Systems Engineer your Retirement by Simply Implementing a Verification Plan

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Abstract.   Of course what comes to mind is 'how can you perform verification without requirements?' Obviously one must develop their retirement requirements but as you do keep verification in mind for several reasons: First, requirements must be written to be verifiable. Secondly, requirements that will not be verified, i.e., included in a planned verification event or activity, are useless rubbish. Thirdly, through identification of verification events or activities it is often realized that requirements are either missing, incorrect, or should be deleted. Finally, when new system designs or services to be provided are the same or similar to what has been done before the requirements most likely already exist and have been verified; therefore they may be borrowed and used with minimal alterations.

Certified scuba divers are taught this rule: Plan your dive and dive your plan. This is the key to a successful gratifying dive experience.   It is no coincidence that a successful gratifying retirement experience must also be planned. As System Engineers (SEs) we know a lot about planning and every program we work has several types of plans: Concept of Operations, Program Execution, SE Management Plan, Requirement Development, Requirement Management - just to name a few. I propose if you only use one SE plan for your retirement the best plan to select is a verification plan. I say this because the quality of your life is based on what you do. Verification demands awareness as to what you are doing or not doing. It provides a necessary check as to whether or not precious time is being wasted on projects that are off track from your intended retirement pursuits.

As you increase your skill in writing necessary verifiable requirements, verification events, approaches, success criteria, closure statements, and verification reports, for your own life the better qualified you will become in your SE career.   Remember, it is never too soon to begin planning for your retirement. Also, based on the evidence from human behavior research, too many workers fail to plan appropriately for their retirement. Therefore, the development of a prime SE retirement verification plan template may serve as a beneficial INCOSE technical working group project for the benefit our INCOSE membership and beyond.

Introduction

Employee Benefit Research Institute. To optimally prepare for financial security at retirement requires in-depth knowledge of a number of issues, including expenses in retirement, life expectancy, taxation, and capital-market expectations. Only 43% of the people who need to prepare for financial security perform a retirement-needs calculation, based on current human behavior research from the EBRI. And a retirement-needs calculation is just the beginning; the amount needed at retirement must be translated into an appropriate current savings rate and an optimal investment portfolio to show the best possible return against lowest possible risk.

As difficult as all of this may be, the employer offered financial retirement plan or 401(k) design of yesterday essentially left workers to make these decisions on their own, despite evidence that they lacked the skills and knowledge necessary to assume this responsibility. According to EBRI's most recent Retirement Confidence Survey, 40% of workers are not currently even saving for retirement.

It is intuitive that information, education, and guidance would have positive effects on decision making, but this is not always the case. There are no significant improvements in participant knowledge despite the millions of dollars and significant amounts of time spent on education by both the participant and the plan sponsor. Typically, when retirement-plan participants have access to integrated advice tools through their retirement plan, only about 5% to 15% actually use them.

Consumer Driven Health Care. More than 75% of survey respondents without access to a consumer-driven health plan (CDHP) said they were not interested in having access. These health insurance plans allow members to use personal Health Savings Accounts (HSAs) to pay routine health care expenses directly, while a high-deductible health insurance policy protects them from catastrophic medical expenses. High-deductible policies cost less, and the user pays routine medical claims using a tax-deductible pre-funded spending account. Anyone who is HSA-eligible and paying for health care expenses out-of-pocket instead of from an HSA is missing out on the tax advantages that HSA accounts offer.

With respect to health-care decision making, although only 5% of workers with employment-based health benefits available are uninsured, workers do appear to be relatively disengaged when it comes to their interest in consumer-driven health plans. When subjects received the additional information on how to understand the plan-quality charts, they were actually *less* able to understand the charts and more likely to describe the benefits incorrectly. People who received more information were less likely to use it and also less likely to switch plans.

Obesity Epidemic. Nearly one-third of America's population is obese, despite obesity's strong links to poor health outcomes such as Type II diabetes and heart disease. Data from two National Health and Nutrition Examination Surveys show adults ages 20–74 prevalence of obesity increased from 15% (in the 1976–1980 survey) to 32.9% (in the 2003–2004 survey). As for worker's capability to make appropriate health care choices, a similar case to their financial participation is observed, merely calculating a worker's share of health insurance costs for a year—a basic and critical part of evaluating one's health care coverage—is considered to be one of the most difficult tasks.

