Projected Annual Quantity

Project the annual quantity expected to be sold in the next five years, for each model, domestic and international. Note if presented in units or thousands of units. Values are considered estimates until the Development Gate is approved, when then become measures of performance.

Model / SKU#	Description	FY1	FY2	FY3	FY4	FY5
Domestic		2015	2016	2017	2018	2019
22327	Dingo TX 1000 Narrow Track	103	171	242	294	334
22328	Dingo TX 1000 Wide Track	216	456	517	578	636
	Total	319	627	759	872	970
International		2015	2016	2017	2018	2019
22327	Dingo TX 1000 Narrow Track	7	12	15	18	23
22328	Dingo TX 1000 Wide Track	18	25	29	35	41
	Total	25	37	44	53	64

TORO-0000966

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Project Investment

Estimate the project investment by fiscal year and by phase. Update projections and actual at each Gate.

Project Investment by Phase

	Dollars in Thousands ($,000.)	Concept Phase	Feasibility Phase	Development Phase	Mid-Development Phase	Mfg Pilot Phase	Total	Comments
Engineering	Original Estimate		665	849	145	118	1,777	
	Current Projection				189	114	2,075	
	Actual		665	1,107			1,772	
	Variance			258	44	(4)	298	
Tooling	Original Estimate			150	100	100	350	
	Current Projection			150	100	170	420	
	Actual							
	Variance					70	70	
Marketing	Original Estimate			50	75	75	200	
	Current Projection				100	50	150	
	Actual							
	Variance			(50)	25	(25)	(50)	
Other	Original Estimate							
	Current Projection							
	Actual							
	Variance							
Total	Original Estimate		665	1,049	320	293	2,327	***Original Estimate***
	Current Projection			150	389	334	2,645	*Current Projection*
	Actual		665	1,107			1,772	***Actual to Date***
	Variance			208	69	41	318	***Variance***

* Actual spending is through January 2014

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Project Investment

Estimate the project investment by fiscal year and by phase. Update projections and actual at each Gate.

Dollars in Thousands	Project Investment by Fiscal Year					
Fiscal Year	*2013*	*2014*	*2015*	*2016*	*2017*	Total
Engineering	$ 512	$ 955	$ 608			**$ 2,075**
Tooling		$ 250	$ 170			**$ 420**
Marketing		$ -	$ 150			**$ 150**
Other						$ -
Total	**$ 512**	**$ 1,205**	**$ 928**	$ -	$ -	**$ 2,645**

*Added spending was mainly in 2015 because of the extension of the project due to the engine change

TORO-0000968

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REDACTED

4.0 Mid-Development Entrance Gate

W250: Next Gen TX

2/20/2015 8:10:10 AM 41

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TORO-0000969

Project Schedule and Milestones

List the milestones and dates that are critical to achieve the planned project schedule.

Milestone Dates	3.0 Plan	Actual / 4.0 Update	Comments
2.0 Approval	3/11/13	3/11/13	
2.0 Prototype Build Completed	10/7/13	10/7/13	
3.0 Signoff	2/17/14	2/17/14	
3.0 Prototype Build Completed	5/27/14	7/23/14	
3.5 Update	6/23/14	11/3/14	DR to change to D1305 engine
Long Lead / Tooling Releases	9/25/14	11/19/14	Major weldments and castings released here
4.0 Signoff	10/15/14	1/30/15	
4.0 Updates (build)	10/29/14	2/3/15	In process; all weldments now complete
5.0 Signoff	1/5/15	3/9/15	
Pilot Build Start	1/14/15	4/14/15	
Production Start	3/12/15	5/26/15	
Release to Ship	3/19/15	6/16/15	
500 hours complete on 4.0's	3/18/15	6/11/15	See Test Plan for details

TORO-0000970

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Mid-Development Phase Actions

List the most critical actions the team needs to complete in the Mid-Development Phase for this project to fully satisfy the stated project objectives.

Engineering

- Finish 4.0 build
- Finish final releases
- React to field and lab issues
- Complete Risk assessments
- Complete application reviews, including Kubota approval
- Marketing support for Rental Show
- Attachment work
  - 3 skus assigned for 2 new buckets and strengthened forks
    - Buckets samples are being welded now; more work is required on the forks
  - Backhoe will not initially be available for this unit without some kind of adapter kit

TORO-0000971

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Mid-Development Phase Actions

List the most critical actions the team needs to complete in the Mid-Development Phase for this project to fully satisfy the stated project objectives.

Marketing

- Successful debut at ARA (Rental) Show
- Complete effective demo product training and webcasts to our Channel partners
- Provide effective TX 1000 launch materials and effectively communicate the planned marketing activities to our Channel

TORO-0000972

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Mid-Development Phase Actions

List the most critical actions the team needs to complete in the Mid-Development Phase for this project to fully satisfy the stated project objectives.

- Service
  - A service manual will be developed off a pilot unit or a marketing unit after ARA
  - Service schools will likely take place in the fall

TORO-0000973

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Project Risks and Risk Management Plan

List the risks that may limit the project from achieving the goal. Consider all aspects including: marketing, competition, distribution, quality, performance, price, design, supply, etc. For each risk state the impact, the likelihood of occurring, the mitigation actions to prevent the occurrence and the contingency plan if it occurs.

Priority	Risk	Likely To Occur	Impact	Mitigation Actions	Contingency Actions
Rank	What is the issue that may impact the project?	High Medium Low	If it occurs how will it effect the project?	What are the actions being taken to prevent the occurrence or minimize the impact?	If the Risk does occur what actions will the team take?
1	Lack of durability testing on new engine, loader, controls, and track changes	High	Unknown failure types and issues in the field	Loader arm cycle test; Control cycle test, expedited field testing; more visits to test site to monitor and jump on test issues	Review and address field issues
2	Loader arm complexity and durability results in failures	Med	Increased weight, cost, and time to develop the arm	Loader arm linkages revised for 4.0 and more iterative FEA completed; Aggressive loader cycle test in process	Revise and reinforce loader design

TORO-0000974

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Project Risks and Risk Management Plan

List the risks that may limit the project from achieving the goal. Consider all aspects including: marketing, competition, distribution, quality, performance, price, design, supply, etc. For each risk state the impact, the likelihood of occurring, the mitigation actions to prevent the occurrence and the contingency plan if it occurs.

Priority	Risk	Likely To Occur	Impact	Mitigation Actions	Contingency Actions
Rank	What is the issue that may impact the project?	High Medium Low	If it occurs how will it effect the project?	What are the actions being taken to prevent the occurrence or minimize the impact?	If the Risk does occur what actions will the team take?
3	Late changes, releases, and modifications for the pilot	High	Delay pilot and production	Work with vendors to expedite parts as nec. – quickly react to Test issues	Modify and rework as nec. to achieve the production dates

TORO-0000975

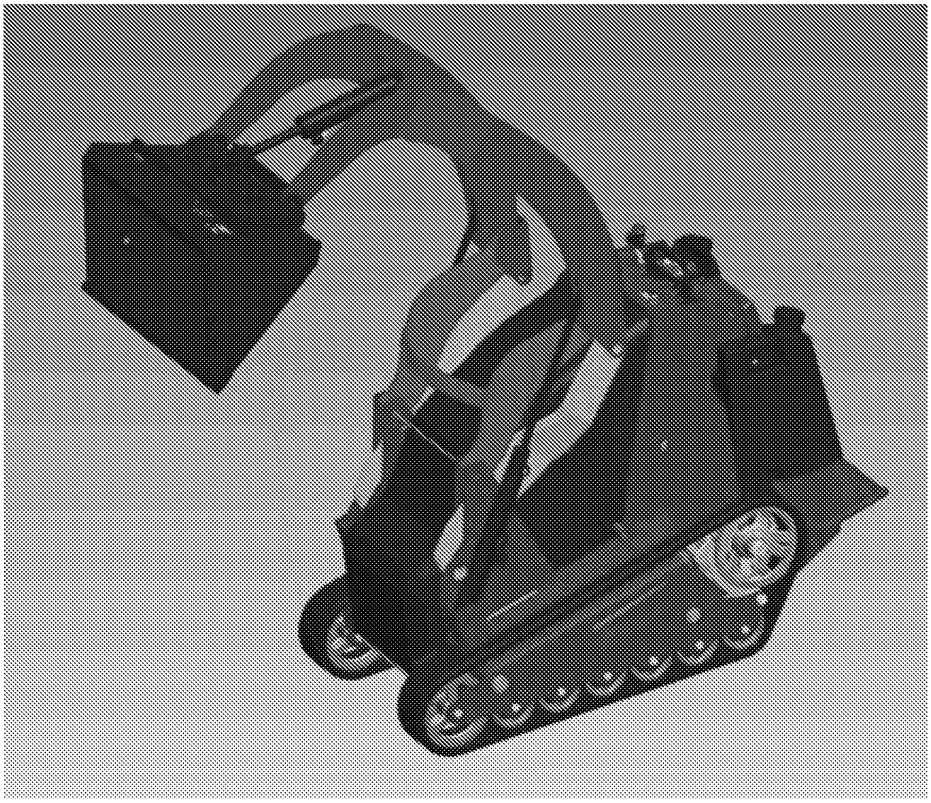
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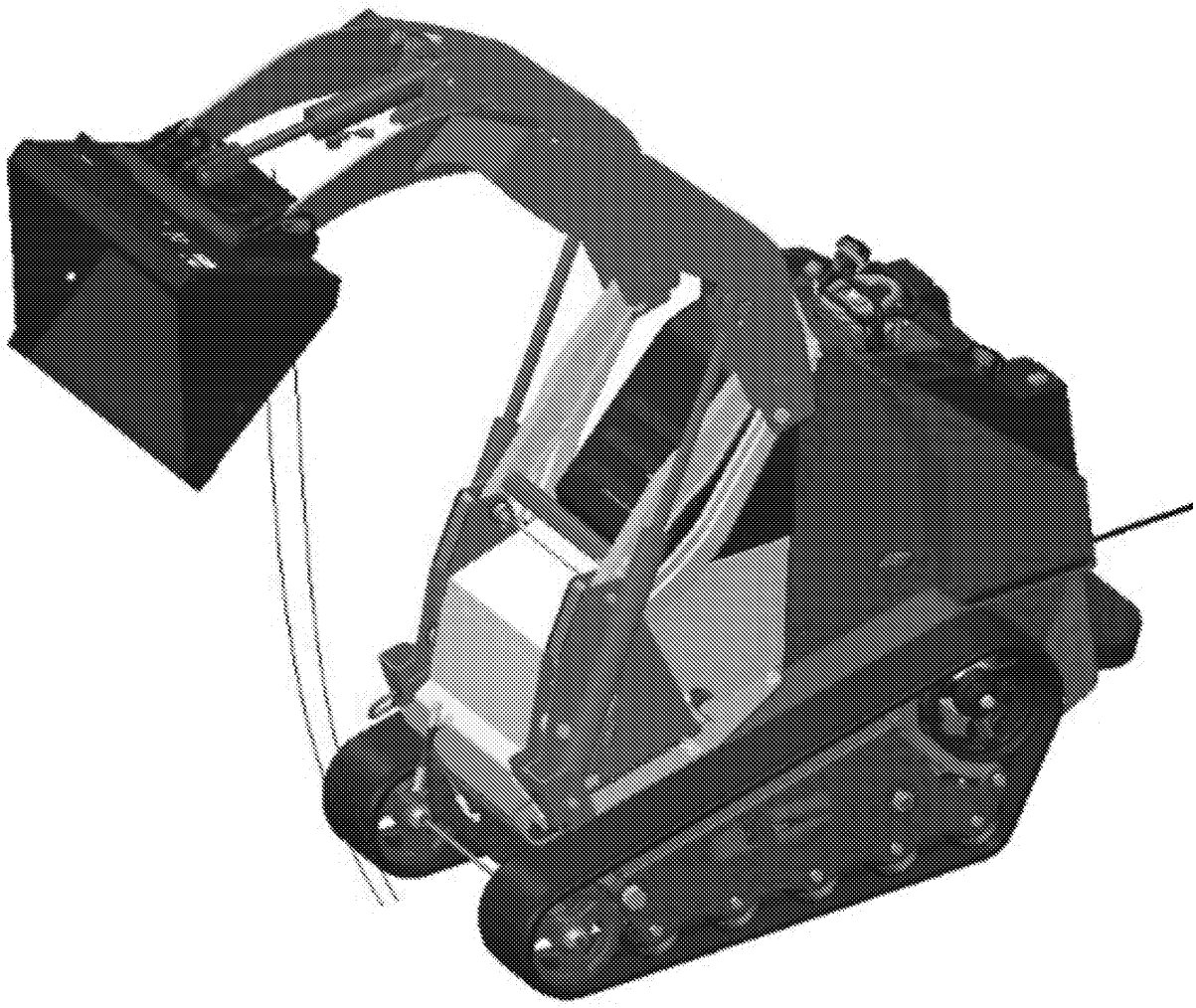
Business and Project Strategy

Explain how this new product aligns with the business strategy and product category strategy. Describe how the market strategy will optimize the sales of this new product.

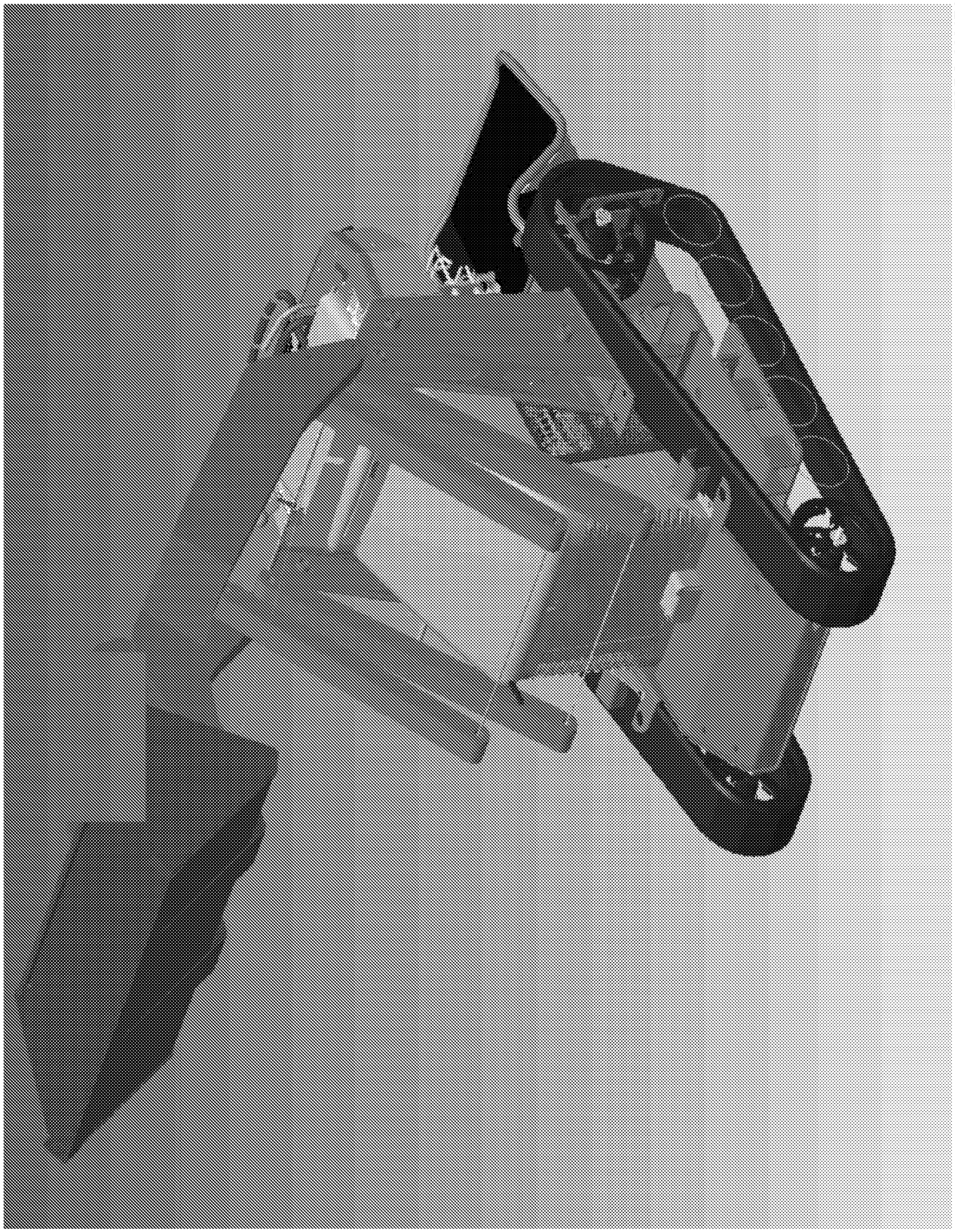
- Successfully expand the Dingo product line offering with the introduction of the TX 1000 Narrow Track and Wide Track units
  - TX 1000 units were additions to the existing TX line
  - Existing 427, 525 and wheeled units have significant value, in both the dealer and rental channels
- Become the #1 Compact Utility Loader of choice for contractors and rental
  - Meet, and exceed, competitor specifications and incorporate key features
    - Greatest rated operating capacity (1000 and 1075 lbs) in the CUL category
    - 81" hinge pin height to clear 30 yard dumpsters and one ton truck with 24" sideboards
    - High drive track system
    - High max travel speed in forward (4.7 mph) and reverse (4.7 mph)
    - Intuitive and differentiated traction controls
- Re-establish Toro as the CUL market leader
  - Toro invented the category, and Toro has re-invented the category through TX 1000 product innovation
    - Vertical lift loader arm design and traction controls

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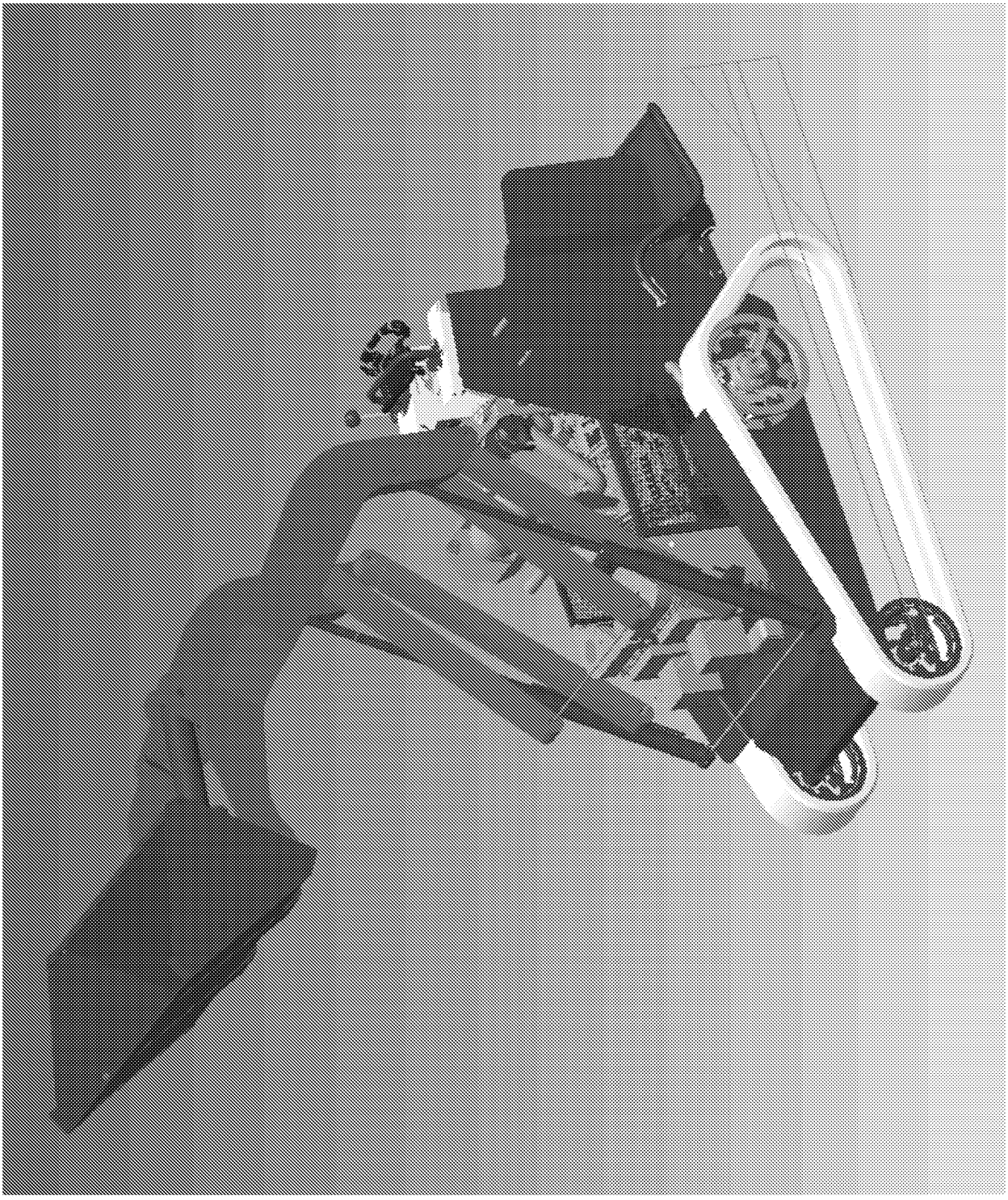


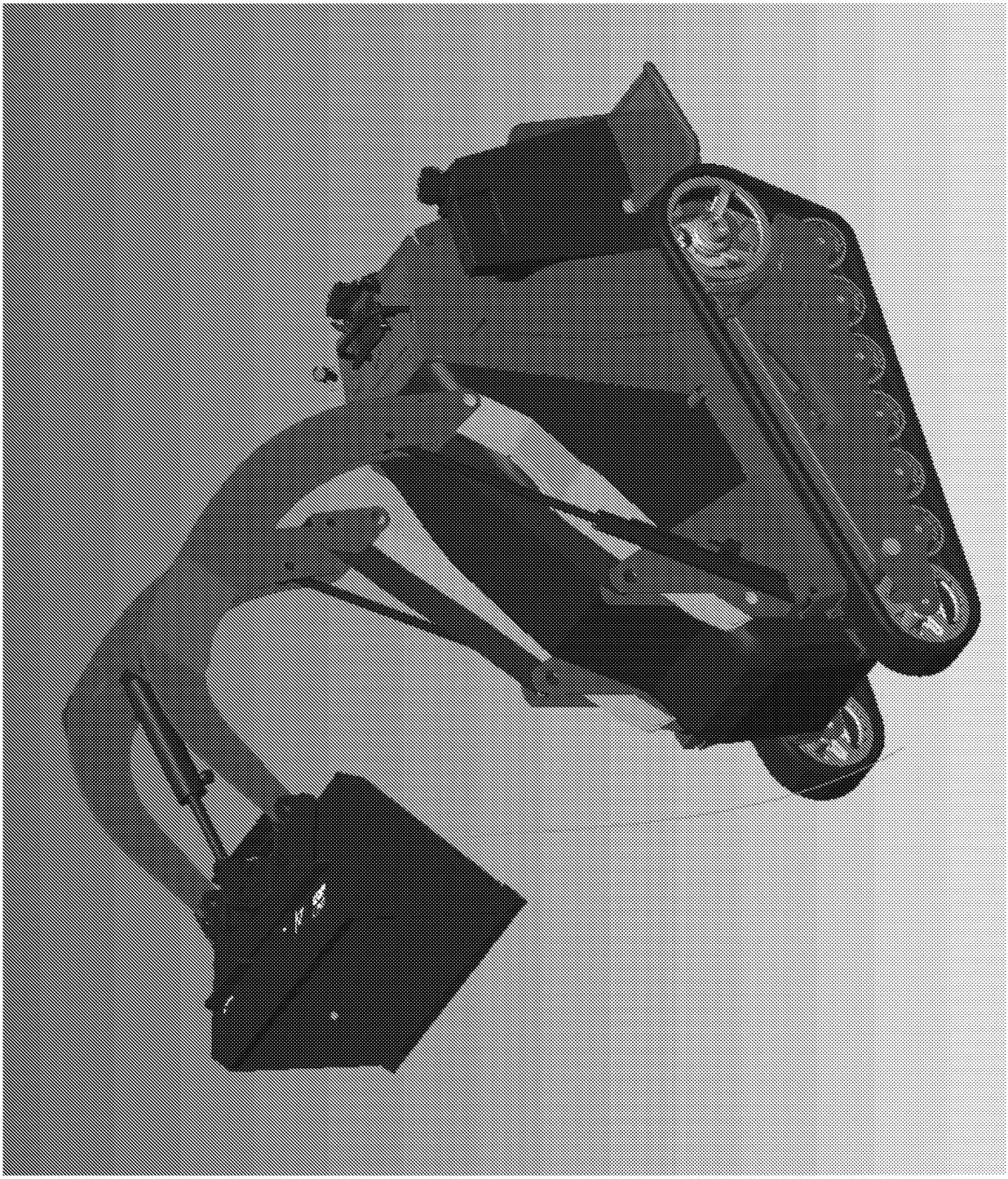


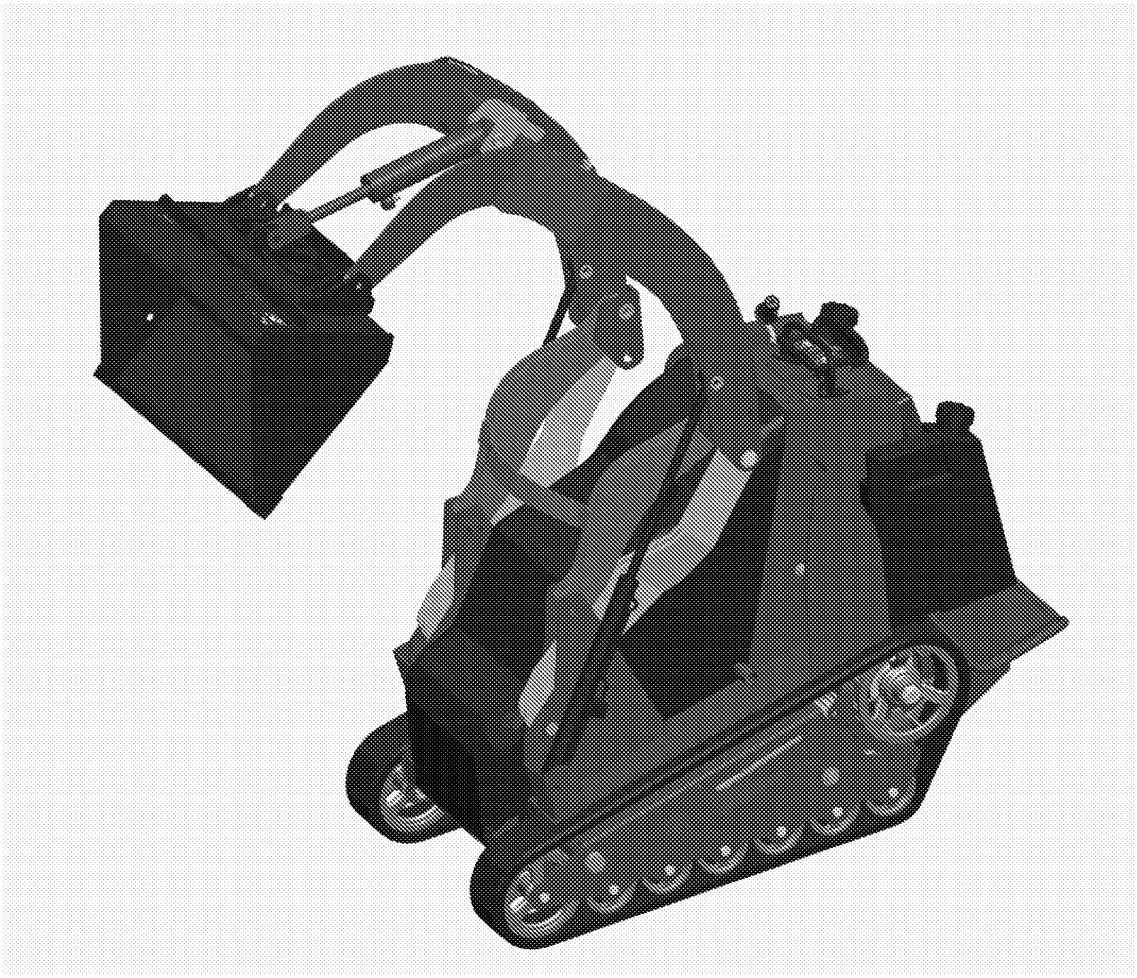
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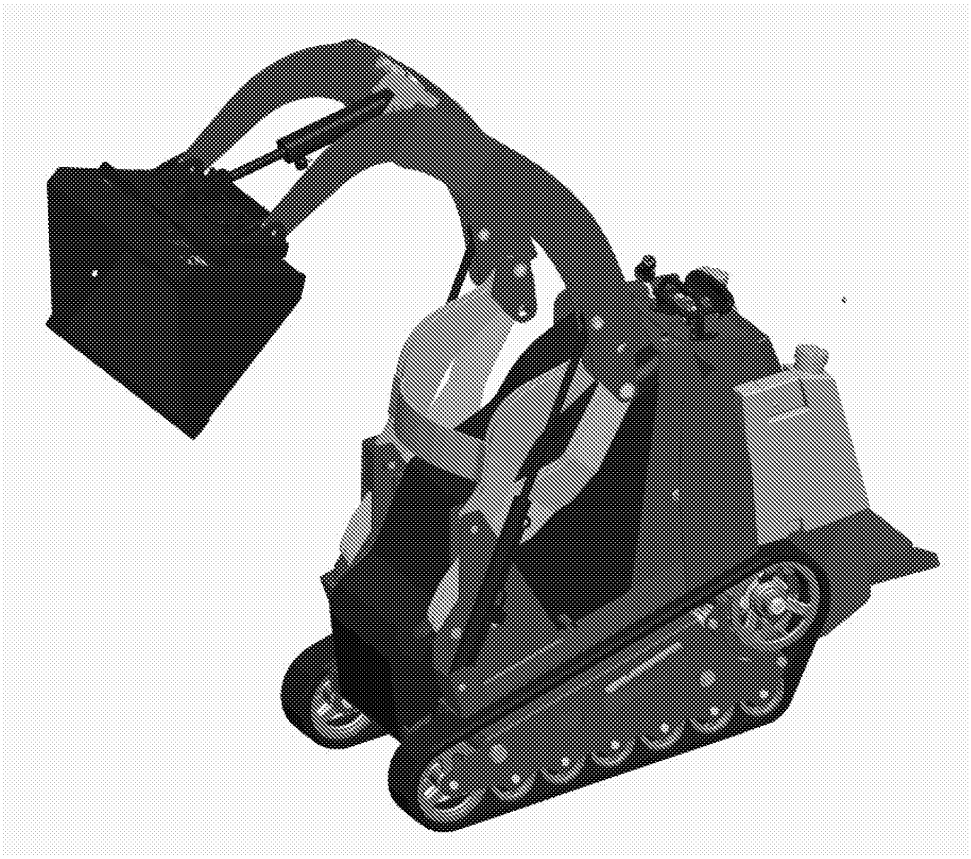


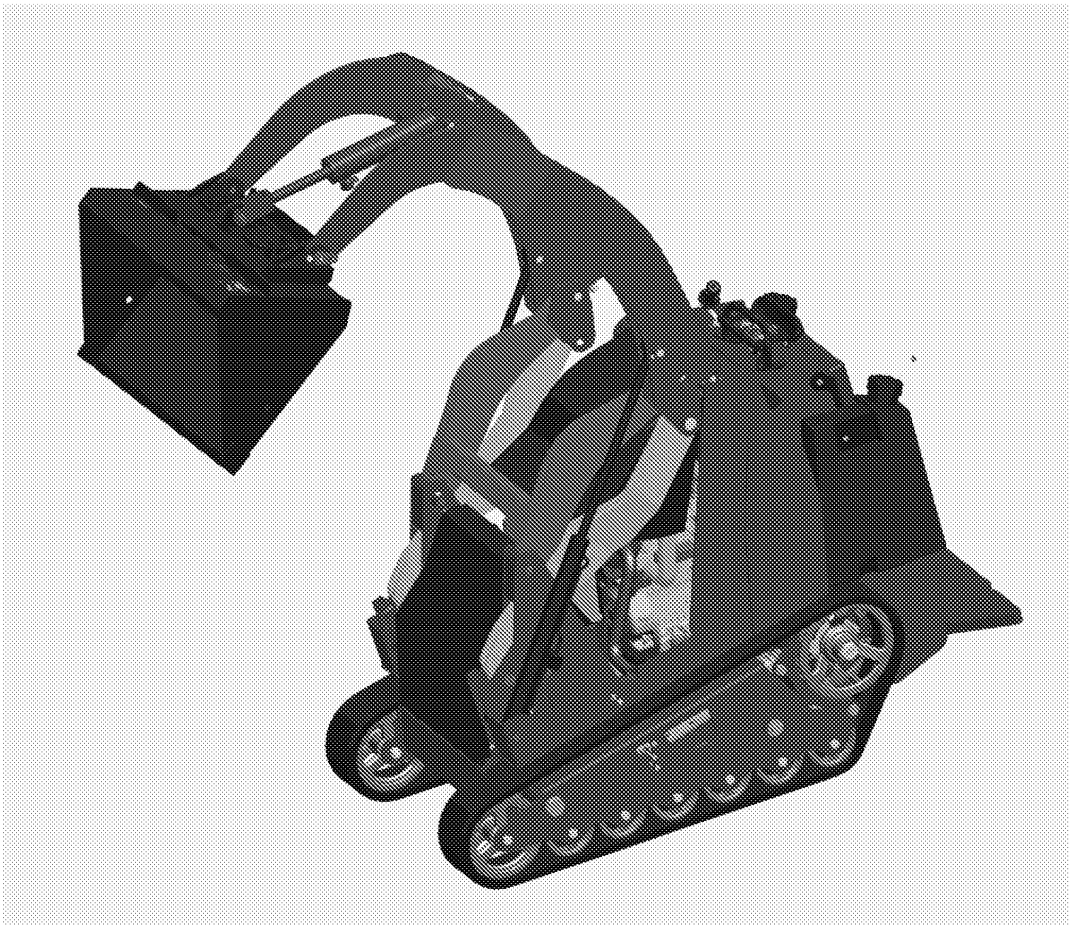
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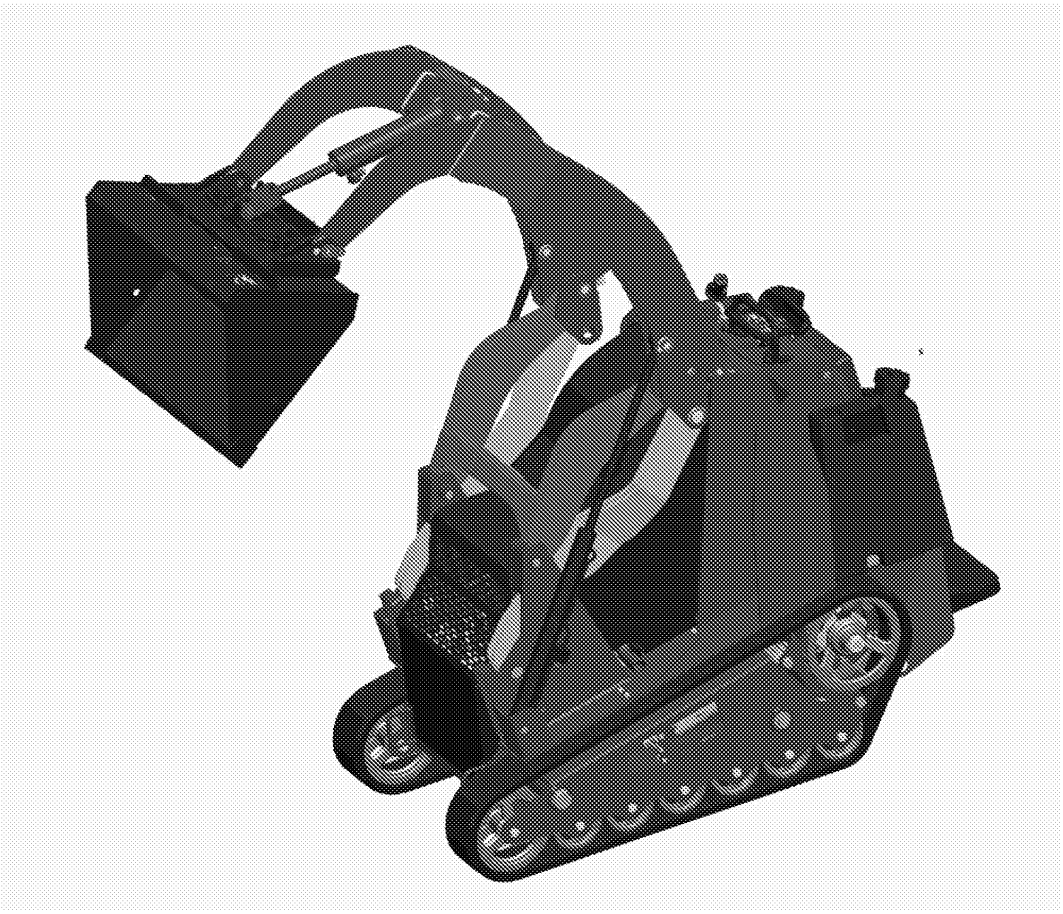


