

Aspects of Heavy-Duty Truck

PREDICTIVE Maintenance

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Wade&Partners

Practical Predictive Maintenance

The Internet Tells All ... Google Counts:

| | |
|-------------------|---------|
| Unmodified Search | 231,000 |
| Medical | 54,000 |
| Automotive | 9,500 |
| Aviation | 8,000 |
| Diesel | 5,800 |
| HD Truck | 1,200 |

Potential Problems with PPM in the Fleet Environment:

- Equipment Typically Mobile, Multi-Domiciled
- Definition of Failure for Cost Calculations
- Failure is Often Product of Least Component
- Diagnostics Show Condition, Not Cause:
 - Vibration
 - Fluid Status
 - Temperature
 - Flow/Pressure/Rate

Good Existing Possibilities

PRESSURE SWITCH STATUS • **ABS CONTROL STATUS**

PARKING BRAKE STATUS • TRAILER TETHERED STATUS

WHEEL SPEED SENSOR STATUS • **TRAILER WEIGHT**

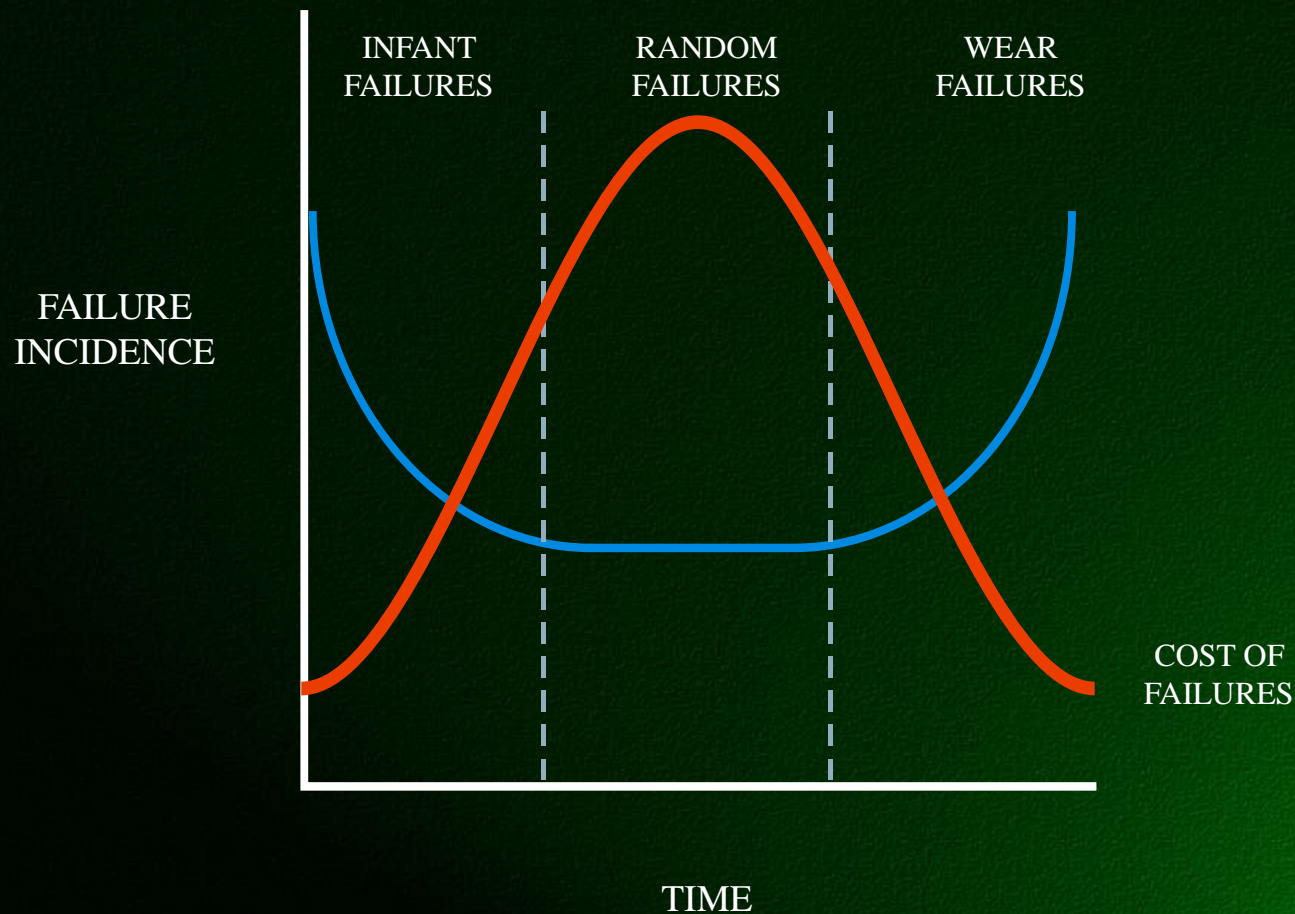
BRAKE APPLICATION PRESSURE • BRAKE SUPPLY PRESSURE

BRAKE LIGHT STATUS • BRAKE CONTROL PRESSURE

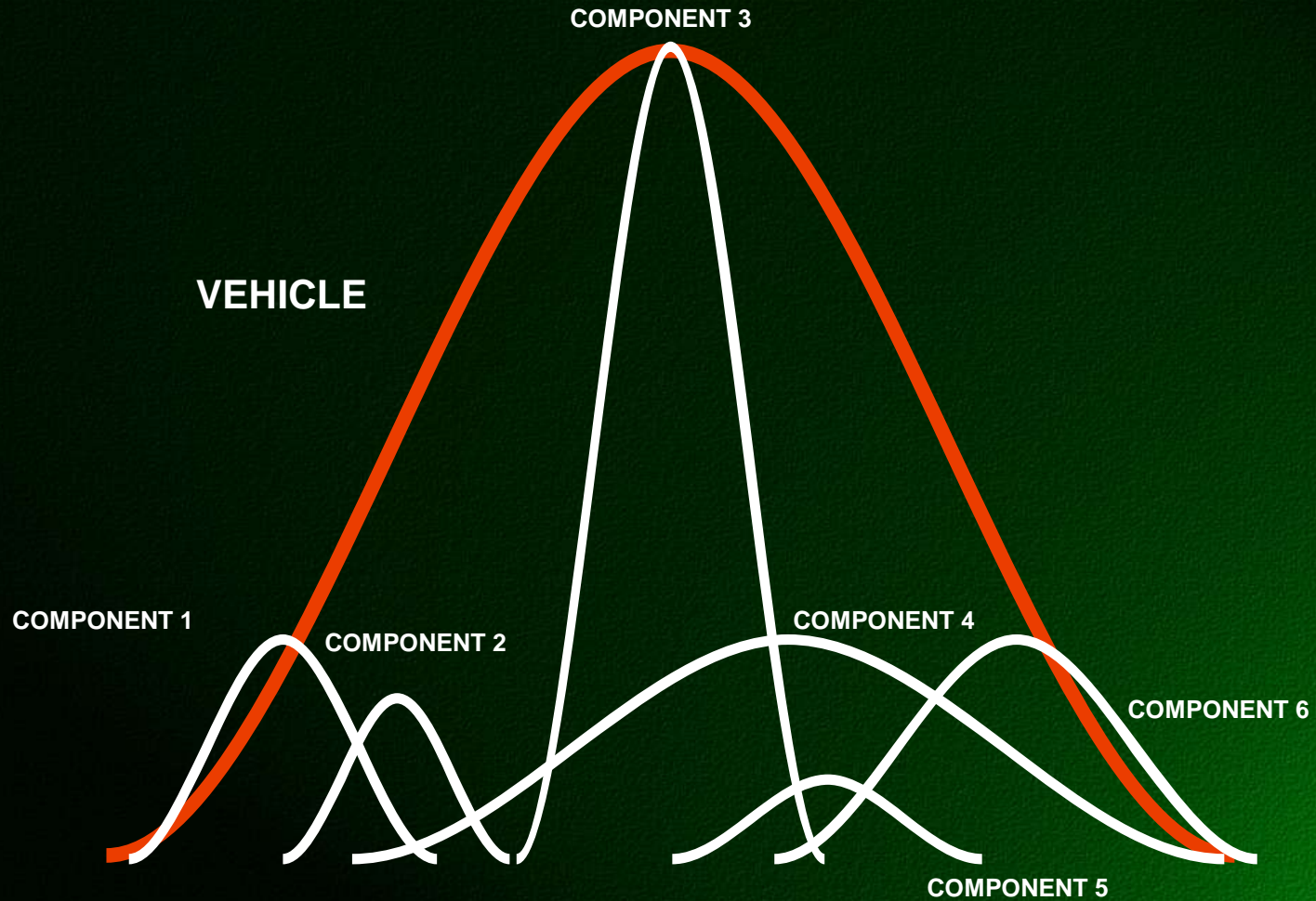
BATTERY POTENTIAL • AUTOMATIC RAISING OF LANDING GEAR

