



## **Toho Tenax America, Inc.**

**March 20<sup>th</sup> , 2011 Presentation to:  
Oil & Gas Seminar  
Rio de Janeiro**

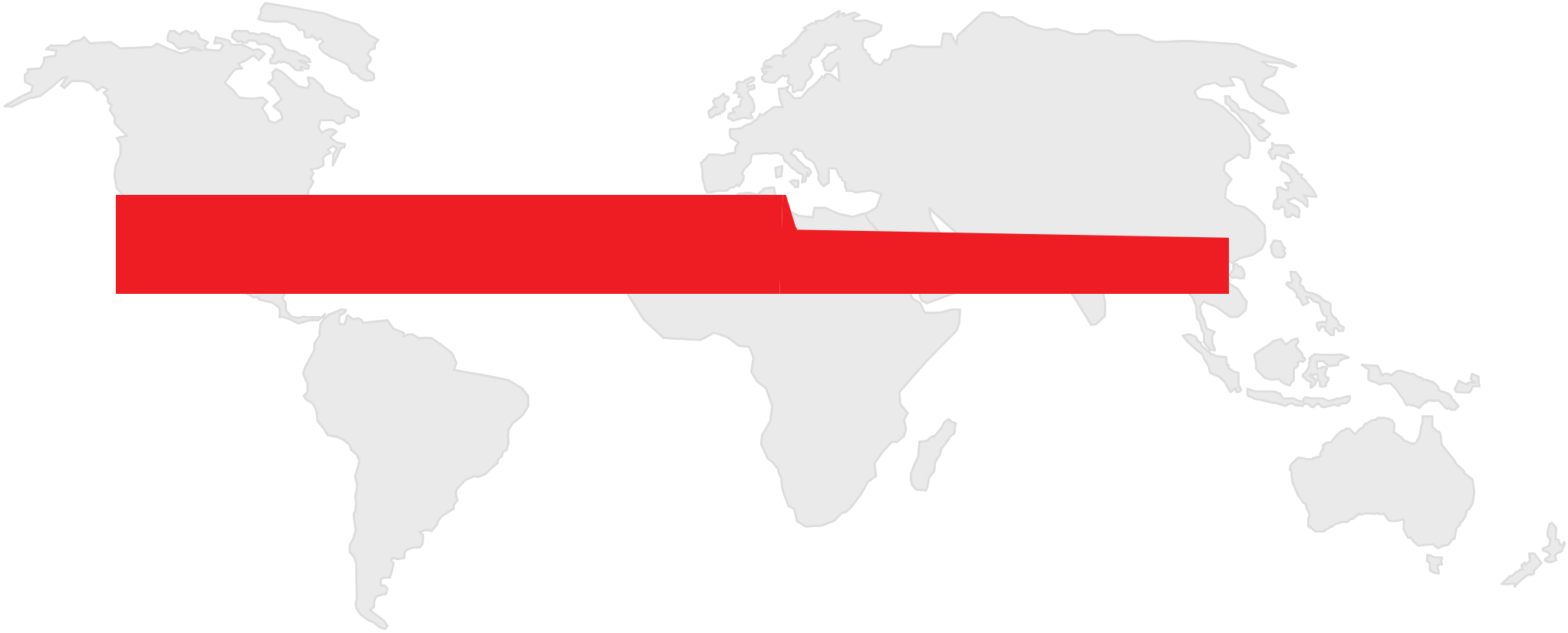
**Carbon Fiber and Pultrusions on  
Oil&Gas Market**

