IN THE CIRCUIT COURT

FOR

LOWNDES COUNTY, ALABAMA

KENT H. CRENSHAW and
CARMEN W. CRENSHAW,

Plaintiffs,

Vs. CIVIL ACTION NO.
CV-93-75

FORD MOTOR COMPANY, et al.,

Defendants.

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DEPOSITION OF DAVID J. BICKERSTAFF,

taken pursuant to stipulation and agreement before Lisa J. Nix, Registered Professional Reporter and Commissioner for the State of Alabama at Large, in Room 316, Ritz Carlton, Dearborn, Michigan, on Friday, September 30, 1994, commencing at approximately 12:20 EDT.

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INDEX

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STIPULATION

It is hereby stipulated and agreed by and between counsel representing the parties that the deposition of DAVID J. BICKERSTAFF is taken pursuant to the Alabama Rules of Civil Procedure and that said deposition may be taken before Lisa J. Nix, Registered Professional Reporter, and Commissioner for the State of Alabama at Large, without the formality of a commission, that objections to questions other than objections as to the form of the question need not be made at this time but may be reserved for a ruling at such time as the said deposition may be offered in evidence or used for any other purpose by either party provided for by the Statute.

It is further stipulated and agreed by and between counsel representing the parties in this case that the filing of said deposition is hereby waived and may be introduced at the trial of this case or used in any other manner by either party hereto provided for by the Statute regardless of the waiving of the filing of the same.

It is further stipulated and agreed by and between the parties hereto and the witness that the signature of the witness to this deposition is hereby not waived.

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DAVID J. BICKERSTAFF

The witness, after having first been duly sworn to speak the truth, the whole truth, and nothing but the truth testified as follows:

EXAMINATION

BY MR. ALLEN:

Q. Give us your full name, please, sir.

A. David John Bickerstaff.

Q. And your current address?

A. 3755 Indian Trail, Orchard Lake, Michigan 48324.

Q. Where is Orchard Lake in relation to Detroit?

A. It's a northwest suburb of Detroit.

Q. How long have you lived in, I'll say, Michigan?

A. Since 1972.

Q. Where are you from originally?

A. England.
Q. Did you move from England to Detroit?
A. I lived in England and then came to Detroit for a scholarship with GM and then went back in 1970. And then two years later, I came back here.
Q. What were the inclusive dates that you were with GM?
A. Let's see if I can remember. Okay. It would have been 19 -- I think 1964 to 1970 -- the end of 1971.
Q. Okay. And what department --
A. '72? Yeah.
Q. Are you finished?
A. Go ahead. '71 or '72, somewhere around there.
Q. What department were you in with GM?
A. I was an undergraduate engineer trainee, and I also worked in tires and tire design and vehicle development and testing and then -- while I was at Vauxhall, England, which is a part of GM.

I then came here in 1970 for a

scholarship, to GMI, and I worked with Chevrolet and worked in the proving grounds on various testing. And I worked in the Chevrolet Corvette group on the handling of the Corvette. And I worked in suspension design, designing stabilizer bar systems. And I obviously went to GMI at the same time.

Then I went back to England. And then I was responsible for ride and handling and chassis and vehicle -- general overall vehicle tests and testing for Vauxhall, which was cars and light trucks and some heavy trucks.

Q. What types of cars were being produced?

Is there a plant in England?

A. Small cars --

There's a plant in England.

Q. Okay.

A. And all manner of cars: small cars, full-size cars, small vans, parcel delivery vans, vans like the Econoline called the Bedford CF, and various trucks.

Q. Were you in charge of -- I say in charge. Were you working in suspension and design --
A. No. I was an engineer in testing, and I tested suspensions and tires and handling, road test procedures, and wrote test reports and that type of thing.
Q. So did you have a proving ground in England --
A. Yes.
Q. -- for those tests?
A. Yes, we did. That's what I did. When I went back after my year at GMI, we had a brand new proving ground, so I went there to set up handling and testing, other procedures.
Q. Did you run actual J-turn tests and maneuvers?
A. We did some J-turn tests at reduced tire inflation to see if we could unseat the beads of tires in the J-turn tests. We did explosive tests with explosives on tires so we could blow a tire up and measure a vehicle's handling performance and

straight-line stability with tires blown up. I invented some ways to do that that we used on the tire.

Q. You did that for how many years?

A. A couple of years.

Q. Two years?

A. Right.

Q. Then did you come back to GM in the United States after that?

A. Well, my wife is American, and I married her while I was at GMI. And so she really wanted to come home. So the end of -- Actually, at the end of 1972, we came over here and I started working with -- with Ford in 1973, I think it was.

Q. Give me the inclusive dates that you were with Ford, first of all.

A. I was with Ford from 1973, January I think it was, until the end of July 1982.

Q. And give me sort of a progression, if you don't mind, while in the Ford organization during that time frame.

A. The first -- The first period of time was

spent in light truck vehicle development, and I did work on slide in campers and vehicle rollover, the response to a docket on future rulemaking from the truck point of view on -- I think it was 73-10. I don't remember the exact number, but --

I worked on various handling test procedures, trying to make objective handling test procedures where we could instrument vehicles and measure certain response characteristics.

I did testing on tires with multiple tire suppliers. I developed new skid trailers to measure the coefficient of friction between the road and the tire. Wrote a couple of papers.

And then I was promoted into the fuel economy group, which I had no prior background in, to help Ford to become leader of fuel economy.

Q. Let me back up. On that first position, what would your job title have been?

A. Light truck development engineer. I was a

grade -- a grade seven. And then I was promoted during that time to a grade eight engineer, salary grade eight engineer, which would be the highest engineer you can be without having people reporting to you at that time.

