identifier "********* ELECTRONIC QUALIFICATION **********."

iii. The eORR must be submitted to the PMA prior to distribution for review of approvers and project stakeholders.

iv. The eORR will be distributed via email to the project stakeholders and review approvers for review and comment with a specific expected response date stated in the email.

v. Approvers must be explicitly identified and their response (approve/reject/comment) is mandatory.

vi. When the PM has received and addressed all comments and approval of the review has been unanimously given by the review approvers, the PM generates a set of meeting minutes incorporating the reviewers' comments and their resolution along with the approvals.

vii. The eORR meeting minutes along with an updated presentation package are distributed to all reviewers and approvers via email and submitted to DMS for release.

viii. DMS approvers are limited to the approvers in the original eORR preliminary review distribution.

eORR Approvals - see Part IV-1.d.v (Project Review Approvals)

l. Post-Commissioning Review [TOC] [Meeting Listing]

The purpose of a PCR is to review the operation and performance of a new piece of equipment/system against the original project requirements and objectives after first use.

A PCR may be requested by any interested project stakeholder. The PM will evaluate the request with the project team and the PMA to determine if a PCR is warranted, or if the requester's concerns can be addressed less formally.

In the event a PCR is held, the invitee list should be jointly developed by the PM and the requester of the PCR.

The following is provided as guidance to help the project team structure a PCR:

PCR Presentation Guidance

i. Project Overview

- High-level overview of project motivation, objectives, and requirements
- Equipment/system overview
- Concept of Operations Overview

ii. Operational Performance

- First-use date
- Equipment/system performance against requirements
- Sample data images, etc.
- PI comments/feedback
- Instrument Specialist comments/feedback
- Operations personnel comments/feedback

iii. Issues/Concerns/Lessons Learned

- Operational issues or concerns identified
- Procedural revisions identified
- Safety issues identified
- Desired equipment/system improvements to be made prior to next use
- Lessons learned to be applied to future use, or future equipment/system designs
- Current equipment/system status
- Action items

m. Project Status Review [TOC] [Meeting Listing]

The typical purpose of a PSR is to inform LLE management, relevant stakeholders, and other interested parties of progress against the projects objectives.

Motivation for holding a PSR may be: achieving a major project milestone, a recommendation to change project direction, completion or abandoning of the project, or at the request of LLE management.

The following is provided as guidance to help the project team structure a PSR:

PSR Presentation Guidance

i. Project History and Status

- Project motivation and goals, review
- Principal physics/system requirements, review, and changes from last review
- Progress against project objectives
- Remaining work
- Review of budget

ii. Project Team Recommendations

- e.g., change of focus/objectives
- e.g., request for additional funds/personnel resources/schedule
- e.g., conversion to full project/proceed to implementation

Part V

Project Roles and Responsibilities

Nominal project roles and responsibilities are described in the following paragraphs.

1. Project Manager (PM) [TOC]

The PM has responsibility for the schedule, budget, planning, scope, risk, execution, monitoring, reporting, and closure of LLE-approved projects.

Depending on the scope of the project, the PM may delegate significant portions of the project to members of a project team or assume multiple team roles as appropriate.

a. Project Administration [TOC]

i. is the principal interface to the project customers/end users to ensure the project objectives are satisfied

ii. works with the Project Management Administrator (PMA) to develop a tailored project plan for execution of the project

iii. assembles the Project Team by requesting support from the appropriate Engineering and Operations Group Leaders

iv. manage the overall progress, priorities, and direction of the project consistent with achieving the project objectives

v. develops and maintains, in conjunction with the project team, a project schedule that is consistent with the customer's need date and project lead times

vi. request the PMA to have project budget activated upon completion of the Conceptual Design Review (CDR), or authorization of Division Director(s)

vii. actively monitor and manage the approved project budget to meet project objectives and prevent budget overruns

viii. provide timely budget updates to the appropriate LLE Division Director(s) as the project develops and final costs are determined

ix. submitting Project Budget and Resources Request (PBRR) updates when there is a budget excess, shortfall, cancellation, or for existing projects carrying over to a new fiscal year

x. assemble the Directors Approval Package and route for approvals, as specified in [Part VIII, Enclosure (9)] (Project Approval Cover Sheet)

b. Project Execution and Logistics [TOC]

i. Complete a tailored project plan [Equipment Qualification Checklist (EQC), Electrical and Controls Review Checklist (ECRC), and/or Software Review Checklist (SRC)] as applicable with assistance from project team to ensure no major items are missed during project execution.

ii. Conduct regular Working Group Meetings to facilitate common communication of project priorities, status, and emerging issues, and to identify specific actions, responsible individuals, and work plans to be accomplished for the next Working Group Meeting. Publish minutes from all Working Group Meetings.

iii. Lead the project team in the development and documentation of flow-down engineering and operations requirements from the project's established principal science/system requirements.

iv. Facilitate completion of the Safety Risk Assessment (SRA) and Failure Mode and Effects Analysis in collaboration with the appropriate safety officers and project team members.

v. Coordinate fit-and-function tests, hardware installation, and other activities that require Omega Laser Facility time with the Operations shot schedule, personnel availability, and external resources (e.g., visiting scientists, contractors, etc.).

vi. Maintain the project database and project action item database on WEBEQC.

c. Project Reviews [TOC]

i. Schedule project reviews as required.

ii. Lead the Project Team in preparing for project reviews.

iii. Support the project reviews by preparing a task list of required review/inspection elements and assign reviewers/inspectors for each element.

iv. Conduct project reviews.

v. Publish project review minutes, maintain the project Action Item Database in WEBEQC, and ensure that all action items are completed.

d. Project Closure [TOC]

i. Ensure that all project documentation is appropriately archived in the Document Management System (DMS) and the project folder on Sequoia.

ii. Ensure all project action items, including those identified during the Operational Readiness Review (ORR), first use, or at a Post-Commissioning

Review (PCR) are appropriately resolved and closed in the Action Item Database.

