General Electric U-boats

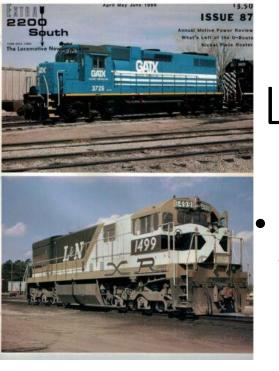
12500

euse River Valley Model Railroad C

November 16, 2023

This is not a GE U-boat





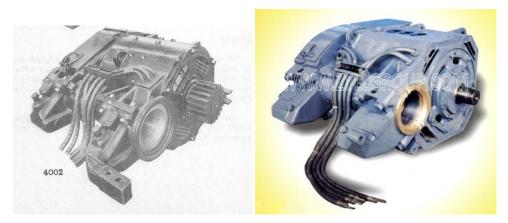
Locomotive Phases

- No locomotive manufacturer ever used the term phase for its locomotive or any of its parts
 - Changes that occurred during production of a particular model were just evolutionary steps
- The term phase was originally used by the publication, *Extra* 2200 South, started by rail historian and enthusiast Jerry Pinkepank, to identify changes in specific models
 - For example, there were 6 different phases of EMD F3s
- The use of phases to identify different characteristics of the same model was expanded by other rail historians

DC Traction Motors

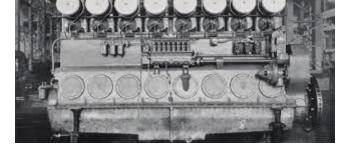
- Best to Worst
 - Westinghouse 360 to 370 Series
 - Introduced in the late 1920s
 - Westinghouse exited the locomotive traction business in 1955
 - General Electric 752 Series
 - Evolution of the 726 to 746 series
 - Introduced in the late 1940s
 - Last produced domestically for new locomotives in 2015, still produced for international customers
 - EMD D Series (D7 D100)
 - Based on the GE 716 traction motor, which EMD bought the rights for production
 - Introduced in 1938
 - Last produced domestically for new locomotives in 2011, still produced for international customers
 - MPI/MK Rail MK 1000 Series
 - Based on EMD traction motors
 - Introduced in the early 1990s, still produced upon request
- Durability Length of time to run with excessive amps
 - Based on amount of copper wiring in motor
 - Southern Pacific performed study to confirm





Manufacturers' Diesel Engines

- Only 2 of the major diesel locomotive manufacturers developed and built their own diesel engines
 - EMD
 - Fairbanks-Morse
- Origins of diesel engines for other manufacturers
 - Alco purchased McIntosh & Seymour in 1929
 - Prior to 1929, Alco used Ingersoll-Rand diesel engines
 - Baldwin purchased I. P. Morris & De La Vergne in 1931



- Prior to 1931, Baldwin used Krupp and Knudsen diesel engines in locomotive development
- The last 3 locomotives built used Maybach diesel engines
- General Electric rights for the 7FDL diesel engine purchased from Cooper-Bessemer in 1956
 - Prior to 1956, GE used Buda, Busch-Sulzer, Caterpillar, Cooper-Bessemer, Cummins, Hercules, and Ingersoll-Rand, depending upon model and buyer
 - 44-ton used Caterpillar engines, and the 70-ton used the Cooper-Bessemer FWL-6T
- Lima merged with General Machinery Corp of Hamilton, Ohio in 1947
- MPI/MK Rail Primarily used EMD, but also Caterpillar, Cummins, General Electric, and Sulzer (Swiss)
- Others Krauss-Maffei (Maybach), Siemens (Cummins), Budd RDC (GM Detroit Diesel), Alstom (EMD)
- Small industrial switchers variety of domestic gasoline and diesel engines, including truck type

