





The Future of Wearable Technology

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TOPICS – *The Future of Wearable Technology*



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TOPICS – The Future of Wearable Technology



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Who is a Fire Fighter?

as an individual



- NFPA Professional Qualification Standards
- Emergency Medical Service
 Credentials
- Public Safety Officer Benefits
- Other...

| NFPA 1000 | Fire Service Accreditation and Certification Systems |
|-----------|--|
| NFPA 1001 | • Fire Fighter |
| NFPA 1002 | Fire Apparatus Driver/Operator |
| NFPA 1003 | Airport Fire Fighter |
| NFPA 1005 | Marine Fire Fighting for Land-Based Fire Fighters |
| NFPA 1006 | Technical Rescue Personnel |
| NFPA 1021 | • Fire Officer |
| NFPA 1026 | Incident Management Personnel |
| NFPA 1031 | Fire Inspector and Plan Examiner |
| NFPA 1033 | Fire Investigator |
| NFPA 1035 | Public Fire and Life Safety Educator |
| NFPA 1037 | • Fire Marshal |
| NFPA 1041 | Fire Service Instructor |
| NFPA 1051 | Wildland Fire Fighting Personnel |
| NFPA 1061 | Public Safety Telecommunications Personnel |
| NFPA 1071 | Emergency Vehicle Technician |
| NFPA 1072 | HazMat / Weapons of Mass Destruction Responder Personnel |
| NFPA 1081 | Facility Fire Brigade Member |
| NFPA 1091 | Traffic Control Incident Management |
| | |





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Volunteer Departments

Non-

Structural

FF

Career Departments

Structural

Fire

Fighting







FF



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Fighting



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What is Wearable Technology?

- Generally focused on the Personal (and Personnel) Area Network
- Carried directly by a fire fighter









What is Wearable Technology?

Examples:

- Smart Physiological Monitoring
 - (e.g., SMARTER, WASP, PHASER, etc.)
- Smart Accountability/Tracking
 - (e.g., GLANSER, etc.)
- Programmatic Efforts
 - (e.g., DHS Next Gen First Responder, UNM Cyber ESE FF)
- Targeted Delivery Technology
 - (e.g., Tanagram, etc.)









- DHS initiative
 Focus: Reducing
- cardiovascular risk Big Question: How to implement the technology?



What is Wearable Technology?

Examples:

- Nanotechnology
- Electronic Textiles
- Biomedical Systems
 - Embedded
 - Attachable
- Other...













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Other Professions



Comparison of Professions Using Interoperable ESE



| | APPLICATION | INTEROPERABILITY STATUS | HAZARD EXPOSURE DURATION | INTENSITY OF EXPOSURE |
|----------|-----------------------------|----------------------------|-----------------------------|--------------------------|
| BASELINE | STRUCTURAL FIRE FIGHTING | EVOLVING | SHORT | EXTREME |
| 1 | AVIATION | RELATIVELY MATURE | MODERATE | Low |
| 2 | MILITARY (GROUND FORCES) | RELATIVELY MATURE | SHORT | MODERATE |
| 3 | SPACE | MATURE, WELL- PROVEN | LONG | EXTREME |
| 4 | UNDERWATER | EVOLVING | MODERATE | MODERATE |



Characteristics & Attributes



 Basic Categories of Emergency Responder ESE





Characteristics & Attributes



 Application and Delivery of ESE





Characteristics & Attributes



 Key Interoperability Performance Characteristics for ESE



Characteristics & Attributes

- ESE Component Attributes
- A.K.A., the "Illities"
- Failure of any single attribute will likely result in unsustainable proliferation

Characteristics & Attributes

 Operational Hazards to/from ESE

Intrinsic Safety

- Overview of Fireground
 Intrinsic Safety
- In addition to impact to the equipment from the environment, also concerned with impact to the environment from the equipment (e.g., igniting a flammable gas)

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Intrinsic Safety

Overview of Hazardous Environments for Electrical Equipment

| | CLA | SS I | CLA | SS II | CLAS | SS III |
|------------------------|-----------------------------------|--------------------------------------|--|---|---------------------|-------------------|
| HAZARDOUS SUBSTANCE | Combustible Gases | | Combustible Dust | | Combustible Filings | |
| | DIVISION 1 | DIVISION 2 | DIVISION 1 | DIVISION 2 | DIVISION 1 | DIVISION 2 |
| HAZARDOUS PRESENCE | Normal | Abnormal | Normal | Abnormal | Normal | Abnormal |
| | GRC | DUP | GRC | DUP | GRO | OUP |
| DAMAGE POTENTIAL | A Ace B Hydrogen C Ethylene | tylene Equivalents and Similar | F Combustible F Carbonac G Grain, Wood | e Metal Dusts eous Dusts I, Plastic Dusts | No | ne |

Intrinsic Safety

- ESE Intrinsic Safety Trade-offs
- What classification should fire fighter ESE be designed to?

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EFIGHTER PHYSIOLOGICAL MONITORING

Intrinsic Safety

 Overview of Fire Service Hazardous Environments

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Gathering, Processing, Delivering

 Based on the Project Report available on the FPRF and NIST websites

www.nfpa.org/SmartFireFighting

Gathering, Processing, Delivering

- The New Era of Cyber Physical Systems
- World of Cyber Physical Systems composed of three basic areas:

1) Gathering of data (communication)
 2) Processing of data (computation)
 3) Use of data (targeted decision-making)

Our Changing World

 Today's World is Increasingly Sensor Rich

One Exabyte = 1 x 10¹⁸ Bytes

Our Changing World

- Example: Smart Phones
- Purposes they serve:
 - Communication
 - Recording
 - Sensing
 - Information
 - Other
- Portal into another world...

