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MAIN JSSE TOPICS
- Safety by design
- Safety on long duration missions
- Launch and re-entry safety
- Space hazards (debris, NEO objects)
- Space weather and radiation
- Environmental impacts
- Nuclear safety for space systems
- Human factors and performance
- Safety critical software design
- Safety risk assessment
- Safety risk management
- Organizational culture and safety
- Regulations and standards for safety
- Space-based safety critical systems
- Space Situational Awareness
- Space traffic control
- Space traffic and air traffic interfaces
- Space materials safety
- Safety & Rescue
- Safety lessons learned

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ABSTRACT

The international need for a safety and mission assurance (S&MA) training is narrow, but deep. Although some universities have ventured into this area and offered degree programs in the past, they quickly found that the narrowness made it unprofitable. The question arises as to how we as S&MA professionals train those in our field with the needed knowledge to prevent the potentially catastrophic events that may occur.

A-P-T Research, Inc. is currently in the initial stages of developing a web-based training program for S&MA professionals that will pool resources from multiple professional organizations and Government agencies. The S&MA virtual classroom will host online training classes in a variety of the S&MA disciplines, capture guest lectures, and offer professional certifications that are missing from our industry.

1. APT SEAC

In 2004, the Safety Engineering and Analysis Center (SEAC) was formed as a division of A-P-T Research, Inc. As an APT Division, the SEAC supports all aspects of safety engineering with emphasis on three overlapping disciplines: System Safety, Range Safety, and Explosives Safety. Each of these three disciplines contains elements that are unique to it alone. Each also has elements that are common among the others, including risk management and risk assessment.

The mission of the SEAC focuses on the proper practice of safety engineering. In support of the mission, SEAC personnel provide analytical services, prepare special analyses including quantitative risk assessments, develop new methods, draft safety engineering standards, build software models, conduct safety training, serve as expert witnesses, participate in special studies, support accident investigations, perform third-party reviews, and conduct testing.

The SEAC is a collaboration of experienced practitioners and has attracted distinguished and experienced members of the S&MA community who have a desire to mentor the next generation of safety professionals. One of these members is the late Pat Clemons. Pat was widely recognized as a mentor of system safety and brought the insight of over 50 years of experience. Prior to joining APT Pat had trained over 2000 safety practitioners and assembled the first training classes offered by APT.

1.1 APT Continuing Education and Training Division

As a division of the SEAC the APT Continuing Education & Training Division (CE/T) supports the mission of the SEAC by providing both internal and external training to the S&MA community.

Each year APT trains a wide variety of S&MA professionals on topics such as system safety, software safety, explosive safety, and site planning software. Conducting training for more than 250 safety professionals annually. Safety practitioners from the Army, Air Force, Navy, National Aeronautics and Space Administration (NASA) as well as others from industry and internationally regularly take APT CE/T courses.

2. THE CHANGING OF THE TIMES

In the past government organizations developed S&MA training programs. In the 70’s and 80’s over 200 people went to the US Army Intern training program, many of which went on to careers in DoD and NASA. As time went on these types of formal training programs slowly evaporated from industry. Although, higher education attempted to duplicate these types of training programs for industry in the form of professional and continuing education it soon found that the audience for these types of programs was so vast that they soon found these types of programs unprofitable and ultimately these programs would also disappear from the list of options.
3. THE ADVANTAGE

Professional and Continuing Education has always been a pursuit of both individuals and corporate initiatives. The approach to Professional and Continuing Education should not be taken as a singular experience but rather as a career long practice. The benefits have been studied at length and result in increased cognitive abilities, spark interest and new methodology, and a curiosity to continue to learn more. There is also evidence that suggest that there is a positive correlation between effective training and an increase in effective teamwork [1].

4. DEVELOPING PEOPLE, NOT COURSES

One of the most important aspects that should be considered is that our mission should be to develop people, not courses. The systems that S&MA professionals work on in this day and age can change rapidly. Looking closely at the evolution of NASA in recent years this is extremely evident. During the 80’s and 90’s NASA space travel was conducted by the shuttle. NASA’s S&MA professionals only had a need to be concerned with a single system and the familiarity of the system was an advantage to the S&MA community. The day-to-day operations were familiar and it wasn’t uncommon to find engineers or safety professionals that may have up to 20 years of experience on the same system.

This is no longer the case. Today, these systems are designed by multiple commercial companies including, but not limited to, Blue Origin, Sierra Nevada Corporation, Space Exploration Technologies (Space-X), and The Boeing Company. Even the systems within a commercial company are not fixed. Space-X for example utilizes several orbital launch vehicles including Falcon 1, Falcon 9, and the Falcon Heavy, some of which come in a variety of configurations.

In a report [2] published by the National Transportation Safety Board (NTSB) it was determined that failing to consider the possibility that the test pilot had the ability to unlock the feather early, a single point human error, ultimately resulted in the break-up of the vehicle. NTSB also determined that the test pilots were poorly trained and did not fully comprehend the risks of unlocking the feather early. Although, the issue was well known by designers the operators (pilots) were lacking the proper training and knowledge needed to safely operate the system, no doubt attributed to the unfamiliarity with the system itself.

