

A PROTOTYPE SYSTEM TO PREVENT COMBINE FIRES IN SUNFLOWERS

Daniel Humburg, Joe Polin,
Zhengrong Gu, Kevin Dalsted

*South Dakota State University
Brookings, SD 57007*



Funded by the South Dakota Oilseeds Council

Outline...

- ▣ Laboratory Study of Dust Properties Relative to Ignition (Joe Polin)
- ▣ Prototype Concept
- ▣ Prototype Field Experience
- ▣ 2013 Experiments Planned
- ▣ Your input requested

2011 Study Results

- ▣ Sunflower residue ignites at lower temps than other residue
 - Most likely the pith in the stem that forms white “dust” under dry crop stem conditions
- ▣ Producer experience indicates fires are closely linked to engine load
- ▣ Suggests that fires originate with fine dusts at the exhaust manifold and turbocharger and then “distribute”

Ag. Dust Comparison

Mesh #	Particle Size (μm)	Ignition Temp. (Deg. F)	
		Corn Stover	Sunflower
50	710-300	608	554
100	300-150	590	536
230	150-63	590	536
500	63-25	572	500
500 Mesh Samples Volatilization Temp.		482	428
Volatilization Energy		67.85 (J/g)	75.11 (J/g)
Total Combustion Energy		12.48 (kJ/g)	13.77 (kJ/g)

Prototype Concept – Fall 2011

- ▣ Enclose the exhaust manifold, turbocharger, and exhaust pipe
- ▣ Draw air through a filter to remove organic dusts, similar to engine air filter
- ▣ Pump clean air into the enclosure around the exhaust system
- ▣ Provide means to control the exit of air from the enclosure to manage heat transfer

