HVAC SYSTEM COMPARISON FOR THE PRESIDENT'S HOUSE

	OPTION 1 MATCH EXISTING CONFIGURATION plus CONVERSION TO 4-PIPES	**OPTION 2** SINGLE CENTRAL AHU IN BASEMENT (CV)	**OPTION 3** SINGLE CENTRAL AHU IN BASEMENT (VAV)	**OPTION 4** SPACE PAK/UNICO FOR 2ND & 3RD FLOOR PLUS BASEMENT AHU
Mechanical Space Requirements	1. Matches Existing	1. Unit is approximately 3' longer than existing and requires equipment room doors to be moved. 2. Two new duct shafts required on each floor eliminating closets and requiring changes to 2nd floor toilet rooms.	1. Unit is approximately 3' longer than existing and requires equipment room doors to be moved. 2. Two new duct shafts required on each floor eliminating closets and requiring changes to 2nd floor toilet rooms. 3. Requires access doors at knee walls.	1. Reuses mechanical room in basement. 2. Requires access star to attic and platforms to be built. 3. Requires use of 3rd floor knee wall spaces. **Space Pak** 1. 2-ton Unit (14"H x 24"W x 39"LG) 2. 5-ton Unit (14"H x 44"W x 39"LG) **UNICO** 1. 2-ton Unit (17"H x 25"W x 52"LG) 2. 5-ton Unit (17"H x 38"W x 52"LG)
IAQ Outdoor Air / Relief Air Separation	1. There is no outdoor air mechanical introduced in the house, nor do we recommend it. 2. Minimal filtration available (1").	1. Improved filtration for 2nd & 3rd floor.	1. Improved filtration for 2nd & 3rd floor.	1. Only standard filtration commonly available.
Condensate Drains	1. Poor: Distributed throughout 2nd & 3rd floors.	1. Very Good: Centralized.	1. Very Good: Centralized.	1. Fair: Located in basement and attic.
Humidification	1. Humidification delivered at (1) central location. 2. Does **NOT** humidify 2nd & 3rd floors. 3. Present campus steam humidifier to be replaced with electric steam.	1. Humidification at (1) central location. 2. **DOES** humidify 2nd & 3rd floors. 3. Single unit -less costly to install and maintain.	1. Humidification at (1) central location. 2. **DOES** humidify 2nd & 3rd floors. 3. Single unit -less costly to install and maintain.	1. Humidification delivered at (1) central location. 2. Does **NOT** humidify 2nd & 3rd floors. 3. Single unit -less costly to install and maintain.
Noise	1. Existing AHU and FCU's are reasonably quiet.	1. Very Good	1. Very Good	1. Very Good at 1st floor 2. Fair at 2nd & 3rd floors
Louvers	1. N/A	1. N/A	1. N/A	1. N/A
Zone Control / Comfort	1. Very good / 15 zones 2. Converting to 4-pipes addresses time lag associated with existing 2-pipe change-over system.	1. Poor / Only 1 zone. 2. Heating from ceiling on 2nd & 3rd floors.	1. Fair / 5 zones +/- 2. No simultaneous heating & cooling unless VAV's have reheat. 3. Heating from ceiling on 2nd & 3rd floors	1. Fair / 6 zones +/- 2. Can do simultaneous heating & cooling. 3. Heating from ceiling on 2nd & 3rd floors
Power Distribution	1. Power distribution more costly since units are distributed.	1. Power distribution is minimal.	1. Power distribution is minimal.	1. Power distribution to only 2 locations.
Mechanical Failure / Maintenance	1. FCU failure requires maintenance staff on the upper floors. 2. A unit failure impacts relatively small area. 3. Filter replacements are distributed throughout house.	1. Unit failure impacts entire house.	1. Unit failure impacts entire house.	1. Equipment located in tight spaces in more difficult to install and maintain.
Smoke Control	1. N/A	1. N/A	1. N/A	1. N/A
Cost	1. Lowest	1. Relatively High	1. Highest	1. Moderate
Energy Costs	1. Good	1. Good	1. Very Good	1. Fair
Operating Life	30 Years +/-	30 Years +/-	30 Years +/-	20 Years +/-
LEED	N/A	N/A	N/A	N/A
Dehumidification	1. Is possible for AHU only, if campus steam remains live in summer.	1. Is possible only if campus steam remains live in summer.	1. Is possible only if campus steam remains live in summer.	1. Inherently does better job with dehumidification.
Comments	1. Visibility of FCU's in all 2nd & 3rd floor rooms. 2. Minimizes additional damage to historic fabric. 3. Requires routing of 4-pipes to all units **or** at least to the AHU.	1. Consumes a lot of historic fabric. 2. Eliminates FCU's on upper floors. 3. Adds ceiling registers in upper floors 4. Requires cutting & patching of knee wall.	1. Consumes a lot of historic fabric. 2. Eliminates FCU's on upper floors. 3. Adds ceiling registers in upper floors 4. Shut-off style VAV boxes only w/o heat. 5. No simultaneous heating / cooling. 6. Requires cutting & patching of knee wall.	1. Equipment size is small 2. Ductwork size is small (9"/10") 3. Is a better A/C system than heating system. 4. Need to determine location of return grilles. 5. Various available air outlet styles. 6. Requires cutting & patching of knee wall.