AXLE LIFT AIR PRESSURE • **CARGO AMBIENT TEMPERATURE**

Cost of Random Failure



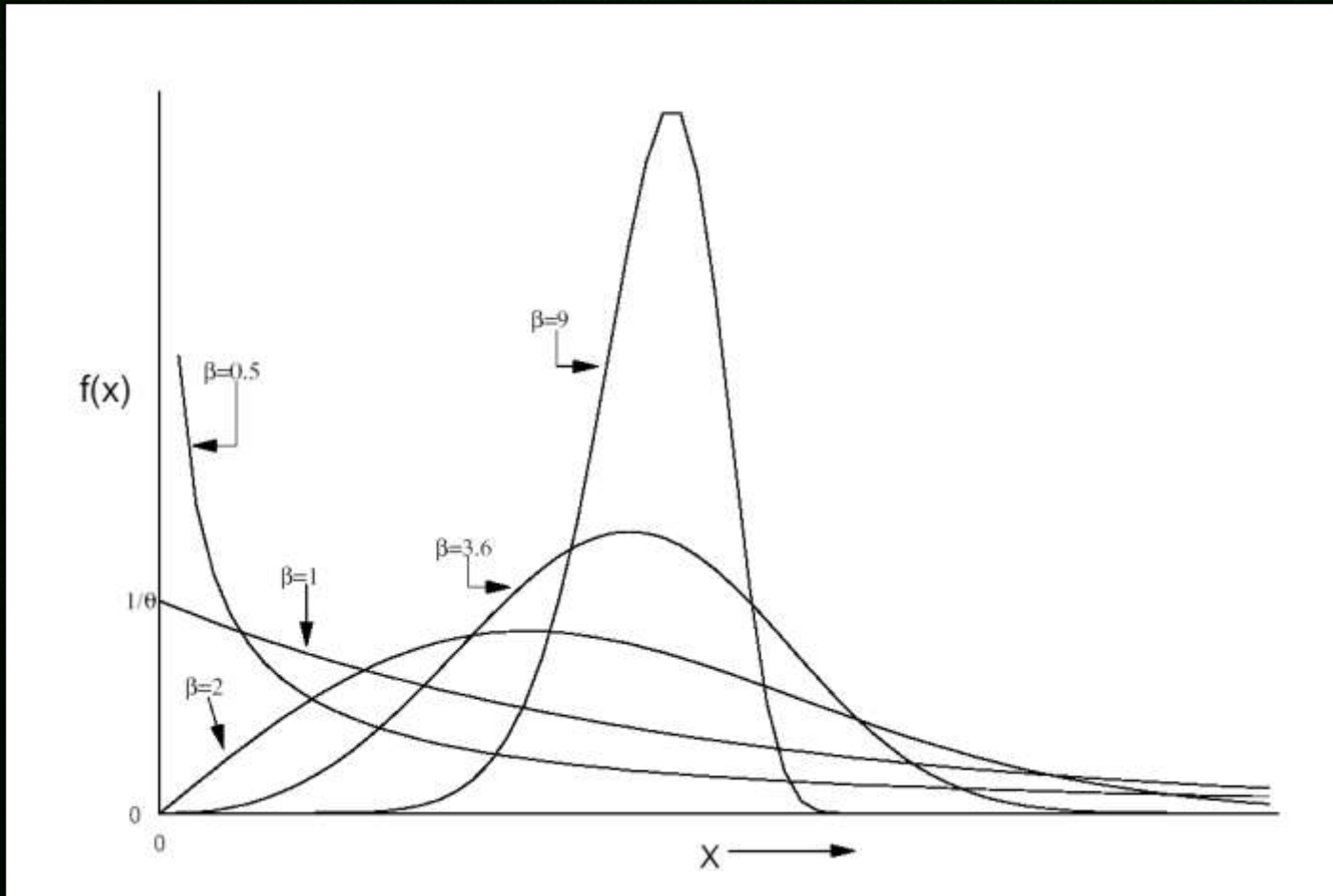
Curves of Curves



Weibull Probability Density Function

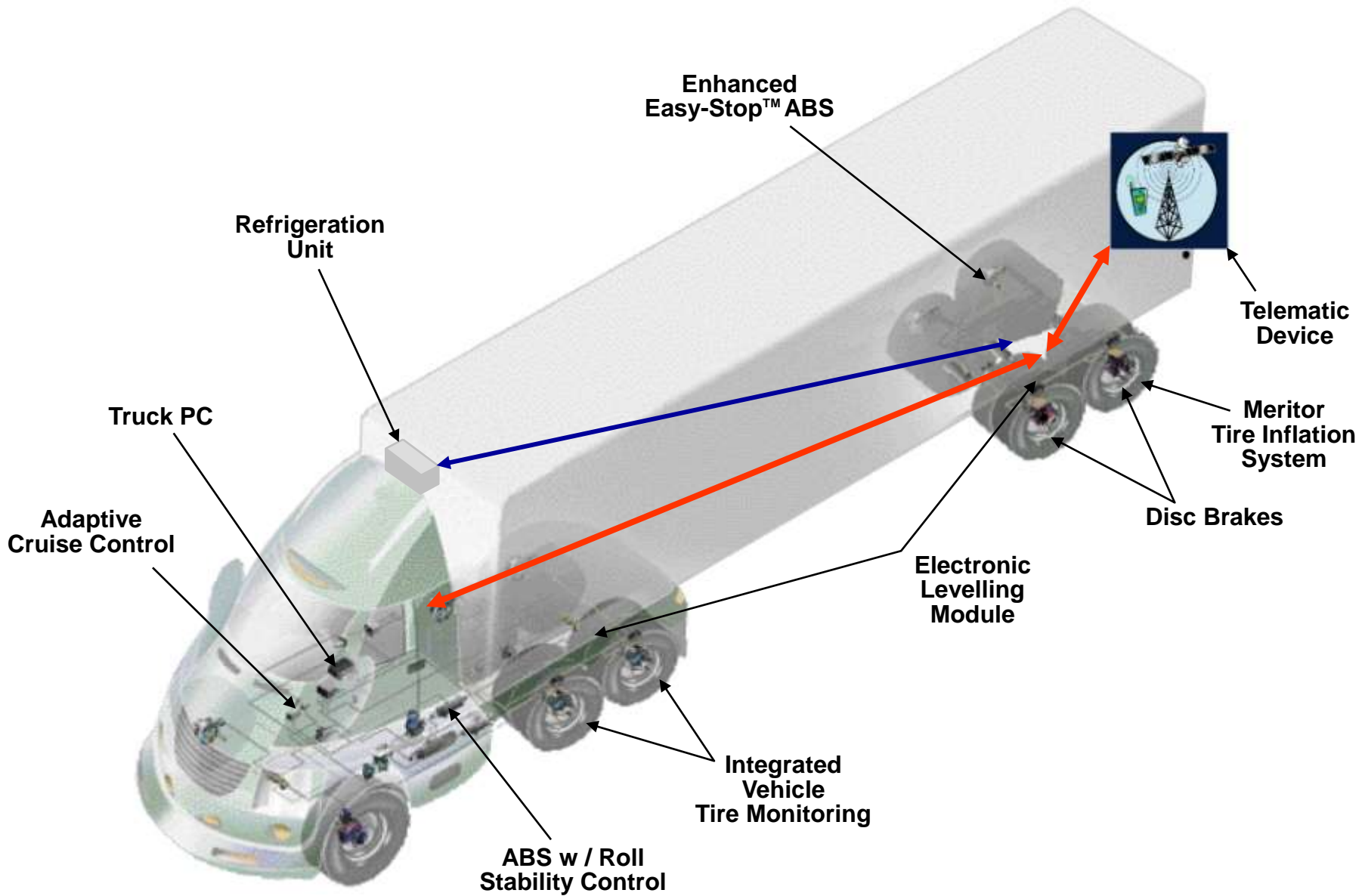
$$f(x) = \frac{\beta(x - \delta)^{\beta-1}}{\theta^\beta} \exp\left[-\left(\frac{x - \delta}{\theta}\right)^\beta\right], x \geq 0$$

