JSC/EC5 U.S. Spacesuit Knowledge Capture (KC) Series Synopsis

All KC events will be approved for public using NASA Form 1676.

This synopsis provides information about the Knowledge Capture event below.

Topic: Fifty Years of Observing Hardware and Human Behavior

Date: December 8, 2011 **Time:** Unknown **Location:** JSC/B5S/R3102

DAA 1676 Form #: 29411

A PDF of the presentation is also attached to the DAA 1676 and this is a link to all lecture material and video: \\js-ea-fs-01\pd01\EC\Knowledge-Capture\FY12 Knowledge Capture\20111208 J.McMann_50yrs_Lessons-Learned_half-day\For 1676 Review and Public Release

*A copy of the video will be provided to NASA Center for AeroSpace Information (CASI) via the Agency's Large File Transfer (LFT), or by DVD using the USPS when the DAA 1676 review is complete.

Assessment of Export Control Applicability:

This Knowledge Capture event has been reviewed by the EC5 Spacesuit Knowledge Capture Manager in collaboration with the author and is assessed to not contain any technical content that is export controlled. It is requested to be publicly released to the JSC Engineering Academy, as well as to CASI for distribution through NTRS or NA&SD (public or non-public) and with video through DVD request or YouTube viewing with download of any presentation material.

Presenter: Joe McMann

Synopsis: During this half-day workshop, Joe McMann presented the lessons learned during his 50 years of experience in both industry and government, which included all U.S. manned space programs, from Mercury to the ISS. He shared his thoughts about hardware and people and what he has learned from first-hand experience. Included were such topics as design, testing, design changes, development, failures, crew expectations, hardware, requirements, and meetings.

Biography: Joe McMann was graduated from the University of Notre Dame in 1959 with a bachelor of science in chemical engineering. He joined NASA in 1961 as a member of the Space Task Group. During his 35-year NASA career, he was a project engineer on the Apollo Environmental Control System; a project engineer, technical manager, and test subject on the Gemini and Skylab EVA life support systems; and a subsystem manager, test subject, and contract technical manager for the Space Shuttle EMU and Manned Maneuvering Unit (MMU). McMann has coauthored U.S. Spacesuits with Kenneth S. Thomas of HS (Praxis Press, 2005). He also has conducted training on failure recovery planning and practical project management and has lectured on lessons learned during more than 40 years of experience in the aerospace industry.

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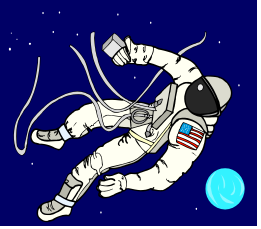
Lessons Learned from Fifty Years of Observing Hardware and Human Behavior

Joe McMann

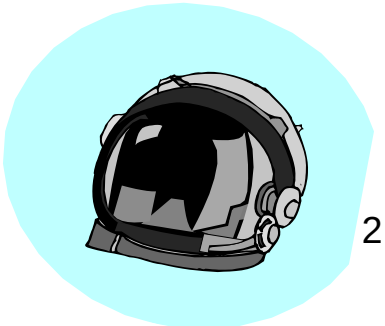
August, 2011

Rev. Nov. 27, 2011

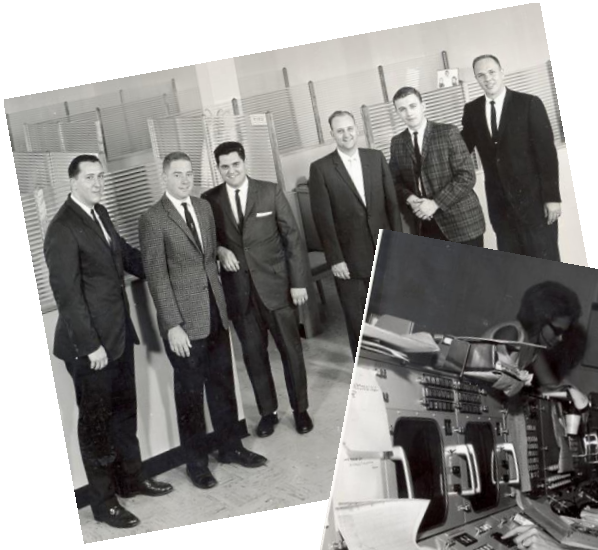


Joe McMann Bio

- Graduated in 1959 with BS in Chemical Engineering from Univ. of Notre Dame
- 1959-1961: Application Engineer for Liquid Carbonic, Chicago, IL
- 1961-1997: Project Engineer, and manager with NASA JSC – associated with environmental control systems and space suit systems-acted as test subject, real-time support engineer, subsystems manager, technical manager
- 1997-2002: Technical Specialist for Hamilton-Sundstrand – associated with space suit failure resolution - development of urine measurement system – teaching failure recovery planning – mentoring
- 2002 – present: Consultant to NASA and industry – co-authored “US Spacesuits” with Ken Thomas of Hamilton Sundstrand – participant in JSC Spacesuit System Knowledge Capture initiative



