Q. What the heck is a HAC?

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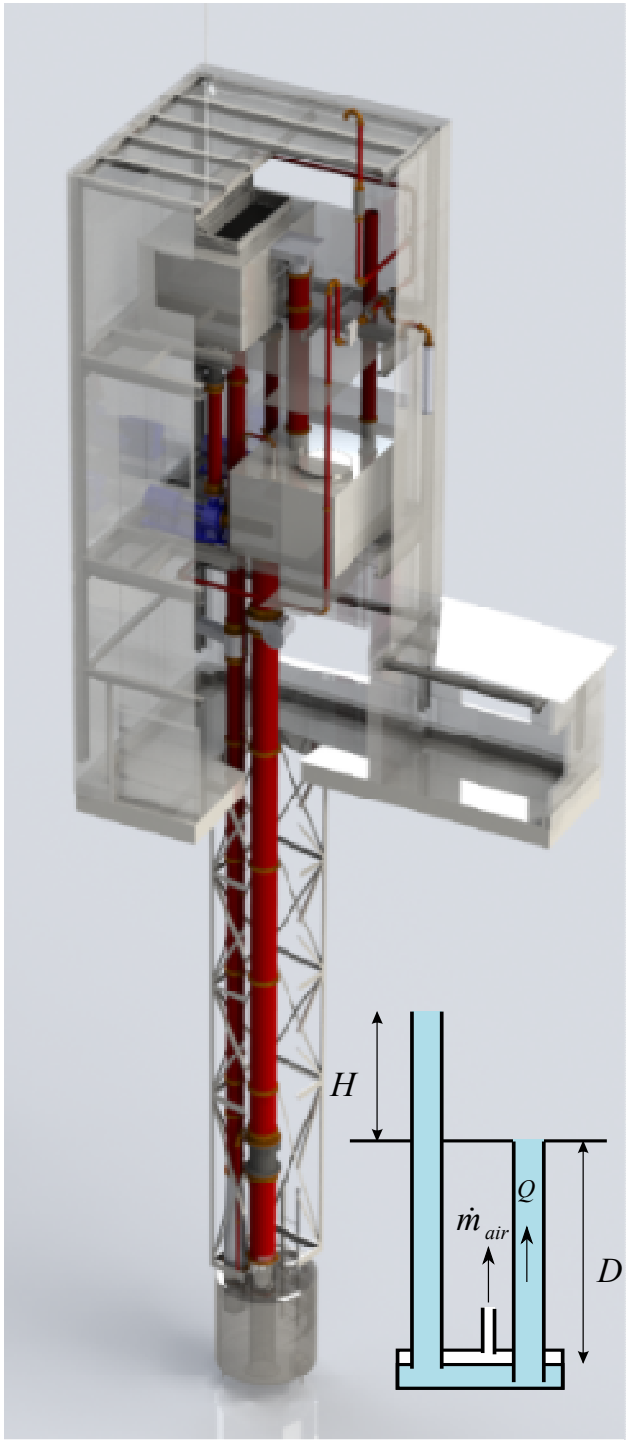


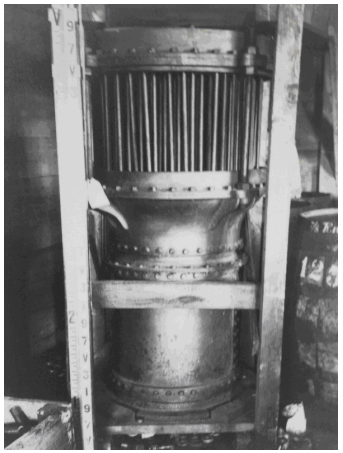
A. An energy efficient, low carbon compressed air installation

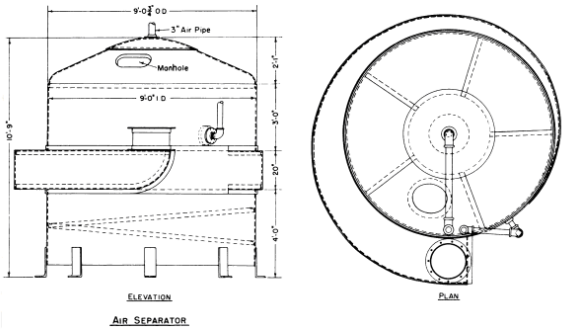
- Water is used to compress the air as it falls
- The water simultaneously cools the air
- Isothermal (constant temperature) compression
  → fundamentally superior than incumbent compressor
  → requires less energy input
  → in fact, requires the least amount of energy input conceivable
- Minimum energy → minimum cost
- Minimum cost → more competitive production

