



Tractor, Full-Track (MC1150/MC1155) Requirements Assessment





Overview



- Both Tractor, Full-Track machines have passed their lifespan.
 - MC1150E W/ Angle Blade B2460
 - MC1155E W/ Bucket B2464
 - Both fielded in 1985
- The 1150 Crawler Tractor line is still manufactured
- The 1155 Crawler Loader line is no longer manufactured
 - Case ended manufacturing in 1996
- There are limited manufacturers of both Tractors with comparable specifications
- Recommend replacing both the B2460/B2464 with a faster, lighter fleet of Multi Terrain Loaders (MTL)



Existing Equipment

- Case MC1150 Crawler Tractor was fielded in 1985
- Case continues production of the MC1150 line (1150H)



Engine	
Model	CDC 6T-590
Net Power	118 hp
Gross Power	129 hp
Operating Specifications	
Ground Pressure	8.5 psi
Tipping Load	16500 lbs
Breakout Force	21000 ft-lbs
Power Train	
Speed forward	6.3 mph
Speed reverse	7.6 mph
Weights	
Operating weight	25050 lbs
Storage size	
Cube	1410.4 cu ft
Square stowage	145.9 sq ft

Case continues to manufacture their Crawler Tractor line



Existing Equipment

- Case MC1155 Crawler Loader was fielded in 1985
- Case continued production of the MC1155 line until 1996



Engine	
Model	CDC 6T-590
Net Power	118 hp
Gross Power	129 hp
Operating Specifications	
Ground Pressure	10 psi
Tipping Load	16500 lbs
Breakout Force	21000 ft-lbs
Power Train	
Speed forward	6.2 mph
Speed reverse	7.4 mph
Weights	
Operating weight	27000 lbs
Storage size	
Cube	1049.5 cu ft
Square stowage	110.5 sq ft

Case dissolved their Crawler Loader line



Market Survey for Comparable Dozers in Production



Comparison Results:					
Manufacturer	John Deere	Caterpillar	Komatsu	Liebherr	J. I. Case
Model	700H	D5N	D41E-6C	PR712B	MC1150H
PRICE	\$143,725	\$147,890	\$126,300	\$140,100	\$163,798
Net Horsepower	130	115	110	105	119
TRANSMISSION					
Type	Hydrostatic	Powershift	Powershift	Powershift	Powershift
Speed Ranges	Infinite	3 x 3	3 x 3	3 x 3	4 x 4
Forward	6.8	5.6	4.7	6.8	5.8
Reverse	6.8	6.9	5.8	5.8	6.9
UNDERCARRIAGE					
Track Gauge in.	66"	70"	70"	70"	62
Length of Track on Ground in.	98"	94"	98"	98"	97
Std. Grouser in.	20"	22"	20"	20"	22
Ground Pressure psi	8.7	6.8	4.98	6.97	6
No. of Track Rollers	6	7	6	7	7
BLADE					
Blade Capacity cu yd	3.4	2.25	3.4	2.8	1.75
Blade Width ft	10	27,585	10'	9' 10"	9' 10"
GENERAL DIMENSIONS					
Height w/ROPS ft	9' 10"	10' 1"	9' 6"	9' 6"	9' 10.8"
Length w/Blade ft	11' 8"	20' 8"	15' 4"	16' 0"	16' 1.5"
SAE OPERATING WEIGHT lb	28,258	32,000	24,140	27,122	27,060



Market Survey for Comparable Loaders in Production



Comparison Results:					
Manufacturer	John Deere	Caterpillar	Dressta	New Holland	J. I. Case
Model	655C-II	953C	175C	CL145	MC1155E
PRICE	\$185,503	\$173,960	\$145,840	\$132,154	
Net Horsepower	130	115	142	128	118
TRANSMISSION					
Type	Hydrostatic	Hydrostatic	Powershift	Powershift	Powershift
Speed Ranges	Infinite	Infinite	4 x 4	3 x 3	4 x 4
Forward	6.8	6.2	5.9	6.45	6.2
Reverse	6.8	6.2	7.0	7.56	7.4
UNDERCARRIAGE					
Track Gauge in.	66"	71"	66"	67.8"	62
Length of Track on Ground in.	98"	90"	89"	90"	96.7"
Std. Grouser in.	20"	15"	16"	17.7"	
Ground Pressure psi	8.7	11.5	10.9	9.44	9.4
No. of Track Rollers	6	6	6	6	7
LOADER					
SAE Heaped Capacity cu yd	2.35	2.25	2.25	2.0	1.75
SAE Breakout Force lb	27,675	27,585	24,620	25,080	21,000
Dump Clearance ft	9' 3"	8' 11"	8' 11"	9' 2.2"	8'7"
Hinge Pin Height ft	12' 0"	11' 10"	11' 3"	11' 7"	11' 2.4"
Reach @ Maximum Height in.	42"	39.3"	45"	39.8"	45.3"
GENERAL DIMENSIONS					
Height w/ROPS ft	10' 3"	10' 1"	9' 9"	10' 1"	9' 10.8"
Length w/Loader Bucket ft	20' 1"	20' 8"	16' 8"	16' 0"	16' 3.9"
SAE OPERATING WEIGHT lb	33,950	32,000	31,225	31,130	27,000