**Rodrigo Cesar Berardine  
Technical Marketing Engineer  
Toho Tenax America, Inc.**

**Phone: (11) 50703862**

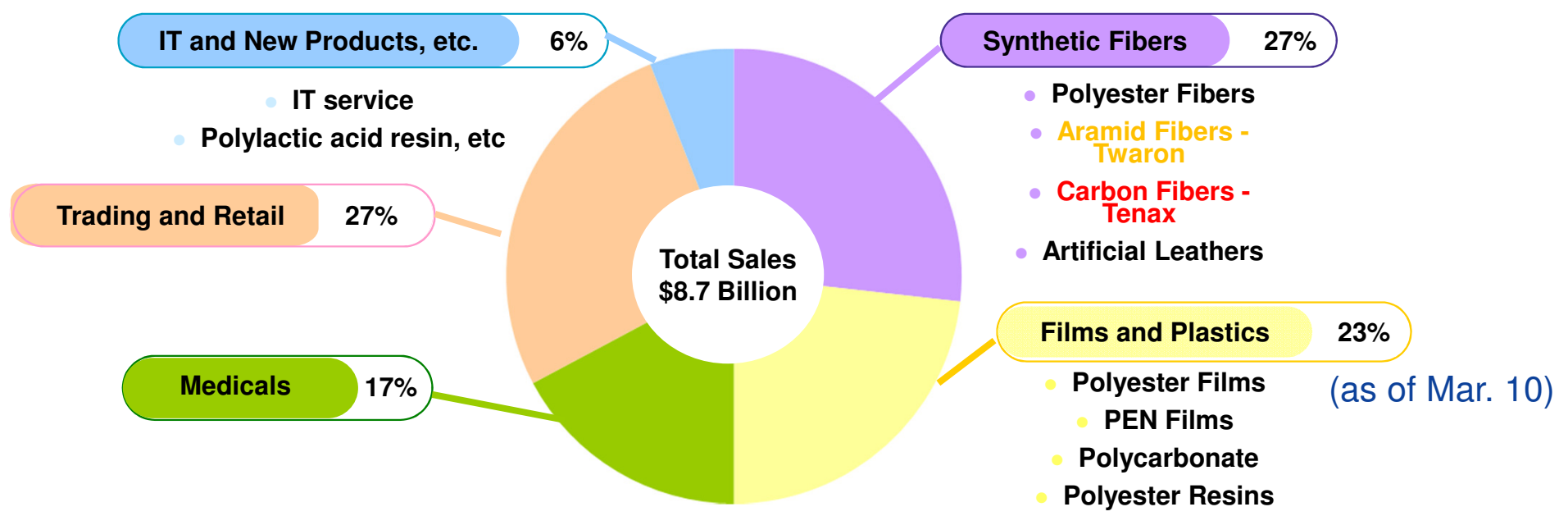
**Mobile: (11) 87061766**

**[rberardine@tohotenax-us.com](mailto:rberardine@tohotenax-us.com)**

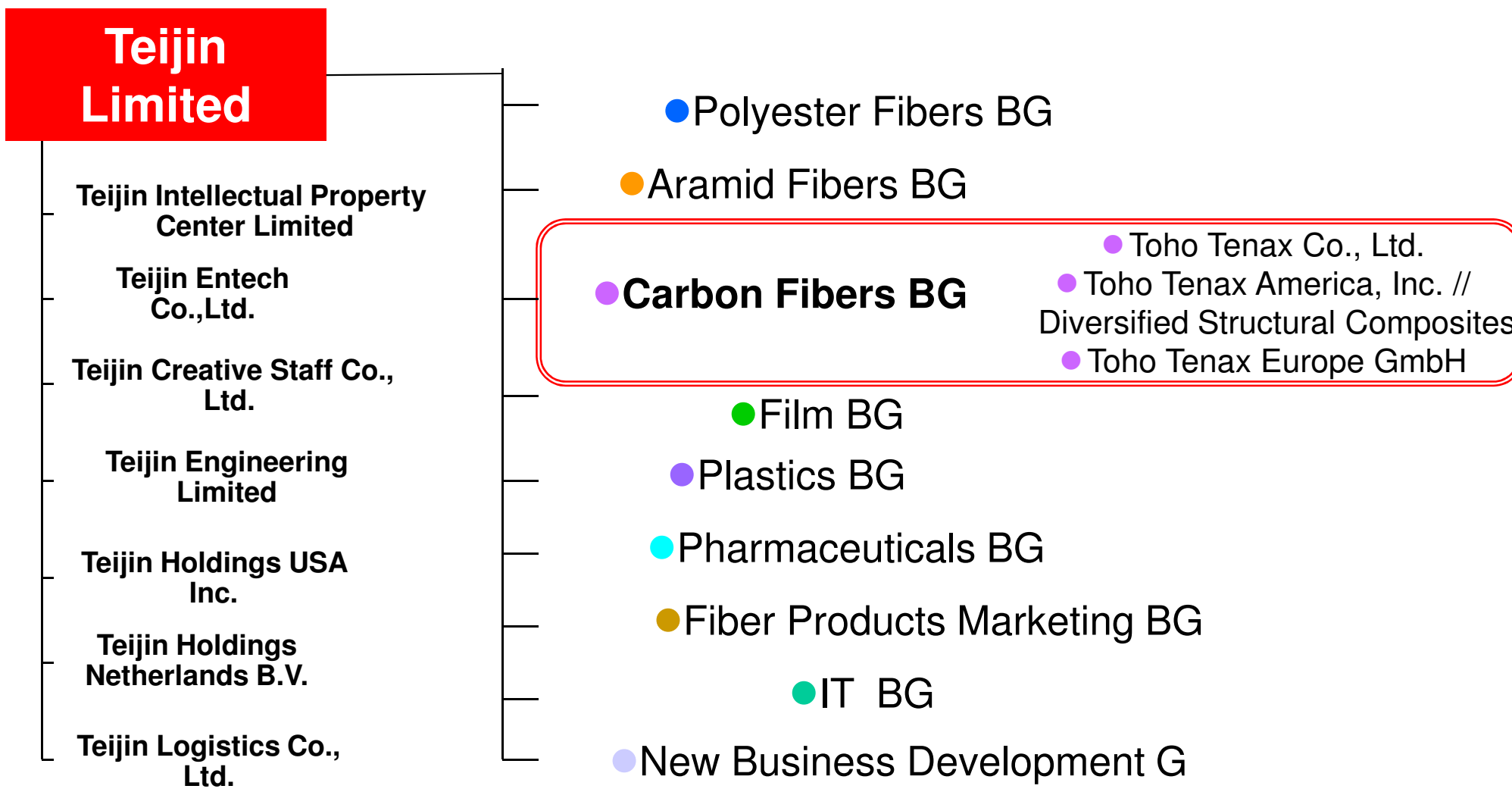


**Teijin Limited**

- **Establishment** June 17, 1918
- **Employees** 18,778 (Japan: 10,197, Overseas: 8,581)
- **Group Companies** 156 (Japan: 76, Overseas: 80)



