ATMOsphere AMERICA
business case
natural refrigerants
25 & 26 June - Atlanta, Georgia

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Principal
CTA Architects Engineers

US Defense Commissary Agency Project

Ammonia/CO2 Cascade Refrigeration System, from design through completion.

#1 Project overview

Who is the Defense Commissary Agency (DeCA)

- Supermarket to the Military
- Global chain of 250 supermarkets on military bases
- Approximately $6B in annual sales

#1 Project overview

- Existing 117,000 Sq/Ft Commissary in San Antonio, TX
- Sustainment Project (Remodel)

#1 Project overview

- **Project Design Partners**
  - DeCA
  - EPA
  - NREL (Department of Energy)
  - Design Consultants

- **Project Funding Support**
  - Commercial Building Partnership

#1 Project overview

Goals of Project

- Low Global Warming Potential (GWP) System or 100% Natural Refrigerant
- More Energy Efficient then Industry Standard Systems
- Eliminate Safety concerns
- Serviceable Equipment
- Reasonable Costs

Possible Systems that met Goals at the time of project

- HFC/CO2 Cascade System
- Transcritical CO2 Systems
- Ammonia/CO2 Cascade System

#1 Project overview

System Selected

- **Ammonia/CO2 Cascade System**

  - Only 100% Natural Refrigeration system at the time that could be used in this environment and still meet the goal of energy reduction.

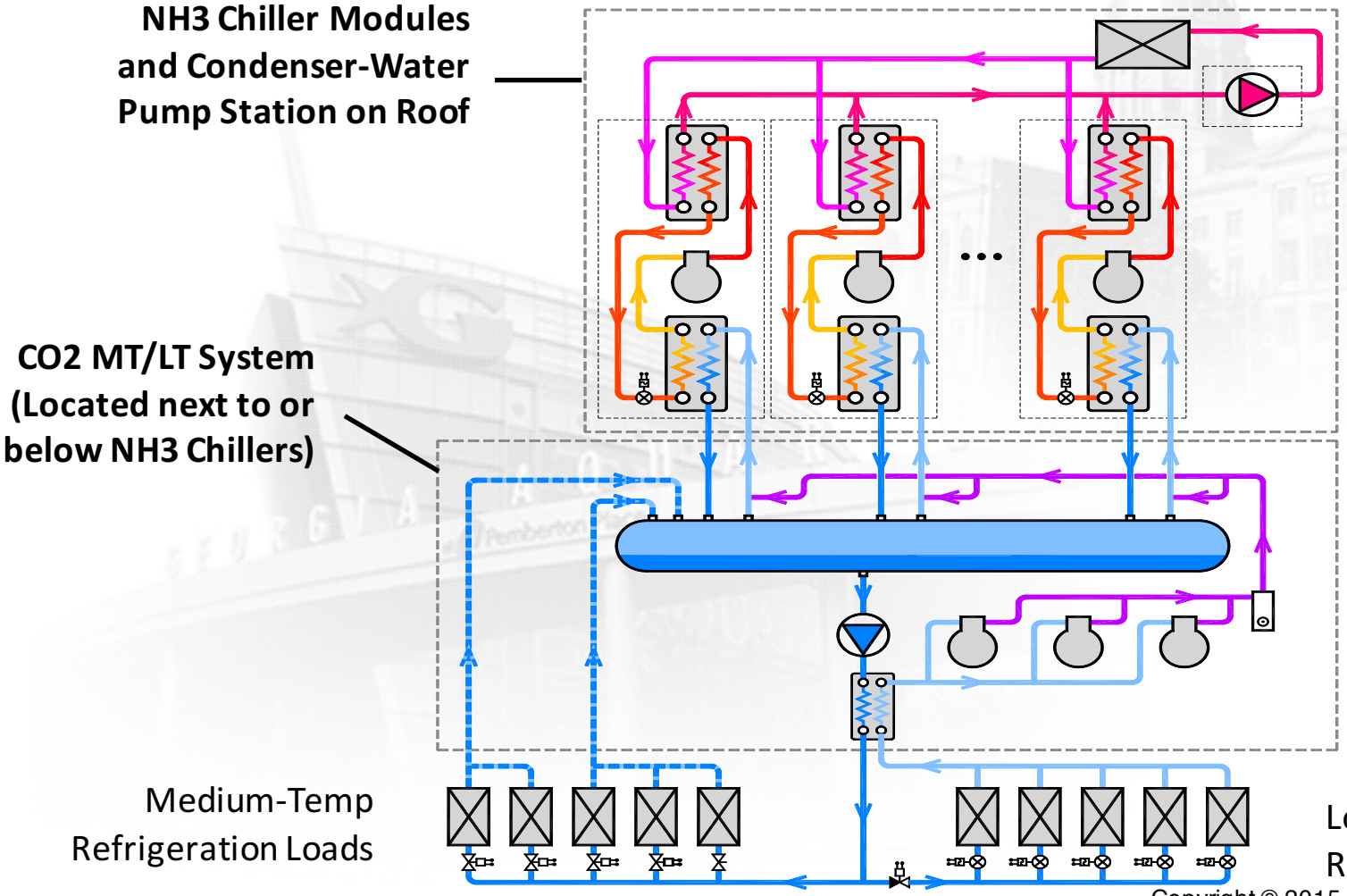
  - This was a demonstration project and did not have a favorable ROI. Initial Simple ROI was over 20 years and even though equipment was less then expected ROI is still calculated to be over 20 years.

