

Omega

LASER FACILITY ORGANIZATION & REGULATION MANUAL

LLE INSTRUCTION 3000

SUBJECT: Laser Facility Organization and Regulation Manual

Purpose: To promulgate the policies, organization, regulations, and administrative procedures for operating the Omega Laser Facility.

Approval:

Samuel Morse
Omega Operations Division Director



Record of Changes and List of Effective Pages

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List of Acronyms

ACN	Advanced Change Notice	ACST	Activation Counting Station Technician
AIBS	Academic and Industrial Basic Science	ALT	Alignment Laser Technician
AT	Amplifier Technician		
BO	Beamlines Operator		
CMR	Cart Maintenance Room	CTF	Cryogenic and Tritium Facility
CTFM	Cryogenic and Tritium Facility Manager	CTHS	Cryogenic Target Handling System
DER	Driver Electronic Room	DOE	Department of Energy
DPP	Distributed Phase Plate	DT	Deuterium–Tritium
DTHPFO	DT High-Pressure Fill Operator	DTHPS	DT High-Pressure System
ECT	Experimental Cryogenic Technician	ESO	Experimental System Operator
EP	Extended Performance	EST	Experimental System Technician
ESG	Experimental Support Group	EUC	Experimental User Coordinator
FASC	Facility Advisory and Scheduling Committee	FTS	Fill and Transfer System
GCC	Grating Compression Chamber		
HED	High Energy Density		
ICF	Inertial Confinement Fusion	IRDP	Infrared Diagnostic Package
IR	Infrared	IST	Instrument Specialist
IR-ALT	IR Alignment Laser Technician		
LANL	Los Alamos National Laboratory	LFORM	Laser Facility Organization and Regulation Manual
LARA	Large-Aperture Ring Amplifier	LIM	Linear Induction Motor
LBS	Laboratory Basic Science	LLE	Laboratory for Laser Energetics
LDO	Laser Drivers Operator	LLNL	Lawrence Livermore National Laboratory
LDT	Laser Drivers Technician	LSO	Laser Sources Operator



LF	Laser Facility	LST	Laser Sources Technician
LFM	Laser Facility Manager		
MCTC	Moving Cryostat Transfer Cart	MPD	Multiple-Pulse Driver Line
NLUF	National Laser Users' Facility	NRL	Naval Research Laboratory
NNSA	National Nuclear Security Administration	NTA	Near Target Arm
OAP	Off-Axis Parabola	OOO	Out of Commission
OLUG	Omega Laser User Group	Omega	OMEGA 60, OMEGA EP, and Cryo and Tritium Facility
OSHA	Occupational Safety and Health Administration	OMEGA	OMEGA 60 Laser
OTDR	Optical Time-Domain Reflectometry	OMEGA EP	OMEGA Extended Performance Laser
PCE	Power Conditioning Executive	PGR	Pulse Generation Room
PCO	Power Conditioning Operator	PI	Principal Investigator
PCT	Power Conditioning Technician	PLC	Programmable Logic Controller
PDM	Product Data Management	PPE	Personal Protective Equipment
PEPC	Plasma-Electrode Pockels Cell	PT	Processing Technician
RID	Request Identification		
SD	Shot Director	SRF	Shot Request Form
SNL	Sandia National Laboratories	SS	System Scientist
SPC	Science Policy Committee	SSD	Smoothing by Spectral Dispersion
SPDP	Short-Pulse Diagnostics Package		
TAD	Tertiary Activation Diagnostic	TRF	Target Request Form
TCC	Target Chamber Center	TRS	Tritium Removal System
TCTRSO	Target Chamber Tritium Removal System Operator	TSF	Transport Spatial Filter
TFS	Tritium Filling Station		
UR	University of Rochester	UV	Ultraviolet
UR LLE	University of Rochester /Laboratory for Laser Energetics	UV-ALT	UV-Alignment Laser Technician



WAP Work Authorization Procedure

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Part I: Concept of Operations and Scheduling

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1000 Laser Facility Overview

The Omega Laser Facility is a multi-kilojoule-class laser facility located at the University of Rochester's Laboratory for Laser Energetics (UR/LLE). It includes the 60-beam OMEGA compression laser system, the four-beam extended performance (OMEGA EP) laser, and the Cryogenic Target Handling System. The laser systems can be operated independently, with separate scientific objectives for each, or jointly with the combined capabilities addressing a single requirement.

The OMEGA compression laser system is a 60-beam neodymium glass laser that is frequency converted to deliver up to 30 kJ of 351-nm light on target. This system is capable of conducting fully diagnosed direct-drive or indirect-drive target-physics experiments, including direct-drive planar or spherical cryogenic experiments. The system is designed to operate on a 1-h shot cycle and will nominally deliver 1200 shots per year at 80% capacity.

The OMEGA EP Laser System consists of four beams—two that have both long- and short-pulse capability and two that have only long-pulse capability. The short-pulse beams deliver 1- to 100-ps pulses at energies up to 2.3 kJ per beam to either the OMEGA or OMEGA EP target chambers. The long-pulse beams deliver 0.1- to 10-ns pulses at energies up to 5 kJ per beam to the OMEGA EP target chamber. When coupled to the OMEGA target chamber, the OMEGA EP Laser System supports short-pulse backlighting and advanced-ignition experiments with the short-pulse beams and laser-plasma interaction (LPI) experiments with the wavelength-tunable UV beam. When coupled to the OMEGA EP target chamber, the system is capable of fully diagnosed high-energy, high-intensity planar experiments. The system is designed to operate on a 2-h shot cycle and will nominally deliver 600 shots per year at 80% capacity.



The OMEGA Cryogenic Target Handling System (CTHS) is capable of filling, layering, and characterizing cryogenic DT spherical targets and D₂ planar targets. It delivers and positions them in the target chamber and supports them at target chamber center until they are shot.

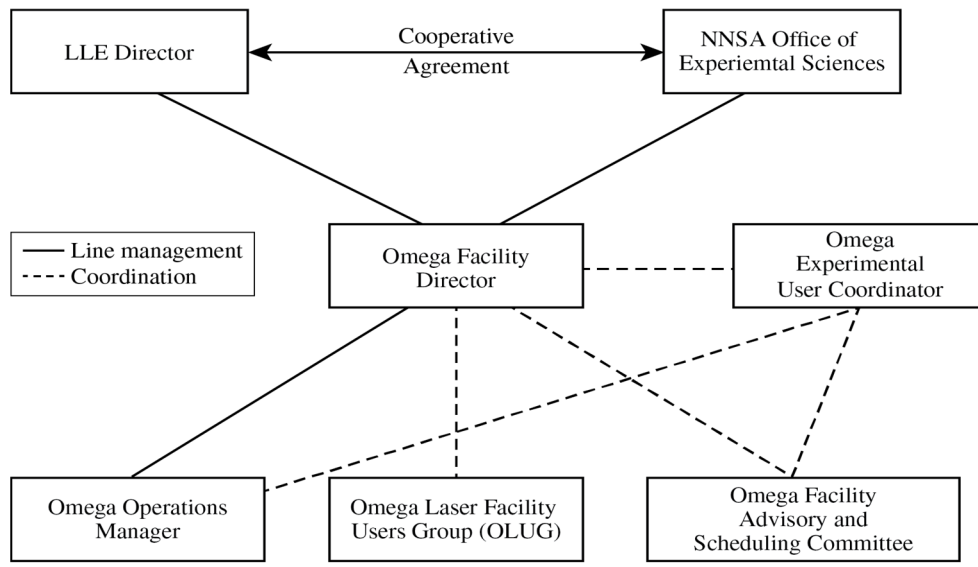
The Omega Laser Facility is funded by the Department of Energy (DOE) through the National Nuclear Security Administration (NNSA) and is housed in the University of Rochester–owned Laboratory for Laser Energetics’ facility located on the South Campus of the University of Rochester. Under the Cooperative Agreement the UR/LLE operates the National Laser Users’ Facility (NLUF). Shots are made available to NLUF users at the Omega Laser Facility; however, the NLUF users are funded by DOE outside of the DOE–UR/LLE Cooperative Agreement.

1001 Not Used

1002 Omega Governance Plan

2.1 Introduction

The Omega Governance Plan covers the process by which the Omega Laser Facility, including the 60-beam OMEGA and the 4-beam OMEGA EP systems, is governed to determine the allocation of system time, schedule user experiments, and ensure that users’ current and future requirements are presented to the Omega Facility Director. This governance plan does not cover the line-management functions of the Omega Facility Director to operate and maintain OMEGA and OMEGA EP. The organization for Omega Governance is outlined in Fig. I-1.



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Figure I-1: Schematic organizational diagram for Omega Laser Facility Governance

2.1.1 LLE Director

The LLE Director is responsible for the overall direction of the laboratory to ensure that NNSA program goals are supported. The Director is responsible for appointing the Omega Facility Director

- The LLE Director is selected by the President and approved by the Board of Trustees of the University of Rochester in consultation with NNSA and is appointed for a five-year renewable term.
- The LLE Director reports administratively to the University of Rochester's Vice President for Research. Programmatically, the LLE Director consults with the NNSA Director of the Office of Experimental Science.
- The LLE Director approves and publishes the annual Omega fiscal-year shot schedule three months prior to the start of the fiscal year and certifies that it fulfills the guidance provided by NNSA.

2.1.2 Omega Facility Director

The Omega Facility Director is responsible for defining the overall Omega Facility use that maximizes the benefit to the National Stockpile Stewardship and High Energy Density (HED) physics programs and balances security priorities with broader scientific, technological, and economic competitiveness goals. The Facility Director also chairs the Omega Facility Advisory and Scheduling Committee.

2.1.3 Omega Facility Advisory and Scheduling Committee (FASC)

This committee recommends Omega system time allocation, promotes an effective user community, and reviews the facility's overall effectiveness for users. The FASC formulates the annual facility schedule.

2.1.4 Omega Experimental User Coordinator

The Experimental User Coordinator (EUC) is the single point of contact for all non-LLE Principal Investigators (PI's). The EUC is the liaison between the PI and the Omega support staff for technical information and user support for planning and conducting experiments at Omega. The EUC is also the liaison between the PI and LLE support staff for target fabrication and LLE Engineering. The user coordinator is appointed by the Experimental Division Director.

2.1.5 Omega Operations Manager

The Omega Operations Manager is responsible for the overall operation and operational readiness of the Omega Laser Facility. The OMEGA Laser Facility Manager and OMEGA EP Laser Facility Manager report to the Operations Manager and are responsible for the operation of each respective facility.

2.2 Omega System Time Availability, Programmatic Allocation, and User Support

2.2.1 System Time Availability

The principal uses of Omega are for NNSA-supported research and development in high-energy-density (HED) physics recommended by the HED Council and basic science through peer-reviewed proposals. HED physics is subdivided into: 1) Materials, 2) Thermonuclear Burn, 3) Hydrodynamics and Properties, and 4) Outputs and Survivability. The LLE Director will give guidance on the distribution of shot allocations between these four HED physics areas to the HED Council prior to the April HED Council meeting. Basic science is subdivided into: 1) National Laser User Facility (NLUF) and 2) Laboratory Basic Science (LBS). The allocation of system shot time to users is based on NNSA's programmatic needs and available shot time. The number of shots depends on the type of shots, system availability, experimental effectiveness, and funding levels. The Omega Facility Director will provide the HED Council Chairperson and NLUF Manager the number of available shot days on OMEGA and OMEGA EP for HED, NLUF, and LBS by three months before the May annual FASC meeting. This will assume that the LLE budget from NNSA is the same as the previous year adjusted for inflation.

The HED Council will convene a review meeting of the Omega shot proposals in April in advance of the May Annual Scheduling Meeting. The chairperson of the HED Council will send a memo to the LLE Director and the Omega Facility Director including shot recommendations.

The Omega Operations Manager is responsible for the overall operation of Omega, including ensuring that system availability and experimental effectiveness are optimized. The Operations Manager will provide the following to the Omega Facility Director and the Facility Advisory and Scheduling Committee:

- A monthly report on the number of target shots scheduled and completed by the user, including the overall experimental effectiveness. A yearly summary report will be provided.

A monthly report of Omega system availability and effectiveness, including an analysis of the contributions to system non-availability. A yearly summary report will be provided.

2.2.2 Programmatic Allocation

The Omega FASC will recommend system time allocations as described in **Sec. 1003** following NNSA's guidance on program balance. Contingency will be assigned by the biweekly subcommittee to compensate for low availability on a campaign and/or address additional urgent experimental goals. Total NNSA funded shot days are 190 per year based 80% of 238 available days considering OMEGA operates 3-12 hour days per week less 1 week of maintenance per

quarter and holidays and OMEGA EP operates 2.4-12 hour days per week less 2 weeks of maintenance per quarter and holidays

The notational time allocation of the NNSA-funded shot time in FY23 is 68% for HED physics, 18% NLUF, 9% LBS, and, and 5% for contingency. The FASC advises the LLE Director on changes to the guidance for program balance.

2.2.3 Omega User Support

The Omega Facility Director has fiscal responsibility for operation of the facility and is responsible for ensuring that all appropriate support functions are provided. Standard capabilities required for users to conduct experiments supplied by the facility include:

- Experimental support, including facility diagnostics, operations data processing and access, standard distributed phase plates, distributed polarization rotators, and smoothing by spectral dispersion. An on-site target contractor provides support for national laboratories and NLUF users; however, targets are not supplied for national laboratories. NLUF targets are supplied by GA under the NNSA contract within the LLE allotment as determined annually by the ICF target FPM with input from the National Target Working Group. Targets for other than national laboratories and NLUF are the responsibility of the user (e.g. LBS, LaserNet, CEA, and other users who separately fund their shots). The annual scheduling meeting is scheduled in May of each year to ensure that general target requirements are known by the target manufacturer sufficiently in advance to ensure that target requests can be supported. PIs are required to submit detailed target specifications to the target manufacturer (i.e., target contractor and/or Target Fabrication Group at PIs institution) at least four months in advance of the shot date for routine targets that do not require research and development (R&D). If a target requires R&D or ^3He gas fills, the PIs are required to submit detailed specifications to the target manufacturer at the annual scheduling meeting. To conserve resources and ensure effective target production it is recommended that not more than 20 to 30% additional targets be requested.
- Facility diagnostics are those diagnostics qualified* for use on the facility that reside at the facility and require no external personnel to operate. These diagnostics will be fully supported by LLE.
- User diagnostics are those diagnostics qualified* for use on the facility that require external permission and/or resources to operate. These diagnostics may or may not reside at LLE and will require additional effort to operate. It is the responsibility of the user to obtain permission and external resources for the use of these diagnostics.

*Qualified means completion of qualification process per LLE Instruction 7700. Details of the level of support will be determined after receiving an external project request.

- Administrative support including badging, safety training, facility orientation, data archiving and retrieval, Shot Request Form (SRF) administration and preparation assistance, working areas and logistic support, and computer network connections.
- Engineering support to field/adapt user-supplied diagnostics.
- Technical information and support for planning and conducting user experiments.

1003 FASC Roles and Responsibilities

3.1 Responsibilities

The Facility Advisory and Scheduling Committee formulates the annual facility schedule, reviews experimental proposals for compatibility and safety, and evaluates facility availability and experimental effectiveness. The FASC recommends the annual facility schedule and represents the needs of the users to the LLE Director.

3.1.1 Annual Scheduling Meeting

The full FASC meets in May of each year to formulate the one-year Omega Facility schedule for the upcoming fiscal year. LLE will issue a call for proposals that includes guidance on research categories in February, and these proposals must be received by LLE not later than 31 March. The HED Council will convene a review meeting of the Omega shot proposals in April advance of the Annual Scheduling Meeting, and the chairperson of the HED Council will send a memo to the LLE Director and the Omega Facility Director including the shot recommendations. The FASC reviews facility availability and effectiveness for the previous year and recommends notional shot allowances for the fiscal year after next. Specific responsibilities include the following:

- Schedule the available facility time to fulfill the recommendations of the High-Energy-Density (HED) Council, approved NLUF and LBS proposals and separately funded proposals (e.g. LaserNetUS, CEA, and others).
- Review programmatic requirements for the fiscal year after next and make a recommendation for total system time required and the overall program balance.
- Review target requirements to ensure target manufacture supportability, ³He requirements, and tritium fill requirements.
- Review user requests for facility modifications and recommend appropriate action to the LLE Director.
- Review the Omega availability and experimental effectiveness for the past year and recommend appropriate lessons learned to the LLE Director.
- Review existing experimental capabilities such as diagnostics and information availability, and recommend improvements where warranted.



- Review policy for experimental data ownership, access, and security issues.

3.1.1.1 Membership The FASC committee members are appointed by the host institution and approved by the LLE Director. The membership is summarized below.

Number of Members	Subcommittee	Source
7	HED physics	LLNL(1), LANL(1), SNL(1), LLE (4)
2	Basic Science	NLUF Manager (1) OLUG Chair (1)

As stated in Sec. 2.2.1, HED physics will be presented by category: 1) Materials, 2) Thermonuclear Burn, 3) Hydrodynamics and Properties, and 4) Outputs and Survivability

Each committee members will serve a term determined by the host institution; the term nominally should be for at least two years. The Omega Facility Director will serve as the committee chairman.

The Basic Science subcommittee consists of the NLUF manager and the Omega Laser Users Group (OLUG) Chair. Basic science consists of the NLUF and LBS facility access programs administered by the NLUF Manager at LLE. NLUF participants are from universities and industry in the United States. LBS participants are from the NNSA Laboratories (LLNL, LANL, and SNL), LLE, and Office of Science Laboratories (as recommended by NNSA). LLE will issue a call that includes guidance on research categories for NLUF and LBS proposals in February, and these proposals must be received by LLE not later than 31 March.

NLUF and LBS Proposal Review Panels (PRP) are formed separately and approved by the LLE Director as defined by the NLUF management program contained in the UR/LLE–DOE Cooperative Agreement. The NLUF PRP meets biennially in April to review NLUF facility access proposals on merit and recommends proposals in rank order of shot allocations to the LLE Director. The LBS PRP meets annually in April to review LBS proposals on merit and recommends proposals in rank order of shot allocations to the LLE Director. The recommendations of the NLUF and LBS PRPs approved by the LLE Director and NNSA facility program manager are represented at the FASC by the NLUF Manager. The NLUF Manager also represents externally funded programs such as LaserNetUS at the FASC. NLUF programmatic funding is provided separately and target support is funded through an NNSA GA contract within the LLE allotment. The programmatic funding including targets for the LBS Program is provided by the PI’s laboratory and system time is provided by the facility

3.1.1.2 Committee Procedures The procedures that govern the annual schedule formulation process and facility review are outlined in this section. This process will be initiated each year by the Omega Facility Director issuing relevant guidance and a planning timeline.