2. Principal Investigator (PI) [TOC]

a. Initiates a new project by completing and submitting a PBRR to the appropriate Division Director.

b. The PI is the technical expert for the project responsible for providing the principal science/system requirements necessary to achieve the project objectives.

c. Works with the PM and project team to decompose the principal project requirements into meaningful engineering and operations requirements.

d. Provides insight into potential or anticipated evolutionary applications of the proposed project so the design team may allow for these possibilities within the constraints of the project schedule and budget.

e. Approves the assignment of an Instrument Specialist (IS) and assist the IS and project Operations representative with development of a system Concept of Operations and operational procedures.

f. Certify final equipment/system principal science/system requirements.

3. Project Management Administrator [TOC]

a. Maintains the LLE Project Management Process (LLEINST 7700)

b. Trains LLE personnel in using LLEINST 7700

c. Recommends project scope classification (tailored or exempt) to Division Directors

d. Assists the PM with developing a tailored project plan (EQC, ECRC, and/or SRC) as applicable that efficiently satisfies the objectives of the project and is consistent with laboratory safety polices

e. Approves requests to schedule project reviews

f. Reviews project review materials to ensure the requirements of the project review are met

g. Reviews and approves proposed changes to a tailored project plan (EQC, ECRC, and/or SRC as applicable) prior to submission to other required approvers listed on the EQC, ECRC, and/or SRC

h. Acts as the single point of contact to the LLE Administrative Division for opening project accounts including activating the account on the successful completion of the Conceptual Design Review (CDR)

i. Administers the LLE project database (WEBEQC) and the project file shares on \\Sequoia

j. Exercise approval responsibilities throughout the project process to ensure the requirements of this Instruction are fulfilled

k. Generates project-closure memorandum when all project deliverables are satisfied

4. Omega Laser Facility Division Director [TOC]

a. Reviews, approves, and prioritizes proposed projects, as appropriate, consistent with LLE's established mission, objectives, and goals

b. Participates in design reviews as appropriate

c. Approves operational procedures for Omega Laser Facility equipment projects

d. Ensures personnel complete operational training for Omega Laser Facility equipment projects

e. Recommends approval of project completion

5. Experimental Division Director [TOC]

a. Reviews, approves, and prioritizes proposed projects, as appropriate, consistent with LLE's established mission, objectives, and goals.

b. Recommends approval of project completion as appropriate

c. Participates in design reviews as appropriate

6. Laser Development and Engineering Division Director [TOC]

a. Reviews, approves, prioritizes, and supports proposed projects, as appropriate, consistent with LLE's established mission, objectives, and goals

b. Administers project-prioritization process

c. Approves minor changes to previously qualified equipment that are exempted from the requirements of this instruction

d. Provides oversight of the overall direction of the design, assembly, and integration of projects

e. Participates in design reviews as appropriate

f. Recommends approval of project completion

7. Administrative Division Director [TOC]

a. Administers the request for PBRR's as part of the annual budget call

b. Administers the project financial database and provides periodic project reports

c. Activates project account for purchases after completion of a CDR with authorization from the PMA

d. Assigns property tags at the completion of projects, as appropriate

8. Experimental Support Group Leader [TOC]

a. Single point of contact for all experimental diagnostic project requests (internal and external)

b. Assists internal and external PI's with the preparation of a diagnostic Project Proposal Briefing (PPB) for consideration by LLE management

c. Works with the PMA to tailor a project plan (EQC) for approved diagnostic projects

9. Project Team Members [TOC]

a. Engineering Group Members [TOC]

i. Serve as members of the Project Team

ii. Complete the design, assembly, installation, and testing of equipment as appropriate

iii. Verify that equipment is built and installed per plan

iv. Prepare for and present their portion of design reviews as appropriate

b. Operations Group Members [TOC]

i. Serve as members of the Project Team

ii. Assist the IS and PI in developing the project Concept of Operations and operational requirements. If there is not a project IS then the Operations representative is responsible for developing the operational procedures

iii. Provide relevant operations guidance to the PI, PM, and engineering team members to ensure the design meets operational user and safety needs

iv. Assist with operational procedure development and review final operational procedures prior to release

v. Assist with operational qualification of the project hardware/system(s)

c. Instrument/System Specialist (IS) [TOC]

i. Assist the PM as necessary to execute the project

ii. Develop, oversee publishing, and maintain equipment operating, calibration, alignment, and maintenance plans/procedures

iii. Develop, publish, and maintain a list of required spare parts and equipment consumables (i.e., film, blast shields, filters, etc.)