General Electric U-boats



- GE domestic models (North America) of the Universal Series
 - Most rail historians accept the "U" stands for Universal Series
 - Some say no, but have no backup or alternative, and GE never comments
- Model nomenclature
 - U for Universal Series
 - Numbers designate horsepower (e.g. U25B is a 2,500 hp unit)
 - 1st Letter designates truck (B=B trucked, C=C trucked)
 - 2nd letter designates passenger car heating (G=steam generator, H=electric)
- Produced from 1959 to 1977
 - 3,430 built from all models
 - 20 different models
 - Most produced was the U30C @ 600 units
 - Least produced was the U30CG @ 6 units
 - Actual is the XP24 @ 2 units, but it is included in U25B totals by GE
 - Conrail owned the most at 576, but only bought 10 new, remainder inherited from other railroads
 - Up bought the most new at 367

GE U-Boats Prime Mover

- All U-boats had a version of the 7FDL diesel engine
 - 7 = Power generation or engine in the GE product catalog for all corporate divisions
 - F = Cylinder bore of 9"
 - D = Engine configuration
 - L = GE service category for "locomotive use"
 - Cooper-Bessemer designation is FDL
- Produced domestically from 1956 to 2004
 - Still produced for overseas customers (parts available for all locomotives produced)
- Three versions produced
 - 7FDL-16 = V16 produced for all models except as below
 - hp varied from 2,400 to 4,400
 - 7FDL-8 = V8 rated @ 1,800 hp for the U18B
 - 7FDL-12 = V12 rated at 2,250 hp for the U23B, U23C, and U50C
 - UM20 used a 7FDL-12 rated at 2,000 hp
 - Some B30-7's built for MP used the 7FDL-12 rated at 3,000 hp



GE U-Boat Traction Motors

- Most U-Boats used a version of the GE 752 traction motor
 - HOWEVER some U23B, U30B, U33B, and U36B used Blomberg B trucks traded in from F and GP units
 - It has been stated that the 752 traction motor will not fit into the Blomberg B truck
 - The Blomberg B truck was designed around the GE 716 traction motor (frame motor smaller than the 752 motor)
 - EMD had purchased the rights from GE for production of the GE 716 motor in the 1930's
 - GE manufactured the 726, 731 and the 746 traction motors
 - Some Alco PA's had 746 motors installed, and Alco S-4 and RS-1 were still using 731 motors as late as 1961
 - What motors were installed in the UB units with Blomberg B trucks?
 - Could not find documentation

GE U-boats Trucks

- B trucks
 - AAR Type B
 - Floating bolster FB-2
 - Blomberg B



- From F and GP units traded to GE, exception was Auto Train U36b's
- C trucks
 - Tri-mount double equalized
 - Heavy drop equalizers
 - Floating bolster FB-1
 - Adirondack
 - General Steel Casting
 - Turbine (from GTEL8500)



GE U-boat Development

- GE withdrew from the joint marketing and production agreement in 1953
- 1954 began development long haul, heavy freight locomotives
 - Built 2 cabs and 2 boosters in 1954, one cab & booster rated at 1,200 hp with FDL-12 engines, one cab & booster rated at 800 hp with FDL-8; designated Experimental Locomotive 750
 - 1954 to 1959 rolling test lab on the Erie RR
 - 1959 repowered with 7FDL-12 engines rated at 2,000 hp and sold to UP
- 1956 introduced the Universal Line of export locomotives
 - 400 produced by 1959 when U25B introduced





GE U-boat Development cont.

- 1956 10 UD18 produced for N de M
 - Did not include sealed carbody and filtered air
 - Layout similar to Alco RS-11
 - Forecast appearance of U25B
 - Counted in U-boat totals
- 1959 two XP-24 Produced for demonstration
 - Toured the USA to promote GE as diesel locomotive supplier
 - Introduced the sealed carbody and filtered air concept
 - When U25B announced as domestic freight locomotives, designation changed to U25B
 - Counted in U25B totals
 - Never sold; held at GE Erie Plant for many years
 - Numbered 751 and 752





