The HUMAN CONTINUITY PROJECT®

PLANET-WIDE COLLABORATION FOR
A RESILIENT, SECURE FUTURE

EIS COUNCIL

Background

About EIS Council

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Introduction

EIS Council hosts research, planning, and policy and technology development, with a focus on enabling resilience to extreme "Black Sky"[1] hazards across all key infrastructure sectors. EIS is a not-for-profit organization established in 2009.

In today's tech-driven world, unprecedented tools have enabled efficient, multi-sector connectivity, bridging distances and linking supply chains and nations. This interconnectivity has brought us exceptional opportunities, enabled by the seamless, just-in-time flow of information, goods and services across borders.

Yet interconnected also means interdependent: operations in any sector depend on a network of operations across most of the others. In this new reality, an extreme disaster in one sector or region could metastasize, breaking this just-in-time flow, with disaster swiftly cascading through many infrastructures and regions. If severe, this could devastate global financial markets, supply chains, and even social structures. In short, unprecedented civilization-scale catastrophe.

Building resilience to prepare for disasters on this scale requires vision, drive and deep commitment. It also requires bold ambition supported by a well-informed, structured approach, built with the widest possible collaboration, in small steps, and ultimately scaled sensibly and practically.

Committed to this ambitious vision, working with a wide range of partners, EIS is hosting a collaborative, systematic initiative to begin this effort: the **Human Continuity Project®**.

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1 Black Sky hazards: Events that could cause long duration, extreme, subcontinent-scale infrastructure failures

Why?

The anatomy of the problem

Potential architects of our own demise

Our world is marked by unprecedented capabilities, made possible by today's unprecedented, global-scale webwork of tightly coupled, tech-supported infrastructures and supply chains. Electricity, transport, medicine, finance, communication, food, water, and vastly more. Sometimes called the "metagrid," we often take this fragile resource network for granted. Yet the tech-enabled tight coupling that has given us historic capabilities has also given us a new, civilization-scale vulnerability. Much like a living organism, if any important piece of this network is disrupted, the "metagrid" could fail. Our civilization could collapse.

The "metagrid:" The global-scale webwork of tightly coupled, tech-supported infrastructures and supply chains that sustains our modern civilization

What does our evolving "metagrid" look like?

Global digitization is the connective tissue of our new, interdependent world. By 2024, internet availability had reached 67% of the world's population. Products and services that used to be delivered or enabled by physical channels are now focused on digital alternatives.

What is driving the metagrid's evolution? Where are we headed?

Faster, cheaper, better

Today's tech-driven connectivity has transformed the way we live, bringing us new opportunities and exceptional convenience. Economically, our world has shifted toward a knowledge-based economy

underpinned by digitally rendered services and information technology. With legacy physical alternatives eliminated, we're in a race toward faster, cheaper, and better with no safety net in the event of failure. If important parts of the metagrid stop, our world stops.

The risk, and the price

The road to faster, cheaper and better has produced complex layers of new, digitally-delivered services in every sector. With legacy alternatives left behind, these tightly connected services of convenience have become services of necessity: failures in one could disrupt all the others. But over decades, governments and industry have become resilience-passive, and have not adequately addressed this new reality.

Conventional risk management is insufficient:

The traditional approach to assessing and mitigating risks is no longer adequate. Probabilistic risk-reward assessments, typically based on historical frequency, are useless for rare but extreme, potentially existential crises that have not yet happened. The standard risk equation of likelihood vs consequence must no longer be automatically applied, because some of the consequences are unthinkable, such as Black Sky hazards where, without careful, comprehensive preparation, such events may happen only once.

They may be terminal.

A focus on probability has made decision-makers too willing to ride their luck. The resilience of critical infrastructure is challenged daily and often found to be unprepared. Infrastructure failure affects whole networks and societies and how we live, work, survive and thrive. It's no longer the cost of resilience that counts, but the avoided cost of failure.

Leaders must think and act differently, embracing new concepts such as Strategic Risk Policy®[2], which redefines risk as the impact of decisions or non-decisions and the impact on networks.