iv. Develop and publish appropriate fit and function, installation, and qualification test plans; if a project Instrument Specialist is not assigned, this responsibility falls to the relevant operations/responsible group representative

v. Supervise fit and function and qualification testing

vi. Participate in the training Operations personnel on the installation, setup, and operation of equipment within the Omega Facility

vii. Deliver to Experimental Operation Group a calibrated, ready-for-operation equipment package as necessary

viii. Conduct pre-operations, alignment, and calibration of project hardware/systems

ix. Troubleshoot unexpected, sub-optimal system performance, or system malfunctions

d. System Scientist [TOC]

i. Serve as member(s) of the Project Team, as required

ii. Provide input to the project team on matters relative to the operation and performance of LLE laser systems, as required

iii. Participate in project reviews, as required

iv. Act as a review approver for projects that impact LLE laser systems, as required

e. Safety Officers [TOC]

i. Serve as member(s) of the Project Team, as required

ii. Provide input on safety and adequacy of mitigation efforts

iii. Contribute to and review the project SRA

iv. Conduct safety inspections of equipment at appropriate phases of the project and generate the project safety review memorandum detailing the findings from the safety inspection

v. Participate in project reviews as required

10. LLE Chief Safety Officer [TOC]

a. Serve as member of the Project Team, as required

b. Participate in project reviews, as required

c. Generate and distribute a consolidated project safety memorandum based on the individual safety inspections conducted by discipline-specific safety officers, or based on personal inspection of final project hardware/systems

d. Review, approve, and sign the project blue book to complete qualification of the project equipment/systems for routine operational use

11. Functional Group Leaders [TOC]

a. Assign qualified group members, as needed, to serve as Project Team members

b. Provide technical support to the PM, PI, and IS in fulfilling their responsibilities

c. Assign qualified group members to review and approve all new installation and operating procedures

d. Support installation and qualification of project deliverables

e. Support training of operations personnel

f. Assign qualified group members to participate in design reviews

12. LLE Director [TOC]

a. Approves the fiscal year budget, including projects

b. Approves project completion

Part VI

Project Execution and Management Tools

1. Introduction [TOC]

Part VI of this document describes a variety of project-related tools that are either required for, or can be used to assist in, the execution of a project. Required elements for projects are explicitly identified.

These tools are available on, or from, the LLE project management web page:
http://engineering.lle.rochester.edu/systems.php

Or in the Project_Files folder on Sequoia:
\\sequoia\Project_Files\00_Project Management Guidance\

2. Project Folder Structure [TOC]

All approved projects, internal or external, shall establish a project folder on \\Sequoia\Project_Files [**Part III-1.b** (Project Network Share Folder)] to facilitate project team communication, visibility to LLE management, efficient project closure, and support project archiving for future reference. <REQUIRED>

The basic project folder structure/hierarchy is as follows and may be tailored by individual projects to best meet the project needs and objectives:

- Project Management [Project Proposal Briefing (PPB's), Project Budget and Resources Request (PBRR's), Schedules, Budgets]
- Requirements
- Project Plan [Equipment Qualification Checklist (EQC)]
- Working Group Meetings
- Engineering (Mechanical Engineering, Electrical Engineering, Optical Engineering, Software Development Group, and Optical Manufacturing and Assembly)
- Design reviews
- Procedures
- Qualification [procedures, testing results, Work Authorization Procedures (WAP), Shot Request Form (SRF), and auditor]
- Closure ("electronic" Blue Binder) <REQUIRED>

3. Project Database (WEBEQC) [TOC] <REQUIRED>

The LLE project database provides a summary repository of project milestones and links to project documents and contains other significant project-related information. The database may be reached from either the OMEGA or the OMEGA EP Operations pages or from the following link **https://omegaops.lle.rochester.edu/ceqcReport**.

It is the project manager's responsibility to keep this database up to date at all times. The project will not be closed and the Project Manager (PM) relieved of his/her project responsibilities until the Project Manager Administrator (PMA) has reviewed the project database and verified it to be complete.

a. Action Item Database [TOC]

The Action Item Database is a feature of the Project database used for tracking all project action items to closure. The PM is responsible for maintaining the Action Item database and ensuring all project Action Items are recorded, acted upon, and discharged appropriately.

4. Project Review Scheduler [TOC]

The PM should schedule project reviews based on the progress of the project team against the review requirements defined by this document.

The LLE Coliseum meeting room is generally reserved Wednesday mornings between 0900 and 1200 hours for project reviews. In the case where it is not possible to conduct a review during the reserved Wednesday time slots, the PM will work with their functional group Administrative Assistant to find an alternate time and venue for the review that meets their needs.

Project reviews are scheduled online using the "Request for Design Review Meeting" web page located at https://omegaops.lle.rochester.edu/desRevNew.

The PM submits the request for the review and the PMA reviews and approves the request. After the PMA has approved the review, the Laser Development and Engineering Administrative Assistant schedules the review and sends out the formal meeting announcements.

5. Project Execution and Management Templates [TOC]

The following project templates and checklists are available online at the LLE project management web page http://engineering.lle.rochester.edu/systems.php. These same templates are also available in the Project_Files folder on Sequoia: \\sequoia\Project_Files\00_Project Management Guidance\.

a. Review Presentations [TOC] <REQUIRED>

Templates for the various project reviews are available to assist project teams in preparing their review presentation and to provide a consistent format for all LLE internal project reviews.

External users are not required to use LLE presentation templates; however, they must provide an electronic copy of their presentation in its original, non-pdf format for LLE to archive with the project. External users should include the following fields in the footer of their presentations:

- Date: left-justified and formatted as DD/MM/YY
- LLE Data Management System (DMS) number and Revision letter: center-justified as X-XX-X-XXXX, Rev YY. The LLE PM will provide an appropriate DMS number to the presentation author
- Slide #: right-justified and formatted as slide X of Y

b. Standard Tables for Review Presentations [TOC]

This is a spreadsheet of useful, pre-formatted tables typically required in project-review presentations. Included tables are

i. Agenda's
ii. Project Team
iii. Action Items
iv. Open Issues
v. Requirements and Compliance
vi. Failure Mode and Effects Analysis Summary
vii. Budget
viii. Critical spares
ix. Maintenance Activities
x. Document/Procedure Status

c. Review Checklists [TOC] <REQUIRED>

This is a spreadsheet of pre-formatted project-review requirement checklists. These checklists are tailored with the project and allow the Project Team and the PMA to assess the maturity of a project for a review. These checklists are also a required component of a project-review presentation to demonstrate to the

reviewing audience that the project team has satisfied the requirements for holding the review.

d. Meeting Minutes [**TOC**] <REQUIRED>

A standard meeting minute's template and example are provided for documenting project meetings and reviews. This template is in Microsoft Word format.