- The HED Council provide an input of tier 1 and 2 experimental proposals to be performed at Omega in time to support the annual FASC meeting.
- Approved NLUF and LBS proposals are represented by the Basic Science Subcommittee Chairman.
- The Omega Facility Director collects the inputs from the subcommittees, evaluates facility impact, and formulates a draft fiscal-year schedule for review at the annual FASC meeting. Each laboratory's FASC representative will present the proposals approved by the HED Council broken down into the categories of Materials, Thermonuclear Burn, Hydrodynamics and Properties, and Outputs and Survivability. The Basic Science subcommittee chair will present peer-reviewed NLUF, LBS, and LaserNetUS proposals for system time to the FASC, including the review results of experiments that should be scheduled. Other users that are separately funded will present their proposals.
- The full committee will schedule the proposals approved by the HED Council, NLUF and LBS proposals recommended by PRP's, and other users. If there is inadequate system time to fulfill all requests, the committee will use the HED Council and NLUF and LBS PRP's rankings to reduce the proposals scheduled. The reduction will be on a pro rata basis. The full committee will recommend the fiscal-year schedule that includes 3% contingency to the LLE Director for approval.
- The committee will complete the reviews identified in **Sec. 3.1.1** and report the results to the LLE Director.

3.1.1.3 User Requirements Each laboratory is responsible for formulating an experimental program to fulfill its campaign objectives. These requirements are submitted to the HED Council for review and prioritization. Members of participating laboratories cannot be PI's on NLUF proposals. Proposals from outside entities [for example, proposals resulting from international agreements e.g., Commissariat à l'énergie atomique (CEA), and Atomic Weapons Establishment (AWE)] must be approved by the FASC. Proposal content and PI responsibilities are detailed in **Sec. 1004**.

3.1.2 Biweekly FASC Meetings

A subcommittee of the FASC consisting of the LLE members of the FASC, the Laser Facility Managers, the Experimental Operations Group Leader, the Diagnostic Development and Integration Group Leader, and the Laser System Scientist meet biweekly to administer the facility schedule and monitor its effectiveness (other non-LLE committee members are welcome to call in to this

meeting or attend if available on-site). Specific responsibilities include the following:

- Review recommended schedule changes and formulate schedule changes to accommodate user requests where possible.
- Contingency time is included in the schedule to recover from Facility Availability events (>1/2 day system time lost) or to perform new, high-priority experiments at the recommendation of the HED Council. Assignment of contingency time is recommended by the FASC and subject to concurrence from the LLE Director.
- In general, contingency time should not be assigned prior to six months from the date the contingency day is scheduled.
- Review and approve experimental proposal templates submitted by the PI's for system and experimental compatibility and safety. Approve or recommend changes to the proposals.
- Review experimental critiques submitted by PI's and propose corrective actions to the Facility Director where warranted.
- Evaluate the progress in implementing new/modified diagnostics.
- Conduct a running review of the system schedule to determine the ability to perform previously approved experiments, especially those dependent on system or diagnostic upgrades.
- Ensure that the facility schedule is kept current and posted on LLE's web site.

1004 Experimental Proposals and Principal Investigator Roles and Responsibilities

With respect to the laser facility, PI's are those individuals responsible for proposing experiments to be conducted at the Omega Laser Facility.

4.1 Principal Investigator Orientation

Principal Investigators must complete an Omega familiarization before conducting their first experiment. This familiarization should be scheduled through the respective Laser Facility Manager at least 12 weeks prior to the PI's first scheduled experiment. The familiarization will include the following:

- Briefing on OMEGA and/or OMEGA EP capabilities,
- Review of PI responsibilities including SRF preparation,
- Safety briefing,
- Tour of OMEGA/OMEGA EP,
- Observation of shot operations, preferably by shadowing an experimental PI,
- New pulse-shape request requirements,

- Target metrology and positioning requirements, and
- Briefing on diagnostic procedures.

4.2 Experimental Proposal

Once an experiment is scheduled by the FASC, the PI is responsible for submitting a proposal template and SRF's [a request identification (RID) uniquely identifies an SRF], coordinating experimental and laser requirements, monitoring the experimental execution, and writing a critique of the execution of the experiment within one week of its performance. Principal Investigators are responsible for submitting a proposal template to the FASC that amplifies and extends the information submitted prior to scheduling the experiment. This template and accompanying SRF's, target request forms (TRF's), and VISRAD files must be submitted for FASC approval at least 12 weeks prior to the scheduled date of the experiment. Campaigns that are not approved nine weeks before the shot day may be rescheduled or cancelled at the discretion of the FASC committee.

4.2.1 Proposal Template Instructions

The Proposal Template is available from the operations page (<https://omegaops.lle.rochester.edu/proposalTemplate>).

4.2.1.1 Program, campaign title, laboratory affiliation, date of the campaign, AM or PM, PI names, and applicable laser system (OMEGA, OMEGA EP, or both) will be set up by LLE for the PI to complete all additional details. The PI will identify all collaborators and specifically note citizenship so that access can be arranged for individuals who need to enter LLE for the experiment.

4.2.1.2 Summary of the experiment's objectives. This section allows the PI to attach pdf documents for key stages in campaign preparation.

4.2.1.3 Laser and diagnostic requirements for the campaign. This input must include experimental configuration name(s) and an RID number for each experimental configuration. This section is sufficient to identify qualified facility diagnostics. Qualified diagnostics requiring support from persons not at LLE will require additional coordination. Any questions or concerns should be brought to the attention of the Experimental Support Group Leader.

4.2.1.4 Type and number of targets including number of spares.

- Identify the TRF number for each configuration, if available.
- A sample of complex targets (defined as other than a simple flat-foil, spherical direct-drive capsule, or plain hohlraum) must be delivered to LLE at least one week prior to the scheduled experiment. This will allow the positioning of the target to be tested and the development of accurate target-positioning procedures and reticules by placing the target at target chamber center (TCC) when TCC time is available. Indicate on the proposal if targets

are complex and include the number of targets ordered for each configuration.

- Targets must be metrologized prior to delivery at LLE and verified after arrival at LLE using LLE's Powell scope. Metrology data will be available to the Experimental Operations Group no later than two full working days prior to the day of shots.
- Target, target support, and target shield mass must be minimized to preclude either shrapnel or vapor-deposition degradation of optics. Generally this means that flat targets should be no larger than the beam-spot size plus 100 μm , support structures should be of minimum mass to securely support the target, and shields should be of a minimum area and thickness.
- Theoretical 1-D-calculated neutron yield must be provided for all fusion-yield targets.

4.2.1.5 A VISRAD file that shows the target including the mount stalks and the beams intercepting the target. (Use of the software program VISRAD enhances visualization and importation of data to the SRF.) The file name must be formatted "<RID Number>-<PI Name>.vrw," e.g., for targets corresponding to RID 12345 and PI surname of Heeter, the file name is "12345-Heeter.vrw." VISRAD files must be submitted as attachments to the proposal.

4.2.1.6 Quantity (shot count) of target shots proposed.

4.2.1.7 Identification of diagnostics planned for use on the experiment that are not qualified for use on OMEGA/OMEGA EP. Non-qualified diagnostics are those that have not completed facility qualification per LLE Instruction 7700 and are not generally selectable on the SRF. Note that the introduction of an external or new computer per LLE Instruction 9850 should be identified here. Any questions or concerns should be brought to the attention of the Experimental Support Group Leader.

4.2.1.8 Laser-energy transport considerations (OMEGA only)

A. Estimate laser-energy transmission through target:

Significant transmission of laser light through a target can cause damage to the opposing beam optics of the OMEGA laser. A beam transmitted through an under-dense target can have significant spatial modulation. The potential for such damage is increased when a distributed phase plate (DPP) is used in a beam. To assess the potential for such damage, the PI is required to state the estimated level of laser-beam transmission through the target (including blow-through) for the proposed experimental configuration. The basis of this estimate can be a simulation of the laser-target interaction or data from an experiment that closely simulates the proposed experimental configuration. No experiment will be approved unless such an estimate is provided in the



template submitted for approval to the OMEGA FASC ten weeks prior to the scheduled shot day. Beam dumps or calorimeters can be installed in opposing beams to increase the maximum-acceptable energy transmission (for up to 15 beams). The following table shows the maximum-allowable blow-through under various scenarios:

Beam block (in opposing port?)	DPP location (beam port)	Maximum blow by energy (J) in 100ps	Maximum blow by energy (J) in 1.0 ns	Optics at risk
No	None	10	100	F ASP Pickoff and FCC Cell
No	Input	5	20	
No	Output	5	20	
No	Both	5	25	End Mirrors
Yes	None	30	300	Final Optics Assembly
Yes	Input	25	250	
Yes	Output	25	250	
Yes	Both	20	200	
Gas jet w/ beam block	Input	20*	200*	*under study
BWA cal	Any	50	500	Input FOA

Table I-1: Permissible laser transmission based upon beam block and DPP location. Note that energies can be scaled linearly by pulse width < 1.0 ns

- B. Estimated laser-energy backscatter from the target:
Significant backscatter from a target can cause damage to the beamline optics. To prevent damage, the estimated backscatter energy must not exceed 140 J.
- C. Estimated laser energy reflected from the target:
Significant laser energy reflected from a flat target can be directed into other beam ports and damage beamline optics. To reduce the reflected energy and prevent damage, the maximum angle of incidence of a laser beam on a flat target must not exceed 65°.

4.2.1.9 Special shot-schedule considerations associated with experiment.

4.2.1.10 Campaign configuration variables. Include all shot parameters such as pulse shapes, beam energies, beam delays, diagnostic setup, etc. that will be varied during the campaign.

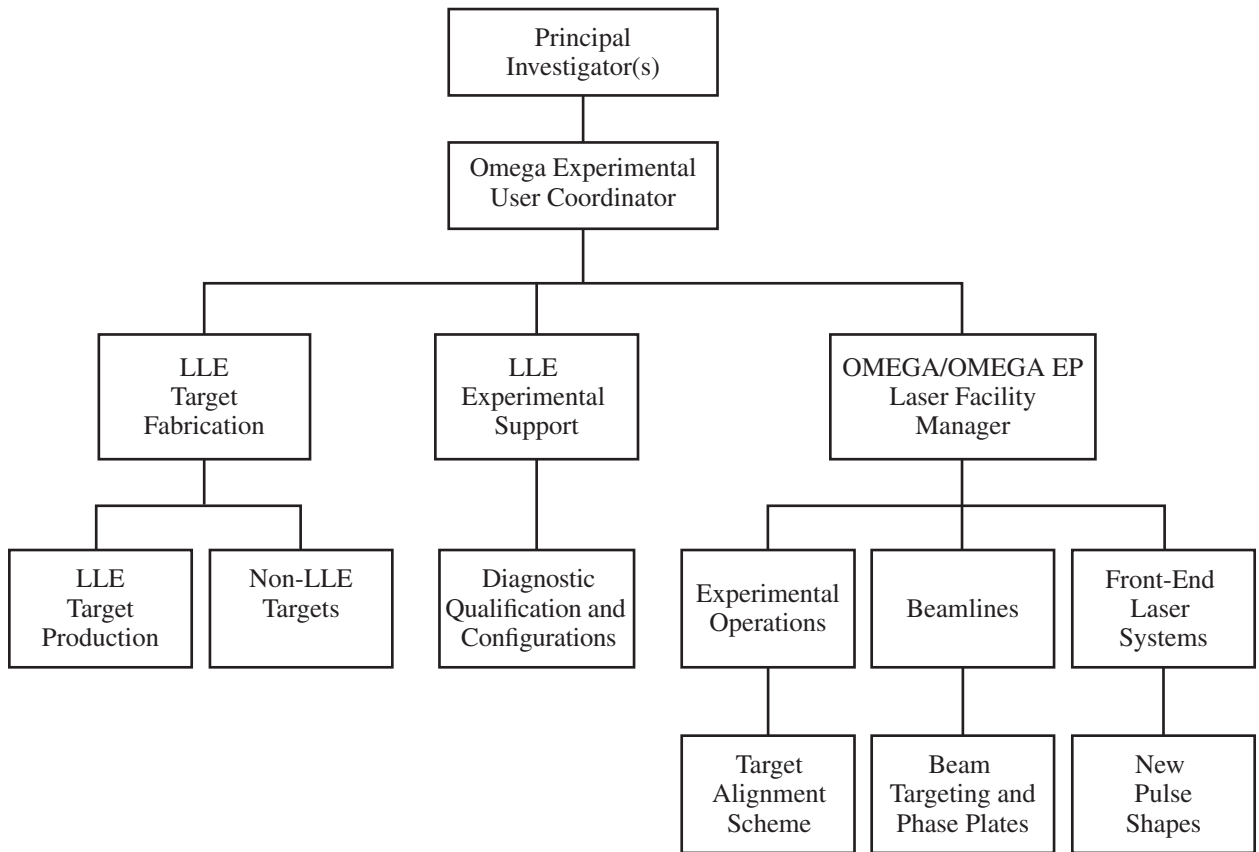
4.2.2 The proposal template table will be reviewed by the FASC to ensure that the experiment’s requirements are consistent with the capabilities of the laser facility.

4.2.3 It is the responsibility of the PI to contact the applicable LFM if changes are desired after the proposal has been approved by the FASC.



4.3 Principal Investigator Responsibilities

Once the PI’s experiment has been scheduled, it will become the PI’s responsibility to interface (via the Experimental Division’s liaison representative for user experiments) with the assigned experimental coordinator, and ultimately with the Laser Facility Manager, the Experimental Support Group, and the LLE Target Fabrication Group (while keeping the experimental coordinator and liaison representative informed) to ensure that the experimental and laser system requirements are coordinated and understood (see Fig. I-2). If a PI requires targets and/or diagnostics not provided by LLE resources, the PI must include those respective requirements in the proposal template and coordinate the external group activities with the Laser Facility Manager and/or Experimental Support Group Leader. All LLE-provided services, including new pulse shapes, target-alignment scheme, and beam targeting shall be coordinated through the Laser Facility Manager to ensure that, at the time the experiment is to be conducted, issues associated with availability or compatibility of those services have been resolved. New pulse-shape requests must be submitted more than 30 days in advance of a campaign. Because of the large burden of computation and testing for new pulse shapes, new pulse shapes requested per campaign should be minimized. The number of new pulse shapes supportable will be dependent on actual system load.



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Figure I-2: Principal Investigator responsibilities.

4.3.1 Experiment Reviews

4.3.1.1 Approximately two weeks prior to commencing the experiment, the PI, or designee, will conduct a comprehensive review of the detailed requirements for their upcoming campaign. This review is for the mutual benefit of the laser and Experimental Operations Group leaders and the scientists involved with the laser and diagnostic systems. If changes have been made since the two month submission, the PI shall submit an updated VISRAD model of the targets and revised SRF's that define each unique shot configuration prior to this meeting. (See **Sec. 4010** "Shot Request Forms and Administration" for more on the forms.)

4.3.1.2 All new diagnostics must be fully qualified two full weeks before the date of the experiment. Contact the Experimental Support Group (ESG) Leader to coordinate the qualification process. Each diagnostic effort can take significant time to complete engineering and review. The intent to field a new diagnostic should be included in the proposal submitted at the annual FASC meeting. Work with the ESG Group Leader to ensure that the diagnostic is making progress adequate for the campaign day.

4.3.1.3 Final SRF's shall be submitted to the respective Laser Facility Manager by the close of business on the Monday prior to the week of target shots. A one-week PI brief is conducted to ensure all elements of the campaign plan are complete in final form prior to execution. The SRF's are locked to changes on Thursday at midnight (local Rochester time) the week prior to the experiment. The Laser Facility Manager shall be notified of subsequent change requests prior to the initiation of the shot by the operations crew. Any special requirements for set up of the diagnostics for the first shot should be clearly indicated: for example, modifications to the ten-inch manipulator setup sheets.

4.3.1.4 By two working days before the shots, the PI will provide target metrology results for all targets to the Experimental Operations Group Leader. Additionally, the theoretical 1-D-calculated neutron yield and method of calculation must be provided to the Laser Facility Manager for all fusion-yield targets.

4.3.1.5 For the day of the campaign, the PI will support the shift briefings as appropriate. During the actual execution of the experiments, the PI will act as an advisor to the LLE Shot Director and may be called upon to render advice on whether to proceed with planned experiments in the event of abnormal system performance. The Shot Director is in charge of the overall laser and target systems during a shot series. If issues associated with safety (personnel or equipment) arise during an experimental sequence, the Shot Director shall abort that shot or possibly the whole series if warranted.

