Carbon Fiber Applications Enabled by Recycled Fiber
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Composite Recycling Technology Center

- We design, develop and manufacture products that utilize carbon fiber scrap
- We are about 2 key things:
  - Eliminating Carbon Fiber Scrap from Landfill
  - Creating jobs in Advanced Manufacturing
CRTC is Approximately 2 Hours from Seattle/Tacoma
CRTC Part of Composite Manufacturing Campus
The Olympus Bench

- Made with recycled Toray Aerospace Grade Carbon Fiber
  - Incredibly strong
  - Extremely durable
  - Easy to clean - power wash
  - Looks great
  - Keeps waste out of landfill
  - Creates jobs
The Olympus Bench

- Manufacturing
  - Chop and Uni prepreg scrap
  - Hi-pressure bladder molded
  - In-mold coat and post paint to custom colors
  - Inlaid Ceramic plaques
  - Brass and Stainless fasteners
  - Corrosion-free solution
SWIFT™ Pickleball Net

- Light – only 13 pounds
- Very strong
- Sets up in under 3 minutes!
- Sets 36” and 34” automatically
- Provides the stiffness of a tournament net
- rCF in the bow, posts and feet
- Patent pending
Net Manufacturing

- Compression molded plates
  - Waterjet to make foldable legs
- Tube roll-wrapping
  - Upright posts and bow sections
  - 3 differing diameters
- Net and soft goods from China
- Injection molded fittings, USA
- Internal machined metal parts
Other Manufacturing

Orthotic Spring

- Used to help lift foot
- Very helpful to those with partial leg functionality
- https://youtu.be/sWCej-K_pHg
Interesting/Exciting Development Projects
Cross Laminated Timber (CLT)  
Wood - Carbon Fiber Hybrid Products

- CRTC is working to enhance CLT’s product offering
  - Carbon fiber provides equivalent stiffness/deflection as steel at about 1/3 the weight
  - Allows smaller beam sizes and thinner panels
  - Provides vibration damping

- Recycled fiber product achieves necessary costing
ENVIRONMENTAL BENEFITS OF WOOD

In addition to storing carbon, wood products require less energy — and therefore fewer carbon dioxide emissions — to produce than other building materials. By specifying timber for a project, a design team will reduce the overall carbon footprint of a building through carbon storage and by substituting wood for more energy-intensive materials.

Replacing concrete and steel with wood can offset decades of carbon emissions from heating, cooling and powering the building. As advances in technology make it possible to build increasingly efficient buildings, using wood could result in a negative carbon footprint over the life of the structure.

- **Total System Costs similar to steel/concrete and dropping dramatically**
- **Timber farm wood mass recovery (usable growth) is now greater than harvest volume**
- **Environmental Solution Valued by Customers – recycled carbon fiber’s low embodied energy is a selling point**
- **Net-zero buildings have majority of environmental impact due to construction and materials**

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**Carbon storage**

One cubic meter of wood stores nearly a metric ton, about 2,200 pounds, of CO₂.

**Energy savings**

Energy requirements in kilowatt hours for producing a 3-meter-tall column (equivalent to 9.8 feet) carrying the same load.

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<thead>
<tr>
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<th>Timber</th>
<th>Steel</th>
<th>Concrete</th>
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<tbody>
<tr>
<td>kWh</td>
<td>60</td>
<td>227</td>
<td>561</td>
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Carbon Fiber/Wood Ideal for Cantilevered Construction
Development of the Ocean NOMAD (Nautical Offshore Macroalgal Autonomous Device) for Low-Cost Production of Biomass for Foods, Feeds, and Fuels
Michael Huesemann, Pacific Northwest National Laboratory

Project Vision
Design and test free-floating, sensor-equipped, carbon-fiber longlines (5 km) with binary culture of bull and sugar kelp to optimize yield and resilience. NOMADs are automatically seeded and harvested offshore as identified by hydrodynamic modeling and TEA.

Project Impact
NOMADs are envisioned to be “infinitely” scalable seaweed cultivation platforms for the cost-effective and environmentally safe and sustainable production of marine biomass for biofuels.
Recycled Carbon Fiber Long-Lines

Novel Pultrusion Adaptation to Make Continuous 10km cable from rCF

- Pultruded 15-mm carbon composite cable
  - 7-strand in-line twisted, 3.4 mm each strand
  - 4 major custom modifications required

rCF FEEDSTOCK

Edge Trim – 2 made for every roll of carbon fiber manufactured, thus **reliable** and **available**

1. Custom Feed Creel – 65 edge trim rolls
2. Induction heated die section – approximately 3-meters long
3. Specialized hydraulic belt puller (to grip 3.4 mm diameter round strand)
4. Develop spool take-up using fail-safe brake and clutch
Partners and Supporters

- Toray Composite Materials America
- State of Washington
- Port of Port Angeles
- IACMI
- Pacific Northwest National Lab & ARPA-E
- Oregon State University
- Pickleball Central
- ELG Carbon Fibres
- Washington State University
- Peninsula College
- City of Port Angeles
- Washington Department of Natural Resources
- University of Washington
- Spindrift Rowboats
- Therma Wood Technologies
- ACMA