

SQUIRE SS-100 CLUB

CLBCOM 24
JUNE '92

Well, Art & Bill's Excellent Adventure has come and gone . I drove Bill Lieske's almost new Chevy 1500 pickup back to Tupelo, Miss. and we picked up Bill Adams car. No slouch at the typewriter, Bill L. has already given us a personal profile of himself and a pretty good synopsis of the trip, both of which are attached. Bill intends to write an update of the work on his Squire each month and share it, and the important repair and maintenance information with the rest of us. I plan to include these with the newsletters as he submits them. I may even ask Bill to take over the newsletter function this Summer if Jean and I decide to escape the heat for a few weeks.

The good news is that Bill is planning a body-off restoration and I believe this will be the first one among the membership. We should un-cover some interesting facts. Having spent his life in the electronics industry he plans to completely re-wire the car and will submit the long needed wiring diagram. He also agreed to help John Fulton with portions of the maintenance manual. I can hardly believe our good fortune!

Note to Tom Niswonger: In loading Bill Adams' car on the trailer I noted that the leading edge of the front fenders were almost flopping in the breeze. The specific problem is that not enough glass matting was installed in the mold when they laid up the body at the factory. The fenders are just too thin. A good body shop familar with fiberglass, like a Corvette shop, should be able to make that repair from below without disturbing your paint job. You may even want to consider an additional steel brace running forward from the cross brace above the front wheels.

Note to Bill Adams: (And everyone else for that matter). Prior to selling his Squire, Bill Adams had installed a new brake master cylinder because he thought the old one was sticking. When the new one also worked hard he thought the shaft between the pedal and cylinder might be mis-aligned but he never got around to fixing it. Now, we have discovered what was wrong Bill, and it's important to the rest of us. Almost all hand built cars have a "clutch box" built below the floor board to contain the brake and clutch pivot points. Some prior owner on Adams car had let that Squire fill up with water more than once and the brake pedal had welded itself with rust to the pivot shaft. We freed-up the pedal with penetrating oil and a lot of pounding but a long term solution is needed. We'll work on it here and keep you informed.

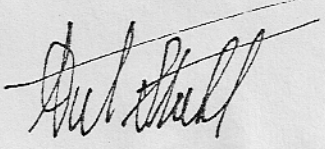
John Falk called from Maryland and said that if the Westerners in our Squire group attend the car show at San Leandro in the Bay Area of San Francisco this September he most likely will fly as far as Phoenix and drive out with us. Great! We have the makings of our first national meeting. Anyone else?

Speaking of Westerners, those of us in the West have had some discussion about unleaded gasoline and it's effect on our Ford engines. You can no longer buy leaded gas in California and we will lose it in Arizona before 1995. I have read the attached well-written article several times and have formed no hard opinion. My best guess is that our more modern engines will perform well on unleaded gas and if I live and drive long enough to require a valve job then I'll install hardened valve seats and sodium filled valves. Just this week I filled my tank with Super Unleaded gas for the very first time and I'll tell you what, my car runs better than it does on leaded regular.

At the beginning of the year I paid up front for a recruiting ad once a quarter in Hemmings but we have had no response from our Hemming's ads in quite a while so I have taken advantage of a 'special' from Deals on Wheels. They have a two-for-one offer and will run our ad, with a picture, in the July issue of both Specialty Car Marketplace and Deals on Wheels for the price of one ad. Do you fellows on the East Coast ever see either of these mags on the news stands?

Ed Spielman called to say he had entered his Squire in a car show and ran off with the trophy for Best Special Interest Car. Neat! However, on the trip home he heard a funny noise in the rear and later inspection showed his car had broken the weld on the spare tire mount. Your spare is mounted on a length of threaded pipe that has a flange with four holes welded on the end. On the back side of the body there is a matching flange and the two sides are joined by four bolts thru the body. The rear flange is welded to the frame via a short length of 1-3/8" pipe and the weld broke there. Ed had his mechanic reweld the joint and add two support struts. Might pay the rest of you to lay down and check yours. That's a lot of weight to have swinging free on the fiberglass body.