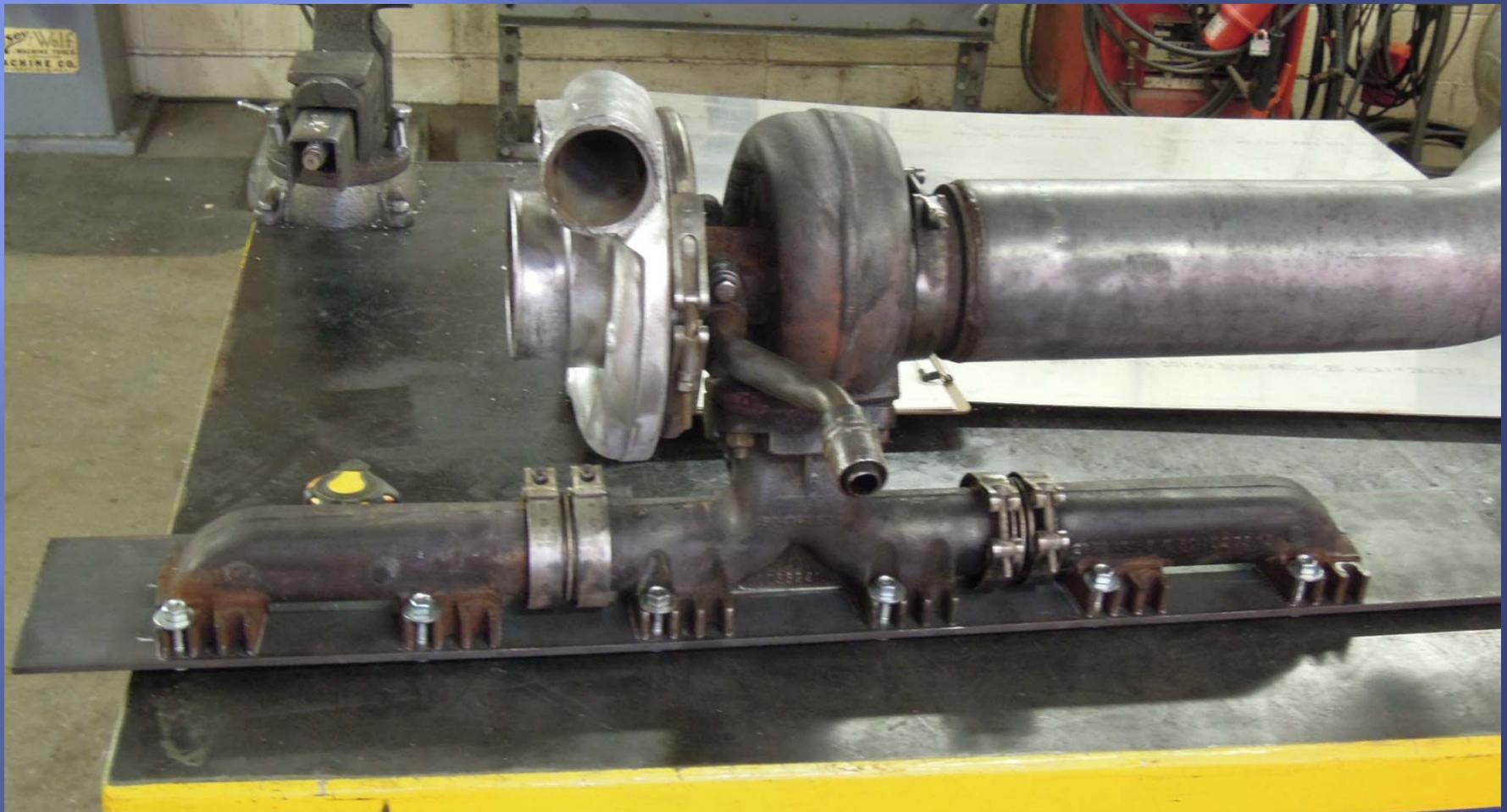
Scott Foth Harvest 2012



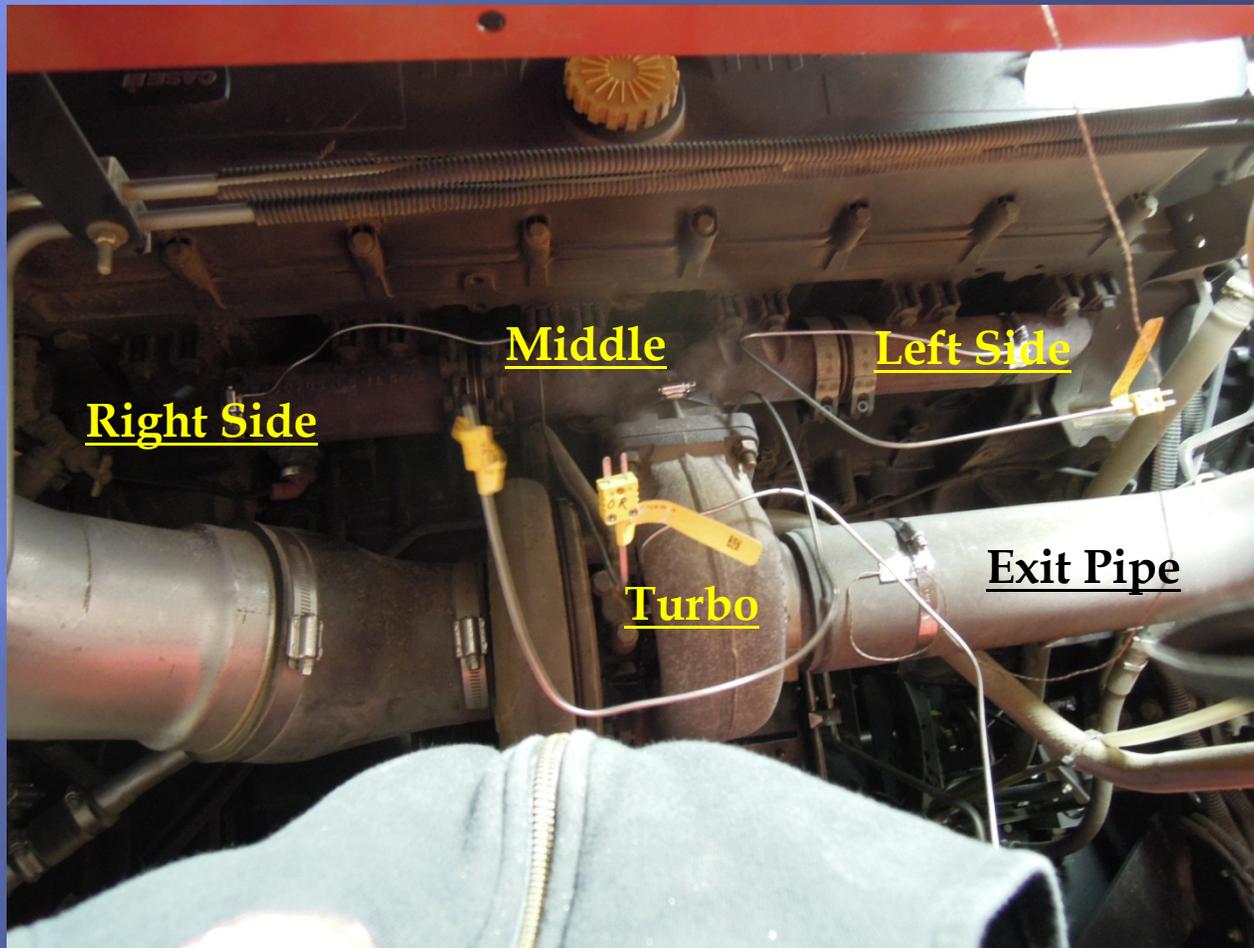
2012 Prototype and Field Test

- ▣ Prototype developed to fit CaseIH 8120
 - Exhaust system salvaged from burned machine
 - Enclosure developed to fit
 - JD engine air filter salvaged for first prototype
 - Crary fan
 - Hydraulic motor drive
- ▣ System installed on a cooperator's 8120 and operated throughout the fall 2012 season
- ▣ Thanks... Scott Foth, Onida, SD.

