Lessons from the Sherman Tank Program

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Keep in Mind

- State of US Tank development/production in 1939 and then in 1945
- Rapid change in Threat
- Tyranny of Time
- Doctrine
- Two Ocean Deployment
- “Good enough” vs. “the best possible”
- Extreme need for rapid military industrialization
- The Sherman was mostly on the offensive in its WWII career

Discussion at End

- How did doctrine influence the development of the Sherman?
- How did resources and industrial capacity affect the development of the Sherman?
- How did the threat and combat experience the development of the Sherman?
- Was the Sherman the best tank of WWII?
- What can you learn from the Sherman program?

US Army Doctrinal Failure?

- "The lack of foresight displayed by both the cavalry and the infantry chiefs was to delay the development of an armored force and open the door to entrepreneurs who saddled the Army Ground Forces with a Tank Destroyer dogma and then denied it the heavy tank it needed to meet the German army on an equal footing."
  - Jarymonwycz, Roman LtCol, *Tank Tactics from Normandy to Lorraine,* p. 60

Prior to 1941

- US Army tank production was “by hand” at Army arsenals
- No Armor Branch; Infantry & Cavalry were the proponents
  - And these two branches openly fought the creation of an Armor Branch while remaining parochial in their view of the tank.
- US lagged in all aspects of tank development: mobility, lethality, survivability
- Doctrine in flux
  - Post WW1, heavy French influence on US Army doctrine in general
- No mention of intelligence input
- Lack of funding for R & D and force structure
- German invasion of Poland in 1939 raises interest
- Fall of France in 1940 raises concern
- GEN McNair’s influence created the notion that the towed anti-tank gun was the way to deal with enemy tanks.

T2 Medium Tank

- Test Program from December 1930 to January 1932
- 47mm Gun/Coax .50 Cal MG in Turret
- 37mm Gun/.30 Cal MG in right hull sponson
- Weighed 31,200 pounds, 338 HP Liberty Engine
- Built at Rock Island Arsenal
- No funds to standardize for production

Medium Tank T5

- Test Program from November 1937 to June 1938
- Twin 37mm M2A1 guns or one HV 37mm gun in turret.
- Twin .30 Cal MGs in hull front, 4 x .30 Cal MGs in Sponsons, Twin AA MGs could be mounted on turret
- 21 Tons, 400hp Wright Air Cooled Radial engine
- Vertical Volute Suspension (VVS)
- Selected for Production June 1938 and standardized as the Medium Tank M2.

Medium Tank M2

- 94 produced from December 1939 to August 1941 at Rock Island Arsenal
- Production ceased due to observations from war in Europe
- High Velocity M19 37mm Gun in turret
- Twin AA .30 Cal Mgs
- 4 Sponson and Twin Hull .30 MGs retained (twin MGs appear eliminated in production)
- 19 Tons, 350 or 400hp Wright Air Cooled Radial engine
- Immediately obsolete but important role as the tank the fledgling armor force trained on.