The fact of the matter is most workers who do participate in employer offered plans are not even *capable* of making appropriate retirement planning or health care choices. It is simply too difficult. This may explain why a certain percentage of workers just are not interested in retirement planning or health care education and information.

Automatic Enrollment. In short, retirement-plan sponsors have come to realize that it is much easier to change *plan design* than it is to change *worker behavior.* Based on lessons learned employers have moved toward the use of default choices (i.e., elections that automatically apply when workers do not make active choices on their own) and greater simplification in the plan itself. The favorable results of automatic-plan features have been impressive—generally more than 90% of automatically enrolled participants remain in the retirement plan. Participants are automatically enrolled in what is judged to be an optimal plan for most and must elect choices tailored to their individual needs. In the case of 401(k) retirement plan design, more employers are moving toward a default of automatic enrollment in the plan, with automatic investment in a diversified portfolio.

When there are numerous funds available in a retirement plan, sponsors will often categorize them by asset class or label a subset of the funds core and segregating the others into increasingly specialized tiers, suggesting that only the most sophisticated investors would be interested in the highest, most specialized tier.

Similar approaches could be taken for health care choices. Automatic enrollment or 'required' active decision making in the health care domain could also have similar positive effects. Because even when 'educated' workers have the intent to make improved decisions they often lack follow-through and fail to take action. Therefore, education and guidance may not be enough to foster improved health care consumerism.

Vacation Plans. Workers may also be disengaged in their own vacations. It is counter-intuitive that anyone who works 50 weeks a year would not be interested in their 2 week vacation. And yet not only do workers fail to plan their vacations but some even fail to take their vacations. We all know co-workers who allow their accumulated earned vacation to surpass the allowed limit; in essence they go to work on their vacation days. Owning a vacation resort time share week or 2 can function like an automated enrollment in a plan. The owner must purchase the week(s) and pay the annual maintenance fees. If the owner doesn't use their week(s), i.e., call and make reservations or request to deposit their week(s) with an exchange service they lose them. The benefit of the service is expert assistance in selecting a vacation time and destination. But even time shares can become too complicated with additional choices such as bonus weeks, week-end get-aways, and VIP options. The result again of too many options, too much information, is no choice being made. As Systems Engineers we know the importance of keeping things simple.

Maximizers. An interesting note on human behavior, people who consistently try to choose the very best (called maximizers) have been found to be less happy, less satisfied with life, more pessimistic, and to have lower self-esteem. They also tend to be less satisfied with their choices. So it pays off to be content with average financial, health, and vacation plans with reasonable expectations.

Retirement Template.   Clearly what employees need is a well rounded retirement plan template. As SEs we could offer such a template in the form of a retirement verification plan (RVP). The requirements in this template may be individually tailored. Therefore, creating a systems engineered RVP may serve as a beneficial project for an INCOSE Technical Working Group.

Retirement Life Cycle

There are five phases to one's retirement life cycle. Phase I involves the concept and scope of one's retirement. Phase II is the development of the retirement verification plan. Phase III is the verification performance or living and documenting the retirement. Phase IV is your plan adjustments, maintenance and updates. Phase V is the disposal or post mortem end of the retirement.

Retirement Plan Phase I. Phase I of the retirement plan life cycle is the concept and involves scoping out the foundation of your retirement life style. There are many generic retirement financial and health plans available to serve as a requirement development template. To enhance a selected template research the lifestyles of favorite retired mentors. To retire like Bill Gates discover the rules he uses to guide his retirement. Anyone with an extensive amount of assets, such as a philanthropist, must manage them responsibly. The financial management of assets is only one set of retirement requirements. To retire like Jack Lalane or Richard Simmons model your retirement based on their physically active lifestyles. Short and long term health care form another set of retirement requirements. To retire like an adventurer such as Steve Fossett identify the rules followed in making lifestyle decisions for selecting and scheduling expeditions. Adventure and excursions are another set of retirement requirements. To retire like an intellectual or wise lecturer such as Joseph Campbell, who has authored many books including The Hero's Journey, then research the retirement lifestyles of such heroes. There are also spiritual lecturers such as Carolyn Myss and Wayne Dyer. If you desire to become a person you admire and to live an honorable life then pursuit of personal growth must be a part of your plan. Personal growth is another set of retirement requirements; reference appendix A Definitions and Human Values. There are also personal decisions to be made concerning post mortem when tailoring a generic retirement plan. How to handle your post mortem remains and unspent assets is another set of retirement requirements. As Suzie Orman says 'It's not a question of whether or not you will die but of when.'

