



Site Planning for SGI Products

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SGI



**41st Cray User Group
Conference
Minneapolis, Minnesota**

Comparing the facility impacts of Liquid Cooled Supercomputers of the 80's and 90's to the Air Cooled Supercomputers of the next Millenium.

- **Then (early 90's)**

- **One to three large mainframe chassis**
- **Refrigerant or liquid cooled with ~85% of heat being rejected to water**
- **Concentrated floor loading, small footprint**
- **Large bulky building blocks**
- **Very specialized site preparations**
- **Mainframes operated on 400hz power**
- **1 to 3% THD**
- **500 millisecond ride through**
- **Low quantity of large power circuits (up to 800 amperes)**
- **Majority of power (~97%) consumed at 400 or 460vac 3 phase**

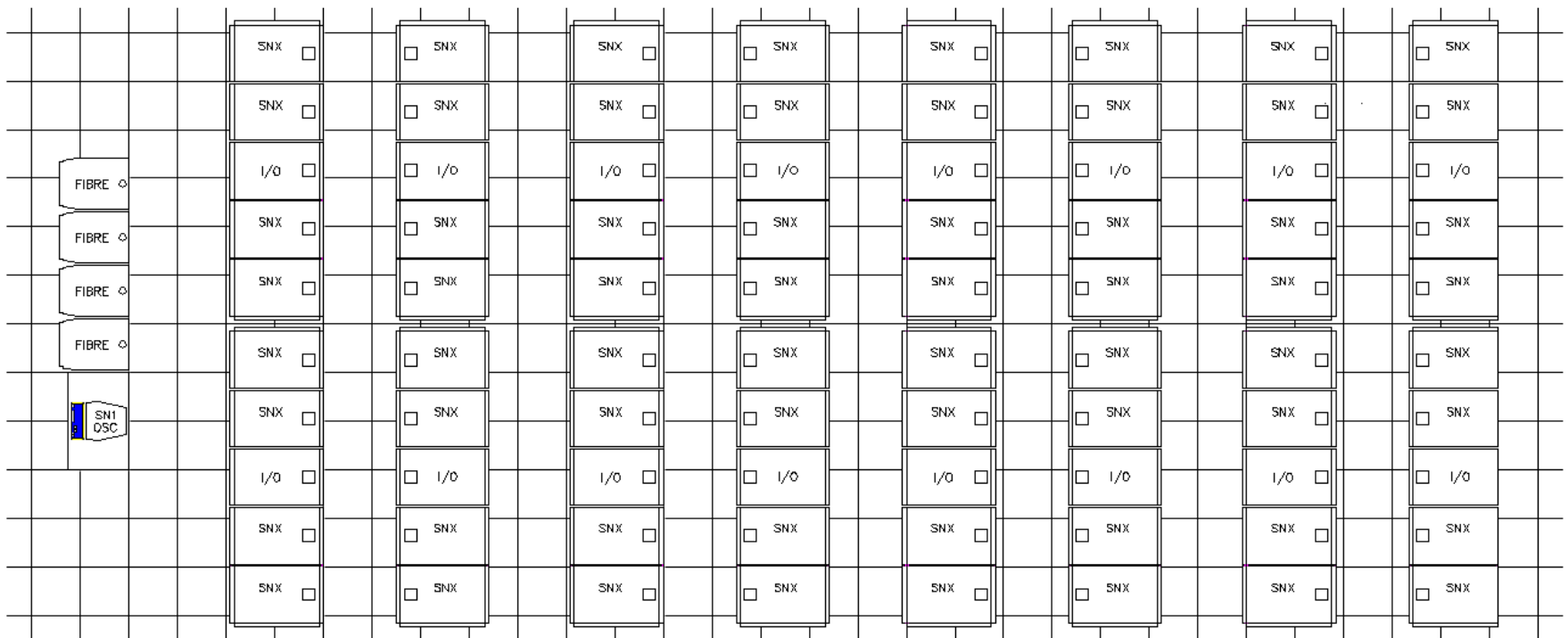
- **Beyond 2000**

- **60 to 120 rack type chassis**
- **Totally air cooled**
- **Floor loading distributed over a large area**
- **Small, relatively light building blocks**
- **Non-specialized site preparations**
- **Operates on 50/60hz utility power**
- **10 to 20% THD**
- **16 millisecond ride through**
- **Many, many small power circuits**
- **All power consumed at 200 to 240vac single phase power**

