

DETROIT: THE “ARSENAL OF DEMOCRACY”

OVERVIEW OF SIX PRODUCTS

ANTI-AIRCRAFT GUNS

World War II marked the refinement of aerial combat and the widespread use of tactical heavy aerial bombing. To counteract the air threat, ground and shipboard anti-aircraft guns were rapidly developed and manufactured. The production tolerances were very strict, often measured in millionths of an inch. Not only did Detroit manufacturers meet the need, but they were often able to reduce production time and cost by fifty percent.



PRODUCTION

As an example of the complexity involved in ordnance production, thousands of sub-contractors were involved in making parts for anti-aircraft weapons, and many others produced millions of rounds of large caliber ammunition.

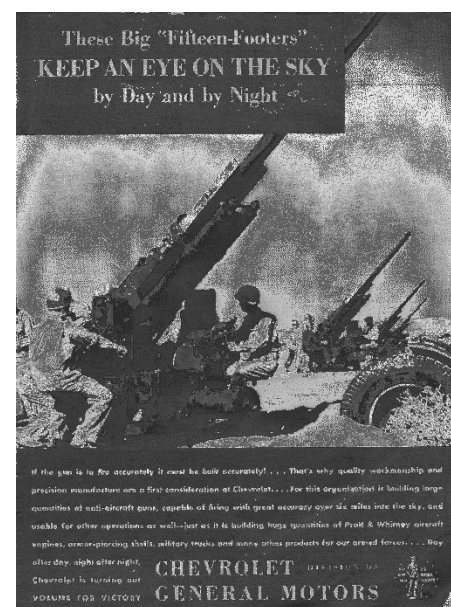
Of the many guns built for the war, three models were built by in the Detroit area: the 20mm Oerlikon anti-aircraft gun, the 40mm Bofors anti-aircraft gun and the 90mm anti-aircraft gun. Several small manufacturers in the Detroit area obtained war contracts to produce gun components and ammunition.

FORD MOTOR COMPANY

- Made 75mm gun mounts, used for large anti-aircraft guns on tanks, including the M4 Sherman tank.
- Built gun directors for the 40mm Bofors gun.

CHRYSLER CORPORATION

- Made over 60,000 40mm Bofors guns and 120,000 gun



barrels at various plants, including the Jefferson-Kercheval arsenal, the Highland Park plant and the Plymouth plant. In total, 11 Chrysler factories were involved in making and assembling the guns.

- Chrysler also involved 2,000 subcontractors in 330 cities to manufacture parts and ammunition.
- Due to the complex design and tight production variances of the Bofors gun, it took the Swedish inventors 450 man-hours to build one gun. Chrysler streamlined production by developing interchangeable parts and applying assembly line techniques, dropping build time to 10 man-hours.

GENERAL MOTORS

- GM's Pontiac division produced 20mm Oerlikon anti-aircraft guns and 40mm Bofors field guns.
- GM's Chevrolet division built over 2,000 90mm guns.

USE

The United States Navy began using the European-developed 20mm Oerlikon gun on its ships in 1942. They worked better than heavier guns in tracking targets at short ranges. As the war progressed and aircraft technology advanced, the gun proved to be ineffective against heavy war planes and Japanese kamikaze attacks.

Originally developed in Sweden, the Bofors 40mm was one of the most popular medium-weight anti-aircraft guns used during World War II. Both the western Allies (Great Britain, France, the Soviet Union, China and the United States) and the Axis powers (Germany, Italy and Japan) used variants of the gun. On naval vessels, two guns often were placed on one mount. The Navy used the gun to cover water landing operations, firing against ground cover. The Bofors gun was also the primary weapon used by PT boats against lesser ships and airplanes.

The 90mm gun was the largest of its type and it was used for both anti-aircraft and anti-tank purposes. It was the U.S.'s primary anti-aircraft gun from just prior to the opening of World War II to the 1950s when most anti-aircraft artillery was replaced by guided missile systems. As the war progressed, they were fitted with searchlights for night attacks, and later were mated with radar units and automatic gun directors that made this gun the most accurate anti-aircraft weapon of the war.

