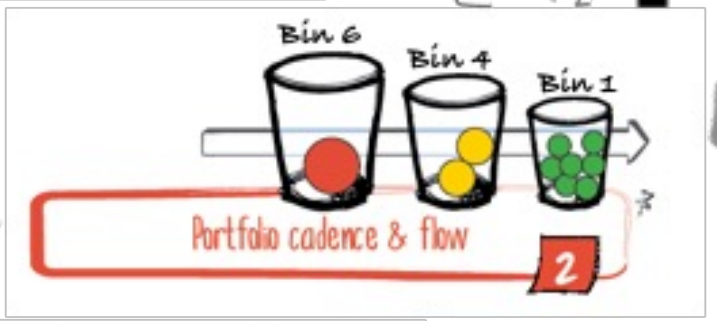
Entrepreneurial System Designer

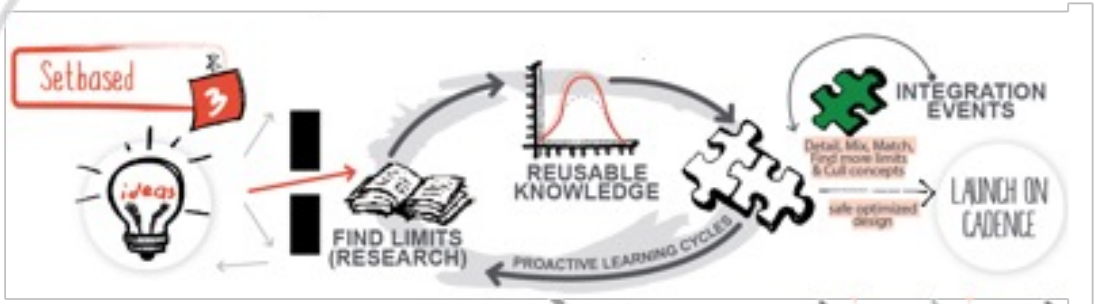
LPPDE Europe 2023 In-Person Conference

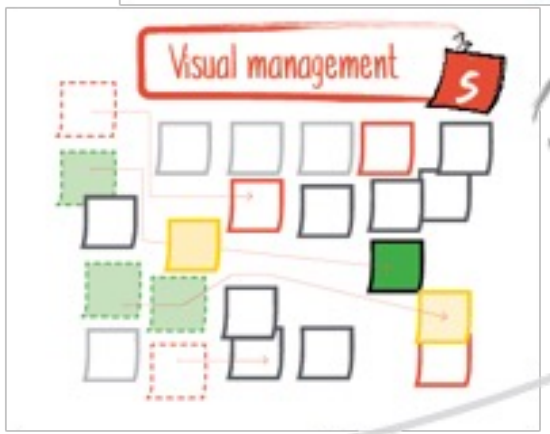
Munich, Germany

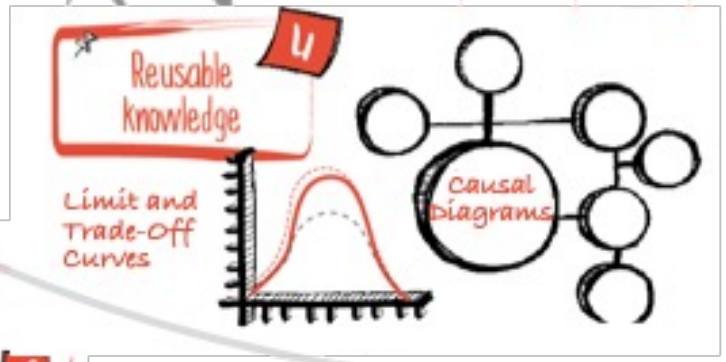
April 24-26, 2023

PURSUE PERFECTION AND DRIVE IMPROVEMENT EVERY DAY









Entrepreneurial System Designers (ESD)

Even with all the elements of Lean Product Development in place, it can not be successfully orchestrated without the conductor

How will I approach extreme leadership as it relates to Entrepreneurial System Designer

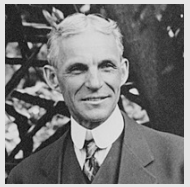
Characteristics of successful entrepreneurs

What are the characteristics of a successful entrepreneur?

