Exhaust Gas Temperature Reduction Utilizing Cooling Fan Discharge

Overview
In response to recent Tier 4 emissions standards employed by the EPA, The John Deere Company has implemented Diesel Particulate Filters, consequently raising exhaust gas temperatures beyond safe operating ranges.

Objectives
The objective of this project is to produce a feasible, low cost solution by exploring possible rerouting of air from the engine cooling fan to induce greater rates of cooling in the exhaust discharge.

Approach
- Weekly teleconference meetings were held with the project sponsor to identify needs and monitor progress.
- After customer needs were identified, multiple concepts were generated and were voted on as a group to identify the most favoured design.
- Relevant patents and products were reviewed and included in all applicable documentation.
- An on-site visit was not feasible; however, weekly meetings were held in lieu of a visit.
- CAD models were generated in SolidWorks to be analyzed in Fluent.
- A prototype was developed as a SolidWorks model, but a physical model was not produced.
- Testing data received from the sponsor was used to confirm ANSYS Fluent models.
- The max pressure on the fan shroud, and the minimum temperature at the outlet of the pipe was extracted from the Fluent analyses.

Outcomes
- We achieved 50% of our temperature target specification by pure mixing alone, assuming an insulated pipe.
- The results demonstrate that the mixing of the fan air discharge into the exhaust flow is a viable element of the solution.
- Further iterations of our proposed design with additional considerations, such as radiation and convection phenomena are recommended for the future.