Joe McMann Bio



Liquid Carbonic - 1960

Gemini MCC - 1965

Test subject – late 1960's

Observations on Hardware and People

- If you're conscious most of the time, you'll start to notice patterns of behavior recurring in hardware and people
- I have noticed that the interaction of people and hardware produces predictable and controllable results in the case of hardware, and often unpredictable and uncontrollable results in the case of people
- I have formulated a number of observations, maybe you could call them laws, based on my fifty plus years of continually making mistakes and living with the consequences
- I have loosely grouped them in egories: Hardware and People

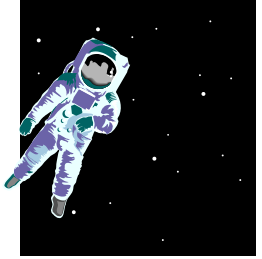
Hardware

- DESIGN
- A hardware design is someone's estimate of what it will take to do a job
  - It will always be wrong, because what we want tomorrow, or next year, is not what we want today
- There are two basic rules of design:
  - 1. Put in plenty of margin
  - 2. Hide it so that managers can't find it
- There are two basic ways to design:
  - Start with everything, and weed out
    - **Up side – you get lots of features, and, hopefully, margin**
    - **Down side – you get lots of "nice" things which can pace your schedule and ruin your budget**
  - Start with nothing and add in
    - **Up side – every feature has to be justified, and it's a lower cost**
    - **Down side – you may not have enough margin**
- Make sure that your specs widen as you go from component to system
  - Especially true for time-dependent responses

HARDWARE

- DESIGN
- The unspoken but primary purpose of a design review is to show the designer how far off-base he is
  - The provider, not the customer, is the primary beneficiary
  - Sometimes the review needs to be held before he's ready so that he can find out just how not-ready he is
- Hold a major design review just before – never just after – a holiday period

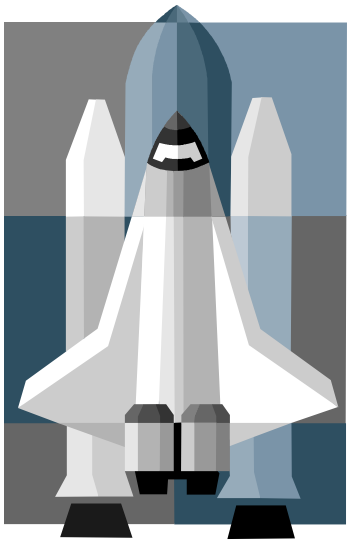
Hardware



- Automatic systems should have a manual back-up
  - **Things like temperature control, mode selection, alternate comm modes**
- Try and use stainless steel in wet environments
  - **Sure, aluminum is lighter and can be coated, but**
  - **COATINGS WILL BE BREACHED**
- Simple designs can be made rugged, reliable and forgiving, but they usually lack flexibility and can be heavier
  - **You have to decide the balance**

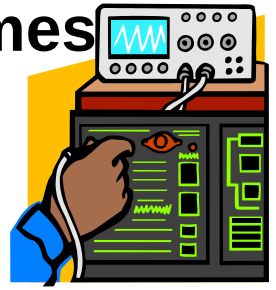
Hardware

- **Hardware always does what you tell it to do – the problem is figuring out what you told it to do**
  - **The laws of physics work 24/7**
    - **There is, though, an element of randomness**
  - **EMU fire of 1980**
  - **Challenger**
  - **Columbia**
- **Laminates delaminate**
  - **Try to go with single-element**
  - **Something always gets between the layers**
- **Coatings uncoat**
  - **Moisture or something will loosen it**



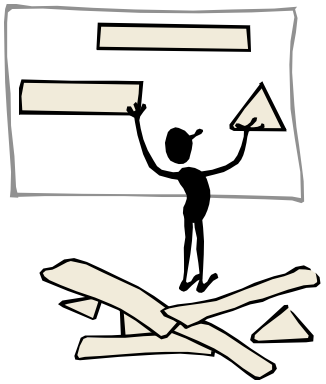
Hardware

- **TESTING**
- **Be ready to live with the answer when you ask the question**
- **When you test, there are three possible outcomes**
  - **You get the answer you want**
  - **You get the answer you DON'T want**
  - **You get an answer you don't understand**
  - **Two out of the three are bad**



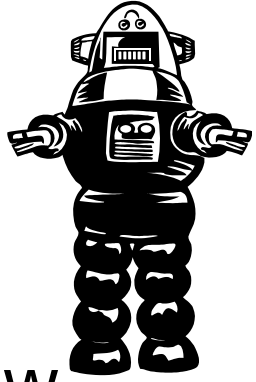
- **Every test should include the following information:**
  - **The configuration of the test item – relatable to flight**
  - **Pass/fail criteria or expected result**
  - **What was done**
  - **The results**
  - **What the results mean**
- **There's a running battle between test and analysis – the best of either is the combination of both**

