Development of modular floating Solar Panel Array – Connectum Clickfloats
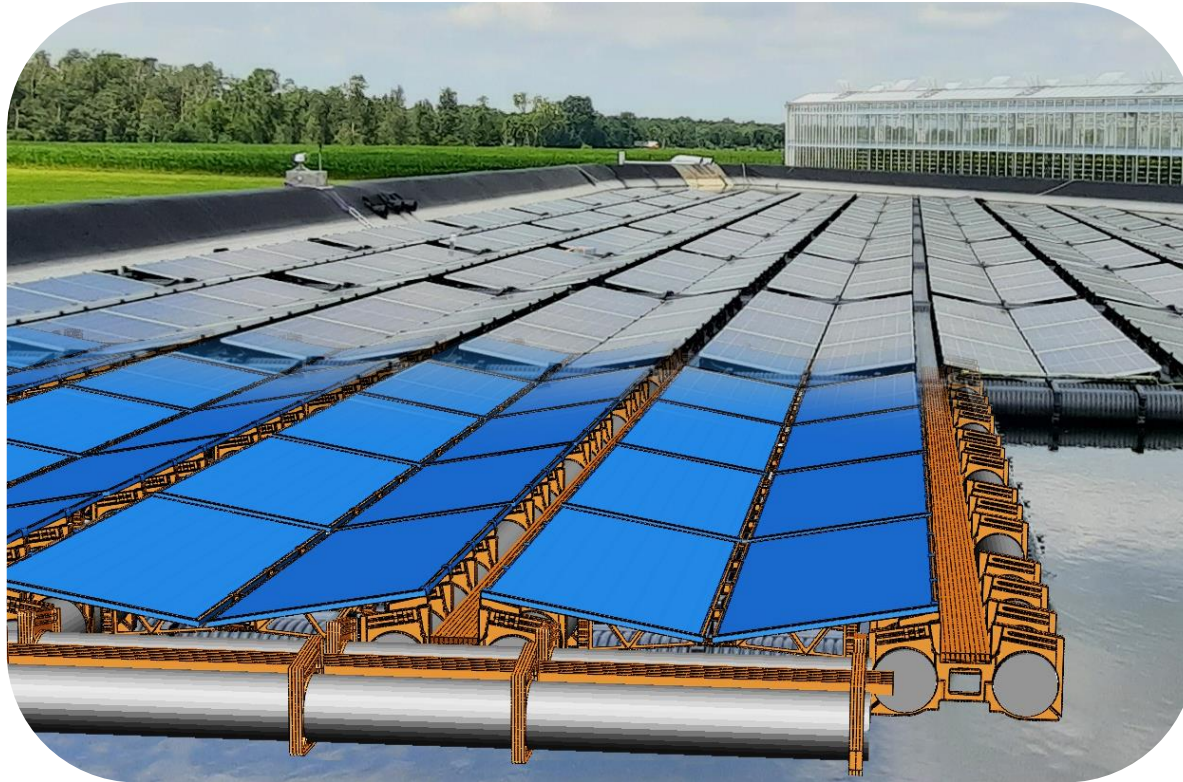
Presented by Matthew Spoor, Vectayn Ltd
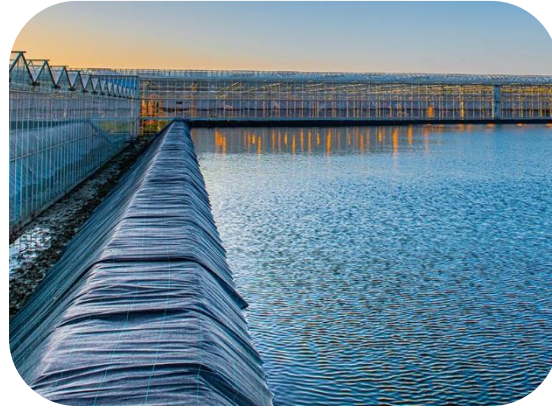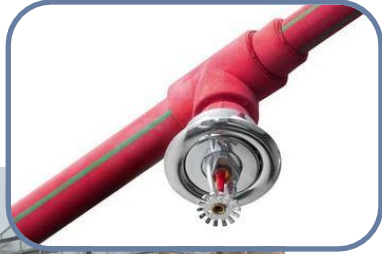

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Outline

- Vision
- Analysis
- Initial Loading
- Service Loading
- Making waves
- The 'C' Word
- Benefits

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- Irrigation requires water and power.

