

Next Generation Buildings Global Building Management Systems

John Huston - Teng Solutions
Steve Walter – City of Chicago DGS



The Teng Companies

- Teng & Associates, Inc. – 1959
 - Full Service A/E firm
 - Teng Solutions - 1993
 - Highly Specialized Business Unit
 - Technology Integration Engineering
 - Technology Partner
- Teng Construction L.L.C.
- Teng Development
 - Waterview Tower - Chicago

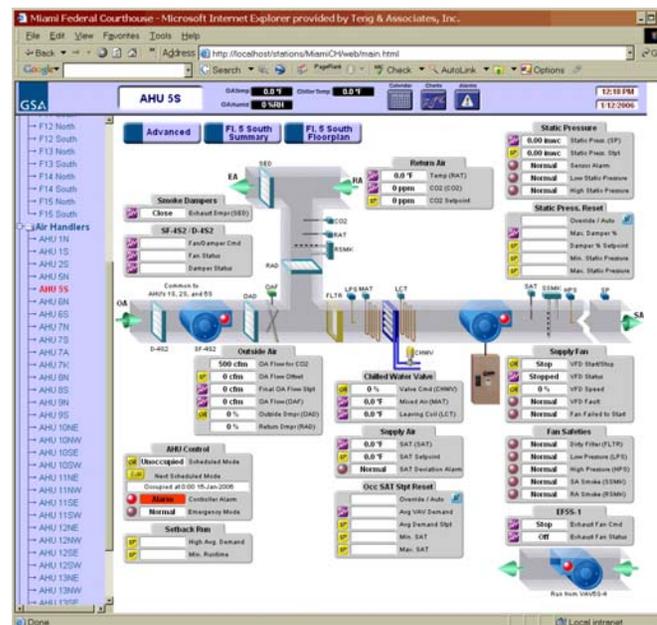
- Specification/Design High Tech Solutions
 - Open Protocols, Enterprise Based Connectivity
 - Building Automation Systems
 - Global Building Management System (Chicago)
 - Integrated Facility Management System (CDC)
- Implementation
 - Design/Build
 - Construction Administration
 - Commissioning, Retro-commissioning

What is a GBMS?

- Way to greatly improve efficiency and enhance security while reducing lifecycle costs
- Gets information into the hands of those that can use it, efficiently and reliably
- Takes advantage of enterprise connectivity, open protocols and latest advancements in technology
- Eliminates the expensive, proprietary lock created through custom, single source solutions
- Enables coordinated subsystem strategies

Subsystem Integration

- Enterprise Connectivity
- Browser Based
- HVAC
- Lighting
- Power Monitoring
- Security
- Fire/Life Safety
- Database Applications