Q. Who was your supervisor while you were with -- light truck engineer?

A. There were several supervisors, but basically the chain of command was Russ Gallerno, Harry Kert, and Hal Smith.

Q. Tell me their positions if you don't mind.

A. Russ Gallerno was the supervisor -- was the group leader. Harry Kert was the supervisor, and Hal Smith was the manager.

Q. Did that same group have any responsibilities of the Bronco II?

A. Bronco II wasn't even in existence at that time.

Q. But I mean later, did they have responsibility?

A. Well, the organization changed a little bit. But later on, they had responsibility to

test the Bronco II using some of the stuff that -- some of the procedures and things that we had developed --

Q. Okay.

A. -- some of the protocols that we had developed.

Q. Let's back up, now. You were a grade seven, then a grade eight. Where did you go from there?

A. Then I was promoted to a salary grade nine, and I had fuel economy responsibility. It was called the fuel economy optimization group. And I had, I don't know, half a dozen engineers reporting to me. And we calculated, tracked, and monitored the fuel economy of Ford's vehicles.

Q. How long did you do that?

A. Probably a little over a year, year and a half. And then -- then I was promoted to a salary grade ten, and I was in charge of vehicle programs.

Q. What was your title at that time?

A. Still, I think it was called, a group

leader. So the title didn't change. So I was group leader of fuel economy optimization group as a nine. And then I got promoted as grade ten to the group leader of Ford vehicle programs.

And my responsibility there was to look at all the future vehicle assumptions for truck programs -- for light truck programs, particularly -- and do engine package work and suspension package work and resolve cross-functional issues between various organizations within the truck group.

So I would be responsible for identifying any problems with, say, fitting a new engine into a given vehicle. And I'd coordinate the information necessary to the various design activities so that they could design and release the various components. I was kind of a coordinator.

Q. Okay.

A. I was also responsible for weight and tracking weight. And we were aggressively looking at potentially downsizing vehicles

to meet impending future fuel economy regulations, of course, which I became aware of while I was doing fuel economy.

Q. Is that the CAFE standards?

A. The CAFE standards, which were being promulgated toward the end of the seventies.

And I was in that position for about a year, and I got promoted again. And this time I was promoted to be head of a group that was called fuel economy and power train planning. And now I was the supervisor of that group.

And, in particular, I developed vehicle simulations of complete vehicles and made recommendations on axle ratios and transmissions and engines for the future to improve fuel economy and meet fuel economy standards for the future. And that was a salary grade eleven position.

And I did that for a couple of years, and then I asked for a transfer into -- back into suspension design. So I kind of went back to my core business.

Q. And what year was that?
A. That would have been 1980.
Q. Okay.
A. Actually, I'm just trying to think. I think 1979, late 1979. I don't remember the exact year. But anyway, I was in there for a couple years. And then I quit, left the company.
Q. Well, what year did you leave the company?
A. In the middle of 1982, the end of July of 1982.
Q. Okay. What was your actual position or job title between late 1979 and mid 1982?
A. I was suspension design supervisor. I was responsible for all light -- all light truck suspension design and release.
Q. Would that include the Bronco II?
A. Yes.
Q. Prior to your taking that position, was the Bronco II in any development stage?
A. It was what we would call an advanced vehicle concept. It was in advanced -- in the advanced phase. It had not been

approved prior to that.
Q. When was it first approved?
A. I think it was approved toward the end of 1980.
Q. Sometime in late 1980?
A. Sometime in late 1980.
Well, there are several stages to approval. There's not a definitive, it's approved, go. There's, okay, we intend to do this, you know, go ahead and start the next step. And then there are various checkpoints as the program proceeds.
Q. What group has to make the ultimate decision of a vehicle concept before it's put into the design phase?
A. Every effect to design activity.
Q. Who would primarily have had responsibility for the Bronco II?
A. Every supervisor that had a component that would have been unique to the Bronco II had to design it, release it, and sign -- and approve it, so --
Q. I'm talking about the vehicle concept. I

mean, who -- what group, if any, decided, okay, we're going to build a utility vehicle to compete with other vehicles?

A. The light truck product planning group had the primary responsibility for determining what vehicles we needed to produce.

Q. Light truck planning group?

A. Light truck product planning I think it was called.

Q. And you think that would have -- their decision would have come at what year as to the Bronco II?

A. I think they were -- probably had been working on it for about a year and -- as a concept, and then it would have been towards the tail end of 1980 that -- let's proceed to -- we need this vehicle; let's proceed to do this vehicle.

Q. Who would have been the person in charge of the light truck planning group?

A. I don't remember how it completely transitions, but the names that come to mind are Greg Rouke. I don't know if George

Baumgartner was involved at that time or not. And I think he worked for Jim Funk. And Funk may have even moved at that time, also. I'm just trying to remember. There was another gentleman, Jim Englehart.

Q. Would this particular group that you mentioned be a part of engineering or would it be a part of marketing within the Ford organization?

A. Actually, the way Ford's product development groups were broken down at that time, there was the car organization, car product development, and then truck product development, which was actually -- has had various names, but truck/recreation products organization.

The truck and recreation products organization is a distinct and separate entity from the marketing arm and the sales and distribution arm of the company, but interfaces with them.

So they -- For example, if you're going to design a new vehicle, they might come up

with the vehicle, and they would have to talk separately to people in marketing to determine how many we might sell. And before the program would be approved, they would make some estimates of that.

Q. Wouldn't some marketing aspect of Ford make the decision, we want a utility vehicle to compete with these other utility vehicles?

A. It's kind of a team decision, I think. I think the product planners might say, I think we need it. Hey, marketing, what do you think? Marketing might also say, hey, we need it. Why don't you guys design one? Or they might both be sitting in a meeting and say, why don't we have one of these? Let's study it.

