



## Instructional Equipment Request

FALL 05

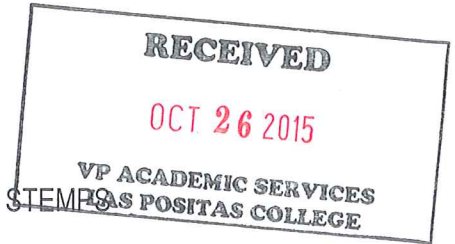
\$ 27,500

### SECTION 1: SUMMARY INFORMATION

Timeframe for the Request: Fall: x Spring: Year: 2015

Name of Requestor: Eric W. Harpell, Andrew Lozano

Division/ Unit: STEM



Brief Title of the Request: Physics Equipment Equipment Location: 1824/1831

### SECTION 2: DESCRIPTION

Describe the specific equipment or materials requested and a brief explanation of how it will be used.  
(Please do not include cost data here.)

Materials will generally be used for the physics laboratory. Some will be shared with engineering, and some will be used for demonstration purposes in physics, astronomy, and environmental science classes

Two items will improve our ability to conduct laboratory activities in astronomy, and provide dark sky observing opportunities for students.

Specifically, the items and their use are:

- 1) **Motion Detector.** Upgrade/New equipment. The Motion Detector uses ultrasound to measure the position, velocity, and acceleration of moving objects such as carts, balls, and students when used with the Vernier Lab Pro interface. These detectors will allow us to increase number of lab groups from six to twelve. This reduces the number of students working together in one group from four or five to two or three students. This will in turn improve student understanding by compelling students to work directly on the experiment rather than dividing up the labor.
- 2) **Lab Quest 2 computer interfaces.** Upgrade/New equipment. These are the "workhorse" computer interfaces used in the physics lab, as well as in astronomy laboratory. They connect to a variety of sensors to measure physical phenomena. The Interfaces can be used with a computer or can be used in "stand alone mode." The purchase of 6 will allow us to increase the number of lab groups from 6 to 12 as discussed above with the Motion detectors.
- 3) **Photogates.** Upgrade/New Equipment. Photogates are used together with the Lab Quest Interfaces (see item #2) in several physics laboratories to measure time intervals during which an infra-red beam is interrupted. Measurements of these time intervals allow students to conduct experiments in kinematics and dynamics, as well as applications of these principles to other areas of physics and astronomy such as measuring magnetic forces and simulating extra solar planet detection. The six photogates being ordered will allow us to increase number of lab groups from six to twelve as discussed in item #1.
- 4) **Dual Range Force Sensor.** Upgrade New Equipment. These sensors are used together with the lab quest interfaces to allow students to measure Force as a function of time, or other input. These sensors are currently used in multiple physics labs and will allow us to increase the number of lab groups to six to twelve as discussed in item #1.
- 5) **Force plate.** Replacement/new equipment. This apparatus will be used for physics labs involving large forces involved when students stand, jump, and push on the force plates. By using this equipment, students better understand the connection between mass, force, and acceleration, as well as work and power. A few of these popular lab equipment items have broken, so this order of 6 will allow to upgrade the number of labs groups from 4 to 10, with the possibility of two groups of the broken items are repaired.
- 6) **Basic Optics X-Y adjustable Diode Laser.** New equipment. This versatile, relatively inexpensive Diode Laser is designed to mount on a rod stand. The laser assembly can rotate 360 degrees. Easy setup makes it perfect for refraction investigations or other general laser experiments. The lasers will be used in multiple optics laboratories and also for demonstrations in physics and astronomy classes.
- 7) **General Flow Sensor with Pitot tube.** New equipment. Determines fluid velocity in air or water by measuring the difference in pressure between the two input tubes. This equipment will be used together with the Lab quest computer interfaces and the Pitot tube. This equipment will allow the development and implantation of lab experiments that help students to better understand the physics of pressure and fluid flow involving Pascal's and Bernoulli's principles. It will also be used in a laboratory that tests the relative advances of energy storage systems related to wind and solar power.
- 8) **Heat Engine Gas law apparatus.** Upgrade. The heat engine/gas law apparatus allows the students to investigate the relationship between temperature, volume, and pressure as described by the ideal gas law, and also to understand heat engines and determine their thermodynamic efficiency. This order will also allow us to upgrade

our current set of apparatus from 3 (or possibly 4) functioning systems to twelve. This will in turn allow us to increase the number of lab groups from 3 or 4 to 12 as described in #1.