B-24 LIBERATORS

During World War II, factories around the United States built approximately 18,500 B-24 bombers. It was the most widely produced bomber during the war, surpassing the more popular B-17 by 6,000 aircraft. There were multiple variants of the B-24. The Ford Motor Company's Willow Run Plant initially produced B-24 D and B-24 E Liberators, and then the better-designed B-24 H by 1944.



The B-24 initially was less popular than the earlier B-17, which was easier to fly in formation. However, the B-24 had a higher top speed, greater range and a heavier bomb load. The B-24 went through several design changes throughout the war. Two models were built in the Detroit area.

PRODUCTION



In only five months, an Ypsilanti farm field became the largest factory in the world. Designed by Albert Kahn, this Ford-managed facility was built with one purpose – to build bombers. Nearly one quarter of the B-24 “Liberators” produced during World War II were built at the Willow Run Plant.

Aircraft manufacturing proved to be the greatest challenge to Ford’s assembly line process. The tooling tolerances were very fine, and the machines were vastly more complicated than an automobile. The average

Ford car had 15,000 parts. The B-24 had 100,000 parts and 300,000 rivets. It took nearly two years to begin production, but gradually the plant was able to produce one bomber an hour, and cut the cost by forty-three percent.

Besides 8,685 B-24s, Detroit’s greatest contribution to the air war was the design and production of millions of engines, parts and sub-assemblies for planes of all kinds.

mission because the B-17 did not have the range to reach Romania from North Africa.

Five groups of B-24 bombers left Libya on the mission. Navigational problems due to weather and flying over unknown territory complicated the mission. By the time the first group of bombers reached Ploesti, the town's defenders had been alerted and responded with strong anti-aircraft fire. When the mission was complete, fifty-four B-24s had been lost and 532 airmen were killed, taken prisoner, missing or interned. The remaining sixty-three aircraft landed at bases on Malta, Sicily, Cyprus and Turkey. Despite the heavy U.S. casualties, the attack destroyed just over 40 percent of the Ploesti's refining and cracking capacities.

Although not considered a triumphant mission, the attack on Ploesti was one of the most impressive individual air raids of World War II. All crew members received the Distinguished Flying Cross for their part in the mission and five Medals of Honor were awarded, three of them posthumously.

HELMETS

While the production of most war goods was contracted to firms around the country, one very important item was produced almost exclusively in Detroit. More than 20 million steel helmets were stamped and fabricated by the McCord Radiator and Manufacturing Company on East Grand Boulevard.

During World War I, heavy artillery and trench warfare caused countless head injuries. Several nations began experimenting with steel bowl-shaped headgear and it took some trial and error before helmets could be mass-produced.

Helmets became standard issue for soldiers during World War II. While engineers were completing the development of a new helmet, called the M-1, the U.S. manufactured 904,020 M-1917A1 Transition Helmets from January to August 1941.

McCord made over 20 million M-1 Helmets., with an average production was 260,000 helmets per month. In January 1943 the Schlueter Manufacturing Company of St. Louis, Missouri also began producing M-1 helmets. They were the only other M-1 helmet manufacturer and they made 2 million during the war. McCord was the sole producer of a limited run of 148,000 M-2 helmets.





St. Clair liners, produced in Marysville, Michigan, were made of resin-impregnated duck cloth cured under 110 pounds of steam pressure. They produced approximately 1.3 million M-1 helmet liners between 1942 and 1944. Capac Manufacturing Company used the more common high pressure process of making liners that used a hydraulic press to form resin-coated duck cloth. They produced 2-4 million liners between 1942 and the end of the war in 1945. In total, 9 American companies produced helmet liners during World War II.

M-1 helmets were so well-designed that they continued to be standard issue for several decades. They were finally replaced in 1985 by the PASGT helmet. Other countries copied the style for their own use.