6. Project Tailoring and Review Guidance [TOC]

The following project checklists are available online at the LLE project management web page http://engineering.lle.rochester.edu/systems.php. These same checklists are also available in the Project_Files folder on Sequoia: \\sequoia\Project_Files\00_Project Management Guidance\.

a. Equipment Qualification Checklist (EQC) [TOC] [**Enclosure (2)**]

The EQC is a checklist of the typical project details grouped by project phase to consider during execution of the project. The EQC is tailored to and represents the project plan [**Part I-6.a** (Tailored Project)]. The EQC becomes a part of the final project record in the Directors Approval Package **(Part VI-7).**

This listing is a tool for the PM and Project Team to use to ensure items are not forgotten or considered too late in the project to take appropriate, effective action.

The PM is responsible completing this checklist with the assistance of the Project Team and the PMA. Checklist items designated as "not applicable" (n/a) require a justification for this determination in the comments field of the checklist and approval of the PMA.

b. Electronics/Controls Review Checklist (ECRC) [TOC] [**Enclosure (3)**]

The ECRC is a checklist of major electronics/controls project details grouped by project phase to consider during project execution. The ECRC is tailored and represented in the project plan [**Part I-6.a** (Tailored Project)]. The ECRC becomes a part of the final project record in the Directors Approval Package **(Part VI-7)**.

c. Software Review Checklist (SRC) [TOC] [**Enclosure (4)**]

The SRC is a checklist of a major software project details grouped by project phase to consider during project execution. The SRC is tailored and represents the project plan [**Part I-6.a** (Tailored Project)]. The SRC becomes a part of the final project record in the Directors Approval Package **(Part VI-7).**

7. Directors Approval Package (electronic "blue binder") [TOC]

The Directors Approval Package, formerly assembled in a "blue binder," is an electronic compilation of the relevant project documentation to demonstrate that all appropriate aspects of the project have been completed per the guidance of this document.

All relevant project documentation must be stored in the project folder on Sequoia and a subfolder within the project folder labeled "Blue Binder" must be used to store the physical documents and/or links to the relevant documents for easy retrieval and review.

The contents of the electronic "blue binder" are tailored from the following listings with the exception of the "Project Approval Cover Sheet," which is required for all projects.

a. Project Approval Cover Sheet [TOC] [Part VIII Enclosure (9)]

The project approval cover sheet is a physical document that must be signed by the individuals listed on the sheet, or their appointed representative. Once the sheet is signed by all parties it is scanned and placed in the project "electronic" blue binder folder.

b. Project Management [TOC]

i. Project Budget and Resource Request(s)

ii. Budget Summary

iii. Project Team

iv. Project Risk Assessment

v. Equipment Qualification Checklist

vi. Safety Risk Assessment

vii. Failure Modes and Effects Analysis

viii. Pre-Operational Safety Inspection Checklist

ix. Safety Inspection Memorandums

x. Fit and Function Report

xi. Action Item Listing with documented resolution

c. Design Reviews with Meeting Minutes [**TOC**]

i. Project Proposal Briefing

ii. Conceptual Design Review

iii. Preliminary Design Review

iv. Software Design Review

v. Electrical and Controls Review

vi. Final Design Review

vii. Preliminary Qualification Review

viii. Installation Readiness Review

ix. Operational Readiness Review

x. Project Status Review(s)

d. Documents [TOC]

i. DMS Document Summary

ii. Requirements Documents

iii. Requirements Compliance Summary Matrix

iv. Interference Checks

v. Procedures

vi. Shot Request Form and Auditor

vii. Work Authorization Procedures

viii. Test Plans and Summary Reports

e. Miscellaneous [TOC]

8. Project Budget and Resource Requests (PBRR) [TOC] <REQUIRED> [**Enclosure (1)**]

The PBRR is the mechanism used for requesting a new project, or to request carrying over an existing project from one fiscal year to the next. The PBRR includes a request for funding, personnel resources, or both, to support the proposed project. All project requests will be initiated with a PBRR.

As of this writing, the PBRR is implemented in Google Forms and instructions for completing the project request are incorporated into the form.

9. Project Risk Assessment (PRA) [TOC] <REQUIRED> [**Enclosure (8)**]

Understanding and mitigation of project risk is fundamental to any project. The PRA is a project management tool used to identify key risk factors that have the potential to impact project execution, budget, or scheduled completion.

The PRA includes an assessment of the probability of each identified risk, its impact to the project, and a high-level mitigation plan for managing the risk.

The development and presentation of a PRA serves to inform management of project challenges such that they may be effectively addressed.

10. Personnel Safety Risk Assessment (SRA) [TOC] <REQUIRED> [**Enclosure (5)**]

The Personnel Safety Risk Assessment is a mandatory component of every project. This checklist must be completed by the Project Team identifying all potential personnel safety hazards associated with the project, the hazard level, and the specific mitigation(s) to be implemented to eliminate or reduce all personnel hazards to level 1 or n/a.