	OPTION 5 AHU'S IN BASEMENT & ATTIC	**OPTION 6** AHU'S IN BASEMENT & 3RD FLOOR	**OPTION 7** AHU'S IN EXTERIOR VAULT
Mechanical Space Requirements	1. Reuses mechanical room in basement 2. Requires stair access to attic and platforms to be built. 3. Requires use of 3rd floor knee wall spaces.	1. Reuse mechanical room in basement 2. Requires use of 3rd floor knee wall spaces.	1. Smallest overall space requirement. 2. Duct shaft on second floor requires less space than mechanical room (140 SF).
IAQ Outdoor Air / Relief Air Separation	1. Good Filtration	1. Good Filtration	1. Better filtration.
Condensate Drains	1. Fair: Located in basement & attic.	1. Fair: Located in basement & attic.	1. Very good: All in vault.
Humidification	1. Humidification at (1) central location, however cold air stream. 2. Less costly to install and maintain. 3. Dehumidification enhanced with O.A. condensing unit.	1. Humidification at (1) central location. 2. Less costly to install and maintain.	1. Humidification at (1) central location. 2. Centralized maintenance of high maintenance equipment.
Noise	1. Good	1. Good	1. Very Good
Louvers	1. N/A	1. N/A	1. N/A
Zone Control / Comfort	1. Fair / 4 zones +/- 2. Heating from ceiling on 2nd & 3rd floors.	1. Fair / 3 zones +/- 2. Heating from ceiling on 2nd & 3rd floors.	1. Fair / 3 zones 2. Heating from ceiling 2nd & 3rd floors
Power Distribution	1. Power distribution only to two locations.	1. Power distribution only to two locations.	1. All in vault.
Mechanical Failure / Maintenance	1. AHU problems in attic may be disruptive. 2. Unit failure impacts relatively smaller area. 3. Filter replacements at two locations.	1. AHU failure on 3rd floor may be disruptive. 2. Unit failure impacts smaller area. 3. Filter replacements at two locations.	1. Failure of single air handling unit could disrupt larger area of building. 2. Use of multiple fans & coils within units can minimize impact of failure. 3. Maintenance required on roof.
Smoke Control	1. N/A	1. N/A	1. N/A
Cost	Expensive	Expensive	<u>Very</u> Expensive
Energy Costs	1. Good	1. Good	1. Good
Operating Life	30 years +/-	30 years +/-	30 years +/-
LEED	1. N/A	1. N/A	1. N/A
Dehumidification			
Comments	1. Avoids new vertical chases. 2. Eliminates FCU's on upper floors. 3. Adds ceiling registers on upper floors.	1. Avoids new vertical chases. 2. Eliminates FCU's on upper floors. 3. Adds ceiling registers on upper floors.	1. Still requires extensive cutting of historic fabric. 2. Eliminates FCU's on upper floors. 3. Add ceiling registers on upper floors.

HEATING PLANT OPTIONS

	OPTION 1 CAMPUS STEAM	**OPTION 2** GEOTHERMAL SYSTEM	**OPTION 3** LOCAL GAS-FIRED BOILER
Mechanical Equipment Space Requirements	1. Recommend converter be located in garage.	1. Requires 8 wells @ 20' oc	1. Could be located in garage.
IAQ Outdoor Air / Relief Air Separation	1. N/A	1. N/A	1. N/A
Louvers	1. N/A	1. N/A	1. N/A
Humidification	1. Discontinue using campus steam.	1. N/A	1. N/A
Noise	1. Good since steam noise is at garage.	1. Very low	1. Good
Condensate	1. N/A	1. N/A	1. N/A
Control	1. Good as long as steam is available all year.	1. Year round	1. Year round
Power Isolation	1. N/A	1. N/A	1. N/A
Mechanical Failure / Maintenance	1. Unit failure impacts all three buildings. 2. Most central equipment provided with redundancy.	1. One well failure has minimal impact. 2. Most central equipment provided with redundancy.	1. Failure of boiler could disrupt all three buildings.
Smoke Control	1. N/A	1. N/A	1. N/A
Cost			
Energy Costs	1. Good. Economy of scale.	1. Very good in cooling mode, moderate in heating mode.	1. Very Good
Operating Life	25 Years +/-	40 Years +/-	30 Years +/-
LEED	1. N/A	1. Requires trenching & possible archaeology.	1. N/A
Comments			

COOLING PLANT OPTIONS

	OPTION 1 LOCAL CHILLER	**OPTION 2** GEOTHERMAL SYSTEM	**OPTION 3** CAMPUS CHILLED WATER	**OPTION 4** WREN BUILDING CHILLED WATER	**OPTION 5** SPACE PACK CHILLER
Mechanical Space Requirements	1. May need more space at garage if steam is located here also.	1. Only need room for pumps, pumps & heat pumps at garage.			1. 7'LG x 36'W x 6'H
IAQ Outdoor Air / Relief Air Separation	1. N/A	1. N/A			
Louvers	1. N/A	1. N/A			
Humidification	1. N/A	1. N/A			
Noise	1. Good since equipment is located at garage	1. Very Good			
Condensate	1. Equipment sweats.	1. Equipment sweats.			
Control	1. Multiple compressors.	1. Multiple units.			
Power Isolation	1. Fewer large feeders are less costly to install.	1. Power distribution a little more costly.			
Mechanical Failure / Maintenance	1. Single compressor failure has small impact. 2. System will have redundant pumps & multiple compressors.	1. Single unit failure has small impact. 2. System will have redundant pumps & multiple compressors.			
Smoke Control	1. N/A	1. N/A			
Cost					
Energy Costs	1. Very Good	1. Very good in cooling mode.			
Operating Life	20 Years +/-	25 Years +/-			
LEED	1. N/A	1. N/A			
Comments			1. Not Recommended – Campus Steam and Chilled Water Analysis done by RMF Engineering, Inc.	1. Not Recommended – See other analysis.	1. Not Recommended - Due to size.