Bus Fires
“Stop Them Before They Start”
Overview

• Every thermal event and fire is, in some way, unique and different from any other.
• There are a number of components necessary to complete an investigation or analysis of any one case.
• The scientific method however, should be applied on every case.
• You, the fleet maintenance director; maintenance manager can, along with industry and government participates can stop these before they start.
Information Sources (technical)
Standard Development - Organizations (SDO’s) such as:

~ SAE
~ ASTM
~ IEEE
~ ISO
~ ASME
~ NFPA

Government Agencies

~ NTSB
~ Fire Marshals
~ State Police / HP
~ FED & State DOTs
~ TRB
~ National Bureau of Standards
Industry Organization & Publications

~ NFPA ~ ANSI ~ Metro Magazine
~ ASTM ~ Mil Standards ~ CTAA
~ SAE ~ UL Publications

Associations (interest groups)

~ TMC ~ UMA
~ NSTA ~ APTA
~ ABA ~ State Fleet Associations.
The Internet

Where many of today’s worldwide bus fires are shown in vivid color.
Initial Review

The First Question always is - “what caused the fire”? The answer is;

Come back later and we might have the answer as we start to;

- Plan the investigation
- Sift through the ashes
- Document the process
- Collect and Preserve Physical Evidence
- Protect the assets (restrict access)
- Protect the scene
- Send samples to labs
- Review vehicle records
- Start the scientific method

Facts are, bus fires are seldom completed quickly by investigators
Bus fires are not a new phenomenon;

- William Fageol and his brother Frank were concerned with fire potential on their gasoline electric buses of the 1920’s.

- Charles Kettering was concerned about the addition of tetraethyl lead to gasoline used in buses.

- Many people today agree that “Exothermic Heat” over the rear axles and in the engine compartments of buses, raises the concern over thermal events and fires.

- We have found that their concerns are valid.
A Bad Mixture -- The under hood fuel load

Or

Amount of fuel present, usually within a compartment such as an engine bay, and near an ignition source.

Fuel Load Products

- Gasoline
- Diesel
- Brake Fluid
- Power Steering Fluid
- Engine Oil
- Gear Oil
- Auto Transmission Fluids
- Ethylene Glycol
- Propylene Glycol
- Methanol
Common Plastics

- Acrylic Fibers = Floor Covering
- ABS = Body Panels
- Fiberglass (Poly resin) = IP Structures
- Polycarbonate = Wiring Insulation
- Polyethylene = Trim, HVAC Unit Structure
- Nylons = Resonator, Air Ducts, Battery Cover
- Polypropylene = Insulation, Padding, Trim
- Polystyrene = Seats, Arm Rests, Trim
- Polyurethanes = Wire insulation, Upholstery
- Vinyl (PVC) = Wire insulation, Upholstery
Metal Melting Temperatures

Pot Metal = 562 - 752 degrees F

Magnesium = 1202 degrees F

Aluminum and Alloys = 1220 - 1280 degrees F

Copper = 1981 degrees F

Cast Iron Grey/White = 2460 - 2550 / 1920 - 2010 degrees F
Most buses today incorporate a full menu of electrical current values. Some of these are;

- 12 volt systems
- 12 and 24 V split systems
- AC and DC current
- 100 to 270 amps.
- 600 volts
- Programmable Logic Control System
- Low voltage multiplexed systems
Hazards Include

- Butt connecting of cables
- System overloads
- Poor grounds throughout the systems
- Misunderstood systems and components
- Poor maintenance of systems
- Bundling of cables
- Poor attachments
- Alternator connections (loose or not supported)
Brakes

Wheel well fires on trucks are well documented throughout the ground transportation sector. With buses, since the advent of the low floor bus it appears that the situation is different.

Exothermic heat build up, blocked wheel holes, high ambient and road temperatures as well as physical hardware problems contribute too many thermal events and fires.
Post Ignition Actions -- Fire Suppression Systems

Sometimes we find that the system did not trigger.
This could be for several reasons:
  System is not secure.

System inspection and operating tests have not been completed.

Operator does not understand how to energize system or ignores the audible and visual warnings.

Operator becomes excited and forgets to perform the functions to energize the system.

At times the fire suppression system works correctly and minimizes the collateral damage to the bus and fire scene.
Without question, the preventive maintenance records and operator inspector reports will be reviewed.

It is understood by most professional that service schedules, procedures, and training (or lack of) can play a key role in the lead up to or prevention of, thermal events and fires.
Trends We Have Seen

Lack of a fire training element for operators and maintenance technicians.

Lack of a consistent classis and driveline cleaning process - even though it’s required in Government mandates.

Lack of a detailed inspection form which targets potential thermal and fire areas, some of these include focus on:

- Leaks of fluids
- Grommets missing
- Frayed wiring
- Bad connections
- High temperatures
- Gaskets
Stopping Bus Fires before They Start

If there really are 10,000 unreported bus thermal events or fires that occur every year then, we have at least three real issues.

1. The economic loss in dollars.

2. A need to get Government and Industry to work on solutions.

3. Develop inspection processes that can fit into the overall P.M. service and operator inspection requirements.
Economic Loss

• The insurance, service loss and repair cost are known only to those paying the bills. We need to understand the full cost of these before we as an industry can measure and manage the problem.

• We need to develop a better understanding of the total vehicle loss and impact. Every organization has a different picture of the situation. Some say it’s less than 10,000 some say more fires must be occurring.
With approximately 750,000 buses in service both Government and Industry already have (through regulation, engineering and technologies) sufficient data and information resources to “hold a summit” on bus fires and begin to tackle the problem. We need a centralized database to get all bus thermal and fire events on record. That way we can begin to stop them before the start.
Training and Inspection Processes

If the driver is the first line of defense against accident and injury and the maintenance technicians support their efforts, I feel we need to improve upon their training, inspection and reporting processes.

Presented by

Halsey King