Andrew Carnegie, Steel Tycoon

Bill Gates, Computers

Sara Blakely, Spanx



Henry Ford, Automobiles

Sir Richard Branson, Industrialist

Jeff Bezos, Amazon

Characteristics of successful entrepreneurs

Entrepreneurs have the innate ability to understand the connection between the **customer need**, the **technical opportunity** and how to make **profit.**

Entrepreneurs are able to formulate a vision and successfully communicate it to engage others.

Entrepreneurs effectively organize and lead resources to execute their vision but do not delegate authority.

Entrepreneurs take complete ownership of their business …

- The Profit & the Loss
- The Success & Failure

2

LEADERSHIP BEHAVIOR

One hell of a ESD and leader*

ESD-specific leadership is demonstrated through 24 behavioral traits

Demonstrating emotional intelligence	Dealing with engineering change	Maintaining an awareness of cultural differences
Representing the voice of many	Showing enthusiasm	Showing accountability
Being the box top	Learning continuously	Becoming a master of risk
Getting a mentor / being a mentor	Serving as a technical authority	Promoting innovation
Demonstrating knowledge of systems engineering	Maintaining fairness	Building a team
Being the adult in the room	Managing yourself	Having the ability to adapt
Acting as the lead technical integrator	Employing sound engineering judgement	Ensuring technical and business excellence
Negotiating solutions	Being good at both tactics and strategy	Having fun and showing it

*** From "Three Sigma Leadership" – Leadership Skills for NASA's Corps of Chief Engineers by Steven Hirshorn**

One hell of a ESD and leader*

ESD-specific leadership is demonstrated through 24 behavioral traits

Demonstrating emotional intelligence	→ Emotional intelligence is undervalued as a dominant and requisite skill
Representing the voice of many	→ Being out in the front is your job
Being the box top	→ Maintain the focus on the big picture
Getting a mentor / being a mentor	→ Few tools are as effective as the person-to-person interaction you get through mentorship
Demonstrating knowledge of systems engineering	→ More than just a process, it is a mind-set and commitment to excellence
Being the adult in the room	→ Behavioral skills that separate poor / barely adequate leaders from truly exceptional ones
Acting as the lead technical integrator	→ Integrate the mind-boggling number of components into a functioning system
Negotiating solutions	→ When it comes to technical, business, or customer-based disagreements, call the ESD! Tie-braker, resolver…

One hell of a ESD and leader*

ESD-specific leadership is demonstrated through 24 behavioral traits

Dealing with engineering change	→ Face the headwinds continuously and develop strategies to prevent change from causing your project irreparable harm
Showing enthusiasm	→ ESD get to be cheerleader, endless supporter, advocate, and biggest fan of whatever the project is doing
Learning continuously	→ Don’t view learning opportunities as distractions; instead, view them as a means to provide a better team
Serving as a technical authority	→ Checks and balances are what it’s all about. It is a safety net
Maintaining fairness	→ Limit any biases you might have that would impede impartiality
Managing yourself	→ Inculcate a sense of strength and security to the team through the perception of stability
Employing sound engineering judgement	→ No good definition, other than applying your best-informed guess given your accumulated experience
Being good at both tactics and strategy	→ ESD need to master both levels – piece-part and big picture, short-term and long-term

