“GIMME WATCHA GOT”

Modern Fire Apparatus and Emerging Technology
Presented by:

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The US Fire Apparatus Fleet

- NFPA estimates 40,000 in-service US fire apparatus were built prior to NFPA 1901 (1991) standard.
  - 10,000 are over 30 years old.
  - 17,000 are 20-29 years old.
  - 13,000 are 15-19 years old.
The US Fire Apparatus Fleet

- Of all US fire apparatus in-service today...
  - 13% are over 30 years old.
  - 21% are 20-29 years old.
  - 19% are 15-19 years old.
- THAT’S 50% OVER 15 YEARS OLD
The US Fire Apparatus Fleet

- 35% of US Fire Depts. Have a formal apparatus replacement program...

- ...BUT 65% DO NOT!
Traditionally.... When Have We Retired/Replaced a Fire Truck?

- When it breaks or crashes?
- When we get some money to buy a new one?
- Maintenance costs skyrocket?
- Engine/pump/aerial craps out?
- When the fast talking salesman shows up?
**BETTER Reasons to Replace Aging Fire Apparatus!**

- Obtain Benefits of Better Technology
- Greatly Improve Firefighter Safety
- Reduce Overall Maintenance Costs and Component Failures
- Increase Reliability
- Reduce Down-time
- Eliminate Parts Availability Issues
Some Safety Statistics…

- Responding/Returning is the 2\textsuperscript{nd} leading cause of FF LODDs
- 15,000 apparatus collisions/year
- 25-30 FF deaths/yr
- 5000 FF injuries/yr
- Cost $7-8 Billion/yr
The Common Sense Solution

- Upgrade substandard equipment.
- Replace old obsolete equipment that can’t be fully upgraded.
- Eliminate dangerous traditional practices.
- Put Safety First and ARRIVE ALIVE!!
Before 2003...

Where Could You Find Fire Apparatus Upgrade & Replacement Guidelines?

Nowhere!
What changed that?

NFPA 1901 (2003) -- “ANNEX D”

- New in the 2003 NFPA 1901 standard.

- Intent:
  - Gain maximum equipment utility.
  - Minimize risk of serious injuries.
  - Encourage fleet modernization.
What Does “Annex D” Cover?

- Minimum requirements for all **first line** fire apparatus.
- Minimum requirements for all **reserve** fire apparatus.
- Definition of **obsolete or unfit** fire apparatus.
NFPA Apparatus Safety Standards

- IAFC has been actively involved since 1912.
- First pumper standard adopted in 1916.
- Regular revisions ever since then.
The Standard Writing Process

• Diverse committee composition.
• Subcommittees by topic or function.
• 5 year revision cycle.
• Ongoing review.
• Public comment.
• Published in writing.
Purpose of the Standards?

- Define state-of-the-art equipment.
- Improve utility.
- Improve durability.
- Ease maintenance.
- Promote safety.
Two Parts of the NFPA Standard

- **“MAIN BODY”** = **“Shall”**
  - Essential & mandatory requirements of the standard.

- **“ANNEX”** = **“Should”**
  - Non-mandatory but important committee recommendations.
Technological Evolution

• Before 1991 revision: “Reactive” Standard
  – New ideas conceived & proven in field first.
  – Usually added to standard years later.

• After 1991 revision: “Pro-active” Standard
  – Embrace new useful emerging technology.
  – Focus on safety and improved capability.
Technological Evolution

- 1991 Apparatus Standard brought

**BIG IMPORTANT CHANGES**

- Pumps & plumbing systems improved
- Cab & body improved
- Chassis improved
- Aerial devices improved
- Firefighter safety improved
Technological Evolution

**Pumps & Plumbing**

- Pump min. cap. 750 gpm.
- Tank min. cap. 500 gal.
- “Slow close” valves.
- Caps tested to 500 psi.
- 30° sweep discharge elbows to prevent kinks.
- Foam systems added.
- Grouping of pump controls.
- Intake relief valve added.
Technological Evolution

• Cab & Body

- Fully enclosed cab.
- Seats / belts for all crew.
- Sirens & horns off roof.
- “Door open” warning.
- Back-up alarm.
- Reduced noise levels.
- Fail-safe door handles.
- Reflective striping added.
- Warning lights improved.
Technological Evolution

• Chassis
  – Automatic transmission.
  – ABS & auxiliary brakes.
  – Increased battery capacity for sure starts.
  – Line voltage electrical systems upgraded.
  – Electrical grounding.
  – New interlocks.
  – Axle & GVW weight standards.
• Aerial Devices
  - 250# min. ladder tip load – 750# for platforms.
  - Controls & breathing air in platform.
  - Water curtain cooling systems.
  - Static load support of 1.5x rated cap.
  - Stabilizer movement alarm & striping.
  - Aerial device movement interlocks.
  - 100% third-party testing required.
Technological Evolution

• **1996 & 1999** revisions brought more technology and improvements.

  – CAFS systems
  – Air systems
  – Quint standards
  – Communications
  – Scene lighting
  – Winches
  – Slip resistance
  – Equipment mounts
  – Air-pack fill stations
  – Load managers
  – Pre-delivery testing
Technological Evolution

- More improvements mandated in 2003 revision.
  - 3rd Party Generator Testing.
  - Standardized Equipment Weight Table in “Annex C”.
  - Inlet relief valve
  - Positive-lock SCBA mounts
  - Ember separator specs
  - Reflective striping on inside of open cab doors
  - Large-capacity pumps
  - Hi-viz red crew seatbelts
The 2009 revision will bring more new technology and improvements.