Helmets were meant to protect soldiers from debris, shrapnel and bullets. Soldiers often refused to buckle their helmets for fear of having their head jerked back by nearby explosions. Though the likelihood of this occurrence was not great, a new buckle was introduced in 1944 to alleviate this concern. The T1 chinstrap, designed to release under pressure greater than 15 pounds, was developed too late to be a significant feature in World War II helmets, but it continued to be used in the Korean War.

Another problem with the M-1 helmet involved their stainless steel rims. The rims did not retain paint and caused parts of the helmet to shine brightly when exposed to light or the sun. McCord and American troops tried to solve the problem by sandblasting and utility tape, but the results were not satisfactory. In May 1944, the U.S. Army requested that the problem be corrected. By October 1944 McCord began using Hadfield Manganese steel, the same that was used for the shells, for the rims.

LANDING CRAFT



At many points during World War II, the Allied forces needed to get soldiers to shore quickly without endangering their ships. The Landing Craft, Vehicle, Personnel (LCVP) allowed them to do it. Along with other landing craft and amphibious vehicles, LCVPs were essential to key maneuvers such as the Normandy landing on June 6, 1944. While Detroit's automobile manufacturers were busy making other war products, its numerous boat and ship makers took on the challenge of

producing the LCVPs.

The LCVP – Landing Craft, Vehicle, Personnel – was a shallow draft vessel with a ramp on the bow. LCVPs carried soldiers to the shore. Their lightness and shallow draft meant they could get much closer to the shore than many other boats. Unlike rowboats, they could also carry guns for defense. Before battle, the boats needed to be transported in larger ships that would wait at a designated distance from the shore before deploying the LCVPs. The landing craft crossed the water toward the beach until the soldiers inside could lower the ramp and land. An LCVP could transport a jeep or up to 36 troops from a ship to a beachhead.

PRODUCTION

American landing crafts were also known as “Higgins Boats,” which were named after their inventor, Andrew Higgins. In the 1930s, Higgins created a shallow-draft boat for use in the Louisiana bayou. In the late 1930s, the U.S. Navy commissioned Higgins to adapt his boat with a quick deploying ramp so it could be used to transport Marines. Made almost entirely from wood, the Higgins Boat could operate in shallow water, easily land its bow and then quickly retract after deploying up to 36 soldiers.



CHRIS-CRAFT CORPORATION

- The Chris-Craft Corporation based in Algonac delivered over 10,000 landing crafts from plants on the St. Clair River, as well as in Cadillac and Holland, Michigan.
- The Chris-Craft factories manufactured several types of landing craft, including 36’ “Eureka” boats, LCPRs, LCVRs and LCVPs.
- They also made thousands of patrol boats, picket boats, target tow boats, personnel transports and rescue craft.



OTHER MICHIGAN MANUFACTURERS

- Chrysler Corporation: Marine engines and turbines, marine tractors
- Gray Marine Motor Company (Detroit): Marine diesel engines
- Hudson Motor Car Company (Detroit): Marine gasoline engines
- Packard Motor Car Company (Detroit): Engineered and made 14,000 V-12 marine engines for PT boats, 600 horsepower V-12 diesel engines, US Navy mine sweepers, stainless steel and other non-magnetic components
- Hacker Boat Company (Mt. Clemens): 45’ Navy picket boats, 34’ radio controlled target tow boats, redesigned the fast Army Air Force rescue boat.



Operation Overlord, also known as the invasion of Normandy, is considered the decisive battle of the war in Western Europe. The naval component of the operation, code named Operation Neptune, was made up of large numbers of warships, auxiliaries and landing craft. In addition to 1,200 warships, Britain, Canada, the United States and the navies-in-exile of France, the Netherlands, Norway and Poland provided 4,126 amphibious landing craft. More than 3,500 were used during the Normandy Invasion. They provided the crucial troop-carrying capacity to land thousands of men,

vehicles and artillery along the 50-mile wide target area in the Bay of the Seine.

