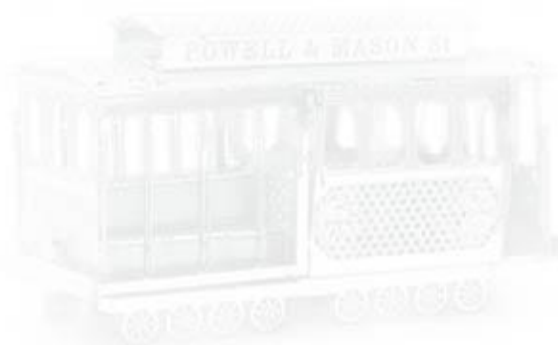




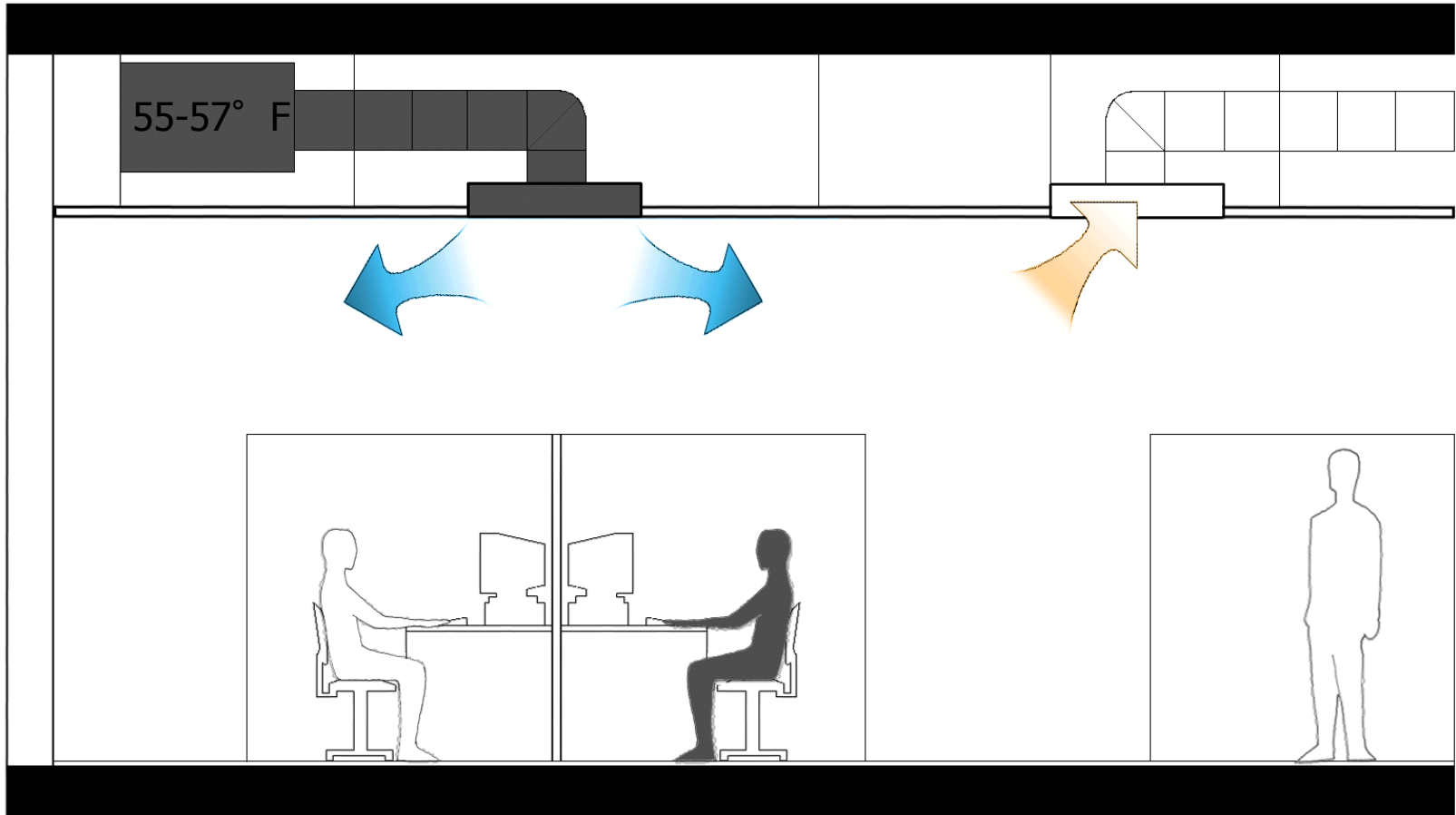
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"INDIRECT/DIRECT EVAPORATIVE COOLING IN THE ARID WEST TO ELIMINATE MECHANICAL COOLING"