Medium Tank M3 Series Lee/Grant

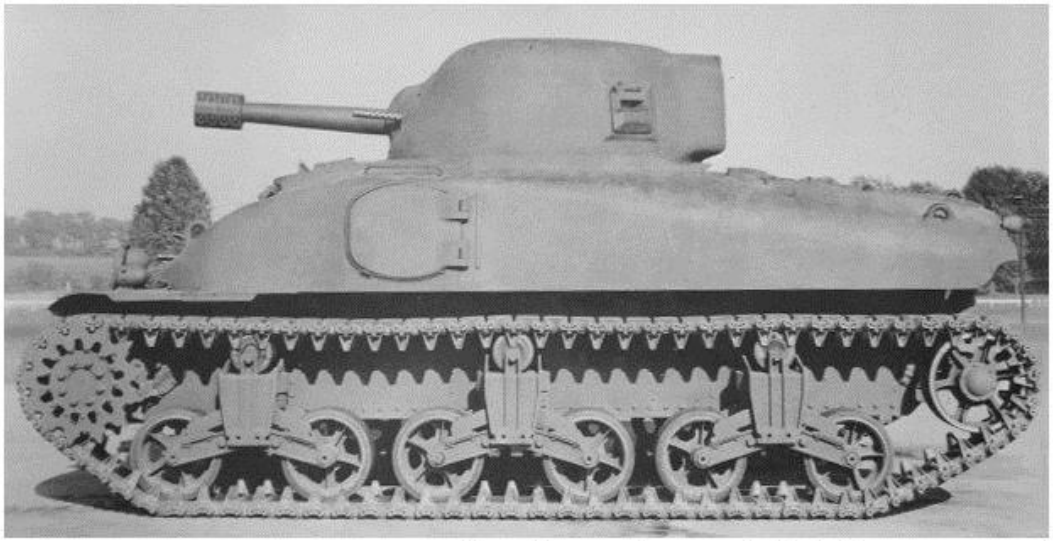
Medium Tank M3 Series Lee/Grant

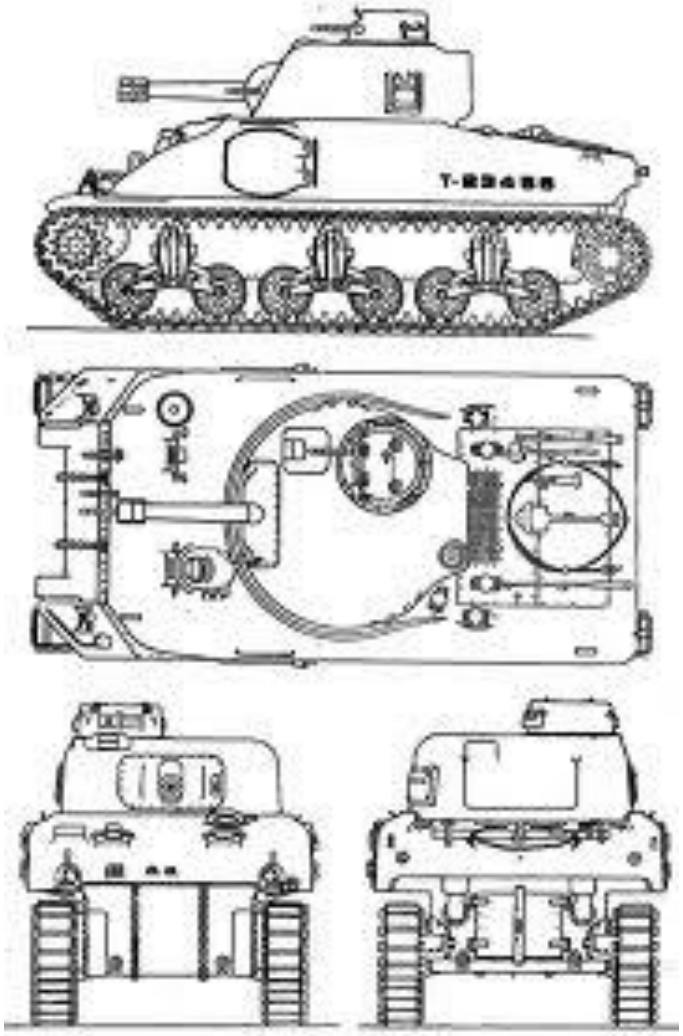
- First true mass produced US Medium Tank
  - Produced at the Detroit Arsenal Tank Plant under Chrysler as RIA did not have capacity for large number production
- Designed in 1940, produced June 1941-December 1942
  - 6258 produced of which 4924 were M3
- Shortcomings:
  - High Profile
  - Riveted Hull (corrected in M3A1 cast hull M3A2 welded hull)
  - Main gun in sponson, 37mm in turret inadequate
  - Immediately declared obsolete
    - *But it got tanks to the field, esp. to the UK forces in the desert, quickly.*

