Automotive History Review

Number 63

Spring 2022

Oldsmobile and its HYDRA-MATIC DRIVE

ESTABLISHED 1969
SOCIETY of AUTOMOTIVE HISTORIANS
SAH
AUTOHISTORY.ORG

Published by
The Society of
Automotive Historians

An Affiliate of the American
Historical Association

Editor's Note

This is the third time around in editing the *Automotive History Review,* and I would like to think that the job is getting easier. I initially thought that editing is not terribly different from grading undergraduate papers, but in fact the task is quite different. Students rarely come in afterwards to discuss their work. Their papers rarely go public. As "master," I rarely was challenged, even though I am sure there were instances where I was probably in error. The sheer number of papers I had to typically grade resulted, however, in little time to ruminate about a student's ideas and organization.

As *AHR* editor, I see myself more as an encourager to those who want their voices heard about historical topics dear to our authors. Often it takes diplomacy and humility on my part. And while I believe I have an eye for good topics, as an arbiter of punctuation and grammar I am rather lacking. As a high school and undergraduate college student I focused on the sciences and mathematics rather than the English, and I only wanted to "knock out" those language course requirements.

In my previous "Editor's Notes," I commented on how during the early spring of 2021 the Covid pandemic was lessening, and life was beginning to open again. That forecast was more than a little off, as after a mid-year lull a new variant surfaced that was more communicable than the previous one and as dangerous. What has followed a year later in the early spring of 2022 was a war in Europe, and so the tumult and life stressors are ongoing with little respite. Amid all this turmoil, it is at times hard to see the relevancy of automotive history. Recently, however, I reread one of the most important automotive books in my library, Wolfgang Sachs, F*or the Love of the Automobile.* Sach's narrative is profoundly insightful. While the focus of his story is on 20th century automotive history in Germany and Austria, it is really about humanity and human desires that span cultural and regional differences. The author digs deep into human desires, behavior and above all what it means to be human in an increasingly technological world. It is about *us,* as individuals and our interactions with each other. Those insights are powerful and transcend time and place. Sach's work—and there are others who chose to study the automobile in context—tell us much about ourselves, our motives, and our relationships. In sum, automotive history is an integral piece of a grand mosaic, and it is a significant area of knowledge necessary for the understanding of the world and the people who have lived in it.

In this volume we have a wide variety of essays that include case studies of business history, the history of technology, regional history, historiography, and a personal account connected to the development of the critical technologies connected with the development of the automatic transmission. The breadth of these topics is sweeping, and it belies some of my colleagues' criticisms of automotive history as being too focused and narrow. These stories are also about what it means to be human—as creative problem solvers dealing with a host of real-life challenges that resemble those we continue to face today. The past has much for us to draw on as we continue to live in a world filled with twists and turns, large and small. Without knowledge of the past, we become lost in the present and fearful of the future.

Automotive History Review (ISSN 1056-2729) is a peer reviewed publication of the Society of Automotive Historians, Inc.

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Design & Printing:
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Erskines, Rocknes, and Champions

Studebaker's Journey to the Low-Priced Market

by Robert R. Ebert, PhD

The introduction of the Champion in April 1939 was not the first Studebaker attempt to succeed in the market for lower-priced cars. For example, the Studebaker Light Six was produced 1920 to 1924 and the Standard Six was built 1925 through mid-1926. Relatively unsuccessful efforts were made to penetrate the low-priced market with the late 1920s Erskine and Depression era Rockne. Then, in 1939, introduction of the Studebaker Champion represented the conviction of Board Chair, Harold S. Vance, and President, Paul G. Hoffman that, to survive, the firm needed to take another risk to find a niche in the low-priced market.

The research presented here builds on earlier work by Studebaker scholars including Fred K. Fox, James Moloney, and Richard Quinn that focused primarily on the features of the Erskines, Rocknes, and Champions.[1] Here, making extensive use of Studebaker corporate documents the economic, production, and marketing decisions of Studebaker management in the 1927 to 1946 Erskine, Rockne, and Champion eras are examined. The thesis is that the decision to introduce the Studebaker Champion represented a major, but carefully calculated and ultimately very successful, risk for the company.

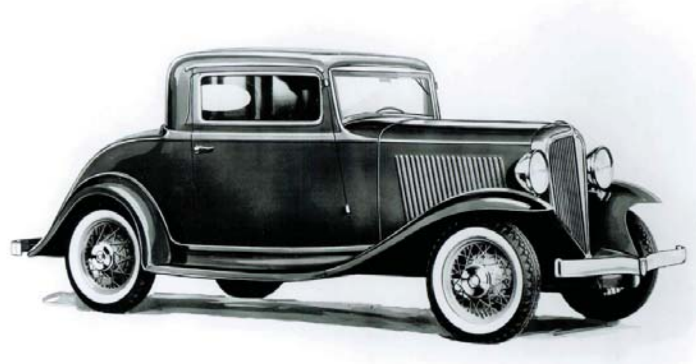
The Erskine Six

"The Erskine Six was designed to meet American requirements of comfort, power, performance and the European demand for economy."[2] With those words the Studebaker Corporation introduced the Erskine Six in January 9, 1927 advertising.

The Erskine Six was named in honor of Albert Russel Erskine, born in 1871, who went to Studebaker in 1911 as corporate treasurer, became first vice president, and in 1915 became president of the company until his death in 1933.[3] Erskine was impressed by the success that Studebaker had in exporting its cars—particularly to Europe. By 1912, Studebaker accounted for 37 percent of cars exported from the United States.[4] The September and October 1924 visit by Erskine to European auto plants and meetings with European Studebaker dealers convinced him that America had the same need for smaller and lower-priced cars that were in demand in foreign markets.[5]

At its October 30, 1926 meeting, the Studebaker Board of Directors learned that two years of planning were coming to fruition. Production of four models of the Erskine Six was to begin in January 1927 at the Detroit Studebaker plant. Erskine noted that the new light-weight smaller car was met with interest when shown at the Grand Palais Automobile Show in Paris and the Olympia Show in London.[6]

Assisting Albert Russell Erskine in bringing the Erskine automobile to market were Harold Vance and Paul Hoffman. Vance was elevated to the position of Vice President of Manufacturing in 1926 after first working for the Port Huron branch of the E-M-F (Everitt-Metzger-Flanders) division of Studebaker and then for



1932 Rockne "65" coupe. (Courtesy of Studebaker National Museum Archives) (SNMA) the Studebaker Detroit factory. Vance was the manufacturing member of a two-person team that included Hoffman, a successful Studebaker dealer in Los Angeles who became Vice President for Sales at Studebaker in 1925.[7] Vance and Hoffman operated out of South Bend where, by the summer of 1926, the headquarters of all departments were consolidated, including those previously in Detroit, to improve company operations.[8]

The initial Erskine offerings were the Custom Sedan priced at $995, the Custom Coupe at $995, the Business Coupe at $945, and the Tourer at $945. By comparison, the lowest priced 1927 Studebaker car with the Studebaker nameplate was the Studebaker Custom Tourer at $1165. Other models in the regular 1927 Studebaker line included the Custom Sedan at $1335, the Commander Sedan at $1585, and the President Seven Passenger Sedan at $2245.[9]

Its pricing put the Erskine into a lower price range than other Studebaker models. However, the Erskine, at prices of almost one thousand dollars, was not in the low-priced automobile market. For example, in 1927, among low-priced cars, when introduced in December 1927, the 1928 Ford Model A Tudor was priced at $500;[10] and a Chevrolet two door coupe was priced at $625.[11] The Erskine base prices even were above those of some medium priced cars such as the 1927 Oldsmobile two-door coupe at $875[12] and a Dodge two-door coupe at $845.[13]

Table 1 shows that from 1925 to 1926 the unit and dollar sales and profit of Studebaker declined. On April 5, 1927, Erskine told the Studebaker Annual Stockholders Meeting that the declines were due to increased demand for lower priced cars and to a slump in the sales of open models. He stated that Studebaker held its position in sales of the President and other Big Six models, and that the Custom Sedans and Victorias broke corporate sales records for that type of vehicle. He was optimistic about prospects for 1927, the Studebaker Diamond Jubilee (75th) Year. His optimism included prospects for the regular Studebaker line and the Erskine introduced at below $1000. Recalling that the Erskine Six was introduced, in part, to take advantage of export opportunities, he noted that in the first quarter of 1927 there were 7427 Erskine Sixes built of which 3759 were exported to 65 countries.[14]

Optimism regarding sales of the Erskine Six proved to be premature. On April 30, 1927, Hoffman told the Board that sales of Erskines in foreign markets were strong, but sales of Erskines in the United States were slow.[15] A year later, optimistic expectations for the Erskine were tempered even further.

Tables 1 and 2 show the results for Studebaker in 1927. Production increased from 1926 to 1927. However, 28,811 of those added units were Erskines which, as lower-priced cars, had narrower profit margins than the larger and more expensive cars in the Studebaker line. Dollar sales for Studebaker in 1927 were down 5.3 percent and profits were down 8.9 percent compared to 1926. High production costs and introductory expenses for the Erskine Six factored into the decline in profits. Adding to the decline in profits were heavy initial production costs associated with the introduction of the new President straight-eight and improved chassis and bodies for the Dictator and Commander lines.[16]

Erskine production peaked in 1928 at 36,101 units (See Table 2). Those data, though, do not reflect the series of challenges that confronted Studebaker in 1928. Those challenges involved the transfer of Detroit production to South Bend, the acquiring of controlling interest in the Pierce-Arrow Motor Car Company, and dealing with a deteriorating marketing position for the Erskine car.

On June 7, 1928, the Studebaker Board accepted a proposal by Erskine that all Studebaker production in Detroit be consolidated in South Bend. Erskine reported that the Detroit plants manufactured stampings and forgings for, machined all parts for, made complete engines, axles, and transmissions for, and assembled the Commander and President models as well as the Erskine. He argued that, although the consolidation would cost about $4 million dollars, more favorable manufacturing conditions in South Bend would result in annual savings of $3 million.[17]

At the October 31, 1928 Board Meeting, Vance announced that by December 1, 1928, assembly of all Studebaker nameplate cars would be performed in South Bend. Assembly of Erskine cars would be transferred in January and be completed by mid-February of 1929.[18] He confirmed to Directors on April 30, 1929 that the transfer of production to South Bend had been completed.[19]

The second challenge confronting Studebaker in 1928 was the acquiring of controlling interest in the Pierce-Arrow Motor Car Company of Buffalo, New York. At a Studebaker Special Directors Meeting on June 26, 1928, Erskine's proposal for the acquisition was accepted. Erskine became the Board Chair of that company.[20] The Pierce-Arrow acquisition was an inter-

Table 1

Studebaker Corporation Finance & Production Data: 1925 – 1946

CALENDAR YEAR	TOTAL SALES[1]	NET PROFITS[1]	FACTORY VEHICLES SOLD*
1925	$161,362,945	$16,619,523	1,346,641
1926	$141,536,652	$13,042,119	1,113,151
1927	$134,007,798	$11,937,862	1,167,401
1928	$177,128,879	$12,654,156	1,426,961
1929	$145,303,834	$11,928,261	1,076,531
1930	$86,083,940	$1,540,202	672,691
1931	$64,406,858	$859,805	582,021
1932	$46,233,830	($8,279,805)	498,681
1933	$35,994,273	($4,876,307)	430,242
1934	Receivership	Receivership	461,032
1935 **	$33,837,892	($1,975,622)	450,681
1936	$68,928,724	$2,187,783	919,981
1937	$70,683,261	$844,874	914,751
1938	$43,768,621	($1,762,465)	526,051
1939	$81,719,106	$2,923,251	1,141,961
1940	$84,164,224	$2,124,628	1,195,091
1941	$115,700,333	$2,486,397	1,338,551
1942	$221,420,582	$2,048,278	92,852
1943	$364,191,211	$2,835,427	***
1944	$415,745,646	$4,038,116	***
1945	$212,833,295	$3,277,008	***
1946	$141,564,321	$948,808	1,207,631

Notes:

* Factory sales data are totals of South Bend, Walkerville, Ontario, and Detroit plants.

** 1935 data are for the ten—month post-bankruptcy period (March—December).

*** World War II production in 1942 through 1945 consisted of heavy-duty military trucks, M-29 cargo carriers (known as "Weasels") and aircraft engines.

Sources:

[1] Studebaker Corporation *Annual Reports, Years Ending December 31, 1925—1946* (South Bend, IN), in the Archives of the Studebaker National Museum, South Bend, IN. (Data in italics and parenthesis indicate a loss.)

[2] James H. Moloney, *Studebaker Cars* (Osceola, WI: MBI Publishing Company, 1994), 202, 214, 276.

Table 2

Erskine, Rockne, Champion Annual Production and Model Year Sales

YEAR	STUDEBAKER FACTORY VEHICLES SOLD	ERSKINE CALENDAR YEAR PRODUCTION	ERSKINE MODEL YEAR PRODUCTION	ROCKNE CALENDAR YEAR PRODUCTION	ROCKNE MODEL YEAR PRODUCTION	CHAMPION CALENDAR YEAR PRODUCTION	CHAMPION MODEL YEAR PRODUCTION
1925	134,664 [1]						
1926	111,315 [1]	26 [2]					
1927	116,740 [1]	28,811 [2]	24,893 [2]				
1928	142,696 [1]	36,101 [2]	22,275 [2]				
1929	107,653 [1]	10,587 [2]	25,460 [2]				
1930	67,269 [1]	9,903 [2]	12,800 [2]				
1931	58,202 [1]			1,264 [4]			
1932	49,868 [1]			22,448 [4]	23,656 [4]		
1933	43,024 [3]			12,896 [4]	14,131 [4]		
1934	46,103 [3]						
1935 **	45,068 [1]						
1936	91,998 [1]						
1937	91,475 [1]						
1938	52,605 [1]						
1939	114,196 [1]					63,985 [4]	33,900 [4]
1940	119,509 [1]					73,895 [4]	67,528 [4]
1941	133,855 [1]					72,200 [4]	85,003 [4]
1942	9,285 [3]					6,080 [4]	29,729 [4]
1943	***						
1944	***						
1945	***					651 [4]	
1946	120,763 [1]					18,624 [4]	19,275 [5]

Notes:

* Factory sales data are totals of South Bend, Walkerville, Ontario, and Detroit plants.

** 1935 data are for the ten—month post-bankruptcy period (March—December).

*** World War II production in 1942 through 1945 consisted of heavy-duty military trucks, M-29 cargo carriers (known as "Weasels") and aircraft engines.

Sources:

[1] Studebaker Corporation *Annual Reports, Years Ending December 31, 1925—1946* (South Bend, IN), in the Archives of the Studebaker National Museum, South Bend, IN. (Data in italics and parenthesis indicate a loss.)

[2] Erskine Production Data courtesy of Richard Quinn. Studebaker production for the 1930 model year included approximately 12,800 Erskines built November 1929 through May 9, 1930 and 9571 Studebaker Sixes built May 10, 1930 through November 1930.

[3] James H. Moloney, *Studebaker Cars* (Osceola, WI: MBI Publishing Company, 1994), 276.

[4] Data courtesy of Richard Quinn. Note: data are not always consistent across various sources.

[5] Richard Quinn, "A Winning Combination: The Story of the 1941-46 Studebaker Champion," *Collectible Automobile,* 21, no. 6 (April 2011): 40-53. *(Note: Quinn explains that sources give varying totals for 1946 Champions. His data are based on the number of bodies produced.)*

esting and complex chapter in Studebaker history, but one that is not directly related to the introduction of the Erskine, Rockne, and Champion models. Therefore, it is not elaborated upon further here but is summarized in Table 3.

The third challenge that Studebaker confronted in 1928 was that Erskine Six sales were not living up to expectations. Hoffman told the Board in late 1928 that although export sales, particularly to European markets, were excellent, the U.S. domestic market held little promise.[21] By April 1929, excessive stocks of Erskine cars existed and cleaning up that stock was hampered by the advent of a Chevrolet selling for $600.[22] A year later, at its April 30, 1930 meeting, the Studebaker Board learned that effective May 10, 1930, the name "Erskine" would be changed to "Studebaker Six" in the belief that the name change would stimulate sales of that model.[23]

By 1930 the effects of the Depression were being felt by Studebaker. The decline in the overall sales and profits of the company in that period are shown in Tables 1 and 2. The weakening U.S. economy was a factor in the decline in market position of the Erskine Six. There is more to the story, though, because of the way the Erskine Six was designed and built by Studebaker.

Table 3

Studebaker Acquisition and Disposal of the Pierce-Arrow Motor Car Company

- Control of the Pierce-Arrow Motor Car Co. was obtained in August 1928.
  - Initial acquisition was of the Class B stock of Pierce-Arrow.
  - Additional acquisition of Class A stock, gold notes, Preferred stock was made.
  - Total cost to Studebaker of all outstanding securities of Pierce-Arrow was $9,573,998.
- Output of Pierce-Arrow under Studebaker ownership:

Year	Number of Cars	Number of Trucks	Total Motor Vehicles
1928	5,492	999	6,491
1929	9,840	507	10,347
1930	6,916	6	6,922
1931	4,210	114	4,324
1932	2,241	70	2,311
Total	**28,699**	**1,696**	**30,395**

- Cars and trucks sold after August 1928 were after Studebaker acquired control of Pierce-Arrow.
- Entire Studebaker equity in Pierce-Arrow was disposed of in August 1933 to a syndicate of investment bankers and others for $1,000,000 in cash.
  - Expenses related to the disposal of Pierce-Arrow by Studebaker included $150,000 paid to White Motor Company to cover losses by White on purchases from Pierce-Arrow and $16,246 paid for Federal stock transfer stamps.
  - Total loss to Studebaker from acquisition and disposal of equity in Pierce-Arrow Motor Car Company was $8,740,244.

Source: Federal Trade Commission, *Report on Motor Vehicle Industry* (Washington, DC: United States Government Printing Office, 1939), 799.

The Erskine was not really a Studebaker car of the kind to which the car-buying public was accustomed. The body was designed by the Dietrich company of Detroit. Production of the bodies was done by the Budd company of Philadelphia. The small L-head six-cylinder engine for the 1927 Erskine Model 50 was not built by Studebaker. It was supplied by Continental Motor Corporation of Chicago. The Erskine was a car assembled by Studebaker but was not a Studebaker car in the traditional sense.[24]

The Erskine was designed and engineered to appeal to both the U.S. and European markets. The appeal to European customers had to be both styling and economy of operation. Therefore, the earliest Erskines had a Continental L-head six cylinder 146 cubic-inch displacement engine that produced only 40 horsepower. Studebaker claimed the Erskine was capable of obtaining between 25 and 30 miles per gallon.[25] Advertising for the 1927 Erskine Model 50 claimed the car was capable of a smooth and quiet 60 miles per hour and accelerated from 5 to 25 miles per hour in 8.5 seconds.[26] However, the relatively modest performance of the Erskine's small Continental engine caused over-revving of the engine which led to engine failures and concerns on the part of potential buyers. With sales below expectations, Studebaker updated the 1928 Erskine Model 51 with a larger 160.4 cubic inch Continental engine which produced 43 horsepower. For 1928 the Erskine Model 51 line included a two-door Club Sedan with body built by Studebaker, not Budd. Other additions to the Erskine line for 1928 included a half-ton Delivery Car and a Cabriolet offered with or without a rumble seat.[27]

The 1929 Model 52 Erskine was introduced in mid-1928 along with restyled Dictator, Commander, and President models. In an attempt to stimulate domestic U.S. demand, the 1929 Erskines were facelifted to look more like other cars in the Studebaker lineup rather than having a "European" appearance. Mechanically the 1929 Erskines were identical to the 1928s, but the wheelbase was increased by two inches to 109 inches. In 1930, the Model 53 Erskines, departing from the original Dietrich styling and use of the Continental engines, were built on a 114 inch wheelbase and featured a 205.3 cubic inch 70 horsepower Studebaker-built engine developed from the Dictator six.[28]

The 1930 Studebaker line ranged from the $895 Erskines to Studebakers at several price points and Pierce-Arrows at $10,000 plus. With that line of cars Erskine was optimistic about 1930, even though the stock market and the economy were weak. Ultimately, with weak demand for it, the Erskine brand was discontinued in mid 1930. What had been the Erskine Model 53 became the new Studebaker Six. The combined production of Erskines and the new Studebaker Sixes in 1930 was below Erskine production in model year 1929. However, the weak economy and automotive market continued to convince Albert Russel Erskine that Studebaker Corporation needed to have economy cars in its lineup.[29]

The Rockne

"…it is recommended…that Studebaker should enter the low-price field as a matter of pressing necessity." That statement from A. R. Erskine in an October 5, 1931 letter to the Studebaker Board of Directors laid the groundwork for the introduction of the Rockne automobile.[30]

Erskine said that Studebaker primarily was in the market for medium-priced cars that included Buick, Chrysler, Nash, Hudson, and Hupmobile. The Studebaker share of that market had been between 15 percent and 17 percent. He argued that even if the industry recovered from its Depression level activity, it was unlikely the medium-priced market would exceed 400,000 units per year. Even if Studebaker obtained 20 percent of that market, it would be only 80,000 units annually, but Erskine said it had the plant capacity to build 200,000 units per year.[31]

Erskine concluded that to be successful in the auto industry as it was evolving in the 1930s, Studebaker had to offer a low-priced car. In 1930, 63.8 percent of the 2,625,979 cars registered in the U.S. were accounted for by Ford and Chevrolet. If Studebaker was to make use of its capacity, Erskine argued it needed to obtain part of the low-priced segment.[32]

A significant concern of Erskine was that Studebaker needed to protect and maintain the strength of its dealer organization. He noted that of the 2100 Studebaker dealers in the domestic market, 400 handled another line of low-priced cars and the number that no longer handled Studebakers exclusively was increasing.[33]

A marketing aspect of the Erskine proposal for Studebaker to enter the low-priced market was that it should be with a brand of car with a name other than "Studebaker." He stated:

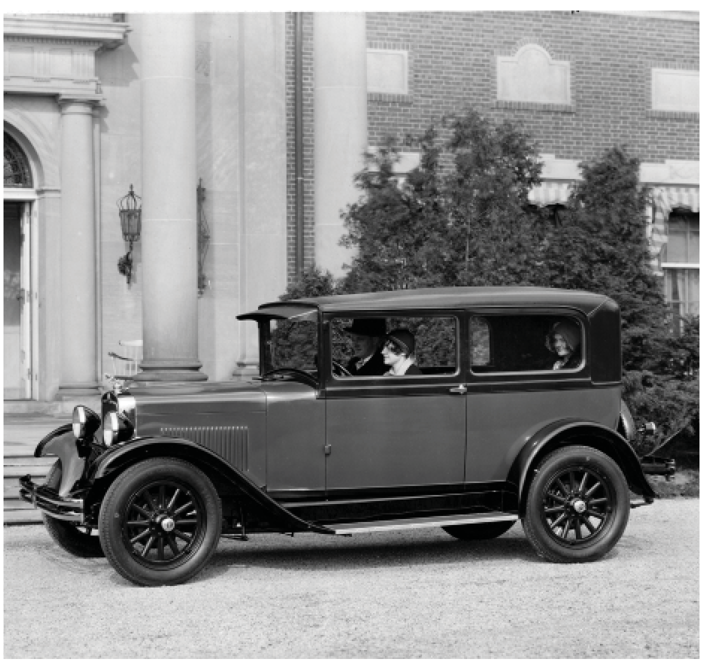
> "Obviously, the easiest and surest way of obtaining a foothold in the low-priced market would be for Studebaker to offer a car under its own name and sold exclusively through its own organization. Were this done, the inevitable result would be the loss by Studebaker of its position in the medium-price field in the mind of the public."[34]

Therefore, Erskine proposed the following:[35]

- First: Studebaker should enter the low-priced field as a matter of pressing necessity.
- Second: the least risky way for Studebaker to accomplish its purposes would be through the organization and operation of a separate company, with a separate identity, and with the objective of obtaining, at least in part, an independent dealer organization.
- The new line of cars would be called the "Rockne" and have two models:
    - A larger model, a six with a 114-inch wheelbase, priced at about $700 for a five passenger four-door sedan. This model would evolve from the existing Studebaker Six and could be produced with a minimum of tooling expense.
    - A smaller model, also a six, but with a 110-inch wheelbase estimated to be sold at about $600 for a five-passenger, four-door sedan.

Erskine proposed that a Rockne Motors Corporation be established as a subsidiary of Studebaker Corporation to assemble its cars in the Detroit plants from parts supplied by the South Bend plants. The Rockne name was

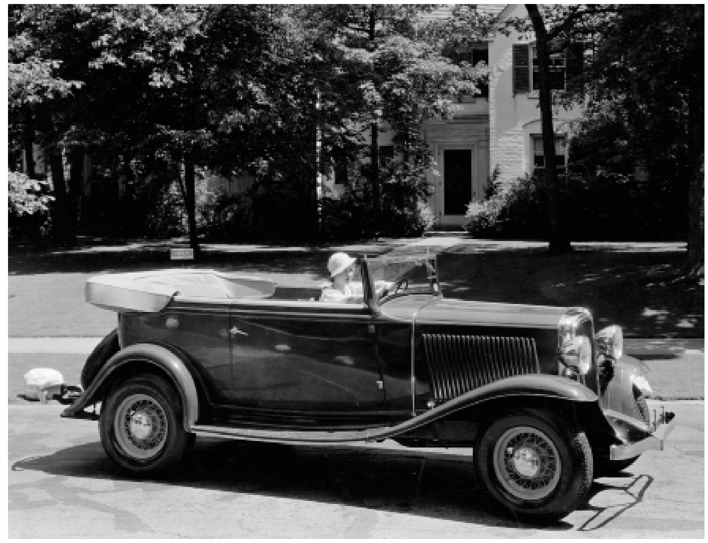
1927 Erskine Coupe shown with a luxury Studebaker President sedan. (SNMA)



1928 Erskine Club Sedan

1930 Erskines were the last. (SNMA)

1929 Erskine 6. (SNMA)



1929 Erskine. (SNMA)

chosen for the new line of cars in honor of Notre Dame University's famous football coach, Knute Rockne, who was killed in a 1931 airplane crash. The Erskine plan for the Rockne was approved by the Studebaker Board on October 27, 1931. Principal officers of Rockne were Erskine as Board Chair and Harold Vance as President. Erskine also continued his official positions with The Studebaker Corporation and The Pierce-Arrow Motor Car Company.[36]

The creation of two models in the Rockne line had its origins as follows: first, Erskine envisioned the Rockne as a low-priced car. Second, there were some internal issues at Studebaker due to development of the Rockne "65" having originally been a car intended for the Willys-Overland Company. Roy Cole and Ralph Vail, former Dodge engineers who had an independent engineering company in Detroit, developed a four-door sedan and a two-door coach sedan for Willys-Overland. However, W-O, which went through receivership, lacked the finances to produce the car. Vail then approached Studebaker at the time Erskine was looking for someone to design the new Rockne. Erskine was impressed by the Vail-Cole vehicle and hired them to put it into production.[37]

Internally, though, the hiring of Vail and Cole created a problem for Erskine. Chief engineer at Studebaker was Barney Roos who was not involved in the development of the Vail-Cole car. So that Roos would not feel left out of the process, Erskine had him design a somewhat larger companion car to the Vail-Cole Rockne. Because funds were limited, Roos evolved the Model 75 Rockne from the 1931 Studebaker Six by using the basic body, chassis, and drivetrain with a redesigned radiator shell and front fenders.[38]

When introduced to the market as 1932 models, the Rockne "75" used the 205 cubic inch engine that had been used in the 1931 Studebaker Six. The 1932 Rockne "65," with a new 189.8 cubic inch engine, had five body styles including a four-door sedan, coupe, coach, two-door convertible sedan, and convertible roadster. The Rockne "75" had only a four-door sedan and a coupe. Sales folders for the Rockne "75" mention a convertible roadster and sedan, but neither was put into production. For 1933, the body styles for the two Rockne lines remained basically the same as in 1932 except for the addition of a commercial chassis and Panel Delivery truck to what had been the Rockne "65" line. For reasons that Studebaker historian Fred Fox termed uncertain, what had been the Rockne "65" in 1932 was called the Rockne "10" in 1933.[39]

The Rocknes represented an expansion of the lines of cars offered by Studebaker for the 1932 model year. In the *1931 Studebaker Annual Report* the company boasted that it covered the low, medium, and high-priced fields in passenger cars and trucks with the following lines:[40]

- Rockne Six, in two wheelbases, 110" and 114", priced from $585 to $840.
- Studebaker Six , in one wheelbase, 117", priced from $840 to $1090.
- Studebaker Eight, in three wheelbases, 117" to 135", priced from $980 to $2095.
- Pierce-Arrow Eight, in two wheelbases, 137" and 142" priced from $2495 to $3250.
- Pierce-Arrow Twelve, in three wheelbases, 137 to 147 inches, priced from $3295 to $4500.

- Studebaker trucks, in various wheelbases and capacities, priced from $695 to $1540.
- Pierce-Arrow trucks, in various wheelbases and capacities, priced from $2950 to $7000.

The Rockne "65" was assembled in Detroit and the Rockne "75" in South Bend. However, as the Depression worsened Studebaker sales declined, and Rockne production, at 22,448 units in 1932, did not live up to expectations.

Meanwhile, an attempted merger of Studebaker with the White Motor Company failed creating a financial problem for Studebaker which went into receivership on March 18, 1933. (See Table 4 for a summary of the attempted merger with White and the Studebaker receivership.) With Studebaker in receivership and Rockne sales disappointing, in April 1933 assembly of the Rockne "10" was moved from Detroit to South Bend. Studebaker expected cost savings from consolidating all assembly operations in South Bend to be $25,000 per month and from a reduction in associated engineering and other personnel to be $15,000 per month.[41] However, Rockne "75" production ended in June 1933 and the move to South Bend did not save the Rockne "10," production of which ended in July 1933.[42]

When Studebaker went into receivership Albert Erskine had expected to remain as company president. However, the Federal Court appointed Harold Vance and Paul Hoffman as receivers. They ended up heading the company during receivership and for many years thereafter.[43] Erskine was now out of a job, had health problems, and was deeply in debt. In July 1933 he committed suicide.[44]

Like Erskine before them, Vance and Hoffman saw opportunities for Studebaker in the low-priced automobile market. With their efforts and planning, success for Studebaker in the low-priced field was given another chance.

The Champion

"Here's news! Studebaker invades lowest price field."[45] With that headline in double page magazine advertisements the Studebaker Champion was introduced in 1939.

1939 Champion. (SNMA)

Table 4
Summary:
Studebaker Acquisition and Disposal of Control of White Motor Company
and
Studebaker Corporation Receivership and Reorganization

- Studebaker Corporation acquired 95.1 percent of the outstanding common stock of White Motor Company of Cleveland, Ohio in late 1932 and early 1933.
- The cost to Studebaker of 594,442 shares of White Motor common stock acquired was $26,853,822.
- The original plan was that The Studebaker Corporation and White Motor Company would merge.
    - A suit by minority interests of White caused the consolidation to not be consummated.
    - Had the merger been accomplished, the White Motor Company funds would have been sufficient to enable the consolidated company to continue to operate.
- Failure of the merger caused Studebaker Corporation to lack sufficient cash to operate.
    - The U.S. banking situation in 1932 meant that the necessary financing could not be obtained.
    - Studebaker was not insolvent and had significant assets at the time of going into receivership. In a Statement to Stockholders, the Directors of Studebaker made the following statement on March 18, 1933: *"A serious situation has arisen in the financial affairs of the Corporation…because of restrictive provisions which prevent the Corporation from mortgaging its fixed assets or from pledging the stock of its subsidiary companies including its 95% interest in The White Motor Company. In view of this condition, the directors concluded that in order to preserve the property of the Corporation, it was for the best interests of all classes of creditors and stockholders to consent to a receivership…"*
    - A court order, based on a Bill of Complainant dated March 20, 1933, made the Rockne Motors Corporation, along with the Studebaker Corporation, a defendant in the receivership.
- The Studebaker Corporation was reorganized as of March 9, 1935. The common stock and control of White Motor Company held by Studebaker was distributed to the creditors of the pre-receivership Studebaker Corporation.
- Holders of common stock of the old Studebaker Corporation (officially of New Jersey) received no equity in the reorganized firm named The Studebaker Corporation (officially of Delaware).
    - The common stock of The Studebaker Corporation (Delaware), formed in 1935, was issued to creditors and subscribers.
- Management of the reorganized Studebaker Corporation (Delaware) in 1935 included the following:
    - Board Chair: Harold S. Vance
    - President: Paul G. Hoffman
    - Note: Vance and Hoffman had been appointed receivers of Studebaker in its receivership.

