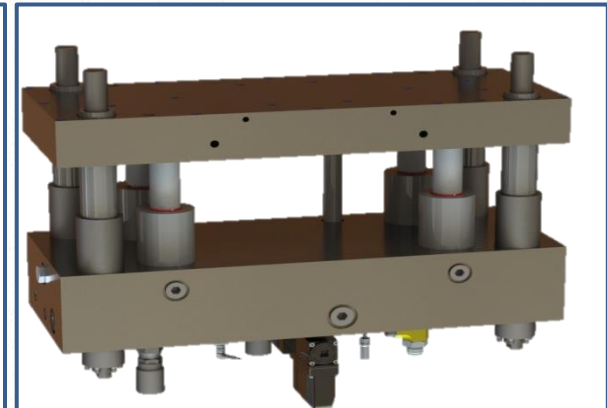
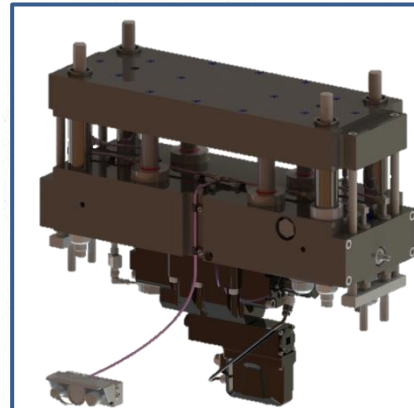
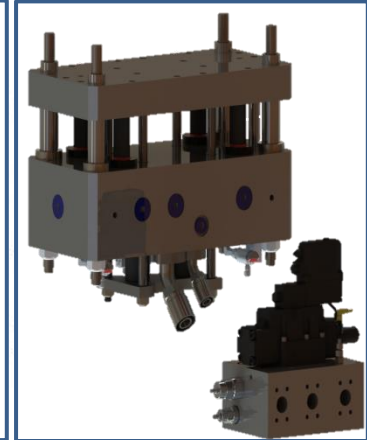
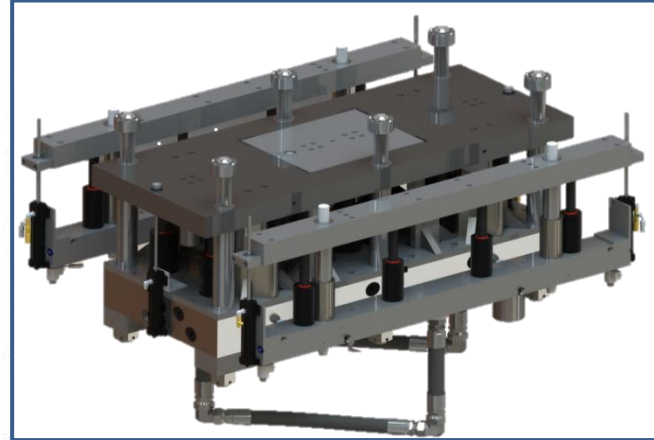
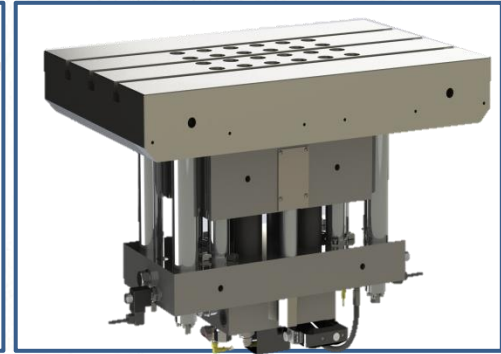
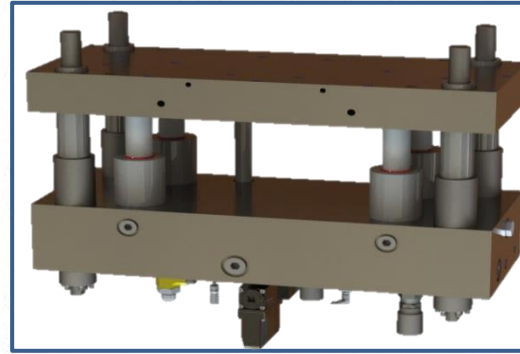


Servo Technology Experience

Nashville, TN – OCT 2016

SERVO CONTROLLED:
**INTEGRATED
FORMING
SYSTEMS**



Darrell Quander Jr

Sales and Product Manager

dquander@hysonolutions.com

216-280-6049



What Is Servo?



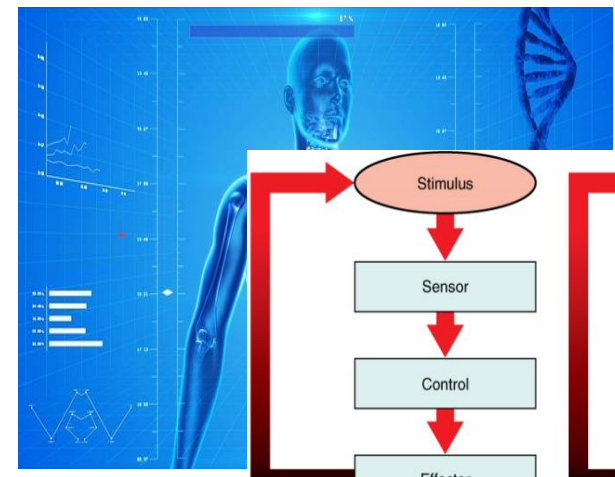
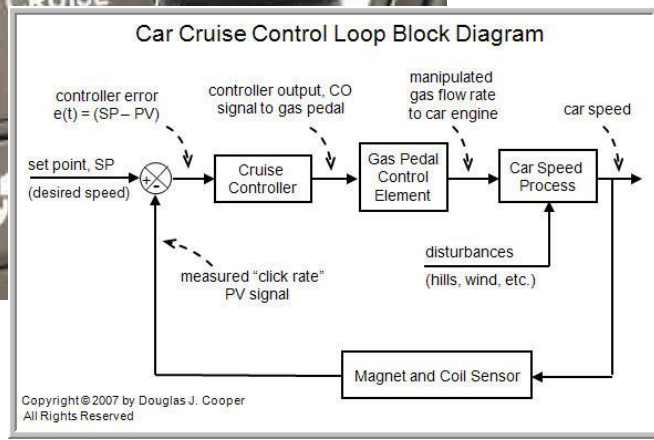
ser•vo•mech•an•ism

('sɜr vooʊ ,mek ə ,nɪz əm, ,sɜr vooʊ 'mek-)

Noun.

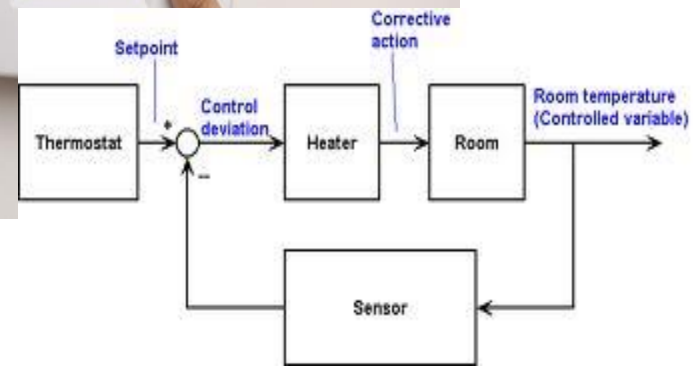
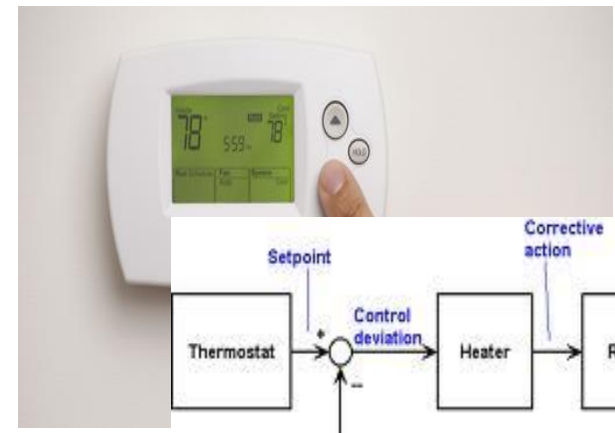
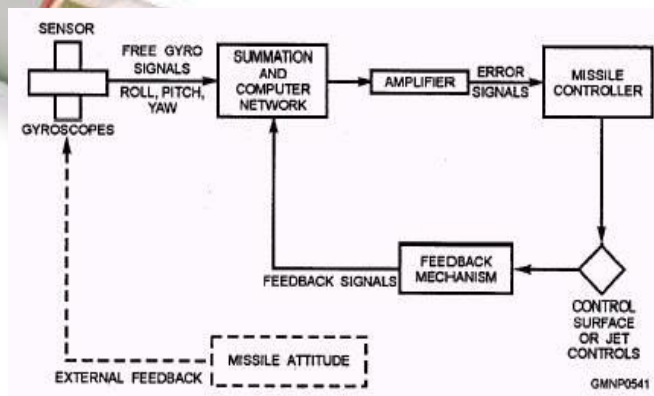
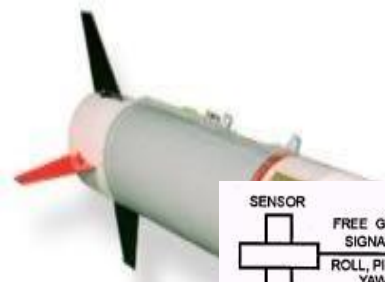
1. An automatic device that uses error-sensing negative feedback to correct the performance of a mechanism such as speed or position
2. A self regulating feedback system for a mechanism
3. A servo system mainly consists of three basic components - a controlled device, a output sensor, a feedback system. This is an automatic closed loop control system. Here instead of controlling a device by applying variable input signal, the device is controlled by a feedback signal generated by comparing output signal and reference input signal