HARDWARE

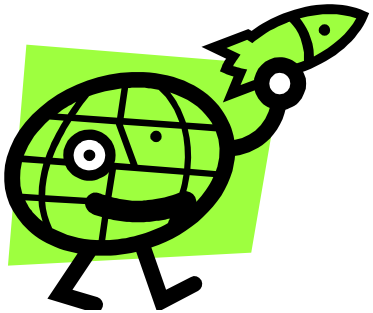


- CHANGES
- All changes have a bad side – hopefully, the good will outweigh the bad
  - **Sometimes, the bad side consists simply of learning the change in hardware personality**
- Beware of “bundling” unnecessary (“nice”) changes along with required changes
  - **Better is the enemy of good (enough)**
- The most important question you can ask about a change is: “Would I fly without it?”
  - **Watch out for the Safety trap:**
    - **If you say the change is needed for Safety, the logical question is “Have we been unsafe all this time?”**

Hardware



- Try and not have more than a couple of new (read: unproven) technology challenges in a major system – and have a backup (back-out) for those
  - It can be disastrous to pursue too many new paths without a fall-back approach– any little glitch in any new technology area can pace your whole program
- Classify features as: Requirements, Desirements and Desires
  - Ask “Would/Could I fly without it?”
  - Go as you can pay



Hardware

- DEVELOPMENT
- You WILL have a development unit
  - You may not start out that way, but it will happen
- The most important function of a development unit is NOT testing
  - **It is to show that you can actually build it**
- The primary benefit of a good development test program is the demonstration of margin
  - Any half-way decent design will meet the base requirement
  - **DEMONSTRATION OF MARGIN IS ESSENTIAL**
- No matter where we start, we end up living in the margin
  - **You can't live in it if it's not there**

Hardware

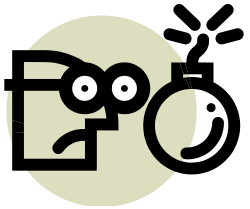
- All hardware items have a distinct personality
  - You get to know it best when using it outside the normal regimes
  - **You get to know hardware only by using it**
- Try and make as many items as possible from one production run
  - Restarts are expensive, and sometimes, results aren't repeatable
- You won't have control over lower-tier suppliers, no matter how good your system is
  - There's an entropy of rigor that increases with distance from the customer
  - Visit your vendors; get to know the people on the line

Hardware

- If Certification worked, you could fire half the contractors and three-quarters of the centers
  - Cert is someone's best guess of what the hardware will see throughout its life
  - It's always wrong – either due to error or lack of knowledge or change in requirements
  - That's why you need MARGIN
- You can't have too much hardware
  - It doesn't ask for sick leave; will work overtime without being asked; and is always cheaper the first time around

Hardware

- **FAILURES**
- **A failure results when you can't meet a SPECIFIED requirement**
- **Failures potentially affect everything of a series, and could affect others with similar components**
  - **In jurisprudence, you're innocent until proven guilty – in the case of a hardware failure, everything's guilty until proven innocent**
- **Failures in training hardware are telling you something**



- **People typically stop short of finding true root cause**
  - **Root cause is the defect in or omission of a process that controls not only your item, but other items under control of the entity**
  - **You know you've found root cause when upper management wants you drawn and quartered because you've found a flaw in an overarching process**

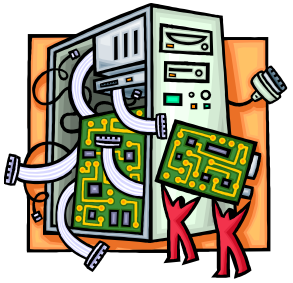
Hardware

- Any outage, failure or not, is worth investigating and documenting
- Sometimes you can't find root cause
  - Not enough time
  - Not enough money
  - Not enough management commitment (Read: guts)
- For unexplained failures, take SOME action
  - Look at most likely cause, and address that
- Until it fails, and you find out why, nobody really understands how it works – until then, you just know how the Designer THINKS it works

Hardware

- When you've had a failure, you want to practice discrimination – find other hardware that's as different from the failed item as possible
  - It may be less time or cycles
  - It may be more time or cycles
  - Different lots; manufacturing methods

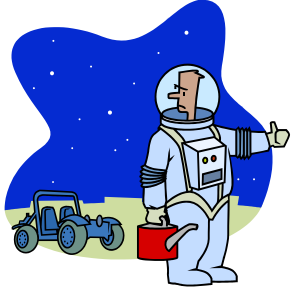
- Use items dispositioned for scrap as learning tools
  - Section them
  - Disassemble them
- When investigating a failed item, disassemble a good one first, so that you know what it looks like and can compare it with the failed item
  - **Take lots of pictures**