Sherman Development

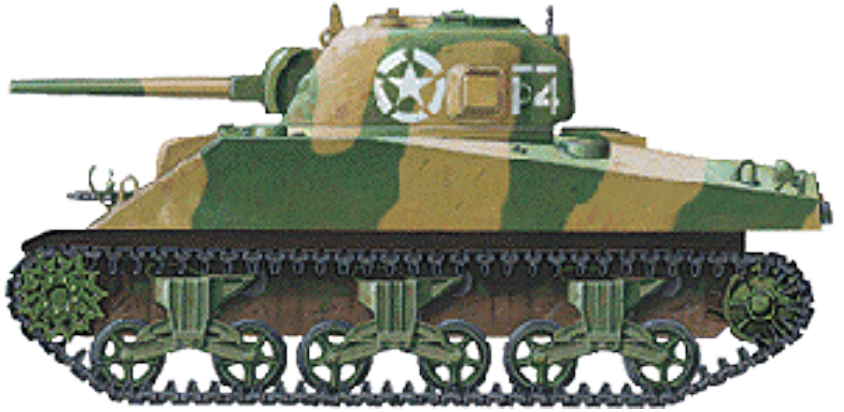
- Ordnance Committee directed design work of improved tank when it ordered M3 production
  - Detailed characteristics set in August 1940, but design work did not start until February 1941
  - To prevent delays in production part should be in common with M3 as much as possible
    - basic chassis, lower hull, engine, power train, suspension
- Eliminate 37mm Gun, put 75mm gun in 360 degree rotating powered turret.
- Reduce height, provision for AA protection
- Crew reduced from six to five
- Cast or welded hull
- Approved as Medium Tank T6, June 1941

Medium Tank T6





M4



- Sherman I in UK
- Continental radial engine
- Welded hull
- 75-mm and 105-mm gunned versions only.
- Users: US, Britain, Poland, France (one vehicle).
- Some very late M4s had composite cast/welded hulls (cast hull front identical to M4A1 (76) W.).
  - **M4(105)** - Upgraded with 105 mm M4 howitzer.
  - **M4(105) HVSS** - M4(105) w/ HVSS.

M4A1, M4A1(76)W

- Sherman II in UK
- Continental radial engine
- one-piece cast hull
- 75-mm and 76-mm gunned versions built.
- Users: US, Britain, South Africa, Poland (M4A1(76)W), France (small numbers), China
- **M4A1E4/M4A1(76)W** – Upgraded with 76 mm M1 gun.
- **M4A1E8/M4A1(76)W HVSS** - Upgraded with widetrack Horizontal Volute Spring Suspension (HVSS), fitted with the 76 mm M1 gun.
- **M4A1E9** - Late war remanufacturing, applique armor, new vision cupola and oval loader's hatch on the turret roof, spaced out VVSS suspension, extended end connectors on both sides of the tracks, but retaining the old 75 mm M3 gun. Users: Chile

M4A1(76)W, M4A1E8

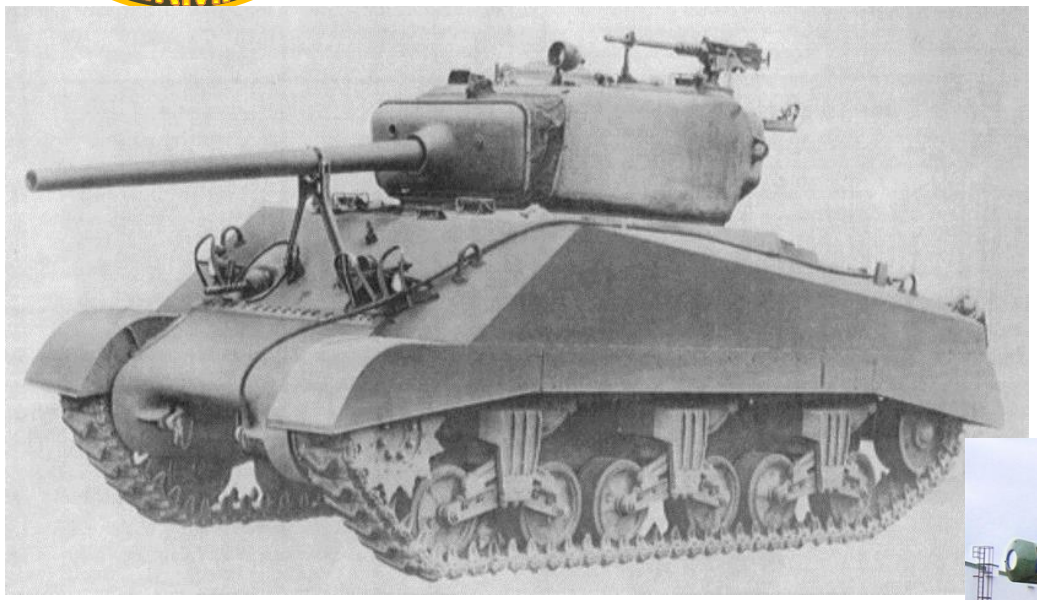
M4A2

- Sherman III in UK
- Diesel-powered
- Welded hul
- 75-mm and 76-mm guns
- Users: USSR (**M4C**), USMC, France, Britain, Poland.
  - No US Army combat use except for DD conversions for the Omaha landings.
- **M4A2E4** - Upgraded with Torsion Bar suspension; not put into production.
- **M4A2E8/M4A2(76)W HVSS** - Upgraded with wide track Horizontal Volute Spring Suspension (HVSS), fitted with the 76mm M1 gun.

