Title Page

Proposal to

UNIDATA COMMUNITY EQUIPTMENT GRANT

Entitled

An Upgrade of the Meteorological Laboratory in Support of Education, Research, and Broader Participation in the Unidata Community

1 July 2013 – 30 June 2014
Total $12,000

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B. **Project Summary**

The meteorological data and visualization laboratory ("weather lab") in the School of Marine and Atmospheric Sciences was constructed in the year 2000 using funds from Unidata (via NSF at the time) and cost share from Stony Brook University. The lab consists of Solaris workstation for LDM Internet Data Distribution (IDD) and decoding, and 12 other Linux workstations for teaching and research. The PI (Colle) and other atmospheric faculty in the department have projects supported by NSF, NASA, NOAA, and DOE that require real-time data ingested into this lab for analysis and running atmospheric models. This data server is nearly 13 years old with too little disk space, so $12,000 is requested from Unidata and Stony Brook will cost share an additional $8,000 to replace the IDD server as well as the 12 workstations in the lab. The new IDD server will allow Stony Brook to serve as a potential data node for the community, as well as store data for education and research using THREDDS and RAMADDA. The upgrade to the 12-seat meteorological lab will allow usage of the Integrated Data Viewer (IDV) from Unidata as well as near future graphical software, such as AWIPS-II.

C. Project Description

1. Background and current configuration

The School of Marine and Atmospheric Sciences (SoMAS) at Stony Brook University, located on Long Island, New York. There are ~200 undergraduate and over 100 graduate students enrolled at SoMAS, with 40-50 (25) of these students in the B.S. (M.S./Ph.D) atmospheric science program. SoMAS is located ~30 km from the New York City National Weather Service (NWS) office. There are typically 3-4 Stony Brook students that intern at the NWS each semester. Stony Brook also has an active collaboration with the NWS through a NOAA Collaborative Science and Technology project on regional weather and ensemble forecasting.

SoMAS has several Linux cluster computers with over 500 processors and 100 Tb of disk space used for research. There are over 30 other workstations, mostly running Linux, with some running Mac OSX or Windows. Each client has local disk for swap and scratch space, and between 512 MB and 8 GB of RAM. Internal networking in the department and in the weather lab is served by gigabit Ethernet.

There are two computer laboratories used for the atmospheric undergraduate and graduate classes. There is a remote sensing laboratory (originally funded by NASA), but these 20 workstations are Windows-based and cannot be easily used with Unidata software. Therefore, we are requesting Unidata support to upgrade our meteorological computer laboratory that has Unix and Linux workstations for classroom instruction and Unidata participation. This laboratory was constructed in the year 2000 using Unidata funds that were distributed through the National Science Foundation (NSF). This allowed Stony Brook to participate in Unidata activities for the first time and grow our meteorology program. The laboratory consists of 11 student Linux workstations, an instructor Linux/windows station, and a SUN Solaris server for Unidata IDD data

ingestion as well as decoding and graphics generation. The student Linux workstations were updated in 2004 and 2008, but unfortunately the university no longer upgrades Linux-related servers in educational computer labs (only windows); therefore, we have been unable to upgrade the weather laboratory. The PI purchased a new SUN workstation 2006 for Unidata local data manager (LDM) ingest using research funds, but this server is now several years old and only has 100 Gb of internal disk space, so it is too slow to process the Unidata data feeds.

This meteorological laboratory has been very important for educational activities at Stony Brook. In 1999, there were only 25-30 atmospheric science majors, and now there are 45-50 students in the program, and the graduate program has increased from 15-25 students. This growth likely occurred from students having access to the Unidata datastream and plotting tools, which as allowed for more integration of synoptic and mesoscale analysis in the classes. The data from the lab has also been used in our weather survey courses that have over 150 students per semester. It also has been used to support a NSF sponsored GEOPREP program (PI Colle is a Co-PI on this project), in which 10-15 high school students and teachers from minority/high needs school districts for the past few years learned more about atmospheric science probed data using GEMPAK. Unfortunately, the current set of machines does not allow for usage of IDV, since the machines are too slow (increasing memory did not help). We believe a computer upgrade will greatly improve the functionality of IDV.