Obviously one's financial, health care, expeditions, soul searching, and post mortem requirements must interface with one another and one's retirement plan must include necessary interface requirements. For example, how much funds are allocated to travel adventures or spiritual retreats. The first phase of retirement life is developing draft requirements to form the concept of one's retirement operations. One must immediately focus on developing a Retirement Verification Plan (RVP) or this concept will end up gathering dust on a shelf, or perhaps more realistically abandoned in an old folder on a huge hard drive.

Retirement Plan Phase II. Phase II of the retirement plan life cycle is development of one's RVP. The first step is to identify known verification events that will occur:

I. Possible Major Verification Events for Retirement:
    A. Financial Consultation to target the date to end employment
          1.   Estimate annual fixed income
          2.   Select health care insurance package
    B. Annual Income Tax Preparations (Federal/State)
          1. Track income, expenses, expenditures
          2. Track investment gains and losses
          3. Track charitable contributions (e.g., Family Planning, Amnesty International)
    C. Annual Physical Exams to monitor health
          1. Food selections
          2. Exercise routines
          3. Dental checkups
          4. Optical checkups
          5. Chiropractic care to relieve pain (central nervous system/muscular skeletal)
    D. End of Life Process
          1.   Living will or trust
          2.   Power of Attorney
          3.   Purchase burial assets
    E. Sponsor the family reunion every 5 years
          1.   Select location of event
          2.   Invitations
          3.   Fund raiser game with prizes

II. Identify Minor Verification Events for Retirement that may occur:
    A. Vacation Travel to desired locations (e.g., use or lose time share weeks)
    B. Experience the arts: Music, Theater, Museums, Opera, Las Vegas
    C. Community involvement
          1. Attend local events (county fairs or surfing competitions)
          2. Voluntary services (neighborhood watch or home owners BoD)
    D. Pursue personal goals
          1. Purchase a retirement or vacation home
          2. Update beneficiaries on financial funds
          3. Participate in adult classes or conferences

The main sections of the RVP should be similar to SE program verification plans, often referred to as summary sheets and closure statements. Each requirement should have a page in the plan consisting of the following:

Requirement Number: Typically assigned by a relational database
Requirement: State what is to be achieved (the shall statement)
Child Requirements: List the next lower level requirement numbers (allocations)
Verification method(s): Select how the requirement will be verified
Verification Activity: Explain the approach to comply with the requirement
Success Criteria: State what evidence will ensure compliance with the requirement
Verification Evidence: List the report(s) or statement location(s) of the verification activity
Requirement Status: Open or Closed (i.e., requirement complied with or not)

Closure Statement: Requirement verification shows compliance and closes

Requirement Decomposition. If you have a top level or parent requirement such as attending the INCOSE International Annual Symposiums (IAS) for the next 20 years then the decomposed lower level or children requirements will need to be verified first. The children requirements may be written as attend: 2020 INCOSE IAS, 2021 INCOSE IAS, … , 2039 INCOSE IAS; then each requirement can only close after that year's event completes. So the top level parent requirement 'Attend INCOSE IAS for the next 20 years' will not close until the 2039 INCOSE IAS concludes and the child requirement closes. Each INCOSE IAS requirement will also have children requirements to ensure funding, participation activity, vacation plans or tourism (etc.) occur to meet the requirement as intended, reference Figure Requirement Decomposition.
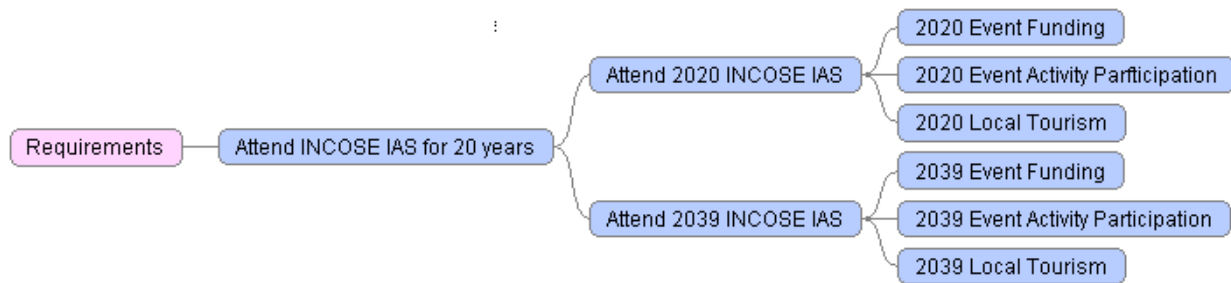