GE U25B

- The U25B was the first commercially successful domestic diesel electric road locomotive designed, built, and sold by General Electric after its split with Alco
- The U25B pioneered the diesel locomotive central air system, pressurized engine and control compartments, advanced wheel slip control, and an improved cooling system
 - All diesel road locomotives subsequent to the U25B are based on this approach
- The U25B is considered to be the first 2nd generation locomotive
- David P. Morgan of *Trains* magazine considered the U25B to one of the 10 most influential pieces of motive power
- The U25B put GE on the road to becoming the top locomotive producer in the U.S., much to the chagrin of EMD
- The U25B was the first unit called the "U-boat"

U25B Demonstrators

- 753-756 High hood units built 01/1961
 - Sold to Frisco
- 2501-2504 One low hood and three high hood units built 02/1962
 - Sold to Union Pacific
 - 2501 was first low hood U25B and first GE low hood unit anywhere
- 51-54 All low hood units built 7/1963
 - Sold to Frisco



U25B Statistics

- Produced from 1959 to 1966
- hp most were 2,500
 - Near end of production, at least 10 were known to be rated at 2,800 hp
- All built with AAR Type B trucks
- Tractive effort 53,000 lbs
- All built with DC generator
- # of Buyers 16 railroads
- Total built 478
 - Largest buyer NYC @ 70 units
 - Smallest buyer N&W @ 1 unit (Wabash wreck replacement)
 - 21 built with high hoods for Frisco and UP
 - XP24 and all demonstrators counted in production totals
 - PRR had 7 low nose with dual controls
- Rebuilds SP rebuilt 2 in kind, 4 with Sulzer engines by MK, Frisco rebuilt one with an EMD 567 engine (only known GE unit rebuilt with an EMD engine)
- Preservation 7 are known to still exist in original form, all at museums; only one is still operational – SP 3100, U25BE (rebuild)

GE U25B Phases

• Technically 6 phases if you count the XP24

• 5 actual phases



Phase 1



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Phase II
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Phase IV w/o Equipment Filter Boxes



Phase V w/Split Window and Sloped Nose

Phase III "Classic" U25B

U25C Statistics

- Produced from 1963 to 1965
- hp most were 2,500
 - Near end of production, 10 were rated at 2,800 hp for ACL, NP, & PRR
- All built with tri-mount double equalized C trucks
- Tractive effort 85,000 lbs
- All built with DC generator
- # of Buyers 1 construction contractor and 6 railroads
- Total built 113
 - Largest buyer NP @ 30 units
 - Smallest buyer LS&I @ 2 units
 - All built with low hoods
- Preservation Only one is known to exist, LS&I 2501, at Marquette, MI in static display

U25C Phases

- 3 phases
 - All phases used the single piece windshield









Phase III

U50 Statistics

- Produced from 1963 to 1965
- hp All but one were rated at 5,000 (two 7FDL-16 engines)
 - UP #52 was rated at 5,600 hp (two 7FDL-16 engines)
- Built with four AAR trucks utilizing a span bolster
 - Used recycled GTEL4500 turbine trucks
- Tractive effort 139,500 lbs
- All built with DC generator
- # of Buyers 2
- Total built 26
 - UP @ 23 units
 - SP @ 3 units
- Believed to be the tallest diesel locomotives ever built
 - Heaviest diesel units on the SP
- UP units originally built without nose doors, added later
- Train crews hated them to be lead locomotive because of blower noise from cooling fan immediately behind the cab
 - Engineers also complained that the short low hood caused a hypnotizing effect when looking down the track



Only One Phase Built

U28B Statistics

- Produced in 1966
- hp 2,800
- All built with AAR Type B
- Tractive effort 64,000 lbs
- Most built with DC generator, toward end of production some built with AC/DC alternator
- # of Buyers 9 railroads, includes NYC subsidiary P&LE
- Total built 148
 - Largest buyer Rock Island @ 42 units
 - Smallest buyer NYC @ 2 units
 - 30 units built with high hoods for N&W, all others built with low hoods
 - 4 built as demonstrators and sold to SP
- Preservation only two are known to exist in museums, and one was rebuilt to U30B specs