- Large open reservoirs incur losses through evaporation and can encourage algal blooms.

- Covering the reservoir surface with solar panels not only provides a source of 'clean' power to pump water but also improves water quality by reducing sunlight below the water surface.
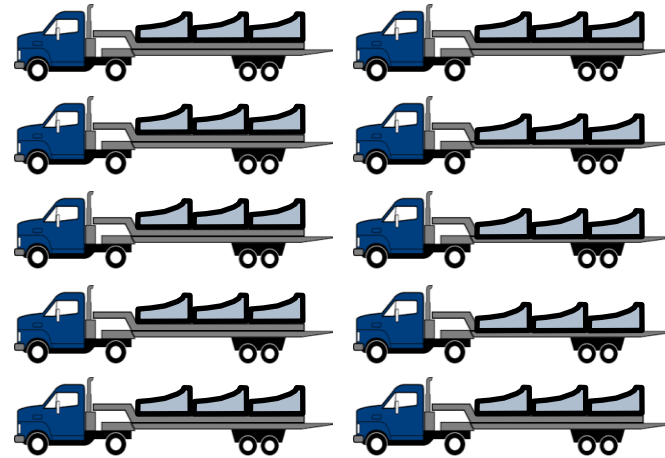
https://www.youtube.com/watch?app=desktop&v=N4fihhw_iCM

- Existing floating solar arrays use large flotation systems

- The large floatation supports are low weight but are high volume and incur significant transportation costs

- A modular design, built on site, significantly reduces the number of vehicles required to deliver the array to site with both environmental and cost savings.

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Vectayn chose to use LS−Dyna to run the simulations using Oasys as the pre and post processing tools.