The price of keeping this new fragile metagrid working is resilience. Yet all-sector resilience is not yet built into the faster, cheaper, better digital tissue of today's rapidly evolving, closely coupled infrastructures.

The price has not yet been paid. If we wish to survive, this will need to change.

Conclusion
The resilience imperative

A healthy organic system develops immune response and self-repair capabilities to protect it against illness and injury. But the metagrid that sustains our daily lives has no autoimmune system.

At a time of growing risk of extreme threats, from high morbidity pandemics to extreme solar flares, terror and war, it is impossible to know how long we have. Building a resilient immune and repair system for the metagrid has become imperative.

If our civilization is to endure, we need to find an alternative to the pervasive culture of short-termism and quick wins. If we can bring together capable, imaginative, committed people in every sector and region, we can begin developing the systematic, evolving all-sector resilience humanity will need to survive, grow and thrive.

2 https://arpi.org.au/strategic-risk-policy/

What?

Growing an immune & repair system for our civilization

The metagrid that sustains our lives is a network of interconnected resources, and protecting such a network requires building a network of cooperation and resilience capabilities. Yet today, risk management and any nascent resilient capability-building are generally approached on a siloed basis. Developing immune and repair capabilities for the metagrid will require collaboration of high-capability organizations and experts worldwide, using the best available methodologies and approaches.

The **Human Continuity Project®** is designed to do just this, framed by the same carefully-structured systems engineering process used by aerospace companies to develop, secure and evolve the world's most complex, tech-driven instruments.

In partnership with many stakeholders, over the last 15 years the Council has taken preliminary steps to help prepare for this Project, with initial development of four essential tools and capabilities:

1. The **Black Sky Emergency Communication and Coordination (BSX®) Project**, including hosting the Energy Sector Web™, linking energy companies across portions of the Eastern Interconnection in the US.
2. The **GINOM® Multi-corporate Operating System (MOS)**, designed to provide nth-level interdependency decision support spanning many infrastructures and supply chains in disasters on any scale.
3. **Black Sky Emergency Power (BSEP)**, structured to advise facilities in all sectors on configuring their emergency power to enable optimization for large scale outages that could span weeks or months.

4. The peer-reviewed, heavily researched **EPRO® Handbook V: Blackstart for a Greener Grid**, summarizing technology development, architecture and policy initiatives that will be essential to enable Black Sky-compatible blackstart (power grid restart) for today's rapidly changing, renewable-heavy power grids.

These tools represent an important head start in structuring the **Human Continuity Project®**, as pilot efforts that will need to be researched, prioritized and implemented according to unique requirements in different regions. However, these initial capabilities represent only some of the first steps in a complex, global-scale initiative that will be framed by a comprehensive, all-sector-informed systems engineering process.

These tools represent an important head start in structuring the Human Continuity Project, efforts that will need to be researched, prioritized and implemented according to unique requirements in different regions.

This project will be performed by an international multi-sector team, with the primary efforts carried out by a **Research and Development Group**, reviewed by an industry, government and NGO **Advisory Group**.

How

Human Continuity Project® Tasks

Overall mission

Develop, plan and encourage implementation of evolving, all-hazard metagrid resilience

The work plan project to accomplish the Project mission calls for an initial startup phase and a following full-scale 2nd phase.

1. Startup "mobilizing" phase

As an initial phase to mobilize the Project, working groups will be established to help refine the project's mission and planning, with multiple teams focusing in eight different areas:

BLACK SKY RESILIENCE WORKING GROUPS

- **Resiliency, Redundancy Policy** | Assessing policy changes needed as enablers for critical Black Sky resilience / redundancy implementation
- **Communication And Emergency Management** | Evolving to all-sector, all-region Black Sky comm and emergency preparedness
- **Blackstart** | Defining concrete steps toward robust Black Sky-class full grid restart capabilities
- **Data Centers** | Planning for all-sector critical data access in Black Sky scenarios
- **Media** | Develop media protocols for Black Sky scenarios
- **Education** | Assessing critical academic engagement: all educational levels
- **Community** | Defining Black Sky societal protocols to ensure life-critical services and security for all: communities on all scales
- **Finance** | Black Sky resilience protocols / implementation-means for all elements of the finance sector
- **Transport** |Develop transport protocols for Black Sky scenarios
- **Resilience Best Practice**