U28B Phases

- Three phases
 - Phase I used the same carbody as the Phase V U25B
 - Phase III used the same carbody as the Phase I U30B



Phase I



U28C Statistics

- Produced in 1966
- hp 2,800
- Phase I built with Tri-mount double equalized C trucks, Phase II built with FB-1 C trucks
- Tractive effort Phase 1 85,000 lbs, Phase II 85,800 lbs
- Most built with DC generator, toward end of production some built with AC/DC alternator
- # of Buyers 6 railroads
- Total built 71
 - Largest buyer CB&Q @ 16 units
 - Smallest buyer L&N @ 8 units
 - All built with low hoods
- Preservation only one is known to exist in a museum, UP 2804 with long hood cut away to show inner workings of a diesel locomotive, used by UP for training

U28C Phases

- Two Phases
 - Phase I used same carbody as the Phase III U25C



Phase I



Phase II

U28CG Statistics

- Produced in 1966
- hp 2,800
- All built with FB-1 C trucks
- Tractive effort 75,000 lbs, maximum speed 93 mph
 - Designed to be dual-service locomotives
- Built with DC generator
- Includes steam generator
- Only one buyer ATSF
- Total built 10



U30B Statistics

- Produced 1966 to 1975
- hp 3,000
- Most built with AAR Type B trucks
 - 38 Built with Blomberg B trucks for ACL, SAL and WP
- Tractive effort 64,000 lbs
- All built with AC/DC alternator
- # of Buyers 11 railroads
- Total built 295
 - Largest buyer N&W @ 110 units
 - Smallest buyer ACL @ 4 units
 - N&W had high hoods and dual-controls, all others built with low hoods
 - 4 built as demonstrators and sold to C&O and WP
- Preservation only two are known to exist in museums

U30C Statistics

- Produced 1966 to 1976
- hp 3,000
- All built with FB-1 C trucks
- Tractive effort 85,800 lbs
- All built with AC/DC alternator
- # of Buyers 18 railroads
 - Also bought by Detroit Edison, Kaiser Steel (for Eagle Mountain Mine), and USDOT
- Total built 600
 - Largest buyer BN @ 180 units
 - Smallest buyer N&W @ 3 units (low hood)
 - USDOT bought one
 - SOU had high hoods and dual-controls, all others built with low hoods
 - Kaiser Steel U30C were the heaviest U-boat C truck units built at 420,000 lbs
 - Beginning in mid 1972, Designation was changed to U30CXR to compete with EMD SD40-2
- Preservation four are known to exist in museums or in static display
 - USDOT U30C is known to exist as a power source for testing of mass transit power cars
 - Many U30C units were rebuilt from trade-ins to C30-S7R or C30-S7N locomotives, and sold to Mexican and oversea railroads
 - NS rebuilt 8 former N&W and SOU U30C to C30-7 (these may still exist on regionals or shortlines)

U30B & U30C Phases

- Five phases
 - Phase I used the same carbody as the Phase III U28B

















Phase IV

U30CG Statistics

- Produced 1967
- hp 3,000
- Built with FB-1 C trucks
- Tractive effort 75,000 lbs, maximum speed 93 mph
 - Designed to be dual-service locomotives
- Built with AC/DC alternator
- Includes steam generator
- Only one buyer ATSF
- Total built 6
- Common to be consisted w/U28CG



