

Sustainable BAS for Sustainable Buildings

ASHRAE TECHNICAL SEMINARS

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The bottom of the slide features a dark brown silhouette of a landscape with rolling hills and several birds in flight against a lighter brown background. A vertical cyan gradient bar is on the right side of this section.

The Building Automation System (BAS) is the most important and critical tool for maintaining tenant comfort & energy conservation in every building. If this tool REALLY does its job, the sustainability of the building will be viable for a long time.

In an Ideal World the owner wants a BAS that has:



- Fair pricing
- Great service
- One product
- A BAS that actually works and lasts longer than 5 years
- ***But how do we achieve this “HOLY GRAIL”?***

The typical new bldg process

- The engineer designs a BAS based on “normal criteria” developed within the firm. This criteria may have been developed to allow for any BAS product to meet spec (we want to be fair – to who?) or based on a specific product
- The BAS is bid through the various mechanical contractors
- Typically only the BAS products are listed – not the installing contractor, who is 80%+ of the solution
- Mechanical contractor issues PO to “his” low bidder without regard to value & features of the various BAS

Why do we retrofit a BAS?

- Improved comfort
- Increased energy savings
- Outdated equipment
- Lack of service & training
- Web-based BAS need
- System & control problems
- Needing a BAS that is easy to use
- Expansion, trending, alarms

The typical retrofit process

- Building engineer calls friend in business
- Gets price for replacement (scope?)
- Presents to owner/manager
- Owner/manager asks for savings & other bids
- Gets two more bids (same scope??)
- Issues PO to low bidder
- Low bidder requests check when he says work is done

Agenda

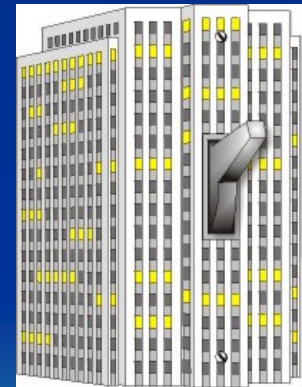
- Pre-planning the process
- Designing the project
- Picking the products & “systems integrator”
- The bidding & scoring process
- Contract administration
- Commissioning and Training

Pre-Planning the Project

- Defining the Project Criteria with the owner & the owner's operating staff is the first step to providing a quality, long-lasting building automation system. This process will help decide items of importance before the design and specifications are "set in stone".
- *What is the "Mission" of the facility?*
- *What level of capability will the staff have?*

Pre-planning the Retrofit Project

- Provide existing drawings, points list, energy bills and current sequences (REAL?) to consultant
- Scope of project (point for point or more)
- Defining unique aspects of facility
 - Smoke control interface
 - Unique systems (hybrid heating)
 - Brandt Z-box (what is that?)
- Alternates to base bid
- What does existing BAS do? (sequences, etc)



Designing the project

- Plan/Spec or Design/Build?
- Open Systems!
- Web Based a must
- Backward compatibility
- Meaningful sequences (improved)
- Plan for future expansion & technologies



The BAS is expected to:

- Be intuitive in its application
- Be long-lasting
- Be dependable
- Be backward-compatible to future generations
- Be serviceable by the owner's personnel (levels to be determined)
- have replacement parts available from multiple sources (guaranteed in writing)

Pre-Selecting the Bidders

- There are about 20-30 choices in this area for system integrators/product combinations (I've seen specs with 12-15 products listed – some don't still exist)
- Relationship to client can be very important
- Select ones that fit the project scope
- A thorough knowledge of the industry (locally & nationally) is a must for the consultant
- Narrow it down to the best three or four

Bid Requirements

- Mandatory pre-bid meeting
- Questions/clarifications due in writing a few days before bids due.
- Open book pricing for future protection
- Emphasize unique aspects of project (smoke control, labs, etc)
- Bids should go direct to owner & the selected BAS be assigned to MC w/ MU

Request for Proposal

- A narrative of the purpose and scope of project helps bidders understand client needs
- Require all BAS firm info including organization chart and resumes
- Product & manufacturer info
- Item by item response to spec sections as to what they can't meet (spec can request more than any one BAS can meet)
- Encourage bidders to include value engineering ideas & areas they exceed requirements
- Request samples of documentation

Open Book Pricing Plan

- This will help ensure a ***long-term financial arrangement*** beneficial to owner & vendor
- Only required from “apparent” low bidder
- The plan should include the following
 - List price of DDC equipment & software with price multiplier
 - Markup (overhead & profit) for any parts not included in the manufacturers price list
 - Labor rates for various types of labor
 - Typical hours (or hour range) for typical tasks
 - "Open Book Pricing" plan duration plus any inflation factors proposed
 - Expect to sign a “non-disclosure” agreement