The weather, climate, and interdisciplinary research has also expanded as a result of this meteorology lab. The PI's Penn State- NCAR Mesoscale Model (MM5) and Weather Research and Forecasting (WRF) modeling efforts since 2000 (Colle et al. 2003), which has included the development of 10-member ensemble using different physics and initial/boundary conditions (Jones et al. 2007; Erickson et al. 2012), have used the data from this lab for initial and boundary conditions as well as for verification. The MM5 and WRF ensemble output has been shared with the New York City National Weather Service office and NWS Eastern Region Headquarters using the LDM IDD, such that they can display the ensemble output in AWIPS. The verification data from NWS model analyses have been used to validate the cyclones in National Weather Service models and ensembles (Charles and Colle 2009; Colle and Charles 2011) as well as regional climate predictions (Colle et al. 2013). The data from field studies have been saved to verify and improve WRF microphysical schemes (Colle et al. 2005; Lin and Colle 2011). The lightning and radar data has been used to determine the climatology of convective storms over the Northeast U.S. (Murray and Colle 2009).

2. Overall goals of the project

The goal of this project is to upgrade the meteorological laboratory, such that educational and research activities can be expanded further while also participating more in Unidata activities. There is already a gigabit connection/switch within the lab and to the department, and a 100 Mbit connection outside the university. The goal of the project is as follows:

1. Install a dedicated Linux LDM server with 18 Tb of disk space, so more data can be ingested, processed, and archived for teaching and research.
2. Replace 12 new classroom workstations, such that the Unidata software can be utilized (wider usage of IDV) as well as explore some new software, such as the proposed AWIPS-II software, which requires 2-3 Gb of members to run efficiently.
3. Setup an open source RAMADDA repositories for ensemble, field data, and regional climate model runs in order to support various research projects.
4. Upgrade in order to potentially serve as an upstream data site for Unidata.

These goals will be accomplished through a cost share between Stony Brook and Unidata. Stony Brook, through the Research Foundation and SoMAS, will contribute $8,000, while $12,000 is requested from Unidata to support the data server and some student workstations. The details of the computers and their usage are described in the next section. SoMAS has two computer support staff, one of which specializes in Linux and has been maintaining the current meteorological lab for the past few years.

3. Proposed equipment

Stony Brook University has a purchasing agreement with DELL that significantly reduces cost, so these machines have been used in our lab. We have found them to be fairly easy to maintain, since they are compatible with the Linux operating system, as well as Unidata and other meteorological software. The computers also come with a 3-year on-site warranty. We have broke the purchase into three pieces, as follows:

a. One (1) Poweredge T420 Dell server with dual quad-core Xeon (2.4 GHz) processors, 48 Gb RAM, 2-500 Gb SATA hard disk drives for system operations and programs and 6-3Tb SATA hard disk drives for storage, both running RAID-5. The extra computing power afforded by the quad-core CPU and 48 GB RAM will ensure that the server will easily be able to run a variety of tasks, such as data ingestion via the LDM, decoding, plotting, archiving, and IO tasks to the other machines in the lab. This server will help consolidate several older servers into a single device, which will have a positive effect on the data center at the School of Marine and Atmospheric Sciences, including a reduction in temperature and rack space utilization.

b. Twelve (12) Dell OptiPlex 9010 minitower machines (64-bit) with 8 GB of RAM, 2 1-Tb hard drives, and a 21-inch flat screen monitor. Eleven of these workstations will be for students to use during classroom lab to run MatLab, IDV, NMAP, and other GEMPAK software, while the 12th machine will be used at the instructor podium for projection of the weather graphics on a big screen in the front of the room. CentOS will be installed on each workstation, however access to Windows software will be available through Stony Brook's Virtual Computer Lab--the Virtual SINC Site (VSS).

c. The department cost share for this project will also be used to obtain a mounted camera Creative Labs Live! Cam Connect 1080 HD Webcam (Price: $89.49) and new Viewsonic PJD6553W HDMI DLP projector (Price: $650.00) (current one is 10 years old). This will allow weather discussions to be shared remotely with our collaborators using Adobe Connect software, and the new projection will provide more resolution to display weather graphics.

3. Benefits to the university and Unidata communities

a. Education

The 11-seat meteorological laboratory supports a wide variety of educational activities, and more classes will use this laboratory once it is updated. For the past year, the following classes have used the meteorology laboratory and its data and software:

ATM247: Atmospheric Structure and Analysis: This class uses real-world applications of basic dynamical principles to develop a physical understanding of various weather phenomena. It has a lab component that uses the various Unidata software: GEMPAK (garp, ntrans, and nmap) and IDV.