U33B Statistics

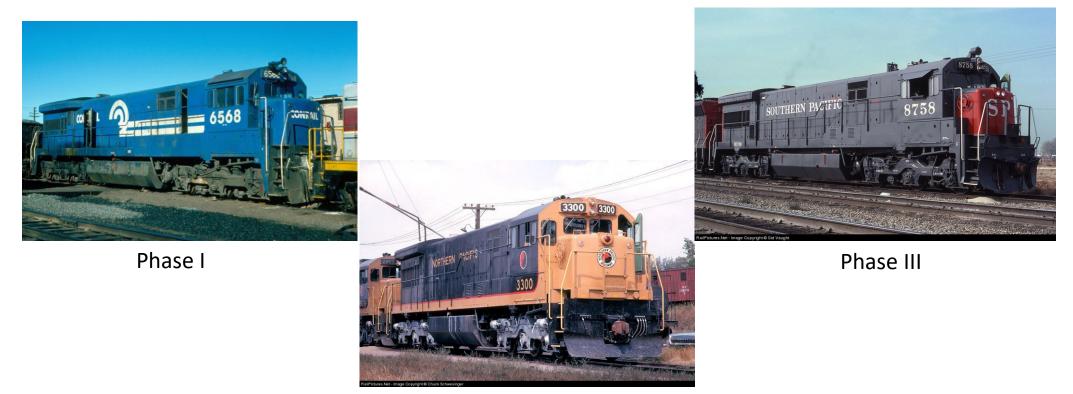
- Produced 1967 to 1970
- hp 3,300
- Most built with AAR Type B trucks
 - 29 Built with Blomberg B trucks for SCL
- Tractive effort 64,000 lbs
- All built with AC/DC alternator
- # of Buyers 15 railroads
- Total built 137
 - Largest buyer PC @ 81 units
 - Smallest buyer NYC @ 2 units (built as part of U30B order but in U33B carbody with U30B builder's plate and later downrated to 3,000hp)

U33C Statistics

- Produced 1968 to 1975
- hp 3,300
- All built with FB-1 C trucks
- Tractive effort 92,500 lbs
- All built with AC/DC alternator
- # of Buyers 11 railroads and one construction contractor
- Total built 375
 - Largest buyer SP @ 212 units
 - Smallest buyer MILW @ 4 units
 - Construction contractor S J Groves and Sons Construction bought 2
 - SOU had high hoods and dual-controls, all others built with low hoods
- Preservation the cab of a D&H U33C is on display at the Toronto Railway Museum
 - Three units were rebuilt by GE in 1987 to B units (no cab) and shipped to China for minework, where it is believed they are still hauling coal

U33B & U33C Phases

- Three Phases
 - Phase III used the same carbody as the U36B, U34CH, U36C and the U36CG



Phase II

U23B Statistics

- Produced 1968 to 1977
- hp 2,250
- 53% built with AAR Type B trucks
 - 45 built with Blomberg B trucks for C&O and WP
 - 210 built with FB-2 trucks for L&N, MP, FNM, SOU, and Southern Peru Copper
- Tractive effort 57,200 lbs
- Customers had option of DC generator or AC/DC alternator
- # of Buyers 15 railroads
 - Also bought by Southern Peru Copper and Texas Utilities
- Total built 481
 - Largest buyer L&N @ 90 units
 - Smallest buyer MKT @ 3 units
 - Texas Utilities bought one
 - SOU had high hoods and dual-controls, all others built with low hoods
- Preservation two are still operable and being used in museum or tourist railroad
 - Two are inoperable and in museums
 - Western Rail operates one as a lease unit
 - Huntsville and Madison County Railroad Authority and RJ Corman still operate one each in daily freight service

U23C Statistics

- Produced 1968 to 1970
 - Produced in Brazil from 1972 to 1976
- hp 2,300
- All built with FB-1 trucks
- Tractive effort 85,500 lbs
- All built with DC generator
- # of Buyers 4 US railroads and one Brazilian
- Total built 53 for US railroads
 - Largest buyer ATSF @ 20 units
 - Smallest buyer LS&I @ 5 units
 - RFFSA (Federal RR of Brazil) purchased 20 units built at the Erie Works and 150 built under license in Brazil
- Preservation one unit, LS&I 2500, is housed at the Arkansas Railroad Museum