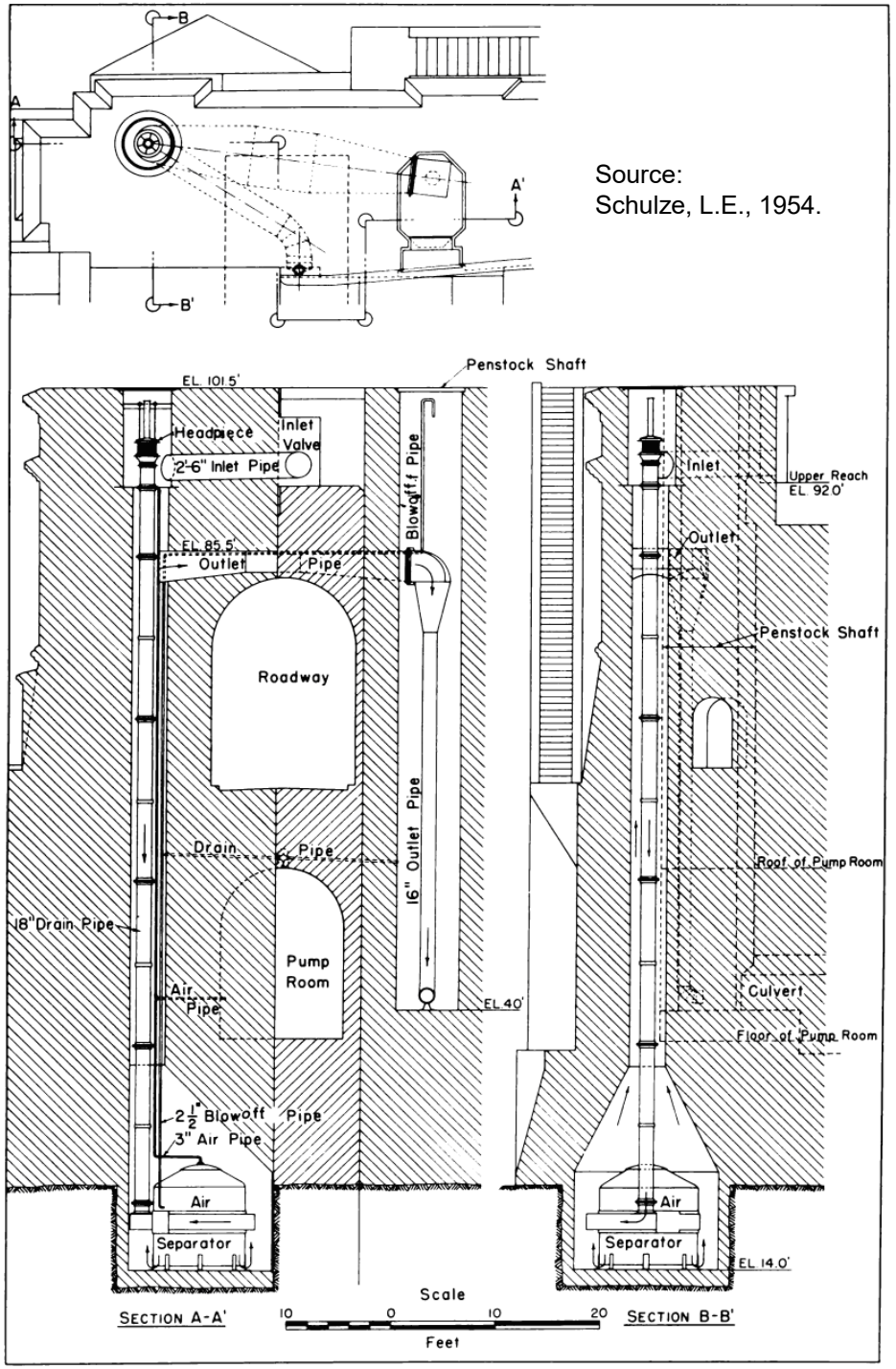
- Other benefits:
  - Few moving parts
  - Low maintenance costs
  - Long operating life
  - Oil-free air
  - Drier air
  - Cooler air