- 9) **VWR E-Series Balances (3000 g with .01 g readability).** *New equipment/upgrade.* These balances replace thirty year old pan balances used in lab to measure small changes in weight associated with measuring electric and magnetic forces, as well as density measurements used labs that test Archimedes principle. They will also replace less accurate and reliable digital balances that are currently in disrepair. The Balances will also be used in a very large number of physics labs where accurate determination of mass over a wide range is required. The two Balances will be shared among six to twelve lab groups to make measurements when necessary. Two will also allow labs to continue in the short time case when one Balance is out of adjustment.
- 10) **VWR Series E Balance (10,000 g with 0.1 g readability).** *New equipment/upgrade* These Balances will allow measurement of Masses to 0.1 gram at masses currently above the range of any existing balances in the physics department. Such measurements a required to accurately determine the amount of water displaced in the Archimedes lab, and also in the moment of inertia lab where masses between 3 and 6 kilograms are typically used. The ability to measure high mass more accurately will also allow the development of labs involving the universal law of gravitation. In practice, these (6) 10,000 g balances will also be the "daily" balances used by students in all physics labs since their range and accuracy can support the majority of experiments currently performed.
- 11) **VWR Clamp Holders Talon Jumbo.** This Case of 25 right angle clamps will allow large rods, ring stands, and table clamps rods up to 21mm (13/16") in diameter to be securely fastened together in the orientation required in a variety of physics experiments in all classes. This order will allow replacement of missing and broken clamps along with permitting the number of lab groups to be increased to 12 per section.
- 12) **Harmonic motion spring sets.** *Upgrade/replacement.* These springs are used in two labs. One involves testing the equations of harmonic motion, and the other in the theory of energy conservation. This upgrade will also us to increase the number of lab groups from 6 to 12 and to replace springs that have been stretched from overuse.
- 13) **Pendulum Clamps.** *Upgrade/replacement.* These clamps are used to attach springs and pendulums for use in harmonic motion and energy conservation labs. They are also used in a number of other labs and demonstrations where objects must move about a pivot point. This upgrade will also us to increase the number of lab groups from 6 to 12 and to replace Pendulum clamps that are in disrepair.
- 14) **Ball Set for Pendulums.** *Upgrade/new Equipment* These balls are small metal spheres will a hole drilled through their diameter so they can be hung from a string and used a simple pendulum. Due to their construction, the period of a simple pendulum can be measured accurately and tested against the theoretical value for a simple pendulum. This is a popular lab or component of labs in physics and astronomy. Twelve sets as ordered will allow us to replace missing balls and upgrade our labs from less than 6 to twelve sets.
- 15) **Slotted Weights.** . *Upgrade/new Equipment* These weight sets include a variety of slotted masses that allow students to do problems in statics and dynamics where the masses must be varied by small amounts to achieve equilibrium. This order of 12 sets will also us to replace missing masses from our 30 year old collection and to upgrade the number of labs groups to 12.

**Check one of the following:**

The equipment is:  A replacement  An upgrade  New equipment

**How does the equipment replace, upgrade or provide new technology to the college? What do you currently have in place?**

See description above. The equipment is an upgrade of existing technology to promote student learning, and new technology which will also students to investigate phenomena they haven't previously been able to. . In general, we are either replacing older equipment with newer versions that are compatible with newer operating systems, buying equipment that uses digital technology that improves on existing 1950s era technology, or buying state of the art equipment that economically uses new technology.

**If request is motivated by a mandate, legal requirement or safety concern, please describe it and why it's important.**

**Please provide any relevant documentation.**

The purchase of newer clamps will allow students to safely put together equipment under physical stress, making the lab environment less prone to possible accidents.