(a) Negative feedback loop

(b) Body temperature regulation



Servo Equipment



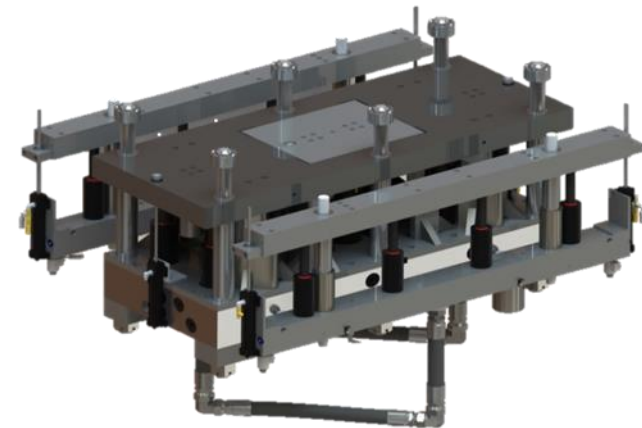
Servo Feed



Servo Transfer
Automation



Servo Press



Servo Force

Servo Equipment



Servo Feed



Servo Transfer Automation

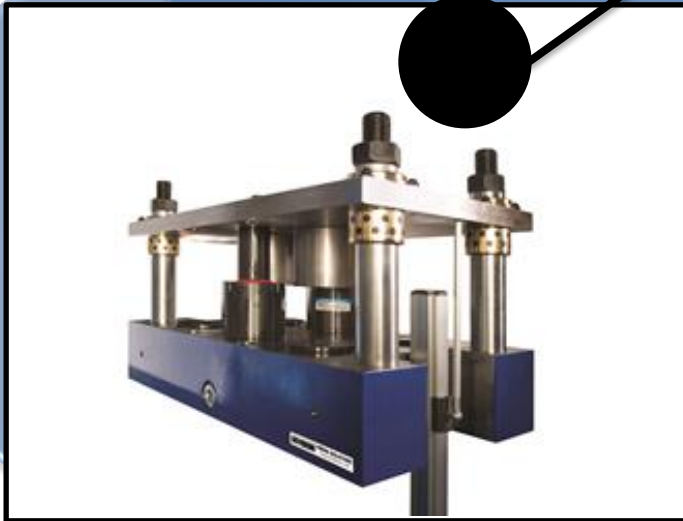


Servo Press



Servo Force

Servo Forming



The Trifecta

- 3 elements working in sync
- The Maximum controllability possible in a stamping process

Position
Velocity

FORCE

The Integration



Servo Controlled Force



Position

FORCE

Velocity

Servo Controlled Force



FORCE

Force Systems in the Industry



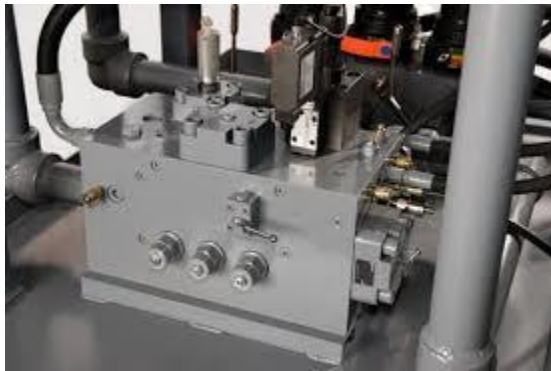
Air Cushion



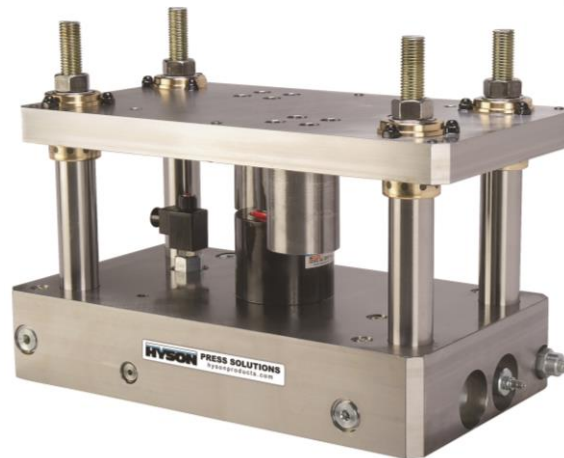
Bladder Cushion



Nitrogen Cushion



NC Cushion



Hydraulic Cushion

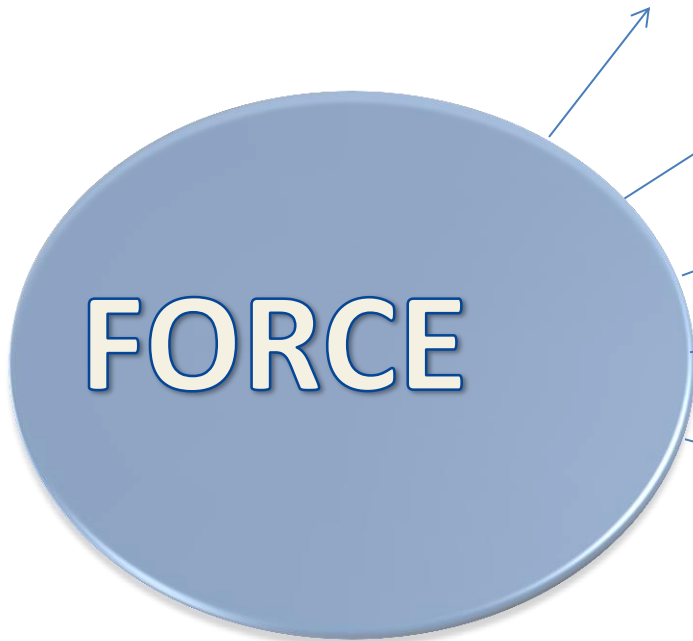
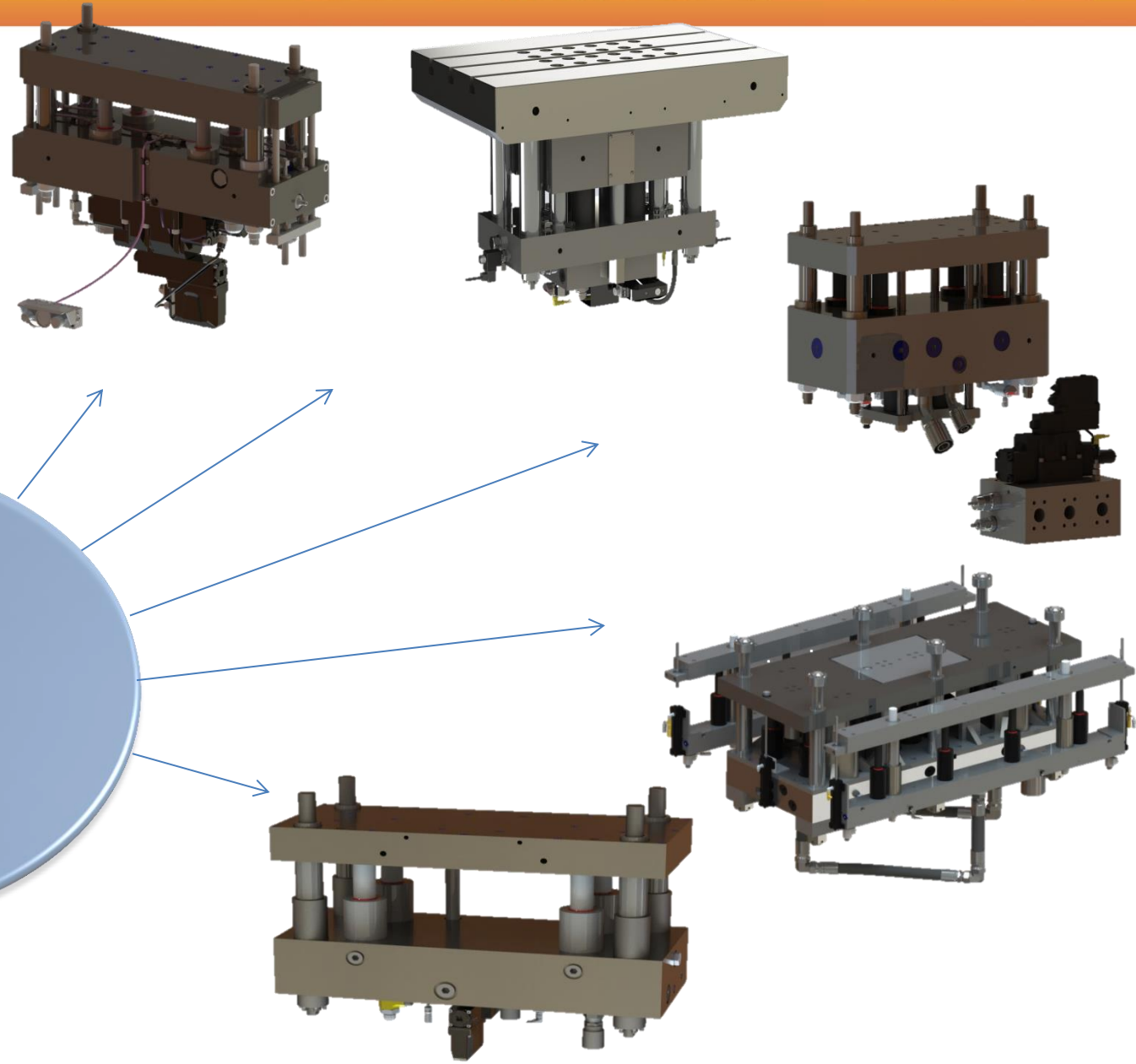


