Canadian Club of Rome

Pandemic Zoom Series #20

by

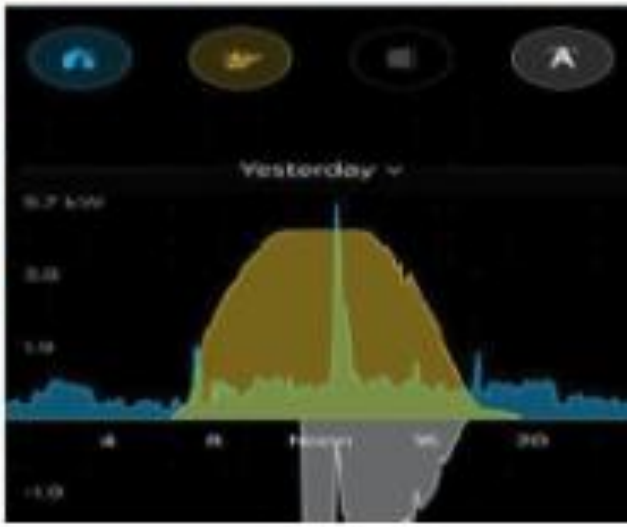
Dr. Art Hunter

- Presentation has two parts
  - Part 1 – Home Solar Siding – R&D and showcase
  - Part 2 – Home SARS-CoV-2 Virus Decontamination Technology showcase and R&D

Part 1
Home Vertical Solar Siding

Adding Solar Siding Generating Capacity
On a South Facing Garage Wall
Autumn 2020
R&D Project in Collaboration with
RoCo Industries Inc.

Future Proofing Renewable Energy
The Manotick Microgrid
A Lifestyle Greening Showcase



Mission Statement

"Retrofit an Ottawa home to live a near autonomous lifestyle."

MAIN FEATURES

- Independence from electrical grid (largely), municipal water, municipal sewage, storm drains, fossil fuels including automotive gasoline.
  - Energy Sourcing (sun, ground, grid, battery, other)
  - Conservation (active & passive demand management)
  - Energy Storage (home battery, ground, grid, EV battery)
  - Transportation (Electric vehicle and charging station)
- Resilience (failure modes, survival, storm forecast preparations)
  - Reliable (island, grid connected, climate chaos hardening)
  - Flexibility (collaborations, operations, growth)

Simultaneous Demonstration

Energy use == Quality of Life

Survival	Sustainable	Resilience	Thrivability
Outlast	Maintain	Bounce back	Bounce forward
Better than dead	Endure in a stable world	Recover quickly from difficult conditions	Prosper, thrive, develop vigorously
Try for personal survival: group or nation	Able to maintain at a given rate, level over time	Survive longer in changing world	Strive for greatness
Meet basic needs	Mitgate damage sacrifice, austerity, obligations	Adaptation, redundancy	Anti-fragile, generate, transform

Project Hardware Providing

Decentralized, Efficient, Innovative Renewable Energy

- **Retrofit an existing Canadian home with a full featured renewable energy living laboratory by developing, acquiring or partnering** ☑
- A 2013 Mitsubishi Electric Vehicle (EV) with 14 kWh battery purchased in 2014 and Level 2 (30 amp) charging station in May 2016.
- 9.25 kW microFIT rooftop photo voltaic (PV) generation array (37 panels March 2017)
- Three Tesla PowerWall 2 AC batteries provide 40 kWh storage (iSolara Solar Power- November 2017)
- 5.5 kW Net Metering rooftop (PV) generation array (iSolara - 22 panels November 2017)
- Geothermal heat recovery and storage subsystem (Bartonair Geothermal - July 2018).
- Electricity consumption sensors: 3 Eyedro Electricity Monitoring Systems (July 2019)
- Artificial Intelligence in multiple platforms under collaboration with Pixcl Automation Technologies. (2019 until Pandemic in March 2020)
- Vertical solar siding collaboration with RoCo Industries Inc. (Autumn 2020)

Command and Control Room

Geothermal Wall with Actuators and Sensors.