Figure Requirement Decomposition

There are also Deviations and/or Waivers, if for example one year more local chapter events are attended in place of the IAS then a deviation from the plan will be recorded. Also, if a schedule conflict occurs and the event is not attended then a waiver is recorded. This deviation or waiver is recorded in the closure statement and is used to close the requirement. The following is an example of a summary sheet and closure statement:

Requirement Number: 1234
Requirement: Shall attend INCOSE IAS for next 20 years
Child Requirements: 1234.1 [2020 ICOSE IAS], 1234.2 [2021 INCOSE IAS], … ,
      1234.20 [2039 INCOSE IAS]
Verification method(s): Demonstration
Verification Activity: Attend each INCOSE IAS from 2020 through 2039
Success Criteria: Attendance through 2039 INCOSE IAS event
Verification Evidence: INCOSE IAS Registration Receipts from 2020 through 2039 located
      with tax records
Requirement Status: Open
Closure Statement: Details of each IAS event located in the lower level requirement verification summary sheets

Verification Methods. There are 3 standard verification methods used to show requirement compliance: Test, Analysis, and Inspection. The Demonstration method is a type of test (e.g., pass/fail) and similarity is a type of analysis (e.g., comparison made between requirements to approve the use of indirect evidence); reference appendix B Definitions. Each method generates a report as evidence to ascertain whether or not the requirement compliance criteria are met.

Each requirement in the RVP must have a documented verification activity or approach and success criteria. The requirement status may be closed when the evidence verifies activities to comply with the requirement are complete. For example, requirements to legally complete a living will or assign someone as power of attorney may be verified by inspection of the legal documents and by providing the document(s) location in the closure statement (e.g., bank safety deposit box information).

Requirements concerning financial investments may be verified by demonstration; i.e., the particular fund achieved growth that year or it did not. It is wise to cut losses by liquidating or selling funds that have ceased to turn a profit. Requirements concerning travel such as accumulating Flyer Miles or purchasing Time Shares may be verified by test. The verification plan approach determines the expectations and the success criteria states what must be experienced to meet those expectations (e.g., quality of air travel and overnight accommodations). Save the details for the verification reports, this is where it belongs, not in the requirements or verification approach activity statement. If the test fails to meet the success criteria then drop the flyer miles plan and/or sell the time share.

Requirements concerning personal growth may be verified by analysis. Heed this quote from Socrates 'an unexamined life is not worth living'. For example, a top level requirement concerning developing and maintaining a positive attitude focused on what you want and not on what you do not want – may have children requirements that specify milestone introspections. For some that may consist of annual New Year's resolutions. These lower level requirements may be written as: January 2020 written resolutions, June 2020 semi-annual introspections, January 2021 written resolutions etc. One could also consult mentors to contribute to their own self-assessments and to provide guidance for selecting resolutions.

Verification Strategy. Verification of hardware on typical design and build programs follows a strategy consistent with testing units at the lowest level. Qualification or Protoqual first units then relax testing to Acceptance tests for replica units; reference appendix B for definitions. Integrate units into a subsystem and verify but do not duplicate tests unnecessarily. Integrate subsystems into a system and verify but do not duplicate tests/analysis unnecessarily (i.e., were satisfied at a lower level).

Verification of software follows a similar strategy, test code 'units' before compiling into the 'subsystem' database. Verify subsystem database after compilation but do not duplicate code self tests. Integrate 'subsystem' databases by compiling into the system database and verify operation, functions, performance, but do not duplicate tests run at a lower level of integration.

Therefore verification of financial, health care, expedition, soul searching, and disposal retirement requirements should also follow a similar strategy. Do not write verification approaches for higher level requirements that merely duplicate verification performed at a lower level. Also, be sure to verify similar requirements in the same time frame; for example, requirements concerning weight loss and lowering cholesterol. Initial trial and error approaches may be necessary to assess a successful health routine and develop desired requirements. Later, perhaps annually, verify the requirements of your health program.

