



Inputs and Outputs – The Field Perspective

Tab 4-2

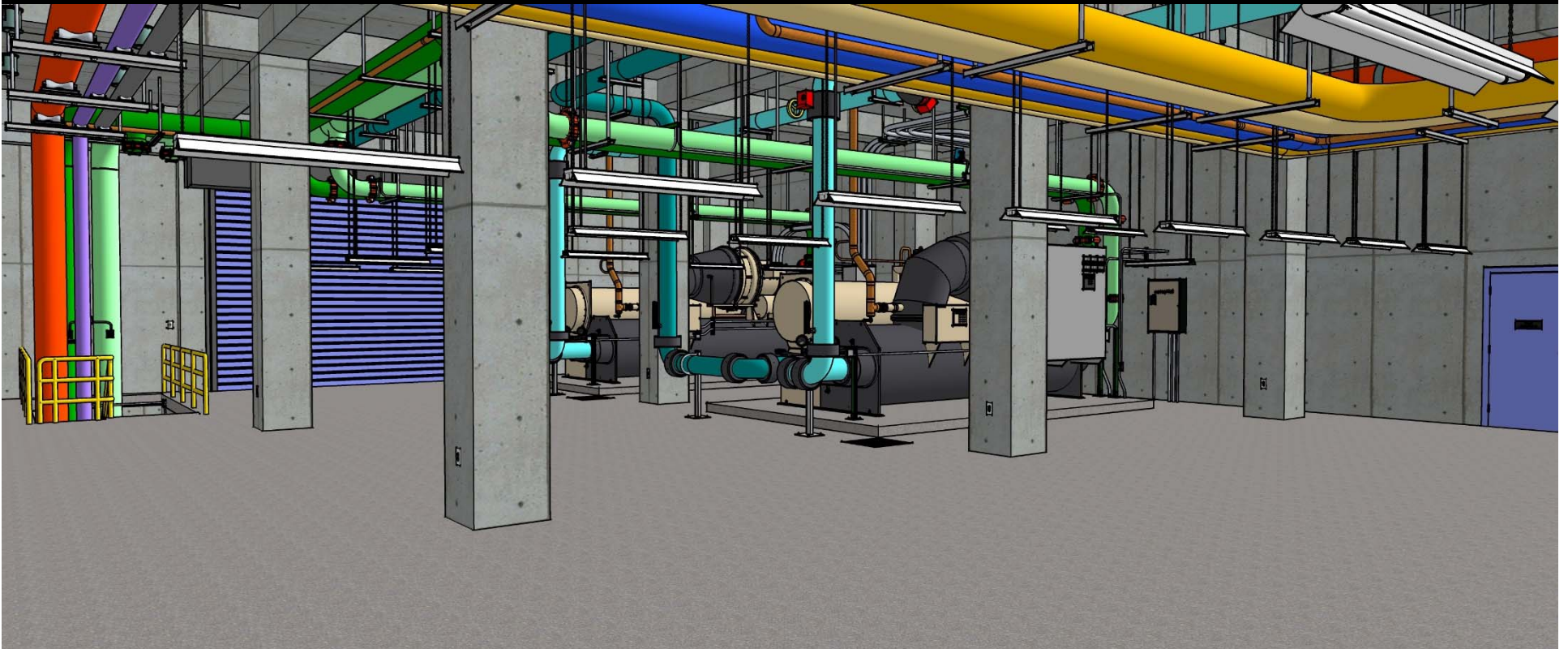
Where We Come From

Presented By:
David Sellers, Senior Engineer
Facility Dynamics Engineering

For Tomorrow

You may want a copy of SketchUp installed if you want to follow along in the models we will work with

<http://www.av8rdas.com/>




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Buildings are Talking to Us

We Just Need to Learn How to Listen

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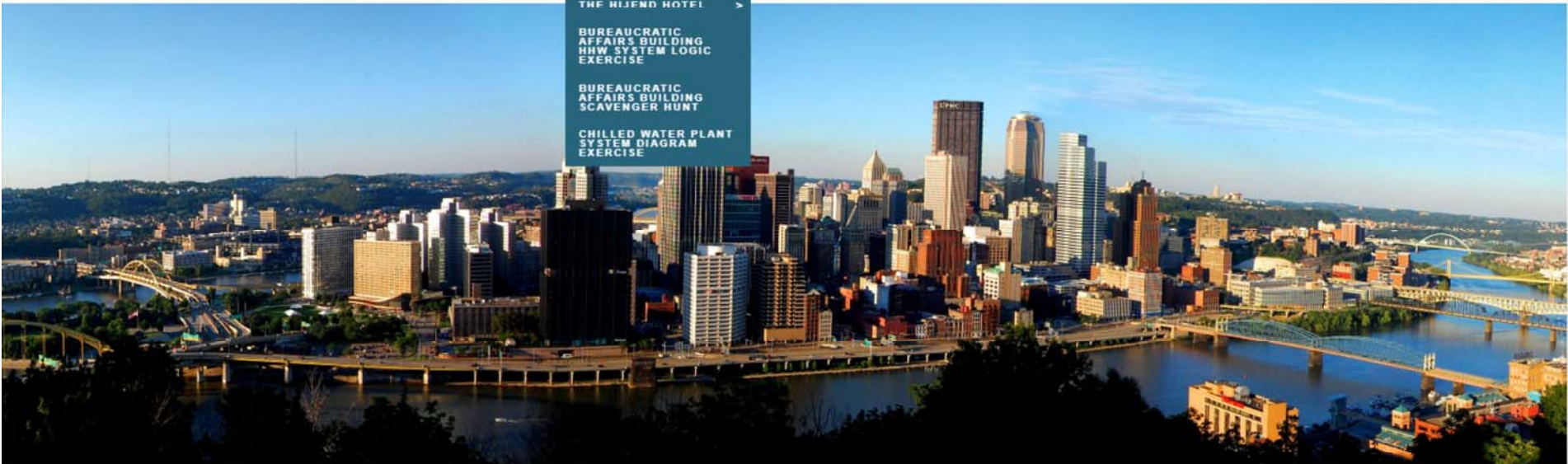
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SKETCHUP RESOURCES

- THE HILFEND HOTEL >
- BUREAUCRATIC AFFAIRS BUILDING HW SYSTEM LOGIC EXERCISE
- BUREAUCRATIC AFFAIRS BUILDING SCAVENGER HUNT
- CHILLED WATER PLANT SYSTEM DIAGRAM EXERCISE



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www.av8rdas.com/sketchup-resources.html

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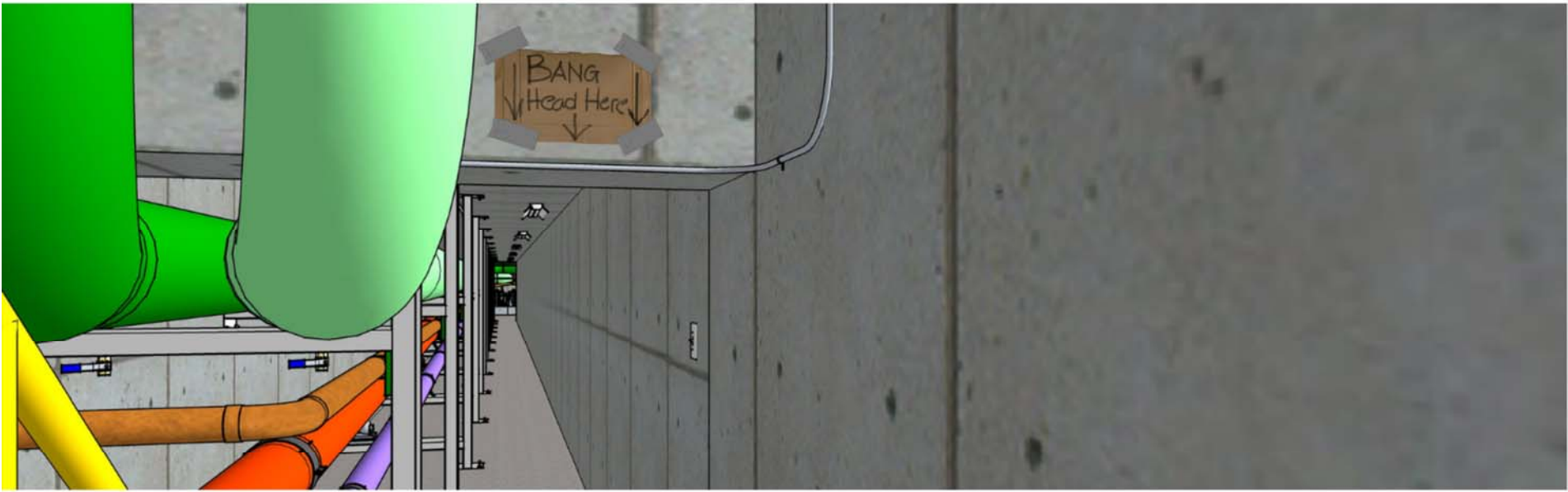
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SketchUp Resources

To use the models, you need to have SketchUp installed on your computer. You can create an online account that gives you web based access to the current free version of SketchUp called SketchUp Free. That version is very full featured and you can do a

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For Tomorrow

And, to the best of my knowledge, you could create objects and content similar to any of my models using the current free version. In addition since the current free version runs in a web browser, you are not as restricted by the operating system (Mac vs. PC, 64 bit vs. 32 bit) and the graphics card that you have in t to the extent that you would be if you were running the software locally.

But, currently, the free version will not support uploading files that are the size of the models I have developed.

In talking with the folks at Trimble about this (they own SketchUp), I suspect that restriction will eventually go away with a subsequent release. Meanwhile, the buttons below will take you to some options that will allow you to work directly with the models on your computer along with some related information you will need to know to install and use SketchUp.

Be sure to to take a look at the section titled A Few Details About Installing SketchUp because it covers a number of common questions that come up.