We have located another Squire. Alert member Mark Offenbergl in the Big Apple spotted an ad in a local publication (?) and passed it along to us. Great work, Mark. It's the local ads that obviously the rest of us don't see. So---meet Michael Lindgren of Sea Cliff, Long Island. He owns #11005525 or number five in the manufacturing sequence. Mileage is 14,000 and it's black with a manual tranny. That's kind of interesting. Michael says he checked the color down past the primer and it was black from the factory. That's the first black one we've heard about. More next month.

A handwritten signature in dark ink, appearing to be 'Paul Hall', written in a cursive style.

PERSONAL BACKGROUND

WILLIAM F. LIESKE
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Born, June 15, 1923 in Buhl, Minnesota. Family moved to Oregon in 1935 looking for a better life in the Golden West. Finished high school in Salem, Oregon. With WW-II imminent, I worked for Boeing Aircraft in Seattle, Washington until getting my draft notice. Having a deep interest in radio and electronics, I enlisted in Army Signal Corps, studied radio communications and radar, spent greater part of 3 years military service as radar instructor at Air Corps Southern Area Radar Command training base at Boca Raton Florida.

Married Lorene Bevan, July 7, 1943. Have one son, Bill, Jr. and three grandsons. During and after WW-II service I acquired a degree in electrical engineering. My working career has been in radio & electronics systems work, sales, sales management and manufacturing management along with electronics product designs and consulting work. At present I am President and general manager of a specialty electronics manufacturing company, EMR Corporation, located in Phoenix, Arizona which I founded in 1980. All major products are of my own designs. I hold several patents and copyrights on electronic and electromechanical devices.

Hobbies and avocations include music, computer programming, technical writing, machine and wood work, RC model aircraft, automobiles, Amateur Radio, live steam model engines and locomotives. I have built boats, trailers, furniture, houses, garages and mountain cabins. Holding a Real Estate Broker's license for eight years, I took part in the development of a high mountain luxury cabin area near Prescott, Arizona.

I have worked on automobiles since my teen years, owned Model A Fords to Cadillacs, plus a few foreign made cars. In earlier years, I did all of my own auto mechanic work, usually out of necessity! I have restored several cars, doing most or all of the engine and running gear work and some body work. Seven years ago, I built a Classic Motors Gazelle kit car on a VW chassis pan. I still have the Gazelle and drive it often. I was one of the founding group of the Arizona Kit Car Club, Inc. which grew to upwards of 200 members, during its most productive period.

As I look to gradual retirement status, I view the acquisition of my Squire SS-100 and its full restoration with considerable pleasure. I hope that the process of total restoration of this car and the chronology of this work will serve to enhance the value to present owners and the future value of the Squires, not to mention the pleasure of owning and driving a car of such special and rare character.

WFL - 6/5/92

THE SAGA OF SQUIRE SS-100 SERIAL NUMBER 11044545

By Bill Lieske

The Beginning.

It all really started when my friend Art Stahl brought his recently restored shiny red Squire past my place of business one morning. I had known that Art had spent about two years restoring a car called a Squire but the impact of the car itself was dazzling! There it was, with its rakish lines, faultless bright red paint, chrome plated 72 spoke wheels and other trim, along with highly buffed aluminum accessories, huge European style headlights, new top and side curtains and the like. Wow!

After a thorough inspection of the car, Art came in to chat and drink a cup of coffee. He then told me some of the history of the Squire SS-100 cars and mentioned that one of the fourteen or so of them known to be in existence could possibly be purchased from Bill Adams of Marietta, Mississippi. Without very much hesitation I told Art that I was interested. This led to an offer to Bill, subject to getting information and possibly photos of the car to assess its condition and restorability.