  - 81 lbs. of Ammonia / 1800 lbs. of CO2

#1 Project overview

System Selected

- **Ammonia/CO2 Cascade System**



#1 Project overview

System Selected

- Ammonia/CO2 Cascade System

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#2 Efficiency Analysis

DeCA Lackland - Comparison of Refrigeration System Energy Use				
System	Subsystem	Baseline System		Proposed Systems
		4-Rack R-404A System		Cascade NH3 Over CO2 System
Rack Systems	LT Compressors	170,671 kWh		
	MT Compressors	225,719 kWh		
	Primary Compressors			277,369 kWh
	Secondary Compressors			81,105 kWh
	Secondary Pumps			6,531 kWh
	SubT Rack Systems	**396,390** kWh		**365,005** kWh
	Energy Use Compared To Existing System			**7.9% Less**

#3 Cost Analysis

- The actual first cost differential between the NH3/CO2 system and a R-404A system turned out to be less than projected.
  - The first cost considering equipment, installation, piping and refrigerant was a $334K premium for the NH3/CO2 system.
  - Annual maintenance cost savings due to reduced refrigerant costs are estimated at $5,500 annually.
  - Energy savings of $3,100 annually remain a projection with actual energy costs to be evaluated over the next year with the system installation completed.
  - The cost savings for 'future proofing" the system are real but difficult to determine.

#4 Barriers and Solutions

- **Barriers that existed**
  - Concerns about Hazards of Ammonia System
    - *Plume Study*
    - *Town Hall Type Meetings*
  - Concerns about Costs increase
    - *Availability of Equipment/Installation Pricing*
    - *DOE Funding*
  - Concerns about capable installation and maintenance contractors.
    - *Install was not difficult but need experienced person at start-up*

#5 Lessons learned

- **Lessons Learned**
  - NH3 Screw Compressors are not as readily available as typical HFC semi-hermetic compressors. Since all modules and compressors are the same size recommend having extra compressor on site.
  - Other ammonia related components are not readily available and should be considered to have on site:
    - Steel solenoid Valves
    - Shaft seals

#5 Lessons learned

- **Lessons Learned**
  - Work out control strategies for these non-standard systems up front.
  - Try not to use separate control manufacture for Ammonia system and CO2 system.

#5 Lessons learned

- **Lessons Learned**
  - I believe potential for low charge Ammonia/CO2 systems in the United States is strong.
    - Can be designed to be safe for general public and service technicians
    - Can be used in any climate zone
    - Reduce energy use over industry standard HFC systems
    - Major Reduction in Carbon Footprint
    - Costs will come down with more use (Industrial Sector already seeing this)

#6 Future plans

- **Similar Projects**
  - Wholefoods - Northern California
  - Albertsons – Carpentaria, California

- **Other DeCA Natural Refrigerant System**

  Transcritical CO2 System
  - DeCA Commissary - Spangdahlem Air Base, Germany
  - DeCA Commissary – Newport, Rhode Island

  NH3/CO2 Secondary System
  - DeCA Distribution Center – Kanto Plains, Japan

DeCA continues to evaluate rapidly evolving technical solutions to reduce F-gas usage.

#7 Action Plan

- **<u>Things that need to happen for Ammonia/CO2 systems to be more widely accepted</u>**
  - Public Opinion to change on safety concerns of low charged ammonia systems
  - Reduction in Costs
    - More manufactures being able to provide a proven system.
    - More Installation contractors with knowledge of install.
    - More Service technicians with experience on servicing.
  - Cost Associated with refrigerant releases or CO2 Emissions

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