Option 1 - Using SketchUp Viewer

Legacy SketchUp Downloads

Using Scenes and Scene Guides

Option 2 - Using a Legacy SketchUp Version

A Few Details about Using SketchUp

Resources for Learning to Use SketchUp

What We Will Cover in This Module

1. An overview of where our technology came from and its potential
2. What we are trying to measure vs. what we are actually measuring

A 1912 Vintage Sensor



A 1912 Vintage Sensor



A 1912 Vintage Sensor

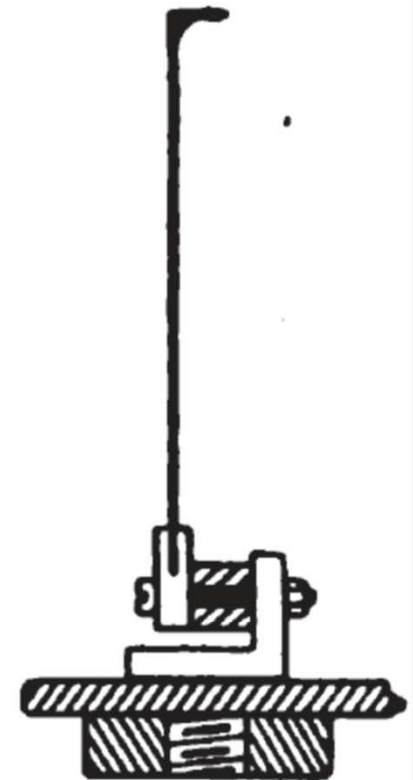
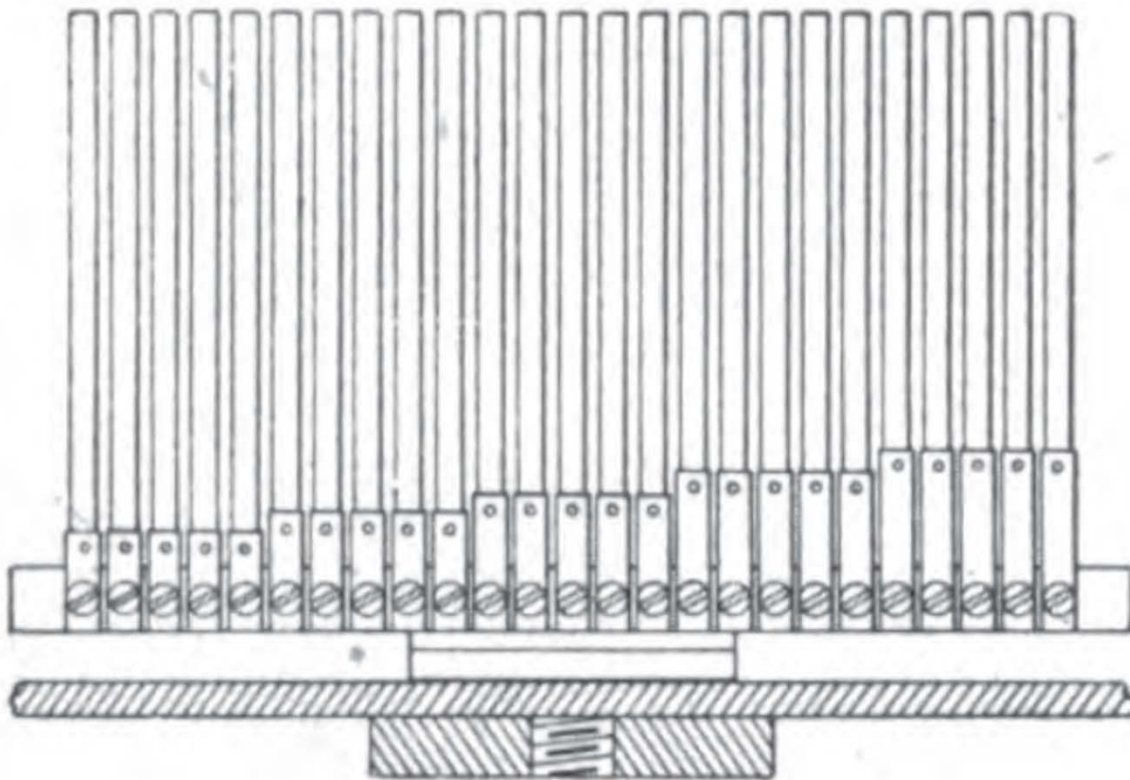
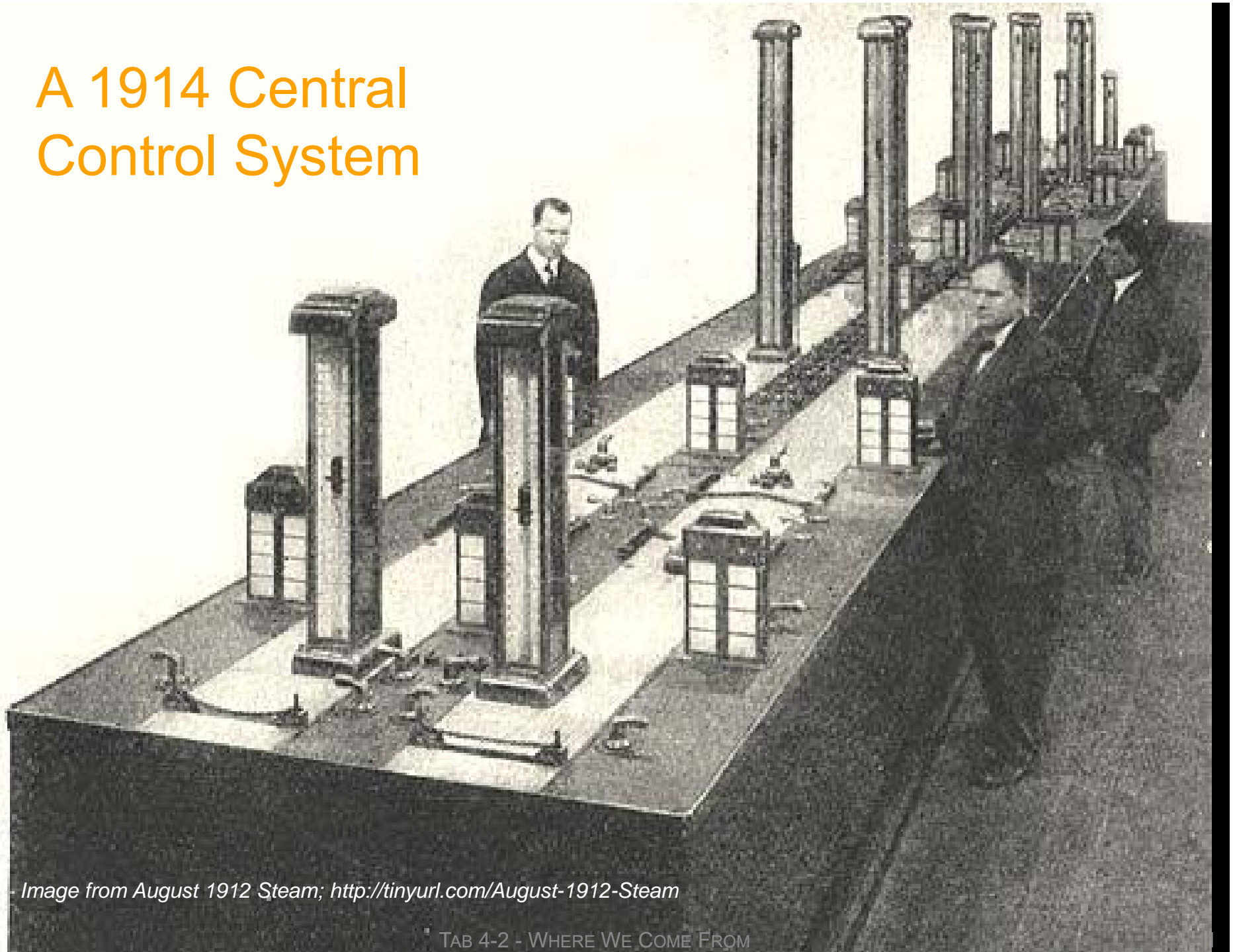