The HAC Pack

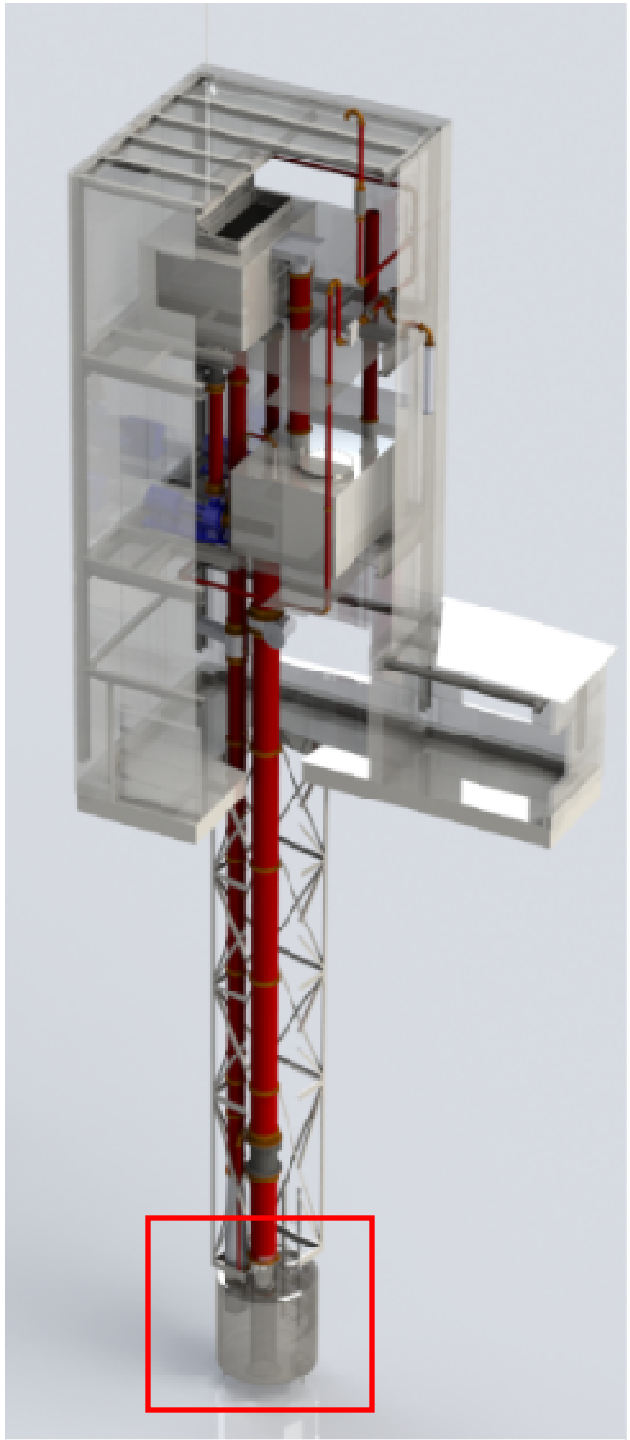
Taylor's HAC installed within Peterborough Lift Lock is the template for Dynamic Earth's HAC Demonstrator





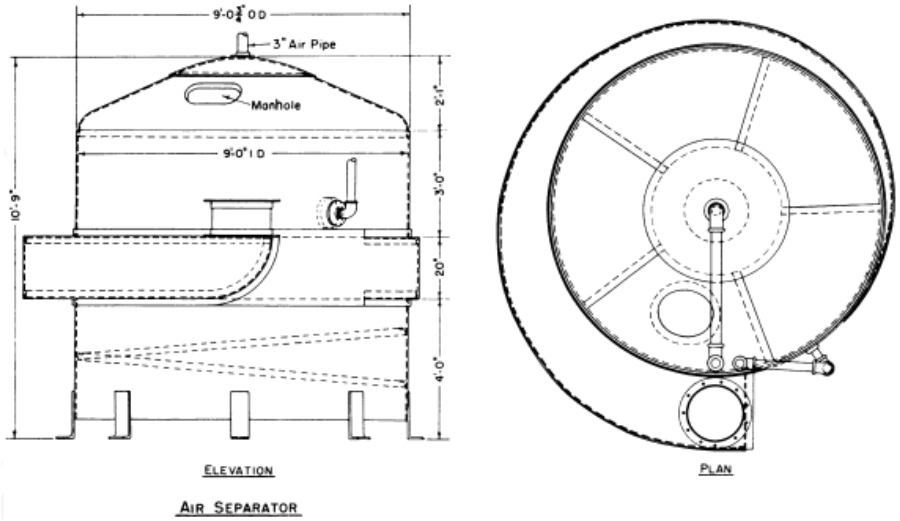


The exterior design of the HAC Demonstrator was conceived and designed by a group of 4, 2nd year students studying at the McEwen School of Architecture