ATM347: Advanced Synoptic Meteorology and Forecasting. This class applies various dynamical and physical principles to the analysis and prediction of the atmosphere. The laboratories and in class weather discussions include extensive practice in forecasting and diagnosis of synoptic and convective systems using various Unidata software: gempak (garp, ntrans, and nmap) and IDV.

ATM437: Forecasting Practicum. The course provides students with additional forecasting experience using Unidata software. Students make at least three forecasts per week for either Long Island or a city designated by the National Forecast Contest.

MAR598: Synoptic and Mesoscale Meteorology. This graduate course examines the structure and evolution of synoptic and mesoscale systems using observations, modern dynamical analysis, and numerical weather prediction models. The student investigate such phenomena in the laboratory as well as individual projects using gempak, IDV, and other software in the lab (GrADS and Matlab).

The additional disk space and RAMADDA in this lab will be a great way for instructors and students to provide an electronic media for posting and uploading homework assignments and lab projects. We will continue to make extensive use of N-AWIPS's product generation capabilities, since it is useful for synoptic and model analysis as well as for those students who get jobs at NCEP's Hydrometeorological and Storm Prediction Centers, since they still use N-AWIPS. With the expected 2013 release of AWIPS-II, we plan to use this software in the lab, since it will help those interested in National Weather Service. Our current lab does not have the specs to AWIPS-II, and IDV is also very slow.

The upgraded lab will allow other classes to utilize the data and software:

ATM320: Spatial Data Analysis Using Matlab: Provides a working knowledge of the multivariate analysis methods used in the earth and atmospheric sciences and the Matlab programming tool.

ATM346: Advanced Atmospheric Dynamics: This class covers advanced concepts of mid-latitude and tropical atmospheric motions, wave dynamics, and numerical methods.

There are also weekly weather discussions on Fridays in this meteorological laboratory during most weeks during the fall and spring semesters led by faculty and graduate students. The weather discussion is sometimes broadcast to the New York City National Weather Service (NWS) using a portable camera and software. We want to install a permanent camera for this project. In these weather discussions, the Unidata data streaming and analysis are used via the IDD feeds and decoded into GEMPAK format, are analyzed and displayed by applications such as GEMPAK/N-AWIPS and the IDV.
We plan to use Unidata's RAMADDA data sharing tool, since this will allow us to extend the educational/research benefit of this discussion group by allowing us to save various case studies for class.

b. Research

An upgrade to the meteorological laboratory will allow for more extensive research for high school, undergraduate, and graduate students. During the last 13 years, storage of the Unidata IDD data for case studies, running models, and software to display (GEMPAK), has fostered cooperative research with NOAA and the National Weather Service (NWS) for the last several years (Prof. Brian Colle and Prof. Edmund Chang). Meanwhile, there is now interdisciplinary work funded by NOAA to look at storm surge prediction and regional climate change over the coastal Northeast (Profs. Malcolm Bowman, Minghua Zhang, Sultan Hameed, Charlie Flagg, and Brian Colle). Here are some examples of research projects completed by Dr. Colle that has led to substantial contributions to operational forecasting and over 30 refereed publications related to operational forecast issues.

1. *NOAA-CSTAR: Predictability of High Impact Weather during the Cool Season over the Eastern U.S: From Model Assessment to the Role of the Forecaster.* This project focuses on the predictability of extratropical cyclones (and associated Rossby wave packets-RWPs) over the eastern U.S. and adjacent offshore waters for the days 1-7 predictions (Colle and Charles 2011), and select mesoscale phenomena associated with cyclones (1-2 day predictions), with particular emphasis on precipitation bands (Novak and Colle 2012).
2. *UCAR-COMET and U.S. Forest Service (PI: Colle): Application of numerical model verification and ensemble techniques to improve operational weather forecasting. Use of mesoscale ensemble weather predictions to improve short-term precipitation and hydrological forecasts. Employing mesoscale ensemble weather predictions to improve fire weather forecasting over the Northeast United States.* 07/15/08-07/14/13. During these projects the PI's group implemented a multi-model (WRF and MM5) ensemble that is highest resolution ensemble over the Northeast U.S. (12-km grid spacing).