Equinox
21 September 2020

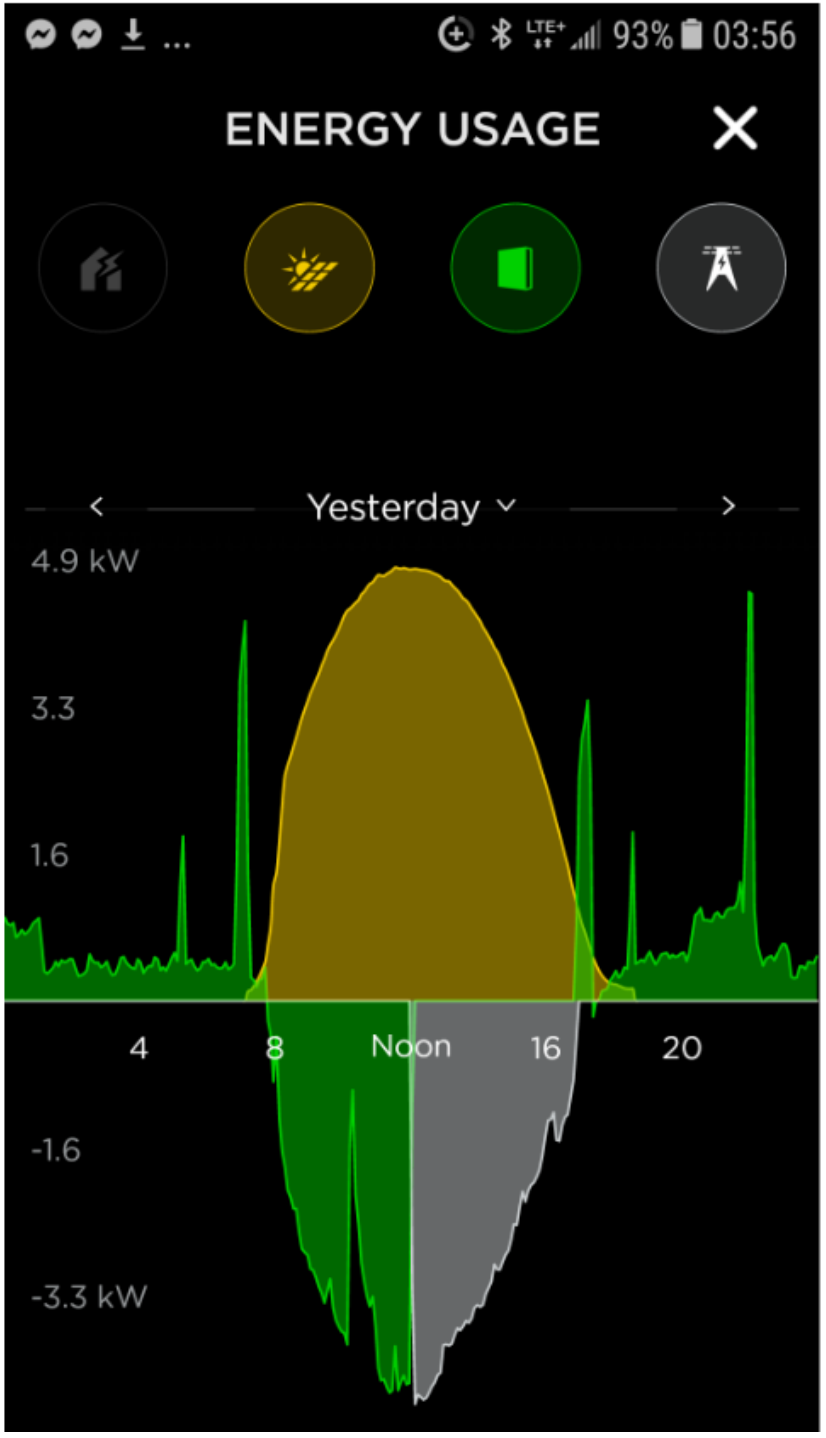
- Near perfect daylight 12 hours

- Night 12 hours

- Battery discharge and charge