FIG. 2. INDICATING REEDS AS MOUNTED IN FRAHM VIBRATION TACHOMETERS

Image from August 1912 Steam; <http://tinyurl.com/August-1912-Steam>

A 1914 Central Control System



- Image from August 1912 Steam; <http://tinyurl.com/August-1912-Steam>

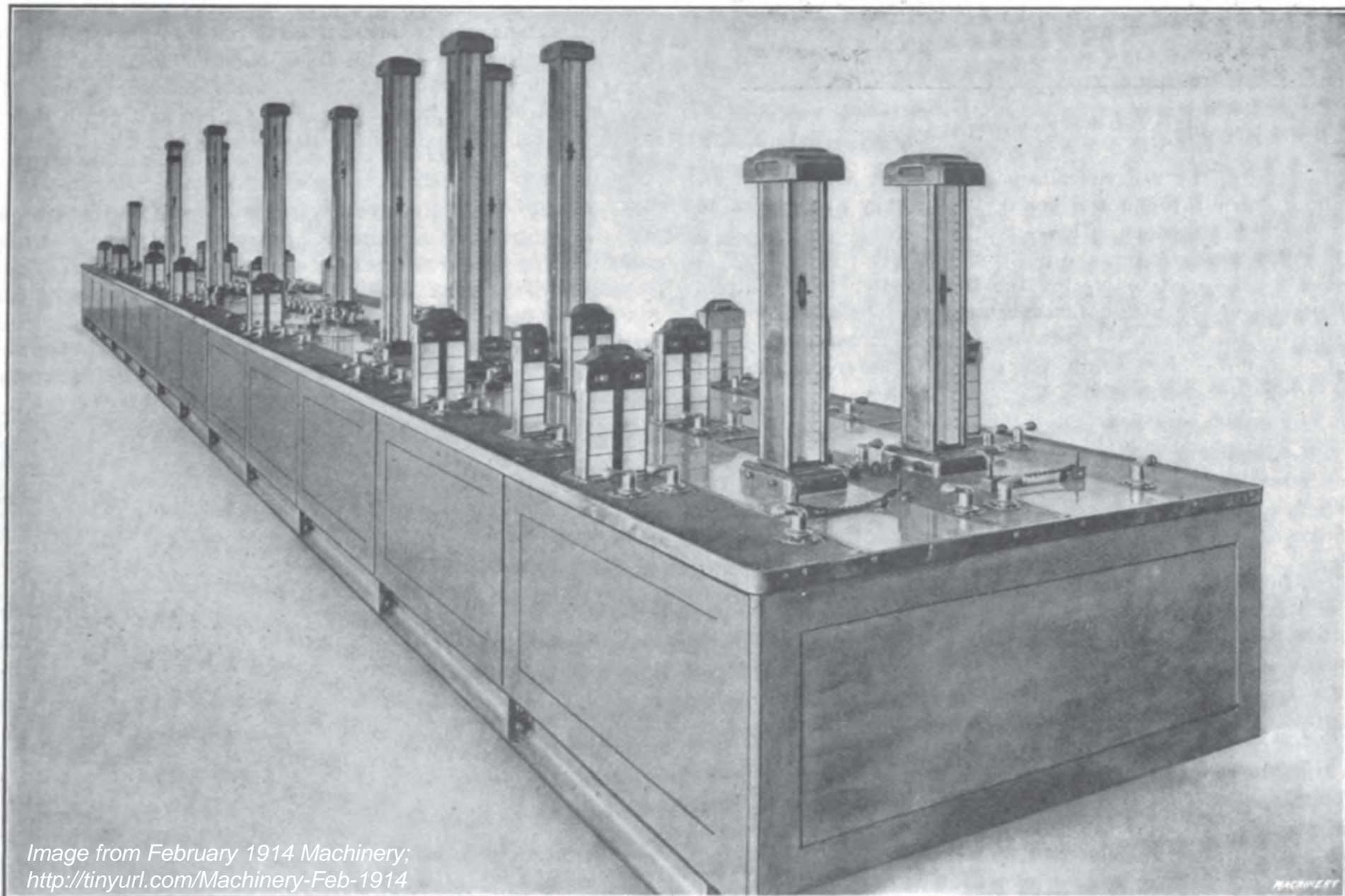


Image from February 1914 Machinery;
<http://tinyurl.com/Machinery-Feb-1914>

Fig. 1. Lock Control-board for Miraflores Locks of Panama Canal—The Water Levels in Different Chambers and Positions of Gates, Valves and Fender Chains are shown by the Indicators seen on Control-board

A 1914 Central Control System

- 2.25 miles of interlocking rod
- 1,100 miles of control wire in the form of 5 to 8 conductor cables
- 732 position indicators and transmitters
- 464 control switches
- 382 indicating lamps
- Accurate to 5/8 inch over a 50 foot span

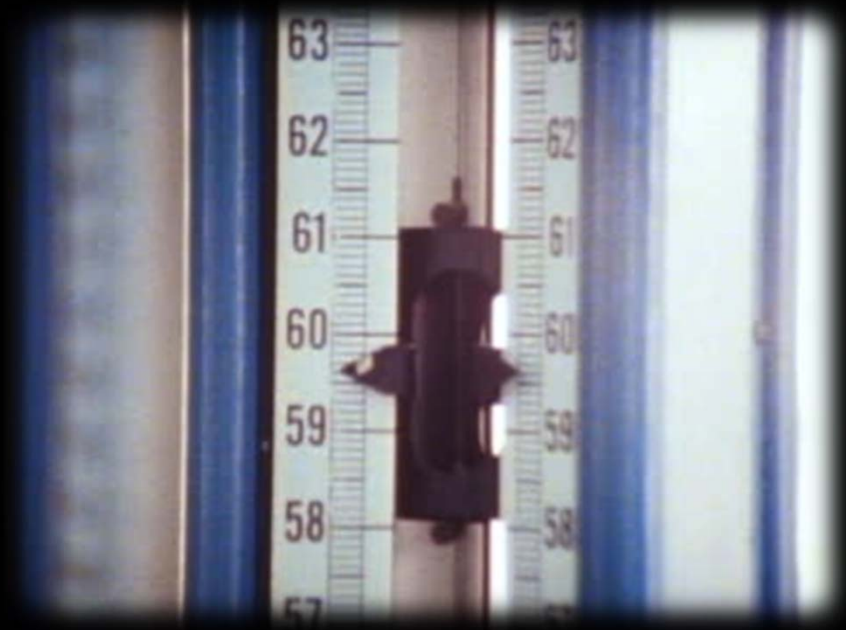


Image courtesy <http://ak5.picdn.net/shutterstock/videos/3832016/preview/stock-footage-panama-canal-lock-control-room-close-up-moving-gauge.jpg>

Still Doing Its
Thing



Image courtesy www.ttnews.com/galleries/panama2014/images05-IMG_3730_lg.jpg





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The Other End of the Spectrum



Image courtesy

http://image.dieselpowermag.com/f/news/9104552+w799+h499+cr1+ar0/0705dp_04_z%2Bnasa_diesel_shuttle_crawler%2Bshuttle.jpg

The Other End of the Spectrum

Aerojet Rocketdyne RS-25 Space Shuttle Main Engine and Controller

- About 50,000 parts
- Rated for multiple flights
- 135 flights with no failures

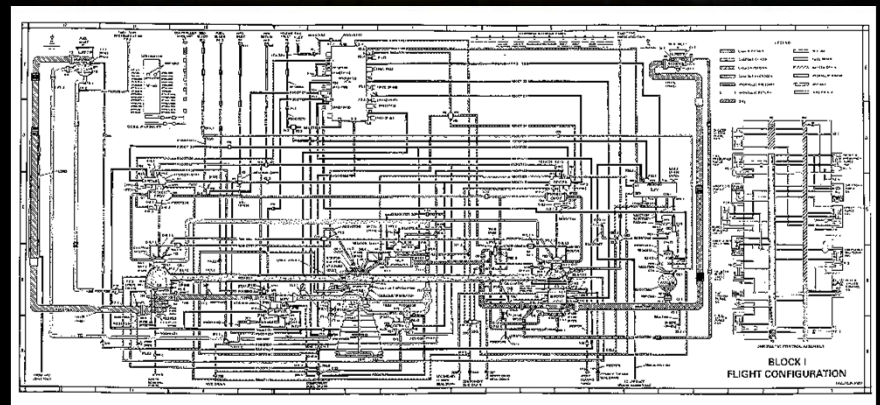
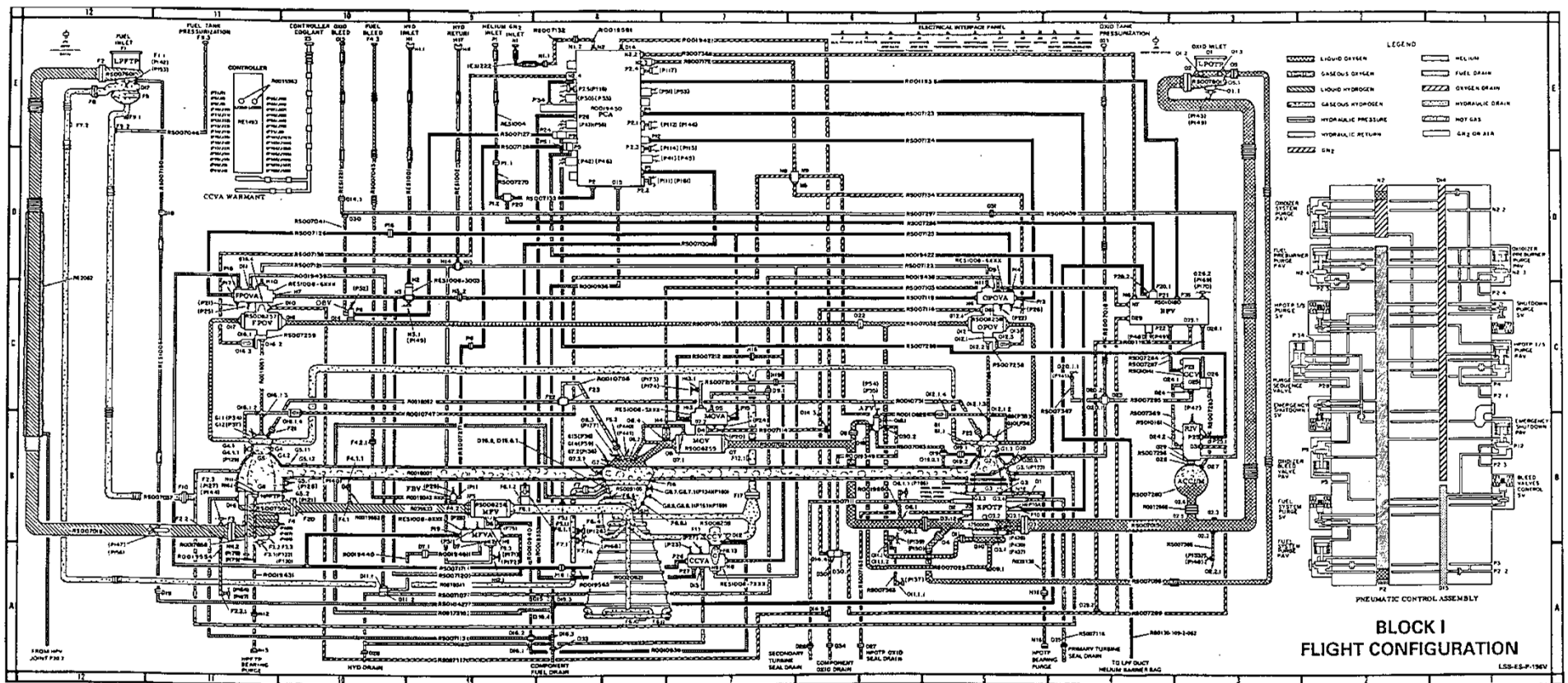