So I don't think it's absolutely clear, exactly, who comes up with the need. It could come several ways. Or we might have said we needed it when I was in the fuel economy group to meet a fuel economy standard. You know, we need a vehicle in this segment to replace the bigger

four-wheel drive vehicle with a smaller four-wheel drive vehicle or a smaller utility vehicle.

Q. So you don't know exactly who it was within the organization that made the decision --

A. Or even if it was a who.

Q. Are any members of marketing on the light truck product planning group?

A. Well, there are people that have marketing backgrounds in the light truck product planning group. But Ford has its own marketing arm -- or at that time I believe had its own marketing arm.

Q. Well, who would the people have been that would have the marketing background on the group?

A. I personally didn't really have anything to do with those people. I had very little to do with them. So I don't remember the names of the people who would have had the marketing experience.

Q. Did you maintain your capacity as the suspension design supervisor for the full

time you were there between 1979 and mid 1982?

A. Yes.

Q. So when you left Ford, you had that title, I guess?

A. Light truck suspension design supervisor, yes.

Q. Give me the chain of command within your department at --

A. I reported to Fred Drotar. Drotar reported to Fred Parrill. Fred Parrill reported to Henry Potoczak. Henry Potoczak, I think, retired sometime during this period and was replaced by Dan Rivard.

Q. Can you spell Potoczak for me?

A. P-O-T-O-C-Z-A-K, I think. Phonetic.

MR. HINGA: P-O-T or D?

THE WITNESS: P-O-T. T as in teddy bear.

Q. And then you said Potoczak retired and was replaced by whom?

A. Was replaced by Dan Rivard. And then I believe Dan Rivard reported to Ed

Hagenlocker. And Ed Hagenlocker reported to --

Q. If you can, spell Hagenlocker so we can make sure we get the names correct.

A. H-A-G-E-N-L-O-C-K-E-R.

Q. Okay.

MR. HINGA: I just want to make a statement for the Record.

David is appearing here pursuant to your notice of 30(b)(6) on certain designated topics. What you're doing right now is generally background as I understand it.

But as to some of the dates, there are documents that reflect some of the dates that you've been asking about, and I would rather have those documents speak for a specific date rather than Mr. Bickerstaff as a 30(b)(6) deponent.

MR. ALLEN: Okay.

Q. Let's go on up the chain of command, if you can, from Mr. Hagenlocker.

And again, we're still talking about light truck?

A. Well, now we're in -- yes, we're still probably in light truck.

Q. Okay.

A. I think Hagenlocker had responsibility for light and heavy truck. I don't remember exactly. And then it would have gone up the chain. Somewhere along the line, he would have reported, I think, to Poling, Red Poling.

Q. Red Poling?

A. Um-huh. (Positive response.)

Q. How is his name spelled?

A. P-O-L-I-N-G? Maybe it's two L's. Might be one.

Q. What was Mr. Polling's position?

A. I think he was the chief -- chief financial officer and maybe even chief executive officer. We didn't have a lot to do with

people at that level, so --

Q. I understand.

And then Ed Hagenlocker, what would his position have been?

A. I think he would have been a vice-president.

Q. And Mr. Potoczak before he retired would have had what position in that time frame?

A. Mr. Potoczak and Mr. Rivard were chief engineer. And Fred Parrill was executive engineer. And Fred Drotar was manager, brakes, steering, and suspension design.

Q. And we've got David Bickerstaff. Would you have supervised any engineers at that time?

A. About thirty engineers. It varied from twenty to thirty. There were several group leaders and a number of engineers.

Q. What types of -- What categories of design would they have had responsibility for?

A. Well, they were all degreed -- mostly degreed engineers or very experienced engineers, and they were responsible for designing all the suspension components. They, in turn, indirectly supervised various

designers and various testing activities and directed various suppliers.

Q. Okay. Well, how was it broken down for these -- among these thirty engineers?

A. Well, I had a rear suspension group and a front suspension group. And then -- See, I had the F Series, Econoline, Arrow Star, Ranger, and Bronco, current and past, and all new designs.

So we changed the organization based on the workload fairly often, and it was really broken down by component responsibility. Like one guy might have leaf springs for the F-250 and 350, and another guy might have the -- like Max Moore, for example, he might have the rear suspension on the Ranger. And Tom Mast might have the front suspension on the Ranger and the Bronco II, and somebody else might have wheel bearings and seals.

Q. Are you just giving me examples?

A. Those are actual examples.

Q. So those people did have that responsibility that you just mentioned?

A. If you take all the pieces that make up the suspension, then I divided them up so somebody was responsible for every component --
Q. Okay.
A. -- for every vehicle we currently made and every vehicle we were planning on making.
Q. Well, who would have been the person under you who would have the primary responsibility -- who was primarily responsible for, say, the front suspension of the Bronco II?
A. Tom Mast.
Q. Is he still with Ford?
A. Yes, he is.
Q. Who would have had responsibility for the tires for the Bronco II?
A. Okay. The tires came under another department, although we had some effect on those. And it was under -- Chuck White was the manager and, I believe, Larry Schrock, S-C-H-R-O-C-K.
Q. And who had the rear suspension

responsibility for the Bronco II?

A. It varied. It transitioned, but Rich Antoun as -- when I was leaving, and John Dziuba, D-U-Z-U-I-B-A. And under him, Max Moore.

Q. Who would have had the primary -- the responsibility, say, for testing of the Bronco II as it relates to handling or stability?

MR. HINGA: Excuse me. What do you mean by testing? Physical testing or something else?