U23B & U23C Phases

• Three Phases



Phase I

Phase II

Phase III

U50C Statistics

- Produced from 1969 to 1971
- hp 5,000 (two 7FDL-12 engines)
- Built with recycled GTEL8500 turbine C trucks
- Tractive effort 88,000 lbs
- All built with AC/DC alternator
- Only one buyer UP
- Total built 40
- The U50C was a disaster for both GE and UP
 - Nearly all of the units had electrical fires as a result of using aluminum wiring
 - The recycled trucks suffered from stress fractures
 - Diesel engines frequently developed low oil pressure
 - The cooling water system leaked
 - Dynamic brake grids were prone to melting
- All were stored in serviceable condition in 1976 and returned to GE in 1977-1978



U34CH Statistics

- Produced 1970 to 1973
- hp 3,430 for traction and 170 for train lighting and HVAC
- All built with FB-1 C trucks
- Tractive effort 72,500 lbs, maximum speed 103mph
 - Designed for commuter rail service



Only One Phase Built

- Built with prime AC/DC alternator for traction and auxiliary AC/DC alternator for train lighting and HVAC
- Only buyer NJDOT and operated by the EL/Conrail (transferred to NJ Transit in 1983)
- Total built 33
 - One unit was rebuilt from a wrecked C&NW U30C and is not counted by GE in the U34CH totals
- Preservation One unit donated to the United Railway Historical Society of New Jersey in 1996, which raised funds to restore unit to working condition. Restoration was initiated in 2022
 - 19 units were sold to Conrail, and subsequently sold to Mexican railroads. The status of these units is unclear

GE U36B Statistics

- Produced 1970 to 1974
- hp 3,600
- 121 built with Blomberg B trucks for SCL and AT
 - 4 built for Conrail with AAR Type B trucks
- Tractive effort 64,000 lbs
- All built with AC/DC alternator
- # of Buyers 3 railroads
- Total built 125
 - Largest buyer SCL @ 108 units



Only One Phase Built

- Smallest buyer Conrail @ 4 units (built as part of order for Auto-Train, but transferred to Conrail with bankruptcy of AT)
- AT units built to SCL specifications, Blomberg B trucks acquired from second hand locomotive dealers
- 1975 to 1976, 6 AT U36B leased to Amtrak for power on the *Floridian*
- Preservation Lake Shore Railway Museum in PA acquired former SCL 1776 (at one time painted in bicentennial colors) in 2018 and plans to restore to working condition
 - All others have been scrapped or sold to oversea customers with status unknown

U36C Statistics

- Produced 1971 to 1975
- hp-3,600
- All built with FB-1 C trucks
- Tractive effort 92,500 lbs
- All built with AC/DC alternator
- # of Buyers 4 US and 2 Mexican railroads
- Total built 238
 - Largest buyer ATSF @ 100 units
 - Smallest buyer MILW @ 4 units
 - ATSF rebuilt 70 to C30-7 standards and classified them as SF30C
 - Only major rebuild of a fleet of U-boats; low hood was changed to be narrower/boxlike
 - GE supplied 10 U36C locomotives to ATSF with 7FDL-16 engines with only 14 cylinders for motive power; the other two cylinders were used to compress air for braking in lieu of a separate air compressor.
- Preservation ATSF SF30C #9501 was donated to the Arizona State Railroad Museum in 2018 by BNSF
 - Of the 94 U36C's sold to Mexican railroads, it is believed some may still exist, but in derelict condition



Only One Phase Built



U18B Statistics (Also Known as Baby Boats)

- Produced 1973 to 1976
- hp 1,800
- 78 w/Blomberg B trucks, 47 w/AAR Type B, and 38 w/FB-2
- Tractive effort 57,500 lbs
- All built with DC generator
- # of Buyers 3 US railroads, one Mexican railroad, and one utility
- Total built 163
 - Largest buyer SCL @ 105 units
 - Smallest buyer Providence & Worcester @ 1 unit
 - All built with low hoods
- Preservation None are known to be preserved; 9 are known to be operated by Pickens Railroad; the P&W U18B is still operating; the Everett Railroad has one, but statis is unknown

