What is Human Factors?

- 70-80% of aircraft accidents are due to human factors – JAA, May 2001

- Maintenance contributed to 15% of commercial jet accidents – Boeing, 1995
20-30% of in-flight engine shutdowns & 50% of delays/cancellations are caused by human error – Boeing, 1997

48,800 non-airworthy aircraft are dispatched each year as a result of maintenance error – Marx, 1998

Ramp accidents cost over $2 billion annually – Ramp Safety Vol.11:3
Avg. cost of an in-flight engine shutdown is $500,000
Avg. cost of a flight cancellation is $50,000
Avg. cost of a return to gate is $15,000
Avg. ground damage incident costs $70,000
One airline estimates $75-$100 million/year is lost
Airline Transport Association estimates that ground damage costs $850 million/yr
Accidents w/ Maintenance Error

- American Airlines Flight 191 – 1979
- Aloha Airlines Flight 243 – 1988
- United Flight 232 – 1989
- Atlantic Southeast Airlines (ASA) Flight 532 – 1995
- Air Alaska Flight 261 – 2000
- Paul Wellstone (B100) crash – 2002
- Spectrum Aeronautical LLC - 2006
General & Corporate Aviation

- Little to no data is available
  - Huge industry push yet we get pushed aside
- With little focus we have to work harder
- Safety Managers will have to adapt and adopt
The Human Element ("Hu")

“We’re only human…”

We *will* make mistakes…

The key is to minimize errors, but how?
The “Dirty Dozen”

- Complacency
- Distraction
- Fatigue
- Norms
- Pressure
- Stress
- Lack of Assertiveness
- Lack of Awareness
- Lack of Communication
- Lack of Knowledge
- Lack of Resources
- Lack of Teamwork
Dirty Dozen - Complacency

“I don’t need to go get the tech data; I’ve done this a hundred times…”

“No need to pull that panel. Last time I checked that linkage had plenty of grease…”

“I’ve been an aircraft mechanic for over 25 years; I know what I’m doing…”
Dirty Dozen - Complacency

Safety Nets

- Always follow checklist(s) &/or squawk cards
- Never work from memory
- Be sure to vary your routine periodically
- Be aware of the dangers of complacency
Dirty Dozen - Distraction

- Phone calls

- Personal Issues

- Water Cooler Talk
Dirty Dozen - Distraction

Safety Nets

- Use a detailed checklist
- Always finish the task
- Double-inspect the work
- Use torque seal &/or safety wire
- Record or tag uncompleted work
- When you return to the task, always go back three (3) steps
Dirty Dozen – Fatigue

What is Fatigue?
- The body’s normal reaction to a physical or mental stress of a prolonged duration
- There are two types
  - **Acute** – short duration; cured with good night’s sleep
  - **Chronic** – occurs over a long period of time; long recovery
Dirty Dozen – Fatigue

- Causes of Fatigue
  - Long hours of labor (any type)
  - High-intensity stress
  - Large temperature variations
  - Noise – above 80db for long duration
  - Sufficient intensity vibration for long periods
  - STRONG lighting
Dirty Dozen – Fatigue

Symptoms of Fatigue
- Enhanced stimulus required in order to respond
- Attention reduced
- Memory diminished
- “Withdrawn” mood
- Circadian Rhythm inconsistencies
Dirty Dozen - Norms

“I don’t care how you did it there, we’ve done it *this* way for years!”

Outdated/inadequate company policies
Dirty Dozen – Norms

What are “Norms” exactly?

The way of doing business that’s not approved, but it’s been done locally for so long that it’s now a “Norm”

ALWAYS work IAW the appropriate tech data, or if needed, have the manual revised

Be aware that “Norms” do not make it right
Dirty Dozen – Pressure

“Get it to the gate!!!”

Too tightly scheduled deadlines

Flat-rated Work Orders that maybe should have been rated
Dirty Dozen – Pressure

Safety Nets

Stop! Assess the situation

Look at the situation rationally

Can I safely do the job on time?

Have I voiced my concerns clearly?

What is the worst thing that can happen to me?

Listen to your rational mind

Has this happened before?

Act

Speak up – ask for help or more time
Dirty Dozen - Stress

- Personal issues
- Weather concerns
- Wanting that “atta-boy” for the boss
Dirty Dozen - Stress

How to Manage

- If you do not manage stress, it will gladly manage you
- Stop burning up emotional energy
- Look rationally at the problem
- Cure the cause, not the symptom
- Listen to your rational, not your emotional, mind
- Act – once you have a plan, go for it
Dirty Dozen - Stress

Other Stress Helpers
- Be sure the solution starts with “I”
- Be realistic and practical
- Take a break
- Talk to someone who is not emotionally involved with the situation
- Don’t expect miracles, just keep trying
Dirty Dozen – Lack of Assertiveness

“Only do what’s expected of me and that’s it... Not a movement more.”

- Not researching all applicable technical data
- Not following technical data to the “t”
Dirty Dozen – Lack of Assertiveness

Safety Nets

- Record all the work you do in the logbook, but only sign for that which is serviceable
- Refuse to compromise your standards
Dirty Dozen – Lack of Awareness

- Not aware of technical data revision
- Not aware of surroundings
Dirty Dozen – Lack of Awareness

Safety Nets

THINK

What could occur in the event of an accident?

CHECK

Will your work conflict with a previous or existing repair &/or modification?

ASK

See if anyone else can spot a problem you overlooked
Dirty Dozen – Lack of Communication

- Either technician to technician
- Management to hangar
- Inspection Department to Maintenance crew(s)
Dirty Dozen – Lack of Communication

Good Communication Tips

- You have:
  - Two ears
  - Two eyes
  - One mouth

- Use them in that order!
Dirty Dozen – Lack of Communication

To Improve Communication
- Learn to Listen

Do NOT
- Debate
- Detour
- Pre-plan
- Tune-out

Do
- Ask questions
- Paraphrase
- Make eye contact
- Use positive body language
Dirty Dozen – Lack of Knowledge

“Am I experienced for this task?”

“Do I have all of the appropriate tech data?”

Aware of FAR’s
Dirty Dozen – Lack of Knowledge

Safety Nets

- Obtain school training on type, model, etc.
- Get supervised on-the-job training
- Use current technical manuals
- Tech Reps &/or Manufacturer Reps are there for a purpose – use them!
Dirty Dozen – Lack of Resources

- Is the appropriate tech data available?
- “Do I have the proper tools and equipment to perform the task?”
Safety Nets

- Check all suspect areas at the beginning of all inspections and AOG the required parts
- Order & stock parts before they’re required
- Know your sources
- Arrange for pooling &/or loaning
- Maintain aircraft to highest standard
Dirty Dozen – Lack of Teamwork

Is this a task that really two technicians should do?

“No, I don’t need any help; I know what I’m doing!”
Dirty Dozen – Lack of Teamwork

Safety Nets

- Always discuss and plan the Who, What, When, Where, and How of the task to be done
- Insure that everyone understands and agrees
Accident Model

The Domino Theory

1. Supervision/Organization
2. Unsafe Condition
3. Unsafe Act
4. Mishap Event
5. Damage/Injury

Dominoes
Reason’s Swiss Cheese Model

- Organizational Factors
- Unsafe Supervision
- Unsafe Act Preconditions
- Unsafe Acts

Latent Condition → Latent Condition → Latent Condition → Active Failure → Accident

HFACS-
Human Factors Analysis & Classification System
• Recap
  • We’re all human and we will make mistakes
  • Know your own limits
  • Learn to recognize it in others

• Cure the cause and not the symptom
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Human Factors in Aviation Maintenance

Questions?