**SECTION 3: EDUCATIONAL ITEMS**

**Which educational programs or institutional purposes does this equipment support?**

Physics

Is this in your Program Review?  Yes  No

If yes, please cut and paste the appropriate wording here. If not, explain why.

From III. PLANNING, section A, Planning Update

Summarize your program's plans, initiatives, and objectives accomplished since the Annual Program Review of AY 2011-12 (include accomplishments for the academic years 2012-13 and 2013-14).

“We are in the process of applying for another instructional grant for 2015 similar in scope to our grant in 2014. This grant will allow us to reduce the size of our lab groups from 4 or 5, to 2 or 3, providing more individual hands-on experience and problem solving. ”

And from Planning, section 4:

“new laboratories for physics 8A, 8B, 8C and 8D, along with worksheet based problem solving sections are being tested this semester. These will help the students taken on a more investigative role in learning physics, and provide more opportunities for collaborative problem solving—a skill becoming increasingly more important in physics and Engineering. “

## SECTION 4: TEACHING AND LEARNING

### **Describe in detail the impact this equipment or materials will have on teaching and learning.**

All equipment requested here will improve the ability of teachers to demonstrate how physics and astronomy principles actually work in the real world. In addition, the students will have better experiences in lab, lowering their frustration level and allowing smoother integration of concepts and skills taught in class. Some of this equipment will also serve as demonstration equipment, making it much easier to convey the meaning of otherwise abstract material. Currently lab groups have as many as six students working on a single apparatus. This makes it virtually impossible for all group members to participate in the experiment, and encourages division of labor meaning that students will not be familiar with all parts of the experiment. A main focus of this grant is to remedy this situation by purchasing equipment required to decrease lab group size. Priority was given however to purchasing modern equipment that will not need to be replaced in the near future.

**Number of classes or sections (per academic year) that will be impacted: 18**

### **Will the Tri-Valley benefit from the equipment, and if so how?**

Some equipment will be taken to events, such as, *Science on Saturday* in concert with Livermore lab, and local schools for science demonstrations. It will also enhance the reputation of Las Positas College as an excellent option for students interested in science or engineering in the Tri-Valley. This excellent at the local college will certainly enhance the reputation of the valley.

## SECTION 5: SUSTAINABILITY

### **What is the potential life span of the requested equipment?**

20-30 years, except for the Lab quest computer interface and sensors, which should be 7 – 15 years.

### **How does this equipment meet or exceed basic sustainability efforts and/or provide renewable resources to the college? Please explain**

The **General Flow Sensor with Pitot tube** tests the relative advances of energy storage systems related to wind and solar power. This will raise awareness of the need for sustainable and carbon free energy production and storage. Likewise, the **Heat Engine Gas law apparatus** allows students to understand and determine the concept of thermodynamic efficiency which underlies most energy and transportation technology in use today. By understanding how systems work and what factors govern their efficiency they can better design and choose energy efficient systems for tomorrow. Both the **VWR E-Series Balances (3000 g with .01 g readability)** and the **VWR Series E Balance (10,000 g with 0.1 g readability)** will also be used in the energy and sustainability related laboratories when accurate measurements of the amount of water flowing us required.

### **What will be required to maintain the equipment, such as regular servicing or upkeep? Who will perform the maintenance and are the costs included in the Finance Section?**

Our existing laboratory technician will maintain all equipment. No other maintenance will be required.

### **Where will the equipment be used or housed? If new storage is needed, describe the storage, location and costs to provide for it. Are these costs included in the financial section?**

All of the equipment will be housed in existing storage areas including the physics lab, the physics and engineering storeroom, the third floor astronomy storeroom, and our overflow space on the first floor of the science building. Although storage is tight, most of the items ordered are quite compact and will easily be integrated into existing storage facilities.

## SECTION 6: OUTCOMES

### How will equipment enable student-learning outcomes to be achieved? What are the consequences related to learning outcomes if request is not funded?

The items required will improve understanding and retention of the concepts taught in physics and astronomy courses. These upgrades will also bring the physics department up to date with the latest technology, and will greatly improve the quality of the labs since lab groups will be smaller and more hands-on for more students. Since many of these concepts are also crucial to success in engineering courses, it will also fulfill the same function for engineering courses.

