

VLAD ANTAL STEVEN BANASKA HUSSAIN BIYAWERWALA

HEATTREAT

AN INFORMATION TOOL FOR THE METALS INDUSTRY



I PRO 304-A



FALL 2007

SPONSOR:



A. Finkl & Sons Co.

ADVISORS: WILLIAM MAURER & SHELDON MOSTOVOY

JOHN GROSZKO RYAN JAY KYLE KONING SANGWOOK LEE

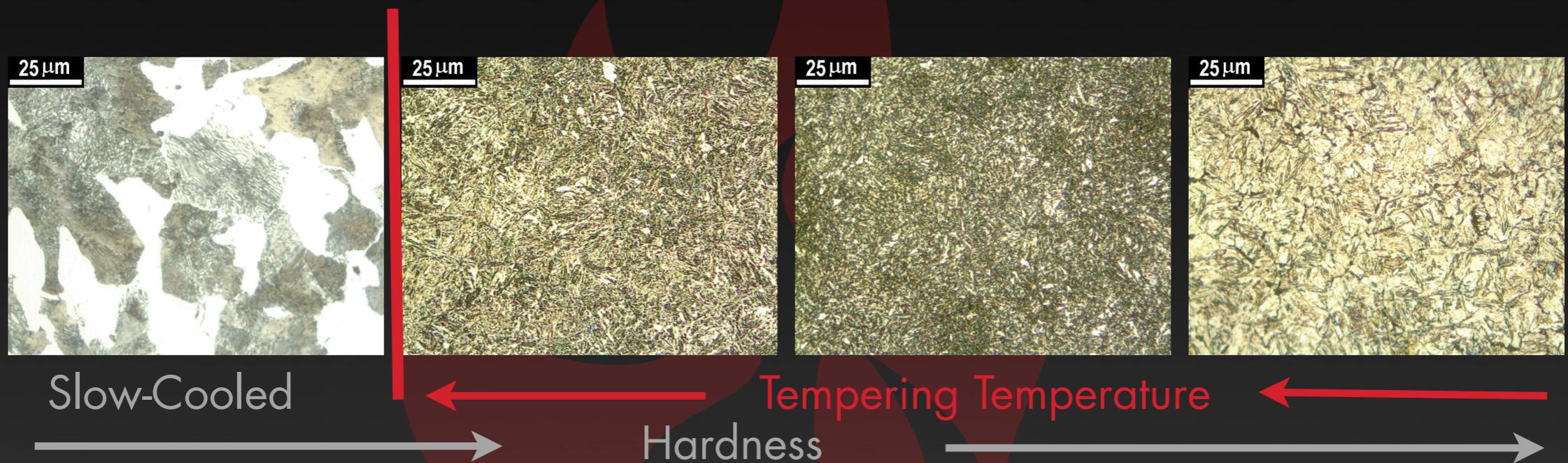


- 🌐 7 Members (in alphabetical order)
- ◆ Vlad Antal, Senior - Mechanical Engineering
- ◆ Steven Banaska, Senior - Electrical Engineering
- ◆ Hussain Biyawerwala, Junior - Electrical and Computer Engineering / Math
- ◆ John Groszko, Senior - Computer Science
- ◆ Ryan Jay, Senior - Mechanical Engineering
- ◆ Kyle Koning, Senior - Materials Science and Engineering / Mechanical Engineering
- ◆ Sangwook Lee, Senior - Electrical Engineering





- What is heat treatment?
 - ◆ Quenching, Tempering, Annealing, Aging



- Batch processes
- Effects of furnace shape
 - ◆ Part geometries



- A. Finkl & Sons Company, Chicago, IL
 - ◆ World's leading supplier of forging die steels, plastic mold steels, die casting steels, custom open-die forgings
 - ➔ Some of highest standards/specifications in the industry
 - ◆ Extensively uses heat treatments
 - ◆ Irregularly shaped parts from 1/2 to 50 tons





- Heat treatment stage

- ◆ Irregular parts, irregular heat treatment

- ➔ Finkl's high standards = high scrap

- ◆ Furnace loading difficult

- ➔ Current solution relies on **Trial & Error** and **Experience**

- ➔ Process bottleneck = Slows production

- Finkl needs a tool to maximize and document both batch quality and batch size thus decreasing scrap, rework, and the production delay



To develop a software solution capable of optimizing the heat treatment process at A. Finkl & Sons.