The initial assault from landing ships and craft was on a five-division front between the Orne River and the Cotentin Peninsula. The region was divided into five landing beaches, code named Utah, Omaha, Gold, Juno and Sword. The American-manned Western Task Force was assigned the first two beaches and the British-dominated Eastern Task Force took the other three.

On June 5, 1944, Operation Neptune put to sea and began gathering in assembly areas southeast of the Isle of Wight. The American landing at Utah beach began at 6:30 a.m. on June 6. Despite landing slightly south of the target area, the U.S. 4th division advanced rapidly toward its initial objectives. At Omaha beach, American landings began at 6:35 a.m. The landing crafts encountered underwater obstacles that slowed progress and made them easy targets for the German gunners on shore. It took a combination of short-range destroyer gunnery support, aerial bombardment and infantry assaults to break the German defenses. It was not until noon that the U.S. 1st and 29th divisions crossed the beach line in force.

The British sector proceeded more smoothly. Despite rougher seas and higher-than-expected tides, naval gunfire support kept German defensive fire suppressed at Sword and Juno beaches. The landings, which began at 7:30 a.m. and 7:35 a.m., respectively, went smoothly and the British and Canadian divisions moved inland by early afternoon. At Gold beach, obstacles were more numerous than expected and many landing craft were lost. This hindered the buildup of forces ashore and it wasn't until nightfall that the beach was secured.

After overrunning the German beach defenses, the Allies rapidly expanded the individual beachheads, and landing craft reinforced the takeover with new troops, munitions and supplies. Allied naval and shore-based artillery helped defeat the initial German counter-attacks, and Allied air attacks hindered the transportation of German reinforcements to the region. By July 25, the Allies were strong enough to launch Operation Cobra and begin the liberation of France.

TANKS

Tanks had proven essential to breaking through trenches and enemy lines during World War I. By the time World War II began, they were indispensable. Their tread could travel over ground that wheeled vehicles could not and their armored bodies shielded the men manning their powerful weapons. The U.S. especially wanted to improve tanks' reliability, which had been notoriously poor in the previous war. Detroit manufacturers worked tirelessly to ensure their tanks were durable, effective and easily maintained. In a short span of years, they produced tens of thousands of tanks.



The U.S. made several types of tanks during the war and had more models waiting to begin production had the war continued into 1946.

The first tank built in Detroit was the M3, in 1941. It was rushed through development and had several weaknesses. The limited mobility of the most powerful gun and the tank's tallness left it vulnerable to attack. However, its large numbers, quick production rates and reliability in the field helped turn the tide of battle in North Africa. To avoid confusion with the M3 Stuart light tank, the M3 medium tanks were referred to as "Lee" or "Grant" tanks, depending on the turret styles.

The M4 Sherman was the primary tank used by the US and its allies during the war. There were several variations on the M4, differing in armor, power and armament. Near the end of the war, German Tiger and Panther heavy tanks began to outclass the M4 in terms of armor thickness and firepower.

The US responded with the M26 Pershing heavy tank. The M26 tank was bigger, heavier, had a better primary weapon and used torsion bar suspension instead of spring suspension. It is a forerunner of modern tanks and its use continued into the 1950s after the end of the war.

Detroit manufacturers also constructed light tanks, called "destroyers." They were fast, lightly armored and carried heavy weapons designed to chase and destroy enemy tanks. The M-8 tank destroyer carried a 75mm Howitzer and could reach speeds of 40 miles per hour. The M-18 Hellcat had a 76mm gun and could go even faster, up to 60 miles per hour. Tank destroyers were very effective against Germany's heavy tanks, which were not built for speed.

PRODUCTION

U.S. automakers produced tens of thousands of tanks, starting well before the U.S. entered the war.