HARDWARE

- **What's crucial is the recovery plan from a failure – five parallel elements – started simultaneously**
  - **1. Identify all affected hardware**
    - **Maybe more than your hardware is involved**
    - **Need to notify potentially affected parties**
  - **2. Come up with plan to support next use**
    - **Could be test; could be flight**
    - **Use hardware without, or low potential for, this failure mode**
  - **3. Come up with way to operate while pursuing root cause and corrective action**
    - **Could be same as plan to support next use**
  - **4. Pursue and identify root cause and corrective action**
    - **Root cause involves underlying process**
    - **Will reside within one of the following: Paper, People, Part itself, Equipment interfacing with failed part, or Environment**
  - **5. Identify viable backup plan**
    - **Should employ hardware with significant differences from failed item**
    - **Must be available in time to support when needed**
    - **May never be used**
- **A full-blown recovery plan is EXPENSIVE**
  - **It's very resource-hungry**
  - **The alternative can be more expensive**
- **As DOD once put it: "Failures in flight are seldom cost-effective"**

Hardware



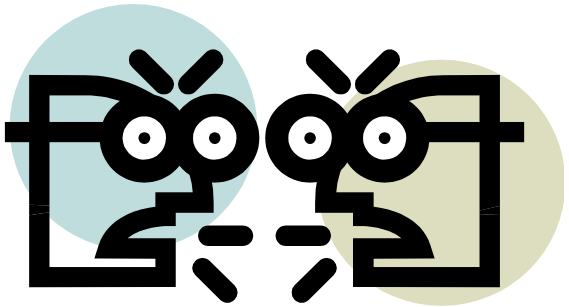
- THE CREW
- Engineers often act like all the crew has to worry about is their particular hardware
  - You may think it's easy to turn knob A; take reading B; slowly open valve C and whistle the theme from "Titanic", but multiply that by hundreds of systems
  - The crew are not supposed to be technicians and troubleshooters
- Make sure that your program is not designed to let the crew screen for failures
  - Test on the ground FIRST with hazardous fluids, environments and conditions
  - Make sure the on-orbit conditions are at least as safe as ground
- Try it out on the ground first, if at all possible
  - Develop the procedure for the crew
  - Find out where it is that you don't know what you're doing

HARDWARE

- All crew-operated hardware must be able to take abuse
  - **It may look good on your desk, but can it take a blow on the corner of your file cabinet?**

Hardware

- **IN THE FIELD**
- **Make sure your hardware is flight-ready when you send it to the Cape**
  - **KSC is the neck of the funnel – don't expect them to do your work for you**
  - **If you have open work, coordinate it (Read: warn the Cape) before you ship**
  - **NO SURPRISES**



Hardware

- When you're introducing a new system to replace an old one:
  - 1. You will have two marching armies until the new one is past the high-risk period
    - The "benefiting" Program has to pay for both
    - The "benefit" better be there
  - 2. You have to be alert to the possibility that THE NEW ONE MAY NOT WORK
    - Keep the old one around until the risk of getting the new one is acceptably low
    - How low is that? That's what you get paid to know

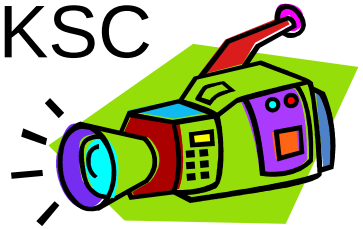
Hardware

- When you're introducing a new design, try to get it in flow, i.e., pathfind it, before you absolutely need it
  - Find out its personality in the field (use) environment
  - Make sure you really understand the process that it will go through

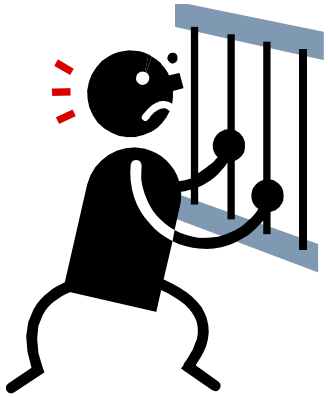
- Whenever you disassemble a controlled unit, chances are you're going to find something wrong
  - It's a variation of being prepared for the answer when you ask the question

Hardware

- Take closeout photos before shipping to KSC
  - **Shoot the items from all angles, and in the shipping container**



- Try and mate hardware that has to fit together before it flies
  - **Not always possible**
  - **Use master tooling, if possible**
- Push back on requirements that are proving difficult
  - **Sometimes, a number is sometimes just someone's best guess**
  - **Propose alternates, e.g., root mean square for stacked component leakages-favors heavy hitters**



$$x_{\mathrm{RMS}} = \sqrt{\frac{x_1^2 + x_2^2 + \ldots + x_n^2}{n}}$$

People

- Forget “Don’t shoot the messenger” – the messenger is ALWAYS shot
  - The messenger is also the representative
  - If you can bring a solution along with the problem, the caliber of the bullet may be reduced
- People respond to two primary motivations:
  - Fear (This is why we went to the moon)
  - Greed (This is the private sector’s motivation)
- There is always one person who will be found to blame
  - Management’s hands can only go around one neck
- When considering doing something stupid, ask yourself the following question:
  - “What do I stand to gain versus what do I stand to lose?”