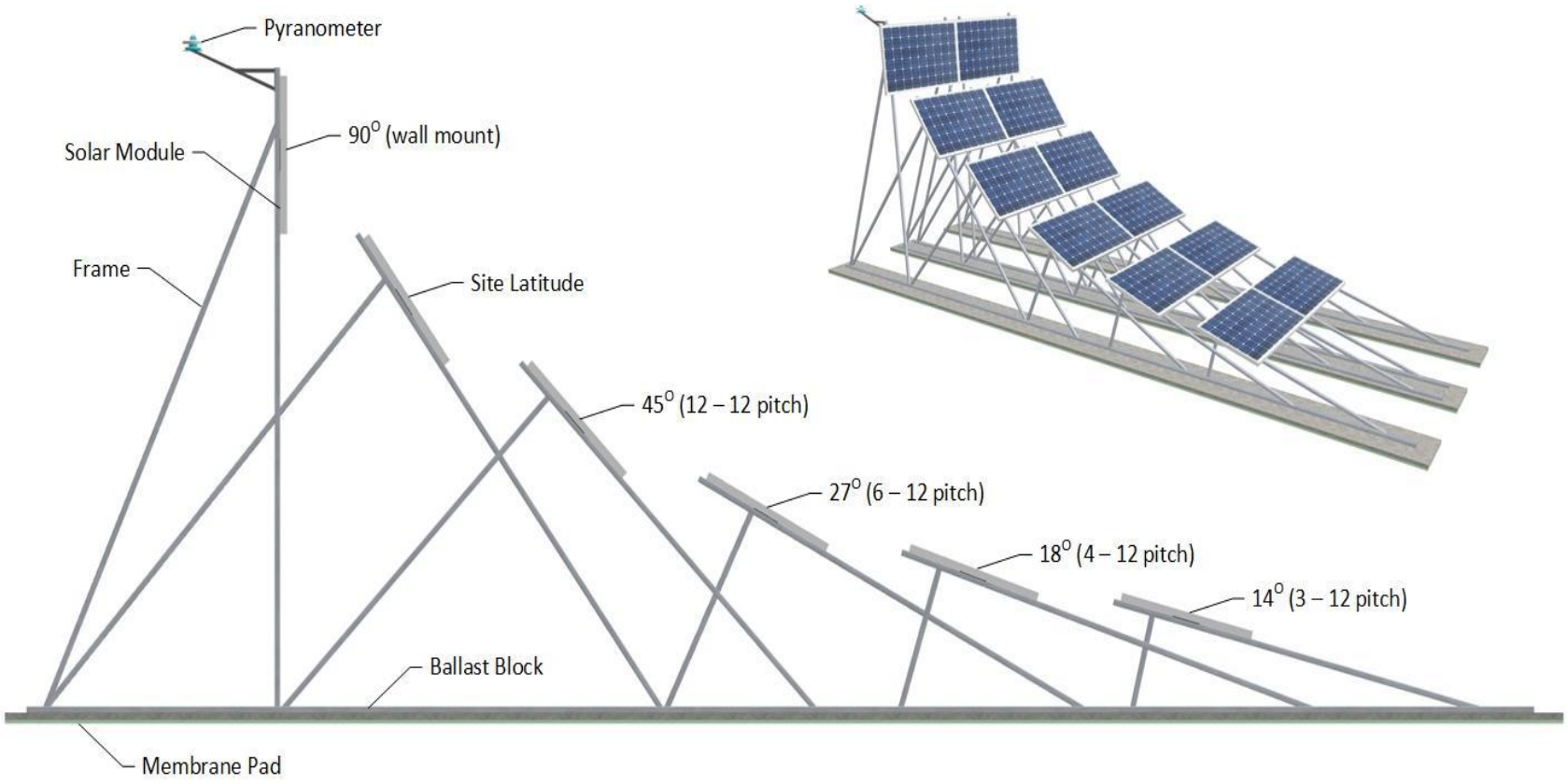
- Grid storage of excess power for usable credits.

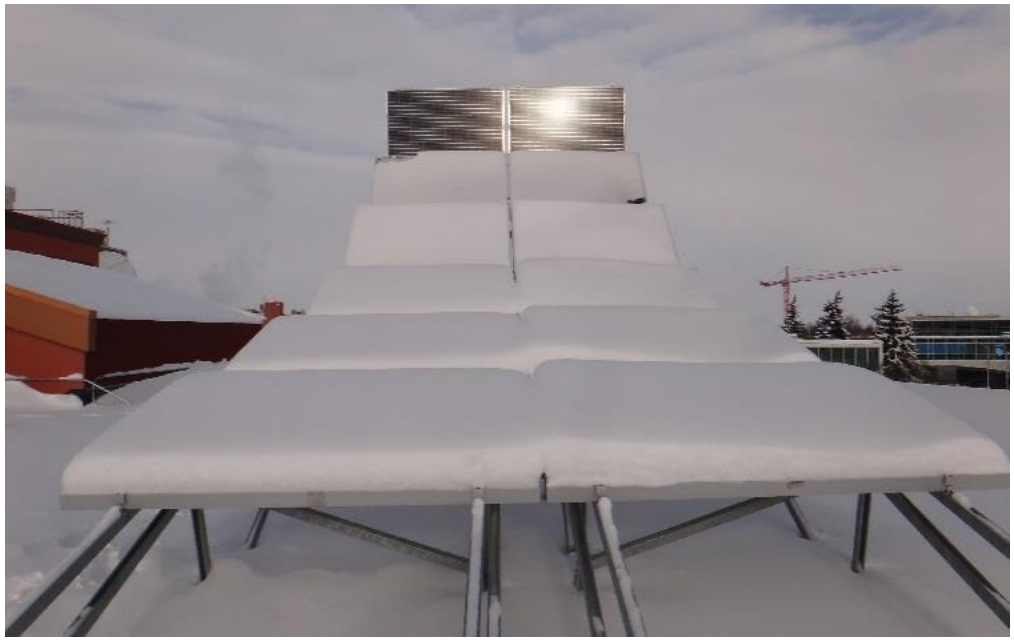
- “OFF GRID” really means not paying for electricity.