Bid Scoring (optional)

- List all criteria and weight each item
 - Weight decided by owner based on their needs
 - Criteria will change for each project
- Score of 1-10 for each bidder
- Don't be afraid to call references to help score
- Scoring system is not published prior to bids
- In the final result, 80% of score will be about the local representative (system integrator)

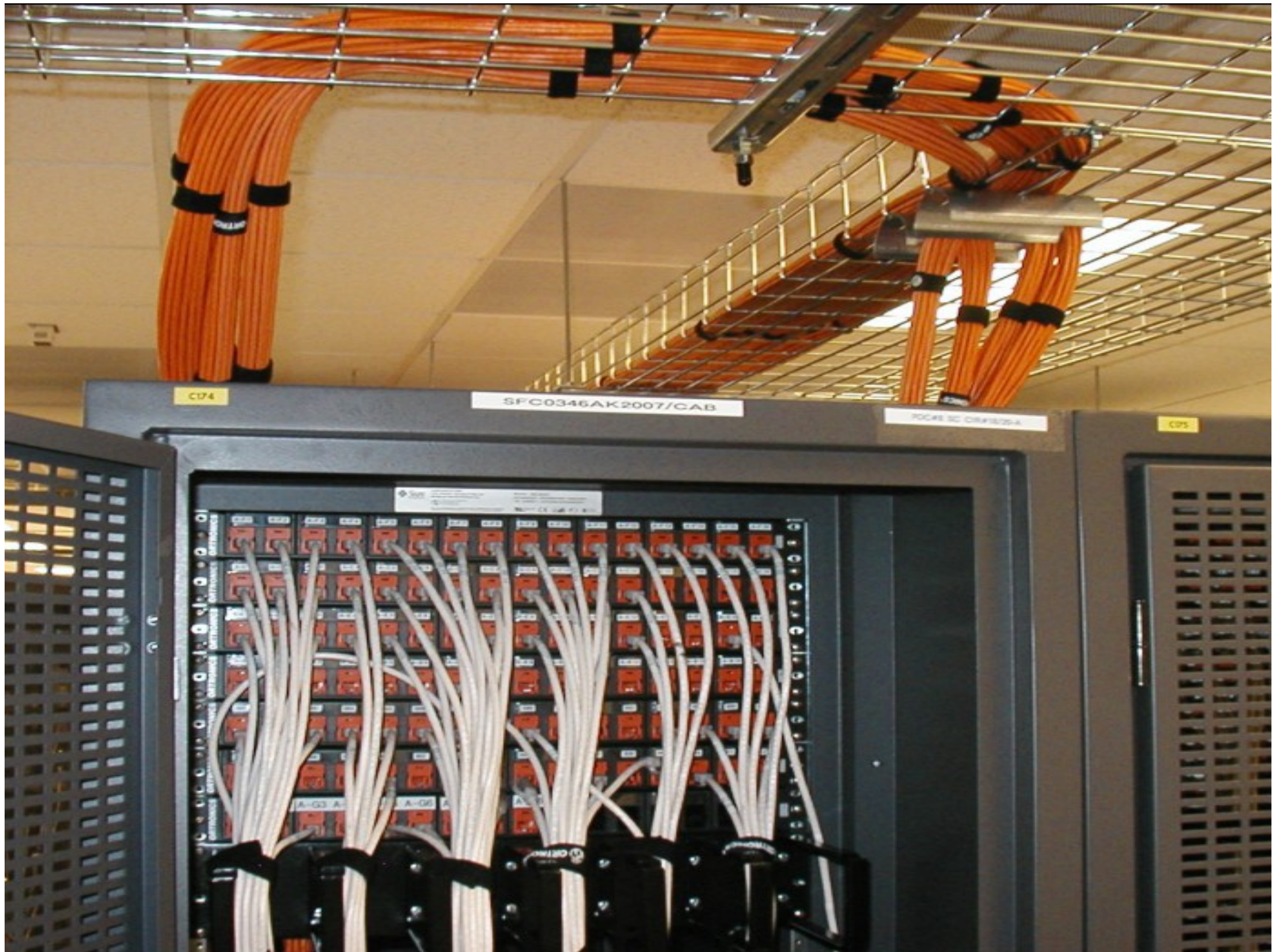
	weight	score	score	score
Price	60	9	9	10
Install	10	8	8	10
Product	10	7	5	8
other source	5	7	0	0
Z-box	15	7	9	9
Smoke Control	10	8	8	8
Hybrid Htg	10	6	10	8
Organization depth	5	5	8	9
UL panels	1	0	0	10
Open system	10	10	10	10
Controls focus	5	8	10	10
Mech Systems	10	10	7	8
Personnel	15	7	8	6
network tech	5	4	7	7
Web-all features	8	3	9	9
UUKL	1	0	0	5
own forces?	10	0	0	10
Open Book \$	10	5	8	3
ASC	1	10	4	7
Training facility/ongoing	20	5	5	10
Response to RFP	3	4	10	2
Score	224	68%	75%	85%