M4A3, M4A3(76)W

- Sherman IV in UK parlance but not used by UK forces
- Ford GAA V-8 engine
- Welded hull
- 75-mm, 76-mm, and 105-mm guns
- Users: US, France (small #), Nicaragua (small #)
  - The M4A3 was the preferred US Army vehicle.
- **M4A3(75)** - M4A3 with 75mm M3 gun.
- **M4A3(105)** - M4A3 with 105mm M4 howitzer.
- **M4A3E2 Assault Tank** - postwar nickname "Jumbo" - extra armor (including 4 inches on front), vertical sided turret, but about 3-4 mph slower. Built with 75 mm gun but frequently re-armed by the using units with 76-mm guns. Grousers fitted to the tracks. Users: US, France (one vehicle)
- **M4A3E4/M4A3(76)W** - M4A3 with 76mm M1 gun.
- **M4A3E8/M4A3(76)W HVSS** (*Easy Eight*) - Upgraded with wide track Horizontal Volute Spring Suspension (HVSS), fitted with the 76mm M1 gun. The new suspension allowed for more armor to be added.
- **M4A3E9/M4A3(105) HVSS** - Upgraded with wide track Horizontal Volute Spring Suspension (HVSS), fitted with the 105mm M4 howitzer.

M4A3(76)W, M4A3(76)W HVSS



M4A4

- Sherman V in UK use
- Chrysler A57 engine
- welded, lengthened hull
- 75-mm gun only as-built
- Users: Britain, France, China, Lebanon (Firefly), Nicaragua (small numbers)
- **Sherman Firefly/Sherman Vc** - About 2,000 were re-armed by the British with their 17-pounder (76.2 mm) guns as the Sherman Firefly
  - The Firefly variant wasn't exclusive to M4A4/Sherman V subtype, as 17-pounder gun was mounted on more Sherman subtypes.

Sherman Firefly

Sherman Production

Sherman Production by Type						Note
Type	**1942**	**1943**	**1944**	**1945**	**Total**	
M4	475	6082	191	0	6748	
M4A1	1785	4496	0	0	6281	
M4A2	2811	4408	834	0	8053	
M4A3	514	1176	2420	651	4761	(W) 1944-45
M4A3E2	0	0	254	0	254	
M4A4	2432	5067	0	0	7499	
M4A6	0	16	59	0	75	
M4A1 (76) W	0	0	2171	1255	3426	incl HVSS
M4A2 (76) W	0	0	1594	1321	2915	incl HVSS
M4A4 (76) W	0	0	3370	1172	4542	incl HVSS
M4 (105)	0	0	1241	400	1641	
M4A3 (105)	0	0	1045	1994	3039	
Total	9959	23188	15123	8738	**49234**	

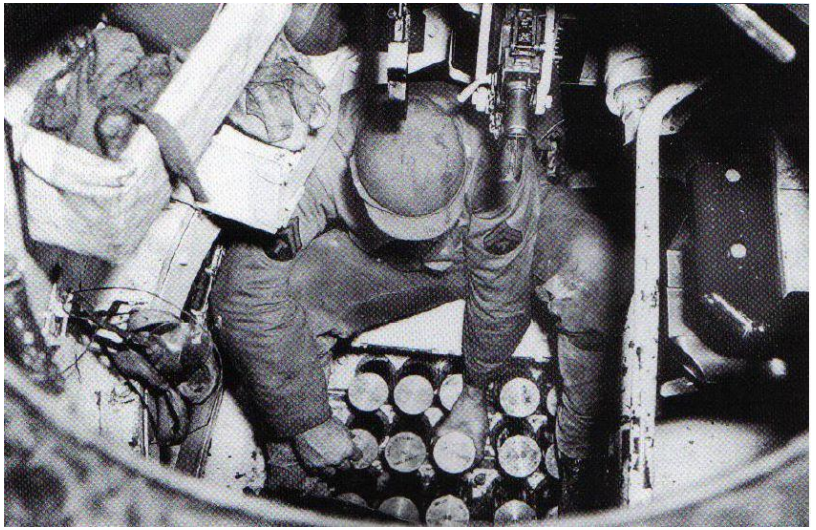
Producers:
American Locomotive Work
Baldwin Locomotive Works
Detroit Tank Arsenal
Federal Machine
Fisher Tank
Ford Motor
Lima Locomotive
Pacific Car & Foundry
Pressed Steel Car
Pullman Standard