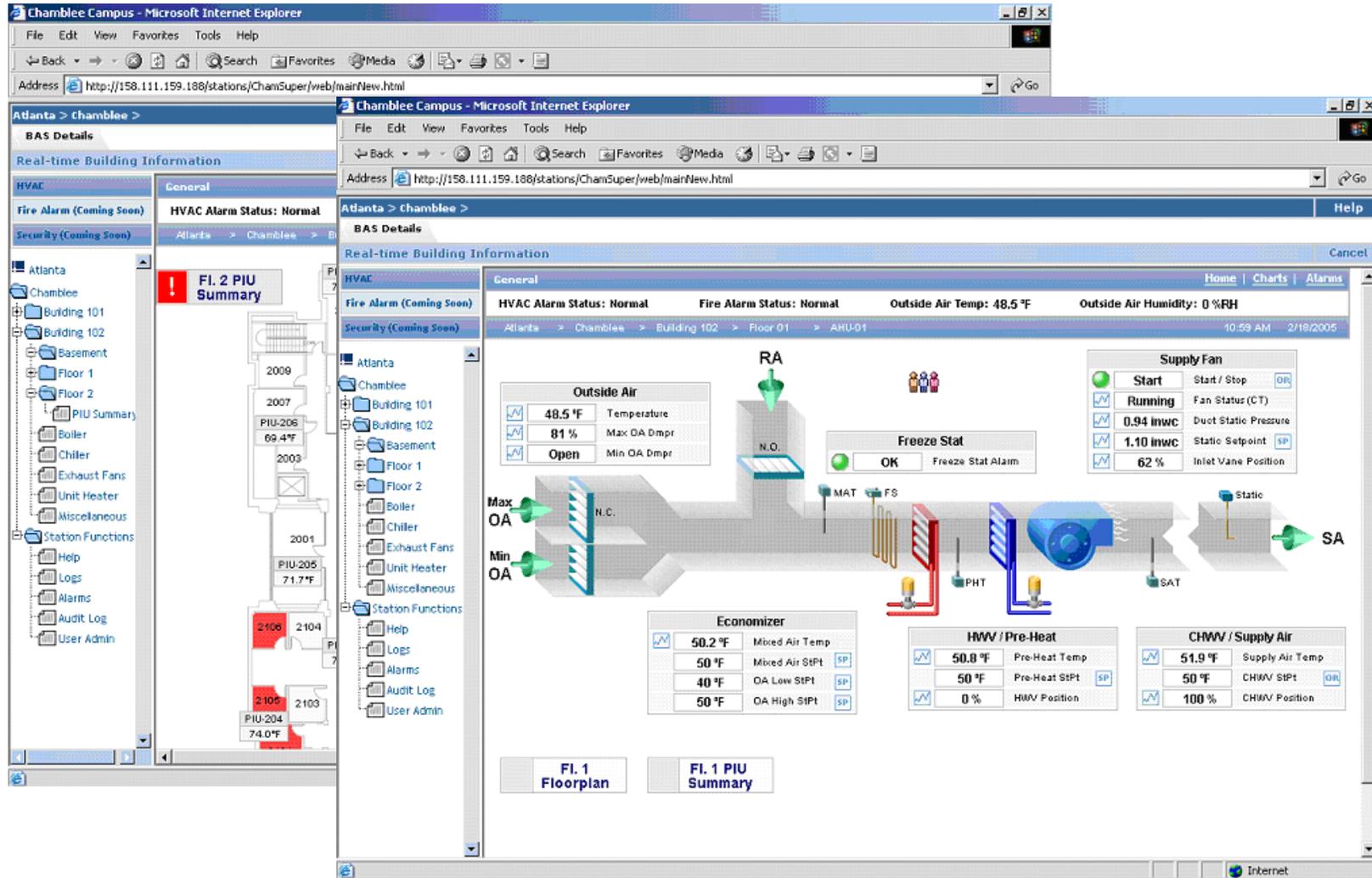


Who's Already Benefiting?

- City of Chicago DGS
- Centers for Disease Control and Prevention
- General Services Administration
- Army Corps of Engineers
- Colorado Springs Utilities
- Boeing Commercial Airplane Group
- EchoStar, US Cellular, SBC, AT&T, Broadwing
- SunTrust Banks
- Numerous Residential



2006 Centers for Disease Control



The screenshot displays a web-based interface for a Building Automation System (BAS) at the Chamblee Campus. The interface is organized into several panels and windows.

Top Panel (Chamblee Campus - Microsoft Internet Explorer): Shows the browser address bar with the URL `http://158.111.159.188/stations/ChanSuper/web/mainNew.html`.

Left Panel (Navigation Tree): Lists the building hierarchy: Atlanta > Chamblee > Building 101 > Building 102 > Basement > Floor 1 > Floor 2 > PIU Summary. A red alert icon is visible next to "FI. 2 PIU Summary".

Main Content Area (Real-time Building Information):

- HVAC Alarm Status:** Normal
- Fire Alarm Status:** Normal
- Outside Air Temp:** 48.5 °F
- Outside Air Humidity:** 0 %RH

Right Panel (Detailed HVAC Controls):

- Supply Fan:** Start/Stop (OK), Running, Fan Status (CT), Duct Static Pressure (1.10 inwc), Static Setpoint (SP), Inlet Vane Position (62 %).
- Freeze Stat:** OK, Freeze Stat Alarm.
- Economizer:** Mixed Air Temp (50.2 °F), Mixed Air StPt (50 °F), OA Low StPt (40 °F), OA High StPt (50 °F).
- HWV / Pre-Heat:** Pre-Heat Temp (50.8 °F), Pre-Heat StPt (50 °F), HWV Position (0 %).
- CHWV / Supply Air:** Supply Air Temp (51.9 °F), CHWV StPt (50 °F), CHWV Position (100 %).