People

- Remember Stutesman's Law: "There are only these three: Cost, Schedule and Performance. You can at best control two of the three, and those will drive the third."
  - I know, I know – there are lots of metrics out there besides these, but just because you CAN measure it, doesn't mean that yo SHOULD
  - SSF – example of Law violation

People

1985 Dual Keel SSF

Estimated Cost: 8B*

Design: Dual Keel; 493 ft. long

Schedule: 1994

2011 Final ISS

Estimated Final Cost: 100B*

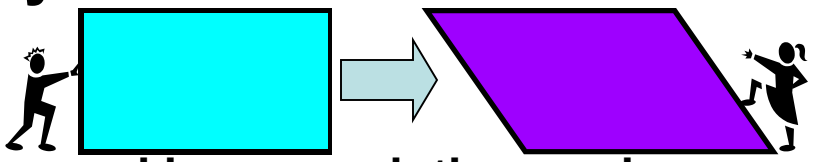
Design: Center Core; 356 ft. long

Schedule: 2011

*Shuttle launch costs and Int. Partners contribution not included

People

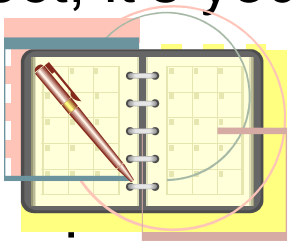
- **“Think out of the box” really means “Think into a new-shape of box”**
  - **“The box” is STRUCTURE**
  - **Making a revolution is easier than making a revolution work**
    - **You need structure to carry out a mission**
  - **After awhile, STRUCTURE can become STRICTURE**
  - **Then, you need a new box**



- **Systems serve us – not the other way around**
  - **Beware of FORMAT over CONTENT**
- **You must have a system, if you want to violate the system**
  - **You will sometimes need to go around the formal system, i.e., to go into panic mode**
  - **If you operate all the time in panic mode, then you have nowhere to go**

People

- The children inherit the sins of the parents
  - When you take over a project, it's yours, including the history
- Everyone has an agenda



  - All of us act in what we perceive as our own self-interest – from Mother Teresa to Josef Stalin
  - You need to figure out what's driving the other guy
- When you see a leadership vacuum, take over
  - Be jury foreman
  - Take minutes and write actions
  - Get up to the board and start asking questions

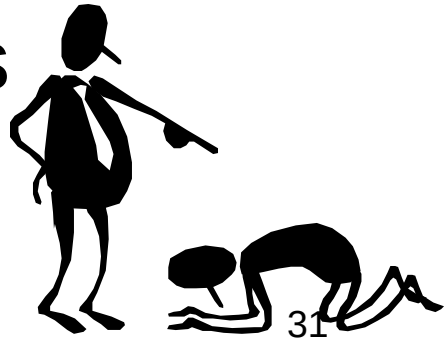
People

- Some people are successful in spite of, not because of, their ability to rant and rave
- It's not a principle if there's no sacrifice and no struggle
- You have to take it away from the engineers when it's good enough
  - Enough margin
  - Satisfies all requirements, and as many desirements and desires as you can afford
- Engineers are hopelessly optimistic: "Give me another month; another pound, and another $500K…"

People

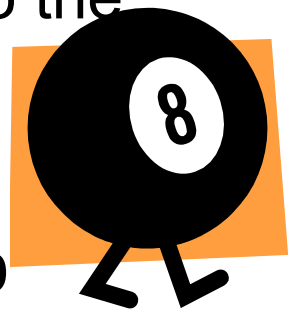
- Be willing to work harder than the other person
  - If you bluff, better be ready to be called
  - Much can be accomplished in a meeting starting at 4:30pm on a Friday before a 3-day weekend

- There are two roads to power: Authority and Influence. Authority is limited to official scope; Influence is limitless
  - One type of influence is intimidation

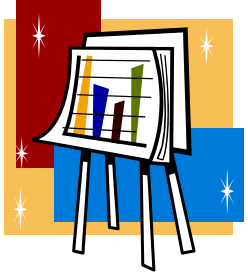


People

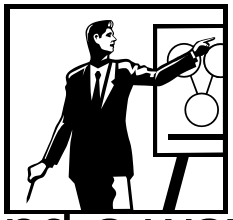
- Keep daring your boss to prove he is, and he will
- If you insist on pouring a gallon of gasoline on your head and asking for a match, someone will eventually oblige
- Rarely have I gotten in trouble by saying too little
  - Answer only what's asked when you're talking to the IG
  - Stop talking when you've sold it
- The worst thing that can happen to you is to have good luck early in your career
  - You begin, maybe unconsciously, to expect it
  - You get arrogant



People



- Thoughts on Meetings…
  - Some people make a career of going to meetings and sharpshooting from the back of the room
  - Always be one to two questions deeper than your charts
  - The greatest compliment you can get is when the chief goes to sleep during your briefing
  - When you're briefing, talk off the charts –don't read them
    - **You're selling confidence in <u>you</u>**
    - **They can read the charts**

