DEVELOPMENT OF AN AUTONOMOUS CRYOGENICS PLANT COOL-DOWN

by

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ABSTRACT

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This paper aims to outline the possible structure and application of a high-level planned control system to adjust and modify existing control structures implemented on all Thomas Jefferson National Laboratory (JLab) Cryogenic Refrigeration Plants to allow for future Autonomous cool-downs.

This dedication is for my Mom because you've been there through it all. Your support and understanding mean everything to me. We've definitely got the ticket now.

ACKNOWLEDGMENTS

I want to start my list of acknowledgments with Dr. Geoffrey Kraft for giving me the opportunity in the first place to get where I am today by offering me a tour of the Old Dominion Center for Accelerator Physics and giving me the choice to join the Virginia Innovative Traineeships in Accelerators program. Followed by both Dr. Krishnanand N. Kaipa and Brian Mastracci for always being there to support me in my goals. I want to also acknowledge the entirety of the Cryogenics Department at Thomas Jefferson National Laboratory for being so supportive and providing so many affable conversations.

NOMENCLATURE

A	area, m2
C	stream capacity,
c	specific heat capacity,
Gr	Grashof Number, (No Units)
M	molecular mass, kg/mole
m	mass, kg
W	mass flow, kg/s
Pr	Prandtl Number, (No Units)
R	universal gas-constant,
Re	Reynolds Number, (No Units)
ε	effectiveness, (No Units)

Subscripts

0	initial condition, (No Units)
iso	isothermal process, (No Units)
lma	log mean average, (No Units)
m	mean value, (No Units)
p	constant pressure, (No Units)
v	constant volume, (No Units)

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Working within the order of precedence of sources referenced within this document. It is best to start with the work of Kays and London *Compact Heat Exchangers*, which is a landmark of the field and is still highly cited in modern research as its ubiquitous use in the design of simple heat exchangers (*6*); in addition, the referenced articles within the chapters of the book are in my opinion essential in the understanding of the dynamics of traditional two-stream heat exchangers (*4*, *7*, *8*).

As (*9*, *10*, *13*)

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APPENDIX A

MATERIAL PROPERTIES

The following tables will include graphed and-or tabulated results of select material properties of Aluminum and Helium within the operating domain of 300 to 2 Kelvin and 20 to 0.125 Atmospheres.

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