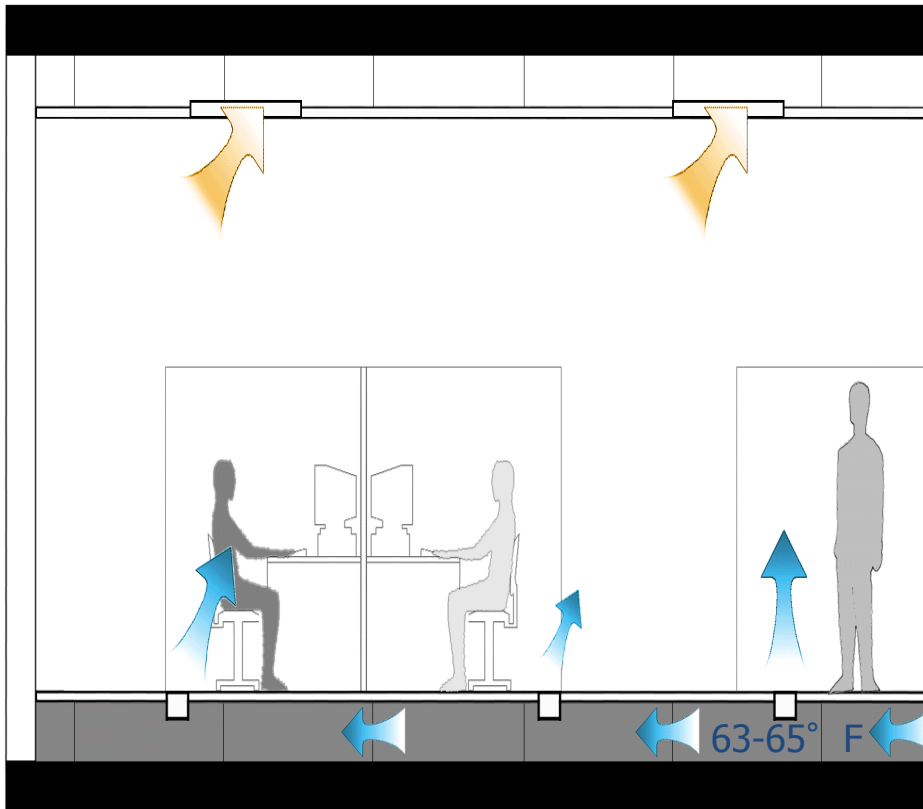
C. Mike Scofield, PE, ASHRAE Fellow



Overhead System



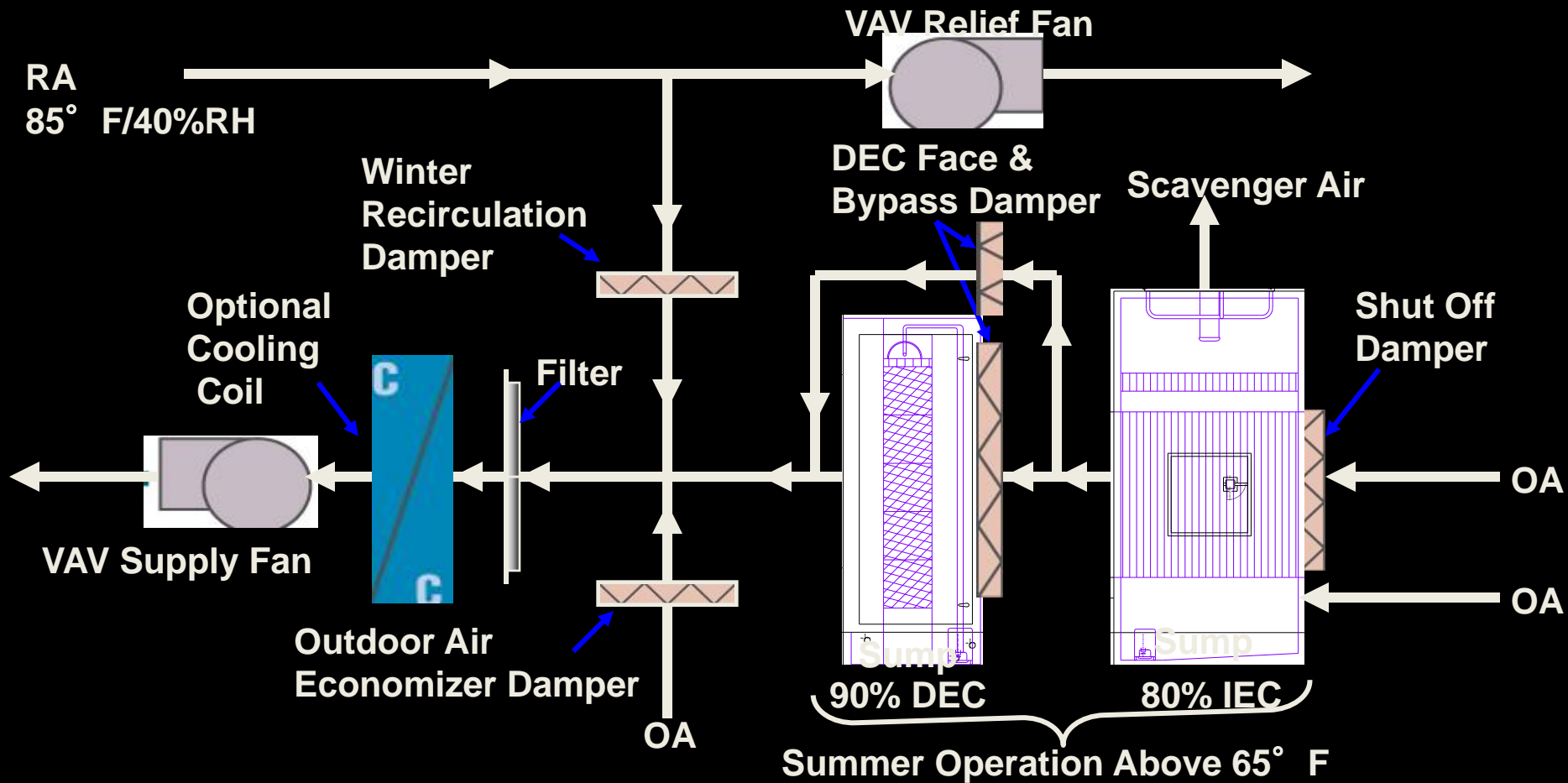
Under floor System



Benefits include:

- Flexibility for Tenant Changes
- Increased Free Cooling Economizer Hours
- Lower Fan Pressure Loss and Reduced Fan Energy
