



# NSIN Beat the Blaze Hackathon

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# Outline

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- Event Background
- Challenge: Beat the Blaze
- Team Members/Supporting Faculty
- Multi-Node Fire Detection Communication System
- Prepare Your Solution
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## NSIN Hackathon

- The National Security Innovation Network (NSIN) Hackathon program is an opportunity for students, faculty, engineers, or any people with experience in communications and marketing who is creative and likes to solve problems!
- NSIN holds participants around the country, each focused on a different challenge with applications to both Defense and commercial markets.
  - At these weekend events, you will learn about the challenge, form teams, come up with novel ideas, work with mentors and subject matter experts to develop your concepts, and pitch your solutions to a panel of judges.





## Event Details

- **What:** Beat the Blaze
- **When:** March 29 - April 16, 2021
- **Where:** Virtual
- **Who:** Open to anyone who is creative and interested in solving communications and information sharing challenges during wildfire operations. (Coding experience not required.)
- **Why:** Continue prototyping your solution with \$15-\$30K investment for winning concepts.



## Event Background

- Multiple consecutive years of catastrophic and deadly wildfires have shattered records and impacted California, Arizona, and many states across the country in devastating ways.
- The NSIN taking part in counter wildfire operations – including the National Guard and civilian agency partners – need a way to have full situational awareness across a given area.
- The abundance of high-fidelity video feeds from human-operated and autonomous aerial vehicles has improved emergency responders' ability to maintain situational awareness of a disaster scene.
- However, with this capability comes the complexity of integrating information and data available to Emergency Managers, while also providing video to the operators in the field with degraded communication environments.





## Challenge

- Increase the information sharing capacity and capabilities between the National Guard and civilian emergency response agencies during wildfire operations.
- Focus Areas:

### HARDWARE

Given the number of interagency partners and platforms, there may be an opportunity to resolve key questions:

- Is the network capacity during emergencies capable of sharing data sizes up to Terabytes of data? Are there ways to extend the range and capacity?
- Can current electronic devices withstand the stresses of wildfire operations? Could device capacity be enhanced while optimizing size, weight and power?

### SOFTWARE AND DATA

The current method for sharing data between agencies includes converting files to different formats manually and sharing data on physical media or cloud-hosted platforms. Key Questions:

- Are there ways to collect and harmonize sensor feeds from different stakeholders into a common operating picture?
- Are there improvements to the user interface that could help end-users understand and process sensor data?
- Can sensor data formats be harmonized to provide a uniform solution usable by different organizations?
- Could artificial intelligence or machine learning techniques quickly process and identify key points within large data sets for further analysis or action?
- Is there adequate bandwidth and capacity to store and share data?



## Team Members

- Students:
  - Wenjie Xu (Graduate Student, EE, Marshall University)
  - Samuel Hedrick (Graduate Student, EE, Marshall University)
  - Derek Chandler (Undergraduate Student, CS, Marshall University)
  - Samuel Temesgen (Undergraduate Student, CS, WV State University)
- Supporting Faculty:
  - Dr. Cong Pu (Marshall University)
  - Dr. Imtiaz Ahmed (Howard University)
  - Dr. Heng Wu (WV State University)
  - Dr. Wook-Sung Yoo (Marshall University)



# Multi-Node Fire Detection Communication System

- A communication system can monitor for fires in large-scale rural areas and provide a real-time alert in response to the system's findings.
  - All individual nodes have been fully constructed and programmed to read temperature, humidity, gas, and smoke sensor measurements and check them against threshold values, determining whether the node is in the presence of fire.
  - Bluetooth communication from the nodes to the central access point have also been accomplished, ensuring that the system can operate wirelessly, and therefore with much greater ease of use than a wired system would allow.
  - A simple user interface has been developed that pulls the sensor data from dynamically updating text files, for each individual node, and displays this data, with declaration of fire or the lack thereof.







# Prepare Your Solution

## I. How to Get Started?

- In such short time (Friday, April 02, 2021 --- Friday, April 9, 2021), proposing a sound solution to solve an existing challenge is not easy.
- You can consider to adopt the existing “Multi-Node Fire Detection Communication System” as the foundation, and then propose your own solution.

## 2. What Could be Your Own Solution?

- You **cannot directly** use “Multi-Node Fire Detection Communication System” as your solution.
  - Because its goal was to develop a fire detection communication system that reduces the likelihood of large-scale fire destruction and minimizes the likelihood of false alarms being generated. (not matching with the goal of challenge)
- You need to analyze the challenge/focused areas/questions, study “Multi-Node Fire Detection Communication System”, identify the problem(s), and propose improvement/extension as your solution.



# Prepare Your Solution

## 2. What Could be Your Own Solution?

- There are several example improvements/extensions that you can think about. However, you are highly encouraged to discover new directions and propose new ideas.
  - New monitoring parameters (temperature, humidity, gas, smoke, ???)
  - Different weight for parameters (images might provide more information than gas data. So, images might take more weight when making decision of fire detection.)
  - Machine learning techniques to analyze the collected data to better decide threshold values, reduce false alarm rate, etc.
  - Analyze the past collected data for pre-detection of fire.
  - Add temporary data storage to store the collected data.
  - More from you...



# Prepare Your Solution

## 3. How to Propose Your Own Solution?

- We suggest all students to have a brainstorm session/meeting after Friday meeting ASAP to propose/finalize the solution, identify a list of tasks, and start working on the solution.
- For your collaboration, there is a channel on Teams, where you can communicate and collaborate.
  - Frequent communication is the key to propose a sound and valid solution.
- We suggest all students actively communicate and engage with online challenge mentors and subject matter experts and seek customer feedback. (*This is one of judging criteria*)
- Please read “NSIN\_BeatTheBlaze\_Participant Guide 2021” to see how to use resources from NSIN.





# Prepare Your Solution

## 4. How Your Solution Should Look Like?

- Most importantly, design a novel **concept** that answers the challenge.
- They don't expect you to build a working prototype over a weekend.
- If you can demonstrate some aspect of your solution, it will certainly help, but isn't required.
- On "Welcome to NSIN's Defense Innovation Network!" (you have to register an account), there is an example solution, which will provide some ideas.



# Prepare Your Solution

## 5. What is the Timeline?

- Friday, April 02, 2021 --- Wednesday, April 7, 2021
  - Students start working on the preparation of solution.
  - You're encouraged to join the conversation Discord to engage with subject-matter-experts, and dialogue with panel mentors who can evaluate your solution's viability, and provide insights and information throughout this process.
- Thursday, April 8, 2021
  - Supporting faculty review your solution and provide feedback.
  - Students revise the solution.
- **Before 8:00 PM EST, Friday, April 9, 2021**
  - Submit the challenge solution on NSIN's Defense Innovation Network



**Good Luck with Your Competition!  
Question?**