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Sales and Marketing Team

Sustainability in Fire Apparatus

- Sustainability Fleet Technology Conference and Expo 2022
- Electric Vehicles (EVs) in Auto Industry, Fleets, and Fire Service
- Charging Technology
- Alternative Fuels
- Telematics
- Idle Reduction Systems
- Conclusions and Takeaways

Sustainability Fleet Technology Conference and Expo 2022

- Durham, NC displayed their new Sutphen (Engine 1) highlighting Harrison Hydragen's hPower idle reduction system
- Conference provided insight into how:
  - Major auto OEMs are addressing the push towards sustainable options
  - Companies are leveraging technology to capitalize on a market with huge growth potential
  - Fleet managers are planning to adopt and implement green technologies now and in the future

Electric Vehicles (EVs) in Auto Industry, Fleets, and Fire Service

- Two biggest hurdles EVs face:
  - 1) Infrastructure for Charging
  - 2) Range Anxiety
- Automotive OEMs – changing portfolios and strategy to offer EV options for all models
- Over $500 billion currently committed to battery technology investment globally over next 10 years
- More cities and municipalities are stepping into the EV/PHEV space for their fleet vehicles including fire apparatus

Charging Technology

- Level 1 (120V) – primarily for plug-in hybrid electric vehicles (PHEVs)
  - Uses household outlets
  - Charging speeds of 3-5 miles per hour
- Level 2 (208-240V)
  - Charging speeds of 12 to 80 miles per hour
- Level 3 (400-900V) – “DC Fast Charging”/”Supercharging”
  - Charging speeds of 3 to 20 miles per **minute**
  - Chargers cost tens of thousands of dollars (not including infrastructure)
  - This level is required for fire apparatus due to duty cycles and battery size

Charging Technology

- Infrastructure
  - Huge push to install charging stations strategically with plans for broader expansion
  - Subsidized by auto OEMs and all levels of government
  - Unanimous hurdle here is nightmarish permitting process that is complex and varies from state to state which also slows progress
- Depots
  - Engineering and designing for future technological advances
  - Makes sense for a lot of fleet vehicles, but doesn’t work for fire trucks

Alternative Fuels

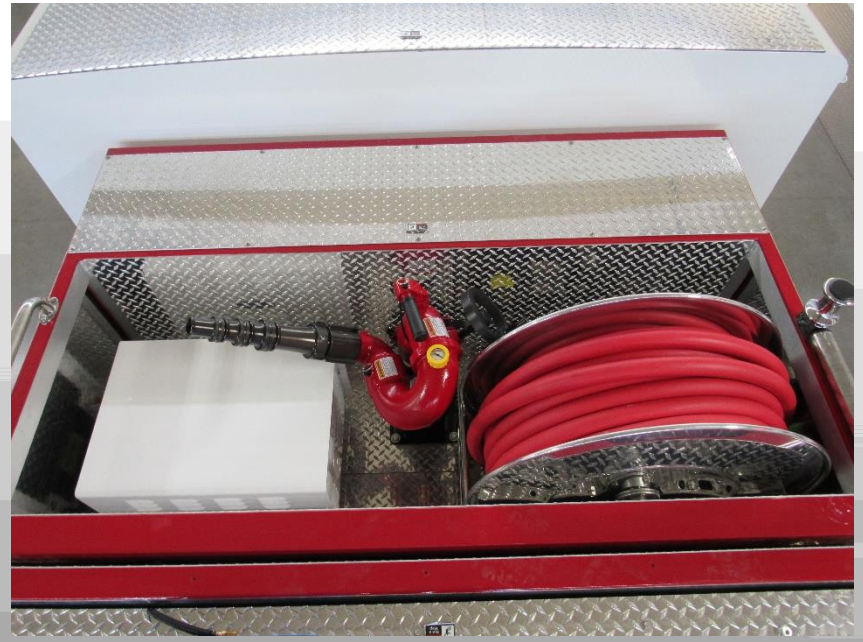
- Unanimous agreement – Future is a mix of fuels
- Pairing right fuel with the right application
- Biodiesels, liquified natural gas (LNG), compressed natural gas (CNG), propane, and hydrogen
- Budgets drive fleet managers decision making
- Planning and keeping the fleet current
  - Replacing pre-2009 diesel trucks with new diesel units with aftertreatment results in lower emissions at minimal additional cost
- Minimizing changes to customer experience compared to standard diesel is paramount