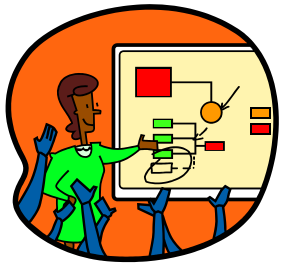


  - At the start of a meeting, try and find a way to ask "What do we want to be the product of this meeting?"
  - Have a "Get off the stage" chart
    - **Don't just end it**
    - **Have some sort of wrapup, message, summary, SOMETHING!**

People

- Cultivate your boss', boss' secretary or Administrative Assistant
- Find out who went in before you, and what happened
  - You'll inherit the consequences, good or bad
- Sometimes you have to tell the boss what he, or she, doesn't want to hear – sorry about that
- Remember, you know about people only what you see – you have no idea of what their lives are like outside the arenas in which you jointly participate
  - They're like icebergs: 8/9 of them is beneath the surface
- Some people think that when you disagree with them, they need to explain it to you again, only LOUDER…and again…and again

People



- If you can't put it on a single 8-1/2" x 11" sheet, you can't manage it
  - You will need further subdivisions, but they should relate to a simple, top-level summary chart
- Never be more straightforward than the people you're dealing with
  - Don't be a tuna swimming with sharks
- Work and life in general are types of games: There are rules (which change); prizes; penalties; winners; and losers
  - **Work and life are not necessarily fun games, BUT**
  - **You can introduce a measure of fun (but don't get caught enjoying yourself)**

People

- All assigned actions should have some common traits:
  - Assign to a person, not a group
  - Have a definite product
  - Have a definite due date
  - Assign someone to follow up on actions, and DOCUMENT THE METHOD AND/OR PRODUCT OF CLOSURE

- In the best functioning teams, you can't tell who is wearing what badge
  - This doesn't mean that there aren't divisions of function – just that everybody is pulling together

People

- CONTRACTS
- Everybody hates ‘em; everybody needs ‘em
- Make sure you pick the right kind of contract for your effort
  - **Fixed Price: When you know EXACTLY (by part number) what you want**
  - **Level of Effort: When you don’t know at 8am what you want at 1pm – “What do I do today, Boss?”**
    - **Need to have MORE TO DO THAN THE CONTRACTOR CAN POSSIBLY DO**
    - **Treat each task like a mini-fixed price contract**
    - **Danger of looking like a “personal services contract”**
  - **Award Fee: When it’s worth something to you to get it better or earlier or cheaper**
    - **Award Fee often used to punish**
    - **Contractor needs to be shown the path to a grade of 100**
    - **In Award Fee parlance**
      - **A grade of “Good” is BAD**
      - **“Excellent” is GOOD**
      - **The contractor has to be HIGH EXCELLENT**
      - **Constant Communication throughout the period is VITAL**
        - » **Don’t wait 6 months to tell him you think he’s LOUSY**

People

- Contracts (cont'd)
  - Incentive Fee: When it's worth A LOT to get it sooner, better, cheaper
    - You will have a target
    - You will have penalties for missing
    - You will have rewards for exceeding
    - These work best if you know EXACTLY what you're buying
    - MAKE SURE YOU AGREE THAT THE TARGET IS REALLY THE TARGET FOR BOTH SIDES

People

- CONTRACTS (CONT'D)
  - Fixed Fee: When you don't know what you want, but are willing to be flexible about what you get
    - Very subject to abuse
    - Can result in uncontrolled changes, overrun
- When contemplating a Gentlemen's Agreement, remember the following Rule:
  - THERE ARE NO GENTLEMEN

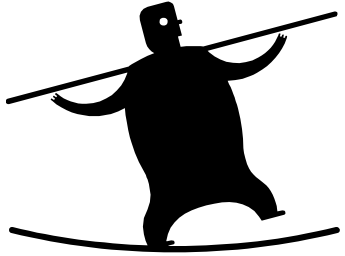
People

- NEGOTIATING
- It is vital that both sides start at the same point
  - Numbers of units; time available; technical requirements
  - Watch out for the guy who starts from an unreasonable position, and then brags on how much he's changed, and how little you have
- Keep a top-level decision-maker away from the day-to-day fray
  - Your point person will, sooner or later, get "used up" in adhering to a position
    - **They get identified with a stance**
    - **You need some "end run" capability**
- Don't get hung up on principle (Read: loss of face) when you're only a few dollars apart
- You better have some margin in when you start, and plenty left when you end negotiations

People

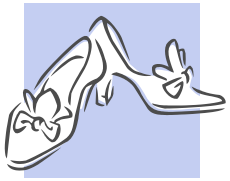
- Email is not mail
  - No expectation of privacy
  - Once you hit “Send”, assume it eventually goes to God
  - People say things in email that they wouldn’t say face to face
  - Before you react to a hot email with an equally hot reply, think about the phone first
- All the smart phones, pads and computers are just tools – they don’t create a thing
  - PRO-E can make crap look good in 3-D and color
  - Your brain, a pencil, a piece of paper and some quiet time make up the best creative system ever devised