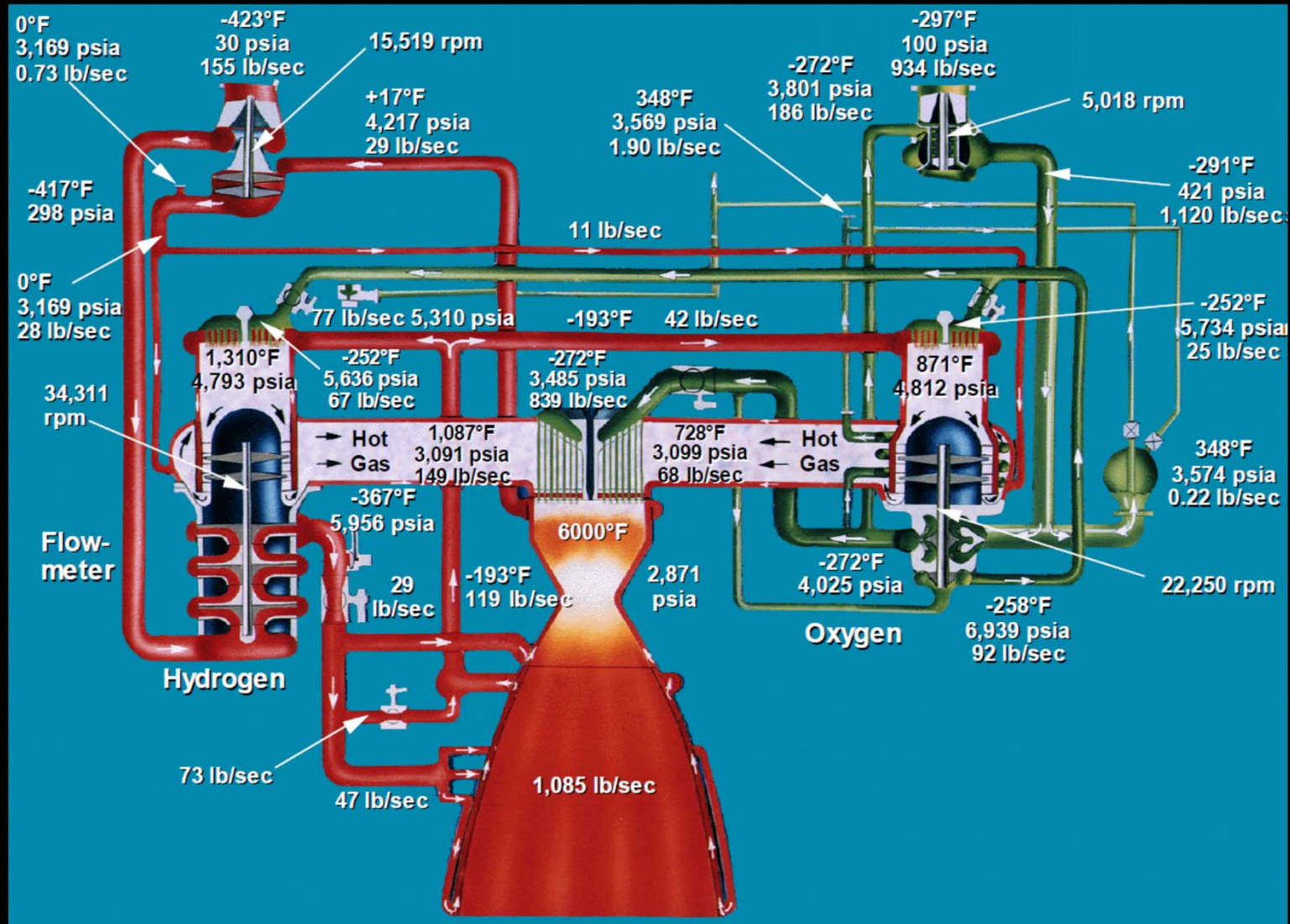
Image courtesy http://large.stanford.edu/courses/2011/ph240/nguyen1/docs/SSME_PRESENTATION.pdf

The Other End of the Spectrum



TAB 4-2 - WHERE WE COME FROM

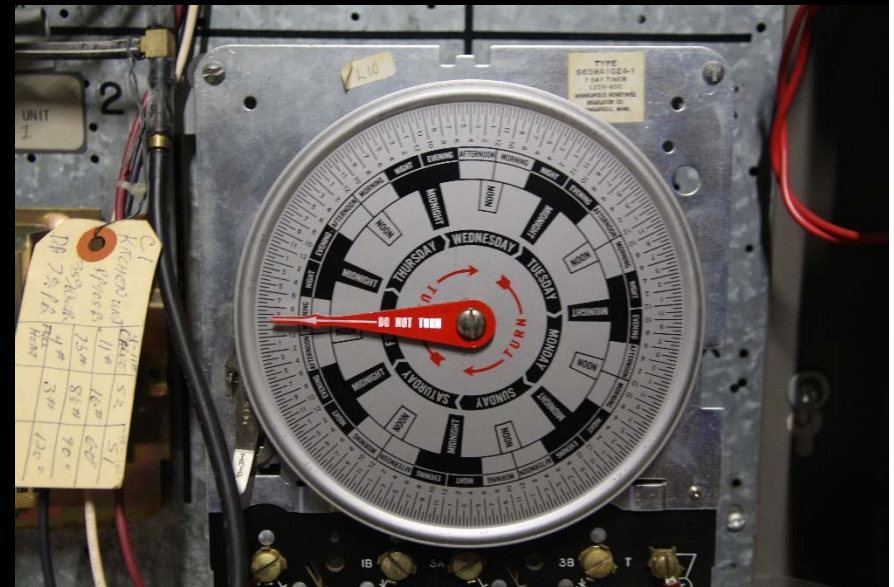
They Are Doing Rocket Science

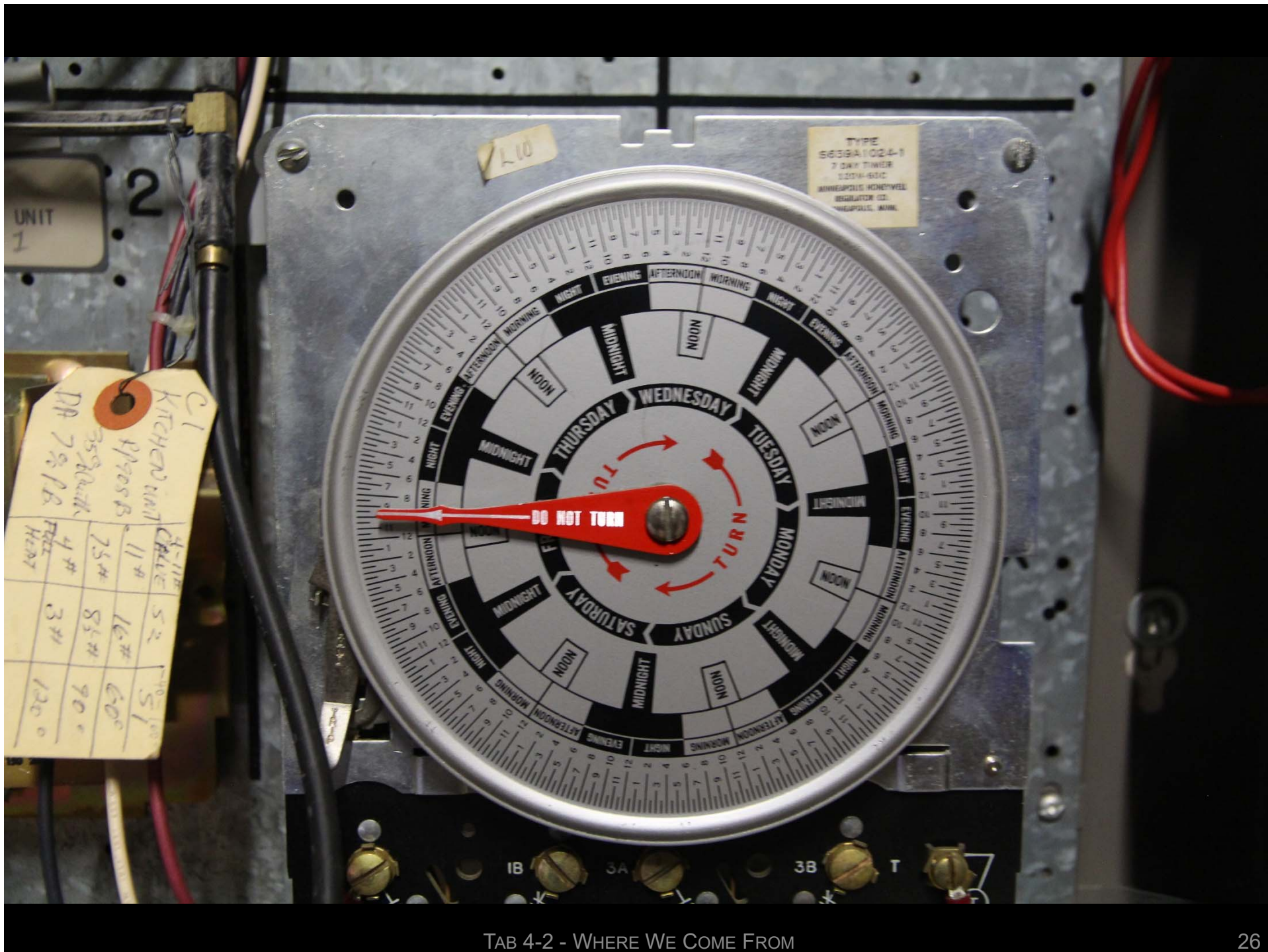


We Are Not Doing Rocket Science

Seems like:

- We should be able to maintain a 57°F discharge temperature by sequencing preheat with the economizer and the chilled water coil
- We should be able to start around 6:00 am and shut down around 7:00 pm