4.3.1.6 Submit the Shot Effectiveness Form via the Shot Images and Reports webpage prior to the shot after next.

4.3.2 Experimental Critiques

Once the campaign has been conducted, it is the responsibility of the PI to upload a written critique to the Campaign Proposal Template webpage for FASC review [within one week after the campaign has been conducted]. The following items should be included:

- Problems encountered
 - laser
 - experimental diagnostics
 - experimental
 - target
- Suggestions for improvements
- Positive feedback

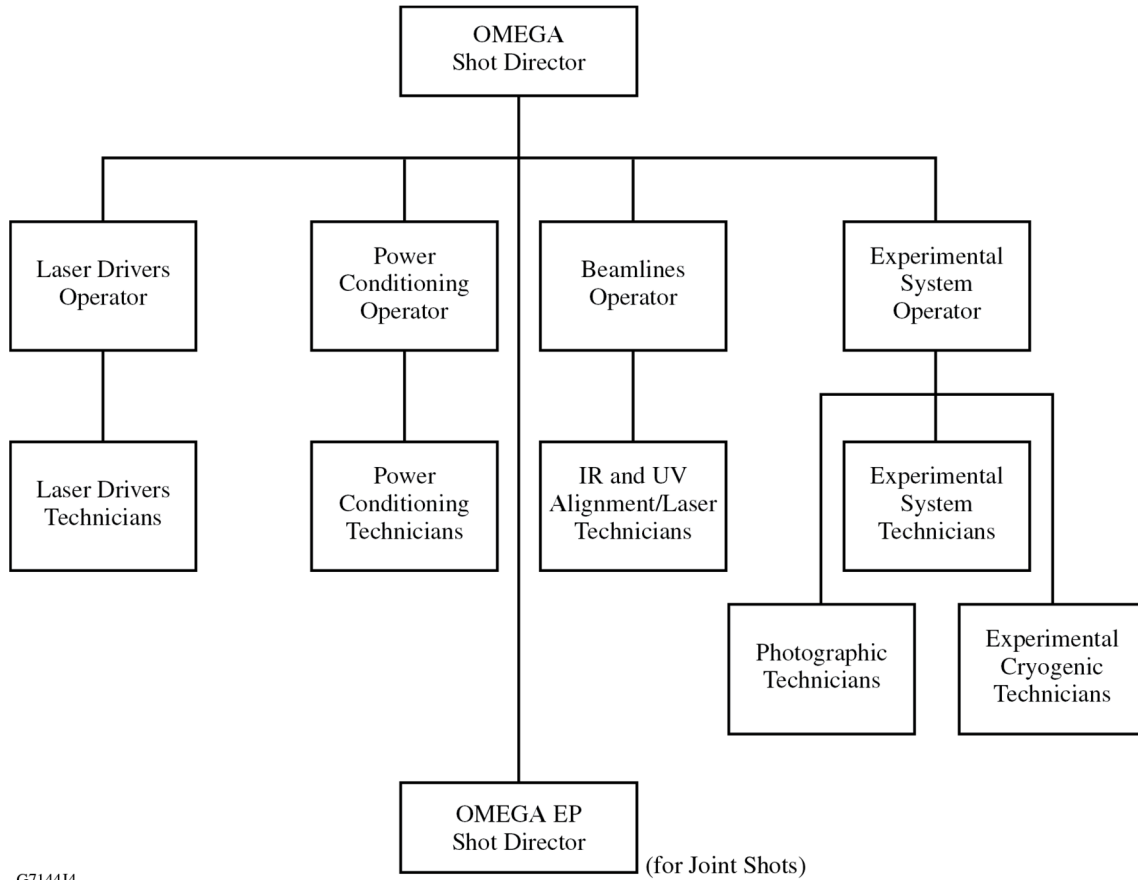
1005 Omega Data Ownership and Access

1. The Laboratory for Laser Energetics of the University of Rochester owns all data stored on the Omega Database.
2. Principal Investigators and Co-PI's listed on the Omega SRF for a system target shot, as well as scientists from the PI's and Co-PI's home institution with Omega web accounts, have access to the data generated on their target shots.
3. Access to the Omega database by non-PI's or Co-PI's for specific Omega target shots can be requested. Requests for such data should be directed to the Omega Experimental Users Coordinator. The Experimental Users Coordinator will coordinate with the institution who conducted the target shots to obtain approval to access to the requested data.

1006 Laser Facility Operations Overview

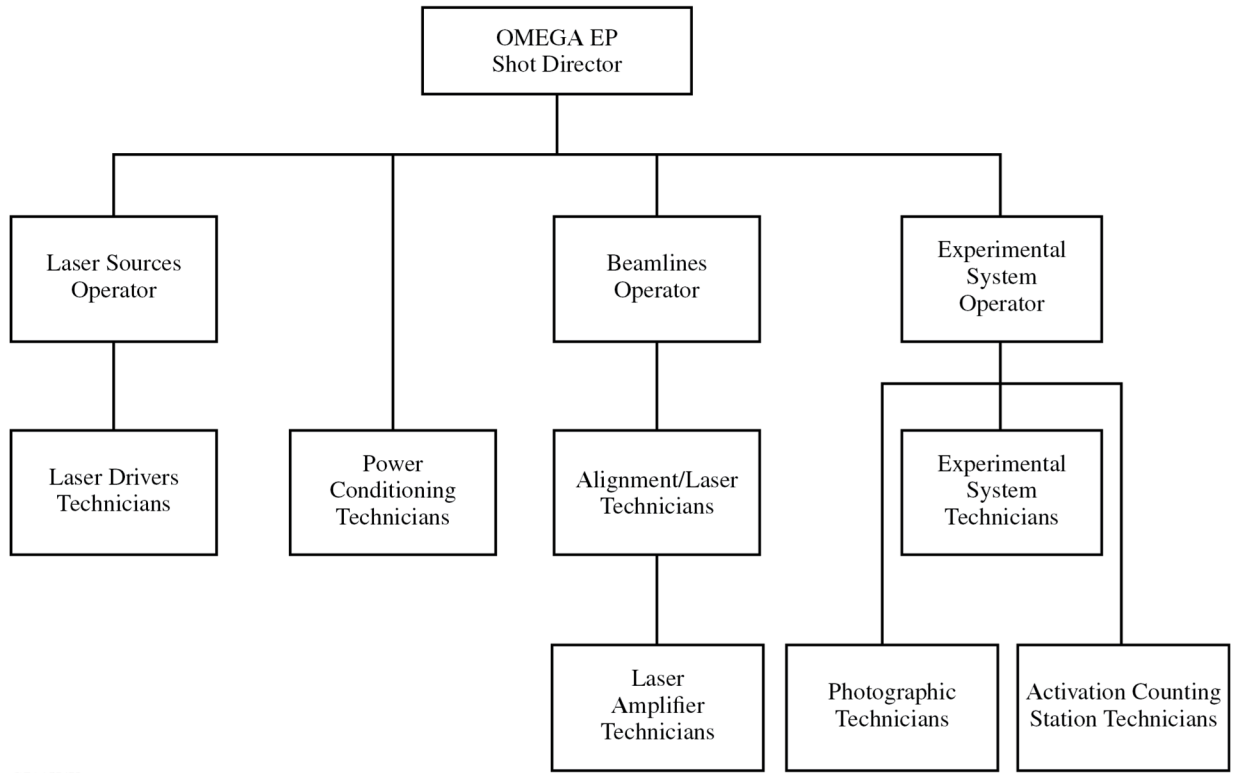
All aspects of Omega shot operations are under the direction and control of the Omega Facility Operations organization shown in Fig. I-3. OMEGA and OMEGA EP may be operated independently, with separate scientific objectives for each system, or jointly with the combined capabilities addressing a single requirement. For certain high-yield shots, the opposite facility will have to be in closed access even though the facilities are operating independently. The Shot Director(s) are under the overall direction of the respective Laser Facility Manager, who heads the Omega Shot Operations watch organization. For joint OMEGA and OMEGA EP operations, the OMEGA EP Shot Director reports to the OMEGA Shot Director. This watch organization will directly control the actual shot operations and will be responsible for safety, shot execution, and data collection.

The CTHS, Tritium Filling Station (TFS), Tritium Removal Systems (TRS), and cryogenic Cart Maintenance Room (CMR) are operated by qualified watchstanders under the direction and control of the Cryogenic and Tritium Facility Manager (see Fig. I-4). The CTHS target chamber insertion and positioning systems are operated through the Omega Facility's watch organization (see Fig. I-4).



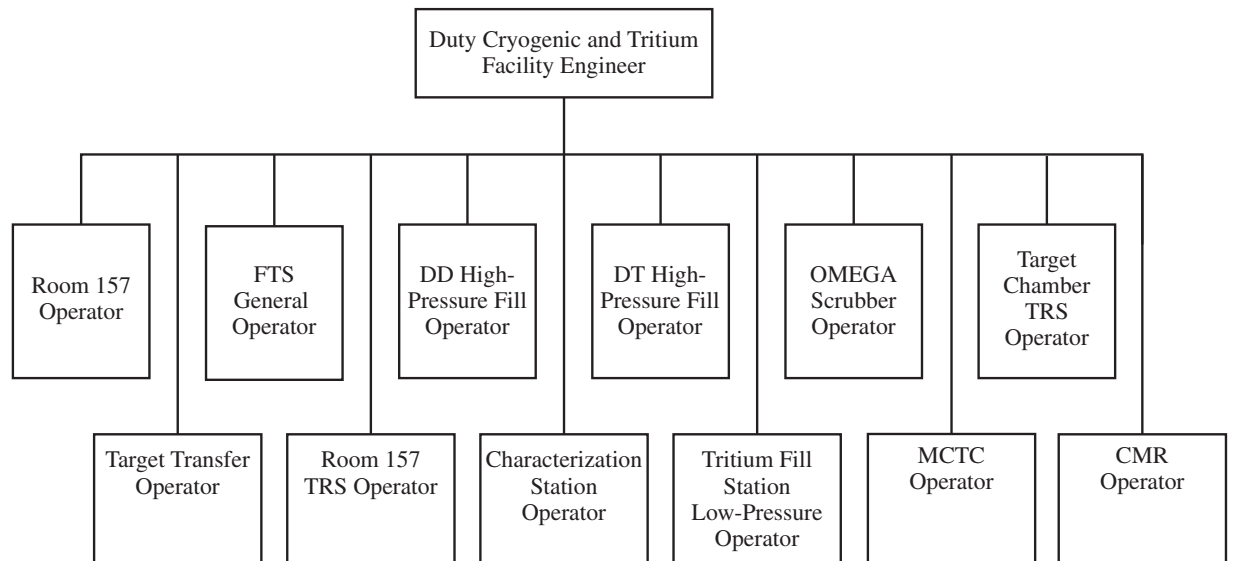
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Figure I-3(a): OMEGA watch organization.



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Figure I-3(b): OMEGA EP watch organization.



G7143JX

Figure I-4: CTHS organization.

The full OMEGA/OMEGA EP shot watch organization (excluding CTHS filling, layering, and characterization watches), unlike the divisional administrative organization, is operative only during shot operations. Personnel qualified for and assigned to these watches during specific periods of time may come from any of the Laboratory's divisions. While assigned to a watch, however, they report to and are directed by the Shot Director until relieved.

For shot operations, the watch organization shown in Fig. I-3 must be manned to the extent detailed in **Sec. 2022**. During non-shot periods (maintenance and/or scheduled system modifications or upgrades) at a minimum, a Shot Director will be stationed.

System corrective and preventive maintenance will be scheduled and performed by the existing Laboratory divisional organization. Divisional responsibilities for services (e.g., mechanical design, electronics design, computer software, etc.) and equipment/systems are detailed below. Where equipment and systems cross divisional lines, one lead Division is assigned the overall responsibility. Corrective and preventive maintenance will be scheduled in consonance with the Laser System Schedule approved by the FASC. Scheduled divisional maintenance will be approved by the Group Leader designated by the Division Director. The Laser Facility Manager, or Cryogenic and Tritium Facility Manager, as appropriate, or person appointed by them will review, track, and monitor the scheduling and completion of all key scheduled maintenance actions.

To ensure the operational readiness of the OMEGA/OMEGA EP Laser Systems, including laser, target, cryogenic targets, and building support systems, the placing of major equipment or systems (those that would prevent completing a fully diagnosed target shot) out of commission will be controlled by the Omega Shot Operations watch organization under the direction of the Laser Facility Manager or the CTHS organization under the direction of the Cryogenic and Tritium Facility Manager as appropriate. The divisional representative will obtain permission from the on-watch Shot Director or Cryogenic and Tritium Facility Manager as appropriate prior to placing major equipment or a system out of commission. The return of equipment and systems to commission after maintenance will also be reported to the Shot Director or Cryogenic and Tritium Facility Manager as appropriate. The Shot Director and Cryogenic and Tritium Facility Manager will maintain a log for their areas of responsibility indicating the current status of equipment placed out of commission. Separate logs for OMEGA, OMEGA EP, and CTHS will be maintained.

Omega Laser Facility service and equipment responsibilities are as follows:

Omega Facility Division

Services:

- Optical design
- Clean room (Laser Bay and Target Bay)
- Film and image plate processing and digitizing

Equipment/Systems:

- Alignment sensor packages

Blast window assemblies, distributed phase plates, distributed polarization rotators
Cryogenic Target Handling System
Deformable mirrors
De-ionized water and glycol cooling systems (including controls, indications, and purification)
Experimental control and data acquisition
Experimental target diagnostic peripherals (e.g., nose cones, filters, pin holes, etc.)
Focus lens subassembly
Frequency conversion
Grating compression chamber and beam transport tubes and associated vacuum systems
Grounding system
Infrared and ultraviolet alignment
Interlock system (door interlocks, motion detectors, warning light and alarm controls, and dump system)
Laser amplifiers and structures (service cranes, etc.)
Laser diagnostics [harmonic energy diagnostic, calorimetry, spectrometer, near-field and far-field measurement, UV transport calibration, wavefront sensors, beam timing, pulse shape, optical time-domain reflectometry (OTDR), and pulse contrast]
Laser control system [including interfaces, cabling, card cages, neuron modules, cable converters, and programmable logic controller (PLC) subsystems less SUN and Linux workstations and displays]
Laser drivers—smoothing by spectral dispersion (SSD), multiple-pulse driver line (MPD), backlighter, and fiducial for OMEGA and short- and long-pulse and 4ω probe for OMEGA EP
Laser elements (alignment sensors, polarization control optics, mirrors, beam splitters, flip-in devices, spatial filters, path-length adjusters, spatial light modulators, static wavefront correctors, tiled-grating assembly, and apodizers)
Nitrogen purge system
Off-axis parabola inserter
Optics
Parabola alignment diagnostic
Periscope mirror assembly
Plasma-electrode Pockels cell (PEPC)
Power conditioning including PEPC power conditioning
Radiation detection system
Short-pulse alignment
Spatial filters
Spatial-filter vacuum systems
Structures (end mirror, target mirror, target area, spatial filter, etc.)
Target chambers and associated vacuum systems
Target positioning

Target viewing
Tritium Filling Station
Tritium Removal Systems

Engineering Division

Services:

Electronics design
Electronics Shop
Machine Shop
Mechanical design
Optical Fabrication Shop
Optical Manufacturing Shop
Software development and maintenance
Computer support
Informatics
Webpage support

Equipment/Systems:

Imaging system
Hardware Timing
System public address system
Control software system
Access control system and facility interlocks
Intercom party line communication system
Beam alignment LON
Network wiring and hub equipment
Facility Wi-Fi
Windows, SUN, and Linux workstations and displays
Databases and file storage

Experimental Division

Services:

Film digitizing
Target production

Equipment/Systems:

Experimental target diagnostics
Laser diagnostics (streak cameras and harmonic energy diagnostics)
Targets

Administration Division

Services:

Accounting
Administrative services
Facility improvements

Personnel services
Purchasing

Equipment/Systems:

De-ionized water and glycol pumps, motors, and heat exchangers
Electrical distribution (switch gear, motor control centers, power panels, breakers, distribution to connected equipment, emergency diesel generators, and distribution to power conditioning units)
Heating, ventilation, air-conditioning system, and digital direct control system
Pneumatic air and nitrogen systems
Target/Laser Bay 10-T cranes
Target Bay elevator

1007 Omega Operations Manager

The Omega Operations Manager is responsible for the overall operation and operational readiness of the Omega Laser Facility including the OMEGA compression and OMEGA EP Laser Systems. The Operations Manager reports to the Omega Facility Director. The Operations Manager has a support staff of an OMEGA Laser Facility Manager and OMEGA EP Laser Facility Manager. The Operations Manager has the following specific responsibilities:

- Manage the Omega Laser Facility to ensure that it is fully ready to execute the schedule of experiments proposed by the FASC and approved by the LLE Director.
- Manage laser facility operations to ensure operations are conducted effectively and safely.
- Manage and report status for action items stemming from Facility Safety inspections, participate in all Laboratory Safety inspections within Facility envelope.
- Administer facility access requirements and procedures.
- Make recommendations regarding the procurement of all laser facility services, operating equipment spares, supplies, and replacement system components.
- Manage all laser facility maintenance to ensure safety and operational readiness.
- Coordinate facility schedule with operations Facility Managers, Group Leaders, and Engineering or Experimental as required.
- Maintain system configuration control and management.
- Recommend and direct improvement projects within the Facility; schedule, monitor, and report on projects.
- Review periodic Facility performance reports.
- Coordinate projects with functional group leaders and engineering group leaders.
- Recommend staffing adjustments and review watchstanding training records.
- Maintain a list (or database) of facility qualified and proficient watchstanders.

- Ensure and certify compliance with periodic Omega Facility training requirements annually.

1008 Laser Facility Managers (OMEGA and OMEGA EP)

The Laser Facility Manager (LFM) is responsible for the overall operation and operational readiness of his respective facility (OMEGA or OMEGA EP). The Laser Facility Managers report to the Operations Manager. The LFM has a support staff of an Associate LFM. The Laser Facility Manager has the following specific responsibilities:

- Directly supervise the OMEGA and OMEGA EP Shot Directors to ensure that he/she fulfills his/her responsibilities in operating the applicable facility.
- Recommend written procedures covering shot operations to the Omega Operations Manager for approval. Approve written change notices as required to clarify or amend these procedures in advance of the approval of a formal revision.
- Control and monitor all laser facility maintenance to ensure safety and operational readiness.
- Make recommendations regarding the procurement of all laser facility services, operating equipment spares and supplies, and system upgrade components.
- Directly manage watchstander training and qualification and certify the qualification of all operators and Shot Directors.
- Serve as a member of the Omega FASC and provide this committee with a review of all experimental proposals, a periodic report of system status, and the status of completing scheduled experimental operations.
- Approve the facility watchbills.
- Review, approve, and schedule all Work Authorization Procedures.
- Maintain facility access authorization list and training material. Approve keycard access to respective facility.
- Provide daily written directions for laser facility operations in the Laser Facility Manager's Day Order website. Separate sites for OMEGA and OMEGA EP will be maintained.
- Present updates of Omega Availability and Effectiveness and operational plans at LLE Group Leader Meetings, provide summaries at the FASC Annual Meeting, and as required by the Omega Facility Division Director.
- Review and approve all requests for device network connection within OMEGA and OMEGA EP, respectively.