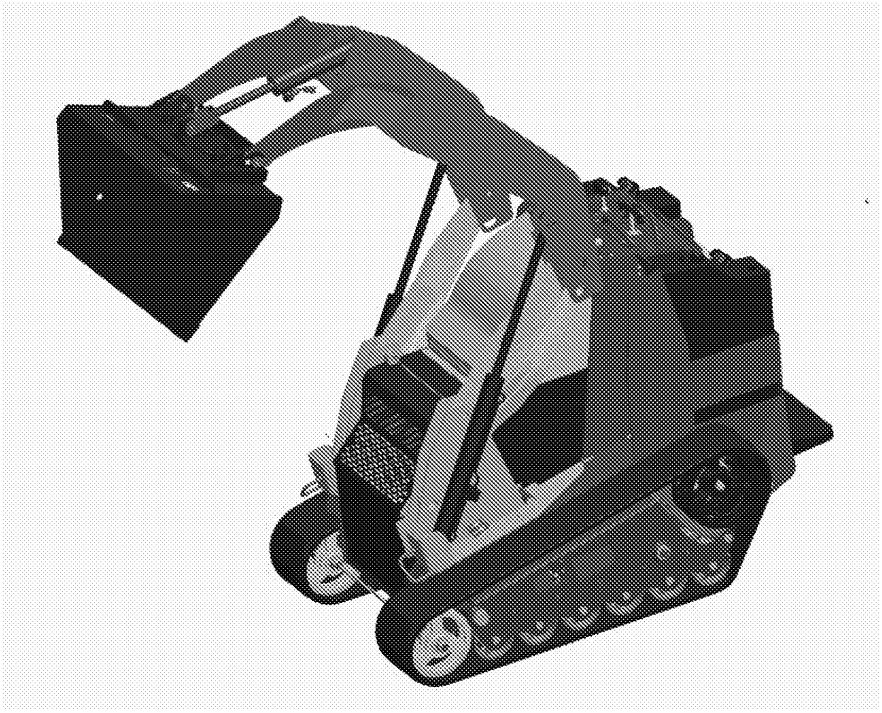


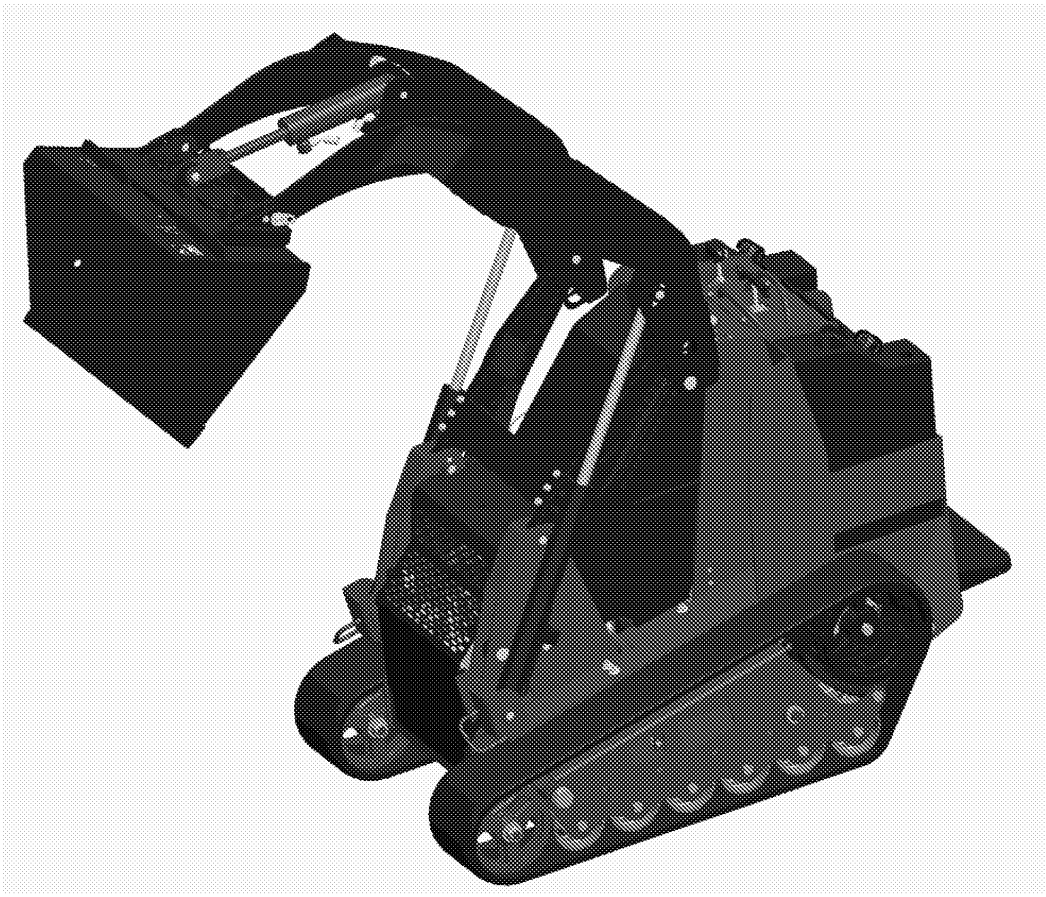


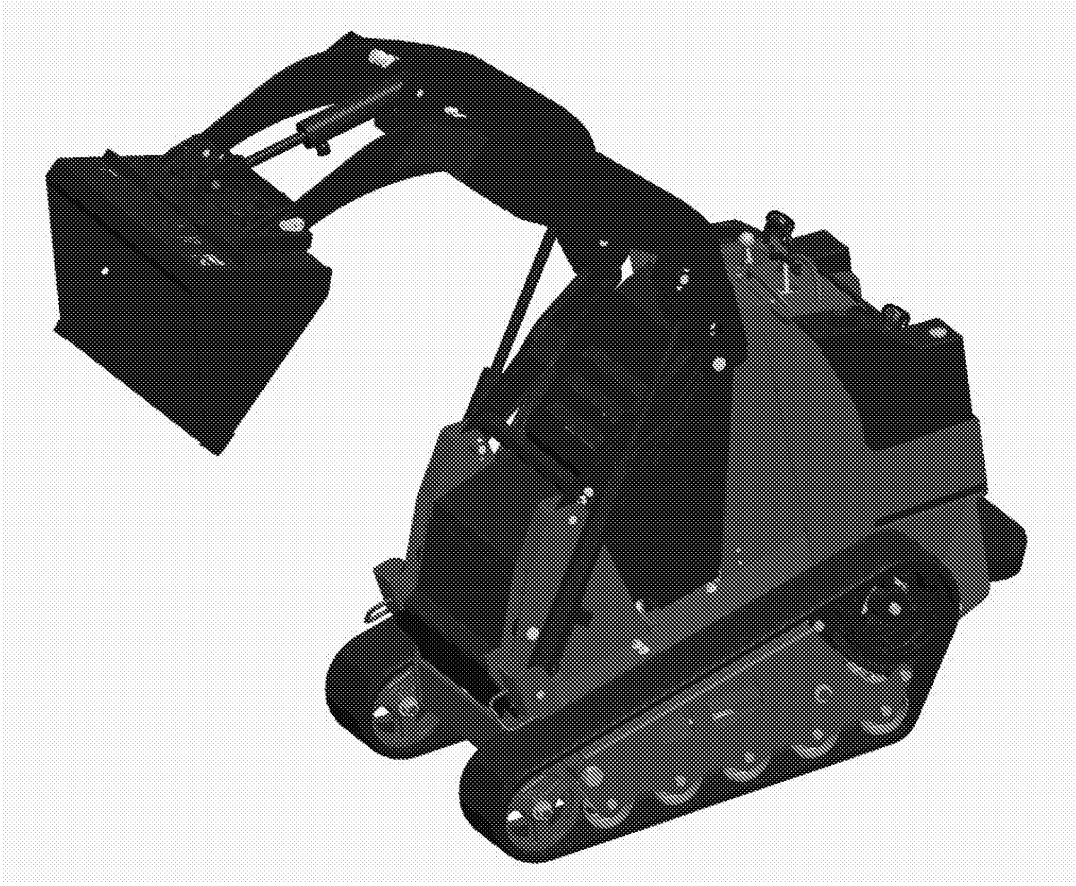


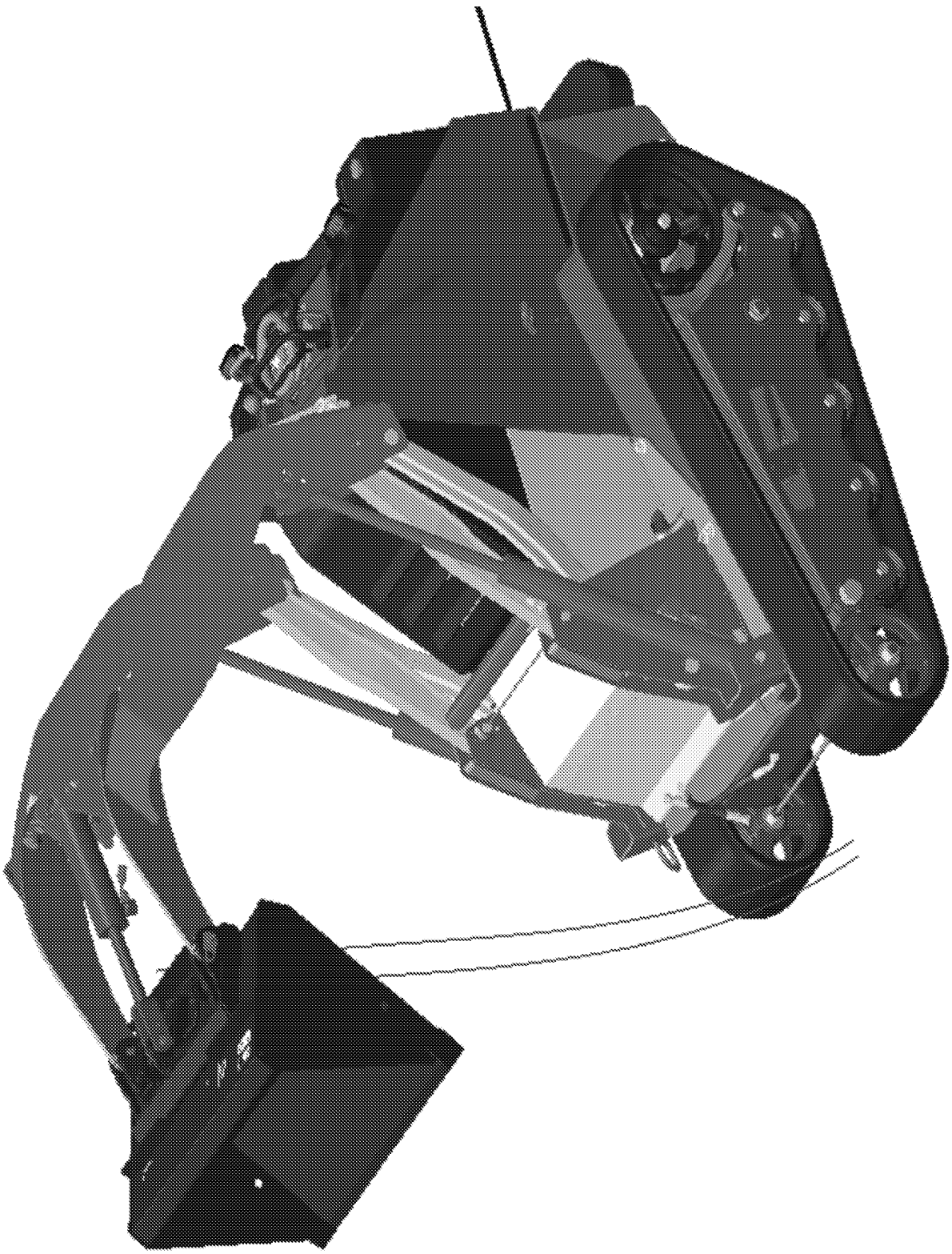








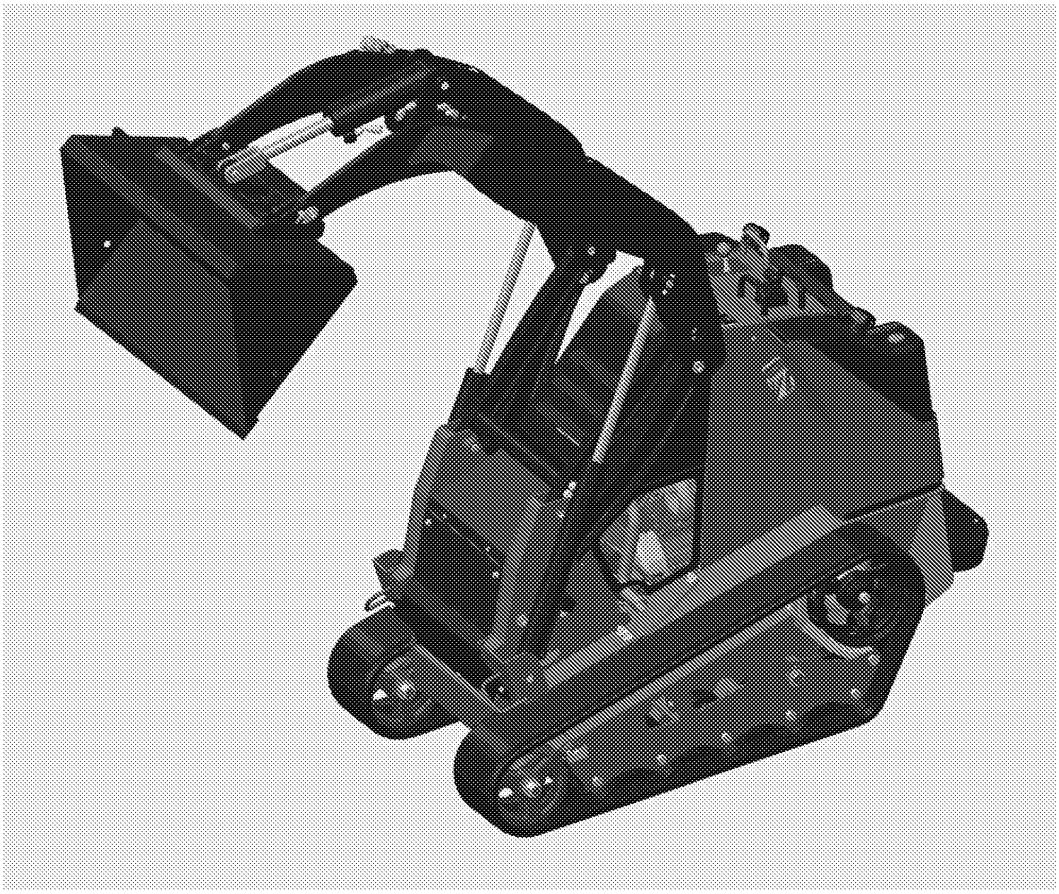


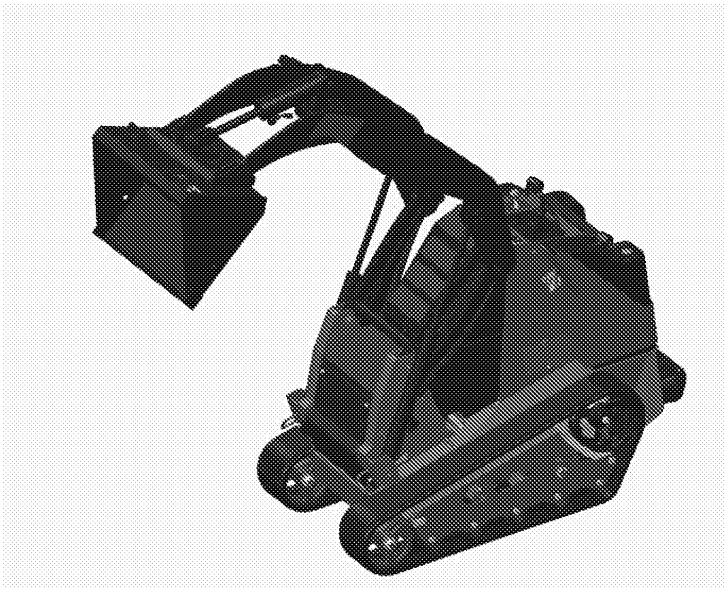


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TX1000 Torque Tube

12/08/2014

Model



- Used geometry from upper_links_fea.asm.1
  - Last geometry, 4.0 Rev 2, will be updated

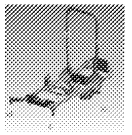
WINDCHILL/SWS/W298/UPPER_LINKS_FEA.ASM

3.0	2	130-5165OLD2	LINK-UPPER
	1	130-5192	SUPPORT-CROSS OVER (MACHI
2.0	1	125-3710	LINKS/CROSSOVER ASM (WELD
4.0	2	130-5165	LINK-UPPER (MACHI
	1	130-1132	SUPPORT-CROSSOVER (MACHIN
3.0 REV 2	2	130-5262	LOADER ARM LINK ASM (WELD
	1	130-5269	CROSSOVER ASM (WELDED)
4.0 REV 2	1	117-1874	UPPER LINK ASM (WELDED (CULTURE)

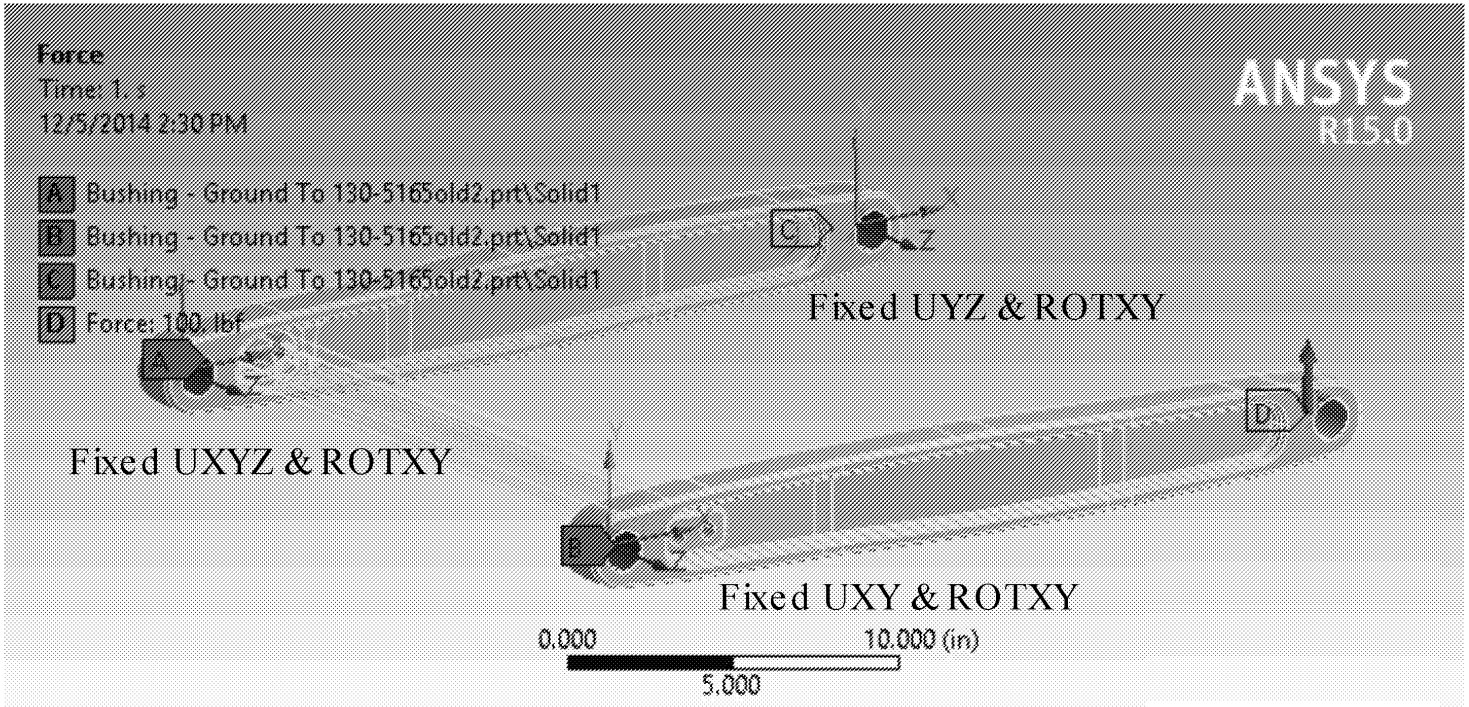
TORO-0001918.2/10

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Torsional Loading

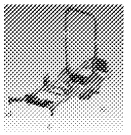


- 100 lb vertical force

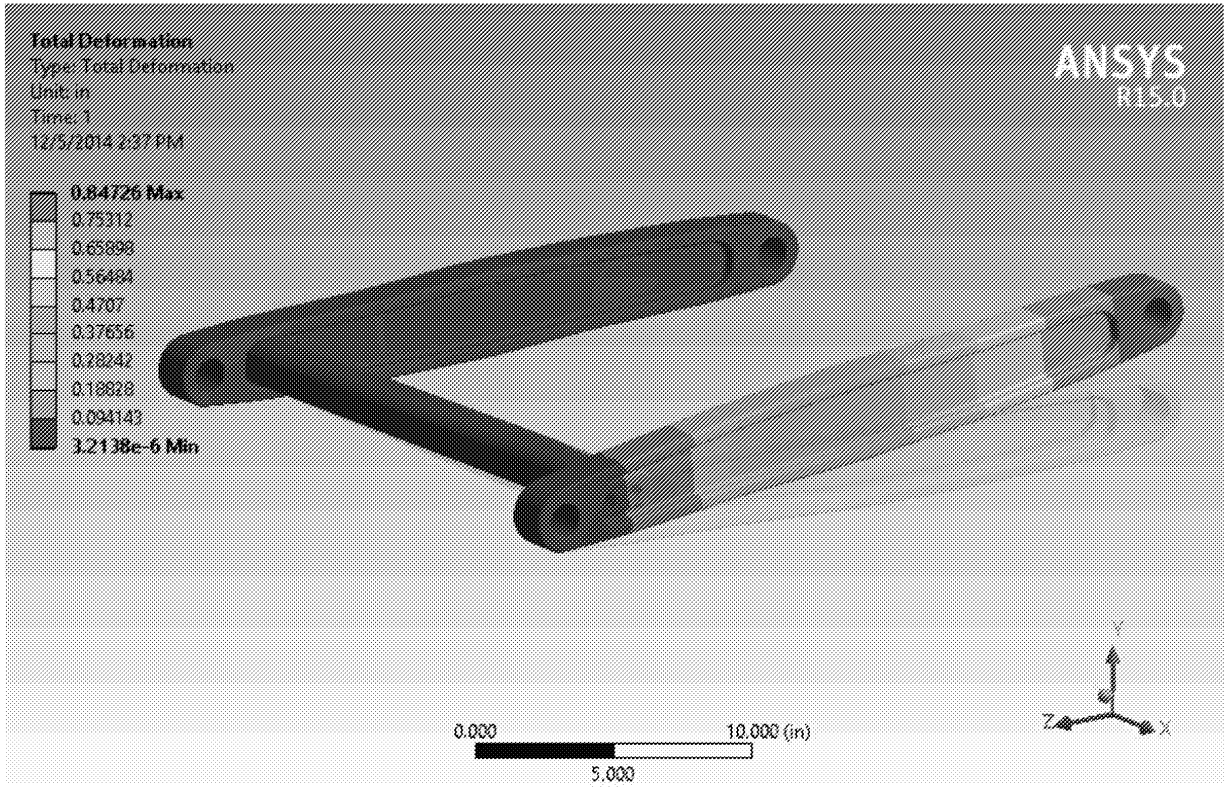


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Configuration 3.0



- Deflection (in)

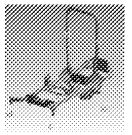


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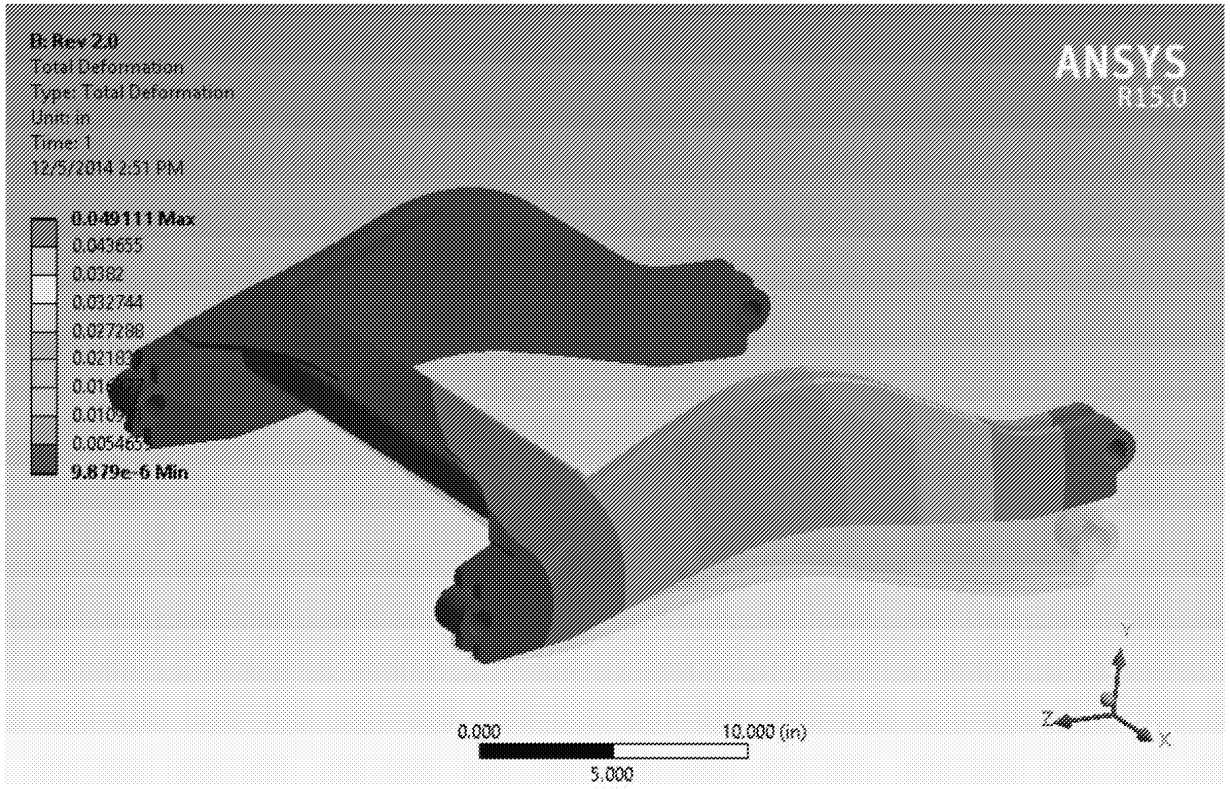
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Configuration 2.0



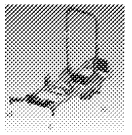
- Deflection (in)



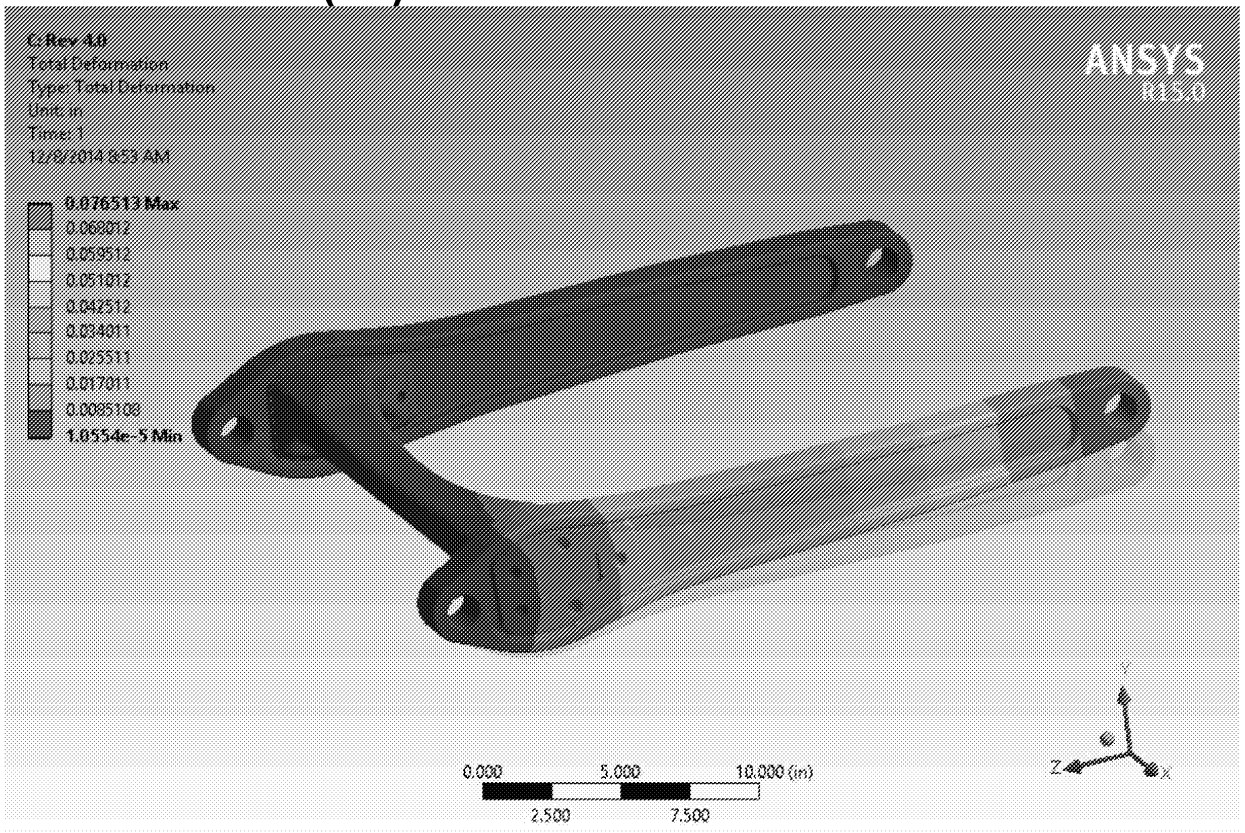
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Configuration 4.0



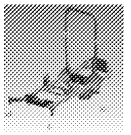
- Deflection (in)



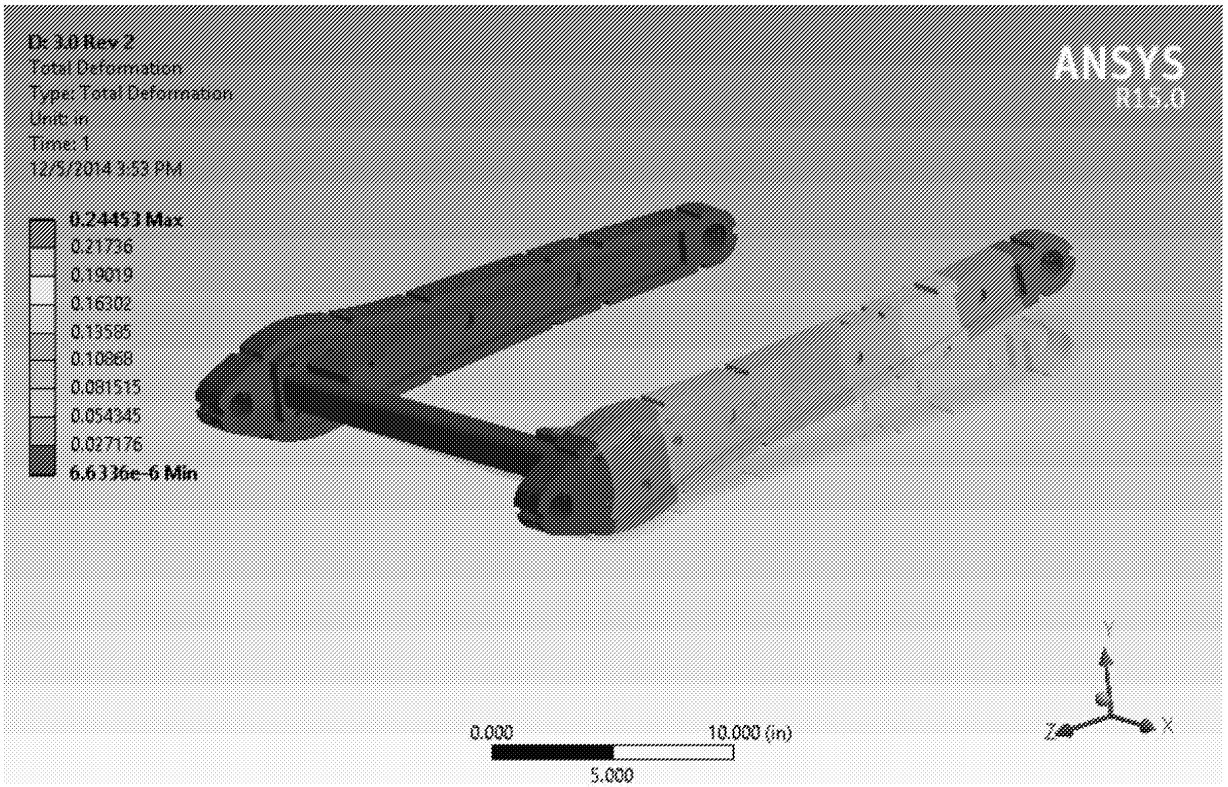
TORO-0001918.6/10

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Configuration 3.0 Rev. 2



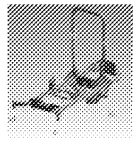
- Deflection (in)



TORO-0001918.7/10

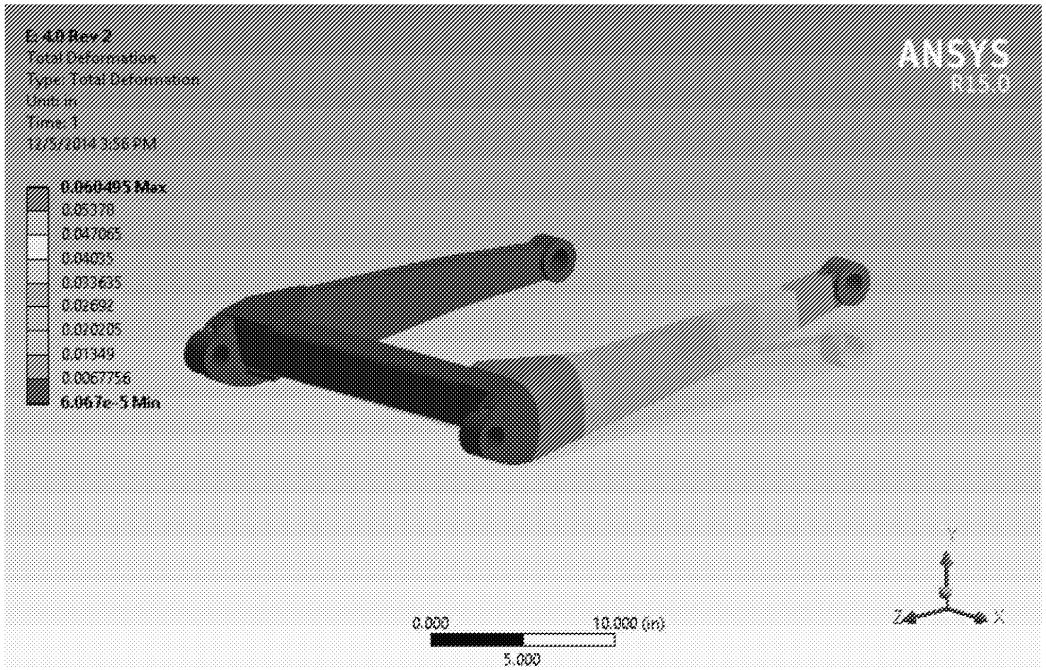
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Configuration 4.0 Rev. 2



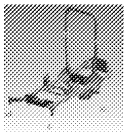
- Deflection (in)

A revision to this configuration is expected, after which thippt will be udpated

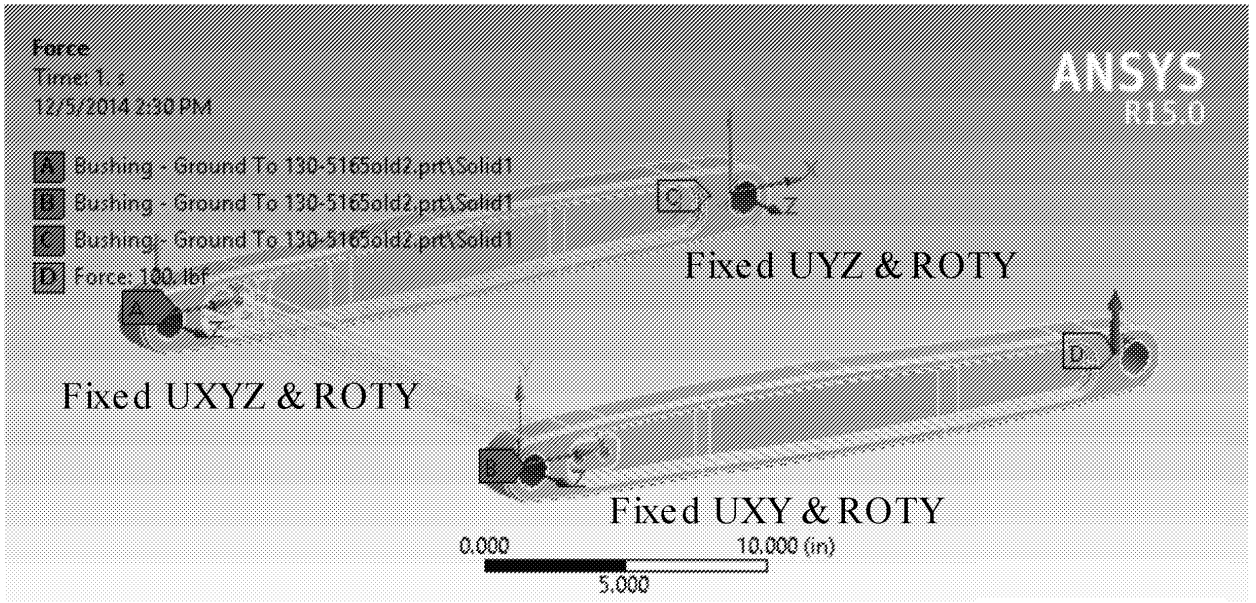


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2nd Case, Torsional Loading



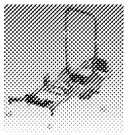
- Case with released ROTX (3 plcs.)
  - No pics included, but added to table of slide 10
  - 100 lb vertical force



TORO-0001918.9/10

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Summary



- Deflection (in)

Configuration	Case 1 Torsional Loading	Case 2 Torsional Loading (no ROTX)
3.0	0.847	1.355
2.0	0.049	0.051
4.0	0.077	0.089
3.0 Rev 2	0.245	0.248
4.0 Rev 2*	0.060	0.062

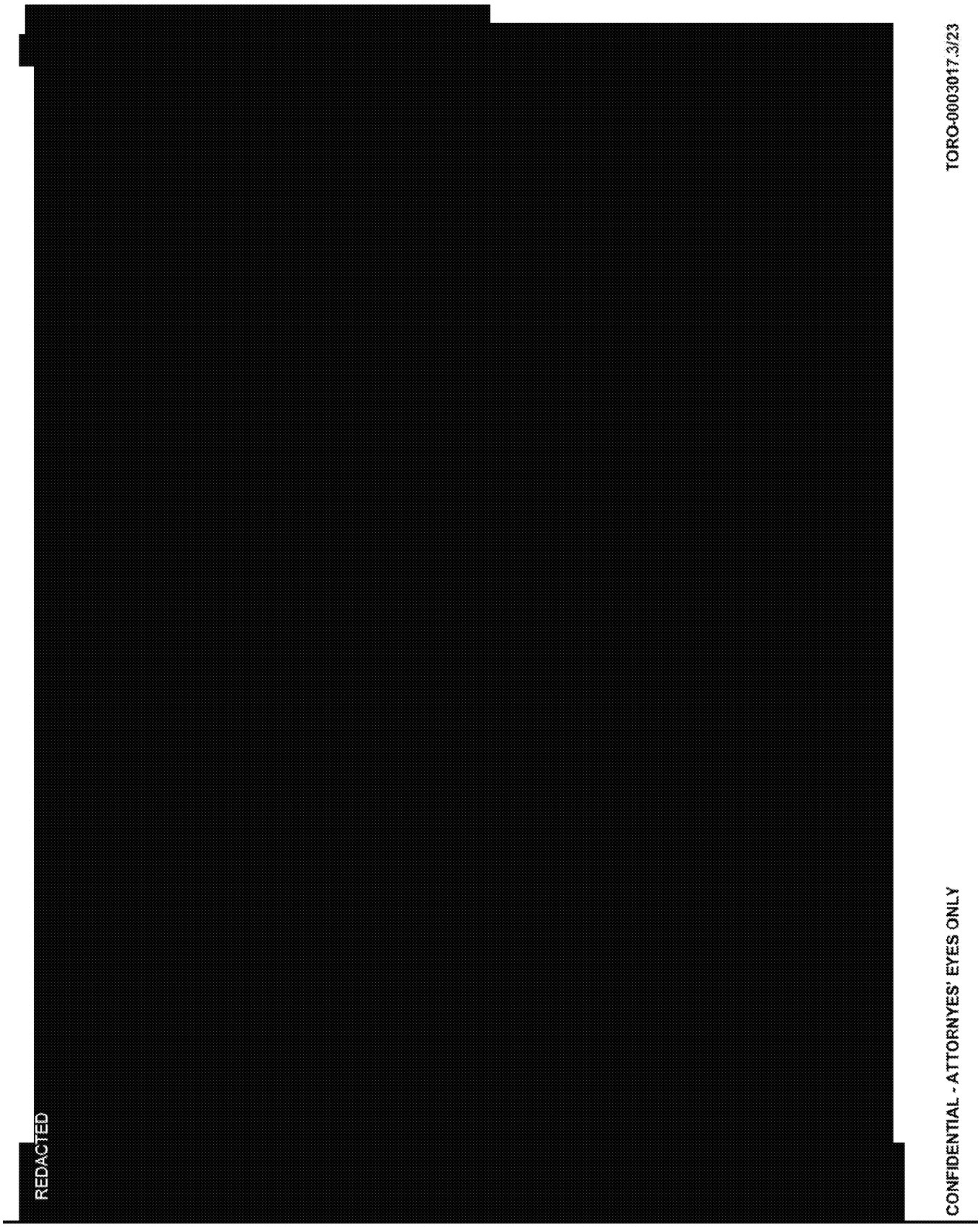
*Revision to this design/results expected

TORO-0001918.10/10

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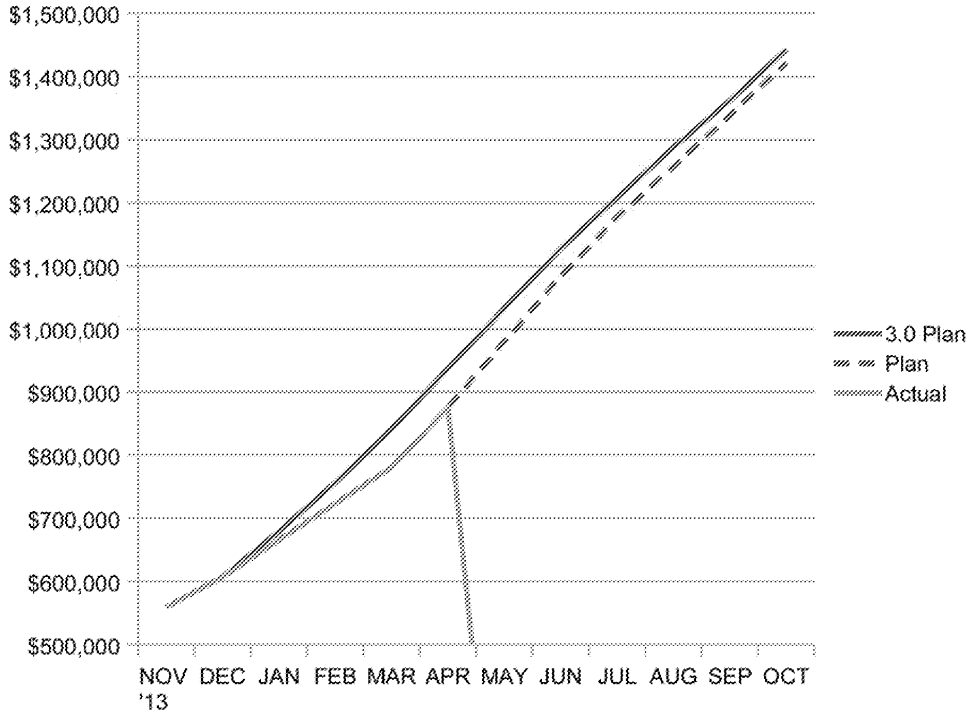
W298 TMAX UPDATE

2
TORO-0003017.2/23
REDACTED
CONFIDENTIAL - ATTORNEYS' EYES ONLY


TORO-0003017.3/23
REDACTED
CONFIDENTIAL - ATTORNYES' EYES ONLY

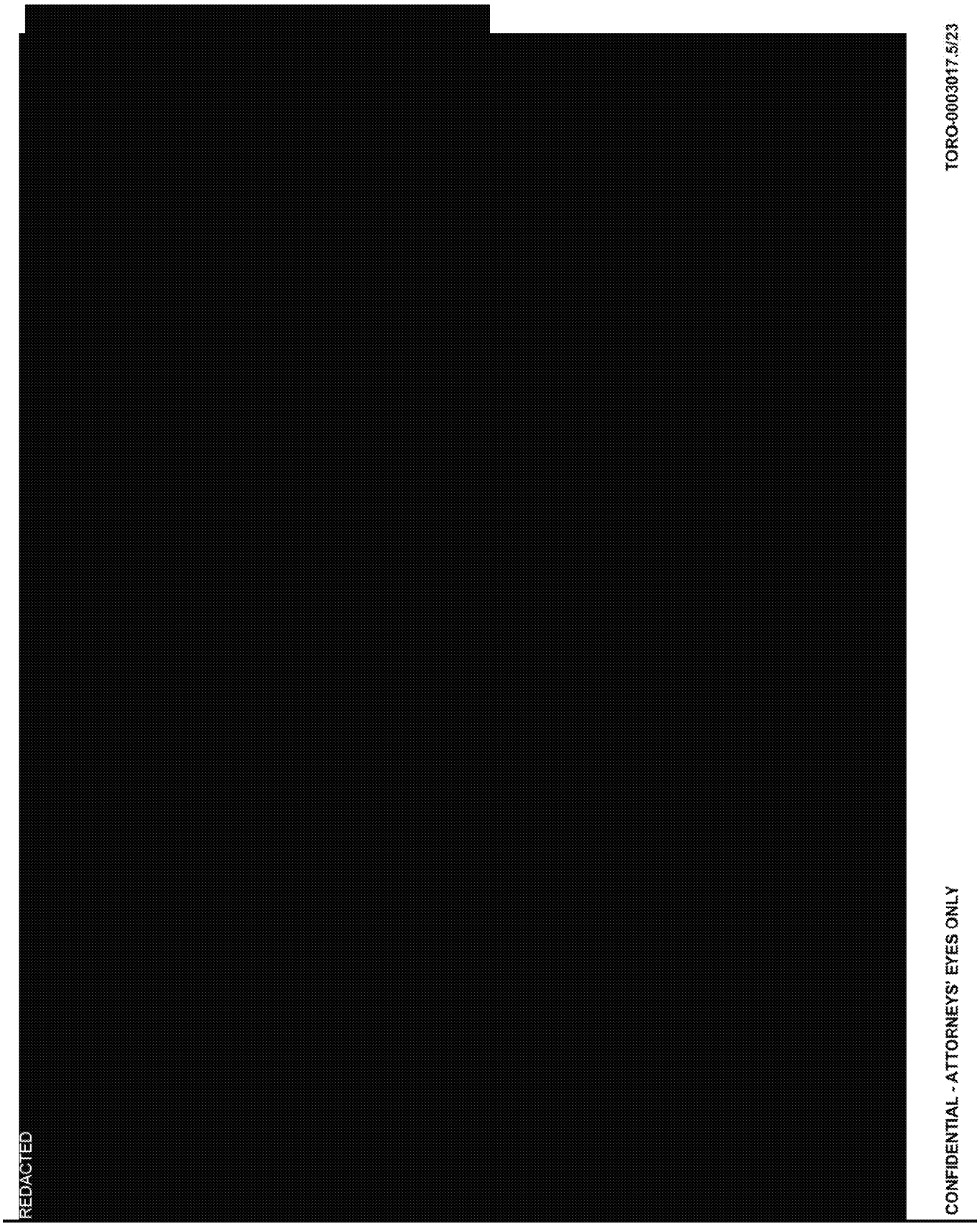
W298 TMAX UPDATE

Budget Update



- Spending is favorable YTD but will catch up as parts P.O.s ramp up
- Graph assumes using $10K from Holdback for Universal Engr.