## Teijin Group Organization





## Toho Tenax Americas (TTA)



# Toho Tenax Europe (TTE)



## Wuppertal

Marketing/Sales, Development/Laboratories  
Employees: > 50



## Oberbruch

CF manufacturing lines  
Employees: > 250





	Sales Office
	CF Production
	CF R&D
	Composites

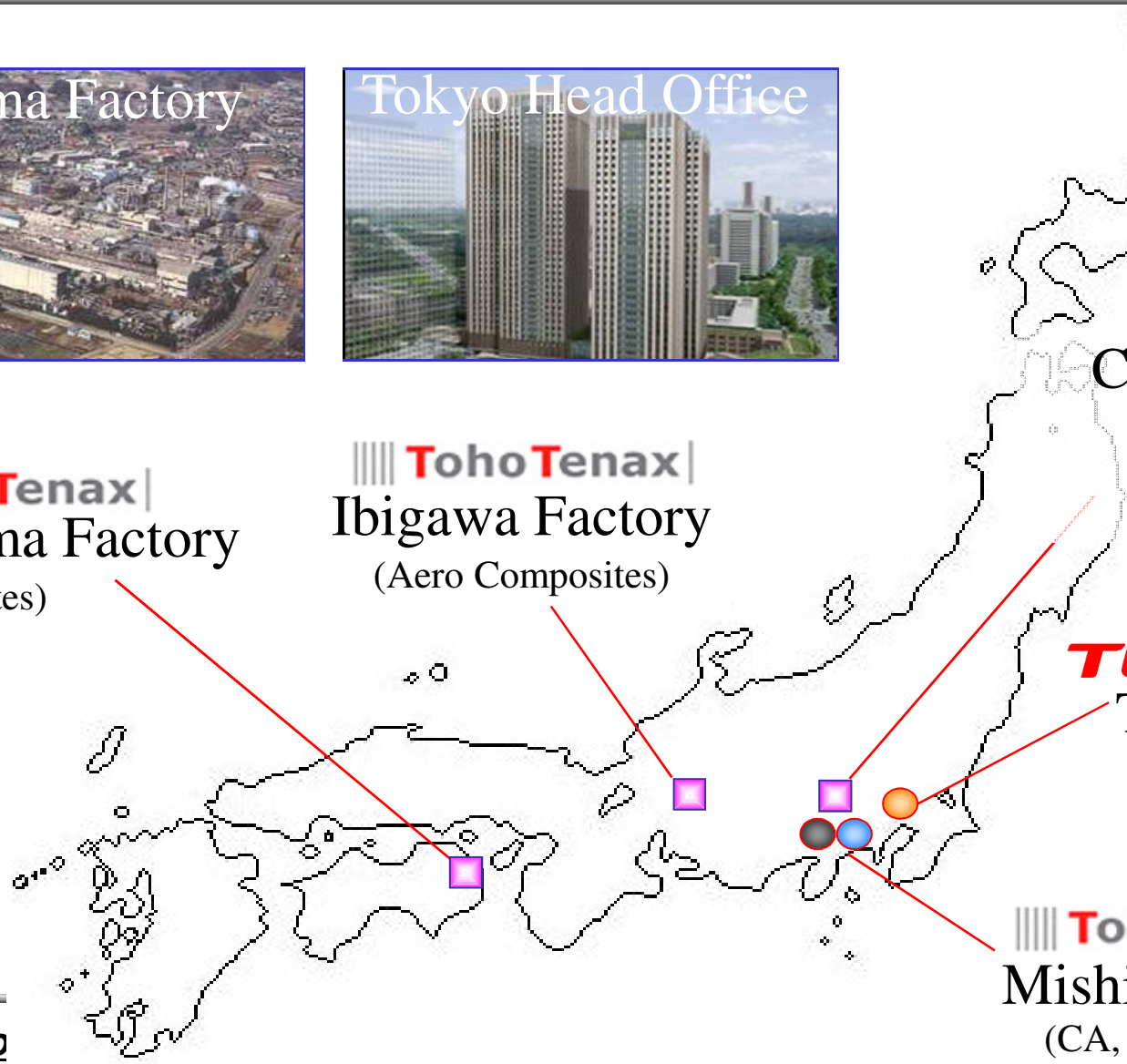
**TohoTenax**  
**Tokushima Factory**  
 (Composites)