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1942 Champion Four door Sedan. (SNMA)

After the March 9, 1935 reorganization from receivership, Studebaker had two good years of sales in 1936 and 1937 and was profitable. However, the decline in profits in 1937 and the economic recession of 1938, that led to a sharp decline in sales and to a financial loss (see Tables 1 and 2), convinced Vance and Hoffman that the long-term financial health of the company required revisions to the Studebaker product line. The design, tooling, and engineering of a new line of 1936 Studebakers reflected the Vance and Hoffman belief that the 1935 models, if continued, would not obtain enough future volume to enable profitable operations. Therefore, a new line of passenger cars and trucks was offered for 1936 (and continued for 1937) including the Dictator priced from $665 to $775, and the President priced from $965 to $1065.[46]

During 1935, an anticipated increase in unit sales led Vance and Hoffman to recommend assembling Studebaker cars in California. They estimated a savings of $35 to $40 per car could be achieved if finished cars did not have to be shipped from South Bend to California.[47] On their recommendation Studebaker built a plant near Los Angeles to which parts were shipped for final assembly. By early 1936, progress at the new assembly plant was gratifying and sales in that region were double of the year before.[48] In June 1936 the Board approved expenditure of $150,000 to double the floor space of the California plant to meet the increased Pacific Coast demand.[49]

For 1938 the Studebaker line was extensively restyled by the Raymond Loewy industrial design firm. When introducing the 1938 Studebakers to dealers, Hoffman referred to them as the most smartly styled of any 1938 cars.[50] Notable in the Studebaker offerings for 1938 was the re-appearance of the Commander 6 model which Studebaker had built from 1927 through 1930. (Commanders were only eights from 1931-1935.) In 1936 and 1937, Studebaker marketed only two models, the Dictator and President. However, the mid-priced Dictator was criticized because the term "dictator" was associated with Adolph Hitler of Germany. For 1938, the Dictator name was dropped and the Commander 6 model revived and offered along with the President 8.[51]

The restyled Studebakers were not enough to strengthen sales during the recession as U.S. automotive production declined 48 percent in 1938 compared to 1937. The decline at Studebaker was 43 percent which created a financial loss for 1938 (See Table 1).[52] The weak automobile market strengthened the Vance and Hoffman view that Studebaker needed a low-priced car. Hoffman proposed such a car to the Board of Directors on April 26, 1938. The new model, which had been in development by the Vance and Hoffman team since 1935, would carry the Studebaker nameplate and compete with Ford, Chevrolet, and Plymouth.[53]

To develop the new model, Roy Cole, Studebaker Vice President for Engineering, had taken some engineers up to the old E-M-F plant that Studebaker had on

Piquette Avenue in Detroit. There they developed the light six-cylinder engine for the Champion as well as a strong light weight frame and new suspension.[54] Body styling for the new low-priced Studebaker was directed by Clare Hodgman of the Raymond Loewy Associates design firm in New York.[55]

In presenting the reasons Studebaker should enter the low-priced market, Hoffman noted that the average number of autos produced per year in the United States during the prior nine years was 3,000,000 units. Of that number, two-thirds, or 2,000,000 units per year, were in the low-priced field. He explained that Studebaker, in order to assure a satisfactory profit margin of $100 per unit, needed to build about 125,000 units, or about four percent of the market, each year. In 1938, Studebaker had only about a two percent market share. Hoffman argued a four percent market share was obtainable if a satisfactory low-priced model was offered.[56]

Hoffman and Vance believed an experimental car developed by the Studebaker engineering department met the criteria presented at the initiation of the project in 1935 for a new type of light weight car that offered comfort, convenience, riding, and handling equal or superior to any car in the low-price field plus increased gasoline mileage. At the April 26, 1938 Board of Directors meeting Vance estimated the cost of tooling for the new car was $3.1 million. Following discussion, the Board approved the low-priced car program for Studebaker.[57]

One director present at that meeting, Frank E. Joseph, abstained from voting on the resolution. After the meeting, Joseph contacted Hoffman and Vance and requested that the management consulting firm of Sanderson & Porter be retained to give an opinion regarding the proposed low-priced car program. Sanderson & Porter was familiar with Studebaker. It had offered an opinion on Studebaker operations prior to the formulation of the 1935 *Plan of Reorganization* from receivership. In its report on the proposed low-priced car program, dated May 14, 1938 and presented at the May 16, 1938 Board meeting, Sanderson & Porter concluded Studebaker's proposed course of action was well advised because:[58]

- All successful companies in the industry had a model in a lower price class.
- Hudson was used as an example. It attained its volume by going to a price just above the lowest price class. In 1937 its Terraplane model, priced substantially below the lowest—priced

Champions had redesigned bodies for 1941. (SNMA)

1946 Champion. (SNMA)

Studebaker, accounted for about 82 percent of Hudson sales. When Terraplane sales declined, Hudson introduced its Model 112 priced lower than the Terraplane and barely above Chevrolet, Ford, and Plymouth.

- Higher price fields are more hazardous due to style factors and greater vulnerability in times of depression.
- The Corporation's present working capital was sufficient for the proposed venture.
- Success of the venture would depend upon the market acceptance of the new car, and upon the success of the Corporation's selling campaign.

In discussion of the Sanderson & Porter report, Hoffman pointed out that although there is always the question of the probable success of a proposed new car, the new Studebaker would be competitive with other low-priced cars because of its emphasis on interior luxury and economy of operation.[59]

Studebaker Board member Frank Joseph, whose questions resulted in the Sanderson & Porter report, remained skeptical of the prospects for success of the new car. He stated that Studebaker should conserve its resources and postpone the bringing out of a new model until overall business conditions improved. Hoffman responded to Joseph that it was impractical for Studebaker to continue its present lines for 1939 without the addition of a lower priced car. Hoffman argued that without a lower-priced car it would be difficult to hold the dealer organization together.[60]

After further discussion, the Board approved the bringing out of the new low-priced car with only Joseph voting in the negative.[61] He later resigned as a board member of the Studebaker Corporation.[62]

At the end of October 1938, Hoffman reported to the Board that reaction to the 1939 Studebaker regular line by dealers and the public was very satisfactory. He predicted that there would be a substantial market for the new low-priced economical car.[63] At the February 24, 1939 Board meeting Hoffman announced the model name for the new low-priced Studebaker would be the "Champion" and that it would be introduced to the public with an advertisement in the April 22, 1939 issue of *The Saturday Evening Post.*[64]

On March 24, 1939, Hoffman told the Board that reaction of dealers and the public to the Champion at a limited number of public showings was very enthusiastic.[65] On April 25, 1939, three days after its official market introduction, Hoffman reported that the demand for the Champion was exceeding the capacity of the plant working on a single-shift basis.[66]

Key to making the Champion an economy car with improved gas mileage was to achieve a reduction in weight. Studebaker engineers brought the basic Champion deluxe model down to 2389 pounds, about 500 pounds less than the average Chevrolet, Ford, and Plymouth. The largest single savings of weight occurred by making the engine and transmission 155 pounds lighter. Advanced steel technology enabled the designing of a frame that was claimed to be stronger and 68 pounds lighter than the Big Three average. Other weight savings were achieved through body and suspension design.[67]

The 1939 Champion was a smaller and lighter vehicle than other cars in the 1939 Studebaker line as shown, below (note: engine size is in cubic inch displacement):[68]

The Champion's 78-horsepower compared to 85 for Ford and Chevrolet and 82 for Plymouth. With weight significantly less than Ford, Chevrolet, and Plymouth, Studebaker claimed Champion fuel economy was at least 20 percent better than the Big Three cars.[69] Hoffman was able to boast to the Board on June 23, 1939 that in a AAA supervised run from San Francisco to New York and return, a stock Champion set a new official economy record. Then, that car with 10,000 miles on it along with a Champion right off the assembly line were taken to the Indianapolis Motor Speedway for endurance runs. They broke every American stock car record for their class.[70] On the San Francisco—New York round trip the Champion averaged 27.25 miles per gallon at an average speed of 40 miles per hour. At Indianapolis the two cars were run for 15,000 miles at an average speed of 62 miles per hour. The round- trip car averaged 18.17 m.p.g. and the newer car averaged 19.34 m.p.g.[71]

The 1939 Champions were available in two trim levels, Custom (lowest priced) and DeLuxe (top of the line). The pricing of the 1939 Studebaker Champion was somewhat higher than Big Three low-priced cars. For example, the basic price of the Custom four-door sedan was $740 compared to an average of about $700 for similar Chevrolets, Fords, and Plymouths.[72]

Fortune magazine analyzed unit manufacturing costs (not including overhead) for the Champion compared to Chevrolets. It estimated that in full production the unit manufacturing cost of the Champion was $470 compared to Chevrolet's unit manufacturing cost of $492. The lower estimated cost for the Studebaker was attributed, in part, to savings in raw material costs due to its lower weight. *Fortune* then raised the question of why the Champion was priced higher than Big Three low-priced cars, but noted that Studebaker put some of that added margin into better suspension systems and interior materials. The interior included items generally not found on low-priced cars such as a column-mounted gear shift, ventilating windows, and under the seat Climatizer heater which circulated warm air throughout the car. *Fortune* estimated that drivers of Champions equipped with overdrive could get 20 to 21 miles per gallon. That was 20 to 25 percent better gas mileage than Big Three low-priced cars. (The Champion was the first low-priced car to offer overdrive.) Over the life of the car the improved gas mileage would more than compensate for the higher price of the Champion.[73]

Data in Table 2 show that in 1939 Studebaker had a significant increase in sales. Hoffman reflected on the reasons for that progress at the August 15, 1939 Press Preview of the 1940 Studebakers. He noted that Studebaker added 846 new dealers in the January through July period. Hoffman also mentioned that Studebaker engineers had greatly improved the Commander and President models as well as having developed the Champion.[74]

Studebaker hoped the Champion could give the company a significant presence in the low-priced auto market. Analysis by Studebaker of the first 23,878 Champions sold in the United States revealed that 60 percent of cars traded in on Champions were Chevrolets, Fords, Plymouths, and Willys. Another 24 percent of the trades were medium priced cars of the Big Three manufacturers. Fifteen percent of the trades on Champions were Studebakers.[75] In total sales (see Table 2) and market penetration, the Champion was achieving the Studebaker goals for it.

The 1940 Studebaker line of Champions, Commanders, and Presidents had mild facelifts. The styling

Paul Hoffman and Harold Vance. (SNMA)

of the 1940 Studebakers included optional Deluxe-tone paint which added visual attractiveness to its models. The styling changes for 1940 helped maintain the sales momentum the company had in 1939 (See Table 2). Champion output of 67,528 was a major factor in the strong showing Studebaker had in the 1940 model year. By the end of July 1940, Hoffman reported that essentially all 1940 Studebakers had been sold.[76] Included in the Studebaker calendar year output were 7271 Champions built in the Los Angeles plant in 1939 and 8610 Champions built there in 1940.[77]

To maintain the momentum achieved in 1939 and 1940, Studebaker management determined it was important to face-lift the Studebaker model line for 1941. The total cost of retooling for the 1941 Studebaker passenger car line was $3.5 million and another $650,000 was expended on tooling for a new line of trucks.[78]

The new bodies for the 1941 Studebakers maintained the character of the 1939 and 1940 models, but with more attractive styling. Also, there were modest engineering changes for 1941. The six-cylinder Champion engine was increased in size to 170 cubic inches and 80 horsepower. The Commander Six retained the 226 cubic inch block but had an increase in horsepower to 94. The President kept its 250 cubic inch straight-eight engine but had its horsepower increased to 117. The Commander wheelbase was increased to 119 inches, the President wheelbase increased to 124.5 inches, and the Champion wheelbase remained 110 inches. Basic prices for the 1941 Studebakers ranged from $690 for the three-passenger Champion Coupe to $965 for the Commander Sedan Coupe to $1235 for the most expensive 1941 Studebaker, the President Skyway Land Cruiser.[79]

Studebaker sales and profits increased substantially in 1941. The Champion continued to be a major factor in that growth. The 72,200 Champions built in 1941 accounted for 55.2 percent of Studebaker calendar year production. For the model year over 85,000 Champions were built. The popularity of the Champion and the whole Studebaker model lineup enabled the company to expand and benefit from an increase in its dealer force from 3130 dealers at the beginning of 1940 to 3598 at the end of the year.[80]

The optimism enjoyed by Studebaker in the 1939, 1940, and 1941 automotive market was tempered by events that involved the United States in World War II. In its *Annual Report 1940,* Studebaker reported that at the request of the Office of Production Management, it would subordinate its tooling requirements for new models and its normal business operations to the needs of the Defense Program.[81]

Although a full discussion of the Studebaker involvement in the World War II effort is beyond the scope of the current paper, following is a brief summary of those contributions. During the time that hostilities were occurring, Studebaker built 63,789 Flying Fortress aircraft engines, 197,678 military trucks, and 15,890 Weasel tracked personnel carriers.[82] When war was declared by the United States, to have adequate capacity for military production, the Office of Production Management ordered that all passenger car production be ended at the end of January 1942. Therefore, the Studebaker 1942 model year was shortened. As a result, Studebaker built only 29,729 Champions for the model year of which 6080 were produced in January 1942.[83] Given the evolving national defense uncertainties, and because Studebaker had spent a considerable amount of money on the restyling of the 1941 model line, there were no major styling changes for the 1942 cars. The front end of the 1942 Studebakers, including the Champions, did have redesigned sheet metal across the front of the cars. Mechanically, the 1942 Champions were basically the same as the 1941 models.[84]

Studebaker began to make plans for its postwar operations before the war ended. At its July 27, 1945 meeting the Board was informed by Hoffman that postwar production plans were well underway. The original plan was for production of an improved 1942 Champion to begin in October 1945 and a new line of restyled Champions and Commanders would go into production in March 1946.[85] From the minutes of that meeting it was not clear what model year would be assigned to the "improved 1942 Champions." Ultimately, they were assigned the 1946 model year designation and the new Champions and Commanders formally introduced in April 1946 were designated 1947 models.

On September 28, 1945, Vance reported to the Board that reconversion of the plants from military to civilian production was proceeding satisfactorily. He stated the factory would be ready to start production of passenger cars and trucks on October 1, 1945 if the necessary materials could be obtained from suppliers. At that meeting the Vice President in Charge of Sales, K. B. Elliott, reported sixty dealer meetings had been held throughout the country at which the reaction to the appearance and mechanical changes of the interim 1946 Champion models was very favorable.[86]

Throughout the fall of 1945 there were difficulties obtaining needed parts for Studebaker to begin production of the interim 1946 Champions. Labor problems, particularly a strike at the Warner Gear Company which supplied gears to Studebaker, meant that no 1946 Champion models had been produced by the end of November (except for six prototype and test vehicles in October) and only 651were built in December. The strike was settled and in late December Vance said Studebaker would begin regular production on January 2, 1946.[87] In the first three months of 1946 Studebaker built 18,624 of the interim model 1946 Champions. With the 651 built in December, that brought total production of 1946 model year Studebaker Champion passenger cars to 19,275.[88] Production of the 1946 Champions ended in March and production of the restyled 1947 model Studebakers began in April 1946.[89]

In promoting the 1946 Champions Studebaker referred to them as having "Skyway" styling. Even though they were an interim model, they received considerable coverage in the *Studebaker Annual Report for 1945.* Perhaps to assure shareholders that the company was, indeed, in postwar production, that annual report featured photographs of 1946 Champions on the assembly line and in paint ovens.[90]

The 1946 Skyway Champions had the same basic styling as the 1942 models and were available as four door and two door sedans and a coupe. They came in a single trim level with twin wipers, door armrests, sun visors, and deluxe steering wheel as standard equipment. Mechanically, the 1946 Champions had the same 170 cubic inch displacement six-cylinder engine that had powered the pre-war cars and the Weasel military personnel carrier. Although early literature said that two-tone color combinations were available, none of that type were built. List price for the two-door sedan was $918, for the four-door sedan, $967, and for the business coupe, $875. The pricing was controlled by the Federal Government Office of Price Administration (O.P.A.) established for the purpose of preventing price gouging and inflation during and immediately after the war. The O.P.A. set the Studebaker prices in the range of $70 to $75 less than the average of the Big Three.[91]

The ending of 1946 Skyway Champion production in March 1946 meant Studebaker would move on to another era in its history. The 1947 Studebakers introduced to the market in April 1947 were designed by the Raymond Loewy studios and styled quite differently from, but were mechanically similar to, the Champions and Commanders of the 1939 to 1946 era.

Conclusion

The road Studebaker traveled to become successful in the low-priced automobile market was complex, arduous, and at times financially painful. In retrospect, the early Erskines, designed and engineered quite differently from the rest of the Studebaker line, were not consistent with American automobile consumer tastes and performance desires. Later, the Depression and Studebaker receivership proceedings brought a premature end to the Rockne experiment.

Through the Erskine and Rockne disappointments Harold Vance and Paul Hoffman never lost sight of the vision, initially brought forth by A. R. Erskine, that Studebaker should be in the low-priced car market. Beginning with the emergence of the company from receivership in 1935, Vance and Hoffman pursued a careful strategy to succeed in the low-priced market.

They were convinced that to survive in the automobile market as it was evolving in the 1930s, Studebaker had to be in the part of the market that had the highest volume potential. The Champion evolved out of their deliberations and planning.

Carefully conceived, styled, and engineered as a vehicle unique within the Studebaker model lineup and unique in the broader economy car market, the Champion proved the vision of Vance and Hoffman correct. Lessons learned from the lack of market success of the Erskine and Rockne were not lost on Vance and Hoffman. They sensed that to be successful the new low-priced car had to carry the Studebaker nameplate—which was opposite of the corporate thinking that led to the naming of the Erskine and Rockne. Further, they sensed that the new low-priced Studebaker had to be attractive, economical, and dependable. With the introduction of the Studebaker Champion in 1939 they succeeded in all those objectives.

The decision to introduce the Champion to the market was not without controversy, even within the Studebaker Board of Directors. It was introduced at a time of serious strains on the United States economy. Had the Champion failed, Studebaker may well have found it difficult to continue in business. In the end, the Champion was a major success for Studebaker and brought it prosperity in both the immediate pre and early post - World War II eras. It can be argued that the Champion was a major catalyst in enabling Studebaker to survive as an automobile manufacturer until the final Studebaker was built in March 1966—about 27 years after the first Champion rolled off the assembly line.

Endnotes

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U.S. Automobile Safety Principles and Strategies of the 1950s and 1960s

Definition of Terms: Crashworthiness versus Crash Avoidance Research

by John L. Jacobus and Evelyn J. Jacobus, Contributor

Automotive safety research has been traditionally separated into two parts: (1) motor vehicle research and (2) human behavior research [DWI (alcohol use), speed, belt use, inattention, reckless driving, etc.]. Motor vehicle research is further divided into Crash Avoidance research (brakes, handling/stability, lighting, etc.) and Crashworthiness research (occupant packaging issues, energy management issues). Another way to look at it is, Crash Avoidance Research deals with the reduction or elimination of the "First Collision" (vehicle striking vehicle/object) and Crashworthiness Research deals with the Second Collision (occupant striking the interior of the car). This paper primarily addresses early U.S. occupant-packaging or crashworthiness safety research efforts from the 1950s to 1960s.

Scientifically developed driver behavioral modifications programs (alcohol, speeding, inattention, etc.) and highway safety programs were not highly developed during the 1950s and 1960s. The easiest path to saving lives appeared to be through "occupant packaging", which included determining "interior body contact points," injuries types and frequency as well as determining the applicable countermeasure technologies such as interior padding, safety belts, and energy-absorbing steering columns. During this early stage of auto safety development, the "how to" or "implementation" phase depended on consumer demand or competition between auto manufacturers. The result was a poor distribution of new technologies among consumers. Eventually many of these new and successful safety technologies were passed along to the U.S. consumer by the automobile manufacturers initially as options, then standard equipment and finally by the federal automotive safety regulatory process or Federal Motor Vehicle Safety Standards (FMVSS), if cost-effective.

Background

In 1950 the nation was facing the ever-growing problem of U.S. motor vehicle deaths and injuries and federal and state leaders did not know how to reverse the trend. The magnitude of highway fatalities had grown steadily from the early years with 512 average annual deaths (1901 to 1910), 701 (1911 to 1920), and growing significantly to 21,917 (1921 to 1930). By the 1931-1940 decade, the average magnitude of deaths had trended further upward and grew by 50%, compared to the previous decade, to 32,726 yearly fatalities. During the next decade (1941 to 1950) average fatalities dropped slightly by 10 percent to 29,510, but jumped up again 22 percent in the 1951 to 1960 decade, to 36,102.[1] For example, 1954 and 1955 saw 33,890 and 36,699 total fatalities, respectively, and with children ages 1-14, accounting for 4,196 fatalities and 146, 860 injuries in 1954 and 4,350 fatalities and 152,250 injuries in 1955. In 1956 there were 5,000,000 accidents, 1,350,000 injuries, and 37,965 deaths.[2] Child injuries increased further to 175,000 in 1957. In 1956 the rise and unchecked number of highway fatalities was termed a "major epidemic" for which a vaccine was needed.

An estimate of the magnitude of the problems was offered by John A. Byrne who stated that "…approximately 38,000 people would lose their lives in auto accidents in 1956 with another 1.5 million injured. Auto crashes had become the chief cause of death for Americans between the ages of 15-24 and second most frequent killer between the ages 25-29."[3]

Although not commonly known at the time, these accumulated fatality and injury counts were correlated to a mathematical construct or metric called "vehicle miles travelled (VMT)" a measure of "exposure to risk" from which the US highway fatality rate is computed. This is a key statistic in measuring federal progress in curbing the increasing number auto fatalities. A mathematical combination of annual federally collected road way use quantities [e.g., (1) number of registered cars on the road, (2) number of licensed drivers on the road, and (3) mileage driven by each licensed driver] are used to compute the annual VMT. The number grows every year as the economy continues to expand. The prosperity of the U.S. economy, desire for mobility and optimism of the American drivers create this situation so the population as a whole is responsible for the ever- expanding VMT. The magnitude of highway carnage is directly proportional to VMT unless safety countermeasures intercede at a significant level.

A succinct analysis of the "highway fatality rate" was made by Alton L. Blakeslee who stated that "…the death rate per 100,000,000 passenger miles fell from 14.7 in 1937 to 6.4 in 1954 even though the number of cars and miles travelled doubled. Far fewer cars killed 2,000 more persons in 1937 compared to 1955. Automakers had introduced some safety features during these years such as: non-shattering glass, steel tops, better brakes and lights, better steering control, greater visibility and greater accessibility to controls. Despite these safety improvements motor vehicle deaths ranged from 31,000 to near 40,000 every year since 1940 with 42,000 fatalities predicted for 1956."[4]

The U.S. highway fatality rate (number of annual highway fatalities divided by the billions of VMT) is an important measure of federal highway safety program performance. During the 1951 to 1960 decade, the highway fatality rate averaged 6.03 whereas during the current decade (2011 to 2020) the fatality rate has averaged 1.13 or about 5 times lower. This lower average fatality rate, in light of ever increasing VMT, indicates federal highway safety and motor vehicle safety programs are working.

The Interstate Highway System funded in 1956 by the Federal-Aid Highway Act created a 48,440-mile, limited access, high speed roadway system over a 40-year period. These highways cover the whole of the U.S. and are estimated to contribute 25% of the annual VMT.[5]

Early on, things looked promising as an array of new Crashworthiness features, considered safety-related by today's standards, were offered. These included Budd's flange-welded, all-steel body made for the Dodge brothers (1912), closed bodies by Fisher Body (1922-1929), 1931Chrysler Imperial steel body, genuine hi-impact safety plate glass (1928) and Fisher Body's all-steel "Turret Top" (1935). Many individual safety improvements were adopted within corporate structures, but none influenced production cars across the U.S. more than the all-steel body.

Aiding this optimism, an impressive array of Crash Avoidance features was offered (also considered safety-related by today's standards) including vacuum-powered windshield wipers (1919), 4-wheel hydraulic brakes introduced in 1921 Duesenberg Model A and 1924 Chrysler 6, the slanted windshield to reduce glare (1930) and back-up lights on the Terraplane (1936). Also, the Cadillac/Oldsmobile Safety Transmission (1937), the Oldsmobile Hydra-Matic Transmission (1939), Buick's turn signal (1939) and sealed beam headlights (1940).[6] We know today these were good safety measures. However, at the time, most were simply considered good engineering practices and followed common sense.

There were other accomplishments that gave heart to the idea that highway safety fatalities in this country could be ameliorated. There were several outstanding examples of automobiles that were either designed or promoted with safety-in-mind. The 1927 "Safety 8 Stutz," with a low center of gravity, was made possible by a Timken worm-drive axle and double-drop frame.[7] The 1931 Chrysler, Plymouth and Dodge all picked the lower center of gravity idea and the better roll stability it offered. Walter P. Chrysler decided to dramatically advertise the strength of one of the first all-steel bodies using a 1931 Chrysler Imperial 8 with an elephant on the roof.[8] The 1934 Chrysler Airflow with appearance, speed, efficiency, roominess, riding comfort and safety promoted rollover strength of their new products in demo films shown in auto show, dealerships and movie houses.[9] Although the name sounded like a contradiction, similar to "Safety 8 Stutz," the 1935 Plymouth "High Speed Safety Car" featured a "Safety Steel Body" as well as power, handling/stability and hydraulic brakes.[10] The 1936 Pontiac ad entitled "Safety and Style: Start at the top on the modern automobile," promoted the Fisher Body all-steel, Turret Top.[11] The 1937 National Auto Show in New York was advertised as "…ushering in a new era of safety and comfort" which the above examples seem to support. Safety was becoming the new burgeoning auto sales feature.[12] In addition, a federal law in 1937 required genuine hi-test, safety plate glass in all auto-

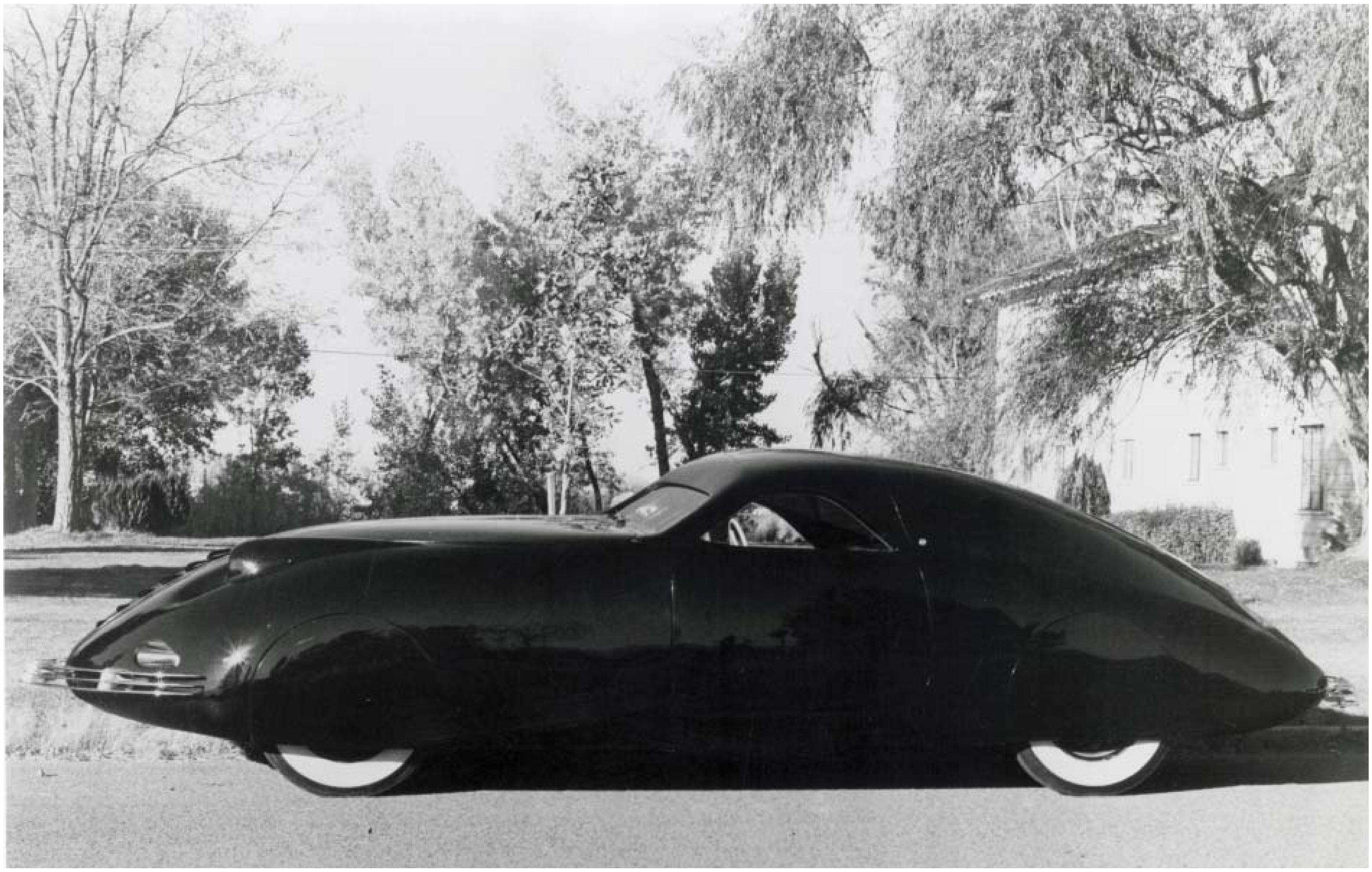

Figure 1: The 1938 Phantom Corsair designed and built by Rust Heinz and Maurice Schwartz, was a 4-passenger aerodynamic prototype built on a 1937 Cord-L chassis and distinguished by its unusual engineered provisions for high speed (122 mph), safety and comfort. The interior was lined with rubber slabs, seats were molded rubber without springs and interior walls were lined with ¾ inch cork composition. There were layers of sponge rubber under the upholstery. The steel "crash" board was covered with 2-inches of rubber covering so the occupants were sound and shock-proofed. The bullet-proof, tinted windows were slanted to eliminate driver glare. Many of these intuitive safety ideas were proven to be effective and became state-of-the-art knowledge by the mid-1950s and later. (Used with permission by the National Automotive History Collection (NAHC), Detroit Free Library, Detroit MI)

mobile windows except for the rear window. This was in-place until around 1950.

There were several safety cars offered to inspire the public, built by entrepreneurs such as Rust Heinz and Preston Tucker which included the 1938 Phantom Corsair and the 1948 Tucker, respectively. The Phantom Corsair was a ("one-off" design) with aerodynamic styling, employing a wide array 1950s era safety "occupant packaging" technologies and was far ahead of its time.[13] The short-lived production 1948 Tucker which "intermixed engineering and safety," and called a "Symbol of Safety" by its designer Alex Tremulis, featured a cyclops headlight that turned with the front wheels, pop-out windshield, padded dashboard, but no seat belts.[14]

Virgil M. Exner Sr. (VP Chrysler Styling in the mid-1950's) observed in reference to the consumer's love affair with tail fins and a possible connection to the streamlining craze of the 1930s that "…in the 1940s the public began to accept streamlined automobiles and to appreciate the improvements in safety, comfort, economy, appearance and aerodynamics."[15]

Some pre-WWII ads hyped engineering innovations that were auto safety countermeasures. One ad by Fisher Body Division captured the state-of-the-art of auto safety at General Motors in 1939-41. The ad emphasized numerous features, what we call safety features today, such as structural integrity (described as "...one substantial steel unit, inseparable unity"), scientifically insulated "Turret Top" or roof, increased forward vis-

Figure 2: According to the Chief Designer, Alex Tremulis, adoption of the Tucker features alone might have saved 10,000 lives a year and there might never have been a need for US DOT/NHTSA. He called this car "Tucker, Symbol of Safety." It was a six-passenger car with 4-wheel independent suspension, aircraft-type disc brakes for panic stops, rigid box frame with massive bumpers, sealed water-cooling system and 335 c.i.d., aluminum rear engine. Also, acceleration of 0-60 mph in 10 seconds, 0.28 drag coefficient,122 mph top speed, 17 mpg and a price tag of $2,245. The design included a padded dash and recessed knobs and levers, but seat belts were not included. The Tucker sales department was opposed to the latter. The car had a centrally located headlight synchronized with the steering-wheel movement yielding a broader nighttime field of view. A curved, laminated pop-out windshield was in the offing for later models of the car. Many of these features were unheard of in any post-war American cars. These ideas have gained traction today among safety researchers. (Used with permission by the NAHC, Detroit Public Library, Detroit MI)

ibility with higher and wider windshield dimensions. Also, a "safety shoulder" or a front seat-back bolster (built in to protect rear passengers in a crash), genuine safety plate glass and adjustable sun visors and "Planned Vision." (Planned Vision coordinated the front and rear windows for more effective rear view mirror placement and included a 10% to 18% larger rear window).[16]

A Fisher ad (1941 Chevrolet Special Deluxe Sport Sedan) entitled "Safety on Her Way," mentions the "…door-hinge at the front for greater safety." This was a subtle reference to the elimination of "suicide doors," in which the flow of air over the body would tend to open a passenger car's side door (risking ejections at high speeds). Doors with front hinges put natural aerodynamic pressure on the passenger doors, keeping them closed (called a fail-safe condition).[17]

In the immediate years after WWII there were a number of "feel good" ads using the word "safety." For example, the 1947 color Fisher ad (little girl in school bus cross walk with a policeman) stated "…she'll go hand-in-hand with safety in all her travels—if you see that she rides in a Fisher Body. There is nothing safer than Fisher's "Unisteel Construction."[18]

Despite the "feel good" theme of many new car ads particularly in the 1950s, some had become more explicit in directing the reader toward safety features rather than power, performance, and styling. For example, in 1956 Ford Motor Company offered the Lifeguard Safety System on their entire product line.[19] A 1956 Lincoln Capri and Premier advertisement presented the

Figure 3: 51 copies of the "Tucker, Symbol of Safety" were made and 47 still exist today. Fifty was the official number for Preston Tucker to qualify as a bonified automobile manufacturer. Three of the Tuckers are on display at the Hershey Antique Automobile Museum in Hershey, PA. These were acquired from the Cammack Tucker Collection. (Used with permission by NAHC, Detroit Public Library, Detroit MI)

new safety package this way "…the retracted steering column with safety flex steering wheel, triple-strength safety-plus door locks, no glare vinyl instrument panel, great visibility (the largest windshield in the fine car field) and optional safety belts."[20]

There would be many more auto safety initiatives which ramped-up the public's attention on to auto safety such as the 1957 Cornell-Liberty Safety Car (Survival Car I), 1962 Survival Car II, the 1966 New York State Safety Sedan.