A week or two later, Bill sent some video clips showing that the car was certainly in need of major work but was, indeed, quite restorable. I called him and confirmed that I would take the car. The saga had now begun.....

Art and Bill's Excellent Adventure.

Art volunteered to make the trip with me to pick up the car. Since I had some business commitments and since Bill Adams had commitments for two weeks starting June 1, 1992, the plan evolved to Art driving my Chevy pickup to Memphis, starting Memorial Day with me to fly there and rendezvous late Thursday evening. A few things happened to modify the original schedule. First, Art made better time than anticipated, arriving in the Tupelo-Fulton-Marietta area of Mississippi on Wednesday. A U-Haul trailer was picked up and the car loaded on it with miscellaneous parts loaded in the back of the Chevy pickup. Art drove back to Memphis, about 120 miles, to meet me.

What happened, is that President George Bush decided to land at the Phoenix Sky Harbor Airport in Air Force One at the exact time of my scheduled departure on Delta Airlines. Sky harbor was closed for 35 minutes until AF-1 and the President were safely on the ground, making all scheduled operations at least one hour late. I missed my connecting flight in Dallas, arriving on a later flight in Memphis at after 1:00 A. M. It was sometime around 3:45 A. M. when we got back to Fulton and hit the sack!

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The next morning, Art met Bill Adams for breakfast and I caught a few extra winks. It was raining as we hooked the trailer to the Chevvy, had an all too short visit with Bill Adams, then headed West. Despite the mild to heavy rains, we made good time, getting to Texarkana, Texas that evening. We found a nice Motel, met some nice folks, had a tasty catfish dinner and got a good night's sleep.

Saturday morning, we noticed that one of the tires on the trailer was flat. After chasing around Texarkana for an hour or so looking for a U-Haul agency, we finally got the tire plugged and were on our way. The particular balance of the trailer on the truck hitch caused an almost gut wrenching bucking horse effect on the concrete pavements through Arkansas and most of East Texas. We arrived in Dallas and found John Fulton's address about 3:30 on Saturday afternoon.

After meeting John we looked over his nice Squire, drove it and took a bunch of photos. Lots of car talk and planning on the work that Art, John and others are doing on the Squire SS-100 Owner/Maintenance manual ensued. This was the first opportunity that I had to really look my restoration project over! From its condition, it was then and there determined that a full tear down would be needed.

I (I should say "we") agreed that the body will come off, the entire undercarriage will be sand blasted, undercoated and repainted. The engine and tranny will come out for rework and clean-up, new gaskets, etc., etc. The body, though essentially sound must be cleaned down to the fiberglass prior to patching, filling, undercoat and repaint. The rear end will be dis-assembled and seals replaced. U-joints will be looked over and replaced if necessary. All brake elements will be replaced, and it looks like a departure from the original will be made in the form of power assisted brakes. All wiring will be replaced.

Most chromed parts will need straightening and re-chroming, as well as the many brackets, hinges, etc. that show severe rust- through. All upholstery, including seats, carpets, kick panels, top and side curtains will be replaced. I expect that 95% or more of the bolts and fasteners will be removed, restored or replaced. Lots and lots of things need to be done to restore this rare vehicle to a show car condition, which is what I am determined to do! Probably twelve months will be needed to accomplish this task. I feel that it will be well worth the time and expense, as the Squires are truly a rare and desirable automobile.

As far as we know, none of the other known Squires have needed this complete a restoration process. As such, this is a rare opportunity to document many specifics about the breed to be

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included in the manual for the benefit of all owners. Phase I of the Saga ended on Monday, June 1 when we arrived in Phoenix about 1:30 P. M. We were pushing a bit hard in the hills of West Texas and apparently overheated the Chevy's transmission, blowing out most of the transmission fluid. Seems like a 2,100 pound U-Haul trailer, a 2,400 pound car and another 4-500 pounds in the bed of a 1989 Chevrolet 1500 Siverado cannot be expected to sustain 65-70 miles per hour uphill for very long. By holding it down to 60 MPH or under for the balance of the trip the tranny fluid held and we still made acceptable time. The good news is that the tranny is OK but will need re-gasketing.