One hell of a ESD and leader*

ESD-specific leadership is demonstrated through 24 behavioral traits

Maintaining an awareness of cultural differences	→ Product Development is becoming increasingly global, and ESD need to adapt to multiple levels of differences
Showing accountability	→ Mean what you say and prove those statements by the actions you take
Becoming a master of risk	→ Risk permeates everything we do. The only option you have is to deal with it and master it
Promoting innovation	→ Encourage crazy ideas and experimentation, eliminate barriers
Building a team	→ You're sort of the boss, with lots of responsibilities, a little authority, and a path to build success
Having the ability to adapt	→ The very nature of change is that it's relentless and unavoidable
Ensuring technical and business excellence	→ ESD establish and maintain their credibility, and in some cases authority, through the demonstration of excellence
Having fun and showing it	→ It shows in your demeanor, in the way you conduct yourselves

Demonstrating emotional intelligence

Emotional intelligence is undervalued as a dominant and requisite skill

- People skills are very important. Successful leaders have them, unsuccessful ones don't
- When people talk to you, listen – even if they are just venting (maybe especially when they are just venting)
- Emotions are not part of engineering, we're told, and emotions are a distraction from the high-risk, time-critical work that we routinely do
- History has noted that more projects fail because of organizational dysfunction or lack of effective leadership than due to hardware exceeding tolerances or operating outside of the expected environment
- Being responsible for a team, we need to deal with subtleties and subjective matters as importantly (or more) than with facts and tangibles
- When discussing technical matters with your team, get used to paying attention to the emotional state, the nonverbal cues and the feeling you get from your people
- Utilizing emotional intelligence is critical in decision-making. Data gives us a wonderful window into technical performance, but data doesn't incorporate experience and wisdom. People do, through – as we as leaders must pay attention to the people as strongly as we do to data
- Most college engineering education (and most other education) simply don't prepare graduates for these tasks
- The engineering culture we live doesn't value emotional intelligence the same way it values technical acumen
- Intuitive skills are wishy-washy. We like data. Inn this case you'll be left with nothing but your intuition – welcome to leadership. But with more practice you become more intuitive

Representing the voice of many

Being out in the front is your job

- A team needs a voice
- Even on small projects, an ESD must delegate and flow the responsibility down to other team members
- You are not just providing your own viewpoints, opinions, perspectives, and concerns, but the ones of your team
- First of all, to be the voice of others you need to understand what they are saying – truly stay connected to your team
- People will have different opinions and ensuring that those viewpoints are heard gives opportunities for dissenting or minority opinions. Organizations where opinions are quashed and/or bottled up tend to become hugely dysfunctional on a project level and at the end on a company-wide level. You need to prevent this from happening. Being the voice of one means giving the voice to many beforehand
- When those maintaining the alternative perspective have the feeling that they have been heard, they most likely will accommodate the majority position

Being the box top

Maintain the focus on the big picture

- In engineering-speak, it's a system-level perspective of all the components, integrated and complete. Maintain the holistic perspective
- On any project the pieces can take a life of their own, everyone seemingly having ultimate importance at any time and garnering the focus of the technical team to solve an intractable issue. Ensure that the pieces come together to produce the desired system
- Sources: needs, goals and objectives (NASA = NGOs) ➜ concept of operations ➜ key driving requirements (KDRs) ➜ measures of effectiveness (MOEs – more subjective qualities of customer requirements) ➜ measures of performance
- Technical measures of performance (TMPs) are useful to maintain focus but can take a life of their own and we lose the forest for the trees. Frequent discussions for when TMPs should go yellow or red – it's your judgement to balance against the top box. The whole system needs to work, not individual TMPs
- On top of the above, you need to be aware of all limitations and constraints: budget ceilings, time limits, workforce prescriptions, regulatory needs, procedural requirements
- Every trade and each choice are decisions made on the path to reaching the system-level solution characterized by the top box
- Carry the top box with you wherever you go to reference it on a daily basis. In fact, NASA developed the NASA Integrated lifecycle (NPR 7123) as a means to manage the top box

Getting a mentor / being a mentor

Few tools are as effective as the person-to-person interaction you get through mentorship