3. *NSF. Impact of Terrain, Land-sea Boundaries, and Urban Areas on Convective Initiation, Structure, and Evolution over the Northeast United States.* This project completed a comprehensive climatology of convection frequency and intensity over the Northeast U.S. using the WSR-88Ds, NOWrad data, and cloud-to-ground lightning.

The current laboratory does not have enough disk space to save any model or archived observations. As a result, the data is scattered around the department. The RAMADDA and THREDDS server will allow data to be more centrally located, which will help improve research efficiency and foster more collaborations among faculty.

c. Outreach

The meteorology laboratory is used for many special projects and outreach. The observations and plots from the laboratory are highlighted on the main SoMAS web page: http://www.somas.stonybrook.edu/. There are often 5-10 high school groups that tour our facilities each year to learn about meteorology. We use the laboratory and Unidata software to highlight the capabilities of meteorologists to use various observations and models.

The PI is involved in a GeoPREP program at Stony Brook, which is sponsored by the National Science Foundation: http://www.stonybrook.edu/est/outreach/stemsmart/geoprep.shtml. The goal is to get more underrepresented minority students more interested in the geosciences through an intensive summer research program as well as in-service teacher training. The meteorology laboratory is used for daily weather data and plots for the students. The in-service training included ways for teachers to access this data and software in their classroom.

d. Responsiveness to review criteria

This proposal addresses the Unidata request to have a data server in the Eastern U.S. that runs the various Unidata software packages (LDM, McIDAS, RAMADDA, THREDDS). Therefore, Stony Brook can contribute to the IDD distribution. The workstations in the lab can also test the prototype AWIPS II software. The data archive on RAMADDA can help foster collaborations for education and research in the Unidata community.

4. Project budget

If this project is funded, the following equipment will be purchased immediately. In addition to the $8000 of cost share, the PI will devote several hours to help get the computers hooked up to various teaching and research datasets, and the system administrator will devote his time to install the new machines in the lab.

Quantity	Item	Unit Price	Total
1	PowerEdge T420	$7,299.60	$7,299.60
Classroom Workstations			
12	OptiPlex 9010	$961.80	$11,541.60
Classroom Technology			
1	Viewsonic PJD6553W projector	$643.00	$643.00
1	Universal Ceiling Projector Mount	$34.03	$34.03
1	Creative Labs Live HD Webcam	$58.77	$58.77
	Total		$735.80
Total Direct Costs			$19,577.00
Indirect Costs (57.5% on $735.80)			$423.00
Grand Total			$20,000.00

Funding Breakdown:

Funds Requested from Unidata:	$12,000
Cost Share Stony Brook VP-Research	$5,000
Cost Share Institute for Terrestrial and Planetary Atmospheres	$3,000

5. Timeline

If this proposal is funded we will submit a purchase order for the proposed hardware. The Unidata software will be installed from mid-July to mid-August, such that the lab will be ready by fall semester 2013. We have extensive experience configuring these types of systems, so deployment should be quite quick. The PI and others will add datasets to RAMMADA for teaching and research throughout the year.

D. References

Charles, M., and B. A. Colle, 2009: Verification of extratropical cyclones within cyclones within NCEP forecast models using an automated tracking algorithm: Part 1: Comparison of the GFS and NAM models., *Wea. Forecasting*, **24**, 1173-1190.

Colle, B. A., and M. E. Charles, 2011: Spatial distribution and evolution of extratropical cyclone errors over North America and adjacent oceans in the NCEP Global Forecast System model. *Wea. Forecasting,* **26**, 129-149.

Colle, B. A., M. Garvert, J. Wolfe, and C. F. Mass, 2005: The 13-14 December IMPROVE event: Part III, Microphysical budgets and sensitivities for the 13-14 December IMPROVE event. *J. Atmos. Sci.*, **62**, 3535-3558.

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Colle, B.A., Z. Zhang, K. Lombardo, P. Liu, E. Chang, M. Zhang, and S. Hameed, 2012: Historical evaluation and future changes in eastern North America and western Atlantic extratropical cyclones in the CMIP5 models during the cool season. In revision to the *J. Climate.*

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Lin, Y., and B. A., Colle, 2011: A new bulk microphysical scheme that includes varying degree of riming and particle habits., *Mon. Wea. Rev.,* **139**, 1036-1047.

