EXECUTIVE SUMMARY
HVAC Excellence Workshop
Bellevue, WA, June 3 – 5 2008

Background. The U.S. General Services Administration (GSA) is dedicated to providing quality Federal facilities for our nation and improving the effectiveness of our Federal workforce by ensuring a quality work environment for them. The Office of Design and Construction Programs (PM), created GSA's HVAC Excellence Program in 1998 as a tool to enhance its portfolio of both new and renovation projects in response to evolving business practices and client expectations.

The HVAC Excellence program has been consistently identified as an opportunity for GSA to increase tenant satisfaction while achieving energy efficiency and ease of operations and maintenance. Responding to this opportunity, the Office of Construction Programs (PM) and the Building Operations & Maintenance division (PVD) jointly requested that The National Institute of Building Sciences (NIBS) facilitate a National HVAC Excellence Workshop to address the issues of: "Fostering integration between design of HVAC systems and operations and maintenance issues, focusing mainly on sustainability, functionality, operability and maintainability in our long-term buildings."

Workshop Summary. This was our 15th workshop and it was held in Bellevue, Washington, just outside of Seattle, from June 3 to 5, 2008. Participants included Regional Property Managers as well as HVAC Advocates and representatives from the Central Office and the Regions and technical experts from the private sector, totaling over 70 attendees.

Vijay Gupta, P.E., Chief Mechanical Engineer, Office of Design and Construction Programs, worked closely with NIBS in all phases of workshop planning. In his opening remarks he welcomed the participants and speakers, including PBS Commissioner David Winstead, Bill Harrison, President-Elect, ASHRAE, Robin G. Graf, Assistant Regional Administrator (ARA), Region 10, Chief Engineer William Holley, and Patrick Fee, Director, Building Operations and Maintenance. He welcomed the participation of property managers from all GSA regional offices and the opportunity for meaningful dialogue between HVAC Advocates and those with the responsibility

of running and maintaining our buildings. Further, he stressed the importance of lessons learned from post occupancy evaluations and showed the DVD "Achieving Excellence in HVAC Design". See full DVD at http://www.gsa.gov/hvacvideo. **Earle Kennett**, AIA, Vice President of NIBS, was introduced as Master of Ceremonies throughout the workshop.

ARA Robin G. Graf welcomed everyone to the workshop and the region and shared highlights of the Seattle area.

The keynote address by Commissioner **David Winstead** focused on "Performance Expectations" and compliance with GSA policies and procedures, including the Facilities Standards for the Public Buildings Service P-100. He stated:

*we need clear and specific performance criteria that will deliver the performance required by EISA 2007

*we need strategies that ensure that Design Excellence is inclusive of HVAC Excellence

*we need to identify those LEED criteria that will have the most significant impact on long-term performance, operability and customer satisfaction as a way of focusing our sustainability effort

*we need processes that improve our ability to realize promised LEED performance as they are reflected in actual operation

*we need to find ways to facilitate integrated design and true interdisciplinary collaboration

*we need to emphasize accountability and share approaches that we know work

William Harrison, President-Elect of ASHRAE spoke on "Maintain to Sustain; Delivering ASHRAE's Sustainability Promise" Highlights included ASHRAE'S priorities, initiatives and challenges in being a global leader in education, certification and advancement of sustainable design and operation. "Energy Waste is a real problem and a real opportunity."

William Holley, P.E., Chief Engineer, spoke about "Energy and Sustainability Requirements" especially as it relates to the new energy legislation. He emphasized the challenges ahead to meet the new energy goals. Some of what we need to do is: 1) Change our design and construction approach to focus on energy efficiency; 2) Review energy use in O&M contracts and 3) Share lessons learned.

Patrick Fee, Director, Building Operations and Maintenance, spoke on "Improving Building Operations." He stated…'the mission of Building Operations is to develop policy, procedures and measures to operate our buildings as effectively and efficiently as possible. Core functions are systems operations and maintenance, custodial operations and energy efficiency. Current initiatives include a PBS National Contact Center, Standard Contract Specifications, Management Analysis and Review System (MARS) and Contractor Performance System (CPS-VPPS) to name a few. The FY08 work plan includes Energy Conservation/Reduction through accountability.'

Other highlights include:

* A two-hour team presentation focusing on "Lessons Learned from Post-Occupancy Evaluations or How to Improve Design and Construction Processes for Future Projects." The Wayne Morse Courthouse in Eugene, Oregon and the Byron Rogers Courthouse in Denver, Colorado were the subjects of the session. These two courthouses were chosen for the Post-Occupancy Evaluations as: 1) both were recognized with LEED Gold certifications; 2) one was a new facility (Morse) and one was a renovation (Rogers); 3) both were about the same size; and 4) both had been occupied for at least one year.