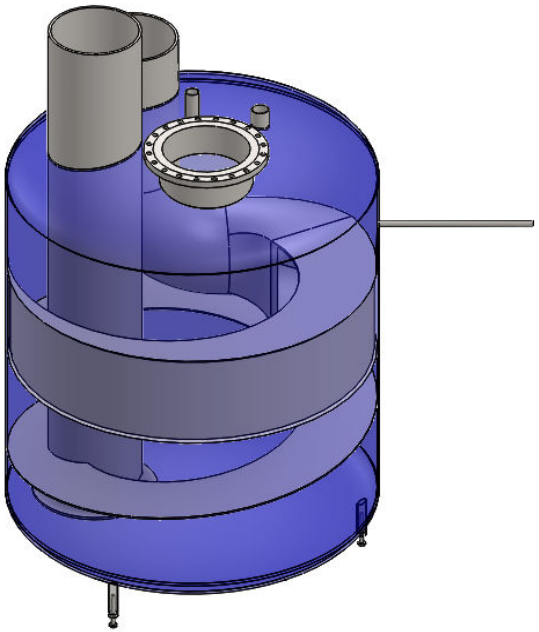


Air-water separator design

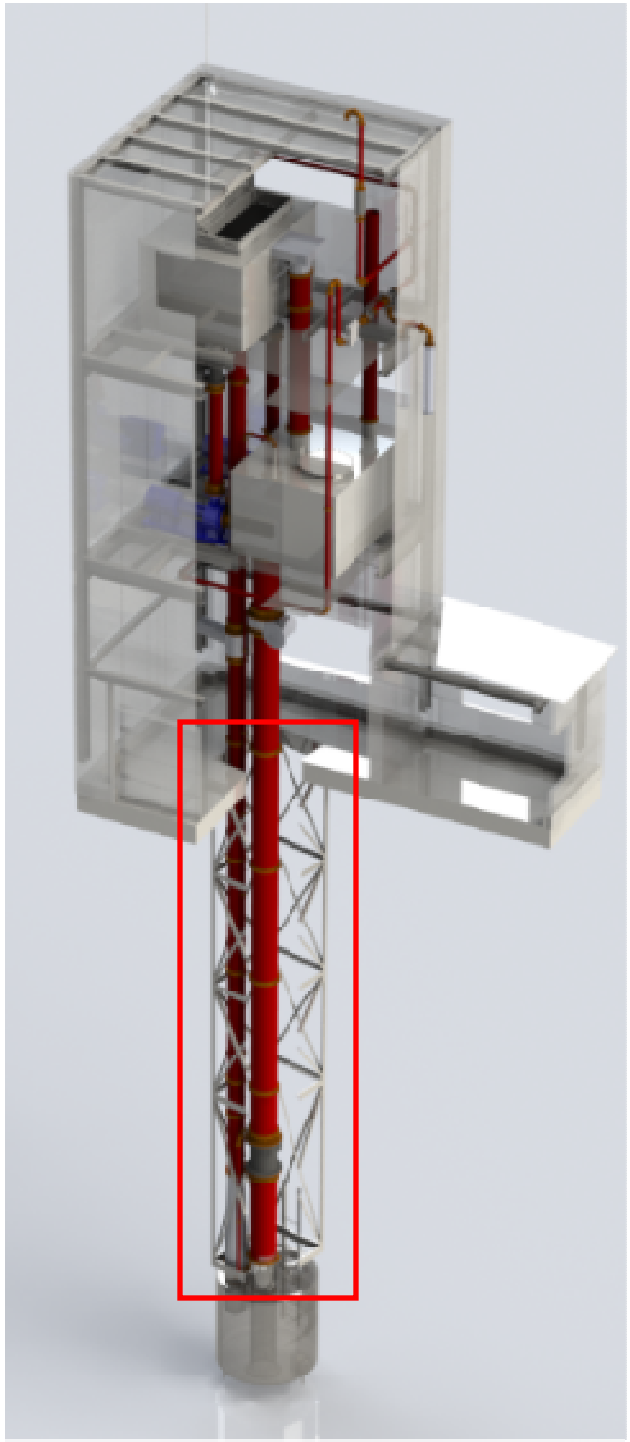
Charles H. Taylor's 1905 design



Alex Hutchison's
2016 design



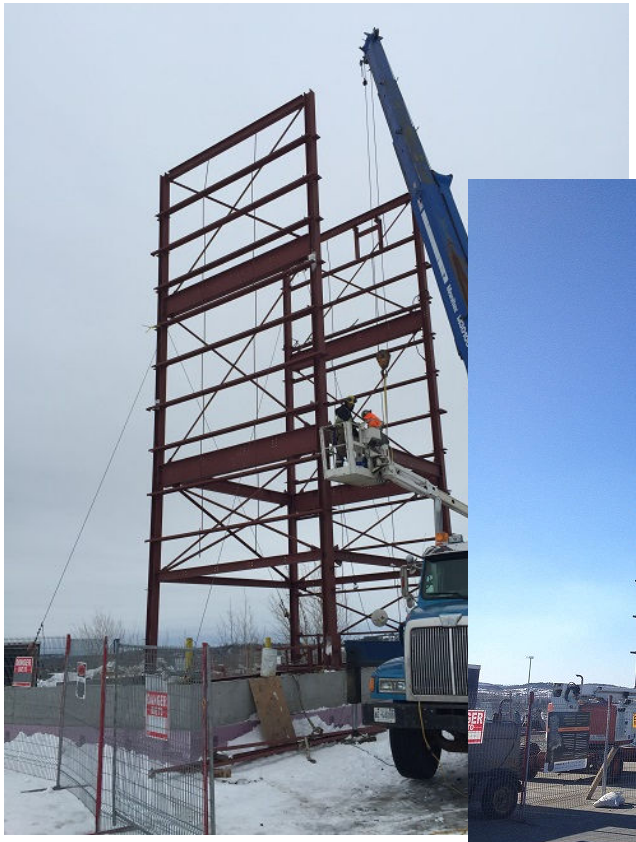
Credits:
Design: Alex Hutchison
Fabrication: Specialty Alloys & Stainless
Installation: Reasbeck Construction Inc.
Fitting: Hanking Mechanical