The trip amounted to 3,963 miles, including one or two lapses in navigation, back tracking and the like. Despite some dark moments, Art and I agree that it was really a fun trip!

What's Next?

As of this writing (June 4, 1992) the Squire sits in my back yard waiting for more dis-assembly, which will start this coming week end. As this progresses, I intend to document all items as to as-is, how done and as finished with photos and verbiage for my own purposes. I will continue this dialogue as things are done, making the installments available for Art's newsletters and using the data accumulated for insertion in the manual. In this manner all Squire SS-100 owners can have information as to what is under, inside of and on the surface of their cars.

Since, as I understand it, each car is somewhat different perhaps this undertaking will serve to be some kind of a standard in the future. Your comments and suggestions are solicited and will be appreciated.

-----End, Chapter I, Squire SS-100 #11044545 Saga-----

SQUIRE SS-100 S/N 11044545 SAGA

Chapter II

For those of you who read last month's ramblings and are interested in this sort of thing, I have more to report. It is now Saturday evening, June 6, 1992 and I am a tired old guy..... Another tired guy (not quite as old as I am) is one Arthur Stahl!

Art and I just couldn't let any grass grow under my Squire, having gotten it as far as reported in Chapter I. So, we agreed to spend today starting its dis-assembly. Although we had agreed on a starting time of 7:00 A. M., Art got going about an hour before I was in full motion.

The first thing needed was to click the brake shoe adjustments on all four wheels to release brake shoe drag enough to be able to push the darned thing into my backyard garage. My yard has been freshly covered with "half minus" decomposed granite. We had this done after fifteen years of trying to maintain a lawn in the Arizona summers with less than stellar success and with ridiculously high water bills. Even after freeing the wheels, the two of us just couldn't push the car over those loose rocks. So, we enlisted the help of a mutual friend, Jim Dimond, who is another car nut (currently finding and rebuilding Sunbeams), a great guy and very husky. The three of us got the Squire turned around and backed into the garage in short order.

By around 10:00 A. M. we had the seats out, the body hold down bolts out, several other things out of the way and had freed the body all around. Jim Dimond had left earlier, and we found that two guys just cannot lift the fiberglass body and maneuver it off of the chassis. More recruits were brought into the action, in the persons of a neighbor, Jim Perry and my son, Bill, Jr. The fiberglass body now rests on some sawhorses. A plethora of parts is now in some disarray, many removed before the body came off and many more after the open chassis was available to strip.

Art, justifiably, had more than a few caustic comments to make about the working space available around the car and my work benches, which were piled with stuff unrelated to the project! I am duly chastised, and plan to spend the time to rectify this situation before proceeding with the next steps. We did, however, get far more accomplished than we had expected.

The rest of this chapter will be devoted to suggestions as to procedures in a full "from the ground up" restoration of a Squire SS-100. The majority of these are things that Art contributed, having restored his Squire and been involved in the restoration or improvement procedures on at least one other before tackling mine. These hints and recommendations should be valuable to anyone who acquires a Squire for restoration or who might want to upgrade one of the beasts to better than new condition.

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After having decided to remove the body on my Squire, I am most happy that this decision was made. The body take-off isn't as tough as one might expect. Of course, mine was already partly disassembled; the hood, doors and most of the trim having been previously removed. I would judge that with two reasonably apt mechanics doing the work, the body can be off in three hours or less, even with coffee breaks and time for head scratching.

Tools needed include a full set of inch and metric open and box end wrenches, 3/8" and 1/2" drive inch and metric socket wrenches, 4" through 15" crescent wrenches and a full range of American Standard and metric allen wrenches. A good collection of screwdrivers is also most important, including blade, Phillips and Torx types.