- Third-party Test Certification
- Vehicle Data Recorders
- Rollover Stability Testing
- Electronic Stability Control
- Tire Pressure Monitor
- Maximum Top Speed Limitation
- New Cert. & Doct. Requirements
- Statement of Exceptions
- Flares, Cones & Vests Required
- AED Required
- Better Walk & Step Lighting
- Seat Belt Warning Panel
- Longer Seatbelt Webbing
- In-Cab Helmet Restraints
Technological Evolution

• More **2009** safety improvements...

  - Reflective Striping on All Doors
  - Cab Structural Integrity Tests
  - Driver Adjustable Mirrors
  - Min. Clearance for Access Ladders
  - Better Handrails & Handholds
  - 50% Rear Reflective Striping
  - Ground Ladder Heat Shielding
  - Winch/Rope Anchor Requirements
  - Intake/Outlet Caps Secured to Truck
  - Aerial – Electronic Envelope Control
  - Aerial – Short-jacking Control
  - Safer Line Voltage Grounding
  - Breathing Air Quality Monitor
  - Winch Free-Spooling Clutch Required
  - Trailer Safety Standards Added
That’s a Pretty Impressive List of Improvements Just Since 1991!
Technological Evolution

So What...

• Only apparatus less than 15 years old (1991 standard or later) should be allowed in **front-line service -- period.**
Technological Evolution

So What...

- Apparatus more than 25 years old should be removed from service - active or reserve!!
Technological Evolution

So What...

• *All* apparatus, *front-line or reserve*, should be upgraded to a minimum equipment level:
  
  - Fully enclosed seating
  - Seat belts for all crew
  - Blocking warning lights
  - Reflective striping
  - Slip resistant walks
  - Non-slip handrails
  - Ground & step lights
  - Horns & sirens off roof
  - Loose gear secured
Technological Evolution

So What...

• *All* apparatus, *front-line or reserve*, should be regularly inspected & serviced for:

  - Engine belts, fuel lines & filters replacement
  - Brakes, brake lines & wheel seals replacement
  - Radial tires & springs service
  - Weight not over axle & GVW ratings
  - Fire pump meets original rating
  - Alternator output meets original rating
  - Water tank & baffles not corroded / distorted
  - All interlocks present & working
  - Radiator checked, coolant hose replacement
  - Generator & line voltage accessories tested
Some Practical Considerations...

- **Sample Upgrade Costs**

  Enclose cab: $20-30K
  New Radiator: $5K
  Jake Brake: $3K
  Telma Retarder: $8K
  New Water Tank: $7-10K
  New Cab/Glider Kit: $100K+
  Aerial Overhaul/Update: $50-125K
<table>
<thead>
<tr>
<th>Upgrade Item</th>
<th>Cost Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Re-painting</td>
<td>$8-12K</td>
</tr>
<tr>
<td>Striping/lettering</td>
<td>$2-4K+</td>
</tr>
<tr>
<td>New alternator</td>
<td>$2-3K</td>
</tr>
<tr>
<td>New tires</td>
<td>$3-4K</td>
</tr>
<tr>
<td>New LED light pkg</td>
<td>$5-8K</td>
</tr>
<tr>
<td>New halogen light pkg</td>
<td>$3-4K</td>
</tr>
</tbody>
</table>
Some Practical Considerations...

- Added New Component Cost

- Foam systems: $8-20K
- CAFS system: $40-50K+
- Hydraulic generator: $18-20K
- Diesel generator: $12K
- Floodlight tower: $5-15K
- Equip. mounting pkg: $5-20K
- Electric cord reel: $2K
Some Practical Considerations...

• **New 1500 GPM Pumper**

  – Average cost in 2007

<table>
<thead>
<tr>
<th>Chassis</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial</td>
<td>$140-175K</td>
<td>$175-225K</td>
<td>$225-350K</td>
</tr>
<tr>
<td>Custom</td>
<td>$225-275K</td>
<td>$275-400K</td>
<td>$400K &amp; up</td>
</tr>
</tbody>
</table>
Modern apparatus provide huge benefits in operating cost, utility, durability, performance, and safety.

Older trucks simply cannot be retrofitted to the same level of capability.

A new truck might just be a better deal all around.
Some Practical Considerations...

- New equipment can also include emerging new technologies...
Emerging Technology

- These advanced technologies are available on new fire apparatus today!
  - Side Air Bags
  - Pretensioning Seatbelts
  - Pretensioning Seats
  - Electronic Stability Control
  - Lateral Acceleration Indicators
  - Electronic Data Recorders
  - Seating Status Indicators
  - Structural Integrity Testing
  - Improved Crashworthiness
Seat & Seatbelt Pretensioners
Pretensioners & Side Airbags
Pretensioners & Side Airbags

RollTek Side Roll Protection

Increased survivable space

Without RollTek

With RollTek
Static Stability Testing
Lateral Acceleration Indicator
Roll Stability Control
Electronic Stability Control
Electronic Stability Control

- Steering angle sensor
- Rotation rate sensor
- Speed sensors on all 4 wheels

UNDERSTEER: ESC applies inside rear brake
OVERSTEER: ESC applies outside front brake
Electronic Stability Control
Event Data Recorders

- Acceleration (MPH/sec)
- Deceleration (MPH/sec)
- Engine speed (RPM)
- Engine throttle position
- ABS event
- Seat occupied status
- Seat belt status
- Master optical warning switch position
- Time
- Date
Seat Status Indicator
Structural Integrity Testing
The Bottom Line

- Many recent changes to the NFPA standard can be linked to a **specific incident** that resulted in damage, injury or death.

- Older, non-compliant fire apparatus place the firefighter and the public at **much greater risk**!
• After the fact...

• ...when the lawyer asks you if the tragedy could have been prevented...

• ...you *don’t* want to testify that safer equipment was not in the budget!
QUESTIONS ?

COMMENTS ?

DISCUSSION ?