**TohoTenax**  
**Ibigawa Factory**  
 (Aero Composites)

**Composites Innovation Center**  
 (Composites)  
 GH craft

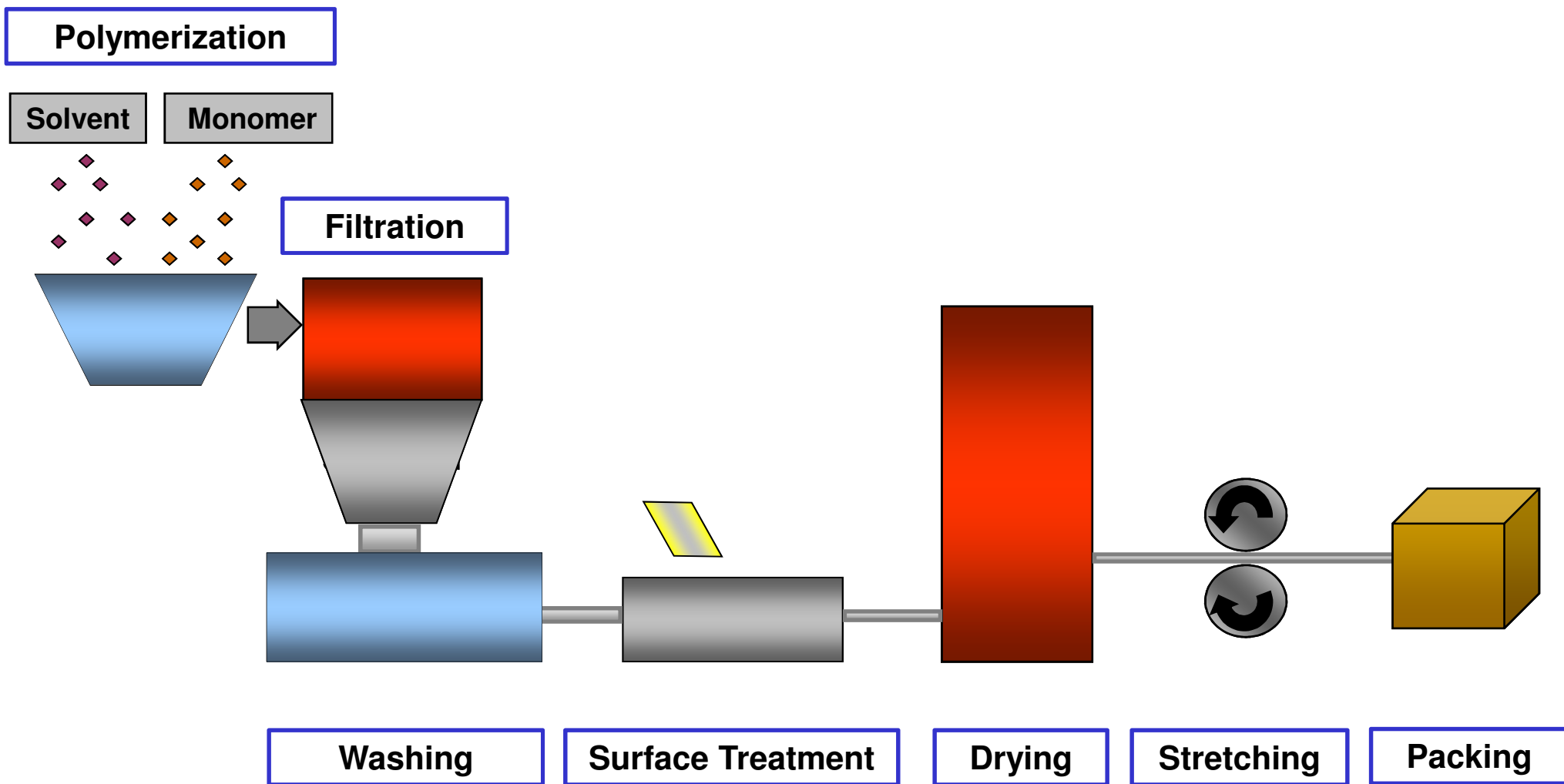
**TEIJIN** **TohoTenax**  
**Tokyo Head Office**