- Mentors can share how they got their scars, scars that they have earned the right to display as badges of honor
- Extreme examples are NASA's Apollo, Challenger, or Columbia missions. Each of these tragedies occurred in separate generations of NASA's workforce
- There are always "gray" areas of the devices – share these facts with the mentor to help making the best choices
- There are always "grey eminences" in every development organizations. Many of them who are in the late stage of their careers take great pleasure to mentor the next generation – take advantage of that
- Not every experienced manager is a good mentor for you – be honest if the relationship works or not
- Mentor is not responsible for providing answers, but instead for assisting recipients in finding their own answers
- Be open to offer your mentorship to other persons in the organization. Offer your experience and guidance

Demonstrating knowledge of systems engineering

More than just a process, it is a mind-set and commitment to excellence

- It forms the basis and structure by which we develop complex systems, from concept development to requirements and design, risk and configuration management, life cycle reviews, verification and validation and all the vital activities leading to an operational capability
- ESD should be able to understand intuitively when the system is mature enough to enter the next milestone
- Understanding that can only be gathered with experience:
  - Differentiate between a good or a poor requirement
  - Basic difference between verification (did I get the system right?) and validation (did I get the right system?)
  - Which products / features are truly required, which are nice to have, or which are superfluous
  - Risk mitigation – an intangible value because project decision-makers expect the project to be successful
- Difference of a Lead Systems Engineer (LSE) and the ESD on the technical side of things:
  - LSE = requirements definition and verification, hardware assembly, integration and test, lead systems engineering team. Manage systems engineering process. Know the next step
  - ESD = maintain oversight of things technical. Maintain authority for technical decisions, owns the technical baseline, provices oversight of the entire system development, is the primary interface with all parties of the development
- ESDs manage the integration events

Being the adult in the room

Behavioral skills that separate poor / barely adequate leaders from truly exceptional ones

- The reputation of effective leaders is based in equal parts on technical acumen and how well they deal with the people on their team (although the latter is hardly ever actively trained or promoted)
- What is it? ➜ taking the high road, controlling emotional outbursts, treating people respectfully, making decisions based on the good of the whole and not of an individual, an individual side or yourself
- You are the person to whom people look to be the adult in the room
- Be the calming influence in heated debates (which occur in every development project)
- Manage and balance all the different “design spaces”, how close we want to be to limits, what type of trade-offs we want to make ➜ each of these topics will bare heated debates (engineers love to protect their “engineering margins”), and you need to be the one who drives the emotionless decisions when are need to be made
- A calm demeanor is your best defense – consciously think about what you say before you say it
- Controlling the “temperature” in the room is a necessary skill. It requires empathy and competence in human psychology (something that often is not natural for an engineer)

Acting as the lead technical integrator

Integrate the mind-boggling number of components into a functioning system

- A clear vision of the system as a whole. ESD must navigate through the design process with a final, intact vision of the system. Intimate knowledge of the key goals, objectives, and driving requirements of the system. Intimate understanding of the stakeholder expectations, operating environment, constant acknowledgement of the constraints and limitations placed upon the system
- An understanding of how the parts fit together. Variables like dimensional tolerances, geographic locations, data processing standards, environmental and physical compatibilities, loads and forces, etc. Interface management with the ability to create “modules”
- The ability to make concessions while holding on to the vision. Choices or trades will confront the ESD on a weekly basis, and decisions will have to be made.
- Communication, communication, communication. Integration is critical, but integration can act as a barrier if it’s not handled well. Get discipline engineers together on a regular basis and talk through the integration as a team
- Ensure integration of requirements. System requirements run into hundreds of individual requirements, and the likely incompatibilities among them need to be resolved
- Ensure integrated series of verification tests
- Ensure that heads are nodding in the same direction and that technical concepts and ideas are understood

Negotiating solutions

When it comes to technical, business, or customer-based disagreements, call the ESD! Tie-braker, resolver…