In the 1950s and 1960s, consumers seemed more in love with speed, power, styling and convenience features like stereo sound systems and power seats, windows and antennas. It appeared that safety ranked low on their shopping lists. The social order seemed to be that hedonism and conspicuous consumption were worth more than saving human lives.

Despite the auto manufacturer's safety-malaise as reflected in some 1950's and 60's auto advertisements, there were some very important auto safety improvements, particularly at GM, with advancements in the understanding of head and chest injury (called biomechanics) as well as the development of safety-products like frontal air bags, child safety seats, energy-absorbing steering columns and side door beams.[21] In addition, GM offered optional safety belts on its 1962 Corvair and as standard equipment on all its car lines before 1966. The mid-to-late 1960s were also marked by the publication of the first set of federal auto safety regulations which included a 1968 requirement for the installation of 3-point safety belts in all new cars sold in the U.S.

Seminal Safety Research

An aircraft and automobile safety pioneer, Col. John P. Stapp changed the world of aircraft and automotive safety research by contributing to studies on the effects of mechanical forces on living human tissue.[22] The human tolerance data accrued from these tests supported development of fighter pilot/paratrooper restraint systems that ensured pilot survival in the event of plane crashes and pilot ejections.

These human tolerance tests also contributed to understanding safety belt and shoulder harness restraints for automobiles. In the Air Force, motor vehicle accidents had been the leading cause of death and injury. The majority of military personnel injured or killed in 1950s accidents were in private vehicles, while off-base and during weekends. Military bases rigidly enforced relatively low speed limits, whereas off-base speed limits were considerably higher.

Human tolerance data was used to develop injury criteria for test instruments namely ATD's or anthropomorphic test dummies (also called crash test dummies) used in full-scale crash tests or sled tests in a laboratory setting. Sierra Sam and family of ATD's were developed under a 1949 United States Air Force contract with Sierra Engineering Company located in Denver, Colorado. These were the first known crash test dummies and would become very important to a new field of science and research called Automotive Biomechanics.

Evidence of the need for safety devices in ground vehicles, in order to improve their crash protection characteristics, was made possible by Col. John P. Stapp. He recommended specifications for lap belts and their installation as well as the use of safety belts in priority vehicles in order to evaluate their effectiveness with three fundamental shoulder belt configurations.

Col. Stapp was present when President Lyndon B. Johnson signed the National Traffic and Motor Vehicle Safety Act of 1966 (creating the US DOT/NHTSA). In 1967 Stapp began working with U.S. DOT/NHTSA as a medical scientist. He was awarded the 1991 National Medal of Technology for his research on the effects of mechanical force on living tissue, leading to safety developments in automobile crash protection technology.[23]

The Automobile Crash Injury Research (ACIR) project directed by John O. Moore was supported by the U.S. Air Force, U.S. Public Health Service, various State Police and Highway Patrols, Ford Motor Company and Chrysler Corporation. The purpose of this groundbreaking effort was to determine the causes and sources as well as types, modes and levels of occupant crash injuries. The table below shows some of the results for 1953 and 1956 as they apply to the interior and structural components of automobiles in highway crashes.[24]

One study by the Cornell Medical College concluded "…vehicles have shown constant improvements in design and mechanical functioning, but their relative crash-protection characteristics have not increased along with other improvements.[25] The state-of-the art, or scientific understanding, of occupant injury production in 1956 made possible by the ACIR activities was as follows:

(1) Prior ACIR research had shown occupants were 2 times more likely to sustain fatal injuries if ejected. Children and adults could be ejected. Safety belts, if worn, prevented occupant ejection.

(2) Doors popped-open for 75% of struck cars; 38% for struck cars without rollover. Open doors create paths for ejection.

(3) In 50 percent of the fatalities the car interior was still structurally viable. Fatalities were caused by striking the interior structures of the automobile or by being ejected. Safety belts, if worn, limit interior contact and prevent occupant ejection.

(4) 40% of all drivers are injured by the steering wheel assembly and 38% of front seat occupants by either the instrument panel, windshield or interior protrusions.

(5) 50 percent of injury-producing crashes occur at speeds of 40 mph or less.

Table 1

1953 and 1956 Causes of Occupant Injury and Death

Cause		1953 ACIR	1956 ACIR
Ejection		20%	
Instrument Panel	Contact	12%	38% (front passengers)
Steering wheel	Contact	11%	40% (drivers)
Windshield	Contact	11%	
Door Components	Contact	6%	
Rearview Mirror	Contact	4%	

(6) Despite the lack of comparative data, physicians and medical professionals have predicted safety belts, if worn universally, could save 5,000 to 10,000 lives annually.

(7) Safety door latches were predicted to reduce the frequency of door openings (without) rollover) by 66%. This reduces the risk of occupant ejection which can be lethal.

(8) The recessed steering wheel was predicted to reduce the severity of crushing type, chest injuries. Results were weak and it was replaced by the telescoping or energy-absorbing steering column idea.

(9) Special energy-absorbing padding did not exist at this time. (Not the same as foam rubber)

(10) Automotive human tolerance data was lacking for the pelvic and abdominal region of the body and was needed to design crash test dummies and build better safety belt systems. Despite the pioneering contributions of Col. John P. Stapp, USAF, there was still a dearth of automotive biomechanics information as this was very young field of endeavor.[26]

Along with Cornell Aeronautical Laboratory, Ford Motor Company and ITTE/UCLA had practically invented this new scientific field of automobile crash testing. All three had worked independently and cooperatively to develop test protocols, instrumentation, photography and data recording techniques. Similar to today's methods, they were, understandably, less sophisticated. The first generation of crash test dummies were very crude as automotive biomechanics had yet to be invented. A truck loaded with instrumentation and dragging cables connected to a test-vehicle was not an uncommon sight. A system of ground cables with pulleys drawing crash vehicles towards another or into a concrete wall or earthen mound could often be spotted. Or a test vehicle towed down a rail and released into a wall was another crash test scenario. And, of course, all of this was conducted outdoors. They examined the dynamics of the various crash types (head-on, side impact, rollovers and rear end impacts) and made measurements of safety belt loads, dummy head and pelvis accelerations/decelerations, body kinematics (motion), body contact and potential injury points and derived safety countermeasure recommendations.

Out of this stream of engineering knowledge grew the research concept of "occupant packaging" and this idea proved fundamental to solving the motor vehicle fatality and injury problem. If the fragile passengers could be kept from being tossed around inside the car and contained inside the vehicle (e.g. "packaged" like an egg suspended in an egg crate), then they could survive a severe crash. At this time, it was believed the crashworthiness (CW) aspects of the problem could be tackled more easily and more successfully than the crash avoidance (CA) aspects of the problem.

Institute for Traffic and Transportation Engineering, University of California at Los Angeles (ITTE/UCLA)

The Institute for Transportation and Traffic Engineering (ITTE) at UCLA was established in 1947 by state legislation to study ways of improving highway safety with automobile/school buses crashes initially, and then followed by crash research involving door latches, seat belt restraints and shoulder harnesses, child seat belts, head restraints to reduce neck whiplash injuries, and automobile bumpers. Researchers used an abandoned airport runway to conduct their outdoor "engineered crash tests." The crash research team, consisting of Derwyn M. Severy and others had worked together as far back as 1951. Although results were reported in Society of Automotive Engineers (SAE) papers (1957-1959), their head-on crash research was publicly described in a July 1957 *Life Magazine* article.

The article stated that:

> Recently a 1956 Ford speeding along an air strip near Long Beach, CA. at 50-mph hurtled into a 1949 Nash Rambler traveling at the same speed.[27] This was not another of the 200,000 head-on crashes that kill some 3,200 people each year in the U.S., but one of a series of controlled experiments conducted by the Institute of Transportation and Traffic Engineering at UCLA.[28]

The article continued:

> The crash test they invented consisted of propelling the towed cars toward each other along a track by an arrangement of pulleys while 13 different types of electronic and photographic devices recorded the fastest, deliberate crash ever staged. The cars were occupied by five dummies designed to react exactly as the human does. Each limb had the same center of gravity as a human limb, and even the skin of the dummies had the same compressibility as human flesh. Before the cars were demolished, only one dummy was given any chance of survival.[29]

The ITTE crash test team employed crash dummy Sierra Sam, and a family of ATD's, for a series of 50-mph head-on crash tests.[30] The goal of these experiments was to determine the occupant packaging necessary to allow a human to survive a 50-mph head-on crash.[31] Some of the findings were:

a.) The zone of preferred collision performance exceeded the 27G sustainable by human volunteers with a lap belt as the only means of restraint and, in all cases, the drivers were categorized as "possible" or "probable" fatalities, whereas all the belted, rear seat passengers survived.[33]

b.) Excessive collapse of the cabin structure around the driver, in some cases, precluded the possibility of survival.

c.) Floor failures and excessive elongation of seat belt anchorages, added to excess upper body excursions and head contacts.

d.) The potential for engine intrusion into the occupant compartment was noted.

e.) Furthermore, in some of the high velocity crashes, the left front wheel was forced through the floor against the driver's legs causing injury and entrapping the driver. Windshields shattered excessively, but none popped -out. For some cars, doors buckled and jammed shut.

f.) The improvements in the door structure and latching mechanism, in the case of the new 1956 Ford Motor Company "Lifeguard Safety System" were evident even in the high velocity impacts.[32]

Head-on crash experiment recommendations included:

a.) the re-design of car interiors to minimize injuries to motorists thrown against the interior surfaces, the removal of hard protuberances and the addition of flush contact surfaces;

b.) restraining the motorist at least at the hips by a high-performance seat belt to more effectively control the forces and loads applied to the occupant. Specifically, there was a recommendation for using a 3-inch wide, 2-point nylon seat belt with 3,000 - 4,000 pounds load capacity. Rear seat occupants with 2-point safety belts survived the head-on collisions (21 to 52 mph), but the control of belt "slack" was essential to help occupants avoid contact with the front seat structure.

c.) total steering wheel and steering column collapse was evident. A chest load distribution surface within the circumference of the steering wheel was recommended and a steering column spline on the other side of the firewall to take-up the rearward crush or deflection of the frame to prevent impaling the driver's chest with the steering wheel hub.[33]

Crash investigators concluded:

> Seat belts and the removal of all dashboard protuberances, the addition of sliding or serrated steering shaft spline, head restraints to support the head and neck (reduce whiplash injuries) and improved anchors of seats. With these precautions, the experts believed almost everybody would have a chance surviving almost every automobile accident.

Some Independent Automotive Safety Studies

Robert McNamara (V.P. of Ford Division, Ford Motor Company) was a member of the famous WWII USAF "Whiz Kids" and a socially responsible executive. He felt businesses owed society something and it was his goal to make Ford a leader in public responsibility. He had worried about auto safety as early as 1952 before he left the Ford Comptroller position. He was aware of John O. Moore, ACIR Director, at Cornell University and the project designed to find the sources and causes of automobile injuries. Moore convinced McNamara that the solution was largely a matter of "occupant packaging."

A number of agencies had studied the crash injury problem, but Ford was the first manufacturer to participate in auto safety research conduction crash tests in Dearborn at a cost of $10,000 each. They had their own crash test dummies (1953-1955) named FERD I and FERD II named after the Ford Engineering Research Division. Ford had researched and developed the 5-part safety package called the "Lifeguard Safety System" and they planned to introduce it in all their 1956 model cars. In addition, Ford demonstrated the efficacy of their safety package with 40-mph crash tests (zero fatalities were estimated) using Ford Fairlanes at their National Safety Forum, held at the Dearborn Proving Grounds, on September 7-8, 1955. In addition, they offered to share their auto safety research with their competitors. In discussing their new 5-part safety package at the National Safety Forum, Henry Ford, President said:

> Beyond the problems of increasing our knowledge of what happens in the course of a crash and the designing of equipment to counteract these things, we face the particularly tough job

of trying to get the public to accept them.[34]

In 1956, A.L. Haynes, a Ford Safety Engineer, explained the key safety principles; (1) keeping the passengers inside the vehicle during a crash and (2) designing components to help occupants absorb the crash shock or crash energy. Haynes announced the 5 main features of the new Ford "Lifeguard" safety system: (1) optional safety belts, (2) optional padded instrument panel and padded sun visors, (3) safety door latches (standard), (4) shatter resistant rearview mirrors (standard) and (5) deep dish steering wheel (standard). Haynes elaborated further:

> Safety Doors—Upgraded and stronger safety latches to prevent the doors from springing open under impact stresses thus giving the passengers protection against being ejected or being thrown-out of the car. Passengers are 2x's more likely to be killed or seriously injured, if ejected. Upgraded safety door locks cost $0.50 per door.
>
> Seat Belts - Structurally anchored seat belts with steel plates are included. Belts that retain the occupants inside the vehicle, but also reduce the chances of being thrown against the instrument panel and windshield area. Belts were available as an option for front and rear seating positions. with 4,000 lbs. tensile strength, about 1,000 lbs. more than airline safety belts.
>
> Panel Padding - Crash cushioning available from Ford was for the instrument panel and sun visors. This was not ordinary foam rubber. This padding was 5-times more shock absorbent than sponge rubber and distributed forces over a wider area of the head and body. 38% of front and center passengers were injured or hurt on the instrument panel according to ACIR.
>
> Rearview Mirrors—The Ford rearview mirrors have a specific backing to reduce the chances of glass falling out when shattered. 4% of all front seat injuries were rearview mirror related. Ford had re-designed the mirror-frame support as well.
>
> Seat Supports—Upgraded front and back seat supports to reduce the possibility of seats breaking loose under the severe shock of a crash.

Some consumers liked the fact that crash padding and seat belts were optional at a suggested retail price of $16.00 while others liked the idea that the deep-dish steering wheel, upgraded door latches and shatter resistant rearview mirror glass were standard equipment. Ford expected their 5-part safety package, if used in all vehicles could reduce the number of auto crash injuries by one-third (1/3).[35]

Ford and Chrysler both made $200,000 contributions to Cornell to support the ACIR project (9/4/55). Chrysler was planning to adopt Ford's "5-part safety package" for their new products, but would lag a few months behind.

General Motors criticized Ford for undermining the integrity what was already believed to be a safe product. Everybody knew automobiles didn't cause traffic crashes, but that drivers did. But the text of a 1956 Chevrolet Bel Air magazine ad revealed GM was on the "safety bandwagon" (just in case this safety idea took-off). The ad stated "…safety door latches and seat belts available as optional equipment at extra cost that make driving more fun—safer too!" [36]

Regrettably, Ford's idea for a new automobile safety product was years ahead of its time and perhaps was not well received due to a lack of focus group or market testing—techniques that hadn't been invented yet. Within a few months of introduction, "Lifeguard" ads were pulled and future plans cancelled. J. Walter Thompson, Ford's ad agency, was asked to revamp the advertising campaign and safety was demoted to third place - below performance and styling. Although well researched from a technical point of view, Ford had not benefitted from advanced consumer feedback.

However, there were early signs that even though safety didn't sell, aspects of McNamara's 5-part safety package were working and doing their job. "…Early findings from Cornell's ACIR project indicated that the new safety measures (e.g., safety belts, upgraded safety door latches, padded instrument panels, recessed steering wheels, and other features" were paying-off. …More new features like recessed handles/knobs and re-designed instrument panels are showing up in some 1957 models."[37]

Comparison of ACIR injury data of earlier pre-1956 Fords vs. post-1956 Fords (those with and without the 5-part safety package) were made as of March 1, 1957. These used the ACIR injury categories, (1) Injuries of all degrees, (2) Moderate to Fatal Injuries and (3) "Danger to Fatal" Injuries.

The available quantified results for the Ford "Lifeguard" results in 1956 were as follows:

> **Seat Belts**—There were 60.4% fewer injuries in "all injuries" categories" and 60% fewer injuries in the "moderate to fatal" category. Occupants with belts had fewer dangerous-to-fatal grade

injuries (but this was not significantly different compared to unbelted occupants).

Door Latches—There were reduced door openings during impact by 33% for non-rollover accidents and somewhat less for rollover. The new Ford door latches reduced ejection risk from an open door by 49%. They reduced the risk of "dangerous-fatal" category by 29% primarily the result of retaining passengers inside the shell of the car. D. M. Severy and his team credited the new 1956 Ford safety door latch system as working very well compared to the other cars tested at 50-mph.[38]

Cornell Aeronautical Laboratory

During the mid to late 1950s, highway crashes and injuries were taking a toll on the insurance company balance sheets. Liberty Mutual Life Insurance Company, in cooperation with Ford and Cornell, conceived the first "research based" safety car in 1957, called the Cornell-Liberty Safety Car. Ford did all the engineering design work and the renowned industrial designer, Raymond Loewy, consulted on all the aesthetic design aspects. This safety car was a concept car and intellectual design exercise, not a crash test vehicle. It incorporated the latest auto safety research, technology and thinking and was considered the state-of -the-art in auto safety at the time.

Cornell's aircraft expertise and their scientific approach would be critical to the study and understanding of the automobile crash dynamics. Their auto safety research experience went back to 1951.

Before a public announcement of the innovative new car, Cornell refined earlier recommendations, to include: (1) replacing the conventional steering wheel with a mechanism controlled by levers, (2) conical sectioned windshield (constant radius of curvature for zero distortion) and similar conical rear windows for enhanced visibility, (3) shock absorbing bumpers for low speed events, (4) rollover bars to prevent roof crush and (5) bucket seating with better lateral head and hip support in a side crash.

Newspaper hype about the Cornell-Liberty Safety Car during 1955-56 included a claim such as "...the design would depart from the conventional design to the extent necessary to allow its occupants to walk away, unharmed from a 50-mph collision."

A *Life* magazine article (July 1957) publicizing the 50-mph ITTE head-on crash experiments prompted a Letter to the Editor from a Liberty Mutual Insurance Consultant, Edward T. Chase. This letter appeared in *Life* Magazine the next month (August 1957) describing a new safety car. The letter stated:

> Here is a drawing of a car now being built which the sponsor Liberty Mutual Insurance Company hopes will be the final answer. It is being constructed by Ford Motor Company in cooperation with the Cornell Aeronautical Laboratory [Buffalo] and will be ready by fall [1957]. It represents years of crash tests and features seat belts, lever-type steering rather than a steering wheel, the driver in the center and a "club car" seating arrangement (one rearward facing and 2 forward facing rear occupant seats). It also had rounded bumpers, extra (interior) roof padding and rollover bars. Now the rest is up to Detroit.[39]

A promotional brochure stated "…after five years of crash testing and research, the Cornell Aeronautical Laboratories—in partnership with Liberty Mutual Insurance Company - developed the 1957 Safety Car."[40] The original 13 page brochure, found on The Henry Ford web site, listed the safety features designed to prevent automobile accidents and protect drivers/passengers against serious injury. Mr. Matthew G. Anderson, current Curator of Transportation at The Henry Ford has provided further clarification on the safety features for the Cornell-Liberty Safety Car. He stated: "…we know one of the overriding safety concepts for the driver was to keep their head from contacting the instrument, dashboard and windshield. The circular windshield with 180 degrees vision, instrument cluster above the cowl and central driver position make this clear." Note: The additional outboard front passengers sat lower and further back to maximize the driver's unobstructed vision." [41]

He continued: "…the instrument cluster and steering levers were on a hinged platform that could move up or down a accommodate different driver sizes or to ease the process of egress/ingress. The driver's seat could slide forward and back on a 15-degree incline, moving up as it moves forward." [42] (Note: The speedometer sat above the cowl at the driver's eye height.)

Anderson further commented: "…Each passenger's seat could slide forward and back. Front seat passengers could slide forward to secure themselves against a padded U-shaped restraint or yoke in front of each passenger seat." Seat belts were used for every seating position." The Cornell-Liberty Safety Car was built by Ford on

Figure 4: 1957 Cornell-Liberty Safety Car designed by Raymond Loewy, built by Ford Motor Company and sponsored by Liberty Mutual Insurance Company. This was a prototype car designed to show-off the latest safety technologies and was used as part of a U.S. auto safety promotion campaign. The A-pillars have been reconfigured to maximize driver visibility and the roof is cantilevered from there forward. The driver and front passengers are seated longitudinally aligned with the A- pillars. The door folds to provide access to both front and rear passengers. The high domed roof was designed for headroom, but accommodated the rollover structure for front and rear passengers. Outside rearview mirrors were visible to the driver via a large distortion-free windshield. The driver and front passengers were located a considerable distance from the instrument panel and windshield glass. (Used with permission by THF)

a 1956 Ford chassis, 115.5-inch wheelbase and 3,300 pounds curb weight.” [43]

This design was experimental and was displayed in shopping malls across the country to promote automobile safety and introduce the public to the outcome of all the safety research that had been conducted through 1957. It embodied the hope that a car manufactured like this by Detroit might save many lives. The Cornell Liberty Safety Car can be viewed at The Henry Ford Museum collection in Dearborn, Michigan.[44]

1966 New York State Safety Sedan

The New York State Legislature was also interested in funding the design of a “Safety Car” as they had become concerned by the rising number of injuries and fatalities on the highways of the State of New York. On July 15, 1965 Governor Nelson A. Rockefeller signed a bill to appropriate $100,000 for a feasibility study and in August major aerospace and engineering companies were invited to bid on the contract.

In October 1965 Republic Aviation, a Division of Fairchild-Hiller Corporation, was selected as the prime contractor. Richard Arbib, a well-known industrial designer who worked with Republic Aviation during WWII, was hired by his former employer to study the “Appearance Characteristics” of the potential safety car. Another former employee of Republic Aviation, George Hildebrand, was named the Safety Car Program Manager. Preliminary design work was carried out in 1966 and work on the final design proposal of what had become known as the “New York State Safety Sedan” was submitted to the National Highway Safety Bureau (soon to become the U.S. Department of Transportation), in Washington DC.

Journalist Drew Pearson hinted at possible threats to the status quo posed by a safety sedan:

> The safety car project in NY State might set a bold safety standard whereby the U.S. government could rate the safety of thousands of cars which it buys for the Armed Services and government agencies.” The Auto Safety Bill about to pass Congress explicitly authorizes the federal government to contract for such safety cars for testing and demonstration. [45]

Essentially, Detroit’s fear was that a new “crash proof” automobile represented a stepping stone or gateway to federal auto safety regulation. Another fear was that if they built and demonstrated an automobile with superior safety qualities, consumers might expect and

Figure 5: Center located driver's seat with left/right levers replaced the standard steering wheel. There was a large block of padding between the levers to cushion the head and chest areas. Driver and front passengers were located back from the windshield to minimize windshield glass contact in a crash. (Used with permission by the THF.)

demand that new level of safety in the cars they buy. The New York State Legislature never authorized or funded the construction of the "Safety Sedan," but in 1971, the project was reincarnated as the Fairchild-Hiller Experimental Safety Vehicle (ESV) program. They became a prime contractor along AMF, Inc to build the new ESV's for destructive testing by US DOT.

Fairchild Hiller Experimental Safety Vehicle (ESV)

The design was hyped as "crash-resistant," but not "crash-proof" with potential to decrease auto accidents deaths and injuries by 50%. Some of the key safety features Hildebrand envisioned included: a roof mounted pylon with rearview mirrors and a deceleration signaling system, interior padding, a stress wall to keep the engine from invading the occupant space, swing bumper to soften collisions, four-wheel drive, strengthened roof, large rounded windows (front, side and rear), high-backed seats with shoulder harnesses, collapsible rear-end structure, a spill-proof or puncture-proof gas tank and rear window wipers.

Crash Worthiness features included (1) semi-monocoque platform chassis with an underlying cage-type structure for strength and weight reduction, (2) both bumpers had elastomeric coverings and were rigid underneath. The front bumper was cushioned by variable hydraulic cylinders and extended proportional to vehicle speed and amount of frontal crash energy to be managed, (3) gas tank filler neck on the side of the rear quarter panel, rather than rear, (4) air bag in the steering wheel and air bags in the ceiling of the rear seats, (5) roof pillars square edged and robust for rollover, (6) all interior facings were smooth, (7) child safety carrier built into the back seat, (5-way harness with quick release, a head rest and side restraints.) and (8) fully padded interior

Figure 6: Rear seat compartment with center, rearward-facing passenger for a child to reduce passenger head contacts in a crash. Note the built-in seat belts and anti-whip lash nets for the forward-facing back seat passengers. (Used with permission by the THF)

with seat belts and contoured seats.[46]

Crash Avoidance features included (1) high mounted stop lamps in the rear, (2) overhead rearview periscope, (3) A-pillars positioned 50 % further forward than conventional cars to protect front seat occupant heads (similar to the Cornell-Liberty Safety Car) and (4) all surfaces in the direct view of the driver (like wiper arms) were flat-finished to eliminate glare due to oncoming car headlights.

Pedestrian safety features included (1) pedestrian friendly elastomer covered bumpers, (2) no exterior protrusions on the ESV to snag or drag pedestrians and (3) flush side marker lamps and curved bumpers surfaces to protect pedestrians.

1966 National Traffic and Motor Vehicle Safety Act (Public Law 89-563)

Several magazine articles (*New Republic* 1959 and *The Nation* 1964) along with Ralph Nader's new auto safety book (1965), focused national attention on the auto industry's "blind eye" toward the number of American deaths on our highways and helped spur passage of Public Law 89-563, the 1966 National Traffic and Motor Vehicle Safety Act.[47] Section 106 covers the establishment of Federal Motor Vehicle Safety Standards, (FMVSS), stating "…that each standard shall meet the need for motor vehicle safety and shall be stated in objective terms." This covered things like head restraints, seat belts, dual braking systems etc., and for 1974 models, passive restraints or air bags. Experimental Safety Vehicles (ESVs) were also included in this new law, "…the Secretary shall conduct research, testing, development and training … including but not limited to…experimental and other motor vehicles for research and testing purposes."[48] These were intended to be experimental or laboratory specimens for destructive testing. This essentially created federal responsibility at the cabinet level for regulating the auto industry, namely U.S. DOT and NHTSA. In 1972 US highway fatalities peaked at

Figure 7: The instrument panel was located above the cowl line, just below the driver's line of sight, to minimize "eyes-off-the-road" time.

an all-time high of 54,589. This was the inflection point as highway fatalities have trended downward each year, despite the growing VMT, due to federal intervention. Today's magnitude of the highway fatality problem is similar to the mid-1950s (about 36,000 fatalities annually on average). The National Highway Safety Bureau (NHSB) had a lot of the day-to-day responsibilities (1966 to 1970) until NHTSA was fully funded, staffed and operational.

Although Program Manager, George Hildebrand, had many concrete component ideas about what the design of the 1971 Fairchild-Hiller safety car should consist of, the U.S. government's proscribed exacting safety performances specification (as opposed to design specs) for the ESV competition bidders to follow: [49]

(1) 50-mph frontal impacts with a fixed object—using air bags restraints, without seat belts, the passengers walkaway unscathed.
(2) Side at 30 mph, rear 75mph and complete rollover at 60-70 mph.
(3) No damage to the car body in front and rear collisions.
(4) Spill proof gas tank.
(5) Improved driver visibility (front, rear and sides).
(6) Improved braking effectiveness with stopping distances of 155 feet (max) from a speed of 60 mph in a 12-foot lane.
(7) Acceleration from 30 to 70 mph in 12 seconds for high speed, freeway on-ramp entry.
(8) Handling/Stability (cornering forces and stiffness, roll and spin-out propensity)
(9) Ability to make an abrupt 180 degree "J" Turn at speeds of 30, 50, and 70 mph without rollover.
10. Curb weight specification was 3,800 to 4,200 pounds.

World-wide Experimental Safety Vehicle (ESV) Competition

The U.S. federal Experimental Safety Vehicle (ESV) ini-

Figure 8: 1971 Ford Experimental Safety Vehicle, was a modified production 1968-1969 Ford Galaxy 500 and is shown in the lower figure compared to original production car in the upper figure. The extended front-end on the ESV reflects the extra crush distance needed to absorb the 50-mph barrier impact energy. The rear deck or trunk appears to be shortened and the whole greenhouse moved to the rear. Note the B-pillars were put back in place for roof crush resistance in rollovers. The front chassis/ frame members employed what were called "plastic hinges" to help absorb a majority (65%) of the frontal crash energy and the body sheet metal absorbed (35%) of the energy. Overall, the objective of designers was to keep the ESV's stylish, attractive and aesthetically pleasing.[51] (Used with permission by the National Automotive History Collection, Detroit Michigan.)

tiative captured the world's attention in a head-to-head competition to build a new generation of crash-proof automobiles. It filled everyone with hope and dreams of a safer tomorrow on the highway. A "Silver Bullet" with effective safety strategies and sufficient occupant packaging to protect its passengers up to 50 mph in a head-on crash could become a reality. The hope was that promising ESV safety technologies could be spun off, adapted, packaged and moved quickly into production. Highway mortality was a world-wide problem shared by all and many European manufacturers got involved building their own ESV's. Thousands of engineering labor hours were consumed and an estimated $200-$250 million was brought to bear on the problem. In the U.S., several federally sponsored ESV's were designed and tested by the government (1970-75 period) including the Fairchild-Hiller and AMF ESV's. These were in the 3,800—4,200 lbs. curb weight range and cost about $8 million for 4 copies (2 each). GM and Ford both made ESVs for federal testing which cost millions to design and build, but charged Uncle Sam only $1.00 per contract. Based on federal testing, a second round of Research Safety Vehicles (RSV's) were designed and tested by US DOT (1975-80 period) at a cost of $30 million. These RSVs reflected a 3,000 lbs. curb weight, more inline with the 1985 market place, with higher mpg, lower emissions and lower consumer cost. This became known as the S3E Program to demonstrate the compatibility of safety, fuel economy, reduced emissions and consumer economy.[50]

Figure 9: 1971 GM ESV. To off-set the weight of a heavier frame structure, the body of the 1971 GM ESV was made of aluminum. The front fixed windows had ports for added air circulation and access to external parking or toll road ticket equipment. The front-end nose and rear end were designed to absorb energy at low impact speeds (up to 10 mph) with a zero-body damage tolerance and subsequent minimal harm to pedestrians.52 (Used with permission by GMMA, Detroit MI.)

Figure 10: This is believed to be mock-up of the 1971 GM ESV (with roof removed) to show the interior padding anticipated for passengers to survive a 30-mph crash without their seat belts and a 50-mph crash with air bags. There is a padded bolster or padded partition between the front and rear occupants which contains the rear occupant air bags. The padded bolster also prevents the 30-mph unbelted rear occupants from flying up and over into the front seating area. (Used with permission by GMMA, Detroit MI)

Figure 11: Interior front seat mock-up of the 1971 GM ESV showing the front occupant padded crash protection areas. A high mounted bolster separated the driver from the front seat passenger (See image right-hand, lower corner). Driver controls were recessed and hard knobs, buttons or protrusions removed so the interior surfaces were flush and smooth. The steering wheel had a large central padded area to distribute driver chest loads in the 30-mph unbelted crash test scenario. Air bags are hidden within the steering wheel hub for the driver and the right-hand dashboard area for the passenger for the 50-mph crash scenario. Also, note driver head-up display at the bottom edge of the windshield. (Used with permission from GMMA, Detroit MI.)