Only One Phase Built



U36CG Statistics

- Produced 1974
- hp 3,600
- All built with FB-1 C trucks



Only One Phase Built

- Tractive effort 75,000 lbs, maximum speed 93 mph
- Built with steam generator behind cab
- All built with AC/DC alternator
- Only buyer N de M
- Total built 20
- The status of the U36CG in Mexico is unknown. Some may still exist, but in derelict condition

P30CH Statistics

- Produced 1975 to 1976
- hp 3,000
- All built with FB-1 C trucks
- Tractive effort 59,000 lbs, maximum speed 103 mph



Only One Phase Built

- Built with 2 Detroit Diesel gensets for train lighting and HVAC located in the rear end
 - The P30CH was the first auxiliary genset locomotive owned by Amtrak
- All built with AC/DC alternator
- Only buyer Amtrak
- Total built 25
 - SP leased 15 in 1978 for *Peninsula Commute* service, and many were leased to Caltrans for Oxnard to LA commute service
- The six-axle P30CHs were plagued with mechanical problems and were never very popular with crews or Amtrak management. The P30CH was guilty by association with the SDP40F with Amtrak moving to B-B locomotives
- All have been scrapped
 - One was sold to USDOT and used for crash tests

U-boat Legacy and Impacts

- Led the revolution to 2nd generation high horsepower locomotives
- Pioneered the use of the diesel locomotive central air system, pressurized engine and control compartments, advanced wheel slip control, and an improved cooling system
- Launched GE as a major supplier of heavy haul freight locomotives
- Supplanted Alco as the #2 builder of diesel locomotives, and established the foundation for GE to become the #1 builder over EMD by the mid-1980s
- Provided GE with the experience to overcome shortcomings in its design to make its follow-up model lines (-7, -8, -9, GEVO) equal to or better than EMD
- Demonstrated that the 7FDL engine was more fuel efficient than the 645/710 engines
- Demonstrated that the 7FDL engine was more expensive to maintain and rebuild versus the 645/710 engine
 - Very few U-boats were rebuilt compared to 567/645 engines
- Notable railroads that never owned a U-boat: BAR, B&O, C&EI, CGW, CNJ, D&RGW, FEC, KCS, NKP, SP&S, Canadian railroads and their subsidiaries; ERIE and DLW did not own, but EL did

Modeling U-Boats

- Issuance of U-Boat models in plastic has been limited compared to EMD models and later model lines of GE
- In O and HO, likely every U-boat model has been issued in brass, specific to the railroad. Not sure of other scales
- HO Scale
 - Athearn in late 1960's released the U28B, U28C, U30B, U30C, U33B, U33C
 - Athearn/Genesis released twice the U50 starting in the 2000's
 - AHM released a U25C in the 1970's
 - Stewart released a U25B in the 1970's (Athearn drive)
 - Starting in the 1990's, Atlas released on multiple occasions U23B, U30B, U33B, U36B, U28C, and U30C
 - Bowser bought the Stewart molds of the U25B, improved them and has been releasing on multiple occasions starting in the 2010's
 - Bachmann issued a U36B in the 2010's
 - Intermountain issued a really nice U18B in the 2000's
 - Rivarossi released the U25C starting in 2015 (a really good model specific to the RR)
 - Rapido recently released the U25B, including the high nose, specific to the RR
 - Details West made some shells that could be detailed specific to the RR
 - MTH issued some







Different Road Number May Be Shown

Modeling U-Boats

- O Gauge/Scale
 - Lionel has issued many of the U-boat models over the years
 - MTH has issued many of the U-boat models
 - Atlas issued U23B and U25B, maybe others
 - Williams has issued some U-boat models
- N Scale
 - Atlas has issued the U25B, U28C and the U30C
 - Kato issued the U30C
 - Minitrix issued the U30CG
- G Scale
 - I believe LGB issued a U25B