Multi Terrain Loaders



ASV RC-100



Caterpillar MTL277



Mustang MTL25



Bobcat T300



Evaluation Data



- U.S. Army Engineer School conducted evaluations to determine useful application of a Skid Steer:
 - Conducted Jun – Jul 1997
 - Performed selected Mission Essential Task List (METL) of a combat engineer battalion.
 - A single Skid Steer was equipped with attachments and tools.
 - Evaluation was conducted with wheeled skid steer, smaller model



Evaluation and Test Data



- Thirteen tasks were identified
- The evaluation platoon completed tasks as listed in METL
 - Using required equipment
 - Dozer (D7G)
 - Small Emplacement Excavator (SEE)
 - By hand
- Then completed again using the Skid Steer



Evaluation Tasks



- Tasks completed:
 - Construct Tank Ditch
 - Construct Log Crib
 - Construct Road Crater
 - Construct Log Post Obstacle
 - Reduce Tank Ditch
 - Construct 4-2 Pace Double Apron Fence
 - Construct Fighting Trench
- Tasks completed
 - Construct Triple Standard Concertina
 - Assemble/Install culvert
 - Clear LZ
 - Construct 2-Soldier Position
 - Construct Machine Gun Position
 - Construct Earth Wall



Evaluation Results



- Skid Steer “effectively, or very effectively”, enhanced construction methods in 11 of the 13 tasks.
- Skid Steer could not match the power of the D-7 Dozer in some tasks, but matched favorably with the SEE Tractor.
- Skid Steer’s ability to out maneuver the SEE in constricted areas was a contributing factor to the faster times for digging.
- Attachments (i.e. auger, grapple) also contributed greatly to faster times for completing tasks.



Detailed Evaluation Data



TASK	METHOD	ARTEP Standard (Manhours)	Actual Time (Manhours)	% chg	Skid Steer (Manhours)	% chg
Construct Tank ditch	dozer team	4.8	12.60	162.50%		
	skid steer				181.80	3687.50%
Construct Log Crib	SEE	144.0	91.00	-36.81%		
	skid steer				19.60	-86.39%
Construct Road Crater	hand/explosives	16.0	15.30	-4.38%		
	skid steer				8.80	-45.00%
Construct Log Post Obstacle	hand	120.0	115.00	-4.17%		
	skid steer	16.0			10.80	-32.50%



Detailed Evaluation Data



TASK	METHOD	ARTEP Standard (Manhours)	Actual Time (Manhours)	% chg	Skid Steer (Manhours)	% chg
Reduce Tank Ditch	dozer team	10.0	8.00	-20.00%		
	skid steer				31.00	210.00%
Construct 4-2 Pace Double Apron Fence	hand	24.0	23.60	-1.67%		
	skid steer				16.30	-32.08%
Construct Triple Standard Concertina	hand	8.0	7.80	-2.50%		
	skid steer				5.20	-35.00%
Assemble/Install Culvert	SEE (trench)	8.0	0.57	-92.88%		
	SEE/hand (complete)	16.0	15.10	-5.63%		
	skid steer (trench)				0.35	-95.63%
	skid steer/hand (complete)				9.50	-40.63%
Clear LZ	hand	24.0	22.40	-6.67%		
	skid steer				16.20	-32.50%