If you have a compressor and air tools, a 1/4" or 1/2" drive impact motor wrench helps immeasurably in breaking loose bolts and nuts from 1/4" to 1" head sizes plus metrics from 6 through 24 mm. You will need some good penetrating oil if your car is any where near as rusty as mine! A range of ball pien hammers and some sharp chisels might be needed to crack a few rust seized nuts. Also, a 1 to 2 ton floor jack and four sturdy jack stands are a must. A cordless or regular electric drill will be needed.

Other suggestions: Unless you have a photographic memory, store all bolts and nuts in the thing that they come out of or go into! The ones that cannot be stored this way can be best put in little freezer bags and labelled with a felt pen. This will save you countless problems in trying to remember which SAE, BA Standard metric or Torx screw or bolt goes where! You will probably want to replace a lot of them with new fasteners, and this will help you in making a list of what you have to go out and find.

1. Remove all trim and accessories. This includes all lights, the windshield, windshield supports. wiper arms and wiper actuator retaining nuts.

2. Remove the door and cowl trim pads and both doors. Remove the hood and hood hinges.

3. Remove the top and its hardware. Remove all bumpers. Get the steering wheel out of the way by removing the six metric allen head capscrews.

4. Remove the grille. Unbolt the radiator, and the square arch member that holds the radiator and the hood latch mechanism. Drain all radiator fluids, and the block, using the draincock on the right side of the engine. Loosen and remove the radiator hoses. If your car has an automatic transmission, carefully unfasten the transmission cooler lines at the bottom of the radiator. You can now lift the radiator out of the car.

5. It appears that if the dash with instruments are to be left intact, you should be able to remove the dash mounting screws and leave the dash hanging with the dash wiring intact. Your choice. If you take the dash out, unfasten all switches and leave them hanging on the wires. MARK EACH SWITCH with a tag. You can probably pull the instrument lights out of the various instruments. MARK EACH ONE with a tag. Most wires have typical automotive tab disconnects, however, some require taking nuts and washers off, such as the ones on the ammeter and some other instruments. MARK EACH WIRE WITH A TAG as to which terminal it must go back on.

6. Unbolt the seats, removing the four nuts and washers from underneath the car. Lift the seats out. Whether you have either automatic or stick shift, remove the selector handle, or shifter knob. Take off the shift quadrant cover or gearshift trim plate and boot.

7. Remove the carpeting mats completely. The body pan bolts are under them. You will also best unbolt the hood latch release lever as it may not clear the fiberglass when lifting the body off.

8. With the mats out of the way, you will see several pop rivets holding the integral body pan floor to a fiberglass cover over the transmission. Drill them out with a 5/32" drill.

(9) Now start removing body hold down bolts. There are two in front, just forward of the radiator position that go horizontally through the front frame cross member. Depending on your bumper and headlight mount detail, there may be two or four more bolts and nuts to take off at the front. Take off the carriage head bolts at the outboard positions of both fenders.

(10) There are four bolts down through the inner body pan with square or oblong steel plates under them to remove. Also, two bolts (5/8" or larger heads) rearward (AFT if you were in the Navy) that also hold the seatbelt strap brackets. Check the back apron to see if any bolts were left after removing the rear bumpers. Of course, the spare wheel must be out of the way. Remove the gasoline (petrol, if you must) tank filler cap.

You should now be able to lift around the body and break things loose. Be careful as you do this, to be sure that you haven't missed something and that nothing is binding between the body and the framework. As you and three helpers (or you as foreman and four helpers...) carefully lift the body, it must be joggled a bit forward and backward as it is lifted.

I would recommend that the body lift-off is done out of doors unless you have sufficient clearance to get it well above the firewall, gas tank, etc. and a convenient place to place it.

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My squire was stored under a cover outdoors in the damp Mississippi climate for almost two years. Everything was rusty! We also found numerous hornet and mud wasp dried out nests under it and spider bolls in some unexpected places. I would suspect that any Squire stored or driven in damp climates will have a lot of rust underneath and throughout the undercarriage. Our Italian friends that built them took little pains to use plated hardware and the frame and undercarriage appears to not have been prepared or undercoated at all - just sprayed with low grade enamel or laquer or left as bare metal.