- Provided detailed part to part interaction
- Simulation of joints between parts
- Dynamic Loading
- Detailed material definition created from supplied empirical data
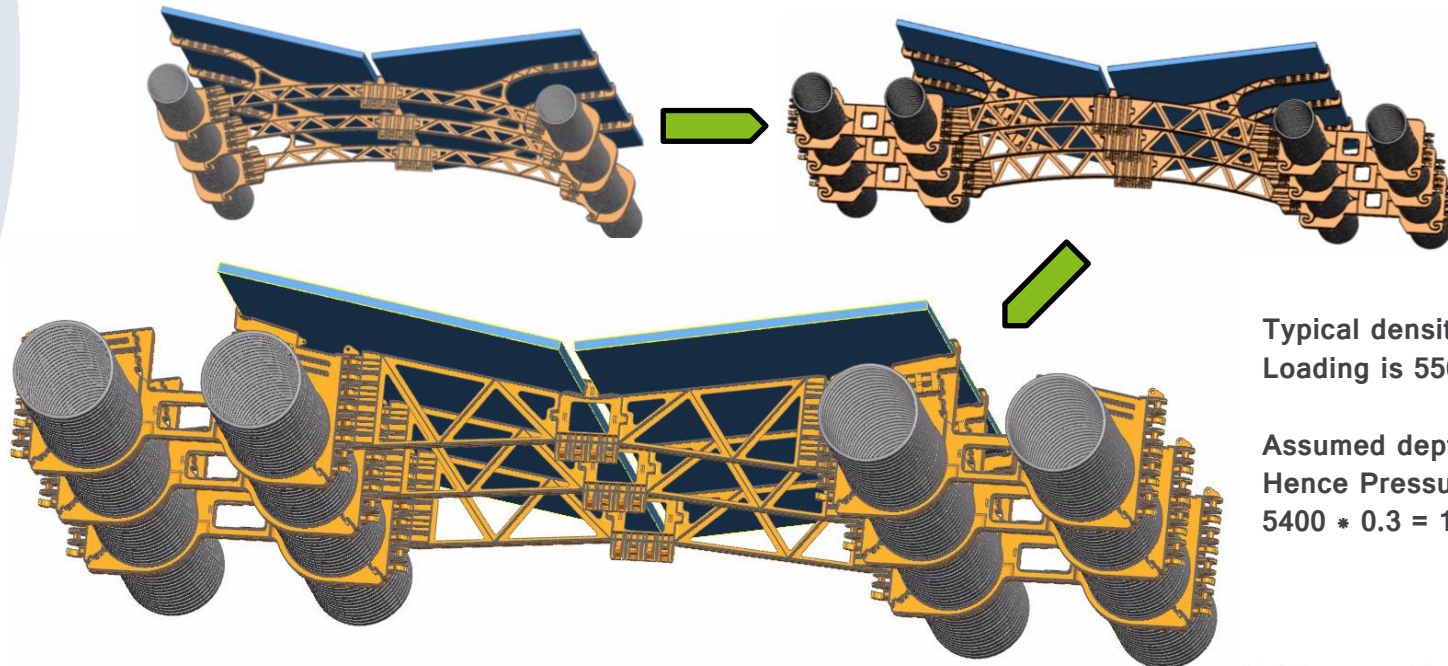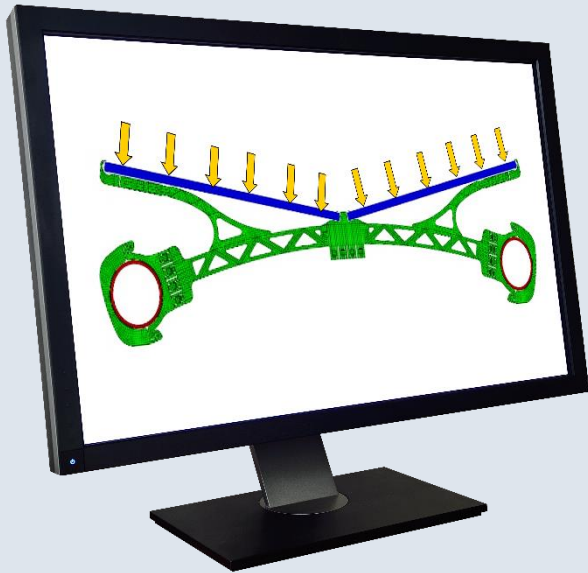- Arbitrary Lagranian Eulerian (A.L.E.) method used for structure / fluid interaction

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Snow Loading (Pressure)