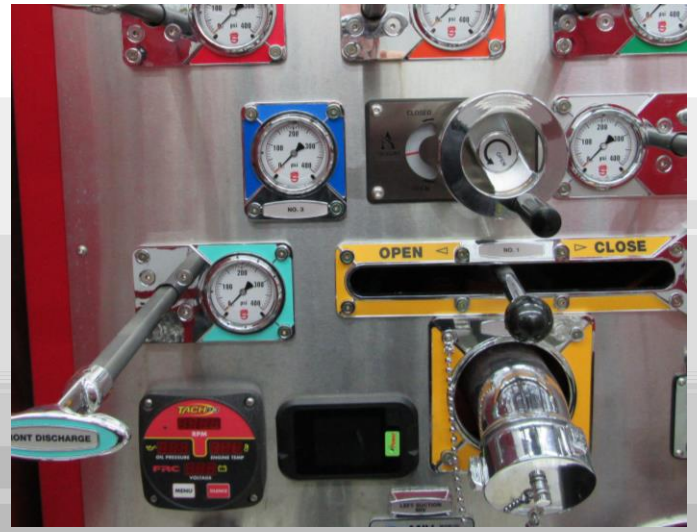
Telematics

- What is telematics?
  - A method of monitoring cars, trucks, equipment and other assets by using GPS technology and on-board diagnostics (OBD)
- The integration of telematics along with data analytics, machine learning, and artificial intelligence (AI) is driving change within fleets
- Relaxing some range anxiety fears
- Batteries are lasting longer than originally projected
- Forecasting and ROI calculations are getting more accurate
- Fleet managers starting to hire Data Analysts to their staff and implement these technologies in all the vehicles they purchase

Idle Reduction Systems

- Harrison Hydragen hPower
  - Installed on Durham, NC pumpers (HS-6849-55)





Idle Reduction Systems

- Harrison hPower
  - Offer 275 and 425 amp-hour DC battery systems (custom sizes as well)
  - DC only: DC system runs all mandatory lighting and other essential loads off the batteries while truck is turned off
  - DC plus AC (inverter): Same as DC only, but adds inverter to supply small amounts of AC power while truck is turned off
  - Lithium-Ion batteries (highest power density and maintain charge better than lead acid truck batteries)
  - The more load tied to the system, the faster the battery power is lost
  - Integrating HVAC into the system usually requires much large battery banks

Idle Reduction Systems

- Kussmaul Xantrex Solar System
- Installed on HS-6938 Clinton Twp, OH built at East
- Covered in detail during 2021 Virtual Dealer Meeting
- Components:
  - -120V SHORELINE INLET, KUSSMAUL SUPER AUTO EJECT-20 AMP
  - -BATTERY CHARGER, KUSSMAUL, CHIEF CHARGER WITH REMOTE CONTROL PANEL- 60 AMP
  - -BATTERIES, XANTREX, LITHIUM ION, 310 Ah (2)
  - -ALTERNATOR, C.E. NIEHOFF, 415 AMP W/ 3RD GEN REGULATOR
  - -SOLAR PANELS, 220W, FLEX (2)
  - -KUSSMAUL INVENTOR, 3000W
    - -INVERTOR TO RUN RV AC WHEN VEHICLE IS SHUT DOWN, MOUNT INVERTOR IN FRONT RAISE ROOF OVERHEAD COMPARTMENT TOWARDS THE DRIVER SIDE.
  - -RV AIR CONDITIONER 15,000 BTU (INVERTOR)

Idle Reduction Systems

- It is critical to understand loading on the alternator and 12V system
  - Engineering must be involved to perform amp draw calculations
- **Some** room for customization with these systems
- It is important customers have the discussion and determine how they want it to function to create valuable impact
- Alignment between Fire Department, System Supplier, and Sutphen Engineering to ensure a positive result

Idle Reduction Systems

- Anecdotal evidence suggests that if operators have a work around to idle the truck, this is the action they will take
- Fleet managers are utilizing telematics and “carrot and stick” policies to create gamification to prevent this so the technology get used
- Technology is rapidly changing how these systems are integrated with the trucks to provide comprehensive solutions
  - Data outputs to help secure funding and drive future decision making

Conclusions and Takeaways

- PHEVs will continue to make their way into the fire apparatus market
- Fleet managers can and plan to spend more effectively elsewhere to maximize fleets impact on green initiatives
  - PHE fire trucks cost 2-3 times more than conventional diesels
  - Charging infrastructure costs need to be accounted for as well
- Idle reduction systems help bridge the gap for our market
  - Systems need to be user friendly and designed to prevent operators from having “work arounds” to see the environmental and financial pay off
- Sutphen will continue to monitor technology in this space and adapt to changing customer demand.