

# GAGE

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# Implementation of Lean Manufacturing Tools in Assembly of Scientific Instrumentation

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## INTRODUCTION

Droplet Measurement Technologies (DMT) is a company that manufactures instruments used for measuring water droplets, ice crystals, black carbon, single particles, and aerosols in the atmosphere.

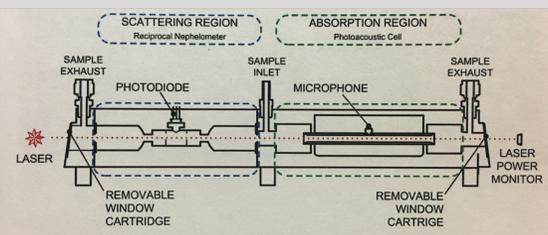
Our project was to create lean manufacturing work instructions by utilizing PowerPoint for building the PAX 870 instrument. We also created pick lists and presentation kits for enhancing efficient productivity of the PAX 870 building process.

## PAX INSTRUMENT



Figure 1. Research station (left photo); the PAX inside the research station (right photo). Photos courtesy of DMT.

The Photoacoustic Extinctionmeter (PAX) is a device that measures aerosol optical properties relevant for climate change and carbon particle sensing, including black carbon. The instrument is suitable for fixed site, mobile or airbone sampling.



The Heart of the Pax is the cell. The cell uses a modulated diode laser to simultaneously measure light scattering and absorption. The standard infrared, 870-nm wavelength option is highly specific to black carbon particles, since there is relatively little absorption from gases and non-BC aerosol species at this wavelength.

Figure 2. Drawing and description of the PAXs Cell. Courtesy of DMT.

## WORKFLOW

### STEP 1:

With observation and documentation, we assembled step-by-step work instructions per Droplet's templates. At end of the steps we created 600 PowerPoint slides. Each slide contains color coded text for tools (green), parts (blue), and notes (orange).

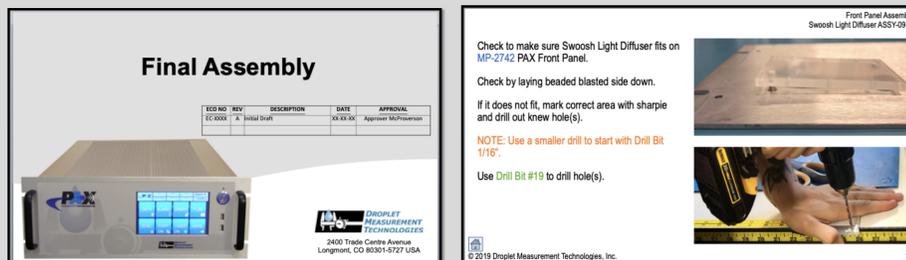


Figure 3. Laser & Final Assembly Instructions using PowerPoint.

### STEP 2:

Using Excel, we created a series of pick lists for each step of the PAX 870 build. These materials included quantities of assembly parts, connectors, cables, hardware, and tools. Color coding was applied to help sort for the Presentation Kit process.

Part No.	Description	Qty	Unit
AAA-0128	PAX 870 - Step 1 - Test Bed		
480-0000	PAX POWER DISTRIBUTION BOARD	1	PCB
480-0001	PAX CONTROL BOARD	1	PCB
480-0002	PAX SCATTERING BOARD	1	PCB
480-0003	PAX LASER POWER DETECTOR BOARD	1	PCB
480-0004	PAX MICROPHONE AMP	1	PCB
480-0005	PAX Rev. A TEMPERATURE BOARD	1	PCB
480-0006	PAX Rev. A PHOTOACoustic BOARD	1	PCB
480-0007	PAX PHOTOACoustic BOARD ASSEMBLY	1	PCB
480-0008	PAX Cable Scattering Det. Assy	1	PCB
480-0009	PAX Cable Microphone Assy	1	PCB
480-0010	PAX Cable Laser Power Assy	1	PCB
480-0011	PAX Cable Laser Power Assy	1	PCB
480-0012	Dual USB A Panel 1 to 2x20, E	1	PCB
480-0013	Microphone Amplifier	1	PCB
480-0014	Microphone Amplifier	1	PCB
480-0015	Microphone Amplifier	1	PCB
480-0016	Microphone Amplifier	1	PCB
480-0017	Microphone Amplifier	1	PCB
480-0018	Microphone Amplifier	1	PCB
480-0019	Microphone Amplifier	1	PCB
480-0020	Microphone Amplifier	1	PCB
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480-0036	Microphone Amplifier	1	PCB
480-0037	Microphone Amplifier	1	PCB
480-0038	Microphone Amplifier	1	PCB
480-0039	Microphone Amplifier	1	PCB
480-0040	Microphone Amplifier	1	PCB
480-0041	Microphone Amplifier	1	PCB
480-0042	Microphone Amplifier	1	PCB
480-0043	Microphone Amplifier	1	PCB
480-0044	Microphone Amplifier	1	PCB
480-0045	Microphone Amplifier	1	PCB
480-0046	Microphone Amplifier	1	PCB
480-0047	Microphone Amplifier	1	PCB
480-0048	Microphone Amplifier	1	PCB
480-0049	Microphone Amplifier	1	PCB
480-0050	Microphone Amplifier	1	PCB

Figure 4. PAX 870 Pick List, created using Excel.

### STEP 3:

By cutting out Presentation Kits, we designed and built tools in order to increase flow in the lean manufacturing process. With materials placed into the foam kits, it makes them fast to build and efficient.



Figure 5. PAX 870 Presentation Kits. Photo before (left) and after (right).

## LEAN MANUFACTURING

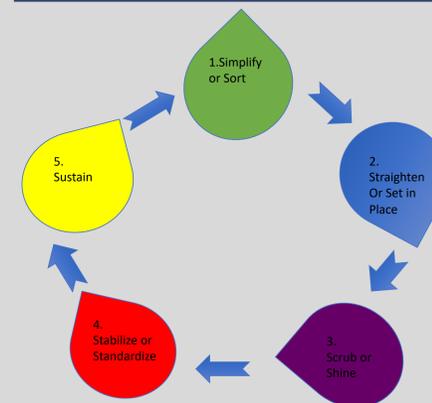


Figure 6. The 5 S's of lean manufacturing

By practicing lean manufacturing for creating work instructions, DMT can make scientific devices at a faster and efficient pace. Scientists can purchase devices and start collecting data more timely.

## FUTURE WORK



Now that the PAX 870 work instructions, pick lists, and presentation kits are completed, DMT will continue creating lean manufacturing instructions for all of their scientific devices. DMT builds around 27 other devices and by employing these lean build instructions, devices can be built with quality.

These instrument can help study:

- Clouds microphysics
- Aircraft icing tests.
- Icing on wind turbines.
- Atmospheric ozone.
- Black carbon which contributes to effects of global warming.

## ACKNOWLEDGMENT

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