Credits:
Mechanical design: Black Rock Engineering
Sub-structural design: Makami Engineering
Structural fabrication: Nickel City Steel
Pipe fabrication: Fuller Industrial
Pipe couplings: Victaulic Canada
Pipe fitting & welding: Talevi Welding & Mechanical

Credits:

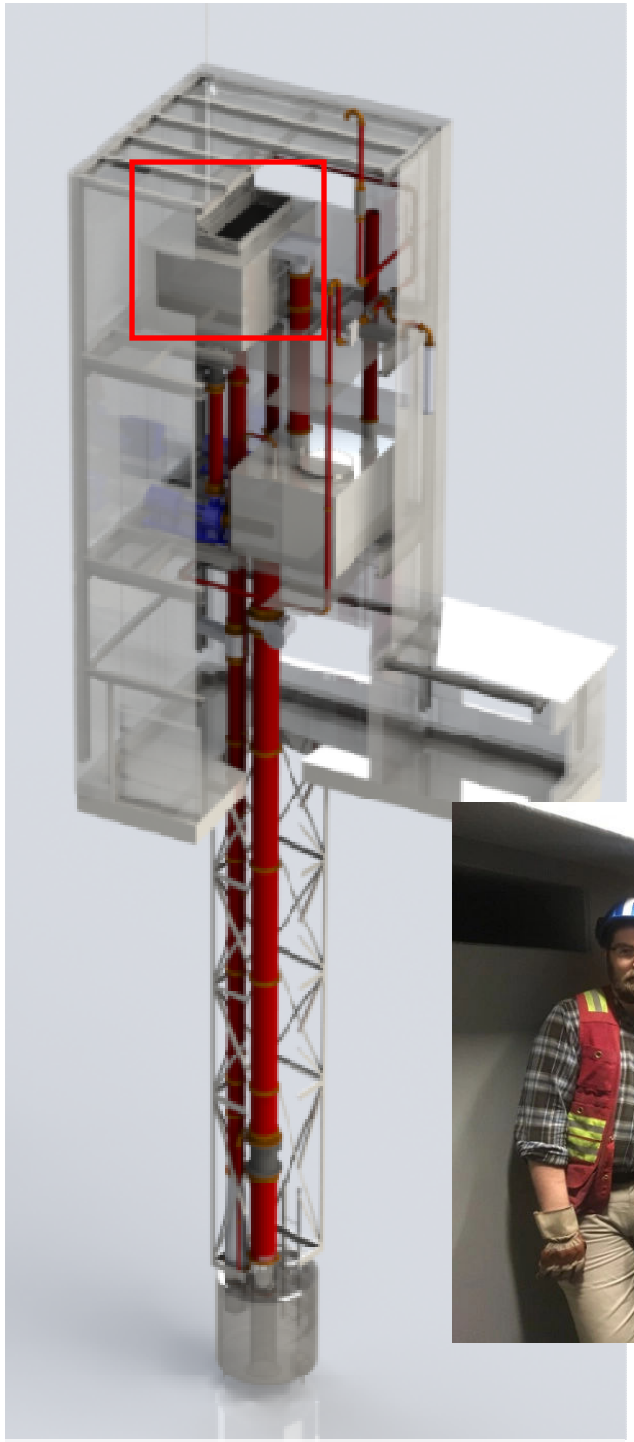
Geotechnical: David Wood
Structural/Foundations: Makami Engineering
Installation: Reasbeck Construction Inc