Hazard Levels

n/a: No personnel hazard

1 : Minor—may cause minor injury; i.e., does not require medical attention

2 : Serious—may cause serious injury; i.e., nonlife threatening, but requires immediate medical attention

3 : Critical—may cause serious injury or death; i.e., requires immediate medical attention, or may cause death

11. Pre-Operational Safety Inspection Checklist (OSIC) [TOC] <REQUIRED> [**Enclosure (6)**]

The pre-operational safety checklist is a required element of any project going into an operational environment. The OSIC must be completed and any identified safety items mitigated prior to approval of the equipment/system for operational use.

12. Failure Modes and Effects Analysis (FMEA) [TOC] [**Enclosure (7)**]

An FMEA is a project design tool used to identify potential failure modes of a system, and the effect of those failures on the system, operations, and personnel. Application of the FMEA discipline uncovers weaknesses in the design that can then be mitigated before the design is finalized.

An FMEA is not a required element of project execution; however, its use is highly recommended due to the benefits that may be derived from its use including early

identification of potential personnel and equipment safety issues, which may then be translated to the required project Safety Risk Assessment.

Part VII

Acronyms

Acronym	Definition
AI	Action Item(s)
BOM	Bill Of Materials
C&RD	Concept and Requirements Development
C&TF	Cryogenic and Tritium Facility
C&TFM	Cryogenic and Tritium Facility Manager
CTFGL	Cryogenic and Tritium Facility Group Leader
CAD	Computer Aided Design
CDR	Conceptual Design Review
ConOps	Concept of Operations
CSG	Computer Support Group
CSO	Chief Safety Officer
DMS	Document Management System
ECE	Electrical & Controls Engineering
ECR	Electronics and Controls Review
ECRC	Electrical and Controls Review Checklist
EDD	Experimental Division Director
EE	Electrical Engineering
EOGL	Experimental Operations Group Leader
eORR	Electronic Operational Readiness Review
EQC	Equipment Qualification Checklist
ESG	Experimental Support Group
ESGL	Experimental Support Group Leader
FDR	Final Design Review
FEA	Finite Element Analysis
FGL	Functional Group Leader
FMEA	Failure Mode and Effects Analysis
IRR	Installation Readiness Review
IS	Instrument Specialist
IT	Information Technology
LCF	Laser Computing Facility
LDE	Laser Development and Engineering
LDGL	Laser Development Group Leader
LDL	Laser Development Laboratory
LFM	Laser Facility Manager
LFORM	Laser Facility Organization and Regulation Manual

Acronym	Definition
LLE	Laboratory for Laser Energetics
ME	Mechanical Engineering
MTW	Multi-Terawatt
n/a	not applicable
OE	Optical Engineering
OIP	Omega Interface Protocol
OLF	Omega Laser Facility
OMAN	Optical Manufacturing and Assembly
ORR	Operational Readiness Review
OSIC	Pre-Operational Safety Inspection Checklist
P&ID	Piping and Instrumentation Drawing
PBRR	Project Budget and Resources Request
PCR	Post-Commissioning Review
PDR	Preliminary Design Review
PF&A	Procurement, Fabrication, and Assembly
PI	Principal Investigator
PM	Project Manager
PMA	Project Management Administrator
PMDB	Preventive Maintenance Database: LLE Tracking System
PMS	Preventive Maintenance System
POC	Point Of Contact
PPB	Project Proposal Briefing
PQR	Preliminary Qualification Review
PRA	Project Risk Assessment
PSR	Project Status Review
R&D	Research and Development
RGL	Responsible Group Leader
RSO	Radiation Safety Officer
SDG	Software Development Group
SDR	Software Design Review
SO	Safety Officer
SRA	Safety Risk Assessment
SRC	Software Review Checklist
SRF	Shot Request Form
SS	System Scientist
TFA	Target Fabrication Area
TFGL	Target Fabrication Group Leader
TIM	Ten-Inch Manipulator

Acronym	Definition
WAP	Work Authorization Procedure
WEBEQC	Web-based Equipment Qualification Checklist
WGM	Working Group Meeting
XOps	Experimental Operations

LLEINST 7700J
15 December 2016

Part VIII

Enclosures to LLEINST 7700J

Project Budget and Resource Request (PBRR) [TOC]

Project Type & Desired Completion Date		
		Desired Completion Date: *<mm/yyyy>*
NEW Project ☐	**OR EXISTING** Project ☐	

Type of Resources Requested		
Funding Only ☐	Personnel Resources Only ☐	Funding & Personnel ☐

Project Title:	*<Existing Title for Existing Projects>*
Proposed TaskID: ***(10 characters max)***	*<Existing TaskID for Existing Projects>*
Principal Investigator:	
Proposed Project Manager:	
Task Group:	

Allowable Task Groups are: *CRYO, Experimental Ops, Experimental Support, External Contract, Informatics, Laser Amplifiers, Laser Drivers/Sources, Laser Technology Development, OMEGA Experiments, Opto-Mechanical, Plasma & Ultrafast Physics, Power Conditioning, and Miscellaneous.*

Describe this project: *(include motivation, principal physics/system top-level requirements, proposed equipment/system modifications, and preliminary concept of operation.*

Justification for project and completion date:
<Progress to date and work remaining for existing projects>

Indicate LLE resource support required:			
Mech. Eng. ☐	Elect. & Controls Eng.☐	Optical Eng. ☐	OMAN ☐
SDG ☐	Facilities ☐	Computer Support ☐	Informatics ☐

