Critical Infrastructure Protection and Recovery

www.incose.org/IW2021

CHAIR

Daniel Eisenberg (Naval Postgraduate School)

CO-CHAIRS

John Juhasz
Anthony Adebonojo
Stephen Sutton
Anthony Gigioli
William Mackey

INCOSE WEB PAGE

https://connect.incose.org/WorkingGroups/CriticalInrastructure/SitePages/Home.aspx

INCOSE CONNECT ADDRESS

https://www.incose.org/incose-member-resources/working-groups/Application/critical-infrastructure

Charter Summary

2021 Annual INCOSE international workshop
Virtual Event
January 29 - 31, 2021

WG PURPOSE/MISSION

The purpose for the Critical Infrastructure Protection and Recovery (CIPR) Working Group (WG) is to provide a forum for the application, development and dissemination of systems engineering principles, practices and solutions relating to critical infrastructure protection and recovery against manmade and natural events causing physical infrastructure system disruption for periods of a month or more.

Critical infrastructures provide essential services under pinning modern societies. These infrastructures are networks forming a tightly coupled complex system cutting across multiple domains. They affect one another even if not physically connected. They are vulnerable to man-made and natural events that can cause disruption for extended periods, resulting in societal disruptions and loss of life.

The inability of critical infrastructures to withstand and recover from catastrophic events is a well?documented global issue. This is a complex systems problem needing immediate coordinated attention across traditional domain and governmental boundaries. For example, the US President issued Presidential Policy Directive PPD?21 that addresses ?a national unity of effort to strengthen and maintain secure, functioning, and resilient critical infrastructure.? This includes an imperative to ?implement an integration and analysis function to inform planning and operations decisions regarding critical infrastructure.?

This working group will seek to support this and other policies with international reach. INCOSE, as the premier professional society for systems engineering, can provide significant contributions toward critical infrastructure protection and recovery.

Charter Summary

2021 Annual INCOSE international workshop
Virtual Event
January 29 - 31, 2021

WG GOAL(S)

This WG will provide and support opportunities to exchange knowledge and systems engineering information and solutions within the scope of the CIPRWG, both within INCOSE and with external organizations sharing similar interests and goals. The opportunities include systems engineering products (e.g. architectures, requirements, IV&V, etc.). This information will be disseminated through publications (papers, articles, briefings) and supporting meetings, conferences, panels, and other means. Specific areas of knowledge include the following.

- The events capable of causing infrastructure disruption. These include short-duration events (e.g., terrorist attacks) and long-term phenomena (e.g., climate change, global competition) that lead to system failures of a month or more, to include all aspects of their characteristics and impacts.
- The socio?technical factors and effects related to CIPR.
- The overarching structure and interconnectedness among the critical infrastructure domains.
- The interaction among infrastructure systems under various degraded states of operation.
- Possible conceptual and design solutions, and related information.
- ?Strategies for verification and validation of solutions.

The CIPRWG will provide a collection of systems engineering and related products that provide understanding and solutions for domain stakeholders impacted by the events. This can include products developed by several working groups and initiatives, such as Architecture, Complex Systems, Model?Based Systems Engineering (MBSE), Decision Analysis, Enterprise Systems, Natural Systems, Resilient Systems, Risk Management, Cost Engineering, Human System Interaction, In?Service Systems, Reliability Engineering, Requirements, System of Systems, System Safety Integration, Social Systems, Automotive, Healthcare, Infrastructure, Power & Energy Systems, and Transportation Systems.

Other working groups also have knowledge to contribute as well. The CIPRWG will endeavor to integrate and coordinate among standards, regulations and best practices of the impacted industries. It will also provide the organizing and development functions to establish new concepts and standards addressing CIPR. Stakeholders with interest in CIPR are international and include all levels of government, defense and security agencies, critical infrastructure domain businesses and agencies, and society in general (e.g. regions, communities and citizens).

Charter Summary

2021
Annual INCOSE
international workshop
Virtual Event
January 29 - 31, 2021

WG SCOPE

Certain man-made and natural events have a known potential to affect societies at a national, continental or even global scale. Such events can cause extreme harm well beyond those experienced from regional catastrophic events, especially when the effects will take longer than a month to recover. Three examples of events with the potential to cause critical infrastructure collapse include Solar Storms caused by Coronal Mass Ejections (CME), Electromagnetic Pulse (EMP) and Cyber Events (intentional and otherwise). The CIPR WG will pursue its goals by addressing these three classes of events, and other classes of events with similar potential, when identified.