- The nature of the work is such that there will be a lot of different opinions, and having all that passion can sometimes produce conflict
- Team members want the project to succeed just as much as the ESD. Don't doubt the good intentions
- Use your emotional intelligence to understand how to deal with the disappointment of your team members. The simple action of acknowledging their feelings can go a long way towards salving their wounds
- Process
  - The technical issue: no decision can be made without a thorough understanding of the situation
  - The decision: what is the driver for having to make this decision at this time? Ensure that when a decision is required, it actually gets made
  - The team: during the discussion, hear both sides equally. Once a decision is made, remain empathetic to the side that "loses". Compliment both sides for raising the issue, give credit to all for a good debate. Look for small concessions on both sides, so that everyone feels they have "won" something

Dealing with engineering change

Face the headwinds continuously and develop strategies to prevent change from causing your project irreparable harm

- Traditional processes: early locked-in requirements and design options with a set baseline will surely have bigger consequences than using the LPD approach
  - Change of requirements can have a 10-fold consequence on the rest of the project
  - Managing change requirements as “disturbance” will only increase frustration and harm the project
  - The decision is: when should I establish a configuration-controlled baseline? Don’t do it too early or too late
- Establish the right processes to deal with the certain changes:
  - Set-based development (avoid the “false positive feasibility” trap)
  - Integration events: set up the right pace to move forward with multi-functional “show-me” events and “knowledge gap” discussions
  - Understand the project through visual management
  - Set-up a ”tolerance management” process – this drives time, costs, and supplier choices

Showing enthusiasm

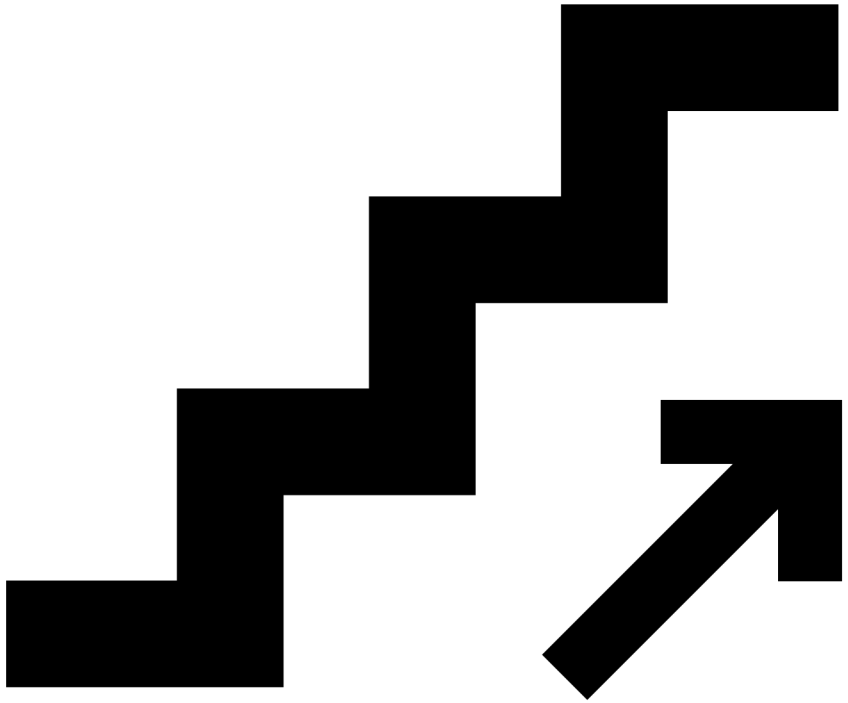
ESD get to be cheerleader, endless supporter, advocate, and biggest fan of whatever the project is doing

- When the going gets tough, the ESD can always be counted on to raise the team's heads high, motivate them to keep pressing forward, work the issues / solve the problems
- There is no one to delegate the health and attitude of your project team
- Be open to admit to your team if you're irritable and short-tempered. They will understand, but not without your honest communication
- Try to run meetings with humor. Humorless meetings are often boring. When humor is allowed, and laughter is encouraged (without overdoing it), they are much more enjoyable and fun
- Enthusiasm is a commodity that must be allocated, portioned, managed, and maintained.
- ESD need to monitor the levels of enthusiasm in their projects. How?
  - Team members stop taking initiative
  - Team members withdraw or uncouple from the work at hand
  - Team members stop offering ideas and/or opinions
- Take every opportunity to celebrate success, even small ones. Rule-of-thumb: 5:1