Bottom Panel (Floorplans): Shows a floorplan for Floor 1 with a "FI. 1 Floorplan" button and a "FI. 1 PIU Summary" button. A detailed floorplan for Floor 2 is also visible, showing PIU units (PIU-206, PIU-204) and room temperatures (e.g., 69.4 °F, 71.7 °F, 74.0 °F).

Bennett Federal Building - Microsoft Internet Explorer provided by Teng & Associates, Inc.

File Edit View Favorites Tools Help

Address http://159.142.240.50/stations/BennettWS/web/main.html

GSA Bennett Bldg Floor 7

OATemp **65.0 °F** OAHumid **70 %RH** Boiler Temp **88.6 °F** Chiller Temp **48.7 °F** 5:50 PM 11/16/2004

Bennett Fed Bldg Floorplans

- Floor G
- Floor 1
- Floor 2
- Floor 3
- Floor 4
- Floor 5
- Floor 6
- Floor 7
- Floor 8
- Floor 9
- Floor 10

FPB/AV Boxes

- Air Handlers
- Central Plant
- Station Functions

Bennett Federal Building - Microsoft Internet Explorer provided by Teng & Associates, Inc.

File Edit View Favorites Tools Help

Address http://159.142.240.50/stations/BennettWS/web/main.html

GSA AHU 702

OATemp **65.0 °F** OAHumid **70 %RH** Boiler Temp **88.6 °F** Chiller Temp **48.7 °F** 5:51 PM 11/16/2004

Bennett Fed Bldg Floorplans

- FPB/AV Boxes
- Air Handlers
- Central Plant
- Station Functions

FI. 7 West Summary

FI. 7 Floorplan

AHU 702

- AHU G01
- AHU G02
- AHU 101
- AHU 102
- AHU 201
- AHU 202
- AHU 301
- AHU 302
- AHU 401
- AHU 402
- AHU 501
- AHU 502
- AHU 601
- AHU 602
- AHU 701
- **AHU 702**
- AHU 801
- AHU 802
- AHU 901
- AHU 902
- AHU 1001
- AHU 1002
- P01 / P02

Central Plant

Station Functions

<p>Outside Air</p> <p>561 ppm RA CO2 (CO2-1)</p> <p>950 ppm CO2 Setpoint</p> <p>0. % Outside Air Damper</p> <p>0. % Min OA Position</p> <p>100 % Max OA Position</p>	<p>Supply Fan</p> <p>Start Fan Start/Stop</p> <p>Running Fan Status (CS-1)</p> <p>0.00 inwc Static Press. (SP-1)</p> <p>1.50 inwc Static Press. Stpt</p> <p>0. % Fan Speed</p>	<p>Ext. Face / Bypass</p> <p>+0. Avg FPB Demand</p> <p>-15 Avg Demand Stpt</p> <p>No If Average Demand < -15</p> <p>No If Average Demand > 0</p> <p>No Ext. Call for Heat</p> <p>Face (CHW) Damper Position</p>	<p>Supply Air</p> <p>66.8 °F Exterior (TTE-3)</p> <p>61.7 °F Interior (TTE-4)</p> <p>60.0 °F Occupied Stpt</p> <p>80.0 °F Unoccupied Stpt</p> <p>80.0 °F Final SAT Setpoint</p>
<p>AHU Control</p> <p>Unoccupied Scheduled Mode</p> <p>Next Scheduled Mode</p> <p>Occupied at 5:30 17-Nov-2004 EST</p>	<p>Static Press. Reset</p> <p>Auto Override / Auto</p> <p>100 % Max. Damper %</p> <p>95 % Damper % Setpoint</p> <p>0.75 inwc Min. Static Pressure</p> <p>1.50 inwc Max. Static Pressure</p>	<p>Humidity Control</p> <p>50 %RH RA Humidity (HTE-1)</p> <p>61 %RH Dehumidify On Stpt</p> <p>60 %RH Dehumidify Off Stpt</p> <p>Off Dehumidify Mode</p> <p>97 % Dehum. CHWV Stpt</p>	<p>Occ SAT Stpt Reset</p> <p>Auto Override / Auto</p> <p>+17 Avg VAV Demand</p> <p>+10 Avg Demand Stpt</p> <p>60.0 °F Min. SAT</p> <p>65.0 °F Max. SAT</p>
<p>Setback Run</p> <p>+60 High Avg. Demand</p> <p>60 %RH High Space Humid.</p> <p>58 %RH Space Humidity</p> <p>20 min Min. Runtime</p>	<p>Alarms</p> <p>OK Controller Alarm</p> <p>Alarm Occupancy Mismatch</p> <p>OK Fan Status Mismatch</p>	<p>Chilled Water Valve</p> <p>0. % CHWV Position</p>	<p>Humidity Control</p> <p>Dehumidify On Stpt MUST BE GREATER THAN Dehumidify Off Stpt</p>