Spontaneity. The question will surely arise as to whether the planning may be squashing the spontaneity out of your life. On the contrary, without plans there is much less likelihood of opportunities where spontaneity can occur to enrich your experience. Too many people recently retired claim they don't know how they ever found the time to be employed because they are so busy now. Do you really want to spend the best kernel of your retirement performing home maintenance, auto repairs, and running errands for others? If so, perhaps for you this is a spiritual Zen experience, write these activities as requirements in your retirement plan. If not, then don't side track from your plan by dedicating too much time to Spring cleaning and Autumn yard work. Be honest with yourself, if you don't intend to throw things out (i.e., a confessed pack rat) then don't waste time cleaning out the garage. Leave this exercise for the next home owner.

Retirement Plan Phase III. Phase III of the retirement life cycle is performing the verification activities established in the plan. This is where the requirements are met; one is living their retirement according to their plan. I'm sure you will discover the efforts made in the development and maintenance of your RVP will come back to you ten fold because energy goes to where attention goes. You are literally breathing life into your retirement making your golden years vibrant. Just as some people have a negative rapport with money – perceiving it as either the root of all evil or worse as something merely fleeting - consequently they never have enough because their energy is not attracting money. As such, there will be those who never fully enjoy their retirement. Don't be one of these people. Retirement is not just passing the time away – not if you plan otherwise.

The verification evidence showing the retirement requirements are being met will often exist in the reports you document. This documentation will contain the details of your experience. For example, you may write an assessment report on whether or not your vacation met your success criteria (expectations). Or perhaps an assessment following annual income tax filings will report on financial success or failure based on specific requirements (e.g., expense goals or stock gains/losses). Feedback from medical exams will enable you to record compliance with your health care requirements. Also, you may record bi-annual introspection progress towards personal goal requirements. These reports not only provide evidence for requirement compliance but may drive the efforts of the RVP adjustments of the retirement plan phase IV.

Retirement Plan Phase IV. Phase IV of the retirement plan life cycle is RVP adjustments maintenance. As you become more mature and experienced in managing your retirement you will surely want to change requirements, as they say, out with the old in with the new. Delete those requirements that no longer work for you, change quantitative measures to be more realistic with the current times, and create requirements for places you were unaware of what you needed or wanted in life. For example, based on your New Year resolutions semi-annual assessment reports you may decide to change your requirements, hopefully to increase your expectations. All failed success criteria, based on assessments, will drive requirement rewrites, deletions, and/or repetitions of activity events.

There is nothing more gratifying in a RVP as when requirements are identified for deletion. Verifying requirements takes time, energy, and money – don't waste these. We all start off clinging to some false beliefs as to what will prepare us for retirement. Unfounded rumors are

often spread such as one must acquired $5M before they can retire securely. Before dedicating enormous amounts of time, energy, and money into accumulating this specific amount please ask yourself if there is any truth to this statement. Do a realistic evaluation of savings. If your research reveals there is no evidence to back this belief then let it go.

As a bonus feature, improving your skill in writing necessary verifiable requirements, verification events, approaches, success criteria, closure statements, and verification reports, for your own life will also make you better qualified in your SE career.   Remember, it is never too soon to begin planning for your retirement.

Risk, Issues, and Opportunities. RIO must be incorporated into your verification strategy and be present in each applicable requirement verification approach and success criteria. Consider investment risks, health issues, and employment or volunteer opportunities.   To mitigate financial risks one must cut losses quickly. All health issues must take precedence of time and energy focus so one may overcome and continue enjoying their retirement.

Long-term health care insurance is a contingency plan to mitigate the risk of spending huge financial resources on hospitalization. Another risk mitigation is assigning a Power of Attorney to ensure choices such as to treat or refuse treatment will be honored. Pending the desire to either prevent long suffering or a vegetative existence or to prevent hastening death where there is no probable cure as in a terminal illness.

Stay open minded to take advantage of various opportunities for continual contributions to society. This may be an opportune time to become more green (i.e., energy efficient), make life style changes to reduce carbon emissions/footprint and take advantage of tax breaks and incentives for living a cleaner life during this concerned awareness of climate change and global 'weirding'.

Traces. Just as requirements are decomposed and allocated down from parent to child as part of the requirement development process; traces flow up from child requirements to parent(s). To trace or not to trace that is the question. If child requirements are mandatory to comply with a parent requirement then the link will ensure the parent requirement is not closed prior to all children requirement closures. Some SEs do not like orphan requirements because they fear the requirement will be overlooked, i.e., not tracked, and left open. The problem with linking non-mandatory requirements to a parent requirement is that the parent cannot close, even if ready, because of an open child. Therefore link with caution. Closure of requirements proves one is on track with their plan, i.e., retiring successfully. Please be diligent in closing requirements on time.