Detailed Evaluation Data



TASK	METHOD	ARTEP Standard (Manhours)	Actual Time (Manhours)	% chg	Skid Steer (Manhours)	% chg
Construct 2-Soldier Position	hand	6.0	6.10	1.67%		
	skid steer (2x24)				3.60	-40.00%
	skid steer (3x24)				3.20	-46.67%
	skid steer (2x36)				2.60	-56.67%
	skid steer (backhoe)				1.45	-75.83%
Construct Machine Gun position	hand	7.0	0.90	-87.14%		
	SEE		2.97	-57.57%		
	skid steer (3x24)				3.42	-51.14%
	skid steer (backhoe)				2.17	-69.00%
Construct Fighting Trench	hand	74.0	74.90	1.22%		
	SEE	12.0	7.70	-35.83%		
	skid steer (backhoe)	12.0			10.50	-12.50%
Construct Earth Wall	SEE	3.0	0.77	-74.33%		
	dozer	3.0	0.45	-85.00%		
	skid steer				0.56	-81.33%



Effectiveness of Skid Steer



- Construct Tank Ditch - **not effective**
 - Skid Steer is not capable of moving dirt in the same amounts as the dozer
- Construct Rectangular Log Crib - **very effective**
 - Skid Steer auger and grapple provided additional capability
- Construct a Road Crater - **very effective**
 - Skid Steer auger used to bore holes
- Construct Log Post Obstacle – **effective**
 - Skid Steer auger saved time and soldiers energy
- Reduce Tank Ditch – **not effective**
 - Skid Steer's smaller bucket required a pass ratio of 8:1 to match the dozer output



Effectiveness of Skid Steer



- Construct 4-2 Pace Double Apron Fence - **effective**
 - Skid Steer attachment used to drive pickets contributed to the ease of the task
- Construct Triple Standard Concertina - **effective**
 - Skid Steer attachment used to drive pickets contributed to the ease of the task
- Assemble/Install Culvert - **effective**
 - Skid Steer was faster than the SEE in excavation efforts and outmaneuvered the SEE in constricted areas
- Clear Landing Zone – **effective**
 - Skid Steer saved significant time when using the clamshell bucket to remove felled trees and debris
- Construct 2-Soldier Fighting Position – **very effective**
 - Skid Steer auger attachment was used to bore starter holes which saved time and energy



Effectiveness of Skid Steer



- Construct Machine Gun Position - **effective**
 - Skid Steer backhoe attachment was used and contributed to the ease of the task
- Construct fighting Trench – **marginally effective**
 - Skid Steer was comparable to the SEE
- Construct Earth Wall - **marginally effective**
 - Skid Steer was faster than the SEE but slower than the dozer



Example Multi Terrain Loaders



Engine	ASV RC-100	Bobcat T300	Caterpillar MTL 277	Mustang MTL25
Model	Cat 3054C	Kubota V3300-TE	Cat 3034 turbo diesel	Yanmar/4TNE106T
Gross Power	99.5 hp	81 hp	80 hp	101.5 hp
Operating Specifications				
ROC: 50% tipping load	3,800 lbs	4,286 lbs	2,950 lbs	3,528 lbs
Ground Pressure	3.5 psi	4.1 psi	3 psi	4.3 psi
Tipping Load	7,600 lbs	8,571 lbs	5,900 lbs	7,056 lbs
Breakout Force, lift cylinder	ft-lb	ft-lb	4,339 ft-lbs	8,549 lbs
Breakout Force, tilt Cylinder	ft-lb	ft-lb	5,259 ft-lbs	8,692 lbs
Power Train				
Speed forward	10 mph	6.6 mph	6 mph	6.9 mph
Weights				
Operating weight	10,150 lbs	9,354 lbs	9,126 lbs	10,692 lbs



MTL Benefits

- At around 10,000 lbs, the MTL will utilize the new Engineer Equipment Trailer
 - Trailer will allow transportability behind MTRV/Dump Truck
- MTL can be transported in MTRV Cargo and Dump Variant
- MTL can be stored and shipped in 20 ft ISO Container
- Rubber Track Undercarriage transfers machine weight to the ground through wheeled contact points
 - Low ground pressure and high flotation allows MTL operation in soft underfoot conditions
- Quick Coupler & Work Tools
 - Universal work tool interface
 - Tools include:
 - Angle Blade
 - Auger
 - Buckets
 - Forks
 - Hammer
 - Compactor



