



Vandal Bucks

CALIBRATION FIXTURE FOR RIVET INSERTION EQUIPMENT

PROBLEM STATEMENT

- ✘ Create test fixture and associated calibration methods to measure the required force to optimally compress and seat rivets in the production of knives. Provide assistance to both designers and machine operators that improves the quality and consistency across a spectrum of knife families.

PROJECT SCOPING

- ✘ Focus on single rivets
- ✘ Independent variables: compliant bushing material, maximum insertion force, bolster materials, rivet materials, rivet hole clearance, dwell time?
- ✘ Dependent variables: rivet sealing, rivet displacement (finished height), hydraulic pressure required, closing action, blade play
- ✘ Detailed studies w/SATEC reported to Buck
- ✘ BENCHTOP instrumentation/methods delivered to Buck
 - + Control load w/manual actuation (required)
 - + Measure force (required)
 - + Measure displacement (desired)
 - + Manual readouts

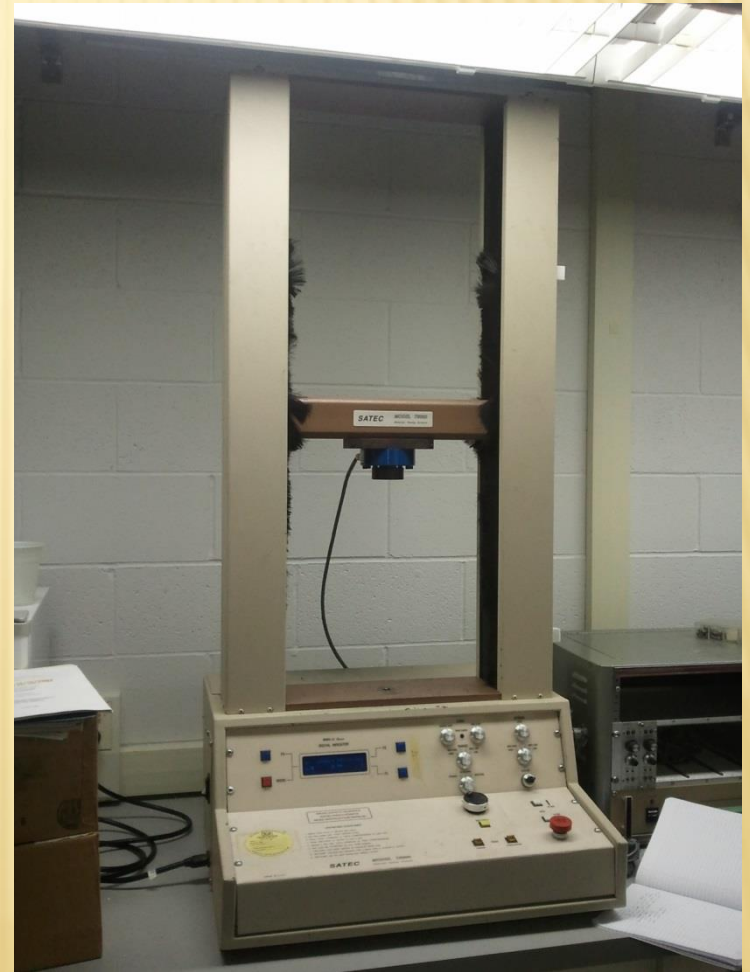
EXISTING DESIGN PROBLEMS

- ✘ Single rivet press
- ✘ Press load based on hydraulic pressure
- ✘ Limited calibration capabilities
- ✘ Limited adjustment capabilities



CURRENT TESTING

- ✘ SATEC load testing
- ✘ Loads up to 5000 lbs. in compression
- ✘ Variable applied load speeds
- ✘ Data acquisition capabilities



CURRENT EXPERIMENTATION

- ✘ Use of single rivet anvil press
- ✘ Varied applied loads for compression
- ✘ Accurate representation of current design



RESULTS

Load	Knife Performance
700 lbs.	Rivet still able to be moved by hand Lots of play in knife blade
850 lbs.	Rivet tighter but sill movable Lots of play in knife blade
1000 lbs.	Rivet compressed Lots of play in knife blade
1300 lbs.	Rivet compressed Some play in knife blade
1450 lbs.	Rivet compressed Little play in knife blade Blade snaps shut and opens easily
1600 lbs.	Rivet compressed No play in knife blade Blade snaps shut and opens easily
2100 lbs.	Rivet compressed No play in knife blade Blade movement is stiff and doesn't close

FUTURE TESTING

- ✘ Multiple rivet compression
- ✘ Manual press with higher load capabilities
- ✘ Load cell for force measurement



FUTURE DESIGN CONCEPTS

- ✘ Fixture for a multiple rivet press
- ✘ Optimal applied load location
- ✘ Use of compliant materials to protect knife



PROPOSED BUDGET

Item	Quantity	Cost
Manual Hydraulic Press	1	\$500 - \$750
Compression Load Cell	1	\$500 - \$1000
Miscellaneous Testing Components		\$100 - \$250
Materials		\$200
Shop Usage		\$300
Travel		\$400
Total		\$2000 - \$3000

TIME LINE

- ✘ February 3rd-8th: Design Review
- ✘ March 11th: Spring Snap Shot
- ✘ April 1st: Begin Final Testing
- ✘ May 2nd: Design Expo
- ✘ May 15th: Delivery to Client

QUESTIONS TO ADDRESS

✘ From a Designer Perspective

- + How are dimensions and tolerances selected for rivets and holes?
- + How is correct knife functionality (opening and closing) insured?
- + What design rules are used for multiple rivets (spacing, size, location).
- + What metrics are used to determine acceptable and unacceptable surface finishes after pressing.

QUESTIONS TO ADDRESS

✘ From a Operators Perspective

- + What assistance in machine set-up is desired to assure proper system pressure for acceptable rivet insertion?
- + What variation in system pressure is experience throughout the course of a shift?
- + What methods are used to determine adequate knife functionality (opening and closing)?
- + What methods are used to determine adequate surface finishes after pressing?