LewInt; a GUI and Analysis Toolset for LEWICE 3.2.2 Revisited

American Kestrel Company LLC

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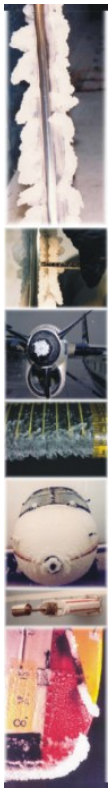
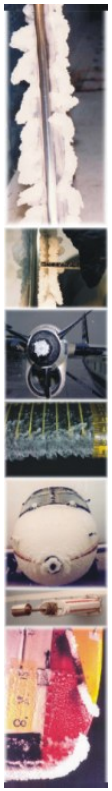
Overview



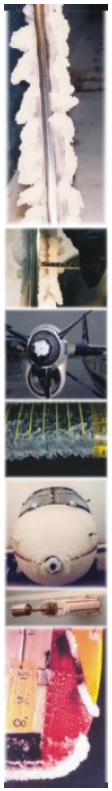
- Introduction
- History
- Features
- Topology of LewInt
- Example: determining critical hold shape
- Current State
- Questions

Introduction



- Began as an automated plotting tool written in MATLAB.
- Evolved into an internal tool to facilitate analysis, improve accuracy and organize ice accretion analysis.
- Based on industry feedback was offered as a commercial product.
- NASA interest in interface resulted in Space Act allowing direct and international distribution of LEWICE by American Kestrel.

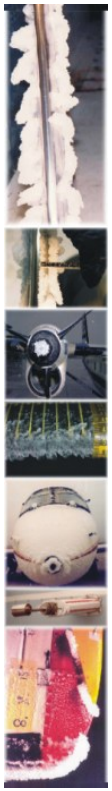
International Distribution



LewInt with LEWICE 3.2.2 is available through a NASA Space act for international distribution.

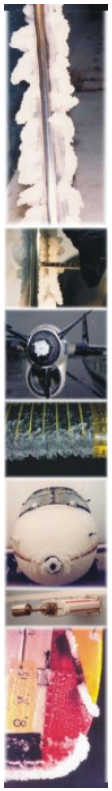
- Note: Licensee acknowledges and agrees that the Program(s) are subject to U.S. laws governing the export and/or re-export of Program(s) including, but not limited to, the Export Administration Regulations, regulations promulgating financial transaction restrictions administered by the Office of Foreign Asset Controls of the U.S. Department of the Treasury, the International Emergency Economic Powers Act, the United States Export Administration Act, the United States Trading with the Enemy Act, and all regulations, orders and licenses issued thereunder.

History



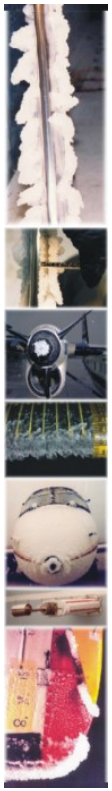
- LEWICE Validation report 01/99
- Initial demonstration of LewInt ~2003
- LEWICE v 3.2.2 released 2006?
- Initial LewInt announcement 9/24/2007
- Space Act SAA3-989 Signed 5/2008
- Alpha LewInt released 2/18/2009
- Version 0.9.4 released 3/14/2009
- Version 1.01 released 9/8/2011
- Version 1.04 released 1/1/2012

Features



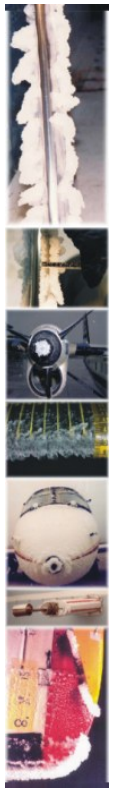
- GUI driven operation of LEWICE
- Can run up 64 icing runs sequentially.
- Organizes analysis results through root name and run index.
- Checks LEWINT input/flags/values for validity
- Automated plotting with descriptive titles.
- Plots have fixed 1:1 aspect ratio when appropriate.
- Overlay of ice traces.

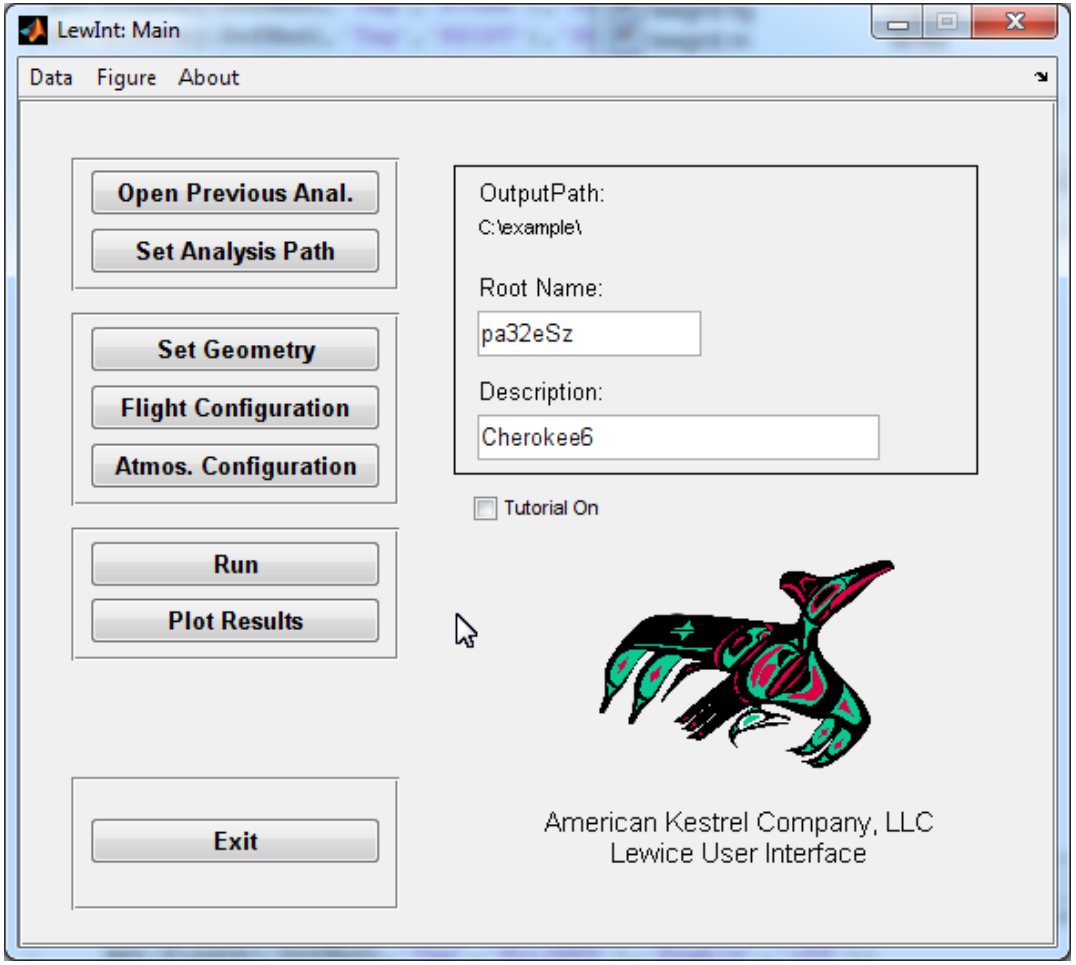
New Features Including V 1.02



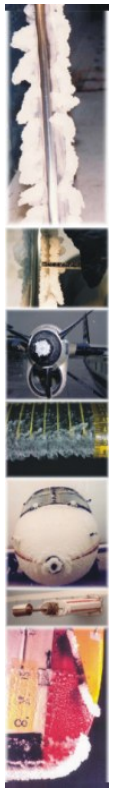
- Extensive update of thermal analysis functions.
- Additional plotting (mass fraction, energy balance, etc.)
- Use of external solvers (limited to input files already accepted by LEWICE)