Servo Cushion

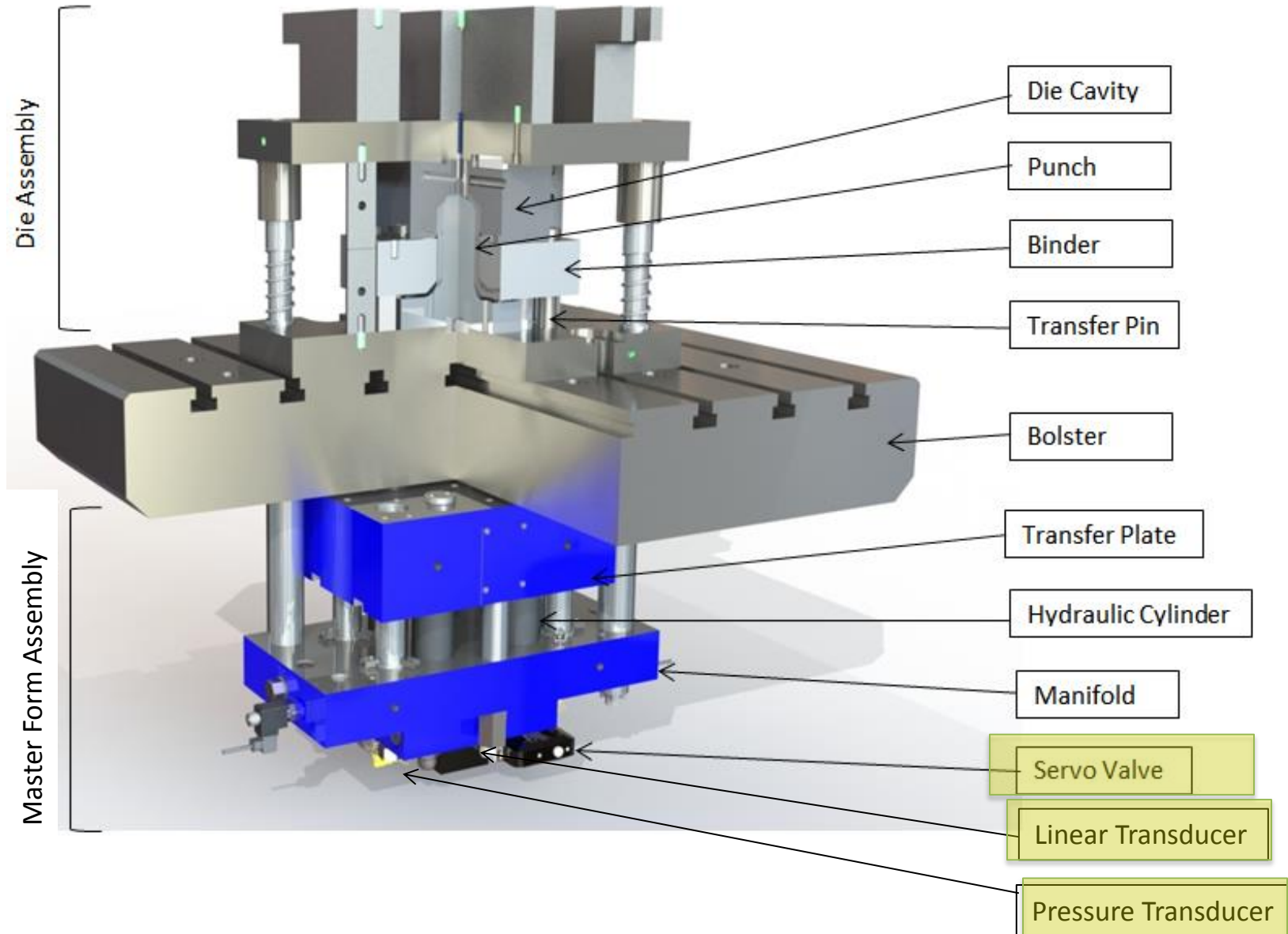
Current Technologies

Characteristics	Air	Nitrogen	Hydraulic	Servo
Force	Fair	Good	Best	Best
Maintenance	Fair	Best	Good	Good
Flexibility	Fair	Fair	Good	Best
Controllability	Fair	Fair	Good	Best
Programmability	Fair	Fair	Fair	Best
Initial Cost	Best	Best	Good	Fair
Lifetime Cost	Fair	Good	Good	Best