Floor Space

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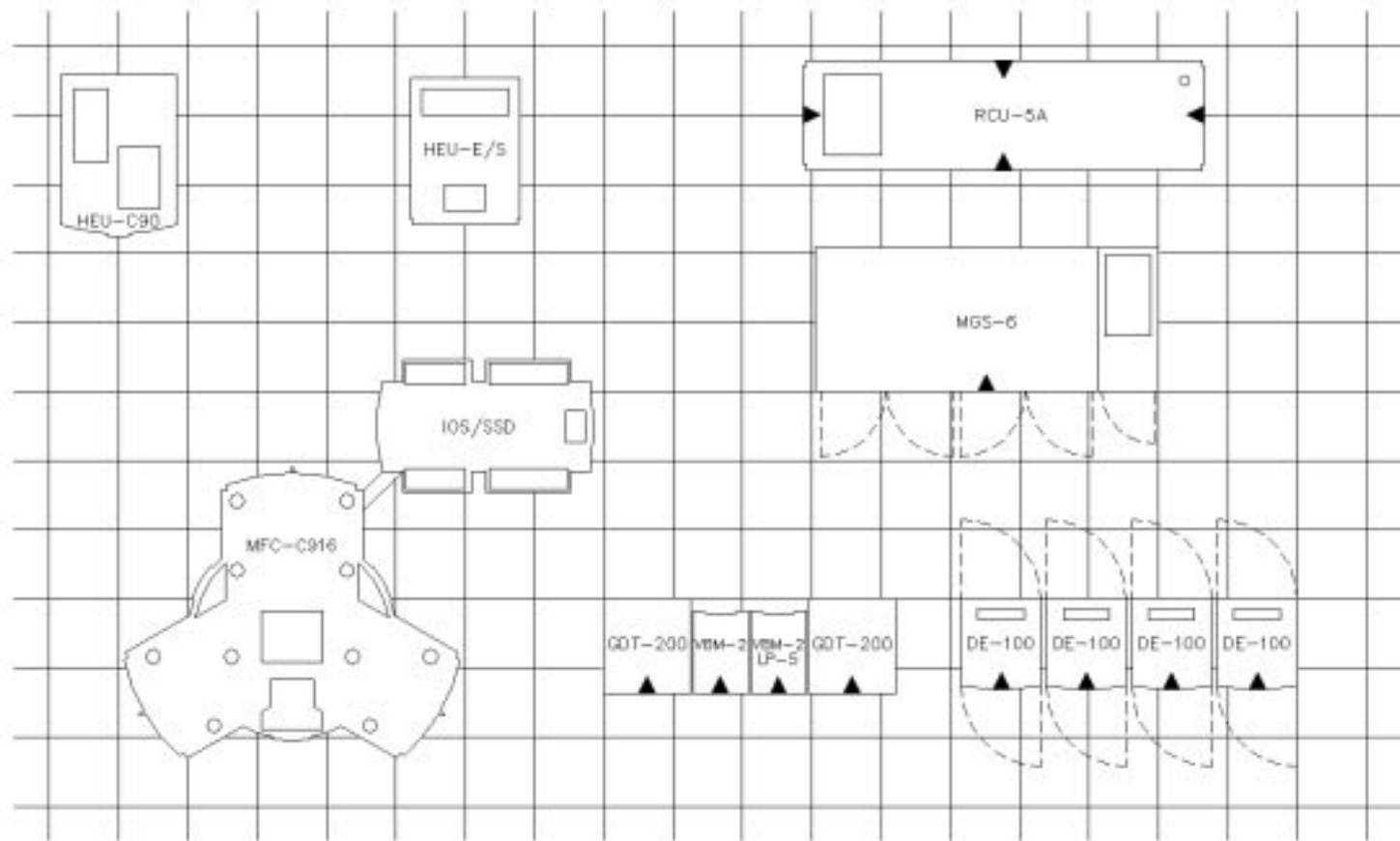
Air cooled systems consume more floor space.