Relational Database Tool. Managing the RVP is best achieved in a database designed for requirements and relating verification artifacts.   To select a relational database tool for generating and maintaining the RVP is an easy task. If by chance one wins a lifelong license to a commercial requirements management tool, e.g., Cognitive Cockpit, during this INCOSE event then by all means implement what you have at your finger tips. There are many experienced SE tool users within INCOSE who can make qualified recommendations. Select a tool for easy use not numerous extra features that tend to go unused. Perhaps select a web based RVP with

accessibility via any internet connectivity. Also, gather lessons learned from those who are experienced users of personal planners for tips on efficiency and ease of use.

Retirement Plan Phase V. Phase V of the retirement life cycle is the disposal or post mortem final closure to one's retirement. Some people have a slow death and others go quickly. Disposal phase requirements may include retirement home or hospice care. It is important to plan ahead and assign a power of attorney to ensure your life or death desires are fulfilled. Now is the time to answer the tough questions: Do you want to receive life-support and if so under what circumstances? When would you consider yourself to no longer be of sound mind? How often will you update your will, especially beneficiaries? If and when do you want to establish a living will or trust? Who will care for you when you can no longer care for yourself? Do you want burial by cremation, casket, or other? Do you want to spend all your money before you die, or even before you lose your physical mobility? Is life insurance part of your plan? Record your answers as requirements in the RVP and create the verification summary sheets and closure statements as applicable, reference phase III of the retirement life cycle in this paper.

Once you are no longer able to maintain your RVP it won't become something for the trash. It can certainly serve as a wonderful biography to leave to loved ones. They will remember you for what you desired, accomplished, and documented in the best years of your life.

Summary

This paper may serve as an inspiration to create a service for an automated enrollment in a well rounded systems engineered retirement plan. There are five phases to one's retirement life cycle. Phase I involves the concept and scope of one's retirement. Phase II is the development of the retirement verification plan. Phase III is the verification performance or living the retirement. Phase IV is the plan adjustments maintenance to keep it relevant to current wants and needs. Phase V is the disposal or post mortem end of the retirement. Planning will not squash the spontaneity out of one's life. On the contrary, with plans in place there is much more likelihood of opportunities where spontaneity can occur to enrich one's experience.   One will discover the efforts made in the development and maintenance of their RVP will come back to them ten fold because energy goes to where attention goes. One will literally breathe life into their retirement making their golden years vibrant.   As a bonus feature, improving one's skill in writing necessary verifiable requirements, verification events, approaches, success criteria, closure statements, and verification reports, for their own life will make them better qualified in their SE career.   Remember, it is never too soon to begin planning your retirement. Perhaps knowing what we do about human behavior proposing an INCOSE Technical Working Group to prepare an automated enrollment retirement plan would be beneficial to our membership. Once our members have their RVPs in place it will free up their time; thus enabling them to pursue increased participation in our future INCOSE events.

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Appendix A: Definitions and Human Values

Planning is a process used to identify and select appropriate goals and courses of action.
Planning process steps:
1. decide which goals to pursue
2. decide what course of action to adopt to attain each goal
3. decide how to allocate resources to attain goals

Values definition: What you want to achieve in life and how you want to behave.
Terminal value: a lifelong goal or objective you seek to achieve.
1. a comfortable, prosperous life
2. an exciting stimulating, active life
3. a sense of accomplishment or lasting contribution
4. a world at peace, free of war and conflict
5. a world of beauty, nature and the arts
6. equality, equal opportunity for all and brotherhood
7. family security, ability to take care of loved ones
8. freedom, independence, free choice
9. happiness or contentedness
10. inner harmony, free from inner conflict
11. mature love, sexual and spiritual intimacy
12. national security, protection from attack
13. pleasure, an enjoyable leisurely life
14. salvation, saved, eternal life
15. self-respect, self-esteem
16. social recognition, respect, admiration
17. true friendship, close companionship
18. wisdom, a maturing understanding of life

Instrumental value: a mode of conduct you seek to follow.
1. ambitious, hard working, aspiring
2. broad minded, open minded
3. capable, competent, effective
4. cheerful, lighthearted, joyful
5. clean, neat, tidy
6. courageous, standing up for your beliefs
7. forgiving, willing to pardon others
8. helpful, working for the welfare of others
9. honest, sincere, truthful
10. imaginative, daring, creative
11. independent, self-reliant, self-sufficient
12. intellectual, intelligent, reflective
13. logical, consistent, rational
14. loving, affectionate, tender
15. obedient, dutiful, respectful]
16. polite, courteous, well-mannered
17. responsible, dependable, reliable
18. self-controlled, restrained, self-disciplined

Appendix B: Verification Definitions

Verification **-** includes the activities necessary to evaluate progress and effectiveness of evolving system products and processes, and to measure specification compliance.