The entire undercarriage will be stripped, scraped and/or sandblasted, primed and painted with a high grade of tough enamel. I will also undercoat the entire underside for further rust protection and erosion of the fender undersides from rocks and road junk.

The frame appears to be sturdy and in general well conceived. Some of the welding, on mine at least, is rough but adequate. The inside and underside fiberglass matte surface is quite rough and in many places on the body is surprisingly thin. I will build up fiberglass in many places that I have looked at for rigidity and crack resistance.

I note that a 1/4" to 1/2" pad of what appears to be cotton based felt pad material was glued along most frame top areas that come in contact with the fiberglass body. This stuff has essentially disintegrated into powder. Also, there are several large mis-drilled holes in the body pan which would permit water to splash up and soak the carpets. These will all be patched.

I have taken two 36 shot rolls of pictures, so far. If anyone plans to pull the body and upgrade a Squire, prints can be made available. I plan to continue this photo record as the various stages of restoring the car are accomplished.

My next decisions are how far apart the engine, transmission and differential will be dis-assembled and refurbished. We shall see, as time goes on! My good wife, after looking at the clutter of things in the back garage observed: "I just cannot understand how you guys can call this kind of thing fun!" Am I being Chauvanistic to observe that women just don't understand what real fun is all about?

-----End, Chapter II, Squire SS-100 #11044545 Saga-----

UNLEADED GAS AND YOUR CLASSIC

by J. D. Chase

The following article was written by Mr. Chase for the April issue of the Classic Car Club Bulletin. It has been edited for length by deleting comments primarily of interest to owners of older classic cars. It is reprinted with his permission.

In spite of the many passionate and "expert" responses, the sad fact is that no one really knows whether unleaded gas will cause harm to Classic engine exhaust valves. The many "experts" I have read so far on this issue suffer from one of two failings: either they rely on the comments of other "experts" who do not understand the phenomena or they fail to account for the large differences between Classics and the engines which have actually been tested.

First it is paramount for anyone concerned to understand the basics of what "valve recession" actually is. During the exhaust stroke the exhaust valve first opens and then closes on its seat to allow the exhaust gas to escape. Because the exhaust can exceed 1800 degrees, the exhaust valve and its seat may exceed 800 degrees. If otherwise unprotected, the exhaust gases can oxidize the iron in a soft cast iron seat and form hard nodules which adhere to the valve face, turning it into a grinding wheel which can cut the seat and cause the seat to wear into the block or head. The effect of lead additives is to create protective layers of lead halides on the valve seat and lead oxides on the valve which inhibit the oxidation of the iron and reduces adhesion of the abrasives on the valve. Valve seat recession has nothing to do with oil lubrication of the valve or its guide!

As early as 1937 an engineer named C.G. Williams reported in "Engineering" that the mechanism of valve seat recession was an oxidation phenomena. In a very comprehensive series of tests he showed that seat recession was nearly eliminated if an exhaust valve was operated with a rich fuel/air mixture in which the combustion

was complete enough to leave no free oxygen in the exhaust. In a lean mixture typical of highway cruising (greater than 15/1) there is not enough fuel to completely consume the available oxygen during combustion, thus providing the oxygen necessary to oxidize the iron seat.

Many have stated the conviction that these old engines were "designed" to run on unleaded gas because lead was not universal before WWII. Lead was originally added to control detonation (spark knock). Its effect on valve life was coincidental and not appreciated until the reintroduction of unleaded in the early 70's., when valves were expected to last 100,000+ miles between valve grinds. While it is true that many prewar cars were run on unleaded, it should also be remembered that in those days valves were routinely re-ground at intervals as low as 15,000 miles, a procedure so common that mobile services were available to do it at your house. It is interesting to note that while Williams tested 30 different valve and valve seat combinations from 1933 to 1937, he conducted only one quick, inconclusive test with leaded fuel, verifying that the connection between lead and valve seat life was not fully realized during the Classic era. Prewar valve seats cast from iron alloys with high chrome contents (such as Pierce V-12) were more resistant to recession due to better oxidation resistance, and the improvement to valve seat life was noted at the time.