The software must be capable of:

- Determining best part placement for best heat treatment
 - ◆ Maximizing batch size
- Outputting the loading pattern in simple format
- Functioning with CAD Packages and Finkl
- Accepting upgrades developed by future IPROs

Replace current hand-drawn method



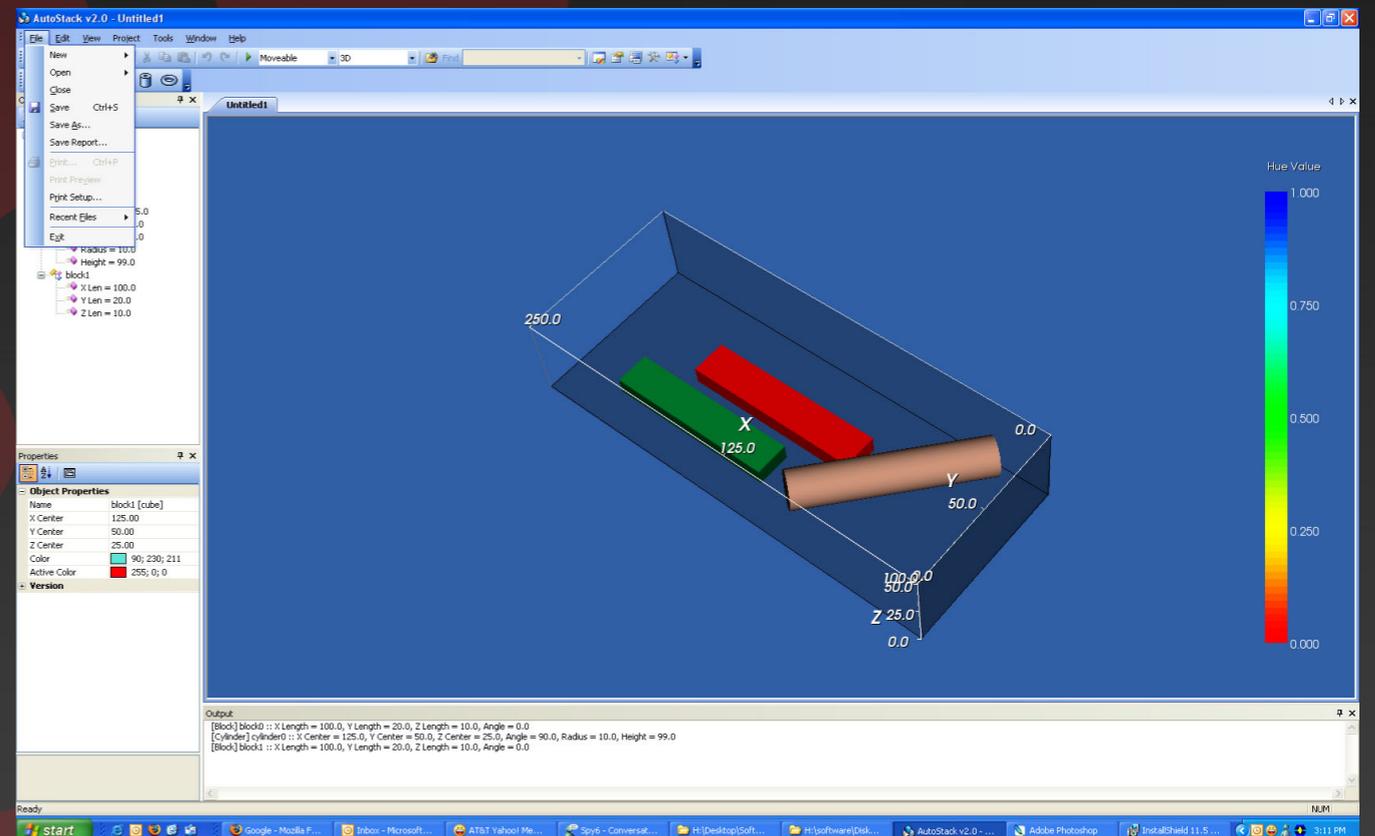


● IPRO 330 Spring 2006 and AutoStack Software

- ◆ 3D part representation in “furnace”
 - ➔ Part Manipulation and collision detection

● Disadvantages

- ◆ Non-solid modeling
- ◆ Incompatibility
- ◆ Difficult to upgrade





- Reconstruct the AutoStack Software
 - ◆ Eliminate drawbacks and limitations
 - ◆ Build a highly capable and compatible platform

- Construct a template portfolio of Finkl parts
 - ◆ Modeled with ProEngineer
 - ◆ Compatible with Finkl work order database





- Review the past
- Examine development packages
 - ◆ Limitations, advantages
- Meet with Finkl
 - ◆ What they want, what they need
- Develop the software
- Progress meeting with Finkl
- Solution foundation delivery





● Build Environment

- ◆ Microsoft Visual Studio and Qt

● Development Packages

- ◆ HOOPS 3D Application Framework (Graphics Engine)
- ◆ 3D ACIS Modeler (CAD/CAD 3D Modeling Engine)



● Management of Software Development

- ◆ TRAC Project Management
- ◆ Subversion (Central Source Code Repository)

● Part Template Modeling

- ◆ ProEngineer (Wildfire 2.0)





- Based on technical skill sets, personal interests, and work load division
- Software Development
 - ◆ Steven Banaska *Software Developer*
 - ◆ John Groszko *Lead Software Developer*
 - ◆ Sangwook Lee *Software Usability Tester*
- Template Database Development
 - ◆ Vlad Antal *3D Modeler*
 - ◆ Ryan Jay *3D Modeler*
- Communications and Project Support
 - ◆ Hussain Biyawerwala *Document Coordinator and Secretary*
 - ◆ Kyle Koning *Visual Media and Communications Designer*