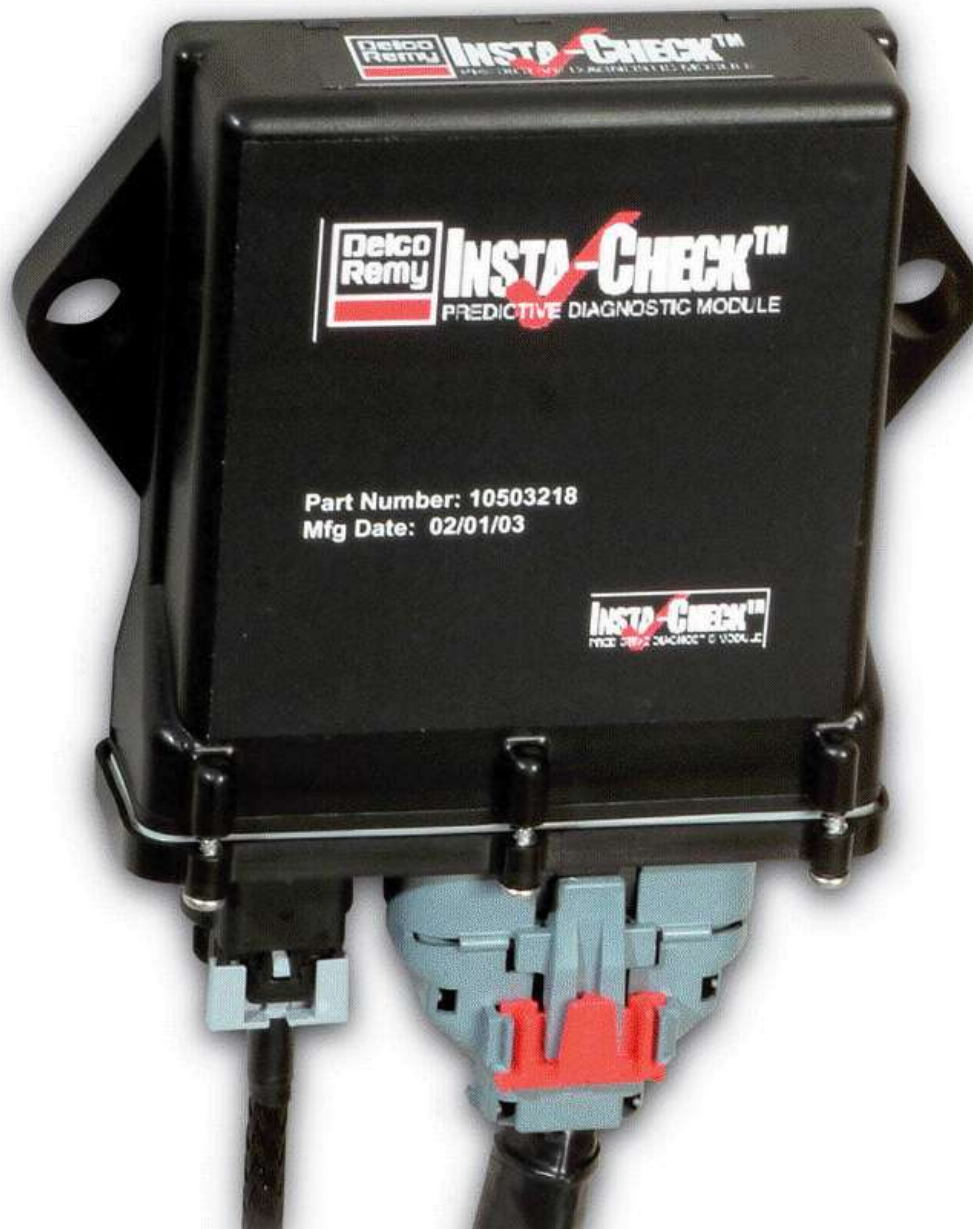
Weibull Probability Density Function



Obvious Potential Problem Areas:

- Data Overload
- Communication Protocol
 - J1708 (SAE)
 - J1939 (SAE)
- Common Nomenclature
- Diagnostics of Root Cause
- Cost/Benefit Equation





ALTERNATOR Insta-Check™

Predictive Diagnostic Module

No charge

Qualcomm

Keyboard
Display

Defective Alternator, critical,
turn off all unnecessary loads
and immediately get to a repair
facility.

Partial Charge

voltage falls below 12.5 and
> 600 RPM

Qualcomm

Keyboard
Display

Defective Alternator, critical,
turn off all unnecessary loads
and immediately get to a repair
facility.

voltage over 12.5
and > 600 RPM

Qualcomm

Keyboard
Display

Defective Alternator, not
critical, report to operations.

