2019
Annual INCOSE
international workshop
Torrance, CA, USA
January 26 - 29, 2019

# Critical Infrastructure Protection and Recovery

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## CHAIR

Mitchell Kerman (mitchell.kerman@inl.gov)

## MEMBERS

80

## CO-CHAIRS

John Juhasz (telepath.juhasz@yahoo.com)
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## INCOSE CONNECT ADDRESS

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

## INCOSE WEB PAGE

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

# Charter Summary



## 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 underpinning 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 manmade 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.

## WG GOAL(S)

This WG will provide and support opportunities to exchange knowledge and systems engineering information and solutions within the scope of the CIPR WG, 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.

# Charter Summary



Specific areas of knowledge include the following.
a) The events capable of causing infrastructure disruption for periods of a month or more, to include all aspects of their characteristics and impacts.
b) The socio-technical factors related to CIPR.
c) The overarching structure and inter-connectedness among the critical infrastructure domains.
d) The interaction among infrastructure systems under various degraded states of operation.
e) Possible conceptual and design solutions, and related information.
f) Strategies for verification and validation of solutions.
The CIPR WG 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, Automotive, Healthcare, Infrastructure, Power & Energy Systems, Transportation Systems, and Anti-terrorism. Other working groups also have knowledge to contribute as well.
The CIPR WG 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).

## WG SCOPE

Certain manmade 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. 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. Other domains may be addressed as the need is identified.

1) Chemical and other industrial bases
2) Communications
3) Electrical & Energy production and distribution
4) Emergency Services
5) Financial Services
6) Food and Agriculture
7) Government Services & Facilities
8) Healthcare and Public Health
9) Information Technology
10) Nuclear Reactors, Materials, and Waste
11) Transportation
12) Water storage, treatment and distribution
13) Waste handling and disposal (water, refuse, hazardous)
14) Society at large

# IW Outcomes



## IW Outcomes

- Reviewed and accepted our current charter (no changes)
- Discussed process of engaging international community in projects
- Some projects have "sensitive" information and involvement from members outside of INCOSE. These members cannot work with foreign nationals.
- WG Chair is final authority in allowing membership in sub-WG teams
- International members can be engaged in many projects, but not all projects under the WG
- Reviewed and discussed current modeling efforts
- Microgrid modeling
- Initial work / base reference model completed by S. Friedenthal
- This effort to continue work by a sub-WG team
- Resilient Hospitals modeling
- Work is continuing with INCOSE and outside membership (SDMPH, JHU/APL, etc.)
- VSE WG attended discussion; may have products applicable to this area
- Lean Startup Method used to begin this modeling effort
- Publications Planning
- Discussed development of CIPR Primer and appendix (systems thinking based) for InfraGard"s *Powering Through 2.0*
- Inter-WG Collaboration
- John Brtis, Chair RSWG, presentation on Resilient Systems
- Jimmie McEver, Complex System WG, discussion of Complex Systems and interactions, anti-fragility principles, books and publications

# Planned Work past IW



## PLANNED ACTIVITIES

- Continue modeling efforts -- both Microgrid and Resilient Hospitals modeling efforts
- Continue publications development

## PLANNED WORK PRODUCTS

To be published in 2019
InfraGard Publication: Powering Through 2.0
Submitting appendix concerning systems thinking / science / engineering view of CIPR
CIPR Primer (targeted publication before end of CY19)
Use PT 2.0 appendix as base document and modify to a primer
Future Publications
CIPR themed issue of INCOSE INSIGHT – planned for March 2020 issue
Possible document (4 to 5 pages) describing the Micogrid reference model and approach