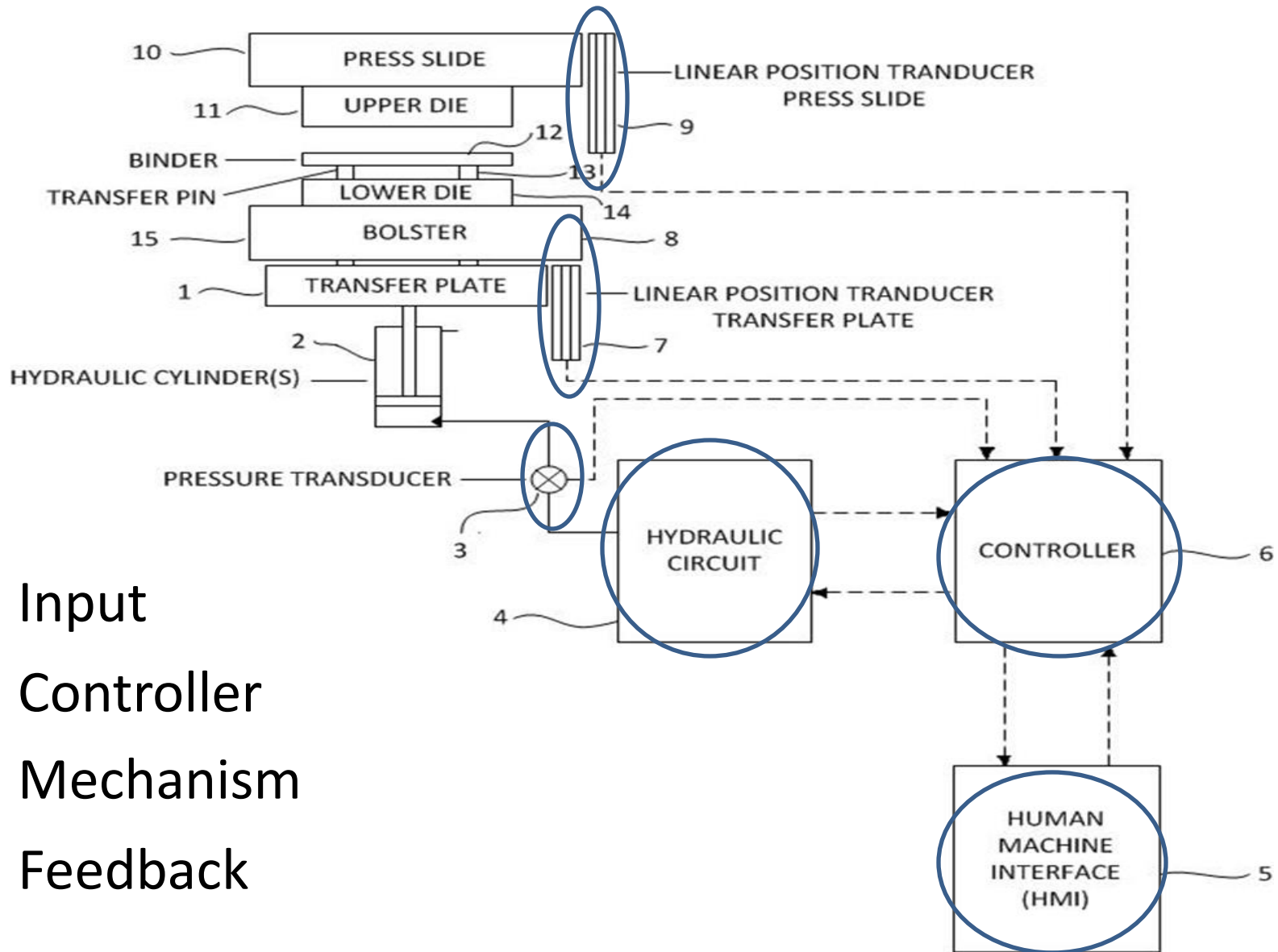
Servo Controlled Force



Master Form - Integrated Forming Systems

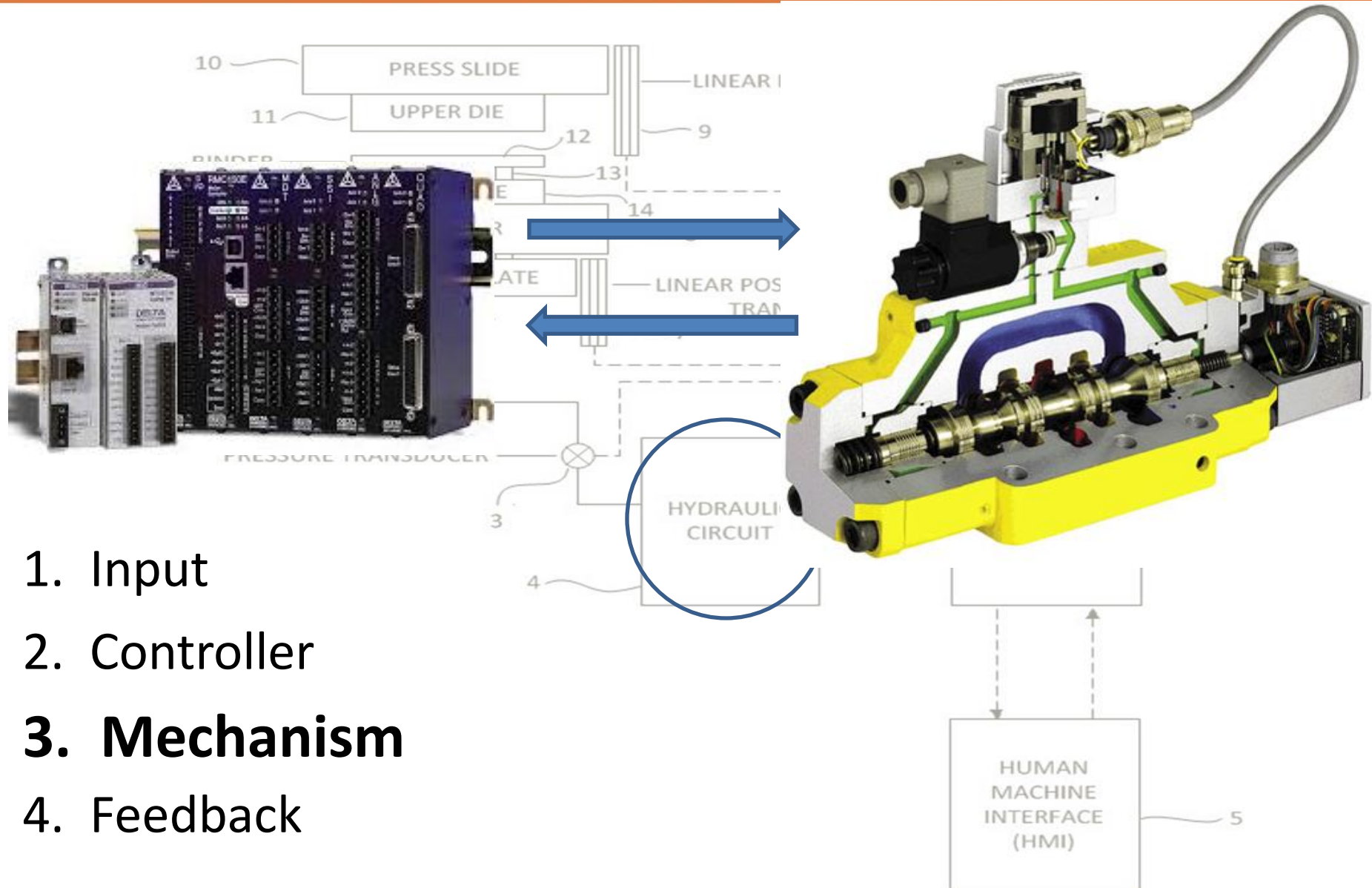


Servo Schematic



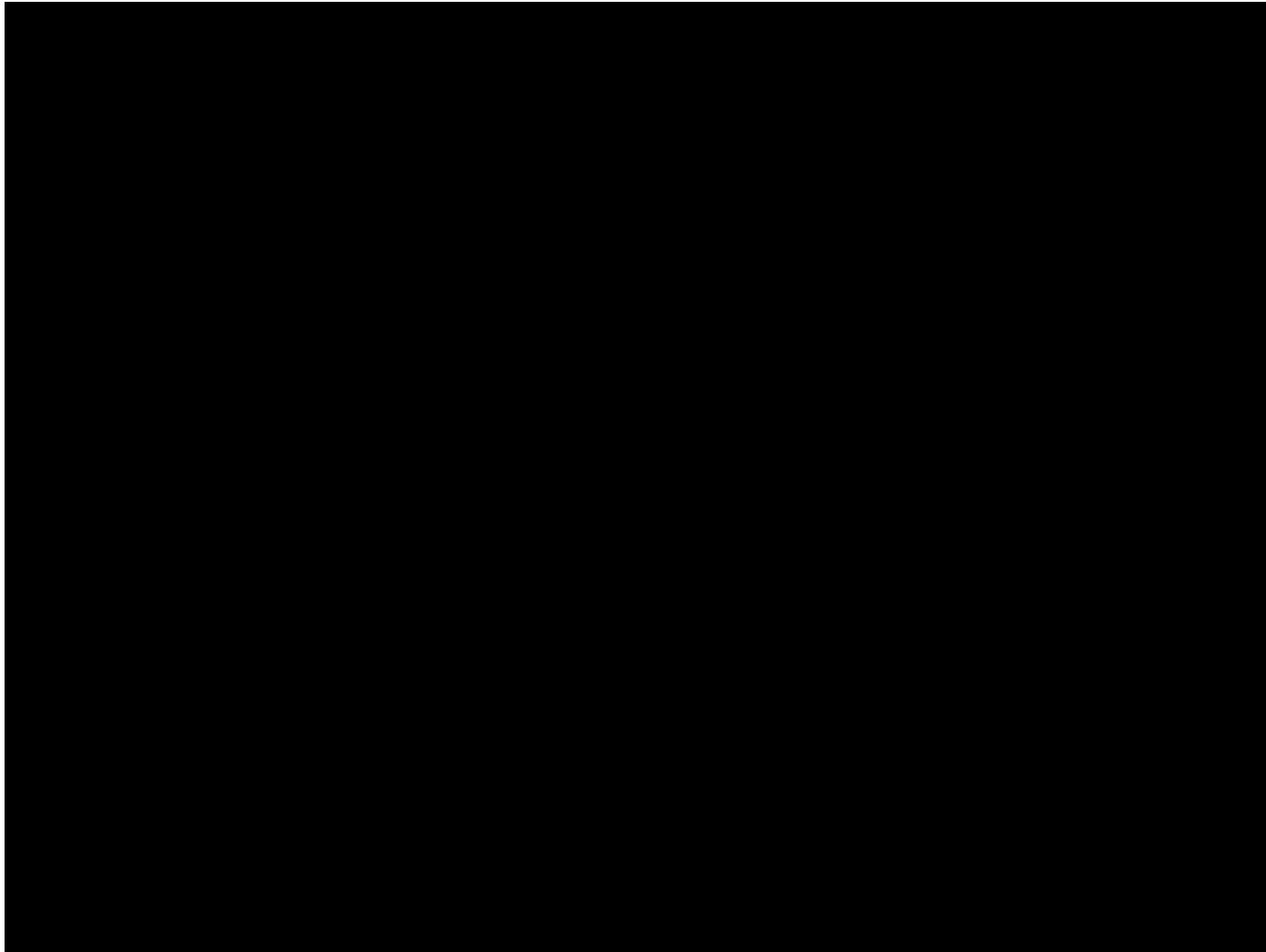
1. Input
2. Controller
3. Mechanism
4. Feedback

Servo Mechanism



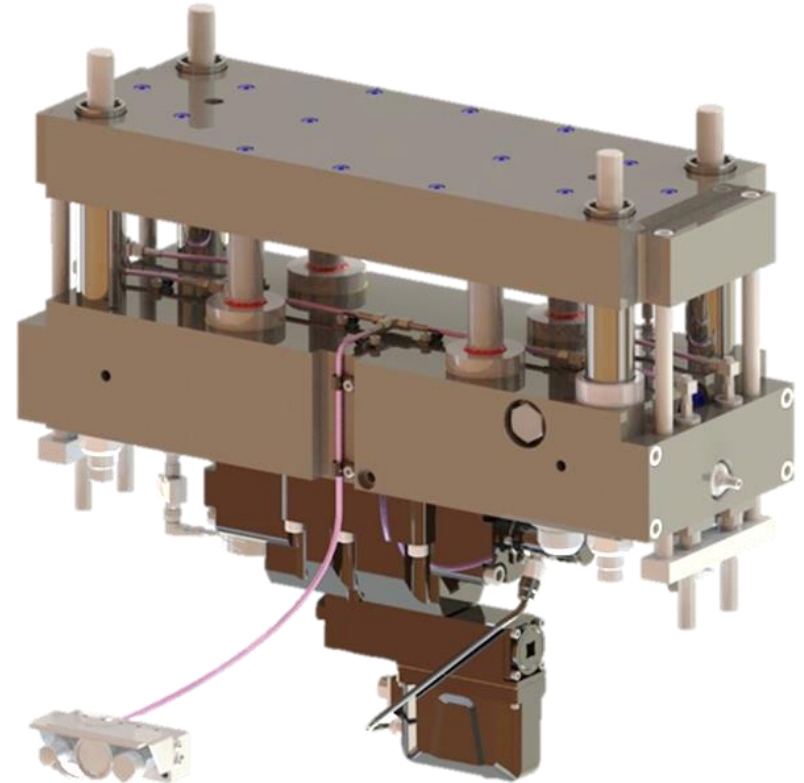
1. Input
2. Controller
- 3. Mechanism**
4. Feedback

Closed Loop Feedback System



- **Key Features**

- Accuracy within microns
- Response times within mS
- Programmable dynamic force
- Digital touch screen interface
- Ability to delay at BDC
- Ability to utilize multiple zones
- Reverse Forming



The Integration



One Integrated System
Designed for each Press
Designed for each Process

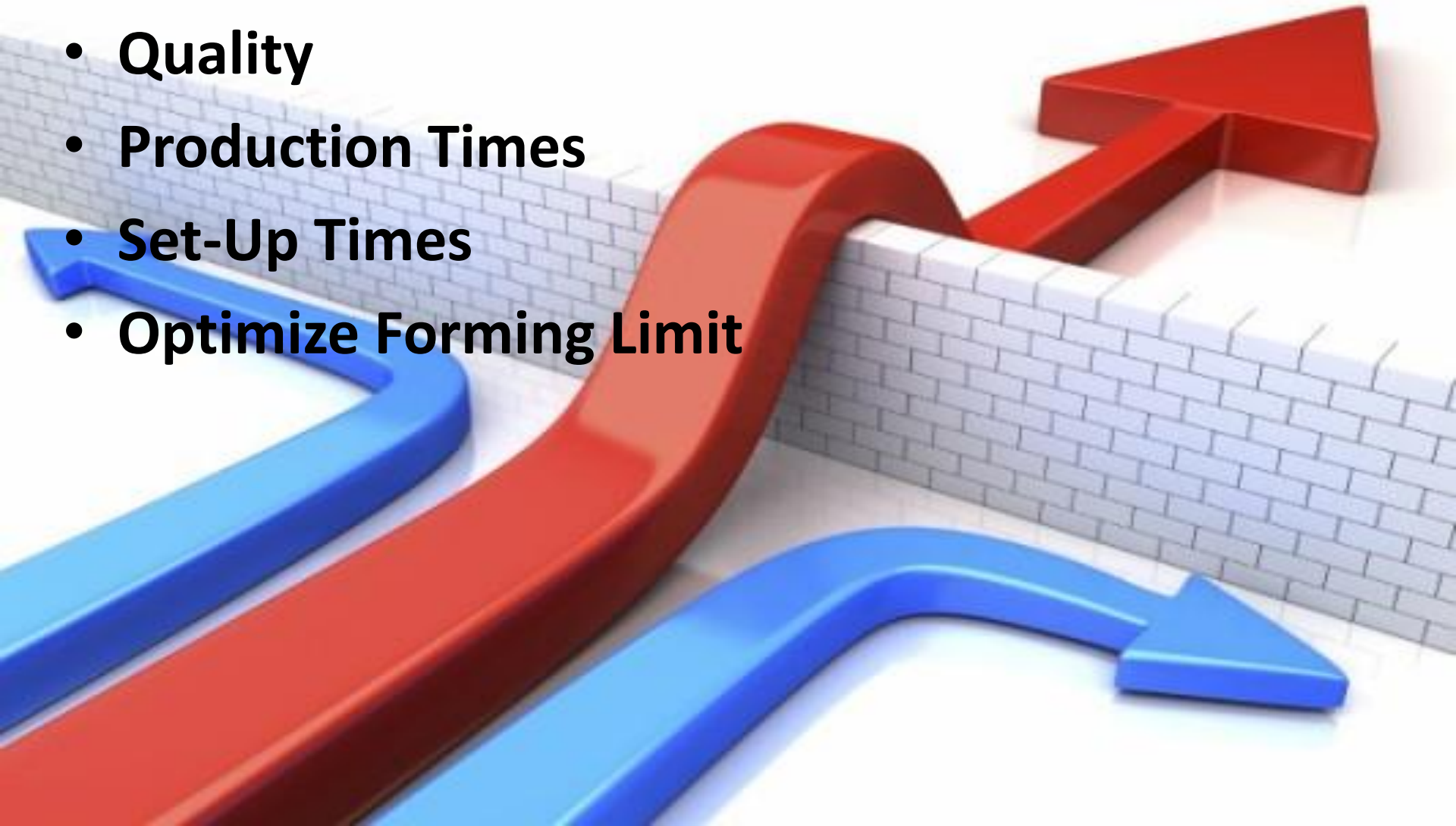


How Does Servo Force Change the World?