MR. ALLEN: Testing as to handling and stability.

A. Testing the vehicle, there are two kinds of testing we did. One was what I call computer-aided engineer, CAE, which would be on the computer. That was my responsibility, and I assigned that to Rich Antoun.

And the other kind of testing, which is done with physical vehicles, was done with -- by the light truck development department.

Q. The what?
A. The light truck development department, the same department I started my career with Ford with.
Q. Who was in charge of that group?
A. Well, it would have been Hal Smith, Harry Kert, Jim McClure.
Q. Okay. So --
A. Manager, supervisor, group leader I just gave you.
Q. Okay. Would they have had the responsibility for the testing that was done on the proving grounds?
A. Yes.
Q. What were the inclusive dates of testing on the proving grounds for the Bronco II?
A. Which particular -- Which Bronco II do you mean? Any derivative, workhorse, any kind of prototype at all?
Q. Yes. Let's start with the prototype and move through -- up until the time you left. And if you know from the time you left --
A. Well, in early -- probably early -- mid to

early '81, we started to get various prototypes at different levels, and we would start testing them. Some of the tests would be done stationary, in the lab. And that would go on through -- right up until and even beyond Job One.

Q. So there were tests on the proving grounds up through 1983?

A. Probably through 1988. I mean, however long that vehicle was produced. I'm sure there's some testing that goes on.

Q. On the proving grounds?

A. Sure.

Q. Would that include maneuver tests: ramp steer, reverse ramp steer?

A. Those are kind of special tests that you do. There are various ranges of tests. Some tests are standard, and some tests you may do for various reasons that are not always done on every vehicle.

Q. What I'm asking about, the maneuver tests or the ramp steer, reverse ramp steer, were they done from the conception of the vehicle

through and including the Job One and even to the time it was --

A. I believe there were some kind of ramp steer tests done, not necessarily the same exact test all the time. But there were steering -- There were tests done with steering inputs that would be ramp inputs probably throughout the development of the vehicle.

Q. Would there be documents and films and all of that that would show all of the ramp steer tests and maneuvers that were done?

MR. HINGA: Object to the form of the question. Compound.

A. Not necessarily. There may be. Some may be reports. Some may be summarized. Filming might be done if we wanted to demonstrate a visible correlation to a model. Filming was not a normal -- Video was not really in its heyday then. It was film that you had to do, and it was a pretty tedious process. So we didn't film a whole lot of stuff back then.

Q. Are you aware of any films of any of the ramp steer tests or the J-turn tests that were done between 1982 and 1989 at Ford?
A. I believe there was some filming done. I left -- Any filming that was done after July of 1982 I'm not specifically familiar with, but I believe there was some filming done. And we did do some -- I do remember some filming being done on J-turn tests while I was -- while I was there. There were some films made.
Q. Would the filming done after you left -- I mean, what opportunity, I guess, would you have had to review that?
A. Only in conjunction with various depositions and trials where somebody may have shown me, have you seen this before? So all of the -- Most of it I've seen for the first time as a result of these various depositions, jury -- the trials I've been involved with.
Q. After you left Ford in '82, where did you go?
A. I was -- I got a job as vice-president of

engineering for a company called Ferro Manufacturing, F-E-R-R-O. And they made body hardware and seat tracks, recliners, various window regulator mechanisms, various latches and remotes.

Q. How long did you work there?

A. I worked for them for a little under two years.

Q. And where did you go then?

A. Well, I had had it with big companies and small companies, so I formed my own.

Q. And the name of that company?

A. DJB&A, Inc. David J. Bickerstaff and Associates, Inc.

Q. Who was your supervisor at Ferro?

A. Jim Stewart, the president of the company.

(Brief interruption.)

Q. Where is Ferro Corporation?

A. Ferro Corporation was a multi-plant company that was headquartered in Detroit that had evolved since the turn of the century. It was a pretty old company. And I left because they were acquired by another

company.
Q. What company or person?
A. Johnson Controls.
Q. Did you resign, or what was your -- the circumstances of your leaving Ferro?
A. I didn't agree with what they were doing and how they were treating their customers, and they wouldn't change to what I wanted to do. And I realized I wouldn't survive as a vice-president when the company was acquired, so I left.
Q. Is Mr. Stewart still around? Is he still with that company?
A. Yes, he is.
Q. Is he here in Detroit?
A. Oh, not still with that company, no. All the vice-presidents of that company are no longer with that company. So I made a good decision.
Q. Where is Mr. Stewart now?
A. Mr. Stewart has -- got a large sum of money as a result of the settlement on that company and has had various business

ventures and resides between Naples and St. Clair -- I'm trying to remember. Somewhere on the river that goes up to Port Huron. Between St. Clair -- Between St. Clair and Port Huron.

Q. I'm not familiar with --

MR. MEANS: Michigan.

A. Michigan.

(Off the Record discussion.)

Q. Now, what does DJB&A stand for?

A. It's my initials, and I have some associates.

Q. Who are your associates?

A. My employees and a couple of guys that I hire once in a while to help me out.

Q. What is the business -- nature of the business?

A. We've -- We're management consultants. Idea generators, problem solvers, engineers. And we're who you call if you can't make something happen in the automotive business.

Q. Primarily, who would you deal with? Who would your customers be?

A. We've dealt with Ford a lot recently. We've dealt with the Budd Company, with American Sunroof Company, with GM White, Volvo. With Maumack, Rockford Products, Schlaegel.

Q. Give me some idea of what you do for those companies.

A. Well, we've -- we've done quality training programs to teach them how to get quality, to educate their work forces.

We've provided strategic planning services for their management, to refocus their company's efforts so they can meet automotive requirements in the future.