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TORO-0003017.5/23
CONFIDENTIAL - ATTORNEYS' EYES ONLY
REDACTED

W298 TMAX UPDATE

Cost Updates

- Cost increases are mainly due to adding money back in to the loader arm and cylinders for durability after FEA results
- Cost decrease on the WT is mainly due to the drive wheel and track quote
- Still pursuing a major cost reduction on the WT bearing REDACTED REDACTED
- Cost risks:
  - Final control configuration will likely add cost back
  - Main loader castings, not all final quotes are in
  - Assembly and weld rates have not been reviewed since 3.0

*Highlighting Added = CONFIDENTIAL ATTORNEYS' EYES ONLY

TORO-0003017.6/23

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[redacted]

REDACTED

TORO-0003017.7/23

CONFIDENTIAL - ATTORNEYS' EYES ONLY

[redacted]

REDACTED

TORO-0003017.8/23

CONFIDENTIAL - ATTORNEYS' EYES ONLY

W298 TMAX UPDATE

Test Updates – 2.0 machines

- Both machines were updated with heavier duty arms and lift cylinders (still 2.0 geometry)
- Duty cycle work with several attachments was completed at Riverside to verify FEA numbers and scaling
  - Trenching
  - Auger
  - Bucket
  - Leveler
  - Forks
  - Grapple



TORO-0003017.9/23

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W298 TMAX UPDATE

Schedule Update

Milestone Dates	3.0 Plan	Update	Comments
3.0 Signoff	2/17/14	2/17/14	
3.0 Prototype Build Completed	5/27/14	6/19/14	Current date assuming tooled radiator lines and tanks
3.5 Update	6/23/14	7/28/14	Control decision after VOC of 3-4 designs
Long Lead / Tooling Releases	9/25/14	10/6/14	Assumes 16 wk lead time – Poclain pumps will be earlier
4.0 Signoff	10/15/14	11/7/14	
4.0 Updates	10/29/14	11/10/14	Complete 500 initial test hours and then update – Completely update Mktg unit for Sales matls
5.0 Signoff	1/5/15	1/12/15	
Pilot Build Completed	1/14/15	1/23/15	
Rental Show 2015		2/22/15	See Marketing plan if pilots are not available for ARA
Production	3/12/15	3/23/15	
Release to Ship	3/19/15	3/30/15	

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W298 TMAX UPDATE

Schedule Issues – Getting back on track

Long lead items

- Radiator hoses could not be finalized until the radiator was finalized; these need to be tooled and held us up during the 2.0 build
  - Action Plan: Push Veyance to make hoses; temporarily use flex hoses
- Fuel tanks require long lead tooling; We did not want to finalize the design until we were satisfied with the shape and function
  - Action Plan: Run with temporary tanks until tooled tanks are available
- Loader castings – see next page

TORO-0003017.11/23

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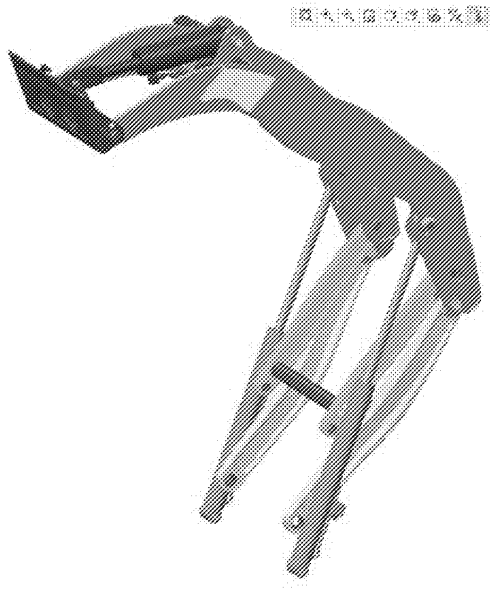
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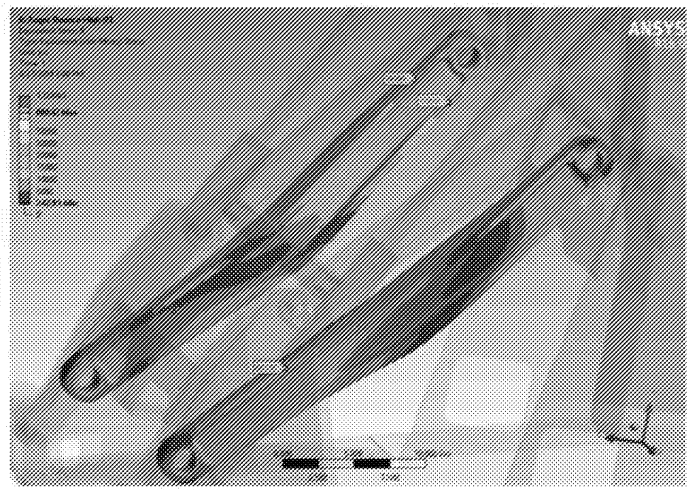
W298 TMAX UPDATE

Schedule Issues – Getting back on track

Ensuring durability

- Since the loader is a major durability concern, those parts were held until a 2nd iteration of FEA was completed and verified against field data
  - Action Plan: Castings have been upgraded based on FEA and sourced with Craft and are not going to be an availability issue





TORO-0003017.12/23

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W298 TMAX UPDATE

Controls

- Based on VOC, team has been challenged to come up with controls that are better suited for the Next Gen (controls that closely align with this larger, faster machine with dedicated platform)
- On Next Gen units the current TX-style controls are:
  - not ideal for operating with one hand – max efficiency requires controls be operated with one hand majority of the time
  - too big and bulky for the larger, higher speed machines on the market today
  - too cumbersome and time consuming when performing the significant number of tight turns that are required at today's jobsites, especially with higher speeds
  - best suited for walk behind units

TORO-0003017.13/23

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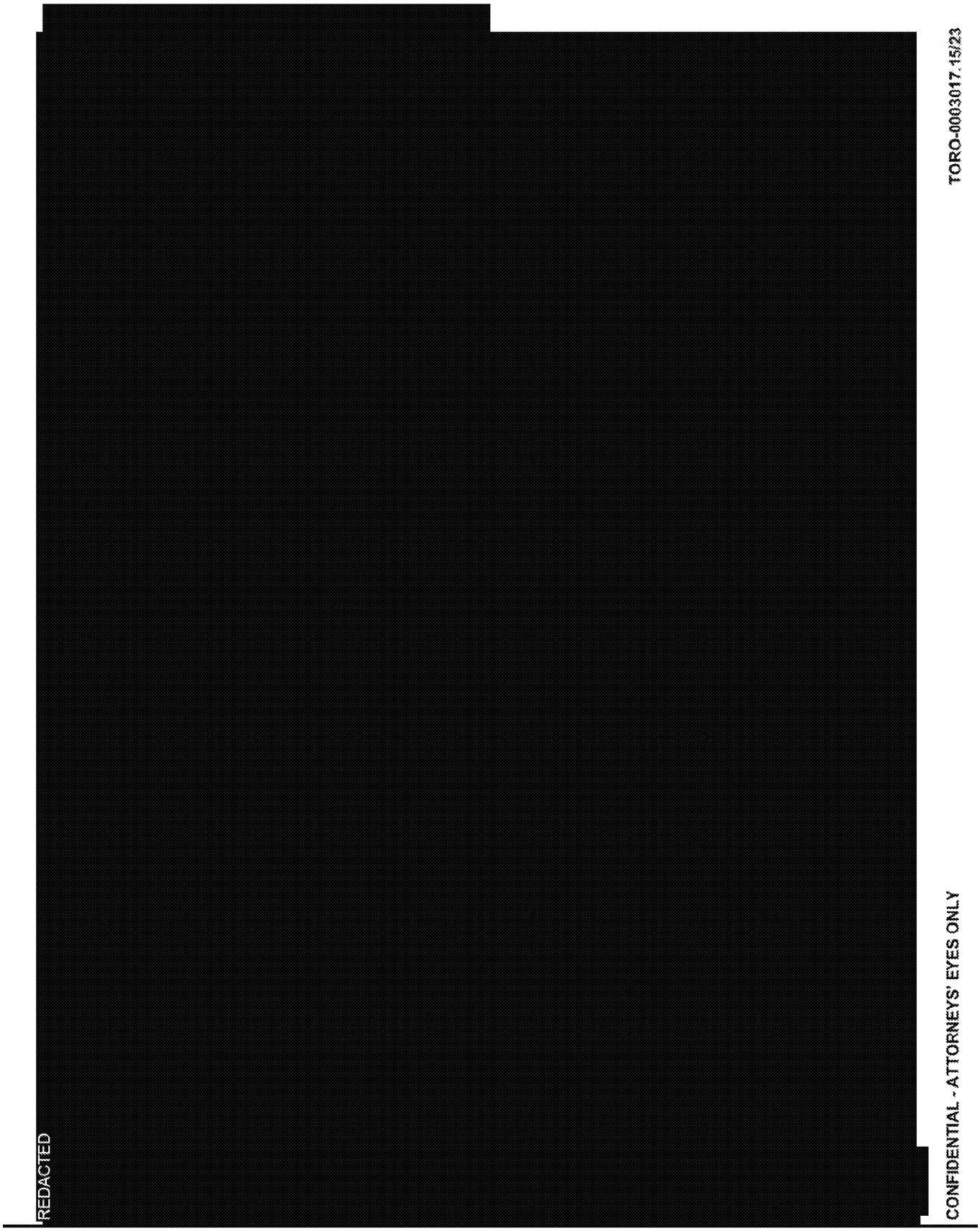
W298 TMAX UPDATE

Schedule Issues – Getting back on track

Controls

- Implementing control ideas that work – We are still searching for an acceptable method of actuation and control shape
  - Action Plan:
    - Build with "default" two-lever design; the control area is designed so it can be easily switched out on the prototypes
    - Assign one design idea to Joe Knipp to finish out (Dogbone)
    - Utilize Universal Engineering for a 2nd design (Steering Wheel)
    - Complete VOC in June and July with a decision by the end of July
    - Assuming 14 weeks of testing prior to 4.0 update, controls will still have 350 hours on them before 4.0
    - Lab cycle testing of agreed-upon control system

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TORO-0003017.15/23
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TORO-0003017.16/23

CONFIDENTIAL - ATTORNEYS' EYES ONLY

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TORO-0003017.17/23

CONFIDENTIAL - ATTORNEYS' EYES ONLY

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TORO-0003017.18/23

CONFIDENTIAL - ATTORNEYS' EYES ONLY

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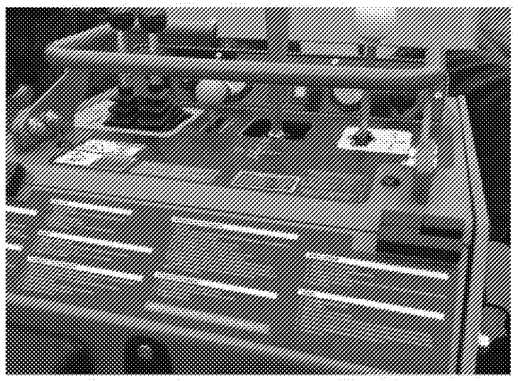
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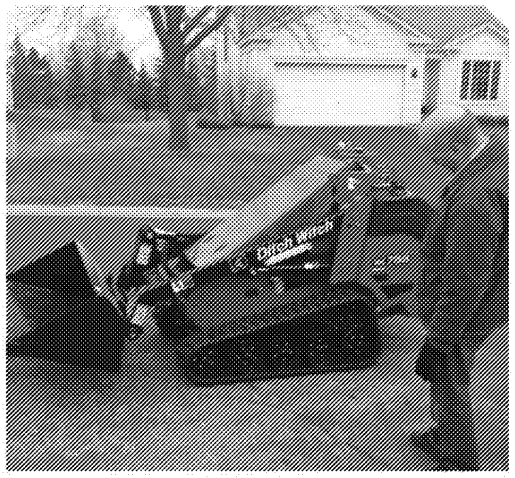
W298 TMAX UPDATE

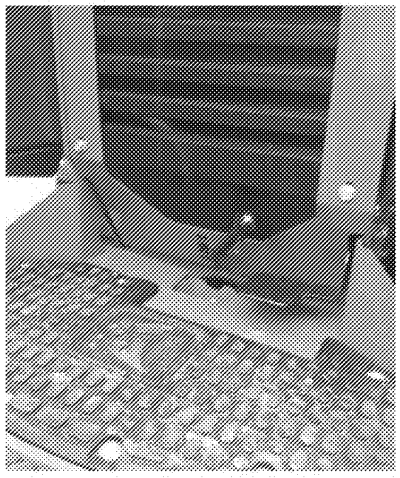
Ditch Witch VOC

- Consistently positive feedback on the controls
- High value placed on the platform and foot pedal
- Combination of increased specs and price is attractive to landscapers
- Track system does have its deficiencies









TORO-0003017.20/23

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TORO Count on it.

W298 TMAX UPDATE

Recent Competitive Actions

- How have competitors responded to Tier 4 Final?
  - Vermeer S800 TX now features a 40hp EFI engine (formerly a 35 hp diesel)
  - Reportedly, Ditch Witch is no longer manufacturing the SK 755 (featured 32.8 hp diesel engine), just the SK 750
  - The Ditch Witch SK 750 has the same lift capacity and lift height as the 755 but features a 24.8 diesel engine

TORO-0003017.21/23

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W298 TMAX UPDATE

Launch Planning

- Conducting regularly scheduled launch planning meetings
- Met with AV regarding timing of introduction, photography and video needs
- Held initial discussion with Performance Marketing regarding launch timing, launch communication ideas, and advertising plan
- June 5 meeting scheduled to discuss 2015 trade show assets and planning
- Launch will also focus on the entire family of Dingo products
  - No comparable breadth of product in the marketplace
  - All video, literature, and images of current TX and Wheeled Dingo product and attachments will also be updated
  - Updating of materials for current product will be done this summer (July 22-24)

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Questions?

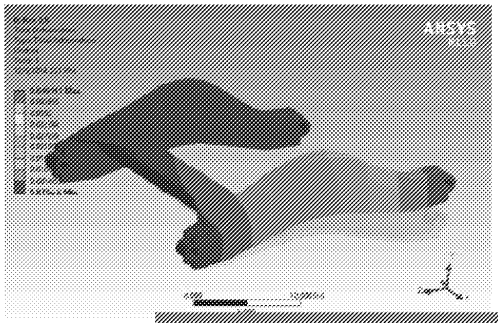
TORO Count on it.

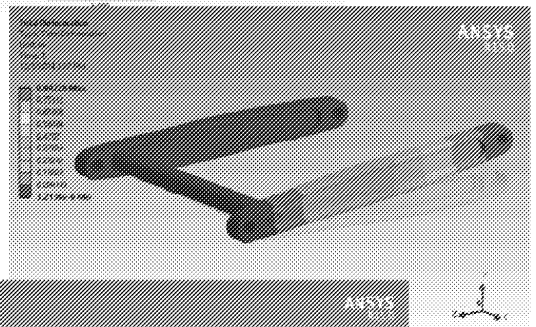
W298 TX1000 UPDATE

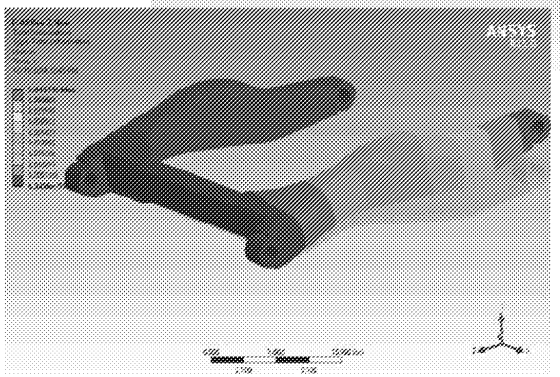
12/15/14

Loader Arm Testing

- FEA has confirmed the upper link can flex to cause independent movement between the lift cylinders
- A fabricated single piece link was designed to exceed the 2.0 design (since this design does not have a racking problem)
- Proceeding with updating all machines with this design
- FEA on entire loader will be re-run with the new piece to confirm







TORO-0003163

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W298 TX1000 UPDATE

12/15/14

Loader Arm Testing

Configuration	Case 1 Torsional Loading	Case 2 Torsional Loading (no ROPS)
3.0	0.847	1.355
2.0	0.049	0.051
4.0	0.077	0.089
3.0 Rev 2	0.245	0.248
4.0 Rev 2	0.046	0.048

TORO-0003164

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W298 TX1000 UPDATE

12/15/14

Combined Flow Aux. system

- The lab unit was set up with a combined flow system and run with the auger (found to be acceptable)
- Gear pumps are in to update all 4.0 machines with combined flow pumps
- This also gives us a future “low flow” option feature if we want it by adding a diverter valve to the circuit
- Will still pursue a split flow system as backup, but combined is the “default” design at this point.

TORO-0003165

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W298 TX1000 UPDATE

12/15/14

Engine Heat work

- After modifications to the rear radiator intake; heat runs were able to be completed
  - Water and oil cooling seems adequate but we are not expelling the heat from the machine
  - Need to find exit lanes for the air out the front of the machine (move air cleaner, open up hood louvres)

TORO-0003166

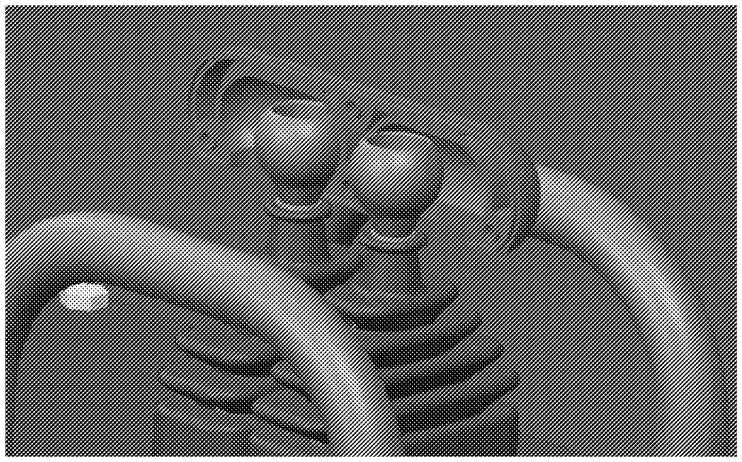
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W298 TX1000 UPDATE

12/15/14

Controls

- Input received from Micron on shaping, fastening, and materials for control parts
  - Outer handle: glass infused nylon
  - Inner ball: delrin
- Longer handle printed to increase available rotation (on the field unit)



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TORO-0003167

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W298 TX1000 UPDATE

12/15/14

Tomah Build / Releases

W298 Tmax	1305 Refit Plan	Current / Actual	Notes
Weld tool releases (902)	n/a		
Other long lead releases (902)	n/a		
3.0 updates (rework frame, muffler, and hoses)	11/12/2014	11/20/2014	1st unit up and running; 2nd unit followed a few days later
500 hours completed (902)	n/a	n/a	The D902 3.0 machine stopped at 224hrs due mainly to poor weather
Weld tool releases (1305)	11/5/2014	11/24/2015	Loader arm was the last major weldment released; still a full 16 wks from pilot date; a few minor weldments (platform) are still unreleased as we design around them
Other long lead releases (1305)	12/5/2014	12/1/2014	Engine was released 12/1. Combined flow pump is not released but is already in Casappa's system and readily availble
4.0 updates / 1305 refit	1/15/2015	1/16/2015	Current start date for the build is 1/12
Final releases	1/27/2015	1/27/2015	
Pilot Build	3/10/2015	3/16/2015	Date officially in the line 15 schedule
Production	4/28/2015	4/22/2015	Date officially in the line 15 schedule
Release to ship	5/5/2015	5/5/2015	
500 hours completed 1305	6/9/2015	6/9/2015	
1000 hours on engine	10/27/2015	10/27/2015	

TORO-0003168

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W298 TX1000 UPDATE

12/15/14

Tomah Build / Releases

- 4.0 build
  - Releasing the last of the steel parts for the 4.0
  - Will begin some teardown work on the 3.0's this week (loader test unit, field unit?)
  - Most weldment parts are due in prior to Christmas, will depend on Woody's availability
  - Will need to tool handle parts from a rapid prototype vendor
  - Gabe will likely weld all of the new upper links for 4.0 updates

- Production
  - Stock Kubota engines will need to continue to be used until we finish Kubota's application approval, possibly up to and including first production
    - Stock engines already ordered for pilot
    - Will possibly rout through a Kubota dealer to rework to our spec

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TORO-0003170

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TORO Count on it.

W298 TX1000 UPDATE

12/15/14

Photo/video shoot - Pensacola, FL





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W298 TX1000 UPDATE

12/15/14

10

TORO-0003172

W298 TX1000 UPDATE

12/15/14

TORO-0003173

W298 TX1000 UPDATE

12/15/14

TORO-0003174

W298 TX1000 UPDATE

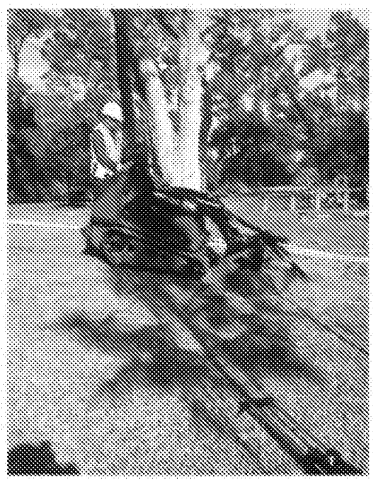
12/15/14

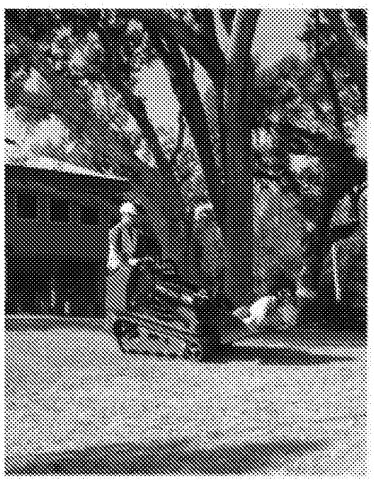
13

TORO-0003175

W298 TX1000 UPDATE

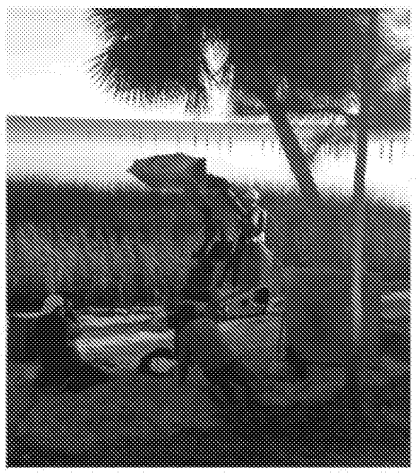
12/15/14





W298 TX1000 UPDATE

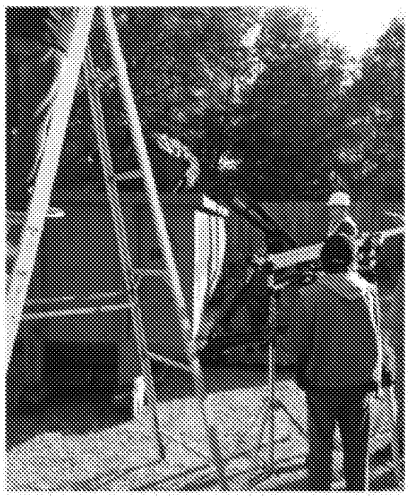
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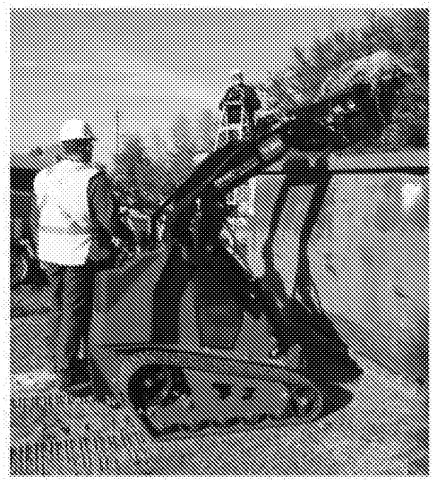




W298 TX1000 UPDATE

12/15/14





TORO

TX1000
Torque Tube

12/11/2014

TORO-0000571.1/10

Model



- Used geometry from upper_links_fea.asm.1
  - Last geometry, 4.0 Rev 2, will be updated

WINDCHILL/SWS/W298/UPPER_LINKS_FEA.ASM

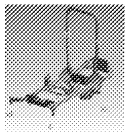
3.0	2	130-5165OLD2	LINK-UPPER
	1	130-5192	SUPPORT-CROSS OVER (MACHI
2.0	1	125-3710	LINKS/CROSSOVER ASM (WELD
4.0	2	130-5165	LINK-UPPER (MACH)
	1	130-1132	SUPPORT-CROSSOVER (MACHIN
3.0 REV 2	2	130-5262	LOADER ARM LINK ASM (WELD
	1	130-5269	CROSSOVER ASM (WELDED)
4.0 REV 2	1	117-1874	UPPER LINK ASM (WELDED (CUTTING)

Received 12/10/2014

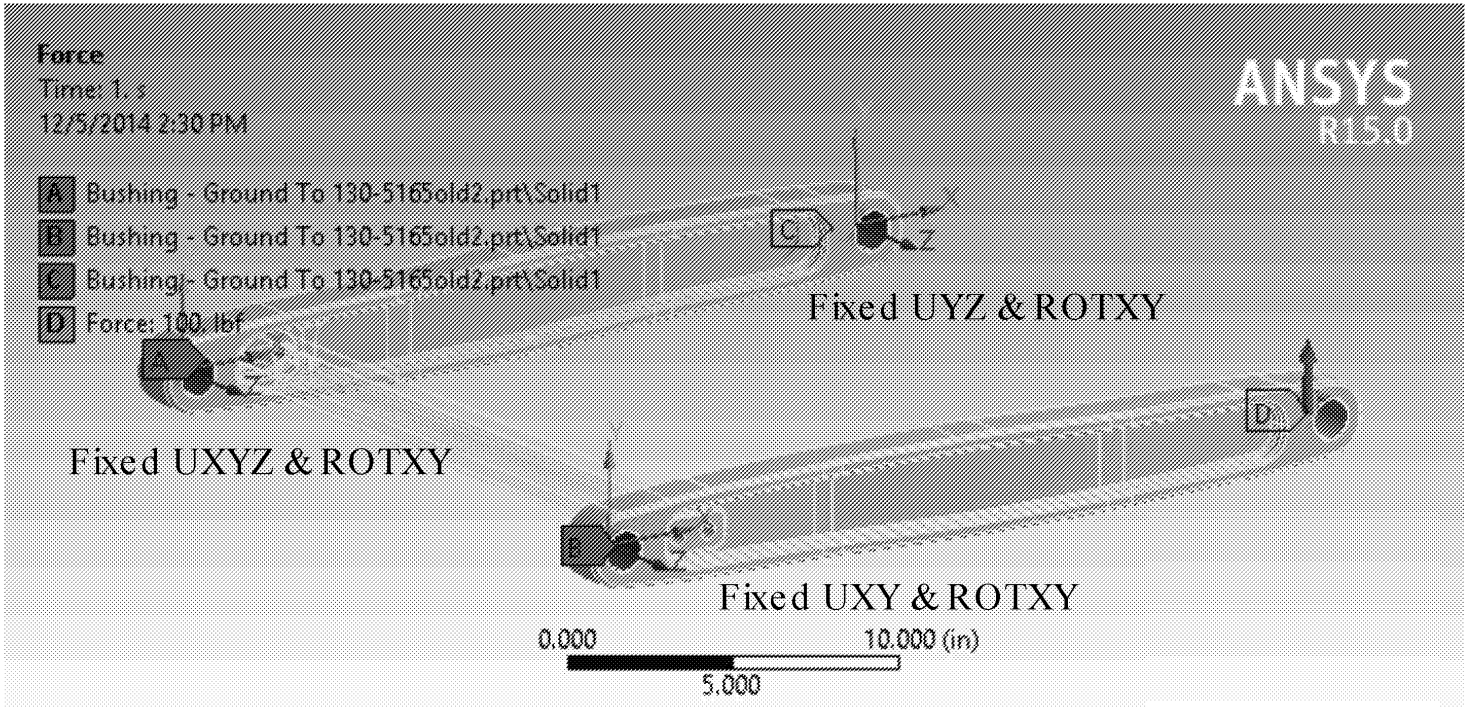
TORO-0000571.2/10

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Torsional Loading



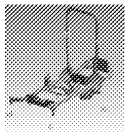
- 100 lb vertical force



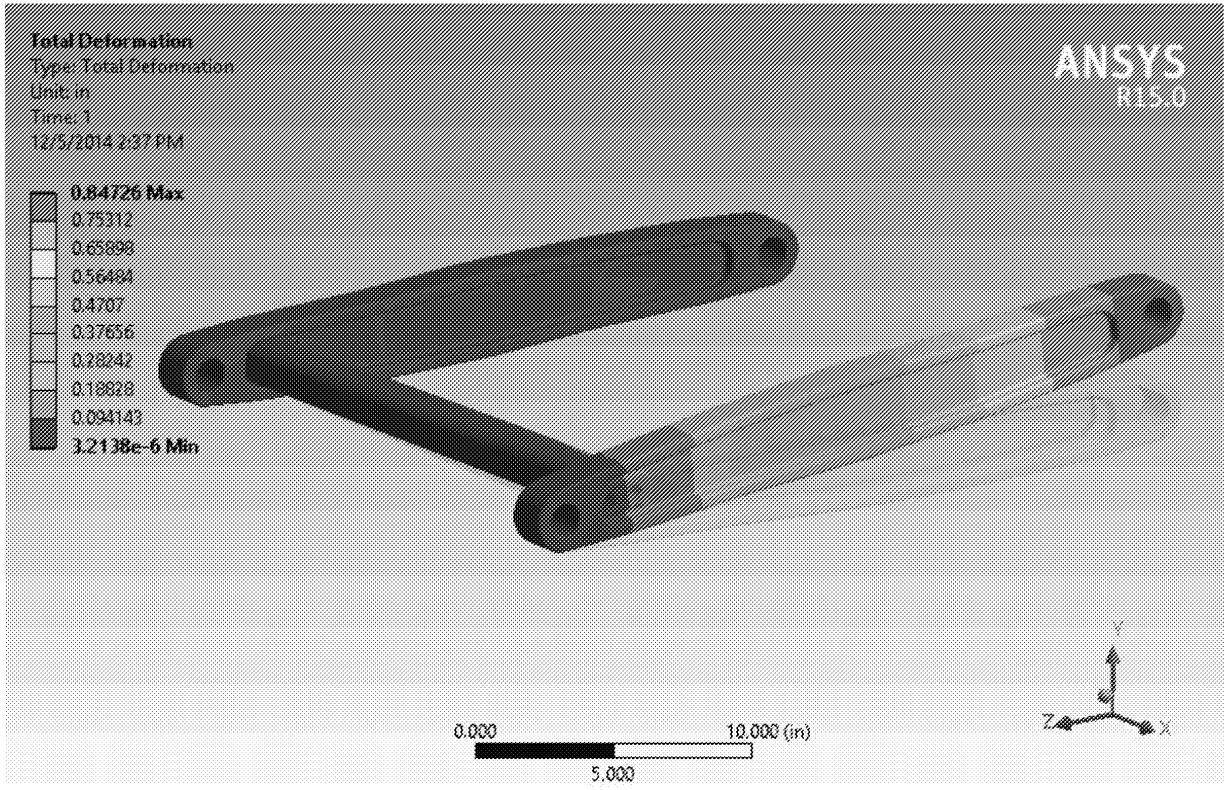
TORO-0000571.3/10

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Configuration 3.0

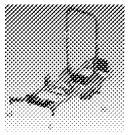


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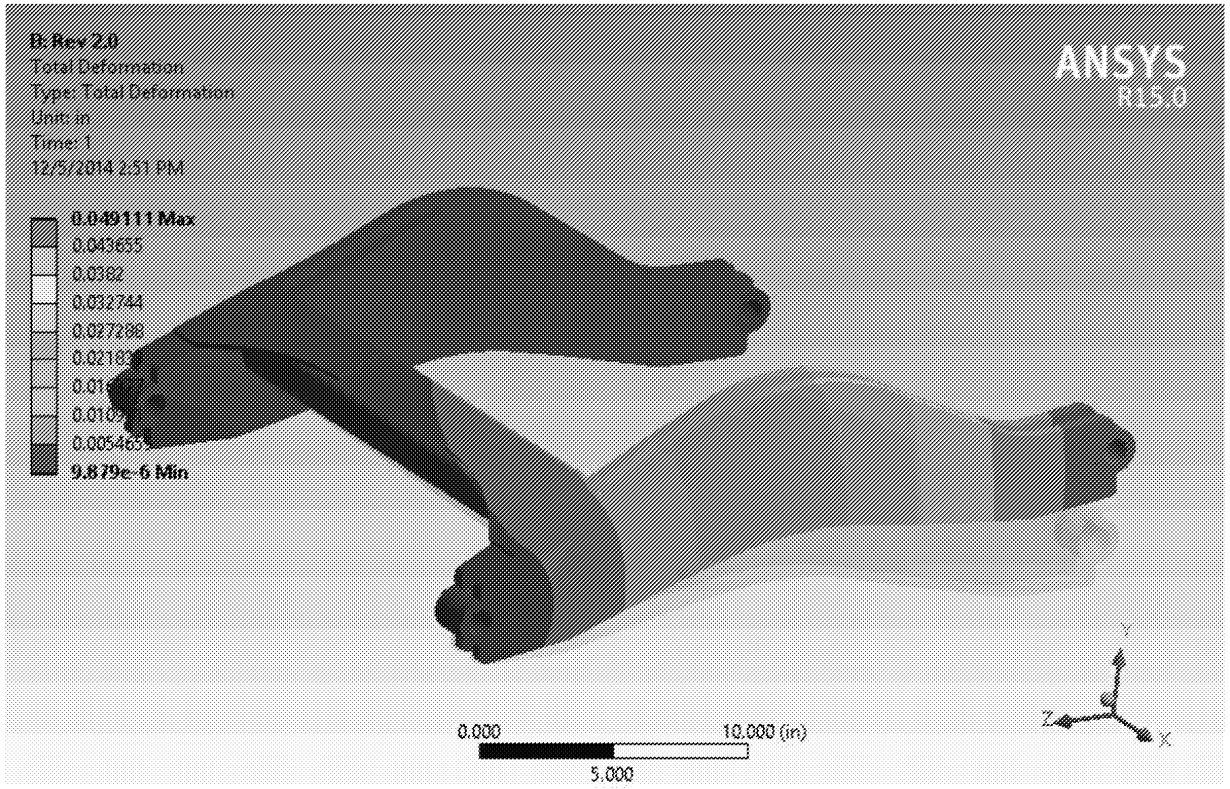


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Configuration 2.0



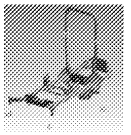
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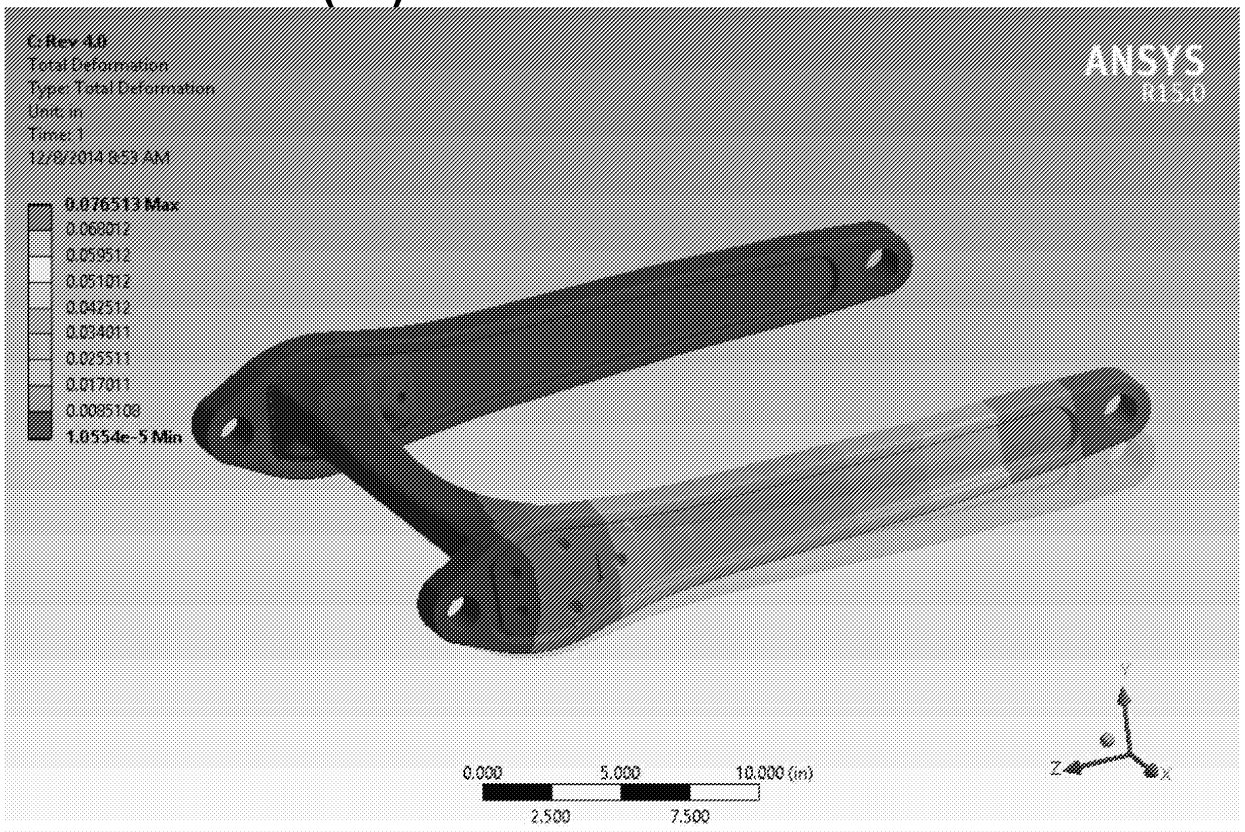
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Configuration 4.0



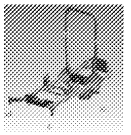
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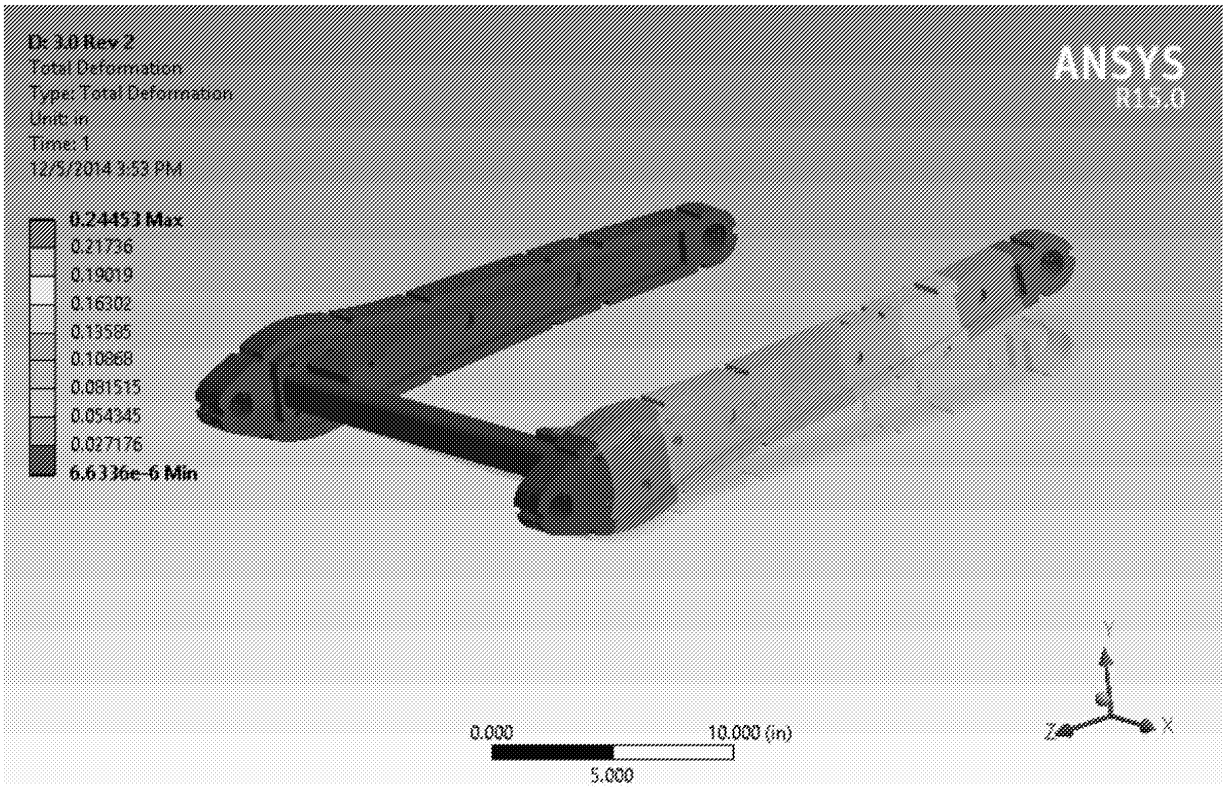
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Configuration 3.0 Rev. 2



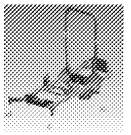
- Deflection (in)



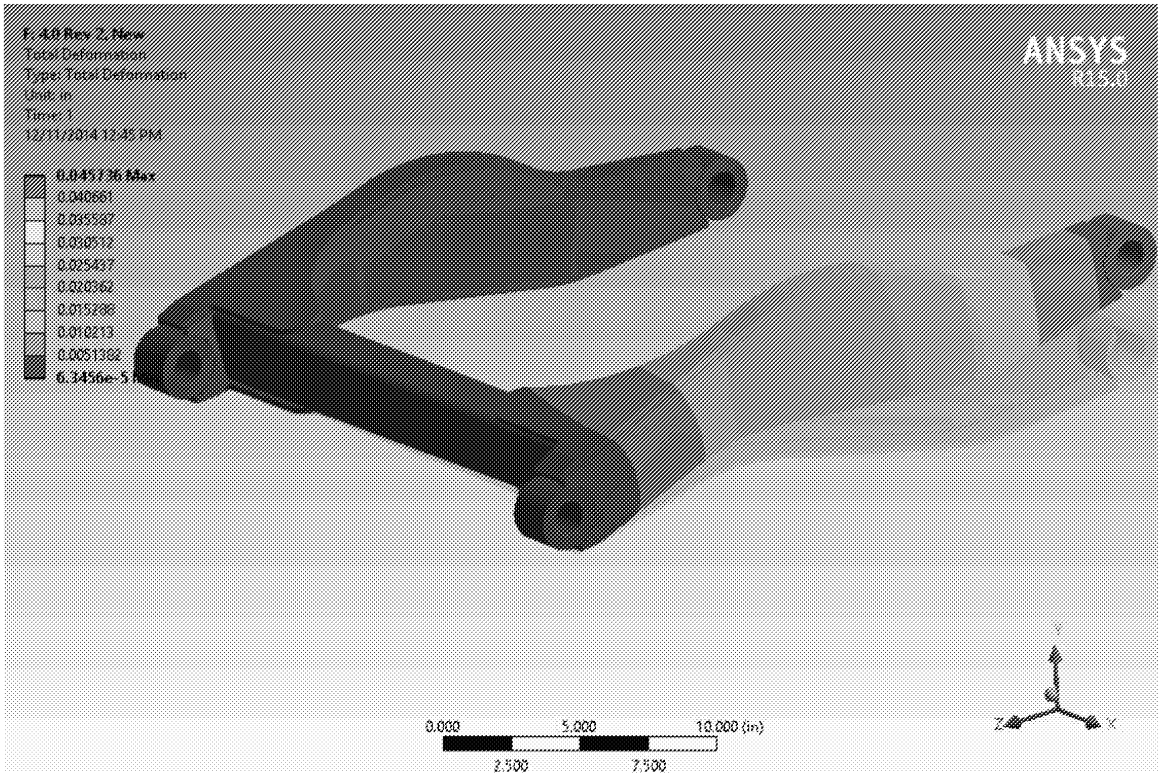
TORO-0000571.7/10

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Configuration 4.0 Rev. 2



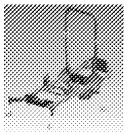
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- Deflection (in)



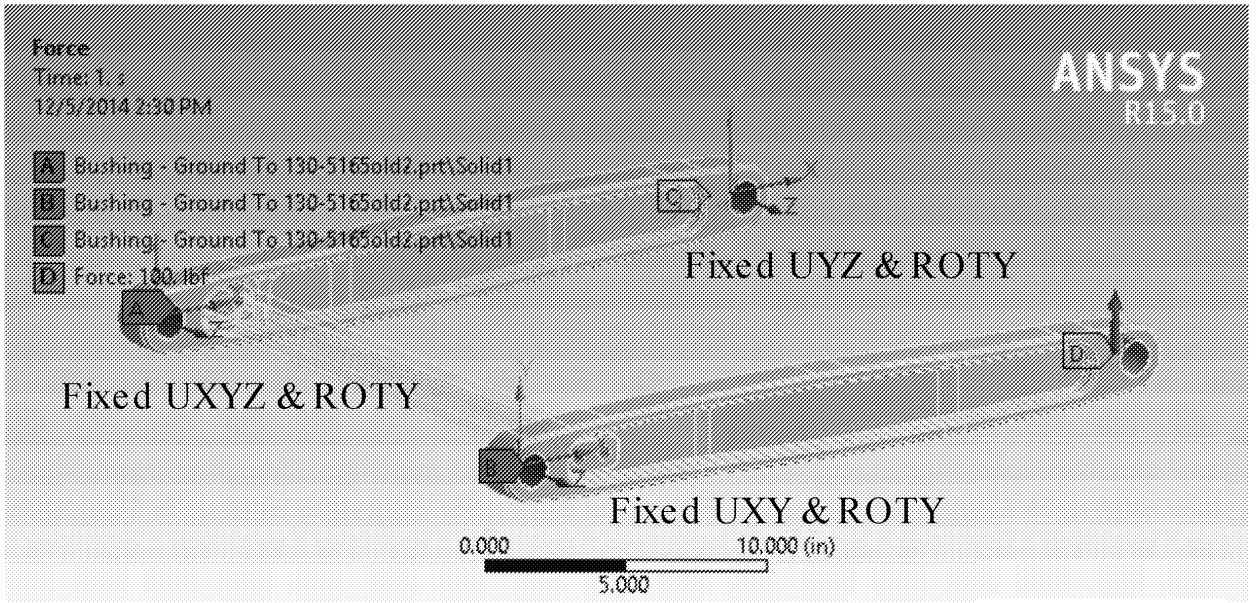
TORO-0000571.8/10

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2nd Case, Torsional Loading



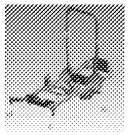
- Case with released ROTX (3 plcs.)
  - No pics included, but added to table of slide 10
  - 100 lb vertical force



TORO-0000571.9/10

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Summary



- Deflection (in)

Configuration	Case 1 Torsional Loading	Case 2 Torsional Loading (no ROTX)
3.0	0.847	1.355
2.0	0.049	0.051
4.0	0.077	0.089
3.0 Rev 2	0.245	0.248
4.0 Rev2	0.046	0.048

TORO-0000571.10/10

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2.0 Feasibility Entrance Gate Decision and Feedback

2.0 Feasibility Entrance Gate Approval Requirements

Use the calculation and matrix below to determine approval requirements.

Corporate Project Spending Approval Requirements (in Thousands)	
Project spend to date (including tooling) (in Thousands)	**$2**
Spend projected **to *complete the Feasibility Phase*** (including tooling) (in Thousands)	**$495**
(use this Total to determine approval level) (in Thousands) **Total**	**$497**

Corporate Project Approval Matrix: Total		
All Amounts	**Total ≥ $250k**	**Total ≥ $500k**
Division Managing Director/GM	Division Managing Director/GM	Division Managing Director/GM
	Group Vice President	Group Vice President
		Managing Director, Corporate Controller
		Vice President of Finance/CFO
		Chairman & Chief Executive Officer

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2.0 Feasibility Entrance Gate Decision and Feedback

Decision Makers	Name	Ok As-Is	OK w/Changes Noted	STOP	Rework & Return	Signature	Date
Vice President, RLC	Michael Happe						
GM Siteworks Systems	Rick Rodier						
Division Controller	Brad Mlynar						
International Controller	Mike Hall						
Marketing Manager	Neil Borenstein						
Engineering Director	Joe Hager						
Manufacturing Director	Cabrini Brandl						
National Sales Manager	Butch Greeninger						
Customer Care / Service Director	Jack Hensley						
Engineering Tech Svcs Director	Greg Tonsager						
Marketing Director, International	Mike Brugh						

Details, 2 pgs

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TORO-0000763

2.0 Feasibility Entrance Gate Decision and Feedback

Project Team			
Marketing Leader	Sean O'Halloran	**Quality Engineer**	Tony Niemczyk
Engineering Leader	John Azure	**NPD Sourcing Specialist**	Randy Huerkamp
Manufacturing	Doug Arch	**Customer Care**	Kevin Conney
Advanced Manufacturing Engineer	Andrew Berglund	**Test**	Dave Murray
Financial Analyst	Justin Huth		

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2.0 Feasibility Entrance Gate Decision and Feedback
Feedback
W298: Next Gen TX
2.0 Feasibility Entrance Gate
Detail 2 / 2
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TORO-0000765

Business and Project Strategy

Explain how this new product aligns with the business strategy and product category strategy. Describe how the market strategy will optimize the sales of this new product.

