

Autonomous Snowplow Competition



**ION North Star Section
Outreach Program**

Autonomous Snowplow Committee

**Collaborative Design Review (CDR)
Presentation Information & Outline
2021-22 Competitors**

March 2021

CDR Presentation Overview

- Collaborative Design Review (CDR) Objectives
 - Present to ASC Judges the vehicle design, collaborative vehicle design, and movies that demonstrate how the snowplow vehicles will plow the Single “I” and Triple “I” snowfields (Squad = 2 collaborative Teams)
- CDR presentation slides and movies must follow the provided outline
 - Standardize judging for all Teams/Squads
 - Squads can work together on collaborative CDR sections and movies
- CDR presentation slides and movies submission deadline: *final* version
 - 9 pm (Central Time); 6 April 2021
 - Instructions will be sent by 2 April 2021 to upload presentations and movies to an accessible Google drive

**Teams and other interested parties (family, friends, colleagues)
are invited to view all CDRs**



CDR Presentation Setup

- CDR presentation day: 8 April 2021
 - Presentation medium: Zoom Meeting (Video Conference)
 - ASC Committee will set up one Zoom Meeting for the entire CDR
 - **ASC Committee requests all participants turn their cameras on!**
 - **Teams will be provided with a Zoom Meeting invite by 2 April 2021**
- CDR presentation time: each Squad is allotted 40 minutes
 - **Squads provide their 1st, 2nd, and 3rd choices of time slots by 31 March 2021 (please see slide 7)**
 - Email time selections: vibhor.bageshwar@honeywell.com
 - ASC Committee will make every effort to assign Squads with their first choice
 - **ASC Committee will provide CDR schedule by 2 April 2021**
 - First CDR presentation begins on April 8 at 5:00 pm (Central Time)

CDR Presentation Format

- 40 minute presentation time breakdown
 - Team 1, Student presentation: 11 minutes maximum
 - Switch between Teams: 30 seconds
 - Team 2, Student Presentation: 11 minutes maximum
 - Switch to Squads: 30 seconds
 - Squad (Teams 1 & 2) Presentation: 12 minutes maximum
 - Q&A with Judges: 5 minutes maximum
- Team scoring and reviews
 - Team scoring will be returned to Team contacts: 11 April 2021
 - Team scores will be updated on website in May 2021

**Presentation Time Breakdown is very strict;
Please time your presentations & slides to maintain schedule**



CDR Presentation Rules

- CDR Presentation Outline: ASC Committee Hints
 - Judge's scoring form follows the outline exactly
 - Slide/Movie titles should match outline titles
 - Follow the slide/movie outline order
 - Address each section of the outline using at least one separate slide
 - Teams will not score points if sections of the outline are not addressed
 - CDR sections on collaborative operation
 - Teams are encouraged to collaborate on these CDR sections as these slides & movies will be presented by both Teams together
 - Use Figures and Tables to convey information to ASC Judges
 - Minimize the use of text where possible!!
 - Be sure to spend time to explain figures

CDR Summary: Actions

Date	Actions
31 March 2021	<ol style="list-style-type: none">1. Select 1st, 2nd, and 3rd CDR times (see slide 7)2. Email time selections to Vibhor
2 April 2021	<ol style="list-style-type: none">1. Zoom Meeting information sent to Teams2. Google Drive site sent to Teams3. CDR Schedule sent to Teams
6 April 2021	Upload final versions of CDR slides to Google Drive site by 9 pm (Central Time)
8 April 2021	CDR!
11 April 2021	CDR scores sent to Team contacts
May 2021	Website updated with CDR scores

CDR Presentation Schedule

Squad (2 Teams)	CDR Time (Central)
	5:00 pm
	5:45 pm
CDR Judges: 20 minute break	
	6:45 pm
	7:30 pm
CDR Judges: 20 minute break	
	8:30 pm

CDR Presentation Scoring

- CDR presentation scoring: 2 Categories
 - **Team**
 - Squad
- **Team**
 - PDR: 20% of the total Competition score for 2021
 - Based on the PDR's Single Individual Team presentation portion + PDR's Ability to Engage Audience
 - CDR: 80% of the total Competition score for 2021
 - Based on the Individual Team presentation portion indicated below

CDR Category	Scoring
Quality of Presentation Slides / Technical Presentation	40
Single I Movie	40
Ability to Engage Audience	20
Total Points	100

CDR Presentation Scoring

- CDR presentation scoring: 2 Categories
 - Team
 - **Squad**
- **Squad**
 - PDR: 20% of the total Competition score for 2021
 - Based on the PDR's Collaborative Team's Scores (2 Team average)
 - CDR: 80% of the total Competition score for 2021
 - Based on the Collaborative Team presentation portion indicated below

CDR Category	Scoring
Quality of Presentation Slides / Technical Presentation	30
Triple I Movie 1	30
Triple I Movie 2	30
Ability to Engage Audience (includes Q&A)	10
Total Points	100



CDR Presentation Outline: Team

Slide Title	Suggested Format	Minimum # of Slides
Title Slide		1
Team Composition		1
Objectives	Text	1
Team Requirements	Table	1
Snowplow Vehicle Design	Figure	1
Failure Modes & Recovery Actions	Table	1
Overall Risk Assessment Summary	Table	1
Vehicle Design Challenges	Table	1
Single "I" Snowfield Movie	Movie	1

PDR slides can be reused; however, think about how to update the slides based on PDR comments

Team Presentation Details 1/3

- Title Slide (1 slide)
 - Team university/name/logo
 - Hint: superimpose vehicle or something interesting on slide
- Team Composition (1 slide)
 - Team composition
- Objectives (1 slide)
 - Team objectives for the Single “I” snowfield
 - Hint: consider all the tasks the snowplow vehicle has to accomplish
- Top-Level Requirements (1 slide)
 - Hint: a requirement is a number that indicates when a design satisfies an objective
 - Hint: during the presentation, the Team doesn’t need to go through every requirement; instead highlight the important requirements for the Judges

Team Presentation Details 2/3

- Snowplow Vehicle Design (minimum 1 slide)
 - Snowplow vehicle and blade designs
 - Hint: include physical dimensions (size and weight)
 - Hint: consider plowing load
 - Sensor + component housing
 - Hint: address temperature control
 - Hint: label locations of key sensors and components
- Failure Modes and Recovery Actions (1 slide)
 - Identify failure modes and recovery actions
 - Hint: consider operational problems and snowplow vehicle recovery
- Overall Risk Assessment Summary (1 slide)
 - Evaluate major subsystems – identify the risk of subsystem issues on snowplow vehicle performance
- Vehicle Design Challenges (1 slide)
 - Highlight vehicle or system design changes from the existing designs
 - Highlight the design challenges the Team will face adapting the vehicle and its systems to this year's Competition and weather conditions
 - Hint – first year Teams: identify major design decisions
 - Hint – returning Teams: highlight the design challenges adapting the vehicle and its systems to this year's competition

Team Presentation Details 3/3

- Single “I” Snowfield Movie
 - Demonstrate the entire Single “I” snowfield set-up plus the snowplow vehicle plowing the snowfield
 - Start movie with following baseline
 - Set-up Single “I” snowfield, garage, and boundaries
 - Place obstacle in 7th square from garage
 - Snowplow vehicle in garage
 - During movie show the following
 - Navigation beacon(s) or landmark(s) set-up
 - Snowplow vehicle starting from and stopping in the garage
 - Snowplow vehicle plowing snow into designated zones
 - Obstacle detection and avoidance
 - Hints
 - Highlight when the vehicle uses a specific beacon(s) or landmark(s)
 - Highlight vehicle nominal trajectory
 - Highlight when vehicle detects obstacle
 - Highlight vehicle obstacle avoidance trajectory
 - Highlight when vehicle makes decision to turn
 - General
 - » Verbally narrate key points of the movie
 - » Movie plus verbal narration should be less than 2 minutes (movie doesn't have to be in real-time)

CDR Presentation Outline: Squad

Slide Title	Suggested Format	Minimum # of Slides
Objectives	Text	1
Squad Requirements	Table	1
Joint Communication System Design	Figure	1
Joint Failure Modes & Recovery Actions	Table	1
Joint Overall Risk Assessment Summary	Table	1
Triple "I" Snowfield Movie 1	Movie	1
Triple "I" Snowfield Movie 2	Movie	1

Squad Presentation Details 1/3

- Objectives (1 slide)
 - Squad objectives for the Triple “I” snowfield
 - Hint: consider all the tasks both snowplow vehicles have to accomplish
- Top-Level Requirements (1 slide)
 - Hint: identify requirements that both vehicles would have to each satisfy to plow the Triple “I” snowfield
- Joint Communication System Design (minimum 1 slide)
 - Outline methodology of inter-vehicle communication and equipment
 - Equipment mounting position on snowplow vehicles
- Failure Modes and Recovery Actions (1 slide)
 - Identify failure modes and recovery actions during joint operation
- Overall Risk Assessment Summary (1 slide)
 - Evaluate major joint systems – identify the risk of issues on joint snowplow vehicle operation

Squad Presentation Details 2/3

- Triple “I” Snowfield Movie 1
 - Demonstrate entire Triple “I” set-up plus snowplow vehicles plowing entire snowfield under nominal conditions – everything working perfectly
 - Start movie with following baseline
 - Set-up Triple “I” snowfield, garages, and boundaries
 - Place obstacle in center row, in 5th square from either garage (Squad’s choice)
 - Both snowplow vehicles start in garages
 - During movie show the following
 - Navigation beacon(s) or landmark(s) set-up
 - Snowplow vehicles starting from and stopping in the garage
 - Snowplow vehicles plowing snow into designated zones
 - Obstacle detection and avoidance
 - Hints
 - Same as Single “I” Snowfield movie applied to the Triple “I” Snowfield
 - Demonstrate intervehicle communication and information sharing (think about a telemetry box)
 - General
 - » Audience and Judges should understand how the snowplow vehicles collaborate to plow the snowfield

Squad Presentation Details 3/3

- Triple “I” Snowfield Movie 2
 - Demonstrate entire Triple “I” set-up plus snowplow vehicles plowing entire snowfield under 1 failure condition – intervehicle communication breaks down 45 seconds after vehicles start plowing
 - Start movie with following baseline
 - Set-up Triple “I” snowfield, garages, and boundaries
 - Place obstacle in center row, in 5th square from either garage (Squad’s choice)
 - Both snowplow vehicles start in garages
 - During movie show the following
 - Navigation beacon(s) or landmark(s) set-up
 - Snowplow vehicles starting from and stopping in the garage
 - Snowplow vehicles plowing snow into designated zones
 - Obstacle detection and avoidance
 - Communication breakdown, vehicle actions following breakdown including when vehicle identifies a communication breakdown, and recovery actions
 - Hints
 - Same as Single “I” Snowfield movie applied to the Triple “I” Snowfield
 - Demonstrate intervehicle communication and information sharing (think about a telemetry box)
 - Clearly demonstrate how vehicles establish communication breakdown and recovery