9.81 m/s²

0.5 sec

1620 N/m²

0.6 sec   1.5 sec
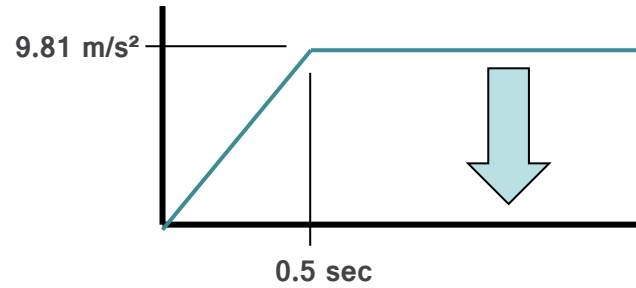
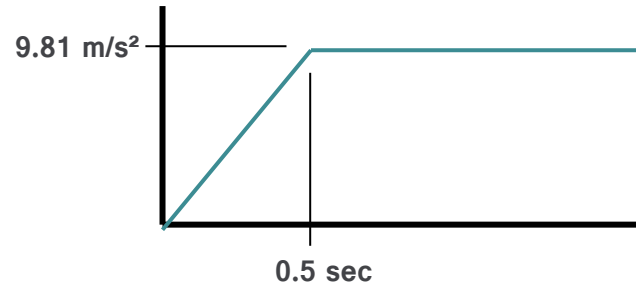Gravity loading is applied using 'ramp up' to ensure stability
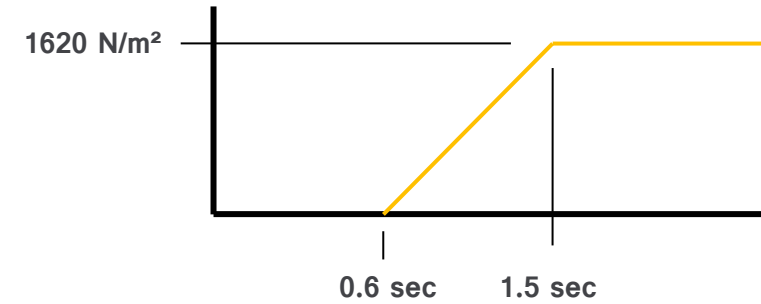
A pressure load is applied after the gravity load has 'settled' and then ramped to 1.5sec.
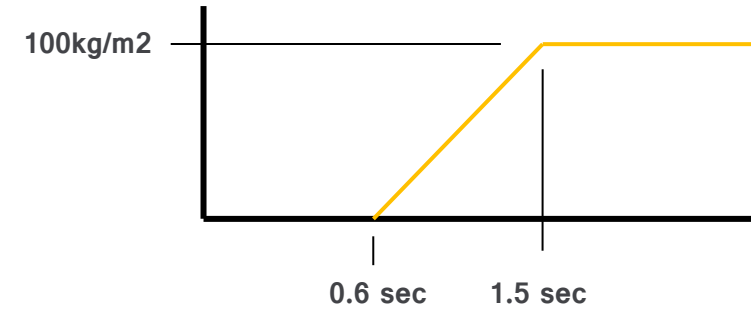
Typical density of snow = 550 Kg/m³
Loading is 550 ∗ 9.81 = 5400 N/m³

Assumed depth of snow = 300mm
Hence Pressure on panels =
5400 ∗ 0.3 = 1620 N/m²

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Wind Lift Loading

9.81 m/s²

0.5 sec

Gravity loading is applied using 'ramp up' to ensure stability

100kg/m2

0.6 sec   1.5 sec

An agreed pressure load is applied to the upper surface of the two solar panels starting at 0.6sec ramping to a maximum value at 1.5sec

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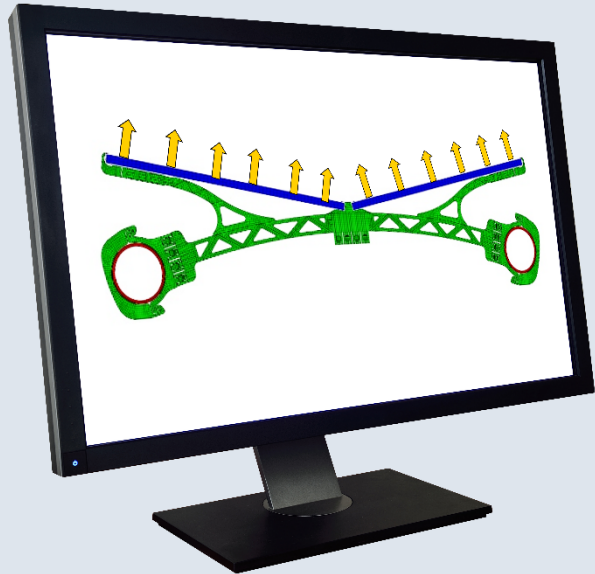
Service Loading

## Walking between panels to service them

This is intended to simulate two people carrying a solar panel, walking down the walkway, each on one foot.

