On-boarding an IPM freezer

Eric Breitung – Department of Scientific Research – Research Scientist
Michael Millican – Director's Office – IPM Manager

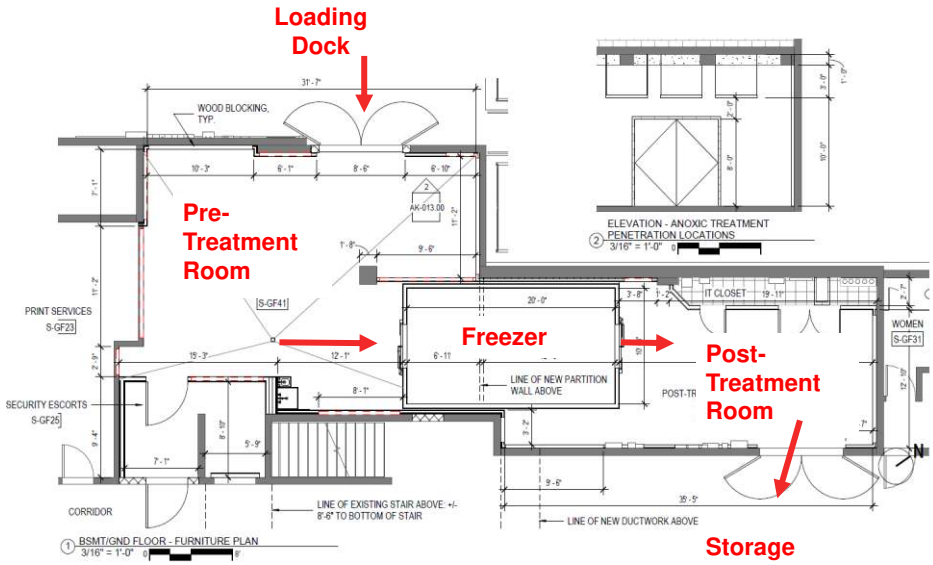
11 March 2021

MuseumPests 2021

1

1

Built Spring 2020



2

2

Key specifications:

- Took best practices from several other institutions with freezers: PMA, AMNH, SI, Yale, TM, etc.
- Built to operate at -40°C, expecting it would operate closer to -35°C

Calculated load for -35° C is 5976 BTU's/hour calculated from 24° C ambient temperature, 21.1° C floor temperature (insulated floor), 11 minutes open door time per 24 hours for each of (2) 48" x 78" walk-in doors opening into 24° C ambient (normal use), no air vent, no people working in the room, no additional electrical load, and 240 pounds of carpet and fabric entering at 21.1° C to be cooled to -35° C in 6 hours. All calculations are based on data supplied by ASHRAE publications.

↳ Calculated time to -35°C from room temp = 6 hours with 240 pound load of fabric!

- 20' long x 11' wide x 10' tall
- Floor countersunk so no ramp required for entry/exit
- LED lighting (low profile to allow tall carts)
- 4' x 7' doors
- 5" thick walls
- Connected to BMS, and independent temperature sensors with alarms

3

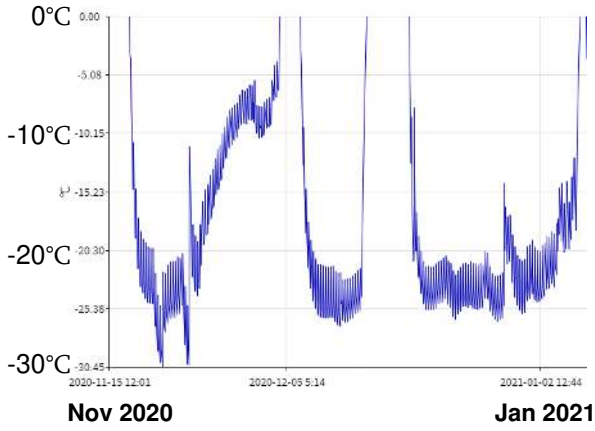
3

Startup issues and timeline

- February 2020: MuseumPests meeting – freezer built but not commissioned
- February 2020: Freezer and space **commissioned** (established -41C capability)
- March 2020: Covid shutdown
- November 2020: Turned on freezer post Museum shutdown (unable to reach -25C)
  - Added wireless T/RH sensors. Testing showed that freezer compressor and other components needed recalibration. Remote monitoring revealed fluctuations in temperatures and RH, and inability of the Freezer to maintain kill temperatures over 7 days.
- December 2020: Recalibrated freezer (able to reach -28C but not colder)
  - Began testing uniformity and surrogate materials: textile, wood, costumes.
- January 2021: Confirm stability of temp and RH over more than 7 days.
- February 2021: Began treatments of Art objects: 29 Objects completed to date.
- March 2021: Continued recalibration of Freezer, -40C goal.
  - Treatments continue