Solving Some of Life's Challenges

- **Quality**
- **Production Times**
- **Set-Up Times**
- **Optimize Forming Limit**



FORMING CHALLENGES



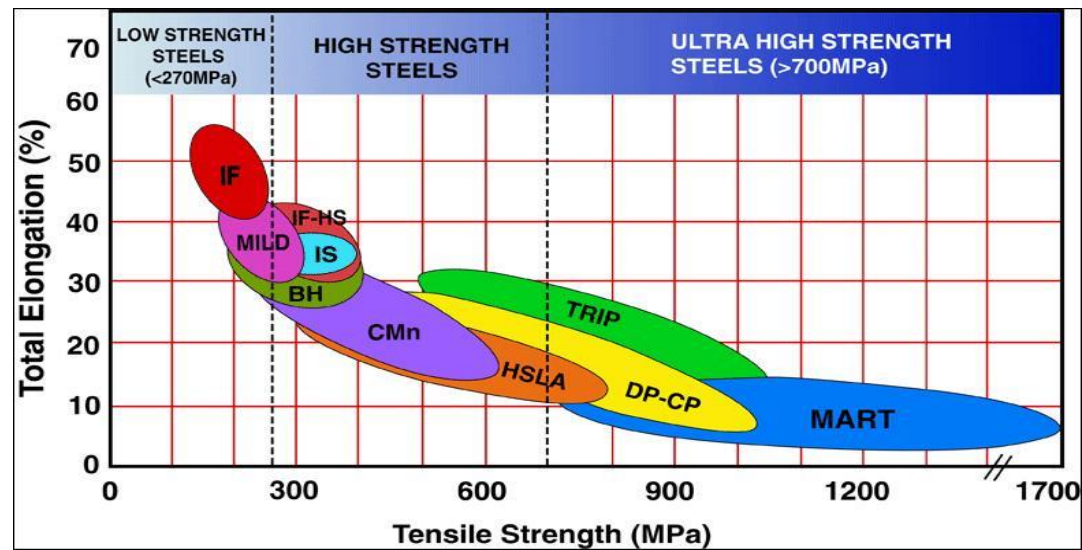
- Quality
- Production Times
- Set-Up Times
- Optimize Forming Limit



When too much force is applied part will tear or crack



When too little force is applied part will wrinkle crack



Example #1 – High Strength Steel Draw Study



Joint Study in Japan with Amada, Reiken, Ogitech
 Material: JSC 590 Blank DIA: 109 mm



Outcome	Bad Part	Good Part	Good Part
Force Style	Air Cushion Mode Constant Force	Variable Force	Variable Force
Actual Force	1.3 ton	1.3 ton – 0.3 ton	1.3 ton – 0.3 ton
Draw Depth	20mm	20 mm	30 mm

Application Example #2

HYSON



Trial	1	2	3
Force	30-30 ton	30-10 ton Step func	30-10 ton Smooth func
Speed	5 spm	5 spm	5 spm
	Broke	Good	Good

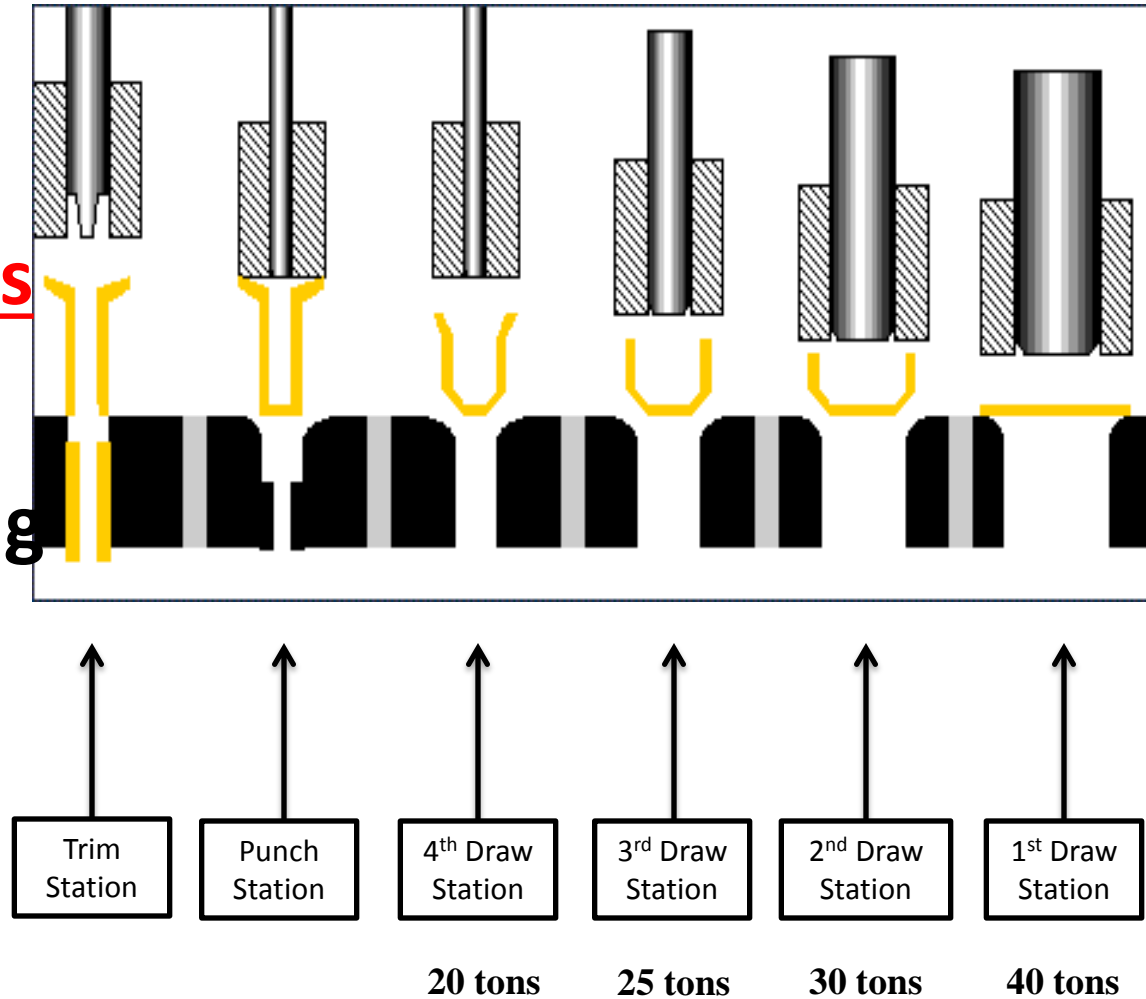
[Material: 980 Galvanized Dual Phase, 1.2 mm Thick]

HYSON WE ARE ONE TEAM

HYSON



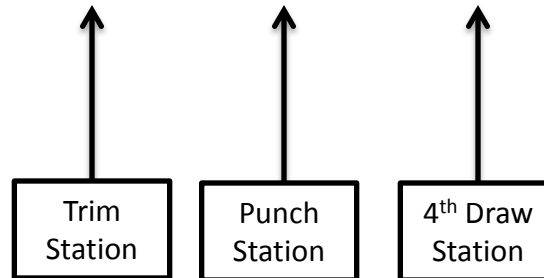
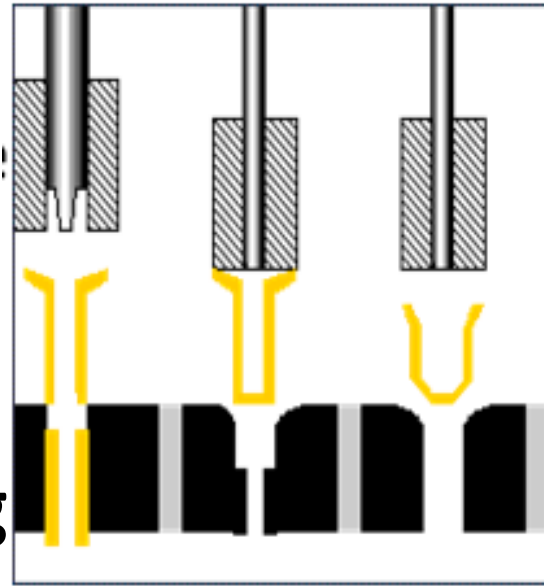
- Quality
- Production Times
- Set-Up Times
- Optimize Forming Limit