Learning continuously

Don’t view learning opportunities as distractions; instead, view them as a means to provide a better team

- Example technical learning progression (you don’t get there is you don’t learn continuously)



Leadership, team-building, interpersonal skills

Cost and schedule, critical paths, benefits and risks (f.e. make/buy), project management, decision-making

Expand interdisciplinary boundaries of what is possible

Learn more about what does and does not work, and why

How to interface with other disciplines

Design principles, engineering standards, best practices & procedures

Serving as a technical authority

Checks and balances are what it's all about. It is a safety net

- NASA instilled this role after the tragic event of the space shuttle Columbia (mission STS-107) on Feb. 1st, 2003
- Technical authorities ensure a separate path of reporting for issues of safety and mission success: Health & Medical, Safety & Mission Assurance, Engineering (ETA)
- ETA provide for authority in approving waivers of or deviations to technical standards. The ETA, ESD or higher "own" the technical standards

Maintaining fairness

Limit any biases you might have that would impede impartiality

- Actively listen to both sides and allow each adequate time to make their case. Let others speak, even if you don't agree with them (at least not initially)
- Find ways to recognize the entire team
- Act in an equitable fashion based on what is good for the project, the team, and the system under development
  - Be fair
  - Be impartial
  - Look for objective data (maximize use of data, facts and real-life experience, and avoid using guesses, theories, blame, invective)
  - Be ethical
  - Choose fairly (fairness may be the most critical component in building and maintaining functional and high-performing teams)
- When deciding, lay out your rationale so that others can understand it

Managing yourself

Inculcate a sense of strength and security to the team through the perception of stability

- What are symptoms of good practices:
  - Time management
  - Limiting or eliminating clutter
  - Self-organization
  - Self-awareness
  - Work-life balance
- Team members want their leaders to be the embodiment of good practices. They want their leaders to personify exemplary behaviors

Employing sound engineering judgement

No good definition, other than applying your best-informed guess given your accumulated experience

- Engineering judgement is subjective
- But the ESD, when using their engineering judgement, ensure that it is based on reality, good engineering practices, reasonable assumptions, and can be supported by previous experience
- Normally it is defensible through historical precedent or anecdotal experience

Being good at both tactics and strategy

ESD need to master both levels – piece-part and big picture, short-term and long-term

- ESD need to see the big picture, the whole, the system-level perspective, and consider long-term needs and implications
- Engineers are good problem-solvers and many problems exist at the levels of details. It's critical we get the details right because entire systems have the potential to fail If we get single critical detail wrong
- Systems engineering was developed to provide a holistic, integrated scheme taking the entire system into consideration and optimizing at that level
- Risk management is another area in which the ESD needs to apply tactical-strategic skills
- ESD need to ask the right questions to approach both sides of the coin:
  - How to address the short-term issue and maintain the long-term schedule?
  - Are there legacy mechanisms / modules that can be used to keep the project on track, even if we don't meet all requirements?
  - Can I negotiate the requirements themselves with stakeholders?
- Development processes usually start with more strategic questions, then evolve into more tactical ones. It goes from *what* the project should be about and *why* stakeholders want it vs. *how* to execute it

Maintaining an awareness of cultural differences

Product Development is becoming increasingly global, and ESD need to adapt to multiple levels of differences

- Sources of cultural bias:
  - Cultures and basic viewpoints
  - Geographic distance
  - Lifestyles
  - Project managers vs. scientists / researchers
  - Communication
- Since we can't get away from cultural conflict, all we can do is recognize that it is part of any team's dynamics
- Any diverse team is stronger than a homogeneous one
- Give everyone the opportunity to speak, listen empathetically, avoid accusing anyone of anything less than having honest intents