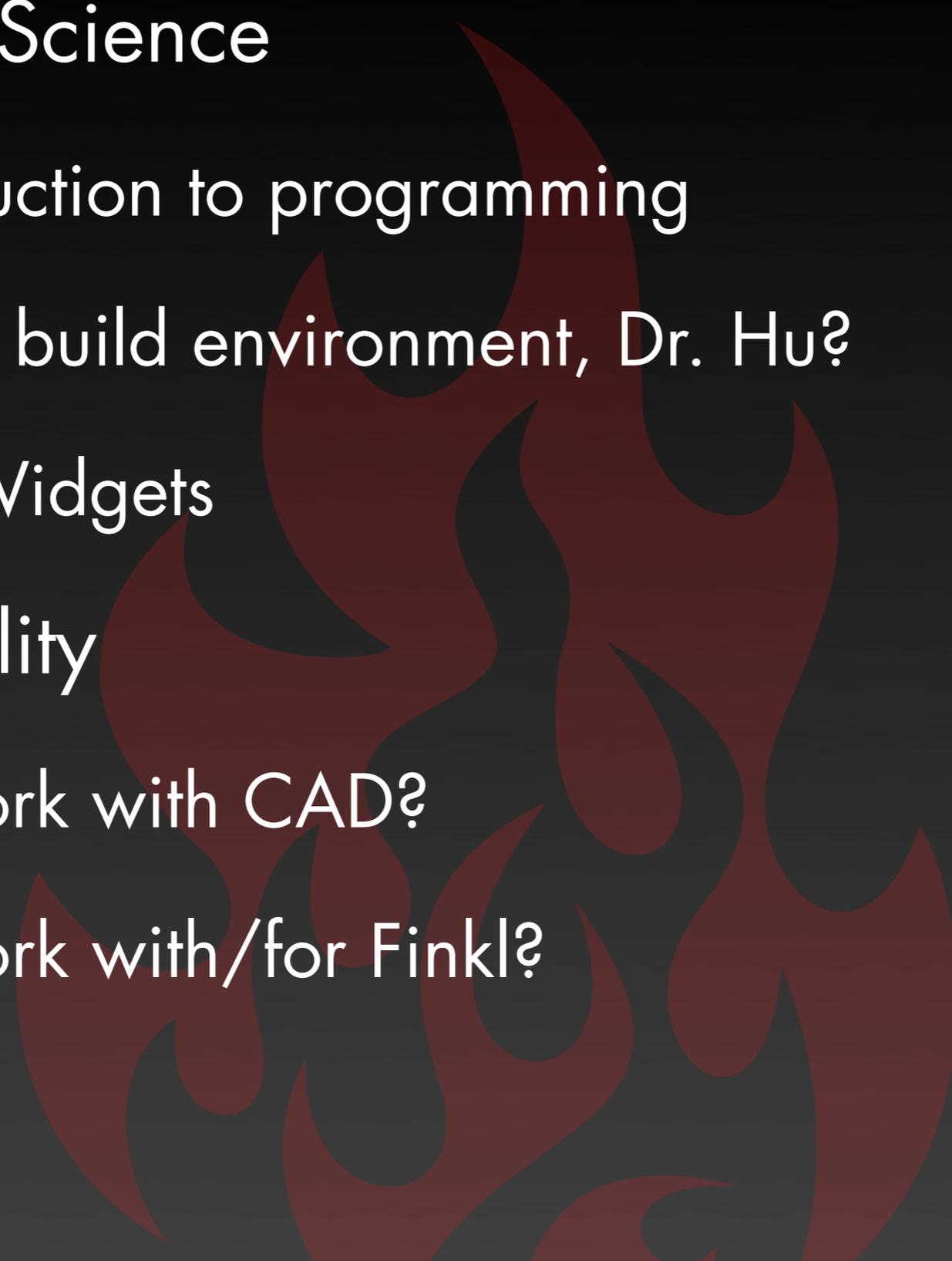


Computer Science

- ◆ Re-introduction to programming
- ◆ What's a build environment, Dr. Hu?
- ◆ Qt and Widgets

Compatibility

- ◆ Will it work with CAD?
- ◆ Will it work with/for Finkl?





● Code of Ethics Summary for Software Development

◆ Pressures:

➔ *Sell and use the software for commercial purposes without adequate permissions and licensing*

◆ Risks:

➔ *Delivering educational/trial/development software to Finkl*

➔ *Permitting sale of educational/trial/development software*

➔ *Using copyrighted code and programs*

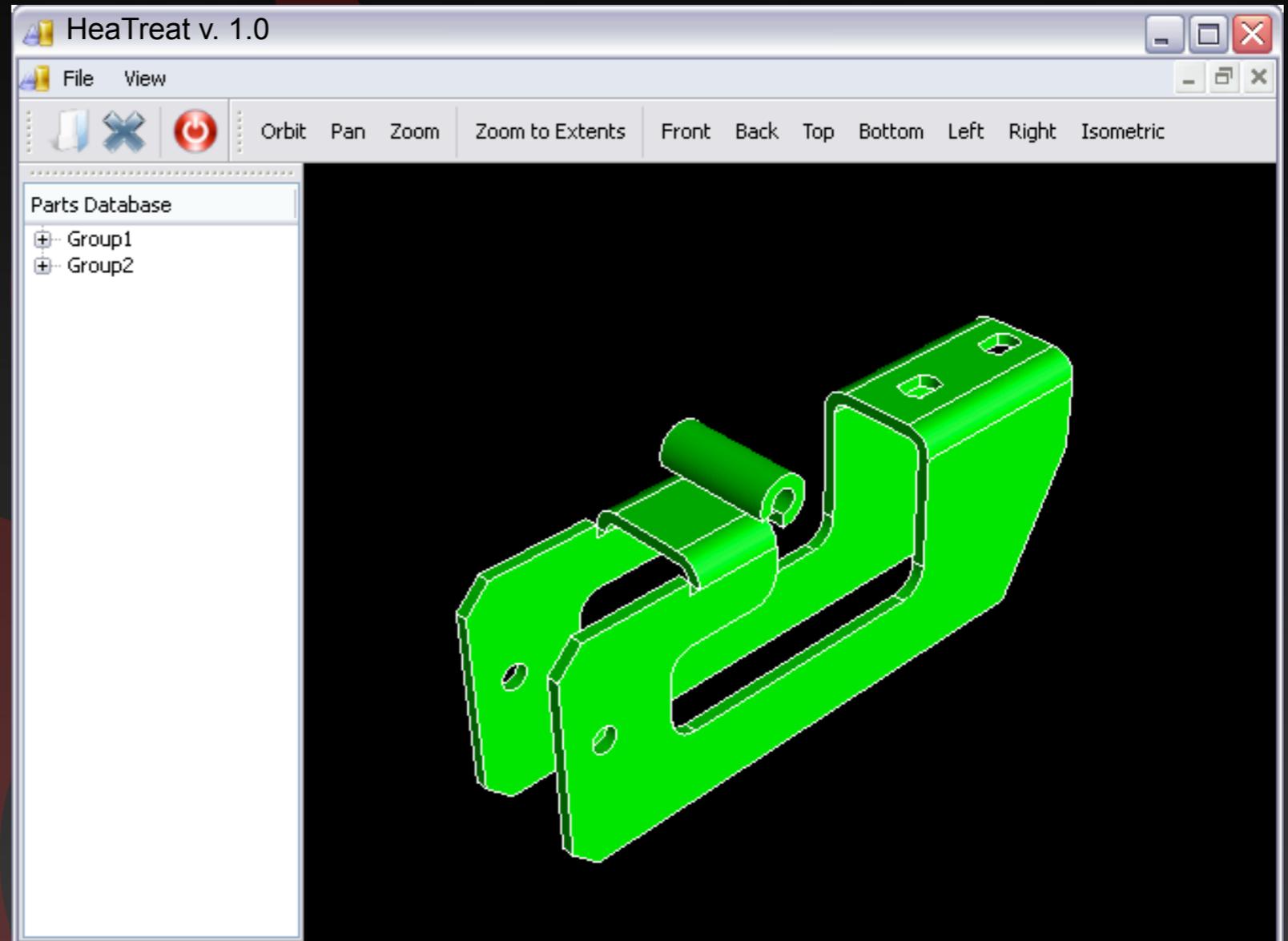




● HeaTreat Software



- Compatible
- Simple Interface
- 3D Modeling
- Robust Graphics
- Upgradeable

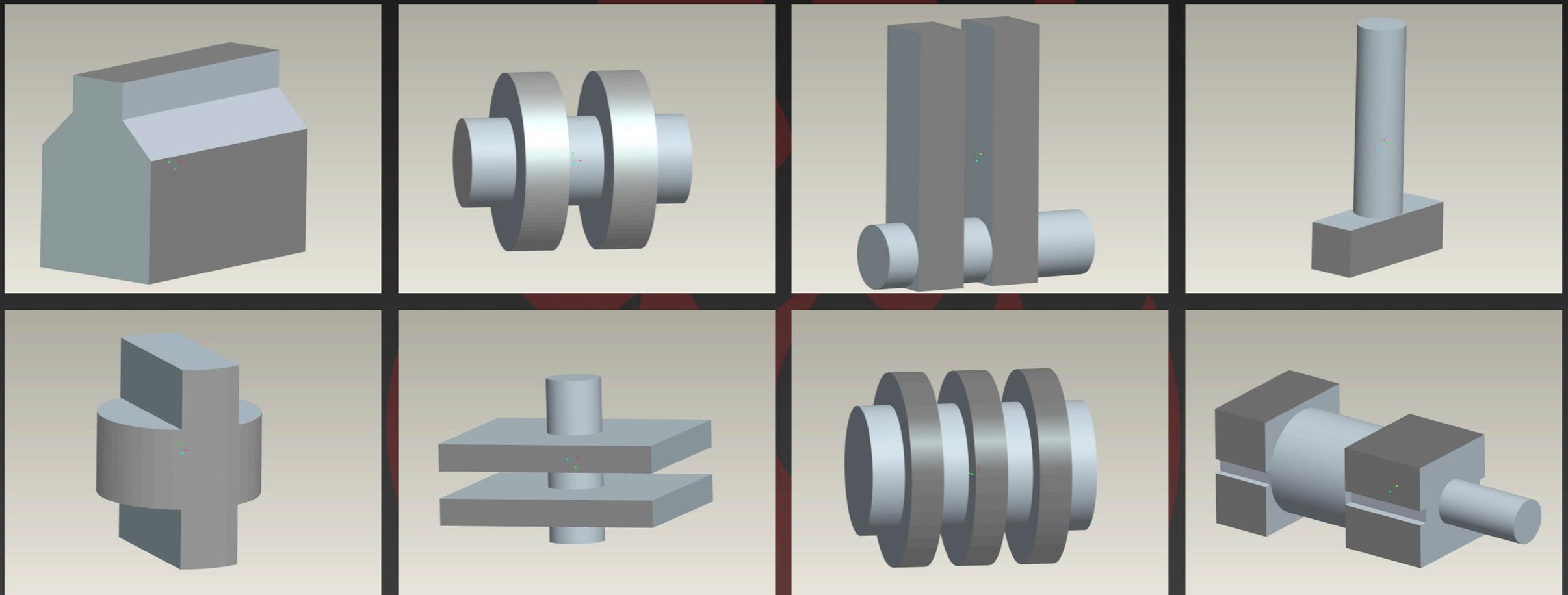




● Completed:

◆ Template Portfolio

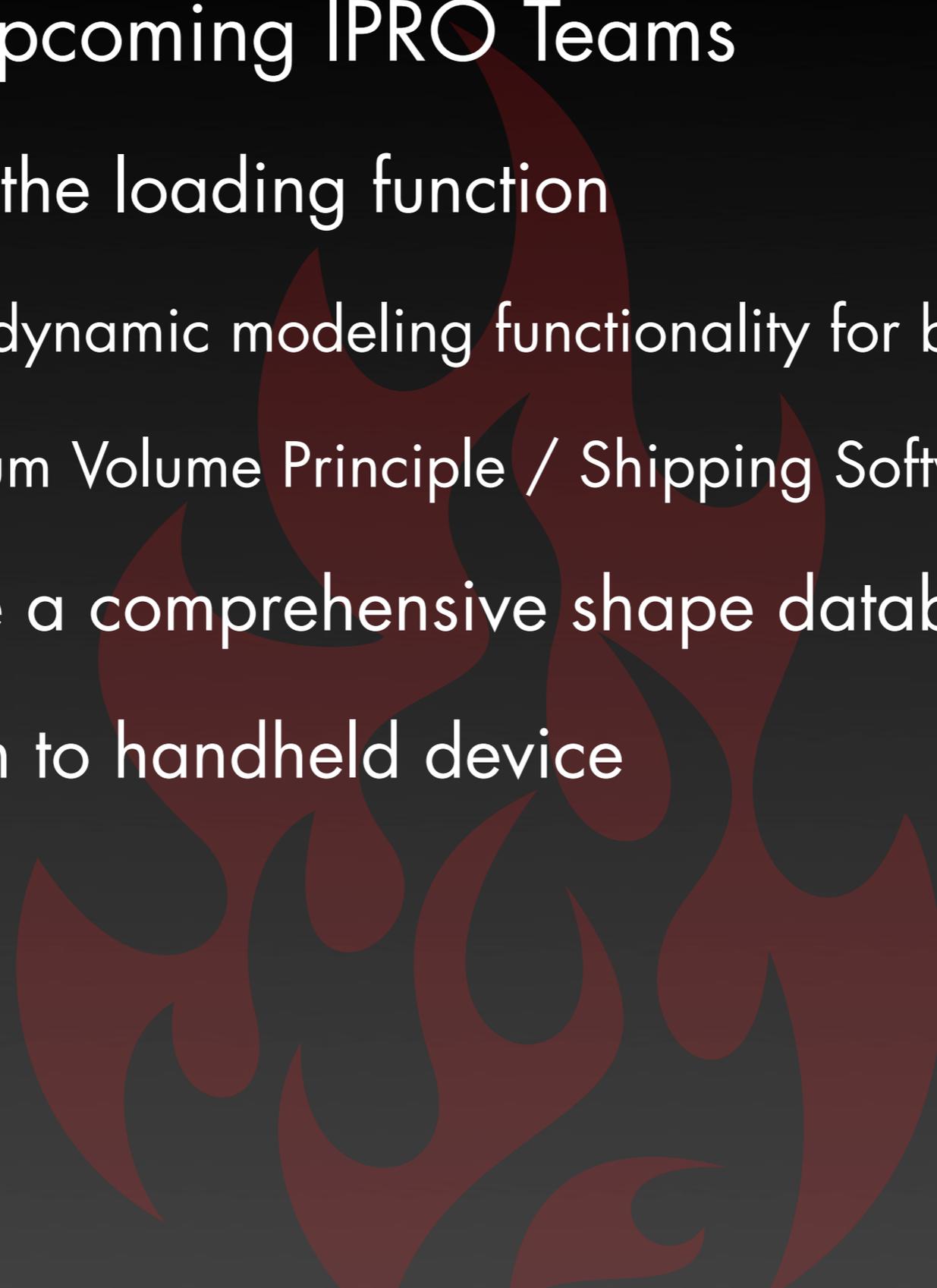
➔ Represent actual Finkl parts available for purchase