Performance Requirements



	ASV RC-100	Bobcat T300	CAT 277B	Mustang MTL25
Performance Requirements for the Light Crawler Tractor				
Power				
diesel driven	Y	Y	Y	Y
charging alternator	Y	Y	Y	Y
cooling system	Y	Y	Y	Y
electrical system	Y	Y	Y	Y
exhaust stack rain cap or curved	Y	Y	Y	Y
Horsepower >110	99.5	81	82	101.5
Transmission				
full power shift	Y	Y	Y	Y
no less than 2 forward and 2 reverse	Y	Y	Y	Y
speeds manually selected	Y	Y	Y	Y
movement lock	Y	Y	Y	Y
Attachments				
Angle Blade	Y	Y	Y	Y
Single Drum Winch	N	N	N	N
ROPS/FOPS	Y	Y	Y	Y
Fixed Draw Bar	N	N	N	N
night operations and blackout lights	Y	Y	Y	Y
Additional Requirements				
transport by road, rail, air and sea	Y	Y	Y	Y
fording capability 60 in	N	N	N	N
meet federal health and safety regs	Y	Y	Y	Y
reliability, availability and maintainability meets commercial standards	Y	Y	Y	Y
fuel tank allowing >10 hours of operation	Y	Y	Y	Y
weight < 32,000 lbs with blade	Y	Y	Y	Y
meet USMC standard instrument gauges requirement	Y	Y	Y	Y
slave receptacle	N	N	N	N
standard drawbar and adapter to install pintle hook	N	N	N	N
track assembly saltwater corrosion resistant	Y	Y	Y	Y



Trade Offs



- Cost (new)

- Comparable Crawler Dozer (average) \$144,362
- Comparable Crawler Loader (average) \$159,364
- Multi Terrain Loader \$52,974

MTL – 63% less expensive than Dozer and 67% less expensive than Loader

- Horsepower

- Crawler Dozer – 118 hp
- Crawler Loader - 118 hp
- MTL - 80 hp

Dozer and Loader – 32% more horsepower



Trade Offs



- **Transportability**

- Crawler Dozer and Loader require special transportation (MK-18 or lowboy). C-5 and ship transportable.
- MTL will have dedicated Trailer. Trailer can carry two MTLs. MTL will have complete 209J certification including external Helo lift. Can be lifted by 53, and V-22.
- MTL cube storage is 433.3 cu ft while the Dozer/Loader cubic storage is 1410.4 cu ft and 1049.5 cu ft respectively

MTL has dedicated trailer and can be towed by MTRV. MTL can be externally lifted and has a cube storage 70% to 59 % less than the Dozer/Loader

- **Attachment Capacity**

- Crawler Dozer (Blade) – 1.75 cu yd
- Crawler Loader (Bucket) - 1.75 cu yd
- MTL – (Bucket) .52 cu yd
 - BHL has bucket capacity 1.25 cu yd
 - TRAM has bucket capacity 2.50 cu yd

When required, MTL, BHL and TRAM can team for the largest jobs



Trade Offs



- Onsite Maneuverability

- Crawler Dozer and Loader's size, weight and ground pressure of 10.0 psi make movement in confined soft conditions difficult.
- MTL has ground pressure of 4.1 psi and carries 64% less weight allowing it to outmaneuver a SEE and Crawler Loader.

As evidenced during Army tests, MTL has capability to outmaneuver larger equipment in tight spaces allowing

- Additional Work Tools

- Crawler Dozer has an Angle blade (no other attachments)
- Crawler Loader has 4 in 1 bucket (no other attachments)
- MTL has Auger, General Purpose and 4 in 1 Buckets, Compactor, Grapple, Hammer

MTL additional work tools allow greater capability and flexibility



Scenario #1

Replacement of all 1150 and 1155 with a Multi Terrain Loader

Dozer MC1150	Scenario #1	
	SUPT CODE	SLEP 1150
GEN SUPT	10	0
I MEF	24	0
II MEF	23	0
III MEF	14	0
MPS_1	36	0
NALMEB	9	0
RES	23	0
Total	139	0
New Skid Steer	\$7,363,386.00	
SLEP 1150		\$0.00
TOTAL	\$7,363,386.00	\$0.00

Loader MC1155	Scenario #1	
	SUPT CODE	SLEP 1155
GEN SUPT	0	0
I MEF	18	0
II MEF	18	0
III MEF	11	0
MPS 3	14	0
NALMEB	9	0
RES	20	0
Total	90	0
New Skid Steer	\$4,767,660.00	
SLEP 1155		\$0.00
TOTAL	\$4,767,660.00	\$0.00

Cost for Replacement of 1150:
\$7,363,386 (MTL)

Cost for Replacement of 1155:
\$4,767,660 (MTL)