- Tracked Dingo units have been losing market share in the tracked utility loader segment. The Next Generation Dingo will create momentum for the product line and allow Toro re-gain significant market share.
- It is important to do the project now so that market share loss can be stopped and Toro can quickly gain share.
- The Next Generation Dingo project will improve upon a number of unit features so that Toro can meet, and exceed, competitors' specifications and become the #1 Compact Utility Loader of choice for contractors.

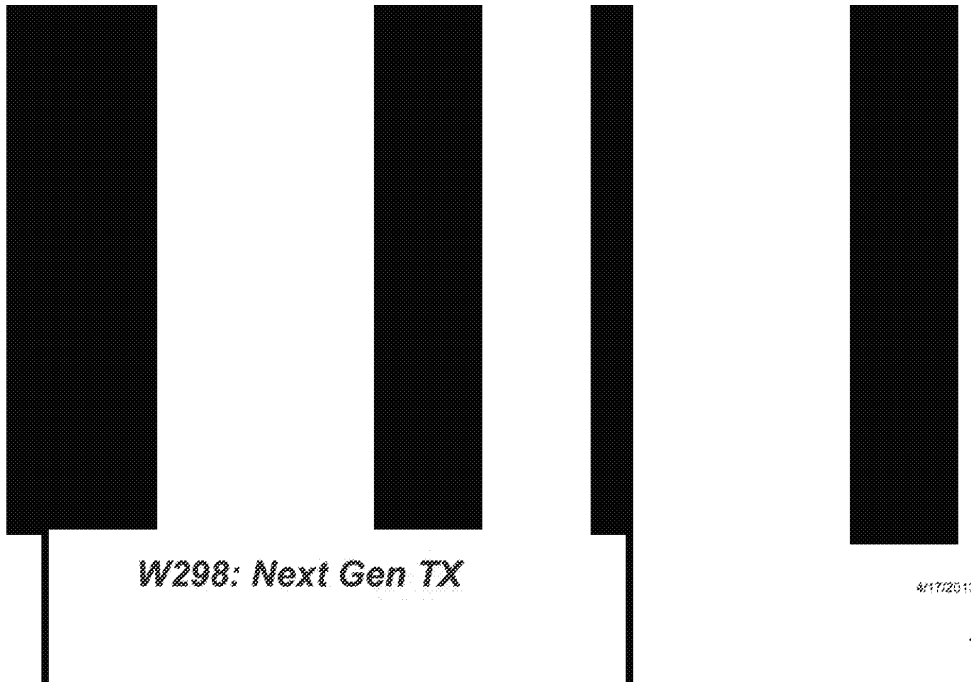
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Project Objective

Define the specific objective of the project. Describe the purpose of the project and identify the measures and timing of project success. Include a description any constraints or nonnegotiable parameters set for this project or product that must be achieve.

- Increase Toro market share in the compact utility loader category with the introduction of the Next Generation Dingo.
- Leverage the success and innovation of the Toro Tracked Dingo units and carryover the line's reputation for performance and durability to the Next Generation Dingo.



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Plan for obtaining the Voice of the Customer

Explain in detail how you will collect the voice of the customer data for this product and market. Include the definition of the target customer, what is now known, what is unknown, which customers you will contact, how the customers will be chosen, how the customer information will be recorded, and the timing for the research.

- VOC activities planned during Feasibility Phase
  - Interview current loyal Tracked Dingo users in all regions and continue to gather feedback on current models
  - Gather additional contractor feedback on the newest/largest Vermeer and Ditch Witch models (in addition to other competitors)
  - Gather specific feedback on the Next Gen prototype units that will be built during the Feasibility Phase
    - 1 national account customer
    - 2 current customer accounts
      - Bobcat Enterprises of Cincinnati, OH
      - 1 additional account in the mid-Atlantic region
    - Feedback from select contractors in Mpls/St. Paul area
    - (Prototype build currently scheduled to be complete 7/29/13)

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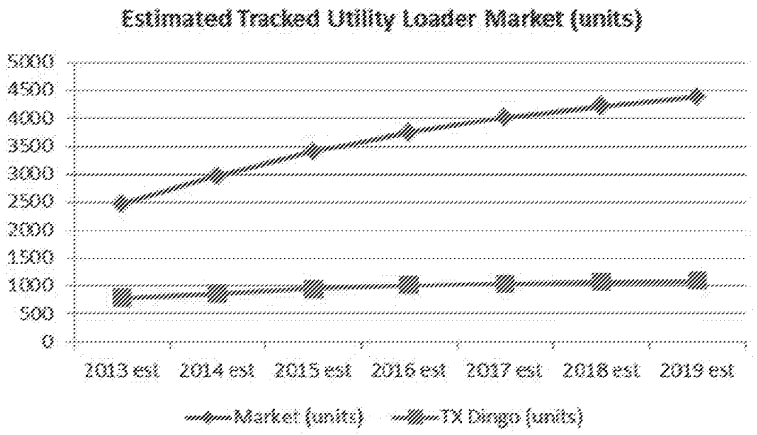
Ex. 2015
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Market Estimate

Estimate the total global market size, the segments and trends. Describe growth potential and significant factors influencing the market.

- AEM provides unit data for the number of Tracked Utility Loaders sold
  - 2006 was the peak year with REDACTED units sold (U.S.)
  - 2010 experienced the lowest number of units sold with REDACTED units (U.S.)
- Category growth will continue to outpace modest Tracked Dingo product line growth without the Next Generation Dingo

REDACTED



2.0 Feasibility Entrance Gate

W298: Next Gen TX

Details, 1 pgs

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*Highlighting Added = CONFIDENTIAL ATTORNEYS' EYES ONLY

TORO-0000769

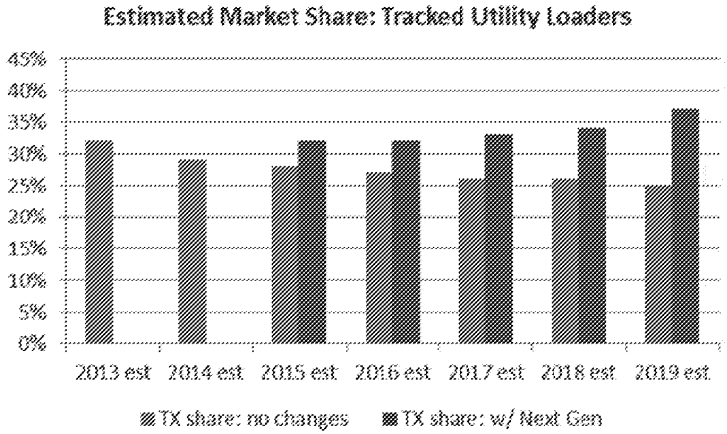
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Market Estimate

Estimate the total global market size, the segments and trends. Describe growth potential and significant factors influencing the market.

- U.S. market share for Tracked Dingo units has dropped significantly since pre-2008 levels
- With availability in 2015, the Next Generation Dingo will result in increased market share and growth for the product line

REDACTED



2.0 Feasibility Entrance Gate

W298: Next Gen TX

Detail 1 / 1

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TORO-0000770

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Competitive Products and Services

ey the competitors and list the strengths and weaknesses of companies/brands and models that would pete with our current product and the new product. Consider services a customer may also choose as a hasing alternative.

- Ditch Witch and Vermeer are Toro's two largest competitors in this segment. Toro continues to lose sales to these competitors because they have specifications that the tracked Toro Dingo units cannot currently match. These key specifications are:
  - Hinge Pin Height, Dump Height, and Tipping Capacity
  - (see slide on next page for a listing of specifications)

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Competitive Products and Services

vey the competitors and list the strengths and weaknesses of companies/brands and models that would pete with our current product and the new product. Consider services a customer may also choose as a hasing alternative.

- Lost market share is a direct result of the Tracked Dingo units being insufficient in 3 major specifications:
  - Hinge Pin Height, Dump Height, and Tipping Capacity
- The main competitors' largest units can lift more weight, lift more weight to a much greater height, and dump more weight at a much greater height

	Toro				Ditch Witch		Vermeer			
Specs	TX 427	TX 427 Wide Track	TX 525 Diesel	TX 525, Diesel Wide Track	DitchWitch SK750 (Diesel)	DitchWitch SK755 (Diesel)	Vermeer S450TX - Gas	Vermeer S450TX - Diesel	Vermeer S650TX - Diesel only	Vermeer S800TX - Diesel only
Unit weight without bucket (lbs)	1882	2075	1904	2001	2890	2890	2120	2300	2560	2950
Hinge pin height, max (inches)	65.8	65.8	65.8	65.8	81	81	72	72	80	84.5
Dump height, max - std. bucket (inches)	46.1	46.1	46.1	46.1	64	64				
Reach	21.8	21.8	21.8	21.8	17	17				
Tipping capacity (lbs)	1530	1530	1580	1580	2285	2285	1430	1430	1890	2400
Rated operating capacity ~ 35% of tipping capacity (lbs)	535	535	553	553	800	800	500	500	660	840
Engine Horsepower	27	27	25	25	24.8	32.8	27	24.8	24.8	35.1

*Note that Vermeer does not currently list their dump height and reach information

TORO-0000772

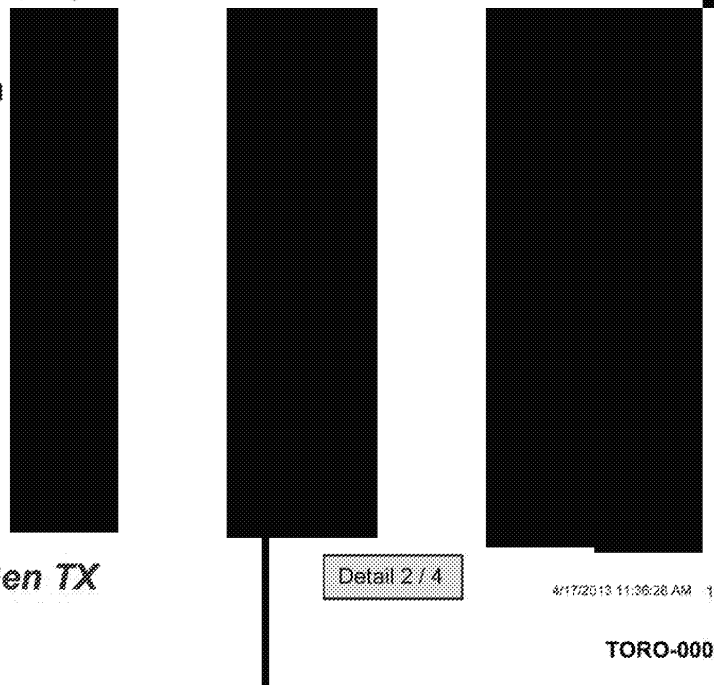
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Competitive Products and Services

ey the competitors and list the strengths and weaknesses of companies/brands and models that would pete with our current product and the new product. Consider services a customer may also choose as a hasing alternative.

- Not being able to match or exceed these key specifications translates into some specific and very common current jobsite activities that the Toro Dingo cannot currently accomplish:
  - Dumping jobsite material into a 1 ton truck
    - Truck bed height is 41", plus 24" raised sides = 65", plus additional needed clearance room
    - Reach becomes important when dumping into a shallow truck bed
  - Dumping material into a dumpster
    - 72" dumpster height is very common



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W298: Next Gen TX

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TORO-0000774

2.0 Feasibility Entrance Gate

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2.0 Feasibility Entrance Gate

W298: Next Gen TX

Detail 4 / 4

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TORO-0000775

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Details, 7 pgs

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TORO-0000776

W298: Next Gen TX

2.0 Feasibility Entrance Gate

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Detail 1 / 7

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W298: Next Gen TX

2.0 Feasibility Entrance Gate

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TORO-0000777

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Detail 2 / 7

W298: Next Gen TX

2.0 Feasibility Entrance Gate

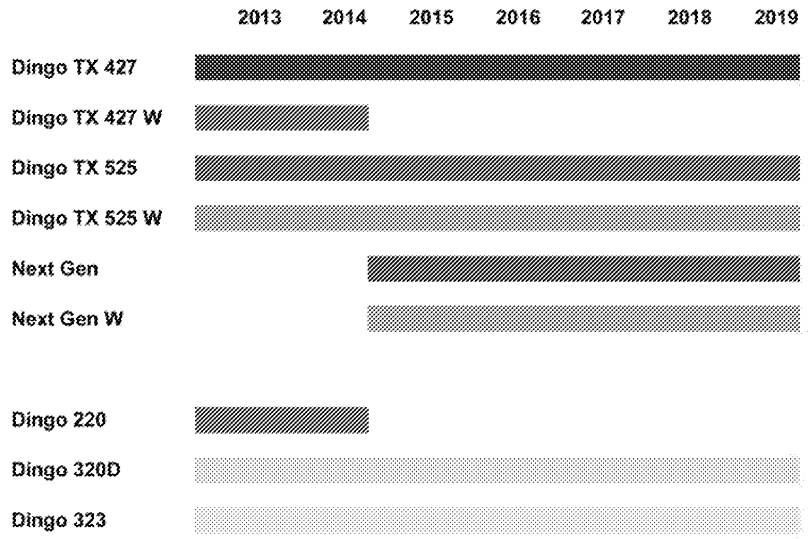
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TORO-0000778

Current Product Baseline

uate the current version the product we now sell. Establish a baseline by characterizing the total performance
e existing product. Sales, product cost, customer satisfaction, production performance, sourcing, warranty an
ice, and the product's performance specifications. Highlight the parameters which the new product must
ove.

- 2015 Tracked Dingo offering would be:
  - 427, 525, 525W, Next Gen, Next Gen W
  - When also looking at Wheeled Dingo units this would result in 7 total Dingo models with the Next Generation launch in 2015 (same number of models as before Next Generation launch)



2.0 Feasibility Entrance Gate

W298: Next Gen TX

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Detail 4 / 7
W298: Next Gen TX
2.0 Feasibility Entrance Gate
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TORO-0000780

Current Product Baseline

uate the current version the product we now sell. Establish a baseline by characterizing the total performance
e existing product. Sales, product cost, customer satisfaction, production performance, sourcing, warranty an
ice, and the product's performance specifications. Highlight the parameters which the new product must
ove.

TX Customer wish list (these will not nec. be incorporated into the design but have been accumulated from years of customer feedback):

- Lift height and capacity to match the competition
  - Retain the compact design of the Dingo
- Hi-drive track
- Low operator control forces
- Ride-on platform with improved ground clearance
- Improved Qtach geometry
  - Durability / cylinder advantage
  - Increase rollback and dump
- Improved visibility to the attachment
  - Should be able to see the bucket edge when digging / grading
- Faster ground speed / variable torque traction

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Current Product Baseline

uate the current version the product we now sell. Establish a baseline by characterizing the total performance
e existing product. Sales, product cost, customer satisfaction, production performance, sourcing, warranty an
ice, and the product's performance specifications. Highlight the parameters which the new product must
ove.

TX Customer wish list cont…:

- Easy cleanout radiator
  - We changed screens on the Diesel TX to help with this but radiators still become plugged and compacted with debris
- Lower frame cleanout
  - Mud accumulates in the frame an corrodes the traction fittings
- Loader tower cleanout (debris gets under the cylinders)
- Track tensioner improvements
  - Dirt and mud also infiltrate the tensioning system and cause it to seize
- Improved parking brake
  - We have continually fought with the durability and action of the parking brake
- Improved track lug life
  - This has improved over the years but we have another opportunity to reduce the edges that cut the lugs

TORO-0000782

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Current Product Baseline

uate the current version the product we now sell. Establish a baseline by characterizing the total perfo
e existing product. Sales, product cost, customer satisfaction, production performance, sourcing, warr
ice, and the product's performance specifications. Highlight the parameters which the new product mu
ove.

TX Customer wish list cont.…:

- Track suspension
- Low flow aux. flow option for cylinder applications
- Load sensing auxiliary
- Loader lock that does not bend the lift cylinder rod when engaged
- Improved hydraulic and engine noise characteristics
- Improved batter access (diesels)
- Improved snow performance for the track system

TORO-0000783

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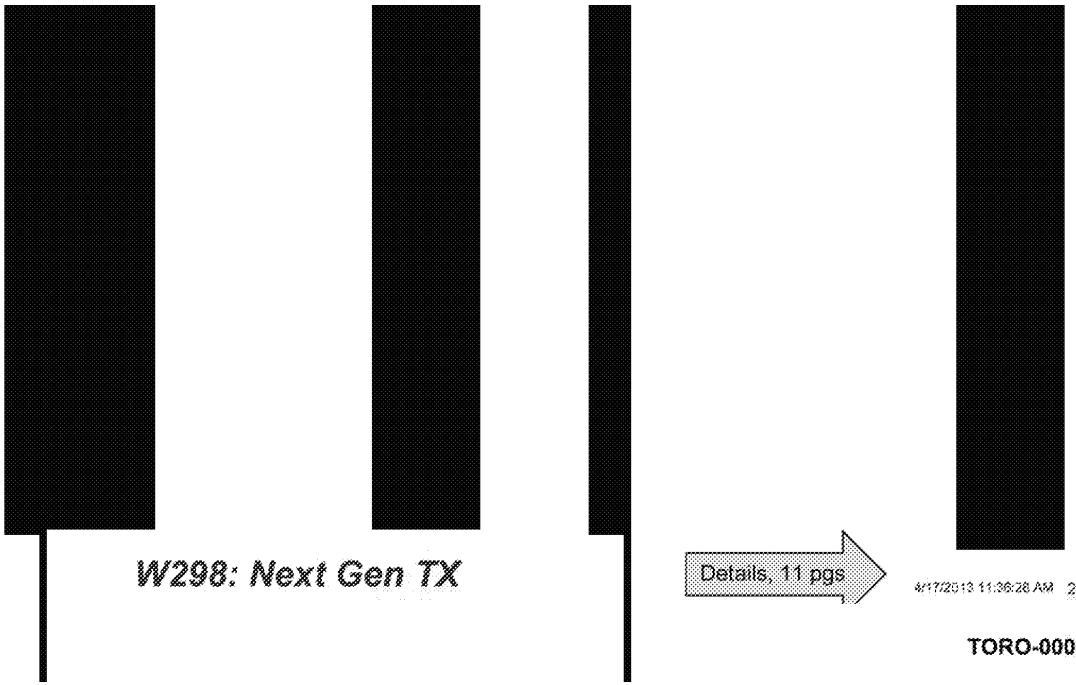
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Solution Alternatives

List possible product design ideas or service solutions. Do not let feasibility constraints limit you. For each solution or idea, note the benefits and limitations, from the customer perspective. Stretch for innovation.

Key specs and features to consider on the new TX design:

- Pin Height
- Lift Capacity
- Tracks
- Controls
- Engine
- Operator Zone



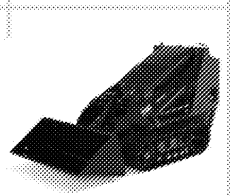
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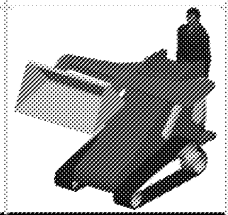
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Solution Alternatives

List possible product design ideas or service solutions. Do not let feasibility constraints limit you. For each solution or idea, note the benefits and limitations, from the customer perspective. Stretch for innovation.

TX / Tmax Spec Comparison





	Part / Feature	DingoTX 525	Preliminary TMax
Loader			
	Style	Radial Lift	Vertical Lift
	Hinge Pin Height (inches)	65.8	81
	Dump Angle (degrees)	38	40-45
	Reach, Fully Raised (inches)	21.8	>21.8
Performance			
	Tip Capacity (lb)	1580	2285
	Operating Capacity (35%)	553	800
	Horsepower (hp)	25	25
	Ground speed (mph)	0-4.5 forward, 0-2 reverse	0-4.5 forward, 0-2 reverse (2-speed?)
Tracks			
	Style	Standard wrap	High Drive
	Wheel Base (inches)	31.1	34
	Ground Pressure (w/ out bucket or operator) (psi)	5.08	5.08
	Track Width (inches)	5.88	5.88

[redacted]

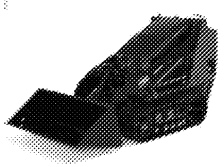
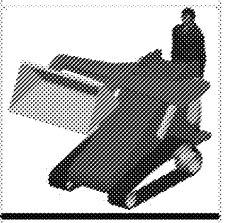
TORO-0000785

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Solution Alternatives

List possible product design ideas or service solutions. Do not let feasibility constraints limit you. For each solution or idea, note the benefits and limitations, from the customer perspective. Stretch for innovation.

TX / Tmax Spec Comparison			
			
Weights and Dimensions			
	Overall Length with Bucket (inches)	92	<105
	Overall Width (inches)	33.7	33.7
	Overall height (inches)	46.1	<57
	Overall Weight without Bucket (lbs)	2001	2031
	Max. Ground Clearance (inches)	4.6	6-8
Hydraulics			
	Aux / Primary Pump (gpm)	13.8	13.8
	Loader / Secondary Pump (gpm)	5.5	5.5
	Drive Pumps (gpm)	16.9	16.9 - 21
	Drive Controls	Hydrostatic T-Bar	Tbar? - Electronic? - Piloted?
	Loader Controls	Joystick	Joystick
	Auxiliary Control	OPC Lever	Electronic, Capacitive?
Other Features			
	Platform	Optional fold-up	Standard fold-up

[redacted]

TORO-0000786

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Solution Alternatives

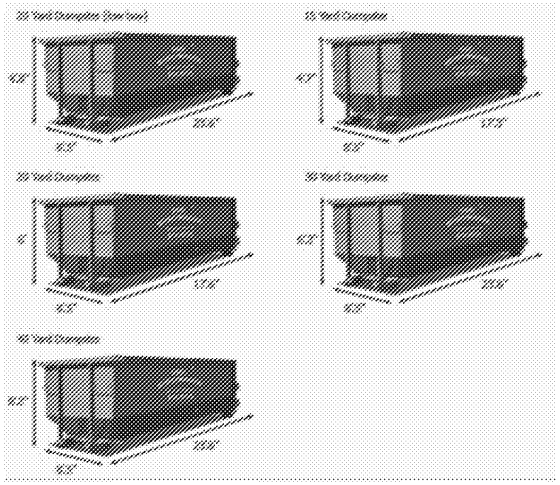
List possible product design ideas or service solutions. Do not let feasibility constraints limit you. For each solution or idea, note the benefits and limitations, from the customer perspective. Stretch for innovation.

Pin Height

•Requirement for pin height is fairly well established

- Dumping into a 1-ton truck (65” high bed sides)
- Dumping into a 30-yd dumpster (75-78 inches)

•Plan is to match DW pin height of 81 inches



TORO-0000787

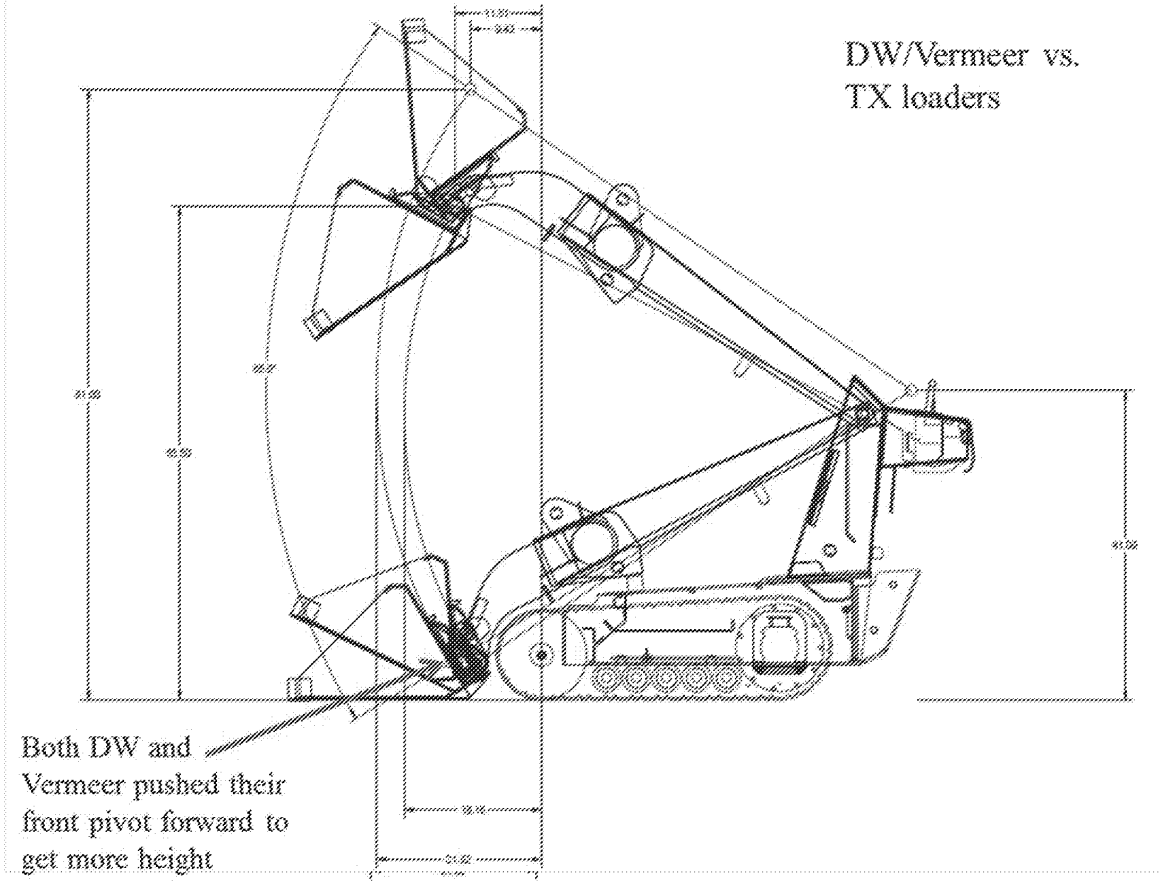
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Solution Alternatives

List possible product design ideas or service solutions. Do not let feasibility constraints limit you. For each solution or idea, note the benefits and limitations, from the customer perspective. Stretch for innovation.

Pin Height



2.0 Feasibility Entrance Gate

W298: Next Gen TX

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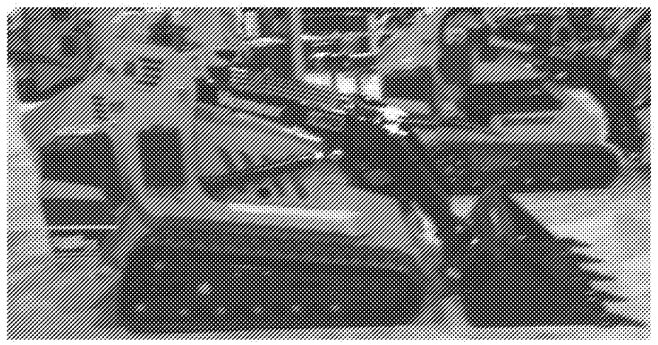
Solution Alternatives

List possible product design ideas or service solutions. Do not let feasibility constraints limit you. For each solution or idea, note the benefits and limitations, from the customer perspective. Stretch for innovation.

Lift Capacity

- We need to match the DW and Vermeer specs of 800 lbs (2286 lb tip)
- Loader geometry has a large impact on lift capacity
  - There are two methods to meet requirement
    - Retain radial lift loader arm and increase machine weight
      - DW and Vermeer machines are 2,900 lbs without a bucket
    - Use a vertical lift loader arm to keep the load consistently close to the machine





TORO-0000789

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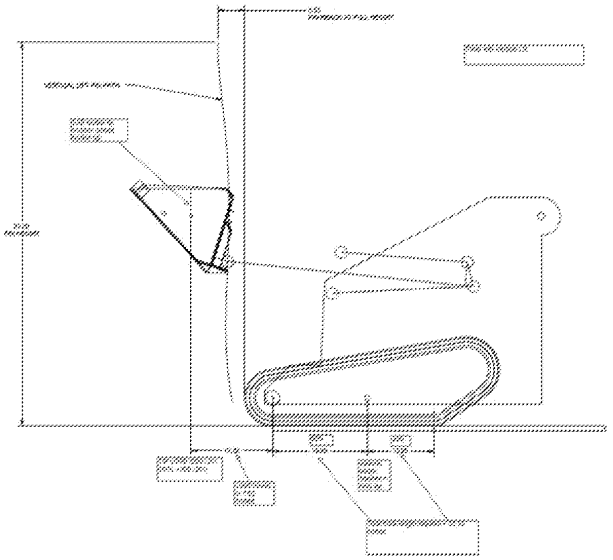
Solution Alternatives

List possible product design ideas or service solutions. Do not let feasibility constraints limit you. For each solution or idea, note the benefits and limitations, from the customer perspective. Stretch for innovation.

Lift Capacity

•We will investigate a vertical lift loader due to its advantages over a radial lift

- Achieve needed pin height with a more compact geometry
- Keeps the load consistently close to the machine while matching reach at full height
  - Lower machine weight is needed to lift the same amount
- Flat lift path will make the auger drive easier to use
- Improved dump and rollback angles



TORO-0000790

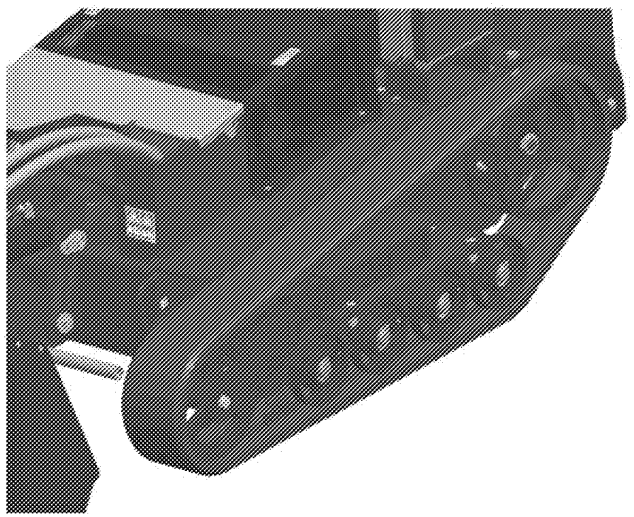
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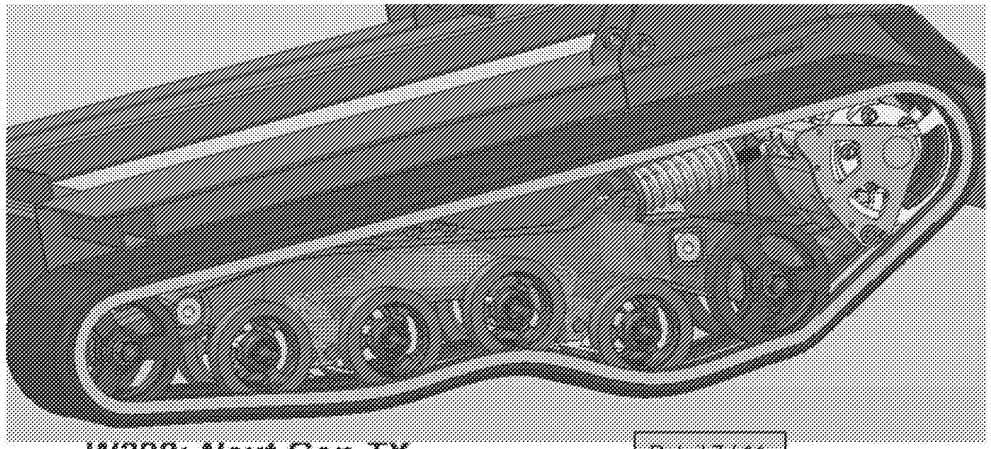
Solution Alternatives

List possible product design ideas or service solutions. Do not let feasibility constraints limit you. For each solution or idea, note the benefits and limitations, from the customer perspective. Stretch for innovation.

Tracks

- Hi-drive track improves
  - Wheelmotor loads
  - Curb jumping
  - Ground clearance
- Utilize learnings from the STX-38 track drive and the Atlas track drive designs
  - Detracking and tensioning work will be key





W298: Next Gen TX

TORO-0000791

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Solution Alternatives

List possible product design ideas or service solutions. Do not let feasibility constraints limit you. For each solution or idea, note the benefits and limitations, from the customer perspective. Stretch for innovation.

Tracks

- Retaining current ground pressure spec is affected by overall machine weight and track length
- Maximum machine weight to retain ground pressure with the STX-38 track is 2031 lbs

Narrow Track Ground Pressure				
	Track Width (in)	Track Length (in)	Weight, unit only (lbs)	Ground Pressure (PSI)
Current TX	5.88	31.50	1882	5.08
	5.88	35.15	2100	5.08
	5.88	39.34	2350	5.08
	5.88	43.52	2600	5.08
	5.88	47.71	2850	5.08
Ditch Witch SK750	7.00	43.00	2890	4.80

Wide Track Ground Pressure				
	Track Width (in)	Track Length (in)	Weight, unit only (lbs)	Ground Pressure (PSI)
Current TX	9.50	31.50	1990	3.32
	9.50	32.33	2150	3.50
	9.50	36.09	2400	3.50
	9.50	39.85	2650	3.50
	9.50	43.61	2900	3.50
Ditch Witch 755	9.00	43.00	2940	3.80
Vermeer 800	9.00	46.00	2950	3.56

TORO-0000792

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Solution Alternatives

List possible product design ideas or service solutions. Do not let feasibility constraints limit you. For each solution or idea, note the benefits and limitations, from the customer perspective. Stretch for innovation.

Controls

•We will investigate control methods and styles in the 2.0 stage

•Considerations:

- Ease of use
- Control forces / control stroke
- Stand-on / ride-on / hang-on

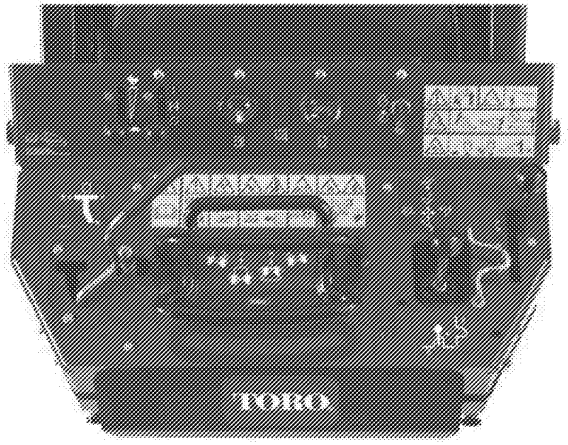
•Methods

- Manual (current)
- Pilot operated (DW and Vermeer)
- Electronic proportional

•Styles

- T-bar (current)
- Joystick (DW and Vermeer)
- Steering wheel
- Other?





TORO-0000793

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Solution Alternatives

List possible product design ideas or service solutions. Do not let feasibility constraints limit you. For each solution or idea, note the benefits and limitations, from the customer perspective. Stretch for innovation.

Engine

- Tier IV likely limits hp options to sub-25hp (current Kubota 902 engine)
- We will investigate higher diesel hp options in the 30-35 hp range for expense and size
  - Kohler
  - JCB
  - Yanmar
- We will also investigate high hp gas EFI engines (Kohler)

[redacted]

TORO-0000794

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Solution Alternatives

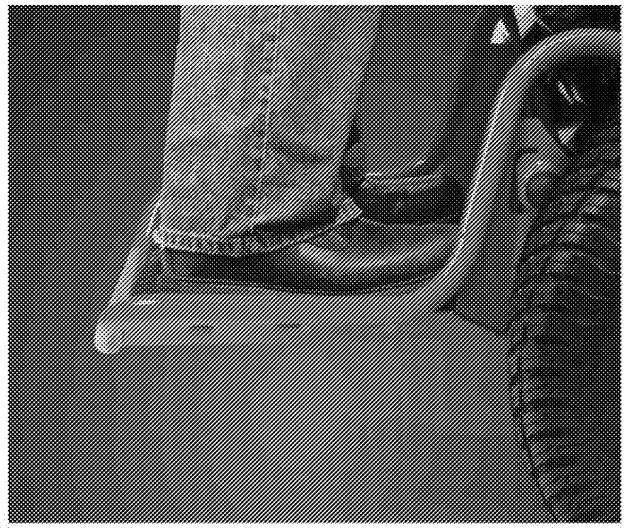
List possible product design ideas or service solutions. Do not let feasibility constraints limit you. For each solution or idea, note the benefits and limitations, from the customer perspective. Stretch for innovation.

Operator Zone

•Investigate a fold-up platform with improved ground clearance over the current TX (4-8 inches)

- Fold-up option makes the machine more compact for trailering
- Walk behind option makes the unit safer and easier to use in tight spaces and on grades

•A balance will have to be found between control height and platform ground clearance (adjustable control height?)



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REDACTED

2.0 Feasibility Entrance Gate

W298: Next Gen TX

Details, 4 pgs

4/17/2013 11:36:28 AM 35

TORO-0000796

CONFIDENTIAL - ATTORNEYS' EYES ONLY

REDACTED
Detail 1 / 4
4/17/2013 11:36:28 AM 36
W298: Next Gen TX
2.0 Feasibility Entrance Gate
CONFIDENTIAL - ATTORNEYS' EYES ONLY
TORO-0000797

REDACTED

2.0 Feasibility Entrance Gate

W298: Next Gen TX

Detail 2 / 4

4/17/2013 11:36:28 AM 37

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TORO-0000798

REDACTED

2.0 Feasibility Entrance Gate

W298: Next Gen TX

Detail 3 / 4

4/17/2013 11:36:28 AM 38

TORO-0000799

CONFIDENTIAL - ATTORNEYS' EYES ONLY

REDACTED
W298: Next Gen TX
2.0 Feasibility Entrance Gate
Detail 4 / 4
4/17/2013 11:36:28 AM 38
TORO-0000800
CONFIDENTIAL - ATTORNEYS' EYES ONLY

Project Investment

Estimate the project investment by fiscal year and by phase. Update projections and actual at each Gate.

Project Investment by Phase

Dollars in Thousands ($,000.)	Concept Phase	Feasibility Phase	Development Phase	Mid-Development Phase	Mfg Pilot Phase	Total	Comments
Original Estimate							
Current Projection		497	995	218	192	1,902	
Actual							
Variance		497	995	218	192	1,902	
Original Estimate							
Current Projection			125	125		250	
Actual							
Variance			125	125		250	
Original Estimate							
Current Projection			100	100		200	
Actual							
Variance			100	100		200	
Original Estimate							
Current Projection							
Actual							
Variance							
Original Estimate							***Original Estimate***
Current Projection		497	1,220	443	192	2,352	*Current Projection*
Actual							***Actual to Date***
Variance		497	1,220	443	192	2,352	***Variance***

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REDACTED
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TORO-0000802
W298: Next Gen TX
2.0 Feasibility Entrance Gate
CONFIDENTIAL - ATTORNEYS' EYES ONLY

Project Investment

Estimate the project investment by fiscal year and by phase. Update projections and actual at each Gate.

PJ2 F'13 PLAN SWS Core Group													
Project	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Totals
W258 - SWS R&D	$17,093	-$8,333	$4,167	$4,167	$7,251	$7,251	$7,251	$7,251	$7,251	$7,251	$7,251	$7,255	**$75,106**
W261 - Dingo TX DCI	$16,901	$24,807	$36,558	$35,386	$20,571	$19,286	$20,226	$19,538	$20,688	$21,088	$23,488	$21,538	**$280,076**
W263 - Admin Allocation	$8,893	$8,893	$8,893	$8,893	$8,893	$8,893	$8,893	$8,893	$8,893	$8,893	$8,893	$8,893	**$106,717**
W264 - International Allocation	-$22,917	-$22,917	-$22,917	-$22,917	-$22,917	-$22,917	-$22,917	-$22,917	-$22,917	-$22,917	-$22,917	-$22,917	**-$275,004**
W280 - SWS Cost Reduction	$476	$1,036	$1,429	$4,514	$0	$0	$0	$0	$0	$0	$0	$0	**$7,456**
W281 - Field Test Allocation	$1,548	$1,537	$1,537	$1,537	$1,537	$1,537	$1,537	$1,537	$1,537	$1,537	$1,537	$1,537	**$18,454**
W287 - 35hp STX/Other Large Machine	$48,321	$41,896	$30,877	$9,110	-$8,300	$0	$0	$0	$0	$0	$0	$0	**$121,905**
W293 - Atlas	$0	$0	$476	$0	$0	$0	$0	$0	$0	$0	$0	$0	**$476**
W297 - Hold Backs	$0	$0	$0	$0	$8,375	$8,375	$8,375	$8,375	$8,375	$8,375	$8,375	$8,375	**$67,000**
W298 - Next Gen TX	$0	$737	$1,627	$6,693	$60,513	$98,496	$77,378	$76,737	$88,020	$79,934	$71,674	$59,822	**$621,631**
W299 - TRX-38 Trencher	$19,123	$864	$2,824	$11,052	$12,109	$2,634	$0	$0	$0	$3,991	$8,068	$10,541	**$71,206**
Totals	**$89,438**	**$48,520**	**$65,471**	**$58,435**	**$88,032**	**$123,555**	**$100,743**	**$99,415**	**$111,848**	**$108,152**	**$106,369**	**$95,044**	**$1,095,022**

PJ2 Plan refocuses spending from Atlas and the Trencher project into project W298

Some spending is retained under W299 to rebuild the TRX38 and begin work at the end of the year

[redacted]

TORO-0000803

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2.0 Feasibility Entrance Gate

W298: Next Gen TX

Detail 3 / 4

4/17/2013 11:36:28 AM 43

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TORO-0000804

[redacted]

REDACTED

2.0 Feasibility Entrance Gate

W298: Next Gen TX

Detail 4 / 4

4/17/2013 11:36:28 AM 44

TORO-0000805

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Prototype Plan and Results

Describe the plan and the estimated schedule for prototypes to be built and tested. Report results of prototypes that have been built.

2.0 Stage (Build on 7/23/13)

- Build 3 prototypes
  - 2 narrow track units
  - 1 wide track unit
- Usage
  - 1 unit for lab work
  - 1 unit for field / performance work
  - 1 unit dedicated to VOC
- Units may have a mixture of engines (gas-diesel) depending on project direction

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Prototype Plan and Results

Describe the plan and the estimated schedule for prototypes to be built and tested. Report results of prototypes that have been built.

3.0 Stage (Prototypes built 3/18/14)

- Build 5 prototypes
  - (1) for Lab
  - (2) for Field
  - (1) for Marketing
  - (1) for Mfg

4.0 Stage (Updates after 500 hours on the 3.0)

- Any updates required (permanently tooled parts for example) will be fit onto the 3.0 machines after initial field testing is complete

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Project Schedule and Milestones

List the milestones and dates that are critical to achieve the planned project schedule.

Milestone Dates	Plan	Actual	Comments
2.0 Approval	**3/11/13**		
2.0 Prototype Build Completed	**7/29/13**		Build 3 prototypes for qualification and VOC work
3.0 Signoff	**11/4/13**		Allows 12 weeks for VOC and qualification work
3.0 Prototype Build Completed	**3/18/14**		
Long Lead / Tooling Releases	**7/31/14**		
4.0 Signoff	**8/6/14**		
4.0 Updates	**9/3/14**		Bring units in for updates after 500 field hours
5.0 Signoff	**11/6/14**		
Pilot Build Completed	**11/19/14**		4.0 qualification completed by this date
Production	**1/15/15**		
Release to Ship	**1/29/15**		Product fully released and available for Rental Show

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Feasibility Phase Critical Actions

List the most critical actions the team needs to complete in the Feasibility Phase for this project to fully satisfy the stated project objectives.