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Crowds at Papal Elections in 2005 & 2013 (Courtesy of NBC News)

Our Changing World

- "Data is the new oil. It's valuable, but if unrefined it cannot really be used. It has to be changed into gas, plastic, chemicals, etc. to create a valuable entity that drives profitable activity; so must data be broken down, analyzed for it to have value."
- Clive Humby, UK Mathematician & architect of Tesco's Clubcard, 2006

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Data

is the

New

Oil

Our Changing World

Data is the New Oil

| Rank | 2011 (as of 31/Dec) | 2016 (as of 30/Mar) | 2017 (as of 31/Dec) |
|------|----------------------------------|---|-----------------------------|
| 1 | Exxon Mobil - \$417B | Apple Inc - \$597B | Apple Inc - \$869B |
| 2 | PetroChina - \$326B | Alphabet - \$515B | Alphabet - \$727B |
| 3 | Apple Inc \$321B | Microsoft - \$434B | Microsoft - \$660B |
| 4 | ICBC - \$251B | Amazon Inc \$356B | Amazon Inc \$563B |
| 5 | Petrobras - \$247B | Berkshire Hathaway - \$350B | Facebook - \$513B |
| 6 | BHP Billiton - \$247B | Exxon Mobil - \$347B | Tencent - \$493B |
| 7 | China Construction Bank - \$232B | Facebook - \$326B | Berkshire Hathaway - \$489B |
| 8 | Royal Dutch Shell - \$226B | Johnson & Johnson - \$301B | Alibaba Group - \$441B |
| 9 | Chevron Corporation - \$226B | General Electric- \$296B | Johnson & Johnson - \$375B |
| 10 | Microsoft - \$213B | Wells Fargo - \$246B | JPMorgan - \$371B |
| | | 2 2 2 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 | |

Note1: Publicly traded companies having the greatest market capitalization.

Note2: This list is based on the Financial Times Global 500 rankings.

Comparing the Top Ten Public Corporations 2011, 2016 and 2017

Our Changing World

Data is the New Oil

How is Crude Oil Refined?

The DIKW Pyramid

- On the backbone of Technology, we harvest Data
- Data given context yields
 Information
- Information given meaning yields Knowledge
- Knowledge given insight yields
 Wisdom
- With Wisdom comes <u>Power</u> to control your destiny

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- <u>Wisdom (Applied)</u>: I should stop the vehicle!
- <u>Knowledge (Context)</u>: The traffic light before me has turned "red".
- Information (Meaning): The East traffic light at 1st and D streets has changed to "red".
- <u>Data (Raw)</u>: The color "red" RGB 255.1.1

The DIKW Pyramid

- On the backbone of **Technology**, we harvest **Data**
- **Data** given context yields Information
- **Information** given meaning yields Knowledge
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- With **Wisdom** comes **Power** to control your destiny

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Firefighter Needs Help

- Wisdom (Applied): RIT needed on side B near 2nd hallway door
- Knowledge (Context): Immediate intervention is needed based on fire condition and FF location
- Information (Meaning): FF needs assistance
- Data (Raw): Mayday alert signal with GPS location

The DIKW Pyramid

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 Wisdom
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Long Term Health & Wellness 1) What's in it for me? 2) What's in it for wo?

2) What's in it for we?

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The Greatest Challenges

- Technological development is NOT the greatest challenge
- We are rapidly solving the technological challenges, but the greater challenges that are surfacing are legal, social, cultural, etc.
 (e.g., privacy of data, confidentially, proprietary information, competition, and so on).

Technology Development

 We do not necessarily need to invent or re-invent anything, but instead work with others who can and are doing this now (e.g., military, industry, etc.)

The Cost of Success (Dangers)

- With Progress will come Setbacks
- Going forward, what will be the weakest link?

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U.S. military reviewing its rules after fitness trackers exposed sensitive data

By Liz Siy, Dan Lamothe and Craig Timberg January 29 🔀 Email the author

GPS tracking company Strava published an interactive map in Nov. 2017, showing where people have used fitness tracking devices. (Patrick Martin/Toe Washington Post)

BEIRUT — The U.S. military said Monday that it is reviewing its guidelines for the use of wireless devices at military facilities after revelations that popular fitness apps can be used to expose the locations and identities of individuals

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World

The Cost of Success (Dangers)

- With Progress will come Setbacks
- Going forward, what will be the weakest link?

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|--|--|
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| BRP and Riv There said they terretund a glassed they terretund a glassed Bala is set to bey up to | Tensions Lead to Dueling Protests in China and Japan |
| have secured one-third of the \$0.8 billion of transport a | |

Data is the New Oil

Innovative Use of Data (Gains)

Case Study
 Example:
 Data Mining
 of Social
 Media

Innovative Use of Data (Gains)

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Where Next: Case Study

- Where will Wearable Technologies go next?
- As a Case Study: Consider Hearing Aids
- Fire Fighters with Hearing Impairments Need Assistance.
- Why Is This Not Being Developed for All Fire Fighters, with Features to Optimize Fireground Work?
 - Allow setting for an individual's hearing (needed or not)
 - Optimize/enhance certain sounds (e.g., radio, mayday, etc.)
 - Muffle/cancel certain sounds (siren, saws, etc.)
 - Satisfy the "Illities", and make available for all fire fighters
 - Vision: standard helmet attachment

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