## SECTION 7: FINANCIAL

### Part 1

**Total amount requested:** \$27,443.79

Explain the details behind the amount requested above.

Equipment or Materials:

Vendor	Product/part number	Product description	Unit price	Units	Total	% of total grant request
pasco.com	<b>OS-8526A</b>	Basic Optics X-Y Adjustable Diode Laser	\$199.00	12	\$2,388.00	9.29%
pasco.com	<b>PS-2225</b>	General Flow Sensor and Pilot tube	\$199.00	12	\$2,388.00	9.29%
pasco.com	<b>TD-8752</b>	Heat Engine/Gas law apparatus	\$399.00	8	\$3,192.00	12.41%
us.vwr.com	<b>10204-992</b>	VWR® E-Series Balances 3000g with 0.01g Readability	\$1,161.49	2	\$2,322.98	9.03%

us.vwr.com	10204-998	VWR® E-Series Balances 10000g with 0.1g Readability	\$1,161.49	6	\$6,968.94	27.10%
vernier.com	MD-BTD	Motion Detector 2	\$79.00	6	\$474.00	1.84%
vernier.com	LABQ2	LabQuest 2	\$329.00	6	\$1,974.00	7.68%
vernier.com	VPG-BTD	Photogate	\$45.00	6	\$270.00	1.05%
vernier.com	DFS-BTA	Duel-Range Force Sensor	\$109.00	12	\$1,308.00	5.09%
vernier.com	FP-BTA	Force Plate	\$245.00	9	\$2,205.00	8.57%
wardsci.com	21572-556	VWR® Talon® Jumbo Holders	\$723.70	1	\$723.70	2.81%
wardsci.com	160656	Harmonic Motion Spring	\$27.50	12	\$330.00	1.28%
wardsci.com	153124	Pendulum Clamp	\$27.90	12	\$334.80	1.30%
wardsci.com	160502	Ball Set for Pendulum	\$31.95	12	\$383.40	1.49%
wardsci.com	4751100	Slotted Weight Set	\$38.00	12	\$456.00	1.77%

Delivery:  
Installation:  
Facilities Modification:  
Sales Tax:\$ 2380.97  
Other:  
Vendor Discount (if applicable):

**Total amount:** \$27,443.79

\$ (Attach copies of quotes or estimates)

NOTE: Requests for computer related equipment must be reviewed by LPC IT Department

IT Department Authorized Signature: \_\_\_\_\_

In addition to the amount requested above, what ongoing costs will be incurred per year? This is trying to determine the total cost of ownership.

COSTS



Upkeep and Maintenance: 0  
Storage: 0  
Other : 0

How will these ongoing costs be paid for? N/A

Part 2

How long will this equipment last and when will it need to be replaced? When replacement is needed, how will it be paid for? (such as another IER, grant, etc.)

Equipment is expected to last between 7 and 30 years as mentioned above. Existing budget should be sufficient to cover replacement or repair costs.

What outside sources of funding, discounts or help have you explored and what is the outcome? (items such as CTE and grants)

We have benefited from LPC foundation grants each of the past two years for items not covered in this grant. CTE has not provided funding for physics and astronomy.

Signatures:

Eric W. Harpell

*A. Lozano*

Requestor

*[Signature]*

Dean

10/21/15

*[Signature]*

Vice President

Request Approved:  Yes  No

Approved by:

<Approver>

Date Approved:

<mm/dd/yyyy>

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### Standard Products

Description	Catalog #	Unit	Qty	List Price	Extended Price	
<input type="checkbox"/> TOPLOADING BALANCE 3000G X 0.01G	<a href="#">10204-992</a>	EA	<input type="text" value="2"/>	\$1,161.49	\$2,322.98	✕
<input type="checkbox"/> TOPLOADING BALANCE 10000G X 0.1G	<a href="#">10204-998</a>	EA	<input type="text" value="6"/>	\$1,161.49	\$6,968.94	✕