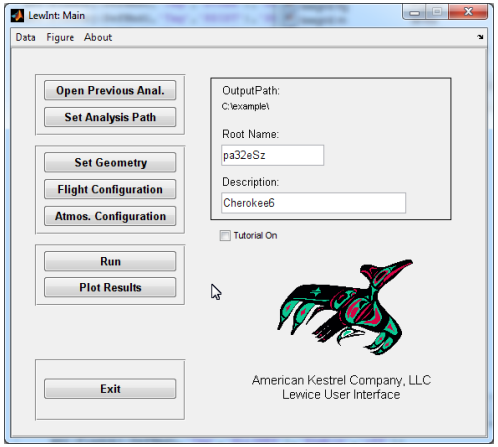
Menu – Topology

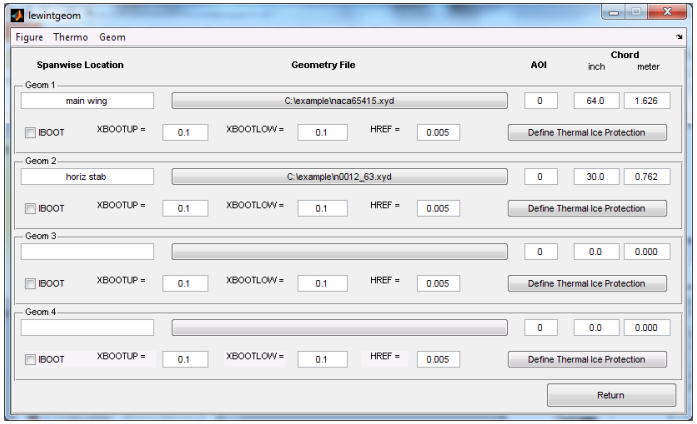


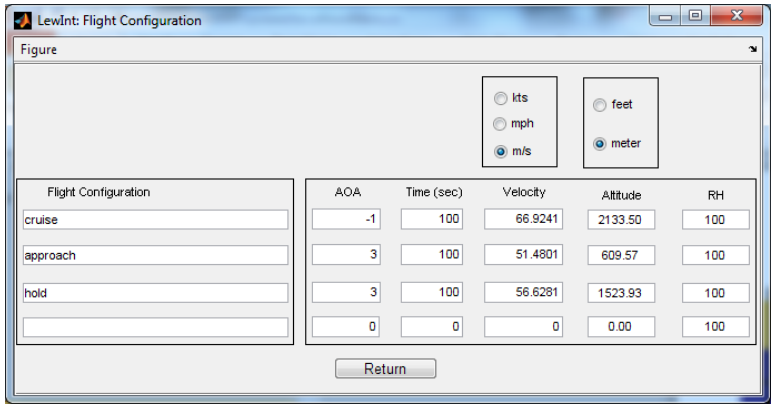


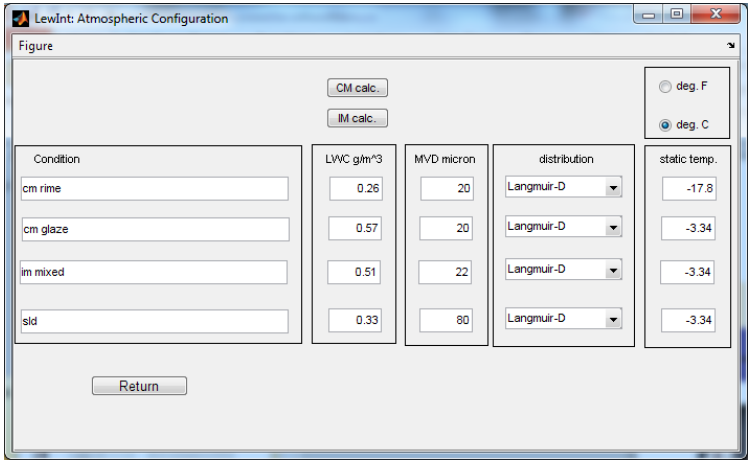
Menu – Ice Accretion



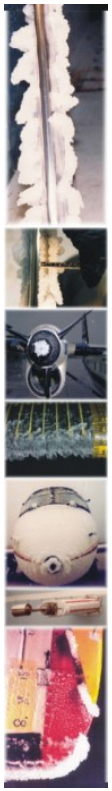


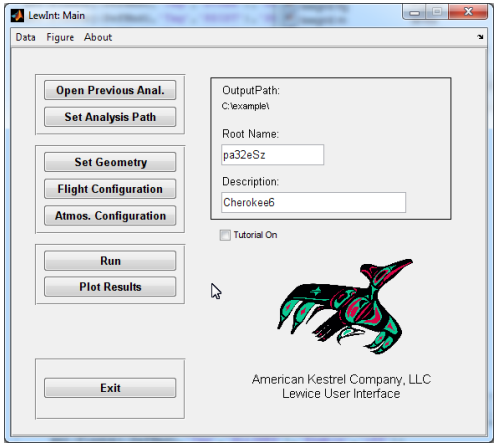


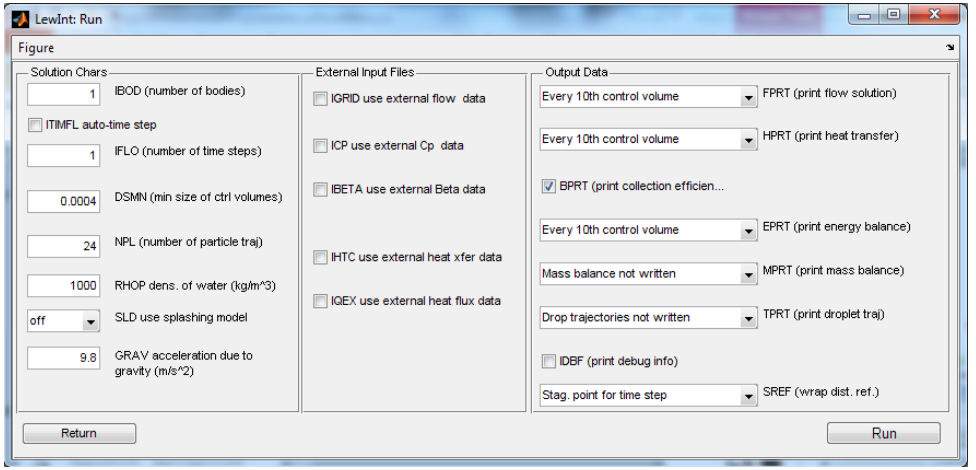