1009 Laser System Scientist

The Laser System Scientist is responsible for the safe propagation of the laser in each laser system. The Laser System Scientist reports to the Omega Facility Director and has the following responsibilities:

- Support the preparation, qualification, and operation of the laser in close coordination with the Laser Facility Manager and Shot Directors. He/she is available during daily system qualification, subnanosecond or unique pulse shaping, and when oversight of system energy or energy balance is required. When not on site, he/she should be accessible by cell phone and/or virtual meeting room.
- Qualify the laser-beam spatial profile at the start of daily shot operations.
- Maintain the system energy balance and specify the system setup for unique energy balance conditions specified by experimental PI's.
- Qualify the laser for short-pulse and picket-pulse operations and approve the pulse shape and energy settings for each shot.
- Analyze system performance.
- Advise the Laser Facility Manager and Shot Director during any abnormal laser conditions including directing the suspension of operations if deemed necessary.

1010 Cryogenic and Tritium Facility Manager

The Cryogenic and Tritium Facility Manager is responsible for the overall operation and operational readiness of the Cryogenic Target Handling System, Tritium Filling Station, Tritium Removal Systems, and Cart Maintenance Room [collectively included in the Cryogenic and Tritium Facility (CTF)]. The Cryogenic and Tritium Facility Manager reports to the Omega Facility Division Director and has the following specific responsibilities:

- Manage the CTHS to ensure the reliable delivery of cryogenic targets of acceptable quality to the OMEGA laser to execute the schedule of experiments proposed by the FASC and approved by the Director of LLE.
- Control access to the CTF and ensure that personnel who are not qualified as LLE Radiation Workers are escorted.
- Manage the TFS to ensure room-temperature DT targets are supplied to the OMEGA compression facility.
- Direct facility operations to ensure that they are conducted effectively and safely.
- Directly supervise the CTHS, TFS, TRS, and CMR operators to ensure that they fulfill their responsibilities.
- Coordinate the preparation and maintenance of written procedures covering CTHS, TFS, TRS, and CMR operations. Approve written change notices as required to clarify or amend these procedures in advance of the approval of a formal revision by the Omega Facility Division Director.
- Manage and control all CTHS, TFS, TRS, and CMR maintenance to ensure operational readiness.

- Make recommendations regarding the procurement of all services, operating equipment spares and supplies, and system upgrade components.
- Be responsible for the overall CTF system configuration control and management. Coordinate all control system modifications including ensuring Omega Laser Facility Manager approves applicable changes.
- Directly manage watchstander training and qualification and certify the qualification of all CTHS and TRS watchstanders.
- Maintain a list of qualified and proficient CTF watchstanders.
- Maintain the tritium inventory and a log of radioactive material.
- Ensure that all radiological safety procedures are followed and report any radiological incidents to the LLE Radiation Safety Officer.
- Ensure compliance with all procedural requirements of this LFORM; Vol. IV, Operating Procedures; the LLE Radiological Controls Manual; and other LLE Instructions.
- Control of system status including placing systems and equipment out-of-commission for maintenance and/or testing, maintaining the Equipment Status Log (**Sec. 4004**), and approving system/equipment Tagouts/Lockouts (**Sec. 4005**). NOTE: Where systems interface with the OMEGA facility, the facility Equipment Status Log and Tagout system under the purview of the Shot Director should be used.
- Ensure that qualified watchstanders (**Sec. 2024**) are stationed in accordance with the posted watchbill (**Sec. 2022**) prior to conducting CTHS or TRS operations.
- Ensure a CTHS, TFS, TRS, and CMR Facility Log is maintained to document operations.
- Conduct prewatch and watch briefings as required.
- Approve and inspect all radioactive material shipments received in and transferred out of the CTF.
- Keep the Omega Facility Director, appropriate Group Leaders, and others, as appropriate, informed of system status and problems. As a minimum the following will be reported:
 - Failure to have targets ready for scheduled experiments (Omega Experiments Group Leader and Laser Facility Manager).
 - Failure of equipment that disrupts operations (applicable Division Director and Group Leader).
 - Any release of tritium above normal (LLE Radiation Safety Officer).
 - Accident or incident that causes or could have caused personnel injury or significant equipment damage (applicable Division Director, Laboratory Safety Officer, and applicable Functional Safety Officer). Additionally, incident



investigation and reporting in accordance with LLEINST 6950 must be completed



Part II: Watch Organization and Watch Relief

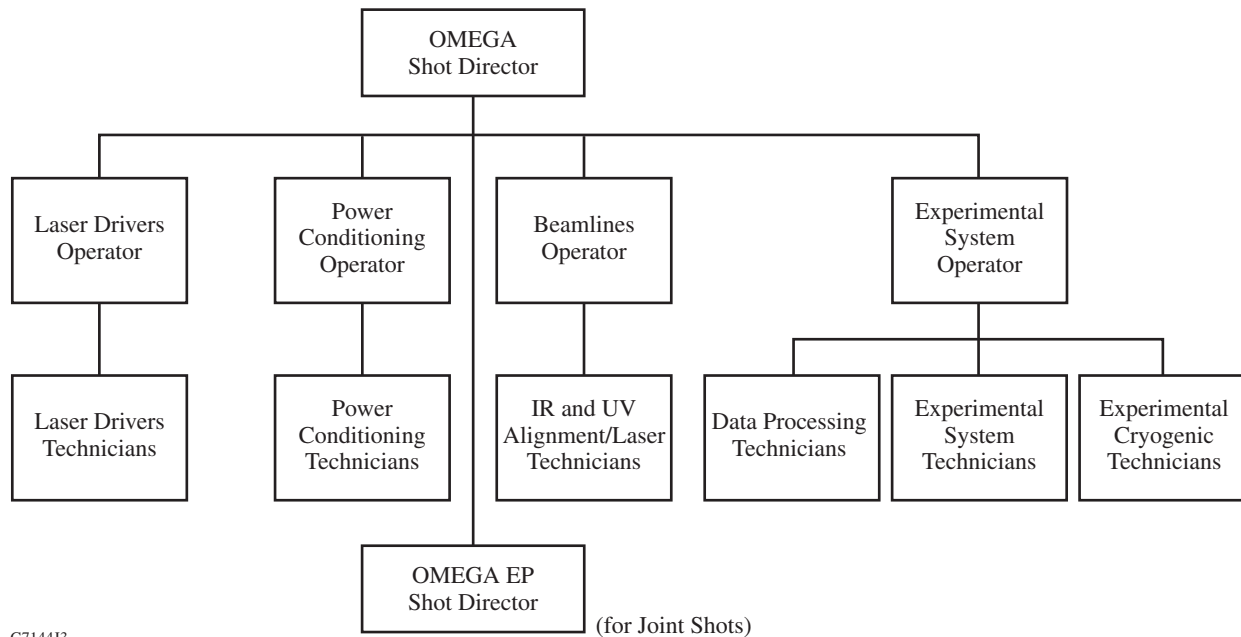
2000	Watch Conditions
2001	Shot Director (SD)
2002	Laser Drivers/Sources Operator (LDO/LSO) for OMEGA and OMEGA EP
2003	Power Conditioning Operator (PCO)
2004	Beamlines Operator (BO)
2005	Experimental System Operator (ESO)
2006	Laser Drivers/Sources Technician (LDT/LST) for OMEGA and OMEGA EP
2007	Power Conditioning Technician (PCT)
2008	UV-Alignment Laser Technicians (UV-ALT) for OMEGA/ Alignment Laser Technician (ALT) for OMEGA EP
2008A	IR-Alignment Laser Technician (IR-ALT) for OMEGA/ Amplifier Technician (AT) for OMEGA EP
2009	Experimental System Technician (EST)
2009A	Processing Technician (PT)
2009B	Experimental Cryogenic Technician (ECT)
2009C	Instrument Principal Investigator/Specialist/Technician
2009D	Cu Activation Counting Station Technician (ACST)
2009E	Image-Plate Scan Technician
2010	Room 157 Operator
2011	FTS Target Transfer Operator
2012	FTS General Operator
2013	Characterization Station Operator
2014	DD High-Pressure-Fill (HPS2) Operator
2015	Tritium Fill Station Low-Pressure-Fill Operator
2016	DT High-Pressure-Fill Operator
2017	Room 157 TRS Operator
2018	OMEGA Scrubber Operator
2019	TC TRS Operator (TC TRSO)
2020	Cart Maintenance Room (CMR) Operator
2020A	MCTC Operator
2020B	LaCave MCTC Operator
2021	Condition 1 Watch Organization—Maintenance Operations
2022	Condition 2 Watch Organization—Shot Operations
2023	Watchbill
2024	List of Qualified and Proficient Watchstanders
2025	Pre-Watch Briefing and Watchstander Relief
2026	Laser Facility Manager Day Orders
2027	Shot Director Log
2028	Watchstanding Proficiency

2000 Watch Conditions

One of two watch conditions will be stationed whenever the Omega Laser Facility (LF) is open for scheduled maintenance or shot operations. These watch conditions apply independently to both OMEGA and OMEGA EP. Normally, the LF is open from 0400–1730 on Monday and Friday and from 0400–0100 (next day) on Tuesday, Wednesday, and Thursday. Extended-shift experimental shot operations are conducted from 0800–2000 (0800–2100 on OMEGA EP) on Tuesday, Wednesday, and Thursday on OMEGA. Maintenance or laser system shots are conducted on Monday and Friday. The watch conditions are defined as follows:

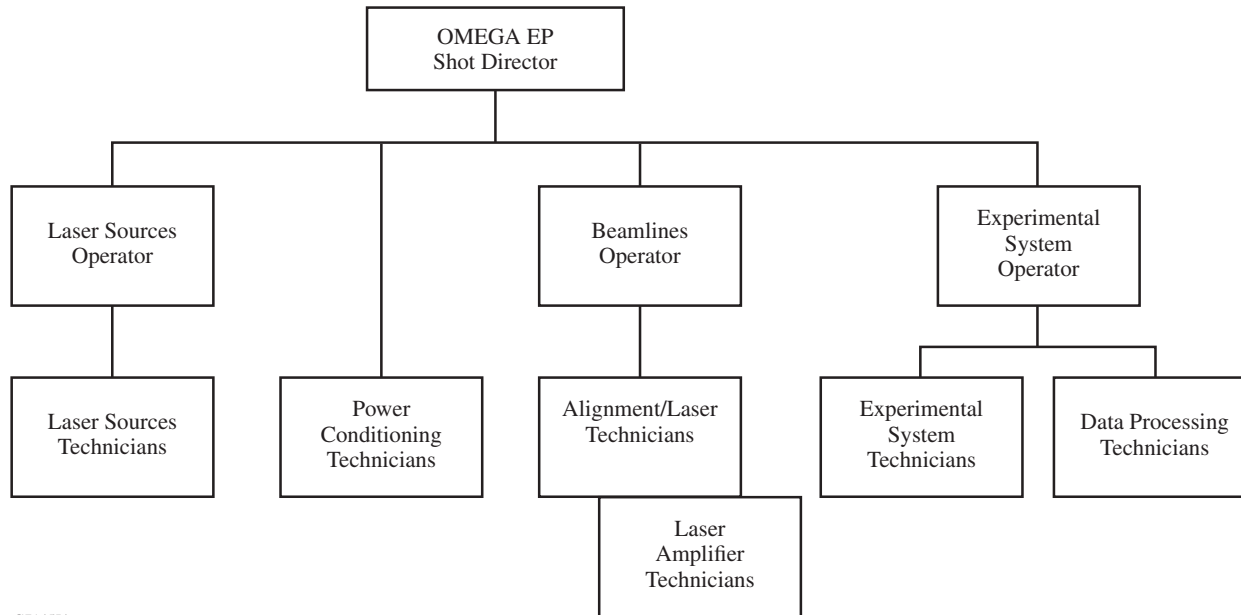
Watch Condition 1: This watch condition applies during LF maintenance, the time prior to shot operations when preoperational checks are being completed, or when shot operations are disrupted for a significant period of time.

Watch Condition 2: This watch condition [Figs. II-1(a) and II-1(b)] applies during LF shot operations. The Shot Director will transition to watch condition 2 before establishing “closed access” for the first shot of a day and remain stationed throughout the period of shot operations. During this watch condition, watchstations must be manned according to the shot type detailed in **Sec. 2022**. Watchstations not required for shots may be secured with Shot Director approval.



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Figure II-1(a): OMEGA watch organization.



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Figure II-1(b): OMEGA EP watch organization.

2001 Shot Director (SD)

The Shot Director (either for OMEGA or OMEGA EP) is the senior watchstander responsible for the overall operation of the respective laser during shot operations as well as during maintenance periods. The SD's area of responsibility includes the operational control of all laser and target systems, equipment, and ancillary support systems. Additionally, the SD operates the software applications that control facility access and safety interlocks, and the Shot Executive. A separate SD for OMEGA and OMEGA EP will be stationed whenever the applicable facility is open and will be located within the building for the duration of his/her shift. During stand-down periods when Watch Condition 1 is stationed, such as meal breaks, the Shot Director may go off-site briefly, as long as he/she has a communication device. The SD must be in the control room when establishing "closed access" and for performing checklists until the shot is complete. The SD reports directly to the applicable Laser Facility Manager. For joint operations, the OMEGA EP SD reports operationally to the OMEGA SD and administratively to the OMEGA EP Facility Manager. The SD's specific responsibilities include the following:

- Direct operational control of the OMEGA or OMEGA EP Laser System and assigned watchstanders in the completion of all laser and target shots. This includes coordinating the completion of preoperational checks, alignments, and preparations required to fulfill the system or experimental requirements, directing the completion of actual system and experimental shots, and ensuring that the requisite system and experimental shot data are collected.

- Provides the primary interface between the Principal Investigator and the shot crew.

- Operation of the Shot Executive.

Ensuring compliance with all procedural requirements of this LFORM, the Laser Facility procedures and other LLE Instructions.

Ensuring compliance with safety procedures including that upon establishing “closed access” the applicable Laser Bay, Target Bay, Capacitor Bay, LaCave, Diagnostic Bays, Laser Sources Bay, and Viewing Gallery are cleared of all personnel, as appropriate, prior to executing a shot.

Ensuring that the Laser Facility shutdown checklist is completed at the conclusion of operations. The shutdown checklist must be completed daily at the end of maintenance or shot operations.

Control of system status including placing systems and equipment out-of-commission for maintenance and/or testing, maintaining the Equipment Status Log (**Sec. 4004**), approving system/equipment Tagouts/Lockouts (**Sec. 4005**), and maintaining Work Authorization Procedures (**Sec. 4003A**).

Reviewing the Equipment Status Log prior to assuming watch.

Controlling access to the Target Chamber Center to ensure against conflicting requirements.

Controlling access to the Control Room during Watch Condition 2 (**Sec. 4001A**).

Control facility access and escort requirements in accordance with **Sec. 4002**.

Ensuring that qualified and proficient watchstanders (**Secs. 2024 and 2028**) are stationed in accordance with the posted watchbill (**Sec. 2023**) prior to conducting shot operations.

Keeping a Shot Director Log (**Sec. 2027**).

Conducting prewatch and watch briefings as required.

Creating, controlling, and/or modifying shot templates, including updating the SRF database entries to reflect the final shot configuration.

Performing the functions of the Power Conditioning Operator. The OMEGA EP SD will perform the function for all shots. The OMEGA SD will only perform these functions during startup qualification shots.

Keeping the Laser Facility Manager (LFM), Operations Manager, Principal Investigator (PI), applicable Division Directors, and others, as appropriate, informed of system status and problems. As a minimum the following will be reported:

Failure to commence shot operations as scheduled (LFM, Operations Manager, PI, Facility Director, and Experimental Division Director).

Failure of a system, equipment, or diagnostic that disrupts operations (LFM, Operations Manager, PI, applicable Division Director, and applicable Group/Section Leader).

Opening and closing of a target chamber or the grating compression chamber (LFM, Radiation Safety Officer).

Accident or incident that causes or could have caused personnel injury, causes or had the potential to cause significant equipment damage, causes environmental discharge limits to be exceeded, or causes a significant loss of Omega System effectiveness or availability (LFM, Operations Manager, applicable Division Director, Laboratory Safety Officer, applicable Functional Safety Officer). Additionally, incident investigation and reporting in accordance with LLEINST 6950 will be completed.

2002 Laser Drivers/Sources Operator (LDO/LSO) for OMEGA & OMEGA EP

The Laser Drivers/Sources Operator is the watchstander responsible for operation of the Laser Driver/Sources Executive to ensure that the necessary laser driver/source control, pulse shaping, and diagnostic functions are provided. He/she has overall responsibility for verifying that the laser driver/sources equipment is configured to support planned shot operations. The LDO/LSO will be stationed during Watch Condition 2 as required by **Sec. 2022**. During the time from performing checklist until a shot is completed, he/she must be present in the Control Room. The LDO/LSO reports directly to the Shot Director. His/her specific responsibilities include the following:

- Operation of the Laser Driver/Sources Executive and pulse-shaping controls.

- Keeping the Shot Director informed as to laser driver/sources status and reporting any system abnormalities or failures that affect the ability of the system to shoot.

- Coordinating the efforts of the assigned Laser Driver/Sources Technician Watchstanders in the operation of the Laser Driver/Sources System.

- Reporting his/her relief to the Shot Director.

2003 Power Conditioning Operator (PCO)

The Power Conditioning Operator is the watchstander responsible for operation of the Power Conditioning Executive to ensure that the correct amplifiers are armed and that the charge voltages are consistent with operational limits and beam-balance requirements. He/she has overall responsibility for ensuring that the power conditioning equipment is configured to support planned shot operations. The PCO will be stationed during Watch Condition 2 as required by **Sec. 2022**. During the time from performing checklist until a shot is completed, he/she must be present at the Power Conditioning console. The PCO reports directly to the Shot Director. His/her specific responsibilities include the following:

- Operation of the Power Conditioning Executive.

- Keeping the Shot Director informed as to power conditioning status and reporting any system abnormalities or failures that affect the ability of the system to shoot.

- Coordinating the efforts of assigned Power Conditioning Technician (PCT) Watchstanders in the operation of the Power Conditioning System.

- Maintaining a log of amplifier hardware changes that could affect amplifier energy performance.

Assisting the PCT with safing and repairs of power conditioning units (PCU's) as required.

Reporting his/her relief to the Shot Director.

