

Thomas Jefferson National Accelerator Facility

7. INFRASTRUCTURE

Overview of Site Facilities and Infrastructure

TJNAF, located in Newport News, Virginia, operates a unique, world leading electron accelerator facility for research in nuclear physics which supports DOE’s Science Strategic Goals. TJNAF is operated by Jefferson Science Associates, LLC (JSA), a joint venture between Southeastern Universities Research Association (SURA) and Computer Sciences Corporation (CSC). TJNAF is located on a 170 acre federal reservation. North of the DOE-owned land is an eight acre parcel referred to as the Virginia Associated Research Campus (VARC) which is owned by the Commonwealth of Virginia and leased to SURA and sub-leased for \$1 dollar per year to DOE for use in support of the Lab. SURA owns 43.6 acres, adjacent to the TJNAF site, where it operates a 42-room Residence Facility at no cost to DOE.

TJNAF consists of 70 DOE owned buildings (673,477 SF), two state leased buildings (37,643 SF), and 19 real property trailers (21,310 SF) totaling 732,430 (SF) plus roads and utilities. Additionally the Lab leases 43,332 SF of office and lab space from the City of Newport News located in the Applied Research Center (ARC), constructed by the City of Newport News and located on the TJNAF campus. In addition to these facilities, TJNAF has 74 shipping containers (22,104 SF) used for storage and 16,755 SF of off-site leased storage space. There are no planned real estate actions in FY 2009 or FY 2010 involving leases of more than 10,000 SF. At the end of FY 2007, a total of ~650 FTEs were employed and occupying site facilities. TJNAF serves a user and visiting scientist population of about 2,200 from the United States and around the world. In FY 2007, the user and visiting scientist population averaged ~ 300 per month.

A current copy of the Land Use Plan can be found in the [JLab Ten Year Site Plan](#).

Table 1 reflects an Asset Condition Index at the beginning of FY 2008 that meets the current goal established by DOE SC for Mission Critical facilities. Mission Dependent facilities are below the established goal due to aging real property trailers. Through GPP and SLI investments, TJNAF will achieve the SC goal for Mission Dependent facilities by FY 2014. The Asset Utilization Index is at 100% and has been since construction of the Lab. In most areas space is not adequate to accommodate a productive and efficient work environment.

SC Infrastructure Data Summary

Replacement Plant Value (\$M)		185
Total Deferred Maintenance (\$M)		10
Asset Condition Index	MC	0.96
	MD	0.78
	NMD	N/A
Asset Utilization Index	Office	1
	Warehouse	1
	Laboratory	1
	Housing	N/A
Prior Year Maintenance (\$M)		3.3

MC = Mission Critical, MD = Mission
Dependent, NMD = Non-Mission Dependent

Table 1

Facilities and Infrastructure to Support Laboratory Missions

Jefferson Lab’s vision of a modernized Lab is to have sustainable facilities and infrastructure that:

- Enhance safety and security

- Facilitate work flow, creativity, and productivity
- Eliminate physical and intellectual boundaries and encourage interaction
- Provide flexibility with space that can be easily reconfigured to meet Office of Science mission demands.

Today, with few exceptions the technical facilities supporting TJNAF’s scientific mission are mission ready. The completion of the 12 GeV Upgrade, scheduled for FY 2015 with the addition of the fourth experimental hall along with upgrades to experimental halls A, B and C will provide TJNAF users with state-of-the-art facilities necessary to advance science in support of DOE SC goals. Additionally, completion of the Technology and Engineering Development Facility, scheduled for FY 2012 will provide a first rate facility for the advancement of research and development in superconducting radio frequency technology (srf). The support facilities and infrastructure as a whole cannot be called mission ready. TJNAF’s mission readiness assessment identified several immediate conditions and capability gaps that will jeopardize the delivery of scientific mission objectives if not addressed during the ten-year planning period.

The Mission Readiness assessment of technical and support facilities and infrastructure is summarized in Table 2. TJNAF is seeking DOE support for three SLI line item projects to address these concerns and mission deficiencies.