Northern Alberta Institute of Technology

Solar Photovoltaic Reference Array Report – March 31, 2016





Construction Phase

To make the wall able to install SparClad, which have dimensions of 4' x 6", the cabinet doors needed to be re-made and the wall made flush.

Once the cabinet wall was re-done the wall was prepared for siding. Wall paper (vapour barrier) was installed and some lap boards were installed (would be furring boards for house wall).

Finishing work

Adjacent walls: The regular siding will be installed on the adjoining walls. For this installation molding will be needed to extend the wall surface from the edge of the panel installation to that of the outer walls..

Outer wall siding: The same siding that was originally on the wall can be re-used to fill in the edge walls for an architecturally integrated solar installation.

Building Code: While this cabinet does not need to meet the same building code that an internal wall may need, our installation strived to install the SparClad panels to the same standards as with an inner wall.

Project Status

- Covid-19 delayed progress
- Waiting on Electrician to complete the installation by connecting the solar siding to the existing system.
- Expect solar reflection off the ground snow to have about a 20% power improvement (albedo effect)
- Microgrid performance expected to improve with added generation (1.5 kW book value) and help achieve 300 day “OFF GRID” target. Today – 23 September 2020 -- is off grid consecutive day 201
- Upgrade to next manufacturing generation panels is delayed waiting on R&D to reach a Manufacturing Readiness Level.

Part 2

Home Decontamination Chamber Technology (showcase and R&D) for solid surface cleansing