TAB 4-2 - WHERE WE COME FROM

Comprehending the Situation

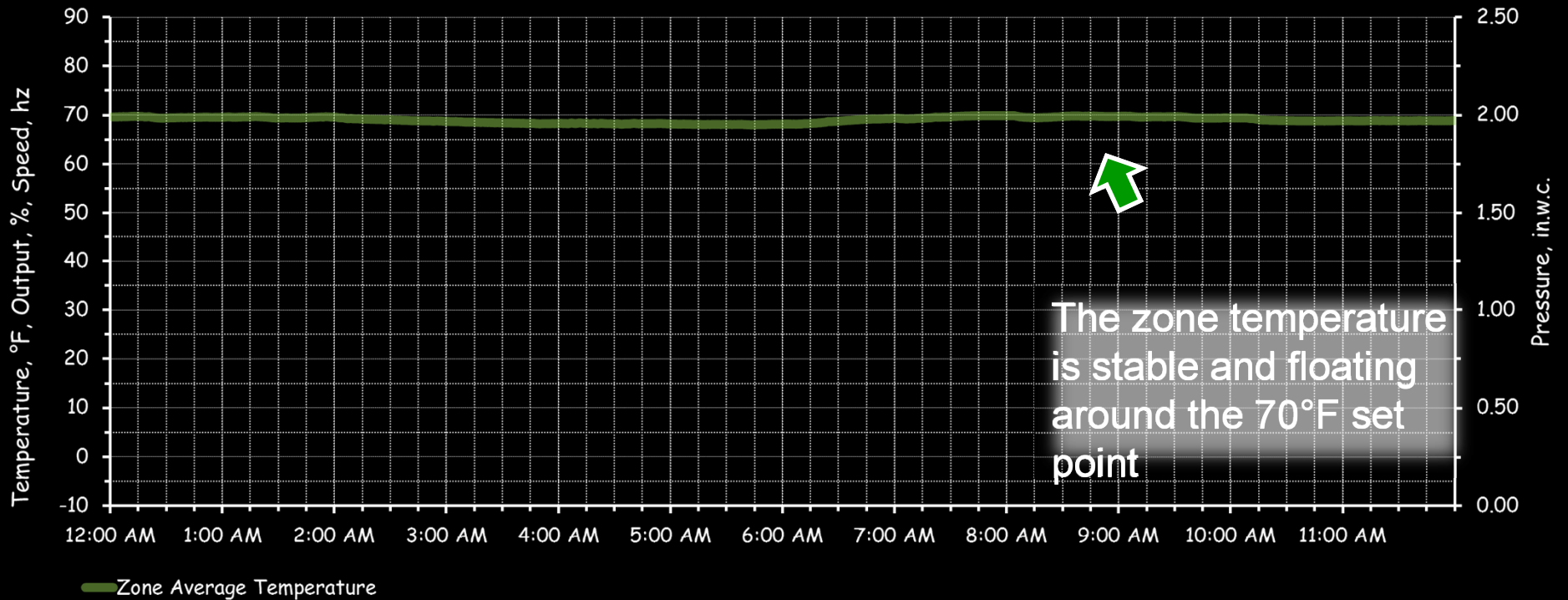


“Madame, if you are piloting an untested vehicle on its first test flight and that vehicle contains more propellant than was ever placed on a launch pad before and the vehicle was assembled by the low bidder and you aren’t a little nervous, then you don’t fully comprehend the situation”

Paraphrased; John Young to Barbara Walters when asked if he would be nervous as the test pilot on the first manned shuttle flight

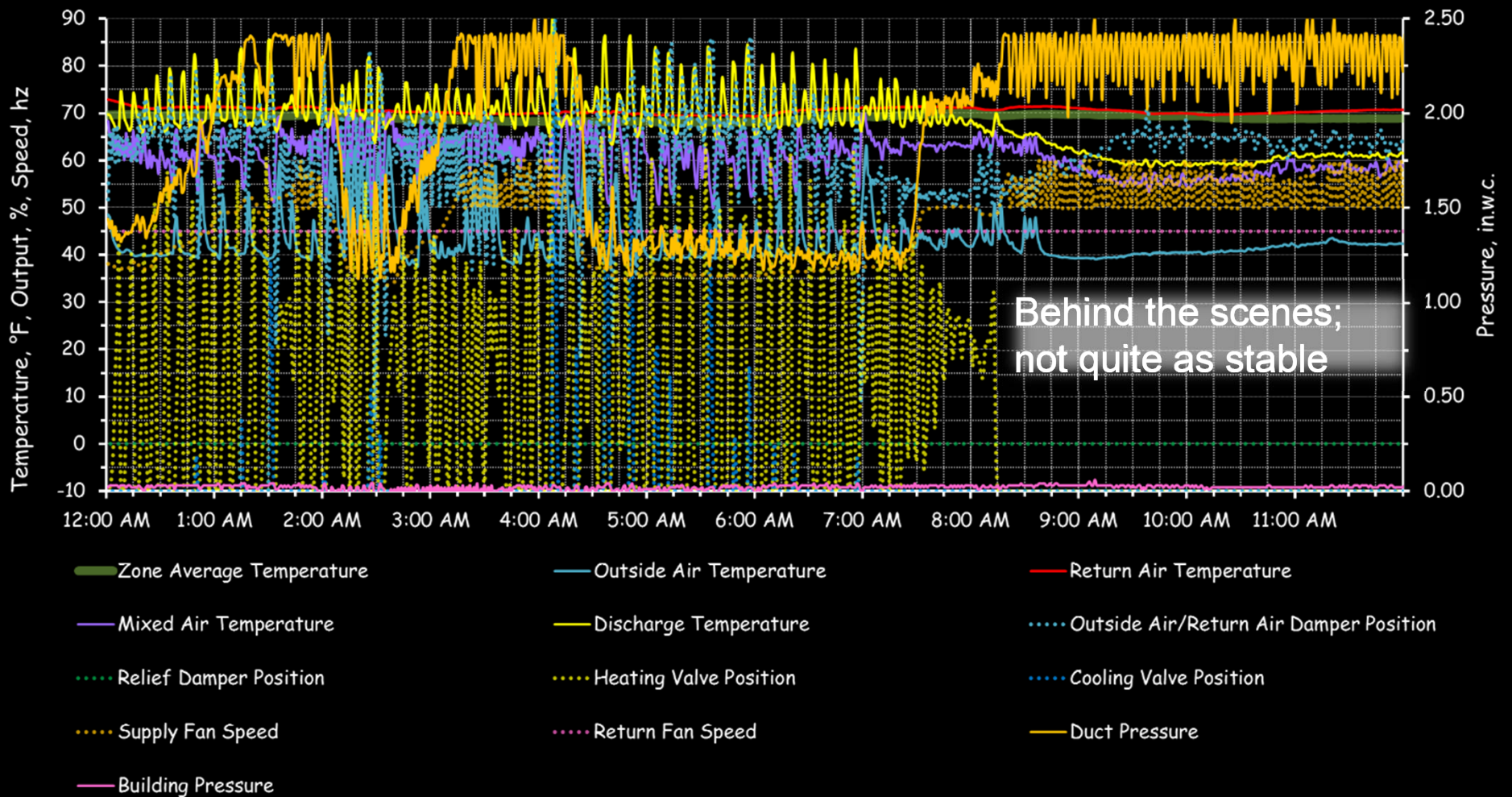
To the casual observer, are doing O.K. ...

RTU2 Control System Operation
December 7, 2001



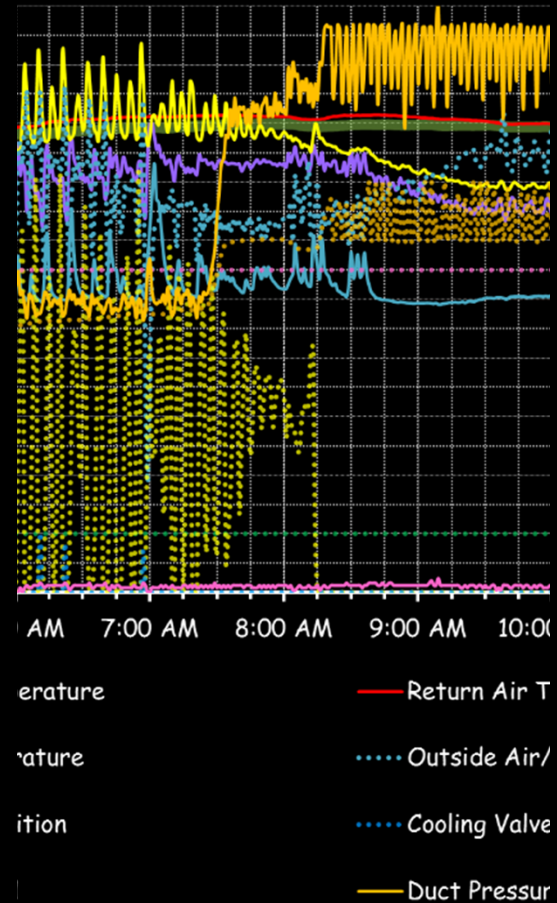
... but maybe not if you take a closer look

RTU2 Control System Operation
December 7, 2001



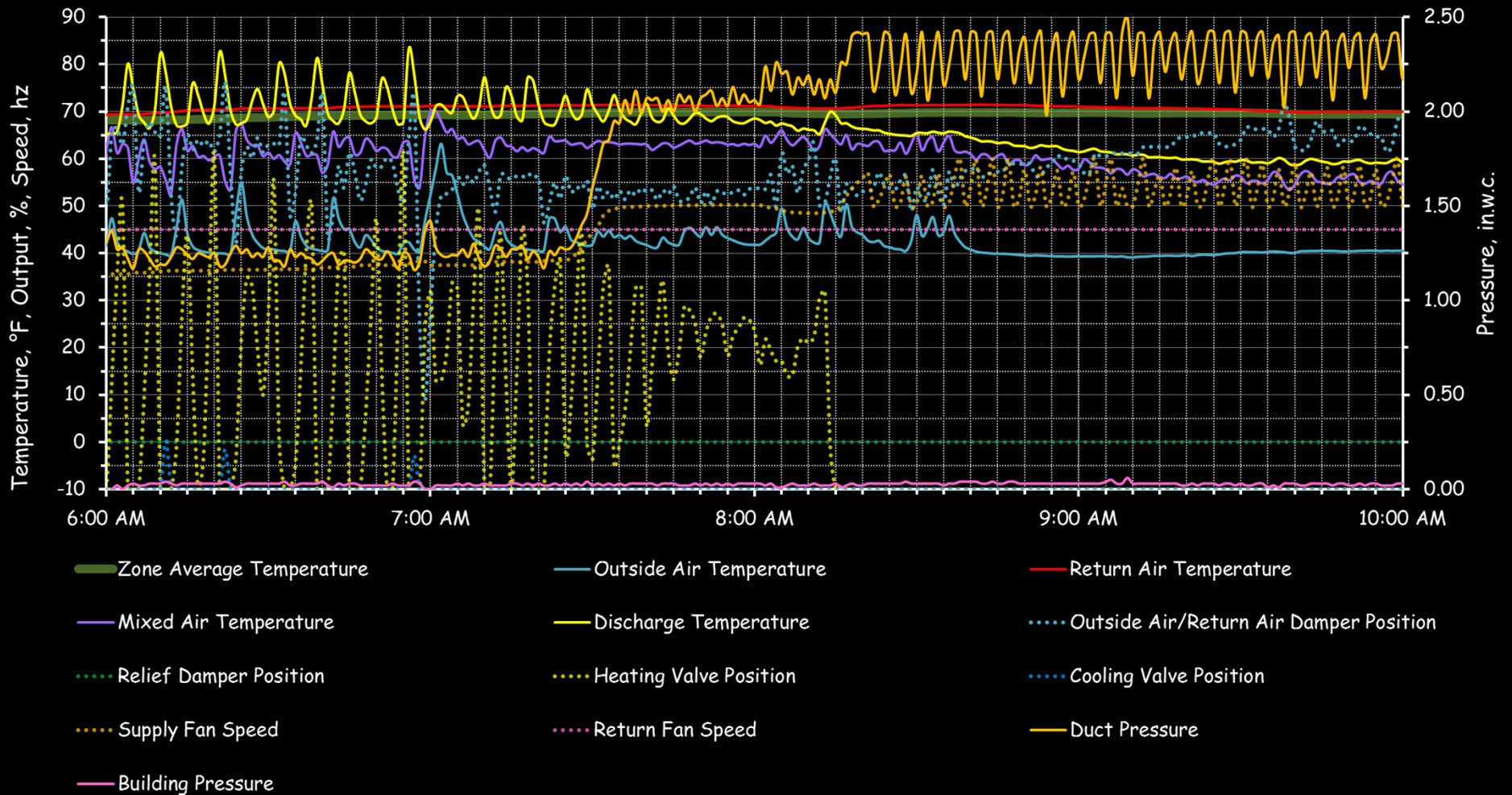
... but maybe not if you take a closer look