The Ronson

Survivability Improvements

- Initial Shermans were prone to burn after penetrating hit due to ammunition fires
  - Ammunition stored in Sponsons and Ready Rack on turret floor.
- First attempt was appliqué armor over ammunition storage areas of the right and left sponson
  - Minimal affect
  - Some received appliqué on turret and in front of driver and assistant driver
- Best solution was “Wet Stowage” under turret floor
  - Huge reduction in lethal fires in the Sherman
- Increased armor in HVSS models
- Assault Tank: The Jumbo
- Field improvement popular but did little except hurt mobility and maintenance

Survivability Improvements



Field Expedient Armor

Assault Tank M4A3E2 “Jumbo”*

* The name “Jumbo” was given post war and non-official

Lethality Improvements

- 76mm Gun, M1, M1A1, M1A1C, M1A2
  - longer barrel, higher velocity
- 17 lbr Gun (UK)
- Ammunition:
  - HVAP M93 (APCR-T) for 76mm Gun M1 series
    - Limited issue
  - APDS for 17 lbr
- 75mm Gunned Shermans preferred by Infantry Commanders
  - Higher rate of fire
  - Better HE round
- 105mm Gun M4
  - Was proposed to equip all Shermans
  - Assault Tank Platoons in Tank Battalions
  - HEAT Round only AT ammunition, loses accuracy at longer ranges
  - Priority to artillery gun production

Mobility Improvements

- Various Track designs
- Ford GAA Engine
- HVSS Suspension
  - Wider track, less ground pressure
  - Smoother ride
  - Could add weight for more armor
- Track Grousers

The Threat

Bundesarchiv, Bild 101I-710-0371-20
Foto: Gronefeld, Gerhard | 1944 Frühling

General Threat Notions

- Tank Technology, Tactics & Operations Doctrine Developed rapidly as war progressed
- German tank superiority is somewhat of a myth
- Lethality generally overmatched survivability
- Training was very important
- Western Front tank engagements usually at 400-800 meters
  - In Russia and desert they were much longer
    - LtCol Jarymowycz claims most tank battles fought in desert were under 500 meters
- After 1941, Eastern Front drove German tank improvements, tactics and doctrine
- In the PTO the Sherman reigned supreme
  - Individual Japanese Suicide Tank Killer was the threat of concern in 1944-45
- Antitank mines serious threat throughout the conflict
  - US Army doctrine was that mines would be cleared by engineers and not mitigated by vehicle survivability

PzKpfw III

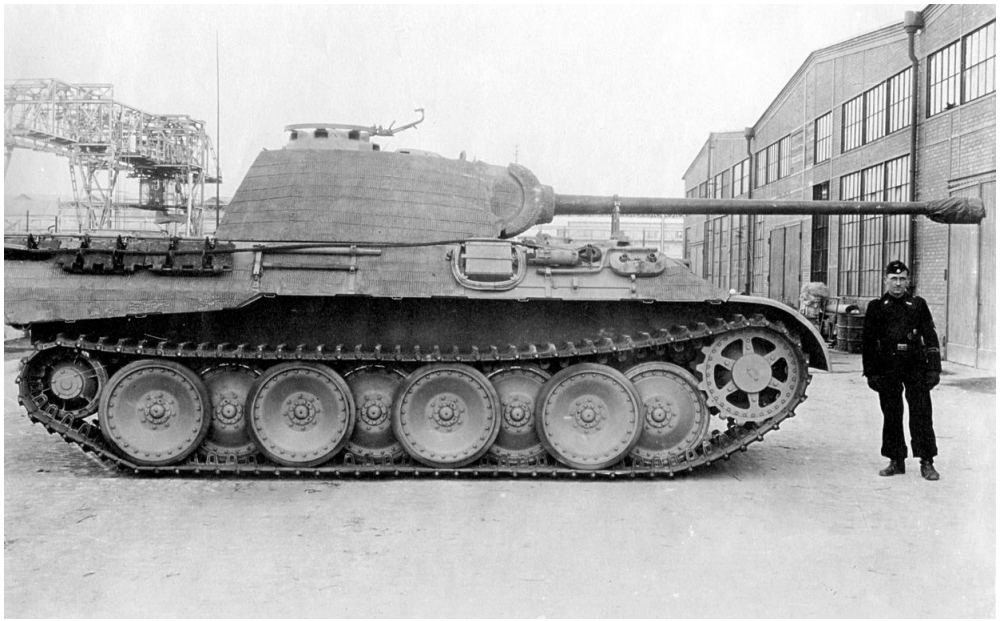
- Armor 5–70 mm (0.20–2.76 in)Main
- Main Armament
  - 1 × 3.7 cm KwK 36 *Ausf. A-F*
  - 1 × 5 cm KwK 38 *Ausf. F-J*
  - 1 × 5 cm KwK 39 *Ausf. J[1]-M*
  - 1 × 7.5 cm KwK 37 *Ausf. N*
- Weight 23.0 tonnes
- Produced 1939–1943
- Number built 5,774