Mission Readiness 2008			
	Not	Partial	Capable
Technical Facilities			
Nuclear Physics			
CEBAF			X
Experimental Halls			X
Photon Source			
FEL			X
Support Facilities			
Research & Development			
Shops		X	
Experiment Assembly		X	
Cryomodule Assembly & Testing		X	
Work Environment			
Offices		X	
Cafeteria & Food Service		X	
Wellness	X		
Conference & Collaboration Space			
		X	
Roads & Grounds			
Roads & Sidewalks		X	
Parking		X	
Site Services			
Medical Clinic			X
Property & Logistics		X	
Material Management & Storage		X	
Utilities			
Electrical		X	
Cryogenics		X	
Process Cooling		X	
Telecommunications		X	
Waste Management		X	

Evaluation Criteria: Productive Work Environment, Safe and Secure Environment, and Efficient Operations/Maintenance

Table 2

Specific projects that support TJNAF major business lines and scientific mission are described in Table 3.

<i>Facilities and Infrastructure to Support Laboratory Business Lines</i>			
<i>Business Line</i>	<i>Facilities and Infrastructure</i>	<i>Summary Condition Evaluation</i>	<i>Planned Investments</i>
Nuclear Physics	Bldg 8 Central Helium Liquefier (CHL) Bldg 38 S. Access Bldg 67 N. Access	New facilities and infrastructure are required to support the 12 GeV upgrade project	- 12 GeV Upgrade Conventional Facilities(Line Item) \$27.5M in 2008-2012
	Bldg 58 Test Lab Various trailers	Buildings are supporting this business line however overall space availability is inadequate. Largest facility built in 1965 with deferred maintenance above acceptable level.	- Test Lab rehab and construction of 100,000 SF of additional space (SLI) \$72.5M in 2009 – 2013 - Targeted deferred maintenance reduction funding of \$1.9M in 2008 – 2010 - Ice Target Facility (GPP) \$1.2M in 2009
	Bldg. 97 Counting House	Major systems have reached the end of lifecycle and need updating.	Counting House Rehab (GPP) \$1.1M in 2013
	Bldg 90 Experimental Equipment Lab (EEL)	Major systems have reached the end of lifecycle and need updating. Building needs reconfiguration for current use.	EEL Rehab (GPP)\$3.6M in 2016 - 2017
Accelerator Science and Technology	Bldg 58 Test Lab Bldg 57 Cryogenics Test Facility (CTF)	Infrastructure at best marginally supports mission. Bldg built in 1965 inadequate in size with level of deferred maintenance above acceptable level. Many systems past design life.	TEDF (SLI) in 2009-2013 Expand CTF \$4M (GPP) in 2015-2017
Photon Science and Technology	Bldg 18 (FEL)	Infrastructure supports basic requirements	Third party financing associated with Naval INP Project
General Purpose	Electrical Dist. Cooling Water Systems Cryogenic Cooling Communications	Electrical distribution, cooling water, and communications systems supporting business need but are at end of life cycle and in most cases at capacity. Cryogenics inadequate to fully support srf, FEL R&D, and experimental hall ops.	Utilities Modernization (SLI) \$22M in 2010-2013 AC Power Reduction & Load Control \$0.4K (GPP) in 2011 Cooling Tower Reclaimed Waterline \$0.4K (GPP) in 2010
	Bldg 12 (CEBAF Center)	Portion of main office bldg 20+ years old and needs to be renovated. Additional space is needed to consolidate staffs from leased buildings and eliminate overcrowding.	CEBAF Center Complex Addition /Upgrade \$62M (SLI) in 2013 – 2015
	Site LCW capacity	Inadequate capacity to fully support future operations	South Site LCW \$1.2M (GPP) in 2010
	Bldg 90 (Shipping & Receiving)	S/R currently mid campus in major experimental lab bldg. Functionally needs to be relocated to site perimeter to make room for additional experimental setup space.	Relocate Shipping & Receiving \$3M (GPP) in 2011-2012
	Fire Alarm System	Some existing Bldg. systems aging equipment and have inadequate capacity to connect additional requested devices. Current combination of Access control and fire alarm systems has not proven to be efficient	Fire Alarm Upgrade \$0.4K (GPP) in 2008 – 2009
	Multiple Buildings		Targeted deferred maintenance reduction funding (\$1.9M) in 2008 – 2010