Marketing

- Thoroughly investigate market share loss
  - As previously indicated, market share loss is a result of being out-spec'd by competitors
  - Competitor pricing is also affecting market share loss
    - Formal market research will be conducted during the Feasibility Phase to understand the importance of price in the purchase decisions of Ditch-Witch users (to what degree price is influencing purchase decisions), price elasticity, and the importance of product specs relative to price.
- Cost reduction efforts
  - Work with the team to ensure all Dingo TX BOM items are reviewed for cost reduction opportunities (cost reduction opportunities for current models and eventual Next Gen models)
    - Dingo TX BOMs are currently being reviewed
    - 1 current cost reduction opportunity: current wide drive track wheel cost is REDACTED
- Continue ROI analysis
- Prototype review and agreement on product specifications
  - Specifications to be based on VOC and internal results
- More detailed competitive analysis based on user feedback

Engineering

- Purchase a Vermeer 800 or DW 750 for competitive evaluations
- Finalize all key specs and design features
- Build three prototypes for VOC work and performance evaluations

*Highlighting Added = CONFIDENTIAL ATTORNEYS' EYES ONLY

TORO-0000809

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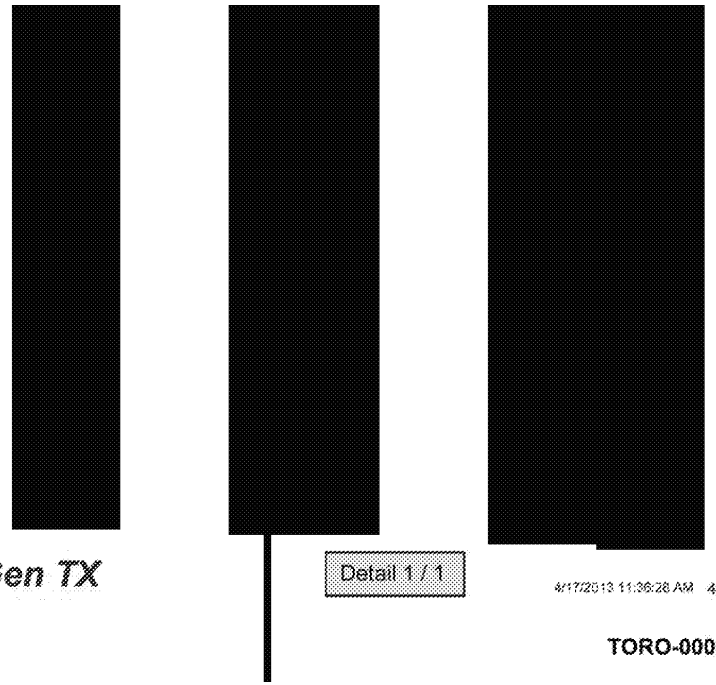
Ex. 2015
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Feasibility Phase Critical Actions

List the most critical actions the team needs to complete in the Feasibility Phase for this project to fully satisfy the stated project objectives.

Engineering (continued)

- Begin preliminary qualification work on key new design areas
  - Lift capacity and other loader characteristics
  - Engine and hydraulic performance and cooling
  - Track performance and detracking
  - Operator controls
- Determine product and project costs for the 3.0 approval
- Review standards and develop a test plan for the 3.0 approval
- Investigate patent opportunities



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Project Risks and Risk Management Plan

List the risks that may limit the project from achieving the goal. Consider all aspects including: marketing, competition, distribution, quality, performance, price, design, supply, etc. For each risk state the impact, the likelihood of occurring, the mitigation actions to prevent the occurrence and the contingency plan if it occurs.

Priority	Risk	Likely To Occur	Impact	Mitigation Actions	Contingency Actions
Rank	What is the issue that may impact the project?	High Medium Low	If it occurs how will it effect the project?	What are the actions being taken to prevent the occurrence or minimize the impact?	If the Risk does occur what actions will the team take?
1	Missing target costs due to expense of desired product features	High	Results in uncompetitive pricing or a product that does not meet customer requirements	Utilizing innovation like vertical lift to keep machine weight and corresponding costs down. Initiate DFMA activities as early in the design process as possible.	Compromise on product features to keep cost in balance

TORO-0000811

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Competitive Product Evaluation

Provide an objective and comprehensive evaluation of competitive products available to the customer, including our product that is now in the market. Consider the total product including: performance, quality, marketing message, serviceability, ease-of-operations, appearance, finish, packaging, availability, specification statements, etc.

Tracked CTLs	Toro NextGen W TX	Toro NextGen N TX	Toro 325W TX	Ditch Witch SK 750/755	Vermeer S650 TX	Vermeer S800 TX
Tipping capacity (lbs)	**3,070**	**2,857**	1,580	2,285	1,890	2,400
Rated operating capacity (35% of tip)	**1,075**	**1,000**	553	800	660	840
Hinge pin height (inches)	**81**	**81**	66	81	80	84.5
Horsepower (gross rating)	**24.8**	**24.8**	24.8	24.8 / 32.8	24.8	35.1
Max ground speed - forward (mph)	**4.7**	**4.7**	4.0	4.7	4.5	4.5
Max ground speed - reverse (mph)	**4.7**	**4.7**	2.0	4.7	4.5	4.5
Machine weight (lbs)	**2,633**	**2,450**	2,001	2,890	2,560	2,950

- Next Gen vertical lift loader arm design is a key differentiator
- Next Gen 1,000+ lb. rated operating capacity is unprecedented
  - Next Gen (wide) rated operating capacity is 28% greater than Vermeer's
- Next Gen units will weigh significantly less than Ditch Witch and Vermeer's largest units
  - Next Gen (wide) will weigh 317 lbs. less than Vermeer S800 TX
  - Doing more with a machine that has a lighter footprint

TORO-0000854

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Proposed Solution

Describe in detail the recommended solution that best meets the customer needs and the business needs. Identify the fundamental system and sub-system alternatives that must be considered, and state why this choice is preferred.

Key Features that innovate and "leapfrog" the competition

- Vertical lift loader design
  - Outperform the competition on lift capacity while retaining a smaller, more compact machine
  - 1000 lb operating capacity from a sub-2,500 lb machine
- Toro all-rubber track system
  - Retain the advantages of the Dingo track design vs. a Bridgestone track system
- Toro-designed operator controls
  - Eliminate the shortcomings of the competitive designs and retain Toro's leadership in control systems
- Toro designed electronic module
  - First introduction of "smarts" in the Dingo product line
  - Will integrate warning switches, automate the glow plug and provide interlock logic for the machine

TORO-0000865

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Project Risks and Risk Management Plan

List the risks that may limit the project from achieving the goal. Consider all aspects including: marketing, competition, distribution, quality, performance, price, design, supply, etc. For each risk state the impact, the likelihood of occurring, the mitigation actions to prevent the occurrence and the contingency plan if it occurs.

Priority	Risk	Likely To Occur	Impact	Mitigation Actions	Contingency Actions
Rank	What is the issue that may impact the project?	High Medium Low	If it occurs how will it effect the project?	What are the actions being taken to prevent the occurrence or minimize the impact?	If the Risk does occur what actions will the team take?
1	Missing target costs due to expense of desired product features	High	Results in uncompetitive pricing or a product that does not meet customer requirements	Utilize VOC feedback to decide which new features can be downgraded; Reduce machine weight; DFMA review of major components and systems	Revise specs and features to further reduce weight and cost
2	Loader arm complexity and durability results in failures	High	Increased weight, cost, and time to develop the arm	Iterative rounds of FEA in the 2.0 phase to address problem areas	Revise and reinforce loader design

TORO-0000894

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4.0 Mid-Development Entrance Gate Decision and Feedback

4.0 Mid-Development Entrance Gate Approval Requirements

All Amounts : Division Managing Director/GM

Decision Makers	Name	Ok As-Is	OK w/Changes Noted	STOP	Rework & Return	Signature	Date
General Manager, SWS	Rick Rodier						
Division Controller	Brad Mlynar						
Marketing Director	Neil Borenstein						
Engineering Director	Joe Hager						
Manufacturing Director	Cabrini Brandl						
Sales Director	Butch Greeninger						
Customer Care / Service Director	Jack Hensley						
Engineering Tech Svcs Director	Greg Tonsager						
Sr. Marketing Mgr, International	Michael Brugh						

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4.0 Mid-Development Entrance Gate Decision and Feedback

Project Team			
Marketing Leader	Sean O'Halloran	**Quality Engineer**	Tony Niemczyk
Engineering Leader	John Azure	**NPD Sourcing Specialist**	Randy Huerkamp
Manufacturing	Scott Vollmer	**Customer Care**	Kevin Conney
Advanced Manufacturing Engineer	Andrew Berglund	**Test**	Dave Murray

TORO-0000930

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4.0 Mid-Development Entrance Gate Decision and Feedback

Feedback

-
-
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-
-

4.0 Mid-Development Entrance Gate

W298: Next Gen TX

Detail 1 / 2

2/20/2015 8:10:10 AM 3

TORO-0000931

Scanned Copy of Prior Gate Approval and Feedback

W298 FEASIBILTY FEEDBACK

- Need 3.0 on project update at Scope tickers for this project

Happe - Next Gen TX 2.0 Feedback

- In addition to the market share gain, we need to see gross margin on the next Gen Dingo slightly improved. It is important we drive the Core Sova product category Core to double digit yield.
- Have a specific mkt share goal. 8:1 is nice but may not always equate to rising market share. We should consider 4o% w/in-backed utility loadout.
- VOC w/ non Dingo owners critical to achieving growth
- How do we define a new specification category if we can deliver significant innovation? We have to maintain meaningful differentiation so we don't lose a spec war in the future. What customer problems will we solve that no one else does or can? Risk lists drive incremental improvements; problems drive value
- Good quality results on current Dingo — can't go backwards
- Controls key area to investigate for differentiation ——> smarter, intuitive
- Time-to market (short) value ——> should make move & on upswell
- Target financial improvements: REDACTED
- Is there any part of NGTX project spending that is helpful for the ATLAS product?
- Are there any Operational Impacts: DFMA, Parts count, [redacted] Consider?

4.0 Mid-Development Entrance Gate

W298: Next Gen TX

Detail 2 / 2

2/20/2015 8:10:10 AM 4

*Highlighting Added = CONFIDENTIAL ATTORNEYS' EYES ONLY

TORO-0000932

Business and Project Strategy

Explain how this new product aligns with the business strategy and product category strategy. Describe how the market strategy will optimize the sales of this new product.

- Successfully expand the Dingo product line offering with the introduction of the TX 1000 Narrow Track and Wide Track units
  - Next Gen units will be additions to the existing TX line
  - Existing units have significant value, in both the dealer and rental channels
- Become #1 Compact Utility Loader of choice for contractors and Rental
  - Meet, and exceed, competitor specifications and incorporate key features
    - Greatest rated operating capacity (1000 and 1075 lbs) in the CUL category
    - 81" hinge pin height to clear 30 yard dumpsters and one ton truck with 24" sideboards
    - High drive track system
    - High max travel speed in forward (4.7 mph) and reverse (4.7 mph)
    - Intuitive and differentiated traction controls
- Re-establish Toro as the CUL market leader
  - Toro invented the category, and Toro is re-inventing the category through TX 1000 product innovation
    - Vertical lift loader arm design and traction controls

TORO-0000933

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Business and Project Strategy

Explain how this new product aligns with the business strategy and product category strategy. Describe how the market strategy will optimize the sales of this new product.

- Grow market share
  - Toro tracked CUL share grew slightly in 2014 (31% through Nov); the strategy is to gain significant share
    - Obtain 38% market share in 2019 (as measured by AEM, units shipped)
- Protect margin and profit
  - TX 1000 units will feature lower margin than current TX products
  - Team has a cost reduction action list for TX 1000 items

TORO-0000934

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Project Objective

Define the specific objective of the project. Describe the purpose of the project and identify the measures and timing of project success. Include a description any constraints or nonnegotiable parameters set for this project or product that must be achieve.

- Introduce Dingo TX 1000 models that:
  - are differentiated from competitor units
  - have key specs and capabilities that are greater than competitor units
  - better meet end-user product requirements, for both professional contractors and rental customers
- Increase Toro market share in the tracked compact utility loader category
  - Achieve 38% market share in 2019
- Project success will be measured by:
  - Successful launch and introduction at the ARA show - February 23-25
  - Securing orders for a minimum of 200 units before the end of March (in advance of anticipated June/July shipments)
  - Market share gain, 32.3% share by the end of 2015

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Customer Feedback

Identify customers from whom feedback was received. Explain in detail the specific feedback the customers provided. Describe the actions that will be taken to respond to the feedback.

- Customers provided traction controls feedback regarding:
  - Intuitiveness of controls and ease of operation
  - Control design and ergonomic preferences
  - Level of operator strain/fatigue
  - Machine responsiveness when changing direction
- Customers also provided input regarding
  - General impressions of the 3.0 units
  - (Most of these customers had previously reviewed the 2.0 machines)

Name	Company
Charlie Kraemer	Landscape Charlie
Bill Jorgensen	Landscapes by Lora
Evan Jorgensen	Landscapes by Lora
Jack Evans	Natural Elements Lawn and Landscape
Simon Huxtable	Patio Plus LLC, owner
Mike Hart	Beds and Borders Landscape and Design
Andrew Riegert	Natural Surroundings Landscape and Design
Cory Unterschuetz	Cities Edge Landscaping
Dean Bjorkstrand	Bjorsktrand, Inc. Landscaping
David Titus	Sunbelt Rentals
Jeff Reid	BlueLine Rental
John McVeigh	BlueLine Rental

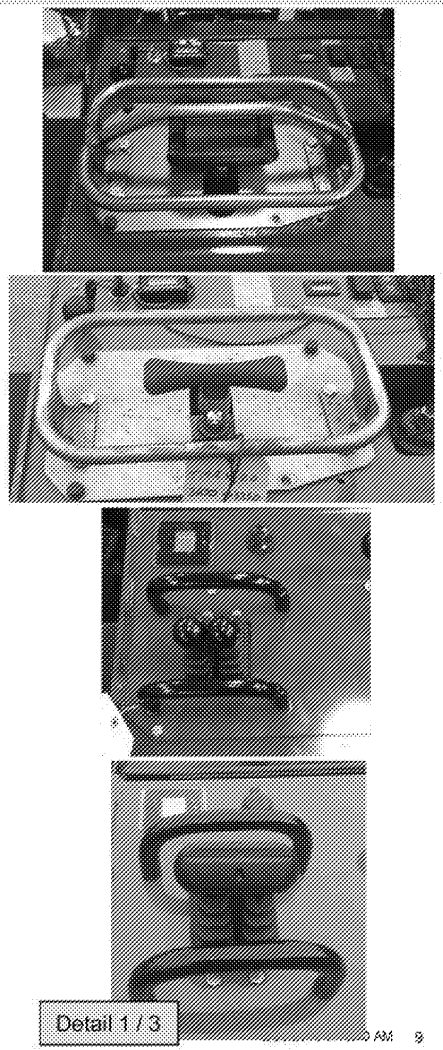


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Customer Feedback

Identify customers from whom feedback was received. Explain in detail the specific feedback the customers provided. Describe the actions that will be taken to respond to the feedback.

- #1 Shrunken-down TX control
  - Control was too large and too bulky
  - Reference bar did not sync up well with control
  - Not comfortable, difficult to operate
- #2 Dog-bone
  - Similar to Bobcat's style
  - Too much twisting required for basic movements
  - Not ideal for turning
  - Contributed to operator fatigue
- #3 Two-levers
  - Similar to Ditch Witch controls (viewed positively by DW owners)
  - Intuitive, easy, simple, effortless
  - Not ideal for tight turns, and difficult to go straight in reverse
- #4 TX 1000 traction controls
  - Intuitive, easy, effortless, simple
  - (Additional info on the next slide)



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TORO-0000937

Load Case 3, High Position

Load Case 3, High Position

Load Case 4, High Position

Inside cutaway view

Load Case 4, High Position

Load Case 5, High Position

Load Case 5, High Position

TMAX Loader

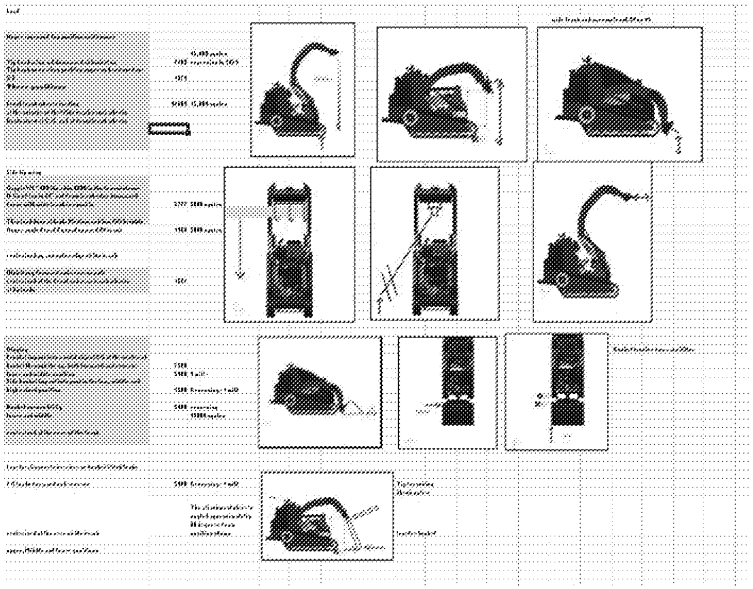
Arm Plates

03/06/2014

21 Load cases



- Uses defined loads (21 cases)
- High Position - Leveler Load now originates 32” below bucket
  - And 12” forward





... within Epsilon

TORO-0000381.2/22

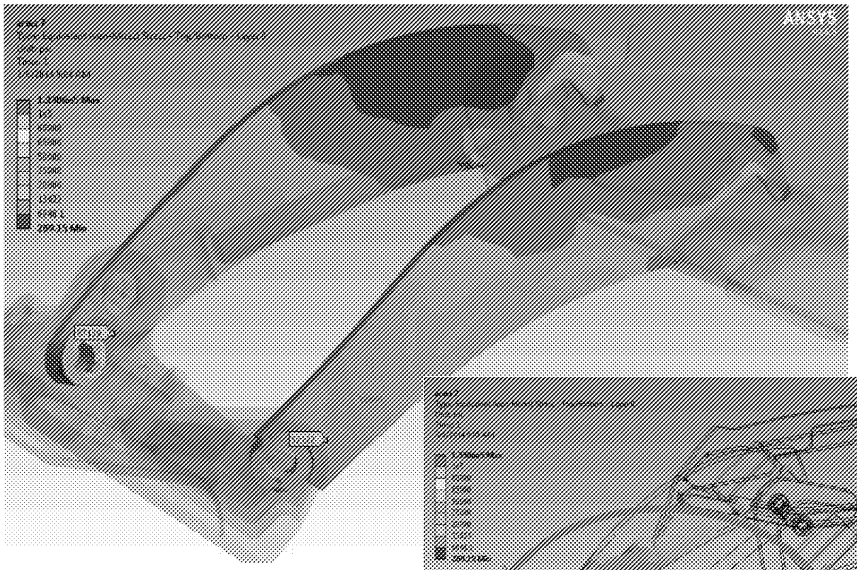
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Kubota North America Corporation et al

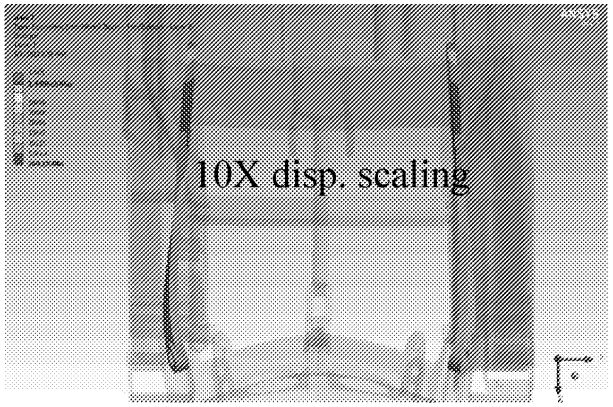
Ex. 2015
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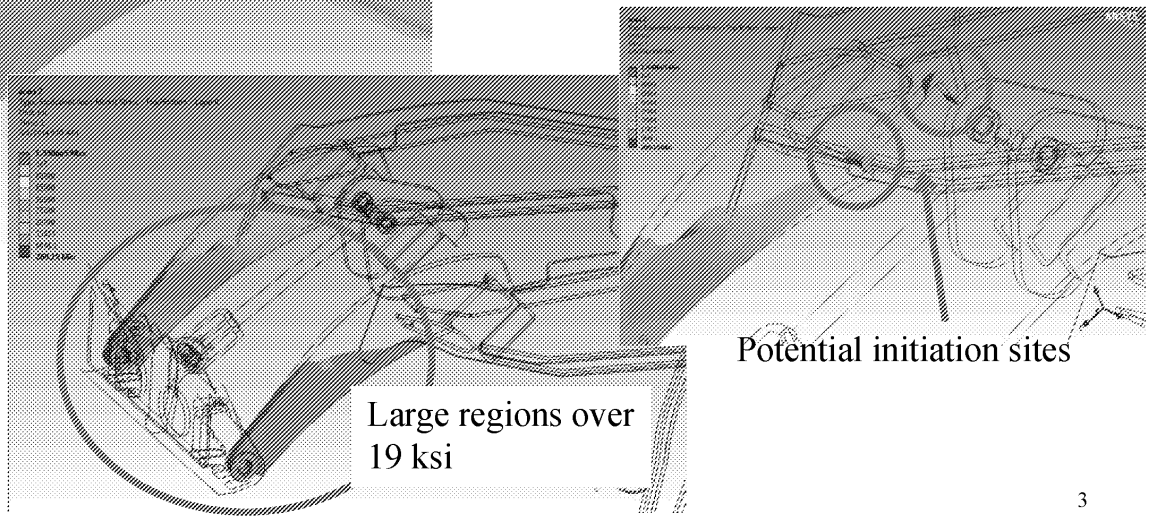
Fatigue Criteria (19 ksi?)



- Leveler, High Position
  - Force originates 32” below bucket
  - 45 Kip bucket piston force







... within Epsilon

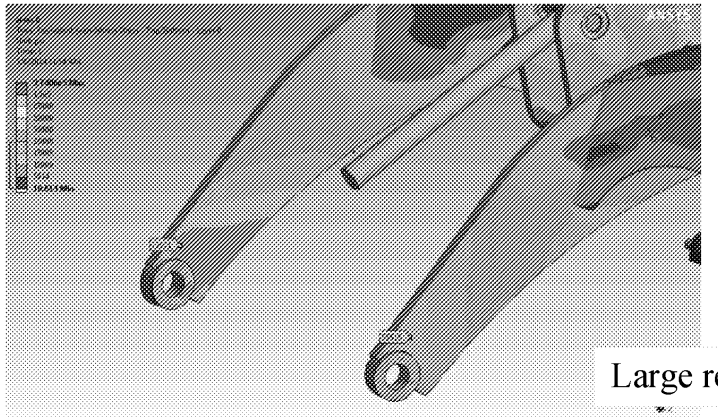
TORO-0000381.3/22

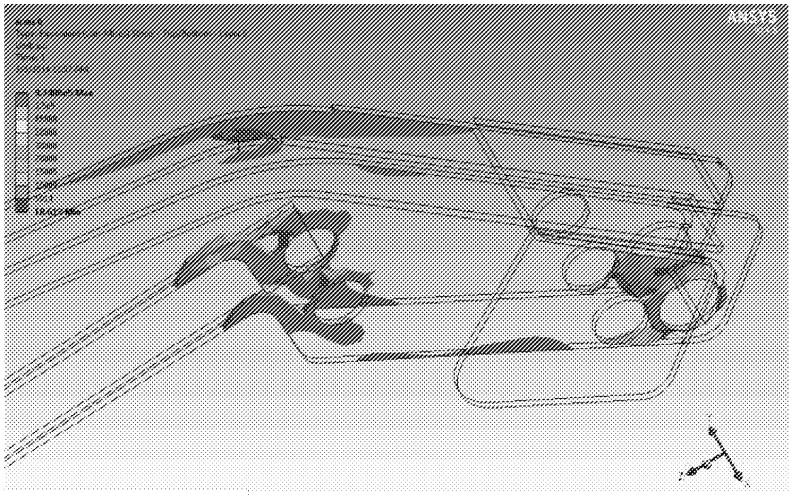
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Kubota North America Corporation et al
Ex. 2015
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Fatigue Criteria (19 ksi?)

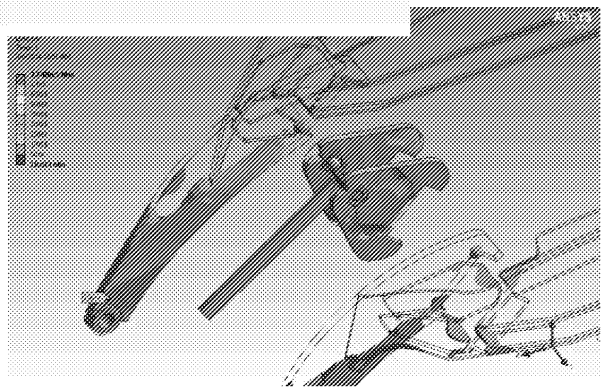


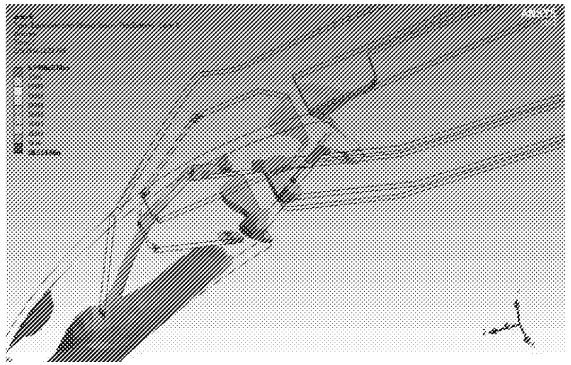
- Leveler, Med Position
  - Force originates 32” below bucket
  - 45 Kip bucket piston force





Large regions over 19 ksi





... within Epsilon

TORO-0000381.4/22

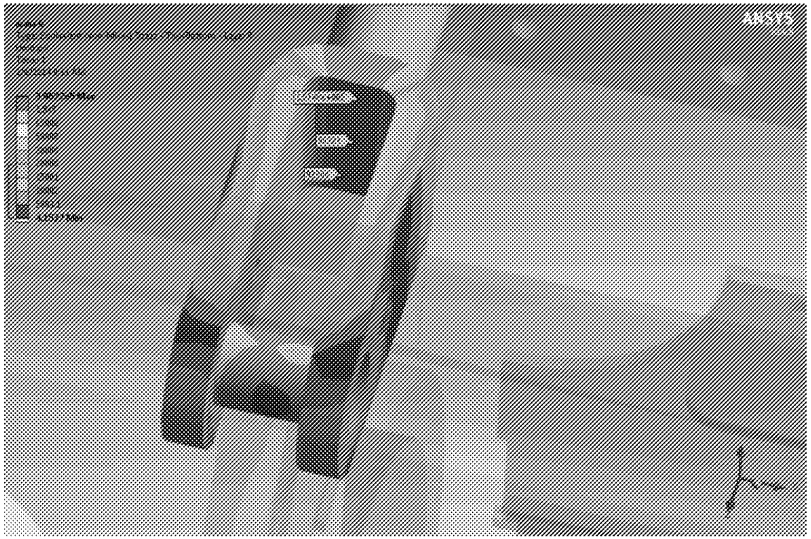
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Kubota North America Corporation et al

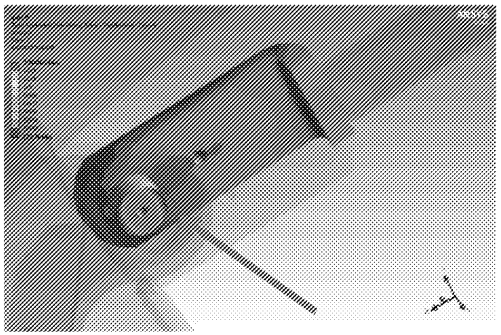
Ex. 2015
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Fatigue Criteria (19 ksi?)



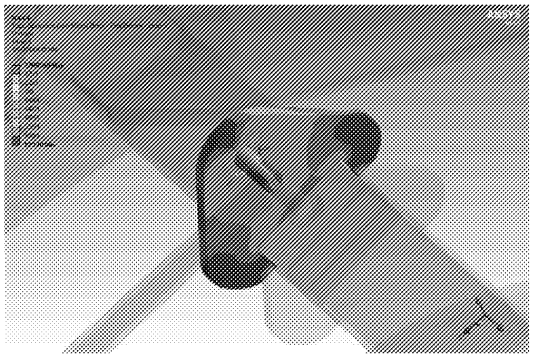
- Leveler, High Position
  - Force originates 32” below bucket
  - 45 Kip Bucket Piston Force





Pin x-sect. area = 0.78 in^2
45 kip gives 58 ksi avg. shear stress!

Pin x-sect. area = 0.59 in^2
45 kip gives 58 ksi avg. shear stress!



... within Epsilon

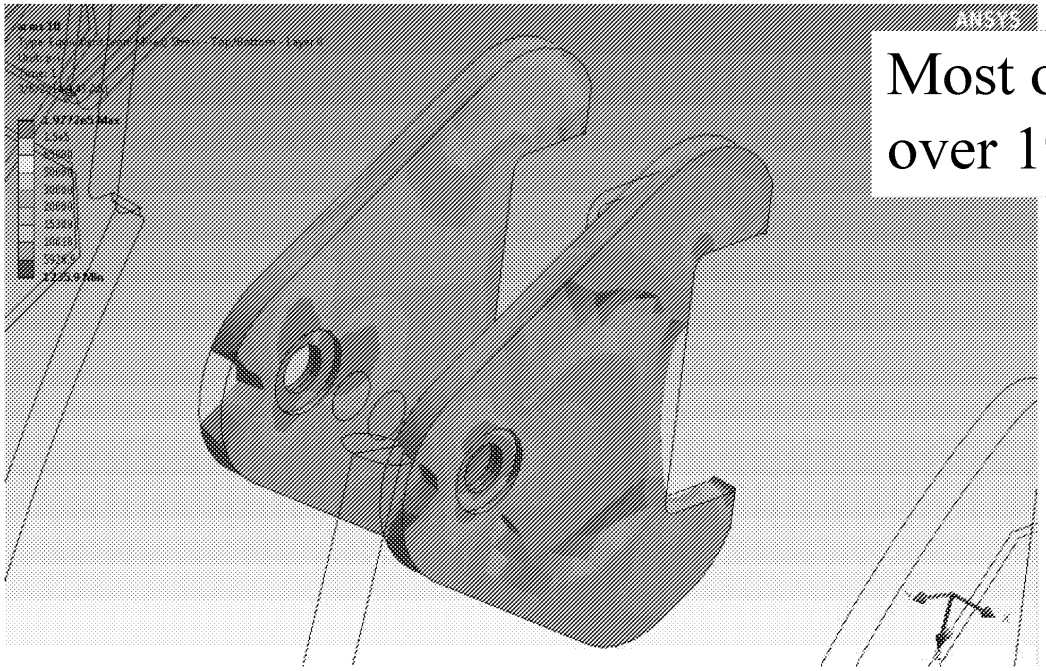
TORO-0000381.5/22

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Fatigue Criteria (19 ksi?)



- Leveler, High Position
  - Force originates 32” below bucket
  - 42 Kip Bucket Piston Force



Most of the plates are over 19 ksi

... within Epsilon

TORO-0000381.6/22

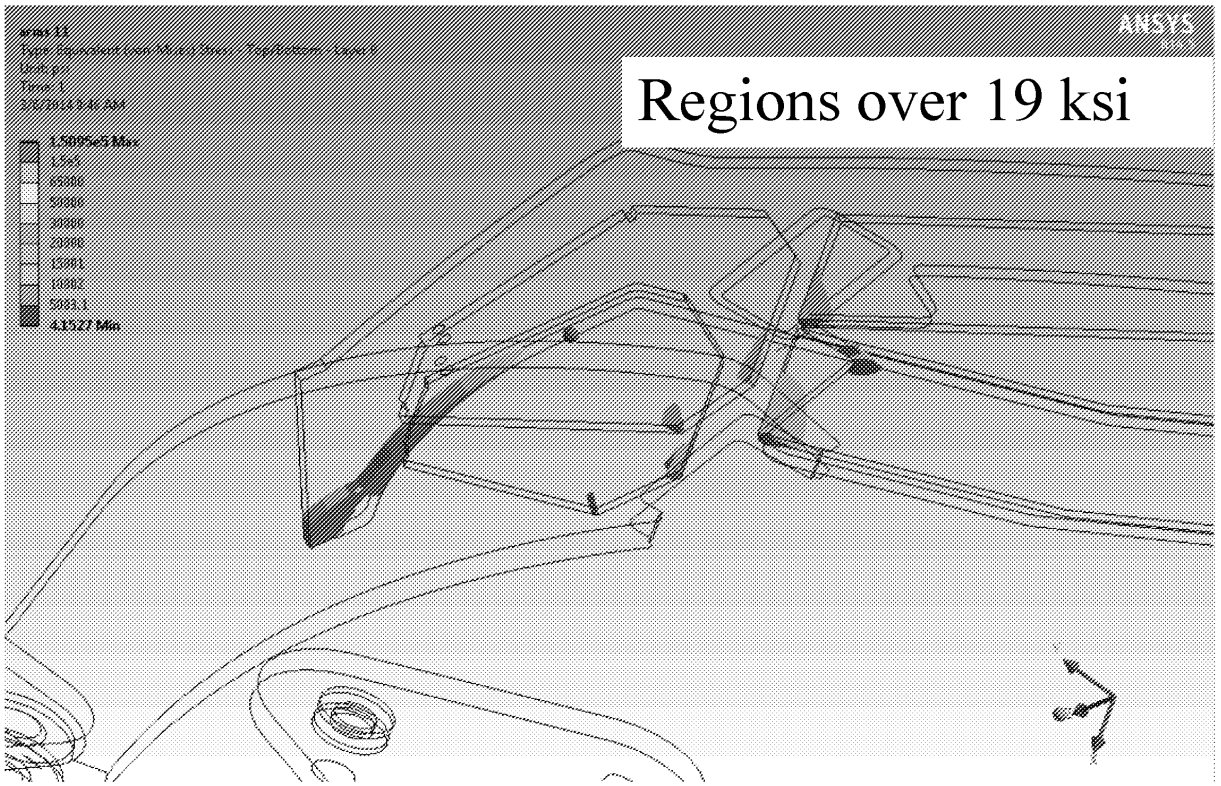
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Fatigue Criteria (19 ksi?)



- Leveler, High Position
  - Force originates 32” below bucket
  - 45 Kip Bucket Piston Force



... within Epsilon

TORO-0000381.7/22

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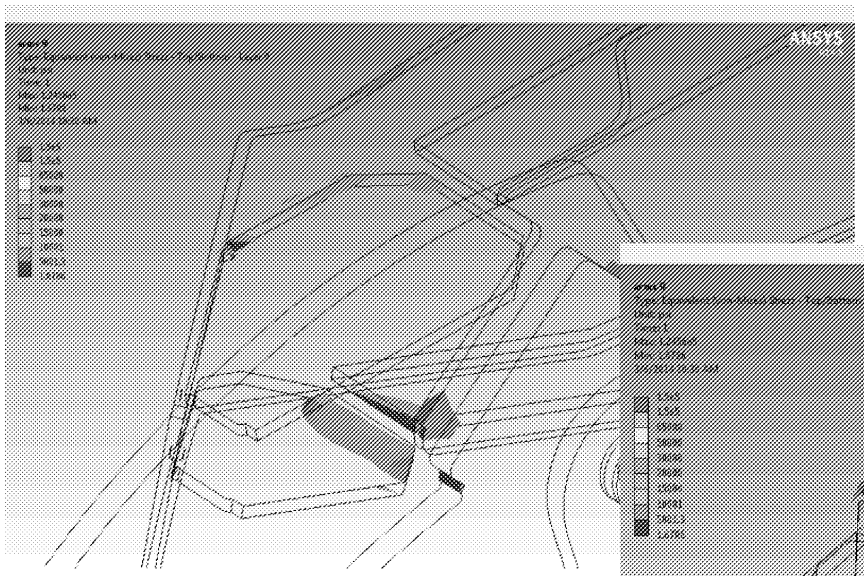
Ex. 2015
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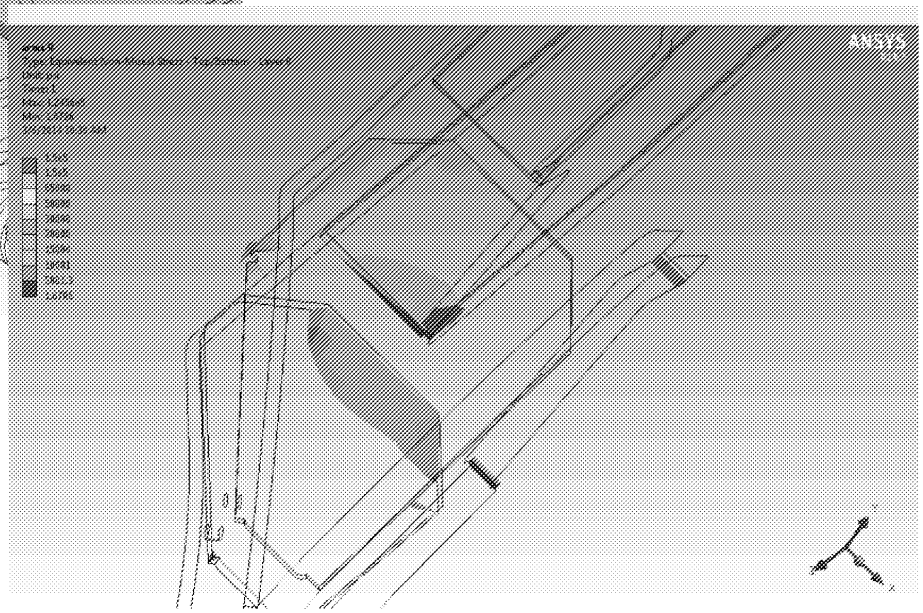
Fatigue Criteria (19 ksi?)



- Digging, Down Position

Regions over 19 ksi





... within Epsilon

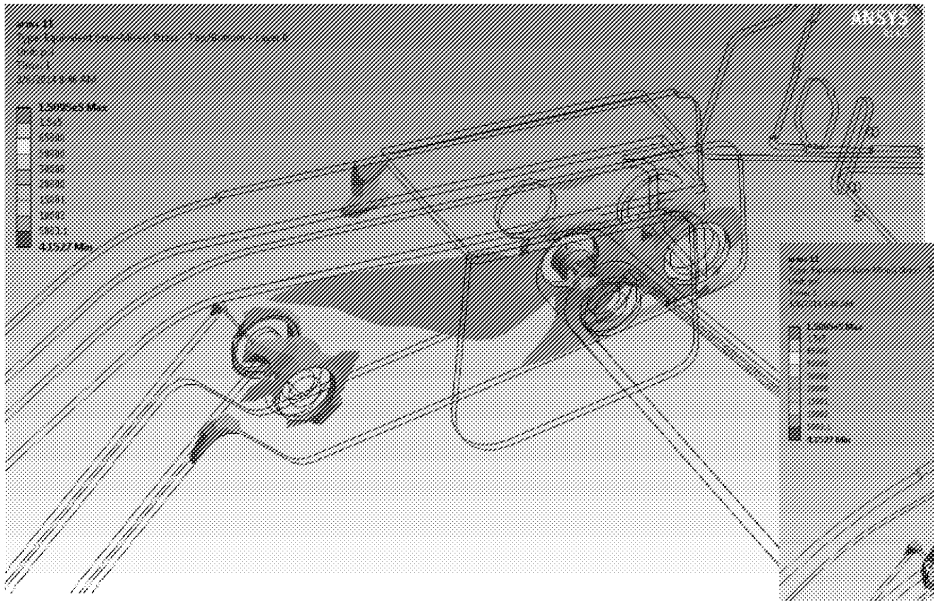
TORO-0000381.8/22

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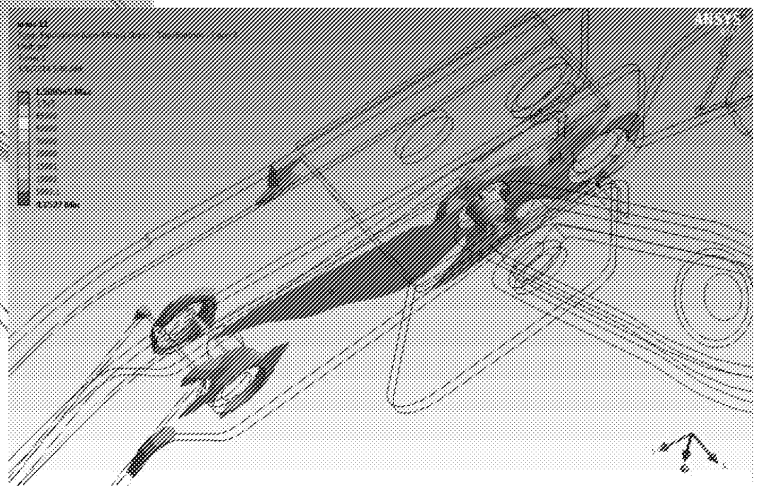
Fatigue Criteria (19 ksi?)



- Leveler, High Position
  - Force originates 32” below bucket
  - 45 Kip Bucket Piston Force



Other regions over 19 ksi



... within Epsilon

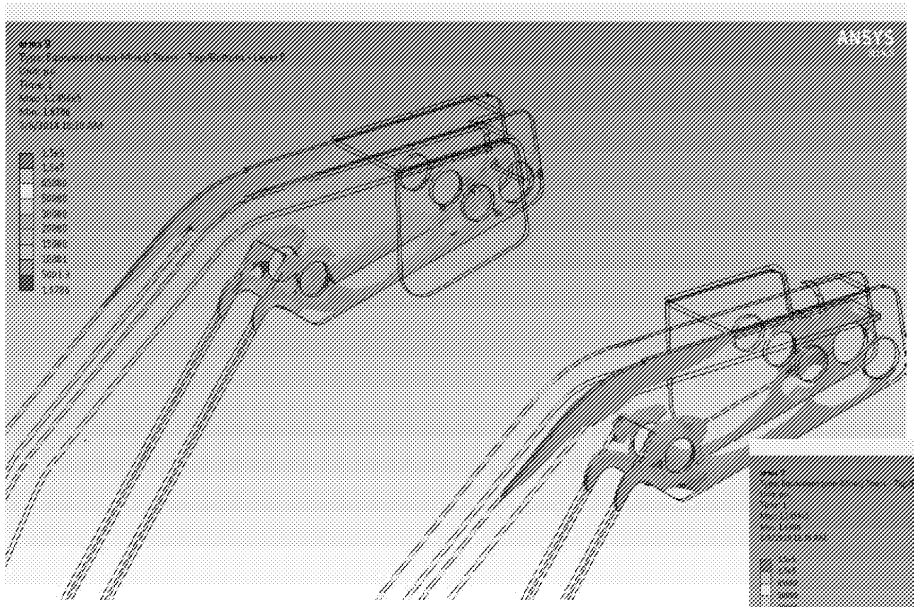
TORO-0000381.9/22

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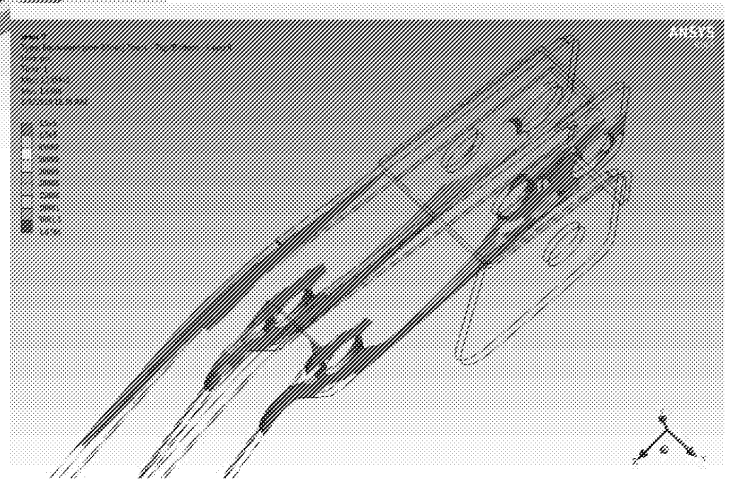
Fatigue Criteria (19 ksi?)



