Teamwork in extreme environments: Lessons, challenges, and opportunities

Summary
Given the numerous calls for researchers to examine teams in the wild to better understand the impact of context on team dynamics and performance, there has been increased consideration of teams operating within extreme environments. As such, this special issue is focused on better understanding the factors that shape teamwork in extreme environments so that the lessons learned can be leveraged within extreme as well as in other team contexts as appropriate. To this end, we present five exemplar papers that span disciplines, address diverse research questions in unique samples, and employ varied methodologies and research designs. Each of these papers not only contributes new insights to the understanding of teams in extreme environments (i.e., lessons) but also highlights the challenges that exist in conducting research in such contexts and sets the stage for additional opportunities within the extreme team literature moving forward.

1 INTRODUCTION

Across a variety of disciplines, research has demonstrated the value of teams to addressing complex and challenging problems. Seeking to leverage these capabilities, team-based work arrangements have been adopted in diverse contexts ranging from traditional, for-profit firms to more nontraditional settings such as health-care organizations, military special forces, emergency response, space exploration, and technology innovation start-ups (e.g., Mathieu, Maynard, Rapp, & Gilson, 2008; Tannenbaum, Mathieu, Salas, & Cohen, 2012). Although teams appear to have benefits across these varied contexts, there have been numerous calls for researchers to examine teams in the wild (e.g., Burke, Salas, Estep, & Pierce, 2007) to better understand the contextual nuances faced by teams (e.g., Johns, 2006). Likewise, Mathieu et al. (2008) advocated that team researchers need to more fully capture and embrace the “complexities of current team arrangements” (p. 463). Responding to these calls, organizational researchers have begun to more fully incorporate situational complexities and nuances into empirical examinations of team functioning and effectiveness.

In one noteworthy stream of work, researchers have used the term extreme to describe intense, risky, and often dangerous environments that place unique demands on the teams operating within them (e.g., Bell, Fisher, Brown, & Mann, in press; Hällgren, Rouleau, & De Rond, 2018; Klein, Ziegert, Knight, & Xiao, 2006). For example, researchers have studied teams that regularly operate in extreme environments such as disaster response (e.g., Rankin, Dahlbäck, & Lundberg, 2013; Wageman, Gardner, & Mortensen, 2012), community building in Afghanistan (Kemp, 2011), polar expedition (e.g., Leon, Sandal, Fink, & Ciofani, 2011), police SWAT teams (e.g., Bechky & Okhuysen, 2011), emergency rooms in trauma hospitals (e.g., Klein et al., 2006), mining (e.g., Allsop & Wray, 2012), and space exploration (e.g., Keeton, Schmidt, Slack, & Malka, 2012).

Given the insights gained from such studies and the emerging literature devoted to understanding teams in extreme contexts (e.g., Bell et al., in press; Bishop, 2004; Hällgren et al., 2018), we present this special issue dedicated to examining teamwork in extreme environments. A primary aim of this special issue is to provide a place for researchers working in this area to share knowledge from cutting-edge research and enable a cross-fertilization of lessons learned from these contexts to be translated into actionable knowledge. To this end, we present five exemplar papers that span disciplines, address diverse research questions in unique samples, and employ varied methodologies and research designs. Each of these papers not only contributes new insights to the understanding of teams in extreme environments but also highlights the challenges that exist in conducting research in such contexts.

In the sections that follow, we begin by discussing the factors that make an environment extreme and then provide an overview of each of the five papers. We conclude by extrapolating lessons learned from this set of papers, examining some of the key challenges to conducting research on teamwork in these unique contexts, and discuss opportunities for future research to advance our understanding of teamwork in extreme environments.

2 WHAT MAKES AN ENVIRONMENT EXTREME?

Recently, researchers have begun to identify the features that set extreme environments apart from more traditional contexts, as well
as uncertain environments and crisis situations. Hannah, Uhl-Bien, Avolio, and Cavarretta (2009), for one, proposed that extreme environments are characterized by extreme events that are “a discrete episode or occurrence that may result in an extensive and intolerable magnitude of physical, psychological, or material consequences to—or in close physical or psycho-social proximity to—organization members” (p. 898). In turn, environments are extreme “where one or more extreme events are occurring or are likely to occur that may exceed the organization’s capacity to prevent and result in an extensive and intolerable magnitude of physical, psychological, or material consequences to—or in close physical or psycho-social proximity to—organization members” (p. 898). Relatedly, Bell et al. (in press) defined extreme teams as “teams (a) that complete their tasks in performance environments with one or more contextual features that are atypical in level (e.g., extreme time pressure) or kind (e.g., confinement, danger) and (b) for which ineffective performance has serious consequences (e.g., compromised health or well-being of the team or the team’s clients)” (p. 2).

Both definitions highlight that teams in extreme environments operate under unique constraints and demands imposed by the circumstances they face. Researchers have also taken a more granular evaluation of these situations to identify the specific factors that contribute to the level of environmental extremity. In one of the most comprehensive models, Hannah et al. (2009) proposed that five factors contribute to the level of extremity of a situation, including the (a) temporal order of extreme events and their aftermath, (b) magnitude of consequences in terms of the scope and scale of damage, (c) probability of those consequences occurring, (d) physical or psycho-social proximity, and (e) physical, psychological, or material form of the threat. These authors further note that time and complexity can intensify the effects of these factors. Bell et al. (in press) further proposed that extreme circumstances intensify situational strength and present unique demands that are not present in other contexts. Situational strength refers to the salience of contextual cues signaling the desirability of specific actions (Meyer, Dalal, & Hermida, 2010; Mischel, 1977). For example, some extreme events such as an emergency response event will signal the need for specific, immediate actions. Adding to these factors, Driskell, Salas, and Driskell (in press) argued that stress resulting from high threat levels and the intensity of the task and performance demands is the defining feature of extreme environments. In turn, stress increases cognitive load, negative emotions, anxiety, social impairment, and distraction while also decreasing attentional focus (Driskell & Driskell, 2015). These factors, which bring attention to the varied ways that extreme environments amplify or alter the drivers of effective teamwork, are clearly on display in the research contexts and samples represented in the papers included in this special issue.

Looking beyond the defining features of extreme environments, Häggren et al. (2018) further distinguished extreme environments in terms of the event context including: inherent risk, emergency response, and disruptions. In risky contexts, teams are regularly exposed to potentially extreme events and face the challenge of preventing catastrophes. Risk is a salient characteristic of the research contexts included in this special issue. In emergency contexts, teams with advanced preparation must effectively respond to evolving events to curtail further damage. Three of the papers within this special issue examine teams responsible for providing emergency response including emergency medical response, crisis management, and police. Finally, in disrupted contexts, teams must also respond efficiently to evolving events; however, those events are generally unprecedented and catch the organization off guard. One of the papers in this special issue focuses on crisis management teams that are preparing to respond to disruptive events.

3 | SUMMARY OF SPECIAL ISSUE PAPERS

3.1 | Teams in isolated, confined, and extreme environments: Review and integration

Our special issue starts with an integrative review of work that has studied teams in isolated, confined, and extreme (ICE) environments. Accordingly, Golden, Chang, and Kozlowski (2018) review a specific type of extreme environment but provide insights and recommendations for research that extends beyond ICE environments to include other extreme contexts. They propose that the literature on ICE is fragmented across various disciplines and outlets. Their review integrates the ICE literature into the broader organizational teams literature by way of leveraging traditional team effectiveness frameworks (i.e., input–mediator–outcome–input; Ilgen, Hollenbeck, Johnson, & Jundt 2005). Interestingly, their review highlights that less work has been conducted on team process and outcomes within ICE environments, which are certainly key critical areas for future researchers to explore. In particular, very little work has studied the full mediational chain from inputs to mediators and ultimately to outcomes. The paper culminates in an assessment of the current state of ICE team research and pinpoints what is known currently and what still needs to be studied.

3.2 | Examining the behavioral and structural characteristics of team leadership in extreme environments

In the second article within the special issue, Burke, Shuffler, and Wiese (2018) emphasize the important role of team leadership in extreme contexts. Accordingly, they build upon prior work that has focused on input variables within extreme environments to examine the role of leadership. In conducting their study, they leverage a unique methodology (i.e., historiometric analysis paired with the critical incident technique) to examine leadership within the context of space exploration, polar exploration, and long-duration sailboat racing. In particular, they find that in such contexts, leadership is most often enacted by someone within the team. Furthermore, they highlight various leadership functions that are important in each situation and examine their salience during both transition and action phases of teamwork in extreme contexts. Their findings indicate that teams in extreme contexts leverage a mixture of formal and informal leadership. Similarly, they found that leadership in extreme contexts is typically a combination of leadership residing within a single person and being shared among team members and that there is a trend for
this difference to exist as teams move from transition to action phases. As such, these authors reinforce what may be obvious to some organizational researchers, namely, that leadership plays a salient role in enabling teams to function effectively in extreme contexts. However, within their study, these authors dig deeper to understand what leadership functions and when such leadership functions are most likely to be beneficial. Accordingly, this work lays a solid foundation for future examinations of leadership within teams that operate in extreme environments.

3.3 | Information sharing and decision making in multidisciplinary crisis management teams

Whereas Burke and colleagues focused primarily on the role of leadership as a team input, Uitdewilligen and Waller (2018) shine the light a bit more on team processes, which Golden et al. (2018) noted in their review as having been given limited consideration within research on teams in extreme environments. More specifically, Uitdewilligen and Waller primarily focus on information sharing and processing in their study of 12 multidisciplinary crisis management teams involved in a crisis simulation in the Port of Rotterdam. Although a behavioral simulation, these teams were composed of individuals who worked for the fire brigade, police force, and similar functions that would respond to a crisis in the port if one were to occur. Accordingly, this makes for a nice sample to understand how extreme teams function with the value of having some control over the situation, which, as noted by Golden and colleagues, is a methodological challenge of studying extreme teams in the wild. Likewise, Uitdewilligen and Waller leveraged objective measures of performance as rated by the simulation instructors, which also addresses another gap that Golden and colleagues noted, that is, a lack of research that assesses performance metrics of extreme teams. This work also coincides with the work of Burke and colleagues because Uitdewilligen and Waller were able to watch team dynamics and the role of leaders in shaping those dynamics from the onset of the team, which was limited by the archival nature of Burke and colleagues’ work.

3.4 | Reflection in the heat of the moment: The role of in-action team reflexivity in health-care emergency teams

In our fourth paper, Schmutz, Lei, Eppich, and Manser (2018) leveraged a behavioral simulation sample involving 70 medical teams to examine a different team process variable: in-action team reflexivity (TR). Accordingly, this work also addresses the apparent gap in the extreme team literature to more fully examine team processes. In particular, although prior work on TR has typically viewed it as a process that occurs during downtime within a team, these authors recast TR as occurring during a performance episode and hence the label in-action TR. They argue that this type of TR is particularly salient in extreme environments where teams may not have time at their disposal to conduct robust debriefs and after-action reviews. Likewise, they argue that this form of TR is indispensable for extreme teams given their need to adapt. Again, a value of leveraging a behavioral simulation is that these authors can rely upon observation of in-action TR. Observational measures overcome some of the challenges that may arise from trying to assess this construct from member surveys in extreme environments where it may be difficult for members to dedicate time to providing such information because of the demands of the context they are facing. These teams worked on cases such as near drowning, cardiac arrest, respiratory failure, and severe septic shock and therefore represent instances where teams faced severe consequences for poor performance.

3.5 | When does performance management foster team effectiveness? A mixed-method field study on the influence of environmental extremity

The final paper in this special issue provides insights into the features of performance management systems that help police teams to work effectively in extreme environments. Two aspects of this paper are particularly noteworthy. First, van Thielen, Decramer, Vanderstraeten, and Audenaert (2018) begin with an inductive, qualitative study to identify the features of performance management systems most valuable to fostering team development and effectiveness. From a set of 45 interviews with police team members, leaders of police departments, and human resource manager informants, four key performance management features emerged from the findings including (a) vertical alignment of goals with the department, (b) constructive feedback, (c) consistency across the process, and (d) two-way communication. Second, in a quantitative study, the authors explicitly measure the degree of extremity in the environments that the teams operate in using a novel, archival approach. Drawing on criminality figures released by the Belgian Federal Police Force, the authors derived a metric of extremity as the ratio of public violence per 1,000 citizens. They then used this environmental extremity metric to determine whether the effects of each of the four performance management system features on team effectiveness were conditional on environmental extremity. Across a sample of 212 police teams, they found the importance of these four performance management features were nuanced and dependent upon environmental extremity. Findings from this study highlight that environments vary in their level of extremity, and these differences are likely to affect the importance of various input, process, and emergent state mechanisms.

4 | LESSONS, CHALLENGES, AND OPPORTUNITIES

This special issue presents an exemplar set of papers that provide new and cutting-edge research about teamwork in extreme environments. Equally important, collectively these papers offer a number of lessons about researching teams in extreme environments and highlight several opportunities that need to be addressed in future examinations. Below, we highlight several of key insights from this set of papers.
4.1 | The importance of time

Interestingly, although our call for papers did not explicitly ask researchers to consider time and temporal conditions, many of the papers in this special issue weave in such considerations. Incorporating time into the study of teams is important for expanding our knowledge (e.g., Cronin, Weingart, & Todorova, 2011), and the papers herein show how the dynamics, timing, sequences, and phases of teamwork are relevant in extreme environments. That is, beyond providing a review of the literature, Golden et al. (2018) draw attention to the important role that temporal factors play in examinations of teams in ICE environments. They discuss how emotions, anxiety, cohesion, and hostility can change over time for the team as well as for specific team members who constantly face the challenges of such contexts over long periods of time. Burke et al. (2018) shed light on not just the importance of leadership, but they also begin to peel back the construct of leadership in extreme contexts to suggest that certain leadership functions are more important at different phases of teamwork. They also suggest that the formality and locus of leadership may ebb and flow during the life cycle of the team. Uitdewilligen and Waller (2018) also examined the teams in their sample over the entire length of the simulation so that they could investigate how the information-sharing processes that they focused on changed over the entire life of the extreme teams that they studied. Schmutz et al. (2018), like the studies mentioned above, also addressed temporal considerations as they hypothesized and found support for teams engaging in more in-action TR later (rather than earlier) in a team’s performance episode. Taken together, the papers in this special issue highlight the need for further scrutiny in terms of how time and temporal conditions affect teamwork in extreme contexts.

4.2 | Enabling resources and mechanisms

We learned from our set of exemplar papers that there are several factors that teams and team leaders may want to leverage in extreme environments to adequately address the challenges faced within such settings. Although many of the resources and mechanisms discussed may be extrapolated from research about more conventional teams, researchers have long argued that context shapes organizational phenomena (e.g., House, Rousseau, & Thomas-Hunt, 1995; Johns, 2006; Rousseau & Fried, 2001), and the papers in this set provide support and evidence that factors may change or amplify processes and outcomes in extreme environments. For example, on the basis of their review, Golden et al. (2018) indicate that research has considered various types of inputs such as personality, and the collectivistic versus individualistic tendencies of team members as well as environmental stressors such as darkness and cold temperatures. Additionally, research has examined mediators such as stress, affect, team climate, and the seeking of social support. In fact, it appears that seeking social support may have negative consequences in extreme environments as compared with the more positive consequences noted in more traditional team settings. Burke et al. (2018) find that structure and planning, as well as sensemaking, are the most impactful leadership functions during the transition phases of teamwork, whereas team problem solving, supporting the social climate, and monitoring the team collectively are most impactful during action phases. Uitdewilligen and Waller (2018) found that higher performance teams spent more time on structuring and information-sharing communication phases and less time on decision-making phases. Likewise, they found that within the decision-making phase, higher performing teams used significantly more collective interpretation sequences. Additionally, they investigated whether the use of a whiteboard to structure communication within the crisis team was beneficial, and they found that it enhanced collective sensemaking processes and team performance. Schmutz et al. (2018) found a positive relationship between in-action TR and performance as evaluated by outside clinical observers. Likewise, this relationship between in-action TR and performance was moderated by team size such that in-action TR had a stronger effect on performance in larger teams. Finally, van Thielen et al. (2018) found that the generally positive effects of vertical alignment and constructive feedback performance management features on police team performance weakened as environments became more extreme. Alternatively, consistency across the performance management process and two-way communication during the process were only related to team performance for police teams operating in more extreme environments (i.e., those districts plagued by higher levels of public violence). Further work is now needed to better understand the nuanced way that these and other resources and mechanisms work in extreme environments.

4.3 | The levels of extremity and generalizability

An issue that has surfaced as we, the editors, reviewed the exemplar set of papers as well as research conducted within the domain of extreme teams is the manner in which extreme environments are conceptualized as being similar yet different from one another. Accordingly, we suggest that it is essential for researchers to consider the degree or level of extremity in the environment as discussed earlier and captured in a couple of the papers in this special issue. Conceptualizing and operationalizing the degree or level of environmental extremity along a continuum will enable researchers to provide more precise explanations for how and when extreme environments intensify or attenuate the effects of teamwork. We draw on the insights of our exemplar papers for further reasons and evidence to follow such an approach. For example, in table 2 of Burke et al. (2018), they discuss different dimensions of the contexts included in their study. This might be a foray into delineating the level of extremity that teams encounter. More work on this front may allow for researchers to examine the different dimensions and start to view extremity as a continuum that all teams face—similar to the trend that is happening within the virtual team literature where virtuality is now viewed as a variable faced by all teams (e.g., Maynard, Mathieu, Rapp, & Gilson, 2012).

Van Thielen and colleagues (2018) also provide a nice starting point to this conversation as they used an environmental extremity metric to determine whether the effects of each of the four performance management system features on team effectiveness were conditioned on environmental extremity. Such a measure may have further applicability in understanding not only the context at hand but also the comparability of contexts at the same level of
extremity. Adding more clarity around the level of extremity can help researchers bridge extreme environments and allow for greater generalizability across seemingly different contexts and provide greater insights for teams researchers and practitioners.

### 4.4 Research methods in extreme environments

Finally, we want to acknowledge the demands and difficulty of studying teamwork in extreme environments. In their review, Golden et al. (2018) close with several themes that should be explored in future work of ICE environments as well as future research suggestions for teams that work in extreme but not necessarily ICE contexts such as fire, police, medical, and military. These authors also provide some recommendations regarding ways to overcome the methodological challenges that exist in studying teams within such environments (see also Bell et al., in press). Interestingly, several of the research gaps identified by Golden et al. (2018) are addressed in the other articles included in our special issue. One approach employed by two of the special issue papers was behavioral simulation (i.e., Schmutz et al., 2018; Uitdewilligen & Waller, 2018). Indeed, it may be that such robust lab studies that can mimic extremity may help build a foundation of understanding about how teamwork should and could unfold in an extreme environment. Behavioral simulation studies may be particularly impactful when combined with an interview, survey, or observational field study of teams in extreme settings to isolate and test key features identified in field research.

That said, as the literature develops, we will undoubtedly need field research to tackle all the research questions that may be considered, and therefore, research will need to go into the wild. However, this raises additional challenges such as the difficulty in obtaining primary data and real-time data. Accordingly, rather than shying away from such challenges, we recommend that researchers get creative and rely on approaches leveraging archival sources, postevent interviews/focus groups, and other techniques. Further, researchers within the extreme teams literature need to know more about the lessons learned and best practices in gaining access to samples in extreme environments. Accordingly, we hope that this special issue will start the conversation around such points. These avenues of inquiry and knowledge sharing will help define, motivate, and promote future teamwork research in extreme contexts.

### 5 CONCLUSION

Our hope is that this special issue serves as a resource for readers of the *Journal of Organizational Behavior* and teams researchers from other disciplines to gain insights into the lessons learned from studying teamwork in extreme environments. Additionally, beyond emphasizing these lessons, our intent with this special issue was to also highlight the challenges and opportunities for research teams in such contexts in the future. These papers highlight the benefits and need for more research studying teams in the wild where insights into inputs, processes, emergent states, and outputs might otherwise be missed in more conventional environments. We are confident that the findings and implications provided by the authors will help to guide the development of new theory and empirical studies, and to generate actionable knowledge for practitioners working with teams in both extreme and more traditional contexts.

M. Travis Maynard1
Deanna M. Kennedy2
Christian J. Resick3

1Colorado State University, College of Business, Fort Collins, Colorado
2University of Washington Bothell, School of Business, Bothell, Washington
3Drexel University, LeBow College of Business, Philadelphia, Pennsylvania

**Correspondence**
M. Travis Maynard. College of Business, Colorado State University, Fort Collins, CO.
Email: travis.maynard@colostate.edu

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**REFERENCES**


M. Travis Maynard. Ph.D. is an Associate Professor within the Department of Management at Colorado State University. Travis has conducted extensive research in the area of organizational team effectiveness with a special emphasis on the role that team context has on team interactions and outcomes. In particular, Travis has conducted several research projects examining teamwork within healthcare settings which has given rise to his research stream on extreme contexts. Likewise, Travis has become increasingly interested in the topics of team adaptation and resilience in a variety of contexts including healthcare, military, law enforcement, energy, expedition, and NASA.

Deanna M. Kennedy, PhD is an Associate Professor and Academic Area Coordinator of the Operations Management and Information Systems in the School of Business at the University of Washington Bothell. She received her PhD in Management Science from the Isenberg School of Management at the University of Massachusetts Amherst. Her research focuses on the study of managing team projects, team communication, team adaptation, and other team processes.

Christian J. Resick, is an Associate Professor of Management and Organizational Behavior with the LeBow College of Business at Drexel University in Philadelphia. His research focuses on the social and cognitive psychological processes associated with leader influence, teamwork, and organizational culture and fit. Christian’s work has appeared in numerous leading management journals such as the *Journal of Applied Psychology, Organizational Behavior and Human Decision Processes, the Journal of Organizational Behavior, The Leadership Quarterly, Human Relations, and the Journal of Business Ethics*. He received his Ph.D. in I/O Psychology from Wayne State University in Detroit.