



AMENDMENT 2

TO AGREEMENT ACT00001.0 of 16 September 2013

On this day, month, and year, the following Parties:

Lawrence Livermore National Security, LLC, a limited liability company organized in the State of Delaware, having an administrative office at 2300 First Street, Suite 204, Livermore, CA 94550 represented by Dr. William Goldstein

("LLNS")

and

Fyzikální ústav AV ČR, v. v. i., located at Na Slovance 2, 182 21 Praha 8, Id. No 68378271 represented by prof. Jan Řídký DrSc.

("IOP", "CLIENT")

(collectively referred to as the "**Parties**")

have agreed on this Amendment of the AGREEMENT ACT00001.0 made between the Parties on 16 September 2013 (the "**Amendment**"):

PREAMBLE

- A. On 16 September 2013, the Parties entered into the AGREEMENT ACT00001.0, the subject of which is a development of High Repetition Rate Advanced Petawatt Laser System (the "**Agreement**" and the "**HAPLS**" or "**L3**"). The Agreement was awarded in accordance with the procurement procedure according to the Czech Republic Act No. 137/2006 Coll., on Public Procurement, as amended (the "**PPA**").
- B. On 13 December 2016, IOP determined that the HAPLS met Milestone D6 Acceptance Criteria.
- C. IOP is seeking the most efficient as possible use of time between completion of the D6 milestone at LLNL and the beginning of installation of the L3-HAPLS laser system at the **CLIENT'S** facility. With readiness of the laser building for installation of L3-HAPLS later than expected, IOP's intention is to continue to operate the system and acquire additional operational data and experience, train IOP staff in troubleshooting and maintenance of the laser, and improving the system at LLNL until its shipment to the **CLIENT'S** facility.
- D. IOP is seeking operating experience and performance characterization data from the fully integrated L3-HAPLS when run at longer durations (one hour or longer) and while completing multiple laser startup cycles typical for an experimental facility. The data obtained during this **Prolonged Operations, Staff Training and Diagnostics Campaign (POSTDC)** will provide both the **CLIENT** and **LLNS** with an extensive set of benchmark data to use once L3-HAPLS has been



transferred to the **CLIENT'S** facility. This is expected to allow IOP to substantially reduce the time between installation of the system at the **CLIENT'S** facility and start of L3-HAPLS experimental user operations shortly after its installation

- E. IOP is seeking to conduct risk mitigation experiments at LLNL that will inform the path forward for subsequent performance ramping of L3-HAPLS at the **CLIENT'S** facility.
- F. IOP is seeking to maximize the reliability and availability of the laser at or beyond the Project Completion Criteria (PCC) for experimental operations as soon as possible after installation of the system.
- G. IOP is seeking cross-training of its laser personnel on integrated operations and maintenance of the entire L3-HAPLS, including direct control of the full system in regimes consistent with user experimental conditions. This will allow transition to user experimental operations immediately after installation and commissioning at the **CLIENT'S** facility.
- H. IOP is seeking to use the POSTDC period to make specific improvements to L3-HAPLS as direct precursors to performance ramping, most notably regarding high-energy long-time operation of the pump laser, and commissioning of the IOP-procured spare short-pulse Beta amplifier head. IOP also expects to identify system improvement opportunities as a result of the additional operating time at LLNL.
- I. IOP is seeking additional IOP staff operating experience with the IOP-provided Short Pulse Diagnostics Package (SPDP) as well as an opportunity for software improvements and SPDP-hardware upgrades prior to shipment to the **CLIENT'S** facility.
- J. Therefore, the **CLIENT** is requesting a minimum three month prolonged operations, staff training and diagnostics campaign period for the integrated L3-HAPLS system at LLNL consistent with A-I above. The POSTDC period is expected to contribute to accelerated readiness of the L3-HAPLS for user operations at the **CLIENT'S** facility, while minimizing associated risks.
- K. All terms used in the Amendment have the same meaning as used in the Agreement, unless expressly stipulated otherwise in the Amendment.