**TohoTenax**  
**Mishima Factory**  
 (CA, CF, Prepreg)

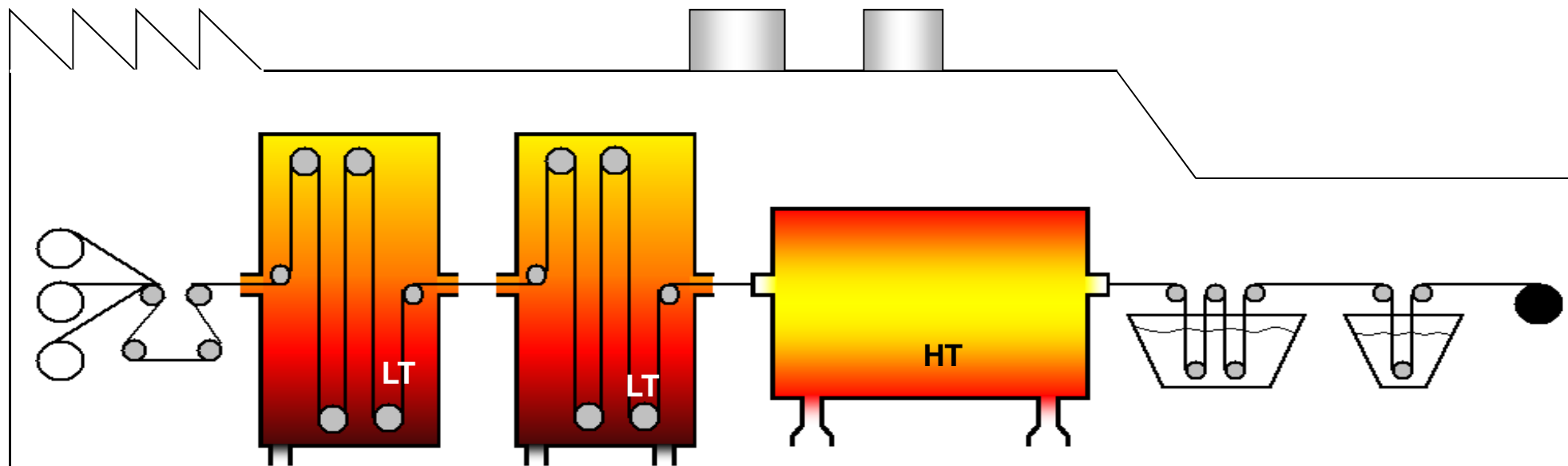




## Precursor (PAN) Production Process



## Carbon Fiber Production Process



Stretching

Oxidation

Carbonization

Surface Treatment

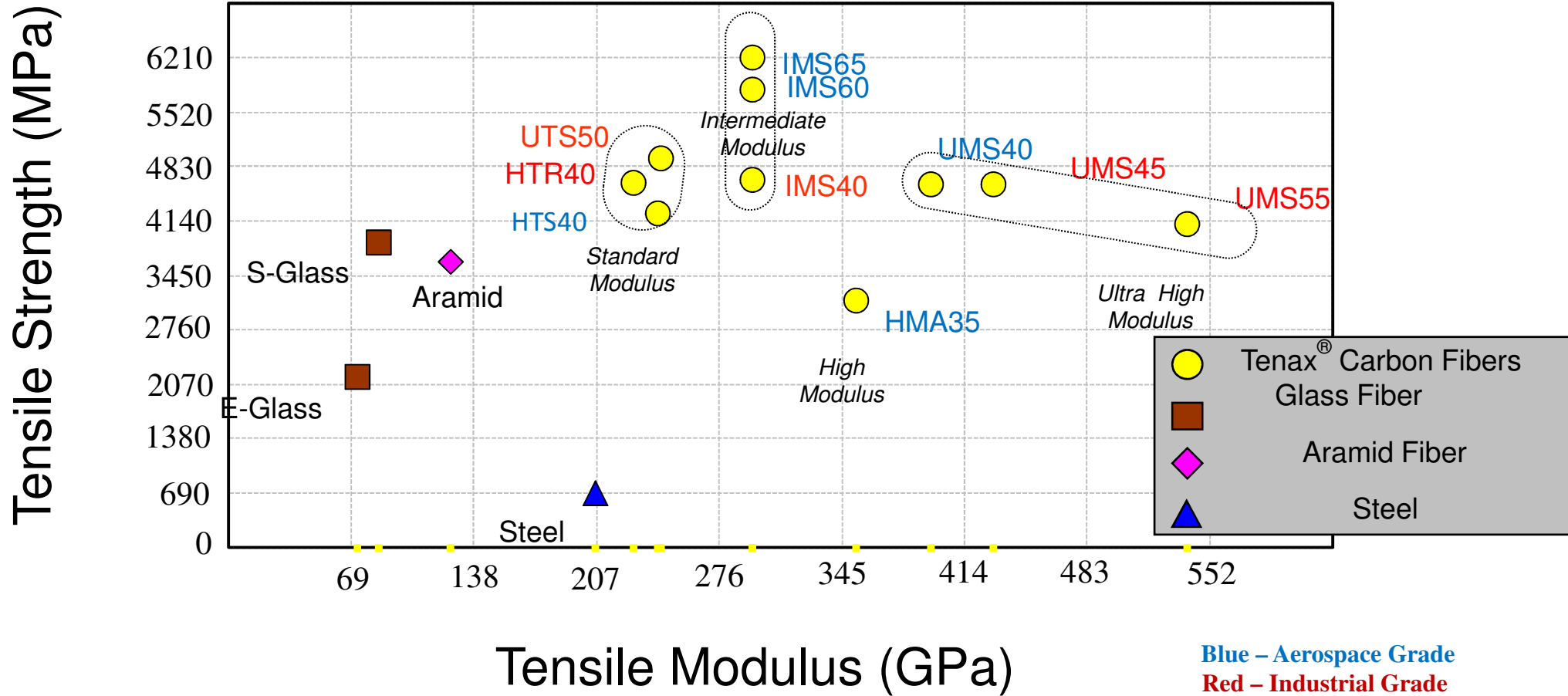
Winding

- Complex chemical plant: nitrogen, energy, toxic exhaust fumes
  - Substantial plant size 200m length, 18m height
  - Three shift, 24 hours production process on 360 day/year
    - 2kgs of PAN for 1kg of carbon fiber