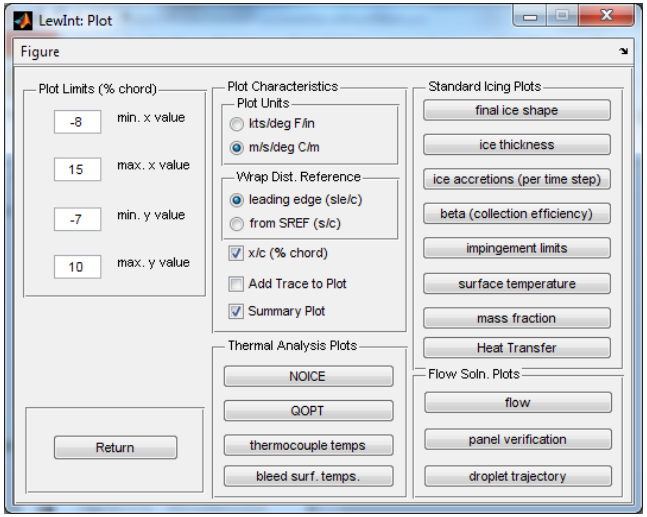


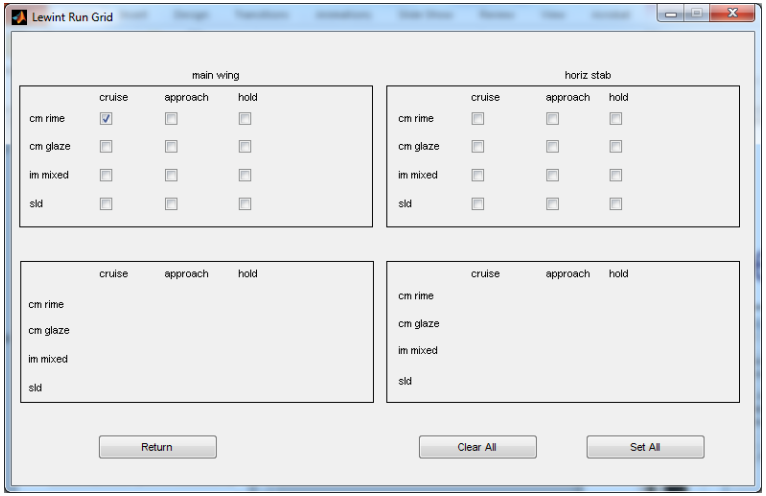
Menu – Run and Plot



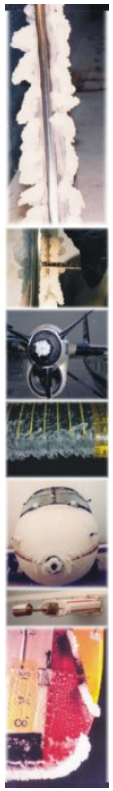


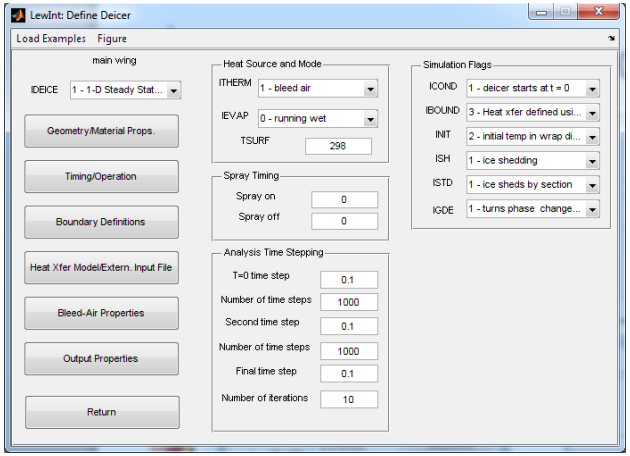


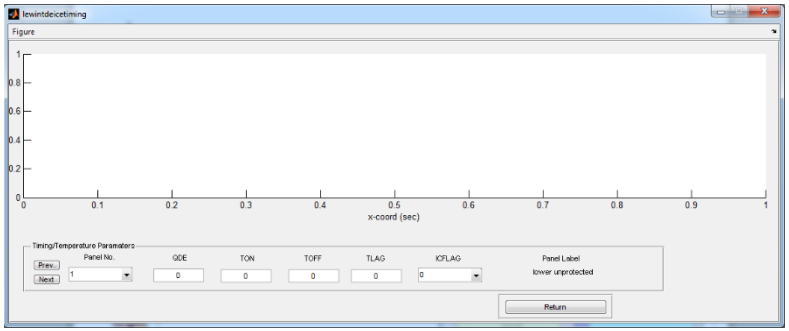


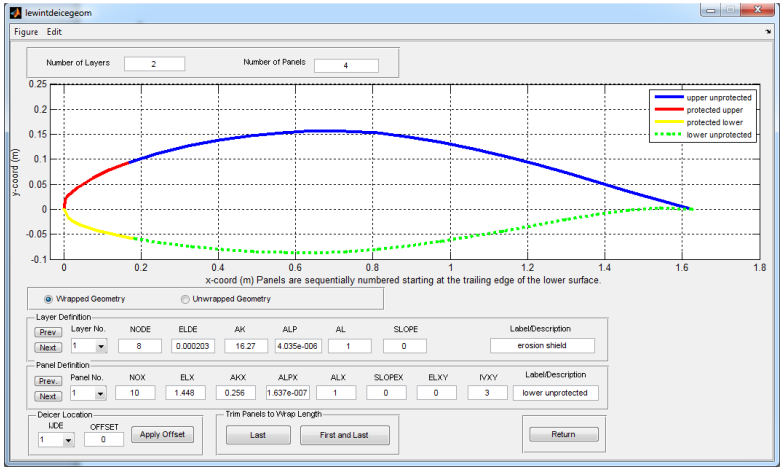


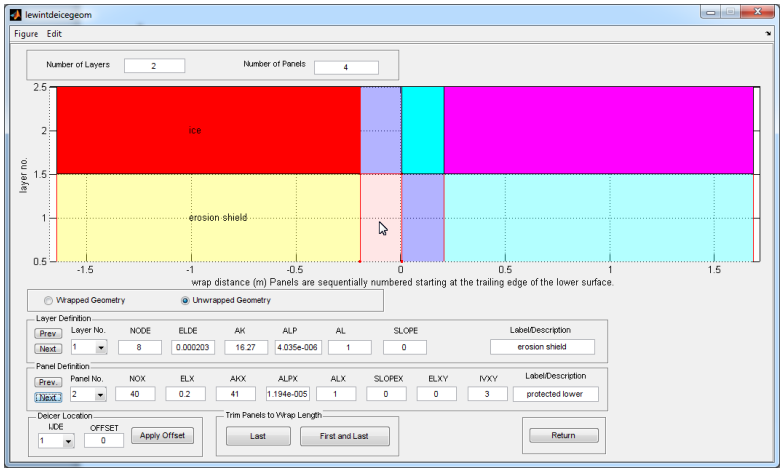
Menu – Thermal (1)