The major lessons learned from these evaluations were: *the buildings did not achieve promises made through the LEED certification. Energy used by Wayne Morse courthouse is 53,386 Btu/GSF whereas the designers predicted 30,500 Btu/GSF in order to obtain a higher LEED rating, one that is not justified by actual performance. Byron Rogers courthouse complex prior to renovation was 76,315 Btu/GSF and after renovation was 82,207 Btu/GSF. Designers predicted a 40% reduction in energy use in order to claim a LEED Gold rating, so the building uses approximately 180% of the claimed performance. If these buildings had claimed the actual, measured energy performance, they would have received LEED Silver or lower ratings. Similarly, water usage predictions were not met. **Earle Kennett** and the evaluation team spoke about numerous issues detailed in their evaluation report. Among them:

The Wayne Morse Courthouse has an underfloor air distribution system in most of the occupied spaces. During construction, the

design and construction teams, jointly with the commissioning team, conducted air leakage tests. Initial air leakage rates were 80%. Through the mitigation process they were able to reduce the air leakage to 10% in one of the zones. The construction team learned numerous lessons during the process. However, during the post-occupancy evaluation two zones were tested and the air leakage rates were 60% and 150%. The conclusion from this is either the construction team did not follow through with the lessons learned or it is just too difficult to build an air-tight underfloor plenum.

See Appendix B for current Underfloor Air Distribution Policy and Standards

Window treatment was also found to be problematic in the Wayne Morse Courthouse: 1) window washing was difficult with conventional equipment due to inaccessibility in several areas; and 2) glare from large glazed areas was excessive.

The Byron Rogers Courthouse complex has only one loading dock with two berths serving the existing complex and the new Arraj Courthouse which is about 500' away from the loading dock. The total area served is approximately one million square feet. Please note details on this in **Stuart Knoop**'s presentation on "Process Issues and Recommendations for Byron G. Rogers U.S. Courthouse."

In both the Wayne Morse and Byron Rogers Courthouse Post-Occupancy Evaluations, the building automation systems were found to be only partially functioning.

See Appendix A for full evaluation reports.

Major recommendations by the evaluation team:

- Update and enforce P100
- Ensure LEED compliance with P100
- Accept LEED certification only after occupancy and verification that the actual performance is as predicted. If the actual performance is lower, accept only the rating justified by measured data.

There are numerous other lessons learned which are described in detail in the presentations by **Earle Kennett, Stuart Knoop, Jim Woods and Joe Deringer.**

Additional highlights:

* To provide sufficient daylighting while keeping balance with the thermal heat transfer, Effective Aperture (EA) of 0.15 to 0.30 is a good target value. Basic daylighting system has the potential to work reasonably well if properly calibrated. **(Deringer – Lighting pdf.)**

* A safe and healthy facility can increase the well being of its occupants, increase their productivity, improve their health and help keep them free from illness and injury. And, from an engineering point of view, PBS Facilities Standards for the Public Buildings Service, P-100 is on the mark. Also, the key Indoor Air Quality technologies include Demand Controlled Ventilation, the use of high efficiency filtration and UVc irradiation of the cooling coils, and Source Control. **(Marciniak)**

* Assistant Commissioner **Bill Guerin** gave an overview of the goals of the Office of Design and Construction Programs.

* Adjustments to controls in HVAC components can conserve a tremendous amount of energy. **(Sullivan)**

* A cost effective HVAC and controls program can save energy AND make people more productive; "What gets measured, gets done. What doesn't get measured gets ignored." **(Williams)**

* One lesson learned from the site visit to the Seattle Courthouse is the problem with the loading dock, a problem that was also found in the Byron Rogers Courthouse complex. The loading dock contains only two (2) berths. One is always occupied by the dumpsters. The remaining one is insufficient for the incoming and outgoing deliveries. The delivery trucks must backup to the loading dock which was unacceptable to the US Postal Service. For the first four (4) months of occupancy the mail was not delivered to the building. The lesson learned here is that the programming and designing for loading dock applications needs more emphasis in the P-100.

Another lesson learned from the discussion of the site visit is that potential conflicts can arise when an "energy services performance contract" (ESPC) is issued in a new construction project, especially when the ESPC and the controls contract are issued to the same holding company.

Additional "lessons learned" can be found with the **Sayer** presentation (**Thomas and Truax).**

* A dedicated ventilation system can make the design, operation and maintenance simple; Design Innovation occurs when we go back to the fundamentals; Simplicity – The Hallmark of Elegant Design. **(Coad)**

* To achieve a potentially successful Underfloor Air Distribution System there is an additional cost of $25 per square foot compared to conventional HVAC systems. **(Segal/ Wong)**

See Appendix B for current Underfloor Air Distribution Policy and Standards

See HVAC Excellence Agenda for complete listing of speakers and presentations

See Appendix C for Photos of the Workshop

See Appendix D for DVD "Sharing Lessons Learned" January, 2006

See Appendix E for Lessons Learned from Post Occupancy Evaluations

ACTION ITEMS and TOPICS FOR FUTURE MEETINGS

1. P-100 update for EISA 2007 & High Performance Buildings
2. Hot line for P-100
    a. Development and Implementation of a Hot Line for questions on P-100

3. Pre-conceptual design reviews by HVAC Excellence Review Teams are critical
4. Task Force needed to evaluate:
    a. Impact of EISA 07
    b. Energy Service Performance Contracting for "prospectus projects", new and renovation
    c. Risk Management and ESPC (Benefit/Cost Analysis)
    d. Validation of performance of ESPC contractor
5. Water Conservation Management – (e.g. Legionellosis)
6. Update P-100 to incorporate recommendations and measurable criteria requirements.
7. Formalize value engineering process
8. Modify architect-engineer selection process by enhancing role of engineering
9. Involve architect-engineer during construction process

The entire workshop was videographed and highlights will be posted on the website in the near future.

END OF SUMMARY