System Operation
Mar 7, 2001



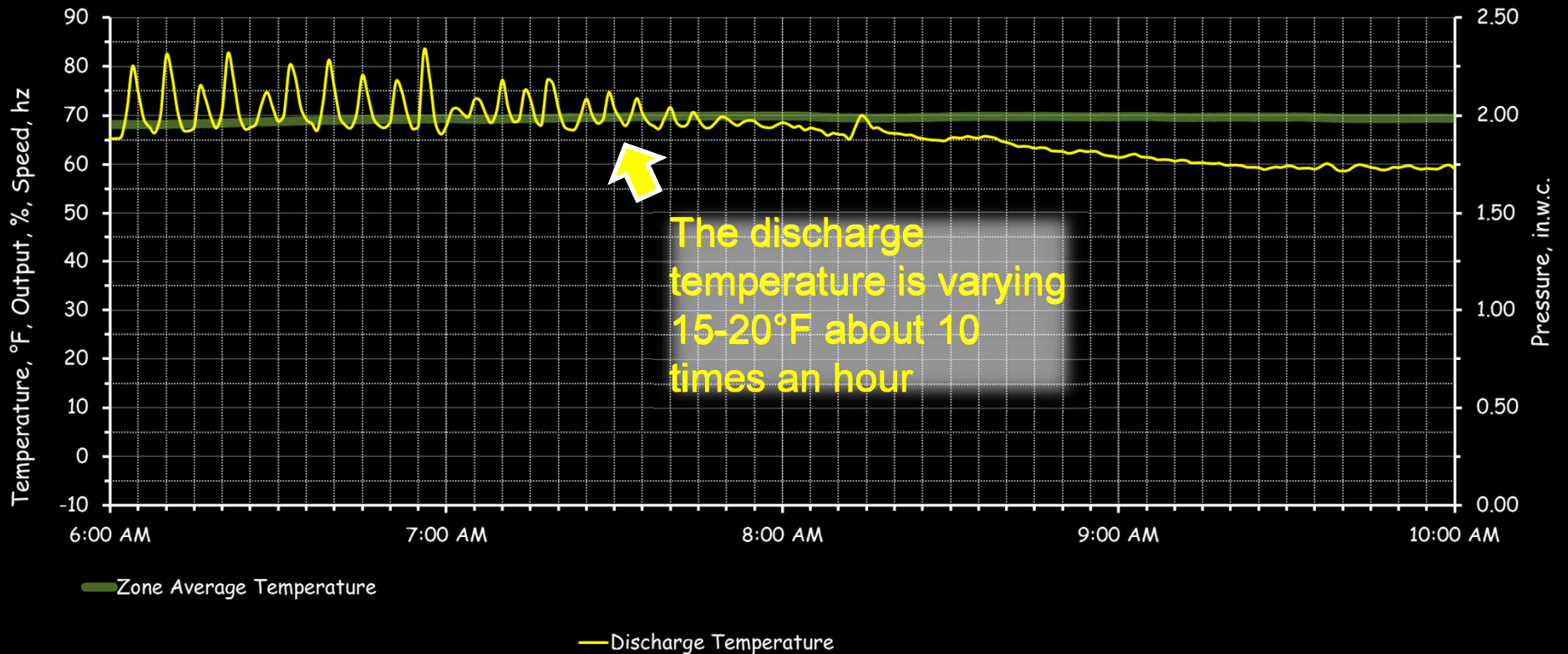
... but maybe not if you take a closer look

RTU2 Control System Operation
December 7, 2001



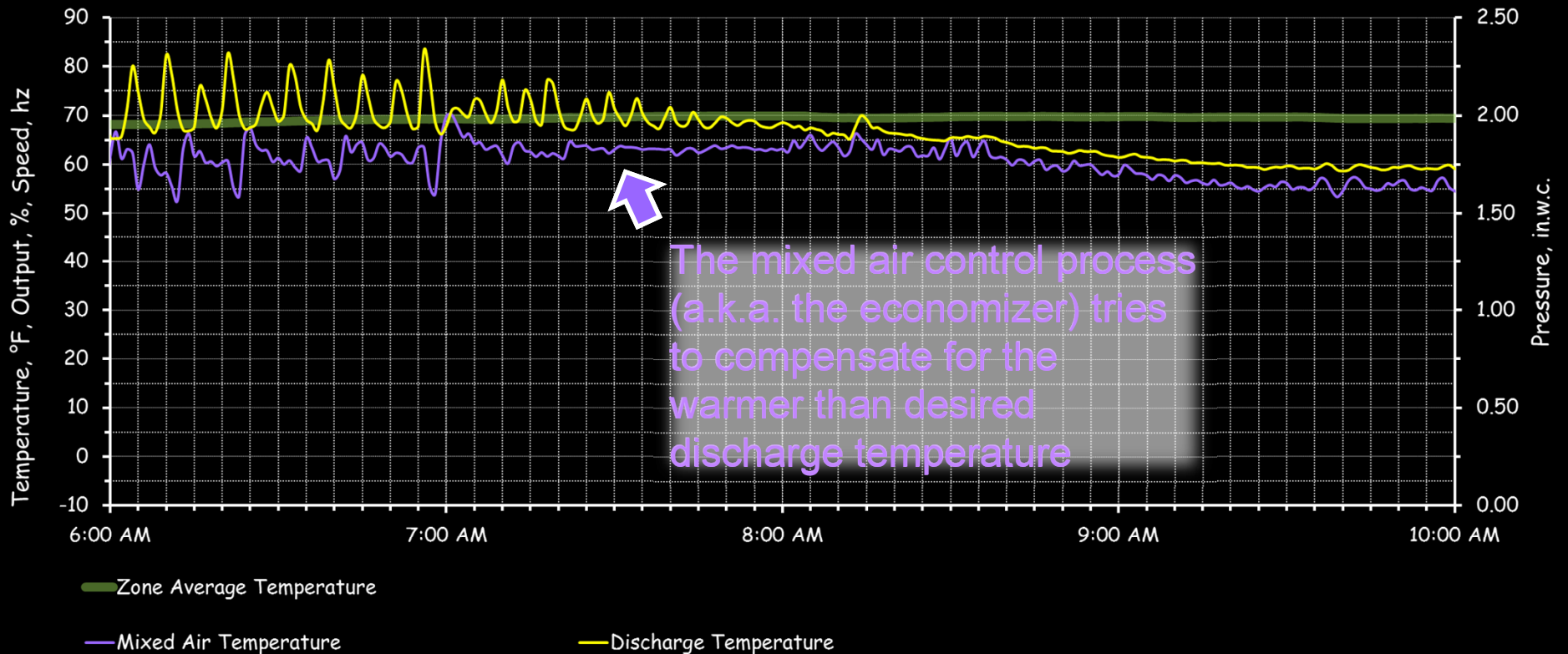
... but maybe not if you take a closer look

RTU2 Control System Operation
December 7, 2001



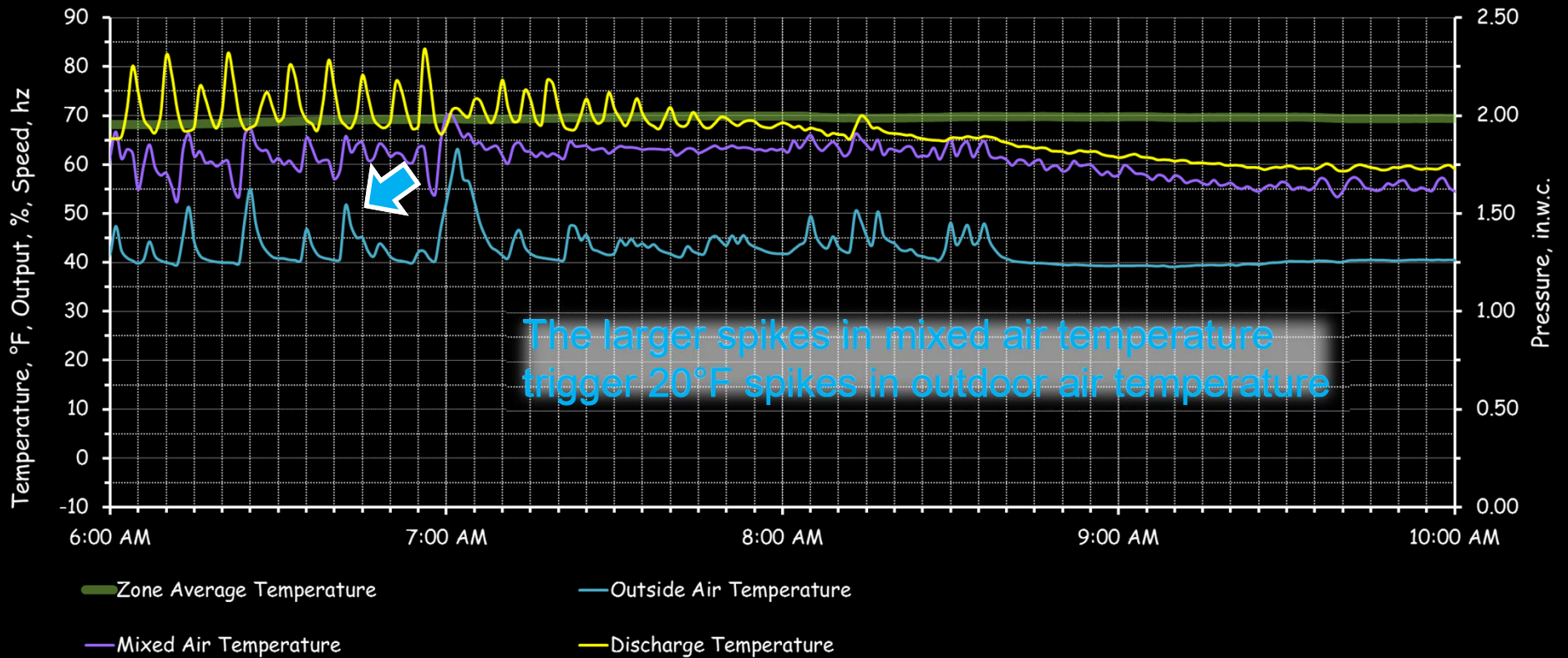
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RTU2 Control System Operation
December 7, 2001