2004 Beamlines Operator (BO)

The Beamlines Operator is the watchstander responsible for operation of the Beamline Executive to align and control the optical path from the driver/sources to the target prior to shot operations, to ensure the functionality of laser diagnostics at shot time, and to assess results between shots. The OMEGA EP BO is responsible for the alignment of the short-pulse IR beam to both the OMEGA and OMEGA EP target chambers. He/she has overall responsibility for ensuring that the alignment sensors, beam splitters, frequency-conversion crystals, spatial filter, and beam transport systems are configured to support planned shot operations. The BO will be stationed during Watch Condition 2 as required by **Sec. 2022**. During the time from performing checklist until a shot is completed, he/she must be present in the Control Room. The BO reports directly to the Shot Director. His/her specific responsibilities include the following:

Operation of the Beamlines Executive.

Keeping the Shot Director informed as to alignment and beamline diagnostic status and reporting any system abnormalities or failures that affect the ability of the system to shoot.

Coordinating the efforts of assigned IR and UV Alignment Laser Technician Watchstanders in the operation of the alignment, laser amplifier, frequency conversion, or beam transport systems.

Reporting his/her relief to the Shot Director.

2005 Experimental System Operator (ESO)

The Experimental System Operator is the watchstander responsible for operation of the Experimental System Executive to insert, view, and position targets; control target chamber vacuum systems; and operate experimental diagnostics. He/she has overall responsibility for ensuring that target and diagnostic systems are configured to support planned shot operations. The ESO will be stationed during Watch Condition 2 as required by **Sec. 2022**. During the time from performing checklist until a shot is completed and data acquisition has concluded, he/she must be present in the Control Room. The ESO reports directly to the Shot Director. His/her specific responsibilities include the following:

Operation of the Experimental System Executive; vacuum, diagnostic, and cryogenic target controls; and target diagnostic status.

Keeping the Shot Director informed as to target and diagnostic system status and reporting any system abnormalities or failures that affect the ability of the system to shoot.

Coordinating the efforts of assigned Experimental System Technician Watchstanders in the operation of the target vacuum, positioning, and diagnostic systems including film and neutron activation sample retrieval and developing/counting.

Coordinating the efforts of assigned Experimental Cryogenic Technician Watchstanders in the operation of the Moving Cryostat Transfer Cart (MCTC) and Lower Pylon systems in preparing for and recovering from cryogenic shots.

Coordinating access of individuals (internal and external) authorized by the Shot Director to the Target Bay, including assigning escorts as required.

Supervise the secondary ESO (when assigned) to ensure a distinct division of responsibilities is assigned and completed.

In conjunction with the Shot Director, control access to Target Chamber Center to ensure against conflicting requirements.

Update SRF database entries to reflect the final shot configuration of targets and diagnostics.

Reporting his/her relief to the Shot Director.

2006 Laser Drivers/Sources Technician (LDT/LST) for OMEGA & OMEGA EP

The Laser Drivers/Sources Technician is the watchstander responsible for local monitoring/adjustment of the drivers/sources. The LDT/LST will be stationed during Watch Condition 2 as required by **Sec. 2022**. The LDT/LST reports to the Shot Director via the Laser Drivers/Sources Operator. His/her specific responsibilities include the following:

Local monitoring and operation of the laser drivers/sources from the oscillator through the large-aperture ring amplifier (LARA) for OMEGA and to the injection table for OMEGA EP.

Keeping the Laser Drivers/Sources Operator informed as to drivers/sources status and reporting any system abnormalities or failures that affect the ability of the system to shoot.

The LST shall be responsible for conducting Laser Sources Bay sweeps.

Reporting his/her relief to the Shot Director.

2007 Power Conditioning Technician (PCT)

The Power Conditioning Technician is the watchstander responsible for preoperational checks and required corrective maintenance of the Power Conditioning System during shot operations. The PCT will be stationed during Watch Condition 2 as required by **Sec. 2022**. The PCT reports to the Shot Director via the Power Conditioning Operator for OMEGA and directly to the Shot Director for OMEGA EP. His/her specific responsibilities include the following:

Completing preoperational checks and maintenance of the Power Conditioning System.

Keeping the Power Conditioning Operator (OMEGA)/Shot Director (OMEGA EP) informed as to power conditioning status and reporting any system abnormalities or failures that affect the ability of the system to shoot.

Safing of power conditioning units as required for laser amplifier lamp replacement or maintenance.

Conducting Capacitor, Diagnostic Bay, and LaCave sweeps.

Reporting his/her relief to the Shot Director.

2008 UV-Alignment Laser Technician (UV-ALT) for OMEGA/Alignment Laser Technician (ALT) for OMEGA EP

The UV-Alignment Laser Technician is the watchstander responsible for alignment of the optical path from the stage-F alignment sensor package (F-ASP) to target, operation of the laser diagnostics, and frequency-conversion crystals during shot operations. Additionally, they perform corrective maintenance of the alignment, frequency conversion, beam transport, and laser diagnostic systems during shot operations. In OMEGA EP, the Alignment Laser Technician is responsible for aligning the short-pulse IR beam to both the OMEGA and the OMEGA EP target chambers. The UV-ALT's and the ALT will be stationed during Watch Condition 2 as required by **Sec. 2022**. They will keep the BO informed as to their whereabouts. The UV-ALT's and ALT report to the Shot Director via the Beamline Operator. Their specific responsibilities include the following:

Completing preoperational optical alignment and other amplifier, frequency conversion, beam transport, laser diagnostic, and ancillary system startup/checkout to support shot operations.

Keeping the Beamline Operator informed as to beamline status and reporting any system abnormalities or failures that affect the ability of the system to shoot.

Conducting Laser Bay sweeps.

Reporting his/her relief to the Shot Director.

2008A IR Alignment Laser Technician (IR-ALT) for OMEGA/Amplifier Technician (AT) for OMEGA EP

The IR Alignment Laser Technician/Amplifier Technician is the watchstander responsible for servicing amplifiers during shot operations. He/she will be stationed during Watch Condition 2 as required by **Sec. 2022**. The IR-ALT/AT reports to the Shot Director via the Beamline Operator. His/her specific responsibilities include the following:

Conducting maintenance of the amplifiers and amplifier DI water and glycol cooling systems.

Replacing amplifier flash lamps and making cable connector repairs.

Maintaining the Amplifier Facility Controllers.

Conducting Bay sweeps, as required by the Shot Director.

Reporting his/her location to the Beamlines Operator and Shot Director.

Reporting his/her relief to the Shot Director.

2009 Experimental System Technician (EST)

The Experimental System Technician is the watchstander responsible for preparation of target diagnostic systems prior to shots, retrieval of film and neutron activation specimens, and target diagnostic change outs between shots. He/she is also responsible for the insertion of the off-axis parabola (OAP) and the parabola alignment diagnostic to support alignment of the OAP to target. The EST will be stationed during Watch Condition 2 as required by **Sec. 2022** and will normally be present in the vicinity of the Control Room or Darkroom during “closed access.” He/she will keep the ESO informed as to his/her whereabouts. The EST reports to the Shot Director via the ESO. His/her responsibilities include the following:

Completing preoperational checks of the target chamber vacuum, OAP insertion, and target diagnostic systems to support shot operations.

Servicing diagnostics, retrieval of film, knock-on detectors, and neutron activation specimens and insertion of warm targets between shot operations.

Keeping the Experimental System Operator informed as to target diagnostic system abnormalities or failures that affect the ability of the system to shoot.

Preparation and securing of the Target Bay equipment that is specific to cryogenic shots including the upper pylon/linear induction motor (LIM).

Escort authorized personnel from LLE and outside organizations while in the Target Bay in support of shot operations.

Conducting Target Bay sweeps.

Reporting his/her relief to the Shot Director.

2009A Processing Technician (PT)

The Processing Technician is the individual responsible for the development of all film and image plates associated with laser and target operations. The PT will be stationed during Watch Condition 2 as required by **Sec. 2022** and will normally be present in the Darkroom. He/she will keep the ESO informed of his/her whereabouts. His/her specific responsibilities include the following:

Operation of JOBO film processors to develop all film associated with laser and target operations.

Operation and maintenance of image-plate scanners for laser and target operations.

Drying, labeling, and storing/filing of processed film.

Film preparation and loading film packs.

Maintaining inventory of film(s), image plates, and developmental chemical inventories.

2009B Experimental Cryogenic Technician (ECT)

The Experimental Cryogenic Technician is the watchstander responsible for connection of the MCTC to the lower pylon and its operation in support of OMEGA cryogenic shot operations. The ECT will be stationed during Watch Condition 2 as required by **Sec. 2022**. He/she will keep the ESO informed as to his/her whereabouts. The ECT reports to the Shot Director via the ESO. His/her responsibilities include the following:

Preparation, operation, and securing of the lower pylon including the chain locker.

Docking of the MCTC at the lower pylon and operation of the jointed subsystems through the shot cycle.

Disconnecting the MCTC and securing the lower pylon after the target is expended.

Keeping the ESO informed as to the status of the equipment.

Maintaining appropriate liaison with the MCTC Operations Engineers in CTF.

Reporting his/her relief to the Shot Director.

2009C Instrument Principal Investigator/Specialist/Technician

An Instrument Principal Investigator is the system expert for a specific instrument who is the point person for administering changes to design or answering questions on performance of the instrument. Normally, the Principal Investigator is the developer for the instrument or a designee of the developer. An Instrument Specialist is one who is qualified by the instrument Principal Investigator to handle alignment and repairs to the instrument in addition to nominal operations. An instrument technician is qualified to operate the instrument for either shot operations or preparations for shot operations. Instrument Specialists/Technicians will be administratively qualified by completing the qualification card in **Sec. 3009C**. The completion of annual refresher training is necessary to maintain proficiency.

2009D Cu Activation Counting Station Technician (ACST)

The Cu Activation Counting Station Technician is responsible for operating the copper (Cu) activation counting station to assay on-shot samples collected by the activation retractor diagnostic, tertiary activation diagnostic (tad), and near target arm (NTA) diagnostics.

2009E Image-Plate Scan Technician

An Image-Plate Scan Technician is responsible for preparing the image plate for use, operating image plate scanner, and storing data into the shot archive. The Image-Plate Scan Technician will be qualified by completing the qualification card in **Sec. 3009E**.

2010 Room 157 Operator

The Room 157 Operator is the watchstander responsible for the general operations in the cryogenic and tritium facility. This is a prerequisite for all other CTF watchstanding positions.

2011 FTS Target Transfer Operator

The Target Transfer Operator is the watchstander responsible for transferring targets from the Fill and Transfer System (FTS) to the MCTC. The target transfer operator reports to the Cryogenic and Tritium Facility Group Leader via the FTS Engineer. His/her responsibilities include the following:

- Loading targets in the target rack and insertion into the FTS permeation cell.
- Transferring cryogenic targets from the FTS rack to the MC stalk.
- Removal of the target rack from the FTS and decontamination of the target rack.

2012 FTS General Operator

The FTS General Operator is the watchstander responsible for the cooldown and warm-up of the FTS. The FTS operator reports to the Cryogenic and Tritium Facility Group Leader via the FTS Engineer. His/her responsibilities include the following:

- Warm-up and vent of the FTS.
- Cooldown and evacuation of the FTS.

2013 Characterization Station Operator

The Characterization Station Operator is the watchstander responsible for cryogenic target layering and characterization. The Characterization Station operator reports to the Cryogenic and Tritium Facility Group Leader via the MCTC Engineer.

2014 DD High-Pressure-Fill (HPS2) Operator

The DD High-Pressure-Fill Operator is the watchstander responsible for filling and cooling DD targets in FTS 2. The DD high-pressure-fill operator reports to the Cryogenic and Tritium Facility Group Leader via the FTS Engineer.

2015 Tritium Fill Station Low-Pressure-Fill Operator

The Tritium Fill Station Low-Pressure-Fill Operator is the watchstander responsible for TFS operations. The Tritium Fill Station operator reports to the Cryogenic and Tritium Facility Group Leader via the FTS Engineer. His/her responsibilities include the following:

- Filling low-pressure, warm DT targets.
- Operating and maintaining the TFS purification system.
- Assaying and maintaining the inventory record for the DT in the TFS.

2016 DT High-Pressure-Fill Operator

The DT high-pressure-fill Operator is the watchstander responsible for filling and cooling DT targets in FTS 1. The DT high-pressure-fill operator reports to the Cryogenic and Tritium Facility Group Leader via the FTS Engineer. His/her responsibilities include the following:

- Operating the TFS, DT High-Pressure System (DTHPS), and FTS 1 to fill and cool cryogenic DT targets.

- Informing the Group Leader of any E Stop and initiating corrective action.

2017 Room 157 TRS Operator

The Room 157 TRS Operator is the watchstander responsible for Room 157 Tritium Removal System (TRS) operations. The Room 157 TRS operator reports to the Cryogenic and Tritium Facility Group Leader via the TRS Engineer. His/her responsibilities include the following:

- Startup and operation of Room 157 TRS.

- Regeneration of the beds/cryotrap.

- Operation of the CTHS cleanup purifications system.

2018 OMEGA Scrubber Operator

The OMEGA Scrubber Operator is the watchstander responsible for operating the OMEGA tritium scrubber. The OMEGA scrubber operator reports to the Cryogenic and Tritium Facility Group Leader via the TRS Engineer. His/her responsibilities include the following:

- Operating the OMEGA tritium scrubber in support of target chamber cryogenic pump regeneration.

- Maintaining the scrubber beds.

2019 TC TRS Operator (TC TRSO)

The TC TRS Operator is the watchstander responsible for operating the OMEGA target chamber TRS. The TC TRS operator reports to the Cryogenic and Tritium Facility Group Leader via the TRS Engineer. His/her responsibilities include the following:

- Startup and operation of the TC TRS.

- Regeneration of the dryer beds.

- Collection of tritiated water for disposal.

2020 Cart Maintenance Room (CMR) Operator

The Cart Maintenance Room Operator is the watchstander responsible for operating the equipment located in the Cart Maintenance Room. The CMR operator reports to the

Cryogenic and Tritium Facility Group Leader via the MCTC Engineer. His/her responsibilities include the following:

- Repair and refurbishment of MC and MCTC equipment.
- Performing preventive maintenance on MC and MCTC equipment.
- Decontamination of MCTC's.
- Operation of the CMR vacuum manifold.

2020A MCTC Operator

The MCTC Operator is the watchstander responsible for operating and transporting MCTC's. The MCTC operator reports to the Cryogenic and Tritium Facility Group Leader via the MCTC Engineer. His/her responsibilities include the following:

- Transport of MCTC's
- Docking of MCTC's at all stations
- Starting up and powering down MCTC's

2020B LaCave MCTC Operator

The LaCave MCTC Operator is the watchstander responsible for assisting the Experimental Cryogenic Technician in the moving of the MCTC to the lower pylon and its operation in support of OMEGA cryogenic shot operations. The LaCave MCTC Operator will be stationed during Watch Condition 2 as required by **Sec. 2022**. The LaCave MCTC Operator reports to the ECT. This position may be staffed by an operator who has completed the qualification card for Experimental Cryogenic Technician or MCTC Operator.

2021 Condition 1 Watch Organization—Maintenance Operations

The following watchstanders will be stationed during Watch Condition 1:

- Shot Director
- Others considered appropriate during special test/maintenance evolutions.



2022 Condition 2 Watch Organization—Shot Operations

For OMEGA: The following watchstanders will be stationed during Watch Condition 2:

Watchstation	Shot Type ^a							
	1	2	3	4	5	6	7	*
Shot Director	x	x	x	x	x	x	x	x
Laser Drivers Operator	x		x	x	x	x	x	
Power Conditioning Operator	x ^b	x ^b	x ^b	x ^b	x	x	x	
Beamlines Operator		x	x	x	x	x	x	
Experimental System Operator					x	x	x	
Second Experimental System Operator (if required)						x	x	
Laser Drivers Technician	x		x	x	x	x	x	
Power Conditioning Technician	x	x	x	x	x	x	x	
IR-Alignment Laser Technician	x	x	x	x	x	x	x	
Second IR-Alignment Laser Technician (if required)	x	x	x	x	x	x	x	
UV-Alignment Laser Technician					x ^d		x ^d	
Experimental System Technician					x	x	x	x
Second Experimental System Technician (if required)						x	x	
Processing Technician						x	x	
Experimental Cryogenic Technician						x ^c	x ^c	
LaCave MCTC Operator						x ^c	x ^c	
Room 132A Cu Activation Counting Station Technician							x	

*OMEGA EP high-x-ray shot

NOTES:

- a. “x” denotes watchstations that must be manned. Shot types are defined as follows:
 1. Driver
 2. Nonpropagating
 3. Terminating at Stage-A calorimeters
 4. Beamline, contained within the Laser Bay
 5. Beamline, terminating at Stage-F calorimeters
 6. Target, low yield (<10¹⁰)
 7. Target, high yield (>10¹⁰)
- b. The SD may operate the Power Conditioning Executive for driver and single-beam leg shot in lieu of stationing a PCO.
- c. Experimental Cryogenic Technicians (ECT’s) are required only during shots that involve the CTHS.
- d. The Beamlines Operator may act as the UV-ALT for shots where no special setups are required.



For OMEGA EP: The following watchstanders will be stationed during Watch Condition 2:

Watchstation	Shot Type ^a							
	1	2	3	4	5	6	7	*
Shot Director	x	x	x	x	x	x	x	x
Laser Sources Operator	x		x	x	x	x	x	
Beamlines Operator		x	x	x	x	x	x	
Experimental System Operator				x ^b		x	x	
Laser Sources Technician	x		x	x	x	x	x	
Second Laser Sources Technician (as required)	x		x	x	x	x	x	
Power Conditioning Technician (on call)		x	x	x	x	x	x	
Alignment Laser Technician		x	x	x	x	x	x	
Laser Amplifier Technician (on call)		x	x	x	x	x	x	
Experimental System Technician (2nd and 3rd as required)				x ^b		x	x	
Processing Technician						x	x	
Room 132A Cu Activation Counting Station Technician (as required)							x	

* OMEGA high-yield shot (type 7b or 7c)

NOTES:

- a. “x” denotes watchstations that must be manned. Shot types are defined as follows:
 - 1. Source Bay
 - 2. Nonpropagating
 - 3. Pre- transport spatial filter (TSF) for OMEGA EP source and 4□ probe
 - 4. Beamline terminated at the infrared diagnostic package (IRDp), short-pulse diagnostics package (SPDP), or target chamber without amplification
 - 5. Beamline terminated at calorimeter, amplified
 - 6. Target, long pulse
 - 7. Target, short pulse
- b. Required when shot terminates in the target chamber
- c. On call watchstanders must be at LLE during the time of shot, available for consultation, and available to make system repairs when required.