Conclusions

The year 1972 marked the inflection point of the mounting U.S. highway safety problem due to the application of federal initiatives. The countermeasures involving changes in human behavior and technology have created a continuous downward trend in magnitude of highway fatalities. Studies such as those by Kahane and others show that the federal approach has worked. The annual magnitude of fatalities today are about the same level as they were in the mid-1950s. The 2020 average decade fatality rate is five times lower than the 1950 decade. State mandates such as belt use laws (adult and child) as well as motorcycle helmet laws are crucial as well as national highway safety programs administered by the states. Meanwhile, new fields of engineering science and research have been created to focus on the problem (e.g., crashworthiness, crash avoidance, biomechanics and injury criteria, anthropomorphic test devices (ATD's), full-scale crash testing and instrumentation, laboratory sled testing, finite element analysis, highway crash data and analysis, and in-depth special crash investigation techniques.

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20. Advertisement entitled "Unmistakably the finest in the fine car field, LINCOLN FOR 1956." color, magazine name and date unknown.

21. https://en.wikipedia.org/wiki/Fisher-Body Fisher Body Web site with chronology and dates of GM's safety improvements. (Accessed 8/21/21)

22. Col. John P. Stapp USAF, was an American hero, USAF officer, U.S. Army Flight Surgeon, physician, biophysicist and automotive safety pioneer. Many times, placing himself at great risk as a volunteer, he tested the limits of humans in rocket sleds, wind blast experiments and high-altitude sky diving experiments. On December 10, 1954, he set a land speed record on a rocket sled called "Sonic Wind" achieving 632 mph

in 5 seconds subjecting him to 20G's of force during acceleration. When the sled stopped in 1.4 sec. Stapp was subjected to 46.2 G's, more than anyone had ever endured. Stapp became an international sensation and was acclaimed "the fastest man on earth." He made 29 rocket sled runs during his career. The human tolerance data that accrued from these tests helped in the development of fighter pilot/ paratrooper restraint systems to help survive airplane crashes as well as to survive pilot and co-pilot seat ejections.

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The Origins of NASCAR and American Stock Car Racing

The Development of a Historiography

by H. Donald Capps

A review of the *Proceedings* for the annual conferences of the North American Society for Sports History (NASSH) for the years 2008 to 2012 finds that of the 667 papers scheduled for presentation during this five-year period, only six were related to automotive competition, motor sport-related topics. Three papers were presented in each of the conferences for the years 2008 and 2009, and then none during the following three years, 2010 to 2012. Given the inclusive nature of the topics presented at the annual conferences of the NASSH, this absence seems to be an accurate reflection of the state of automotive competition history in North America.[1]

The most popular and visible form of automotive competition in the United States today is stock car racing. The largest sanctioning organization for stock car racing in America is NASCAR, the National Association for Stock Car Auto Racing. The events of the NASCAR Sprint Cup Series are now as much a fixture on television as the games of the National Football League (NFL), Major League Baseball (MLB), the National Basketball Association (NBA), and the National Hockey League (NHL). In terms of viewers, NASCAR is second only to the NFL when it comes to televised sports.

The origins of NASCAR tend to be somewhat vague among most sports fans, especially given that NASCAR and the sport of stock car racing have become so intertwined that they are virtually synonymous to those interested in the sport. The situation would seem to be little better among those who write about the sport.

A review of the literature related to the origins of NASCAR reveals that there appears to be three distinct groups that have written about the topic: the first being journalists and freelance writers; the second, sports geographers; and the third, historians. The last group, the historians, is defined as being professional historians within the academic community, with their work being published by university presses or in scholarly journals.

The review of the works of the journalists and freelance writers, was—with one exception, restricted to books, there being a total of 19 books and only one article included in the review, with publication dates ranging from 1965 to 2010. The books tend to fall into two broad categories: one that focuses on Bill France and the need to organize the sport of stock car racing and the other that contends that those in the illegal alcohol business, moonshiners and bootleggers, who allegedly were responsible for the origins of stock car racing and, as a result, NASCAR.

The first category can be thought of as the Bill France/Daytona Beach school of thought regarding the origins of NASCAR. These books tend to focus on the founder of NASCAR, William Henry Getty "Big Bill" France, an organizational meeting held in Daytona Beach, Florida, during December 1947 to form NASCAR, and the events surrounding that meeting.

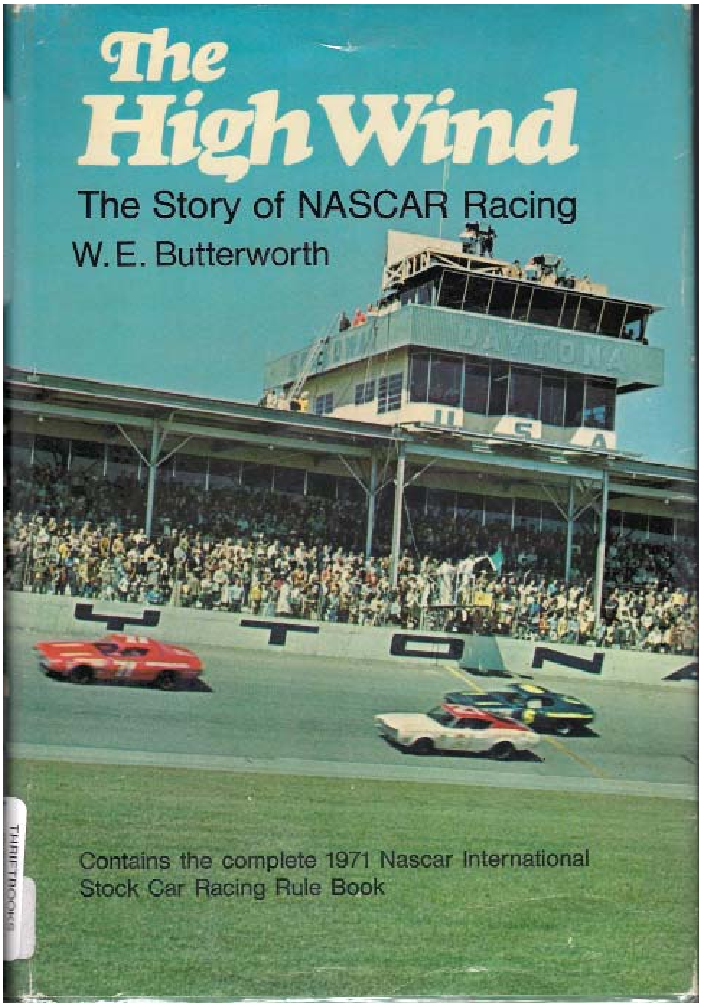
The first of the books in this category was *The Racing Flag: NASCAR—The Story of Grand National Racing*[2], written by Associated Press sportswriter and the founder of NASCAR, Bill France, which appeared in 1965. As a result of France's involvement, *The Racing Flag* can be said to represent that "party line" as to how NASCAR viewed its origins. The rationale for the organization of NASCAR can be found in a narrative that relates how a race promoter sweeps into town, lines up a card of races at the local track, holds the races, and then disappears with the gate, stiffing the racers by not distributing the purse—and as often as not, not paying the track owner as well. In addition to this all too frequent story, the rules varied from track to track as to not only what the technical specifications were for the cars, but also the classes for the cars to compete in, and driver eligibility and race purses. The origins of NASCAR, in France's view, had its roots in the notion that an organization had to be established to bring order to an often confusing, even chaotic situation. Thus, in late 1947, France sent invitations to several fellow race promoters and others involved in stock car racing for a meeting to be held in the Ebony Room of the Streamline Hotel in Daytona Beach, December 14-18, 1947.

The Racing Flag does not credit NASCAR with creating the sport of stock car racing, noting that stock car races were held at Daytona Beach prior to World War II. Additionally, annual speed trials were held on the beach for several years at the turn of the century as well as being the site for speed record attempts until the mid-Thirties. The relationship of NASCAR and stock car racing to the heritage of speed and racing at Daytona Beach is part of the origins story that France wished to definitively confirm in the book.

In *Ford: The Dust and the Glory, A Racing History*[3], journalist Leo Levine provides a straight-forward account of both the formation of NASCAR in December 1947, along with the involvement of one manufacturer, Ford, in broad sweeping study that included stock car racing long prior to the presence of NASCAR. Levine devotes attention to the stock car race held in March 1936 at Daytona Beach, as well as a number of the other prewar stock car races that were held, not just in the Southeast, but also in the North and Midwest at places such as Langhorne, Pennsylvania, and Fort Wayne, Indiana. By doing so he establishes that there was certainly stock car racing prior to World War II and the organization of NASCAR in late-1947, but also that Bill France was active in the sport at that time as both driver and promoter.

The High Wind: The Story of NASCAR Racing[4], by freelance writer W.E. Butterworth, devotes its opening chapter to a brief biography of Bill France. He then examines how France created NASCAR. Butterworth repeats the storyline regarding the problems of stock car racing in the days immediately following World War II: the lack of any organization for the racing and uniform technical rules; standards for drivers and promoters; guarantees regarding the purse for events; and finally the absence of an adequate insurance system for the racing. A complete account of the organizational meeting proceedings is included.

Journalist Allan Girdler begins *Stock Car Racers: The History and Folklore of NASCAR's Premier Series*[5], with a quick look at the forma-



tive years of American racing. The author then provides a short account of the prewar stock car races at Elgin, Illinois, and on the beach at Daytona. Girdler describes an account of the formation of NASCAR by Bill France and the others present at the December 1947 meeting in Daytona Beach. The trials, tribulations, and successes of the early seasons of NASCAR are given their attention, covering the growth of both NASCAR and stock car racing in the late-Forties. In general, Girdler provides a very good, credible history of the formation of both stock car racing and NASCAR.

The interest of freelance writer Greg Fielden in the history of NASCAR's Grand National series, then called the Winston Cup Series, led to an ambitious project to publish a history of the first 40 years of "stock car racing"—although it was actually that of the first four decades of the Grand National/Winston Cup Series. The first volume of Fielden's history, *Forty Years of Stock Car Racing, Volume I, The Beginning, 1949-1958,* Revised Edition[6], provides a quick review of the organizational meeting held in December 1947. Fielden then moves to a review of the 1949 season, which witnessed the debut of the "Strictly Stock Division," which was renamed as the Grand National Division beginning with the 1950 season.

The only article selected for this historiographical grouping is from the inaugural issue of what was intended to be a quarterly devoted to the history of NASCAR and stock car racing, entitled *American Racing Classics*. After the first four volumes, the demand apparently did not exist and after two additional volumes, one for January 1993 and the other for 1994, the journal ceased publication. It can be suggested that the publisher overestimated the interest in the history of stock car racing.

The lead article of the first volume was by Ben White, managing editor of the journal, and, appropriately, was "The Formation of NASCAR,"[7] a close look at the organizational meeting of NASCAR in December 1947. While this article differs little from previous coverage of the meeting, it focuses on many of the personalities present at the meeting and their later roles with NASCAR.

The second category can be considered as the "Moonshiner" school of NASCAR and stock car racing history. This grouping places the importance of the transportation of illegal alcohol squarely at the core of stock car racing's origins, and includes its importance to the formation of NASCAR. Although Leo Levine mentions that those involved in the illegal alcohol business did gather at the garage of noted racing mechanic Red Vogt in Atlanta, he also notes the Bill France convinced the drivers that racing was more profitable than hauling moonshine[8].

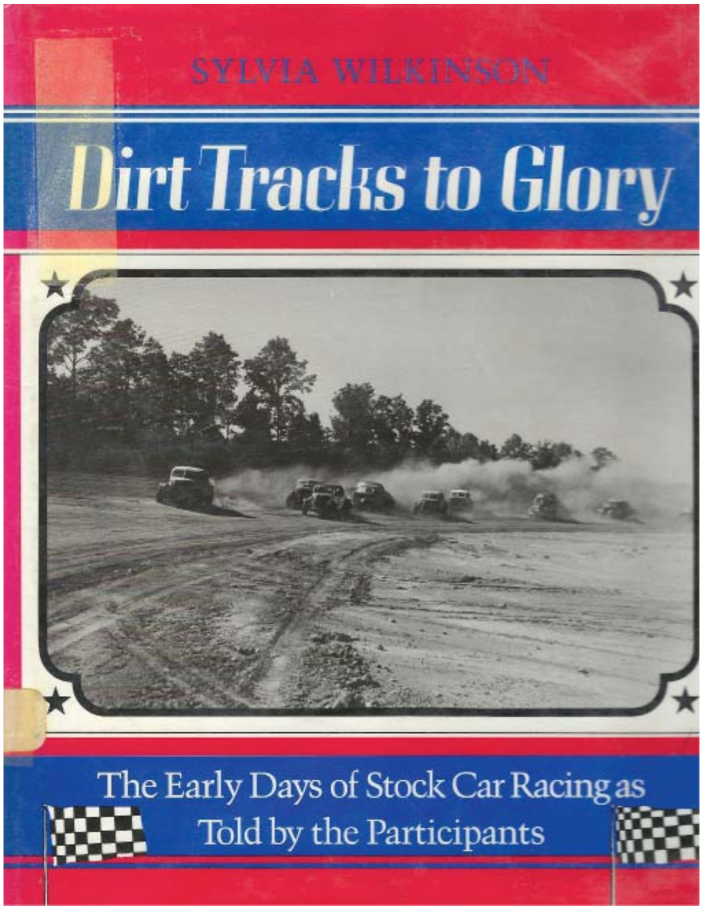
NASCAR: The Definitive History of America's Sport[9], by journalist Mike Hembree, may not be the "definitive history" of the sport, but despite a large, coffee table format, with its pages filled with many illustrations, the book does attempt to address that history in what can be considered as a serious manner. Hembree provides a brief overview of American racing, from its origins in the 1890s to the racing and record-setting efforts in the sands of Daytona Beach to the emergence of stock car racing during both the prewar and postwar years. Hembree's narrative is factual, often being more reliable than most of the previous attempts to relate the place of NASCAR and stock car racing within the realm of American automotive competition history. Although Hembree does mention drivers involved with bootlegging, it is in passing and, due to apparently being a NASCAR-approved publication, they play no role in the origins of either NASCAR or stock car racing.

Similar in many ways to the Hembree book, a large format layout and with many illustrations, *The American Stock Car*[10], by William Burt, essentially complements the Hembree book. Focused primarily on history in the chapter covering the origins of the sport, the book also lacks a bibliography that would reflect where this material could be found for someone wishing to investigate further into the history of the sport.

There is a definite trend towards large format, heavily illustrated books on NASCAR's past (and that of stock car racing). For example, Greg Fielden served as the author of what is essentially the same book under two different titles, differentiated by slightly different covers and the addition of four years of racing when comparing the 2003 to the 2007 versions. *NASCAR Chronicle* and *NASCAR: The Complete History*[11], provide the basics of both stock car racing's and NASCAR's early years in both text and photographs. While some of the photographs are interesting and well-chosen, neither version tells us anything new beyond that of the previous work of Girdler, Hembree or White.

The first book that directly addresses the connection between the illegal alcohol business and stock car racing—and NASCAR—is freelance writer Kim Chapin's *Fast as White Lightning: The Story of Stock Car Racing*[12]. Using both the racing scrapbooks and oral interviews with former NASCAR champion (1952 and 1955) Tim Flock, Chapin develops the connection between bootlegging and stock car racing. Flock maintains that stock car racing had its origins in the Atlanta area, that during the Thirties moonshiners cut an oval in a field on the outskirts of Stockbridge, Georgia, which is southeast of Atlanta, and held competitions that determined who had the fastest car, bets being settled on the track. From there, the idea of stock car racing spread through the Southeast region, following the trail of the illegal alcohol business into the Carolinas and Virginia. Another driver that Chapin profiles with an involvement in bootlegging is Curtis Turner, whose family was involved in the production and distribution of illegal alcohol in the western area of Virginia.

Sylvia Wilkinson's *Dirt Tracks to Glory: The Early Days of Stock Car Racing as told by the Participants*[13] is the result of an oral history project. The author conducted interviews with 13 participants ranging from the founder of NASCAR, Bill France, to beauty queen Linda Vaughn to drivers Tim Flock and Wendell Scott, the last two who were bootleggers prior to becoming racing drivers. Flock repeats to Wilkinson the same tales that he told Chapin



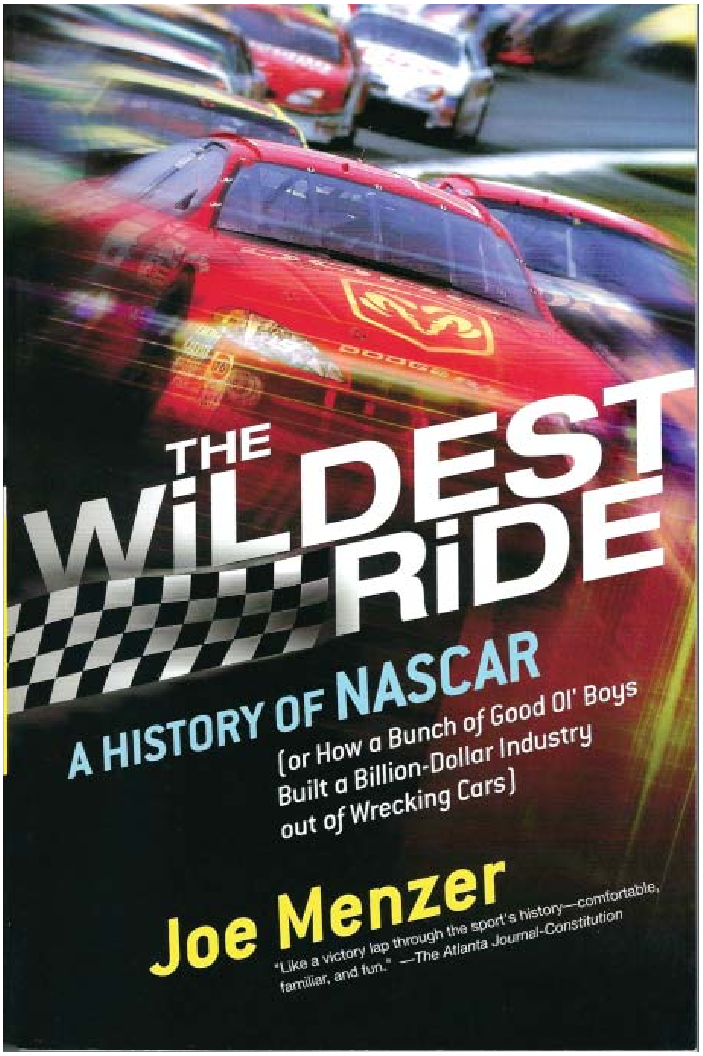
regarding the origins of stock car racing with moonshiners in the Atlanta area. Flock embellished the Stockbridge story by adding Bill France as a promoter trying to place some form of organization upon these ad hoc events, making the races profitable for all involved.

Allan Girdler is squarely in the school claiming that it was Bill France who created NASCAR and that the origins of American stock racing could be traced to the beginning of the century. However, he does not entirely ignore the bootleggers and their involvement in stock car racing. The involvement of Tim Flock and his brothers (and fellow stock car drivers) Bob and Fonty in the transportation of moonshine is mentioned, as is fellow bootlegger from Virginia, Curtis Turner. However, Girdler does not credit the moonshiners with creating the sport. Rather, that point is a distortion of history that has taken a life of its own.

Sportswriter Peter Golenbock used the 1992 Winston Cup season to cover the sport of stock car racing and NASCAR. *American Zoom: Stock Car Racing—From the Dirt Tracks to Daytona*[14]. The book is a mixture of journalistic enthusiasm and oft-muddled racing history. Chapters are generally devoted to the profile of an individual, allowing Golenbock to then pursue various aspects of the sport. In his chapter on Junior Johnson, Golenbock devotes his attention to bootleggers and stock car racing, opining that the leading stock car drivers "were mostly bootleggers,"[15] citing Tim Flock and his tale that the first stock car races were held by bootleggers in a cow pasture outside Stockbridge, Georgia, during the mid-Thirties. Given that Junior Johnson was from a family of moonshiners and had served time in a federal penitentiary after being caught by Federal officers at a family still, the topic is legitimate. However, Golenbock provides little support for Flock's statement, repeating it from Chapin and Wilkinson, although there is no bibliography supporting the book.

A North Carolina sportswriter, Joe Menzer adds little to the historiography of NASCAR or stock car racing with his book, *The Wildest Ride: A History of NASCAR (or How a Bunch of Good Ol' Boys Built a Billion-Dollar Industry out of Wrecking Cars)*[16]. While entertaining in some places and even informative in others, unlike many of the other books written by other journalists or freelance writers on the topic, Menzer does provide a bibliography, even if it is scarcely a little over a half-dozen books.

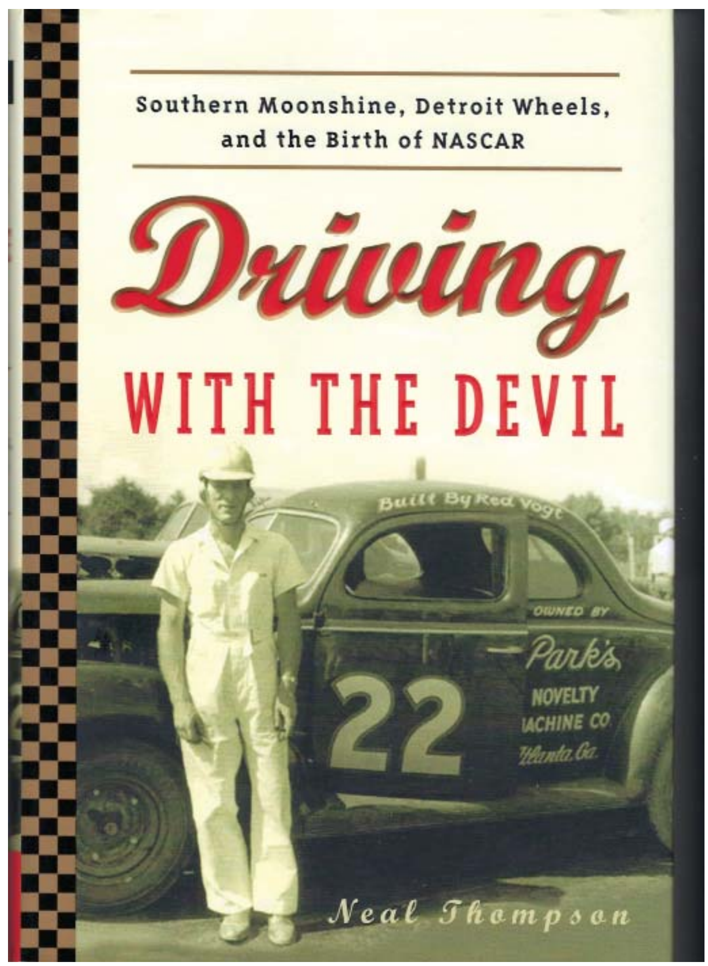
NASCAR: The Early Years[17], by Bob Kelly, follows the efforts of Girdler, Hembree, and Burt to provide the history of American stock car racing and NASCAR that is both easy to read—it is yet another large-format, heavily-illustrated book—and historically accurate. The book covers the years prior to the formation of



NASCAR. It then spans the years beginning with 1948, when NASCAR held its first season, and ends with the 1958 season, the last year that stock cars ran on the combined road-beach course at Daytona Beach. Where Kelly departs from the others and why it is grouped among those books of the "Moonshiner" school, is that Kelly devotes much attention to the role of bootleggers during the prewar days of stock car racing in the Southeast. While there is no doubt that Lloyd Seay, Roy Hall, and several others involved in the transportation of illegal alcohol also raced stock cars, there is some question as to their impact on the sport. That Kelly inserts bootleggers into the origins, the beginnings of stock car racing and NASCAR is an interesting shift, particularly with the book having the support of NASCAR, William C. "Little Bill" France, son of founder "Big Bill" France providing the foreword.

The *NASCAR Encyclopedia*[18], edited by Peter Golenbock and Greg Fielden, is relegated to the "Moonshiner" category due to Golenbock's not only repeating Tim Flock's story, even if the location is not mentioned in this instance, and dwelling on bootleggers in such a way as to clearly imply that they were a major factor in the origins of stock car racing and NASCAR. The coverage of the organizational meeting of NASCAR and the first seasons repeat Hembree's and Kelly's narratives.

The appearance of *Driving with the Devil: Southern Moonshine, Detroit Wheels, and the Birth of NASCAR*[19], by journalist Neal Thompson, in 2006, provided the Moonshiners and Bootleggers school of thought with a vindication. Using the general absence of names such



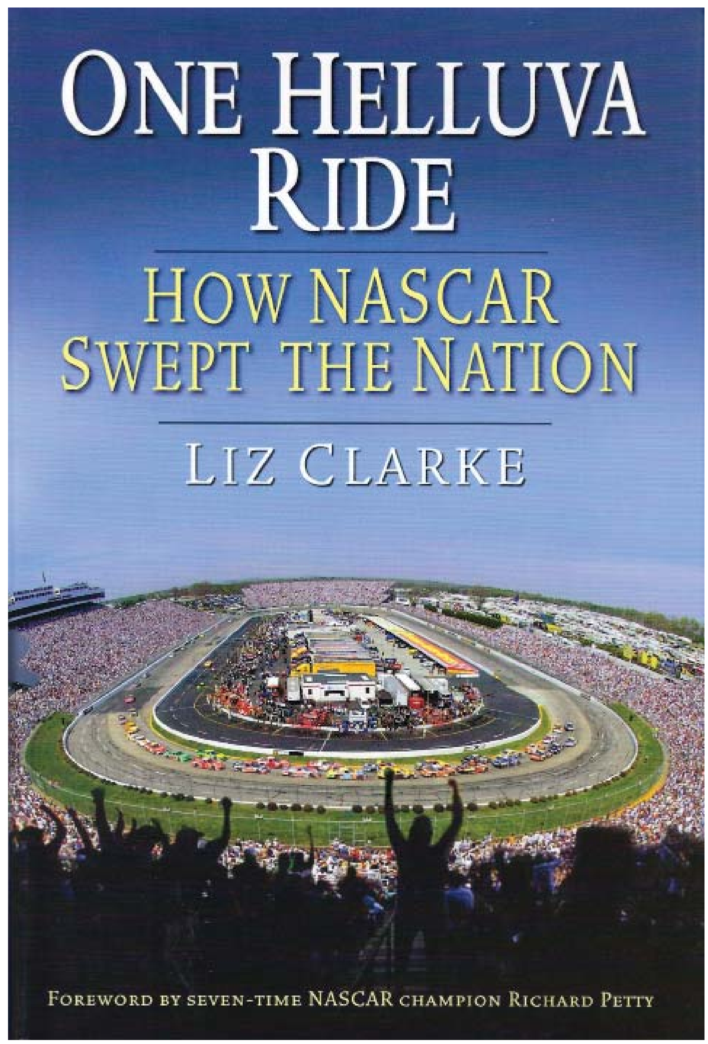
as Raymond Parks, Lloyd Seay, Roy Hall, and Red Vogt from the prevailing and often "authorized" discussion of stock car racing and its origins, Thompson suggests that they were all involved in the illegal alcohol business. This, then, was due to "NASCAR's dirty little secret: moonshine."[20]

Parks, bootlegger turned owner of an Atlanta-based enterprise that owned and operated cigarette machines, jukeboxes, pinball machines, and slot machines, was involved in both bootlegging and stock car racing prior to World War II as a car owner. The racing was part of the way to "launder" money from Parks' involvement in bootlegging. His drivers were Seay and Hall, who were cousins. Using cars prepared by master mechanic Red Vogt, Seay and Hall were among the most successful drivers of the period. Red prepared cars in addition to his general work as a mechanic in the employ of the Atlanta Police Department. While there is no doubt that those in the bootlegging business that were also involved in prewar stock car racing, Thompson names only a few others besides Seay and Hall.

Thompson does provide one of the best efforts to date to cover the prewar stock car racing that took place in the Eastern United States. This is an area of stock racing history that is still generally neglected and needs much more research. The immediate postwar years of stock car racing are also well covered, especially when any possible bootlegger involved can be tied into the story. The Thompson version of the origins of NASCAR and stock car racing differs from that established by Bill France. Parks is quoted as stating that the numbers of times that a promoter held a race and then skipped town were very few, scarcely the problem that France made it out to be.

Thompson conducted several interviews and generally relied on secondary sources as references in his *Driving with the Devil*. Numerous drivers also shared their racing scrapbooks with Thompson. While Thompson does not state that stock car racing had its origins in a Stockbridge cow pasture being used by bootleggers, he does note that there were many such pastures in the Atlanta area.[21] Although well-written, interesting, and the obvious product of a great deal of research, *Driving with the Devil* falls short of the mark in a number of areas. In short, the book seems to be as much a look at moonshine as a part of Southern culture as it is about stock car racing.

Liz Clarke, a reporter for the Washington Post, covered the origins of stock car racing in the first pages of *One Helluva Ride: How NASCAR Swept the Nation*[22]. Moonshine and bootleggers are a part of that story. While gen-



erally well-written and entertaining, Clarke's book does nothing for developing new insights related to the historiography of the sport.

The efforts of the journalists and freelance writers regarding the history of the origins of NASCAR and stock car racing tend to be very uneven. These works range generally between fair to poor as a resource for a historian conducting research on this topic. While several of the books do have merit, even if it is to suggest areas for further research,most notably Neal Thompson's *Driving With the Devil* and Leo Levine's *Ford: The Dust and the Glory*. In general, this genre most should be warily approached and used carefully by historians. There can be useful information and context drawn from these books, but the general lack of attribution and sources greatly diminishes their utility.

Sports geographers have a role in the development of stock car racing historiography, beginning with the work of Richard Pillsbury. In his earliest article on the sport, "Carolina Thunder: A Geography of Southern Stock Car Racing,"[23] the author notes that while stock car racing is perceived as a southern sport, its origins are national. Stock car races took place in the Northeast, Massachusetts and New York, as well as the Midwest and California during the 1930s and early 1940s as stock car racing took form. However, since the sport was poorly developed in the South, there were relatively few events held in the region.[24]

Pillsbury notes that the reasons for stock car racing in the regions of the Carolina-Virginia piedmont are unclear. Many voices suggest that the importance of the moonshining trade allowed drivers to learn their craft while transporting moonshine.[25] Pillsbury suggests that there is little doubt that did occasionally occur in the early days of the sport. However, he questions that moonshining was a significant force in the development of stock car racing. He cites the unsuitability of the cars used for transporting moonshine as one reason. He submits that if the cars were used for both racing and hauling moonshine, the sport would never gotten past the Super Modified cars. A more plausible explanation, Pillsbury suggests, is that open-cockpit type cars simply never gained popularity in the South.[26] The lack of growth of the stock car contests in other regions while it concurrently developed in the South might serve as another explanation. With the rise in popularity of the stock car racing in the South during the 1950s and 1960s was a marked contrast with its decline in popularity elsewhere in the nation.[27]

In "A Mythology at the Brink: Stock Car Racing in the American South,"[28] Pillsbury addresses several aspects of the lore that has developed regarding stock car racing. He suggests that the lore of "moonshining, good old boys, and hype" was utilized from the start as a means to promote the sport.[29] Pillsbury asserts that as the folklore that has long bound stock car racing to the South was jeopardized by changes in the sport, its regional identity was being threatened. Thus, Pillsbury suggested that the myth of Southern stock car racing was at the cusp of broader complex social and economic change.

A quartet of professors at East Carolina University—Derek H. Alderman, Preston W. Mitchell, Jeffrey T. Webb, and Derek Hanak—reassessed the work of Richard Pillsbury in the article, "Carolina Thunder Revisited: Toward a Transcultural View of Winston Cup Racing."[30] The authors did not directly address the issue of the origins of stock car racing, whether it was in the South or elsewhere, but rather considered the issue of regional identity that Pillsbury also addressed. That said, the article can be of value when exploring the related issue of regional identity given that the authors present an interpretation that contrasts with that of Pillsbury. These authors suggest "that NASCAR is actually 'transcultural' in nature."[31] That is, considering popular culture as the intersection and expression of local cultural traditions and the larger national and transnational demands of the culture industry, mass commercialization and mass communication do not necessarily obliterate local or regional cultures.[32] This is in contrast to the fixed regional identities that Pillsbury subscribed to in his work. The transcultural view provides a greater appreciation of the ways the South is connected to, rather than isolated, from the nation and world at large.[33] This interpretation could be applied to further work in the formation and development of stock car racing as a regional or national sport.