We've done design contracts, where we've designed products using advanced computer-aided methods and solid modeling.

We've analyzed data, collected data, done market research. Taught them how to use electronic methods to manage their business operations. We've run, you know, a host of different seminars.

More recently, we -- the client comes to us now. We have a very comprehensive

training facility, so the client tends to come to us now; whereas, the first six years of our business, I tended to be on the road all the time.

Q. Do you also testify in litigation?

A. Only because I have to.

Q. Are you under subpoena here today?

A. Not really. Ford -- I am quite knowledgeable about what happened in the course of the development of these vehicles, and so I have -- as a minor part of what I do, I testify when required.

Q. Well, do they compensate you for your time?

A. I get compensated one way or another, yes.

Q. What's your fee for testifying for Ford?

A. Five thousand a day. It's the same fee as my consulting.

Q. How many cases would you say you've consulted with Ford on since you left?

A. Maybe -- I'm aware of -- The stuff that I've actually consulted on or been compensated for, maybe ten.

Q. How many have you consulted on?

A. I don't know the exact number, but maybe ten.
Q. How many times have you been deposed?
A. That's a combination of the depositions and trials. So all the cases I've been deposed except for one, I think, and there's been, I think, four trials.
Q. How many depositions have you given?
A. I don't know the exact -- I haven't kept count of them. There may be ten, maybe a dozen.
Q. When was the first deposition that you gave in any products liability case?
A. Three or four years ago? Three years ago?
Q. Do you recall? What case was that?
A. I don't remember.
Q. Don't remember the name of the plaintiff?
Have you testified in any other case other than Bronco II cases?
A. No.
Q. I'm sorry?
A. No.
Q. And the employees that work for your

organization, do any of them work in the litigation area?

A. No.

Q. So I take it that you've never testified on behalf of a plaintiff in any case?

A. I don't think I've ever testified on behalf of a plaintiff, no.

Q. Would the five thousand dollars a day include, for example, meeting with the attorney before a deposition?

A. It might.

Q. For example, prior to this deposition, did you meet with Mr. Hinga?

A. For about two minutes.

Q. What did you charge for that?

A. I don't charge by the minute or the hour. I mean, I've got plans to do things for a day. And if you screw up my day, it costs you five thousand bucks. And I've been quite straightforward in saying that in every deposition I've done. It's a real problem for me to be out. I have a major business to run. I'm trying to grow it and I've got

a big investment, and being here takes away from that.

Q. Well, I just want to make sure where we stand.

So you didn't charge for yesterday? Is that what you're saying?

A. I didn't do any work for Ford yesterday -- on depositions, anyways.

Q. And trial testimony, would the same fee apply?

A. Same fee, yeah.

Q. And you say you've probably given a dozen -- ten to twelve depositions in the Bronco II area. Have there been other cases that you've looked at that Ford asked you to look at that you didn't give a deposition in?

A. You mean not regarding Bronco II?

Q. No, regarding Bronco II.

A. Well, the pro forma is that they occasionally send me stuff on other trials that they think may require a deposition. And I generally don't look at it until the day before, if there's going to be a

deposition, because they generally get cancelled about half of the time, so it's a waste of time.

So the answer is yeah, I'm aware of other stuff, but I -- I typically haven't spent that much time on it.

Q. Okay. Well, I'm just trying to get some concept of how many cases that they've sent to you to look at that may potentially result in you giving a deposition or testifying at trial.

A. Well, there might be -- there might be twenty names that I've heard associated with cases, of which ten have resulted in depositions or trials, somewhere in that neighborhood.

Q. How many trials have you testified in?

A. Four.

Q. In any of those cases, do you sit in as the corporate representative?

A. I'm not sure exactly how I was represented there. One of those I may have been a fact witness on, but I think the other three

were -- I was an expert or classified as an expert. I don't understand what the subtle differences are.

Q. Well, I'm thinking in terms of someone who comes in for the corporation and sits there during trial. Have you ever done that in any of the cases?

A. No.

Q. So you just come in and testify and leave?

A. I just come in and do my stuff and leave, yes. I've never sat through a full trial.

Q. That was the question.

Did you testify in the Denny trial up in New York?

A. Yes, I did.

(Brief interruption.)

(Brief recess was taken.)

Q. Just so I'll be clear, the first time that you testified in a Bronco II case would have been after you had left Ford?

A. Yes.

Q. And I want to make sure. You've not testified in any other case other than the

Bronco II cases as far as being an expert or a corporate representative?

A. I don't think I've testified in any other cases. I think I may have done some reconstruction work in a latch case a long time ago, but --

Q. Was that with --

A. I don't think I ended up testifying, I don't think.

Q. Was that after you left Ford as well?

A. Yes.

Q. Was that latch case on behalf of Ford or some other --

A. No, it was just a friend of mine.

Q. Who was your friend?

A. A guy by the name of Andy Gilberg.

Q. Was he an attorney?

A. No. He was a forensic expert.

Q. And you say you don't think you testified in that case?

A. I didn't testify. I don't remember doing a deposition or anything, but I did provide some information.

Q. With that one exception, though --
A. Nothing.
Q. -- all the other cases would have been Bronco II cases?
A. Everything I've done has been Bronco II. I've never been asked to look at anything else.
Q. You've not looked at any of the Ranger cases?
A. No.
Q. Did you have any responsibility for the suspension system of the Ranger vehicle?
A. I had responsibility for all suspension systems. When I had come into the suspension design department, the Ranger suspension was already halfway there, already halfway designed. So my job then was to make sure it was tested and the components were released. And I did get involved with suspension components for the Ranger.
Q. But you've not testified in any of those cases?

