As recently as seven to ten years ago, usage of high pressure reinforced spoolable composite pipe was still in the early adoption stage in North American oil and gas service. Since then, the technology has gained significant acceptance and has displaced a growing portion of steel pipe usage in high pressure applications. These applications include flowlines, gathering lines, produced water lines, water and CO2 injection lines, saltwater disposal lines, and frack water management lines – all of which can be highly corrosive. There are at least five manufacturers of spoolable composite pipe who are active in North America. This paper will identify the value brought by spoolable composite pipe and the various types of technology in the market today. When properly applied and installed, reinforced spoolable composite pipe can provide many years of safe, reliable, and maintenance-free operation.

The Value Proposition
Usually reinforced spoolable pipe is first tried by the user to solve a corrosion problem. Because the pipe is non-metallic, solving corrosion issues is a key benefit. However, once users see how fast and easy the pipe is installed, they often then select the pipe for economic reasons. The benefits of using spoolable composite pipe also include:

- Low installed costs and fast completion of projects.
- Very safe because of small installation crews and less equipment on the Right-of-Way.
- Low environmental footprint, again due to less equipment and activity on the ROW.
- Low ownership costs, Elimination of expensive corrosion inhibitor chemical programs.
- No welding, no x-rays, no cathodic protection.
- Increased cash flow because production comes on quicker.
- Able to handle high pressure and temperatures.
- Light weight, low freight costs, easy to handle in the field.
- Compliant with industry standards
- Proven materials

The Technology
There are usually three materials used in the manufacture of spoolable composite pipe. The inner liner is usually made of High Density Polyethylene (HDPE), a material that is corrosion resistant and has many decades of successful experience in low pressure oil and gas service. But HDPE by itself is pressure and temperature limited. Because of its low friction characteristics, HDPE has a higher flow rate than steel pipe of comparable diameters. For example, often an operator can deploy six inch composite pipe instead of eight inch steel pipe and accomplish flows that can satisfy the project requirements.

The second material employed is used as a reinforcement material that allows the pipe to now handle higher pressures. The liner travels through a series of winders where the reinforcement wrap is applied at very specific angles. Depending on the pipe manufacturer, the reinforcement material could be braided Polyester, or fiberglass strands, or various types of steel bands and cords. Other reinforcement materials could include carbon fibers and Kevlar® aramid fibers, again, depending on the manufacturer. Some manufacturers wind these various fibers in a dry (or unbonded) process and others use an epoxy to bond the fibers. Either approach has its own merits and should be understood prior to making a purchase decision. The third and final pipe material that is utilized is an extruded HDPE (or other plastic) layer that is used as a protective outer jacket to protect the pipe during installation. Pictured here is one manufacturer’s design, SoluForce®RLP, that depicts a pipe cutaway showing the HDPE liner on the right, the Polyester braided reinforcement wrap in the middle, and the extruded HDPE jacket on the left. All of these materials are fully compatible with the chemistry seen in oil and gas production.

Connecting multiple reels of pipe is accomplished by using couplings made of coated carbon steel, stainless steel, and now a totally non-metallic electrofusion coupling has been developed. Pipe terminations are done by installing weldneck or flange fittings, again made of a variety of corrosion-resistant materials. Steel risers can be welded directly to the weldneck fitting if the user wishes to bring steel pipe to the surface. All these fittings are typically installed in the field and most manufacturers provide field service training for the users chosen contractor. The fittings design varies from manufacturer to manufacturer but some utilize a fitting installation process that is pressed in to and then crimped on to the pipe – very similar to a hydraulic hose type of connection.

Landowners appreciate the low impact that spoolable pipe installation has on their land. The real payoff is when the operator gets long lengths of pipe in the ground safely, quickly, and cost-effectively. Note the lack of people and equipment normally seen in steel pipe projects. Spoolable pipe requires smaller crews and fewer pieces of equipment.
The pipe is fully tested at the plant prior to shipment. Typically a section of pipe is pressured to a burst point that is several times higher than its rated design. The ratings are developed by following stringent industry standards that require extensive long-term testing at high pressure and high temperatures. Other tests include cyclic performance where continuous and constant pressure amplitudes are exerted on the pipe. Axial and circumferential strengths are developed through design and testing of various reinforcement materials and various winding angles of the reinforcement material. Long lengths of pipe are shipped on reels that are then deployed in a variety of installation methods including open trench, surface lines, and plowing. Diameters available range from two inch through eight inch and pressure ratings can be more than 2000psi. A variety of other fittings and accessories are available including T’s and Y’s, threaded terminations, tracer wire, etc. Because of its flexibility, elbows are usually unnecessary. Because of the durability of the outer jacket, padding the trench is usually not necessary. Spoolable pipe can be pigged and hot-oiled if warranted. However, this is usually unnecessary due to the smooth HDPE inner wall.

High pressure reinforced spoolable composite pipe should be considered when pressures and temperatures exceed the limits of other low pressure pipe materials. If the project utilizes diameters in the two through eight inch range then it should be considered as a good alternative to steel pipe. Once the project hydrotest is successfully completed, the operator can be assured of safe and reliable operation throughout the project’s design lifetime.

Authors Note: Thank you to SoluForce® RLP for the use of their photos. For more information, the writer can be contacted at steve.swanstrom@pipelife-jetstream.com or by visiting www.soluforce-rlp.com