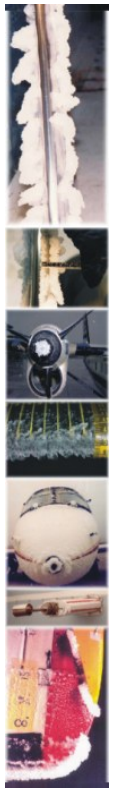


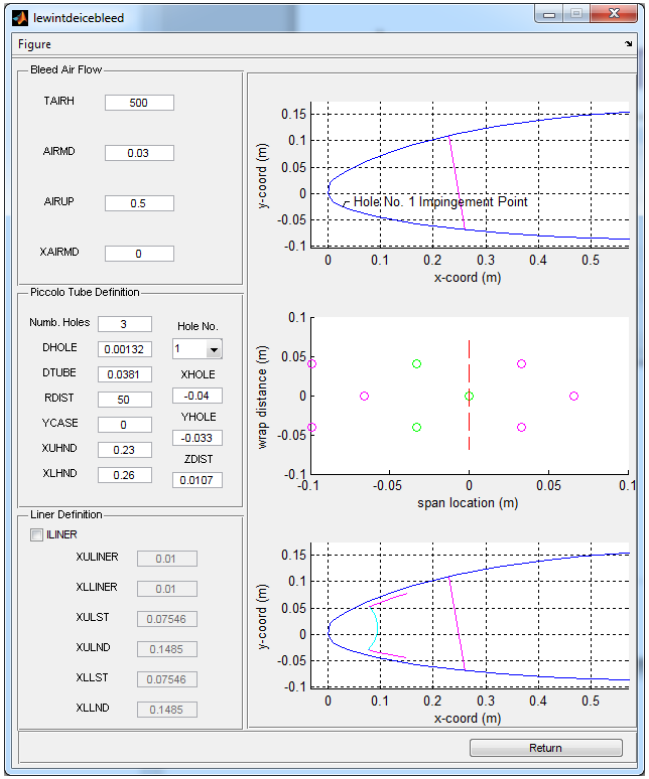


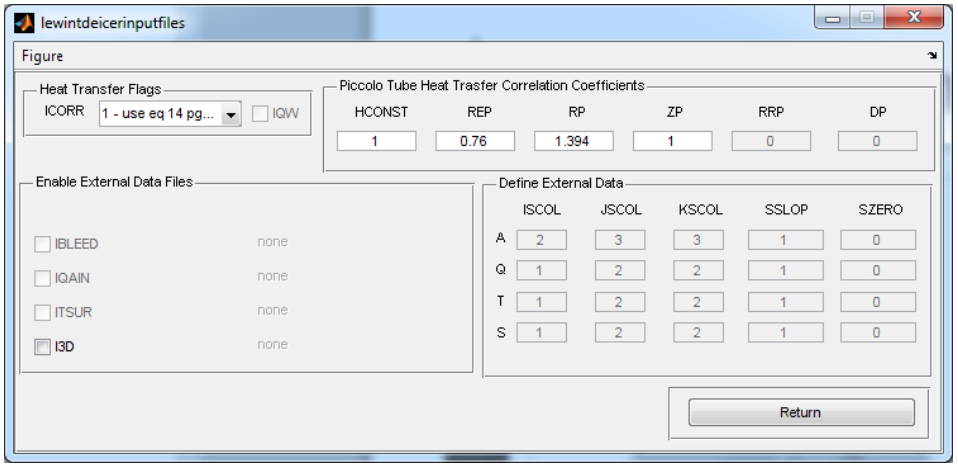


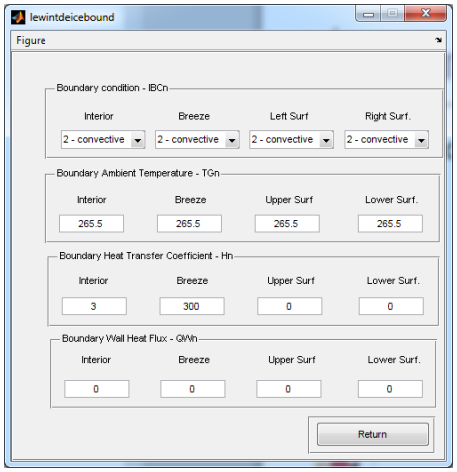


Menu – Thermal (2)

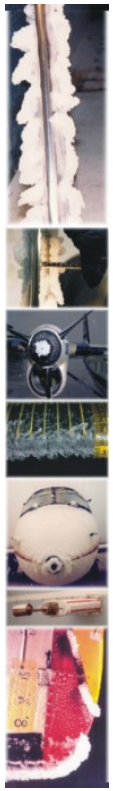


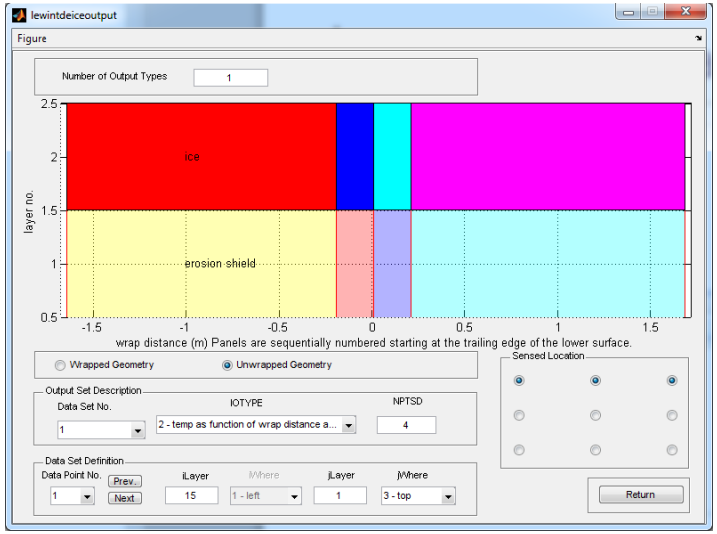


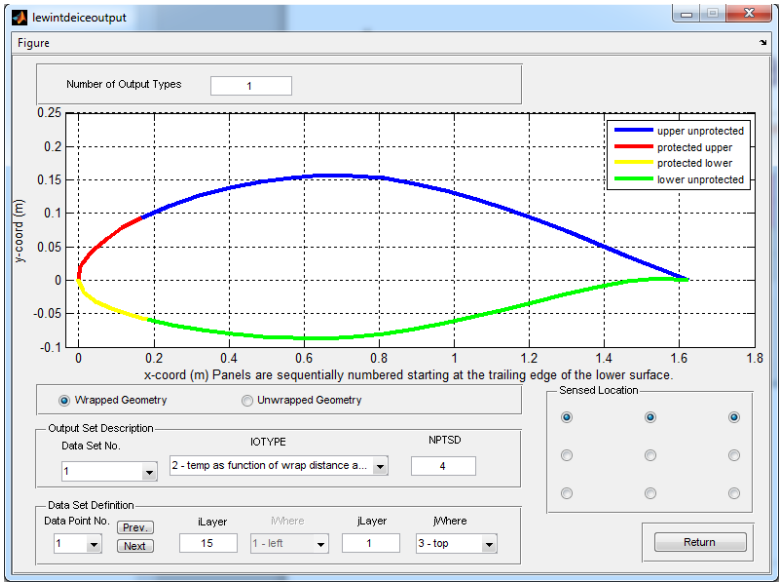




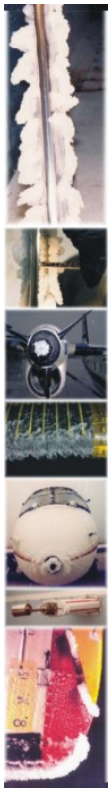
Menu – Thermal (3)







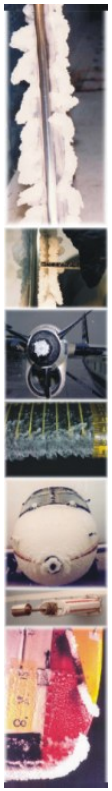
Example based on PA32 Bleed Air System

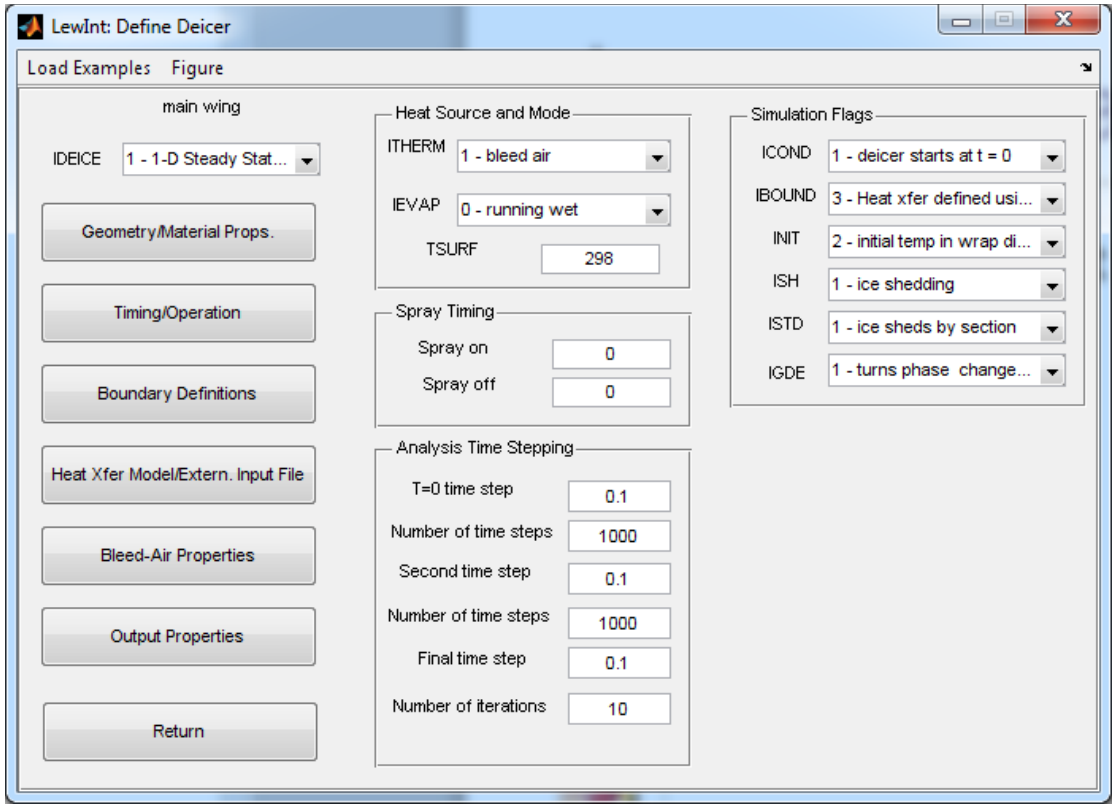


- PA-32 wing bleed air ice protection system analysis.
- Initially a 1D running wet analysis.
- Then bleed air standard heat transfer model:
  - Piccolo design used,
  - Internal heat transfer model,
  - Three hole model,
  - External surface temperatures plotted.