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Novak, D. and B. A. Colle, 2012: Diagnosing snowband predictability using a multi-model ensemble system.. Sin *Wea. Forecasting*, **27**, 565-585.

Stony Brook Research

Stony Brook University

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March 7, 2013

Dr. Brian Colle
School of Marine and Atmospheric Sciences
SUNY Stony Brook
Stony Brook, New York 11794-5000

Dear Dr. Colle:

The Office of the Vice President for Research (OVPR) is pleased to support your application to Unidata, entitled: "Upgrade of the Meteorological Laboratory in Support of Education, Research, and Broader Participation in the Unidata Community." The Office pledges $5,000 in FY 13 / 14 University Research Development Funds (URDF) for this purpose.

Purchases made with University Research Development Funds must take place within six months of the establishment of the award account. Please also note that any reduction in sponsor support will result in a parallel reduction in OVPR support.

Sincerely,

Benjamin S. Hsiao, Ph.D.
Vice President for Research

SoMAS
School of Marine and
Atmospheric Sciences

Stony Brook University, Stony Brook, NY 11794-5000
631-632-8319 / Voice 631-632-6251 / Fax

Sultan Hameed, Professor
Director, Institute for Terrestrial and Planetary Atmospheres

February 21, 2013

Vice President for Research
Stony Brook University

The Institute of Terrestrial and Planetary Atmospheres strongly supports the proposal for Unidata funding from Professor Brian Colle. The equipment in our weather lab is quickly becoming outdated and needs to be upgraded soon to maintain its relevance to the weather and climate related research programs of several of our faculty members, in addition to serving the needs of our students.
The Institute has committed $ 3000 from its limited IDC funds to share the cost of Professor Colle's proposal. We would greatly appreciate approval of the requested amount from OVPR.

Sincerely,

Sultan Hameed

Sultan Hameed
Director, ITPA

Print Summary



PowerEdge T420

Price **$7,299.60**

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- **PowerEdge T420**

Date	3/4/2013 8:49:38 AM Central Standard Time
Catalog Number	25 Retail rc970901

Catalog Number / Description	Product Code	Qty	SKU	Id
PowerEdge T420: PowerEdge T420	T420	1	[225-3264]	1
Processor: Intel® Xeon® E5-2440 2.40GHz, 15M Cache, 7.2GT/s QPI, Turbo, 6C, 95W, Max Mem 1333MHz	E52440	1	[319-0193][319-0337]	1550
Additional Processor: Intel® Xeon® E5-2440 2.40GHz, 15M Cache, 7.2GT/s QPI, Turbo, 6C, 95W	2E52440	1	[319-0032][319-0193]	1551
Memory Configuration Type: Performance Optimized	PEOPT	1	[331-4428]	1562
Memory DIMM Type and Speed: 1333 MHz UDIMMs	1333UD	1	[331-4423]	1561
Memory Capacity: 4GB UDIMM, 1333 MT/s, Low Volt, Dual Rank, x8 Data Width	4U3LDR	12	[317-6881]	1560
Operating System: No Operating System	NOOS	1	[420-6320]	1650
OS Media Kits: No Operating System Media Kit	NOSDOC	1	[420-1908]	1652
Chassis Configuration: Chassis with up to 8, 3.5" Hot-Plug Hard Drives	8HP	1	[331-7560][331-7930][342-4612]	1530
RAID Configuration: RAID 1/RAID 5 for H710p/H710/H310 (2 SATA + 3-14 SAS HDDs)	R152SM	1	[342-4669]	1540
RAID Controller: PERC H710 Integrated RAID Controller, 512MB NV Cache, Full Height	PH710IR	1	[342-4048]	1541