1. THE PURPOSE AND SCOPE OF THE AMENDMENT

- 1.1. At the completion of the L3-HAPLS Project Completion Criteria (PCC) demonstration associated with the D6 milestone in accordance with Article 4.A of the Agreement, **LLNS** in conjunction with **CLIENT** personnel will begin the POSTDC period. This will involve the following:
 - 1.1.1. Prolonged operations of the integrated L3-HAPLS with all subsystems running, at conditions emulating actual operation of the system for users, characterization of long-term performance of the high-average power short-pulse Ti:sapphire chain, collection of extensive diagnostics data and analysis of performance trends to understand the behavior of ultrafast optical component and coatings, and evaluation of L3-HAPLS long-term performance stability;



- 1.1.2. Improvement of stress birefringence balancing of pump laser amplifier heads (depolarization) running at 3.3 Hz, as a direct precursor for ramping the pump laser towards higher pulse energy and/or repetition rate, including upgraded diagnostics for assessment of the depolarization level, and development and implementation of software upgrades to support tuning of the system for lower depolarization levels;
 - 1.1.3. On-the-job cross training of **CLIENT's** personnel in integrated operations under conditions emulating actual operation of the L3-HAPLS for users, and training focused on future performance ramping of the integrated system at the **CLIENT'S** facility.
 - 1.2. The POSTDC period will last at least 3 months. **CLIENT** subject matter experts (SMEs - the POSTDC team) will participate and receive training at LLNL.
 - 1.3. Additional system operation time includes the risk of encountering component and infant failures, material degradation or fatigue, unintended equipment damage that may require repair, replacement or improvement, and other risks. Responsibility for these cost, consequential schedule, and all other risks will be carried exclusively by the **CLIENT**, including with respect to meeting remaining milestone deliverables due to the occurrence of such risks as described above. However, consistent with the current ACT agreement, **LLNS** shall continue to exercise 'Due Professional Care' during all proposed work activities. Appropriate and required cargo/property insurance will be maintained by LLNS in accordance with Article 6 – Insurance of the Agreement. Articles 4.C. and 12 of the Agreement remain in effect.
 - 1.4. **CLIENT** and **LLNS** will jointly establish a system operations control board (SOCB) consisting of IOP and LLNL-HAPLS subject matter experts. This board will evaluate test plans and associated project risks for proposed POSTDC operation campaigns. LLNS shall exercise Due Professional Care in order to cause that proposed operating modes and campaigns, including potential performance improvements to any L3-HAPLS subsystem, should maximize the ability to characterize the long-term performance of the integrated L3-HAPLS consistent with the goal of achieving the D8 Deliverable milestone and early user operations, while minimizing the risk of inducing failure modes that could be detrimental to achieving this same goal. The charter, membership and management processes for the SOCB shall be documented and jointly agreed. The ultimate decision for a campaign will jointly be made by appointed IOP and HAPLS project management representatives, based on recommendations by the SOCB.
 - 1.5. **CLIENT** reserves the right to exercise contractual options for defined POSTDC extensions. Exercising any or all extensions will be at the sole discretion of **CLIENT**. For any or all extensions the **CLIENT** subject matter experts (SMEs - the POSTDC team) will participate and receive training at LLNL.

2. AMENDMENT TO THE EXISTING STATEMENT OF WORK



Parties agreed that Appendix A: Statement of Work of the Agreement shall be extended by adding the following new wording (that shall apply in addition to the existing wording in Appendix A and shall not replace that wording):

*“The **CLIENT** and **LLNS** agreed on a Prolonged Operations, Staff Training and Diagnostics Campaign (“POSTDC”) period that is expected to minimize the time between installation of the L3-HAPLS at the **CLIENT’s** facility and start of L3-HAPLS operation for users, and that is expected to maximize the reliability and availability of the laser for experimental operations.*

The scope of work associated with the POSTDC is as follows:

- *With the **CLIENT** POSTDC team as defined in Section 8 hereof, **LLNS** will conduct system characterization studies and long term operational testing of the integrated L3-HAPLS over a three-month period at LLNL. The system and subsystems will be operated at levels up to and including the PCC. This will provide the **CLIENT** POSTDC team with direct operational experience of the full system, including the short-pulse Beta Ti:sapphire power amplifier, in regimes consistent with future user experimental conditions, and will allow transition to experimental operations for users immediately after installation and commissioning at the ELI-Beamlines facility. These activities are intended to decrease the risk for transitioning the L3-HAPLS system into the beginning of experimental operations.*
- *Study and/or test specific improvements identified during long term operations as well as D6 milestone recommendations. Implement improvements to the L3-HAPLS where applicable. These improvements are intended to result in lowered integration risk, including with the **CLIENT**-supplied compressor, at the ELI-Beamlines facility.*
- *Develop failure mode resolution actions for operation of the entire system, including the short-pulse Beta Ti:sapphire power amplifier, in regimes consistent with future user operations at levels up to PCC. This is intended to contribute to shortened maintenance cycles of the L3-HAPLS system in early operation at **CLIENT’s** facility and reduced maintenance overhead costs.*
- ***LLNS** will provide to the **CLIENT** POSTDC team extended operation training, hands-on training and maintenance training on the full-integrated L3-HAPLS. The **CLIENT** POSTDC team will consist of **CLIENT** staff with the skills, knowledge, and abilities (SKAs) defined in Section 8 hereof. This training will be tailored to the SKAs of the specific **CLIENT** POSTDC team members. The focus of the team will be to learn and train on:*
 - *Integrated operation of the L3-HAPLS including short-pulse Ti:sapphire Beta amplifier and associated key operational procedures:*
 - *Installation and alignment of the beam wavefront corrector of the Ti:sapphire Beta amplifier output*
 - *Inspection, alignment and maintenance of the full pump image relay beamline of the Beta Ti:sapphire amplifier*
 - *Integrated operation of L3-HAPLS under conditions consistent with actual operation of the*



system for users

- *Work authorization process for safe operations of the integrated L3-HAPLS*

3. SPARE PARTS PROVISION

LLNS has procured initial operational spare parts for the pump laser to be delivered to the **CLIENT** under the Agreement (Appendix D Spare Parts Option, Section 1 Operational Spare Parts) along with some residual construction spares. These spares (operational and residual construction) were planned to be available for the early commissioning and operational phase of the project at ELI-Beamlines. With POSTDC adding at least 3 months of operational time of the full integrated L3-HAPLS system at LLNL, **CLIENT** will make available for **LLNS** use operational spare parts where construction spare parts are not available. **LLNS** will not procure additional spare parts for any parts consumed under POSTDC unless directed in writing by the **CLIENT** under the terms of the Agreement.

At the end of the POSTDC, **LLNS** will provide a list of remaining and intact operational and construction spare parts. During POSTDC, **LLNS** will optimize the allocation of resources consistent with the commissioning plan, delivery schedule, and technical specifications.

LLNS will inform the **CLIENT** on use of operational spare parts, that are high cost and/or long-lead procured items. **LLNS** shall be obligated to procure substitute spare parts upon the **CLIENT's** request.

All costs associated with this Article shall be the responsibility of the **CLIENT**.

4. ADDITIONAL DELIVERABLE

***LLNS** shall deliver to the **CLIENT**, within the deadline set forth in the Delivery Schedule in Section 7 of this Amendment, a POSTDC Status Report providing details on operation and achieved performance of the fully-integrated L3-HAPLS during POSTDC, including operation of the short-pulse Ti:sapphire Beta amplifier, in regimes consistent with future user conditions at the **CLIENT** facility, and describing in detail the L3-HAPLS system improvements made during the POSTDC period. The report shall provide a description of developed failure mode resolution actions for operation of the integrated L3-HAPLS system, including operation at PCC performance levels. The report shall include a description of the status of **CLIENT** staff training related to the specific training activities provided by **LLNS** during the conduct of the POSTDC.*

The Acceptance Procedure for this Deliverable will be in accordance with provisions defined in Appendix A Section 5.2 (and all related subsections) of the Agreement.