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Total: \$9,291.92

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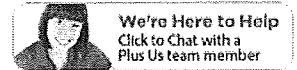
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Description	Item #	Unit	Qty	Your Price	Extended Price	
<input type="checkbox"/> VWR CLAMP HOLDER TALON JUMBO.	<a href="#">21572-556</a>	CS	<input type="text" value="1"/>	\$723.70	\$723.70	✘
<input type="checkbox"/> SPRING HARMONIC MOTION	<a href="#">160656</a>	EA	<input type="text" value="4"/>	\$27.50	\$110.00	✘
This product has been discontinued. Please make sure you are logged in to view any remaining available stock.						
<input type="checkbox"/> PENDULUM CLAMP	<a href="#">153124</a>	EA	<input type="text" value="12"/>	\$27.90	\$334.80	✘
<input type="checkbox"/> BALL COLLISN PB WD CRK BRSS AL 19MM SET7	<a href="#">160502</a>	KT	<input type="text" value="12"/>	\$31.95	\$383.40	✘
<input type="checkbox"/> WEIGHTS SLOTTED W/HNGER 5-250G SET13	<a href="#">4751100</a>	KT	<input type="text" value="12"/>	\$38.00	\$456.00	✘

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Item Subtotal =	\$2,007.90
Estimated Shipping =	\$56.21
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Estimated Order Total =	\$2,229.24

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# LAS POSITAS COLLEGE Equipment, Apparatus and Service Requisition

#R

FOR REIMBURSEMENT: List payee name & ssn. TAX ID# FOR OFFICE USE ONLY  
 SUGGESTED VENDOR **wardsci.com**

NAME OF STAFF MEMBER: Andrew Lozano DATE WRITTEN: 10/19/2015 DATE REQUIRED: 10/31/2015 DIVISION/ DEPARTMENT: STEmps/Engineer For inventory purposes include room # where equipment will reside: 1824 RETURN COPY OF REQUISITION TO: K Rose, A. Lozano

DESCRIPTION	(PRODUCT, TYPE, SIZE, COLOR, STOCK NUMBER)	UNIT	QTY	UNIT PRICE	EXTENDED COST
21572-556	VWR® Talon®		1	\$723.70	\$ 723.70
160656	Harmonic		4	\$27.50	\$ 110.00
153124	Pendulum		12	\$27.90	\$ 334.80
160502	Ball Set for		12	\$31.95	\$ 383.40
4751100	Slotted Weight		12	\$38.00	\$ 456.00

Vendor Information/ Remit To: Deliver To, include room # (optional): Room 1824

on file	Subtotal	\$	2,007.90
	Tax	\$	0.0950
	Shipping (if available):	\$	190.75
	<b>TOTAL COST</b>	<b>\$</b>	<b>2,198.65</b>

Comments:

## Instructional Equipment Request

Original invoices and receipts must be attached for payment. Include current taxes unless incorporated in price.

ACCOUNT # \_\_\_\_\_ FUND \_\_\_\_\_ ORG \_\_\_\_\_ ACCT \_\_\_\_\_ PROGRAM \_\_\_\_\_

APPROVALS Supervisor/ Coordinator/ Director *[Signature]* Dean/ VP/ President



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<input type="text" value="6"/>	Motion Detector	MD-BTD	\$79.00	\$474.00
<input type="text" value="6"/>	LabQuest 2	LABQ2	\$329.00	\$1,974.00
<input type="text" value="6"/>	Photogate	VPG-BTD	\$45.00	\$270.00
<input type="text" value="8"/>	Dual-Range Force Sensor	DFS-BTA	\$109.00	\$872.00
<input type="text" value="9"/>	Force Plate	FP-BTA	\$245.00	\$2,205.00
			<b>Product Total</b>	<b>\$5,795.00</b>
Add a product by order code <input type="text"/>			<b>Subtotal</b>	<b>\$5,795.00</b>







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▶ PS-2226	General Flow Sensor with Pitot Tube	12 <a href="#">Remove</a> <b>FACTIONS</b>	\$229.00	\$2,748.00
▶ OS-8526A	X-Y Adjustable Diode Laser -- Basic Optics	12 <a href="#">Remove</a> <b>FACTIONS</b>	\$199.00	\$2,388.00

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