Developing the S&MA community to be adaptable to multiple systems means giving them the professional training that they need and making this training accessible to them on an as-needed basis. By taking this approach it is more likely that our S&MA professionals will have the correct solution at the critical time. Resulting in an overall reduction to the risk imposed to both life and mission that our community works to improve on a daily basis.

5. THE WAY WE LEARN

It is undisputed that our universities and colleges have developed students utilizing a structure of curriculum based learning since the inception of formal education. With the evolution of technology, society has changed the way learning and information transfer occurs. Understanding that our employees and our professional community has changed is of upmost importance as we seek to design a new learning environment for professional and continuing education that will provide our employees and ultimately our discipline with the maximum benefit.

As a society we have become more focused on information seeking than retaining information. This really is an evolution of the way we operate in our work environments as well. There is constantly an influx of tools and information. Whether they are software tools, hardware tools, or even instructional manuals and knowing how to use these can provide a variety of benefits. However, we must educate the community on the proper way to use them. Software tools can provide advantages by giving quick analysis answers, but if the community using them doesn’t understand the way they work they can also provide detrimental outcomes when used inadequately.

There is no other sector of the population for which this is more applicable to than the millennials, usually described as the generation born between the early 80’s and the 2000’s. The largest sector of this group, those 23 years old, were influenced by the internet during their formative years and it is no surprise that if you ask a millennial a question they don’t know the answer to and they are likely to respond with: “Let me google that for you”. They use tools like Google, Wikipedia, and YouTube to find quick answers to questions. They’ve grown accustomed to instantaneous connection and nearly immediate responses. In the workplace, they expect the same environment. They want to be able to ask questions and get training and career advice all the time, on demand. By 2025 they will make up 75% of the workforce so it is important that we take their influence into account as we develop training they will be engaged in and benefit from, focusing more on a spirit of information seeking vs. banking knowledge.
6. CONTENT

The APT S&MA classroom will focus on developing online training courses, capturing guest lectures from S&MA subject matter experts, and providing discussion boards for collaboration. The online classroom embraces the spirit of an information seeking user and will enable students to develop their own curriculum specific to the issues and topics that are most applicable to both their professional and personnel goals. The online classroom will be available 24/7 and have a fully functional searchable catalogue enabling students to quickly find the topics that are of need/interest.

Although the content may be expanded in the future, the initial focus of the classroom will be to provide content on the following subject matters.

- System Safety
- Quality Engineering
- Reliability and Maintainability
- Operational Safety
- Software Assurance
- Aviation/Range Safety
- S&MA Managerial and Leadership

The technical subject matter closely resembles the structure of NASA’s Safety and Mission Assurance Technical Excellence Program (STEP) developed by the NASA Safety Center (NSC). STEP is one of the first comprehensive training programs that has been developed to address the needs of the S&MA community. The success of this program within the NASA community lays a foundation for the future success of the APT S&MA classroom that will be accessible to an international audience.

In addition to the topics presented above the online classroom intends to have other resources such as:

- Case Studies
- Guest Lectures
- Discussion Forum
- Resource Library

7. GETTING INVOLVED

The APT S&MA classroom will not be a success without the support of the S&MA community. There is already a vast database of material available to those in our community and APT would like to invite professional societies, organizations or individuals who have content to collaborate on this effort. Those organizations who have a desire to participate in the advancement of the discipline and the development of the APT S&MA classroom should provide contact information to training@apt-research.com.

8. REFERENCES

1. Take time for team training: the benefits of continuing education are numerous—a more qualified team and motivated employees are among them. Here’s how to get the most out of these training sessions. (2010, August). Veterinary Economics, 51(8), 39+. Retrieved from https://portal.lib.fit.edu/login?url=http://go.galegroup.com.portal.lib.fit.edu/ps/i.do?id=GALE%7CA238980808&sid=summon&v=2.1&u=melb26933&it=r&p=AONE&sw=w&asid=d77d27495a1391e9920e925ca9c83615

Progress in space safety lies in the acceptance of safety design and engineering as an integral part of the design and implementation process for new space systems. Safety must be seen as the principle design driver of utmost importance from the outset of the design process, which is only achieved through a culture change that moves all stakeholders toward front-end loaded safety concepts. Superb quality information for engineers, programme managers, suppliers and aerospace technologists.

Space Safety Regulations and Standards is the definitive book on regulatory initiatives involving space safety, new space safety standards, and safety related to new space technologies under development. More than 30 world experts come together in this book to share their detailed knowledge of regulatory and standard making processes in the area, combining otherwise disparate information into one essential reference and providing case studies to illustrate applications throughout space programs internationally.

Safety Design for Space Operations provides the practical how-to guidance and knowledge base needed to facilitate safe and effective operations safety in line with current regulations. With information on space operations safety design currently disparate and difficult to find in one place, this unique reference brings together essential material on: safety design practices, advanced analysis methods, and implementation procedures.
GLOBAL SPACE EXPLORATION CONFERENCE (GLEX 2017)

6 - 8 June 2017
Beijing, China

The GLEX 2017 programme is designed to bring together leaders and decision-makers within the science and human exploration community – engineers, scientists, entrepreneurs, educators, agency representatives and policy makers. It will provide a forum to discuss recent results, current challenges and innovative solutions and it will contain several opportunities to learn about how space exploration investments provide benefits as well as discuss how those benefits can be increased through thoughtful planning and cooperation.

www.glex2017.org