2023 Watchbill

For each week that the Laser Facility is open, separate watchbills will be prepared for OMEGA and OMEGA EP by the person(s) designated by the Operations Manager for each section. The watchbills must be approved by the Laser Facility Manager and available on the operations web site. Any substitutions after approval must be approved



by the Laser Facility Manager. Sample watchbill formats are shown in Figures II-2(a) and 2(b).

OMEGA Laser Facility Watchbill

Date: 20-24 July 2020

WatchStation	Monday	Tuesday	Wednesday	Thursday	Friday
LFM (On Call 0000-2400)					
SD Alternate*					
Software Support					
Hours	0800-1700	0800-2000	0800-2000	0800-2000	0800-1700

*SD Alternate reports to 1st & 2nd shift briefings and relieves 1st & 2nd shift SD when requested

System startup assignments: **

Assignment	Monday	Tuesday	Wednesday	Thursday	Friday
Driver Startup					
Beamline Startup					

First Shift: **

WatchStation	Monday	Tuesday	Wednesday	Thursday	Friday
Shot Director					
System Science					
LDO					
LDT					
PCO					
PCT					
BO					
UV-ALT					
IR-ALT 1					
IR-ALT 2					
ESO 1					
ESO 2					
EST 1					
EST 2					
EST 3					
ECT 1					
LaCave MCTC Operator					
PT					

Second Shift: **

WatchStation	Monday	Tuesday	Wednesday	Thursday	Friday
Shot Director					
System Science					
LDO					
LDT					
PCO					
PCT					
BO					
UV-ALT					
IR-ALT 1					
IR-ALT 2					
ESO 1					
ESO 2					
EST 1					
EST 2					
EST 3					
ECT 1					
LaCave MCTC Operator					
PT					

** Reporting times are per operational section instruction to support OMEGA Operational needs.

Pre-Watch briefing (First Shift): 0800 Tuesday - Thursday
 Pre-Watch briefing (Second Shift): 1330 Tuesday - Thursday

M. Labuzza (585) 862-5856
 A. Conzattino (585) 455-2996
 J. Path (585) 478-1285
 S. Morse (585) 682-5372

Approved: _____
 Laser Facility Manager Date

Figure II-2(a): OMEGA Watchbill



OMEGA EP Laser Facility Watchbill

Date: 20-24 July 2020

WatchStation	Monday	Tuesday	Wednesday	Thursday	Friday
LFM (On Call 0800-2400)					
SD Alternate*					
Software Support					
Hours	0800-1700	0800-2100	0800-2100	0800-2100	0800-1700

*SD Alternate reports to 1st & 2nd shift briefings and relieves 1st & 2nd shift SD when requested

System startup assignments: **

Assignment	Monday	Tuesday	Wednesday	Thursday	Friday
Source Startup					
Beamline Startup					

First Shift: **

WatchStation	Monday	Tuesday	Wednesday	Thursday	Friday
Shot Director					
System Science					
LSO					
LST 1					
LST 2					
BO					
ALT					
AT					
PCT					
ESO					
EST 1					
EST 2					
PT					

Second Shift: **

WatchStation	Monday	Tuesday	Wednesday	Thursday	Friday
Shot Director					
System Science					
LSO					
LST 1					
LST 2					
BO					
ALT					
AT					
PCT					
ESO					
EST 1					
EST 2					
PT					

** Reporting times are per operational section instruction to support OMEGA EP Operational needs.

Pre-Watch briefing (First Shift): 0845 Tuesday - Thursday

Pre-Watch briefing (Second Shift): 1345 Tuesday - Thursday

- D. Canning (585) 469-4935
- S. Housholder (585) 746-3551
- J. Path (585) 478-1285
- S. Morse (585) 683-5373

Approved: _____
Laser Facility Manager Date

Figure II-2(b): OMEGA EP Watchbill

2024 List of Qualified and Proficient Watchstanders

All personnel must complete the initial watchstation qualification specified in Part III of this manual. Only those who have completed the requisite qualification and have maintained watchstanding proficiency may stand watch and be assigned on the Laser Facility watchbill. To ensure that only qualified personnel are assigned to watches, a list of currently qualified and proficient watchstanders by facility (i.e., separately for OMEGA and OMEGA EP) will be maintained and be accessible to the applicable Shot Director. The Operations Manager or the person designated by him/her will maintain these lists of qualified and proficient watchstanders. The qualified and proficient

watchstander list will be maintained by watchstation for each facility and will list the names of those qualified and his/her date of qualification.

2025 Pre-Watch Briefing and Watchstander Relief

Prior to the commencement of each shift of shot operations, the Shot Director will conduct a briefing of key personnel. In this context, shot operations means anytime a laser amplifier is pumped by a PCU that can be controlled by the Power Conditioning Executive (PCE). A pre-watch brief will also be conducted for coordinating system testing or system enhancement projects as deemed necessary by the LFM. As a minimum, the Control Room Operators and the Principal Investigator will attend this briefing. As a minimum, the following will be covered in this briefing:

- Status of completion of alignment, preoperational checks, and readiness of the system.

- Scheduled shot requirements including driver/source, target, beam, diagnostic, and data.

- Review of problems experienced during the previous shift.

- Review of the Laser Facility Manager Day Orders. Prior to taking on the responsibility of watch standing, all individuals shall review the facility day orders, the Out of Commission log, and the relevant Material Deficiency list for their watchstation. When possible, a discussion with the outgoing watchstander shall include important tasks in process and issues experienced in the shift. During startup, this discussion shall be replaced with a review of the station log. At times, it will be required that the previous watchstanders hand off lockout/tagout responsibilities (reference **Sec. 4005**) to on coming crew members.

2026 Laser Facility Manager Day Orders

The Laser Facility Manager will prepare directions for Laser Facility operations on a daily basis that is made available digitally to the Shot Director prior to each day's operations. A separate record will be prepared for OMEGA and OMEGA EP. The following exemplify material to be included in these day orders:

- Laser and experimental target shot plan for the day

- Pre-operational and alignment checks required prior to conducting shot operations

- Significant testing or maintenance actions scheduled

- Problems or special circumstances that warrant particular attention

- Administrative items of general interest to facility operators

The Day Orders will be read on a daily basis by all watchstanders prior to assuming watch.

2027 Shot Director Log

The Shot Director will keep an electronic log to document the operation of the Laser Facility during his/her watch. Each entry will record the time and include the identity of

the shot director on watch. Separate logs will be maintained for OMEGA and OMEGA EP. The following are required entries in this log:

Stationing and securing of Watch Condition 1 or 2.

Shot Director Watch Relief.

Significant problems or accomplishments shall be recorded. Each entry shall indicate all operational and support groups associated with the event.

Opening and closing of the target chamber or grating compression chamber.

An incident that results in personnel injury or significant material damage.

2028 Watchstanding Proficiency

Watchstanders must stand at least two (one for ECT only) watches per quarter to maintain proficiency on individual watchstations. Personnel who do not stand at least two watches per quarter will be removed from the list of qualified watchstanders and may not stand watch until qualification is recertified. In special instances, such as a senior supervisory watchstander, the Laser Facility Manager may approve an exception on a one-time basis. Personnel who do not complete refresher safety training will be removed from the list of qualified watchstanders until training is complete.

Part III: Watchstander Training and Qualification

3000	Watchstander Training and Qualification Administration
3001	Example Qualification Card
3002	Index of Qualification Cards
3003	Watchstanding Proficiency

3000 Watchstander Training and Qualification Administration

All personnel assigned to stand watch in OMEGA, OMEGA EP, and the CTF must complete a formal documented qualification process that consists of the following:

- Completion of prerequisite safety training and watchstation qualifications
- Completion of knowledge requirements
 - LFORM (LLEINST 3000)
 - Incident Review and Reporting (LLEINST 6950)
 - Facility and Safety Interlocks
 - Demonstration of technical system, subsystem, and equipment knowledge and associated engineering principles
- Completion of watchstanding requirements (under oversight of a qualified watchstander instructor)
 - Watchstanding requirements are fulfilled by standing a watch shift under the oversight of the qualified watchstander. The qualified watchstander is responsible for all actions by the trainee. Since some shifts may include unexpected disruptions, the instructor must use his/her best judgement to certify completion.
- Completion of Practical Factors (under the oversight of a qualified instructor)
 - Trainees are to spend time observing and being trained by qualified instructors, with opportunity to ask questions before being given the opportunity to demonstrate skills by completing practical factors.
 - Practical factors are to be completed correctly under the oversight of the instructor without the instructor's intervention. The instructor is encouraged to ask questions to ascertain full understanding.
 - Practical factors include startup, shutdown, and maintenance activities to ensure a broad base of knowledge and capability in the watchstanding role.
 - To obtain a signature, the trainee must perform the task correctly (without intervention or correction by the instructor).
- Completion of Qualification Certification
 - After all requirements are completed on the qualification card, the qualification will be certified by the completion of an oral examination by the individual designated on the qualification card and by the applicable LFM (or CTFM).

After certification of qualification, the individual will be added to the list of qualified watchstanders (**Sec. 2024**) by the LFM.

The completed qualification card is to be filed as a permanent record.

All qualification cards are to be issued by a Laser Facility Manager or the Cryogenic and Tritium Facility Manager who will give the expected qualification timeframe, Fig. III-1. After the qualification card is issued, the appropriate group/section leader shall assign a mentor to aid in the qualification process. This mentor will meet regularly with the trainee to answer questions, give guidance on instructors for each signature, and facilitate a thorough and efficient qualification process. The mentor will also advocate for training opportunities within the group to ensure that infrequent activities are not missed.

While personnel from any Division/Group may qualify on any watchstation, and are encouraged to do so, normally watchstanders come from specific Divisional Groups as follows:

OMEGA Facility Division

Laser Drivers/Sources Section: LDO, LDT, LSO, LST
Beamlines Section: BO (OMEGA or OMEGA EP), UV-ALT, ALT
Amplifier Section: IR-ALT, AT
Experimental Operations Section: ESO (OMEGA or OMEGA EP), EST
(OMEGA or OMEGA EP), PT
CTF Group: ECT, Room 157 Operator, FTS Target Transfer Operator, FTS
General Operator, Characterization Station Operator, HPS2 High-
Pressure-Fill Operator, Tritium Fill Station Low-Pressure-Fill Operator,
DT High-Pressure-Fill Operator, Room 157 TRS Operator, OMEGA
Scrubber Operator, TC TRS Operator, CMR Operator, MCTC Operator

Engineering Division

Electronics Engineering Group: PCO (OMEGA or OMEGA EP), PCT (OMEGA
or OMEGA EP)

Experimental Division

Experimental Support Group: ESO or EST

Personnel who are qualified to sign qualification card requirements are as follows:

Knowledge Requirements

Person designated on the qualification card
Cognizant Group Leader
Other personnel designated in writing by the LFM or CTFM

Watches and Practical Factors

Personnel qualified on the watchstation



Qualification Certification

As indicated on the qualification card

3001 Example Qualification Card

Each qualification card shall have similar formatting with all prerequisites, knowledge requirements, watchstanding requirements, and practical factors specifically called out and an associated signature line for each task. The qualification cards are to be reviewed for required changes in conjunction with the introduction or removal of hardware/software or with significant changes to protocols for safety.

<p>LFORM Qual Card 3005 OMEGA Experimental System Operator</p> <p style="text-align: right;">M-QC-M-006 Rev. A 3/20/2018</p> <p style="text-align: right;"><small>LLE</small></p> <p>OMEGA Experimental System Operator Qualification Card</p> <p>Name: _____ Date of Issue: _____ Training Mentor: _____ Expected Completion Date: _____</p> <p>Prerequisite: OMEGA Experimental System Technician Qualification</p> <p>Knowledge Requirements: Demonstrate knowledge of the following by satisfactorily completing an oral examination by qualified individual:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 60%;">REQUIREMENT</th> <th style="width: 40%;">QUALIFIED SIGNATURE / DATE</th> </tr> </thead> <tbody> <tr><td>1. LFORM & LLEINST3000</td><td>LPM _____ / _____</td></tr> <tr><td>2. Incident Reporting (LLEINST 6507)</td><td>LPM _____ / _____</td></tr> <tr><td>3. 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3002 Index of Qualification Cards

Each qualification card is uniquely tailored to the individual watchstation requirements and is released as a product data management (PDM) approved document. The table below lists each qualification card giving the PDM document ID, the original LFORM number, and the title. Training time varies based on the complexity of the watch station and other responsibilities of the individual in training.

PDM Document ID	Old ID	Watchstation or Role
M-QC-M-002	3001	OMEGA Shot Director Qualification Card
M-QC-M-003	3002	OMEGA Laser Drivers Operator Qualification Card
M-QC-M-004	3003	OMEGA Power Conditioning Operator Qualification Card



M-QC-M-005	3004	OMEGA Beamlines Operator Qualification Card
M-QC-M-006	3005	OMEGA Experimental System Operator Qualification Card
M-QC-M-008	3006	OMEGA Laser Drivers Technician Qualification Card
M-QC-M-009	3007	OMEGA Power Conditioning Technician Qualification Card
M-QC-M-010	3008A	OMEGA IR-Alignment Laser Technician Qualification Card
M-QC-M-011	3008B	OMEGA UV-Alignment Laser Technician Qualification Card
M-QC-M-012	3009	OMEGA Experimental System Technician Qualification Card
M-QC-M-013	3009A	OMEGA/OMEGA EP Processing Technician Qualification Card
M-QC-M-014	3009B	Experimental Cryogenic Technician Qualification Card
M-QC-M-015	3009C	OMEGA/OMEGA EP Instrument Specialist/Technician Qualification Card
M-QC-M-016	3009D	OMEGA/OMEGA EP Activation Counting Station Qualification Card
M-QC-M-017	3009E	OMEGA/OMEGA EP Image-Plate Scan Technician Qualification Card
M-QC-M-018	3010	Radiation Worker Qualification Card
M-QC-M-019	3011	OMEGA EP Shot Director Qualification Card
M-QC-M-020	3012	OMEGA EP Laser Sources Operator Qualification Card
M-QC-M-021	3013	OMEGA EP Beamlines Operator Qualification Card
M-QC-M-022	3014	OMEGA EP Experimental System Operator Qualification Card
M-QC-M-023	3015	OMEGA EP Laser Sources Technician Qualification Card
M-QC-M-024	3016	OMEGA EP Alignment Laser Technician Qualification Card
M-QC-M-025	3017	OMEGA EP Power Conditioning Technician Qualification Card
M-QC-M-026	3018	OMEGA EP Amplifier Technician Qualification Card
M-QC-M-027	3019	OMEGA EP Experimental System Technician Qualification Card
M-QC-M-028	3020	Room 157 Operator Qualification Card
M-QC-M-029	3021A	FTS 1 Target Transfer Operator Qualification Card
M-QC-M-030	3021B	FTS 2 Target Transfer Operator Qualification Card
M-QC-M-031	3022A	FTS 1 General Operator Qualification Card
M-QC-M-032	3022B	FTS 2 General Operator Qualification Card
M-QC-M-033	3023	Characterization Station Operator Qualification Card



M-QC-M-034	3024	HPS 2 High-Pressure-Fill Operator Qualification Card
M-QC-M-035	3025	Tritium Fill Station Low-Pressure-Fill Operator Qualification Card
M-QC-M-036	3026	DT High-Pressure-Fill Operator Qualification Card
M-QC-M-037	3027	Room 157 TRS Operator Qualification Card
M-QC-M-038	3028	OMEGA Scrubber Operator Qualification Card
M-QC-M-039	3029	TC TRS Operator Qualification Card
M-QC-M-040	3030	MCTC Operator Qualification Card
M-QC-M-041	3031	Cart Maintenance Room Operator Qualification Card
M-QC-M-042	3032	Recertification Card
M-QC-M-043		DBRS Qualification Card
M-QC-M-044		Ambient DT Target Transfer Operator Qualification Card

3003 Watchstanding Proficiency, Training Progress, and Quarterly Tracking

Watchstanders must stand at least two (one for ECT only) watches per quarter to maintain proficiency on individual watchstations. Personnel who do not stand at least two watches per quarter will be removed from the list of proficient watchstanders and may not stand watch until qualification is recertified. In special instances, such as a senior supervisor watchstander, the LFM may approve an exception on a one-time basis. Personnel who have lost watchstanding proficiency as a result of insufficient frequency must complete a Recertification Card before being restored to the list of proficient operators for that watchstation. Personnel who do not complete refresher training within one quarter will be removed from the list of qualified watchstanders.

At the end of each quarter, the Operations Manager will audit the watchbills to determine deficiencies in proficiency. The qualification cards will be audited to identify persons lagging behind expectations in training (**Sec. 2024**), and the completed qualification card will be filed as permanent record.

Part IV: Standard Operating Procedures

4000	Laser Facility Overview
4001A	Control Room Access and Formality
4001B	Room 157 and Cart Maintenance Room Access and Formality
4002	Omega Facility Access
4002A	Closed Access
4002B	Restricted Access
4003	Control of Maintenance
4003A	Work Authorization Procedures
4004	Equipment Status Log
4005	Tagout/Lockout
4006	Target Chamber Entry
4007	Grating Compression Chamber Entry
4008	Safety
4009	Communication Procedures
4010	Shot Request Forms and Administration

4000 Laser Facility Overview

The Safety Analysis Documents for OMEGA and the Environmental Assessment for OMEGA EP identify the safety hazards and how they are mitigated by design, interlock, and procedure. Of the hazards reviewed, protection from personnel exposure to hazardous levels of laser and nuclear radiation and high voltage requires that no personnel are in the hazardous areas during shot operations. To assure that no personnel remain in hazardous areas upon establishing “closed access” as well as the need to avoid the potential for significant equipment damage dictates the need for formal compliance with approved operational procedures.

In the context of operating the Omega Laser Facility, including the OMEGA, OMEGA EP, and CTF/CTHS, formal procedural compliance means:

Only formally approved written procedures will be used to conduct shot and tritium operations. These procedures are contained in the applicable Operations Procedures Webpages and released in the PDM per M-TM-P-028.