Area = 1627 ft² / 151 m²

Floor Space

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Area = 936 ft² / 87 m²

System Cooling



- **Liquid cooled systems reject:**
 - 2 tons of heat to air per 100 square feet
 - 8 kW of heat to air per 10 square meters
 - 11.5 tons of heat to water per 100 square feet
 - 43 kW of heat to water per 10 square meters
- **Air cooled systems reject:**
 - 11 tons of heat per 100 square feet
 - 42 kW of heat per 10 square meters
- **This 5 fold increase in heat density may create problems at some data centers.**

System Cooling



- Centers built in the 80s and 90s were typically designed to handle 1 to 2 tons per 100 square feet of space (3.8 kW to 7.6 kW per 10 square meters of space).
- Capacity isn't enough, air distribution is critical. Location of air handlers, vented tiles, plenum pressures, air handler blower speeds must all be reviewed.

System Cooling

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This can create real nightmares if trying to cool an air cooled system with existing office cooling systems.

<i>Considerations</i>	<i>Comfort Air Conditioning</i>	<i>Process Cooling for Computer Rooms</i>
Design Conditions	78-80 db; 50% RH	72-75db; 45-50% RH
Sensible Heat Ration	.67-.75	.90-.98
Load Density, (sq. ft./ton)	200-400	50-100
Air Circulated, (cfm/ton)	350-400	600-1000
Outside Air	15-20%	1-2%
Air Distribution	Overhead	Underfloor
Quality of Air Filtration	Important	Mandatory
Vapor Barrier Need	Important	Mandatory
Max. R.H. of Supply Air	Saturated	80%
Flexibility	Some Concern	Mandatory
Equipment Failure Alarm	Desirable	Mandatory
Hours of Operation Yearly	1200 Hours	8670 Hours
Need for Redundancy	Nice to Have	Essential
Consequences of Downtime	Costly	Disastrous

Floor Loading

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- **Liquid cooled mainframes exerted as much as 1450 pounds per square foot (7079 kg per square meter) of concentrated floor loading.**
- **The average floor loading for an air cooled rack is 150 pounds per square foot (732 kg per square meter).**

Ease of moving the system into the computer room

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- **Liquid cooled systems had single components that weighed 11,500 lbs. (5200 kg) and measured 11 feet (3.4 m) long by 4 feet (1.2 m) wide by 6.5 feet (2.0 m) tall.**
- **Air cooled rack systems weigh less than 1800 lbs. (816 kg) and are less than 4.5 feet (1.4 m) long by 3 feet (0.9 m) wide, making the systems much easier to move into a facility.**

Site Preparations



Liquid cooled systems required:

- **Chilled water and/or refrigeration piping**
- **400hz power wiring and distribution**
- **The concentrated floor loading of the system often determined the location of the system.**