Facility Requirements *(power, cooling, special gases, triggers, data capture, and storage, etc.)*

Budget—List materials required.			
Required Item	**# Units**	**Unit Cost**	**Cost**
			$0
			$0
			$0
			$0
Total Budget			$0

Equipment Qualification Checklist [TOC**]**

Note: *The phasing of these deliverables may be restructured to accommodate the dynamics of each project with the caveat that all applicable deliverables, with the exception of those listed under "Project Closure," are required to be complete, or "n/a,"* ***prior to an equipment/system being approved for use.***

Phase/Item	Complete Date or n/a	Comments	PM Initial	PMA Initial
Kickoff Phase				
Review PBR & PPB with PI				
Establish Project Team				
Prepare kickoff meeting				
C&RD Phase				
Finalize principal science/system requirements				
Develop Concept of Operations (ConOps)				
Initiate SRA development–feed forward into design				
Initiate engineering requirements development (mech, opt, elec, controls, s/w, IT/network, facility infrastructure…)				
Conduct CDR				
Design Phase				
Finalize hardware requirements (mechanical, optical, electrical, facility, function, interfaces, FMEA)				
Finalize control requirements (function, interfaces, I/O)				
Finalize IT/Network requirements				
Finalize software requirements (function, interfaces, I/O, executive s/w modifications)				
Finalize facility infrastructure requirements (power, air, N_2, water, vacuum, etc.)				

Phase/Item	Complete Date or n/a	Comments	PM Initial	PMA Initial
Develop P&ID				
Verify physical envelope/space claim				
Address access/rigging issues				
Identify new Laser(s) to be added to LLE laser inventory				
Define required SRF modifications				
Define required SRF Auditor modifications				
Initiate LLEINST 9800 Computer Identification Data Sheet				
Begin development of Fit, Function, and Qualification Test plans				
Begin development of Installation and Operating Procedures				
Conduct Beam and Diagnostic Interference checks				
Identify critical spares				
Identify consumables				
Identify required maintenance				
Conduct PSR				
Conduct PDR				
Conduct ECR (Enclosure 3)				
Conduct SDR (Enclosure 4)				
Conduct FDR				
PF&A Phase				
Engineering detail drawings (mech, elec, optical, controls) released				
Cabling diagrams released				
Finalize Fit, Function, and Qualification Test plans				
Finalize Installation procedures				
Release draft operating procedures				
Develop maintenance procedures				

Phase/Item	Complete Date or n/a	Comments	PM Initial	PMA Initial
External user Finite Element Analysis (FEA) complete				
External user Safety Note(s) complete				
Conduct PSR				
Qualification Phase				
New Laser(s) have been entered into LLE laser inventory database and have been tagged with LLE Laser ID tag				
Safety Inspection				
Work Authorization Procedure prepared, including approved installation procedures				
Completed hardware in final configuration in house at LLE				
Conduct Installation Crew orientation				
Equipment installation				
Conduct fit and function tests				
Conduct alignments/calibrations				
Conduct Qualification tests				
Implement SRF modifications				
Implement Auditor modifications				
Conduct operator training, including safety aspects				
Implement Shot Executive software modifications				
Conduct PSR				
Conduct PQR				
Conduct IRR				
Conduct ORR/eORR				
Resolve and close all action items prior to first use				

Phase/Item	Complete Date or n/a	Comments	PM Initial	PMA Initial
Directors Approval Package (blue binder) signed a minimum of two weeks prior to first use				
Project Closure				
Conduct PCR				
Conduct PSR				
Laser Facility Model updated by ME				
Project budget closed				
Equipment/System tagged with property asset tag				
Update and release operations procedures based on first use experience				

Required approvers (list each by position and name):

Title _____ **Name** _____

Title _____ **Name** _____

Title _____ **Name** _____

Title _____ **Name** _____

Title _____ **Name** _____

Title _____ **Name** _____

Title _____ **Name** _____

Electronics/Controls Review Checklist [TOC**]**

Project TASKID: _____

Controls Review Criterion	Primary			Ancillary	
	CDR	FDR	ORR	PDR	IRR
Requirements					
High-level summary	X	X	X	X	X
Interfaces (Human/Hardware/ Software)	D	F	C	P	F
Concept of Operations (full cycle)	—	F	C	P	F
Changes	—	X	X	X	X
Architecture and Design					
High-level block diagram	D	F	C	P	F
Detailed Hardware/Software Block Diagram	—	F	C	P	F
Software (Platforms/OS/ Language/Legacy Code)	D	F	C	P	F
Primary data and control points	—	F	C	P	F
Interlocks	—	F	C	P	F
Schematics, board/chassis/rack layouts	—	F	C	P	F
Connector and cabling drawings	—	F	C	P	F
System interconnect drawing	—	F	C	P	F
Space claim	—	F	C	P	F
User Interface(s)					
GUI hierarchy/overview	—	F	F	P	F
Screen shots of main window and significant dialogs	—	F	F	P	F
Operator training	—	P	F	—	F
OIP Requirements					
Message, Action, Response	—	F	F	P	F
R4C criteria	—	F	F	P	F
Error thresholds	—	F	F	P	F
Testing					
Available test hardware/simulators	—	F	C	P	C
System installation and test plan (with durations)	—	F	—	—	—
Testing Results	—	P	F	P	F

Controls Review Criterion	Primary			Ancillary	
	CDR	FDR	ORR	PDR	IRR
Safety Concerns and FMEA					
Features for mitigation	—	F	C	P	C
Procedures for mitigation	—	F	C	P	C
Documentation					
Finalized TRD	—	F	C	P	C
Controls Design Description	—	F	C	P	C
Interface documents	—	F	C	P	C
Test Plan	—	F	C	P	C
User's Manual	—	P	F	—	F
Action Items	X	X	X	X	X
Risk Assessment	X	X	X	X	X
Resources	X	X	X	X	X
Schedule	X	X	X	X	X

X = Required
D = Draft
P = Preliminary
F = Final

C = Item has changed from last review or final document.