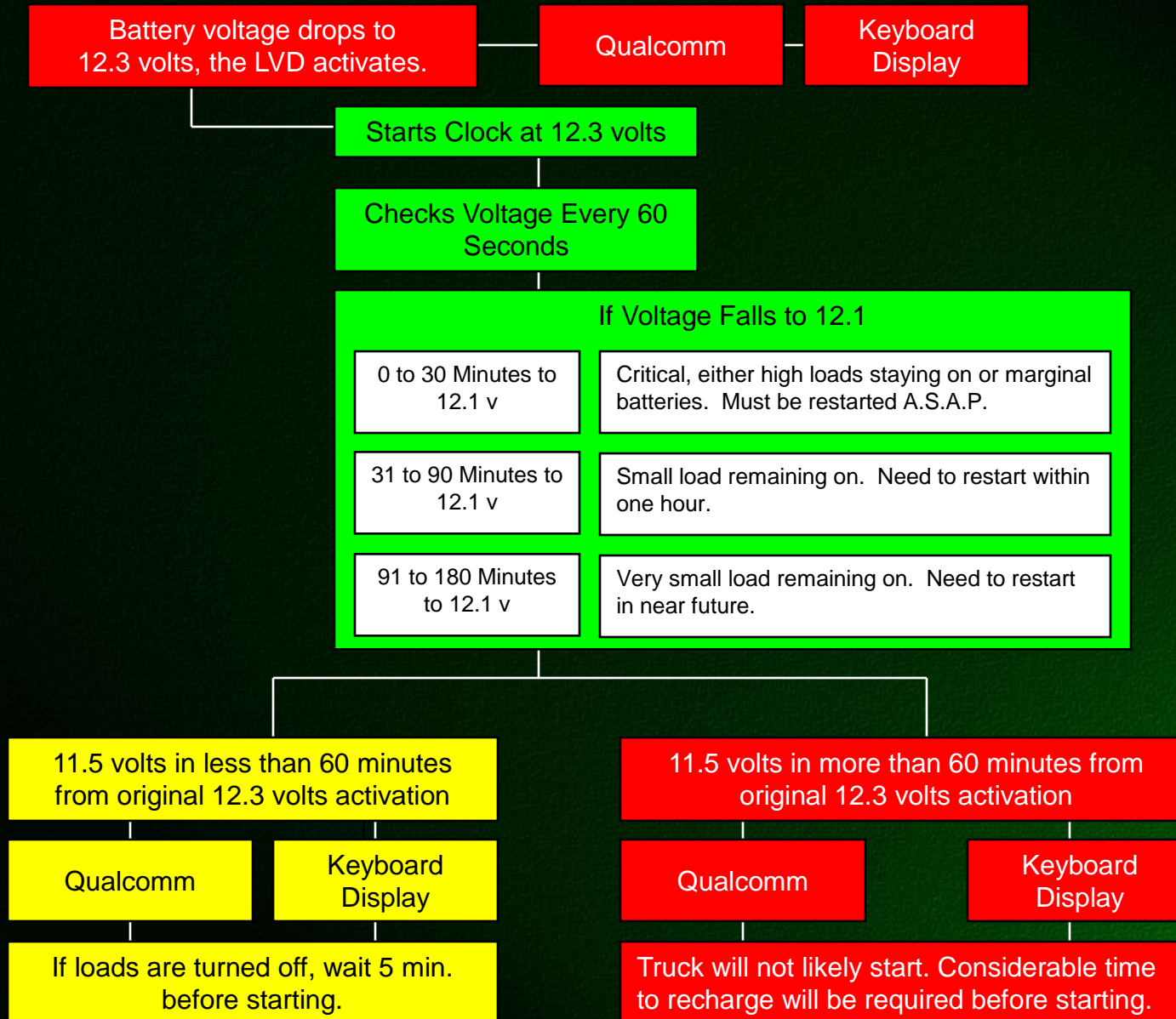
Over Charge

Qualcomm

Keyboard
Display

Turn on electrical loads.
Lights, blower motors, etc.
Report to operations.

Low Voltage Disconnect Functions



Smart tags get serious

Chicago meeting has companies mapping future of wireless bar code

Associated Press

Backers of new radio-tagged product codes, a kind of souped-up wireless bar code, are heralding this as the week the technology finally moves off the drawing board and into the physical world.

Unlike traditional bar codes, Radio Frequency Identification tags don't need to pass under a laser reader. They're already commonly used by drivers with "speed passes" at toll booths, U.S. military quartermasters and ranchers tracking livestock from "farm to fork."

But the MIT lab developing the technology and sponsors including Wal-Mart, Gillette and Procter & Gamble are calling the Electronic Product Code Symposium, being held through Thursday in Chicago, the beginning of the next step. That is, embedding the chips in shipping crates to help big companies save billions by tracking their products from factory to warehouse to store-room.

For now, the focus is on logistics: making sure there's enough product to fill the shelves but not so much as to clog up supply lines or waste away in warehouses. Using RFID to track individual products all the way to the checkout line is considered further down the road, until costs come down.

"The symposium is intended to be a bit like a starting pistol for this new technology," said Kevin Ashton, executive director of MIT's AutoID Center. "It's where we cross the line from research to reality."

Vernon Hills-based Zebra Technologies was at the Chicago event, demonstrating



MARK WELSH/DAILY HERALD

Zebra Technologies will offer companies like Wal-Mart a new system using Radio Frequency Identification. Here, senior manager for the system Matt Ream shows off the bar code.

Links

dailyherald.com/ez
Bookmark our Web page for hyperlinks to more information

AutoID Center
Zebra Technologies
Casplan

its three new printer/encoder products for RFID.

The global tech firm introduced the R110Alchemy smart label print-and-apply engine, and two versions of its R4Mplus UGH (900 MHz) smart label printer/encoders.

"We've made a sizeable commitment to research and development in this area," said Stuart Itkin, Zebra's vice president of marketing and product development.

"After today, we'll be introducing a steady stream of new products in the next couple of months."

The technology got a push —

See TAGS on PAGE 3

New wireless way to track inventory

Products are tagged with computer chips that transmit information via radio waves.

Retail applications for Radio Frequency Identification (RFID)

- Locates items in stockrooms and identifies where they need to go in the store
- Monitors expiration dates and warns when items need to be removed
- Tracks inventory on the shelves and informs clerk when an item is selling out
- Alerts staff when someone is shoplifting
- Identifies returned merchandise by date sold, store location or whether or not it was stolen; allows customers to check out by scanning their carts