- Personalized Climate Control for Occupants
- Improved Indoor Air Quality

Under Floor Supply System Air Handling Unit Schematic



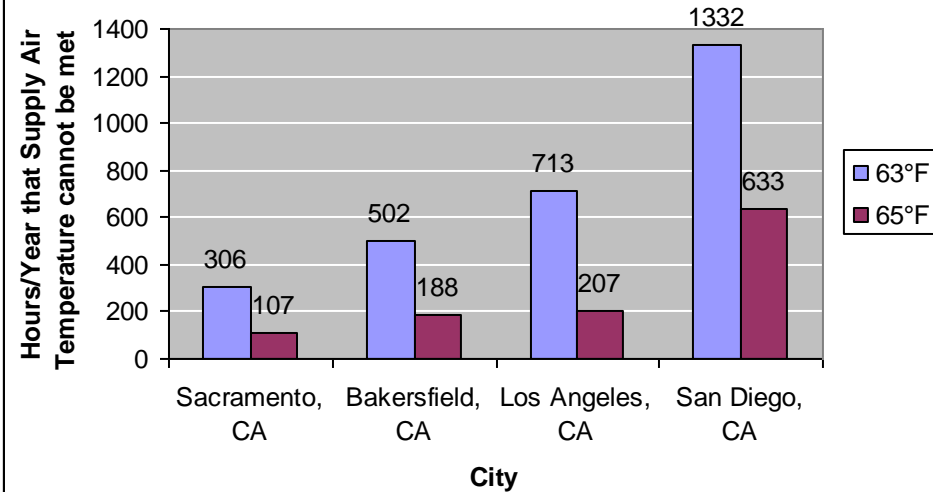
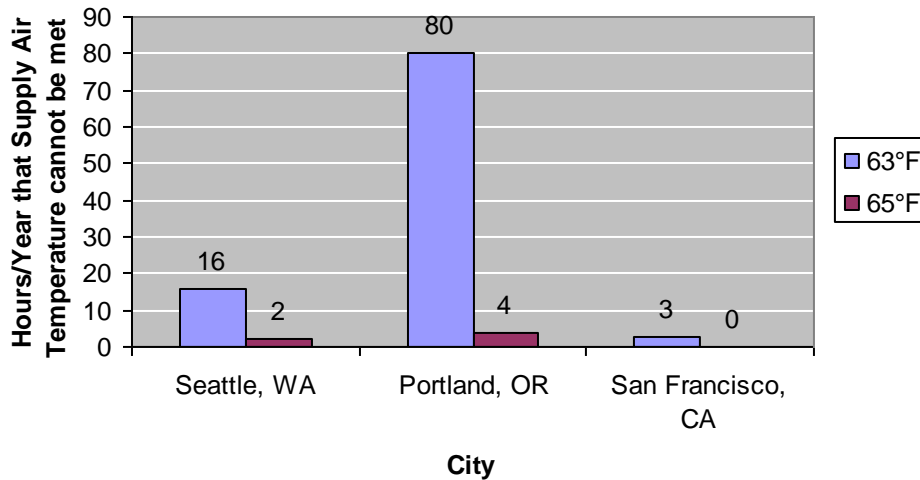
Under Floor Supply System – Air Handling Unit Schematic