FORD MOTOR COMPANY

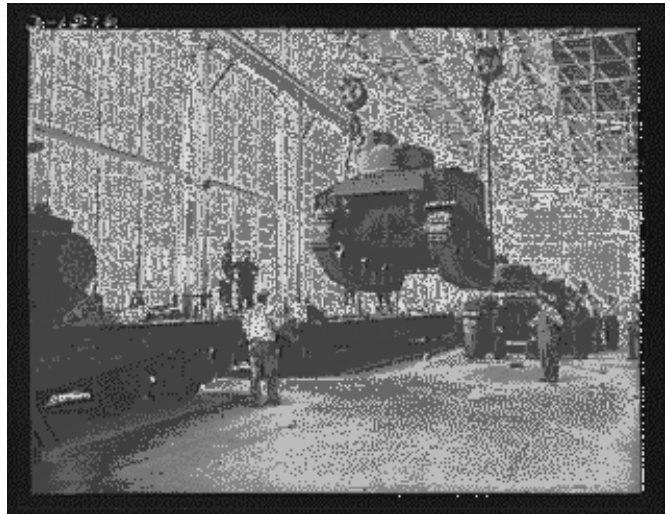
- Ford manufactured almost 1,700 M4A3 tanks and over 1,000 M4 tank destroyers.

CHRYSLER CORPORATION

In September 1940 the Army partnered with Chrysler Corporation and architect Albert Kahn to build the one million square foot Detroit Arsenal Tank Plant in Warren. In 1942, it expanded to 1,248,321 square feet.

When the Tank Arsenal reached full production, its 5,400 employees were working 24 hours each day, 6 days a week and were prepared to turn out 1,000 tanks a month. In December 1942 they produced almost 900 tanks.

Chrysler's Tank Arsenal surpassed all facilities in the rapid assembly of the main battle tanks. The complex depended on more than 700 sub-contractors, often small machine shops in Detroit, to manufacture the parts for a tank.



- By the end of the war, 22,234 tanks were made at the plant, a quarter of all US production.
- Almost 18,000 were M4 Shermans. 7,500 were given the innovative multibank engines. About 800 M4s were later modified for the British army in 1943.
- Of the 6,258 total M3 tanks built in the U.S., 3,352 were assembled at the tank arsenal.

GENERAL MOTORS

- Buick produced 2,500 M18 Hellcat tank destroyers.
- Cadillac manufactured 6,550 M5 Stuart light tanks, almost 3,600 M24 light tanks and more than 1,700 M8 tank destroyers.
- General Motors also turned out engines for the M5 tank, as well as gun carriages and chassis for various tanks.
- Fisher Body made thousands of M4 Sherman tanks in Grand Blanc, as well as T25s and T26s.
- Pontiac made M5 Stuart light tanks.

USE

The United States' efforts to produce tanks quickly and efficiently for the British and others were instrumental in helping the Allied Forces gain lost ground in North Africa, as well as in conquering Italy. This is especially true of the M3 and other early models.

Armored units were the "cavalry" of World War II. Tanks could fire at enemy lines from a distance as well as flush out cave and pill boxes; their armor gave the soldiers inside some protection from enemy fire on the ground and in the air. As tanks got bigger, more powerful and better-armored, tank destroyers also grew in significance.

M3

- Of the 6,258 M3s produced by the U.S., 2,855 were supplied to the British army and about 1,368 to the Soviet Union.
- British M3s were used against Rommel's forces at the Battle of Gazala near Tobruk, Libya on May 27, 1942. They continued to serve in North Africa until the end of that campaign.
- U.S. 1st Armored Division in North Africa also used M3 tanks in the North African campaign.
- Several M3s saw limited action as armored recovery vehicles in the battle for Normandy.
- M3s were used on the Arctic Front in the Red Army's offensive on the Litsa front towards Kirkenes in October 1944.
- During the battle for Tarawa Island in 1943, the U.S. Army attacked nearby Makin Island supported by a platoon of M3A5 Lee medium tanks. It was the only U.S. Army combat use of the M3 in the Pacific Theater.
- In the Far East, the M3's main task was infantry support. It played a pivotal role during the Battle of Imphal, during which the Imperial Japanese Army's 14th Tank Regiment encountered M3 medium tanks for the first time.