1-D Thermal Model Design

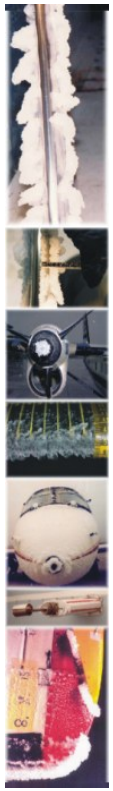
- 1-D
- Bleed air
- Running wet

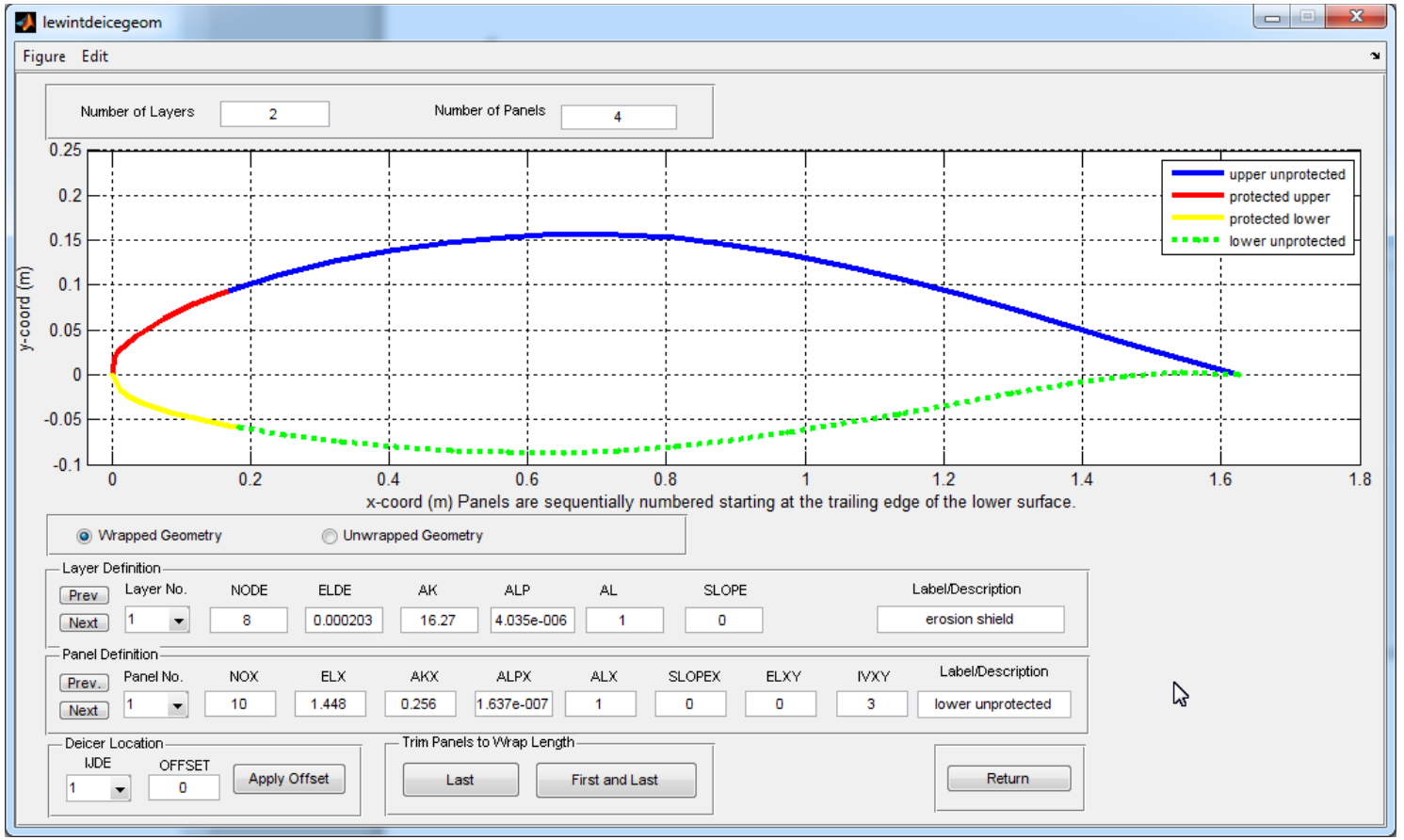




Deicer Geometry

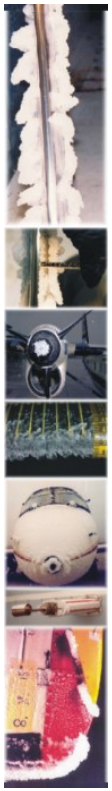
- Four panel two layer model

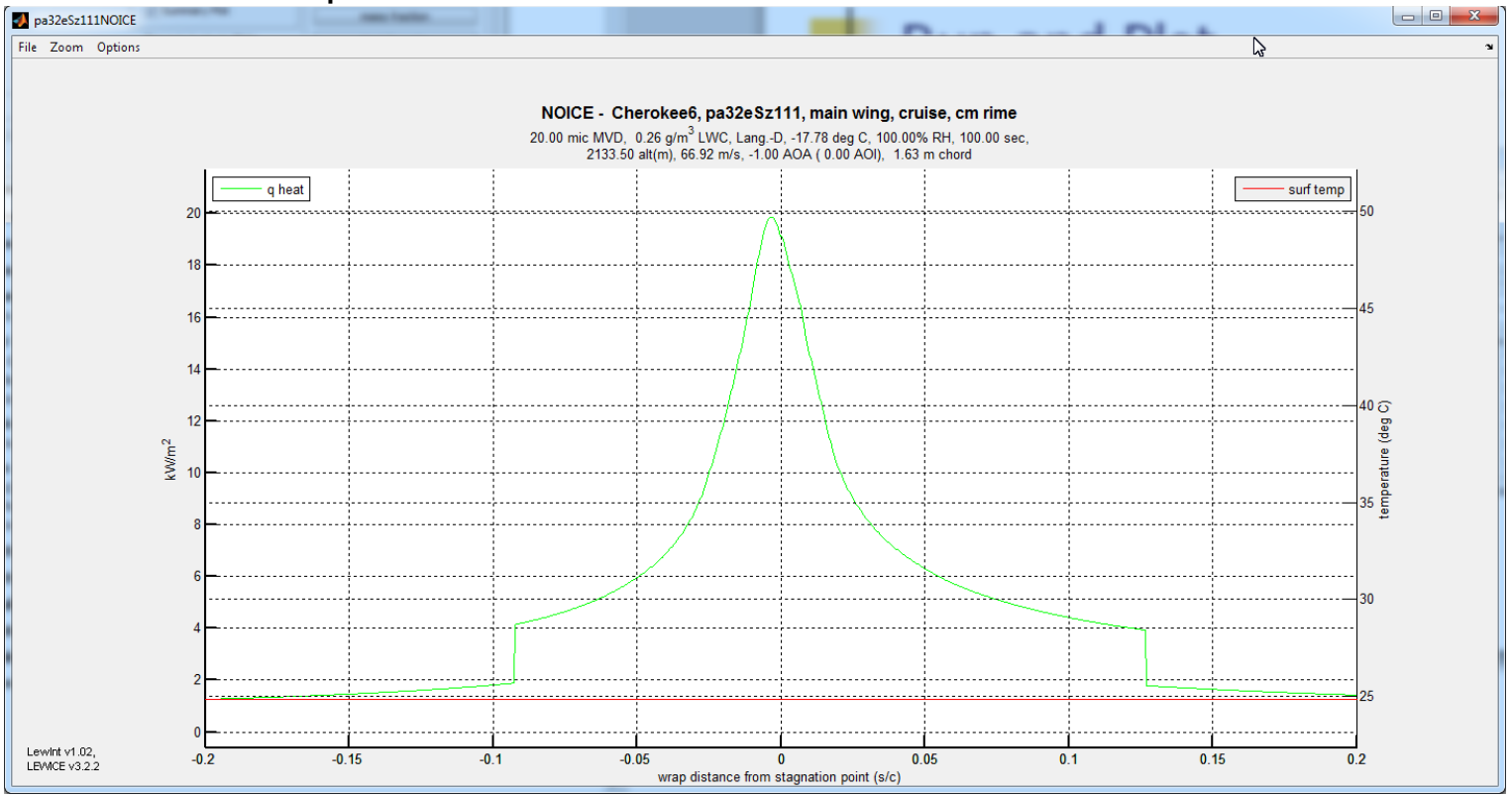