Total Cost for Scenario #1:
\$12,131,046



Scenario #2

Replacement of 50% of 1150 and 1155 with a Multi Terrain Loader

Dozer MC1150	Scenario #2	
SUPT CODE	Skid Steer	SLEP 1150
GEN SUPT	5	5
I MEF	12	12
II MEF	12	11
III MEF	8	6
MPS_1	21	15
NALMEB	5	4
RES	12	11
Total	75	64
New Skid Steer	\$3,973,050.00	
SLEP 1150		\$5,543,500.80
TOTAL	\$3,973,050.00	\$5,543,500.80

Loader MC1155	Scenario #2	
SUPT CODE	Skid Steer	SLEP 1155
GEN SUPT	0	0
I MEF	9	9
II MEF	9	9
III MEF	6	5
MPS 3	9	5
NALMEB	5	4
RES	10	10
Total	48	42
New Skid Steer	\$2,542,752.00	
SLEP 1155		\$4,015,972.80
TOTAL	\$2,542,752.00	\$4,015,972.80

Cost for Replacement of 1150:
\$3,973,050 (MTL)

Cost for SLEP of remaining 1150
\$5,543,500

Cost for Replacement of 1155:
\$2,542,752 (MTL)

Cost for SLEP of remaining 1155
\$4,015,972

Total Cost for Scenario #2:

\$16,075,274



Scenario #3

SLEP all of 1150 and 1155

Dozer MC1150		Scenario #3	
SUPT CODE	Skid Steer	SLEP 1150	
GEN SUPT	0	10	
I MEF	0	24	
II MEF	0	23	
III MEF	0	14	
MPS_1	0	36	
NALMEB	0	9	
RES	0	23	
Total	0	139	
New Skid Steer	\$0.00		
SLEP 1150		\$12,039,790.80	
TOTAL	\$0.00	\$12,039,790.80	

Loader MC1155		Scenario #3	
SUPT CODE	Skid Steer	SLEP 1155	
GEN SUPT	0	0	
I MEF	0	18	
II MEF	0	18	
III MEF	0	11	
MPS 3	0	14	
NALMEB	0	9	
RES	0	20	
Total	0	90	
New Skid Steer	\$0.00		
SLEP 1155		\$8,605,656.00	
TOTAL	\$0.00	\$8,605,656.00	

Cost for SLEP of 1150:
\$12,039,790

Cost for SLEP of 1155:
\$8,605,656

Total Cost for Scenario #3:
\$20,645,446



Scenario #4

Procure new 1150 and 1155

Dozer MC1150	Scenario #4	
	SUPT CODE	SLEP 1150
GEN SUPT	0	10
I MEF	0	24
II MEF	0	23
III MEF	0	14
MPS_1	0	36
NALMEB	0	9
RES	0	23
Total	0	139
New Skid Steer	\$0.00	
New 1150		\$20,066,318.00
TOTAL	\$0.00	\$20,066,318.00

Loader MC1155	Scenario #4	
	SUPT CODE	SLEP 1155
GEN SUPT	0	0
I MEF	0	18
II MEF	0	18
III MEF	0	11
MPS 3	0	14
NALMEB	0	9
RES	0	20
Total	0	90
New Skid Steer	\$0.00	
New 1155		\$14,342,760.00
TOTAL	\$0.00	\$14,342,760.00

Cost for new 1150:
\$20,066,318

Cost for new 1155:
\$14,342,760

Total Cost for Scenario #4:
\$34,409,078



Cost Comparison

Scenario	Total Cost
1) Replacement of all 1150 and 1155 with MTL	\$12,131,046
2) Replacement of 50% of 1150 and 1155 with MTL (SLEP remaining 1150/1155)	\$16,075,274
3) SLEP all of 1150/1155	\$20,645,446
4) Procure all new 1150/1155	\$34,409,078



Conclusion

- Marine Corps is looking to replace the MC1150E Tracked Dozers and MC1155E Tracked Loaders
 - They have exceeded their life cycle
 - They are too costly to replace
 - They are not easily transportable
- That the MTL be considered by the Marine Corps as a replacement for the B2460 and B2464:
 - MTL is Light and compact (More maneuverable for operational tasks)
 - MTL is more easily transportable
 - MTL has multiple work tool possibilities
 - When paired with the BHL on difficult tasks, delivers more capability



Recommendation



- Approve replacement of MC1150E and MC 1155E with a Multi Terrain Loader
- Replace the current inventory of Crawler Dozers and Loaders period commencing Fiscal Year 2005, with a commercial Off the Shelf (COTS), Multi Terrain Loader.