Source: Auto ID Center

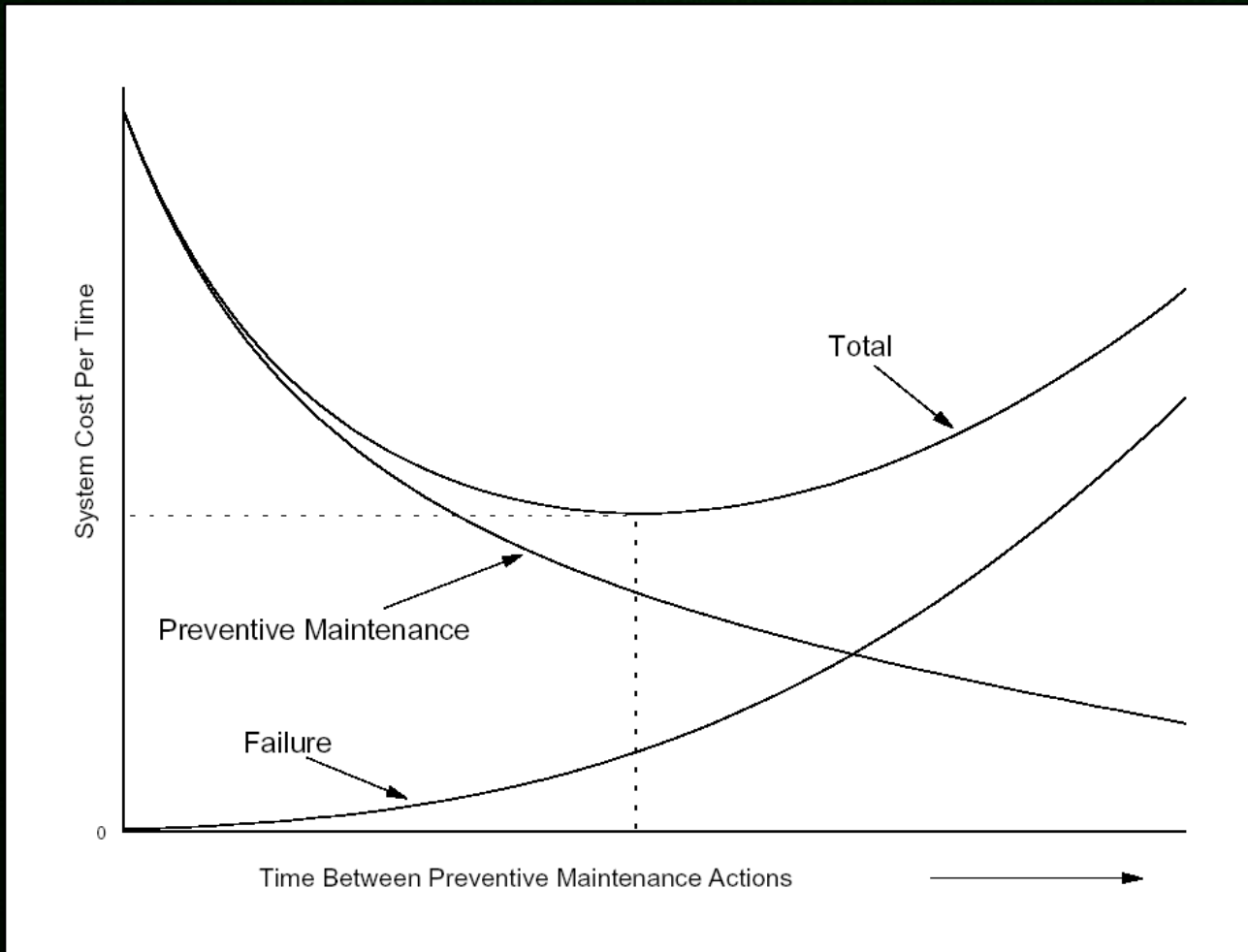
AP

Data Overload

Where is the Practical Limit?

- Approaches
 - Reactive
 - Periodic
 - Inspection
 - Predictive
- Tool Kits
 - EDI
 - SAIM
 - InfoLink™ System
 - Statistics Based Maintenance

Optimum Schedule for Preventive Maintenance



Information Trumps Iron, Again

- Clean, understandable, significant data is the first critical step.
- Information has time & place utility.

Data

Information

Knowledge

Wisdom

Key Fleet PPM Technologies:

- On-Vehicle Communication
- Multiplex Supply Hose (not chain)
- Diagnostic Force Multipliers
 - CU / Cme Mobile Video
 - Expert (decision tree) Systems
 - PC and PDA Based Software to analyze J1939 data
- Functional Consumer Conditioning (process)
- R & R Training

PPM Human Resource Hurdles

- Bi Modal Experience Distribution
- Competition for Technical Talent
- Cost Consequences of Supply / Demand
- Non-Traditional Talent Pool
- Culturally Appropriate Training
- Information Synchronization

Education

Study: Most high school grads don't have what it takes for college

Only 32% of 18-year-olds met criteria for readiness; minorities fared worst

By Greg Toppo
USA TODAY

Only one in three 18-year-olds are even minimally prepared for the rigors of college, a provocative new study suggests, and it paints an even bleaker picture of minority students' literacy, achievement and high school graduation rates.

The study, released today by the Manhattan Institute, says only 32% of students in the high school class of 2001 had what it took to be admitted to college or succeed there.

"We aren't producing enough college-ready students, particular-

ly enough minority college-ready students," says researcher Jay Greene of the conservative think tank. The study was funded by the Bill & Melinda Gates Foundation.

Greene and co-researcher Greg Forster used federal databases to find how many students took basic courses in high school, passed a 12th-grade reading test given nationwide and graduated on time.