Another consideration of NASCAR and regional identity is, "Dialed In? Geographical Expansion and Regional Identity in NASCAR's Nextel Cup Series,"[34] by Douglas Hurt. The article provides a brief summary of the origins of NASCAR in its discussion of the temporal dimensions of NASCAR. Hurt describes the early period of NASCAR stock car racing as:

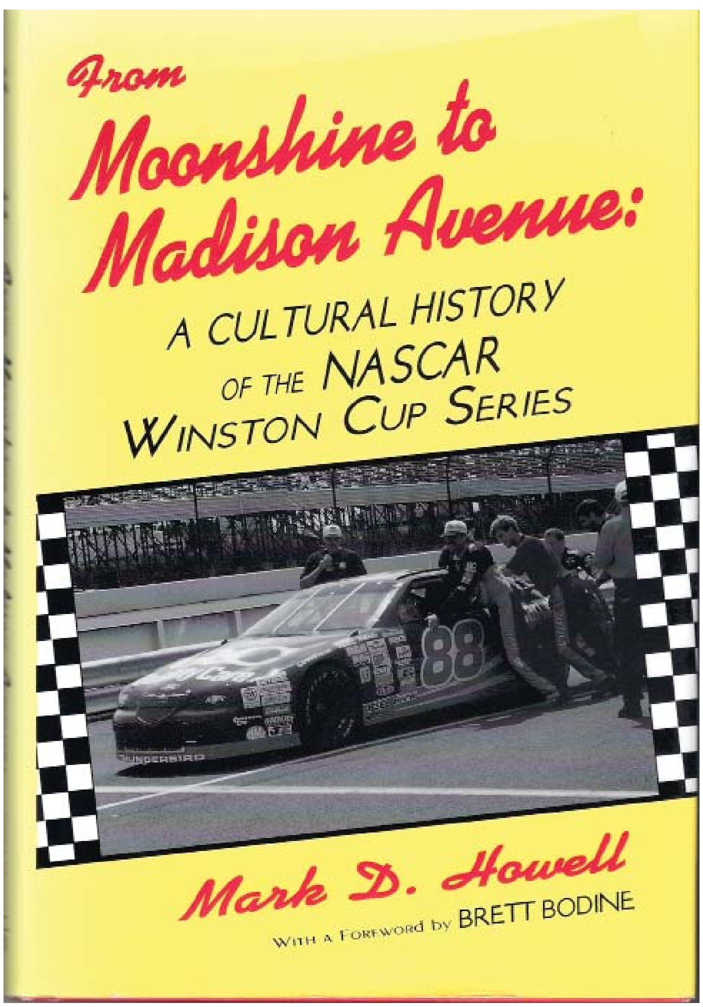
> Initially, rural and small-town white southerners embraced NASCAR—either by attending races or by showing a willingness to help friends and family members race their own cars in NASCAR events. A segment of drivers learned racing skills while transporting moonshine over southern back roads. Many of these folks attempted to win money by competing in the fast cars they used to out-run law enforcement officials. Southern fans identified with stock car racing like no other group, typically believing that the men piloting the stock cars were good ol' boys—men much like themselves.[35]

This is a summation that leads to another consideration of NASCAR, linking stock car racing, and regional identity. Other than that which has been noted, Hurt does not focus on the origins of stock car racing. His analysis of regional identity leads him to develop an interpretation that is similar to that of Alderman, Mitchell, Webb, and Hanak, but Hurt thinks that NASCAR's duality, being both a regional and national sport, is in part due to the sport never being entirely regional.

In "Mapping NASCAR: Charlotte as a Knowledge Community,"[36] Ronald L. Mitchelson and Derek H. Alderman address the question as to why Charlotte, North Carolina, and not Atlanta, Georgia, has become the focal point of NASCAR and stock car racing. Their conclusion: "Charlotte's current centrality to the NASCAR Nation is anything but an accident of history. It started with a lucrative and illegal moonshine relationship between the rural and urban South. Then it was directed toward Charlotte early on because of Atlanta's negative reaction to that racing/moonshine culture."[37] This interpretation is based upon their readings of Thompson, Golenbock, Burt, and Mark D. Howell.[38] Given that this interpretation is based upon works that themselves are based largely on oral history and secondary sources, there is, perhaps, reason to critically question it. However, there is also the thought that they have reached the right conclusion, Charlotte as epicenter of NASCAR, despite using possibly flawed or suspect sources. That said, this is a very useful article given the methodology that the authors use to address the issue of mapping a community of technological knowledge.

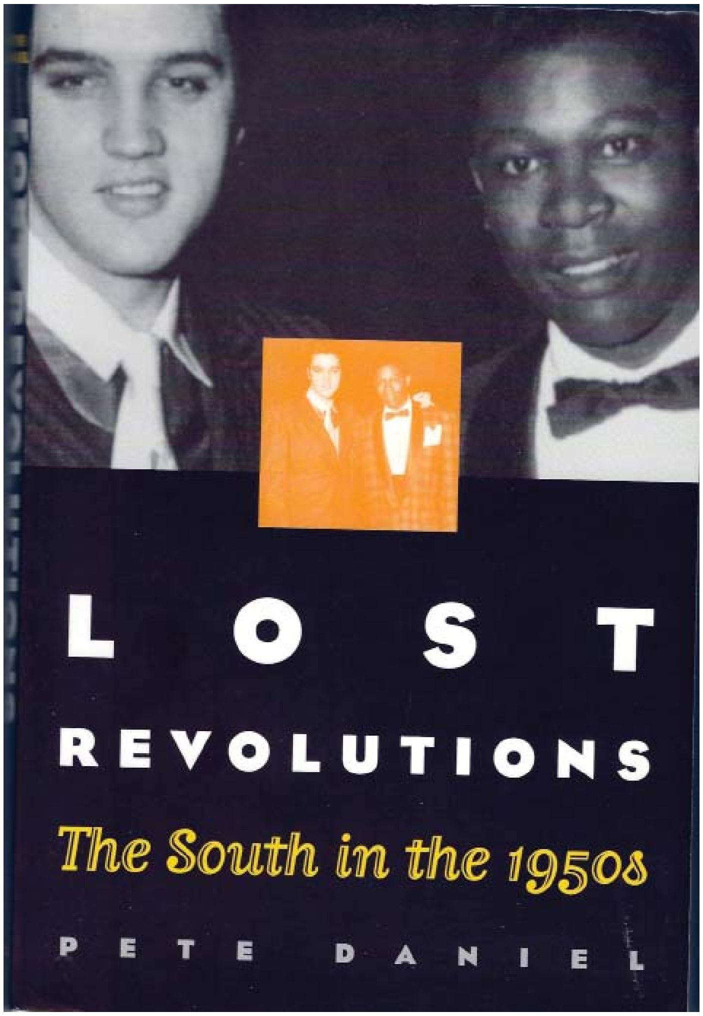
Sports geographers, as can be seen, may provide additional resources to the development of a historiography of stock car racing. The story of NASCAR, they argue, is not necessarily the issue of origins, but rather the related issue of regional and national identity. Thus, cultural history can also benefit from the use of materials and sources generated by sports geographers.

During the past 15 years, a number of professional historians have turned their attention to stock car racing and NASCAR, often taking rather different approaches to the subject. Among the first of these works to appear was *From Moonshine to Madison Avenue: A Cultural History of the NASCAR Winston Cup Series*[39], by Mark Howell, a professor of American Thought and Language at Michigan State University. As noted in the title, Howell is interested in taking a cultural approach to the topic. His treatment of the origins of the sport differ little from those of the non-historians. Thus Howell provides a brief synopsis of the efforts of Bill France to organize stock car racing so as to provide stability rather than the confusion then plaguing the sport.[40]



After a brief discussion of folk heroes, among them being racing driver Barney Oldfield,[41] Howell suggests that, "Stock car racing is a fertile field for the creation of such folk legends."[42] Howell then discusses the relationship between stock car racing and moonshiners, placing the latter within the folklore and regional identity of the sport.[43] It is as "cultural myths" that the relationship between the bootleggers and stock car racing rests, according to Howell.[44] Thus, he suggests that while there is debate between historical "fact" and historical "fiction" within the realm of stock car racing, this is also within the context of the folk hero -- the bootlegger against the law.[45] This interpretation brings to mind the words of Maxwell Scott, the character in the closing scene of *The Man Who Shot Liberty Valance*: "This is the West, sir. When the legend becomes fact, print the legend."

Following Howell was *Lost Revolutions: The South in the 1950s*[46], by Pete Daniel. Daniel traces the political and social development of the South during the 1950s, the movement from rural to urban, the high aspirations of the early 1950s eventually giving way to the turmoil of the conflicts created by the resistance of the segregationists and the timidity of white moderates. This very important book devotes much attention to working-class whites, and one chapter on stock car racing. Daniel suggests that, "Southerners manifested an inordinate interest in automobiles."[47] As a result, "automobile racing became the ultimate working-class sport."[48] The author ties the bootleggers to stock car racing, but also notes that the reluctance of the "trippers," as the drivers



were known to leave records or seek publicity. Consequently, they tended to be nebulous figures.[49] Daniel quotes South Carolina driver Jack Smith who estimated that in the formative years of Southern stock car racing about 70 percent of the drivers may have had an involvement with the illegal alcohol business.[50] The "creation tale" of Tim Flock regarding the origins of stock car racing in a cow pasture outside Atlanta, is provided, as well as the story of promoters leaving with the gate receipts, with the arrival of Bill France bringing order to the sport.[51]

While one might question Daniel's suggestions regarding the origins of NASCAR and stock car racing, his portrait of the sport as it developed during the 1950s and its cultural aspects, especially as it pertained to work-class whites, provides an important contribution to stock car racing as cultural and social history.

Jim Wright's In *Fixin' To Git: One Fan's Love Affair with NASCAR's Winston Cup*[52], suggests that from its formation, stock car racing was a national sport, not simply a Southern regional sport. Wright, a sociology professor at the University of Central Florida, argues that this is a regional fable, citing the venues from the early seasons of NASCAR that ranged from Ohio to California to New York to Pennsylvania. He also points out the half of the drivers in the top 50 in points in the 1949 season were from outside the South.[53]

Wright also takes exception to the role of bootleggers in both the formation of stock car racing and the extent of their participation. By cross-referencing the top 50 drivers of the 1949 NASCAR season against every reference to their involvement in moonshining, Wright found an established relationship in only nine of the 50 drivers.[54] He then points out those successful drivers from that season who were not bootleggers, such as Gober Sosebee, Herb Thomas, and Lee Petty.[55] This strongly suggests that previous authors had failed to undertake such obvious, even intuitive, research.

Although often seeming to vacillate between being an academic monograph and book for general readers, Wright's study is a well-written, informative, and entertaining book, for both audiences. The author is not afraid to challenge the mythology and folklore, as his examination suggests a number of bootleggers that may have participated in early NASCAR events as well as the regionalism of sport. He also tackles what he terms the "culture of the proles,"[56] and this foray sets the book apart from the majority of works on the topic.

Two works by Randal Hall, "Before NASCAR: The Corporate and Civic Promotion of

Automobile Racing in the American South, 1903-1927,"[57] and "Carnival of Speed: The Auto Racing Business in the Emerging South, 1930-1950,"[58] provide a significant contribution to the historiography of both stock car racing and automotive competition in the South. Hall suggests that historians studying the South and its sport, had only begun to turn their attention to automobile racing, an activity which has the "potential to reveal much about the region."[59]

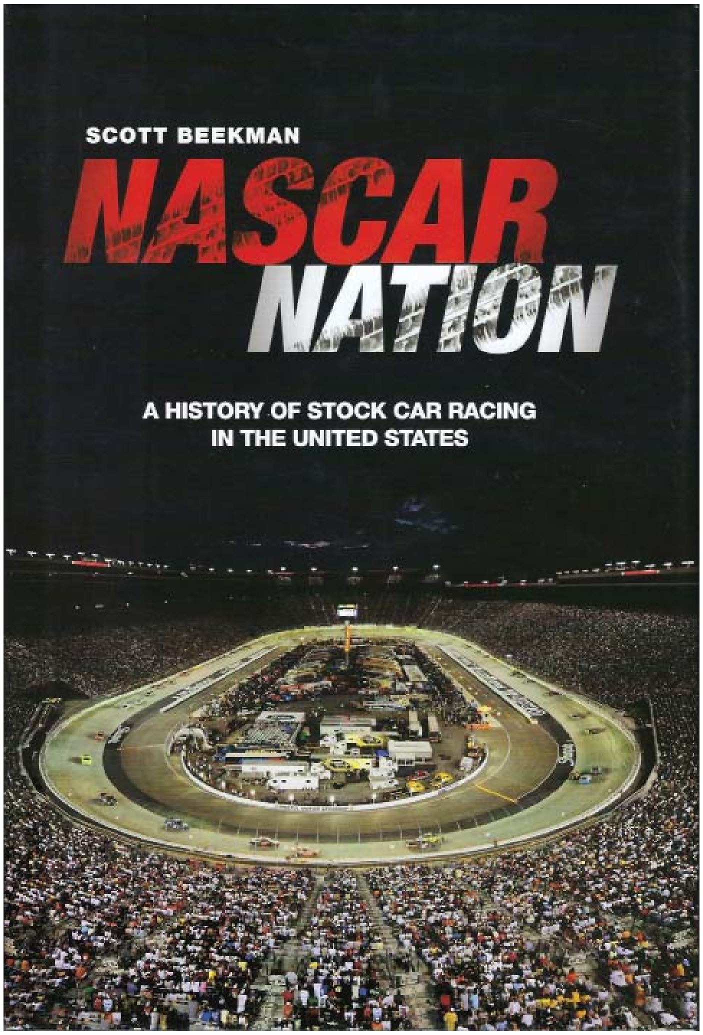
In "Before NASCAR," Hall covers the automobile racing that took place in the South during the early decades of the 20th Century. This racing took place at such venues as the sands of Ormond and Daytona Beaches in Florida, Denver Beach in Galveston, the motordrome in Atlanta, and the Vanderbilt Cup and Grand Prize races at Savannah. He also points out that from 1924 to 1927, there was a planked board track conducting national-level racing in Pineville, North Carolina, which is just on the outskirts of Charlotte. There was also the Baltimore-Washington Speedway, another board track, that was in operation from 1925-1926 in Laurel, Maryland. What Hall clearly establishes in "Before NASCAR" is that, contrary to popular belief and perception, there was automobile racing in the South several decades prior to the formation of NASCAR.

In "Carnival of Speed," Hall covers Southern automobile racing during the two decades straddling World War II. Prior to World War II, there were automobile races in such places as Wilson, Raleigh, Shelby, Winston-Salem, Greensboro, and Charlotte in North Carolina, Spartanburg and Columbia in South Carolina, Richmond, Virginia, Tampa, Florida, Atlanta, Georgia, as well as venues in West Virginia, Oklahoma, Dallas and San Antonio in Texas, Louisiana, Mississippi, and Tennessee. That fact often comes as a surprise to even the most fervent stock car racing fan. While most of these events involved open-cockpit type racing cars, stock cars also competed.

The promoters of these races, such as Ralph Hankinson and Sam Nunis, operated both before and after WWII, with dozens of events being held in the South each season. Hall devotes attention to Bill France and his activities as both racer driver and race promoter before and after WWII. In doing so, he provides a more-rounded, nuanced interpretation of not only the birth of NASCAR, but the origins of stock car racing, one far more complete and researched than anything else in the field, making "Carnival of Speed," along with "Before NASCAR," keystones in this historiography.

NASCAR Nation: A History of Stock Car Racing in the United States[60], by Scott Beekman, a professor at the University Rio Grande, is a compact (only 172 pages), readable, and excellent history of American stock car racing. Although it is aimed at a general audience, it is well-researched, which is readily apparent not only in the notes, but the interpretations he offers. After providing a review of the development of sport in general in the South, Beekman covers much of the same ground as Hall in his coverage of the origins and development of automobile racing in the South. He does challenge the mythology of bootleggers creating stock car racing. The author also provides a steadied, nuanced discussion of their role in the sport, furthering the ideas of Wright in this instance. Although his coverage of the formation of NASCAR by Bill France does not provide any new interpretations, it is a very thorough and well-written history.

Dan Pierce, a professor at the University of North Carolina-Asheville, provides a valuable addition to the historiography with *Real NASCAR: White Lightning, Red Clay, and Big Bill France,*[61]suggesting that the involvement

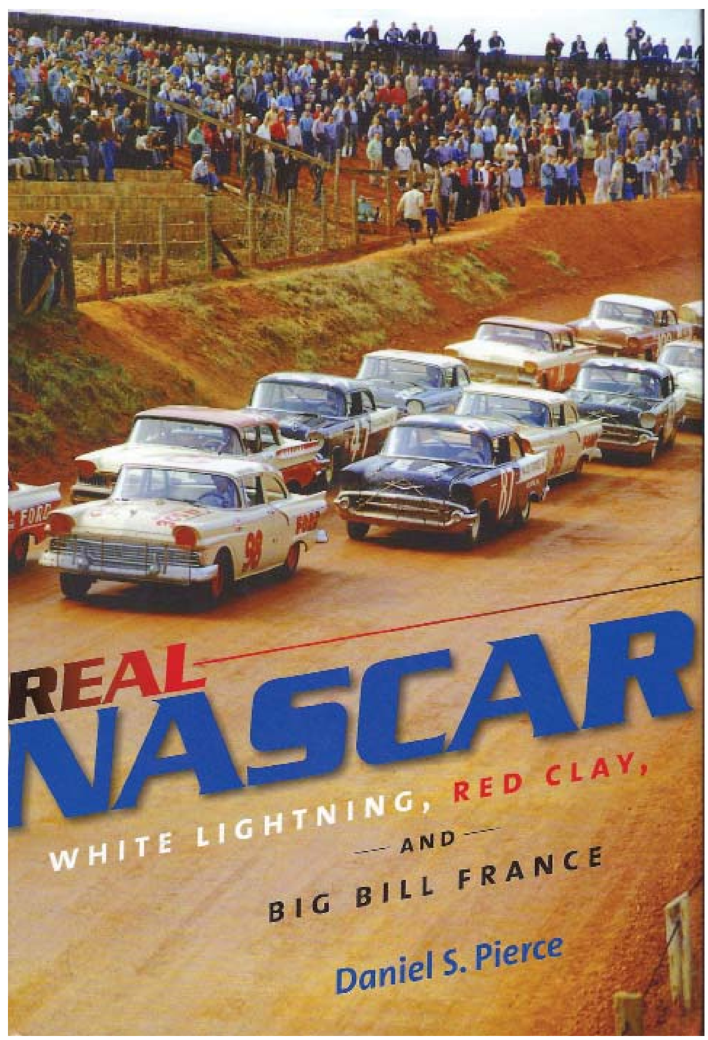


of moonshine in the sport was not necessarily restricted to the bootleggers participating as drivers, but as a means to finance the sport. As Pierce notes regarding his research into the relationship of stock car racing and bootlegging, he, "discovered that, if anything, NASCAR's connection to the manufacturing, transportation, and sale of illegal alcohol has been both underestimated and misunderstood."[62] One aspect Pierce discusses is his look at the "bootlegger tracks," such as North Wilkesboro and Martinsville.[63]

Pierce demolishes the oft-told "creation tale"[64] of Tim Flock.[65] He states that, "Flock's 'racing in cow pastures' story is either untrue or greatly exaggerated."[66] An examination of archival materials and other resources by Pierce failed to find any suggestion that there was a racetrack in the Stockbridge area at the time or any other collaboration to establish that this may have happened. This is one aspect of Pierce's suggestion that the role and the mythology of the bootleggers in the creation of stock car racing needs to be re-interpreted.

Using Bill France as the means to explore the development of Southern stock car racing, Pierce provides what is perhaps the first, in-depth interpretation of France and the creation of NASCAR, which, Pierce makes clear, is separate from that of stock car racing. This work by Pierce, as is that of Hall, plays a fundamental role in the development of an historiography of stock car racing.

With professional historians finally turning their attention to stock car racing and NAS-



CAR, there have been significant changes in how the history of the sport is now presented and interpreted. From Howell to Wright to Daniel to Hall to Beekman and, finally, Pierce, there is now a solid foundation for future historians to begin to investigate various themes and, in turn, develop new interpretations to further develop this historiography.

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Demystifying the Fork-Tailed Devil

The Origins of 1950s Tailfins

by Elton G. McGoun

The Mythology

A considerable amount of historical writing is filled with mythology that is based upon explanation without sound and thoroughly researched evidence. Consequently, the story is recycled from one generation to the next. Indeed, the tale takes on a life of its own, ingrained within a cultural context and never questioned. Such is the case of the history of the P-38 and its influence in the design of the tailfin-happy cars of the later 1950s. This study seeks to unpack a familiar interpretation that proliferates the automotive history literature. Furthermore, while automobiles and aircraft developed within the same timeframe and have had synergistic influences upon each other, little has been examined on this topic beyond work in the history of aerodynamics and aircraft engine developments. The connection is obvious, but what are its complexities and how have those complexities obfuscated historical storytelling?

The automobiles of the 1950s are icons of the decade's distinctive aesthetic, none more so than the legendary 1959 Cadillac, a sea of pastel sheet metal accentuated with expanses of chrome and crowned by towering fins. The latter's supposed origins have achieved mythical status, as cogently described in William Knoedelseder's *Fins: Harley Earl, the Rise of General Motors, and the Glory Days of Detroit*:

> In the spring of 1941, Harley [Earl] heard through the GM grapevine that one of the P-38 test planes was being housed at Selfridge Field, an army air base thirty miles north of Detroit. So he pulled some strings, possibly with [William S.] Knudsen, and took several of his top designers, including Frank Hershey and Bill Mitchell, on a field trip to check it out, thinking the plane's supposedly radical design might provide some styling inspiration for the staff. Frank Hershey was particularly taken with the plane's twin tail rudders. He thought about them all during the drive back to the city and immediately began sketching them on his drawing board at the studio. "I fell in love with those tail fins," he told Harley's granddaughter fifty years later."[1]

Whatever Hershey remembered, the role of the P-38 Lightning, also known as "The Fork-Tailed Devil," in the automotive history of the 1950s has been vastly overstated. It is a stunning aircraft that is as attractive today as it was when it first appeared. However, its first public appearance had occurred over two years earlier, and with the exception of the twin booms, its design elements that were applicable to automobiles had appeared on several other aircraft. Earl didn't tell this tale until thirteen years later in 1954 when there was an apparent demand for an origins story, and the memories of actual events likely adapted themselves to satisfy this need. As endearing—and enduring—a legend as Harley Earl, Bill Mitchell, and Frank Hershey's 1941 visit to Selfridge Field is, the P-38 might have assisted in the development of the aesthetic of the 1950s, but it certainly cannot be given full credit for achieving that accomplishment.

The Selfridge Field trip is a familiar story with a long history, but not one without a fair amount of imaginative variation and embellishment. Differing at times in minor detail, it has been prominently featured in coffee-table books as well as in the more serious histories. All of these versions are second-hand. At differing degrees of fine details, they stem from accounts of the visit provided by those involved, sometimes referenced inac-

1959 Cadillac Coupe de Ville (Wikimedia Commons)

Lockheed P-38 Lightning (USAAC) (Wikimedia Commons) curately and sometimes not at all. The original story first appeared in the August 7, 1954 issue of the *Saturday Evening Post* in an article with the byline "Harley J. Earl, as told to Arthur W. Baum."

> This might be a good time to confess, too, that I have been deeply affected by airplanes. I was so excited by the P-38 Lockheed Lightning when I first saw it that I contrived a viewing for members of my staff. We had to stand thirty feet away from it because it was still in security, but even at that distance we could soak up the lines of its twin booms and twin tails. That viewing, after the war ended, blossomed out in the Cadillac fishtail fenders which subsequently spread through our cars and over much of the industry as well. The so-called fishtail descendant of the P-38 on the Cadillac started slowly because it was a fairly sharp departure. But it caught on widely after that because ultimately Cadillac owners realized that it gave them an extra receipt for their money in the form of a visible prestige marking for an expensive car. A further point about the fishtail was that it helped give some graceful bulk to the automobile, and I have felt for a long time that Americans like a good-sized automobile as long as it is nicely proportioned and has a dynamic, go-ahead look.[2]

Over twenty years later, in 1975, Richard Langworth incorporated interviews with Bill Mitchell and Frank Hershey in an article "Of Fins and V-8's." By that time, almost thirty-five years had elapsed since the Selfridge Field visit.

> During this time in 1941, Earl took his team to view the still secret fighter. "We had to stand thirty feet away," Mitchell continues, "because it was still in security. We all admired the P-38's streamlining and individuality in design, with its twin fuselages and twin tail fins. For several hours we absorbed all details of the Lightning's lines. Every facet of the twin tails and booms stretching out behind the engine enclosure was recorded mentally. After returning to the studios, Mr. Earl immediately put the designers to work adopting the ideas to automobiles. Small models of automobiles embodying the P-38's characteristics were made in all the studios.[3]
>
> Frank Hershey set to work with Ned Nickles, who he recalls "was just starting out and making original drawings under my supervision . . . We made a series of models and sketches including the Lockheed's fins and slash."[4] Hershey's duties also included advanced styling, and he remembers two running prototypes that had been tested before the war shut things down. "They were fastbacks with short sloping hoods and no running boards, and *their styling used many ideas from the P-38 including the tail fin*. We tested them at the proving grounds and they were excellent roadwise, but too far out for production. In December came Pearl Harbor, and all automotive design was permanently shelved for the duration.[5]

The italicized phrase in the quotation suggests there was more to the reputed P-38 influence than just the tail fin, which is reiterated elsewhere in the article. But to Langworth's credit, he questions the centrality of the P-38 in the design process—skepticism which has been lost as the tale (of the tail) has been retold. Langworth went on to say:

> Persistent picayune palavers disclose a few items that can be set down as fact. It is true, for example, that the 1948 Cadillac was inspired by the Lockheed P-38 Lightning fighter aircraft. It is true, as endlessly repeated, that GM's legendary styling chief Harley Earl became so entranced with the lines of the P-38 that he arranged to hype up his designers by showing it to them. And it is true that the prototype was named "Interceptor" with the aircraft in mind. But the Lightning wasn't the only design factor involved; there were others, some going back to the mid-Thirties.[6]

One might regard Langworth's article as expanding upon what had received only a brief mention in a book published three years earlier by *Automobile Quarterly*, Maurice D. Hendry's *Cadillac—Standard of the World*. Indeed, the story appeared not in the body of the text but in the caption to photos of the post-visit models, not all of which sported tail fins.[7] Hendry's description stated:

> Julio Andrade (above), assistant to Harley Earl, stands among Cadillac prototypes for 1948 restyling, inspired by the Lockheed P-38 fighter of World War II. Many features of the airplane were considered in addition to tail fins: pontoon

> fenders, bullet-like noses, cockpit-shaped greenhouse designs. But the tail fins were in the end the only major P-38 influence on what became, on the 1948 Cadillacs, one of the remarkable postwar automotive designs.[8]

In the course of his own interview with Bill Mitchell, C. Edson Armi, in his 1988 *The Art of American Car Design*, confesses his own belief (with which Mitchell agreed) that the pre-war influence of the P-38 has been overrated and the post-war Cadillac design was really quite different. Armi asserted that:

> Everyone always talks about Earl taking the group to the Lockheed studio[9] in '41 and showing them the P-38, and that that is the origin of the tail fin. But I have always felt—and this has really confirmed it—that the sleek look only came along at the end of the war.[10]

In short, the conventional story is indeed the sort of tale Frank Hershey would want to be able to tell Harley Earl's granddaughter about the birth of a design legend for which he and her grandfather (and Bill Mitchell) were responsible. It is also the sort of anecdote regarding serendipitous circumstances that subsequently had momentous consequences that enlivens any history. There is no doubt that Harley Earl, Bill Mitchell, and Frank Hershey visited Selfridge Field in 1941 (not "in the late 1930s," "sometime during World War II," "shortly before the end of the war," or "in 1947" as variously related) to see a P-38, which might have been—but probably was not—an early model. If so, this would have been the thirteenth YP-38 (development aircraft) delivered to the Army in June, 1941.[11] However, does that encounter deserve to be lauded as responsible for what has become the look of a decade, as numerous authors have claimed, or was it not such a momentous occasion, as is the view of Langworth and Armi?

Scoping Out the Role of Forked-Tail Devil in the Tailfin Story

Familiar details of the story deserve a closer look; in truth, the issue of a "closer look" itself deserves further scrutiny. The P-38 had a wingspan of 52 feet, length of 37 feet 10 inches, and height of 9 feet. Therefore, the 30-foot distance at which Harley Earl and his designers were positioned would have given them an excellent view of the aircraft's lines, which was their main—and likely *only*—interest. There might have been propulsion and control surface details that the United States Army Air Corps (USAAC) would not have wanted to expose, but it is more likely that the distance restriction was normal military procedure, as was the requirement to obtain special permission to enter the airbase. These have been routine precautions to ensure the security of all warplanes at all times at all bases. If the plane had been truly secret, no one would have been given "several hours" to "absorb all the details" as Bill Mitchell reported.

The P-38 in 1941 was anything but secret; it might have been exposed to the public as early as 1938, the moment the first one exited the building in which it was assembled. There do not appear to have been special measures taken to hide the original experimental XP-38. Author Jerry Scutts described the scene as:

> At the roll-out ceremony [at the Lockheed facility in Burbank, California] the 'hand-built' XP-38 looked extremely sleek, dramatically futuristic and huge for a fighter, dwarfing every other 'pursuit' type then in inventory. . . . Having announced its new baby to the world, Lockheed disassembled 37-157 and loaded it on to three trucks. Shrouded by canvas covers, the aircraft was driven to March Field, where it arrived in the early hours of New Year's Day, 1939. By 9 January it was reassembled and ready for its first flight, and Ben Kelsey prepared for an historic take-off.[12]

However, another description of the event by Steve Pace suggests that secrecy was an important consideration.

> After midnight on New Year's Eve, 1 January 1939, after most of the parties were over, the disassembled airplane was secretly hauled by truck from Lockheed's experimental shop in Burbank, California, to March Army Air Field (AAF)—now March Air Force Base (AFB)—at Riverside, California. Escorted by Army soldiers and a number of Lockheed plant security guards, the one-of-a-kind airplane arrived safely in early morning.[13]

The "roll-out ceremony" might have been a private affair, and the "announcement to the world" might be hyperbole. And the well-guarded convoy of shrouded parts over the New Year's holiday might certainly have been intended to maximize secrecy. On the other hand, there would simply have been less traffic over the New Year's holiday to impede the progress of the convoy, the canvas shrouds would have protected the valuable parts from contamination by wind-blown debris, and the soldiers and security guards would have been a precaution to do whatever was necessary to deal with any threats of traffic accidents.

Once at March Field, the first flight took place on January 27, 1939, after which there was very limited flight testing. Then as soon as early February, the XP-38 was scheduled to fly to Wright Field outside Dayton, Ohio, for more comprehensive USAAC testing. There had been several photographs taken of the P-38 outside the Burbank shop and on the tarmac at March Field, photographs which are now readily available in archives and publications but might or might not have been accessible to the public at the time.

Regardless, by the time of what became a cross-country flight, secrecy was clearly not an issue. As cavalier as the publicity policy might sound, the U.S. was not at war in early 1939, and there were no indications that any declaration of war was imminent, as Scutts hints:

> The possibility of flying on to Mitchel Field, New York, had previously been put forward, and in discussion with Gen. Henry H. 'Hap' Arnold this was decided upon [after touchdown at Wright Field]. The Air Corps chief thought that a complete transcontinental dash by the XP-38 would make some great headlines and show the world that the U.S. aviation industry had successfully weathered years of isolationist neglect.[14]

And in the words of the pilot Ben Kelsey:

> General Arnold concurred in the estimate that the delivery flight to Wright Field operated at cruise power would approximate the flight speed of the then existing coast-to-coast record of Howard H. Hughes. Being interested in having a demonstration that American planes were not behind European ones and in using this to take off some of the political heat in Washington, he approved a continuation beyond Dayton to Mitchel Field in New York if the flight to Dayton indicated the possibility of approaching the Hughes' record. Arnold gave the final approval.[15]

In a photo caption, Warren Bodie removes all doubt regarding public disclosure of the P-38 in the course of the February 1939 flight. "Exposed to the Dayton (Ohio) newspaper reporters for the first time at Wright Field during the refueling stop . . ."[16]

Clearly, for well over two years before the legendary visit to Selfridge Field, anyone with any interest in aircraft would have seen photographs of the P-38 and was familiar with the essentials of its design. Other now-familiar early photographs were of the P-38's unfortunate crash landing at Mitchel Field that ended the cross-country flight, which photos of course would not have displayed the plane to its best advantage. It is difficult to believe that such photos were not seen by Harley Earl and his design staff. In fact, Earl clearly stated in 1954 that he had seen the plane before the visit. "I was so excited by the P-38 Lockheed Lightning when I first saw it that I contrived a viewing for members of my staff."[17] Why, then, did the visit come about if everyone involved already knew what the aircraft looked like? The simplest answer is that the P-38 was and still is a stunning plane, and everyone interested in aircraft would, even for no special reason, seize the opportunity to see one in person. No matter how many photographs of something one has seen, they can never be as informative or as influential as a personal encounter.