4

Erratic and not reaching -35C



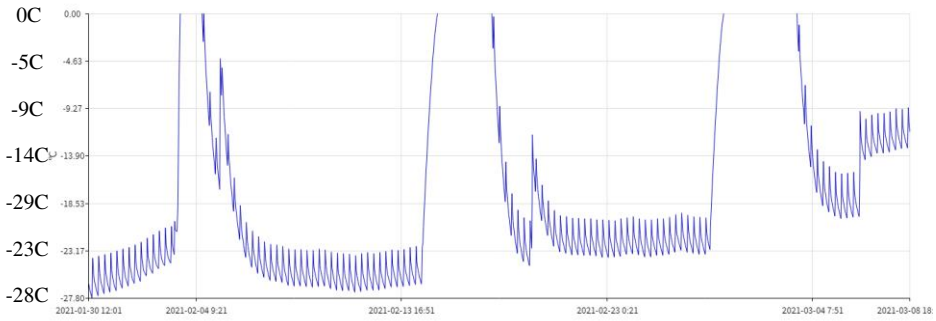
Nov 2020 **Jan 2021**

Open air sensor showing inconsistent low temps day to day and week to week

5

5

Improved consistency, but >-35C



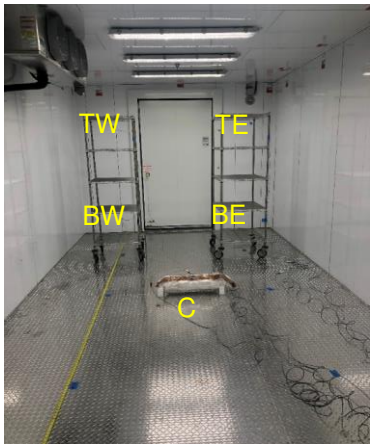
Jan 30, 2021 **Mar 08, 2021**

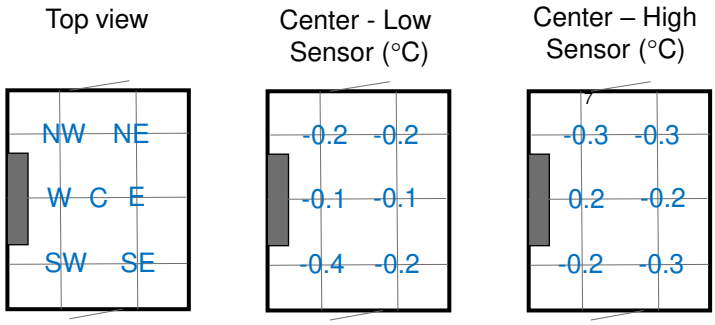
Open air sensor showing more consistent temps day to day,
but slowly increasing week to week

6

6

Testing: Uniformity





No obvious warm spots
Temps are +/-0.3°C throughout

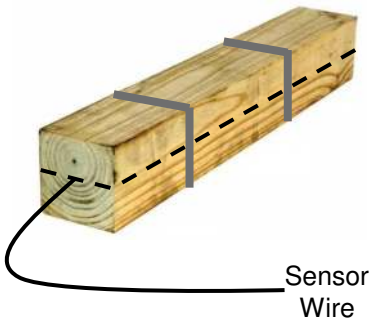
7

Surrogates for Art:

, Surrogates for art, Time to '-35C'

Textile/carpet:

Wood:

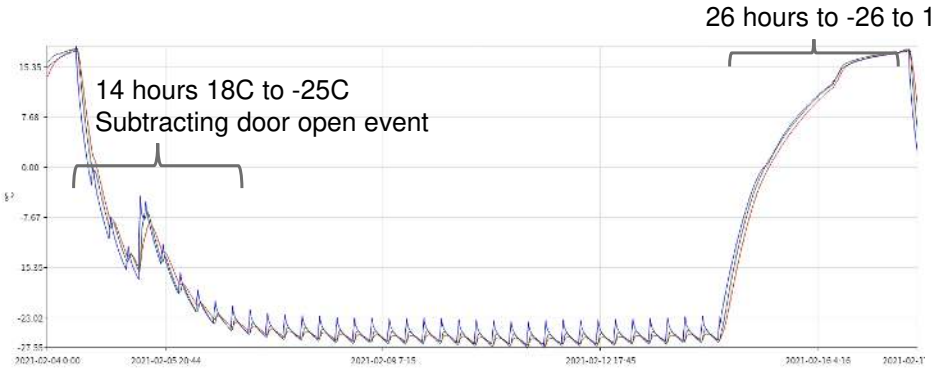


Temperature sensor embedded into a rolled textile and block of wood.
Textile wrapped with tissue & sealed in plastic bag. Wood is as shown.