- Digging, Low Position



Regions over 19 ksi



... within Epsilon

TORO-0000381.10/22

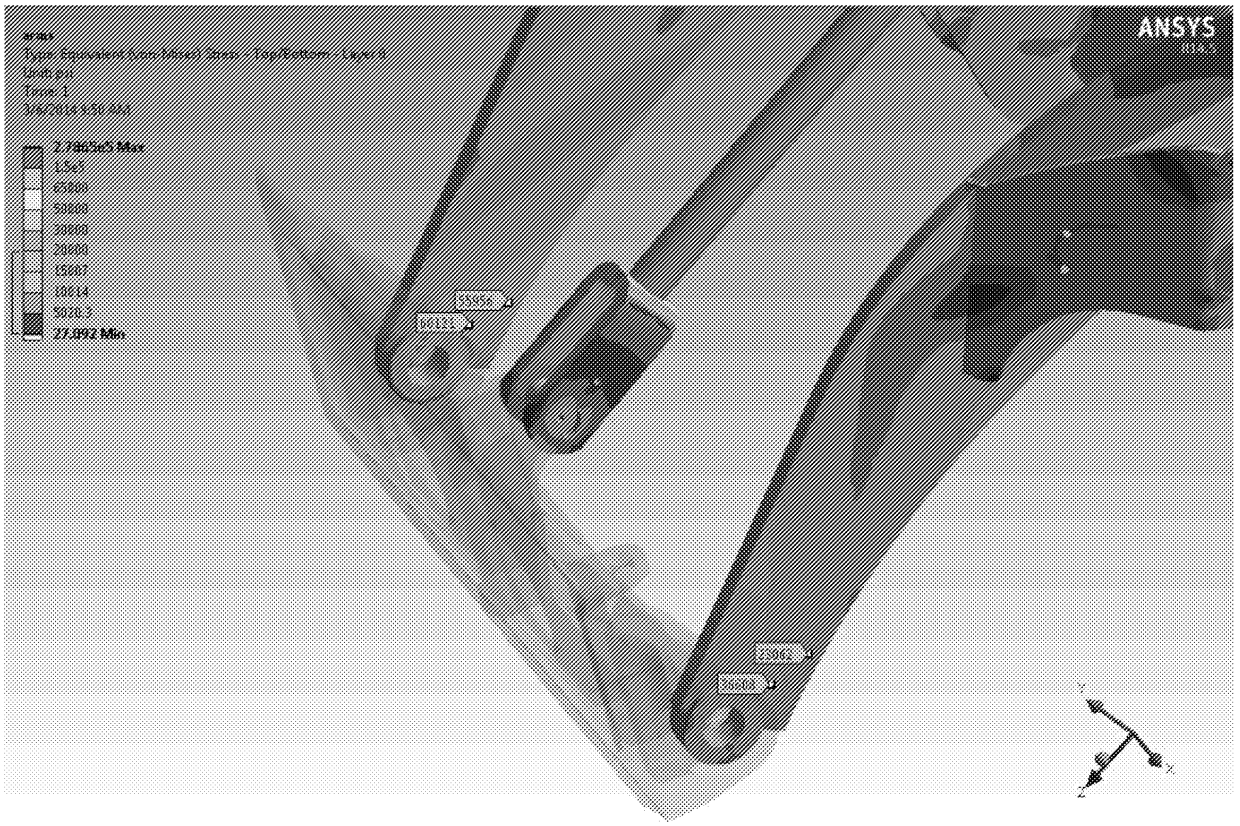
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Yield Criteria (50 ksi)



- Auger Bounce, High Position
  - 27 kip bucket piston force



... within Epsilon

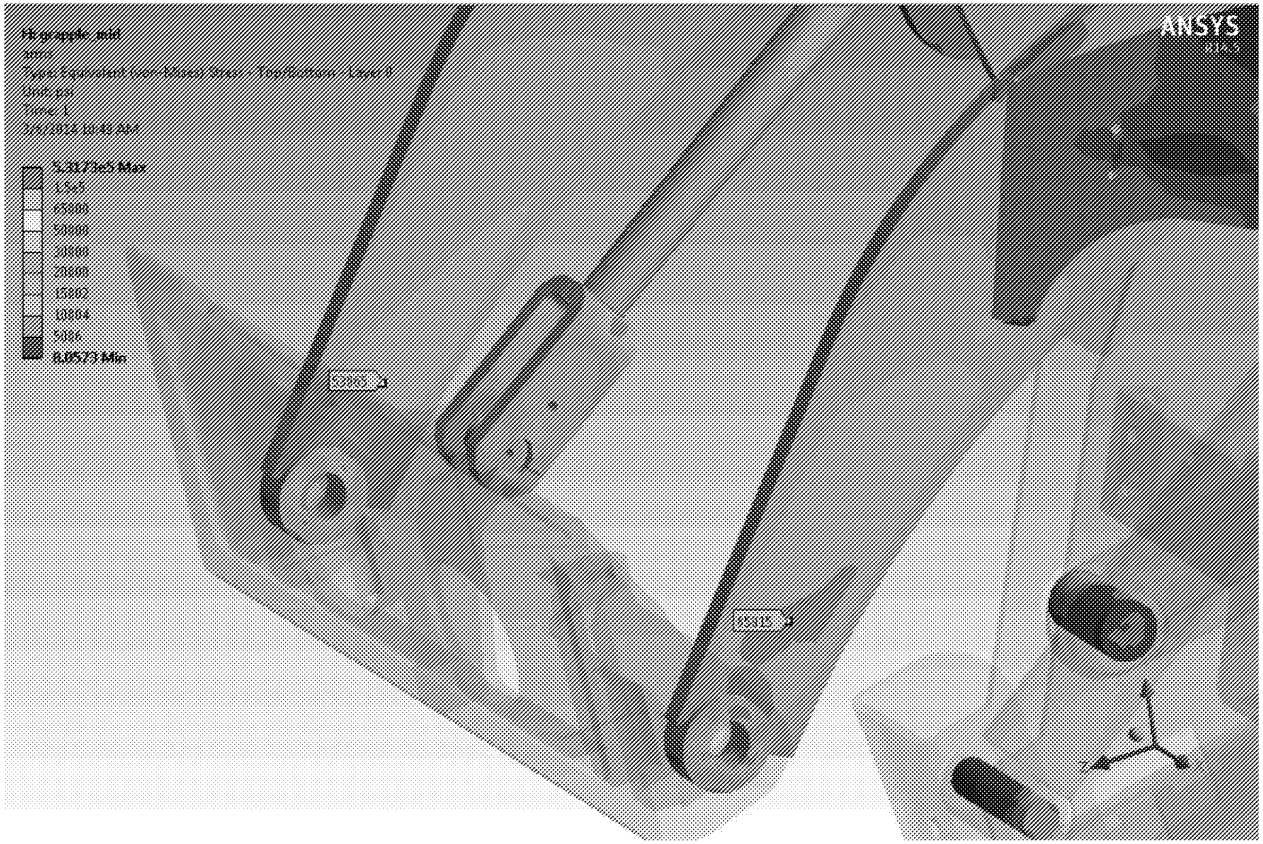
TORO-0000381.11/22

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Kubota North America Corporation et al
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Yield Criteria (50 ksi)



- Offset Grapple, Middle Position



... within Epsilon

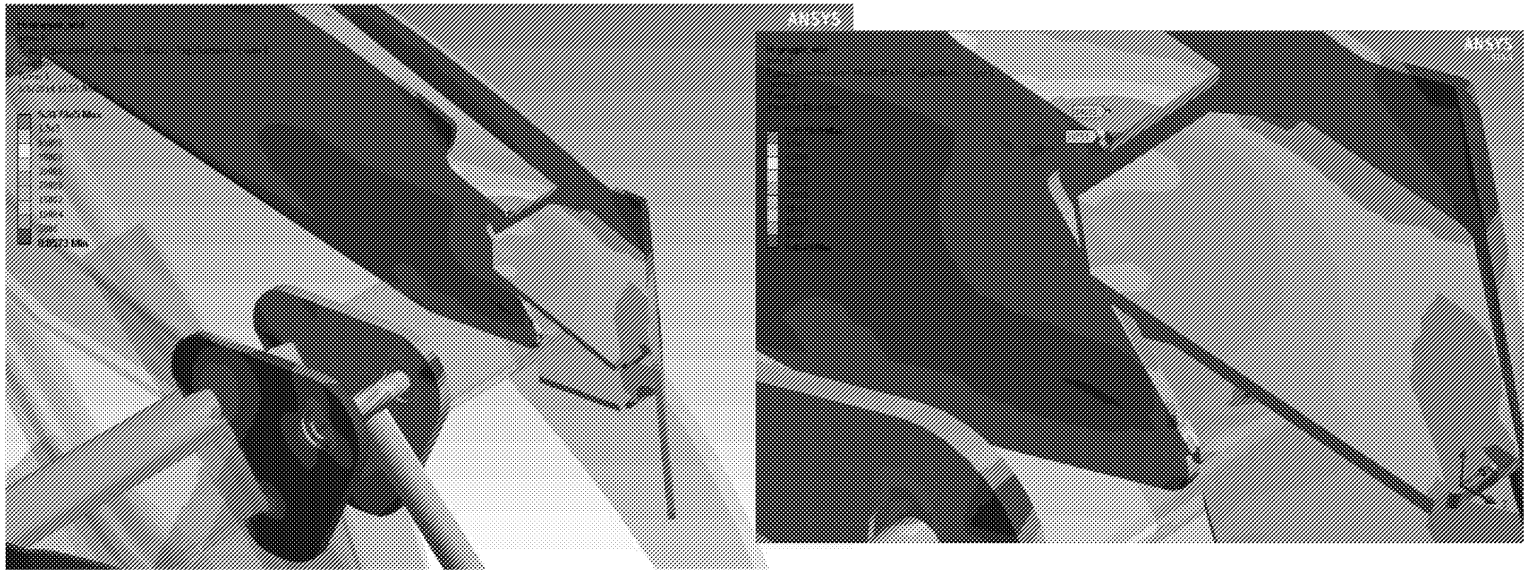
TORO-0000381.12/22

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Yield Criteria (50 ksi)



- Offset Grapple, Middle Position



Top 85, ksi
Bottom, 21 ksi

... within Epsilon

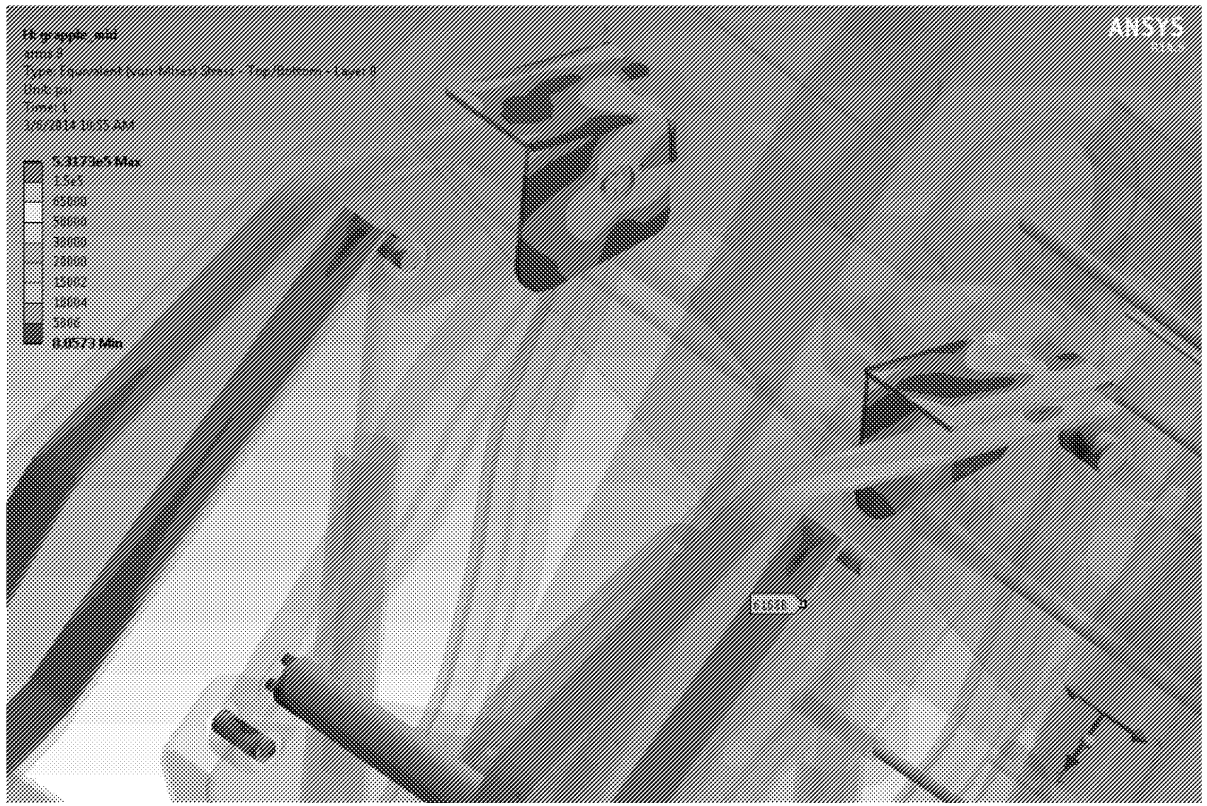
TORO-0000381.13/22

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Ex. 2015
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Yield Criteria (50 ksi)



- Offset Grapple, Middle Position



... within Epsilon

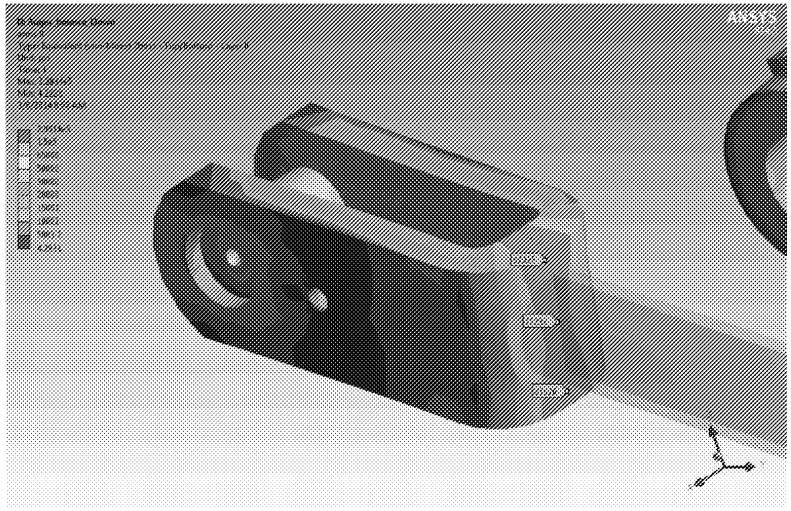
TORO-0000381.14/22

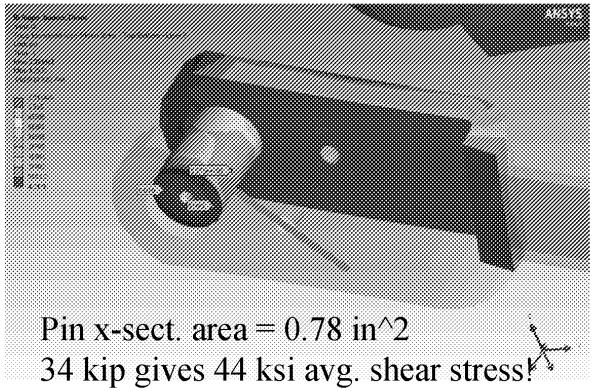
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Kubota North America Corporation et al
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Yield Criteria (50 ksi)

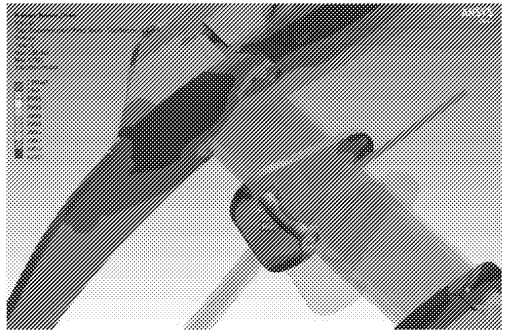


- Auger Bounce, Down Position
  - 34 Kip Bucket Piston Force





Pin x-sect. area = 0.59 in^2
34 kip gives 58 ksi avg. shear stress!



... within Epsilon

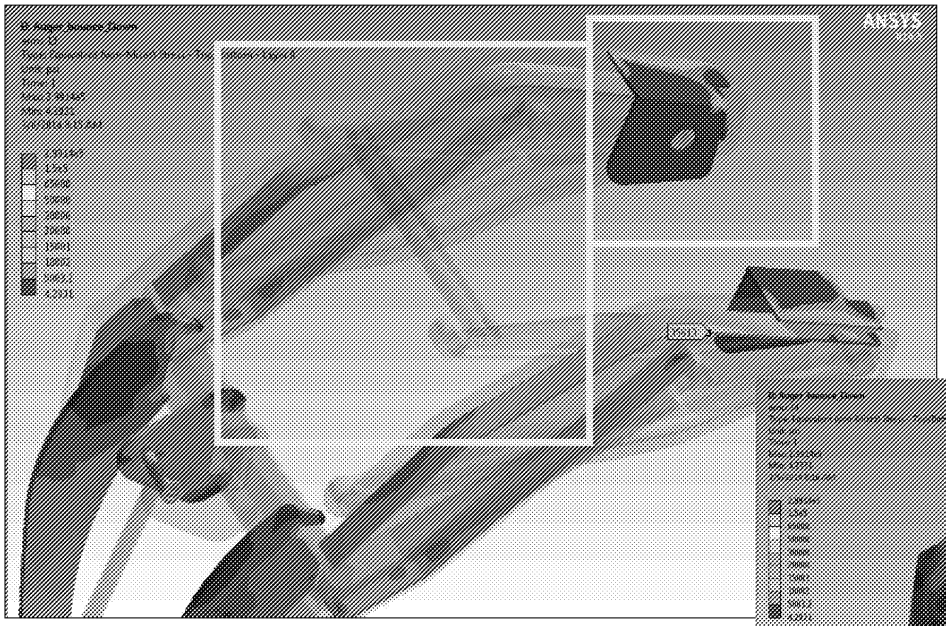
TORO-0000381.15/22

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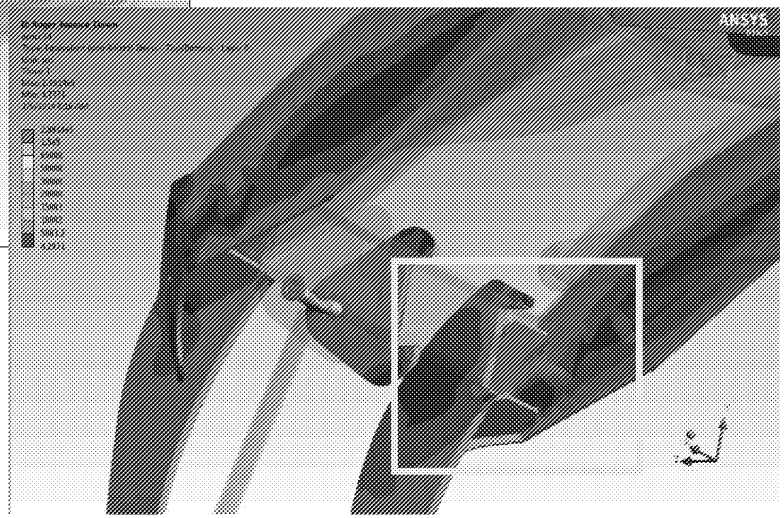
Yield Criteria (50 ksi)



- Auger Bounce, Down Position



Looks good!



... within Epsilon

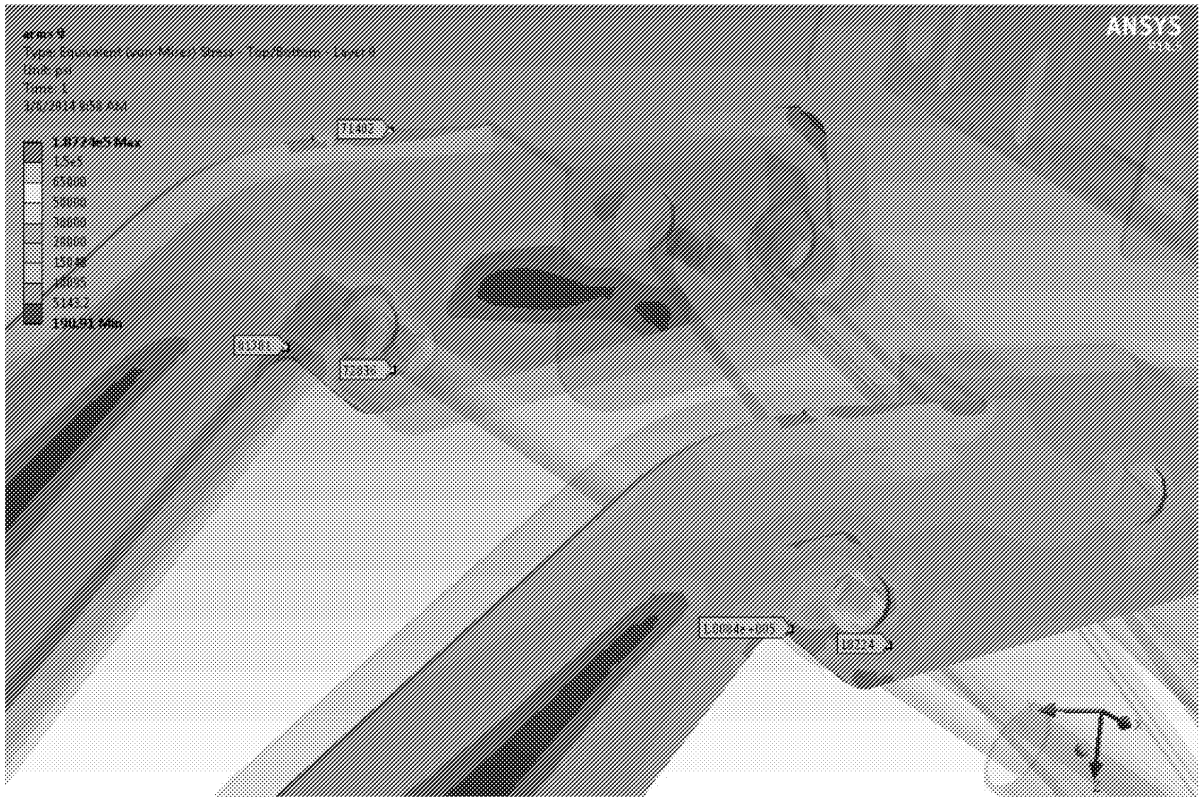
TORO-0000381.16/22

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Yield Criteria (50 ksi)



- Auger Bounce, high Position
  - Outboard Plates



TORO-0000381.17/22

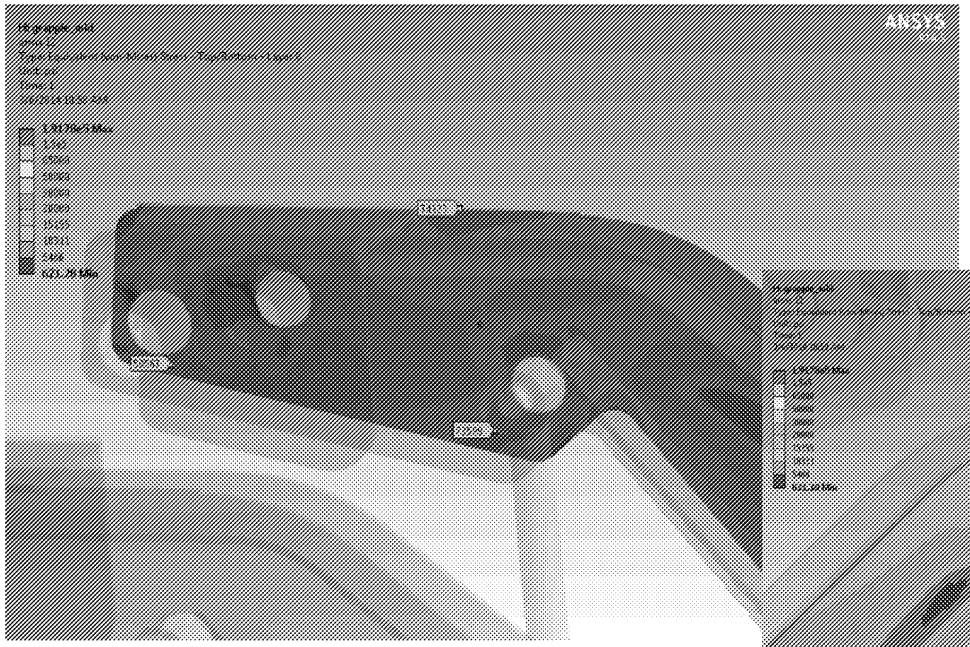
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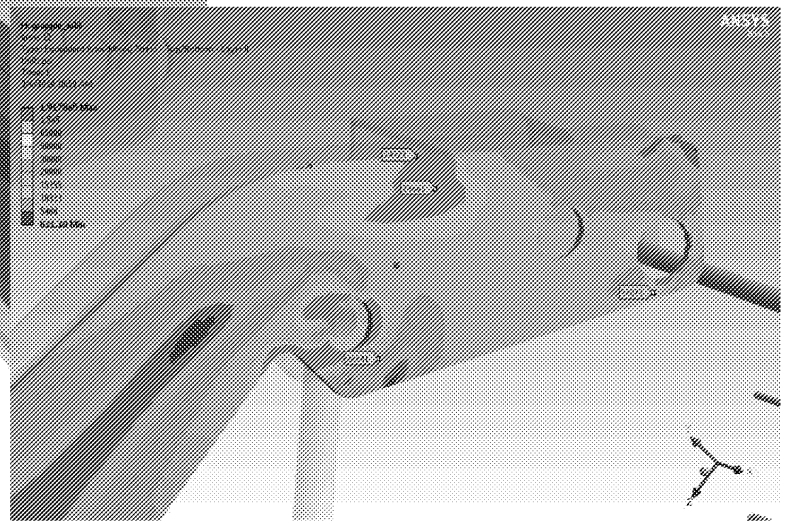
Ex. 2015
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Yield Criteria (50 ksi)



- Offset Grapple, Middle Position
  - Outboard Plates





... within Epsilon

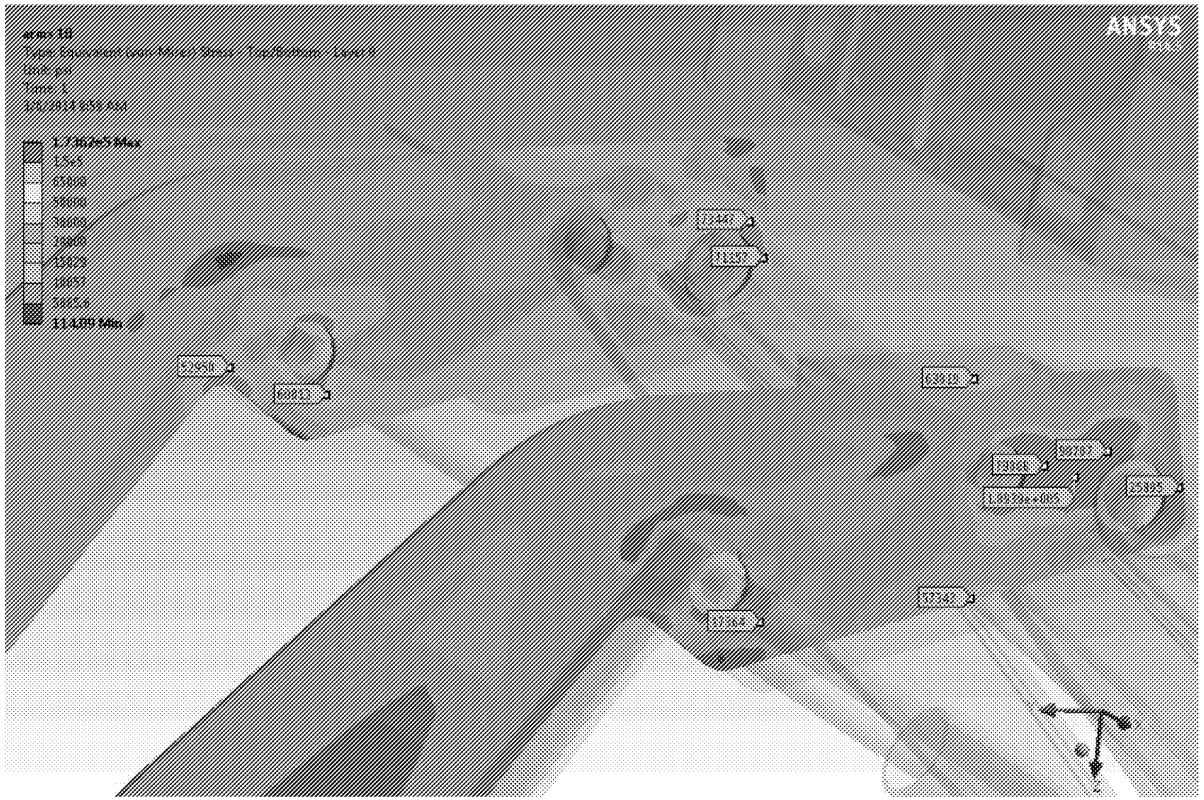
TORO-0000381.18/22

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Yield Criteria (50 ksi)



- Auger Bounce, High Position
  - inboard Plates

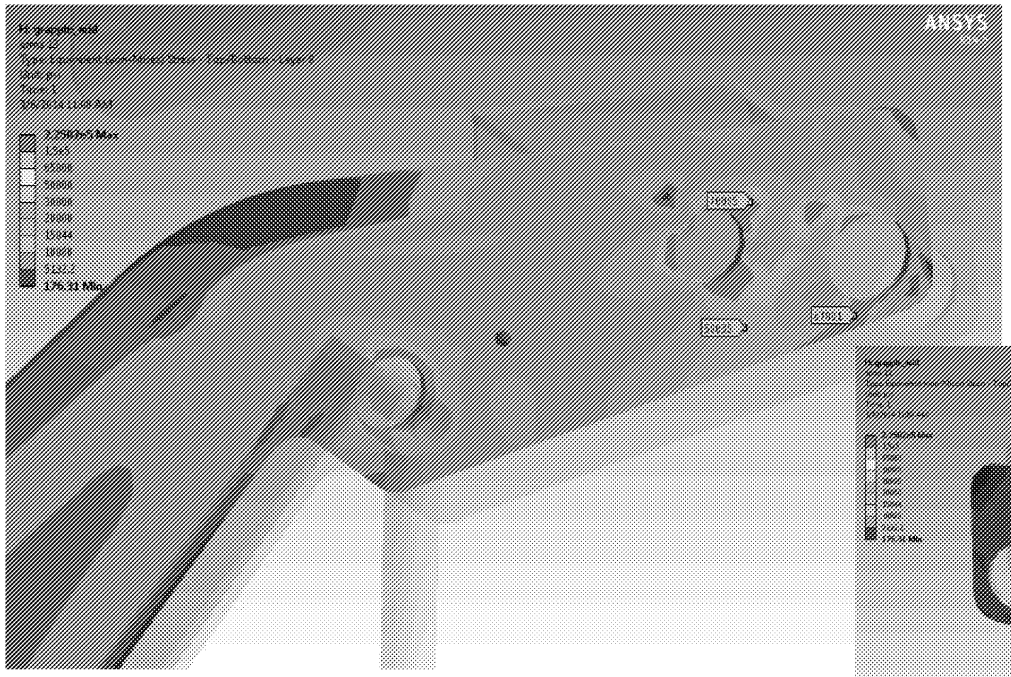


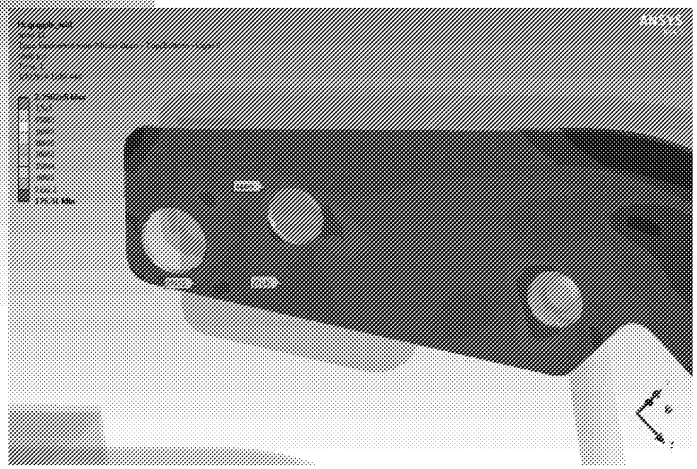
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Yield Criteria (50 ksi)



- Offset Grapple, Middle Position
  - inboard Plates





... within Epsilon

TORO-0000381.20/22

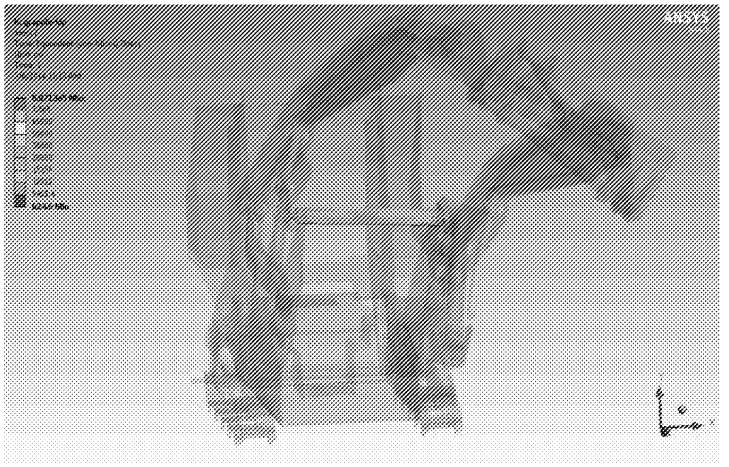
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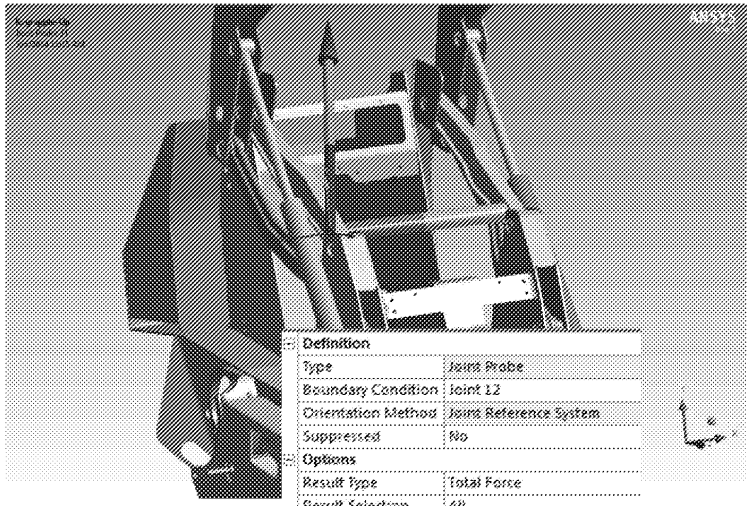
Ex. 2015
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Yield Criteria (50 ksi)

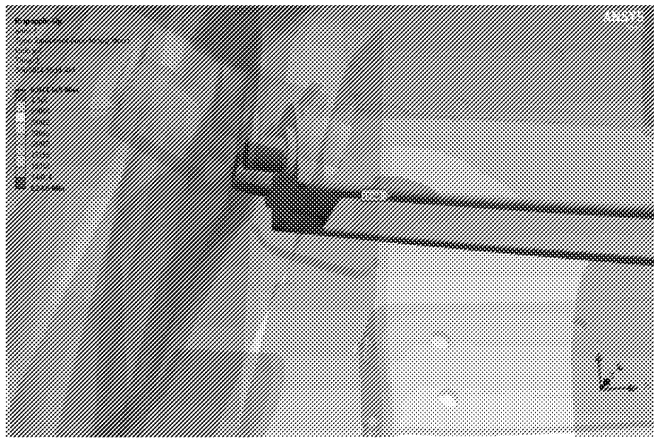


- Offset Grapple, High Position
  - Crossbar
  - 5X displacement scaling
  - No bolt-pretension modeled





Definition	
Type	Joint Probe
Boundary Condition	Joint 12
Orientation Method	Joint Reference System
Suppressed	No
Options	
Result Type	Total Force
Result Selection	All
Display Time	End Time
Results	
Maximum Value Over Time	
X Axis	-2030.1 lbf
Y Axis	2890.5 lbf
Z Axis	-1191.3 lbf
Total	3727.7 lbf



... within Epsilon

TORO-0000381.21/22

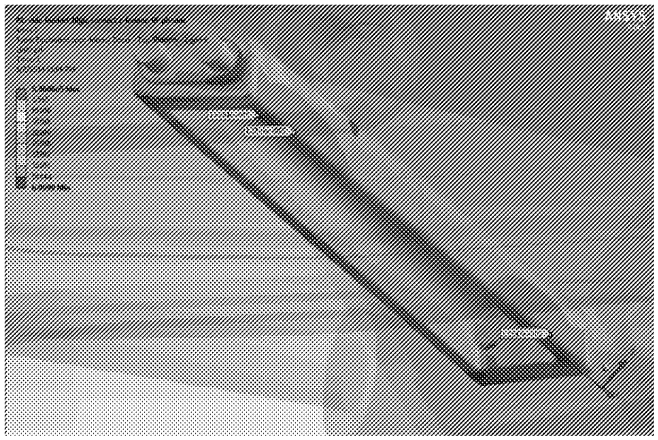
EX1030 / Page 671 of 900
Kubota North America Corporation et al

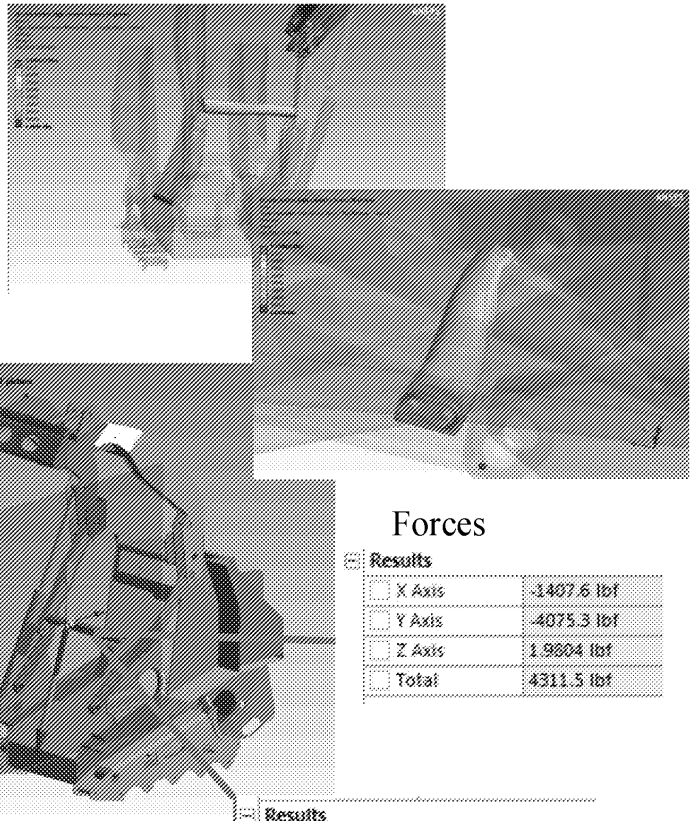
Ex. 2015
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Yield Criteria (50 ksi)



- Side Impact, Bucket - High Position
  - Crossbar
  - 10X displacement scaling
  - No bolt-pretension modeled





Forces

Results	
X Axis	-1407.6 lbf
Y Axis	-4075.3 lbf
Z Axis	1.9804 lbf
Total	4311.5 lbf

Moments

Results	
X Axis	19209 lbf·in
Y Axis	-6556.9 lbf·in
Z Axis	7072. lbf·in
Total	21494 lbf·in

... within Epsilon

TORO-0000381.22/22

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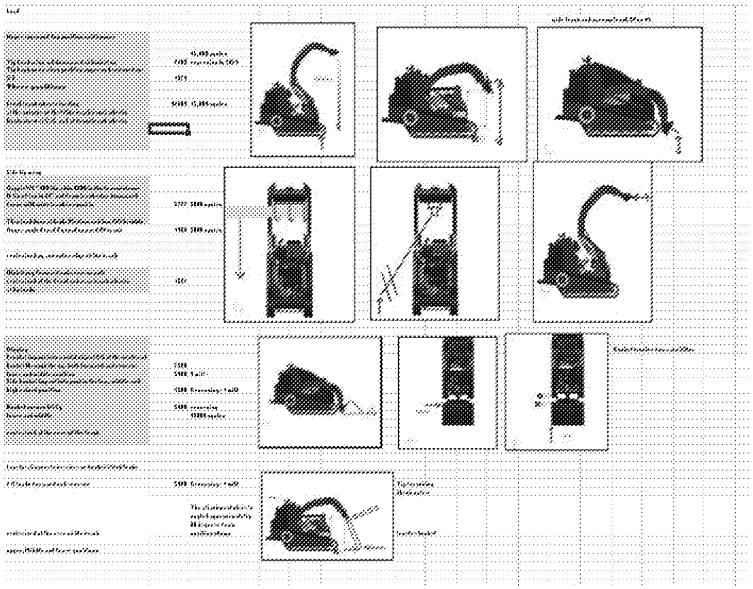
TMAX Loader Cab

03/05/2014

21 Load cases



- Uses defined loads (21 cases)
- High Position - Leveler Load now originates 32” below bucket
  - And 12” forward





... within Epsilon

TORO-0000382.2/9

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Summary



- See Excel sheets

		Case Label	Peak Tower Stress (ksi)	F.S	Cab Stress		Tracks		A
Low Cycle									
Auger Bounce	High	F	171	0.29	51	0.98	51	0.98	
	Med	U	123	0.41	77	0.65	41	1.22	
	Low	B	172	0.29	82	0.61	39	1.28	
Offset Grapple	High	K	92	0.54	87	0.52	56	0.89	
	Med	H	97	0.52	110	0.45	33	1.52	
	Low	O	124	0.40	95	0.53	35	1.43	
Auger kick-out / angle	High	L	63	0.79	32	1.56	24	2.08	
High Hang Fwd	High	G	42	1.19	25	2.00	13	3.85	
Side Bucket hit	High	AC	80	0.56	67	0.75	47	1.06	
	Med	AD	36	1.39	29	1.72	22	2.27	
	Low	AE	25	2.00	14	3.57	18	2.78	
Corner Bucket Hit	Med	AB	27	1.85	46	1.09	22	2.27	
	Low	AG	65	0.77	13	3.85	10	5.00	
High Cycle Fatigue Cases									
Leveler	High	N	51	0.98	50	0.98	50	0.98	
	Med	Y	52	0.97	21	0.91	13	1.48	
Trencher	Med	X	5	3.84	4	4.80	13	1.48	
	Low	S	5.7	3.37	6	3.20	12	1.60	
Digging	Med	V	36	0.53	42	0.46	37	0.52	
	Low	C	78	0.25	26	0.74	12	1.60	

... within Epsilon

TORO-0000382.3/9

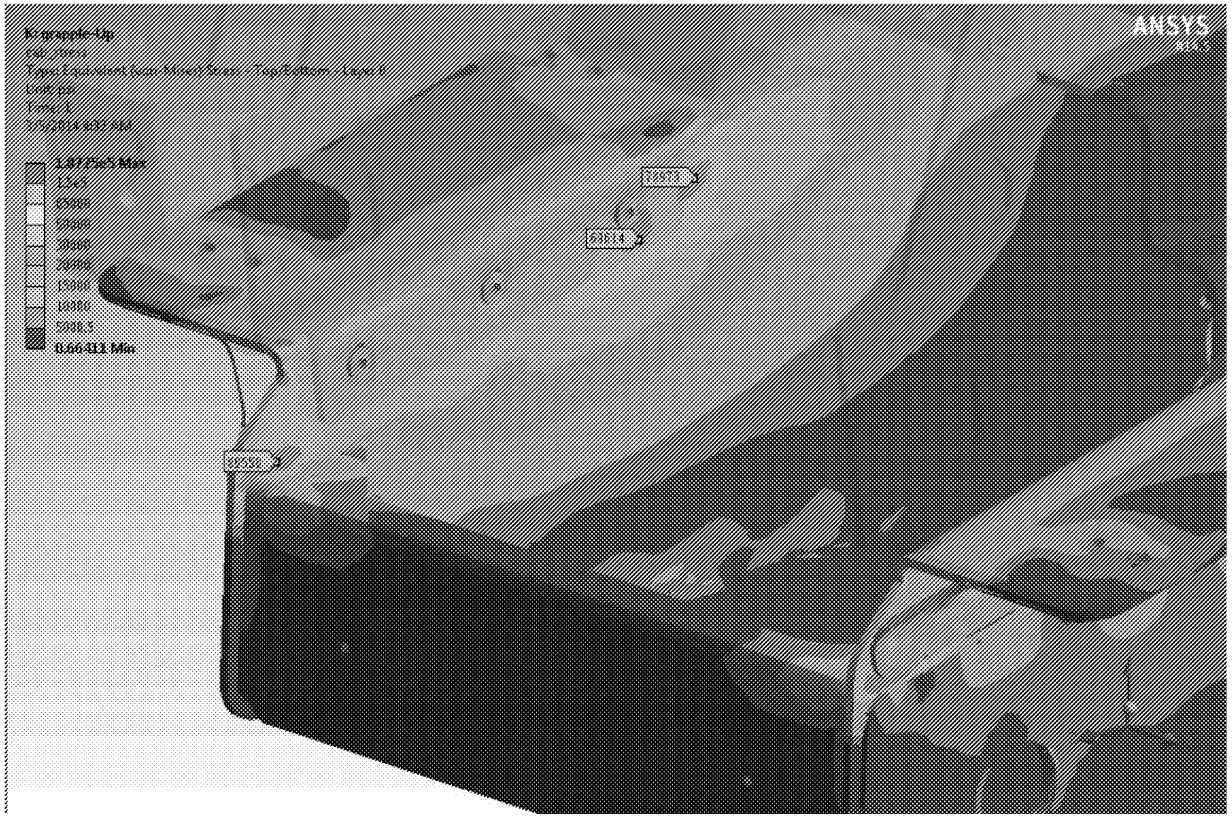
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Yield Criteria (50 ksi)