Miami Federal Courthouse - Microsoft Internet Explorer
 File Edit View Favorites Tools Help
 Address http://192.168.1.100/stations/MiamiCH/web/main.html

GSA Miami Federal Courthouse
 OATemp 0.6°F ChillerTemp 0.0°F
 OAHumid 1%RH

Floorplans
 Floor 1N
 Floor 1S
 Floor 2N
 Floor 2S
 Floor 3N
 Floor 3S
 Floor 4N
 Floor 4S
 Floor 5N
 Floor 5S
 Floor 6N
 Floor 6S
 Floor 7N
 Floor 7S
 Floor 8N
 Floor 8S
 Floor 9N
 Floor 9S
 Floor 10N
 Floor 10S
 Floor 11N
 Floor 11S
 Floor 12N
 Floor 12S
 Floor 13N
 Floor 13S
 Floor 14N
 Floor 14S
 Floor 15N
 Floor 15S

VAV Boxes
 F01 South
 F02 South
 F05 North
 F05 South
 F06 North
 F06 South

Central Plant
 Chilled Water (CHW)
 Condenser Water (C)

Extras
 Charts
 Alarms
 User Admin
 Miami Manuals
 Miami Drawings
 Tridium Info

AHU 13NE
 OATemp 0.5°F ChillerTemp 0.0°F
 OAHumid 0%RH

Advanced | **Fl. 13 North Summary** | **Fl. 13 North Floorplan**

Return Air
 Temp (RAT) 72.3°F
 CO2 (CO2) 404 ppm
 CO2 Setpoint 800 ppm

Static Pressure
 1.49 inwc Static Press. (SP)
 0.75 inwc Static Press. Stpt
 Normal Sensor Alarm
 Normal Low Static Pressure
 Normal High Static Pressure

Static Press. Reset
 Auto Override / Auto
 68% Max. Damper %
 95% Damper % Setpoint
 0.75 inwc Min. Static Pressure
 1.50 inwc Max. Static Pressure

Outside Air
 0 cfm OA Flow for CO2
 0 cfm OA Flow Offset
 4601 cfm Final OA Flow Stpt
 4828 cfm OA Flow (OAF)
 77% Outside Dmpr (OAD)
 100% Return Dmpr (RAD)

Chilled Water Valve
 90% Valve Cmd (CHWV)
 72.7°F Mixed Air (MAT)
 52.7°F Leaving Coil (LCT)

Supply Air
 54.9°F SAT (SAT)
 62.5°F SAT Setpoint
 Normal SAT Deviation Alarm

Occ SAT Stpt Reset
 Auto Override / Auto
 -46 Avg VAV Demand
 +10 Avg Demand Stpt
 55.0°F Min. SAT
 62.5°F Max. SAT

AHU Control
 Occupied Scheduled Mode
 Next Scheduled Mode
 Occupied 8/6/2006 @ 12:00 AM
 Normal Controller Alarm
 Normal Emergency Mode

Setback Run
 +60 High Avg. Demand
 20 min Min. Runtime

Supply Fan
 Start VFD Start/Stop
 Running VFD Status
 67% VFD Speed
 Normal VFD Fault
 Normal Fan Failed to Start

Fan Safeties
 Normal Dirty Filter (FLTR)
 Normal Low Pressure (LPS)
 Normal High Pressure (HPS)
 Normal SA Smoke (SSMIQ)
 Normal RA Smoke (RSMIQ)