With these basics in mind, some of the factors which affect valve seat recession can be listed:

1) As outlined above recession is favored by lean air-fuel ratios. This factor would at first seem to reduce the risk of our prewar Classics, as they were usually set up slightly richer than later engines. Unfortunately test of prewar engines show some amount of free oxygen is present in the exhaust even at very rich mixtures due to imperfect combustion. Williams' 1937 report presents engine test data indicating seats recessed at 1/3 the rate on a rich mixture as they did on a lean mixture. Many Classic engines were set up richer because the mixture distribution to each cylinder was not uniform (particularly for those long straight eights, V-12's, and V-16's). Thus an average mixture of 14/1 might result in some cylin-

ders running at a lean 16/1 (15.1/1 is ideal theoretically).

2) The oxidation of the soft iron seat and the resulting formation of damaging abrasives is favored by high temperatures of the exhaust gas, valve, and seat. This is why recession is more pronounced as the engine power level goes up. Because it takes time for metal to get hot, short term exposure to high power such as a quick 5 miles down the freeway should not be significant.

3) Valve rotation exacerbates recession through additional grinding action. In the case of the Packard 320 and 395 units this is favorable as the valve key system discourages rotation. I am not sufficiently familiar with others to comment, but unless restrained most valves with half circle restraint keys will rotate.

4) The exhaust temperature is a function of compression ratio and heat losses to the coolant. Believe it or not, it is basic thermodynamics that exhaust temperature rises as compression ratio drops, while exhaust temperature drops as heat losses increase. The combination of low compression with higher heat losses typical of prewar engines appears to be a wash compared to the 1960's era engines tested for recession. In the 1930's Williams measured peak valve temperatures of several engines and found a range remarkably close to a similar survey by Cherrie in 1964; 1300 to 1420 degrees.

How real is the risk? How much power is needed? An oft quoted chestnut is that there will be no problem as long as you drive less than 70 mph. The original source for this "70 mph" rule seems to be a test carried out by Godfrey and Courtney on six automobiles run on unleaded gas; two powered by 302 V-8's, two 318 V-8's and two 400 cubic inch V-8's. They drove the cars at 70 mph during hot summer temperatures for between 9,000 to 11,000 miles and measured the average valve seat recessions: .040 inch for the 302's, .050 for the 318's and .008 for the 400's.

In SAE report #710841 Doeling tested a 350 cubic inch V-8 operated on gasoline containing a very low level of lead - .04 grams/gallon. In 100 hours of testing at 2650 Rpm and 108 horsepower the valve seat recessed an average of .039 inches.

by actual testing and service experience: lead, sodium and phosphorous. Any additive that fails to divulge its active ingredient and does not have well documented comparative engine testing to back up its claims should be viewed with a skeptical eye.

What about hardened seats? This is the solution adopted by most post 1971 autos but poses a certain amount of risk in retrofitting old engines not designed for them. There may not be enough metal left under the new seat to prevent problems and the skill machinist to properly and install hardened seats may not be easy to find.

REFERENCES: Society of Automotive Engineers (SAE) reports #650484 by Cherrie; #710841 by Doeling; #710842 by Pahnke & Bettoncy; #710356 by Godfrey & Courtney; "Induction Hardening Make Valve Seat Wear Less With Nonleaded Fuel" by Giles, Automotive Engineering vol. 79, number 6; "Factors Influencing Wear of Valve Seats In Internal Combustion Engines", by Polsen, 1947. I also thank Mr. Vernell Hance, a retired Chevron Research engineer for his recollections of the six automobile tests discussed in SAE #710356.