When they applied the criteria to the class of 2001, researchers found that 32% of students met all three. Black, Hispanic and Native American students fared worse: Only 20% of blacks, 16% of Hispan-

ics and 14% of American Indian students were "college-ready."

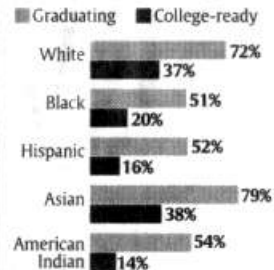
The researchers looked for students who took at least four years of coursework in English, three years of math and two years each of history, science and a foreign language. Among high school graduates, about half didn't have the coursework required to apply to "even the least selective four-year colleges," Greene says.

He also says the figures show that virtually all of the minority college-ready students actually do attend college, suggesting that financial aid and affirmative action policies may not affect the number of minority students in college.

"All affirmative action can do is assign students from one college to another, but it can't increase the

States of readiness

The percentage of public high school students, by race who graduate from high school, and who leave high school ready for college:



Source: Manhattan Institute Education Research Office

By Quin Tian, USA TODAY

total number of minority students in higher education," Greene says. "It's like opening the spigot on a pipe, but there's no more water coming through."

Kati Haycock of the Education Trust, a Washington group that advocates for low-income and urban students, disagrees with that conclusion.

"Among low-income kids achieving in the top quarter of all kids nationally, about 40% are not going to college," she says. "We're losing a ton of low-income, high-achieving kids, and so the suggestion that financial aid couldn't change that is just wrong."

Donald Heller, associate professor at Penn State's Center for the Study of Higher Education, agrees with Greene's assertion that school

districts must do more to help students graduate and prepare for college, but he says Greene's criteria for who is "college-ready" may be irrelevant because of college remediation programs available to struggling students.

"Many of those students did get to college, and many of them will be successful there," he says.

Brian Fitzgerald, director of the Advisory Committee on Student Financial Assistance, which advises Congress, says several states have raised high school graduation rates through better financial aid and college counseling and planning. "Part of the reason for dropping out or failing to take the courses necessary is that students frankly don't see that they have a future in going to college."

Nation

Plane repair manual may confuse

FAA to issue emergency correction

By Alan Levin
USA TODAY

The Federal Aviation Administration plans to issue an emergency order requiring airlines to correct a misleading diagram in repair manuals for a popular type of commuter plane, sources familiar with the planned action told USA TODAY.

One of the 19-passenger Raytheon Beech 1900Ds crashed Aug. 26 near Hyannis, Mass., on its first flight after repairs to the tail section. The manual contains a poorly drawn diagram that could cause mechanics working on the same part of the plane to wrongly adjust a component that raises and lowers the plane's nose, according to the sources and others familiar with the manual.

The cause of the Colgan Air accident, which killed the two pilots, has not been identified by the National Transportation Safety Board. Officials cautioned that the repair manual may not be relevant.

But the upcoming FAA action marks the second time this year that investigators have spotted problems with the manuals for the 1900D after a fatal crash. An Air Midwest Airlines 1900D crashed shortly after takeoff Jan. 8 from Charlotte/Douglas International



By Joel Finley, AP

Crash site: A pleasure boat moves through the debris field minutes after a plane crash Aug. 26 off the coast of Hyannis, Mass.

Airport. Improper repairs appear to be responsible. All 21 people aboard died. Several flaws in the manuals were discovered after that accident.

The FAA order would affect 367

Beech planes registered in the USA. It pertains to the 1900D and its predecessor models, the 1900 and the 1900C. It requires owners of the planes to update maintenance procedures, correct the

manuals and perform additional checks after any repair work to ensure the tail section functions correctly. Raytheon issued a safety bulletin Sept. 24 telling plane owners to follow the same steps.

"We're certainly addressing this issue and are taking all the necessary actions to ensure safety with our aircraft," Raytheon spokesman Tim Travis said.

The two accidents involve apparent problems with the horizontal wing on the tail of the plane, which keeps it flying level. Sources familiar with the investigations say the crashes appear to have different causes. But investigators are concerned that two accidents involving a similar part on the same model plane within months of each other could indicate an underlying problem.

The Colgan Air plane, which was being moved to Albany, N.Y., and had no passengers aboard, crashed minutes after takeoff. One of the pilots radioed he had a problem with the "trim," an apparent reference to adjustments on the tail wing. The plane crashed into shallow water as the pilots tried to return to Barnstable Municipal Airport.

The investigation has focused on maintenance performed the day before on the trim system. Investigators found that the maintenance manual contained a diagram that directed mechanics to set the rear wing so it would behave opposite of what pilots intended.

However, those familiar with the manual say the text is correct. The manual also calls for a check that should have caught any error.

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PREDICTIVE Maintenance

Watch for our upcoming seminar

**HOW POWERPOINT
HAS RUINED THE AFTERMARKET**