M4

- The U.S. Army was issued 19,247 M4 Shermans and the U.S. Marine Corps received 1,114. The U.S. also supplied 17,184 M4 tanks to Great Britain, 4,102 to the Soviet Union and 812 to China.
- The British 8th Army was the first to use M4 tanks in battle at the Second Battle of El Alamein in Northern Africa in October 1942
- The U.S. first used M4 Shermans during Operation Torch, a British-American invasion of French North Africa in November 1942.
- The M4 and M4A1 were the main tank types in U.S. units until late 1944, when the Army began replacing them with M4A3, which had a more powerful engine. Some M4s and M4A1s continued in U.S. service for the rest of the war.

M26

- The M-26 was developed near the end of World War II and named after World War One General John J Pershing of the American Expeditionary Force.
- The M26 Pershing was slow to develop, since the U.S. Army did not initially need a heavy tank. When the Germans debuted their Panther and Tiger series of tanks in mid-1943, the U.S. Army finally needed a heavily-armed and armored weapons system.
- Overall, the M26 Pershing arrived too late to be an effective tool in the European Theater, but roughly 200 saw service with the 3rd and 9th Armored Divisions.
- M26 Pershings were part of the armored column that crossed the Remagen Bridge over the Rhine River and into Germany in March 1945.
- Ten M26s were shipped to the Pacific Theater for action in Okinawa, but they arrived too late to be of effective tactical use.

TRUCKS

Although their military purposes had been pioneered during World War I, automotive vehicles had greatly improved by the late 1930s. Detroit car manufacturers were instrumental in designing and building trucks, ambulances and Jeeps for the Allied forces. Chrysler, Ford, General Motors and others produced hundreds of thousands of vehicles in the early 1940s.



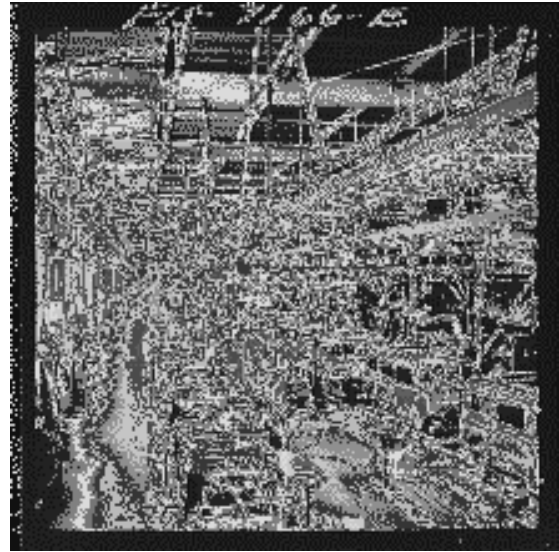
World War II trucks came in a variety of sizes and were adapted to diverse purposes. Though some trucks were single-axle drive, many were 4x4 or 6x6 models that could carry large amounts of cargo over tough terrain. The trucks ranged in size from ½- and ¾-ton trucks made in the early stages of the war to GMC's 2½-ton "workhorses." Jeeps – the light utility vehicle most often used by the armed forces – had load limit of 800 pounds.

The military tried to standardize vehicle design to minimize the kinds of replacement parts it needed to carry on hand. As a result, trucks and jeeps were built with interchangeable, often identical, components.

Often it was the equipment carried or attached rather than the build of the vehicle that determined its purpose. Jeeps and trucks could be fitted with searchlights, radar, radios, supplies or guns depending on the need.

PRODUCTION

Detroit's auto manufacturers and parts suppliers produced more than 2.5 million rubber-tired non-armored transports. The trucks and parts were manufactured in factories all over the country, with Detroit as the center for design.



FORD MOTOR COMPANY

- Ford manufactured 12,500 armored cars, over 12,000 amphibious jeeps, 93,000 trucks, and 12,500 autos.
- Ford and Willys-Overland, with facilities in Detroit and Toledo, produced about 640,000.