Hard Drives: 3TB 7.2K RPM Near-Line SAS 6Gbps 3.5in Hot-plug Hard Drive	3TBHHD	6	[342-2336]	1570
Hard Drives: 500GB 7.2K RPM SATA 3Gbps 3.5in Hot-plug Hard Drive	500S3	2	[341-8728]	1570
Power Supply: Single, Hot-plug Power Supply (1+0), 750W	NPS750	1	[331-4606][331-7658]	1620
Power Cords: NEMA 5-15P to C13 Wall Plug, 125 Volt, 15 AMP, 10 Feet (3m), Power Cord	125V10F	1	[310-8509]	1621
Power Management BIOS Settings: Power Saving Dell Active Power Controller	DAPC	1	[330-5116]	1533
Embedded Systems Management: Basic Management	BMC	1	[331-3482]	1515
Add-in Network Adapter: On-Board Dual Gigabit Network Adapter	OBNIC	1	[430-4715]	1514
Rack Rails and Casters: Tower Chassis, No Casters	NOCSTR	1	[330-4120]	1610
Bezel: No Bezel	NOBEZEL	1	[313-0869]	1532
Internal Optical Drive: DVD ROM, SATA, Internal	DVDO	1	[313-6765]	1600
System Documentation: Electronic System Documentation and OpenManage DVD Kit for T420	EDOCS	1	[331-7978]	1590
Shipping: PowerEdge T420 Shipping	SHIP	1	[331-7656]	1500
Hardware Support Services: 4Yr Basic Hardware Warranty Repair: 5x10 HW-Only, 5x10 NBD Onsite	U4OS	1	[994-4019][995-1654][995-2644][996-5317][996-5407][996-5497]	29
Installation Services: No Installation	NOINSTL	1	[900-9997]	32
Proactive Maintenance: Maintenance Declined	NOMAINT	1	[926-2979]	33

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Description



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SYSTEM COMPONENTS

Optiplex 9010 Energy Star Minitower	Qty	12
OptiPlex 9010 Minitower w/ up to 90% Efficient PSU, Windows 7 Home Premium,Media, 64-bit, English	Unit Price	$961.80

Catalog Number: **25 RCRC1121069-3454065**

Module	Description	Show Details
OptiPlex 9010 MT	OptiPlex 9010 Minitower w/ up to 90% Efficient PSU	
Operating System(s)	Windows 7 Home Premium,Media, 64-bit, English	
Processors	3rd Gen Intel® Core™ i7-3770 (Quad Core, 3.40GHz, 8MB w/HD4000 Graphics)	
Memory	8GB, NON-ECC, 1600MHZ DDR3,2DIMM	
Keyboard	Dell KB212-B USB 104 Quiet Key Keyboard,English	
Monitors	Dell Pro P2212H,Wide screen,21.5in VIS,HAS,VGA,DVI	
Graphics Cards	1GB AMD RADEON HD 7470,FH,w/VGA	
Boot Hard Drives	1TB 3.5 6Gb/s SATA with 32MB DataBurst Cache™	
Mouse	Dell MS111 USB Optical Mouse	
Systems Management Mode	Intel® vPro Technology Enabled	
Removable Media Storage Device	16X DVD+ and -RW SATA	
Thermals	Heat Sink, Performance, Minitower	
Speakers	Internal Dell Business Audio Speaker	
Power Supplies	OptiPlex 9010 Minitower Up to 90 Percent Efficient Power Supply	
Documentation	OptiPlex 9010 Documentation English and French	
Productivity Software	No Productivity Software	
Second Hard Drive Options	1TB 3.5" SATA 6Gb/s with 32MB DataBurst Cache™	

Options	
Hard Drive Mode	No RAID
Energy Efficiency Options	Energy Star 5.2 Category D (less than 234kWh TEC), EPEAT Gold, Dell Settings
Resource DVD	Resource DVD - contains Diagnostics and Drivers
Hardware Support Services	4 Year Basic Hardware Service with 4 Year NBD Limited Onsite Service After Remote Diagnosis
Installation Standard	No Onsite System Setup
Security Hardware	Chassis Intrusion Switch Option
Setup and Features Information Tech Sheet	Tech Sheet, English
Ship Packaging Options	Shipping Material for System, Minitower
System Recovery	Dell Back-up and Recovery Manager for Windows 7
Processor Branding	Core i7 vPro Sticker
POET Approval	POET #P566020186

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Item added on Mar 4, 2013	**PJD6553W HDMI DLP Projector with Crestron e-Control** Part Number: VIPJD6553W Manufacturer: Viewsonic Commodity Code: 45111600-3880600-572 Audio visual & presentation materials-Projectors and supplies	650.00 USD EA	1	**650.00** USD
Item added on Mar 4, 2013	**Live! Cam Connect 1080 HD Webcam** Part Number: CRVF07600000 Manufacturer: Creative Labs Commodity Code: 45121519-3820000-572 Cameras, video-Low light camera	58.77 USD EA	1	**58.77** USD

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