In this case, however, Earl might have had an ulterior motive. Langworth speculated that "he arranged to hype up his designers by showing it to them."[18] It would have taken quite some time to make the drawings—and especially to construct the model—that the P-38 is reputed to have subsequently inspired, and according to Bill Mitchell, the designers leapt immediately to these tasks. "After returning to the studios, Mr. Earl immediately put the designers to work adopting the ideas to automobiles. Small models of automobiles embodying the P-38's characteristics were made in all the studios.[19] This leads one to suspect that there hadn't been that much important work going on in the studios that couldn't be dropped, and the visit was arranged by Earl to light a fire under the staff.

Regarding the specific timing of the visit, it is unclear how Knoedelseder learned that "[i]n the *spring* of 1941, Harley [Earl] heard through the GM grapevine that one of the P-38 test planes was being housed at Selfridge Field."[20] All other sources, including the principles in the event, are no more specific than locating the event sometime in 1941 (or perhaps even later). In 1941 Selfridge Field had hosted the first operational unit to receive P-38s—an occasion which would likely have been common knowledge within the community and had probably been highly publicized—and this would have been the perfect stimulus for the visit. "The Lockheed Lightning entered service with the USAAF (the USAAC became the USAAF on 20 June 1941) in the summer of 1941, when the 1st Pursuit Group (PG) (Fighter) partly re-equipped with P-38-LOs at Selfridge Field in Michigan."[21] As previously mentioned, the thirteenth YP-38 development aircraft (which could have been called a "test" aircraft) was delivered in June, 1941. It is possible that it was included in this deployment, but unlikely. More likely is that Earl and his designers viewed a P-38D-LO. Robert Pęczkowski has a photo captioned "P38Ds assigned to 1st Pursuit Group photographed during war games in the fall of 1941."[22] And Bodie has another photo captioned "Brand spanking new P-38D was seen at March Field in August-September 1941, en route to Selfridge Field via El Paso and St. Louis."[23] Twenty-nine of the initial order of 66 P-38s were P-38-LOs, and the remainder were P-38D-LOs.

There was indeed a flurry of activity in the General Motors studio after the visit, and one can expect that the resulting drawings and models were taken down from the shelf after the war to play a role in the design of the 1948 Cadillac. Although history has attributed considerable significance to the visit, this cannot be taken for granted. It is safe to conclude that Harley Earl (and likely all his designers) had already seen photos of the P-38 and been especially impressed with it. It is also safe to conclude that Earl had some inkling of what it was about the plane that he imagined might be applied to an automobile. Was this his signal that he wanted features of the P-38 specifically to inform new automobile designs or that he intended his designers to employ more aircraft references in general? In short, was there anything unique about the P-38 that inspired the 1948 Cadillac or was it a matter of timing? Would any of a number of other planes had that same effect if seen during that field trip in 1941?

Bringing It Down to Earth

Although Harley Earl emphasized "the lines of its twin booms and twin tails,"[24] Armi asserts that Earl "impressed upon his men the significance of the bulky pontoon shape," and Mitchell was quoted as saying "You have to understand the value of what we saw in that plane's design. We saw that you could take one line and continue it from the cowl all the way back to the tip of the tail—that you could have one unbroken, flowing line."[25] Was the 1941 P-38 so original that it displayed these elements for the first time or did some—or all—of them stem from earlier aircraft?

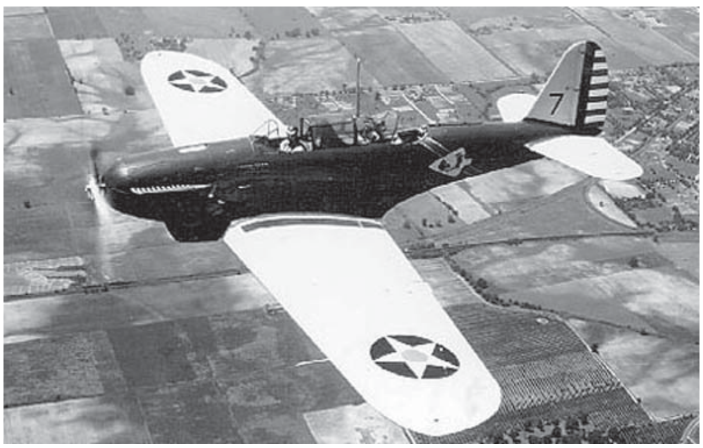
The Wright brothers' first powered flight took place in 1903, and their biplane configuration was the norm for aircraft until the early 1930s. While aircraft might always have been emblematic of speed and their large radial engines emblematic of power—the image of which attributes automobile manufacturers wanted their products to have—the biplane and radial engine aesthetics did not lend themselves especially well to adaptation for earthbound automobiles. Not until monocoque monoplanes with linear engines appeared was it to automobiles' advantage—or even possible for automobiles—to employ aircraft styling. Among the U.S. Army Air Corps (USAAC) fighters (or pursuit planes as they were known at the time) which reached mass production, the first monoplane was the Boeing P-26 "Peashooter", which made its inaugural flight in 1932. However, it was driven by a Pratt & Whitney R-1340-27 9-cylinder radial engine and had fixed landing gear and bracing wires. The Consolidated P-30, a monoplane with retractable landing gear powered by a Curtiss V-1570-61 12-cylinder linear engine, underwent test flights in 1934 and was the first production American fighter aircraft that had a clean, modern look. According to Robert Dorr and David Donald:

> On 6 December 1934, the Army placed a firm contract for a production batch of 50 P-30As and made plans for the 1st Pursuit Group at Selfridge Field, Michigan, to operate the type. . . . They became a familiar sight in war games at USAAC aerodromes during the 1930s.[26]

The attractive P-30 would therefore have been in a position impossible for Detroit's automobile designers to miss.

What these aircraft had in common with all others

Boeing P-26 "Peashooter" (Wikimedia Commons)



Consolidated P-30 (Wikimedia Commons)

produced since WWI was a single fuselage ending in a T-tail. While the central aerodynamically-efficient fuselage could be attractively adapted for an automobile, neither the front propeller nor the T-tail could have been applied in any way to an automobile without the result being somewhat eccentric. However, this may well be an anachronistic assessment. In today's eyes it would have been eccentric to have a bold circular centerpiece in the front end of an automobile and a tall fin in the center of its rear, but it could have been acceptable if done at the right time by the right company as subsequent concept cars attempted.

Lockheed's P-38 Lightning was a clever twin-engine innovation powered by two Allison V-1710-111/113G30 12-cylinder linear engines. It was created by a design team of which the soon-to-be legendary Clarence L. (Kelly) Johnson was a member. Functionally, it enabled the installation of center-line machine guns that did not have to be synchronized with a propeller. And from an aesthetic standpoint, both its front and rear had automobile design potential. Realistically, a P-38 was the equivalent of two P-30s joined together at the wing, a configuration which eventually appeared near the end of the war in 1945 when two P-51 Mustang fuselages were conjoined to create the F-82 Twin Mustang. However, the P-38 had a pilot pod between the fuselages, which the F-82 lacked.

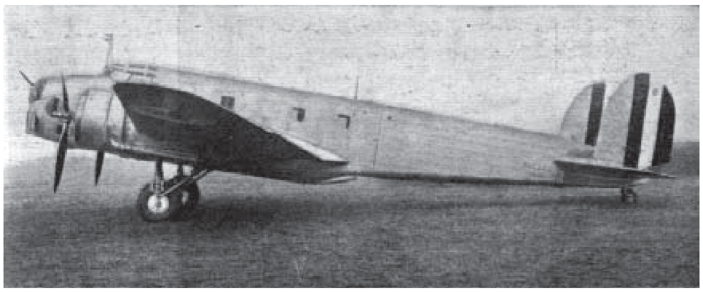
Contrary to Mitchell and Hershey's assertions, then, the only innovative feature of the P-38 was its twin booms, each of which was equipped with its own tail. This was Earl's claim in his 1954 article. One could therefore more easily imagine it on a highway with four wheels. The question, of course, is why the combined artistic talents of Harley Earl and his designers could not have seen a similar adaptation of the P-30 in their minds' eyes or the same thing from the P-38 photographs. Recall that they could have seen—and likely did see—the widely-disseminated P-38 photographs at some time during the over two years preceding their Selfridge Field field trip.

Oddly, a number of bombers had appeared before the P-38 which shared its most desirable design features. Although they only had a single fuselage, they had twin engines and a center cockpit and an H-tail with twin vertical rudders. Harley Earl and his designers might be forgiven for being unaware of the German Dornier Do-17 (first flight on November 23, 1934 and entered service in 1937), of the Italian Fiat BR 20 (first flight on February 10, 1936 and entered service in 1936), and even of the British Handley Page Harrow (first flight on October 10, 1936 and entered service in 1937). It is difficult, however, to imagine them not being familiar with the roughly contemporary four-engine American Consolidated Vultee B-24 Liberator (first flight on December 29, 1939 and entered service in 1941) or the twin-engine American North American B-25-Mitchell (first flight August 19, 1940 and entered service in 1941) which might well have been equally inspiring.[27] Of course, bombers do not have the romantic aura that surrounds fighters, and none came to be called the "Lightning" or have such an evocative nickname as "the fork-tailed devil." Neither appellation had U.S. origins—the first being supplied by the British and the second by the Germans.

Birth of a Legend

There is indeed a link between the P-38 and the "Fabulous Fins of the Fifties." However, the line of descent is not so straightforward as the legend would


Dornier Do 17Z (Wikimedia Commons)


Fiat BR 20 (Wikimedia Commons)


Handley Page Harrow (Wikimedia Commons)

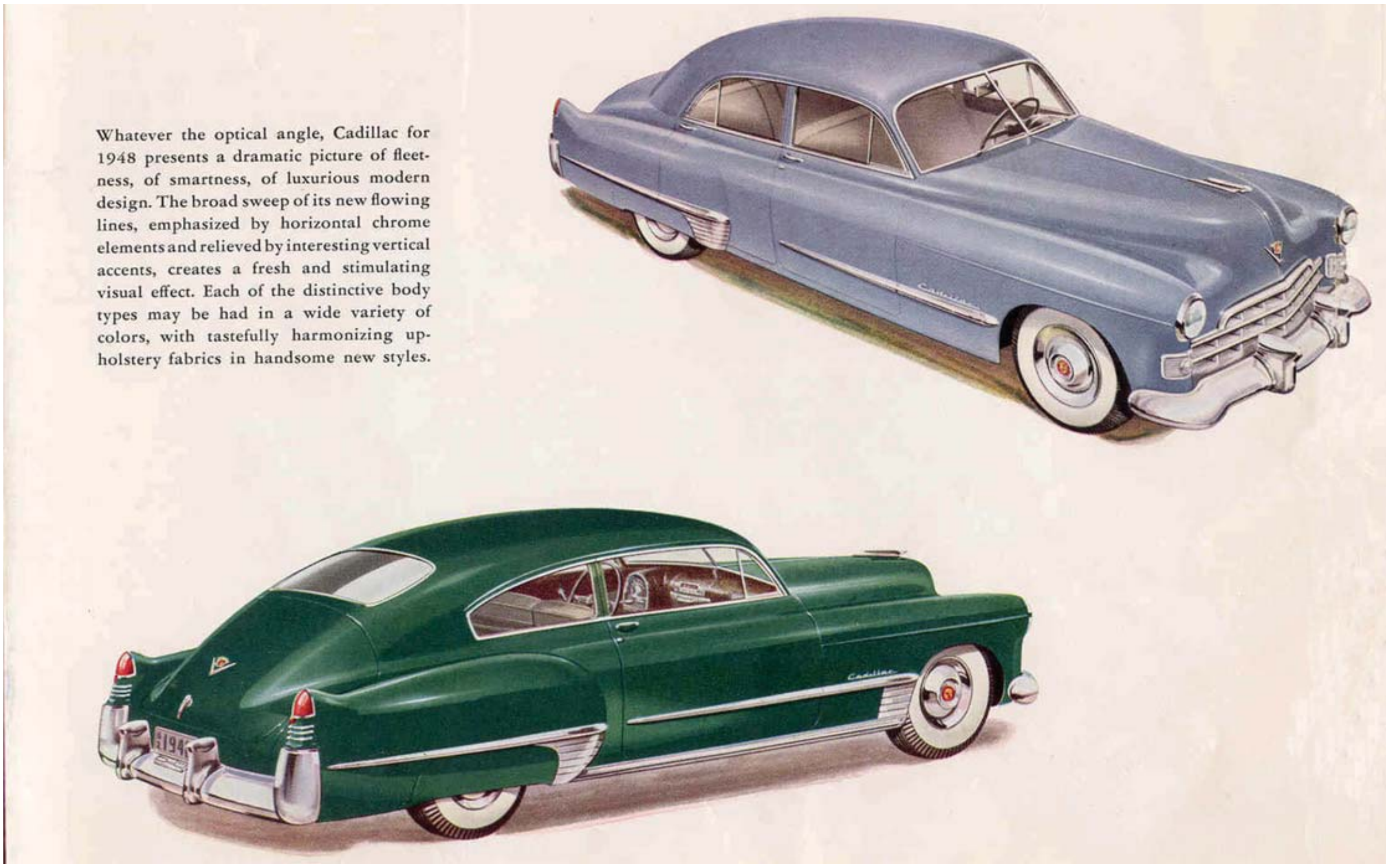
have it. In the late 1930s and early 1940s, Harley Earl and his designers were certainly aware of the revolution in aircraft design. Biplanes had disappeared in favor of monoplanes, linear engines had begun to appear challenging radials, and the combination created a new aerodynamic style, elements of which could certainly be employed on automobiles to signal the image of their sharing the power and speed of aircraft. The P-38 was an especially striking example of the emerging aesthetic, and when one of the first operational units deployed at Selfridge Field, it was an excellent opportunity for the General Motors designers to get an in-person look at what they had only seen in photographs. After the field trip, a number of concepts were modeled, but to attribute the features of those models solely to the P-38 and not to the other aircraft that had preceded it and were accompanying it as well is too grand a claim. Recall that Langworth explicitly concluded: "But the Lightning wasn't the only design factor involved; there were others, some going back to the mid-Thirties."[28] As the familiar statistical principle has it, correlation is not causation.

A more subtle issue, however, is whether the 1948 Cadillac had "fins" in the same sense that aircraft had "tails." The earliest published account of the P-38 legend is the previously-quoted one by Harley Earl in 1954 in the *Saturday Evening Post*, by which time the dramatic fins for which the fifties are known had not yet appeared on production vehicles but were on the drawing board and on well-known concept cars such as the General Motors Le Sabre and Firebird I.

But what was the contemporary view? In the *Saturday Evening Post* article, Earl refers to the 1948 Cadillac fins as the "so-called fishtail descendent of the P-38 on the Cadillac." His use of the word "so-called" suggests that he did not use the term "fishtail" himself; rather, it was applied later by others. Then in the article, Earl explains that a "further point about the fishtail was that it helped give some graceful bulk to the automobile." Prior to the 1948 Cadillac, one would have had great difficulty identifying an American automobile from the rear, and Earl and his designers would have been well aware that it was unexploited territory for styling distinction. Even without the inspiration of aircraft, building the rear fenders upward would have been an obvious alternative for making the rear of an automobile bulkier and bolder. Langworth argued that:

> Bill Mitchell . . . reminds us that the tail was at first "merely a humped-up taillight really, it wasn't a fin at all." More important than fin or hump, from GM's standpoint at least, was that the '48 Cadillac brought product identity to the rear of the automobile. Group any random sample of prewar cars together and cover their front ends, and you realize just how significant this was. Mitchell remembers that when the humped taillight became a fin and "was still debatable," GM chairman Al Sloan remarked to general manager Jack Gordon, "Jack, now you have a Cadillac in the rear as well as in the front."[29]

Although this quotation makes it sound as if a

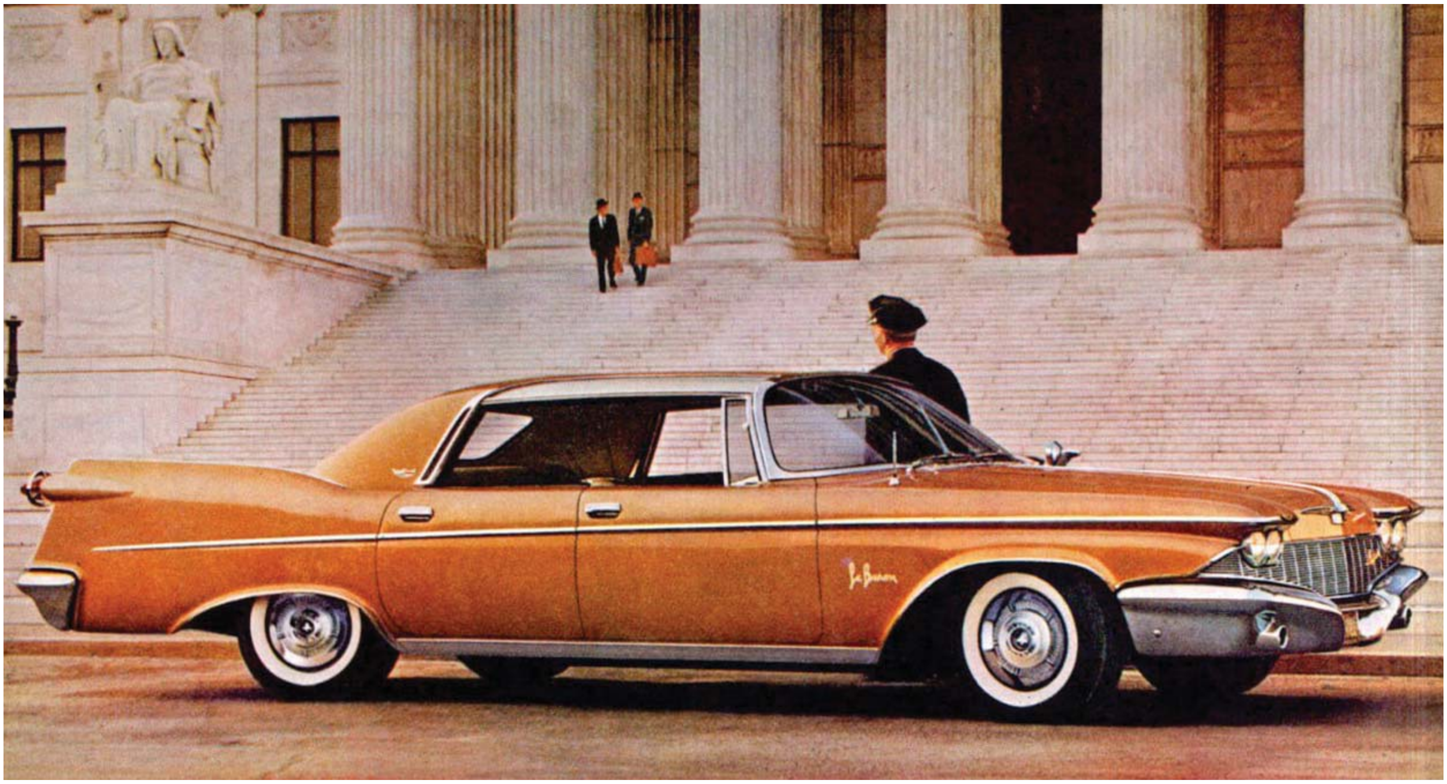


1948 Cadillac Sales Brochure featuring the rear of the car. (OldCarBrochures.com)

Classic Cadillac on Route 66, Staunton, Illinois, 2009. (Highsmith Collection, Library of Congress)

1951 Le Sabre (Wikimedia Commons)

1954 Firebird I (Wikimedia Commons)



1960 Imperial Le Baron four-door Southhampton. (Chrysler Corp.)

"hump" became a "fin" during the development process, that is not a foregone conclusion. Thirty years after the event, Frank Hershey was using the word "fin" to describe further details of that somewhat controversial process, but of course by that time the legend of the P-38 and the 1948 Cadillac was ubiquitous, and no one would have used any word other than "fin" in its telling. Langworth retold the story:

> Hershey recalls that the uplifted taillight idea was for a time touch and go. "One day Harley came running in all excited. I remember he said to 'take that goddam fin off, nobody wants it.' I covered the fin with a big sheet, and he came in a week later with [then general manager] Nick Dreystadt and again told me to take it off and threatened to fire me if I didn't."[30]

If Hershey's memory can be trusted, Earl's "goddam fin" became a "fishtail" to him eight years later.

We do, however, know that the word "fins" was indeed being used—and the aircraft connection being made—contemporaneously. The April, 1948 issue of *Popular Science* magazine had drawings of front and side views of the Cadillac accompanied by a short paragraph with the title "Power in Sleek Package."

> New note in the 1948 Cadillac is the distinctive rear fender that immediately catches the eye in the Series 50 five-passenger sedan shown above. Taking a leaf from aircraft design, the rear fenders are projected to form vertical fins [my emphasis]. Directional lights have been fitted into the trailing edge. Front view, at left emphasizes the car's traditional road-hugging lowness and massive width. The Cadillac 150-hp. V-8 engine continues to power all new models.[31]

Although it is not possible to be certain, this has the sound of a press release issued by the company, which suggests that the word "fins" and the aircraft connection were being communicated by Cadillac in their promotions. However, neither the imagery nor the text in the print advertisements for the 1948 Cadillac addresses the rear styling or its aircraft origins explicitly or implicitly.

Clearly, how and why the "fishtails" or "humped-up taillights" of the 1948 Cadillac became "fins" deserves further research. But what is certain is that the role of the P-38 Lightning, a.k.a. "The Fork-Tailed Devil," in their origin has been vastly overstated. It is a stunning aircraft in its own right that is as attractive today as it was in 1938 when it first appeared. But as endearing—and enduring—a legend as Harley Earl, Bill Mitchell, and Frank Hershey's 1941 visit to Selfridge Field is, the P-38 might have assisted in the development of the aesthetic of the 1950s, but it certainly cannot be given full credit for achieving that feat.

Endnotes

1. William Knoedelseder *Fins: Harley Earl, the Rise of General Motors, and the Glory Days of Detroit*, (New York: HarperCollins Publishers Inc., 2018), 177.

2. Harley J. Earl (as told to Arthur W. Baum), "I Dream Automobiles," *Saturday Evening Post*, (August 7, 1954), 82.

3. Richard M. Langworth, "Of Fins and V-8's," *Automobile Quarterly*, 13.3 (1975), 311.

4. It is unclear what feature of the P-38 the term "slash" refers to.

5. Langworth, 312. (*italics added*)

6. *Ibid.*, 310-11.

7. No other sources consulted for this paper had these photos.

8. Maurice D.Hendry, *Cadillac—Standard of the World: The Complete History*, fourth edition update by David Holls, (Kutztown, Pennsylvania: Automobile Quarterly Publications, 1990), 284.

9. It is very unusual that Armi—without being corrected by Mitchell—should have referred to the trip to the airfield as a trip to a "studio".

10. C. Edson Armi, *The Art of American Car Design: The Profession and Personalities*, (University Park, Pennsylvania: The Pennsylvania State University Press, 1988), 214-15.

11. Jerry Scutts, *Lockheed P-38 Lightening*, (Ramsbury, Wiltshire: The Crowood Press, 2006).

12. *Ibid.*, 13.

13. Steve Pace,, *Lockheed P-38 Lightning*, (Osceola, Wisconsin: Motorbooks International Publishers & Wholesalers, 1996), 17.

14. Scutts, 15.

15. Quoted in Pace, 17.

16. Warren B. Bodie, *The Lockheed P-39 Lightning,* (Hiawassee, Georgia: Widewing Publications, 1991), 34.

17. Harley J. Earl (as told to Arthur W. Baum), "I Dream Automobiles," *Saturday Evening Post*, (August 7, 1954), 82.

18. Langworth, 311.

19. *Ibid.*

20. Knoedelseder, 177. (*italics added*)

21. Scutts, 35.

22. Robert Pęczkowski, *Lockheed P-38 Lightning: Early Versions*, (Sandomierz: MMP Books, 2017), 14.

23. Bodie, 65.

24. Earl, "I Dream Automobiles," 82.

25. *Lightning Strikes*, a publication of the P-38 National Association (2007), 9.

26. Robert F. Dorr and David Donald, *Fighters of the United States Air Force: From World War I Pursuits to the F-117*, (London: Temple Press/Aerospace, 1990), 57.

27. Jon Lake, *The Great Book of Bombers: The World's Most Important Bombers from World War I to the Present Day*, (St. Paul, Minnesota: MBI Publishing Company, 2002).

28. *Ibid.*, 311.

29. *Ibid.*, 310.

30. *Ibid.*, 312.

31. "Power in Sleek Package," *Popular Science*, (April, 1948), 125.

Texas Automobiles, Assembly Plants, and Fraudsters: 1900-1950

by Wayne Moore

In 1900, there were approximately 3,000 cars produced by auto manufacturers in the United States. Fifteen years later, the United States produced some 800,000. By 1950, more than 6.5 million were manufactured. In the broadest context, "The number of active automobile manufacturers dropped from 253 in 1908 to only 44 in 1929, with about 80 percent of the industry's output accounted for by Ford, General Motors, and Chrysler. Most of the remaining independents were wiped out in the Great Depression, with Nash, Hudson, Studebaker, and Packard hanging on only to collapse in the post-World War II years."[1] By 1950, there were fewer than 20 automobile manufacturers. When we think about the history of automobiles and automobile manufacturing in the United States, most of us think of the mid-west states, especially Michigan, Ohio, and Indiana, as the manufacturing centers. However, between 1900 and 1950, Texas had its share of distinctive car companies and upstart would-be manufacturers as well as major automobile assembly plants. What follows is their story.

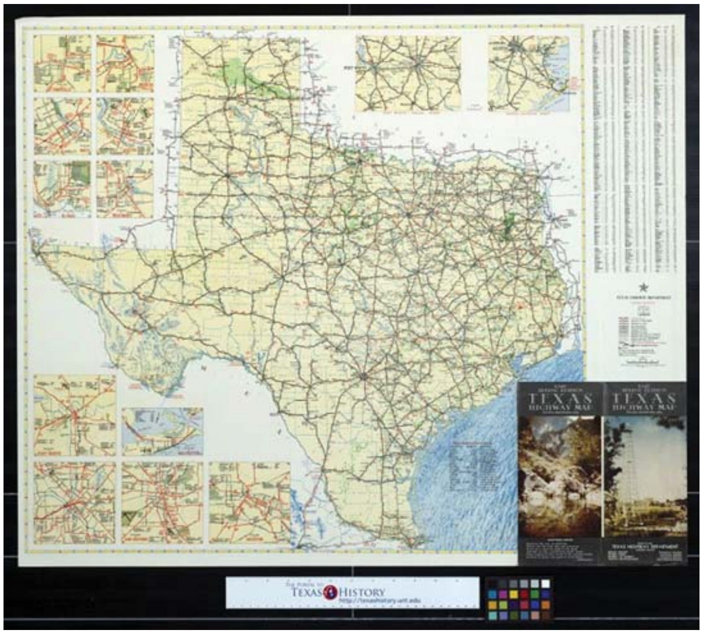
In the 1940s and 1950s, a popular radio and television program starred the Lone Ranger, a Texan. Each program began with the stirring music of the William Tell Overture and the narrator's hyperbolic words "From out of the past come the thundering hoof beats of the great horse Silver!" When I read some of the automobile journals in the early 1900s, I hear some of the same hyperbole. For example, the announcement of one of the first Texas automobile manufacturing companies falls into that category: "From out of the Southwest come two new claimants for honors in the modern priced class and to judge from their specifications there is little doubt but that they will succeed in carrying them off. To be more definite, they are the Dixie and the Dixie flyer, and they hail from Houston, Texas, where the Southern Automobile Company is a pioneer firm in this line."[2]

The cars the writer seems excited about were not that special, however. They were the Dixie—a touring car—and the Dixie Flyer—a roadster. Each had a wheelbase of 102 inches. Each had a four-cylinder four-cycle 28/30 horsepower engine equipped with a Schebler carburetor. Ignition was supplied by a six-volt system, and a 60-ampere hour battery was included. Two forward gears were all that were needed since the torque of the engine was good for speeds from four to 50 mph in high gear. An advertisement described, "Two sets of brakes centered on drums on the rear wheels are fitted being of the internal expanding and external contracting type. … A 15-gallon fuel tank is fitted. Both types list at $1500, with tools and oil lamps. Gas lamps and speedometer are $150 extra."[3]

The Dixie Flyer was a participant in an early endurance contest that turned out to be in reality a "race" in Houston in January 1908. Described as

> A most successful run it promised to be but several accidents, one in which one of the cars collided with a streetcar resulted in a fatality, and resulted in the run being officially called off by the officials. All of the cars with exception of three finished with perfect scores, however, and the best time of the day was made by the American roadster driven by EA Sontag who covered the distance of five miles on the straightaway shell road between Cypress and Houston at the rate of 70 mph. The endurance test was not to be a race but local rivalry between car owners and dealers made the run decidedly interesting from a speed standpoint.[4]

One of the finishers was a Dixie Flyer with a perfect score driven by a Mr. Ayres for the Southern Motor

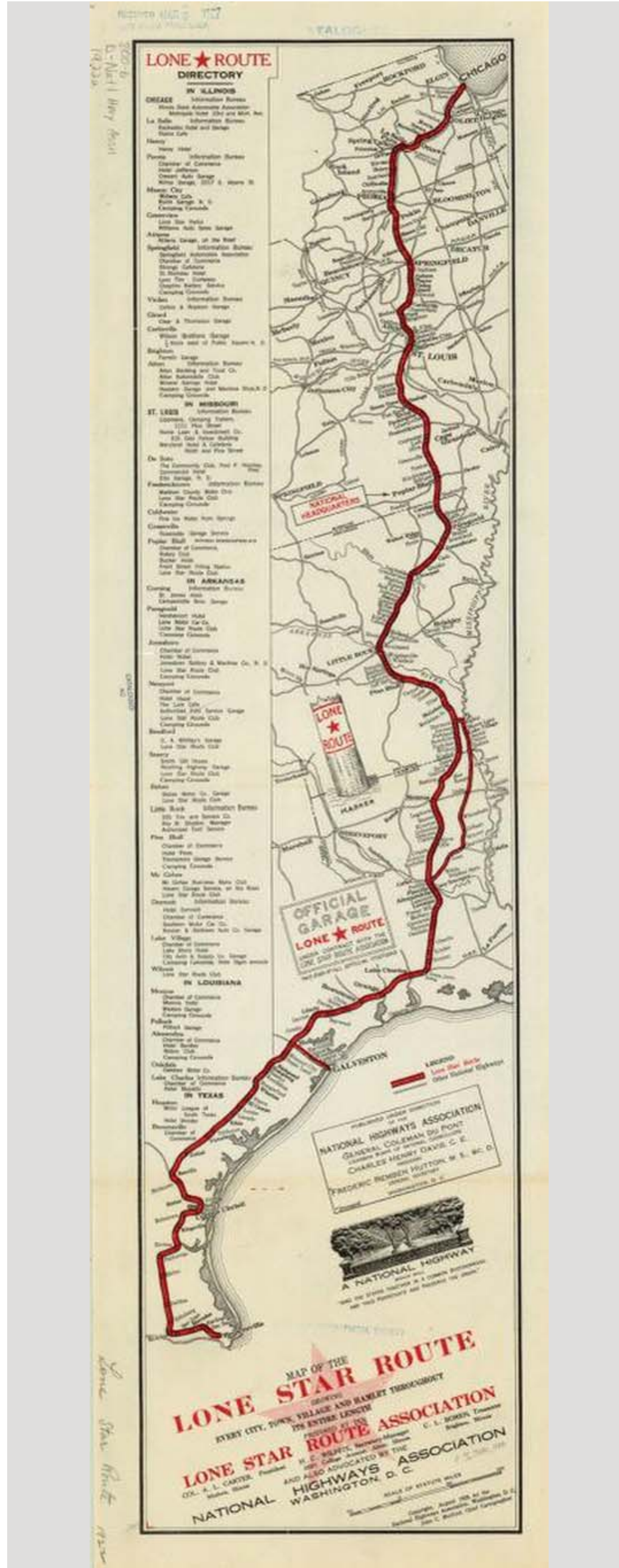


Texas Highway Map, 1940. Between 1922 and 1940, a complex network of highways was constructed to serve a growing number of automobiles. (University of Texas at Arlington Library)

Company. Three things stand out concerning this event. First, that an average speed of 70 miles per hour was achieved; second, that there was only a brief mention that they called off the event because of the person killed in the accident; and third, that a Dixie Flyer finished with a perfect score. That perfect score, however, did little to ensure the success of the Dixie automobiles. The company folded after only two years.