PzKpfw IV

- Armor 10–88 mm (0.39–3.46 in) (w/ armour skirts)
- Main Armament
  - KwK 37 L/24 75 mm *Ausf. A-F1*
  - KwK 40 L/48, 75mm Ausf. F2-J
- Weight 25.0 tonnes
- Produced 1936–45
- Number built ~8,553

PzKpfw V Panther

- Armor: 15–120 mm (0.59–4.72 in)
- Main armament: KwK 42 L/70, 75mm
- Weight: 44.8 tonnes
- Produced: 1943–1945
- Number built: ~ 6,000



PzKpfw VIe Tiger

- Armor: 25–120 mm (0.98–4.72 in)
- Main armament: KwK 36 L/56 88mm
- Weight: 54 tonnes
- Produced: 1942–1944
- Number built: 1,347

PzKpfw VIb Tiger II (Kingtiger)

- Armor: 25–185 mm (1–7 in)
- Main armament: 88 mm KwK 43 L/71
- Weight: 68.5 tonnes
- Produced: 1943–1945
  - Fielded in late 1944
- Number built: 492

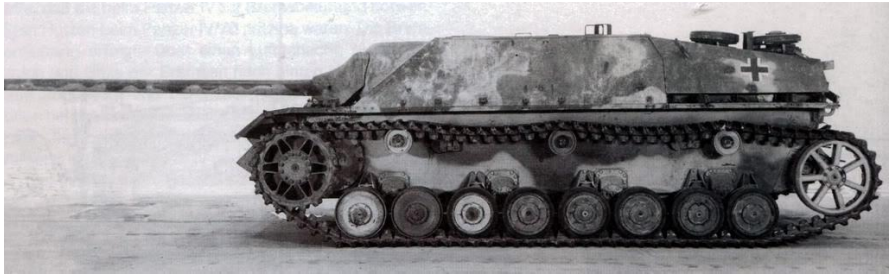
StuG III

- Armor: 16 – 80 mm (.62 - 3.15 in)
- Main armament: 75 mm StuK 40 L/48
- Weight: 23.9 tonnes (52,690 lbs)
- Produced : 1940-1945
- Number built
  - ~10,086 StuG III
  - ~1,299 StuH 42 (105mm gun)

JagdPanzers

JagdTiger

JagdPanzer IV Lang



JagdPanther

Hetzer

Panzerabwehrkanone

Bundesarchiv, Bild 101I-299-1831-26
Foto: Hähle, Johannes | 1944

8.8 cm Flak 18/36/37/41

Infantry Antitank Weapons

Bundesarchiv, Bild 1011-292-1262-07
Foto: Teschendorf | 1942 Sommer

1941 Threats

	Most Likely	Most Dangerous
Anti-Tank Gun	50mm Pak 38	88mm Flak 36 or 37
Infantry Anti-Armor	Panzerbusche 38 & 39	Panzerbusche 38 & 39
Tank	Panzer III G, H	Panzer IV D, E
Emerging Tank		