Peak Tonnage Reductions for Various West Coast Cities

City	ASHRAE 0.4% Dry Bulb Design DB°/WB°(F)	Supply Air After 80% IEC and 90% DEC DB°/WB°(F)	Air Economizer Mixed Air to Cooling Coil DB°/WB°(F)*	Avoided Peak Sensible Tons Per 10,000 CFM
Seattle, WA	85/65	60.7/59.6	85/67	22.3
Portland, OR	90/67	62.1/61.0	86.3/67.0	22.1
Sacramento, CA	100/69	62.4/60.8	88.7/67.5	24.1
San Francisco, CA	83/63	58.5/57.4	84.5/66	22.5
Bakersfield, CA	104/70	62.9/61.1	89.7/67.7	24.6
Los Angeles, CA	85/64	59.3/58.2	85/66	23.5
San Diego, Ca	85/67	63.3/62.4	85/67	19.9

*Assumes 25% minimum outdoor air and return air at 85° F and 40% RH

TMY Weather Data Chart



Data Assumes 24/7 Duty Cycle and 80% WBDE Indirect with 90% WBDE Direct Evaporative Cooling Systems and 100% Outdoor Air and Exhaust Air

THE DONA SPRING ANIMAL SHELTER









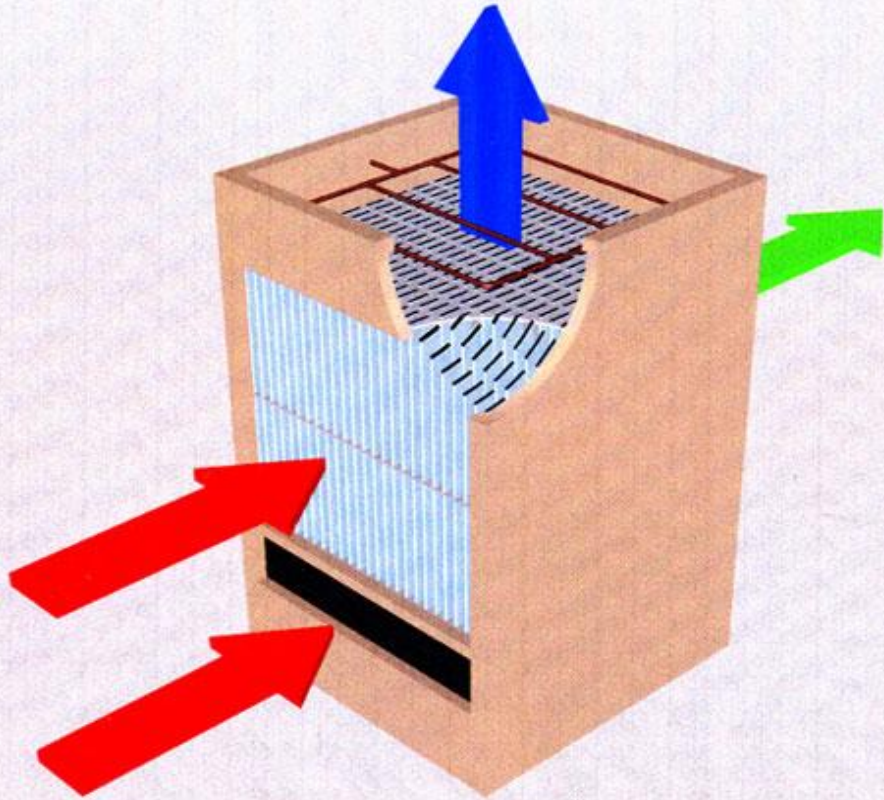








Summary of Benefits of Evaporative Cooling Design



- All outdoor air during cooling operation for better indoor air quality
- System may eliminate mechanical cooling in many west coast cities
- Building peak electrical demand reductions of 20 to 30% compared to refrigeration design with air cooled condensing system



ATMO
sphere

business case

natural refrigerants

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