A. No, I haven't.
Q. Is there any type of agreement with your company -- between your company and Ford about testifying in the Bronco II cases?
A. What do you mean by an agreement?
Q. Either oral or written.
A. Well, I've told them I'll do it, and I'd like them to restrict it as much as possible and work it into my schedule as much as possible and pay me my standard rate.
Q. But there's no written contract between you and Ford, you being you and your organization and Ford?
MR. HINGA: Concerning testimony?
MR. ALLEN: Or anything.
A. I think there may be some letters that I've sent in to say, you know, this is what I expect. I mean, maybe once I wrote a letter.
Q. But there's no written contract?
A. No, not -- if you mean, you know, a full-blown contract. I don't have a written contract with anybody.

Q. Well, I'm just asking.
A. No.
Q. If you don't, that's fine.
When I say you, I'm talking about DJB and Associates.
A. No. We get purchase orders. We do the job. We get paid.
Q. Since you've left Ford, have you had a chance in working on any of these cases to look at or review any documents that have been generated since the time you left Ford?
A. I've seen some documents that were generated since I left, yes.
Q. So would you be familiar with any changes in the design as it would relate to handling and stability from the time that you left?
A. I'm aware of a few things, not necessarily in specific detail. But I can, you know, look at one of the reports and understand if that report affects something that changed and interpret the report. But I haven't gone through and studied every document that was written since I -- since I left the

company.

Q. But you have a general understanding of the changes that were made in handling and stability?

I'm going to ask you --

A. General --

Q. -- about it, so I want to find out what the basis of your knowledge is.

A. I have some -- some understanding.

Q. When was the first Bronco II produced?

A. The date that it went into production?

Q. Yes.

A. I think it was 1983 and a half or 1983 and three-quarters. I don't know the exact -- I didn't really follow the exact date that the vehicle went into production.

So it would have been -- it would have been planned -- If it was 1983 and a half, it would have been planned to have been produced towards the end of 1982, I guess, early '83, somewhere in that time frame.

Q. In some of the documents I've seen the term Job One used. Is that the first -- the date

that they planned to produce the first vehicle?

A. That's the date -- It's not when the first one is produced, actually, because there are several vehicles produced up to that point. But it's the point at which they start to ramp up and sell the vehicles to dealers, sell those vehicles. The vehicles after Job One go to dealers.

Q. Everything before that would be prototypes of some form or fashion?

A. There are some levels of prototypes that are considered salable units prior to Job One. But for the most part, Job One is the day at which you feel the vehicle is ready to be sold.

Q. Do you remember the Job One date for the Bronco II?

A. I don't remember the exact Job One date, no.

Q. Also in looking at the documents, I see the term Yuma Utility. Is that referring to the Bronco II prototype?

A. That's right. That's -- No. That's the

code name for the program. The Ranger program was code named Yuma. And the Yuma Utility was the name that was used prior to selecting the name Bronco II for the marketing name for the vehicle.

Q. If I look through the documents and I see the term Yuma Utility, they're talking about the prototype for that -- what ultimately became the Bronco II?

A. Well, they're talking about the Bronco II as it was at that time. It's the same -- Yuma Utility was what we referred to prior to knowing it was going to be called a Bronco II. And then there may have been some transition where people hadn't really figured it out yet, so there may even be some documents that refer to Yuma Utility even after we knew it was going to be a Bronco II. So they're interchangeable.

Q. Now, I also see UN48. I don't know if that's the correct code name. Do you know what that stands for?

A. UN48 or UN46?

Q. Maybe it was 46.
A. UN-46 is the Explorer.
Q. Did you ever work on that?
A. I did, actually. But I only worked on that in the capacity of my present work that I do with DJB&A.
Q. What have you done for Ford on the Explorer?
A. What we did for Ford, we set up the quality plan for the vehicle so it would be a world-class vehicle. And we met with all the suppliers and all of the engineers -- not all of the engineers -- most of the suppliers and most of the engineers in the areas where components had been problems, quality problems, things gone wrong issues, lack of customer satisfaction with particular areas.
Q. Did you do anything with respect to the suspension design for the Explorer?
A. We talked about some aspects of the suspension on the Explorer. But what it was, a big brain-storming exercise to identify how we could make the vehicle

better. And that was done, I think -- I think in the '86 time frame.

Q. Okay.

A. Maybe '84, '85, '86. That vehicle -- I think it was a 1990 vehicle, so it was about three to four years before the vehicle came out. I was retained to help develop a plan to make that a super vehicle for quality.

Q. Have you done anything since that time as it would relate to the Explorer?

A. Not really. As a matter of fact, I really stopped working on that about twenty-four months before it went into production. I think they had incorporated most of the ideas they could that they got from us, and then we stopped working on it.

Q. What would the inclusive dates of production have been for the Bronco II?

A. Well, if we assume they started production in January or somewhere around that time frame, somewhere in '83 or late '82, then -- I don't remember when it went out of production. I want to think '88. It's a

matter of record when it went out, and I didn't bring a fact sheet of, you know, when they started and stopped, so I'm just relying on memory.

It was a fairly reasonable production run, I suppose. It might have been later, actually, thinking about it, '89. Because I think -- the reason -- I think the Explorer essentially replaced it. So it was phased out in the Louisville assembly plant and then the Explorer was phased in. So there may have been a period when they stopped producing the Bronco II while they were getting ready to produce the Explorer.

Q. Well, the reason I asked the dates is for this. Do you know of any changes in the design of the suspension system for the Bronco II from Job One until they completed or stopped producing the vehicle as it would relate to handling stability?

A. There may have been -- There may have been some changes. It's quite normal to try and cost reduce and improve. So there may have

been -- There may have been relatively work -- or minor changes throughout that time.