Fighting back against the

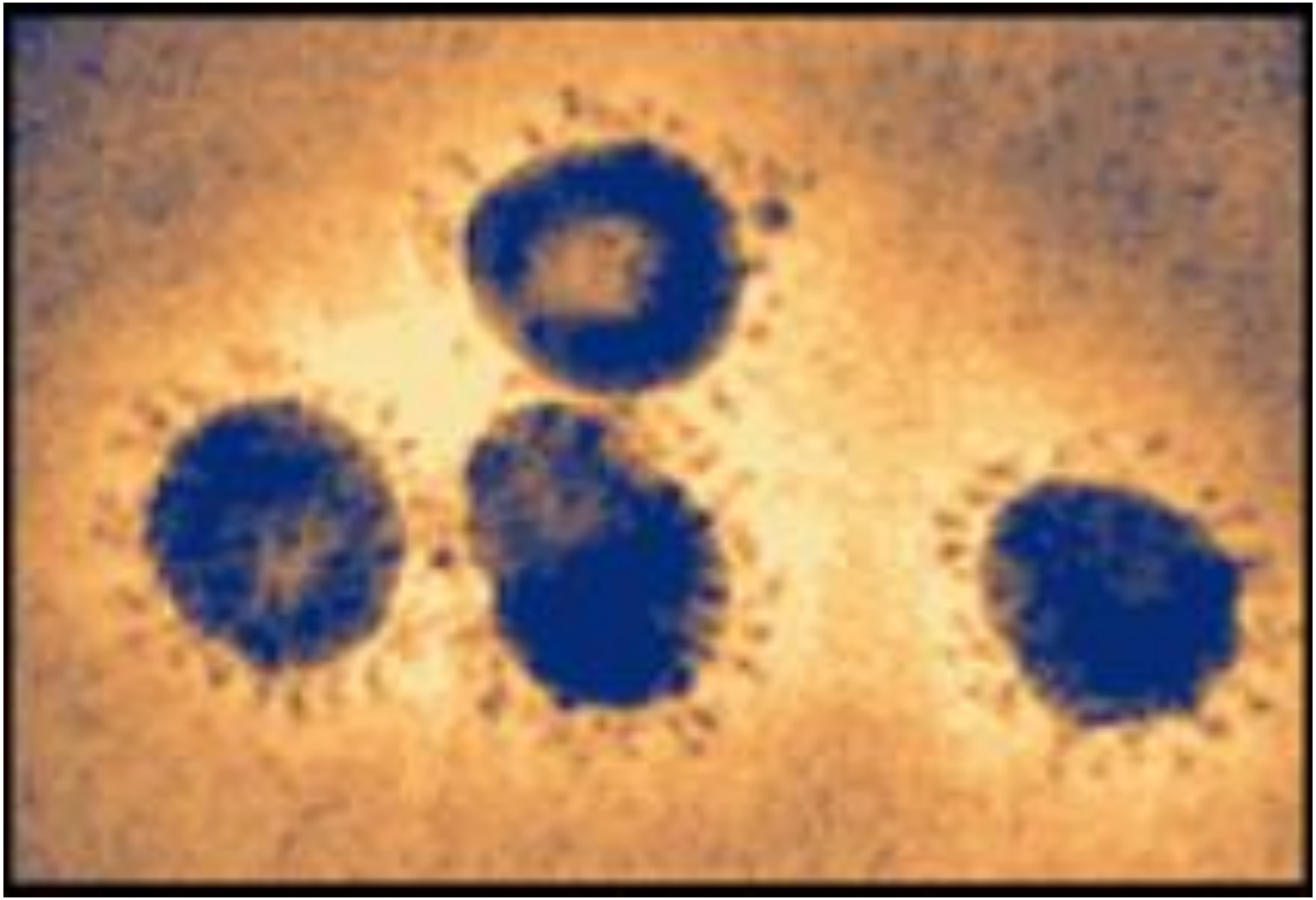
SARS-CoV-2

Virus

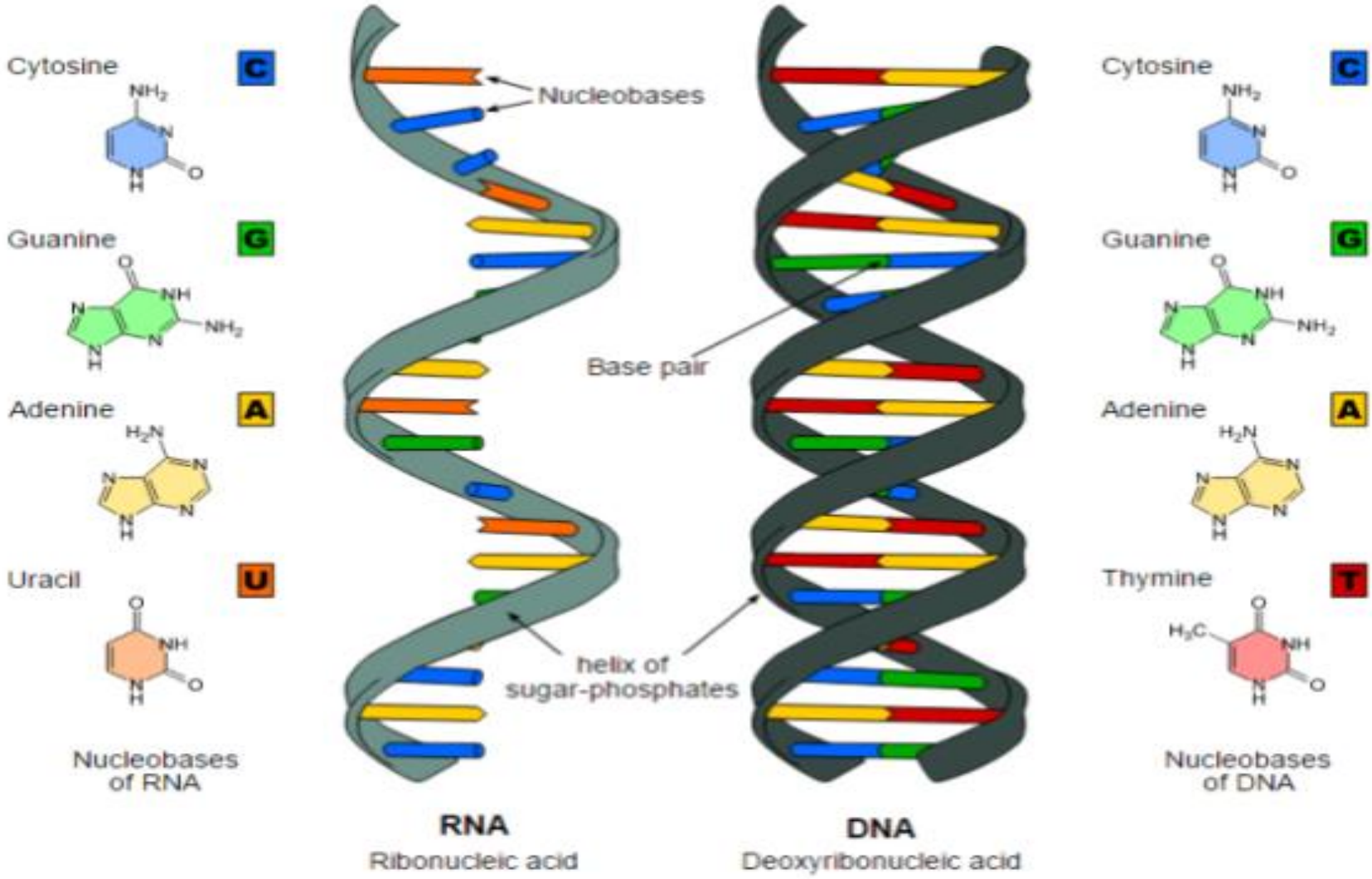
RNA viruses

- In biology, viruses are small infectious agents, which invade living cells and take over the processes inside them.
- Notable human diseases caused by RNA viruses include the common cold, influenza, SARS, COVID-19, Dengue Virus, hepatitis C, hepatitis E, West Nile fever, Ebola, rabies, polio and measles.

SEM of Corona Virus Particles



SARS-CoV-2 is a RNA Virus Molecule



What is UVC

- Ultraviolet light from the sun is categorized as coming in three different wavelength bands.
- UV-A and UV-B travel through the Earth's atmosphere with some attenuation and cause the tanning action on human skin.