Table 3

General Purpose (continued)	Roads & Parking	Roads and parking meeting basic requirements to support mission, capacity lacking.	North Connector Parking Lot in \$0.3K(GPP) in 2011 Site Road & Parking Improvements \$1.7M (GPP) in 2012, 2013, 2018-2018
	Waste Management	Shipping containers being used to currently perform function providing inadequate and insufficient work space for sorting and processing	RADCON Storage Bldg \$.4K (GPP) in 2009 Lay Down Yard \$0.2K (GPP) in 2010
	Experimental Assembly/Material Management	Inadequate onsite equipment assembly/work space to support current needs. Currently using 74 shipping containers to fulfill some of these needs.	Experimental Assembly Bldg \$3.0M (GPP) in 2013-2014.3 Material Management& Storage \$3.4M in 2015-2016

Table 3 (Continued)

Strategic Site Investments

Modernization Program

TJNAF’s investment strategy to achieve modernization goals includes:

- DOE major line item funding for new or expanded missions,
- General Plant Project (GPP) funding for improvements and modernization to support current and future missions,
- Science Lab Infrastructure (SLI) line item funding for major modernization of facilities beyond the funding capability of the Lab,
- Third party energy savings funding where a repayment funding stream is practical,
- Adequate investment for preventive and corrective maintenance, reduction of deferred maintenance as well as needed operational leases, and
- Third party financing.

Laboratory Investments

- **General Plant Projects (GPP)** Since FY 2000, TJNAF has supported modernization by investing over \$6.2M in general plant projects. An additional \$24M will be invested over the 10-year period to complete 14 projects identified in the TYSP that will address facility and infrastructure needs and contribute to a fully modernized and mission capable facility.
- **Maintenance Investment** TJNAF has and will continue to adequately fund facility and infrastructure maintenance by meeting or exceeding its goal to invest 2% of RPV each year. In FY 2007 TJNAF invested 2.94 % of RPV (\$3.3M) in maintenance spending and is committed to achieve the annual DM reduction goals. This expenditure along with other planned investments will result in the Lab’s facilities meeting the DOE ACI goal by 2014.
- **Energy Savings** TJNAF using \$4.2M financed through Bonneville Power Administration (BPA) executed seven projects replacing equipment that resulted in saving 3,080 Mwh of electricity and 20,400 ccf natural gas through mechanical system replacement and lighting upgrade for an annual savings of \$220,000.

Implementation of the Ganni Cycle at the Lab’s Central Helium Liquifier (CHL) has dropped the electricity demand for TJNAF cryogenics from 6 Megawatts (MW) to 4.2 MW, resulting in a direct savings of \$396,000 per year in electricity costs.

Installation of geothermal heat pumps for CEBAF Center Addition is saving 333.4 Mwh or \$13,300 per year.

- **Third Party Financing** TJNAF intends to pursue the construction of a third party financed building to support our efforts for the Office of Naval Research's (ONR) Innovative Naval Prototype program. The building would be located on SURA land and would have similar physical characteristics to the existing TJNAF FEL building. The ~20,000 SF building is required to support initial commissioning and testing of a 100 kW FEL and would be rented for 4 years by the industrial contractor chosen as prime by the ONR. The building could also serve long term needs of TJNAF as a staging area for 12 GeV nuclear physics experiments or as a testing area for srf modules, e.g., for ILC support. The schedule for this effort would lead to 90% A&E design by end of FY 2010, construction approval at the beginning of FY 2011 and occupancy 18 months later in mid-FY 2012

SC Strategic Investments

- **12 GeV Conventional Facilities (Line Item)** All of the conventional facilities required for construction and operation of CEBAF at 12 GeV are included as part of the 12 GeV CEBAF Upgrade project. The conventional construction includes 31,200 SF of new space including an extension to the tunnel, a fourth experimental hall, and upgrades to Halls A, B and C.
- **Technology & Engineering Development Facility (SLI)** The project renovates Building 58, the current Test Lab (about 88,900 Square Feet(SF)), removes over 10,000 SF of inadequate and obsolete work space in and adjacent to the Test Lab, and removes 12,000 SF of dilapidated trailers that are characterized as inefficient, poor quality work environments, and not meeting current commercial standards. The project includes construction of a new building(s) which will add over 100,000 SF of needed workspace for critical technical support functions including mechanical and electrical engineering, cryogenics engineering and fabrication, and environment, safety, and health.
- **Utilities Infrastructure Modernization Project (SLI)** This project replaces or upgrades the following utility systems:
 - Cryogenics/Cooling Complex: Upgrade cryogenics complex to fully support srf and FEL R&D and Experimental Hall operations. Replace/upgrade 20 to 40 year old site cooling towers and chiller plant.
 - Power: Install secondary/redundant electric feeders, increase size of site alternate power feed.
 - Communications: Replace 20 to 40 year old underground communications and data cabling and equipment.
- **CEBAF Center Addition & Upgrade (SLI)** This project funds the modernization of the CEBAF Center, which is the hub of the Lab. It includes construction of 95,000 SF in two additional wings (Wings D and F) for the CEBAF Center as well as the rehabilitation of 67,300 SF of current space in the facility. The project accommodates: overcrowding; relocation of staff and Users currently in leased space; planned staff growth; eliminates leased space.