The CIPR WG will promote and apply systems engineering principles with emphasis on policy, analysis and concepts useful to understand, protect and recover existing operational infrastructure, and to provide strategies, standards and concepts for more resilient approaches, through evaluation, development and implementation of specific recommendations that can be accomplished with primarily volunteered resources. It will promote and perform activities supporting the stated goals.

This scope is synergistic with other INCOSE WGs identified above (e.g. MBSE, System of Systems, Resilient Systems, Power & Energy, etc.). For example, the application of model-based approaches will be essential to analyze the problem and to communicate alternative conceptual solutions. Therefore, this WG will seek interest and participation from INCOSE members and the other INCOSE WGs. It will also reach out to engage international and governmental organizations, professional groups, critical infrastructure providers, and others stakeholders. MOUs, contracts and other kinds of agreements may be sought with external organizations as needed to further the effort. These agreements, if any, will be established according to INCOSE guidelines, processes and procedures.

The critical infrastructure domains addressed by the CIPR WG include the following sectors. Other domains may be addressed as the need is identified.

1. Chemical
2. Commercial Facilities
3. Communications
4. Critical Manufacturing
5. Dams
6. Defense Industrial Base
7. Emergency Services
8. Energy
9. Financial Services
10. Food and Agriculture
11. Government Facilities
12. Healthcare and Public Health
13. Information Technology
14. Nuclear Reactors, Materials, and Waste
15. Transportation Systems

Charter Summary

16. ?Water and Wastewater

OUTCOMES (PRODUCTS/SERVICES)

IW Outcomes

2021 Annual INCOSE international workshop
Virtual Event
January 29 - 31, 2021

IW OUTCOMES

During the INCOSE IW 2021, the CIPR WG held three meetings and events:

1) Invited Speaker Session on Critical Infrastructure Resilience: Current Practices and Future Needs

- CIPR WG members were provided background on current US Federal efforts for critical infrastructure resilience and identified growing needs and issues that form the future threat environment for critical infrastructure systems.
- Stephen Cauffman from the US Cybersecurity & Infrastructure Security Agency introduced members to current CIPR efforts with the US Department of Homeland Security. He provided details on recent Critical Infrastructure Resilience Planning efforts and background on the analyses and tools used for regional resilience assessments. He further gave insight into how methods like model-based systems engineering can support current efforts.
- Gregory Copley from the International Strategic Studies Association discussed the current threat environment impacting critical infrastructure systems and operations, with an emphasis on geopolitical and technical developments that challenge past practices and methods. He emphasized current offensive actions by nation states and emerging areas like space warfare that influence the vulnerabilities of critical systems like electricity and water.

2) Critical Infrastructure Protection & Recovery Workshop

- CIPR WG leadership introduced the integration of the Anti-Terrorism International (ATI) WG. Each WG provided background on past accomplishments and future goals for CIPR related technical projects and products.
- This session also elicited research topics and established the technical products that the CIPR WG should lead and support for the 2021-2022 year. 12 technical products and projects were presented and pitched to the CIPR WG members. Members joined breakout groups and identified which products were most impactful, interesting, and feasible. The workshop established four project and products for the 2021-2022 year.

3) CIPR Leadership Meeting

- CIPR WG leadership established new roles and organization for incorporating the ATI WG as co-chairs. TPP plans were established for all products and projects established in the CIPR Workshop. Plans for upcoming meetings and international calls were established.

IW Outcomes

2021 Annual INCOSE international workshop
Virtual Event
January 29 - 31, 2021

PLANNED ACTIVITIES AFTER IW

The CIPR WG Leadership will conduct the following activities:

- Weekly CIPR Leadership calls to coordinate technical products and projects
- Monthly CIPR International Calls open to INCOSE membership and broader research community
- Submit 4 technical project proposals related to the products and projects established in the CIPR Workshop
- Establish a coordinated presentation, session, or track to be included in the INCOSE IS 2021 or 2022 program
- Develop more robust outreach plan to academic and professional organizations

PLANNED WORK PRODUCTS AFTER IW

The CIPR WG will submit technical project proposals and complete the following technical products:

- **A SysML model of the Dept. of Homeland Security critical infrastructure sectors and their relationships:** this model will present a simple way to navigate the relationships across numerous critical infrastructure systems.
- A **resilient hospital reference model:** this model will support emergency planning for hospitals, with emphasis on black sky events like long-term blackouts.
- A model of the **COVID 19 vaccine last-mile supply chain:** we will develop a model to determine how and why there are significant delays in COVID 19 vaccine distribution
- A standard for **data and sensing cybersecurity and trust:** we will work with experts across organizations to help develop a standard for data collection and sensing equipment for industrial controls.