The loading is simulated by placing two blocks on the central walkway at a spacing of 2.9m, each with a mass of 120Kg. Gravity is applied to the assembly.

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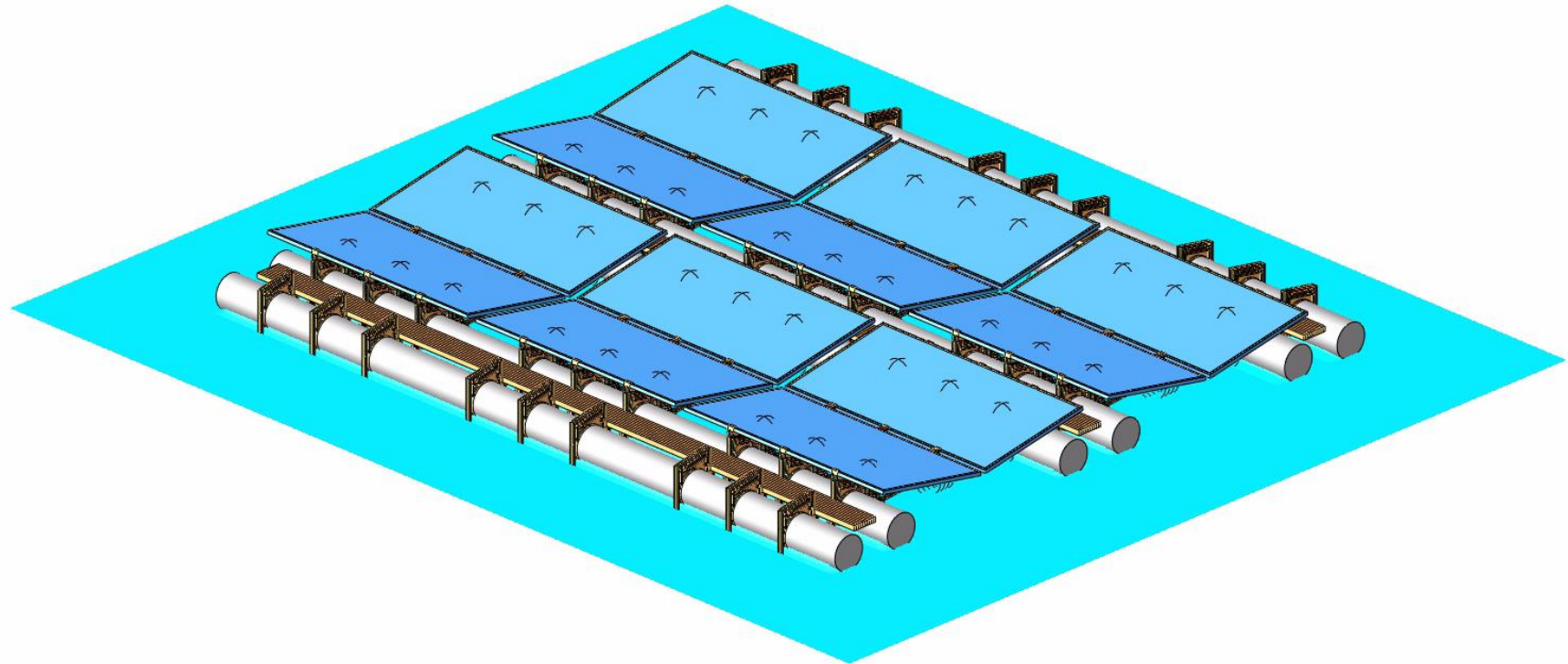
Wave Loading