- Offset Grapple, High Position



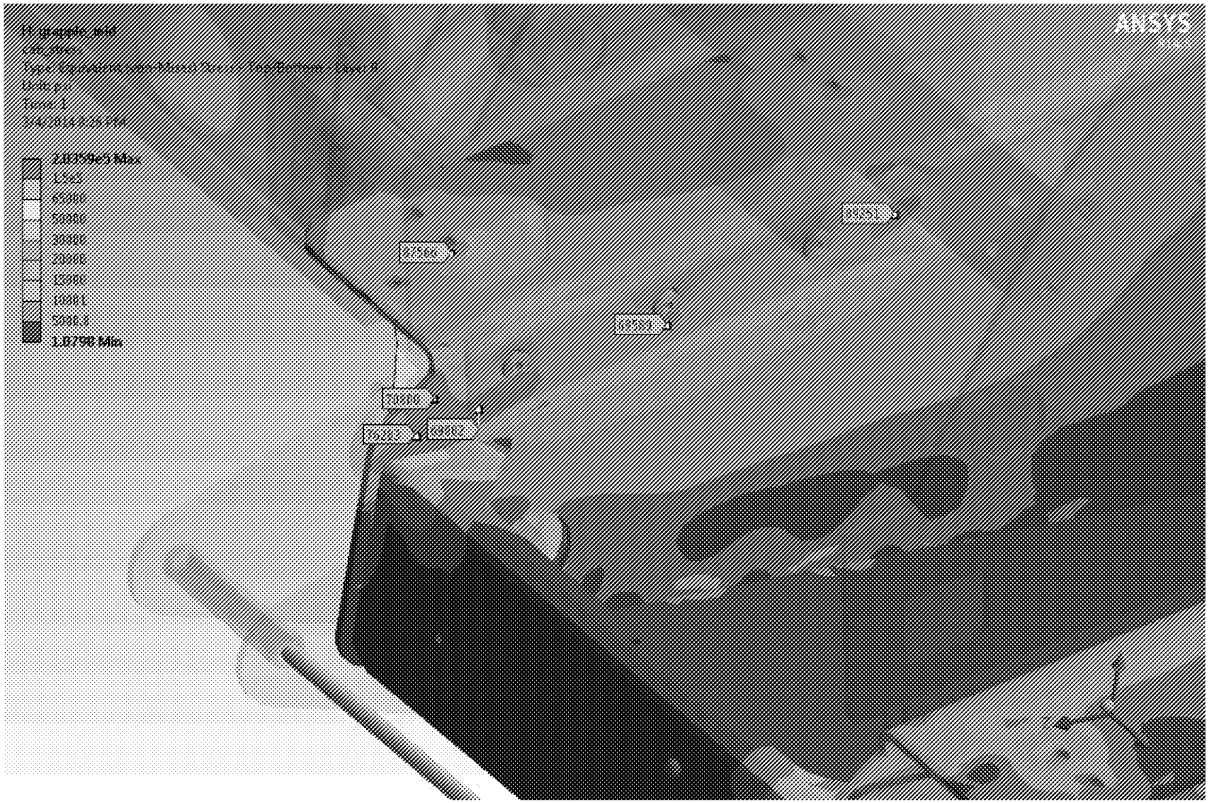
... within Epsilon

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Ex. 2015
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Yield Criteria (50 ksi)



- Offset Grapple, Mid Position



... within Epsilon

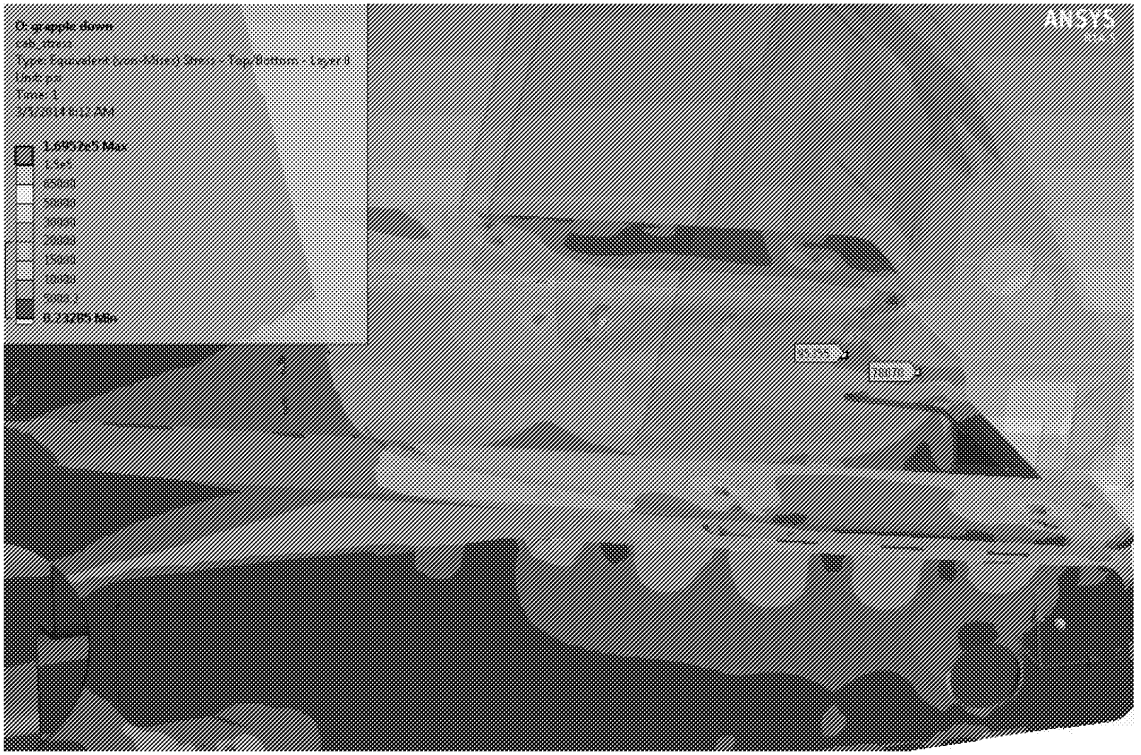
TORO-0000382.5/9

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Ex. 2015
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Yield Criteria (50 ksi)



- Offset Grapple, Low Position



... within Epsilon

TORO-0000382.6/9

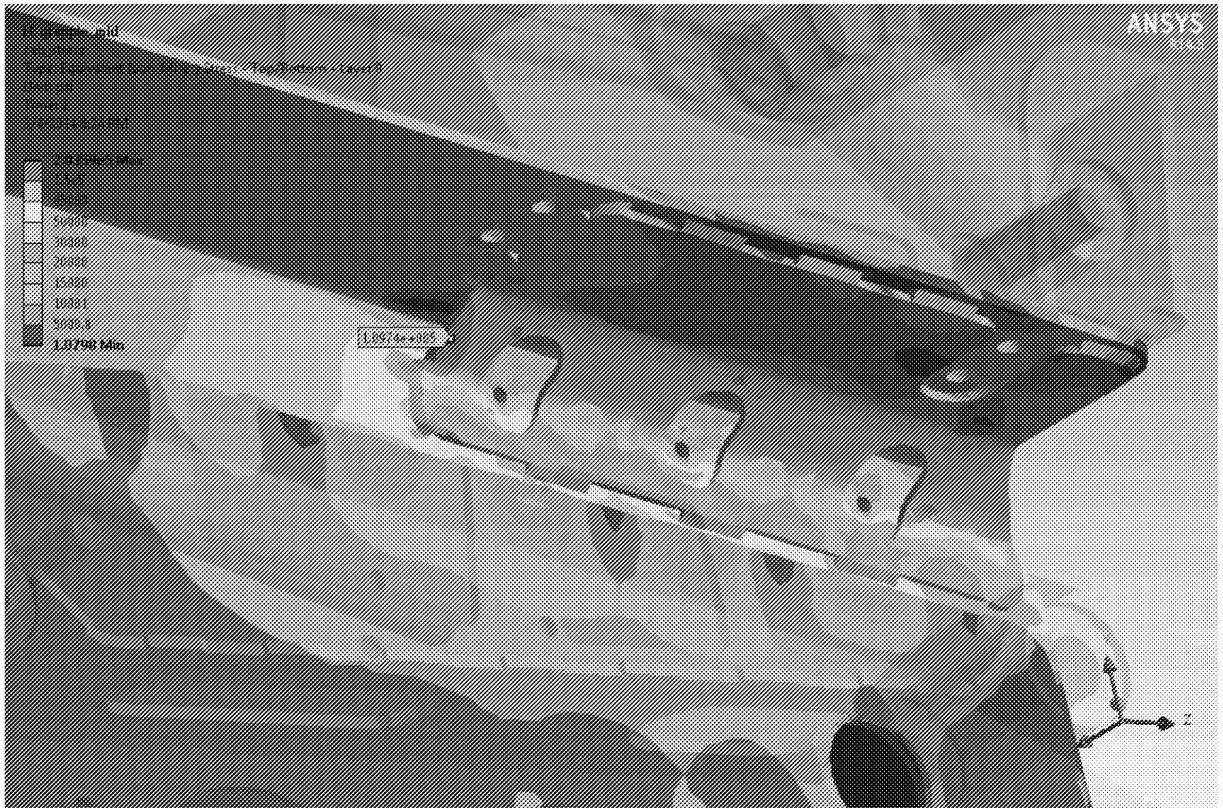
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Yield Criteria (50 ksi)



- Offset Grapple, Mid Position



... within Epsilon

TORO-0000382.7/9

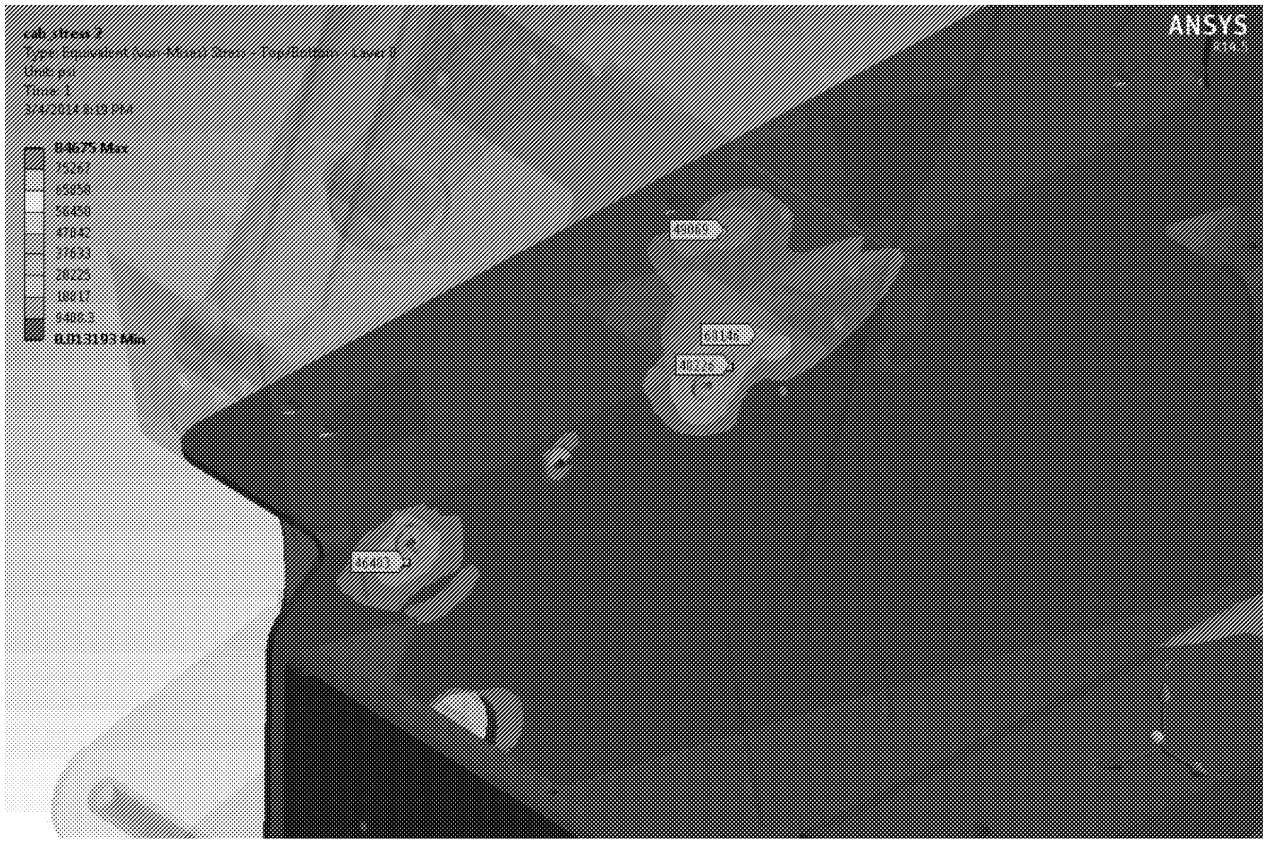
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Kubota North America Corporation et al

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Fatigue Criteria (19 ksi?)



- Leveler, High Position is critical case



... within Epsilon

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TORO-0000382.8/9

Fatigue Criteria (19 ksi?)



- Digging, Low is critical case



... within Epsilon

TORO-0000382.9/9

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TMAX Loader

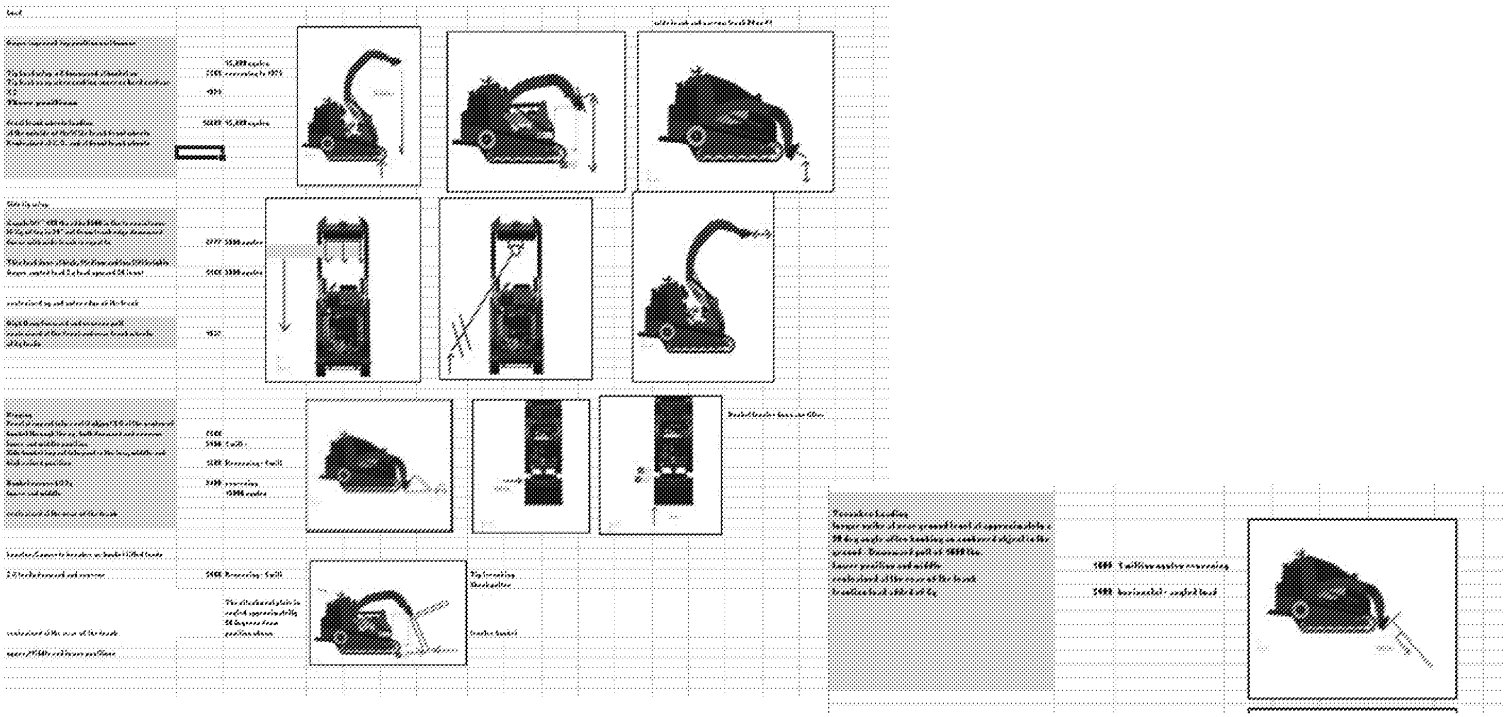
Lower Arm Stresses

02/28/2014

21 Load cases



- Uses defined loads (21 cases)



... within Epsilon

TORO-0000383.2/8

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Summary



- See Excel sheets

		Case Label	Peak Stress (ksi)	F.S	Axial Force (lbf)	Shear Load (lbf)	Moment (in	Moment (i	FX	FY	FZ	FX	FY	FZ	MX	MY	MX	MY	Theta
Low Cycle																			
Auger Bounce	High	F	149	2.32	38,913	-3888	3831	1212	10368	13757	0	21453	19778	-3889	583	529	3822	-2546	46.5
	Med	G	89	3.92			0	0											14.6
	Low	B	112	3.42	38,118	3820	-3518	-1279	17667	3382	0	21277	1310	3682	148	-427	-3647	-943	6.9
Offset Grapple	High	K	75.8	6.59	21,536	-3309	-2891	-2635	-11813	85	-3309	-7940	-19799	0	-2714	1883	-462	-721	46.5
	Med	H	58.7	8.75	21,563	2090	1866	2253	12199	-3501	2090	7281	8589	0	1979	583	149	1711	14.6
	Low	O	76.7	6.58	-	0	0	0											6.9
Auger kick-out / angle	High	L	38.4	1.24															
High Hang Pwd	High	G	48	1.05															
Side Bucket hit	High	AC	61.5	0.73	-	0	0	0											46.5
	Med	AD	8.3	5.23															
	Low	AE	11.1	4.05															
Corner Bucket Hit	Med	AB	9.8	4.53															
	Low	AG	45.8	0.98	-	0	0	0											6.9
High Cycle Fatigue Cases																			
Leveler	High	N	78.9	0.22	22,566	-2087	1966	869	7002	7328	0	10931	11577	-2087	220	241	1764	-1089	46.5
	Med	Y	34.4	8.46	11,404	-1035	-927	-284	4569	1681	0	6642	1236	-1035	9	-114	-978	73	14.6
Trencher	Med	X	1.5	11.38															
	Low	S	3.4	5.02															
Digging	Med	V	4.6	3.72															
	Low	C	51.4	0.33	18,358	-1738	-1729	-900	8590	1298	0	9692	903	-1738	-63	-202	-1761	-485	6.9

... within Epsilon

TORO-0000383.3/8

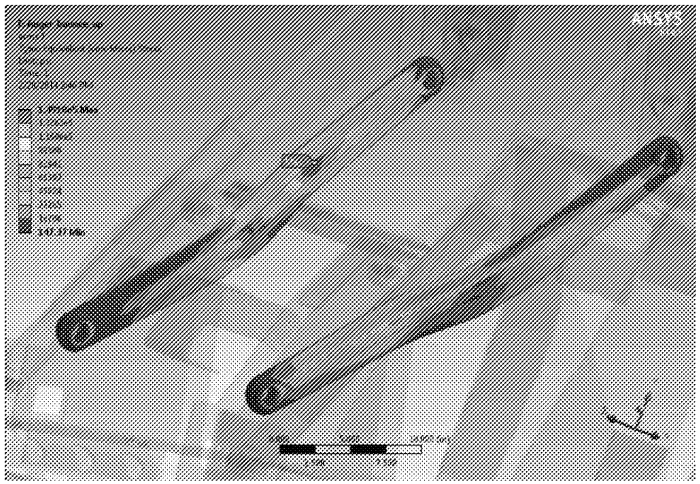
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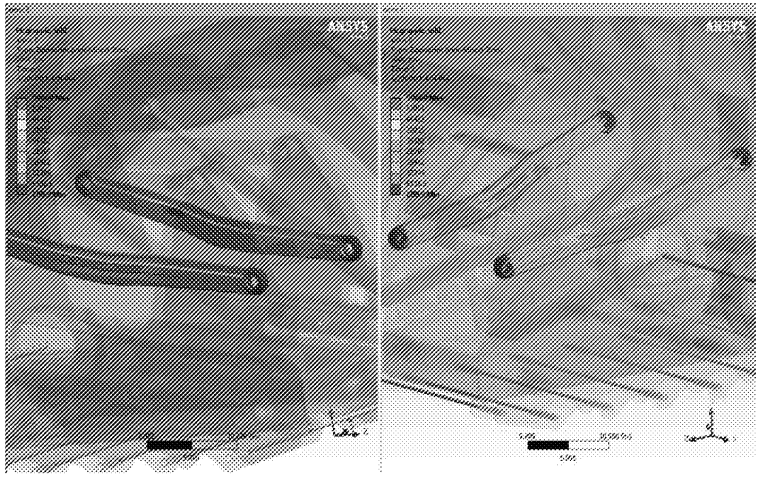
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Yield Criteria (45 ksi)



- Auger Bounce, High is critical case
  - 149 ksi equivalent stress
  - 40 kip axial force
  - 4 kip shear force
  - 3900 in-lb longitudinal moment
- Offset Grapple Middle has highest moment (bending), 2900 in-lb





... within Epsilon

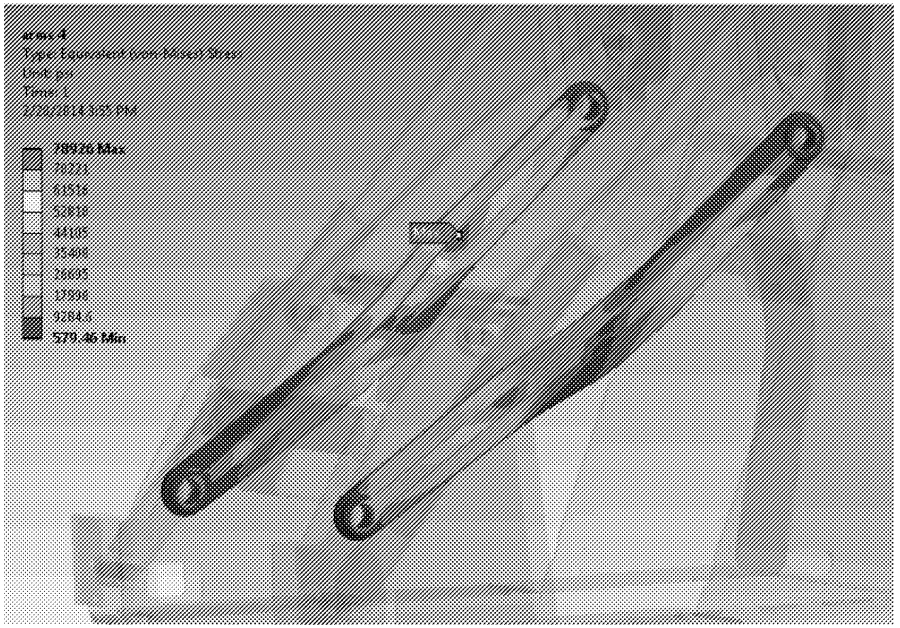
TORO-0000383.4/8

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Fatigue Criteria (17 ksi?)



- Leveler, High is critical case
  - 79 ksi equivalent stress
  - 14 kip axial force
  - 2.4 kip shear force
  - 1300 in-lb longitudinal moment
  - 2270 in-lb bending moment



... within Epsilon

TORO-0000383.5/8

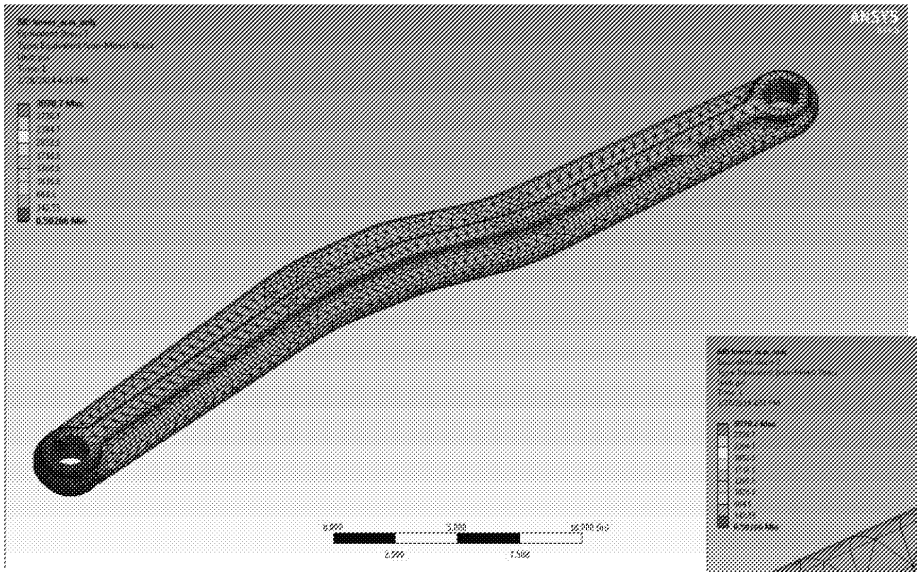
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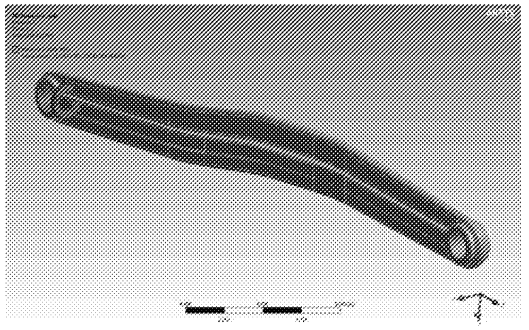
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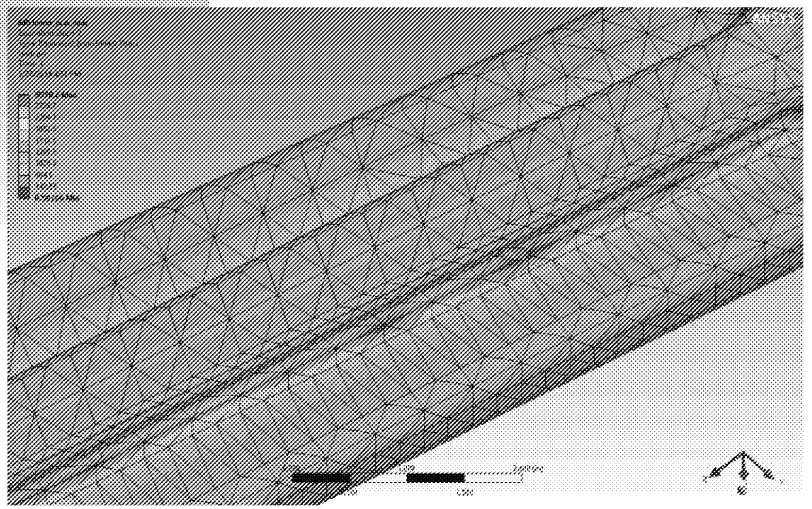
Baseline Stresses



- 1000 in-lb longitudinal moment







... within Epsilon

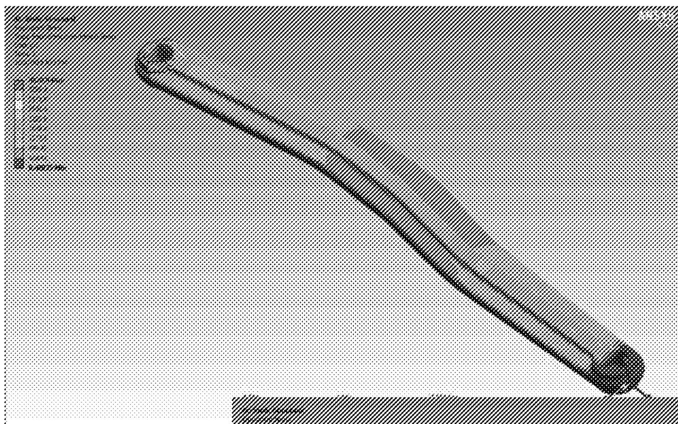
TORO-0000383.6/8

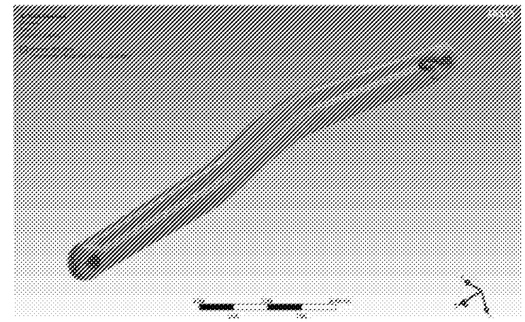
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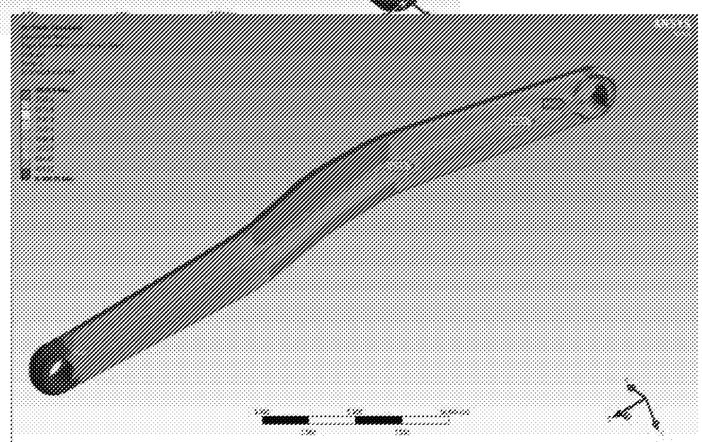


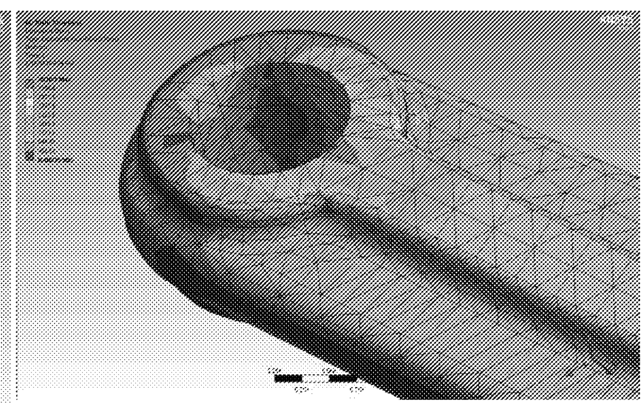
Baseline Stresses

- 1000 in-lb bending moment







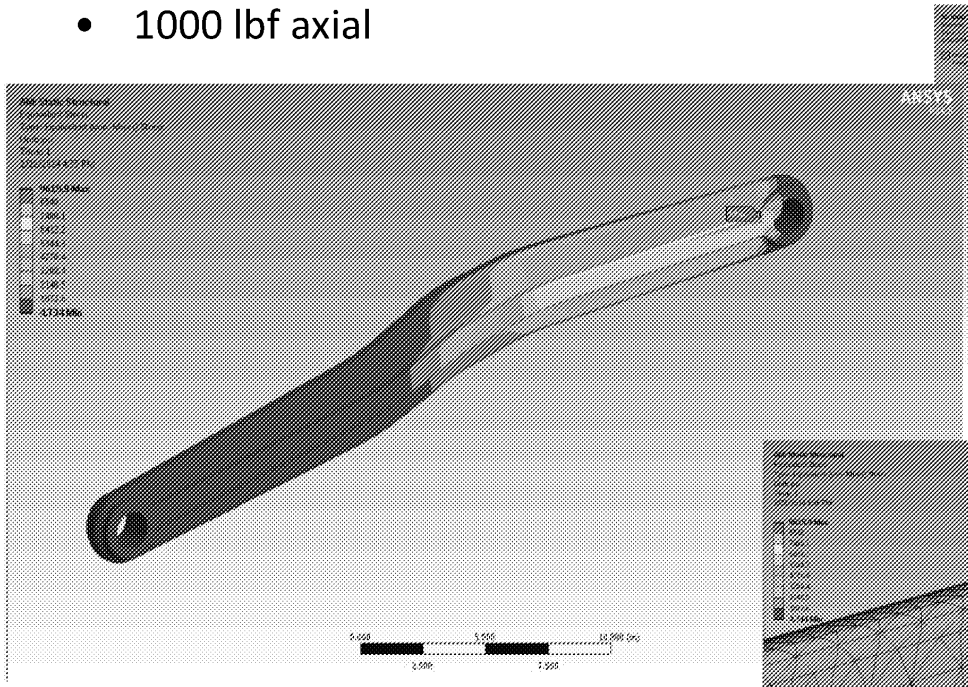


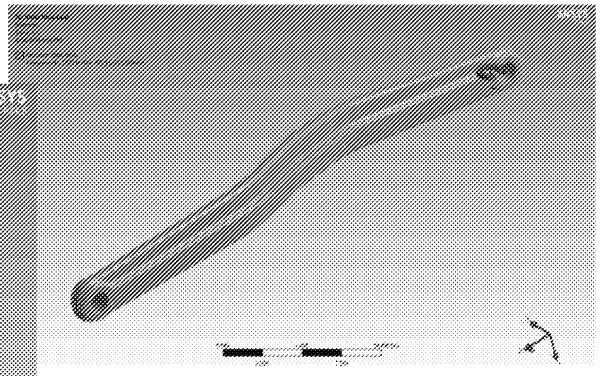
... within Epsilon

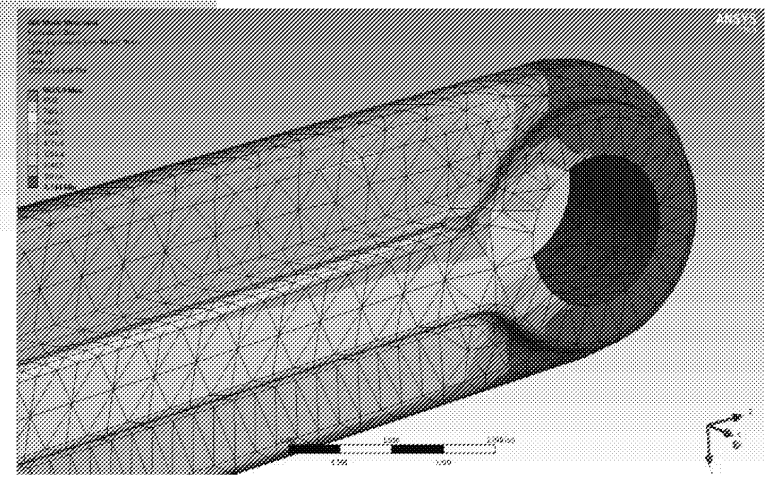
Baseline Stresses



- 1000 lbf axial







... within Epsilon

TORO-0000383.8/8

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TMAX Loader

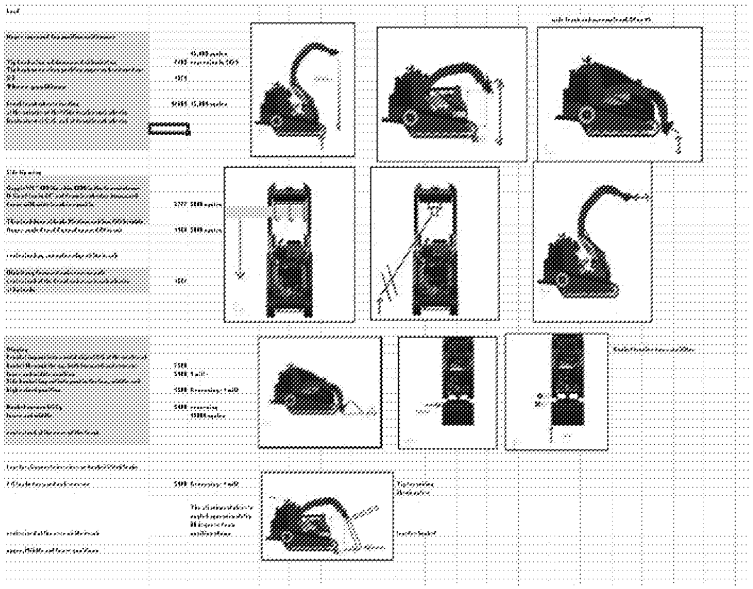
Tower

03/04/2014

21 Load cases



- Uses defined loads (21 cases)
- High Position - Leveler Load now originates 32” below bucket
  - And 12” forward





... within Epsilon

TORO-0000387.2/6

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Summary



- See Excel sheets

		Case Label	Peak Stress (ksi)	F.S	A>
Low Cycle					
Auger Bounce	High	F	171	0.29	
	Med	U	123	0.41	
	Low	B	172	0.29	
Offset Grapple	High	K	92	0.54	
	Med	H	97	0.52	
	Low	O	124	0.40	
Auger kick-out f angle	High	L	63	0.79	
High Hang Fwd	High	G	42	1.19	
Side Bucket hit	High	AC	90	0.56	
	Med	AD	36	1.39	
	Low	AE	25	2.00	
Corner Bucket Hit	Med	AB	27	1.85	
	Low	AG	65	0.77	
High Cycle Fatigue Cases					
Leveler	High	N	51	0.38	
	Med	Y	52	0.37	
Trencher	Med	X	5	2.84	
	Low	S	5.7	3.27	
Digging	Med	V	36	0.53	
	Low	C	78	0.25	

... within Epsilon

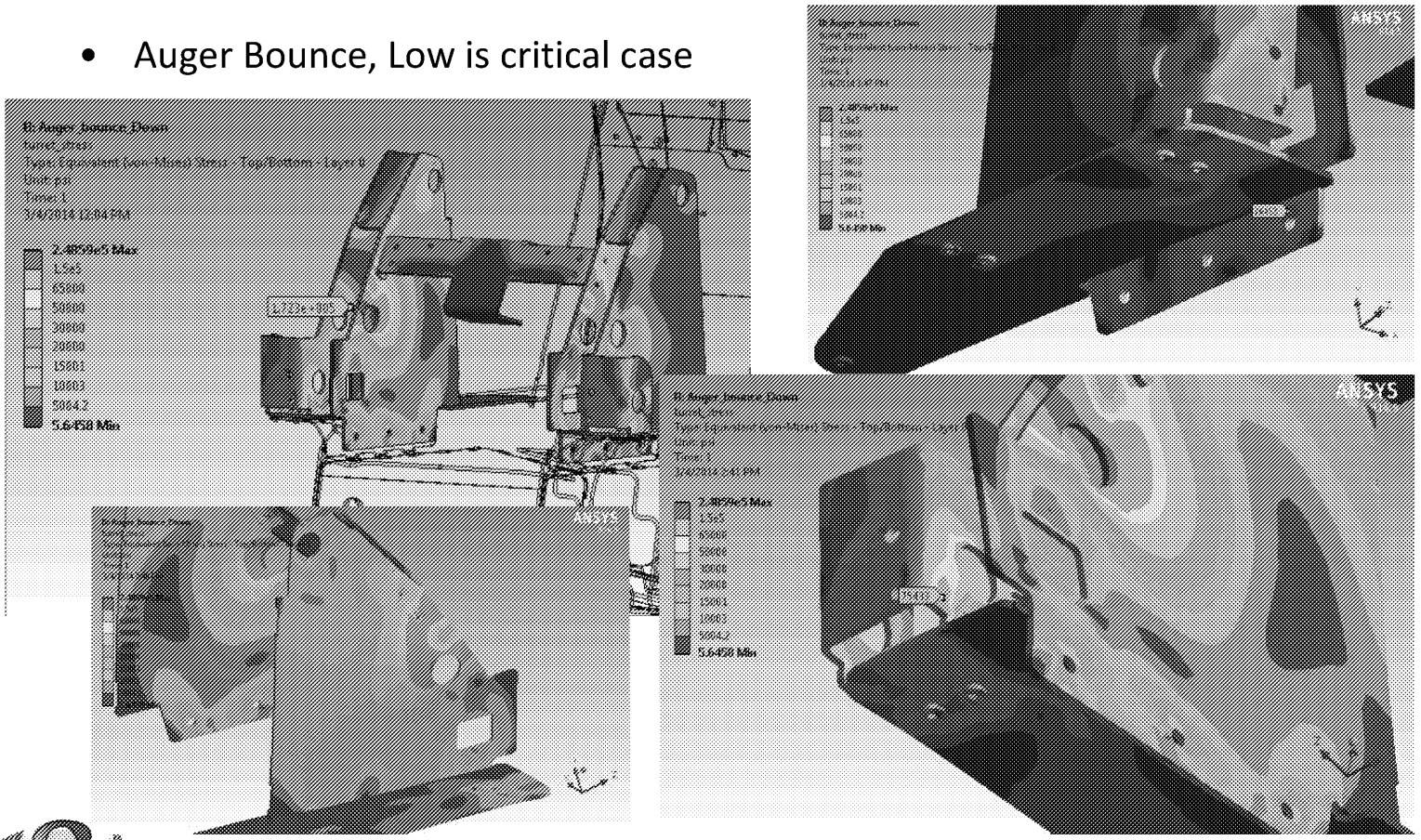
TORO-0000387.3/6

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Yield Criteria (50 ksi)



- Auger Bounce, Low is critical case



... within Epsilon

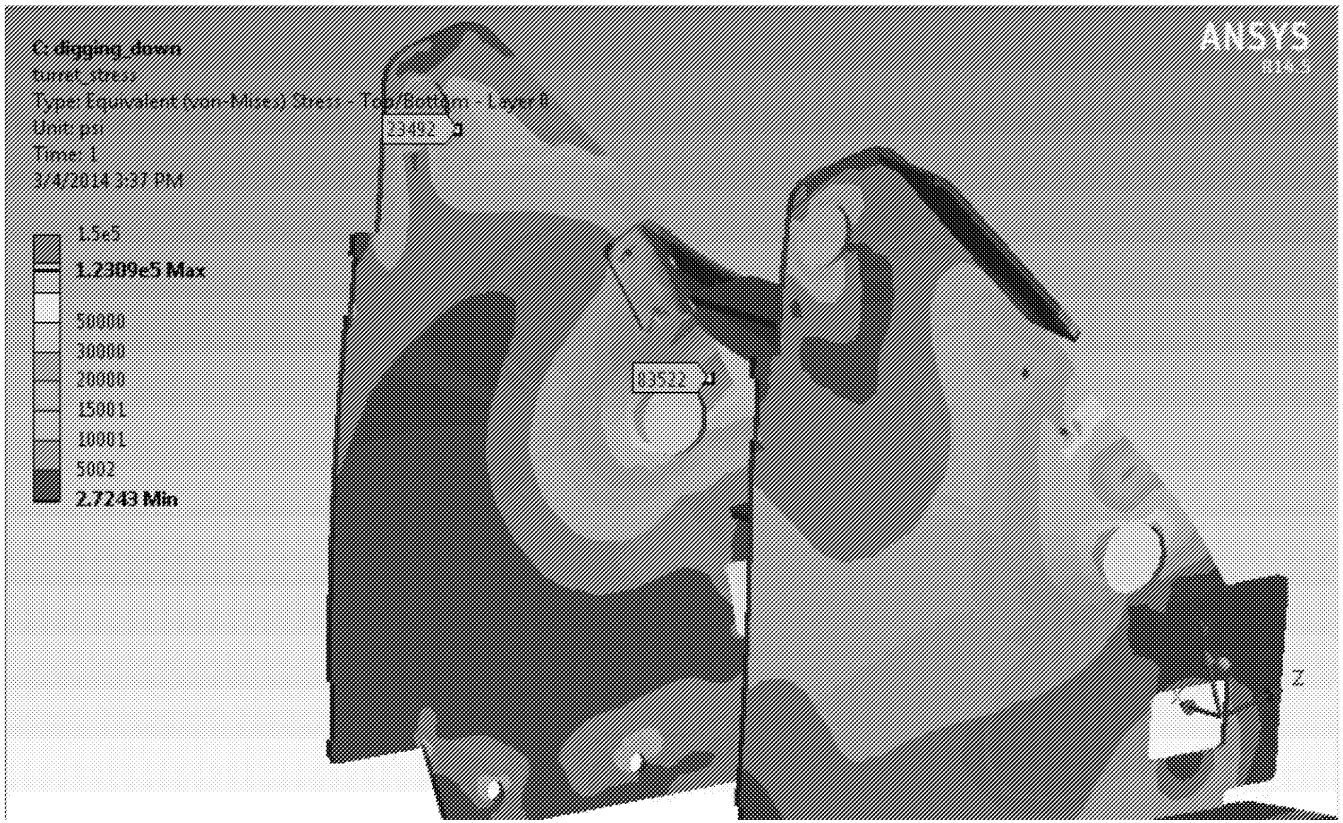
TORO-0000387.4/6

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Fatigue Criteria (19 ksi?)