Run and Plot

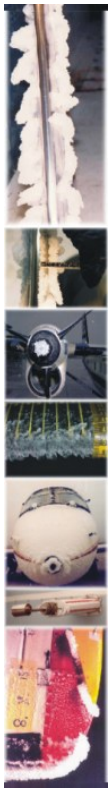
- NOICE plot data available
- Plot heat required and surface temp.

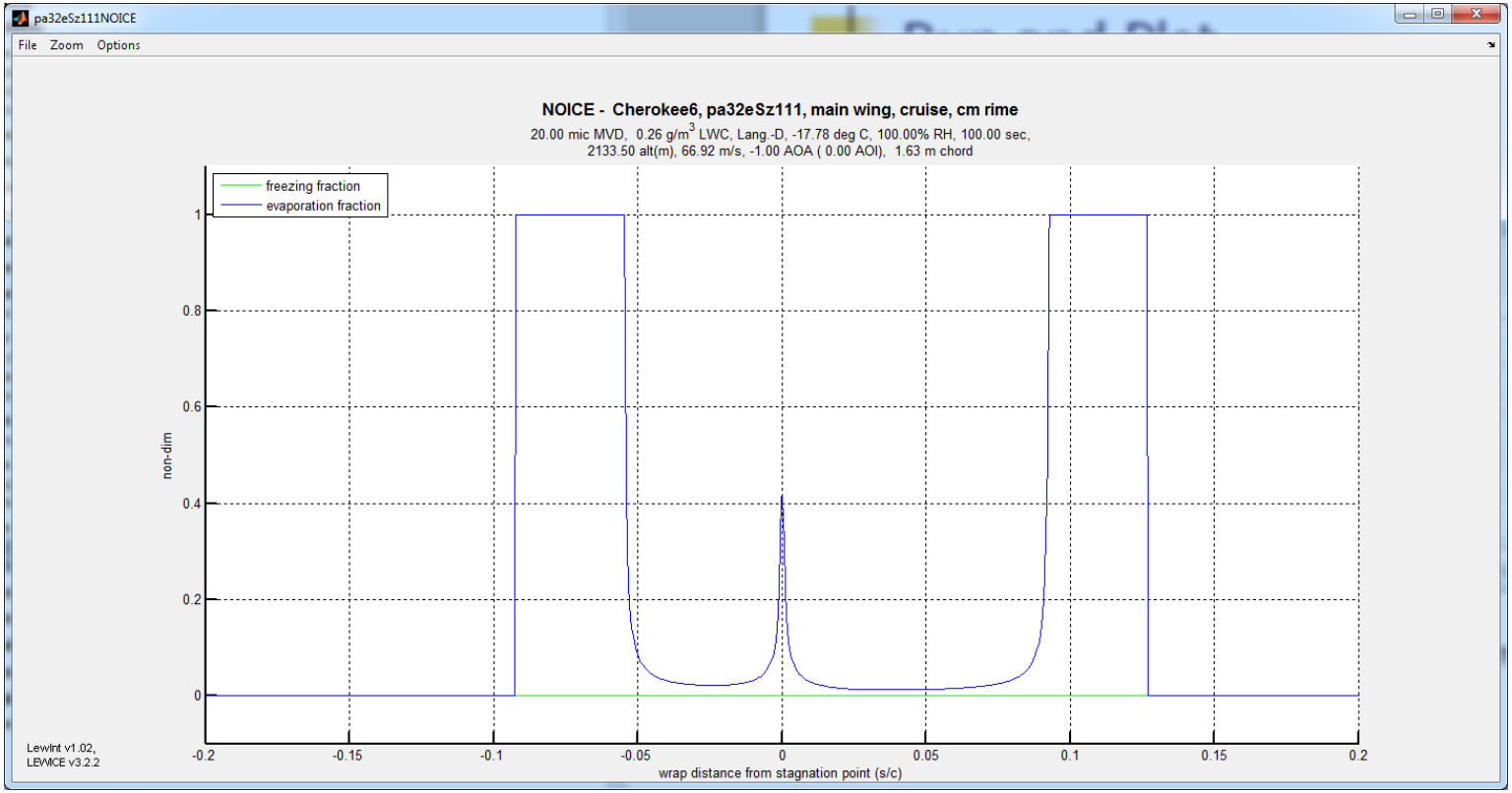




Run and Plot

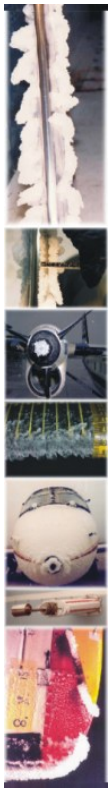
- Plot freezing and evaporative fractions.