If an error or omission that prevents continuing is noted in an Operations Procedure, the system will be placed in a safe state and the operation will be halted until a formal written Advanced Change Notice (ACN) to the procedure is written by the section leader or subject expert and approved by the Laser Facility Manager (LFM) or Cryogenic and Tritium Facility Manager (CTFM) as applicable. All ACN procedures will be stamped and signed by the LFM or CTFM and logged in the Equipment Status Log.

The System Operation Procedures will be referenced as required during operations. For Shot and Tritium Operations, the applicable procedures will be open and used as a check list by the Shot Director, Control Room, and CTHS Operators. For all other evolutions, e.g., system preoperational checks and startup, system shutdown, and maintenance operations, the procedure will be referenced as frequently as necessary to ensure compliance with the procedural requirements.

4001A Control Room Access and Formality

The Control Rooms are the central control station for the operation of OMEGA and OMEGA EP. To ensure the safe and proper operation of the facility, the atmosphere in the Control Room must be formal and businesslike. To ensure that the desired level of formality is maintained, the following will be enforced:

Access is restricted to those who have a need to be there and will be strictly controlled by the Shot Director. During periods of power conditioning unit charging, as indicated by the flashing "Shot in Progress: Do Not Enter" signs outside the Control Room, no entry will be allowed.

No impromptu meetings or gatherings will take place in the Control Room.

No eating is allowed in the Control Room.

No reading of unofficial or non-work-related material is allowed.

4001B Room 157 and Cart Maintenance Room Access and Formality

Access to Room 157 and the Cart Maintenance Room must be controlled to ensure safety and effectiveness. Unescorted access is allowed only for personnel qualified as radiation workers who are authorized access by the CTFM. Anyone who is not on the access list maintained by the CTFM must be both authorized by the CTFM and escorted by an individual on the authorized access list.

All operations for filling warm DT and cryogenic DD/DT targets occur within Room 157. To ensure the safe and proper operation of the tritium and cryogenic facility, the atmosphere within the facility must be formal and businesslike. This is especially true whenever tritium operations are taking place; that is, whenever the tritium is removed from the uranium getters or a contaminated system is opened. The following will be enforced at all times:

No impromptu meetings or gatherings will take place.

No eating is allowed at any time.

No reading of unofficial or non-work-related material is allowed (at all times).

Personnel not on the CTFM approval list must be escorted.

All personnel within the facility will wear laboratory coats.

The following additional requirements will be enforced during tritium operations:

Only personnel qualified as Radiation Workers are allowed access.

Only the CTHS operators and relevant supervisors are allowed access.

4002 Omega Facility Access

Access to Omega Facility technical areas must be controlled to ensure safety and effectiveness. Unescorted access is allowed only for personnel who are approved and listed on an Access Authorization list maintained by the Laser Facility Manager. Such unescorted access is limited to qualified watchstanders, instrument specialists, safety officers, key engineers/technicians, and management personnel who have maintained safety proficiency. The Shot Director is responsible for controlling the facility access and verifying the status of training. Access of personnel who are not on the Access Authorization list is controlled as follows:

For individual(s) who will not be performing work:

- An escort shall be assigned per the instruction of the LFM

For individual(s) who will be performing work on instruments of the system [i.e., Instrument Specialist Technician (IST)]:

- The LLE Chief Safety Officer shall certify the individual's knowledge of the LLE safety program
- An IST qualification card must be completed for the instrument being worked on
- LFORM orientation shall be completed by the Laser Facility Manager
- Work environment orientation shall be completed by the Associate Laser Facility Manager or Operations Group Leader
- A work authorization procedure (WAP) shall be approved by the Laser Facility Manager and opened by the Shot Director before performing work
- An escort shall be assigned

For external specialists performing work on infrastructure:

- An escort shall be assigned
- A WAP shall be approved by the LFM and opened by the Shot Director before performing work
- An orientation will be conducted by the LFM or his designee before entering the facility
- Additional Safety Training may be required in advance of entering the facility to perform work

Escorts are responsible for:

- Providing required personal protective equipment (PPE) such as laser protective eyewear and hard hats and for ensuring their proper use
- Ensuring that personnel remain clear of exposed optics
- Ensuring that clean room clothing is properly donned and that clean room requirements are enforced

- Ensuring that all safety requirements are enforced
- Maintaining visual contact with all individual(s) under their escort while inside the facility.
- When work is to be performed, at least one escort will be assigned for a work area.

Non-watchstanders must check in with the Shot Director before entering the technical areas. The Shot Director will brief the individual on any concerns relevant to the activity including status of shot preparations or other activities occurring at the same time. The Shot Director also maintains the interlock control to enable laser sources and appropriate door warning signs. All individuals entering the facility must read and conform to the door warning signs.

Inside the technical areas, further access restrictions may be required for safety in localized areas. Appropriate signs shall be placed at all entrances to the area describing the access restrictions, PPE requirements, and watchstander to contact for permission to gain access.

4002A Closed Access

Hazards including high voltage, high-intensity laser light, and ionizing radiation may render spaces unsafe to occupy. Closed Access protocol provides a process to guarantee these spaces are clear of personnel before hazardous conditions are permitted to exist. After a procedural verification that no personnel are in the area, the area is said to be in the “closed access” state and operations that cause hazardous conditions may be permitted. Closed Access protocol includes:

- A Shot Director to perform direction and oversight of Closed Access protocol.
- An area in Closed Access will have a physical barrier at every point of entry. The boundary points accessible by the general public shall be locked and control will be maintained by the Shot Director. Boundaries accessible only by LFORM trained personnel may be established with a physical barrier (chain, gate, etc.) to prevent passing.
- At each barrier, a sign shall be placed which states “**Closed Access: Do Not Enter.**” Illuminated signs will only be enforce when flashing. Physical signs must be placed during the establishing of Closed Access and removed when Closed Access is no longer required.
- The Closed Access sweep procedures shall specify a sweep path and identify boundary points to be verified and/or signage to be posted. Steps shall include provision to ensure that persons in the area do not have a way to move into an already swept area during the sweep procedure. If a distraction or delay is encountered during the performance of the procedure, the sweep procedure shall be restarted.
- When possible, procedures shall include an announcement or tone audible throughout the area entering closed access to signify the beginning of the sweep procedure.

The Shot Director is responsible for overseeing closed access procedures, maintaining the Closed Access state and certifying the completion of all required sweeps before hazardous conditions are permitted to exist. The Shot Director may allow limited personnel entry without reverting to open access if the hazard(s) are not present and the following conditions are met:

- The Shot Director shall track all person(s) entering a closed access area after the sweep is completed.
- The person entering the area is a watchstander or under the escort of a watchstander.
- The watchstander's control room operator is tracking the entry as part of their checklist responsibility during shot preparation. Shot procedures shall verify by checklist that the watchstander(s) have exited.
- The access is required for shot operations.

When both the Shot Director and the responsible watchstander verify the entry is complete, then closed access is reestablished. Access not meeting the above requirements requires reversion to open access.

Some areas, such as unshielded facility roof areas, are not regularly accessed and must remain in closed access during shot activity. These spaces will remain in closed access with a sign and physical lock preventing entry unless entry is approved by the SD. In these cases, the Shot Director will retain control of the key and grant access with physical ownership of the key to a responsible worker who will perform an area sweep before exiting the area, restoring the lock to the barrier, and returning the key to the Shot Director. The Shot Director will verify the status of these keys before activities presenting hazards to these spaces, such as system shots, are permitted.

Adherence to closed-access procedure is critical to the safe operation of the OMEGA/OMEGA EP lasers.

4002B Restricted Access and Area Sweep procedures

Hazards that can be managed with distance from the source may be handled with Restricted Access including Area Sweeps. In these scenarios, the area is systematically cleared of personnel and monitored by a watchstander to ensure that personnel do not encroach the safe distance until the hazardous event is complete.

4003 Control of Maintenance

Maintenance must be controlled to ensure the readiness of Omega or the Tritium and Cryogenic Facility to conduct shot or target operations respectively. Additionally, this is required to determine the applicable post-maintenance inspections and tests that must be completed. Accordingly, the following procedures will be followed:

The approval of the Shot Director or Cryogenic and Tritium Facility Manager, as applicable, must be obtained prior to performing maintenance on or removing a system,

subsystem, diagnostic, or equipment from service that is required to support scheduled shot or target operations.

The Shot Directors for OMEGA and OMEGA EP and the Cryogenic and Tritium Facility Manager will maintain an Equipment Status Log to document systems, subsystems, diagnostics, or equipment placed out of commission or in reduced status.

Corrective and preventive maintenance will be scheduled by the individual work centers in consonance with the applicable facility's operating schedule.

The completion of maintenance and the restoration of systems, subsystems, diagnostics, or equipment to service will be reported to the Shot Director or Cryogenic and Tritium Facility Manager as applicable.

The installation of new equipment, alignment and operation of instruments by instrument specialists/technicians who are not LLE personnel qualified as Omega watchstanders, and tasks specified by the relevant Laser Facility Manager that must be coordinated from an operational perspective will be scheduled and authorized by the work authorization procedures of **Sec. 4003A**.

4003A Work Authorization Procedures

The work authorization procedures (WAP's) of this section are required to ensure that new equipment installations, operations by instrument specialists/technicians, and certain work determined by the Laser Facility Manager that must be coordinated from an operations perspective is performed safely by qualified personnel and on a definitive schedule. Instrument specialists/technicians who are LLE personnel and who are also qualified as an Omega watchstander may start up and operate stand-alone instruments without using these work authorization procedures. The WAP form (M-TM-M-048) will document the process as defined below and an electronic WAP log will be used by the Shot Director to track multiple WAP procedures.

Part I (task information): The WAP form (M-TM-M-048) will be initiated by the project manager or supervisor of the personnel who will perform the maintenance or procedure; e.g., for the installation of a new TIM, the Mechanical Engineering Group Leader would initiate the WAP to install the TIM, and the Controls Engineering Group Leader would initiate a separate WAP to install and test the control system. For operation of the OHRV to support an experiment, the Experimental Operations Group/Section Leader would initiate the WAP.

The initiator is responsible for completing Part I of the WAP in digital format, including the work description, procedural reference, lead person performing the work, listing other personnel involved, and identifying safety risks associated with the task, and how they are to be mitigated. This includes identifying:

- personnel protective equipment (PPE) required
- equipment that must be made safe prior to starting work and how this is accomplished (e.g., lockout and/or tagout, covering optics, installing temporary barriers)
- atypical operations required to complete the task (e.g., removing deck sections, custom rigging, stud welding, drilling, connecting high-voltage power supplies)

If there are no safety risks associated with the task, it must be so noted on the form. The initiator will obtain the electronic signature approval of the Group Leader who supervises the lead person performing the work as well as the Group/Section Leader who supervises the area where the work will be completed. These signatures approve the procedures and personnel performing the work, but does not authorize the work to occur.

Part II (Laser Facility Manager Scheduling and Approval): The LFM, in coordination with the Group/Section Leader responsible for the work and other concerned Group/Section Leaders, will determine and approve the scheduled work start and stop times and dates. Note: this does not authorize the commencement of work. If there is no Safety Assessment information provided, the LFM will not approve the WAP. The LFM will enter the WAP into the WAP electronic log

Part III (Shot Director permission to commence work): When the personnel are ready to perform the work, they will request authorization from the Shot Director (SD) to start the work. The SD will authorize the work after verifying that the workers are aware of the safety risks associated with the task and that the mitigation strategies are being employed. The SD will be notified at the beginning of each day of activity as well as at the completion of each day's activities. . When the activity is completed, the lead person performing the work will inform the Shot Director and the WAP will be closed. If work requires additional time, see the LFM to coordinate an extension. The SD will maintain the electronic WAP log by updating the WAP status and tracking the actual time that the WAP opens and closes

4004 Equipment Status Log

The Shot Directors and CTFM will maintain an Equipment Status Log during both Watch Conditions 1 and 2. This log shall document the current out-of-commission status of systems, subsystems, diagnostics, or equipment and the completion of required preoperational tests and inspections prior to shot operations. This log will be maintained online for each facility (OMEGA, OMEGA EP, and C&TF) and will be maintained in two sections as follows:

Out-of-Commission (OOC) List: This section is a chronological listing of systems, subsystems, diagnostics, or equipment placed out of commission and indicates the current OOC status. This list includes columns to track work completion, tagout requirement, post test requirement and completion, and date/time restored for

operation. When the equipment has been repaired, the work complete date is used to signify readiness for post test. The Shot Director is to be made aware of all entries and updates to the OOC while he is stationed.

Before restoring a system, diagnostic, or equipment and signing the time/date restored block, the Shot Director or Cryogenic and Tritium Facility Manager, as applicable, shall verify that both the lockout/tagout and post-test requirements, as applicable, are completed.

Material Deficiency List: This electronic log is a listing of material deficiencies that do not place a system, subsystem, diagnostic, or equipment out of commission, but require tracking to ensure operator awareness and subsequent correction.

Group Managers and Section Leaders shall review their section of the material deficiency lists at least weekly to address new items. The person who corrects the deficiency shall log the time/date restored.

Advanced Change Notice (ACN) Log: This electronic log is a listing of all procedures that have been found to be deficient (until a new revision of that document has been formally reviewed and approved). ACN entries will be made by the appropriate Facility Manager. All operators are to review the ACN log at the beginning of their shift. The ACN shall be scanned and attached to the log entry for reference. The Facility Manager shall be responsible to audit the ACN log at least monthly to address procedural deficiencies.

4005 Tagout/Lockout

To ensure personnel safety and to prevent equipment damage, positive procedures are required to prevent the inadvertent operation of systems or equipment placed out of commission for maintenance including upgrades. Of particular concern is the risk of electrical shock, exposure to harmful laser radiation, release of the stored energy from pressurized compressible fluids, or the release of toxic chemicals. Accordingly, to ensure the safety of personnel and to protect against equipment damage, formal procedures are required to prevent the inadvertent operation of systems or equipment placed out of commission for maintenance. Historically, lockout/tagout procedures were first introduced at LLE as part of the LFORM. Subsequently they were implemented across the entire laboratory in LLE INST 6300. To ensure consistence and compliance with OSHA requirements, Omega will henceforth use the procedures of LLE INST 6300 as amplified herein. While OSHA only requires lockout/tagout procedures to ensure personal safety, the importance of protecting Omega dictates that these procedures also be applied to protect equipment from damage.

Definition: As used in this procedure, a tagout is defined as the placement of a tag on a breaker, switch, control device, or valve that states that it shall not be operated. Lockout is defined as the installation of a physical barrier to operation such as a lock or the removal of a connecting link to prevent operation of the component.



Policy: LLE INST 6300 shall be followed at Omega to ensure safety of personnel and equipment. As required by LLE INST 6300, a physical lock must be used to ensure personnel safety while performing maintenance if the equipment has the provision for the installation of a lock. If the equipment does not support the installation of a lock, a danger tag will be used. The Shot Director will be responsible for understanding the reason for tagout and ensuring that the lockout/tagout procedures are used when appropriate prior to allowing maintenance to take place.

Procedures: The following policies are in amplification/addition to the procedures of LLE INST 6300 for the Omega Laser Facility. A Lockout/Tagout Log is maintained in digital format to track active and completed Lockout/Tagout processes. The Lockout/Tagout log shall be administered as follows:

- Each item placed Out of Commission shall be entered onto the OOC digital log. When entering an item into the OOC log, the requirement for Lockout/Tagout will be identified (“yes” when required or “no”) as well as the requirement for a Post Test.
- The digital log for Lockout/Tagout (LOTO) will track details of the locks and tags. A single item may require multiple locks/tags to protect against all hazards and these will all have the same lockout/tagout number with a unique identification number/suffix (-A, -B...) to identify the specific lock/tag.
- A tag (Fig. IV-1) shall be filled out for each location called out on the lockout/tagout sheet.

DANGER	
DO NOT OPERATE	
Tag No. ____	Required Position ____
Equipment ID _____	
Breaker/Valve ID _____	
Posted (Hung) by _____	
/	
(Signature)	(time and date)

Reason for Tag:	

Under no circumstances will a breaker, switch, or valve that is tagged by a “DANGER DO NOT OPERATE” tag be operated.

Figure IV-1

- The OOC entry will identify when a post test is required. In cases where the hardware will be operated nominally to ensure functionality, “Op Test” is appropriate here. Other single-word post tests may be used as appropriate such as “PILC.” More involved Post Test instructions will be detailed and tracked in the post test digital log. The Shot Director will verify the post test entry is cleared before restoring equipment on the OOC list.
- After the lockout/tagout sheet and tags are filled out by the person performing the maintenance, the adequacy of the lockout/tagout coverage, de-energization procedure, and post tests will be verified by the Shot Director or Cryogenic and Tritium Facility Manager as applicable who will indicate his/her authorization by signing the lockout/tagout sheet.
- Once the lockout/tagout is authorized, the person installing the locks/tags will position the device, install locks/tags, install his/her personal ID tag to the lock (when used), and sign the tags, and when all locks/tags are installed, he/she will sign step 2 of the lockout/tagout sheet and step 5 of the lockout/tagout sheet to verify the hazardous sources are de-energized. Work may then be started.
- Once the lockout/tagout is authorized, the person installing the locks/tags will position the device, install locks/tags, install his/her personal ID tag to the lock (when used), and sign the tags, and when all locks/tags are installed, he/she will sign step 2 of the lockout/tagout sheet and step 5 of the lockout/tagout sheet to verify the hazardous sources are de-energized. Work may then be started.
- If the maintenance is not completed by the person (the authorized employee) initiating the lockout/tagout, and the maintenance is to be turned over to another authorized employee, the new authorized employee will install his/her lock and personal ID tag and the previous employee will remove their lock and personal ID tag. If maintenance is to be performed by more than one employee, each employee must install their own lock and personal ID tag.
- When work and required inspections are completed, the locks/tags that were hung to support the work will be removed. All tags removed will be delivered to the Shot Director or Cryogenic and Tritium Facility Manager, as applicable, and the person who removed the locks/tags will sign the lockout/tagout sheet to indicate the locks/tags have been removed. The Shot Director or Cryogenic and Tritium Facility Manager will verify all tags listed have been returned and sign the lockout/tagout sheet. He/she will then remove the respective tagout sheet from the active section of the lockout/tagout log and place it in the inactive section of the log. The Shot Director or Cryogenic and Tritium Facility Manager will indicate the maintenance is complete by date stamping the appropriate entry in the OOC log by date stamping the appropriate entry.