Exhaust System Pattern for Prototype Enclosure



Direct View from Above



1:30 AM Installation



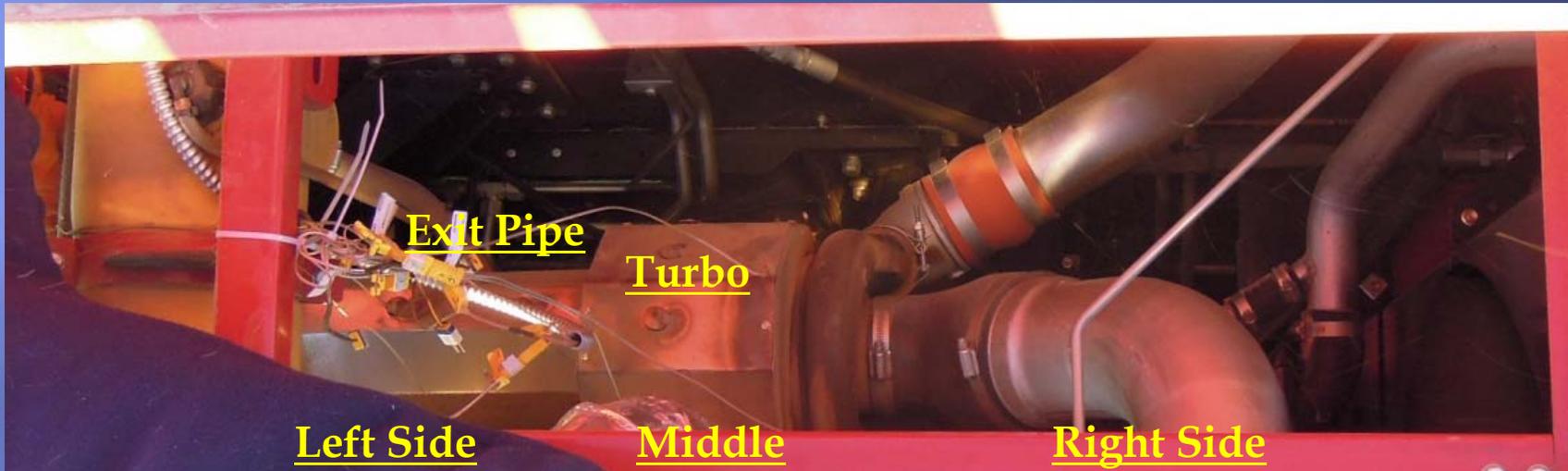
Filter & Blower



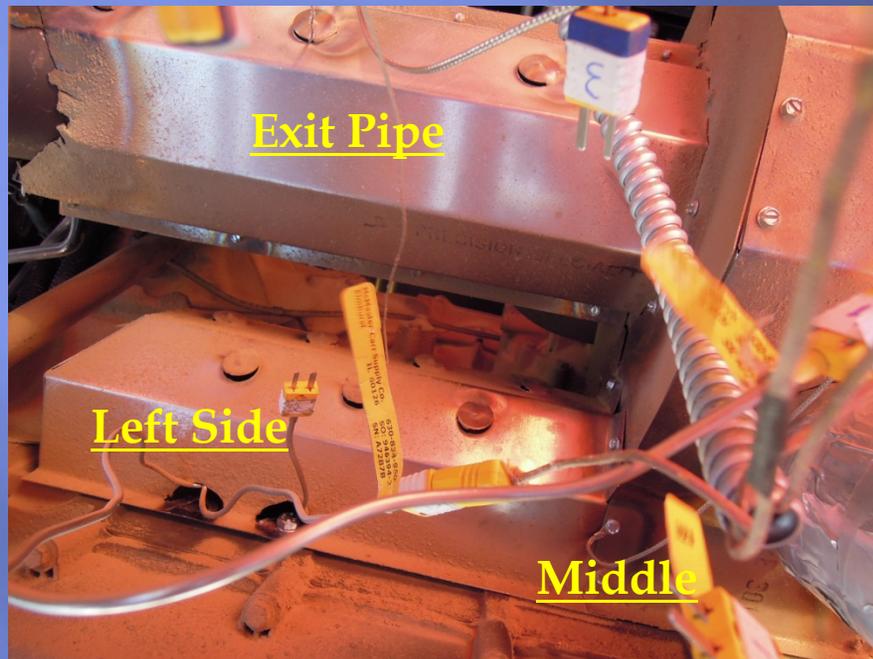
Blower Connection



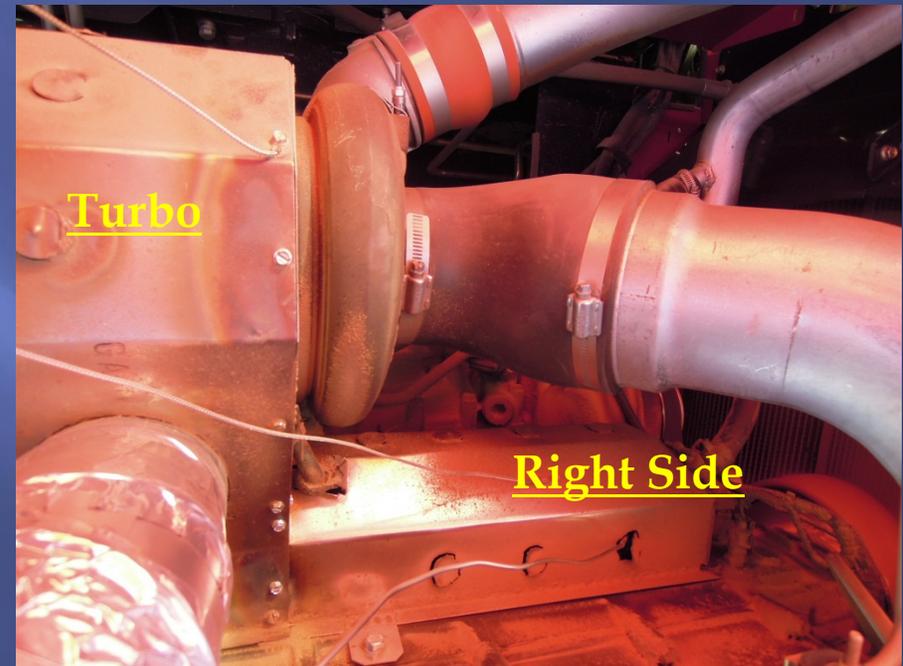
Prototype Shield



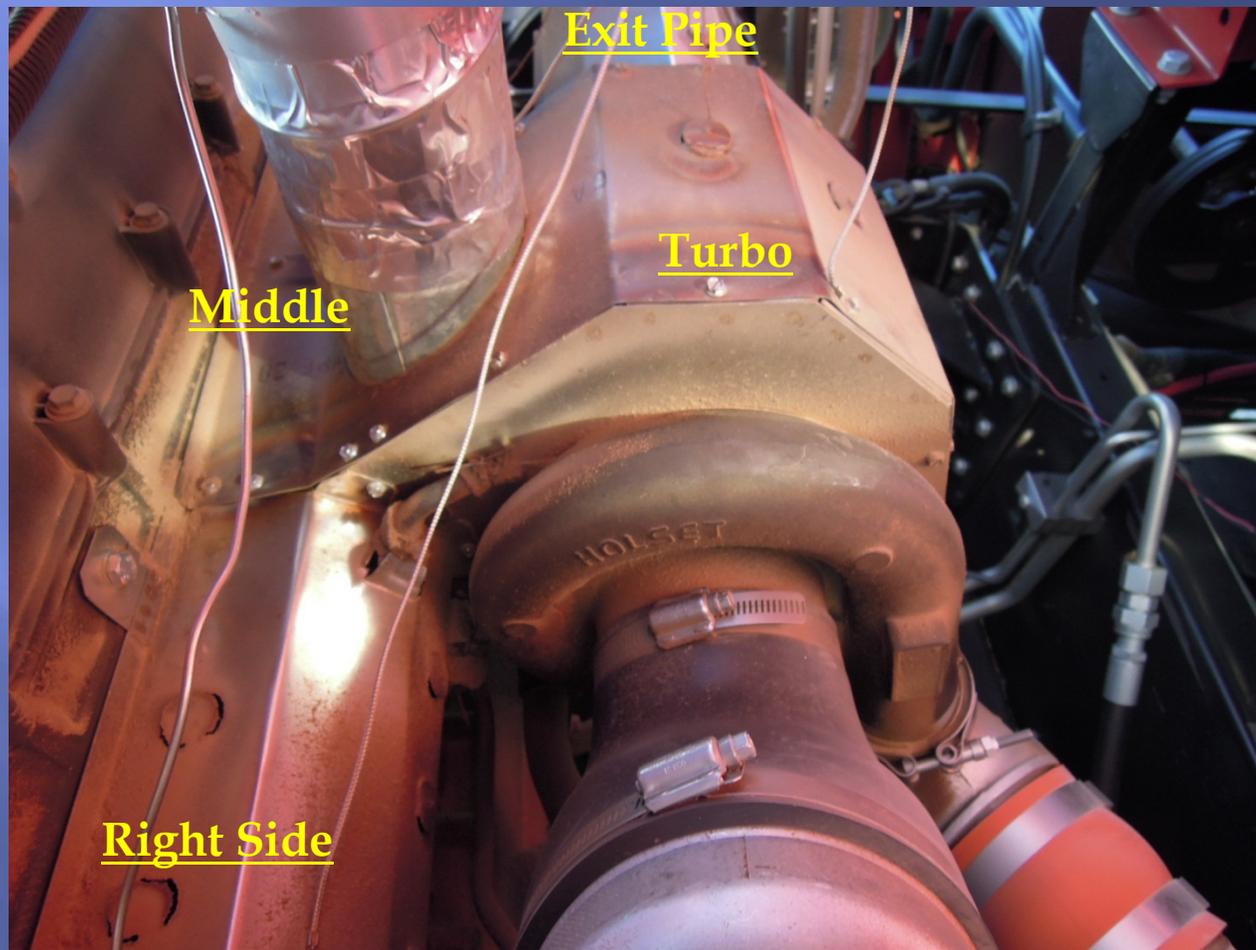
Left Side



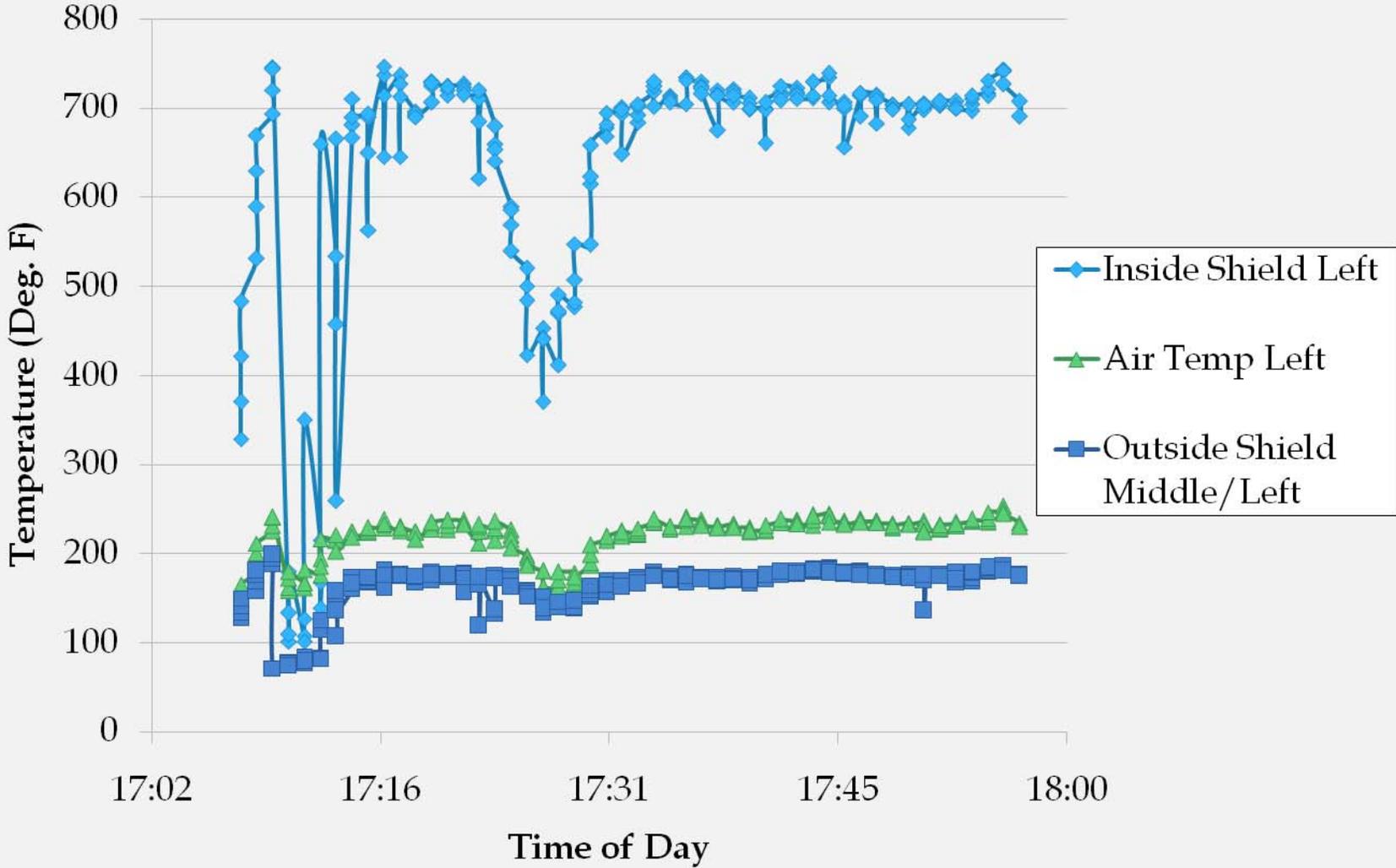
Right Side



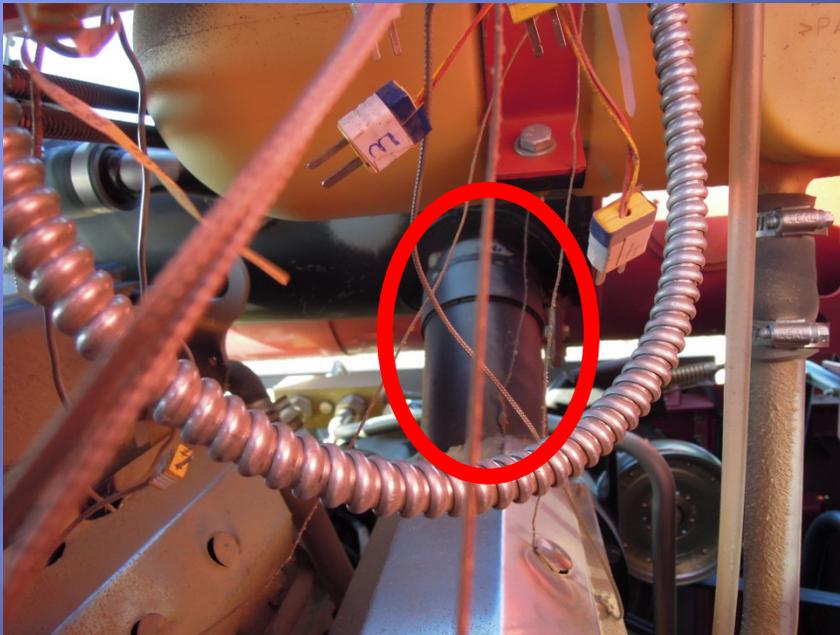
View from Right Side



2nd Field - Left Side of Prototype