Q. Do you know of any?

A. I'm not aware of anything specific.

Q. In working on the cases and reviewing documents from time to time, have you ever noticed anything in those documents that would indicate a change in the design as -- you know, that would have as its purpose the handling and stability of the Bronco II?

A. I don't remember seeing anything.

Q. So the vehicle that was put out -- Job One was the final product and pretty much what people could expect to buy even in '84, '85, '86 as it would relate to handling and stability?

A. I don't know that to be a fact.

MR. HINGA: Interpose an objection. There is a 4 x 4 and a 4 x 2.

THE WITNESS: That is correct. Yeah, I am aware of that.

A. They did come up with a 4 x 2 derivative sometime after Job One.
Q. I'll limit it to 4 X 4s.
A. Okay.
Q. Are you aware of any design changes in the 4 x 4?
A. I'm not aware of any specific changes, but that doesn't mean there weren't any.
Q. Who would know? I mean, who would be the person at Ford to know -- that I would have to talk to to find out if there were any changes during that time frame?
A. Well, the suspension design individuals that would have been responsible there. But basically, the purchasing organization ought to know because they release drawings into the system. The engineering organization has documentation on all of the drawings for all of the parts that identifies a change level. If any change is made, it's recorded on the drawing.
Q. What drawings would you look at as it would relate to suspension and design? What would

I have to ask for to look at those drawings?
A. Any spring, spring towers, frame, wheels, tires, shock absorbers, stabilizer bars, stabilizer bar brackets, rear springs, rear axle. All those -- All the components. Maybe there's a hundred components.
Q. There's not an overall drawing that would show the suspension system and any changes in that --
A. No, none. The way it works is there's a bill of material for the whole product. And once that's released, the suffix for the part number indicates the model series that it's going to be used for. Now, that -- Those parts may also end up being used on other vehicles, so some of them are derivative parts.

And then any changes made to those parts is generally recorded by changing the -- by changing the prefix in the -- by changing the letters in the part number, say, from an AA level to an AB or an AC. So you can see if there's any changes by

looking at the part numbers normally.
Q. Who would have taken your place when you left Ford?
A. The gentleman who took my place was Roger Stoner, who is now deceased.
Q. Do you know who's in his position today?
A. I don't know -- I don't know how it -- I don't know how they changed the organization after Roger left, so I don't know who's actually responsible. And I'm not even sure the organization is even anywhere close to the same today as it was then.
Q. How long would Mr. Stoner have been in that position?
A. I think he was there for a few years. He died three or four years ago, I think, maybe two or three years ago of a heart attack.
Q. So '82 to '83 -- I mean, '84, '85?
A. I think he was still in that position when he died. I think he was still responsible in that suspension area when he died. But I really haven't stayed close to it.
Q. Do you know who would have come in to

replace him basically in the same capacity for the Bronco II?

A. I don't know, but --

MR. HINGA: Object to the form.

A. I don't know who -- the person responsible after Roger, but it would be easy to -- you know, it's a matter of record. You know, I'm sure there's organizational charts that would tell you who actually is responsible -- or was responsible after Roger left. I just don't know.

Q. In this particular case, have you seen the vehicle that Mr. Crenshaw was driving?

A. No, I haven't.

Q. Have you been provided with any specific information about this case?

A. The only information I've been provided is there was a police accident report, which I'm afraid I haven't had time to read, and I think Ford's -- a letter from Ford identifying what would be -- what we'd be testifying about.

Q. Would it be correct that you would be the

person primarily responsible for the suspension of the Bronco II, the development -- design and development of the suspension?

A. Yeah. During my tenure when I was with Ford, I certainly was.

Q. What changes were made in the design of the suspension that would have an effect on handling and stability from the time you left Ford until Job One?

A. I believe that there was a slight additional widening of the track by changing the wheel offset. And I believe there were some -- there were some very small changes in center of gravity height accomplished by weight additions.

Q. Okay.

A. And there may have been further tuning of suspension components. For example, when I left, we were trying to put a bigger front stabilizer bar on the vehicle so we could use -- also use a fairly good-sized rear stabilizer bar, and that had not been

completely proven out. So after I left, I believe those changes were also still being worked on and developed.

Q. Do you know if they ultimately put a larger stabilizer bar in the front?

A. I believe they did.

Q. And the rear?

A. And when I say larger, I mean a more efficient front stabilizer bar system, where we had changed from the initial assumptions, which were a stabilizer bar mainly behind the axle between the two radius arms, to a stabilizer bar system that was then ahead of the axle.

Q. Was that accomplished as well?

A. I believe it was accomplished, yes.

Q. And you say they put a larger stabilizer bar on the rear as well?

A. If we -- We felt that if we didn't -- if we couldn't put a larger stabilizer bar on the front, we wouldn't be able to put as big a stabilizer bar on the rear. So those two went hand-in-hand. The size of the rear

stabilizer bar and the size of the front stabilizer bar were coordinated.

Q. Tell me about the changes in the center of gravity height.

And again, I'm limiting it right now to the time frame when you left Ford until the ultimate production of the first vehicle.

A. I believe a bigger fuel tank was put on the vehicle. I've been told a bigger fuel tank was put on the vehicle. I believe there were some skid plates or protection plates that were put on the vehicle that would have increased the mass below the center of gravity and lowered the vehicle a little.

Q. The larger fuel tank, is that the change from seventeen to twenty-three gallons?

A. I don't know -- I don't know the exact gallons. But if that was -- If there are two tanks -- one, seventeen; twenty-three -- I would presume that would be the case. I don't know for sure.