Site Preparations



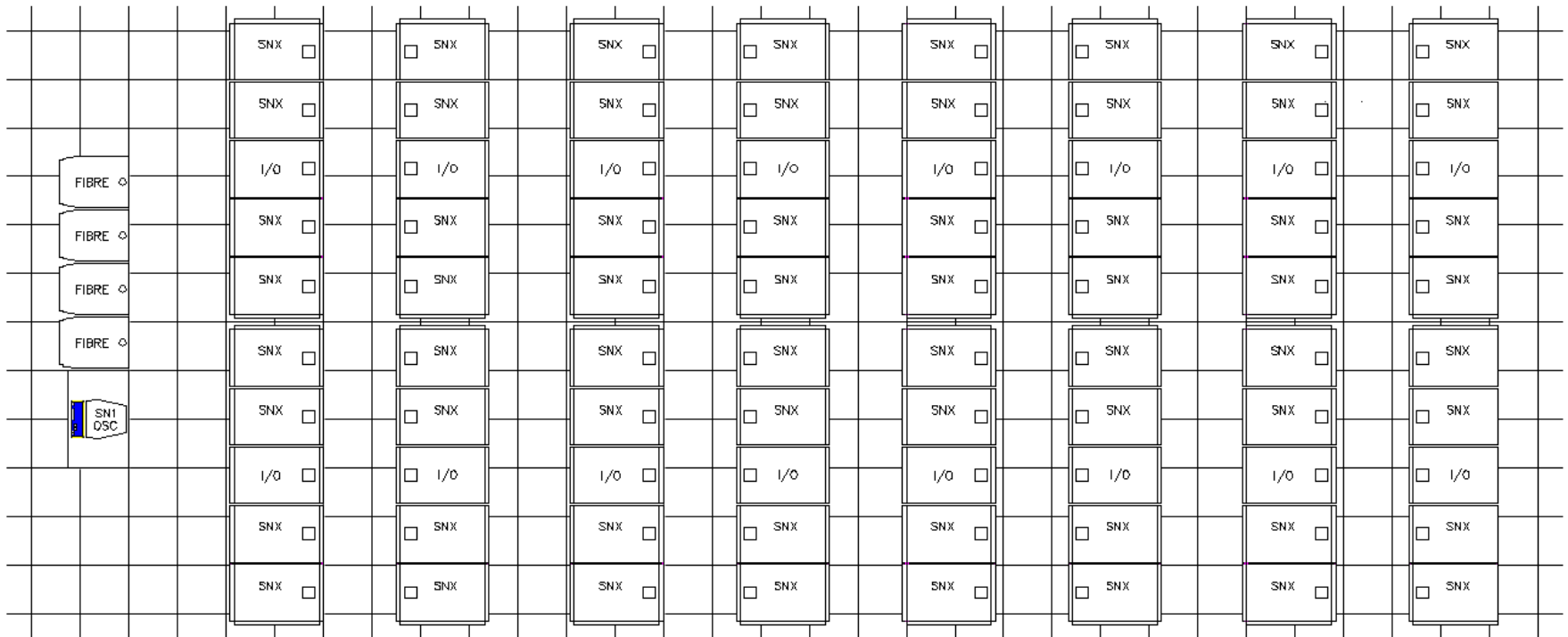
Air cooled systems require little work beyond floor cutouts and power circuits, assuming sufficient air conditioning and circuit breaker panel space are available.

- **Circuit breaker panel space requirements can be quite high for air cooled systems.**
- **Some racks can require as many as six single phase power circuits.**
 - **Over 250 circuits would be required for the system shown in the SNX equipment layout. (Work is being done to provide means to reduce the number of power circuits required by feeding the racks with 3 phase power when it is available.)**

Floor Space

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Air cooled systems consume more floor space.



Area = 1627 ft² / 151 m²

Design Effort



- **When sites were planning for large liquid cooled system installations, electrical, mechanical, and structural engineers were involved.**
- **With today's down-sized corporations and the relative simplicity of installing air cooled systems, the data processing manager may be the only person involved.**

The majority of liquid cooled systems used motor generator sets to provide isolation from the utility, frequency conversion, and ride through.

- These systems could ride through power interruptions of up to 500 milliseconds.

Air cooled systems operate on utility power.

- These systems can ride through roughly 16 milliseconds of power interrupt.
- Any power conditioning or provision for ride through must be provided by the facility.
- In order to ensure maximum availability of large system configurations, Power Conditioning becomes a requirement.

Reflected harmonics (THD) for liquid cooled systems were less than 3%.

Air cooled systems can have harmonics as high as 20% THD at low power supply output loads.

- **These high THDs may cause older facility power distribution and transformers to over heat and fail.**

Conclusion



Air cooled systems:

- Easier to prepare for
- Shorter site prep times
- Greater flexibility
- **Areas to emphasize**
 - power conditioning
 - Power distribution
 - Air conditioning capacity

***Don't get rid of your chilled water systems yet.
A liquid cooled system for the 2003 timeframe is
being developed in Chippewa Falls...***

Site Planning At SGI



Our purpose is to assist customers with any site preparation issues with SGI products.

- **For the full range of product, from the workstation to the supercomputer, if you need information or assistance, contact us.**
- **(715) 726-2820 or site@sgi.com**
- **For access to SGI site planning documentation, visit <http://techpubs.sgi.com>**

Some of the services we can provide.



- Power and cooling figures for specific system configurations
- Machine unit specifications by system configuration
- Equipment layouts by system configuration
- Assistance applying power conditioning
- Site audits to investigate facility power/cooling problems
- Complete turn-key facility preparation