5. ADDITIONAL POSTDC FUNDING LEVEL



Parties agreed that Article 4.A. of the Agreement shall be extended by the following new wording, (that shall apply in addition to the existing wording in Article 4.A. and shall not replace that wording):

“The funding required for the complete POSTDC scope of work defined by Amendment 2 is in addition to the funding levels shown in Article 4.A of the Agreement, and the funding level shown in Article 5 of Amendment 1 of the Agreement. The additional funding level to LLNS for the work to be performed under Amendment 2 is not to exceed one million and one hundred and fifty thousand U.S. Dollars (\$1,150,000 USD). All amounts listed herein are net of value added tax which shall be payable according to the applicable legal regulation.

<i>Funding for the Prolonged Operations, Staff Training and Diagnostics Campaign (POSTDC)</i>	<i>\$1,150,000 USD</i>
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Additional funding may be incurred only in cases of the exercise of one or more of the contractual options described in Article 6 of Amendment 2.

<i>Funding for POSTDC Option-A CADB Beta amplifier commissioning</i>	<i>\$615,000 USD</i>
<i>Funding for POSTDC Option-B Control system software improvements</i>	<i>\$333,000 USD</i>
<i>Funding for POSTDC Option-C SPDP upgrades</i>	<i>\$333,000 USD</i>
<i>Funding for POSTDC Option-D Performance characterization, benchmarking, and optimization</i>	<i>\$333,000 USD</i>
<i>Funding for POSTDC Option-E Additional Performance characterization, benchmarking, and optimization</i>	<i>\$333,000 USD</i>

*The parties mutually agree that any funds originally allocated to be used in support of the D8 milestone may be redirected for POSTDC purposes until replenished by POSTDC funding as indicated by the Amendment 2, Article 7 Revised Payment Schedule. All funds currently allocated to be used in support of the D7 milestone will be maintained to insure the successful packaging and shipping of the HAPLS equipment from LLNL to **CLIENT’S** facility.”*

6. OPTIONAL POSTDC PERIOD STATEMENTS OF WORK

The **CLIENT** reserves the right to exercise options (included in the bid) in accordance with applicable law, to extend HAPLS operations at LLNL beyond the base period defined in this Amendment.

Exercise of any or all optional operations periods shall be at the sole discretion of the **CLIENT**, based on written direction to **LLNS**. Each option is separable from the others, may be exercised individually, but must be executed in a continuous and sequential manner with no interruption.

LLNS will recommend to the **CLIENT** the preferred option(s) to exercise based on current work scope results.

The **CLIENT** will notify **LLNS** of its intention to exercise an option at least one-month prior to the end of the current POSTDC performance period.



The detailed scope of work to be performed through each exercised option will be documented and agreed to through a jointly approved Technical Query in advance of the start of work.

No unique deliverables will be submitted by LLNS to the **CLIENT** specifically as the result of any or all of the exercised options; however, results gained and modifications or improvements to the system made during these optional extension periods will be documented in the proposed *POSTDC status review* deliverable [see Article 4 of this Amendment].

At the completion of the duration defined by each exercised option, consistent with the work scope defined in each associated Technical Query, **LLNS** shall submit an invoice to the **CLIENT** in the amount specified in the options table above. Invoices shall be submitted in accordance with provisions defined in Article 4.D.i of the Agreement.

The following scopes of work associated with each exercised option will be consistent with the planned funding levels identified in Article 5 of this Amendment.

Option A: CADB Beta amplifier commissioning – Two month extension

Installation qualification (IQ) and operational qualification (OQ) of the upgraded short-pulse Beta amplifier using Ti:sapphire slabs equipped with chemically activated direct bonded cladding consistent with high average laser power. Training of IOP POSTDC personnel in servicing of the Ti:sapphire Beta amplifier head and related equipment. Activities will be conducted over a consecutive two-month period.