- Digging (low position) is fatigue critical case



... within Epsilon

TORO-0000387.5/6

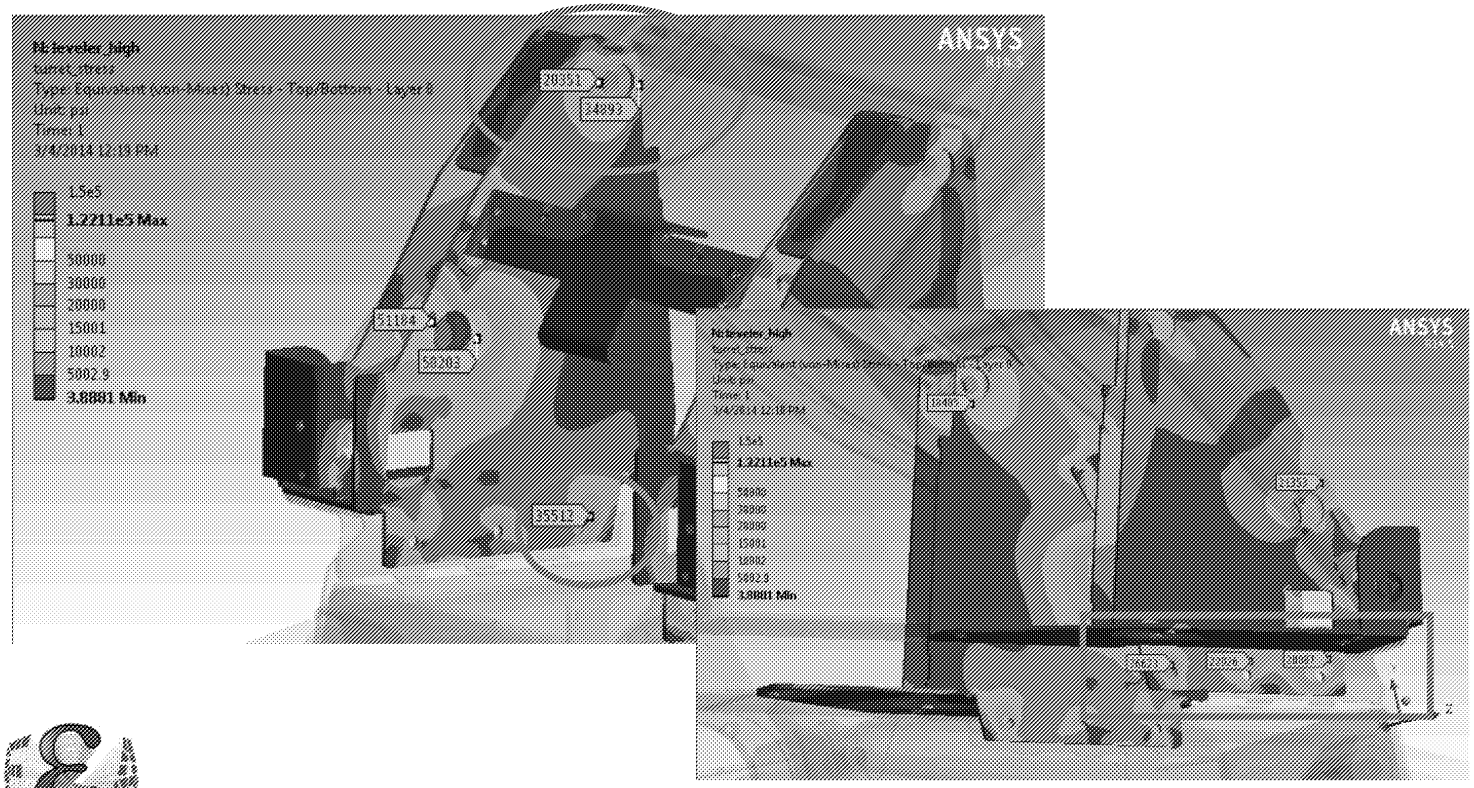
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Fatigue Criteria (19 ksi?)



- Leveler (high position) is fatigue critical case

  Load originates 32” below bucket



... within Epsilon

TORO-0000387.6/6

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TMAX Loader

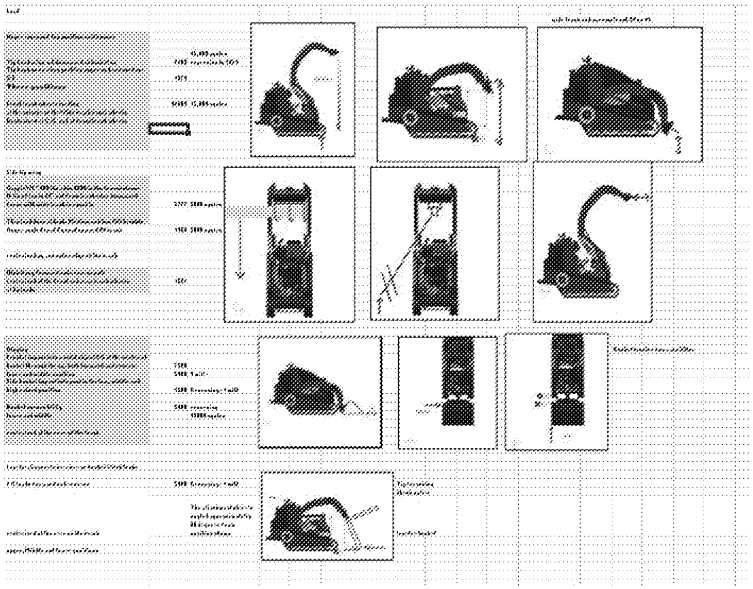
Rectangular Torque Tube

03/03/2014

21 Load cases



- Uses defined loads (21 cases)
- High Position - Leveler Load now originates 32” below bucket
  - And 12” forward





... within Epsilon

TORO-0000389.2/6

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Summary



- See Excel sheets

		Case Label	Peak Stress (ksi)	F.S	Axial Force (lbf)	Shear Load (lbf)	Torsional Moment (in-lb) M2	Long Moment (in-lb) MY	Short Moment (in-lb) MX	FX	FY	FZ	MX	MY	M2	Sig_MX	Sl_MY	SIG_M2	Sig_axial	Sig_Shear	Total
Low Cycle																					
Auger Bounce	High	F	48	0.94																	
	Med	U	70	0.64																	
	Low	S	74	0.61	-1,626	16,977	87,618	-80,856	-14,276	-16,783	2,561	-1,028	-14,276	-80,856	87,618	6,904	21,416	19,072	-316	5,124	52,294
Offset Grapple	High	K	73	0.62																	
	Med	H	80	0.56																	
	Low	O	100	0.45	-1,938	9,174	180,000	-20,436	-5,799	-9,867	2,237	1,165	-5,799	-20,436	180,000	2,805	5,411	39,095	-363	2,823	49,764
Auger kick-out / angle	High	L	11	4.09																	
High Hang Fwd	High	G	6	7.50																	
Side Bucket fill	High	AC	10	3.48																	
	Med	AD	11	4.09																	
	Low	AE	13	4.50																	
Corner Bucket Fill	Med	AB	5	3.00																	
	Low	AG	20	2.25																	
High Cycle Fatigue Cases																					
Leveler	High	N	80	0.19	-1,178	22,522	96,243	-426,000	-13,019	-22269	3427	-478	-1.30E+04	-1.28E+05	9.62E+04	6,282	33,369	20,903	-362	6,930	67,122
	Med	Y	96	0.20																	
Trencher	Med	X	16	1.08																	
	Low	S	18.6	1.70																	
Digging	Med	Y	10	1.42																	
	Low	C	11	1.55																	

... within Epsilon

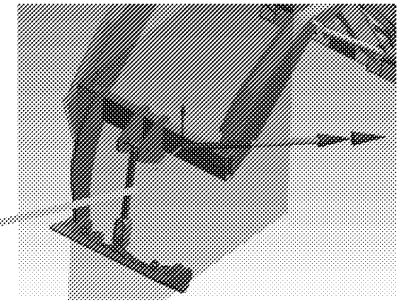
TORO-0000389.3/6

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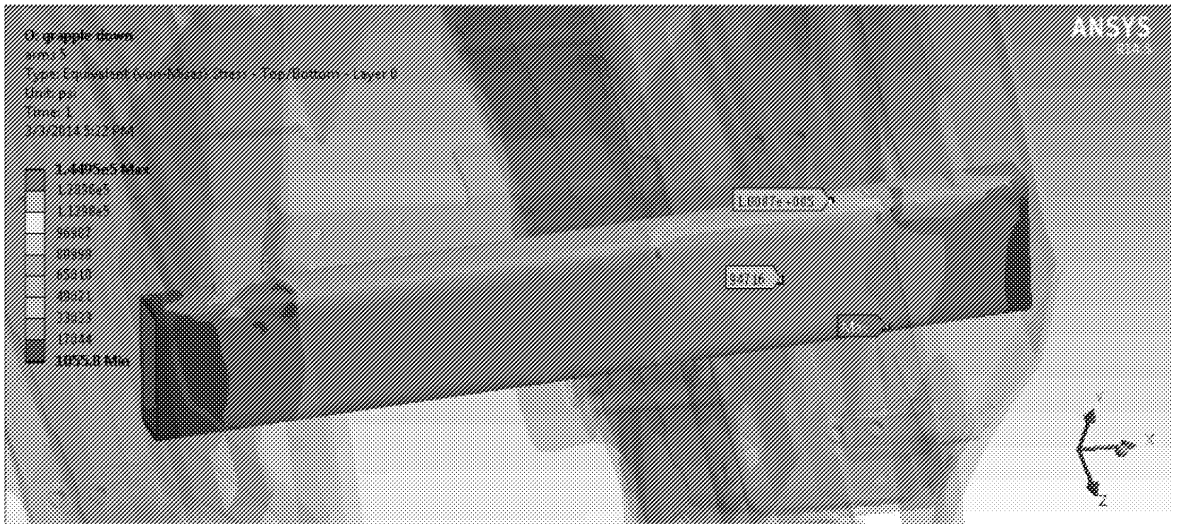
Yield Criteria (45 ksi)



- Offset Grapple, Low is critical case
  - 100 ksi equivalent stress
  - 1.2 kip axial force
  - 9 kip shear force
  - **180,000 in-lb torsional moment (MZ)**
  - 20,000 in-lb long moment (MY)
  - 5,800 in-lb short moment (MX)



Reference axes



... within Epsilon

TORO-0000389.4/6

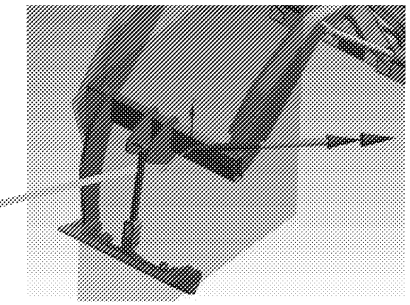
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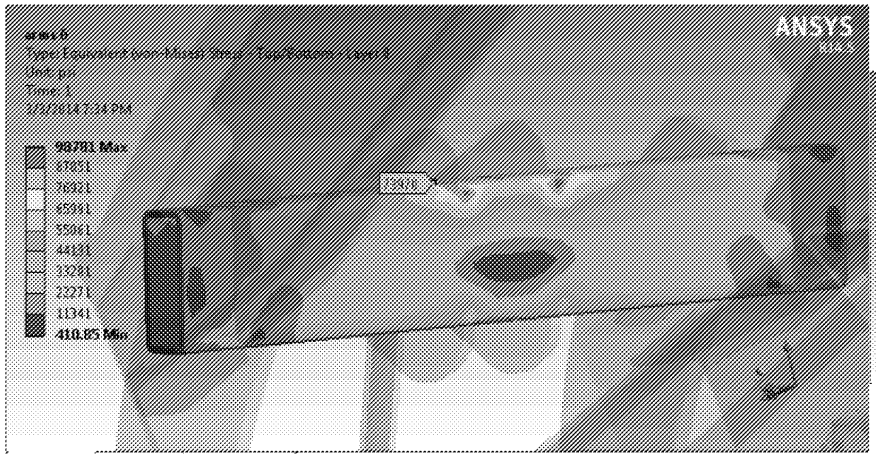
Yield Criteria (45 ksi)

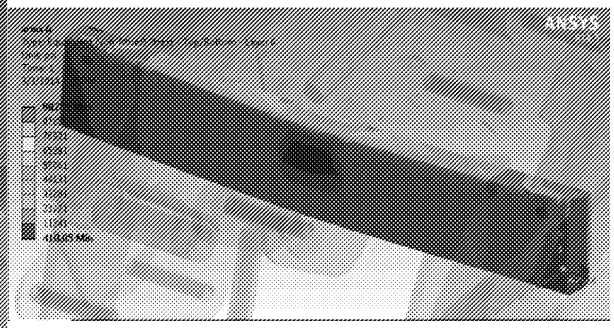


- Auger Bounce, Low is also high-stress case
  - 74 ksi equivalent stress
  - 1 kip axial force
  - 17 kip shear force
  - **87,800 in-lb torsional moment (MZ)**
  - **80,900 in-lb long moment (MY)**
  - 14,300 in-lb short moment (MX)



Reference axes





... within Epsilon

TORO-0000389.5/6

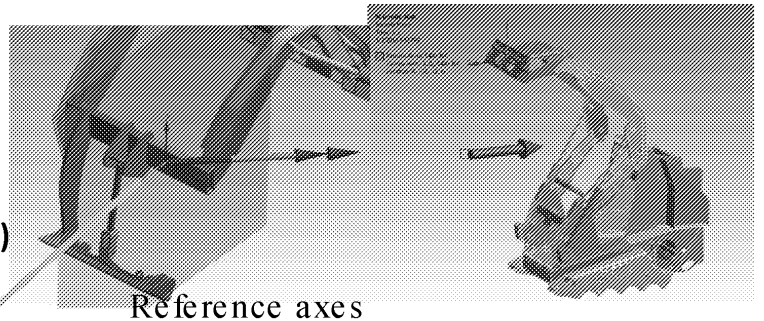
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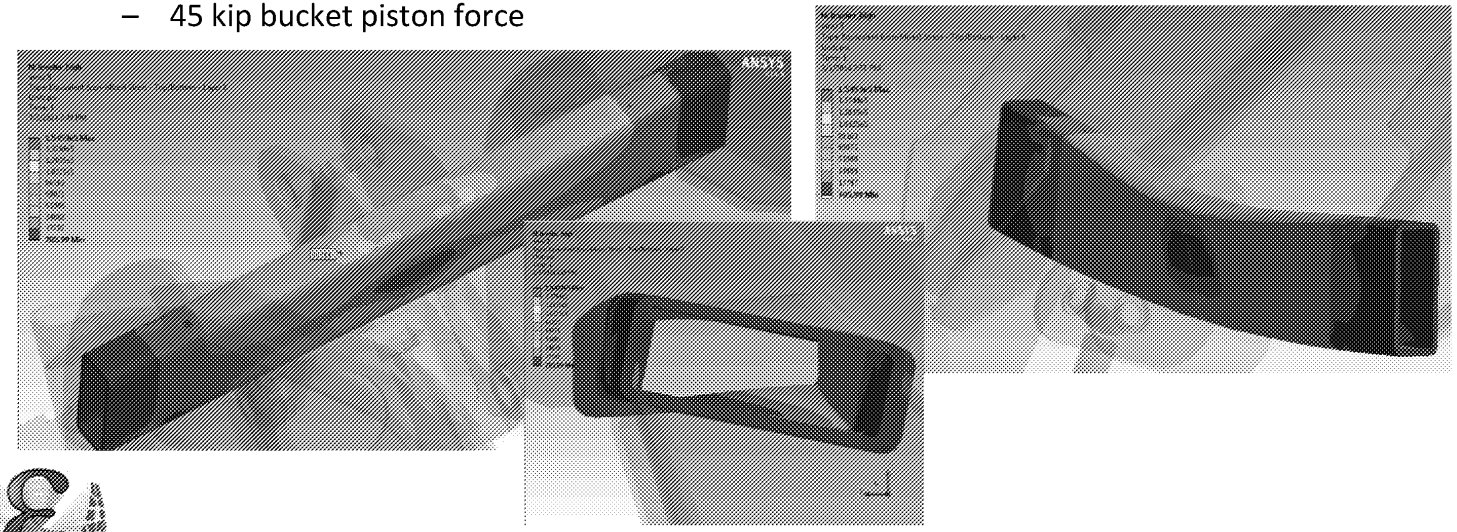
Fatigue Criteria (17 ksi?)



- Leveler, High is critical case
  - 90 ksi equivalent stress
  - 5 kip axial force
  - 24 kip shear force
  - **254,000 in-lb torsional moment (MZ)**
  - **271,000 in-lb bending moment (My)**
  - 22,000 in-lb bending moment (MX)
  - 45 kip bucket piston force



Reference axes



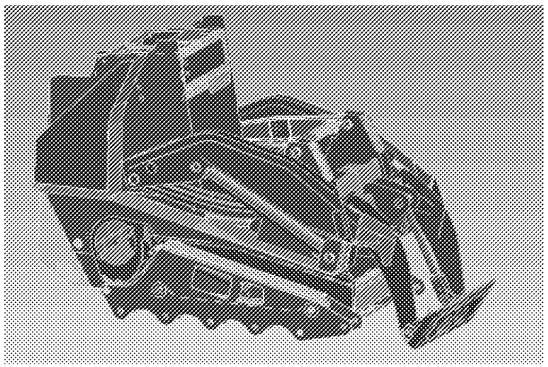
... within Epsilon

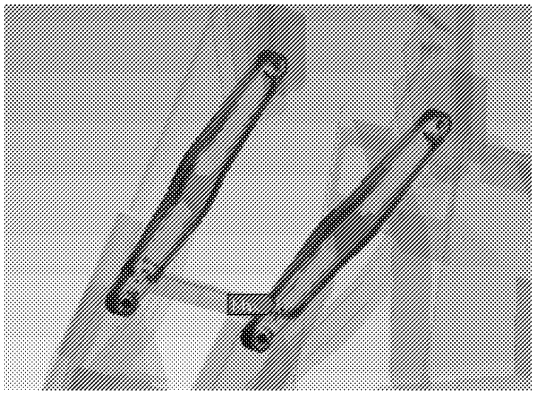
TORO-0000389.6/6

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TMAX Loader
Upper Arm Stresses
02/27/2014



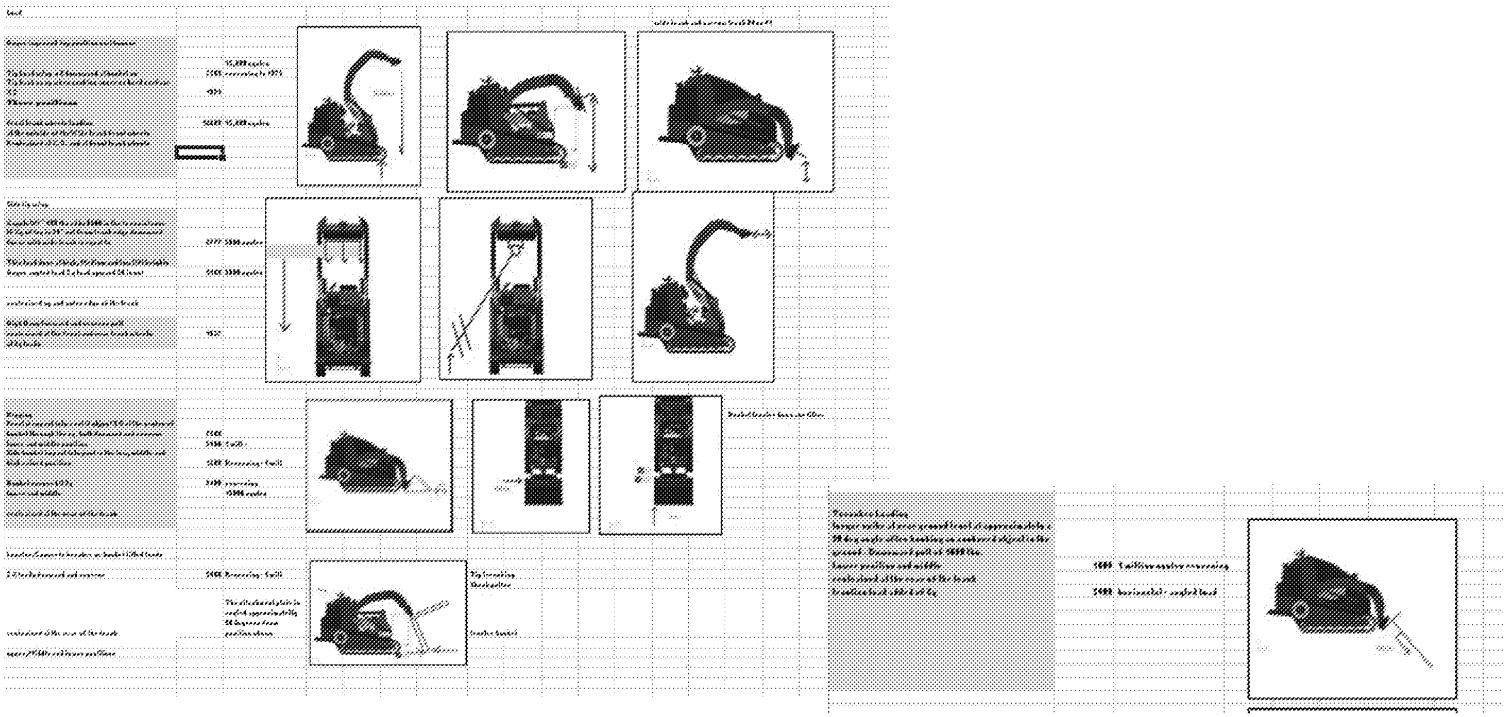


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21 Load cases



- Uses defined loads (21 cases)



... within Epsilon

TORO-0000390.2/8

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Summary



- See Excel sheets

		Case Label	Peak Stress (ksi)	F.S.	Axial Force (lbf)	Shear Load (lbf)	Moment (in-lbf)	Moment (in-lbf)	FX	FY	FZ	FX	FY	FZ	MX	MY	MX	MY	Theta
Low Cycle																			
Auger Bounce	High	F	150	0.70	34,002	4308	1355	-2622	1543	-785	0	-26177	-23425	4208	-233.7	72.2	-735.6	-1868	46.5
	Med	U	66	0.66	-	0	0	0											14.6
	Low	B	65	0.69	16,638	2276	1275	-2570	761	470	0	-17110	2709	2276	130	46	852	-2551	6.9
Offset Grapple	High	K	125	0.36	31,536	3378	3142	961	18672	13904	3376	-2489	1557	0	2142	-1826	712	208	46.5
	Med	H	111	0.41	15,897	-2197	-6346	-379	-18077	-301	-2197	2184	-274	0	-4685	2286	-1552	-1054	14.6
	Low	O	110	0.41	-	0	0	0											6.9
Auger kick-out / angle	High	L	60.8	0.74	10,041	-1443	-651	-1002	-8505	-6607	-1445	968	-570	0	-1037	-42	-138	-176	46.5
High Hang Fwd	High	G	53.8	0.84	13,029	-1450	-989	888	-383	235	0	9794	9007	-1450	-22	-14	-17	1343	46.5
Side Bucket hit	High	AC	111	0.41	13,059	1980	1158	5016	1789	-2182	0	-11683	-8417	1980	489	563	3935	2052	46.5
	Med	AD	80.1	1.40															
	Low	AE	19.8	4.17															
Corner Bucket Hit	Med	AB	33.4	1.35															
	Low	AG	27.8	1.63															6.9
High Cycle Fatigue Cases																			
Leveler	High	N	67.4	0.25	14,474	3482	-1299	-2286	985	-201	0	-11390	-10238	1432	-729	17	-1808	-635	46.5
	Med	Y	26.2	0.65	931	-5800	422	-82	537	37	-5800	-226	877	0	89	128	299	-314	14.6
Trencher	Med	X	2.4	7.08															
	Low	S	9.8	5.87															
Digging	Med	V	14.4	1.18															
	Low	C	29.3	0.58	7,481	921	177	-1782	230	247	0	-7643	1185	921	-5	-147	-22	-1584	6.9

... within Epsilon

TORO-0000390.3/8

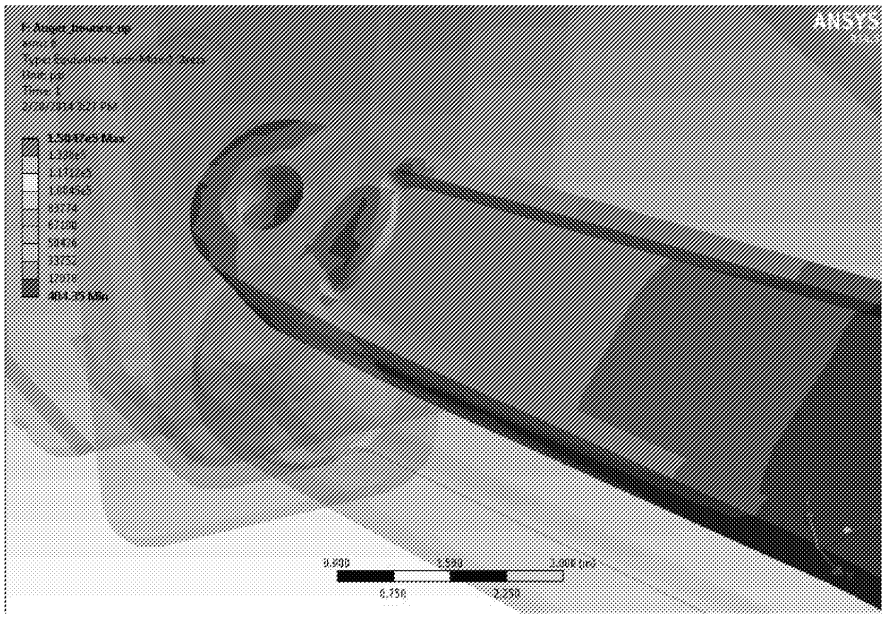
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Yield Criteria (45 ksi)



- Auger Bounce, High is critical case
  - 150 ksi equivalent stress
  - 34 kip axial force
  - 4 kip shear force
- Offset Grapple Middle has highest moment (longitudinal) ,6300 in-lb
- Side Bucket Hit, High gives larges moment (bending), 5000 in-lb



... within Epsilon

TORO-0000390.4/8

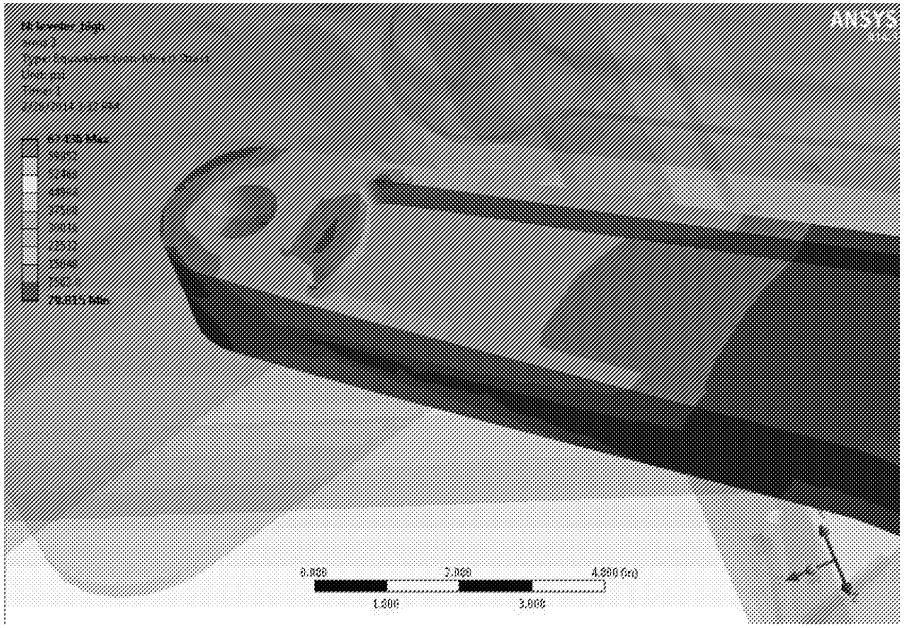
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Ex. 2015
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Fatigue Criteria (17 ksi?)



- Leveler, High is critical case
  - 67 ksi equivalent stress
  - 14 kip axial force
  - 2.4 kip shear force
  - 1300 in-lb longitudinal moment
  - 2270 in-lb bending moment



... within Epsilon

TORO-0000390.5/8

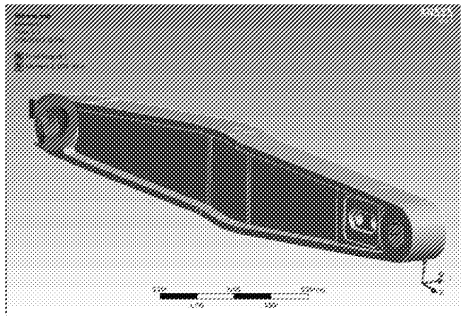
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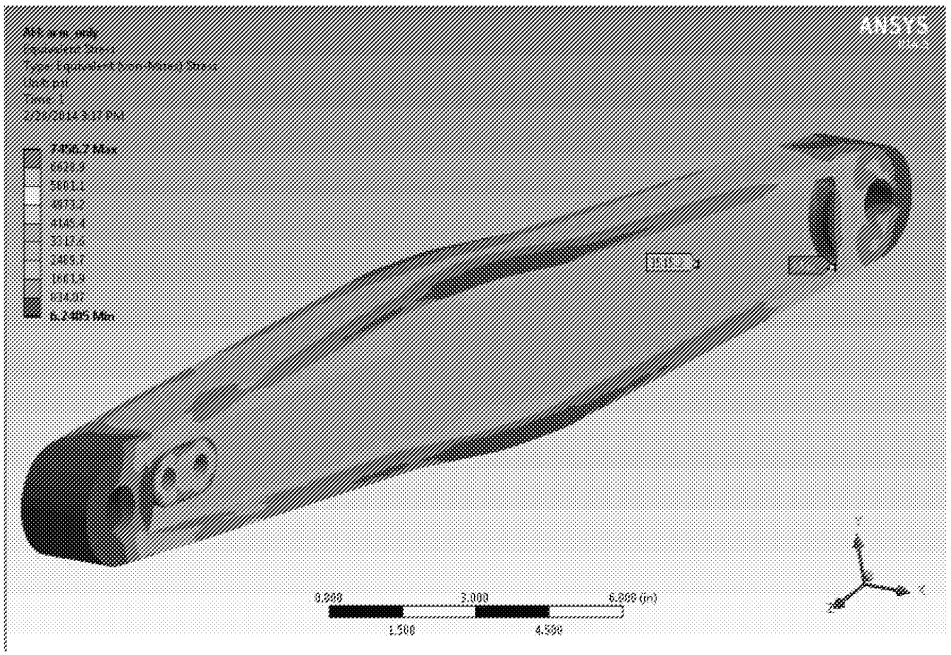
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Baseline Stresses



- 1000 in-lb longitudinal moment





... within Epsilon

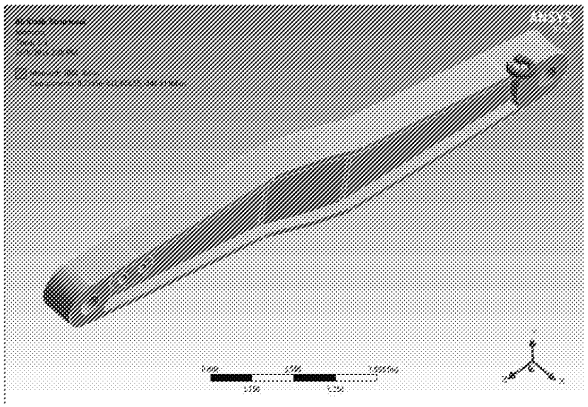
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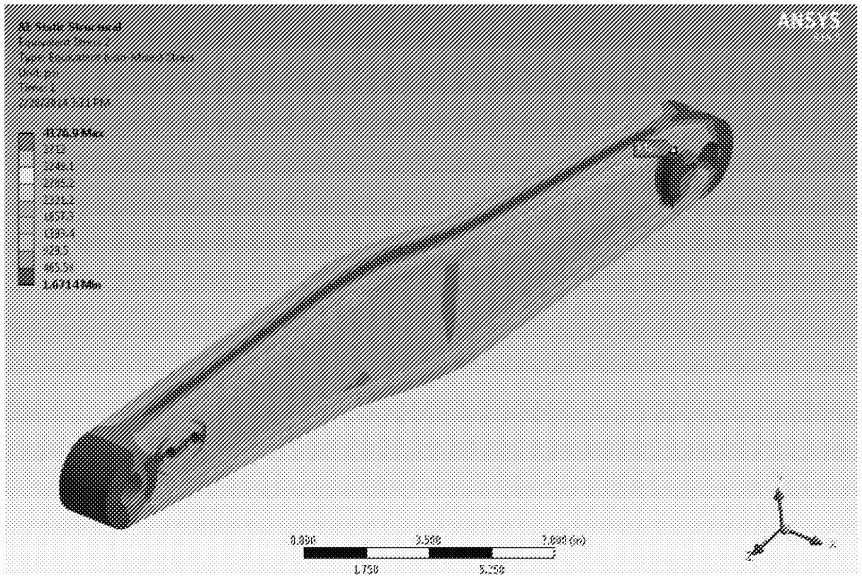
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Baseline Stresses



- 1000 in-lb bending moment





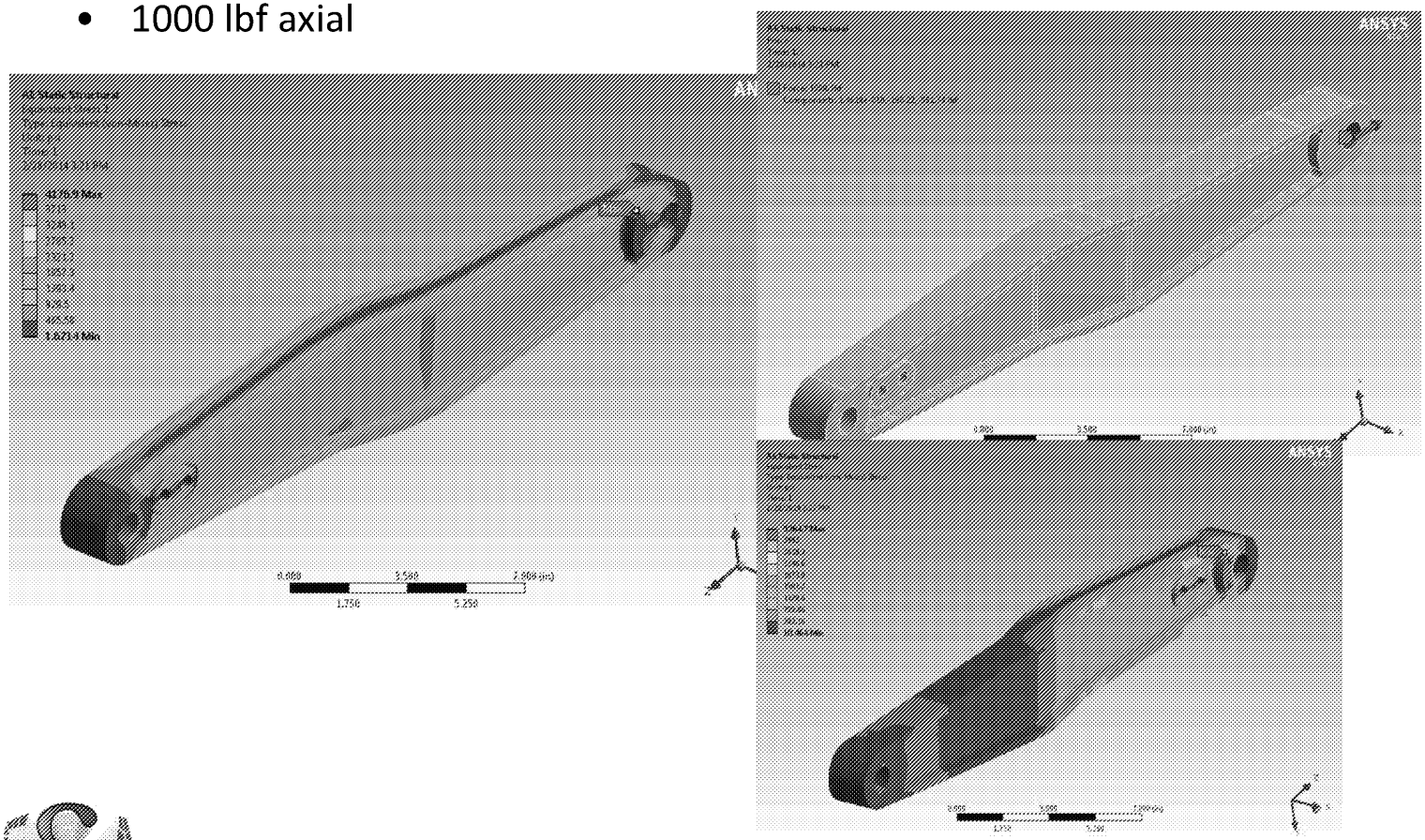
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... within Epsilon

Baseline Stresses



- 1000 lbf axial



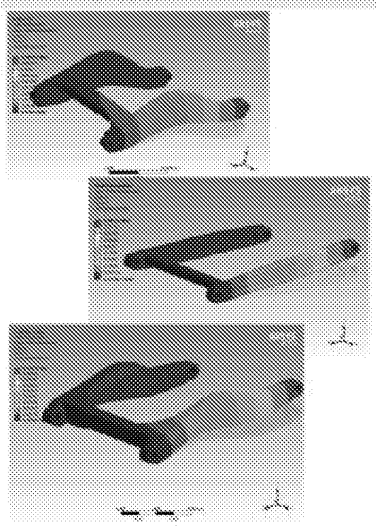
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W298 TX1000 UPDATE

12/15/14

Loader Arm Testing

- FEA has confirmed the upper link can flex to cause independent movement between the lift cylinders
- A fabricated single piece link was designed to exceed the 2.0 design (since this design does not have a racking problem)
- Proceeding with updating all machines with this design
- FEA on entire loader will be re-run with the new piece to confirm



W298 TX1000 UPDATE

12/15/14

Loader Arm Testing

Configuration	Test 1 (Original Loader)	Test 2 (Current Loader per R&D)
3.0	0.847	1.355
2.0	0.049	0.051
4.0	0.077	0.089
3.0 Rev 2	0.245	0.248
4.0 Rev 2	0.046	0.048

W298 TX1000 UPDATE

12/15/14

Combined Flow Aux. system

- The lab unit was set up with a combined flow system and run with the auger (found to be acceptable)
- Gear pumps are in to update all 4.0 machines with combined flow pumps
- This also gives us a future "low flow" option feature if we want it by adding a diverter valve to the circuit
- Will still pursue a split flow system as backup, but combined is the "default" design at this point.

W298 TX1000 UPDATE

12/15/14

Engine Heat work

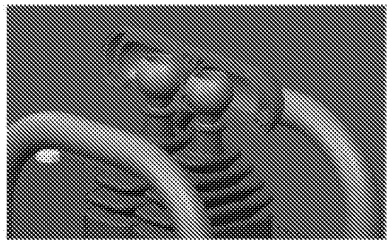
- After modifications to the rear radiator intake; heat runs were able to be completed
  - Water and oil cooling seems adequate but we are not expelling the heat from the machine
  - Need to find exit lanes for the air out the front of the machine (move air cleaner, open up hood louvres)

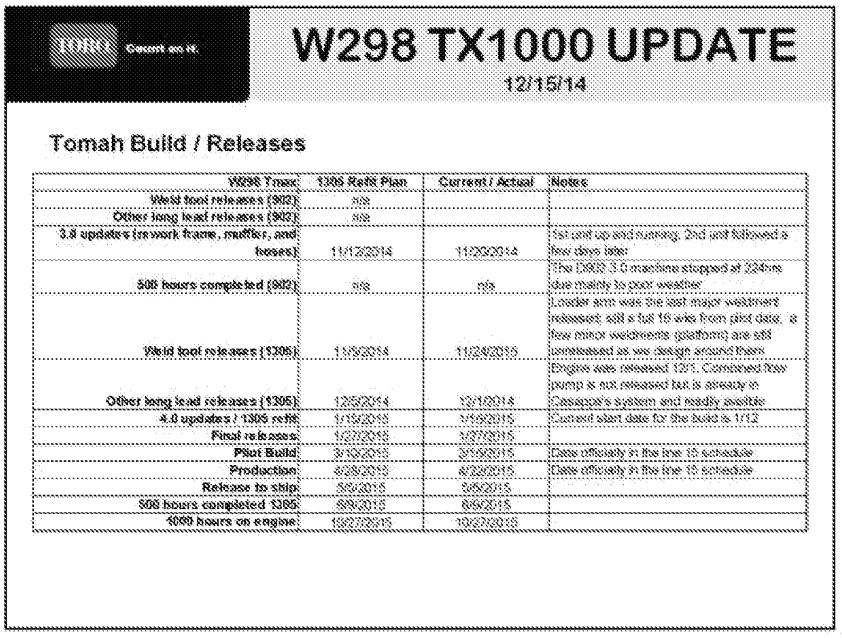
W298 TX1000 UPDATE

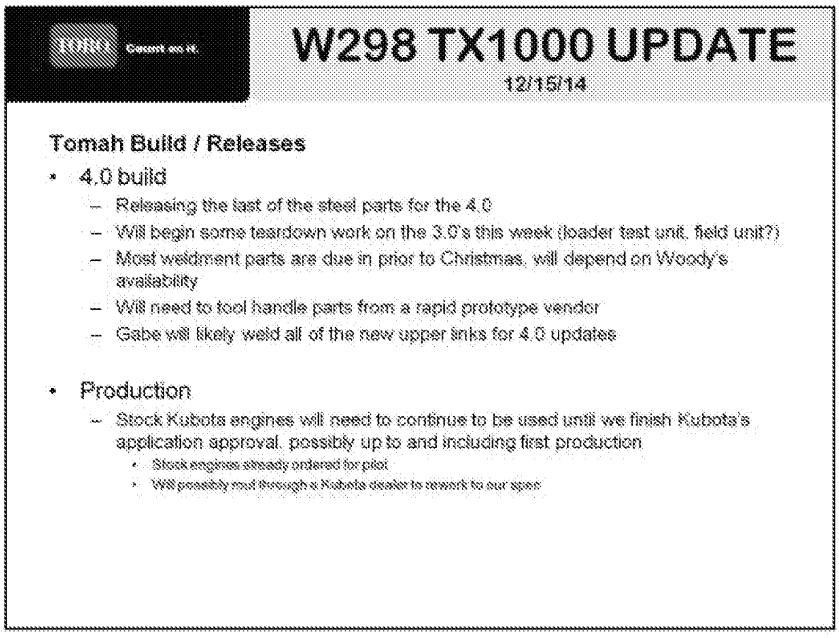
12/15/14

Controls

- Input received from Micron on shaping, fastening, and materials for control parts
  - Outer handle: glass infused nylon
  - Inner ball: delrin
- Longer handle printed to increase available rotation (on the field unit)
- REDACTED




Cannot access it.
W298 TX1000 UPDATE
12/15/14
Tomah Build / Releases
W298 Tmax
1305 Refit Plan
Current / Actual
Notes
Weld tool releases (902)
n/a
Other long lead releases (902)
n/a
3.0 updates (rework frame, muffler, and hoses)
11/12/2014
11/20/2014
1st unit up and running. 2nd unit followed a few days later
505 hours completed (902)
n/a
n/a
The D902 3.0 machine stopped at 224hrs due mainly to poor weather
Weld tool releases (1305)
11/3/2014
11/24/2015
Loader arm was the last major weldment released, still a full 16 wks from pilot date. a few minor weldments (platform) are still unreleased as we design around them
Other long lead releases (1305)
12/5/2014
12/1/2014
Engine was released 12/1. Combined flow pump is not released but is already in Caterpillar's system and readily available
4.0 updates / 1305 refit
1/15/2015
1/19/2015
Current start date for the build is 1/12
Final releases
1/27/2015
1/27/2015
Pilot Build
3/13/2015
3/19/2015
Date officially in the line 15 schedule
Production
6/29/2015
6/22/2015
Date officially in the line 15 schedule
Release to ship
5/5/2015
5/5/2015
505 hours completed 1305
6/9/2015
6/5/2015
1000 hours on engine
10/27/2015
10/27/2015


Cannot see it.
W298 TX1000 UPDATE
12/15/14
Tomah Build / Releases
• 4.0 build
– Releasing the last of the steel parts for the 4.0
– Will begin some teardown work on the 3.0's this week (loader test unit, field unit?)
– Most weldment parts are due in prior to Christmas, will depend on Woody's availability
– Will need to tool handle parts from a rapid prototype vendor
– Gabe will likely weld all of the new upper links for 4.0 updates
• Production
– Stock Kubota engines will need to continue to be used until we finish Kubota's application approval, possibly up to and including first production
• Stock engines already ordered for pilot
• Will possibly rout through a Kubota dealer to rework to our spec


REDACTED