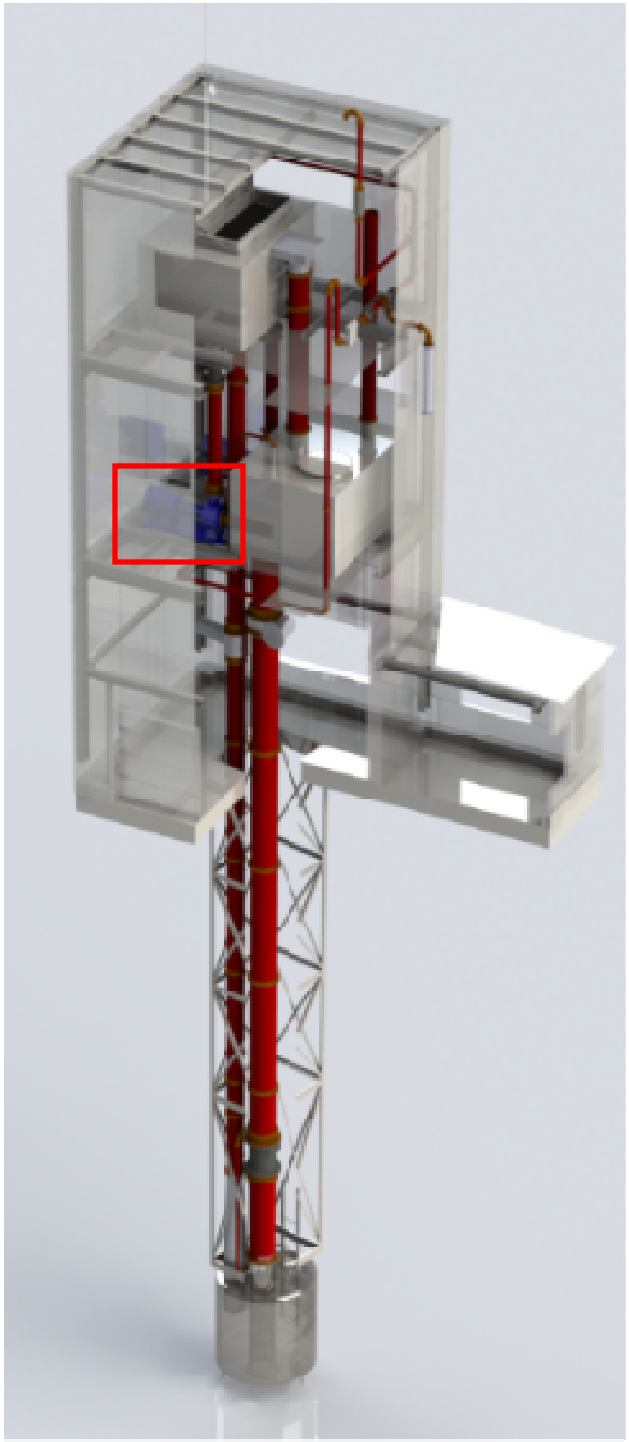


Credits:

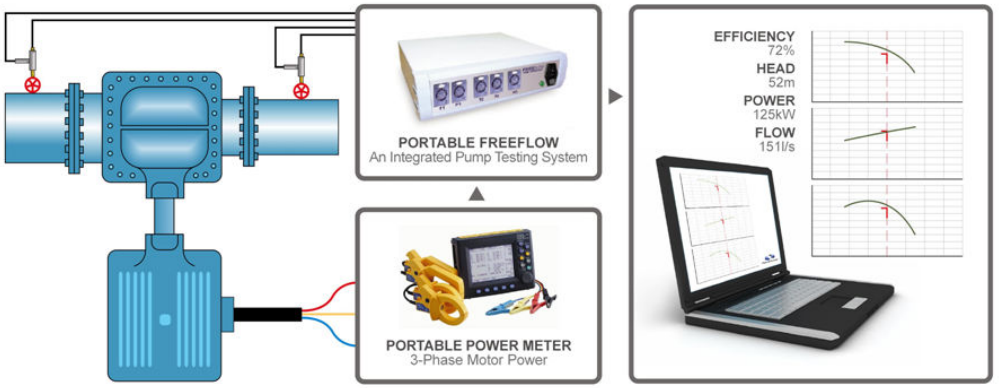
Structural: Makami Engineering
Installation/erection: Reasbeck Construction Inc
Tank fabrication: Specialty Alloys & Stainless
Cladding: Flynn

