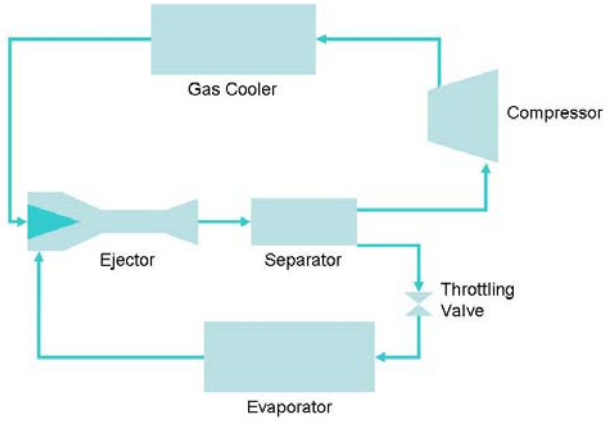
Air-Conditioning and Refrigeration Technology Institute

# Project Summary

## Two-Phase Ejector Expansion Device

Research studies on carbon dioxide ($CO_2$) refrigeration systems have increased in recent years because $CO_2$ is being advocated as a more environmentally friendly "natural" refrigerant alternative to HCFCs and HFCs in vapor compression systems. However, the low efficiency of the basic $CO_2$ refrigeration cycle compared with its HCFC and HFC counterparts is a major hindrance for the technology to make progress towards widespread practical application. The reduction of thermodynamic losses in the expansion process is a key to improving the overall efficiency of the $CO_2$ refrigeration cycle and may also benefit more traditional R-410A cycles. Using an ejector expansion device instead of a traditional expansion valve to recover the expansion losses is attractive, because it has advantages of simple construction, robust operation, and easy control.




**Schematic of a $CO_2$ system with an ejector expansion device**

This project showed by modeling and experimental verification an ejector expansion device for $CO_2$ can improve COP and cooling capacity by up to 38% and 41%, respectively. Similarly, modeling indicated that an ejector expansion device could increase both COP and cooling capacity by 18%. These results can be used by the industry and others to decide whether it is beneficial to further develop ejector expansion devices for use in $CO_2$ cycles and/or R-410A vapor compression cycles.

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