Contract Administration

- Review submittals (a meeting early in the process is great)
- Review contractor installation standards
- Periodic site visits for installation practices
- Review software prior to installation (simulate if possible)

Installation

- BAS must be able to use ***structured cabling*** plus industry standards for sub-network (terminal controller network) and I/O wiring (look for “power over IP”)
- Generic field panel installation: The I/O wiring will be brought to enclosures from sensors and controlled devices
- Controllers will be installed in enclosures and connected to field device wiring



Installation

- Upper level network cabling (CAT6) to field controllers will utilize ***standard IT*** connectors
- AHU controllers and terminal unit controllers will be ***same brand as BAS***. Chiller controllers will come with the chillers and have a BACnet interface.
- Equipment safeties (freeze, smoke detectors, etc.) will be ***hardwired*** into the start circuits for equipment shutdown. All safety devices will be 2-pole devices – one to shut down equipment and one to alarm the BAS.

Control Software

- The primary principle for Sequences of Operation is the “**KISS**” principle – yet it can still be powerful
- Program functionality to reside at the controller level for true ***stand alone operation***. No control sequences will be allowed at the system front-end or in routers/gateways.
- Any ***critical values*** common to the entire system (outdoor air temperature, humidity, life safety points) will duplicated on separate field controllers.

Control Software

- Each AHU and Central Plant system will have field controllers able to handle the larger point counts required
- All *manifolded* equipment that are to be controlled and sequenced together must be controlled from a *single controller*.
- Optimization routines for major equipment operation based on the summation of loads at the terminal unit level, then to the air handling unit level and finally to the central plant equipment. This is sometimes referred to as *“load based control”*.

Control Software

- If ***Smoke control*** is required to be performed within the BAS software, these points and functions should be protected by the highest level of system access. Adhere to UUKL.
- No ***“actuator abuse”***
- The contractor should be prepared to make ***adjustments in the sequence of operation*** at the time of commissioning. Systems seldom perform as intended and final configurations are seldom as designed initially.

Commissioning

- The contractor is expected to ***completely commission*** the building automation system prior to 3rd party/owner Cx
- The contractor will ***submit*** the commissioning procedure and blank log book for approval prior to starting commissioning work.

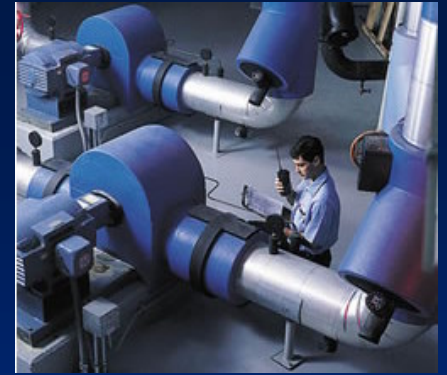


Commissioning



- Start with ***verification*** of the control inputs and outputs
- Each analog input and output will be properly ***calibrated***. This means utilizing an independent certified temperature, pressure, etc. measurement device and performing at least a three point calibration
- The ***sequences of operation*** will be tested in all normal modes and verified back to the final contract documents (***program simulation***)

Commissioning



- ***Loop tuning*** will be performed for all analog outputs under operating conditions. The P, I and D constants will be logged and noted which ones were utilized. “D” can be valuable.
- The alarms, safeties, failure and system re-start modes will then be tested.
- Trends of ALL points required for two weeks on a one-minute basis in “full automatic”

System Training



- ***Adequate training***
- Training should take place ***over a one-year period.***
- The training will include both ***generic system and site specific*** training
- On-line and DVD based interactive training programs should be available for customer refresher training

Other Thoughts

- Occupant/Tenant Portals
- Wireless “mesh networks”
- Real Time Utility Pricing
- CMMS interface