Another of the early attempts to establish an automobile manufacturing company in Texas, the Cleburne Motor Car Manufacturing Company, began in an unlikely place and with an unlikely man. Pastor Eugene Luck of the First Christian Church in Cleburne, Texas, was mechanically talented. He designed and built his own car about 1909. It had a 20-horsepower two-cylinder engine, chain drive, and a planetary transmission. He named the car "Chaparral" after the fleet-footed roadrunners common in Texas.[5] By 1911 many folks admired his creation and several in town got together to create a company to manufacture Chaparrals. Stock was sold, the company created, and the first car left the manufacturing building in late September 1911. By the end of that year the company had completed nine cars. And a year later,

> the Cleburne Motor Car Manufacturing company, had been chartered with a capital stock of $10,000. The incorporators were listed as Luck, G.A. Mc-



Map of the Lone Star Route, issued by the National Highway Association, 1922.This was just a proposed route. (Library of Congress)

> Clung, O.L. Bishop and others. Elected officers were Luck as president; R.H. Crank, secretary; E.N. Brown, first vice-president and F.L. Deal, second vice-president. [6]

In addition to the Chaparral, the company built a vehicle known as the Luck Utility and another called the Luck Truck.

> Rev. Luck and his partners certainly had the right idea in entering the automobile manufacturing business when they did. As an El Paso newspaper had noted in the spring of 1910, in 1908 there had been 55,000 automobiles valued at $83 million manufactured in the U.S. Output for 1910 was estimated at 200,000 vehicles valued at $250 million.[7]

The April 12, 1912 issue of *The Carriage Monthly* has a contemporary account of the company's early cars.

> The Cleburne car company Cleburne TX has begun turning out cars…. The first car appeared on Christmas day and was given a severe trying over Texas country roads. The cars are of the utility type—two and four passenger and all convertible and by change of bodies to light delivery or package service. The motor is a four-cylinder water cooled engine with selective transmission and shaft drive. Solid tires of liberal size are used.[8]

By 1917, however, even with an apparently favorable market, the Chaparral could not compete with the mass produced $400 cars of Ford and Chevrolet. On May 17, 1917, a certificate of dissolution was filed by the company, and pastor Luck's "vision of financial success for his product had disappeared faster than a roadrunner chasing a lizard."[8] Ironically, the Chaparral lives on at Six Flags of Texas as an amusement ride—three-quarter size replicas travel a one-third mile miniature highway.[9]

While Luck's Chaparral was being built in Cleburne, another effort to establish an automobile manufacturer in Texas was being made about 80 miles to the southwest in the tiny town of Comanche. C. Clarence Holden had invented the Holden Three Wheeler. It was produced by the Holden Three Wheeler Company. The September 11, 1915, issue of *Automobile Topics* carries the headline "Three-Wheeler Seen in Dallas." The staggered design was described as "startling" because it looks like a regular four-wheeled car with the right front wheel missing. There are other unusual features as well. "The right rear wheel is not exactly aligned with the left rear wheel and runs idle."[10]

The description in *Automobile Topics* continues by relating the wheel layout being much like a motorcycle with a sidecar, but two wheels are inline on one side and a third wheel is in between on the other side. It appears an asymmetrical layout. However, the patent drawings[10] show the two rear wheels in alignment. The left rear wheel is driven by a chain drive. Other advantages of the setup are described, and it was noted that "the inventor is endeavoring to interest Texas capital in his project, to place the machine on the market at a very low price."[11]

However, the inventor apparently failed to garner the necessary funds to go into production, as there seem to be no additional references to this unusual design being produced. Comanche was not to become an automotive manufacturing center.

The Holden Three Wheeler was not technically a cycle car since its wheels were more like those of a full-size car.[12] During the period between 1910 and 1916, cycle cars were produced all over the country. Texas was no exception. One cycle car company was established in Waco in 1914, The Hall Cycle Car Manufacturing Company. The car had four cylinders, four wheels, eighteen horsepower, seated two persons in tandem, and was called the Hall Cycle Car.[13]

According to *The Old Motor*, the company was incorporated with $25,000, and Hall hoped to sell them for $400.[14] The cycle car era was brief, lasting from about 1910 through 1916. Production of the Hall Cycle car and the company ended in 1915.

The "Wichita" was another brief foray into cycle car manufacturing by the Wichita Motor Car Company, Wichita Falls, Texas. It had a 102-inch wheelbase, a Spacke V-twin engine, and claimed a top speed of 55.[15] The "entire front axle pivoted for steering."[16] Only a few were built between 1920 and 1921. The short lives of the cycle car manufacturers were a result of the dropping costs of regular cars by Ford and Chevrolet.

Comanche, Wichita Falls, and Waco were not the only towns with dreams that never fully materialized. The Bridges Motor & Rubber Company purchased 200 acres in Fort Worth, Texas in 1918. *The Hub* reported in "Vehicle Industry News in Brief" that the intention was to build "an automobile manufacturing plant. Clarence W. Bridges is President and general manager."[17] In the May 2, 1918, issue of *Motor Age*, another reference noted that contracts for several buildings had been awarded. [18] By June 15, 1918, *Automobile Topics* was reporting that folks in Fort Worth have ambitions "to become another automobile metropolis" and are encouraged by the Bridges Motor Car & Rubber Company's president, who "departed early in the month for industrial centers in the East, to secure materials and machinery to build the company's proposed plant, which is to be the 'largest south of Detroit.' Both cars and motor trucks … are in design and sample models, equipped with Bridges tires, are promised for public inspection at an early date."[19] Additional searches for information regarding the "Bridges" motor car turn up only continued references to the proposed company. No additional evidence of the company or of an actual car being manufactured was found.

Fort Worth boosters did not give up however. In *Cars: 1895-1965,* Lou Phillips lists the "McGill" as a six-cylinder 210.5 cubic inch touring car costing $2,385 in 1922. It is noted that the McGill was an "assembled car" produced by the McGill Motor Car Company of Fort Worth, Texas.[20] James McGill was active in promotion of the car and his "name appears as a member of the motor car dealers association in the planning for the fall 1922 Los Angeles auto show that was to present the 1923 year models."[21] Even though the McGill was America's first four-wheel drive, it was only a prototype. [22] Sadly, for Fort Worthians, and despite James McGill's attempts at promotion, the McGill company only lasted one year. No production cars were offered to the public.[23]

In 1917, just a few years before the Fort Worth attempts, a second auto manufacturing company had also sprung up near Cleburne just south of Fort Worth. The Texas Motor Car Association was established by two brothers, James C. and Will H. Vernor. They planned to produce the "Texan," a luxury car and an oil field truck. The city of Fort Worth was so enthusiastic about the possibility of the company that they made plans for a streetcar line to run to the plant.

But the company's life was brief. By 1922 the company had ceased production, hurt by a factory fire, the post-World War I flu epidemic, drought, and competition from cars such as the Ford Model T. Only about two thousand Texan cars and one thousand Texan trucks were built. The car sold for one thousand dollars, had a thirty-five-horsepower engine, thirty-three-inch tires, a wooden dashboard, and a rumble seat. The Texan automobile … was designed specifically for Texas roads and weather. The oversized tires, powerful four-cylinder engine, and extra-wide roof for shade gave it special features for the Texas market.[24]

A Texan is on display in the building that once was the factory but is now owned by Martin Sprocket and Gear Company.[25] The factory at its most productive assembled twenty vehicles per day.[26]

In 1919, a few miles away, another entrepreneur was organizing The Little Motor Kar Company, and the product was called the "Texmobile." William S. Livezey of Maryland organized the company. Offices were established in Wichita Falls and Dallas. Advertised heavily in several Texas newspapers, stocks were sold at first $1, then $2, then $4 per share. Livezey claimed to have raised $100,000, then raised his claim to $1 million, and finally to $3 million. He purchased land in Grand Prairie, Texas, and began construction of one of five planned buildings to produce the Texmobile.[27] The October 26, 1919, *Fort Worth Star Telegram* contained an illustration of the Texmobile "sport car."

The Texmobile "sport car" was to have a 27-horsepower, four-cylinder engine and be built on a 109-inch wheelbase. It was to have wire wheels, two side mounted wheels, and sell for $350. It was first displayed at the State Fair of Texas in Dallas in October 1919. A touring car was also planned and was to be sold for $750.[28] The car was clearly aimed at Texas buyers, and published materials claimed that the Texmobile exhibited "the rugged strength of the pioneers who first settled in this great empire of the great Southwest."[29] Much of the advertising focused on raising funds from the sale of stocks. Hard-sell ads guaranteed huge profits, claiming that the company "showed how a thousand dollars invested in common stock might grow into $100,000 in stock holdings and earn $70,000 in cash dividend in a period of six years."[30] As can be imagined, this kind of return on investment was hardly realistic. Nevertheless, in March 1920, The *Fort Worth Star Telegram* ran a photo of the first automobile to be turned out by the company along with a picture of Livezey. The positive comments in the article proved to be short lived.

In April 1920, the *Dallas Morning News* reported that Livesey and others had been arrested and charged with fraud. They were "Charged with using the United States Mail for fraudulent purposes in connection with the business of the company, and the following officials of the Little Motor Kar Company were placed under arrest by the post office inspectors at 1:00 o'clock this morning: William Livezey, president; McCoy, vice president; George W. Striker, secretary-treasurer; [along with]Herman Striker and J.L. Crow." [31] The trial was held in February 1921, and the prosecutor argued that even though thousands of dollars had been raised from sale of stock, only a few completed cars had been produced. The prosecutor even noted that "no two cars bore any similarity to any others, while some components were made by local blacksmiths."[32]

In addition, a young woman testified before a packed Dallas courtroom that Livezay had come to Aberdeen, Maryland, after becoming connected to the Little Kar Company. She testified also that while there he purchased and gave to her "among other things an Overland sedan, a Stutz roadster [about $447,400 in 2020 dollars], two squirrel coats, one of them 'Siberian squirrel' costing $560 [about $7,400 in 2020 dollars]; many pieces of jewelry, among them being diamond rings set in platinum, a jeweled watch, a saddle horse, a platinum cluster diamond pin, cash and checks totaling $400, a typewriter, and much silk underfinery."[33] That was quite a haul for the young woman, but it proved to be a major part of the prosecutor's case. On February 26, 1921, Livezay was found guilty of using the mails to defraud investors regarding the Little Kar Company. He was sentenced to five years in Leavenworth. Thus ended the short life of the Little Kar Company and the Texmobile.

The interest in the automobile as a business was not limited to the northeast Texas towns like Dallas, Fort Worth, Cleburne, and Wichita Falls. Southeast Texas was also interested. The Ranger automobile was a creation of the Southern Motors Manufacturing Association of Houston. It was announced to the public in September 1920. A 343,000 square foot plant was obtained, and extravagant brochures were printed extolling the capabilities of the factory. A *Motor West* report in April 1921 said that "Good Men Go to Southern Motors" and that the company "recently sent a trainload of automobiles, trucks, trailers, and tractors to Mexico."[34]

The Ranger's advertising was upscale. The description in the brochure pictured uses an excerpt from a poem by Kipling and then goes on to say

> The Ranger Pal O'Mine was built for youth—the heart that is young forever. Frankly made for the lover of the open, with an eye to snap; its daring beauty and fleetness suggested in every line is an esthetic delight, and behind that rakish windshield the feel of this car's velvety, giant power awakens a genuine thrill.[35]

The technical descriptions were also impressive. The Ranger A-20 consisted of two body styles—an open tourer and a roadster. Both models were powered by a four-cylinder engine built in-house. The engine produced 31 horsepower and was claimed to be designed especially for the hot Texas climate. The car had a 116-inch (294-cm) wheelbase. The Ranger featured a black chassis and mudguards, and a choice of two colors for the body—'Ranger Maroon,' or 'Blevins Blue,' named after the company president, Jacques E Blevins …. The tourer was priced at $1,850, while the roadster was priced at $1,595. A top speed of 50 mph was claimed. In a further bid to highlight the virtues of the Ranger, Southern Motors claimed that prototypes had been subjected to a 35,000-mile road test. In 1921, a larger model on a 123-inch wheelbase and powered by a six-cylinder engine developing fifty-seven horsepower was announced in the middle of 1921. This car was priced at $3,550.[36]

In 1922, the company went into receivership and merged with the National Motor Car Corporation.[37] Only a few prototypes of the smaller car were ever produced. That could have been the end of the Ranger story, but it wasn't.

In 1924, fourteen people who had been involved in the company were arrested for fraud. They were accused of collecting more than $6,000,000 from the sale of stocks when only a handful of cars had ever been made. The company's president, Jacques E Blevins, was apparently the brains behind this scheme.

In order to give the impression to prospective shareholders that production of the Ranger had commenced, and cars were ready for sale, prosecutors claimed that the handful of completed cars were shuffled back and forth between the company's lavish showrooms in Houston and the factory on Wallisville Road. Shareholders were entertained at both locations, unaware that they were looking at the same cars in both locations. These cars were sold at cost in 1923 when the company was liquidated, and at least one car survives today, an A-20 tourer. The irony of the demise of the Ranger was that according to all reports it was a well-engineered and assembled car, which may have succeeded on its own merits.[38]

In 1920, the same year the Ranger was announced, The Lone Star Motor Truck and Tractor Association in San Antonio also tried to get into the automobile business. Unlike the Ranger company, the Lone Star Motor Truck and Tractor Association actually had cars to sell. They did so by rebadging cars made by Piedmont, a company in Virginia. "From 1917-1923 Piedmont Motor operated in Lynchburg, Virginia. … Parts purchased from top manufacturers arrived by rail and were assembled into a finished product at the facility. Multiple companies then purchased the cars and sold them under their own label. In Texas, the car was known as the Lone Star, in Chicago it was the Bush, and in Europe it was the Alsace."[39] The Association's Lone Star sold for $1,545, which was about three times the cost of Ford's Model T. "Only a dozen Lone Stars are believed to have been built by Piedmont."[40] The end came for the Lone Star car when Piedmont went into bankruptcy in 1922 after having sold only about 3,000 cars, all painted forest green.[41]

Before the establishment of the Lone Star in San Antonio, others in the city were testing the manufacturing of autos, mostly unsuccessfully. The Commercial Motor Car Company, established with $100,000, built the "San Antonio," and "opened and closed its doors in 1910,"[42] apparently never producing a vehicle. Another company, The San Antonio Motor Car Company, is listed in *Automobile Manufacturers Worldwide Registry* in 1915 as producing the "Tex," a 35-horsepower five-passenger touring car.[43] The Tex only lasted one year, and no record of production numbers are available.

It wasn't just bad management or fraud that contributed to the demise of the small Texas companies. Early on, Ford established a presence in Texas, and its product, the Model T, contributed to the failure of many of the small startups. Ford had established a presence in Dallas with a small service center to handle its fast-selling Model T. By 1914 Model T sales prompted Ford to open an assembly plant in Dallas at a downtown location, the intersection of Main and Commerce.

The Model T was designed with a series of standardized parts and an engine case that was essentially one piece. This allowed for simple, standardized assembly anywhere that the parts could be shipped, a much cheaper method than shipping finished automobiles. The 'Ford way,' as described in a company brochure, was to construct assembly plants in strategic trade centers throughout the country. The brochure stated that the assembly plants 'receive standard parts from the manufacturing plants and assemble them into finished cars and trucks.'… The significance of the Ford Factory to Dallas cannot be underestimated. It was the first automobile assembly plant built in the Southwest by any of the major manufacturers, and it was built to supply North Texas, Western Louisiana, and Southern Oklahoma.[44] In 1915 more than 5,000 Model Ts went out the doors of the first Dallas plant.

By 1924, sales growth again required more capacity, and Ford established a new 23-acre plant on East Grande Avenue. The initial main building was 300 by 840 feet.[45] According to the June 1, 1924 *Ford News*, the new Dallas plant would replace and double the capacity of the existing Dallas plant. More than 80 percent of the floor space would benefit from glass roofing "to afford exceptional lighting and ventilation." [46] A separate adjacent building was designed to house a power plant. Steam powered generators provided electrical energy and "the latest type of oil-burning equipment will insure the utmost cleanliness." [47]

During the late 1930s a sticker that said "Made in Texas by Texas Labor" was placed on the rear window of each car leaving the Dallas East Grande plant. It was later changed to "Built in Texas by Texans."[48]

During WWII, more than 100,000 Jeeps and military vehicles were made at the Dallas plant. In 1947, the one-millionth Ford car was made there. By 1970, twenty-three years later, the plant had become obsolete and was closed after having built more than three million cars and trucks. At the time of closing it was producing 1,750 vehicles per week, about two percent of Ford's capacity in 1970.[49]

On a personal note, this plant provided much needed employment for Dallas citizens in the 1930s. My unemployed grandfather lived in a tiny one-bedroom apartment on South Barry with his wife and two children, as well as his cousin and cousin's wife. South Barry backed up to the plant site and was a short walk from the plant entrance. He got a job there in 1932, bought a house on South Barry in sight of the Ford water tower, and walked to work at the plant every day until his retirement in 1963. On the following page is a 1940/41 photo of my mother and dad standing in the front yard of my grandfather's house on South Barry. Just to the left of my dad's right arm, a portion of the Ford plant building brick can be seen. The Ford water tower is directly behind; the FORD script lit up at night.

Just to the rear of the plant was a company that my boyhood friends and I called the "Convoy." My family drove by the convoy lot every time we drove from my grandparents' house to ours. It hauled new Fords all over the country and "was established in 1930 as a subsidiary of Consolidated Truck Lines. Originally based in Portland, Oregon, it focused exclusively on the shipment of automobiles by truck.[50] Each year about May or June we could see the new model Fords parked in the convoy lot, so my friends and I got a preview of the upcoming models before their public release, usually around September each year. It was always an exciting

Author's parents, 1940/1, Dallas Texas, Ford assembly plant water tower in background. (Author)

time; the most exciting for the eleven-year-old me was the first views of the 1955 Ford Crown Victoria.

Not to be outdone by Ford, General Motors saw the need to establish an assembly plant in Texas to meet its growing production needs for the Chevrolet model. In 1916 Chevrolet announced plans for a plant in Fort Worth, having been lured there by the promise of significant tax breaks. The plant opened in April 1917 on a six-acre site. The construction plans included a 150,000 square foot brick and concrete two-story building.[51]

It employed 500 Texans and built 4,700 cars in 1920. "In May 1917, the Chevrolet plant rolled out its first roadster, which was promptly wrecked by Star-Telegram vice president and general manager Amon Carter Sr. (Carter was said to be an avid motorist but a terrible driver)."[52] In1922, the plant was shut down by GM. One of the reasons was that GM had lost some local tax breaks. There were other reasons as well.

GM had other operations in Texas during this same time. In fact, the closure of the Fort Worth facility coincided with the opening of a Chevrolet facility in Dallas. In 1923, General Motors "decided to move its Southwestern Headquarters from Fort Worth to Dallas. Like the Fort Worth plant before it, the Dallas assembly plant was part of a broader General Motors expansion. … Although the sales, service and supply components of Dallas's automotive industry were already well established, the Chevrolet Motor Company Building was only the second automobile assembly plant built in the city."[53] The four-story 110,000 square foot brick building in Dallas was located near the Texas and Pacific Railroad tracks. It was funded and owned by a real estate firm. GM leased it for a ten-year term. Chevrolet operated from the building until 1935.

Although the building was converted to multiple uses over the years and is currently used for residential apartments, its exterior maintains much of it architectural and historical features; the building was added to the National Register of Historical Buildings in 2003.[54] GM assembly plants did not return to Texas until 1954 with the opening of the Arlington, Texas, facility which is still in operation today.

After 1950, even with the closure of the major Ford plant in Dallas, the state continues to be the home of two motor vehicles assembly plants, Toyota in San Antonio, and General Motors in Arlington. With the changes in customer demands, the types of vehicles are no longer the familiar sedans that dominated production before 1950. The GM plant produces approximately 1,200 vehicles per day, mostly full-size SUVs.[55] The Arlington GM plant produced more than 11 million vehicles between 1954 and 2018.[56] The Toyota plant produced approximately 260,000 vehicles in 2018, all pickups.[57] But even with these impressive production numbers, the current activity doesn't match the excitement of the first half of the 20th Century. The early period produced fewer cars but managed to create more excitement with its entrepreneurial optimism, experimental vehicles, job creation, and fraudsters.

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Put it in Drive: Hydra-matic Shifting Through History

by Bob Elton

(Parts of this article were previously published in the Michigan History Magazine.)

Move the shift lever to Drive, take your foot off the brake, and drive away. It's a sequence of moves so common today that no one gives it a second thought. But without the ingenuity and perseverance of the team that created the original Hydra-matic, the world's first fully automatic transmission, the freedom of driving might well be limited to those with the strength and mechanical ability to use a manual transmission and a clutch.

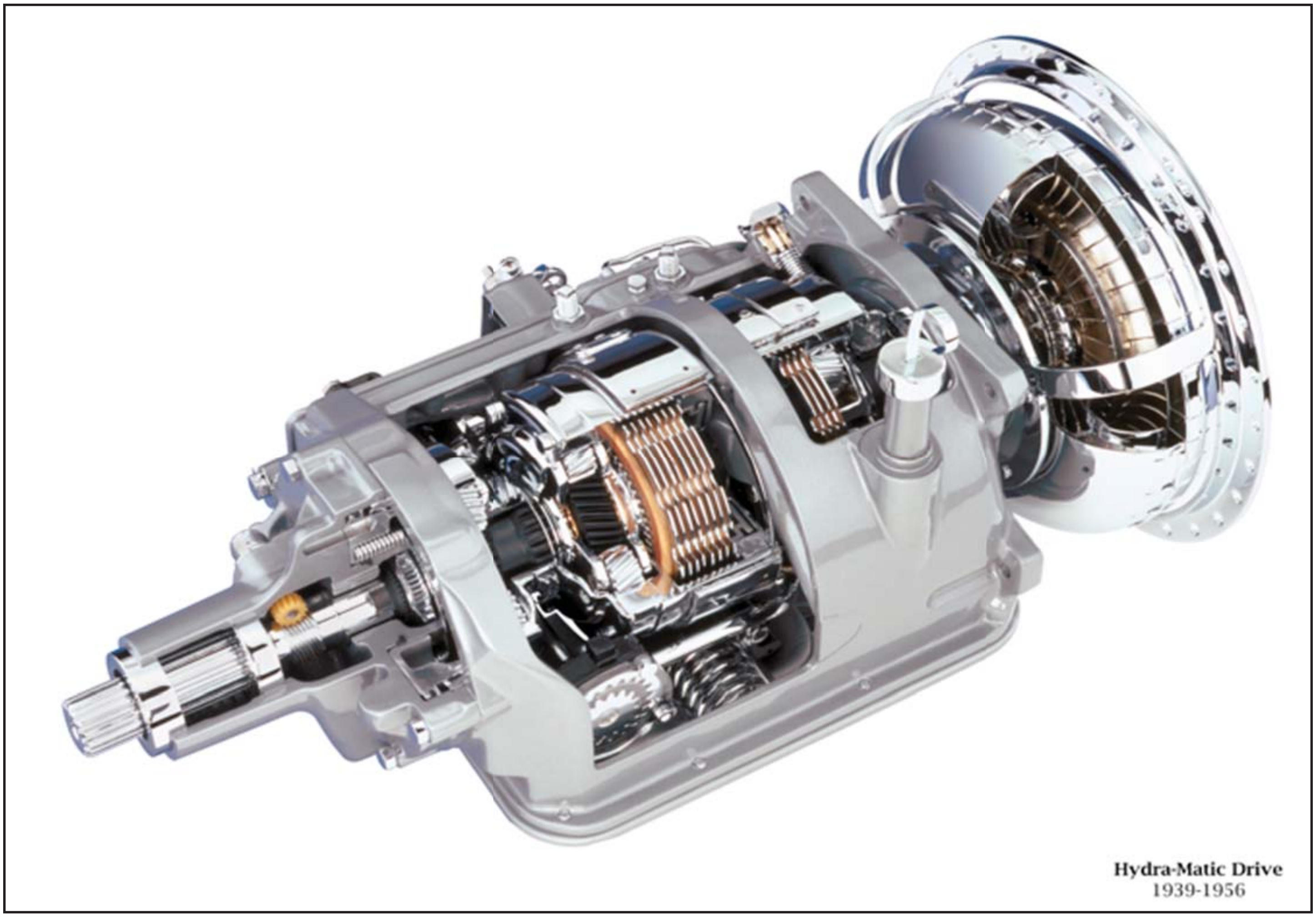
Early gasoline cars had two big disadvantages. The biggest, perhaps, was that it was difficult to start a gasoline engine. It took a lot of upper body strength, and some mechanical aptitude, to crank a gasoline engine to life. That problem was solved when Charles F. Kettering invented the electric starter which Henry Leland put into production on the 1912 Cadillac.

Once the engine was running, it had to be connected to the wheels. Steam engines and electric motors are perfectly happy starting from 0 revolutions per minute. But gasoline engines must run at fairly high speeds to create power, and more importantly, torque. Early engineers created many mechanisms to allow a fast-turning gasoline engine to gradually connect with the wheels. Some early cars used belts that could be loosened or tightened to allow slippage. Various forms of friction drive were tried. Other cars, like the early Cadillac and the first Fords, used a set of planetary gears to provide different ratios, and thus enhance the speed of the car. Bands engaged the planetary gearsets, gradually allowing the engine to move the car from a stop. It took more than a little skill to drive the car without stalling the engine and requiring another arduous cranking session. Because the gears were always engaged, the ratios could be changed by engaging or releasing bands or clutches. Ford used a form of planetary gears on Model T's, where the bands were engaged by foot pedals. Shade tree mechanics quickly learned how to replace Ford transmission bands.

The solution that became the most common was the sliding gear transmission, with a friction clutch. The driver had to slip the clutch just enough to get the car moving in low gear (maximum torque multiplication), yet not slip the clutch excessively and cause it to wear out prematurely. Like the name implies, gear ratios were changed by sliding gears in and out of engagement. The gears were spinning; the gears engaging at equal speeds was a skill that took some learning. Engaging gears that were not at equal speeds caused expensive noises.

Anyone who has driven a car from the teens or twenties knows that this requires skill. Big cars, like a Pierce Arrow or Packard, required a lot of dexterity and muscle input to operate smoothly.

Earl Thompson was a talented and successful young engineer from Oregon. When in college, he had a part-time job as a chauffeur for the college president, driving a Pierce Arrow. This was a difficult car to drive, and shifting gears was perhaps the most challenging task of driving. He decided that it was too demanding to shift gears of the typical automobile transmission and set out to do something about it. He developed a device to synchronize the relative speed of the gears in the gearbox so they could be engaged without clashing, noise and damage. He took his invention to a number of Detroit carmakers in 1922, but none was interested. Cost and complexity, and the fact that customers weren't really complaining, were often cited. So, Thompson installed his synchronizers in a car and drove it to Detroit in 1924. Again, he was met with a total lack of interest, until he was able to demonstrate it to Larry Fisher, head of Cadillac, and Ernest Seaholm, chief engineer. Both were impressed. Fisher bought his patents, and Seaholm



1941-1955 Hydra-matic transmission with planetary gears for reverse. (Ypsilanti Automotive History Museum) (YAHM)

hired him to develop synchro-mesh, as the invention was now called, for Cadillac. It appeared on the 1929 Cadillac, and quickly spread, first to other General Motors cars, and then throughout the industry. All manual transmission cars today use a form of the synchronizers that Thompson invented.

But that wasn't good enough for Earl Thompson. He wanted to completely eliminate the need for the driver to shift. Friction drive transmissions had been tried in the early days of the automobile, with limited success. But Cadillac decided to try again. In 1932, Cadillac took up development work, with a team headed by Thompson. This transmission varied ratios by means of wheels and rollers, pressed between toroidal surfaces. Adjusting the position of the wheels changed the effective ratio. The wheels were driven by the friction between the wheels and the toroidal surfaces. The plan was to use a regular friction clutch, operated by the driver, in conjunction with this transmission. After a great deal of engineering, and expense, the prototype transmission weighed about 300 pounds, or nearly three times the weight of a manual transmission. It cost $500, the cost of a complete Ford sedan. Understandably, perhaps, management killed the project.

Thompson was not dissuaded from the automatic idea. He persuaded Seaholm to give him the funds and a team to pursue the development of a planetary transmission that could be automatically shifted. Ralph Beck and Walter Hendon were the first team members. Beck had been at Cadillac since 1925. His experience with gears, and especially planetary gearsets, led him to design a compact gearset of two planetary gearsets coupled together that yielded four forward speeds.

Herndon was a tool designer at Cadillac. He designed the hydraulic controls and actuation for the early prototypes. Soon William Carnegie and Maurice Rosenberger joined the team. Carnegie had had engine and transmission design responsibilities at Cadillac. Rosenberger had worked in a number of engineering positions at Cadillac and was known for his analytical ability to solve development problems in prototypes.

The team developed a four-speed planetary gearbox that was controlled by hydraulic actuation of bands and clutches. It was a promising start. But, by 1935, Cadillac could no longer afford to fund development. Cadillac sales had plummeted in the Depression, and there was even discussion of closing the division. But the automatic transmission project had the backing of Alfred P. Sloan. Sloan, Chairman of the Board of GM, was a notoriously bad driver. He had repeatedly said that it was important to eliminate the need for shifting so that drivers could concentrate on driving. Rather than lose the project, it was transferred to GM Central Engineering Staff.

Another GM official who shared Thompson's enthusiasm for the automatic transmission was Charles McCuen, the general manager of Oldsmobile Division. As development of the transmission progressed, McCuen became even more convinced that it was worth producing. As a result, Thompson and his team moved to Lansing to work under Oldsmobile's sponsorship.

In 1936, Oliver Kelley joined Thompson's team at Oldsmobile. Kelley had worked with Thompson to develop the production version of the synchromesh transmission. The result of all this work was a semi-automatic transmission, introduced as an option on 1937 Oldsmobiles and Buicks. It was called the Automatic Safety Transmission (AST) and advertised as a safety improvement in that the driver didn't have to work so hard to shift gears when driving.

The driver had to depress the clutch and place the lever in Lo. The driver had to gradually engage the clutch, as in a regular transmission. The car would than start in first gear and automatically shift to second. Then the driver could move the lever, without using the clutch, to Hi. The transmission would than shift to third. As car speed increased, the transmission would shift to fourth. As the car stopped, the clutch had to be depressed to keep the engine from stalling. To reverse the car, the lever was moved to R. A set of sliding gears was engaged, sometimes with a certain amount of clashing and noise, and the clutch pedal released, to reverse the car.

The AST had a few problems. It was soon discovered that drivers could abuse the transmission and burn out some of the internal clutches. The transmission used engine oil for lubricating the internal parts and in the hydraulic control system. Engine oil isn't the ideal lubricant for gears, and the changes in viscosity of engine oil with temperature caused the hydraulic control system to operate erratically. It was also hard to make the clutches and bands work consistently in an engine oil environment. Engine oil also caused sludge and other deposits inside the transmission. Frequent transmission oil changes were recommended, more frequently than engine oil changes. It's not hard to imagine that few transmissions had the oil changed that often.

It was a start, but Thompson wasn't satisfied. It wasn't completely automatic. Oldsmobile did not have the manufacturing capacity to make the transmission, so the job was sent to Buick. Buick wasn't too keen on making transmissions for Oldsmobile and was pressed for space. They had big plans of their own.

GM management resolved the issue by creating a new division, the Detroit Transmission Division. The new division, housed in Detroit in an old Fisher Body plant, on Farnsworth and Riopelle, was responsible for transmission development and manufacturing. Thompson and his team moved back to Detroit. Thompson thought that perhaps a fluid coupling between the gearbox and the engine could eliminate the need for a clutch pedal. Fortunately, Kelley had a background and an affinity for fluid couplings, and their close cousin, the torque convertor.