— = As applicable, where item is not required at the design phase.

Software Review Checklist [TOC**]**

Project TASKID: _____

Software Review Criterion	Primary			Ancillary	
	CDR	**FDR**	**ORR**	**PDR**	**IRR**
Requirements					
High-level summary	X	X	X	X	X
Expected and potential users	P	F	C	P	F
User Interfaces					
Software I/O Interfaces	D	F	C	P	F
Hardware Interfaces	D	F	C	P	F
Prevent identical clients or other points of control	D	F	C	P	F
Shot-Cycle sequence	—	F	C	P	F
Data refresh rate including analysis	D	F	C	P	F
Changes	—	X	X	X	X
Architecture and Design					
Project Life Cycle	P	F	—	F	—
High-level block diagram	D	F	C	P	F
Detailed Hardware/Software Block Diagram	—	F	C	P	F
Software components	D	F	C	P	F
Platforms, OS, Languages	D	F	C	P	F
Libraries to be used with Description	—	F	C	P	F
Legacy code	—	F	C	P	F
Primary data and control paths	D	F	C	P	F
Categories and content of exchanges	—	F	C	P	F
Client/Server, Service	—	F	C	P	F
User Interface(s)					
GUI hierarchy/overview	—	F	F	P	F
Screen shots of main window and significant dialogs	—	F	F	P	F
Executive placement and ProgPanel	—	F	F	P	F
ODV	—	F	F	P	F
Expert interfaces	—	F	F	P	F
Operator training	—	P	F	—	F
Database					

Software Review Criterion	Primary			Ancillary	
	CDR	FDR	ORR	PDR	IRR
High-level schema	D	F	F	P	F
Key features of detailed schema	—	F	F	P	F
Configuration, tracking and on-shot data	—	F	F	P	F
File Requirements					
Calibration, Background, Shot, reduced data	—	F	F	P	F
HDF attributes	—	F	F	P	F
Archival Plan and diagnostic type information	—	F	F	P	F
Data Reduction					
Sources => Algorithms => Sinks	—	F	F	P	F
Processing invocation	—	F	F	P	F
Data rates and logging	—	F	F	P	F
OIP Requirements					
Message, Action, Response	—	F	F	P	F
R4C criteria	—	F	F	P	F
Error thresholds	—	F	F	P	F
Testing					
Available test hardware/simulators	—	F	C	P	C
Use of stubs and drivers	—	F	—	P	—
System installation and test plan (with durations)	—	F	—	—	—
Testing Results	—	P	F	P	F
Safety Concerns and FMEA					
Features for mitigation	—	F	C	P	C
Procedures for mitigation	—	F	C	P	C
Documentation					
Finalized TRD	—	F	C	P	C
Software Design Description	—	F	C	P	C
Interface documents	—	F	C	P	C
Test Plan	—	F	C	P	C
User's Manual	—	P	F	—	F
Action Items	X	X	X	X	X
Risk Assessment	X	X	X	X	X
Resources	X	X	X	X	X

Software Review Criterion	Primary			Ancillary	
	CDR	FDR	ORR	PDR	IRR
Schedule	X	X	X	X	X

X = Required
D = Draft
P = Preliminary
F = Final

C = Item has changed from last review or final document.

— = As applicable, where item is not required at the design phase.

Personnel Safety Risk Assessment (SRA) [TOC**]**

Project TASKID _____

Personnel Safety Risk Assessment		
Item	**Level**	**Mitigation**
Mechanical		
Elevated weight		
Vacuum/pressure vessel		
Operator access (weight, size, reach)		
Personnel hazard		
Other structural/loading		
Hot/cold surfaces		
Rigging (installation, normal use)		
Alternate configurations		
Chemical		
Fuel or oxidizer		
Asphyxiator		
Toxic material		
Reactive/corrosive		
Beryllium		
Electrical		
High voltage		
Unprotected leads		
Overheating		
Stored energy		
Lasers		
Eye hazard – during operation		
Eye hazard – alignment only		
Open focus spot		
Ionizing Radiation		
Radioactive liquid		
Radioactive solid		
Radioactive gas		
Loose-surface radioactivity		
Can become activated		

Personnel Hazard Levels			
—	n/a = No hazard for personnel	2	Serious = May cause severe injury
1	Minor = May cause minor injury	3	Critical = May cause death

All entries having some (non-zero) associated risk must have a corresponding mitigation plan to manage and reduce the hazard level to 1 or n/a.

Submitted by _____ Approved by _____

Project Manager Chief Safety Officer

Pre-Operation Safety Inspection Checklist [TOC]

See instructions on completing this form after the signature page below.