Option B: Control system software improvements – One month extension

Upgrades to the L3-HAPLS control system consisting of implementation of full sequencer capability allowing the state machine to run sequences and minimize laser operations manpower support, upgrades to the system status monitor and the top-level graphic user interface, and implementation of advanced motion software making it possible to fully automatic align specific sections of the system. Activities will be conducted over a one-month period.

Option C: SPDP upgrades – One month extension

Installation and testing of hardware upgrades to the IOP-provided Short Pulse Diagnostics Package (SPDP) including vertical SPDP configuration to be integrated with the laser system and with the L3-HAPLS petawatt pulse compressor, and development and testing of software improvements including fully automated SPDP operations. Activities will be conducted over a one-month period.

Option D: Performance characterization, benchmarking, and optimization – One month extension

*Conduct subsystem and/or system level performance characterization, benchmarking, and optimization activities at LLNL that will inform the path forward for integration of specific improvements and facilitate subsequent performance ramping of L3-HAPLS at the **CLIENT'S** facility. Activities conducted over a one-month period.*



Option E: Additional performance characterization, benchmarking, and optimization – One month extension

*Conduct additional subsystem and/or system level performance characterization, benchmarking, and optimization activities at LLNL that will inform the path forward for integration of specific improvements and facilitate subsequent performance ramping of L3-HAPLS at the **CLIENT'S** facility. Activities conducted over a one-month period.*

7. REVISED DELIVERY AND PAYMENT SCHEDULE

Parties agreed that the Payment Schedule in Article 4.A. of the Agreement shall be fully replaced by the following Payment Schedule. Parties further agreed that all other current provisions in Article 4.A. of the Agreement remain unchanged and effective, including but not limited to the provisions related to acceptance testing and the use of Due Professional Care.

Upon exercise of any or all of the options (A-E) described in Article 6 of this Amendment, the due date for each remaining Deliverable (*POSTDC status review, D7, D7A, ETOP Training Report Update, D8*) in the following Payment Schedule shall be extended by the duration of the exercised option.

Deliverable	Description	To be documented by	Completion Date	Phase	Payment (to fund follow-on work)	Proposed Payment Date
	Sign contract	Contract		1	\$ 8,550,000	7-Sep-2013
D1	Conceptual technical design of the laser beamline, detailed project execution plan, interface definition with the ELI-Beamlines building	Submission of a technical design report including: beamline technology description; detailed project plan; specific roles, responsibilities and interfaces for LLNS and IOP staff; and description of items with long-lead procurements.	30-Nov-2013	1	\$ 9,737,500	31-Dec-2013
		Acceptance Certificate				
D1A	Technical approach for end-to-end dispersion management in the short pulse chain, including design of the stretcher and compressor sub-systems	Submission of a technical report detailing the solution for achieving high fidelity short pulses – addressing one of the critical issues for design and operation of the HAPLS beamline.	31-Jan-2014	1	\$ 7,220,000	28-Feb-2014
		Acceptance Certificate				
D1B	Critical progress review of the Procurement Plan for major components and sub-systems for HAPLS. Update to the Project Execution Plan (PEP)	Submission of a technical progress report on the status of the procurement plan – noting status of orders and vendor response, along with impacts on the PEP and mitigation action undertaken.	30-Apr-2014	1	\$ 6,270,000	31-May-2014
		Acceptance Certificate				