- UV-C radiation is absorbed by the Earth's Ozone layer and atmosphere. Solar UVC never makes it to the surface. Hence all UVC on the planet surface is manmade. It disables the DNA and RNA molecules. Irradiance frequency, power intensity, and exposure time are vital disabling variables.

254.7 nm 36 Watt UVC Lamp
12 LEDs

Run Time Considerations

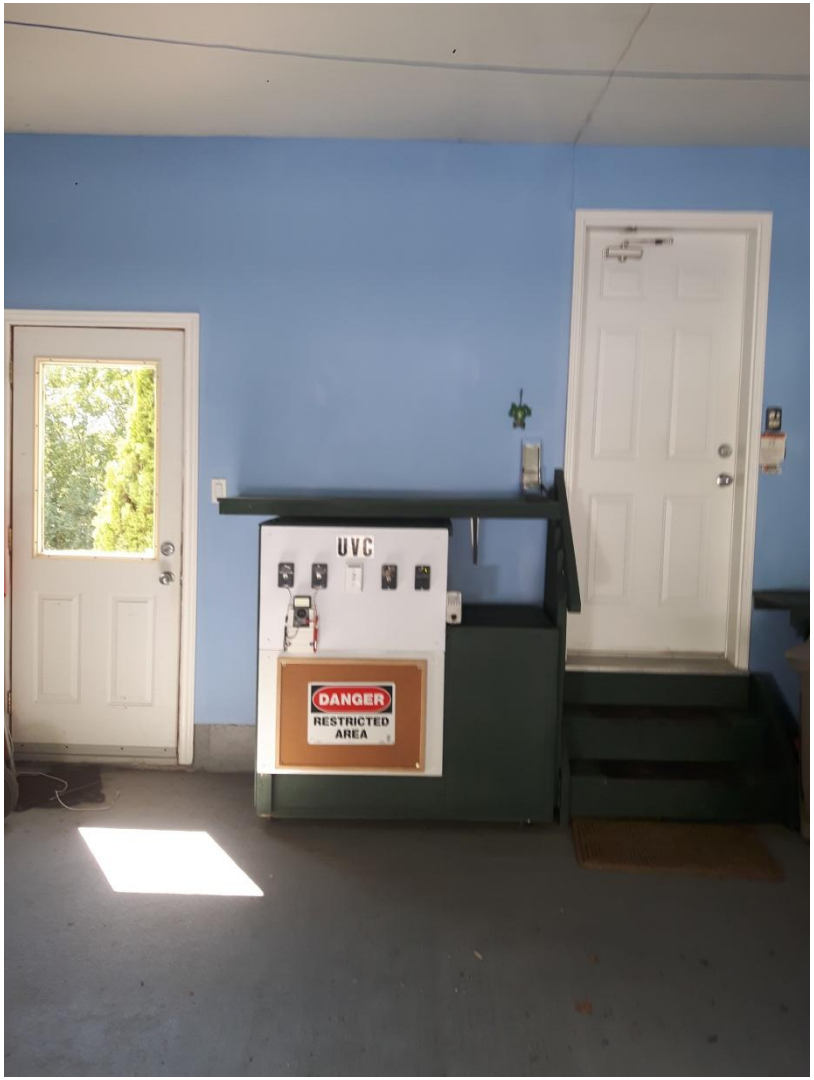
- Researchers found that more than 99.9% of the exposed virus in an aerosol had been deactivated by a very low exposure to 254 nm UVC light.
- Adds energy to the RNA molecule and breaks the atomic bonds
- 90% destruction rate in 2 milliseconds within 10 cm of lamp.
- Suggest 30 second minimum exposure to objects
- UVC will also damage human, plant and pet cells (carcinogenic – skin cancer)
- Safety is vital to prevent accidental exposure to anything other than the target.