These working group teams will develop reports that summarize their

findings, with these reports to be completed following a collaborative, in-person organizing conference at which all working groups will have an opportunity for interchange, review and finalization of the reports, and to prepare detailed plans for next steps.

As a final milestone in this initial phase, the workgroup teams will help catalyze and host an open Black Sky Resilience Conference as a key step toward full scale kickoff of the Human Continuity Project. This will bring the working group planning to the largest annual, international organizing event focused on multi-sector resilience to catastrophic, global-scale events.

Once this initial effort concludes, Project members will seek funding to move on to the four overall tasks that characterize the full Human Continuity Project work plan.

Full scale 2nd phase

The full-scale 2nd phase for the Project includes four primary tasks:

- Systems Engineering
- Operations
- Policy and Standards
- Education & Training

Each of these tasks will include sector-specific, multi-sector and regional subtasks and administrative elements, with the detailed planning to be managed by each task team.

2. Systems Engineering[3]

A. Mission requirements: Developed as a function of region, time and sectors. These requirements will frame a specific, multi-part mission addressing the evolving objectives of the project, including variations relevant to different regions and accounting for development over time.

B. Concept design: The conceptual architecture for the evolving resilience capabilities. This architecture will become the evolving target "metagrid resilience configuration" the project team will be working to achieve with the recommendations and work plans to be developed.

C. System requirements: The specific requirements that the overall plan will need to meet, flowing from the mission requirements and concept design, as a function of region and time.

D. Sector requirements and interfaces: Sector-by-sector requirements and relevant cross-sector interfaces, flowing from the system requirements, also developed as a function of region and time.

E. System modelling: Based on this overall systems engineering process, the systems engineering team will develop a system model that can be used to trade and balance requirements among different sectors, and project resilience capabilities and gaps as a function of scenario, sector, time and region.

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3 See, e.g., NASA's Systems Engineering Handbook; https://www.nasa.gov/reference/systems-engineering-handbook/

3. Operations: Regional, milestone-driven workplan development

All operations subtasks, both workplans and pilots, will proceed, with periodic reviews, focused on implementation of the developing system requirements, and sector and regional requirements and interfaces. As system modelling becomes available, the anticipated results of each subtask will be integrated into system modelling, to validate compatibility with Project mission requirements.

A. Sectoral, regional workplans

As the systems engineering framework for the project proceeds, development of recommended, sector and region-centric workplans will begin. Responding to the specific sector requirements and interfaces, development of these work plans will be led by sector center-of-excellence groups, with participation of high-capability, participating corporations / organizations active in each sector and region. Workplans will be milestone driven, with a primary focus on achieving implementable, near-term objectives, in the context of specific longer term plans. As these plans evolve, they will be published as comprehensive, regionally-optimized reports.

As they develop, each recommended work plan will be reviewed by appropriate members of the Advisory Group.

B. Sectoral, regional pilots

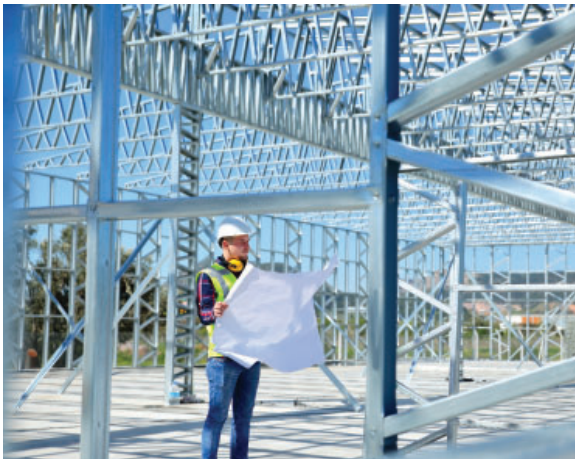
As initial elements of this implementation task, four different pilot efforts will take place. In each case, these efforts will build on the starting points established in earlier work hosted by EIS Council, as summarized above. In particular, these pilot efforts include:

I. **Black Sky Emergency Comm:** Energy Sector Web™ (ESWeb™) pilots, building on ESWeb™ US, a developing interconnected,

multi-layer corporate-owned fiber communication network expanding within the US Eastern Interconnection, this subtask will work to establish similar, collaborative pilots in the UK, the EU, India, Australia and selected other regions and nations.

II. **Black Sky All-Sector Decision Support:** GINOM® Multi-corporate Operating System (MOS) pilot development of optimized GINOM MOS layers, optimized to provide nth-level interdependency decision support operating within each ESWeb Pilot region.

III. **Black Sky Emergency Power:** Advisory support for emergency power systems configured to support long duration, Black Sky scenarios, optimized for sectors and regions, for critical infrastructure facilities.



IV. **Blackstart (Grid Restart) Optimization for DER[4] Grids**: Utilizing EPRO® Handbook V (Blackstart) as a resource, develop optimized, milestone-driven work plans for each region, with a focus on regions implementing ESWeb pilots.

4. Policy and Standards

Policy and Standards subtasks will be designed to enable and foster wide implementation of the operations subtasks. In particular, this will include adequate incentivization to ensure that the recommended workplans and pilots will be substantially revenue positive for corporate facility owners and operators.

Implementation of the Operations workplan and pilot subtasks will typically require parallel development and establishment of appropriate resilience-enabling policy measures compatible with Black Sky-level

4 DER: Distributed Energy Resources, i.e., grids transitioning to high levels of renewable generation

planning. Recommendations for such measures will be developed in three areas:

A. Voluntary industry standards. In addition to the international resilience standard recommendations and the regional and sectoral policy recommendations, this subtask will work with appropriate industry / sector organizations to develop voluntary standards, enabling implementation by early adopter organizations, and as potential precursors to formally established, mandatory policies and standards.

I. Development of international Black Sky resilience protocols. These will be designed to function as a framework enabling and motivating wide implementation of recommended resilience workplans, and continuing evolution to stay current as each sector evolves. These standards will be developed in coordination with relevant national and international organizations and standards advising and setting organizations.

II. Regional and sectoral regulatory and legislative policy recommendations. Teams in each sector and region will develop optimized Black Sky resilience regulatory and legislative recommendations for their domain, with this development coordinated closely with relevant corporate and government advisors and decision-making organizations.

5. Education & Exercising

There is considerable opportunity and requirement for education on approaching risk management differently and building awareness to Black Sky resilience capability gaps. In so doing, education can help to build greater resilience and preparedness.

The outputs from the Policy and Standards subtask create an immediate need to support practitioners and responsible entities and organizations in implementing them. Existing programs, e.g., Executive Leadership programs, can be supplemented with existing and new materials.

A key aspect of learning is exercising, and EIS Council's existing EARTH EX® solution has established a foundational capability to increase awareness of Black Sky resilience capability gaps and build an understanding of the actions required to address them.

Schedule and funding

The scale of effort required to begin building planetary-scale planning for Black Sky resilience has few precedents.[5] For this reason, and to meet the project's regional needs, the **Human Continuity Project®** has been formulated as an international, multi-sector, multi-group consortium with global reach. With the participation of universities, research organizations and NGOs from across the planet and an infrastructure and government advisory group, the Project's expert resources have been structured to meet the scale of the need.

The first phase of the overall project is anticipated to be a three-year effort, beginning in spring, 2025. The project team has estimated overall consortium funding required for this initial, three-year phase at $139M. Once the initial set of Founding Memberships are complete, this funding will be sought from major philanthropic foundations, investor groups and public institutions, both national and multi-national.