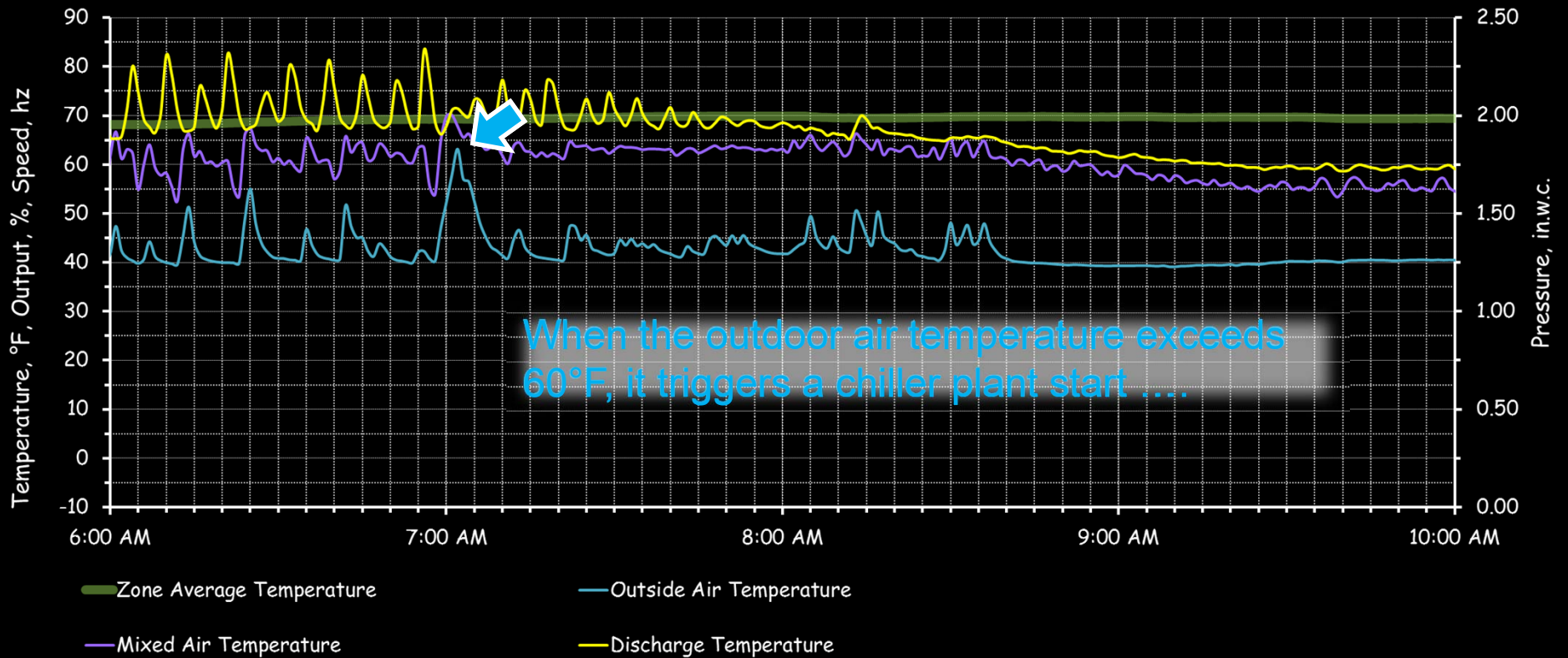
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RTU2 Control System Operation
December 7, 2001



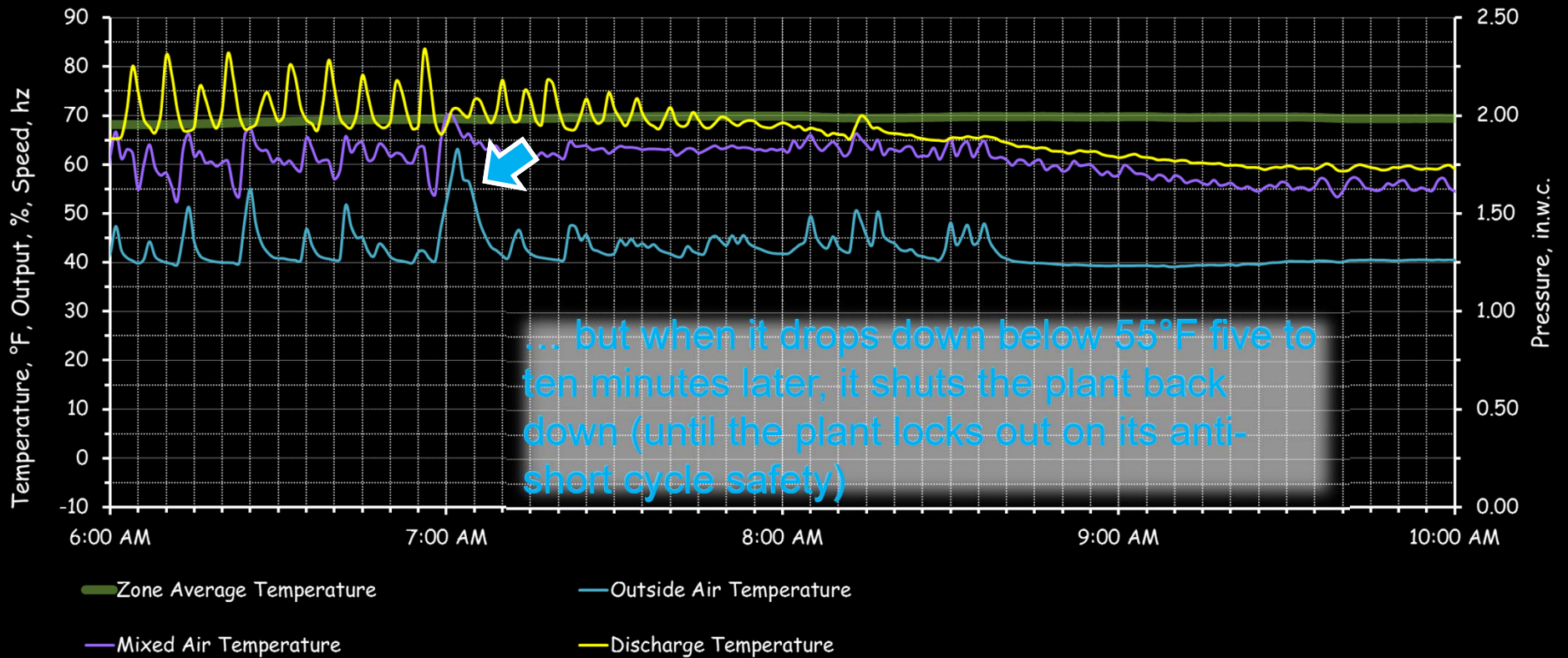
... but maybe not if you take a closer look

RTU2 Control System Operation
December 7, 2001



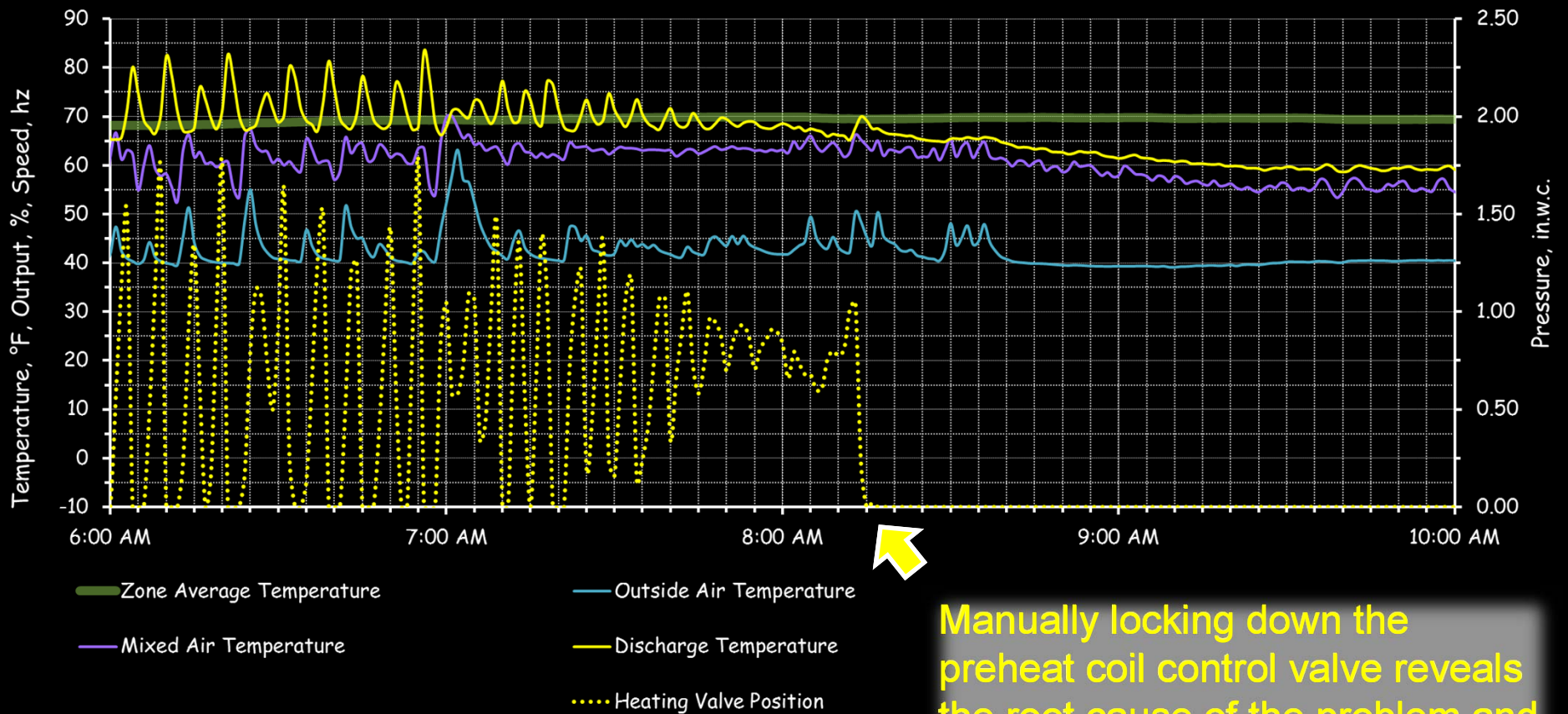
... but maybe not if you take a closer look