Showing accountability

Mean what you say and prove those statements by the actions you take

- The number of people the ESDs must remain accountable to is daunting – their team, their bosses, project management, their stakeholders, etc.
- You must build trust among and throughout all of those groups and keep that trust throughout the life of the project
- EDS often represent the project itself, so if they don't demonstrate accountability the entire project loses credibility
- Establish accountability at the start, and throughout the hundreds of opportunities to maintain and tarnish it
- You may decide not to make a promise at a given moment, and that's OK. But if you make a promise, each one may be a test of your accountability
- Beware of an area where accountability tends to get compromised – right from the start: early formulation of the project, when it needs to secure funding and gain approval. Optimistic schedules, grandiose technical capabilities, aspirational technical advancements
- Accountability equals reputation. You need to know the achievability of the commitment you are making

Becoming a master of risk

Risk permeates everything we do. The only option you have is to deal with it and master it

- Practice risk management yourself and train your brain to think in terms of risk
- Risk should always be on your mind, and you should always stay sensitive to the presence of it. Murphy exists
- Use the risk matrices continuously, as they are helpful tools to train your thinking
- Figuring out which events might bite your project on its rear is frequently the most difficult part of managing risk

Likelihood \ Impact	Negligible	Minor	Moderate	Significant	Severe
Very Likely	Low Med	Medium	Med Hi	High	High
Likely	Low	Low Med	Medium	Med Hi	High
Possible	Low	Low Med	Medium	Med Hi	Med Hi
Unlikely	Low	Low Med	Low Med	Medium	Med Hi
Very Unlikely	Low	Low	Low Med	Medium	Medium

- When reviewing the collection of risks, make sure that:
  - The set represents your understanding of priorities in the big picture and understand impacts on the system as a whole
  - Everyone has the same understanding of the risks
  - You're able to explain the risks to whoever asks (familiarize with the content of each high-priority risk – statement, what it conveys, what it affects within the system)
- Seek out the same matrix for opportunities. Both risks and opportunities utilize actions to affect the desired outcomes
- Build a decision point into the mitigation plan (usually one or more

Promoting innovation

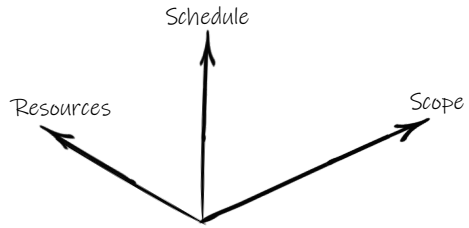
Encourage crazy ideas and experimentation, eliminate barriers

- Innovation doesn't mean taking gratuitous risk, but thinking about a problem from a different angle
- Seven barriers to eliminate:
  - Risk-adverse culture
  - Short-term focus, focusing on day-to-day which encourages band-aid development
  - Instability, changes is direction and decisions. Good ideas are quickly terminated due to the change occurring around the project
  - Lack of opportunity, like technology demonstrations, fairs. No follow-through of good ideas
  - Process overload, like admin. Burden
  - Communication challenges, like silos, "not invented here"
  - Organizational inertia, like lack of trust, innovation as a threat
- Ensure that you manage the "extremes" in your team. Manage both so they don't become disruptive
  - The fearful, who see threats everywhere. They may just need a bit of solace to assuage their fears
  - The impractical, who innovate so much that the project risks to derail if we let them have it all

Building a team

You're sort of the boss, with lots of responsibilities, a little authority, and a path to build success

- What type of project is it? Large and costly, small and agile? Build on the "project bin" structure, the functional block diagram to understand the 3 project levers
- In detail, give the right consideration to the following:
  - Understand how much systems engineering will be required. Do you need a dedicated integration manager?
  - Understand how much testing and verification will be required. Do you need a dedicated test and verification manager?
  - Will you be approaching the project with a low risk tolerance and a high need to mitigate, or is the project inherently risky and much will be allowed? Do you need a dedicated risk manager?
  - The organizational structure of the team will affect how it communicates up, down, and across, and who reports to whom. In any case, use visual management to manage the flow of information and decisions