People

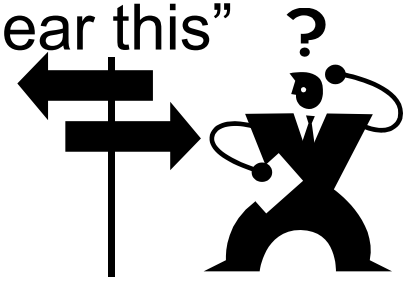


- A large part of what you do is manage risk
  - Cost, Schedule and Performance
  - The tendency is to want zero risk (impossible)
  - The reality is to recognize risk, and take some sort of action to manage or mitigate it
- Ask “Not How, but What If…?”
  - Again – you need to be ready for the answer
- The best managers say: “Don’t TELL me; SHOW me.”
- Watch out for the Challenger Trap
  - They said “Prove to me it’s NOT safe.”
  - They should have said “Prove to me it’s safe.”

People

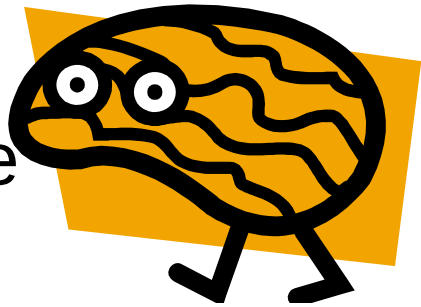


- You can stand in your boss' shoes, but not wear his (or her) hat
  - Figure out what the boss wants and needs to hear
  - Know the "hot buttons"
  - DON'T make his decisions for him or her
    - Present options, even unpopular ones
    - Make a recommendation
    - DON'T decide "He/She doesn't need to hear this"
    - GIVE THEM THE BENEFIT OF YOUR RESEARCH
    - DON'T DECIDE FOR THEM

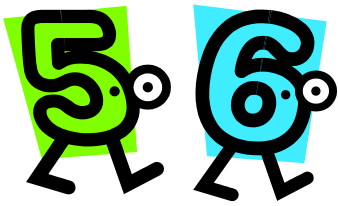


People

- Understand the functional characteristics of the Nominal Upper Management Brain (NUMB)
  - It sees no color – only black and white
  - It understands only zeroes and ones
    - You made it (1)
    - Or you didn't (0)
  - It is a cold sink, constantly requiring warmth
    - It gets its warmth from YOU
    - You give warmth by convincing management that you have your arms around the problem
      - **That relieves them of the responsibility of doing your job for you**
      - **It lets them manage**



People



- THE NUMBER IS THE NUMBER IS THE NUMBER
  - A weight; a date; a cost; a volume – whatever it is…
  - YOUR INITIAL STATEMENT OF A NUMBER IS CARVED IN STONE – what may be your tombstone
    - **It is a stick with which you will be beaten**

  - These caveats DO NOT MATTER:
    - **"This is just a ROM…"**
    - **"We haven't scrubbed it yet…"**
    - **"Don't hold me to this…"**
  - Changes, failures, program stretchouts, things beyond your control DO NOT MATTER
  - Your only salvation is….MARGIN (hidden, of course)

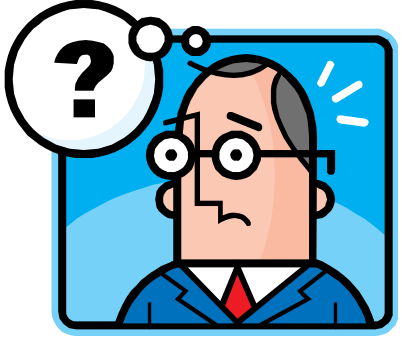
People

- Take a ride on your hardware, if at all possible
  - If you're a rocket engine engineer, OK, that's tough
  - But if you're a suit or PLSS engineer, it's much easier
  - It's a great feeling when you're the only one in the room that knows what it's like to be in a suit

People

- Your signature means something
  - **Let those above you know what it means**
  - **Be aware that the higher you are, the more accountable you are**
  - **OJ won the criminal case, but got nailed by the civil suit**
- The tendency is to want to produce an engineer with a microwave – you have to use a crock-pot
  - **It takes years of making mistakes and living with their consequences to produce a good engineer**
- You can't reason with a fanatic, a drunk or a bureaucrat
  - **Don't waste your time**
  - **Find some way around them**

People



- It's hard to take advice on health from a fat doctor who smokes
  - Consider the source and then make up your mind
- Get input from a number of different people before making a decision
- Never believe the first story
  - Try to get validation before you start blabbing it all over the place, BUT
  - Get to your boss with SOMETHING before he or she hears about it from THEIR boss

PEOPLE

- When trying to unsell on Tuesday the story you so convincingly sold on Monday, be prepared for this response:
  - "Why should I believe you today when you lied to me yesterday?"
  - BE SURE WHEN YOU GO IN THE FIRST TIME; WHEN GOING BACK, BETTER HAVE NEW DATA!