Sherman events: Initial Sherman design resulting in T6 Medium Tank

1942 Threats

	Most Likely	Most Dangerous
Anti-Tank Gun	50mm Pak 38 & 75mm Pak 40	88mm Flak 36 or 37
Infantry Anti-Armor	Panzerbusche 38 & 39	Panzerbusche 38 & 39
Tank	Panzer III G, H, J	Panzer IV F2 & G
Emerging Tank		Tiger I

Sherman events: M4A1 production begins at Lima Locomotive Works &
M4 & M4A1 at Pressed Steel Car Co
M4A3 goes into production.
Shermans go into combat with British Army in North Africa at El Alamein
Development begins on the 76mm M1 series tank gun

1943 Threats

	Most Likely	Most Dangerous
Anti-Tank Gun	75mm Pak 40	8.8cm Flak 41 or 8.8cm Pak 43 or 8.8cm Pak 43/41
Infantry Anti-Armor	Panzerschreck (Feb-Aug) then Panzerfaust, various (Aug +)	Panzerschreck/Panzer faust
Tank	Panzer IV G & H	Tiger I
Emerging Tank		Panther D

Sherman events: US Army uses Shermans in combat in Tunisia.
USMC combat use in Pacific at Tarawa.
Ordnance orders 76mm Gun Sherman production

1944 Threats

	Most Likely	Most Dangerous
Anti-Tank Gun	75mm Pak 40	8.8cm Flak 41 or 8.8cm Pak 43 or 8.8cm Pak 43/41
Infantry Anti-Armor	Panzerfaust, various	Panzerfaust, various
Tank	StuG III G	Panther A/G
Emerging Tank		King Tiger/Jagdtiger

Sherman events: Normandy Invasion,
Sherman Operational Mobility proven across France.
"Wet" tanks fielded.
76mm Gunned Shermans fielded
HVSS production begins

1945 Threats

	Most Likely	Most Dangerous
Anti-Tank Gun	75mm Pak 40	128mm Pak 44 & 128mm Kanone 81 variants
Infantry Anti-Armor	Panzerfaust, various	Panzerfaust, various
Tank	StuG III G	King Tiger/Jagdtiger
Emerging Tank		Panther G with Night Vision

Sherman events: T26/M26 Pershing fielded (limited in ETO), Sherman now obsolete?

Threats vs. Sherman

	M4A1/A3			M4A1/A3 76mm (W)		
	Front	Side	Rear	Front	Side	Rear
Panzerbusche						
Panzerfaust						
Panzerschreck						
37mm Pak 36						
50mm Pak 38		H	H		H	H
75mm Pak 40						
Panzer IVD		H	H		H	H
Panzer IVH/StuG III						
Panther						
Tiger						
Kingtiger						
JagdTiger						

Key: When Hit Sherman	**Loses**	**Depends**	**Wins**

Notes: Ke shots are at 500 meters range. Survivability will go up as range increases
H = Hull vulnerable
Ce warheads are range independent, however engagement ranger was under 200m

Sherman vs. Threats

	Pz IIIg			StuG IIIg			Pz IVH			Panther			Tiger I		
	Front	Side	Rear	Front	Side	Rear	Front	Side	Rear	Front	Side	Rear	Front	Side	Rear
75mm M61 APC							T								
75mm M72 AP							T								
76mm M62 APC										Angle					
76mm M79 AP															
76mm M93 HVAP															
17 lbr APCBC															

Key: When Hit Threat Vehicle **Loses** **Depends** **Wins**

Notes: Ke shots are at 500 meters range. Survivability will go up as range increases

T = Turret vulnerable

Angle = slope of armor may defeat shot depending on angle of fall

IMHO The Sherman was:

- Strategically an outstanding tank.
  - Very highly producible
  - Worldwide employability
- Operationally an excellent tank
  - It could conduct long operational maneuver with high Operational Readiness Rate
- Tactically was excellent at first, remained “good enough” throughout WWII
  - Doctrine, training and NCOs are very important factors
- WWII US Army Technical Intelligence was very good at assessing German weapons and equipment
  - However it did not seem to inform Ordnance within enough time to influence initial designs
- Sherman improvements were reactionary and hindered by the Tyranny of Time.
- It helped win the war.

Discussion

- How did doctrine influence the development of the Sherman?
- How did resources and industrial capacity affect the development of the Sherman?
- How did the threat and combat experience the development of the Sherman?
- Was the Sherman the best tank of WWII?
- What can you learn from the Sherman program?