- If no post test is required, the Shot Director or Cryogenic and Tritium Facility Manager, as applicable, will also update the Out-of-Commission List by indicating the date the equipment was restored to service.
- If a post test is required, it can now be performed.
- When the post test(s) is/are completed, the person completing the test(s) will inform the Shot Director or CTFM and sign the Post Test Sheet and note the completion date on the OOC. The Shot Director or CTFM will then update the OOC list by indicating the post test was completed and the equipment was restored to service.
- In the event that the post test fails and the equipment must be locked out/tagged out again, a new lockout/tagout sheet will be generated and a new lockout/tagout number assigned. A new line in the OCC will track the status of this tag and the post test number will be reused. The old OCC entry line may be cleared at this point. At the point when the post test succeeds, the Shot Director will return the equipment to commission.

Audit: An audit of the Lockout/Tagout Log will be conducted weekly by the LFM or CTFM as follows:

- Check the OOC List/Tagout Index against the Active Lockout/Tagout sheets to ensure they agree.
- For all Active Lockout/Tagout Sheets, verify by visual inspection that all associated locks/tags are in place, the component is in the proper position, and the lock/tag is properly completed and signed. For all inactive lockout/tagout sheets, verify that they have been properly executed. Any deficiencies in the active lockout/tagouts must be resolved by preparing new lockouts/tagouts as required.
- Upon completion of the audit, the OOC List/Lockout/Tagout Index will be recopied to list only the active items. All Inactive Lockout/Tagout Sheets will be filed for two months before being discarded.
- At least annually, an audit will be performed in accordance with LLE INST 6300 and the results reported, in writing, to the LLE Chief Safety Officer.

4006 Target Chamber Entry

Each target chamber is a space that requires special procedures to ensure safe entry. Additionally, radiation safety procedures must be followed to ensure the protection of personnel and to prevent the release and spread of radioactive contamination. To ensure safety and controlled entry, follow the procedures of S-SM-P-395 for OMEGA or S-AB-P-192 for OMEGA EP.

4007 Grating Compression Chamber Entry

The grating compression chamber (GCC) is a space that requires special procedures to ensure safe entry. The OMEGA EP LFM shall conduct access training and maintain a list of qualified individuals who are granted unescorted access into the GCC. Specifically,

because it is a Class-100 clean space that contains very expensive optics, special care must be exercised by personnel who enter the GCC. Additionally, because it has free communication with the OMEGA target chamber, tritium contamination is possible. Radiation safety procedures must be followed to ensure the protection of personnel and to prevent the release and spread of radioactive contamination. If no contamination above the limit is detected in the OMEGA to GCC vacuum tube, the GCC may be assumed to be uncontaminated.

4008 Safety

The safe operation of OMEGA, OMEGA EP, and the Cryogenic and Tritium Facility is of paramount importance and will not be jeopardized. It is the responsibility of all personnel to follow applicable safety procedures. The failure to follow established safety procedures may result in appropriate disciplinary action up to and including dismissal. Since general and specific safety precautions, procedures, laws, and regulations exist from several authoritative sources (e.g., University Environmental Health and Safety procedures, state and local electrical and mechanical codes, NYS laser and radiation safety regulations, Facility Manual Volumes II, V, and VIII, etc.), they will not be enumerated here.

The Operations Manager and Cryogenic and Tritium Facility Manager have the overall responsibility for the safe operation of the Laser Facility and Cryogenic and Tritium Facility respectively under the general guidance and oversight of the LLE Chief Safety Officer and the functional safety officers (Chemical, Electrical, Fire, Laser, Mechanical, and Radiological). If a question arises with respect to safety, it should be resolved by referring to an authoritative reference before proceeding. Should situations arise where procedures are unknown or there are questions of interpretation, the appropriate functional safety officer should be consulted before proceeding. These situations and questions will also be brought to the attention of the LLE Chief Safety Officer before proceeding.

The following policies apply to safety throughout the Laboratory:

No person will willfully operate, energize, or otherwise use any tool, system, or equipment that is known to have a safety defect.

Only personnel who are specifically trained and approved by their Group/Section Leader will perform system or equipment maintenance.

No personnel safety-related interlock, alarm, detector, or device will be overridden or disabled without the specific permission of the LLE Chief Safety Officer.

Safety incidents and potentially unsafe practices or conditions will be reported immediately to the Shot Director/Cryogenic and Tritium Facility Manager who in turn will inform the Laser Facility Manager, Operations Manager, and Omega Facility Director, the appropriate functional safety officer, and the LLE Chief Safety Officer.

No person will intentionally allow him- or herself to be shocked by electricity, to inhale or eat hazardous chemicals or materials including radioactive material, to be exposed

to laser radiation without appropriate protection, or to be exposed unnecessarily to nuclear radiation.

Appropriate safety protective equipment shall be worn when required. This includes:

- appropriate eyewear when entering space where lasers are enabled. NOTE: To ensure that eyewear offers both laser and impact resistant protection, all laser safety eyewear must also be in compliance with ANSI Z87-1-1989 for impact resistance.
- safety glasses, rubber gloves, and laboratory aprons when handling hazardous chemicals or cryogenic fluids
- safety glasses when operating machine tools such as grinders, drills, lathes, milling machines, etc.; and when operating compressed gas systems
- safety harnesses when working aloft, including the top of the GCC
- hard hats in the OMEGA Target Bay and in the area around the OMEGA EP Target Area Structure. NOTE: For evolutions where the wearing of a hard hat interferes with the ability to work effectively, the hard hat requirement may be waived providing (1) there is no potential for objects falling from above and (2) access to the areas above the work area are secured with barriers marked “Do not enter.” NOTE: OMAN optical inspectors are exempted from wearing hard hats during their off-hour inspections of optics provided: (1) the Target Bay has been secured for the day and (2) all other OMAN optical inspectors are working on the same level.

Systems and equipment shall be locked/tagged out in accordance with **Sec. 4005** as required.

All personnel will comply with the electrical and nitrogen safety procedures detailed below.

Outside normal Omega shift hours, at least two people using a “buddy” system must be present in the laser facility.

Hazardous equipment, such as motorized actuators/manipulators, is not to be controlled via a connection outside Omega’s firewall.

Electrical Safety Procedures: Electrical or electronic equipment containing >50 V shall be de-energized prior to performing corrective maintenance. This does not apply to taking readings on, making adjustments to, or trouble shooting electrical or electronic equipment when by equipment or instrument probe design the readings or adjustments can be made without risk of electrical shock. A risk of electrical shock exists if it is possible to inadvertently contact a live electrical circuit. If there is risk of shock and it is necessary to take readings on or perform maintenance adjacent to energized components, then the following procedures for working on energized equipment must be followed:

Permission to work on energized equipment must be received by the cognizant Group/Section Leaders and the LLE Chief Safety Officer or the Electrical Safety Officer. A Work Authorization Procedure shall be used in accordance with **Sec. 4003A**.

Appropriate PPE shall be used as specified by the WAP and approved by the LLE Chief Safety Officer or Electrical Safety Officer.

The equipment shall be de-energized to the maximum extent possible.

A voltage tester shall be used to verify which circuits are energized and which are de-energized before commencing maintenance.

A minimum of two personnel must be present: one who is actually performing the maintenance and one who acts as a safety monitor.

The safety monitor must be knowledgeable. As a minimum he or she must know how to de-energize the equipment, be in a position to observe the worker, and be in a position to pull the worker free in the event he or she receives an electrical shock. Care should be exercised that the safety monitor is not shocked in the process of freeing a shock victim. To this end, a rope should be used to free the victim.

Someone qualified in CPR shall be available in the Laboratory.

Insulating material should be laid out to the maximum extent practical to insulate the worker from ground and to protect against inadvertent contact with energized components.

Electrically insulated tools and instruments shall be used.

Nitrogen Environmental Safety: Spaces that are normally filled with nitrogen when in use, e.g., the large optic test facility, beam transport tubes, etc., may pose asphyxiation hazards if they are not properly vented/monitored. Normally for laser facility systems employing nitrogen, the process of venting or opening them will immediately cause a mixing of room air thereby ensuring sufficient oxygen. Additionally, since the volume of the space into which these systems are vented is so large (e.g., Laser Bay), its environment will be virtually unaffected. This was verified in the safety analysis of each system using nitrogen. However, to ensure safety, any space into which nitrogen is vented that can be occupied or any space that previously contained nitrogen that can be entered must be monitored for oxygen. The oxygen concentration of any occupied space must be verified to be above 19.5%. Additionally, personal oxygen monitors, or their equivalent, must be worn by persons when entering spaces that are designed to be nitrogen purged.

4009 Communication Procedures

The effective and safe operation of OMEGA or OMEGA EP requires that communications be concise, precise, and formal. This applies to all face-to-face, headset, or public address communications. To ensure effective communications, the following standardized procedures apply to all Omega operations:

General

No informal or personal communications will be transmitted on headsets or the public address system.

Headset will normally be worn by all watchstanders and the SD channel should be the primary operations channel. The Shot Director (SD) may use the speaker at the SD station to allow Control Room visitors to monitor events.

Headset communications must be concise, precise, and formal and idle chatter should not occur. Do not interrupt communications in progress, unless you have an urgent communication affecting operations or safety.

For extended communications relative to troubleshooting, maintenance, or other less formal circumstances, a dedicated channel should be used.

To minimize circuit noise, close your microphone when not in use.

To avoid confusion, first names are not to be used in formal communications; rather watchstation titles should be used or, if not on watch, either the last or full name will be used with title (Dr., Mr., Ms.) if appropriate.

Standard Communication Procedures

All communications that are either directive in nature or allow action to be initiated shall consist of a *to/from address, message, and acknowledgment* as follows:

To address—the station to which the message is intended, e.g., “Drivers, Beamlines, Shot Director, etc.”

From address—the station that originates the message. The *from address* is not used for public address system announcements or in other circumstances where the originator of the message is obvious and cannot be confused. For example, when the Shot Director communicates that he/she is ready for completion of the checklist, it is obvious that the Shot Director is the originator. Voice recognition may also make it obvious as to who the originator is, as long as the receiver both recognizes the voice AND has knowledge that the individual is currently assigned to the watchstation from which the communication originated. Both the voice and the authority to issue a directive must be clear (i.e., while a specific individual has authority when actually standing watch, that person does not have authority to issue a directive that changes system status when he/she is not on watch).

Message—the order or informational item to be communicated.

Acknowledgment—the affirmation that a message is received and understood.

- If the message is a directive that requires action—the message must be acknowledged by repeating back the message followed by stating your station title and “aye, understood, roger,” or another clear affirmative word indicating understanding. If the repeat back is in error, the originator will state “**wrong**” and will repeat the entire message.
- If the message is informational—the message need not be repeated back and may be acknowledged by simply stating your station title and “understood, aye, roger,” or other clear affirmative word indicating understanding.



The following standardized terminology will be used for all communications.

Written	Spoken
Shot Director	Shot Director
Principal Investigator	PI
Laser Driver Operator	Drivers or LDO
Laser Sources Operator	Sources or LSO
Laser Driver Technician	LDT
Laser Sources Technician	LST
Beamlines Operator	Beamlines or BO
Written	Spoken
IR-Alignment Laser Technician	IR-ALT
UV-Alignment Laser Technician	UV-ALT
Alignment Laser Technician	ALT
Amplifier Technician	AT
Power Conditioning Operator	Power Conditioning or PCO
Power Conditioning Technician	PCT
Experimental System Operator	Experimental or ESO
Experimental System Technician	EST
Experimental Cryogenic Technician	Cryo Tech
Laser Bay	Laser Bay
Target Bay	Target Bay
Capacitor Bay	Capacitor Bay
LaCave (OMEGA)	LaCave
Diagnostics Bay (OMEGA EP)	Diagnostics Bay
Pulse Generation Room	PGR
Driver Equipment Room	DER
Sources Bay	Sources Bay
Darkroom	Darkroom
Vacuum Pump Room	Pump Room
Fan Room	Fan Room
Control Room	Control Room
(the number) 0	Zero
Alphabet A–Z	Alpha, Bravo, Charlie, Delta, Echo, Foxtrot, Golf, Hotel, India, Juliet, Kilo, Lima, Mike, November, Oscar, Papa, Quebec, Romeo, Sierra, Tango, Uniform, Victor, Whiskey, X ray, Yankee, Zulu <i>(This phonetic alphabet need only be used when necessary to avoid confusion.)</i>
Number 1 Spatial Filter Pump	Number One Spatial Filter Pump
To Start	Start
To Secure (Stop)	Secure
To Open	Open

NOTE:

Many of the elements of the OMEGA system are designated by the “Stage, Cluster, Beam” convention where

Stages are lettered A, B, ... F,

Clusters are numbered 1, 2, ... 6,

Beams are numbered 10–60.

The phonetic alphabet is generally used to convey the stage letter and the cluster, and beam designation is properly pronounced as an ordered pair; e.g., say “Foxtrot One One,” not “eff eleven.”

The following are several example communications [in the correct sequence: *to address/from address/message // acknowledgment* (items included in parentheses () are optional in the circumstance portrayed)].

NOTE:

The acknowledgment must be a verbatim repeat back of the directive.

SD: “Drivers/(Shot Director) ready for checklist.”

LDO: “Ready for checklist, Drivers aye.”

NOTE:

“Aye” is an affirmative statement that means understood. The words “understood” or “roger” may be used in lieu of “aye.”

LDO: “Beamlines/(Drivers) SSD driver spots available.”

BO: “SSD spot available, Beamlines aye.”

BO: “Drivers/(Beamlines) finished with SSD spot.”

LDO: “Finished with SSD spot, Drivers, aye.”

PI: “Experimental/PI (or name) steer TIM one up one hundred microns.”

ESO: “Steer TIM one up one hundred microns, Experimental, aye.”

PCO: “PCT/(Power Conditioning)/safe PCU’s Echo One Four and Foxtrot Three One.”

PCT: “Safe PCU’s Echo One Four and Foxtrot Three One, PCT, aye.”

PCT: “Power Conditioning/(PCT)/PCU’s Echo One Four and Foxtrot Three One are safed.”

PCO: “PCU’s Echo One Four and Foxtrot Three One are safed, Power Conditioning, aye.”

Example of erroneous repeat back: note the use of the word “**wrong**” and a complete repeat of the entire message.

PCO: “PCT/(Power Conditioning)/safe PCU Delta One Zero.”

PCT: “Safe PCU Delta One One, PCT, aye.”

PCO: “**Wrong** PCT/(Power Conditioning)/safe PCU Delta One Zero.”

PCT: “Safe PCU Delta One Zero, PCT, aye.”

4010 Shot Request Forms and Administration

Execution of effective and safe OMEGA and OMEGA EP shots requires complete specification of the laser and diagnostic configuration, extensive advance planning, and many hours of system preparation prior to and during the actual shot day. The Shot Request Form (SRF) for each shot is the primary vehicle for recording and communicating the specifications for a shot. Supplemental tools and forms are used in planning and communicating the sequencing of related shots referred to as campaigns.

The SRF is a database object that is created via inputs made at a web-based SRF user interface. This interface consists of a series of pages or screens called “forms” that collect information of various types. The forms include the following:

- General
 - PI’s campaign identification, planned date, planned order, ...
 - Shot scope: OMEGA only, OMEGA EP only, joint shot.
- Drivers (OMEGA) – driver line(s), pulse shape, SSD modulation, timing
- Sources (OMEGA EP) – one to five sources (including 4ω probe), pulse shape, duration, timing
- Beams (OMEGA) – groups defined by energy, pointing, focus, termination
- Beams (OMEGA EP) – groups defined by energy, short/long pulse, pointing focus, termination
- Target – serial number and general information
- Target diagnostics – specified via a hierarchical series of location and setup forms.

Each SRF is automatically assigned a unique, sequential, identifying number at the time it is created. Appropriate controls are applied to limit both read and write access to the records.

The SRF can be viewed or printed, in part or whole, to provide a standard format for review and implementation. On shot day, SRF data values are also accessed directly by the Omega Control System and used to assist the operators in preparing for and executing the shot. Once an SRF has been used to specify an experimental target shot, it is considered expended and will not be reused. The SRF data values are retained indefinitely. The SRF values, indexed by the unique identifying number, may be retrieved for data assessment and can be copied to create new SRF’s.

The Principal Investigator (PI) has the primary responsibility for preparation and coordination of the Shot Request Forms that define the shots for which he/she is responsible.

The SRF process may be initiated at any time. The key steps and milestones in the preparation and use of SRF's are as follows:

- >Twelve weeks prior to the planned shot week – The PI submits Shot Request Forms to accompany the Proposal Template that define each unique shot configuration to LLE. These SRF's shall be used as the basis for the approval/rejection of the campaign. For complicated configurations, early submission will ensure that all details are negotiated to match the system capabilities in a timely fashion.
- Monday, two weeks prior to the planned shot week – The PI reviews Shot Request Forms that define each unique shot configuration to LLE. This will precede and facilitate the “two-week PI brief.”
- Monday, one week prior to the planned shot week – The PI submits final Shot Request Forms for all of the planned shots to the Laser Facility Manager. This will precede and facilitate the “one-week PI brief.” The Laser Facility Manger shall be notified of all subsequent changes.
- During the interval between submittal and shot day – designated LLE personnel will review the SRF's and may edit/modify data values as required with the concurrence of the PI. Personnel authorized to edit/modify SRF's include diagnostic instruments specialists, the Laser Facility Manager, and the Group members charged with implementing the necessary shot preparations.
- Shot Day – The PI shall inform the Shot Director of any change in the planned shot order.
- Pre-Shot – The Shot Director, System Scientist, and designated system operators may modify SRF data values for the shot that is currently underway with the concurrence of the PI. These changes shall be for the purpose of dealing with situations or details that could not have been anticipated earlier. All such changes shall be implemented and verified prior to charging for the shot.
- Post-Shot – The authorized persons may edit the SRF data to capture the actual shot conditions up to two weeks after the SRF has been used to specify a system shot. This shall be for the purpose of facilitating data interpretation or replication of the shot.