RTU2 Control System Operation
December 7, 2001



... but maybe not if you take a closer look

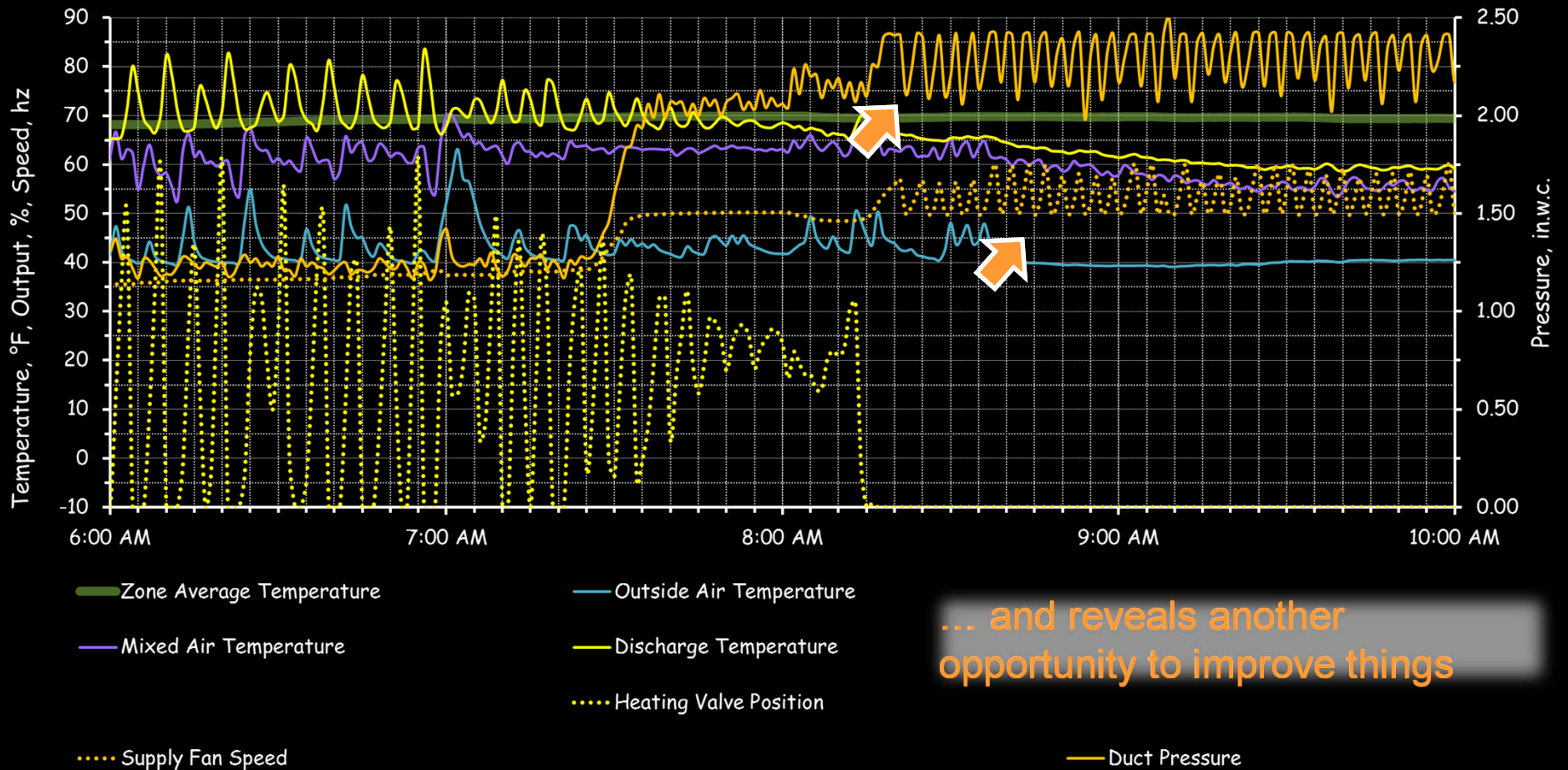
RTU2 Control System Operation
December 7, 2001



Manually locking down the preheat coil control valve reveals the root cause of the problem and how to solve it ...

... but maybe not if you take a closer look

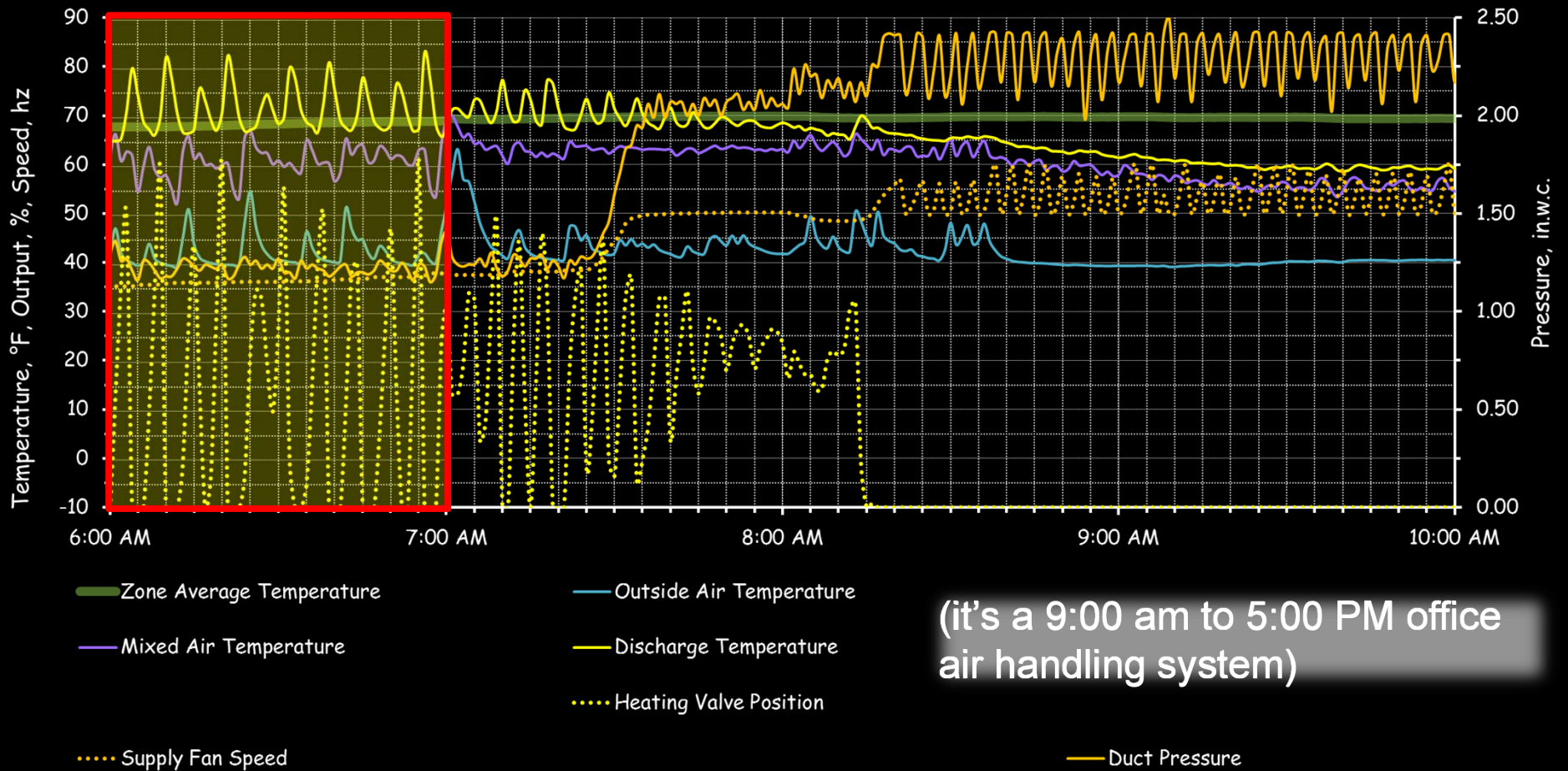
RTU2 Control System Operation
December 7, 2001



... and reveals another opportunity to improve things

And let's not miss the obvious

RTU2 Control System Operation
December 7, 2001



(it's a 9:00 am to 5:00 PM office
air handling system)

Bottom Lines

1. Control systems play a critical role in our facilities
2. Control systems evolved as the industrial revolution evolved
 - a. Measurements are frequently based on fundamental principles
 - b. Applying higher technology frequently brings more complex control requirements with it
 - c. Success with higher technology demands attention to all of the details
3. Things are not always what they seem