Life cycle - The time scope of a system from the start of manufacturing, verification, and integration through deployment, training, operations, and support during all program phases, including upgrades, until final disposal of the system is complete.

Event - A point in a program or contract defined by significant accomplishments and accomplishment criteria (or metrics) in the IMP. The goal for the calendar date to complete an event is documented in the IMS.

Interface - The boundary between two or more systems, functions or other logical representations, or system products or between a system and a facility at which interface requirements or constraints are set. Interfaces can be physical or functional.

Allocation - 1. All or a subset of a requirement for a higher level system element that has been designated to be satisfied by a lower tier element.   2. The act of decomposing the requirements for a system among the elements of the system. 3. The results of (2).

Traceability - The ability to relate an element of the requirements baseline, functional architecture, allocated baseline, design release baseline, and product configuration baseline (or their representation in the decision data base) to any other element to which it has a master-subordinate (or parent-child) relationship.

Test - The verification method of determining performance by exercising or operating the system or system product using instrumentation or special test equipment that is not an integral part of the system or system product being verified. Any analysis of the data recorded in the test and that is needed to verify compliance (such as the application of instrument calibration data) does not require interpretation or interpolation/extrapolation of the test data.

Analysis - 1. The performance and assessment of calculations (including modeling and simulation) to evaluate requirements or design approaches or compare alternatives. 2. The verification method of determining performance (a) by examination of the baselines for a system or system product, (b) by performing calculations based on the design release base-line and assessing the results against the requirements of the allocated or requirements baseline, (c) by extrapolating or inter-polating empirical data collected using system products built, bought, or coded according to the baselines and assessing the results against the baseline requirements, or (d) by a combination of all of the above.

Inspection - The verification method of determining performance by examining (a) engineering documentation produced during development or modification or (b) the system product itself using visual means or simple measurements not requiring precision measurement equipment.

Demonstration - The verification method of determining performance by exercising or operating a system product in which instrumentation or special test equipment is not required beyond that inherent to the product and all data required for verification is obtained by observing operation of the product.

Similarity – The verification method of assessing whether existing compliance evidence for one artefact is acceptable to show compliance to another requirement.

Qualification - 1. For hardware, the verification that a component or higher level of integration, together with its embedded software, meets all requirements and constraints during the

worst-case environmental and operating conditions anticipated over its life cycle. 2. For computer software, the verification that a component or computer software unit meets all requirements and constraints over the possible range of all variables, computational paths, and decision logic outcomes.

Qualification Test A test of a qualification unit that is representative of production units to demonstrate that the design will survive the specified qualification environment. Environments are sized to envelop handling and operational experience to prove design margin. A qualification test must be performed on a unit that is representative of the production item, and a number of qualification units may be built and tested, each for a specific purpose. The structural qualification unit does not need the operational electronics, for instance, during structural tests.

Protoqualification Test A test of a proto-qualification unit, perhaps not the final design production unit to demonstrate the design will survive the specified qualification environment.

Acceptance Test - For hardware, the verification that a component or higher level of integration, together with its embedded software, meets all requirements and constraints for which the verification method is test, inspection, or demonstration following any procedures to ensure workmanship such as environmental stress screens.

BIOGRAPHY

Sherry Pietras, Aerospace Systems Engineer and former INCOSE L.A. Chapter BoD member, has been an INCOSE member for 7 years. Currently employed by Boeing, Sherry has contributed to several military and commercial programs including aircraft simulators, space shuttle, launch vehicles, spacecraft, and the Army's Future Combat Systems during her 20 plus year career. She has volunteered support to various INCOSE events.

She is in pursuit of her PhD in Systems Engineering and received her masters in systems engineering from UMR in 2001, her masters in philosophy from CSULB in 1999, and her bachelors in electrical engineering from Akron University in 1984. Her experience ranges from systems architecting to specialty engineering.