## Tenax carbon fiber production line



## Reinforcement Products




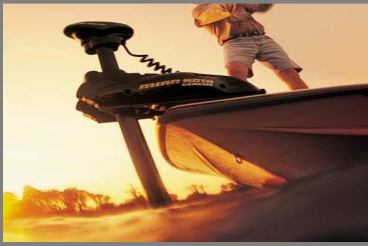
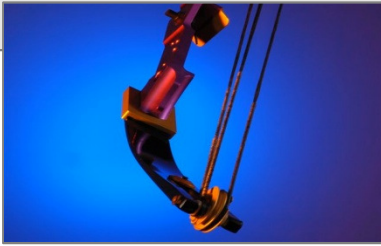






**Diversified Structural Composites, Inc.**  
(DSC) is a wholly owned subsidiary of  
**Toho Tenax America** part of the global  
**Toho Tenax Company, Ltd.**



[www.teijin.co.jp/english](http://www.teijin.co.jp/english)  
[www.tohotenax.com/tenax/en/global](http://www.tohotenax.com/tenax/en/global)  
[www.tohotenax-us.com](http://www.tohotenax-us.com)  
[www.dsc-us.com](http://www.dsc-us.com)

# DSC - Markets / Applications

Construction			
	Building products	Coastal / Corrosion	Highway Products
Recreation			
	Marine	Hunting / Fishing	Hobby
Energy			
	Oil / Gas	Electrical Transmission	Wind

# DSC - Markets / Applications

Transportation



Trucking

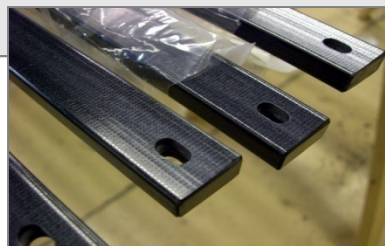


Containers

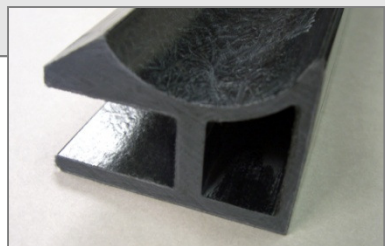


Automotive

OEM



Material Handling



Equipment Components



Medical

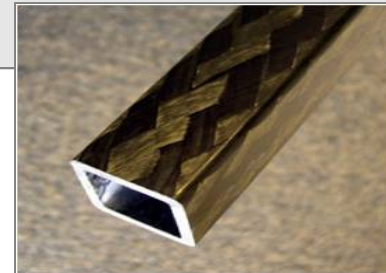
Aerospace



Structural Components



Satellite



Interior Components

## How DSC serves Customers

### What we do :

- DSC develops Pultruded Composite Materials to meet customers application needs and specifications.
- Develops tooling and other machine fixtures to produce products using the Pultrusion process
- Manufactures those products efficiently for a diverse customer base.