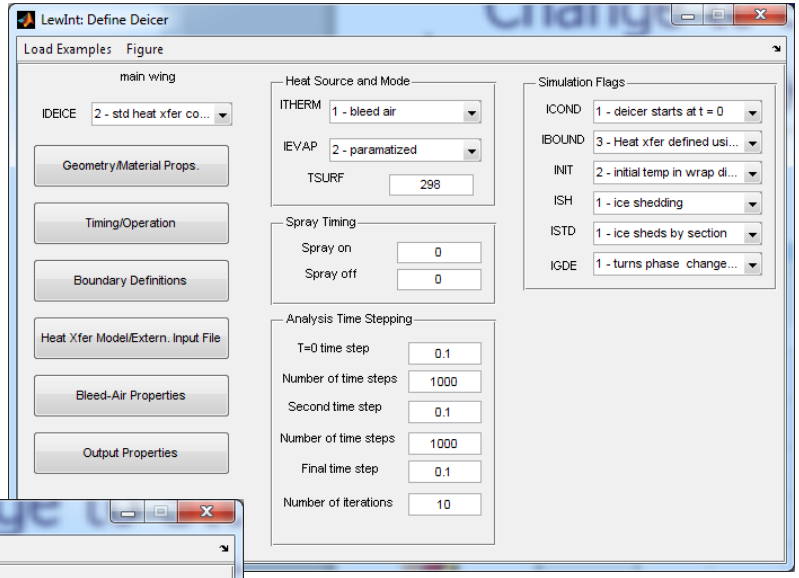


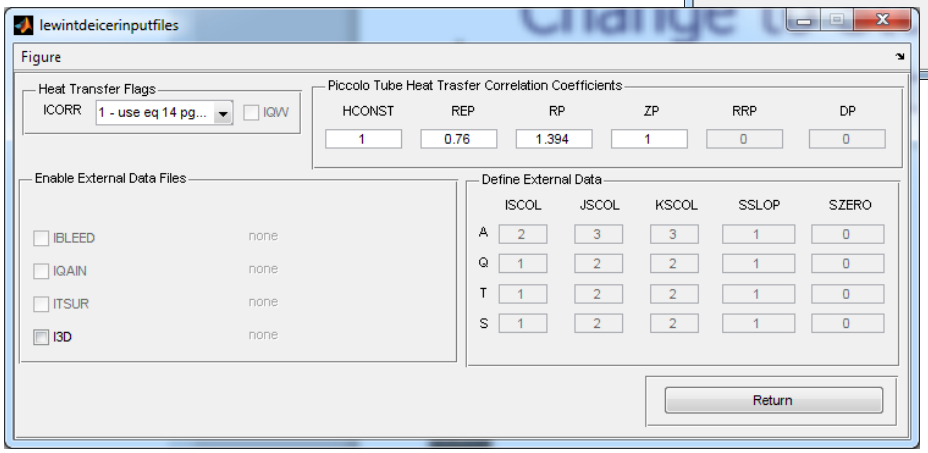


Change to Std. Heat Transfer Bleed Air System

- Std. heat transfer model
- Parametrized
- Internal heat transfer correlation

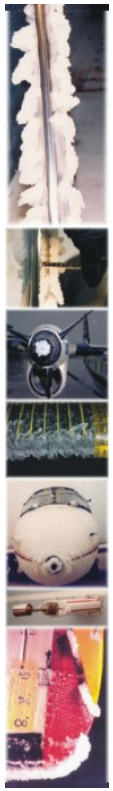


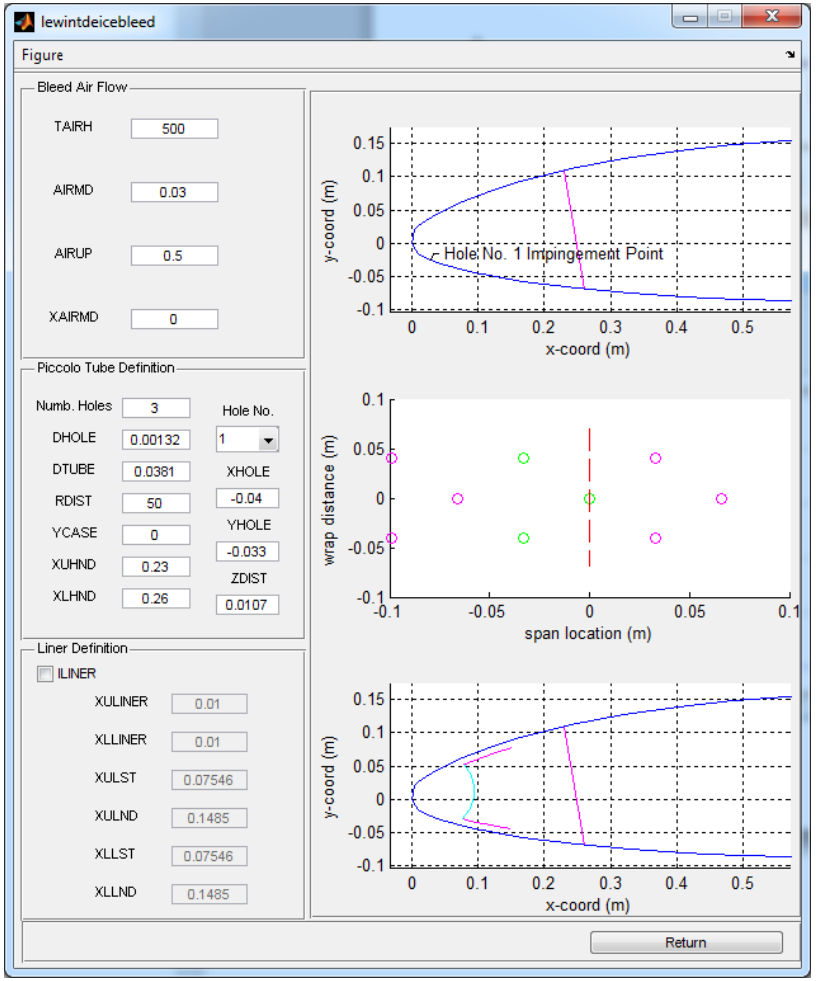




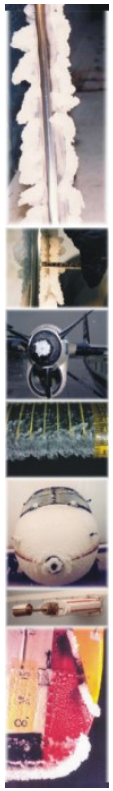
Piccolo Tube Design

- 500 deg K
- 0.03 mass flow
- Three piccolo holes
- No liner

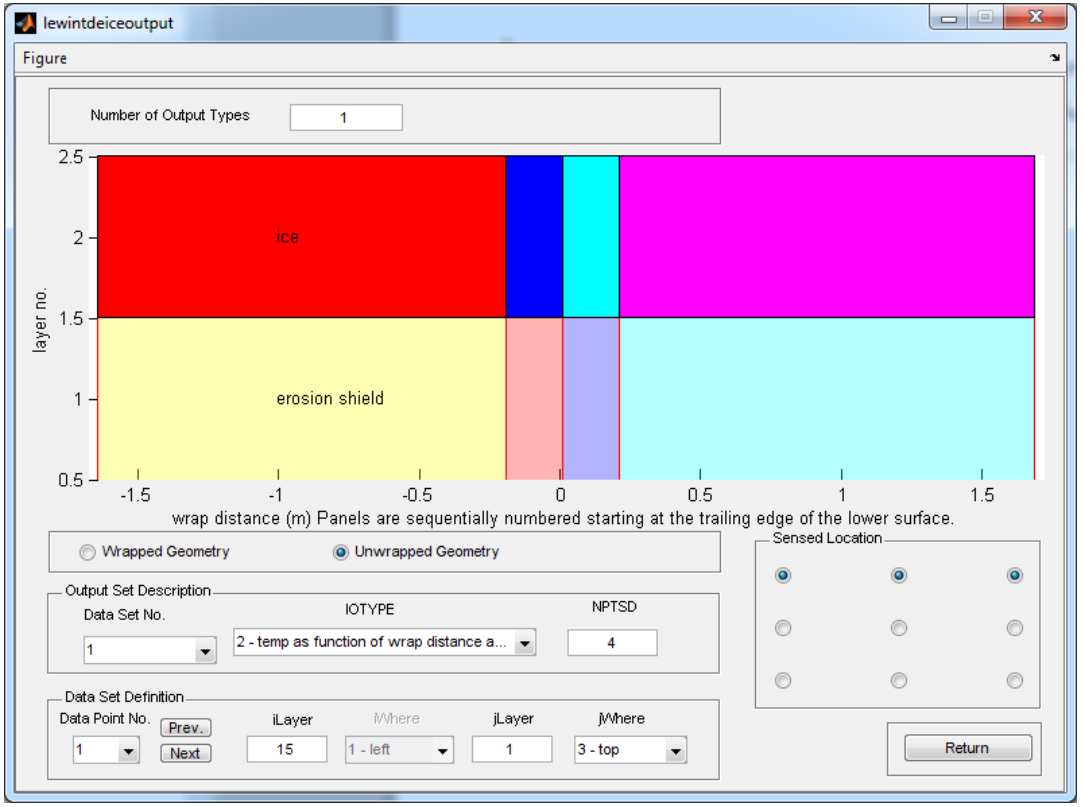




Thermocouple Output

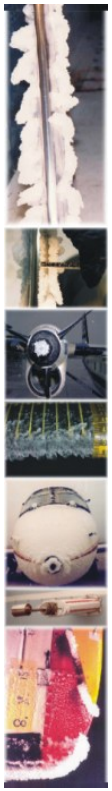


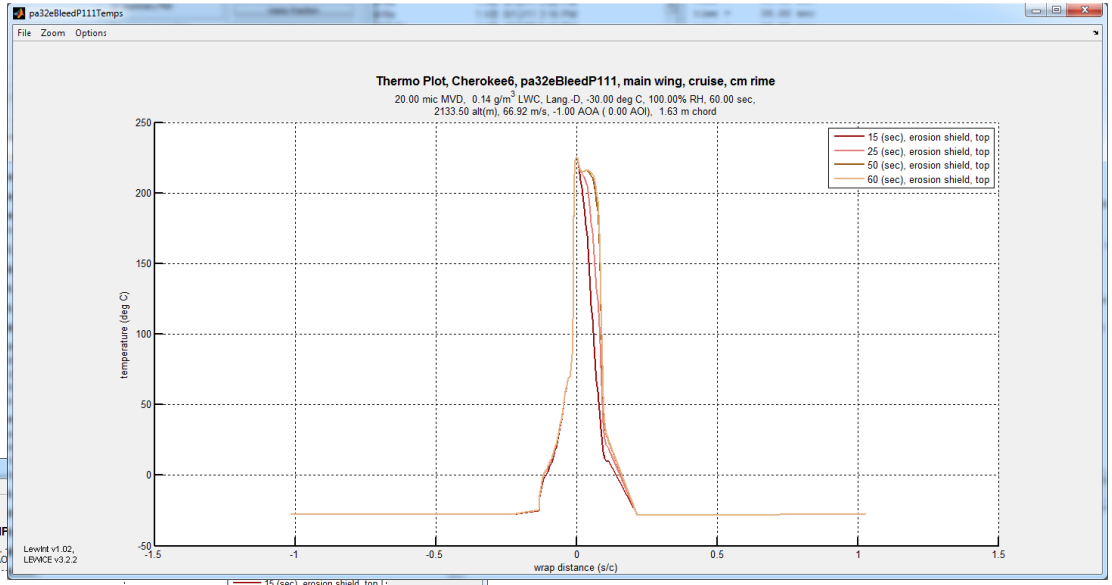
- One output type
- Temp. as a function of wrap distance.
- 4 time steps
- Top surface of erosion shield

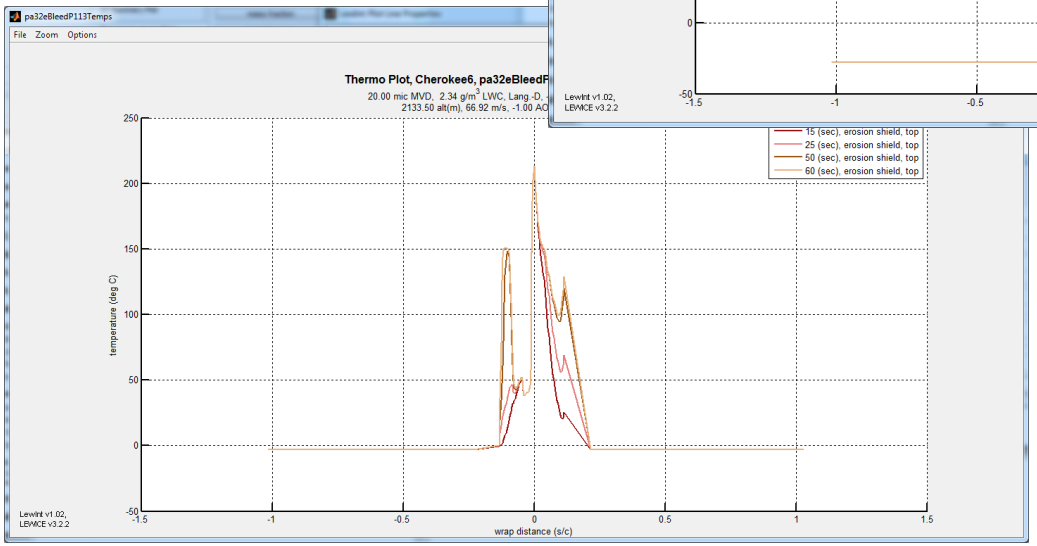


Run and Plot

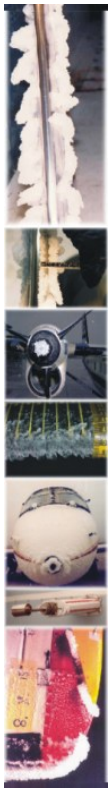
- Thermocouple plot
- Cold temp CM
- Warm temp IM





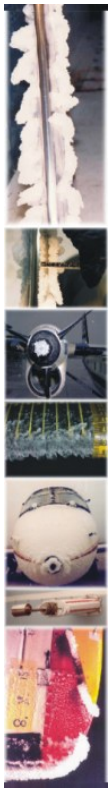


Current State



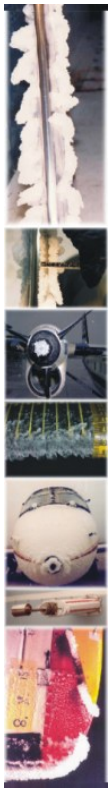
- Full release V1.04 available (current 2021)
- Next release includes;
  - Restricting more thermal configuration flags based on what can or should be run together.
  - Energy balance plotting.
- LewInt/LEWICE training class available on request.
  - Customized material based on active programs of customer can be developed.

Current State (2)



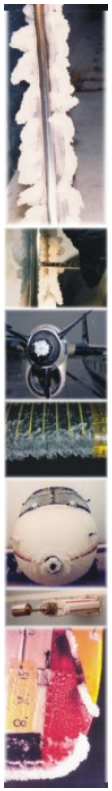
- LEWICE features not supported through LewInt can be used through DOS prompt operation of LEWICE.
- Features not supported by LewInt at this time include:
  - Multiple element
  - Thermal model optimization

Licenses



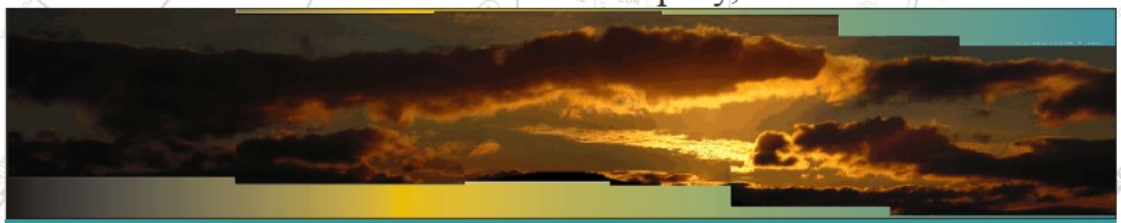
- Licenses are node locked to a particular computer, can be moved to a new computer on request.
- Licenses are permanent and include one year of updates and technical support.
- Try before you buy. Software can be installed and used without limit for two weeks.

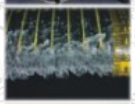
Training & Consulting



- Customized on-site training available.
- Training instructors include Icing DER.
- Certification and analysis consulting by DER experienced in icing analysis utilizing LEWICE.

American Kestrel Company, LLC





Updated 9/29/2011