Exposed Muffler Pipe Location



Producer's Experience

- ▣ No fires on this machine throughout the season
- ▣ Able to load the machine as the crop allowed
- ▣ Reached a point where fire was no longer a worry for this operator
- ▣ Similar system on 2nd 8120 machine
 - Taken out of service for hydr motor seal repair
 - 3 fires in 3 days

Next Steps

- ▣ Develop additional systems to test on 3 or more additional models in Fall 2013
- ▣ SDSU pursuing patent of the system to allow for commercialization if possible
- ▣ Graduate student is working on optimizing the design to allow smallest fan and filter possible
- ▣ Challenge to fit enclosures to multiple brands and frequently changing engine environments

Value to Producers

- ▣ Possible reduction in insurance premiums
 - How much are they now?
- ▣ Move from 65% of available engine power to 95%? How much harvest capacity is gained?
- ▣ Peace of mind during harvest? How much stress involved in monitoring current machines for fire?
- ▣ Could expand Sunflower acreage if producers do not have to worry about loss of machines to fire during harvest.

Value to Producers

- ▣ The system should also reduce fires in soybean harvest (2011 experience in SD,IA)
- ▣ Sunflower combine sales may not motivate JD and CaseIH to incorporate this into their designs. Soybeans could.
- ▣ The insurance underwriters could motivate its incorporation into basic combine designs
- ▣ Please complete the short survey provided



South Dakota
Oilseeds Council

Questions?