FORMING CHALLENGES



- Quality
- Production Times
- Set-Up Times
- Optimize Forming Limit

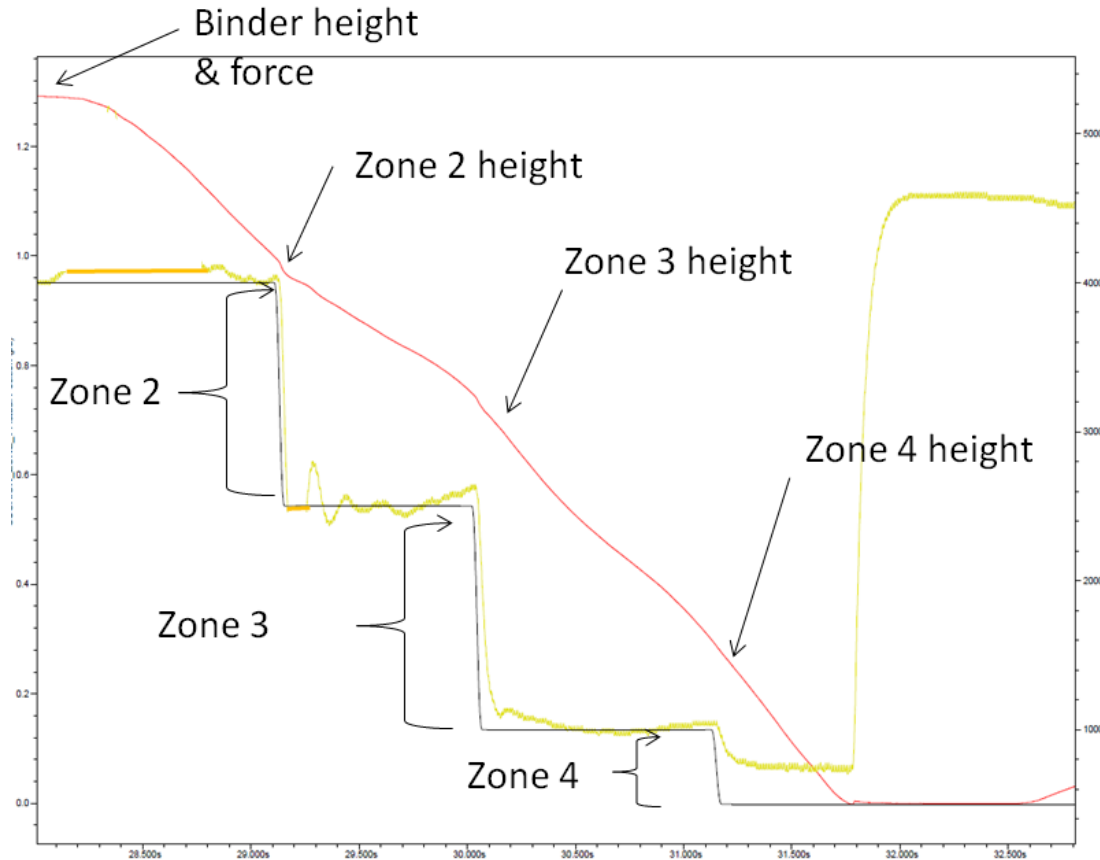


Plus Servo
Controlled Force



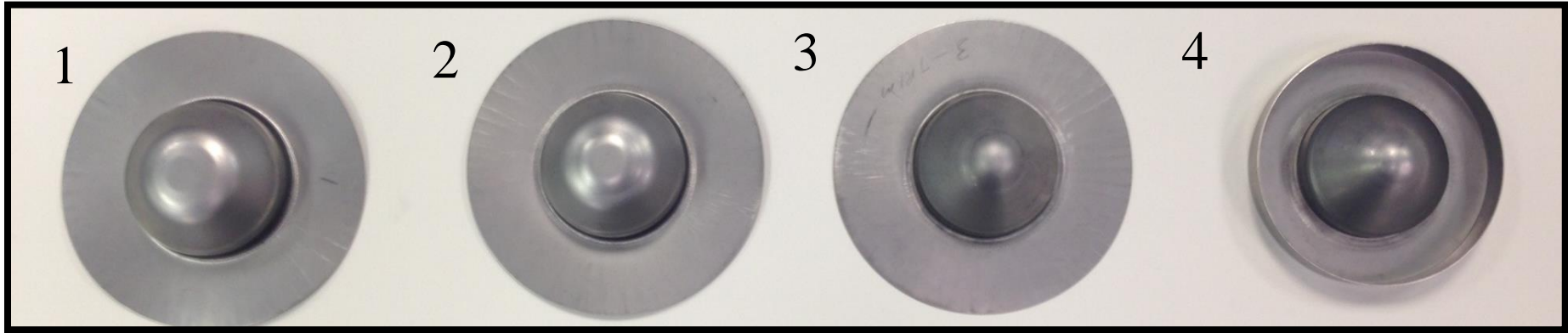
← 40→30→25→20 tons

- Quality
- **Production Times**
- Set-Up Times
- Optimize Forming Limit

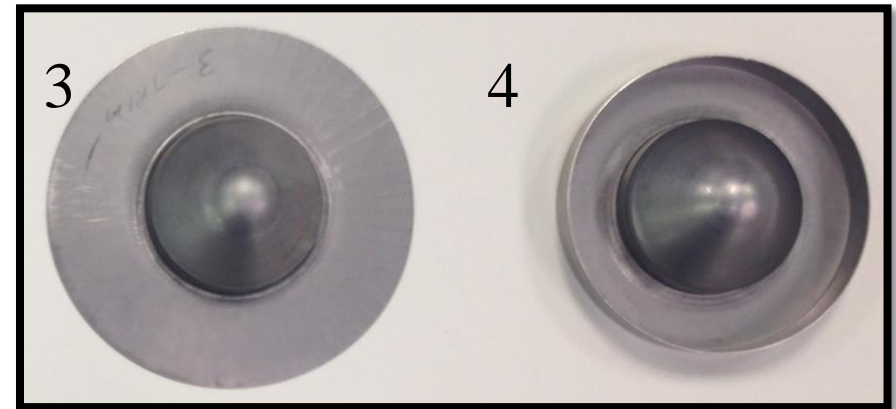


Example #2 – Complex Draw for Filter Assemblies

Mechanical Press with Air Cushion



Servo Press with Servo Controlled Cushion



FORMING CHALLENGES

- Quality
- Production Times
- **Set-Up Times**
- Optimize Forming Limit



HYSON
Metal Forming Solutions™

MAIN MENU

Cushion Slide Height (MM): 0 to -100 (vertical scale)

Cushion Force: 0 to 60000 (circular gauge)

Cushion Temperature (C): 0

Liquid Level Low (red indicator)

*Program will not run when warning indicator is red

Recipe Loaded

Cushion Force (N): 0

Cushion Height (MM): 0.000

Buttons: Modify Recipe, Bleed Cycle, Press to Start Cycle

Recipe Modification

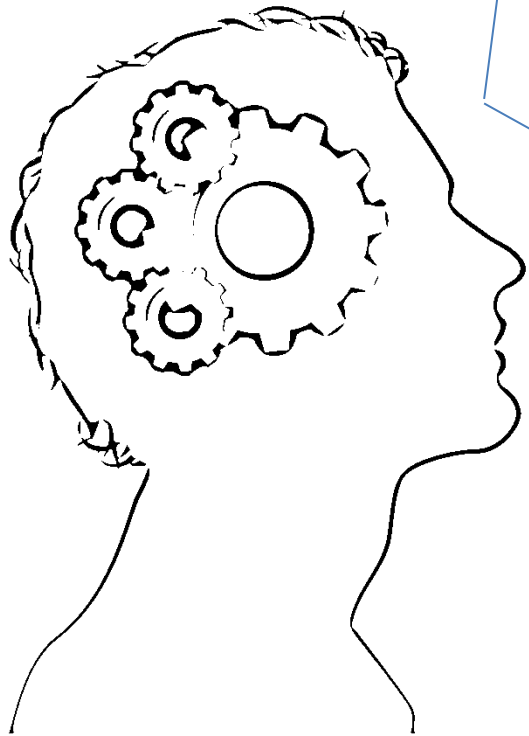
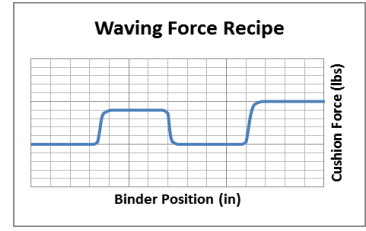
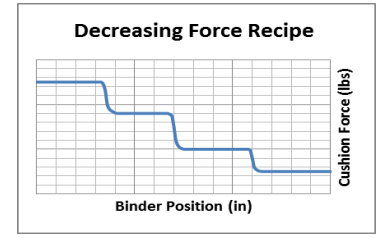
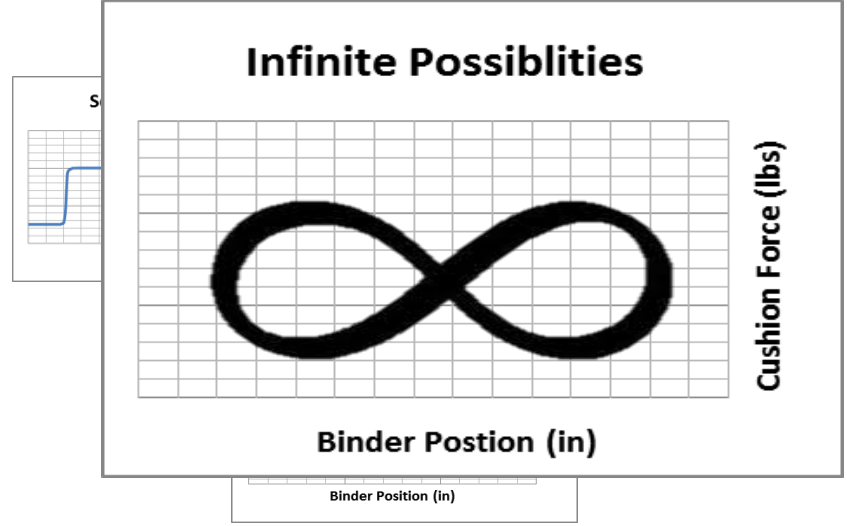
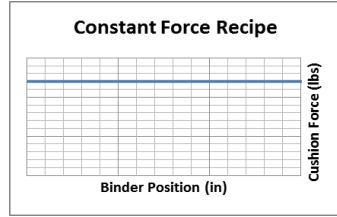
Sample

Recipe Name	Sample123
Cushion Force at Contact (N)	25000.00
Cushion Force 2 (N)	38000.00
Cushion Height 2 (MM)	20.00
Cushion Force 3 (N)	43000.00
Cushion Height 3 (MM)	50.00
Cushion Force 4 (N)	28000.00
Cushion Height 4 (MM)	75.00
Delay Time (sec)	2.00
Reverse Forming (1 on) (0 off)	0.00