Jim Chase is an consulting engineer specializing in aircraft and aircraft propulsion performance. He has a B.S. in mechanical engineering from the University of Idaho 1976, and is a consultant on the RareBear unlimited airt racer which has won the Reno Air Races the past four years and set a new piston engine world speed record. Mr Chase conducted a frame off restoration of his 1936 Packard from 1981 to 1988 and is using his interest in engineering history to gain an accurate picture of the state of the art of prewar automobile technology, and how it applies to driving antiques in modern times.

It should be emphasized that it may take more than 500 miles of operation without lead to burn off the existing coating of lead compounds protecting the seat, and if recession is present, it takes 500 to 1500 miles to build it back up again.

2) Add lead or other additives. This approach does not answer the question long term but it is the minimum risk and least work for the individual. How much lead? The test reports indicate that a level of .1 gram/gallon provides adequate protection for moderate power conditions, .2 grams/gallon will provide protection for the most severe conditions. Concentrations above .2 grams/gallon do not provide significant additional protection. Leaded gasoline was restricted to .1 grams/gallon after 1987. Prior to 1988 leaded regular was restricted to 1.1 grams/gallon.

As mentioned earlier, it takes on the order of 500 miles on unleaded to burn off the protective coating, therefore lead additives may only need to be added every second or third tankful. Because of the time required to build up the coating once it is burned off, some lead should be added during periods of low speed driving. I would suggest adding .1 grams/gallon every other tankful during local driving and increasing to .2 grams/gallon during touring.

As to the many other additives being touted, petroleum based oils, diesel fuel or "top-end" lubricators are unlikely to provide significant protection. Those reporting good results were probably not at risk to start with.

Besides lead, there are two other substances which have been shown to be effective in reducing recession: Phosphorous and sodium. Phosphorous was recognized early on as providing some protection to seats but is not as effective as lead. Sodium additive seems to be a relatively recent discovery manufactured by Lubrizol and marketed by several companies including Chevron and Red Line. Red Line's brochure indicates that the sodium forms sodium oxide coatings on the seat. They show impressive comparative engine test results indicating protection comparable to lead.

The bottom line is that there are three additives I know of which have been shown to be effective

This engine was equipped with valve rotators which probably increased recession rates.

To keep recession in perspective, it must be emphasized that it should only be significant during sustained highway speeds. The more common local trips should not cause appreciable wear.

I apologize for discussing such a confusing array of variables affecting recession, but if I have done nothing else I hope I have made it clear that the subject is far too complicated for anyone to make the kind of blanket statements which have obscured this issue for the past seven years. With so many engine designs, power loadings and driving conditions it should be clear that no one can guarantee that your Classic is immune to valve seat recession unless it is fitted with hardened seats.

What shall you do with your classic? If it will never be used for touring at sustained speeds of more than 45 mph there is little justification for additives. If the car is used for touring, then two different approaches can be taken.

1) Run on unleaded without additives. Since there is a reasonable chance that operation on unleaded will not cause a severe problem, monitor your valve lash very closely and consistently over the next few years. If recession does develop you risk a burned valve if you don't catch it in time. Because this measurement is very tricky, use the identical procedure every time. I usually drive the car on the highway for 10 miles and measure the clearance with the engine idling. Measuring with the engine off is safer and should be fine as long as the engine warmup is identical each time. Valve seat recession would be indicated by a reduction in clearance. Do not adjust the lash too loose: Williams showed that valves adjusted to a clearance of .020 recessed eight times faster than if set to .006. Ideally, those of you who chose this path will keep a log of the total highway miles and approximate speeds so that over the next few years we can use the information. For purposes of research, reliance on after-the-fact recollections and anecdotes is worthless. Participants in the Great American Race could be particularly helpful. Classics equipped with hydraulic lifters or zero-lash automatic adjusters would not be good candidates for this approach since it would be very difficult to measure recession.