UVC Platform in standby mode

The UVC Platform in its home location within the garage. The door on the left may be opened for ventilation or emergency exit. The door on the right is the access door into the house.

SAFETY is top priority. This is achieved by:

1. Three levels of light tight containment. A box within a box within a box.
2. Nine levels of interlocks that are intentionally designed to be complicated and require specialty training and external equipment.
3. Knowledge of the threat imbedded in the operating procedures.
4. Ventilation and isolation in the garage.
5. Warning signage, LED lights and audible sounds.
6. Less than 20 Watts (120 VAC and 5 VDC) of power required.



The platform under full power

The four black boxes each have a coloured LED light indicating from the right to the left:

1. Power passed through two levels of isolation (emergency on/off white switch and Internet Smartphone software) – GREEN LED
2. Power applied to the chamber control system – RED LED
3. Power has been activated in the TIMER circuit: RED LED
4. Power has been delivered to the UVC lamp: WHITE LED.

When the WHITE LED is on, the Voltage from the solar array sensor inside the chamber moves from 0.0 volts to about 7 volts DC.

The Wattmeter on the right indicates power delivered to the UVC LED array of12 LEDs (254 nm UVC).

Full view of the back

The UVC chamber will remain in the garage permanently because:

1. UVC leakage can cause harm to plants, pets and humans while dismantling the DNA of bacteria, viruses and pathogens. Ventilation and social distancing is readily and safely accomplished.

2. Three containment chambers – a box in a box in a box with multiple 90 degree turn labyrinth seals reducing the leakage substantially.

3 The top right is a repurposed microwave oven with all the microwave hardware removed, the front door window sealed inside and outside and most of the controls decommissioned. Only the timer controls, door shut interlock, the LED numerical control window, the firmware and the START button are operational.

4. The white cord is the platform 120 VAC power.

5. Two storage shelves are shown below the chamber.

Containment level 3 door closed

This is a sliding vertical door with a snug fit and labyrinth seals forcing escaping UVD radiation to make at least 3 right angle turns and then will only “see” the rear wall of the garage.

