

## Consortia Worldwide Impact

Concepts NREC has conducted over 25 different multi-company-sponsored programs over four decades with 300 sponsorships. Most of these programs were created by Concepts NREC responding to a perceived need in the turbomachinery field; frequently, these needs were actually brought to us by future clients in response to industry challenges. In every case, Consortia participants received exclusive access to program results, giving them a substantial advantage over the rest of the industry. Some of the milestone activities include:

1. Greatly facilitated the wide introduction of LSA diffusers as a common industrial choice, including patented technology
2. Established preferred pinch schedules for low Ns industrial stages to avoid rotating stall, and hence, mal-performance in the commercial oil fields - guidelines in use today (This project was brought to us by Exxon Corporation due to a perceived risk challenging the entire industry.)
3. Evaluated pump performance with tight inlet bends (distortion) and set industrial guidelines
4. Validated thrust modeling by conducting various examinations of rotors with direct thrust measurement
5. Thoroughly examined and developed means for dealing with scale effects when reducing compressor diameter to sizes that fall within the boundary layer transition regimes (where direct scaling fails)
6. Carefully examined the effects of turbocharger inertia on I.C. engine transient lag
7. Carefully mapped out best design practices for annular diffusers and hoods, which has now been applied to decades of industrial design (see Chapter 10, Axial and Radial Turbines, Moustapha et al., 2003)
8. Developed the world's only systematic, data-driven design system for industrial barrel compressor and pump return channel configurations, also widely used in design today
9. Developed a series of large scale centrifugal compressors for industrial usage (NREC former work), of which many stages are still in profitable production at this time
10. Developed and taught to sponsors the largest comparative centrifugal compressor diffuser design technology base covering the widest range of diffuser types
11. Discovered the diffuser inlet flow field distortion that results from impeller secondary flow and the lack of periodicity (patents pending)
12. Invented the flow-wise grooved cover for high-performance compressor and pump impeller and diffuser close-coupled flow guidance with enhanced performance; (large patent family ensuing, solely for sponsors usage)

These examples serve to illustrate the considerable impact that the Concepts NREC Consortia programs have had on worldwide turbomachinery performance. By close interaction with clients around the globe, Concepts NREC is able to continuously bring valuable design guidance to companies everywhere for truly advanced machines. Concepts NREC enjoys the use of very unique facilities that support our cutting edge work in high-speed turbomachinery. Our eight test bays make use of state-of-the-art equipment, including laser velocimetry, high-speed telemetry, magnetic bearings for dynamic force measurements, and many other capabilities.