Air-water mixer design





An efficient HAC needs efficient pumps



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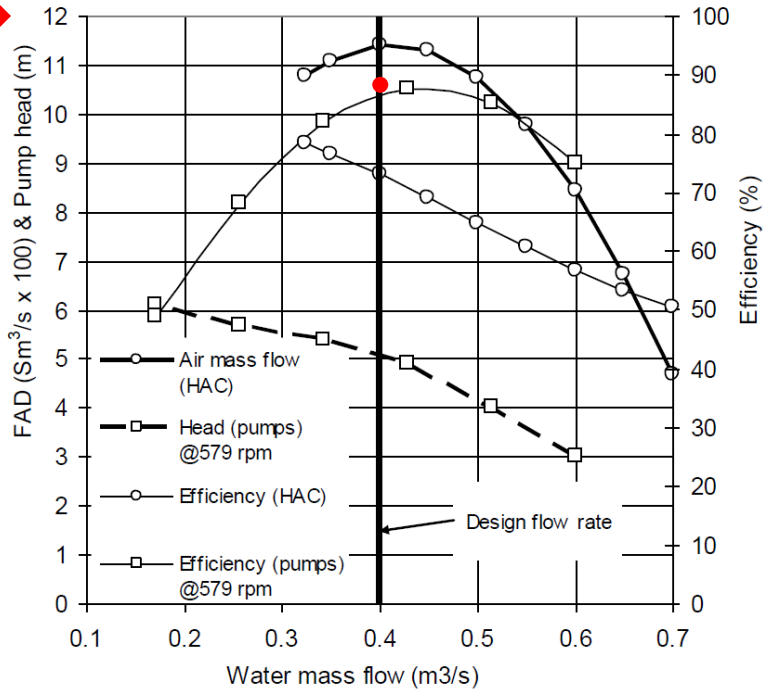
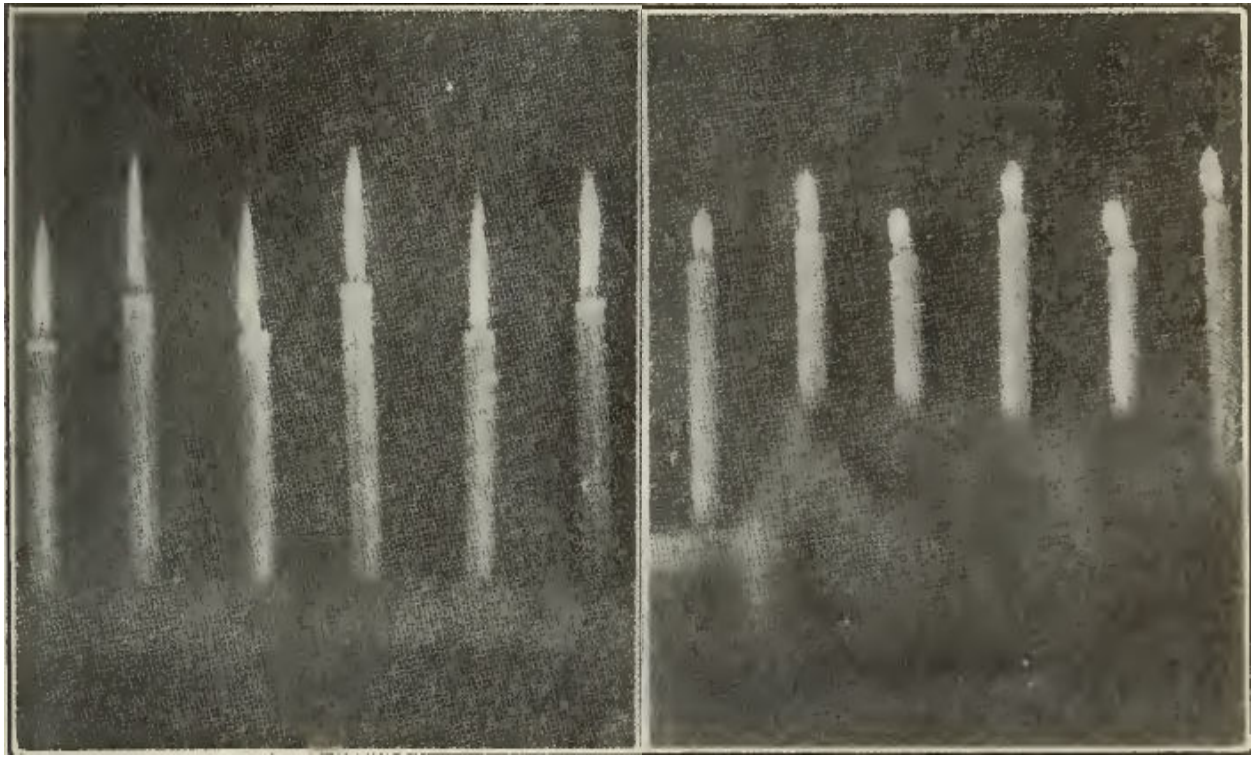


The HAC has an Achilles Heel: some of the gas dissolves in the water, and the problem gets worse when the pressure gets higher