8

8

Surrogates, times to low and high temps

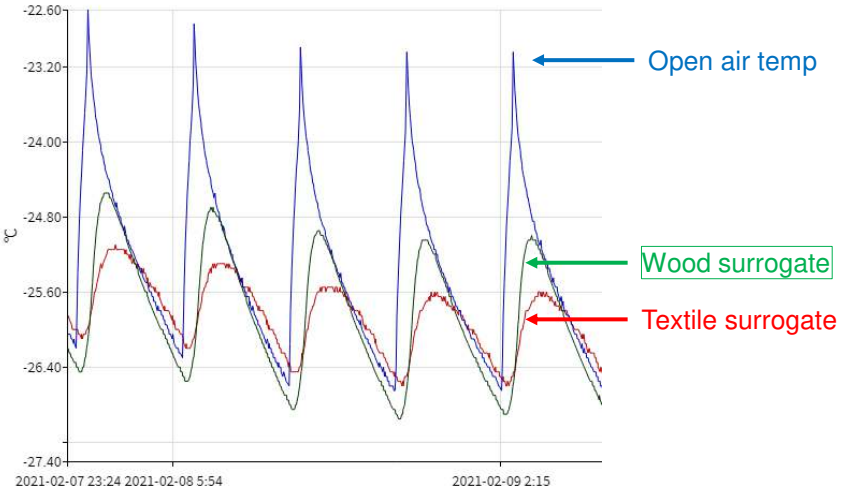


Surrogates track the open freezer temperature
Much longer than 6 hours to not even -35°C
About 24 hours to warm to near room temperature

9

9

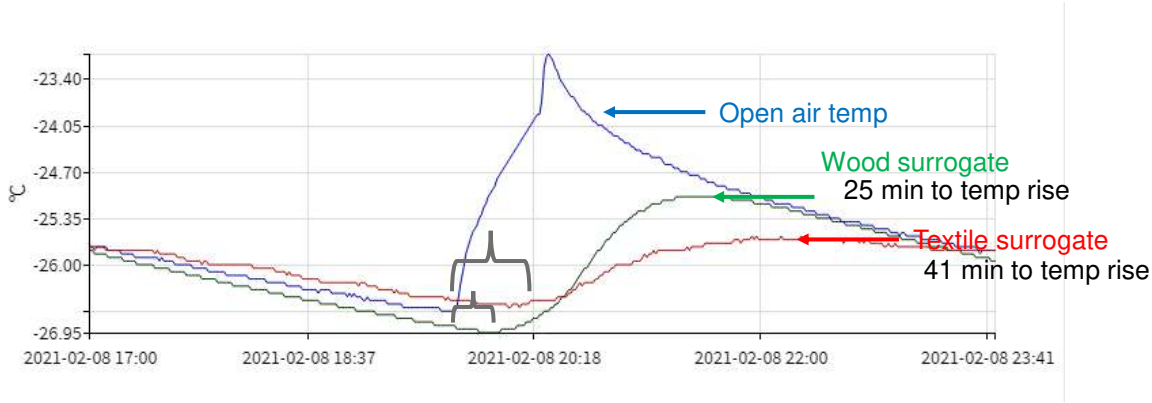
Surrogates vs Open Air Temps



10

10

Surrogates:



Textile is less affected than wood by external temperature change during coil reheat due to non-insulated wire path for sensor in wood

11

11

Present state: Policies/Procedures/Testing

Policies:

- Establishing procedures for movement of insect prone art into and around building
  - Integrating into IPM plan
- Establishing a treatment decision tree
  - Quarantine or treat with anoxic or use low temperature treatment

Testing

- What will we freeze?
  - Test mixed media, mounts with metal staples, rods, threads
  - Run tests to show where real concerns are

12

12

Present state:

Textile hoist

Anoxic treatments and freezer prep

Low temp treatments

trying system and space before setting policies

13

13