**Benefits** - Light weight, Improved Modulus, Conductive Carbon, Non-conductive Glass,

**Materials** - Fibers: Carbon Fiber, Aramid Fiber, Fiberglass, and Resins: Epoxy, Polyester, Vinyl Ester



Fiber Supply



Fiber / Fabric Placement

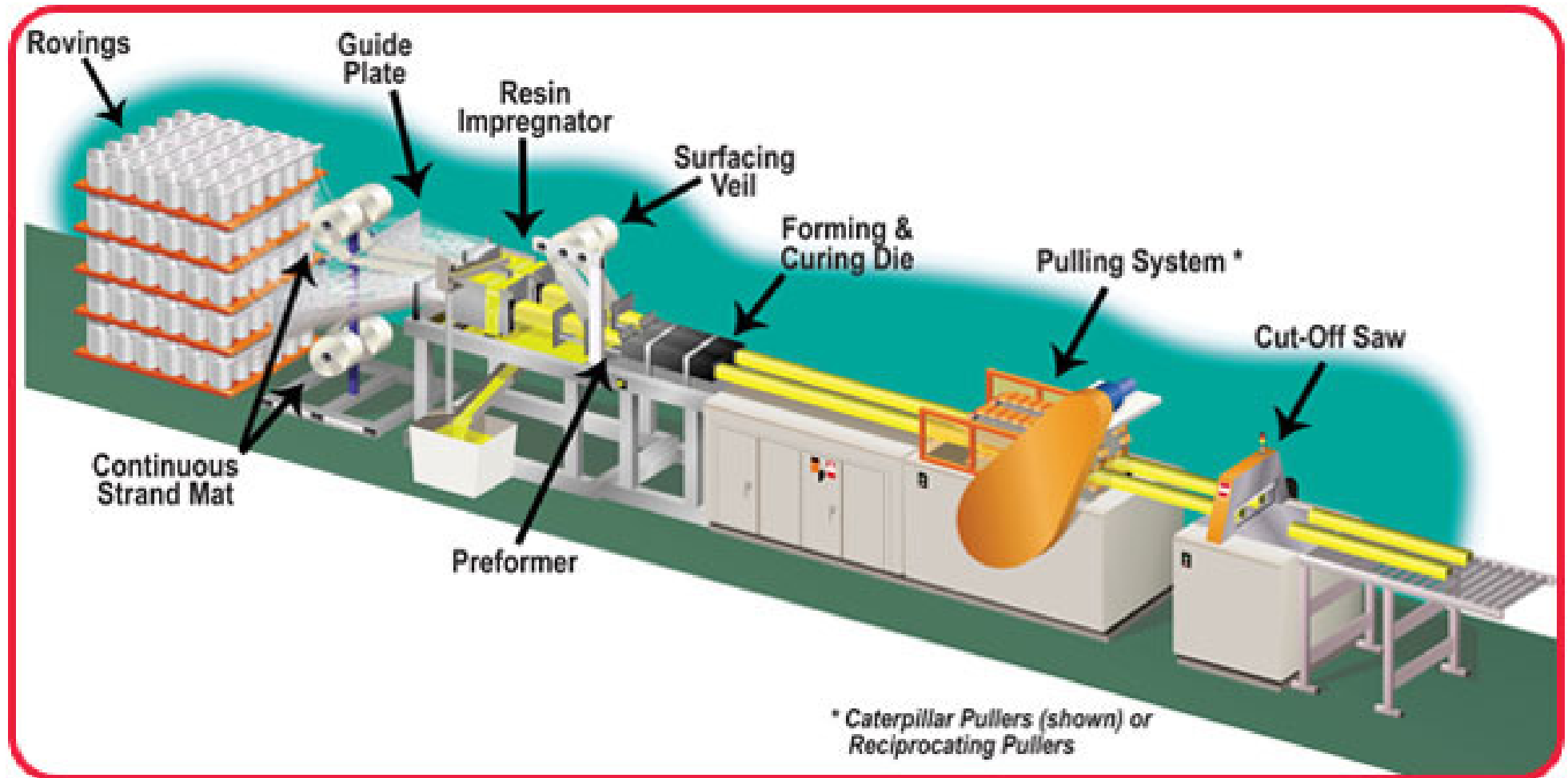


Tooling



# Pultrusion Process

(Cost Competitive Composite Process for Volume Production)



## Pultrusion Process

(Cost Competitive Composite Process for Volume Production)

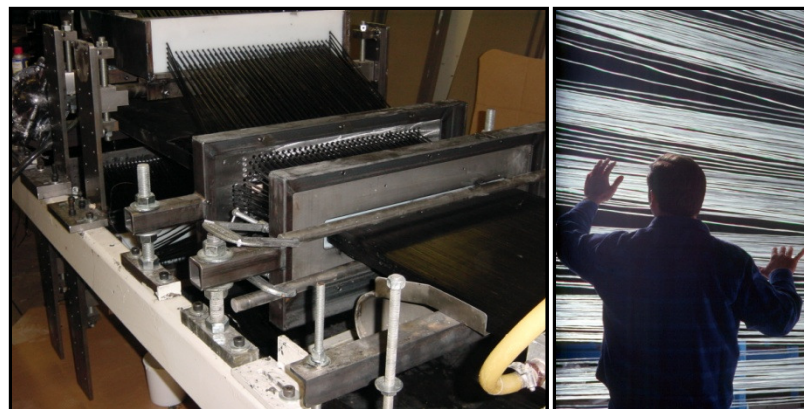
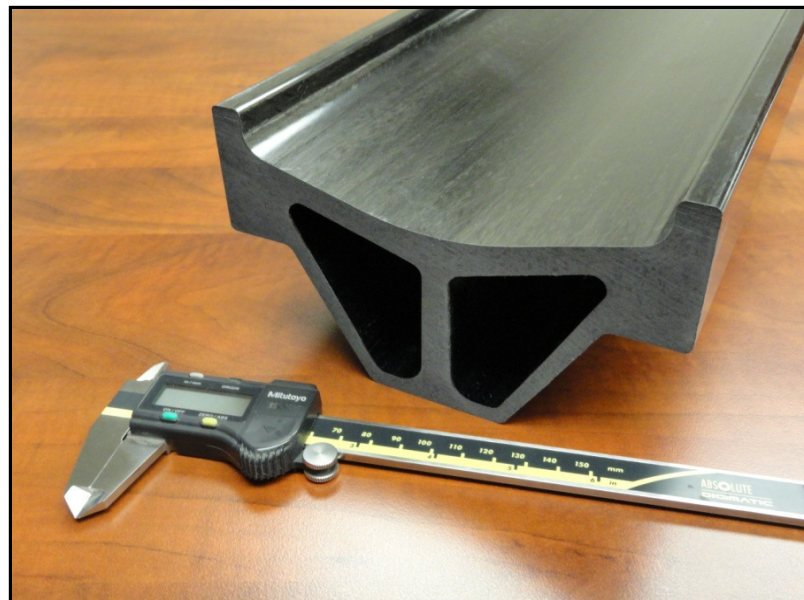
The Pultrusion Process is best suited for continuous large volume production runs. The Pultrusion process allows a smooth continuous flow of materials from efficient rack and creel systems at high rates of cure.