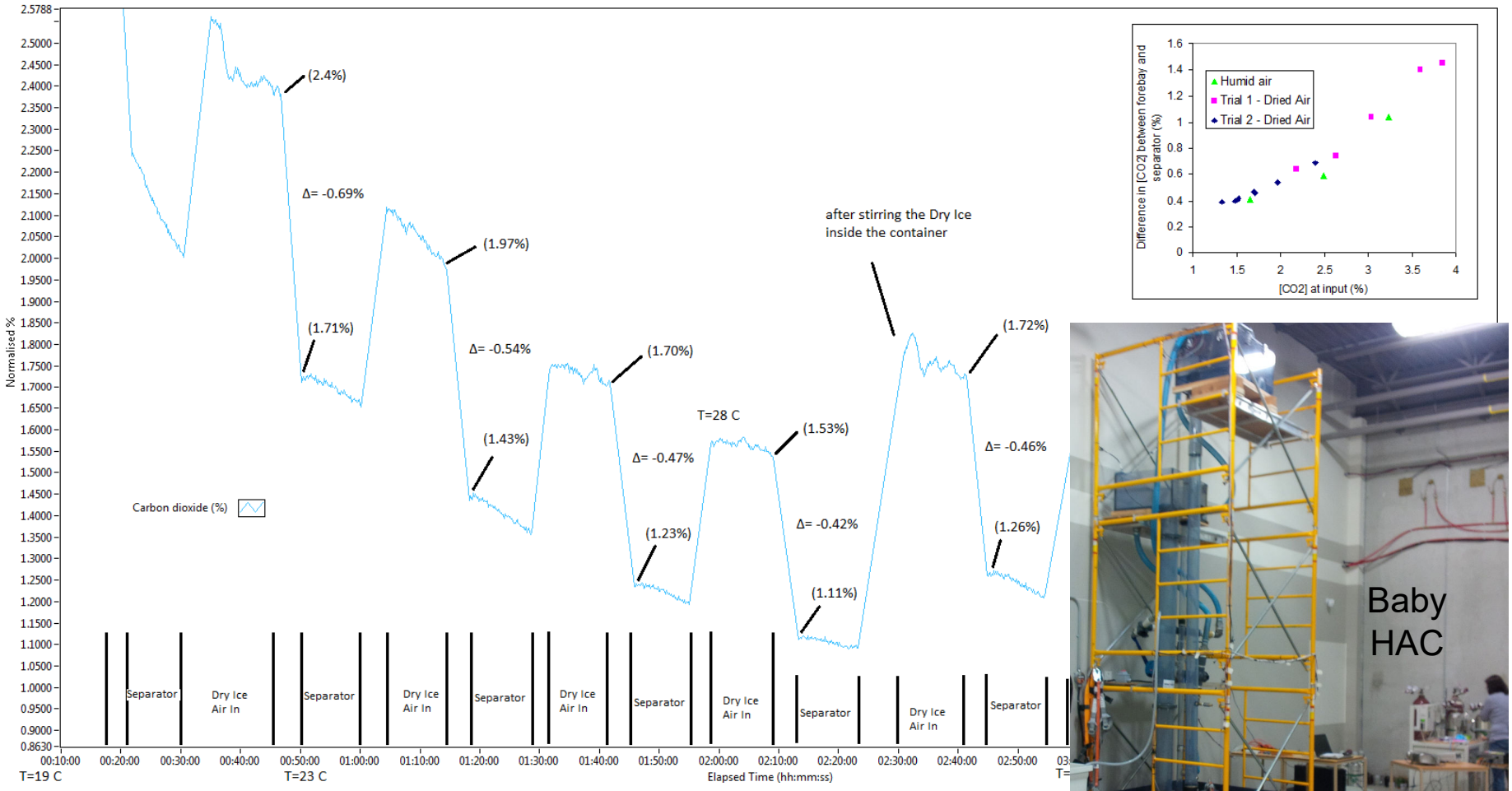


Normal air

Compressor air

McNair, F. W. and Koenig, G. A. (1911) 'Candle tests of air from a hydraulic air compressor', *Compressed Air Magazine*, pp. 5963–5965.

Also, we can turn the gas solubility problem around, and use it to our advantage to capture CO_2 from fossil fuel combustion gases



Investigators: Valeria Pavese and Caterina Noula

The HAC Demonstrator project will …

- …allow models of HAC operation to be confidently applied in the design of industrial scale systems
- …permit the re-writing of one Chapter in thermodynamics text books
- …improve on the systems of 100 years ago, by overcoming the gas solubility ‘Achilles Heel’
- …provide opportunities to enhance the public understanding of science, engineering and innovation by being at Dynamic Earth
- …provide infrastructure to support other research areas: e.g. carbon capture systems, water treatment processes, corrosion protection
- …prove that there is a Northern Ontario based HAC business ecosystem, poised to deliver energy efficient, low carbon compressed air to industry