The wave for the simulation is created by adding a volume of fluid at one end of the tank that is above the natural level of the fluid. Once the simulation is started, gravity pulls the volume into the fluid and a wave is created that flows across the tank. The size and shape of the added volume will determine the characteristics of the wave.
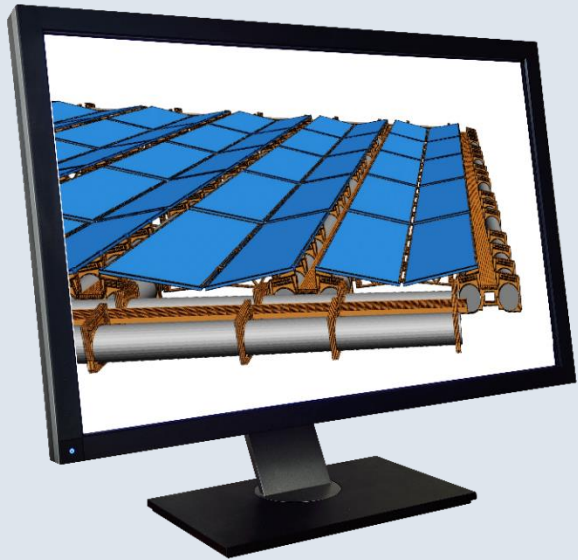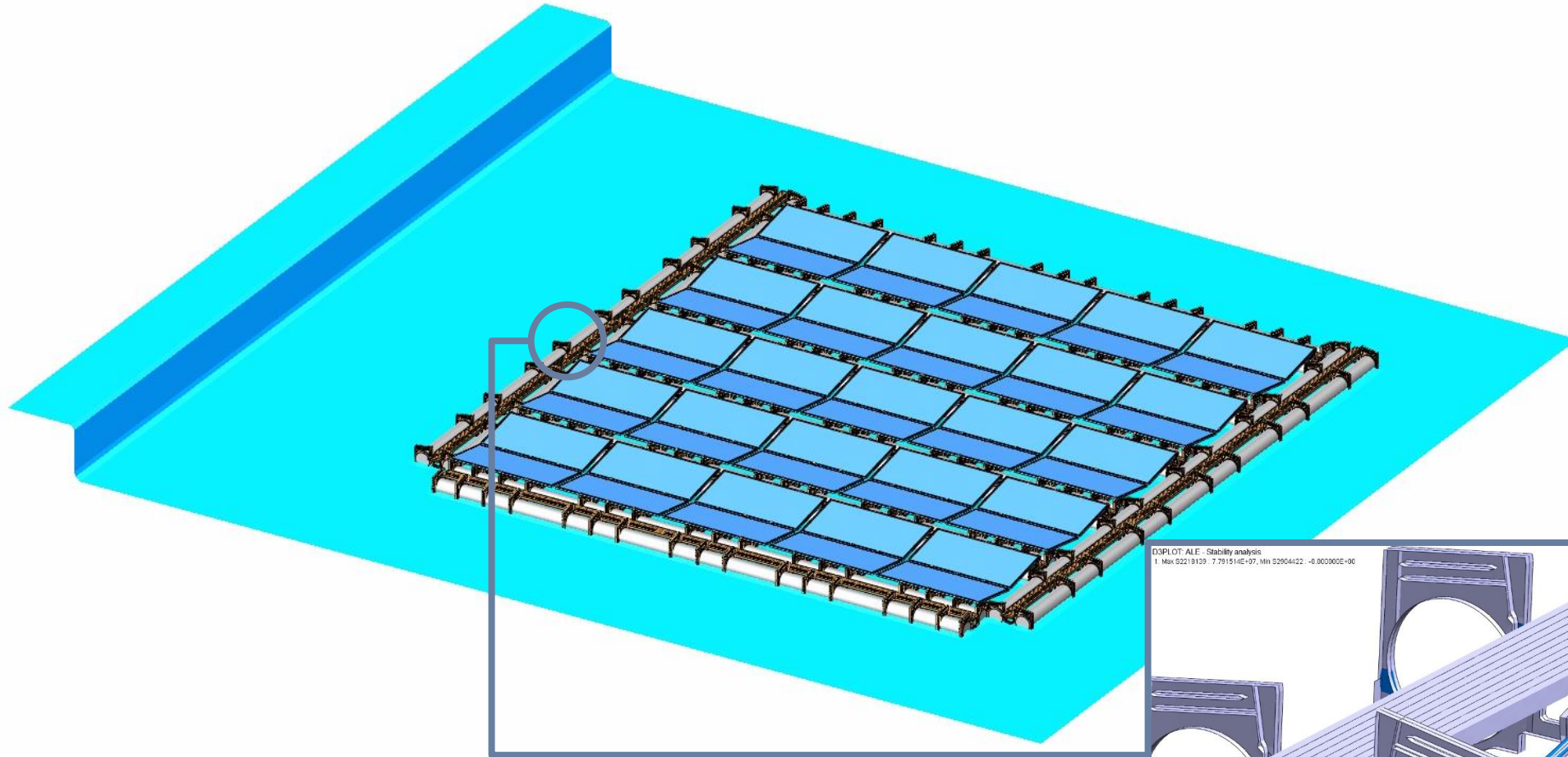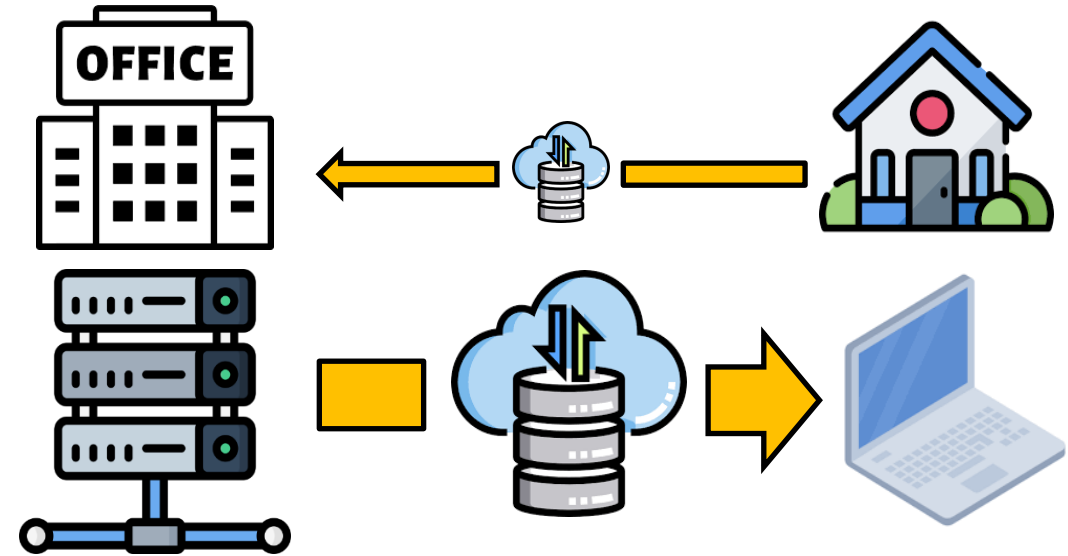
Stress analysis based on loading induced by flexing the array due to wave interaction
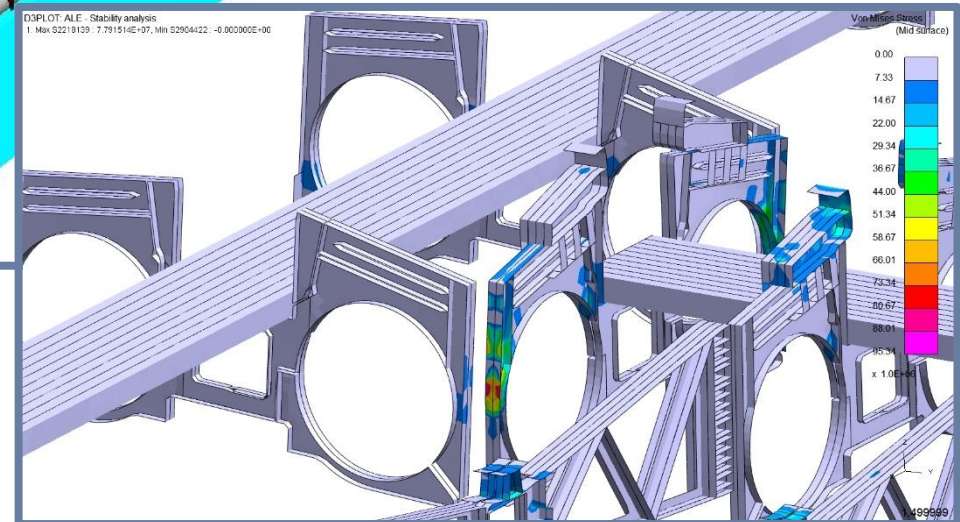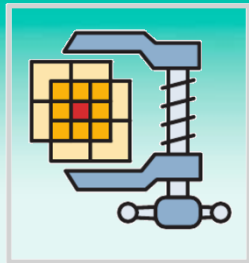
The 'C' Word