- After deciding the structure, you actually need to find the people, get them up to speed on the project and start to work with one another. Make some effort to get to know them individually
- You're responsible to keep the team functioning: set goals, monitor performance, direct and redirect as required, investigate when things aren't working so well, negotiate quarrels, and act as a mentor and counselor, boss and friend.
- Build a RASCI matrix to clearly define roles and responsibilities
- Be a delegator – don't be afraid to give a bit of additional responsibility to your team members
- Celebrate team's successes, even small ones.
- Things you'll have to do (which you will probably not like):
  - Contending with team's problems and issues
  - Intervening between combatting team members

Having the ability to adapt

The very nature of change is that it's relentless and unavoidable

- Configuration, requirements, schedules, Budgets, turnover of team members, contractors – none of us like those changes, because we have to "RE" everything. Redesign, restaff, reverify, etc. Leadership and thorough processes are required to deal with all that – this is where the ESD come in
- Understand which parameters you can fix by process, either company-wide or project-wise, and welcome changes outside of those perimeters. Ex. Fix the time for learning cycles but keep resources and scope flexible. Keep integration events fixed but keep the number of design sets to be evaluated flexible…
- The ESD establishes the pace and volume of changes that the team will manage. He will fix the how to deal with change and when decisions are made
- Adapting also means having the perspective and attitude to accept a required change and working to make it happen
- Make sure that any change is openly communicated in a positive, affirming way
- Empathize with your team members, let them know that you understand the hardship of changes, but make it clear that the change will happen
- The LPD processes and the ESD leadership's goal are to reassert order within the uncertainties of change during a project

Ensuring technical and business excellence

ESD establish and maintain their credibility, and in some cases authority, through the demonstration of excellence

- It's hard to define excellence – it's the standards you hold yourself accountable for
- What are the tenants of excellence:
  - Clearly documented policies and procedures
  - Effective training and development
  - Balancing risks: engineering rigor cannot always be sacrificed for schedules and budgets, and likewise programmatic concerns cannot always be overlooked in the development of technical approaches
  - Continuous communication: risk management, knowledge management, best practices & lessons learned, continuous learning
  - Personal accountability: each individual is responsible for the mission's success
  - Organizational accountability: company has the responsibility to provide the process framework, training, tools, and environment for excellence

Having fun and showing it

It shows in your demeanor, in the way you conduct yourselves

- You love going to integration events. You're proud of the accomplishments to close knowledge gaps and finalize a learning cycle. You look forward to the decisions that will be made with all participating functions
- You love to participate in design reviews. The discussions resonate with you, and you should show it
- Show your internal passion through which you obtain personal and professional gratification
- Balance the "fun factor":
  - Your team should have fun, too. Look for indicators that show if they don't have fun: grumpiness, irritation, short temper, lethargy, lack of motivation, and a sense of being disconnected. Find out why they are not having fun. Listen deeply. Utilize your emotional intelligence. Find a starting point to solve the issues – more jokes will have the opposite effect!
  - A team with "too much" fun is disruptive. Keep them focused on the job and in working in a professional manner

CO-CREATING THE INDUSTRIAL FUTURE

ARGO EFESO
MANAGEMENT CONSULTANTS

www.argoconsulting.com

YOUR CONTACTS:

Andreas Dörken
ARGO-EFESO
Partner
+34 610 250118
a.doerken@argoconsulting.com

Dantar Oosterwal
ARGO-EFESO
Partner
+1 312 292-6148
d.oosterwal@argoconsulting.com

ARGO EFESO
MANAGEMENT CONSULTANTS

Co-Creating the Industrial Future

ARGO-EFESO
WWW.ARGOCONSULTING.COM

455 N. Cityfront Plaza Dr., Ste 2750, Chicago IL, 60611
Tel:
Email: