



CARGOJET DEICING SIMULATOR

A Virtual Reality Deicing Training Platform



PROJECT OVERVIEW

Cargojet's objective is to provide operators with a realistic, repeatable training environment where they can safely develop and refine aircraft deicing skills before performing live operations. By replicating real-world equipment, aircraft, and environmental conditions, the simulator enables operators to build confidence, improve spray technique, and practice operational decision-making without consuming deicing fluid or impacting daily operations.

The proposed solution is a scalable Aircraft Deicing Training Platform centered on the TEMPEST I deicing truck and Cargojet's operational procedures. Operators interact with Cargojet-furnished Tempest I controls while practicing Type I and Type IV deicing procedures on representative aircraft in a realistic virtual environment. Environmental conditions such as contamination, visibility, lighting, and wind replicate the operational challenges encountered during day-to-day deicing activities, while integrated performance metrics provide objective feedback on spray coverage, material usage, and completion time.

To support Cargojet's implementation schedule and budget objectives, ForgeFX has organized the proposed solution into a series of scalable implementation options that expand training capability while leveraging a common software and simulation foundation. The following pages summarize our recommended implementation paths, with a detailed feature comparison matrix provided in **Appendix A**.

IMPLEMENTATION: AT A GLANCE

Based on our proposal review discussion, ForgeFX refined the implementation strategy to prioritize the capabilities that Cargojet identified as having the greatest operational value. The options below represent progressive implementation paths that balance schedule, budget, and training capability while preserving a scalable foundation for future expansion.

Why ForgeFX Recommends Option 2

Following our proposal review discussion, ForgeFX believes Option 2 provides the best balance of implementation schedule, capability, and operational value. This option prioritizes the training capabilities Cargojet identified as most critical—including Boeing 767 operations, Type I and Type IV spray simulation, free-form practice, representative weather conditions, and objective performance feedback on coverage, time, and material usage—while establishing a scalable software foundation for future expansion.

*A detailed feature comparison matrix is provided in **Appendix A**.*

Option	Implementation	Primary Purpose	Duration	Investment
Option 1	Spray Skills Trainer	Foundational operator familiarization with TEMPEST I controls and Type I spray techniques.	5 Months	\$585,000
Option 2 Best fit for realistic operational training.	Spray Performance Trainer	Develop operational spray proficiency using Cargojet’s primary aircraft, spray types, weather conditions, and performance scorecard.	5 Months	\$780,000
Option 3	Core Deicing Simulator	Train complete single-truck Type I deicing procedures within a structured training environment.	9 Months	\$1,200,000
Option 4	Operational Deicing Simulator	Expand training to advanced operational procedures, additional workflows, and instructor-led qualification.	11 Months	\$1,770,000
Option 5	Enterprise Deicing Training Platform	Deliver a comprehensive enterprise training platform supporting multiple aircraft, enterprise administration, and future expansion.	14 Months	\$2,250,000

Implementation Note: Each implementation option includes the capabilities of all preceding options unless otherwise noted. The options are presented as standalone implementation paths, and their pricing is not additive. Should Cargojet elect to expand the simulator in the future, previously developed software, digital assets, integrations, and training content may be leveraged to reduce redevelopment effort and preserve prior investment.

FOUNDATIONAL TRAINING: OPTIONS 1-2

The foundational implementation options are designed to rapidly improve operator proficiency with Cargojet's aircraft deicing equipment and spray techniques before introducing more advanced operational workflows. These options focus on building confidence through realistic spray practice, objective performance feedback, and representative operating conditions while minimizing implementation time and cost.

OPTION 1 Spray Skills Trainer

\$585,000 · 5 months

Best suited for: *Foundational operator familiarization with TEMPEST i controls and Type I spray techniques*

INCLUDES

- ✓ TEMPEST i deicing truck simulation
- ✓ Boeing 767 exterior training aircraft model
- ✓ Type I spray simulation
- ✓ Cargojet-furnished Tempest I physical control integration
- ✓ One guided module
- ✓ One qualification assessment
- ✓ Basic pass/fail reporting

DOES NOT INCLUDE

- ✗ Sandbox practice
- ✗ Type IV Spray
- ✗ Instructor management tools
- ✗ LMS integration
- ✗ Multi-user training
- ✗ Configurable weather

OPTION 2 Spray Performance Trainer

\$780,000 · 5 months

Best fit for realistic operational training



Best suited for: *Operators who require realistic spray practice on Cargojet's highest-priority aircraft and under operational conditions.*

INCLUDES

- ✓ TEMPEST i deicing truck simulation
- ✓ Single Boeing 767 exterior aircraft model
- ✓ Type I & Type IV spray simulation
- ✓ Cargojet-furnished Tempest I physical control integration
- ✓ Free-form sandbox training for independent practice
- ✓ Weather system including frost, light/medium/heavy snow contamination, day/night lighting, low-visibility conditions, wind speed, and wind direction
- ✓ AI-assisted vehicle movement
- ✓ Performance scorecard measuring Type I & IV material usage, spray coverage by aircraft section, and total deicing completion time.

DOES NOT INCLUDE

- ✗ Guided instructional Lessons
- ✗ Instructor management tools
- ✗ LMS integration
- ✗ Multi-user training

Cargojet will furnish the TEMPEST i controls for integration. Development will require 3 sets of controls, of which 2 will be returned as part of the project deliverables. The third set will be retained by ForgeFX for troubleshooting and support.

OPERATIONAL TRAINING: OPTIONS 3–5

The operational implementation options expand beyond individual spray proficiency to replicate complete aircraft deicing operations within a realistic training environment. These solutions introduce operational workflows, instructor-led training, enterprise management capabilities, and expanded aircraft support, providing Cargojet with a scalable platform that can evolve alongside future operational requirements.

OPTION 3 Core Deicing Simulator \$1,200,000 9 months Best suited for: <i>Complete single-truck Type I deicing training</i> INCLUDES Everything included in Option 2, plus: ✓ Four guided learning modules covering complete Type I deicing procedures ✓ Structured learning progression from equipment familiarization through complete operational workflow ✓ One comprehensive qualification assessment validating complete Type I operational proficiency. ✓ Expanded performance reporting including spray coverage, contamination removal effectiveness, procedural compliance, completion time, and pass/fail status ✓ Basic instructor management tools for launching training sessions, monitoring trainee progress, and reviewing assessment results DOES NOT INCLUDE ✗ Additional aircraft beyond the Boeing 767 ✗ Advanced operational workflows (e.g., fluid injection, specialized procedures) ✗ Enterprise reporting and historical analytics ✗ Learning Management System (LMS) integration ✗ Multi-user collaborative training	OPTION 4 Operational Deicing Simulator \$1,770,000 11 months Best suited for: <i>Advanced operational training across Cargojet's aircraft fleet</i> INCLUDES Everything included in Option 3, plus: ✓ Boeing 757, Boeing 767-200, and Boeing 767-300 training aircraft ✓ 6 guided learning modules covering advanced operational procedures and fleet-specific operations ✓ Three comprehensive qualification assessments supporting advanced operational scenarios ✓ Type I and Type IV operational workflows, including fluid injection procedures ✓ Advanced AI-assisted vehicle positioning supporting Cargojet-approved operational drive paths ✓ Enhanced instructor management with expanded scenario control and trainee management ✓ Expanded performance reporting including operational compliance, material usage, procedural scoring, and scenario-specific analytics DOES NOT INCLUDE ✗ Enterprise performance dashboards ✗ Learning Management System (LMS) integration ✗ Multi-user collaborative training ✗ Customer-specific workflow authoring	OPTION 5 Enterprise Deicing Platform \$2,250,000 14 months Best suited for: <i>Enterprise-wide standardized training and long-term program management</i> INCLUDES Everything included in Option 4, plus: ✓ 10 guided learning modules supporting enterprise training and recurrent qualification ✓ Five comprehensive qualification assessments covering enterprise training objectives ✓ Full enterprise instructor management console with advanced scenario authoring ✓ Single- and two-truck operations, engine-running procedures, and fluid injection ✓ Enterprise performance dashboards with historical reporting, trend analysis, and trainee performance tracking ✓ Learning Management System (LMS) integration ✓ Multi-user collaborative training ✓ Cargojet-specific operational procedures, enterprise workflows, and future training content framework.
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PRODUCT OWNERSHIP

ONE COST, INFINITE POTENTIAL

ForgeFX develops custom simulation solutions that provide lasting value beyond the initial deployment. Cargojet will receive the project-specific deliverables developed under the final project agreement, allowing the simulator to be maintained, expanded, and adapted as training requirements evolve.

One-time development cost: The proposed implementation options represent defined project scopes with one-time development pricing. Each option provides a clear implementation path without recurring ForgeFX development fees.

No ForgeFX per-seat licensing fees: ForgeFX does not charge per-seat licensing fees for the custom simulator developed for this project, unless otherwise specified in the final agreement. Cargojet may deploy the completed simulator throughout its approved training environment without additional ForgeFX seat-based charges.

Designed for future expansion: Project-specific aircraft models, training content, scenarios, user interfaces, and workflows can serve as the foundation for future implementation phases, helping preserve the value of Cargojet's initial investment while reducing redevelopment effort.

Proven development foundation. ForgeFX leverages proven simulation frameworks, development tools, workflows, and technical infrastructure to accelerate development and reduce project risk. Pre-existing ForgeFX technology, third-party software, and licensed components remain subject to their respective ownership and licensing terms as defined in the final project agreement.

Long-term partnership. ForgeFX supports clients beyond initial deployment through ongoing maintenance, technical support, updates, and future enhancements as training programs evolve.

SIMULATOR ROI

When evaluating a simulator investment, it's important to consider both the direct and indirect benefits to training operations. A well-designed deicing simulator provides more than just procedural instruction—it enables operators to repeatedly practice critical skills in a safe, controlled environment while reducing reliance on operational equipment and consumable materials. For Cargojet, the proposed simulator is intended to improve operator proficiency, increase training flexibility, and establish a scalable platform that supports long-term operational readiness.

- **Reduced Wear and Tear on Physical Equipment**

Conducting foundational and recurrent training in the simulator reduces the amount of training performed on operational deicing equipment. This minimizes wear on the TEMPEST i deicing truck while reducing the potential for equipment damage and associated maintenance costs.

- **Reduced Training Material Costs**

Simulator-based practice enables operators to develop and refine spray techniques without consuming glycol or tying up operational equipment. Repeated practice can be completed in the virtual environment before transitioning to live operations, reducing the cost of training activities.

- **Increased Operator Proficiency**

Operators can repeatedly practice spray techniques, boom positioning, spray patterns, and operational decision-making under representative environmental conditions before working on live aircraft. Objective performance feedback helps reinforce proper spray techniques while building confidence and consistency.

- **Reduce Training Time & Expenses**

Access to operational aircraft, deicing equipment, and suitable weather conditions can limit training opportunities. The simulator enables training to occur regardless of aircraft availability, weather conditions, or equipment scheduling, improving instructor utilization and reducing operational disruption.

- **Increased Throughput**

A simulator allows multiple operators to complete training throughout the year without relying on seasonal weather events or removing operational equipment from service. This increases training capacity while helping standardize instruction across instructors, shifts, and operating locations.

- **Improve Spray Efficiency and Operational Consistency**

Operators receive objective feedback on spray coverage, material usage, and completion time, allowing them to refine spray techniques before performing live deicing operations. Consistent training helps reinforce standardized operating practices while supporting more efficient and repeatable deicing procedures.



Once our understanding is clear in terms of project goals, features, and budget requirements, we'll be in position to move forward with next steps towards kicking off the development of your project.

ON TARGET?

Goals



Features



Cost





Mary Pierce

*Executive Director of
Enterprise Partnerships*

Mary consults with our clients, studies their business, and generates creative solutions for their training needs.

LET'S GET STARTED!

ForgeFX Simulations looks forward to working with you to design and develop your training simulator. If our proposal is in line with your requirements and you would like to hire us, please contact Mary Pierce to discuss development options and she will send you a project agreement for this proposal to review.



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APPENDIX A

A detailed feature comparison matrix describing the capabilities included within each implementation option

Capability	Description	Option 1: Spray Skills Trainer	Option 2: Spray Performance Trainer	Option 3: Core Deicing Simulator	Option 4: Operational Deicing Simulator	Option 5: Enterprise Deicing Training Platform
Purpose	Overall objective of the implementation package.	Develop foundational spray skills and equipment familiarity. Operators learn how to use the TEMPEST i controls, position the boom, apply Type I fluid, and achieve proper spray coverage in a focused training environment.	Develop operational spray proficiency through free-form practice using the Boeing 767, Type I and Type IV spray simulation, configurable weather conditions, wind effects, and objective feedback on material usage, coverage, and completion time.	Develop proficiency in complete single-truck Type I deicing operations by adding a structured guided learning curriculum, formal qualification assessment, instructor tools, and expanded performance reporting.	Expand training across Cargojet's aircraft fleet and advanced operational workflows, including additional aircraft models, advanced procedures, expanded qualification scenarios, and enhanced instructor management.	Provide a scalable enterprise training ecosystem that supports standardized training, enterprise reporting, LMS integration, multi-user training, and long-term Cargojet-specific expansion.
Simulation Assets	The digital 3D models and virtual environments that form the foundation of the training experience, including aircraft, deicing equipment, airport surroundings, and visual effects.	TEMPEST i deicing truck Boeing 767, one exterior training aircraft model, and representative aircraft deicing area.	TEMPEST i deicing truck, Boeing 767 exterior training aircraft model, representative aircraft deicing area, Type I/Type IV spray visual effects, and environmental visual effects.	Enhanced Boeing 767 training environment supporting complete single-truck Type I workflows, guided learning, sandbox practice, and qualification activities.	Boeing 757, Boeing 767-200, and Boeing 767-300 training aircraft with expanded operational environment assets supporting fleet-based training and advanced deicing scenarios.	Enterprise-ready asset library supporting standardized training, expanded environment use, future content updates, and long-term platform growth.
Environmental Simulation	Environmental conditions, contamination states, visibility effects, and lighting conditions used during training.	Fixed training environment with a predefined contamination condition and core spray visual effects. Weather, visibility, lighting, and contamination settings are fixed and not user configurable.	Weather system including frost, light/medium/heavy snow contamination, low visibility effects, day/night lighting, wind speed, and wind direction. Temperature modeling is excluded	Includes the Option 2 environmental system and applies those configurable conditions to structured Type I workflows, guided learning modules, sandbox practice, and qualification assessment activities.	Expanded environmental use across multiple aircraft and advanced operational workflows, supporting more varied training and qualification scenarios.	Enterprise environmental configuration supporting standardized scenario setup, reporting, and future environmental content expansion.
Guided Training Modules	Structured, interactive learning experiences that teach specific equipment functions and deicing procedures before trainees progress to independent practice and qualification assessments.	1 Guided Module: TEMPEST i Controls & Spray Fundamentals.	Not included. This option prioritizes sandbox-based operational spray practice over guided instructional curriculum.	4 Guided Learning Modules (TBd)	6 Guided Learning Modules (TBD)	10 Guided Learning Modules supporting enterprise training, recurrent qualification, Cargojet-specific procedures, and expanded operational workflows.
Sandbox Practice	An open-ended training environment that enables trainees to independently practice deicing procedures, reinforce learned skills, and build confidence without formal qualification scoring.	Not included.	Free-form sandbox training allowing operators to independently practice Type I and Type IV spray application on a Boeing 767 under configurable weather, wind, visibility, and contamination conditions.	Includes Option 2 sandbox capabilities plus structured use within the complete single-truck Type I training workflow.	Expanded sandbox practice across Boeing 757, Boeing 767-200, and Boeing 767-300 aircraft with advanced operational procedures and fleet-specific practice.	Enterprise sandbox framework supporting standardized practice, multi-user or instructor-led use where applicable, and future scenario expansion.
Qualification Assessments	Structured performance evaluations designed to verify trainee competency in specific deicing skills, procedures, and operational workflows.	1 Qualification Assessment: Spray Proficiency Assessment focused on boom control, Type I spray coverage, and contamination removal.	Formal qualification assessments are not included. Instead, this option provides a sandbox performance scorecard measuring material usage, aircraft coverage, and completion time.	1 Comprehensive Qualification Assessment: Complete single-truck Type I deicing operation.	3 Qualification Assessments: Complete Type I Assessment, Advanced Operational Procedures Assessment, and Multi-Aircraft Operational Assessment.	6 Qualification Assessments supporting enterprise training objectives, recurrent qualification, and expanded Cargojet operational procedures.
Aircraft Library	Digitally recreated aircraft models used for guided training, sandbox practice, and qualification scenarios. Each aircraft includes representative deicing surfaces, restricted areas, spray coverage zones, and operational considerations unique to that platform	Boeing 767 exterior training aircraft model with representative geometry	Boeing 767 exterior training aircraft model with representative geometry, primary deicing surfaces, spray evaluation zones, and section-based coverage scoring.	Boeing 767 training aircraft supporting guided learning, sandbox practice, and complete single-truck Type I qualification assessment.	Boeing 757, Boeing 767-200, and Boeing 767-300, each featuring representative geometry, deicing surfaces, restricted zones, spray evaluation regions, and operational considerations.	Includes all Option 4 aircraft with a framework to support future fleet additions and enterprise training expansion.
Tempest I Control Integration	Integration of Cargojet-furnished TEMPEST i joystick assemblies and operator controls into the simulation environment to provide an authentic hands-on training experience. Scope includes hardware interfacing, input mapping, calibration, and software integration.	Integration of Cargojet-furnished controls with support for core boom movement and Type I spray operations.	Integration of Cargojet-furnished controls with support for core boom movement and Type I/Type IV spray operations. Scope focuses on the inputs required for spray performance practice, not every possible TEMPEST i input.	Includes Option 2 control integration plus support for guided learning, Type I workflow training, instructor-managed sessions, and qualification assessment use.	Expanded control integration supporting advanced procedures, multi-aircraft workflows, and enhanced operational training scenarios.	Full integration supporting enterprise training workflows, advanced procedures, and expanded platform use.

Capability	Description	Option 1: Spray Skills Trainer	Option 2: Spray Performance Trainer	Option 3: Core Deicing Simulator	Option 4: Operational Deicing Simulator	Option 5: Enterprise Deicing Training Platform
Boom & Spray Simulation	Real-time simulation of boom articulation, basket positioning, spray nozzle operation, glycol application, and contamination removal used to train proper aircraft deicing techniques. Performance is continuously evaluated based on spray coverage, procedural execution, and operational effectiveness.	Type I spray simulation supporting boom movement, basket positioning, spray operation, and basic coverage feedback.	Type I and Type IV spray simulation supporting realistic spray practice, fan adjustment, wind interaction, and operational spray techniques.	Includes Option 2 spray simulation applied to a structured Type I deicing workflow with guided instruction and qualification scoring.	Expanded Type I and Type IV operational procedures, fluid injection workflows, and fleet-specific spray practice across included aircraft.	Enterprise-ready spray simulation supporting standardized procedures, expanded reporting, and future operational content.
Vehicle Positioning	Controls how the deicing vehicle moves and repositions around the aircraft during training exercises. In all implementation packages, vehicle movement is automated, allowing trainees to focus on boom operation and spray technique rather than driving the truck.	Simple snap-to-position movement between predefined work locations.	Basic AI-assisted vehicle repositioning between predefined work locations, initiated by the operator. The operator indicates when movement is needed and the simulator performs basic repositioning.	Includes Option 2 repositioning plus structured movement between approved work locations as part of the complete Type I workflow.	Advanced AI-assisted repositioning follows Cargojet-approved drive paths and stopping locations across included aircraft to create a more realistic operational flow.	Enterprise vehicle positioning framework supporting standardized workflows, advanced operating modes, and future operational enhancements.
Operational Workflows	Defines the deicing procedures and operational sequences that trainees can perform within guided training, sandbox practice, and qualification scenarios. Workflow complexity expands with each implementation level.	Spray skills training only.	Independent spray performance practice focused on Type I and Type IV application, wind/visibility effects, material usage, spray coverage, and completion time.	Complete single-truck, engine-off Type I deicing workflow with guided instruction, sandbox practice, qualification assessment, and instructor review.	Advanced operational procedures across multiple aircraft, including Type IV workflows, fluid injection, expanded qualification activities, and fleet-specific operational training.	Enterprise workflows supporting standardized training delivery, recurrent qualification, multi-user or instructor-led training, LMS integration, and long-term Cargojet-specific expansion.
Performance Evaluation & Reporting	Evaluates trainee performance and generates objective feedback based on spray execution, procedural compliance, contamination removal, safety considerations, and completion objectives.	Basic pass/fail summary indicating successful completion of the training exercise.	Performance scorecard measuring Type I and Type IV material usage, total completion time, and aircraft coverage percentage broken down by aircraft section such as left wing, right wing, tail, and other defined spray regions.	Expanded performance summary including spray coverage, contamination removal effectiveness, procedural compliance, completion time, and pass/fail status for the complete Type I workflow.	Expanded operational reporting including coverage, contamination removal, procedural scoring, material usage, workflow compliance, and scenario-specific analytics.	Enterprise analytics including dashboards, historical reporting, trend analysis, trainee performance tracking, instructor comments, and expanded organizational metrics.
Instructor Management	Provides instructors with the tools necessary to administer training sessions, launch exercises, and review trainee performance. Functionality expands with each implementation package to support increasingly sophisticated training operations.	Not included.	Not included. Option 2 is designed for free-form practice and scorecard feedback without instructor management tools.	Basic instructor interface allowing instructors to launch, restart, terminate, and review predefined training modules, sandbox sessions, and qualification results.	Enhanced instructor management with expanded scenario control, trainee management, aircraft selection, workflow selection, and assessment review.	Full enterprise instructor console with advanced scenario authoring, administrative controls, trainee management, reporting configuration, and enterprise training oversight.
LMS Enterprise Integration	Supports integration with Cargojet enterprise systems to streamline training administration, record management, and organizational reporting.	Not included.	Not included.	Not included.	Not included unless added as an optional enhancement.	LMS integration and enterprise reporting framework.
Multi-User Training	Supports multiple participants within the same virtual training session.	Not included.	Not included.	Not included.	Not included unless added as an optional enhancement.	Included for enterprise collaborative training and/or instructor-observer use, subject to final design.
COST ESTIMATE	Price	\$585,000	\$780,000	\$1,200,000	\$1,770,000	\$2,250,000
Duration	Months	5 months	5 months	9 months	11 months	14 months

Key Assumptions

1. Implementation Note: Each implementation option includes the functionality and capabilities provided by all preceding option levels unless otherwise noted. The options are presented as standalone solutions and their pricing is not additive. Should CargoJet elect to expand the simulator in the future, previously developed software, digital assets, hardware integrations, training content, and platform capabilities may be leveraged as the foundation for subsequent phases, reducing redevelopment effort and preserving prior investment. As a result, the cost of future enhancements may be lower than the corresponding standalone option pricing presented herein.
2. Cargojet will furnish the TEMPEST i controls for integration. Development will require 3 sets of controls, of which 2 will be returned as part of the project deliverables. The third set will be retained by ForgeFX for troubleshooting and support.
3. ForgeFX will integrate the customer-furnished controls into the simulator software.
4. Aircraft models are representative training models and are not engineering-accurate digital twins.
5. Guided Training Modules and Qualification Scenarios represent authored content and may be refined during design.
6. Vehicle movement is automated in all proposed implementation options. The primary training objective of the simulator is to develop operator proficiency in boom positioning, spray technique, and Cargojet deicing procedures rather than vehicle driving skills.