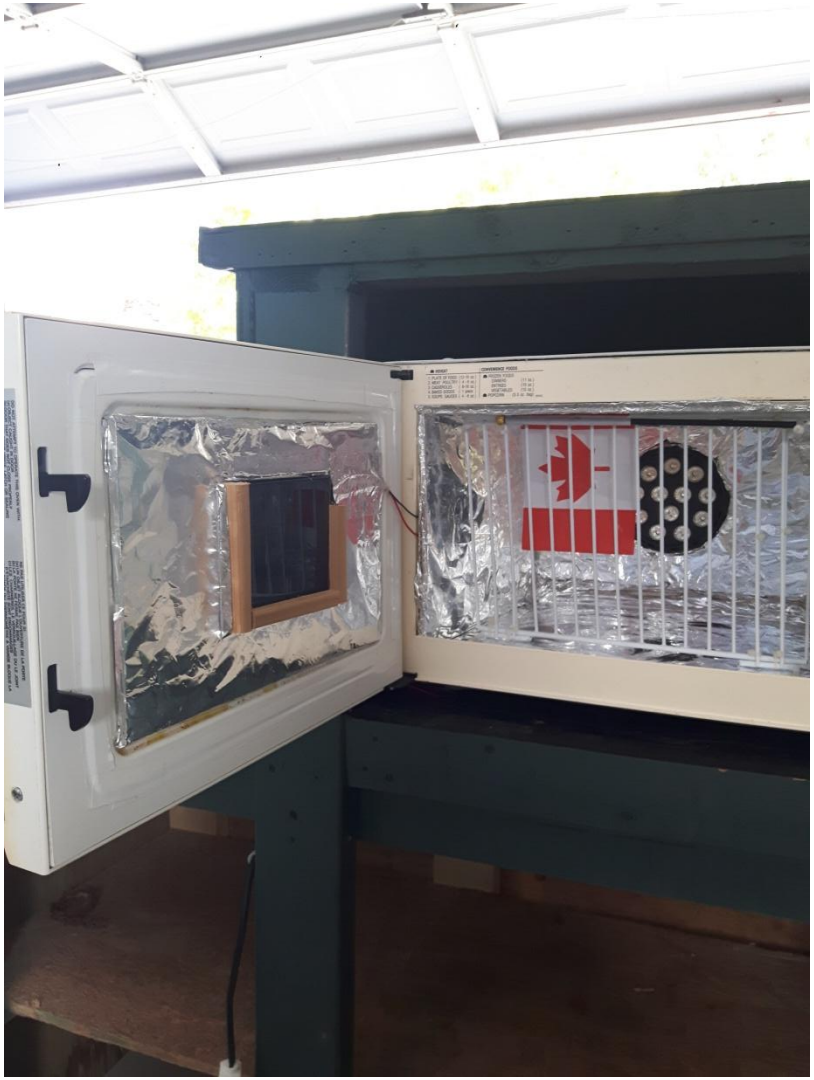
Containment level 3 door open

This vertical manual sliding door can be closed or opened in under 1 second. Here it is in the OPEN position revealing the Level 2 containment door.

Many surfaces along the path of potentially escaping UVC are non-reflective black. The objective is to absorb as much escaping energy as possible and reflect very little.

Inside the Chamber

1. Irregular surface reflective Aluminum foil on 6 surfaces reflects the UVC in a complex reflective way. The intent is to encourage penetration around cellular phone push buttons.
2. Left side is the solar array sensor in a wooden holding frame.
3. Right side but back of chamber is the black UVC lamp with twelve 254 nm LEDs.
4. Miniature Canadian Flag on a holding rack getting exposure to UVC to encourage discolouration or red fading.



Fully powered platform solar sensor output

UVC, like electricity, can't bee seen but we can see the voltage produced by the solar sensor inside the chamber when the UVC Lamp is energized.

In this case, it is 7.35 Volts.

This value is not very significant as the object being decontaminated casts a dark shadow on the sensor as it is partially blocked. The object shape and location inside the chamber will be different with each decontamination object. Hence, the 7.35 volts only shows that the 0.0 volts prior to turning the UVC lamp on had increased to 7.35 volts in this unique case. This means that the UVC lamp is most certainly activated and producing UVC radiation but nothing more.

Power used by the platform without turning on the UVC Lamp

The overhead power for everything in the platform but the UVC Lamp is 4.8 Watts

Platform Power with the UVC lamp energized

17.8 Watts less the overhead of 4.8 Watts says the UVC lamp is drawing 13 Watts of power or 13 Joules per second.

This Home UVC Decontamination Chamber has passed its Commissioning Testing and is ready for production decontamination.

2020-08-23

Art Hunter

Designer, developer, fabricator and owner

Part 2a
Home Aerosol Cleansing Technology (showcase and R&D)

Fighting back against the

SARS-CoV-2

Virus

UVC Furnace Ducting Decontamination Lamp (36 Watts of 254.7 nm)

Inserting into cold air return duct with a count-down timer to clean viral aerosols.

The furnace fan should be running. Automation is the next project phase.

Use when suspected contamination is expected, is happening or after the fact when people penetrate the building envelope and exhale. This lamp is a risk reduction device.

Use when the home is used by visitors

- Cleaning support
- Service technicians
- Neighbours
- Grandchildren
- other

Countdown Timer for the Furnace UVC Lamp

It has 8 settings but expect the operational use will be 1, 2 or 4 hours.

A detailed use procedure will be developed once installed. This is the only R&D content.

This timer switch as been delivered.

Amazon are delivering the UVC Lamp later this week.

Questions and Comments

- Please Use the ZOOM Chat function to John Hollins, Co-Host
- Questions on either
  - Home decontamination chamber for solid surfaces and furnace aerosols
  - Vertical Solar Siding
    - Roderick Costain, President of RoCo Industries is in the audience.
- John Hollins will manage audience participation.