LewInt integrates the ice accretion code LEWICE (version 3.2.2) with American Kestrel's user interface, icing analysis tools, and automated plotting. LEWICE 3.2.2 is a validated ice accretion code developed by NASA Glenn Research Center. LewInt (including LEWICE) is distributed both within the US and internationally under non-exclusive license with NASA Glenn Research Center. LewInt is available to individuals, educational institutions and businesses worldwide.

Just a note, there is not an educational version of the software at this time. I expect the sales volume to be too low to allow an educational discount.

There is a 15 day evaluation included with the download.

Version 1.01 released:

The first full release is available. This version adds numerous other improvements to both ice accretion and thermal analysis. There was a problem with version 0.9.7 release and this has been fixed. Just uninstall the previous one and install this one. Also included is a revised manual (work in process). You can purchase via a PO and check. You can download the latest version here.

Previously installed licenses will continue to work with the new version. If you have previously installed LewInt and the trial period expired you will get another two weeks when installing this version.

Downloads:

Current release of LewInthere - Full version 1.01 released 9/9/2011
LewInt presentaiont given at AC9C 5/5/2009
NASA LEWICE example files - The LEWICE installation discs from NASA include example LEWICE input and output files as well as some papers and training material. These are all specific to LEWICE and not LewInt but are very useful.

Purchase:

Currently only checks or wire transfers are accepted for payment. Send email to LEWINT@AmericanKestrelCo.com for purchasing information. As of October 1, 2011 LewInt is $2000USD for a single permanent license with one year of maintenance and updates. A five pack of licenses can be purchasd for $7,500USD. One year of mainentance is $500USD per license. Quotes previously provided at our lower price will be honored for 90 days from issue of the quote.

Installation:

Download the self expanding file containing the LewInt release. Extract the files into a temporary directory. You will need to execute two installer files. The first