Benefits:

- **Repeatable performance** characteristics of production products.
- **Low tooling and other capital costs** related to production.
- **Excellent fiber placement and alignment** opportunities. (repeatable)
- **Continuous process** with flow speed versus cycle times.
- **Low labor costs**

Negatives:

- Limited to **linear profiles**.
- **Current standards are thermoset** resin systems.



## Pultrusion Process

Pultrusion is the primary process of DSC. Complementary to Pultrusion production DSC performs additional operation to many of the composite profiles we produce. We often provide materials packaged in special ways to fit the end process or special transportation needs. Additionally DSC works with certain customers to provide stocking levels or even consigned materials.

### Examples:

**A** – Detailed machining of Carbon profiles used in a robotic application with clean room requirements.

**B** – Cutting, threading, drilling and part supplies of over 100 SKU components for an OEM application.

**C** – Large profile pultrusions filled, and coated with epoxy surface and aggregate ready for use in highway bridges.

**D** – Coils of Carbon Rod used in a cabling application and the specialized package and coiling designed by DSC for product delivery and use.

**E** – Large coiling device used for containing a 16mm diameter carbon rod 6,000 meters in length. Containment for handling and shipping.

**F** – Machining both ends of a 22 meter long carbon bar.



## DSC's Product Delivery

Diversified Structural Composites has always made **Product Delivery** to our customers an important part of the **Total Service Package**. All materials produced by DSC are unique and require preparation for transport to our customers facilities or to the end use location. We use air, road, container, or combinations to best fit the needs for product. On occasion the transport requirements require special consideration. In some cases special transport is required as parts are larger than traditional transportation allows.



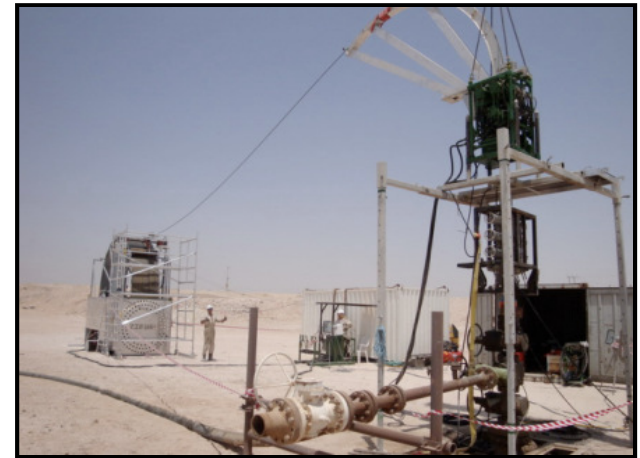
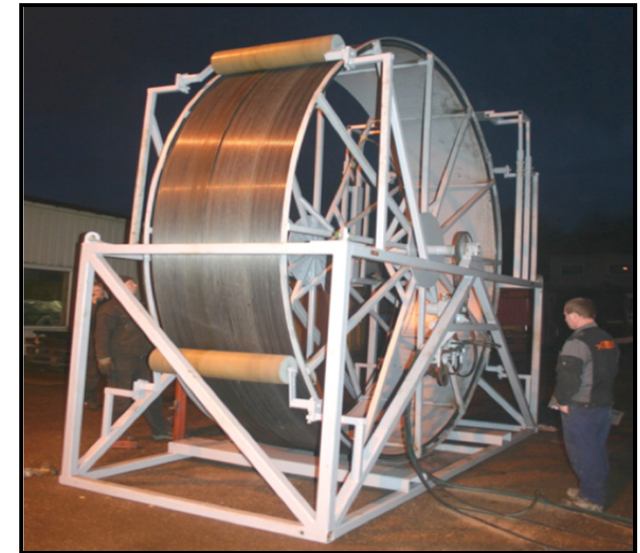
## Product Example

### Oil Well Monitoring Rod

Carbon fiber rod with high temperature epoxy resin to measure the temperature inside the oil wells.

#### Advantages:

- Light weight, High stiffness allows the rod to be pushed up to 10,000ft horizontally inside wells.
- Reduces the cost to maintain the well.
- Allows for improved well out put by mapping conditions along the length of the well for later treatment.



## Other applications

- Umbilicals



## Other Applications

- Platforms (mostly glass fiber)



## Other Applications

- Risers





## Other Applications

- **Spoolable Pipes**



**Thank you!**

**Questions?**