- In March 2020, non-essential employees were required to work from home, but the computing power needed to run the analysis was based in the office.

- Though the input file were relatively small the analysis results, especially for the investigations into the floating array were very large.

- The results data needed to be 'C'ompressed to facilitate data transfer from the office to the home
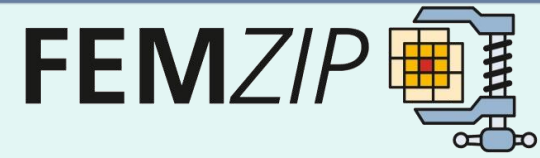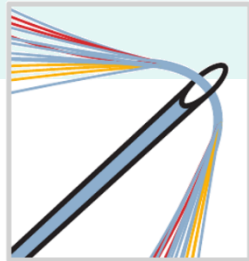
FEMZIP

FEMZIP is a specialised tool for the compression of LS-DYNA results

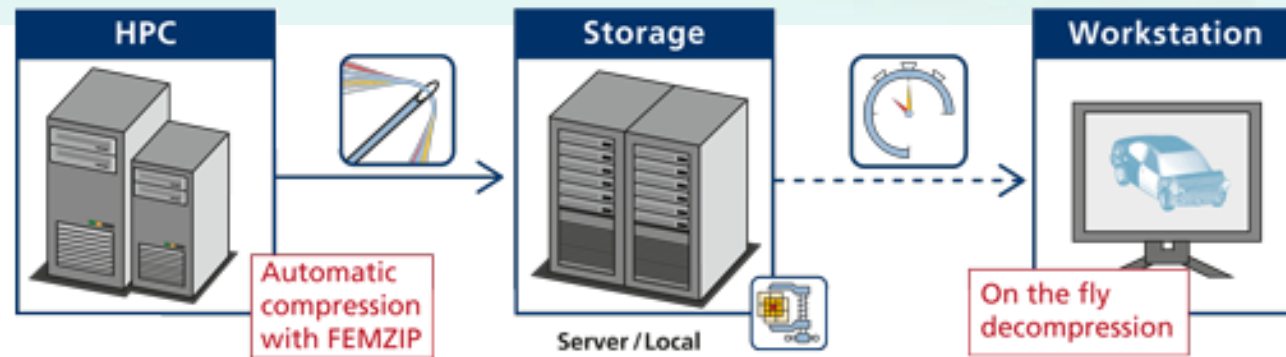**Reduced Archive Size**

Shorter Data Transfer Times

Quicker Data Loading

HPC

Storage

Workstation

Automatic compression with FEMZIP

Server / Local

On the fly decompression

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Connectum Clickfloats
Modular Floating Solar Array

- Extra 8% green energy yield.

- CO_2 reduction − 0.381kg CO_2/kWh green energy

- Water savings

- Improved water quality

CONNECTUM   www.connectum.biz

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