Fluid couplings were not a new invention. Big ships had used them to connect steam engines, and later steam turbines, to the propellors. They provided speed reduction and shock dampening in the drivetrain. Daimler had used fluid couplings in cars in the 1920s and released a production car with a fluid coupling in 1930. It had a fluid coupling between the engine and a normal clutch and sliding gear transmission. It had the advantage of smoothing out driving at very low speeds, as in parades. The car could be stopped without depressing the clutch as the engine's rotation was taken up as slippage in the coupling. GM had purchased a Daimler in 1930, and Kelley and Thompson were both familiar with its fluid coupling.

In 1939, Chrysler released a similar setup, and called it Fluid Drive. While it eliminated the stalling problems at startup, it still required the driver to use the clutch to shift. Thompson and his team started the development of a transmission that used a fluid coupling, followed by a planetary transmission with four forward speeds. It was called the Hydraulic Automatic transmission, and later shortened to Hydra-matic.

Earl Thompson and his team put together the six elements that were the basis for all automatic transmissions for the next half century, and the majority still in use today.

1. Hydraulic connection between engine and gearbox
2. Multiple planetary gearsets coupled together
3. Hydraulic actuation of clutches and bands
4. A control system that accepted inputs from the driver and the car and determined the correct gear ratio to engage
5. A parking lock to keep the car stationary when parked
6. Special oils to optimize the performance of the transmission components

The Hydra-matic consisted of a fluid coupling driven by the engine. It, in turn, drove a four speed planetary gearbox. An additional set of sliding gears provided reverse. A set of hydraulic control valves, called the brainbox, controlled the actuation of pistons that applied clutches and bands to provide the different gear ratios. The brainbox had three inputs. The shift lever on the steering column had N, neutral; D, drive; L, low; and R, reverse, in that order. The brainbox also accepted an input of the throttle position to tell it, by proxy, how hard the engine was working. The third input was from a hydraulic governor that told the brainbox how fast the car was going. The brainbox was, essentially, an analog hydraulic computer.

(YAHM)

Almost all these elements had been invented by Thompson's team. The hydraulic governor that supplied hydraulic pressure that increased in proportion to the speed of the car was one of its innovations. Its signal worked contrary to the signal from the engine's throttle to decide when the transmission should shift up or down. The rest of the valves in the brainbox sent the appropriate signals to the hydraulic actuators in the transmission. Different combinations of bands and clutches were used for each gear ratio, and the brainbox had to send the proper signals at just the right time for smooth shifts. If the driver needed more power, for example when passing on a two lane road, the brainbox would get that signal when the accelerator pedal was depressed and could order a downshift into the next lower gear for greater acceleration. The governor pressure, balanced against the throttle pressure, was the key to the automatic operation of the transmission.

To reverse, the selector lever had to be moved all the way clockwise. The extra travel was necessary because the lever was moving a set of sliding gears into engagement. If the car wasn't completely stationary, bad noise could be heard from complaining gears. This reminded the driver not to do that again.

Drivers often simply left their car in gear when parked, rather than using the parking brake. The Hydra-matic, with a fluid coupling between the engine and the transmission, did not transmit any torque when the engine wasn't running. Thompson and his team resolved this problem in a novel way. When the engine was turned off, hydraulic pressure bled down. A spring-loaded piston then applied one of the bands used in second gear. If the lever was placed in R, the transmission was effectively locked, keeping the car from rolling away.

Along the way, a special oil was developed for the transmission. It was labeled Oldsmobile Hydra-matic Fluid Specification #1 and packaged in yellow and black cans. It addressed the shortcoming of engine oil in transmissions by lessening viscosity changes with temperature, improving gear lubrication, and increasing compatibility with clutches and bands.

The Hydra-matic was introduced as an option on the 1940 Oldsmobile. For the first time, a driver could simply slip the shift lever into drive, release the brake, and drive away. Oldsmobile advertised it as "the car without a clutch," much as the 1912 Cadillac was advertised as "the car without a crank." Hydra-matic was optional on all Oldsmobile models. It was immediately popular, much more than Oldsmobile had planned. So halfway into the year, Oldsmobile limited the option to 8-cylinder cars. Almost half the buyers of 1940 Oldsmobiles paid extra for a Hydra-matic, and Oldsmobile sales soared. Cadillac offered the Hydra-matic in 1941, and soon almost half the Cadillacs had a Hydra-matic.

The Detroit Transmission Division was greatly expanded to meet the demand and worked around the clock. GM could likely have sold even more transmissions had they had the capacity.

Then World War II ended car production, but not Hydra-matic production.

It was difficult to drive a tank with complicated transmission controls. Manufacturing tanks, and teaching men to drive them, was costly and time consuming. Cadillac created a drive system for light tanks that used two Cadillac V8 engines and Hydra-matic transmissions. This had the advantage of using parts already in production and greatly simplified the operation of the tank. Hydra-matic also built giant size versions for use in large trucks and other heavy vehicles, again allowing more men to quickly learn how to operate them.

Oliver Kelley left the Hydra-matic team just as the transmission was introduced. He went to Buick to work with torque convertors. When Buick started to make tanks, Kelley devised a tank transmission that was simply a giant torque convertor. A fluid coupling cannot multiply torque, but it is very efficient. A torque convertor can multiply torque and allow the use of fewer gear ratios. In Kelley's tank transmission, the giant torque convertor provided enough torque multiplication so that no additional gears were needed. Like the Cadillac tanks, this arrangement greatly simplified the operation of the tank.

In 1946, Hydra-matic again began to supply transmissions. Still unsure of the potential demand for the automatic transmission, they expanded sales to Pontiac, and then other smaller car companies like Hudson, Nash**,** Kaiser, Rolls-Royce and Bentley. They even sold transmissions to Ford for use in Lincolns. The original Hydra-matic, with few modifications, was used through 1955, an amazing run for a breakthrough product.

After the war, Oldsmobile created a special discount program for disabled veterans to purchase cars with Hydra-matics. This allowed a great many veterans to drive despite their injuries. Bob Dole was one of those veterans, and he went on to demonstrate Oldsmobiles to veterans for several years.

Buick was not interested in the Hydra-matic. Hydra-matic had a few faults. The fluid coupling was too efficient when the car was idling in gear, and the driver had to place his foot firmly on the brake to keep the car stationary. The other problem with the Hydra-matic was that the shifts could be harsh, especially the shift from 2^{nd} to 3^{rd}. For that shift, one band and one clutch had to be disengaged, and another band and another cutch had to be engaged. Timing this shift with the hydraulic analog computer was difficult.

Kelley developed an alternative transmission for Buick, the Dynaflow. Introduced in 1948, it was, basically, a large, complex torque convertor. In normal driving, the car did not have to shift. The convertor supplied all the torque multiplication required. With no shifting, the power flow was seamless. The drawback to the torque convertor was that it wasn't as efficient as the Hydra-matic fluid coupling. Buicks with Dynaflow had excellent performance, but, it was said, they could pass anything on the road except a gas station.

Until 1950 General Motors produced 100% of the automatic transmissions in the world. Hydra-matic people were not unaware of the drawbacks of the Hydra-matic. In 1956 they introduced a revised transmission that greatly improved the 2-3 shift. It was called the dual coupling transmission, so named because it had two fluid couplings. The second coupling was added inside the gearbox. When the transmission got ready to shift from second to third, the small fluid coupling was emptied, the shift made, and the coupling refilled. This made for a leisurely, but smooth shift. The dual coupling transmission was used through 1964.

But all was not happy in "Hydra-matic-land." Other companies, namely Studebaker, Chevrolet, and Borg Warner, had developed lighter, simpler, and cheaper transmissions. Typically, they used a greatly simplified torque convertor coupled to a two or three speed planetary gearbox.

In 1961, Hydra-matic released the 240 and 375 model transmissions. These were three-speed transmissions, with a torque convertor. The torque convertor was very small, resembling the fluid couplings used in earlier transmissions. It had a multiplication ratio of only about 1.2, compared to a ratio of 2.5 to 3.3 in other transmissions. There were some innovative features. It was the first transmission to use phased pinions to reduce noise. The pinions in the planetary gearsets were arranged so that the noise of one pinion was canceled by the noise of another. The result was a much quieter geartrain. Both transmissions used an aluminum case, which made them weight-competitive with other simpler transmissions. The internal gears, clutches and bands were very similar to those in the larger Hydra-matic transmissions, which made this transmission more complex and expensive than some of the competitive transmissions. The 375 was used in Oldsmobiles and Pontiacs. The 240 was smaller, and used in the Oldsmobile F-85, and in smaller cars in Europe. Both were criticized for their lack of performance and responsiveness.

By the early 1960s, it was becoming obvious to GM management that they had too many transmissions, and most of them were no longer really competitive. There were now three Hydra-matics, two Dynaflows, two Powerglides and a Turboglide from Chevrolet, and TempestTorque from Pontiac. The decision was made to merge the transmission teams of Buick and Hydra-matic. Buick knew everything there was to know about torque convertors, and Hydra-matic had state of the art gears, clutches, bands, and hydraulic controls. Consequently, Buick people were moved to the Hydra-matic facility in Willow Run. They began work on the Turbo Hydra-matic 400.

The THM 400 was superficially similar to the Chrysler Torqueflite. It had a torque convertor, attached to a three-speed planetary gearbox, and used a Simpson gearset. This is an arrangement of planetary gears that use a common sun gear for two sets of planets. But the THM 400 was much more refined in many ways. The torque convertor reflected the Buick Dynaflow experience. While other transmissions used a convertor with a one-piece stator, or reaction member, mounted on an overrunning clutch, some versions of the THM used a stator with vanes whose pitch could be varied. This allowed greater torque multiplication under hard acceleration, and at rest. The greater inefficiency in this mode greatly reduced creep. The moment the accelerator pedal was touched, the stator vanes switched to the higher efficiency position.

While the Simpson gearset was shared with the Chrysler Torqueflite and the earlier Studebaker automatic transmission, the THM used four pinions, rather than the customary three. The even number of pinions in each gearset allowed a complete cancelation of gear noise. Hydra-matic's internal standard for gear noise, when I started there in 1965, was zero. No noise, under any conditions, a standard that clearly was not met by any other transmission at that time.

The THM 400 was the first transmission that never "let go" during a shift. That is, there was never a moment during a 1-2 or 2-3 shift when the engine was disconnected from the wheels. This was accomplished by mounting elements of the gearsets to overrunning clutches. There were clutches that locked the overrunning clutches when the gear was selected or required. When the selector was set in D, a clutch held part of a gearset to an overrunning clutch, to provide the low gear ratio. As vehicle speed increased, a clutch locked another overrunning clutch to engage second gear. Because the clutch for first gear was mounted on an overrunning clutch, it was allowed to simply spin. It did not have to be released. Similarly for the 2-3 shift. There was never a period when the gears weren't engaged. Overruning clutches had been used for the 1-2 shift on the Chrysler Torqueflite and the early Studebaker automatic transmission, but only for the 1-2 shift. The THM 400 was also unique in that it used clutches for all the normal shifts. Clutches were easier to calibrate than bands, as used by Chrysler, and could provide better and more consistent shift qualities. Bands were used when the selector was placed in second or first for engine braking.

The THM 400 had a much more sophisticated shift pattern than other transmissions of the time. When coasting to a stop, most transmissions shifted from third gear directly to first, skipping second. The use of clutches on all the forward gears allowed the THM 400 to shift through all the gears on coast down. This made the transmission much more responsive should the driver decide to accelerate before stopping completely.

Another THM 400 innovation was the use of a vacuum modulator. Earlier cars used a mechanical linkage, or a cable, to connect the accelerator pedal to the transmission. This told the hydraulic computer in the transmission how hard the engine was working. It required adjustment to maintain the correct calibration, and relied on the engine being in tune and working efficiently. The THM 400 eliminated this linkage and levers, and used a small cannister, attached to the side of the transmission. It had a vacuum diaphragm and was connected to the intake manifold. The other side of the diaphragm was directly connected to a valve in the valve body. Thus, intake manifold vacuum, rather than throttle position, was used calibrate the shift quality and timing.

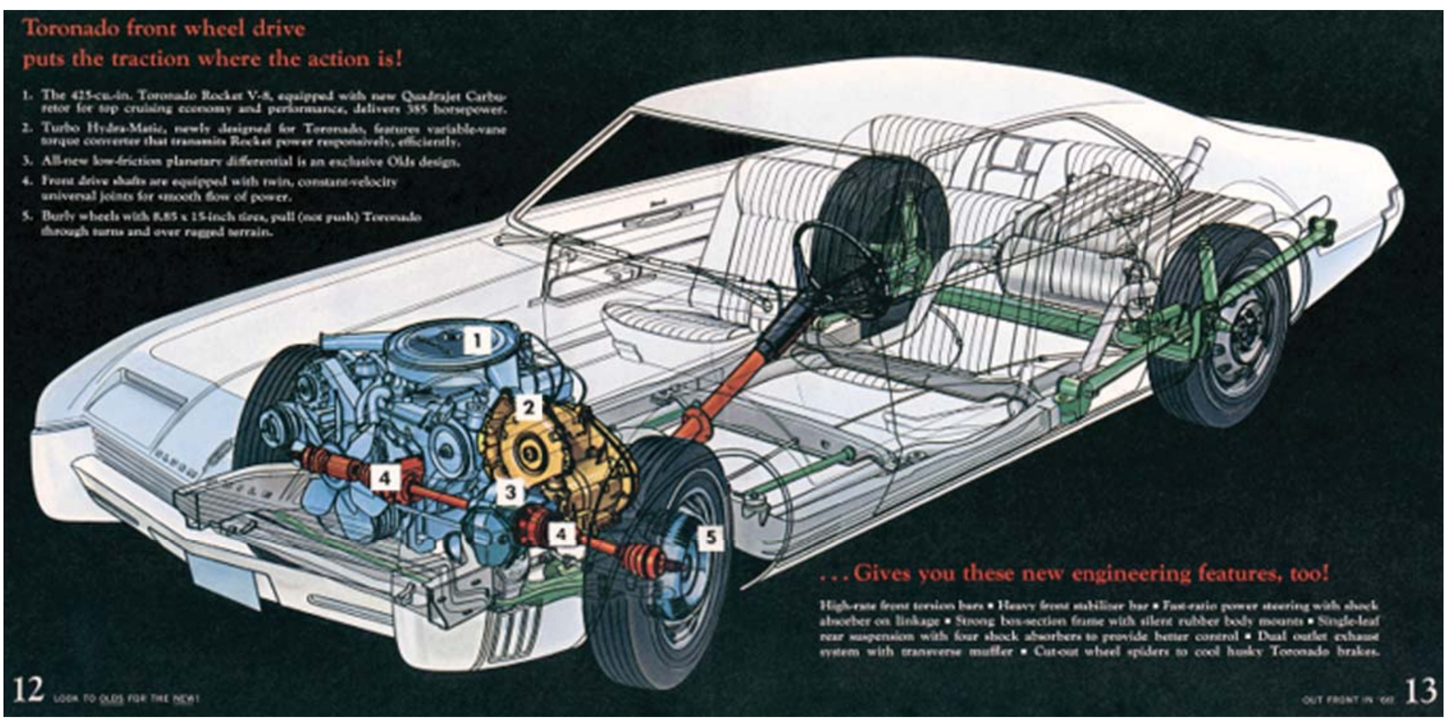
The result was a transmission that had the flexibility of a geared transmission, but whose shifts were nearly imperceptible It was first used on the 1964 Buicks, and some Cadillacs. Buick, unwilling to give up the Dynaflow name, called it the Super Turbine 400 Dynaflow for a year. In 1965, the THM 400 was used in all of GM's premium cars, and eventually in all the larger cars and pickup trucks. Rolls-Royce had been making the original Hydra-matic under license, but management was so impressed with the THM 400 that they. decided to use it in their new Silver Shadow. For many years, all the transmissions in Rolls-Royce and Bentley cars were made in Willow Run, Michigan. Hydra-matic cordoned off the final assembly area of the plant, and created a "clean room," with pressurized, filtered air, to improve the assembly quality of the transmissions. They also created test machinery so that every transmission was functionally tested, running through a full shift pattern, before being shipped.

As a co-op student at Hydra-matic in 1965, one of my first jobs was running transmissions on the dynamometer. The transmission was hooked up to an Oldsmobile 425 CID V8. The dynamometer was calibrated to represent the inertia weight of a particular car. An air cylinder would slam the throttle open, and the engine would run at wide open throttle to about 80 mph, performing both a 1-2 and a 2-3 shift. Then the throttle was closed, and the selector lever moved to Lo. That would force the engine to slow the dynamometer as the transmission shifted from third to second, and then second to low. The cycle was repeated thousands of times. Periodically the engines were serviced, but never the transmission. At times we recorded the engine speed vs output speed, car speed, on a strip recorder. The moving pen having written, we would analyze how the engine rpm was slowed by the transmission. It was quite easy to see from this graph the duration and quality of the shift, and to measure the degradation of the shift quality as the transmission accumulated cycles. I remember making charts showing the degradation over time. The goal was to have no degradation for the equivalent of 100,000 miles.

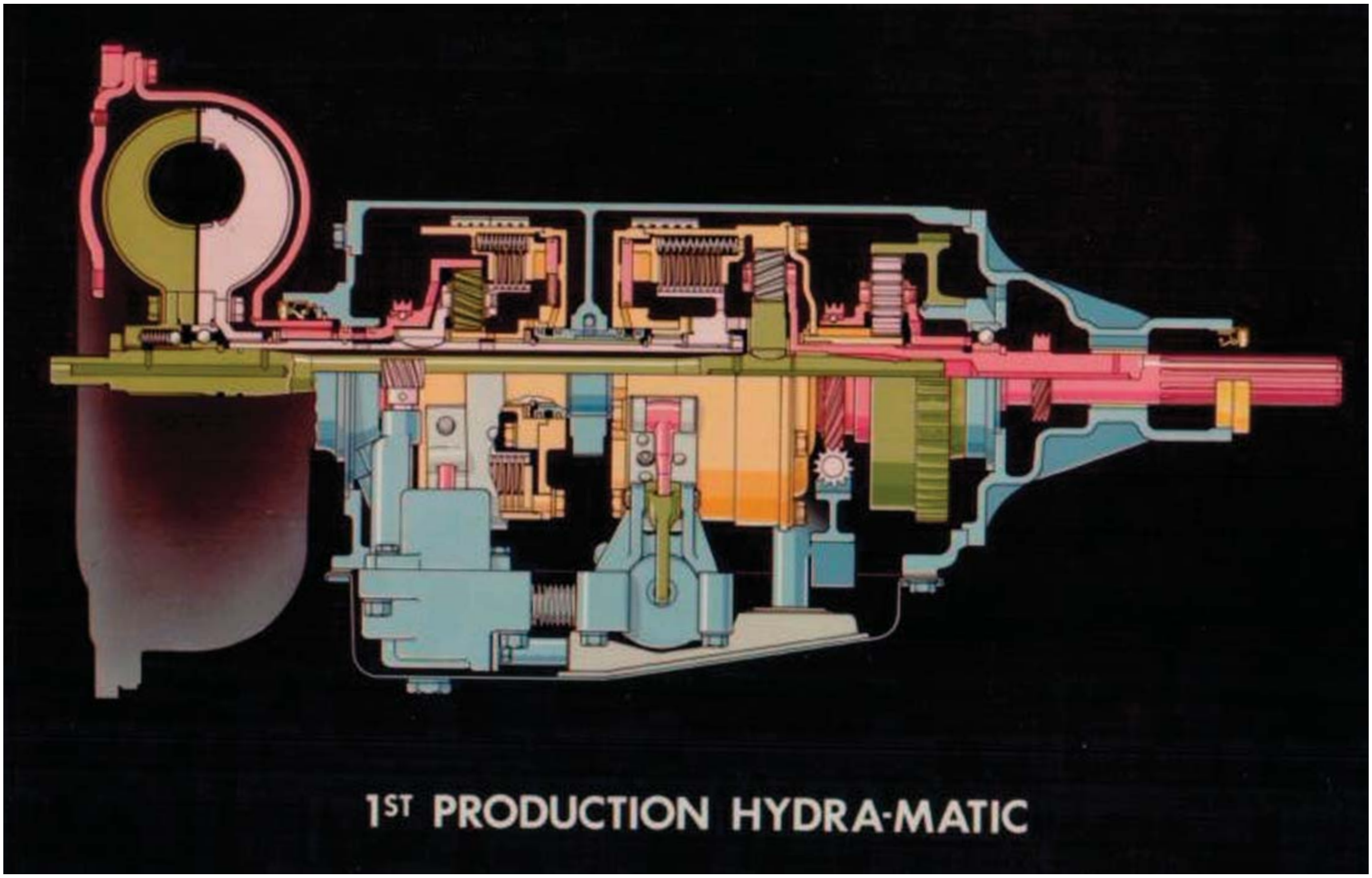
I was told that early in the development of this transmission one had broken an internal shaft, and effectively disconnected the engine from the dynamometer. The engine, at wide open throttle, immediately revved as high as it could, and then exploded with tremendous fury. Old timers would point to engine parts stuck in the ceiling as a result. Implied was the warning not to stand too close to the engine when testing. There seemed to be an endless supply of Oldsmobile engines.

During my time in the dynamometer room, I was subjected to a routine test for newbies. I was given a box of THM 400 parts and told to assemble a transmission. As it turned out, I had disassembled and reassembled an old Chrysler transmission, so I had some idea how these things worked. Everyone seemed quite surprised that I successfully built a THM 400 from the box of parts.

The big news at Hydra-matic when I started was the imminent release of the THM 425, the transmission for the front wheel drive Oldsmobile Toronado. To create the 425, engineers, conceptually, cut off the geared part of the THM 400, turned it around 180 degrees, and then used a chain to connect the torque convertor to the gearbox. Engineers decided how big the chain needed to be, and then used one five times as strong. It was about three inches wide, and about five-eights inches thick, and used a newly designed tooth profile to eliminate noise and reduce the harmonics inherent in a chain drive.



1966 Oldsmobile Toronado Hydra-matic 425 shown in gold. (YAHM)



Sectional view of early Hydra-matic. Note the sliding gear arrangement for reverse. Note also fluid coupling, with no stator or reaction element. (YAHM)

Just as the transmission was about to be released, it was discovered that there was a slight noise in the chain at certain speeds and loads. Very slight, and a customer might never hear it, but Hydra-matic worried about the details back then. The chief engineer ordered that a transparent chain case cover be built. My part was going to the store for some flat head screws. We ran the transmission on the dynamometer but could not duplicate the noise. We were using Oldsmobile 98s with extended front ends as mules, so the transmission with the transparent chain case cover was installed in a mule. The heater was removed, and a hole cut in the firewall. One man drove, and another laid on the floor and watched the chain. Under certain conditions a small wave could develop in the chain. The wave was not bad, but there happened to be a sprue in the cast iron support for the sprockets. The chief engineer and a few of his men went to the foundry in Pontiac. In a few hours, they and the foundrymen worked out how to move the sprue about a quarter inch away from the chain. There was never an issue after that. It was an impressive feat of engineering in a crisis, and I was too young to truly appreciate it.

It was felt that to maintain chain quality, the chains and sprockets should be mated by size. The chains were stretched, and graded A, B, or C according to length. The sprockets were inspected in an optical comparator for size, and graded. They were then matched with the appropriate chain. There were a lot of technicians sitting in shaded booths looking at sprockets for a while. After about six months, engineers realized that these small differences didn't matter, and graded chains and sprockets went away.

The THM 425 was used first in the Oldsmobile Toronado, and, a year later, in the Cadillac Eldorado. When GMC produced its motorhome, it used the Toronado drivetrain, including the THM 425. It was just as responsive, and trouble-free, as the THM 400. It was produced through the 1978 model year.

Development continued on the THM 400. The governor, the mechanism that measured vehicle speed, had four weights of varying sizes that pivoted on little pins to force a valve against hydraulic pressure. One day, someone noticed that the pivot pins, made by Hydra-matic, looked remarkably like eight penny finish nails.

1940 Oldsmobile six-cylinder series 40 with Hydra-matic. (YAHM)

I was sent to the hardware store to buy a pound of nails. A few governors were built using the nails and worked flawlessly. Every THM 400 transmission since had two eight penny finish nails inside

The governor was driven off the output shaft. It had a steel skew gear pinned to its shaft. A supplier thought it could make a plastic gear much cheaper than the metal gear. So, a bunch of governors were fitted with plastic gears and tested. They seemed to work just fine. Some were fitted to test cars. Shortly afterward, the chief engineer arrived in a fury, steam coming out of his ears, and various epithets were uttered. A little while later his Cadillac arrived via tow truck. It seems that while he was driving along at about 80 mph, the plastic gear on the governor had failed. The plastic had simply yielded. The governor had stopped turning. The transmission thought that the car was standing still and placed the transmission in low gear. This suddenly sped the engine up way past its maximum rpm limit, with explosive results. Looking under the hood, I could see parts of the engine that are normally buried deep inside away from view. Plastic gears went back to the supplier for more development.

Another weakness of the original THM 400 was the oil pan. It was made of very thin steel. In the Hydra-matic plant, where care was used in handling transmissions, there was never a problem. But between the Hydra-matic plant and the vehicle assembly plant, transmissions were subject to rough handling, and the pans were often dented. This caused leaks and, in extreme cases, interfered with the operation of the manual selector mechanism. One solution was to use heavier steel in the pan, but that added cost and weight. Another proposal was to use a cast pan, but that added even more cost and weight. One of my fellow co-op students devised the solution. Indentations were stamped in the pan in such a way that they were close to the strong parts of the transmission. When the pan flexed just a little, these dents, or bumps inside the pan, contacted the inner parts of the transmission and prevented the pan from deforming. That was a solution used in transmissions to this day. I was impressed with the simplicity of this solution.

This was about the end of my time at Hydra-matic. My career path led me on to other challenges in other companies. None seemed quite as interesting as those first years at Hydra-matic.

Hydra-matic subsequently made millions more transmissions. Eventually they were absorbed in GM's Powertrain Division, and the Hydra-matic name discontinued. The Turbo Hydra-matic 400 became the 3L80, and it was produced for over 25 years. It's still the transmission of choice for hot rodders and racers who are enamored of big V8 engines, and it served the army in HUMVEES and other vehicles for many years.

It's time to put it in Park, and turn off the engine. May your upshifts be smooth and your downshifts timely.

Contributors, Number 63

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Don Capps is an independent scholar specializing in the history of motor sport. He is a co-founder of the Michael R. Argetsinger Symposium for International Motor Racing History held in Watkins Glen, New York, hosted by the International Motor Racing Research Center, where he is a member of its Historians Council. He has also been an organizer and co-chair of the International Drive History Conferences and a past president of the SAH. In addition to tackling moonshiners and stock car racing, he has challenged several other racing mythologies such as "The Race That Was Rigged -- the 1933 Gran Premio di Tripoli," and the story behind the origins of the Mercedes-Benz "Silver Arrows." He holds graduate degrees from the University of South Carolina, George Mason University, and the U.S. Army Command and General Staff College, as well as being a former faculty member at The Citadel, the Military College of South Carolina. Don is also a retired Army colonel.

Robert R. Ebert
Robert R. Ebert received his Ph.D. in Economics from Case Western Reserve University. He taught economics at Baldwin Wallace University in Berea, Ohio, for 43 years and is retired as Professor Emeritus of Economics. His research interests have involved publishing a number of articles and books on automotive history. His current research continues on the history of the Studebaker - Packard Corporation.

Bob Elton
Bob Elton started his career at Hydra-matic division in 1965 and has worked in the automobile industry in design and engineering for 50 years. Bob is an amateur historian and has long been interested in automotive history. He is a member, and board member, of SAH.

Evelyn (Jeanie) Jacobus
Evelyn (Jeanie) Jacobus, wife of John Jacobus, co-edited his second book on the Fisher Body Craftsmen's Guild, and spent four years researching and writing a Harley J. Earl biography, as yet unpublished. With a background in particle technology, writing technical papers, and publishing in *Microcontamination Magazine*, a Canon Communications Publication, she has gained experience in writing. Since 2009, after meeting John, she has been exposed to all aspects of automobile safety, history, and design. Retired from the Defense Intelligence Agency in 2012. Totally enjoys all things FBCG related.

John L. Jacobus
John Jacobus was a highway safety and motor vehicle safety engineer for 30 years at the US DOT/NHTSA (NUT-ZA) and in this capacity he served as a contact technical manager, technical writer and author of various agency publications. John researched and wrote two books about the historic Fisher Body Craftsman's Guild sponsored by General Motors 1930-1968, and his wife Jeanie edited the second volume. His retirement goal is to write more about auto safety so it is interesting, understandable and enjoyable for readers.

Elton G. McGoun
After a career as a finance professor at Bucknell University, Skip McGoun has been able to devote more time to studying the interactions between popular culture and automobile design and marketing. His most recent article was "Crazy 'Bout a Mercury" in the *Review of International American Studies* about the failure of the Mercury brand despite its 1949-51 status as the all-time custom and the numerous covers of K.C. Douglas's "Mercury Blues."

Wayne Moore
Wayne Moore earned BA and PhD from University of North Texas and is a recipient of Outstanding Alumnus in Higher Education from UNT. He is a retired Vice President and Professor Emeritus of English at the University of Texas Rio Grande Valley. He also served as chief academic officer at the National College of Ireland. He has consulted in strategic planning, facility programming, and master plans in higher education in Saudi Arabia, Ireland, and the U.S. His interest in cars began by helping his father rebuild Model A's. Relevant published works include *The Dashboard Book: American Automobile Dashboards 1899-1969* and *Hood Ornaments: 1899-1959.*

Authors wishing to submit articles for publication in the Automotive History Review are requested to follow these guidelines:

Manuscripts should not exceed 10,000 words and should be double-spaced. An abstract is requested. Judging criteria include clear statement of purpose and testable hypothesis, accuracy and thoroughness of research, originality of the research, documentation, quality and extent of bibliographic resources, and writing style. Diagrams, graphs, or photographs may be included. Submissions are to be electronic, in Word or pdf files only, to the e-mail address below.

Possible subjects include but are not limited to historical aspects of motorized land mobility, automobile companies and their leaders, regulation of the auto industry, financial and economic aspects of the industry, the social and cultural effects of the automobile, motorsports, highway development, roadside architecture, environmental matters, and automotive marketing, design, engineering and safety.

The appropriate translation of tables, figures, and graphs can only be accomplished when sent in Word format since all files must be converted to Adobe Acrobat pdf format for publication in the Review. Remove any hidden commands (i.e., track changes) prior to submitting your electronic file. Incorporate tables in the text, rather than providing them separately.

Photographs that are not especially sharp, such as those taken in the early 20th century, should be submitted as glossies to ensure best-quality reproduction. More contemporary photographs may be submitted as e-mail attachments. TIFF formal is preferable to JPEG. Resolution should be 300 dpi.

The spelling of words that prevails in the United States should be used, e.g, "tires" rather than "tyres;" "color" rather than "colour." Dates should be expressed in the style used in the United States: month, day, year. However, if a publication is cited in which the date of publication is expressed as day, month, year, that style should be used.

Measurements should be in English; followed, if the author chooses, by the metric equivalent within a parenthesis.

Numbers over ten should be expressed in Arabic numbers (for example, "21st century." Numbers nine or less should be spelled. The exception is units of quantity, such as a reference to a "4-door sedan" or a "6-cylinder" engine. If the engine is V-type, place a hyphen between the V and the number of cylinders, e.g. V-6.

Titles of articles referenced should be in quotation marks (British authors should follow the American style of double marks instead of single marks, which seems to be now common in the UK). Titles of books, journals, newspapers, and magazines should be in italics. Following American practice, the period in a sentence ending in a quote should appear following the word, not following the closing quotation mark. However, semi-colons and colons appear outside the closing quotation mark.

For ease of reference endnotes are preferable. When citing works, the following order, style, and punctuation should be used:

> Rudy Kosher, “Cars and Nations: Anglo-German Perspectives on Automobility Between the World Wars,” *Theory, Culture, & Society*, 21 (2004): 121-144.
>
> Alfred P. Sloan, *My Years with General Motors* (Garden City, NJ: Doubleday & Company, 1964), 439-442.
>
> http://www.youtube.com/watch?v=I2cPBl6scJk (accessed July 17, 2008).

Where there is no doubt as to the state where the publisher is located (e.g. Boston, New York City) the state is omitted. When an endnote refers to a work referenced in the immediately preceding footnote, the word "Ibid." is used. When an endnote refers to a work referenced earlier in the article, the following style is used: Foster, *op. cit*., p. 54. If the author has used works that are not referenced in an endnote, they should be added at the end of the article under the title "Additional References."

In cases of doubt, please contact the Editor at **Jheitmann1@udayton.edu**.

Automotive History Review

Spring 2022 Issue Number 63

Inside the 1957 Cornell-Liberty Safety Car