Project TASKID: _____

Pre-Operation Safety Inspection Checklist			
Item	**Pass**	**Fail**	**Comment/Mitigation**
Mechanical (Mechanical SO)			
Moving components			
Elevated weight			
Compressed gas			
Pressure relief valve			
Liquid under pressure			
Stored gravitational energy			
Stored spring energy			
Stored or trapped gas pressure			
Sharp edges			
Head hazard			
Trip hazard			
Noise hazard			
Hot/cold surfaces			
Reach/access			
Supports 200# incidental loads			
Maintenance access – rigging			
Alternate configurations			
Equipment labeled			
Review lockout devices/method			
Cable routing			
Chemical (Chemical SO)			
Fuel or oxidizer			
Asphyxiant			
Toxic material			
Reactive/corrosive			
Appropriate labels			
Appropriate storage			
MSDS			

Pre-Operation Safety Inspection Checklist			
Item	**Pass**	**Fail**	**Comment/Mitigation**
Beryllium			
Electrical (Electrical SO)			
High voltage			
Unprotected leads			
Overheating			
Electrical lockout			
Cabling labeled			
Grounding			
Review lockout devices/method			
Lasers (Laser SO)			
Eye hazard – during operation			λ = ____ nm, Class:
Eye hazard – alignment only			λ = ____ nm, Class:
Open focus spot			
Ionizing Radiation (Radiation SO)			
Radioactive liquid			
Radioactive solid			
Radioactive gas			
Loose surface radioactivity			
Can become activated			
LockOut – Zero Energy State (Chief Safety Officer)			
Review lockout devices/method			

Completed by (as applicable):

_____
Mechanical Safety Officer / Date

_____
Chemical Safety Officer / Date

_____
Electrical Officer / Date

_____
Laser Safety Officer / Date

_____
Radiation Officer / Date

Reviewed by:

LLE Chief Safety Officer / Date

Project Manager / Date

Functional Use Area Owner / Date

Pre-Operation Safety Inspection Checklist: Instructions

1. This checklist is required for all equipment/systems/hardware projects and must be included in the project IRR or ORR and archived with the project documentation.
2. This checklist is to be completed during equipment inspection by the appropriate safety officer or their designated representative.
3. The safety officer **is to initial either Pass or Fail for each line item they are responsible for** and sign the checklist where indicated below.
4. A "Fail" will be accompanied by a required mitigation that must be implemented, inspected, and passed prior to equipment use.
5. If a line item is not applicable, the inspector is to cross out the item with a single line drawn through the line item and pass/fail boxes and then enter a justification for the n/a finding in the comment/mitigation column and initial.

Failure Modes and Effects Analysis (FMEA) [TOC]

This enclosure is for reference only. A Microsoft Excel FMEA spreadsheet is available online in the following locations: http://engineering.lle.rochester.edu/systems.php and \\sequoia\Project_Files\00_Project Management Guidance\10_FMEA

Failure Modes and Effects Analysis

Project: <Project Name Here> PDM#: x-xx-xxxx Date: mm/dd/yy

TaskID: <TaskID Here> Revision: <Rev. Level Here> PM: <Project Manager Name Here>

Line #	System or Subsystem	Category	Failure Mode	Causes (one row for each cause)	Effect(s) of Failure	Unmitigated		Mitigation	Implemented	Mitigated	
						Level	Probability			Level	Probability
1											
2											
3											
n											

Hazard Level Category and Definitions

Probability of Occurrence Definitions	
4	Probable = Expected to happen in the life of the project.
3	Infrequent = Could happen in the life of the project. Controls have significant limitations or uncertainties.
2	Remote = May happen in the life of the project, but not expected. Controls have minor limitations or certainties.
1	Improbable = Extremely remote possibility that failure will occur in the life of the project. Proven controls are in place.

Category
Personnel
Equipment
Data

		Personnel	Equipment
4	Catastrophic	May cause death.	May cause >1 day lost shot time.
3	Critical	May cause severe injury.	May cause <1 day lost shot time.
2	Marginal	May cause minor injury.	May cause ~1 hour of lost shot time.
1	Minor	Not serious enough to cause injury.	May cause delay <0.5 hour of local shot time.
0	None	No hazard for personnel.	No risk of lost shot time.

Note: *For non-shot related equipment, assess hazard level based on programmatic impact (cost, man-hours, delay, etc.)*

Project Risk Assessment (PRA) [TOC]

This enclosure is for reference only. A Microsoft Excel PRA spreadsheet is available online in the following locations: http://engineering.lle.rochester.edu/systems.php and \\sequoia\Project_Files\00_Project Management Guidance\15_PRA

Project Risk Assessment

TaskID: <TaskID Here> Project Manager: <Project Manager Name Here>

Project Name: <Project Name Here> Project PI: <Principal Investigator Name Here>

		Risk and Impact									
ID	Risk Description	Cost		Schedule		Technical		Resources		Status	Mitigation Plan
		R	I	R	I	R	I	R	I		
1											
2											
3											
4											
5											
•											
n											

Risk	
High	High: >80% chance of occurrence.
Medium	Medium: 20% < x < 80% chance of occurrence.
Low	Low: <20% chance of occurrence.

Impact	
4	Project in jeopardy.
3	Primary Science/Physics requirement will not be met.
2	One or more secondary requirements will not be met.
1	No performance impact.

Project Approval Cover Sheet [TOC]

Project Approval Cover Sheet

Project Title _____ Project TASKID _____

Approvals:

Project Manager _____ Date _____

Project Management Administrator _____ Date _____

Chief Safety Officer _____ Date _____

Laser Development and Engineering
Division Director _____ Date _____

Experimental Division Director _____ Date _____

Omega Facility Director _____ Date _____

Conditional Approval

☐ Project Manager check box if approval is conditional.

Approval is conditional based upon the following:

_____

_____

_____

_____

Conditional approval expires _____; thereafter, equipment may not be utilized until all conditions have been satisfied or removed by the appropriate Division Director(s).