Buttons: Load, Save, Save As, Send, Clear

Buttons: Start Screen, Bleed Cycle

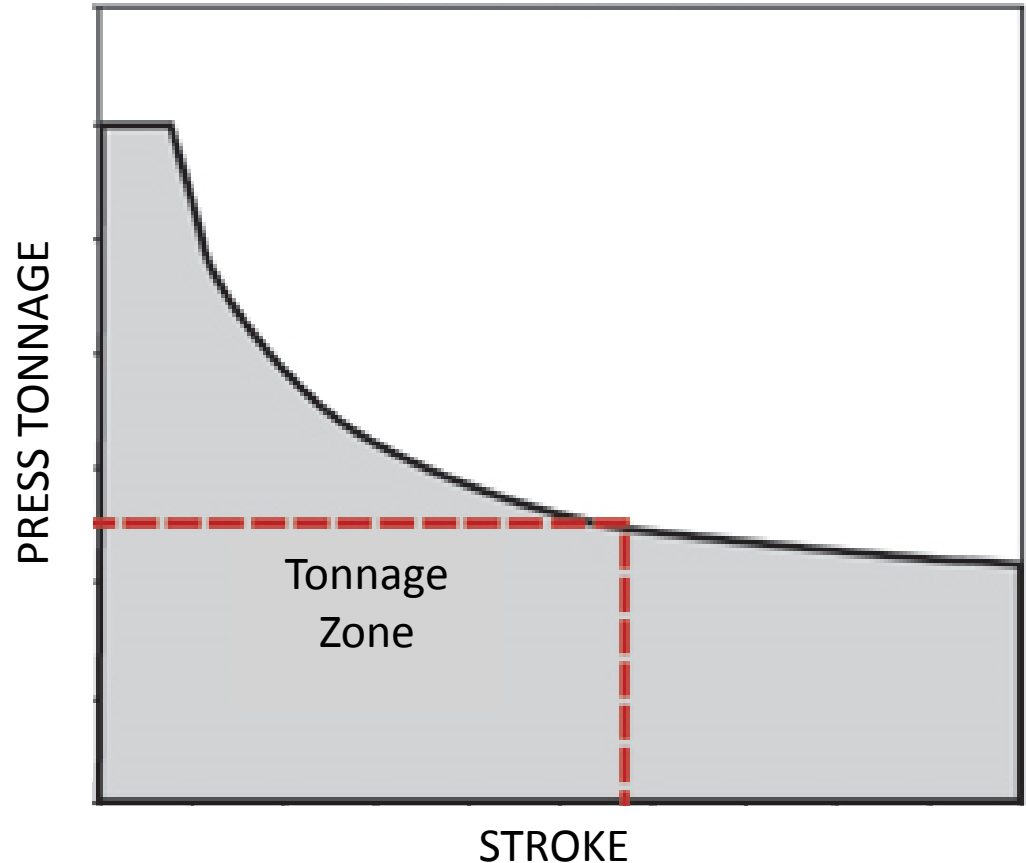
Infinite Possibilities



Forming Problems with AHSS

- Quality
- Production Times
- Set-Up Times
- Optimize Forming Limit

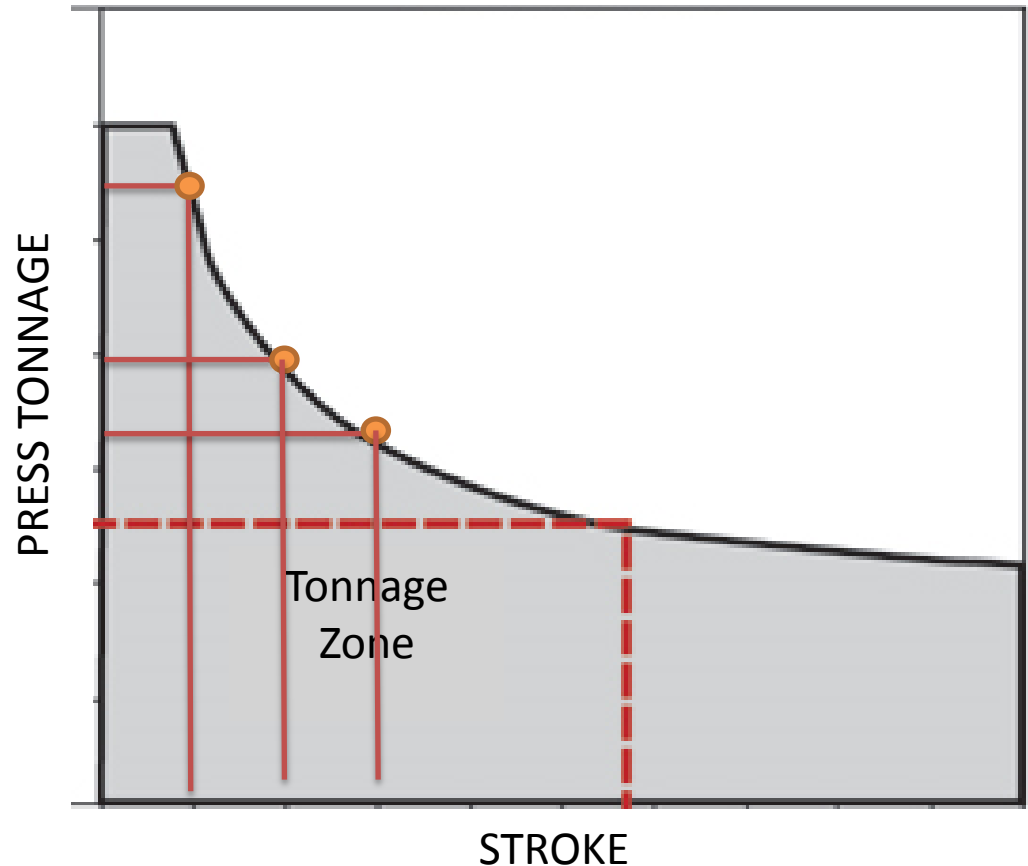
Press-Force Curve



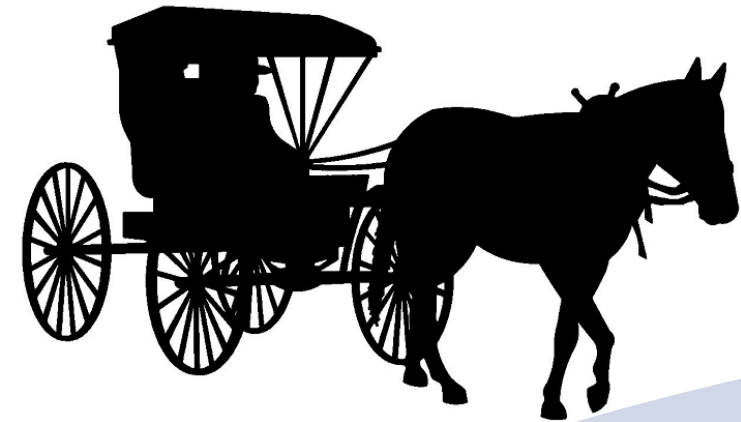
Forming Problems with AHSS

- Quality
- Production Times
- Set-Up Times
- Optimize Forming Limit

Press-Force Curve



The Innovative Spirit



The Innovative Spirit



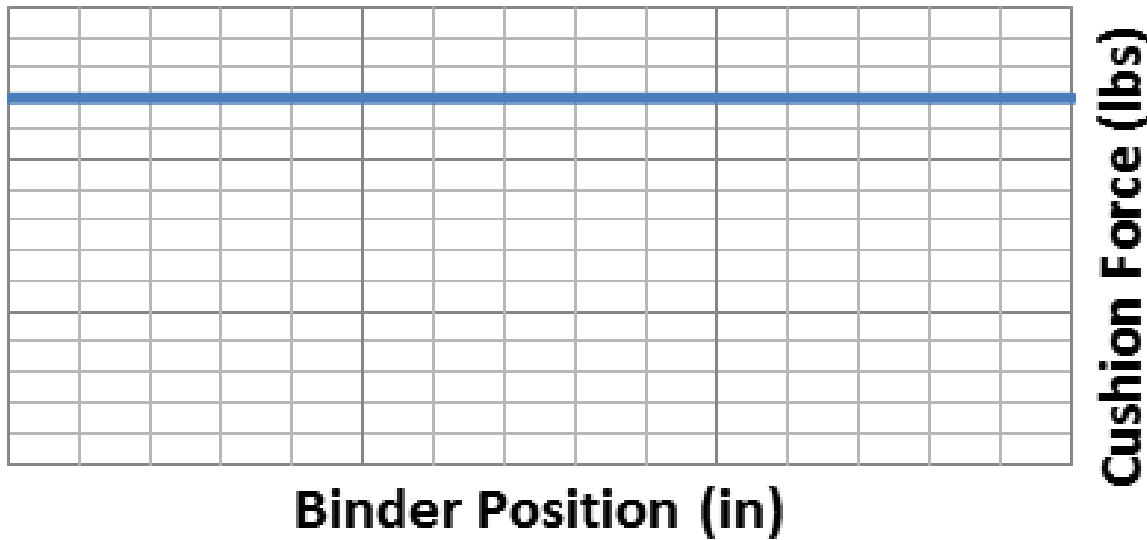
“IF I HAD ASKED PEOPLE
WHAT THEY WANTED,
THEY WOULD HAVE SAID:
FASTER HORSES...”

Henry Ford

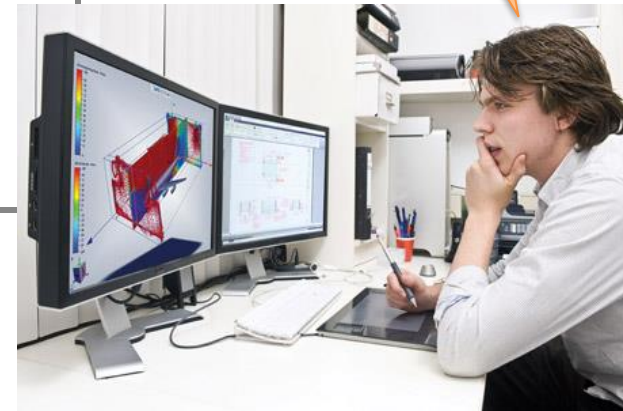
A Faster Horse

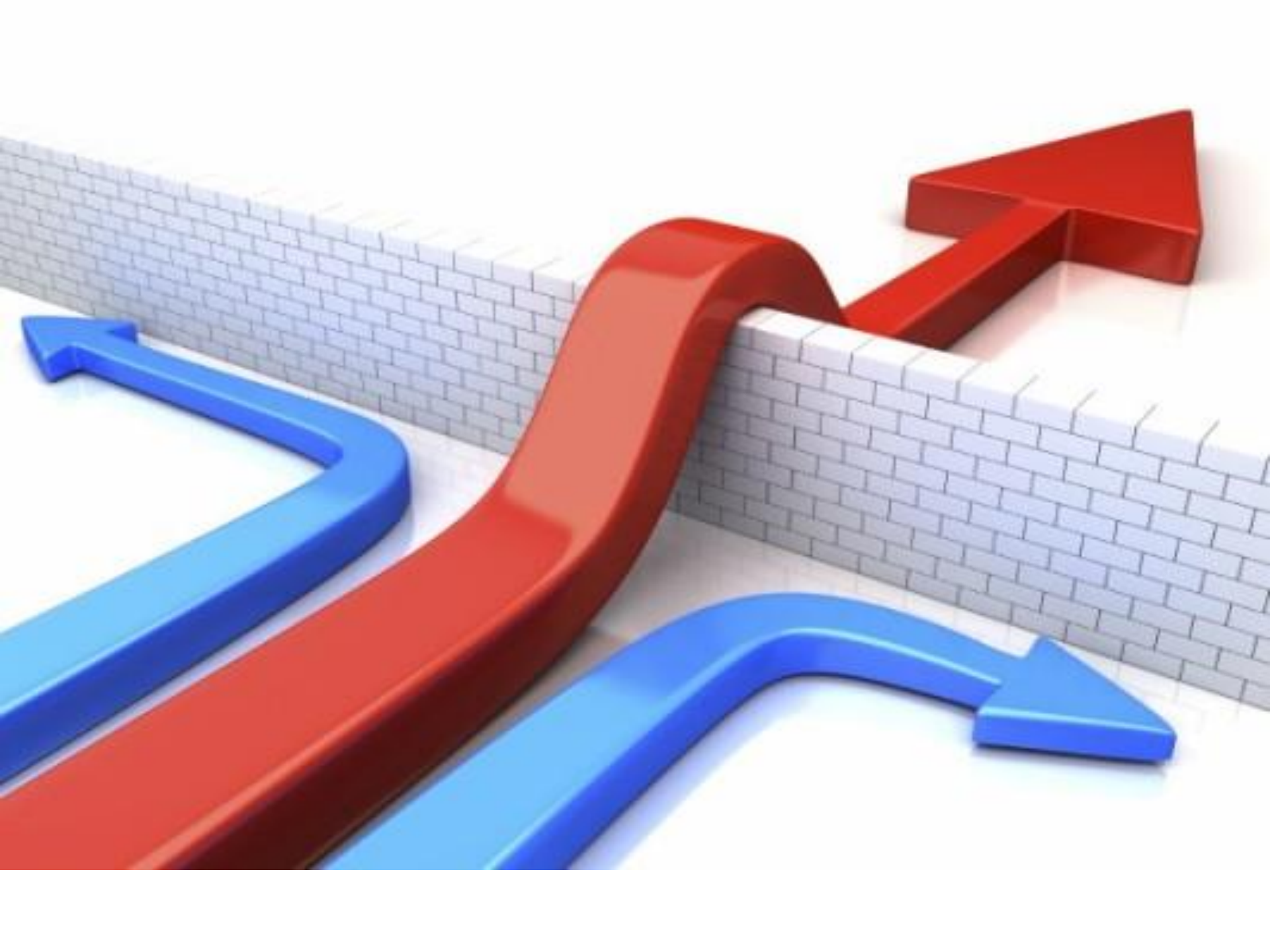


Constant Force Recipe



If I was asked how to design a die for AHSS, I would say **HIGHER FORCE**, or **MORE stations**