People

- **There are three ways of dealing with unwanted people with whom you are afflicted**
  - **1. <u>Stiff-arm them</u>: Ignore them; don't tell them about meetings; don't return calls; leave them off distribution**
    - **Pro: You may get them so frustrated they'll give up**
    - **Con: You spend time trying to stymie them; also, they may bring down management wrath on you**
  - **2. <u>Pay lip service to cooperation</u>: Give them the absolute minimum; when possible, exclude them**
    - **Pro: Same as above**
    - **Con: Same as above, but they probably can't prove you're not cooperating**
  - **3. <u>Bring them fully on board;</u> ask them to help**
    - **Pro: You may be surprised at what they can bring to the table if they feel valued**
    - **Con: Can't think of one, except you have to admit you were wrong**

People

- If you're dissatisfied with your job, there are really only two sensible options:
  - 1. Figure out what YOU can do to improve the situation
    - **You're probably <u>not</u> going to change others**
    - **You <u>can</u> change yourself – your attitude, if nothing else**

    <u>OR</u>
  - 2. Leave
    - **If you are dissatisfied and you stay without resolving the situation, you make life intolerable for yourself and others**

People

- Never pass up a chance to travel to other sites, contractors and, in particular, vendors
  - Visit the people who actually design and build the parts you're responsible for
  - Build "dotted line" relationships
    - **Do favors**
  - INCREASE YOUR INFLUENCE
- Have some ideals, and live by them
  - There's plenty of time to get cynical

People

- Your boss may seem stupid to you, but there's a reason he or she is in that slot…try and figure that out before you judge

- When you hear something that's bad, don't act until you CHECK IT OUT
  - How hard is a phone call?

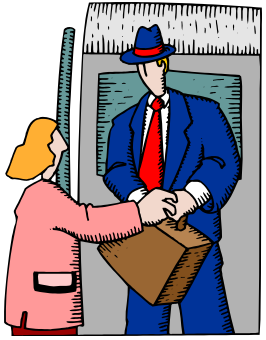
- It is so simple and so important to give credit
  - Anybody can complain, and most do
  - Giving credit is cheap, easy and so beneficial, especially for someone's idea

People

- Beware of the "Good Old Boy" Systems
  - They're not written down
  - They're usually not even known of outside the immediate area
  - WHEN THE GOOD OLD BOYS LEAVE, SO DOES THE SYSTEM
- When something is <u>important</u>, but not <u>urgent</u> – DO IT ANYWAY
  - Something important but not urgent becomes both important and urgent

- All time is not equal: a month in development is much longer than a month before flight
  - You've got control in development; you don't after it ships

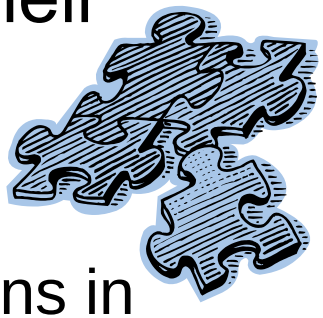
People



- Working 8 hours a day, five days a week won't get it done
  - Somebody, somewhere gets ulcers to make a project succeed
  - Every project needs "champions"
    - People who go the extra 10 miles
- Never, ever, promise to deliver based on a schedule of 3 shifts, 7 days per week
  - Something always goes wrong
  - AT THE MOST, schedule two shifts, 6 days
  - Allow some margin for the inevitable problems

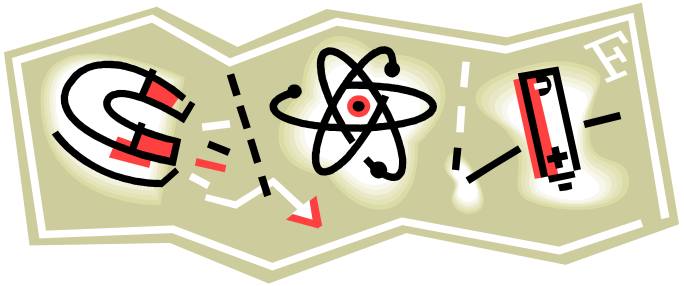
People

- People have a tremendous capacity to distort
  - Remember, a person's perception is their reality
  - PEOPLE ARE INCONSISTENT
    - Just because you can predict their reactions in some situations doesn't mean you can extrapolate



- Try and make decisions on data, not hearsay
  - Remember, "Don't tell me, show me."

Wrap-up



- **The laws of physics work 24/7, and you always get what you asked for**
- **You only know as much about people as your experience with their actions and reactions allow**
- **Every day has the potential to be career-altering or life-changing for you**
- **Time cannot be saved or created or bought – it can only be used**
- **You have arrived, when in a room full of people, you realize that you know more about the subject than anyone else, and you also know how little you know**
- **Have fun in the game of life**
- **Live long and prosper**
- **Use sunscreen**