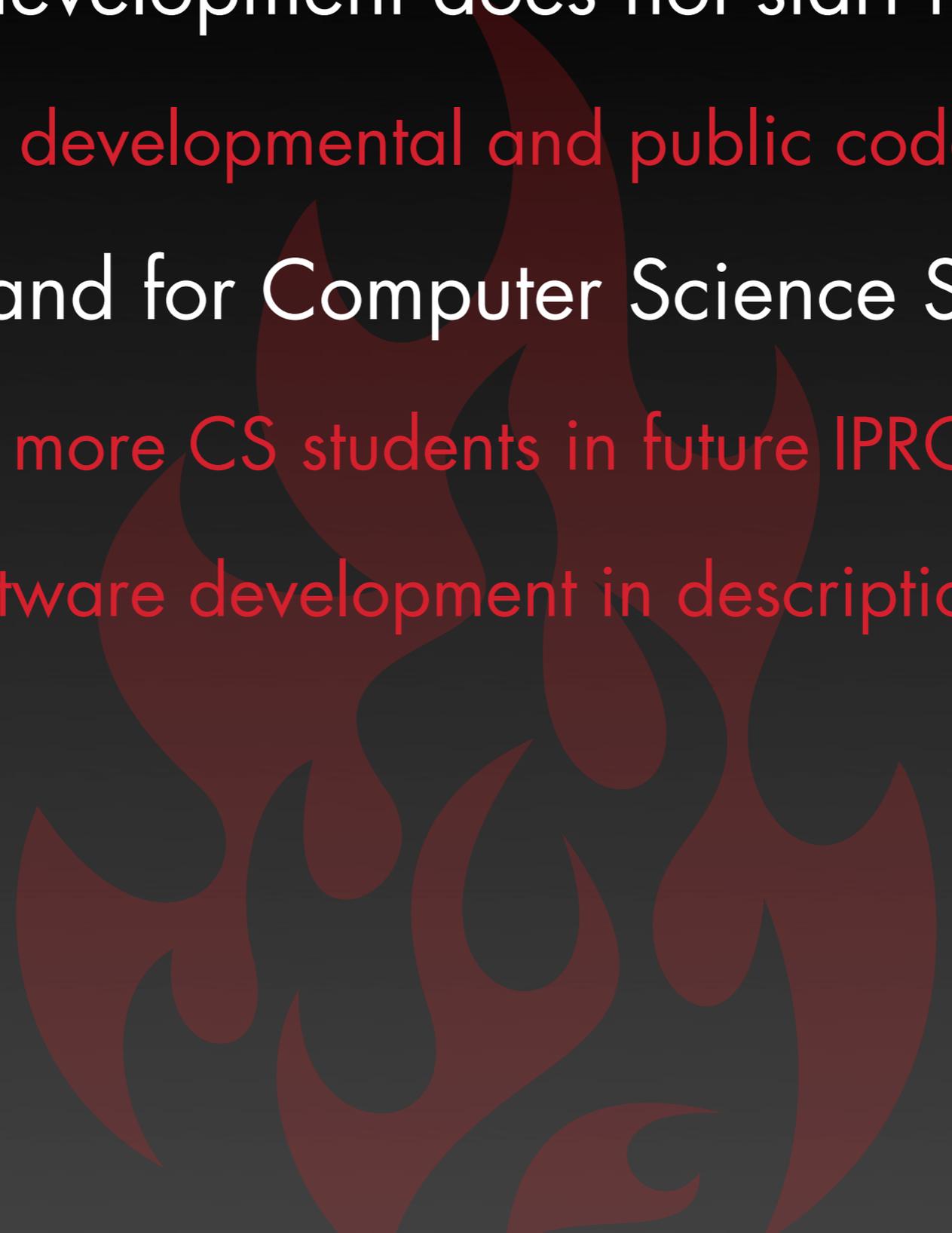
Tasks for upcoming IPRO Teams

- ◆ Creating the loading function
 - ➔ Thermodynamic modeling functionality for best placement
 - ➔ Maximum Volume Principle / Shipping Software
- ◆ Complete a comprehensive shape database
- ◆ Migration to handheld device





- Software development does not start from zero
 - ◆ Based on developmental and public code
- High Demand for Computer Science Skills
 - ◆ REQUIRE more CS students in future IPROs
 - ◆ Stress software development in description





- A. Finkl & Sons - Project Sponsor
 - ◆ Sean McCann (Project Engineer) - Primary Liaison at Finkl
 - ◆ Guy Brada (Chief Metallurgist) and the Metallurgy Staff
 - ◆ The IT Staff
 - Dr. Zhiyong Hu (IIT MMAE Dept.) - Assistance and Guidance with setup of the software build environment
 - Spatial Corp. - Educational Licensing for ACIS and HOOOPS
- The logo for Spatial Corp. is centered on the slide. It consists of a white square containing the stylized letters '3S' in a dark, handwritten-style font, with the word 'SPATIAL' in a smaller, bold, sans-serif font directly below it.
- IPRO 330 (Spring 2006) - Taking the first steps towards a fully functional solution.





Questions?

Concerns?

Clarifications?

Comments?

Suggestions?

The IPRO 304-A Team welcomes your input.

Thank you for your attention!

Please visit our exhibit in the northwest corner of the
1st Floor of the Herman Union Building.