A review of the screening and selection criteria for these three proposed SLI projects as shown in Table 4 indicates that all three projects substantially meet all criteria:

Screening	Meets	Justification
Core Site Infrastructure	✓	All three SLI projects modernize/upgrade facilities that support multiple programs and core infrastructure
No capacity increase	✓	All three SLI projects provide long standing needs to address current deficiencies
Not Applicable for Alternative financing	✓	Provides lab-specific unique capabilities that are not appropriate for general business, manufacturing, DOE owned facilities that have environmental considerations. Requirements are long term and unique.
Beyond GPP	✓	Projects are greater than \$5M or beyond Lab's financial capacity
Mature proposal selection	✓	All projects are articulated in the 10 Year Site Plan and individual Project Data Sheets (PDS)
Selection	Meets	Justification
Mission Relevance	✓	Supports 4 Programs in SC (NP, BES, HEP, BER) and DOD/NASA R&D
Deferred maintenance	✓	- The three SLI projects will eliminate \$7.6M of deferred maintenance (DM), 80% of existing Lab DM
Eliminate Excess	N/A	
ROI	✓	Enables critical srf productivity improvement resulting from improved workflow and reduces risk of injury due to overcrowding and misuse of space. Reduces energy consumption in Test Lab by 20% and new construction is more energy efficient and sustainable than trailers Improved cryogenics increases throughput of experimental halls, 66% energy savings for same load. Will eliminate the need for ~ 40,000 SF of leased office space.
Institutional Commitment	✓	- TJNAF increased GPP commitment - \$4.2M alternate financing - State, local, and corporate commitments of \$1.5M annually, \$6M for 12 GeV plus 3 rd party building

Table 4

Excess Facility/Material/Environmental

TJNAF does not have any excess facilities or environmental issues. A material disposition plan was submitted to the DOE Site Office in 2006 for the FY 2008 budget for 130 legacy concrete blocks from the Test Lab Building previously operated as the NASA Space Radiation Effects Laboratory from 1964 to 1984 and ~ 47 tons of activated material from JLab or that was transferred from other Labs early in the Lab's history. Funds have not been identified for this disposition. While the upper range for the disposition of this material was estimated at \$10M various lower cost alternatives are being evaluated.

Trends and Metrics

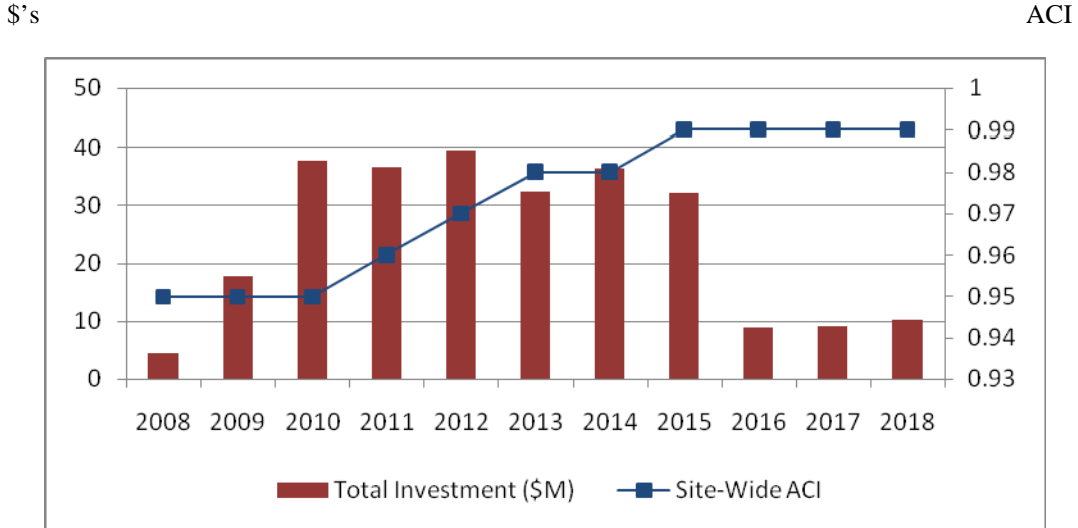
TJNAF has nine PEMP metrics measuring performance covering Excellence in Operating, Maintaining, Renewing Facility and Infrastructure Portfolio receiving an overall score of A- for FY07. The Lab has met or exceeded DOE infrastructure goals in these nine areas for FY 06 and FY07. Projected Facilities and Infrastructure Investments are shown in Table 5 and Graph A below.