EF13N-1
 Start Exhaust Fan Cmd
 Off Exhaust Fan Status

Run from VAV13N6-03

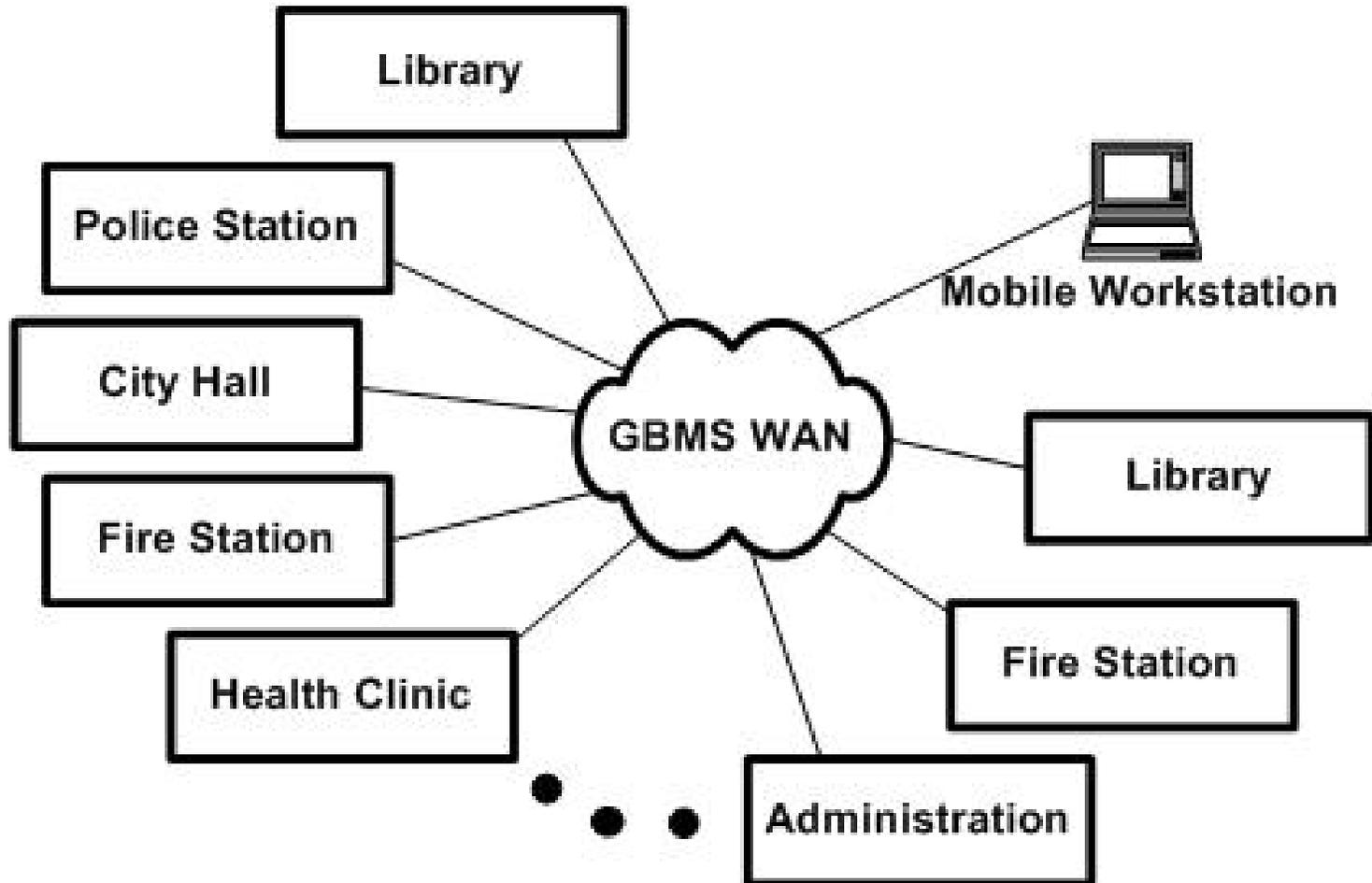
- Design Drawing, Specifications Review
- Controls Submittal Review
- Point-Point Verification (AI, AO, DI, DO)
- Sequence of Operations Testing
- GUI Testing and Graphics Review
- O&M Manual, As-Built Drawing Review
- Insure the Design Intent is Realized