CHRYSLER CORPORATION

- Chrysler's Dodge division produced over 400,000 trucks at the Mound Road Assembly Plant in Warren, MI.
- 255,000 were ¾-ton models (WC-51 – WC-59) made early in the war
- 43,000 were WC-62 and WC-63 versions
- In 1942, the Chrysler Parts Corporation used the John R plant, a former Studebaker factory, for production overflow from its Highland Park facility. It also used several Detroit warehouses for extra storage.

GENERAL MOTORS

- GM made over 925,000 trucks of all kinds, including:
- About 450,000 GMC 2 ½ ton vehicles
- About 470,000 Chevrolet 4x2, 4x4, and 4x6 trucks
- 21,147 DUKW393 "Duck" boats
- Buick manufactured ammunition vehicles and armored personnel carriers.
- Pontiac produced trucks and diesel engines.

USE

Large trucks were especially important in the European theater where there was a lot of land to cover, while Jeeps and smaller trucks were essential in the island landscape of the Pacific theater.

FORD GPW

- Jeeps served with distinction in every aspect of the war and were the key general purpose vehicle.
- They were modified for many different uses, including garbage trucks, artillery platforms, messenger service and heavily armed rapid strike assault vehicles.
- The Navy used Jeeps on fleet carriers as aircraft "tugs."
- In Europe, many Jeeps were field-modified with a 3-ft vertical steel bar welded to the center of the front bumper to break decapitation wires strung across roads.

DODGE WC SERIES

- WC-51 and WC-52 trucks were called weapons carriers. They had folding troop seats on both sides of the cargo area and were primarily used to haul personnel and ammunition, not weapons.
- The WC-53 Carryall had an enclosed body with windows, intended for troop transport or light cargo.
- The WC-54 Ambulance had a crew of 2 and a capacity of 4 casualties on litters or 6 casualties seated. It was used in all theaters of the war and helped assist troops during the invasion of Normandy in 1944.
- WC-56 and WC-57 Command Cars were used for transporting officers and for reconnaissance missions. Their distinctive profiles made them a target and production was ended in 1944.
- The WC-62 and WC-63 were often used in conjunction with the Dodge WC-52 and WC-53 weapons carriers. Their main use was to carry cargo and soldiers.

GMC CCKW - 2 1/2-TON TRUCKS

- Assigned primarily to U.S. Army supply units, these trucks were operated largely by African American soldiers.
- By mid-1944, pre-invasion air raids had all but destroyed the railroads in Normandy. After the D-Day landings, supplies could only reach the troops by truck. The CCKW was a pivotal truck during this initiative, nicknamed the "Red Ball Express." At its peak, the Red Ball Express operated nearly 6,000 vehicles and carried about 12,500 tons of supplies a day. It ran for three months, moved about a million tons of supplies and wore out 50,000 truck tires.
- The CCKW truck remained in service in the U.S. Army and its European allies for decades after the



war. The vehicle remained a stellar logistics performer throughout the Cold War and some armies still used them into the 1990s.

FORD GPA AMPHIBIOUS JEEP

- The GPA, nicknamed “Seep” for “Sea Jeep,” was not popular or successful with the U.S. military. It was judged too small, too difficult to maneuver and subject to swamping in significant waves. Most GPAs were supplied to the Soviet Union, which liked the vehicle and began producing their own version, the GAZ 011.

GMC DUKW 393

- The DUKW was supplied to the U.S. Army, U.S. Marine Corps and Allied forces. 2,000 were supplied to Britain, 535 to Australian forces and 586 to the Soviet Union.
- The DUKW was used in landings in the Mediterranean, Pacific, on the D-Day beaches of Normandy, in Operation Husky and during Operation Plunder.
- Its main use was to ferry supplies from ship to shore, but it was used for other tasks, such as transporting wounded combatants to hospital ships or operations in flooded landscapes.