Facilities and Infrastructure Investments (\$M) – Impact to Asset Condition Index

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Maintenance	2.8	3.5	3.7	3.9	4.0	4.7	5.8	6.1	6.3	6.5	7.4
Deferred Maintenance Reduction (DMR) Goal	0.6	0.5	0.8								
Excess Facility Disposition (overhead)				N/A							
IGPP (1)				N/A							
GPP	0.8	2.0	2.1	2.1	2.2	2.3	2.4	2.5	2.5	2.6	2.7
Line Items (2)	0.2	11.7	31.1	30.4	33.2	25.3	28.0	23.4	0.0	0.0	0.0
Total Investment	4.4	17.7	37.7	36.4	39.4	32.3	36.2	32.0	8.8	9.1	10.1
Estimated RPV	185.0	192.8	201.8	232.9	290.9	305.9	316.8	325.8	369.3	383.9	397.3
Estimated DM	9.5	9.2	9.1	8.7	7.6	6.3	5.1	2.0	2.0	2.0	2.0
Site-Wide ACI	0.95	0.95	0.95	0.96	0.97	0.98	0.98	0.99	0.99	0.99	0.99

1. IGPP is not applicable at Jefferson Lab
2. 12 GeV Conventional Facilities, TEDF, Utilities Modernization, and CEBAF Center Complex Addition/Upgrade.

Table 5



Graph A

Sustainability

Jefferson Lab will present by September, 2008 an executable plan to meet the sustainability requirements of DOE O 430.2B, Departmental Energy, Renewable Energy and Transportation Management and Executive Order 13423, Strengthening Federal Environmental, Energy, and Transportation Management. Jefferson Lab goals include:

- Energy intensity reduction of 30% by 2015.
- Increased use of renewable energy by 7.5%.

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- Potable water consumption intensity reduction of 16% by 2015.
- Incorporate sustainable practices in the design and construction of new and rehabilitation of existing facilities.
- Reduce the vehicle fleet’s total consumption of petroleum products and increase non-petroleum fuel use.
- Increase acquisition of electronic equipment meeting EPEAT product standards.

Jefferson Lab is on schedule to meet the goals established by DOE O 430.2B. The use of financing through Bonneville Power Administration for the replacement of aging HVAC equipment and lighting upgrades allowed the Lab to already reduce energy consumption by more than 20%. The Memorandum of Understanding (MOA) with Hampton Roads Sanitation District offers the possibility of a major reduction in the Lab’s potable water use through the use of “reuse” water for cooling towers and landscape irrigation and will result in a 70% reduction in potable water use. A list of goals developed to date as well as progress is shown in Table 6.

DOE Order 430.2B Goals					
Requirement	Goal	Funding Source	Cost	Milestone	Progress to Date
Energy Intensity Reduction of 30% by 2015	20%	ESPC (1)	\$4.2 M		100%
	10%	GPP/SLI	TBD	FY 2015	
Increased use of renewable energy	7.5%	GPP	TBD	FY 2010	Have achieved 3% using RECs plus installation of geothermal wells at CEBAF Center Addition
Potable Water Intensity Reduction	16%	GPP Operations	\$0.6M	FY 2015	Lab currently working with sanitation district to provide "reuse" water to replace potable water used for irrigation and cooling towers. Project could save TJNAF 70% of potable water use.
Sustainable practices in design and rehab of facilities	New and major rehab projects achieve LEED Gold	All	TBD	Ongoing	Sustainable practices have been used for new building construction since 2002
Fleet Management	100% replacement of fleet with AFV or hybrid	Operations	TBD	2010	29% of TJNAF vehicular fleet has been replaced with Alternate Fuel Vehicles (AFV) – all fleet vehicles will be replaced by the end of 2010.

(1) Financing through Bonneville Power Administration (BPA)

Table 6