- Variety of Building Control Systems
- Over 500 DGS Facilities
- Proprietary standalone systems
 - Difficult to operate
 - Expensive to maintain
 - Various states of efficiency and comfort levels
 - Typical of BCS market for last 25 years
- Building Engineers maintain multiple sites
 - Each facility is unique relative to BCS
 - Access via remote communication limited
 - Requires travel to each site to maintain operation

- Identified Opportunities for Life Cycle Cost Savings
- Apply Latest Building Control Systems Technology
 - Standardize on open protocols – interchangeability, competition
 - Utilize browser based access - uniform training, IT convergence
 - Integrate HVAC, lighting, security, power monitoring, fire/life safety
 - Easy to operate via common interface – web browser
 - Cost effective to maintain – multiple sources throughout lifecycle
 - Maximize efficiency while improving comfort level
 - Address each facility's unique features through common technology
 - Provide the tools for Building Engineers to effectively maintain multiple sites throughout the city – Enterprise connectivity
 - Migrate all facilities over 10-15 years

- Global Building Management System
 - \$150M, 10-15 year Migration
 - HVAC, Security, Power, Fire, Life Safety
 - 3 year Development
 - Concept, RFP, Selection
 - Award expected 2006 – City Council
 - CA/Commissioning - Intent is Realized
 - Initial Implementations:
 - OEMC (911), City Hall, HWL, Police, Fire....

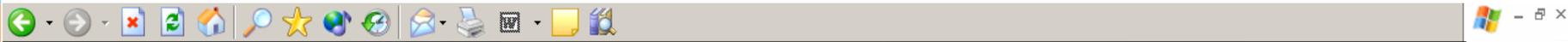
500+ Facilities



Enhances Security

- Remote Access to CCTV and DVRs Reduces the Required Number of Security Guards
 - Monitor City Hall cameras at OEMC
- Integration with Operation Virtual Shield
 - Internal view – GBMS
 - External view – OVS
 - CBR – GBMS
 - HVAC – GBMS – Automatic or Manual Response
 - Future expansion – Both
 - Remote Access through PDAs

- Positions the City to Maximize Efficiency and Lower Life Cycle Costs
 - LEED – Control and Innovation points
 - Energy Savings – City Hall significant savings
 - Improved Comfort - Libraries
 - Continuous Commissioning capability
 - Operations – Workforce
 - Reduced Labor and Overtime Costs
 - Service
 - Maintenance – Preventative Maintenance Software Integration
 - Upgrades – Cost Effective



Building Solutions. Building Performance.

[Main /](#) [Floor Plans /](#) [HVAC /](#) [Heating /](#) [Cooling /](#) [Energy /](#) [Schedules /](#) [Alarms /](#) [Logs](#) [Help /](#)

Chicago City Hall



Fri 23-Jul-2004 1:07 PM

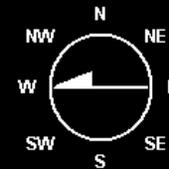
Outdoor Temp: 67.2 °F

Outdoor Humidity: 59.3 %RH

Outdoor Enthalpy: 25.3 btu/lb (da)

Wind Direction: 250 ° From North

Wind Speed: 9.5 mph



Fan System Shutdown



NORMAL

ALL AHU FANS WILL BE DISABLED

- Geographical Information System
- Energy Management
- Maintenance Management
- Inventory Control
- Computer Aided Facility Management
- Asset Tracking
- Facial/License Plate Recognition
- Biometrics, CBR Detection
- Coordinated Response

- Master Lease/Purchase
- Vendor Financing
- Municipal Financing
- City Bonds
- Grants

- **A “revenue stream” will be derived from the resulting savings in energy, workforce and overall efficiencies**

- Develop a Master Plan
 - Analyze Existing Infrastructure
 - Existing BAS, Security, Power
 - Network communications
 - Identify Processes and Procedures
 - Interview Key Personnel
 - Look for Integration Opportunities
 - Present the Options and Associated Costs
 - Matrix Format to Compare Features and Benefits
 - Design a Pilot Project - Verify
 - Develop an Implementation Plan

Thank You

Questions?