Deliverable	Description	To be documented by	Completion Date	Phase	Payment (to fund follow-on work)	Proposed Payment Date
D2	Operational qualification of the short pulse front end, updated technical design of the beamline	Submission of a technical progress report on assembly of the HAPLS front end up to the broadband preamplifier(s), including results of the validation tests and their analysis with respect to the design requirements.	31-Oct-2014	1	\$ 5,085,000	30-Nov-2014
		Acceptance Certificate				
D3	Assembly of key subsystems of the pump laser	Submission of a technical progress report on acquisition, fabrication and assembly of key components and/or subsystems of the HAPLS. The report shall also include the assembly and the validation of alignment of the optical transport system for pumping the broadband power amplifier.	30-Apr-2015	1	\$ 5,470,000	31-May-2015
		Acceptance Certificate				
PHASE 1 REPORT	Summary of Phase 1 achievements	Submission of technical progress report, with detailed inventory of purchased and commissioned equipment.	31-Aug-2015	1	Nil	N/A
		Acceptance Certificate				
	ETOP Initiation	Amendment No. 1 to Agreement	11-Sep-2015	1	\$1,734,000	18-Sep-2015

Deliverable	Description	To be documented by	Completion Date	Phase	Payment (to fund follow-on work)	Proposed Payment Date
D4	Acceptance test of the HAPLS pump laser including PLRCs	Demonstration to CLIENT and submission of a technical report that the HAPLS pump laser meets the specific Pump Laser Readiness Criteria. Submission of a confirmatory technical report recording the measured specifications.	31-Jan-2016	2	\$ 2,367,500	31-Jan-2016
		Demonstration Acceptance Protocol				
	ETOP midterm review	Submission of a Progress report including a description of ETOP activities completed to date.	31-Jan-2016	2	\$2,000,000	28-Feb-2016
		Acceptance Certificate				
D5	Readiness of the IOP-provided PAD diagnostic with integrated controls and control system for performance testing of the HAPLS short pulse beamline	LLNS acceptance of IOP-provided PAD diagnostic with integrated controls and control system.	30-Jun-2016	2	Nil	N/A
		Acceptance Certificate				
D4A	Review ETOP training status of IOP staff on pump laser operations	Submission of a Training Status Report regarding the status of the extended training and operations period on the HAPLS pump laser system, submission of a list of consumed operational and construction spare parts during ETOP, and initial operations assessment.	31-Jul-2016	2	Nil	N/A
		Acceptance Certificate				

Deliverable	Description	To be documented by	Completion Date	Phase	Payment (to fund follow-on work)	Proposed Payment Date
D6	Acceptance test of the HAPLS to PCC	Demonstration to CLIENT and submission of a technical report confirming that the completed HAPLS meets the Project Completion Criteria and is consistent with the result of D4.	31-Dec-2016	2	\$ 665,000	31-Jan-2017
		Demonstration Acceptance Protocol				
	POSTDC Amendment signature	Amendment No. 2 to Agreement	27-Jan-2017	2	\$100,000	31-Jan-2017
	POSTDC Payment point	Submission of an invoice for the work performed during the POSTDC period of performance.	31-Mar-2017	2	\$1,050,000	30-Apr-2017
	POSTDC status review	Submission of a progress report on performance of the integrated L3-HAPLS including operations in regimes consistent with future user conditions and including a description of system improvements made during POSTDC, and submission of a list of consumed operational and construction spare parts during POSTDC.	30-Jun-2017	2	Nil	N/A
		Acceptance Certificate				
D7	Packaging and shipment of the HAPLS to the ELI-Beamlines facility (contingent on ELI-Beamlines facility readiness) (Incoterms 2010 DAP condition shall apply)	Receipt of HAPLS at the ELI-Beamlines facility	30-Jun-2017	2	\$ 380,000	30-Jul-2017
		Acceptance Certificate				

Deliverable	Description	To be documented by	Completion Date	Phase	Payment (to fund follow-on work)	Proposed Payment Date
D7A	Review training status of IOP staff	Submission of a report providing details of the status of IOP staff training on all aspects of the HAPLS system design, commissioning, operation, maintenance, and integration into the ELI-Beamlines facility.	30-Sep-2017	2	\$ 380,000	31-Oct-2017
		Acceptance Certificate				
	Update of the ETOP training report	Submission of an updated ETOP training report including a description of ETOP activities related to the Short Pulse Laser systems.	30-Sep-2017	2	Nil	N/A
		Acceptance Certificate				
D8	Re-assembly and commissioning of the delivered HAPLS at the ELI-Beamlines facility and demonstration of PCCs and PLCCs	Demonstration at the CLIENT's site and submission of a technical report confirming that the completed HAPLS is consistent with the results of D6 and meets the Project Completion Criteria, including the pump lasers achievement of Pump Laser Completion Criteria. Based on achieved performance, LLNS will submit recommendations for operation of the HAPLS at full Performance Requirements.	31-Mar-2018		\$ 75,000	31-Mar-2018
		Demonstration Acceptance Protocol				