The Human Continuity Project® Phase I

Est. Consortium Funding Requirement: **$144M.**

Schedule: **Q1 2026 – Q4 2029**

Phase I mission:

1. Planning, prioritization and development: Core Black Sky-class resilience recommendations and capabilities
2. Defining overall project mission, system, interface and policy requirements
3. Initial implementation in those areas where key recommendations and capabilities are available.

Key Task Areas (with cost estimates):

Cost($M)	Year1	Year2	Year3	~Toal
Comprehensive Global Black Sky Resilience Planning				
Black Sky resilience systems engineering framework development	8	10	12	**30**
Cross-sector infrastructure and supply chain interface assessment	7.0	14	19	**40**
Black Sky resilience policy requirements assessment	2.5	10.5	11	**24**
GINOM MOS advanced development	1.5	3.5	3.5	**8.5**
Core, initial Black Sky-class resilience capabilities development				
Black Sky-class Energy Sector Web pilots (5 nations)	1.0	2.5	3.5	**7.0**
BSEP: Black Sky emergency power pilots (5 key sectors)	1.0	0.5	0.5	**2.0**
Black Sky blackstart (grid restart) planning	3.0	3.0	2.5	**8.5**
Black Sky policy engagement	3	3	4	**10**
Community engagement	2	3	4	**9**
	139	**29**	**50**	**Totals**

HIGHLIGHTS OF PROJECT HISTORY AND BACKGROUND

The project was inaugurated as part of the Resilient, Renewable Planet (R2P) Conference, hosted by EIS Council and Imperial College London on Imperial's campus in London on April 17-19, 2023. Scientists and delegates from utilities, corporations, NGOs and government agencies from many nations used this forum to begin defining urgent efforts needed in the project's initial phase. As a key element, delegates considered critical, time-sensitive resilience policy guidelines needed for the transformation of today's grid energy resource mix

Appendix 1

Structure: Key elements of the **Human Continuity Project®**

If we wish to be capable of preventing or recovering from an extreme, global-scale disaster, a civilization-scale effort will be essential. Reflecting this, **Human Continuity Project®** consortium members will represent every continent and major land mass, worldwide.

Membership categories

1. The Research, Development and Deployment (RD&D) Group

Recognizing both the urgency and the scale of the effort needed, the world's most capable and respected universities, research organizations, academic institutions, corporations and NGOs are now joining together in this collaborative, global Black Sky resilience research and development consortium. *Resilience research, planning and recommendations will include assessments of international, national and regional needs and priorities.*

RD&D Subgroups

A. Interdisciplinary Applied Research organizations. Academic institutions, research and development institutes, resilience-focused NGOs and related organizations.

Mission summary: Broad multi-sector and all-hazard resilience needs assessment for extreme hazard scenarios, and participation in encouraging implementation based on that assessment.

B. Sector "hubs:" Sector-specific skill center organizations. Technical and advisory service organizations with good connectivity and broad capabilities applicable to organizations in one or more sectors.

Mission summary: Assessing critical sector specific and "interface" requirements each sector has with partner sectors (i.e., critical

needs a sector has for products and services of other sectors, and critical products and services the sector provides to those other sectors), focusing especially on critical, minimum interface requirements needed to sustain populations and enable recovery in times of extreme disruption. Based on this assessment, these organizations will have a central role in developing and working toward implementation of recommendations relevant to their sector expertise.

C. Systems engineering team: **Members with systems engineering capabilities, selected from the Interdisciplinary Applied Research and Sector Hub organizations.**

Mission summary: Given the multi-sector and geographic complexity this project will be dealing with, the systems engineering team will be involved continuously. Initially, this team will be instrumental in developing an overall research and development plan and a system resilience concept design. As the project proceeds, their function will shift to include extensive cross-sector and multi-regional coordination, to keep the overall effort focused on the project mission and evolving requirements. As a critical element, this group will also work with Sector Hub organizations to jointly develop sector-specific and multi-sector functional models applicable to each sector.

2. The Advisory Group

Leading utility and infrastructure corporations, government agencies from multiple nations and other key stakeholders will contribute their practical "on the ground" experience to help ensure the project focuses on critical needs for these extreme scenarios, with practical, near term-implementable approaches, and with sensitivity to the needs of *all* segments of society.

Advisory Subgroups

A. Human Continuity Project Advisors: Leading private and public sector organizations, including primary examples of the "customers" for the resilience plans, capabilities, policy adaptations and recommendations the Human Continuity Project® **teams will develop. Structuring the Project's products to be effective for these organizations is essential to ensure they will be able to accomplish their resilience missions.**

Mission Summary: Review developing Project results and advise to help optimize the effectiveness of those results for key public and private sector "customer" organizations.

B. Supplier Advisory Clusters: Interested Project Advisors may reach out to their key primary, secondary and other indirect suppliers to seek their input on relevant questions that arise.

Mission Summary: Providing similar advice to ensure Project results will be effective for key suppliers in all the interdependent sectors.

C. Community Advisors: Community organizations that are prepared to review the Project's developing planning, capabilities, recommended policy adaptations and other suggestions.

Mission Summary: Bringing unique local, regional or national resilience needs to the attention of the Project team to ensure they are addressed in the effort.

D. Resilience Advocacy: People with a special interest, capability or relevant experience in resilience development for extreme disruption scenario.

Mission Summary: Reviewing and commenting on the Project Team's developing products, based on their unique experience and perspectives.

Appendix 2

Current Project Members

The process of inviting organizations to participate in this effort as founding members is in its early stages, and outreach is now being extended to selected additional organizations in the United States, the United Kingdom, India, Switzerland, Israel, Germany, France and Japan. The in-progress, current list of Founding Members includes the following (Note references to Research & Development Group or Advisory Group):

Organization	Leads
Imperial College, London, United Kingdom (R&D Group)	Professor Washington Yotto Ochieng, FREng – Head of the Department of Civil and Environmental Engineering; Chair in Positioning and Navigation Systems; Senior Security Science Fellow at the Institute for Security Science and Technology (ISST)
Northeastern University, and the Global Resilience Institute, United States (R&D Group)	Stephen E. Flynn – Director, Global Resilience Institute, Northeastern University
Cambridge Infrastructure Resilience Group (CIRG), United Kingdom (R&D Group)	Dr. Alexander Taylor, FHEA – Cofounder, CIRG Dr. Henri van Soest – Cofounder, CIRG
Reichman University, Israel (R&D Group)	Professor Yael Parag – Deputy Dean, School of Sustainability, Reichman University Professor Yoav Yair – Former Dean, School of Sustainability, Reichman University
Rand Corporation, United States (R&D Group)	Professor Benjamin Preston – Director of Community Health and Environmental Policy; Senior Policy Researcher, Rand Corporation
PJM Interconnection, United States (Advisory Group)	Tom O'Brien – Senior Vice President and Chief Information Officer, PJM Interconnection Mike Bryson – Senior Vice President of Operations, PJM Interconnection

Federal Energy Regulatory Commission (FERC), United States (Advisory Group)	Joseph McClelland – Director, Office of Energy Infrastructure Security, FERC
North American Electric Reliability Corporation (NERC), United States (Advisory Group)	Jim Robb – CEO, NERC
Electricity Information Sharing and Analysis Center (E-ISAC), United States (Advisory Group)	Manny Cancel – CEO, E-ISAC
Water ISAC (WaterISAC), United States (Advisory Group)	Charles Egli – Director, Preparedness & Response
National Council of ISACs (NCI), United States (Advisory Group)	Denise Anderson – Chair, NCI
The Tennessee Valley Authority (TVA), United States (Advisory Group)	Robert Dalrymple – Senior Vice President, TVA
Israel Electric Corporation (IEC), Israel (Advisory Group)	Elad Shaviv – Director of Innovation, IEC

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