A Faster Horse

Position Control

None

Speed Control

None

Force Control

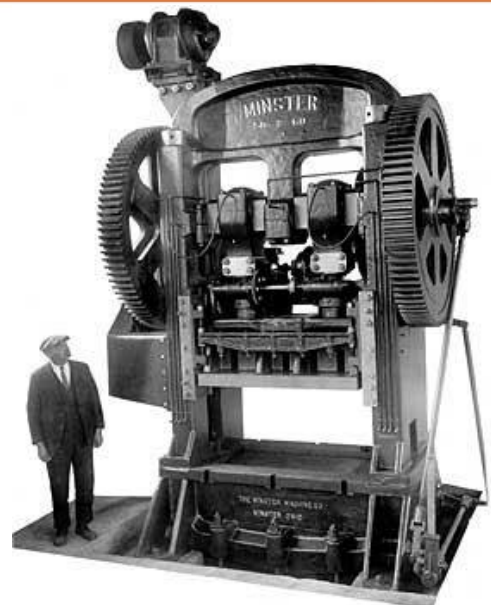
None

Programmability

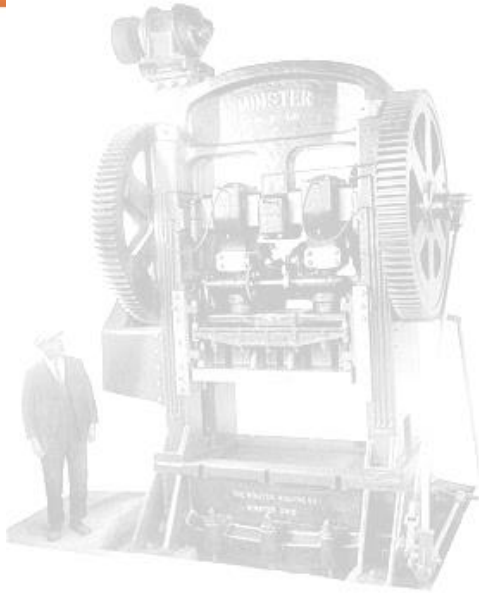
Limited

New Design Options

Limited



New Equipment and Processes



Position Control

None

Most

Speed Control

None

Most

Force Control

None

Most

Programmability

Limited

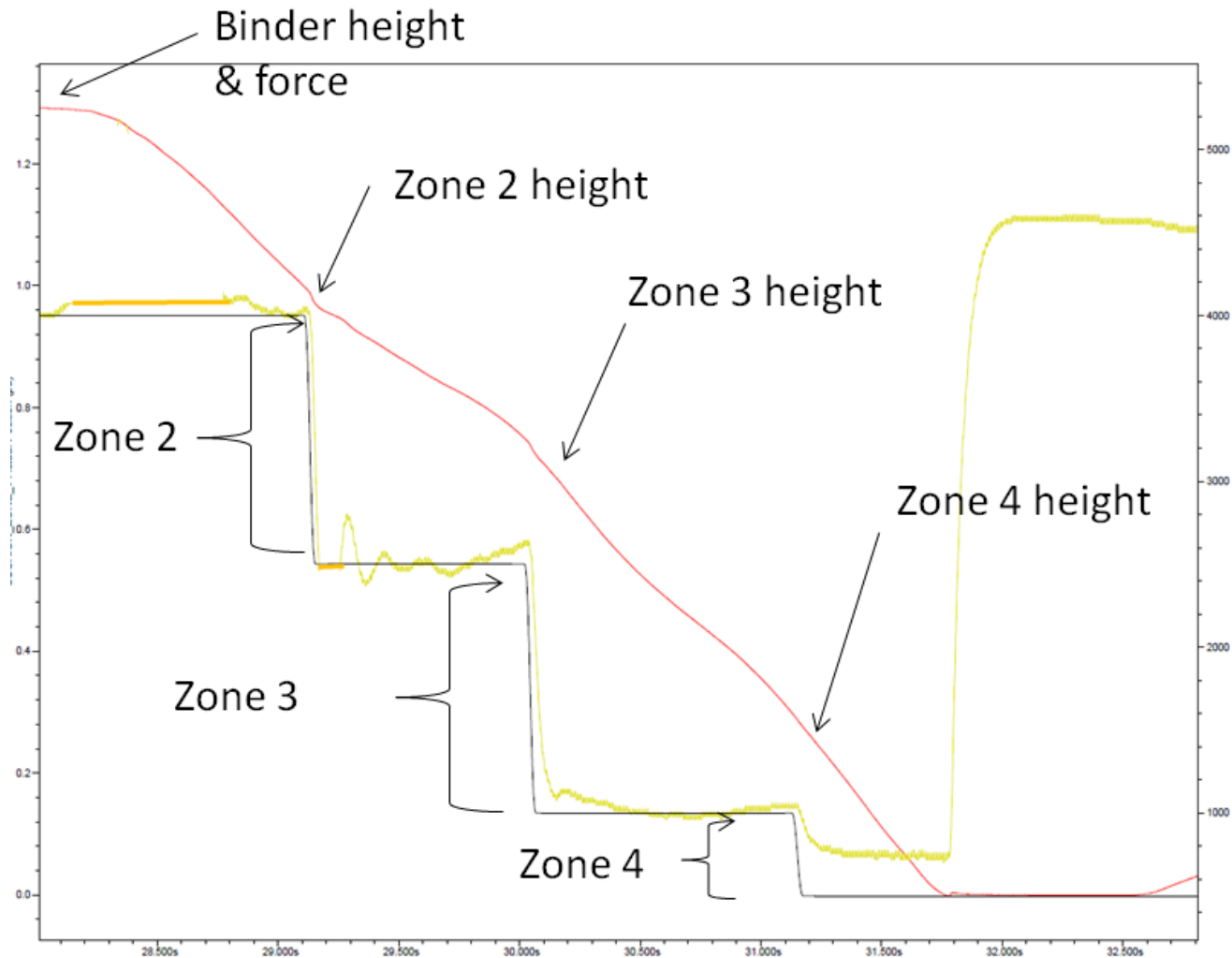
Most

New Design Options

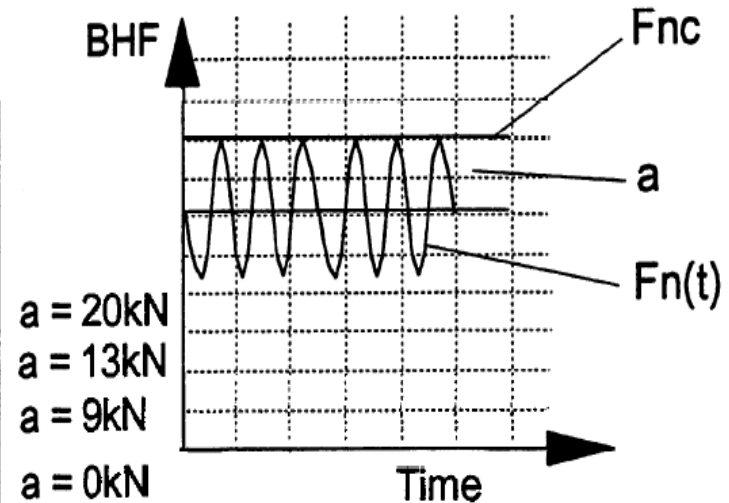
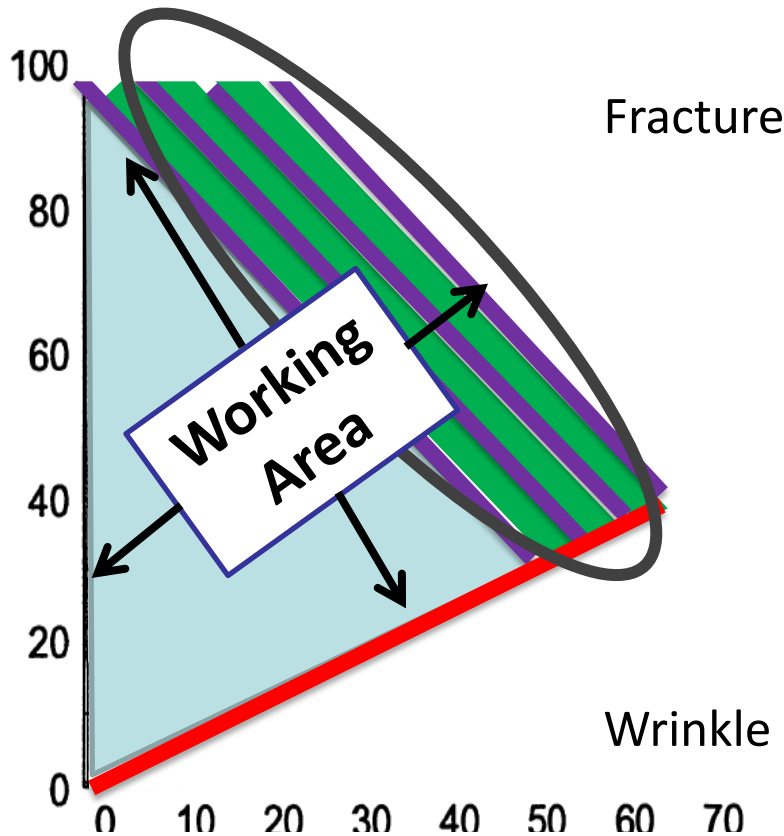
Limited

Endless





Amplitude Study #2



$$F_n(t) = F_{nc} - a + a \sin(\omega t)$$

a : Amplitude
 F_{nc} : Maximal BHF
 $F_n(t)$: Pulsating BHF

Think Vertically



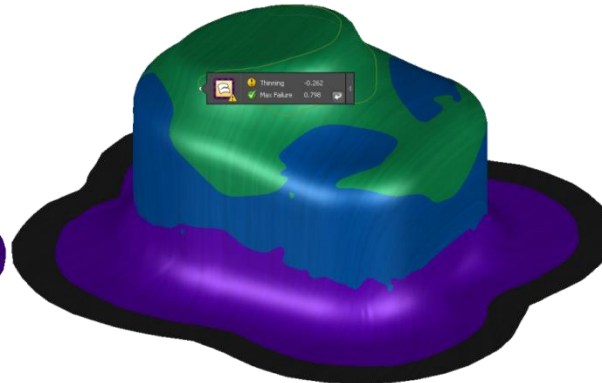
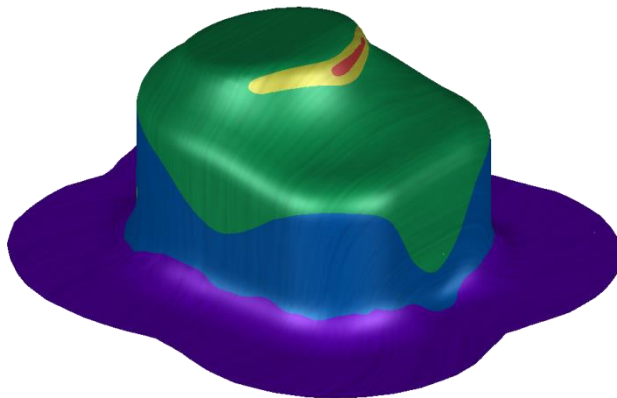
Before



After

Reduces Tearing with decreased force

Reduces wrinkling with increased Force



Thinning -0.262
Max Failure 0.798

THANK YOU ANY QUESTIONS?

Darrell Quander Jr

HYSON

Product Manager

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HYSON
Metal Forming Solutions™