8. ADDITIONAL ROLES AND RESPONSIBILITIES

POSTDC team

The POSTDC team will consist of both **LLNS** and the **CLIENT** staff members.

LLNS POSTDC team

LLNS staff will participate in and provide training on:

- *Integrated operation of the L3-HAPLS including short-pulse Ti:sapphire Beta amplifier and associated key operational procedures:*
 - *Installation and alignment of the beam wavefront corrector of the Ti:sapphire Beta amplifier output*
 - *Inspection, alignment and maintenance of the full pump image relay beamline of the Beta Ti:sapphire amplifier*
- *Integrated operation of L3-HAPLS under conditions consistent with actual operation of the system for users*
- *Work authorization process for safe operations of the integrated L3-HAPLS*

Level of Effort for LLNS

The LLNS POSTDC team will consist of LLNS expert staff members who will participate in POSTDC activities for the duration of the POSTDC at LLNL. The LLNS POSTDC team will include HAPLS subject matter experts in the following areas: Project Management, Systems Engineering, Electrical and Controls Engineering, Mechanical Engineering, Optical and Laser Engineering with skills, knowledge and abilities consistent with the “Dedicated Team Presentation” and technical experience matrix documented in LLNS response to the Tender Documentation for acquisition of the “High repetition rate advanced petawatt laser beam line”.

Client POSTDC team

Parties agreed that Appendix C of the Agreement (“**CLIENT** ROLES AND RESPONSIBILITIES”) shall be extended by the following new wording, (that shall apply in addition to the existing wording in Appendix C and shall not replace that wording):

Background

*The POSTDC will provide continued training opportunities for six (6) **CLIENT** staff members (FTE) that were part of the Integrated Commissioning Team consisting of Laser Scientists, Control Systems Engineers, and Laser and Electro Optics Technicians as described below. **LLNS** will supply on-the-job training based on existing Concept of Operations (ConOps) to **CLIENT** staff. **CLIENT** staff will be responsible for receiving the instruction and documenting in an appropriate format ELI-Beamlines operational and maintenance procedures with the necessary detail to be used for operations in the ELI-Beamlines facility.*

IOP Work Package

The **CLIENT** POSTDC team will participate in and receive training on:

- *Integrated operation of the L3-HAPLS including short-pulse Ti:sapphire Beta amplifier and associated key operational procedures:*
 - *Installation and alignment of the beam wavefront corrector of the Ti:sapphire Beta amplifier output*
 - *Inspection, alignment and maintenance of the full pump image relay beamline of the Beta Ti:sapphire amplifier*
- *Integrated operation of L3-HAPLS under conditions consistent with actual operation of the system for users*
- *Work authorization process for safe operations of the integrated L3-HAPLS*

Level of Effort for CLIENT

The **CLIENT** POSTDC team will consist of six (6) expert staff members assigned and available during the POSTDC period of performance. The **CLIENT** POSTDC team will consist of personnel consistent with skills, knowledge, and abilities of a Senior PhD Laser Scientist, Junior PhD Laser Scientist, Senior Control Engineer, and Senior Laser Electro Optical Technician. All members of this team shall have extensive background knowledge and hands-on experience in the respective fields. Every individual member of this team will be designated by mutual consensus between the **CLIENT** and **LLNS**. The following table lists the five POSTDC **CLIENT** staff members and describes their anticipated skills, knowledge, and abilities:

Position	Min FTE	Education	Expertise
<i>Senior PhD Laser Scientist</i>	1	<i>PhD Laser technology</i>	<p><i>Minimum 6 years substantial hands-on expertise in:</i></p> <ul style="list-style-type: none"> <i>Strong background and knowledge in laser science and technology, specifically in laser pulse generation, amplification, gain media, and laser pulse propagation</i> <i>Establishment of functional requirements and Concept of Operation, risk management, verification and validation methodology</i> <i>High energy laser research and development,</i> <i>Nanosecond laser pulse characterization: Physics and technology of laser diagnostics (pulse shape measurement, near and far field measurement, wave front measurement, energy and power measurement, beam sampling techniques, calibration methods)</i> <i>Review and revision of laser operation procedures and manuals</i> <i>Laser safety</i>
<i>Junior Laser Scientist or laser / optical engineer</i>	2	<i>PhD Laser technology or MS laser / optical engineering</i>	<p><i>Minimum 4 years hands-on expertise in:</i></p> <ul style="list-style-type: none"> <i>Strong background and knowledge in laser science and technology, specifically in laser pulse generation, amplification, gain media, and laser pulse propagation</i> <i>Nanosecond laser pulse characterization: Physics and technology of laser diagnostics (pulse shape measurement, near and far field measurement, wave front measurement, energy and power measurement, beam sampling techniques, calibration methods)</i> <i>Strong background in function and operation of general laser components (laser amplifier, pump cavities, Pockels cells, spatial filters, front-ends, ...)</i> <i>Development of laser operation procedures and manuals</i> <i>Laser safety</i>

Position	Min FTE	Education	Expertise
<i>Laser Electro Optical Technician (LEOT)</i>	2	<i>BS or equivalent</i>	<p><i>Minimum 1 year substantial hands-on expertise in:</i></p> <ul style="list-style-type: none"> • <i>Operation of energetic, high repetition rate laser systems</i> • <i>Handling, preparation, cleaning of delicate optics and optical materials</i> • <i>Assembly of opto-mechanical components and systems</i> • <i>Alignment techniques and precision optical alignment of optical systems</i> • <i>General knowledge and understanding principle of operation for general laser components (laser amplifier, pump cavities, spatial filters, diffraction gratings, front-ends, ...)</i> • <i>Development of laser operation procedures</i> • <i>Laser safety</i>
<i>Senior Controls Engineer</i>	1	<i>MS or equivalent</i>	<p><i>Minimum 3 years substantial hands-on expertise in:</i></p> <ul style="list-style-type: none"> • <i>LabVIEW programming experience (preferable certified):</i> <ul style="list-style-type: none"> ○ <i>Real-time</i> ○ <i>FPGA</i> ○ <i>OPC interfacing</i> ○ <i>Vision and motion control</i> ○ <i>VI level documentation</i> • <i>LabVIEW Code design including formal review, source code control, and issue tracking</i> • <i>LabVIEW driver development, equipment interfacing and controlling</i> • <i>Control system architecture</i> • <i>Facility interface</i>

9. FINAL PROVISIONS

8.1 This Amendment comes into force and effects on the date of conclusion hereof.

8.2 No other modifications, alterations, or interpretations to the Agreement are intended or implied by this Amendment. All existing clauses of the aforementioned Agreement, including Appendices, remain in effect, unless expressly modified or replaced through this Amendment.

8.3 This Amendment has been executed in four counterparts whereas each Party receives two counterparts.

FYZIKÁLNÍ ÚSTAV AV ČR, V. V. I. (Institute of Physics at the Academy of Sciences of the Czech Republic) [CLIENT]	LAWRENCE LIVERMORE NATIONAL SECURITY, LLC [LLNS]
By _____	By _____
Name <u>Prof. JAVU ŘÍDEK, DR.Sc.</u>	Name <u>William H. Goldstein</u>
Title <u>Director, IO PASOR</u>	Title <u>President, LLNS LLC</u>
Date <u>- 2. 03. 2017</u>	Date <u>JANUARY 31, 2017</u>

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