Q. But you do understand that the increase in the size of the fuel tank was to add weight

to the vehicle below the center of gravity?
A. I don't understand that was the reason. If they changed -- You asked me what changes were made that might affect the stability of the vehicle.
Q. Yes, sir.
A. And if I put more mass under the -- below the center of gravity, I may have a slight effect on the stability. But the motivation to do the larger fuel tank may have been to increase the range of the vehicle, and so the other effect may have been incidental.
Q. Let me ask you this, then, since you phrased it that way. Would it be proper in your opinion from an engineering standpoint to increase the size of a fuel tank just to enhance the stability index of a vehicle?
A. I don't know if that's the term that -- there's a -- you can connotate it as being proper or not proper. I mean, it does. It may.
Q. But from an engineering standpoint, you couldn't rely on that for vehicle safety,

could you, because people are going to run out of gas at some point, drive the vehicle on an empty tank? Would you agree with that?

A. Not really. Basically if you have a larger fuel tank with larger fuel, then basically, most of the time, the vehicle is being -- on average, when the vehicle is being driven, it's being driven with a lower center of gravity.

It's true -- You know, there are times when the center of gravity may get a little higher when the tank is empty and maybe a little lower when the tank is full. But the hypothesis that the empty tank condition is unsafe anyway is not necessarily held by me or others.

Q. Well, I guess the question is, it wouldn't be good for an engineer to rely on the fuel in the tank to weigh the vehicle down to give it a better center of gravity if it otherwise didn't have a center of gravity that they thought was --

A. I'm not aware of any engineers relying on that or needing to rely on that. But if you wanted to just increase the stability index and then -- and have a higher number, that would do that.
Q. Okay. Stability index, is it normally calculated with the fuel tank full?
A. I could calculate it empty, full, or half full.
Q. What does Ford do?
A. I don't remember. I really don't remember. I don't know what it is. It might be full. I think curb -- curb weight is considered full fuel, no passengers. So that would be the curb weight.
Q. Okay.
A. It's arbitrary. I mean, you calculate it here, calculate it there. It's just -- It's just what it is.
Q. It's important, though, enough for Ford to have documented it several times in the record, so I'm trying to figure out what their policy was at that time when they were

calculating the stability index. Did they do it with the fuel tank full, with --

A. I looked at stability index, you know, with the vehicle both empty and loaded. And there's no reporting requirement to report stability index to anybody, so that's strictly a comparative figure.

So it's only important probably by way of comparison, and it's an arbitrary number when you're done anyway. So I don't attach any significance to it other than being consistent, maybe.

Q. Well, and that's the reason I asked the question, Mr. Bickerstaff. What's Ford's policy with respect to the stability index? Would it -- If I looked at it, would I know if it was a stability index calculated with the tank full or empty?

A. I don't know.

Q. So you wouldn't know if you looked at a stability index whether -- at Ford whether it would be with a tank fueled or unfueled?

A. Unless it's stated.

Q. Okay.
A. Unless the test report stated the condition that it was in, given that you could calculate the stability under various conditions.

And it's also conceivable that with the suspension compliance, when you put more mass in, okay, that changes of height of the vehicle also occur due to weight. So I don't know how all those things interact, but --

Q. Okay. When you were looking at the stability index of the Bronco II, were passengers accounted for?
A. I think we looked at it both loaded and empty. I remember looking at stability index loaded and empty.
Q. And so you can't tell when you look at a stability index number for Ford whether it's loaded or empty? The same question about -- with respect to --
A. I'd need to know the parameters of the test, of the specific test that was being

generated. So if the stability index was, you know -- was two point oh three with one passenger, you know, maybe it's something slightly higher with no passengers or lower, as the case may be.

And what would be important to me would be that if I looked at it this way versus -- with a different suspension or a different geometry or a different track or a different -- what's the difference for the same condition?

Q. When you talk about curb weight, is that without passengers?

A. Normally the curb weight is considered the without weight of the vehicle, I believe.

Q. And then if you have passengers, is that gross vehicle weight?

A. With passengers and a full load is gross -- is the maximum weight the vehicle --

Q. Maximum weight. Okay.

A. That's like the two extremes of weight the vehicle can possibly be at.

Q. Sure.

You mentioned that a skid plate was added sometime after you left. Where is the skid plate?

A. I don't know exactly where it is. I don't know if it's a shield for the fuel tank or a transfer case shield. I'm just aware that there was some kind of a shield added underneath. I haven't really sought to find out exactly where it was.

Q. Do you know how much it weighs or anything like that?

A. No.

Q. Or what effect it would have on the stability index?

A. No. I would assume it would be very small.

Q. You mentioned that from the time you left until the production of the first vehicle, there was a widening of the track width. How much was it widened and how?

A. I believe the wheel offset was changed or was proposed -- that's what I understand -- and I -- maybe a half an inch, quarter of an inch per side. I think I recall reading

something like that.

Again, it's a matter of record, and I'd defer the specific stuff to what's in the record.

Q. Well, see, that's the problem. I noticed the deposition of the corporate representative who is supposed to be somebody knowledgeable as to the design of the Bronco II, so I've got to get all I can from you. Obviously, I will have to depose somebody else who knows because since you left in '82, this vehicle was manufactured after '83, I've got to know what happened in the meantime. If you can't tell me, that's fine.

A. I don't remember the -- I had no reason to be aware of what those numbers were after I left.

Q. What was the highest stability index rating that you were able to accomplish with the Bronco II?

A. I don't remember the exact numbers. We were in the ballpark of somewhere around two.

And I think, depending on various things being looked at, it was -- it was maybe in the one point eight six, one point nine region when we started, and we got into the two plus region and -- you know, maybe two point oh six or something like that.

I think I recall looking at things that we didn't think were feasible that would get us higher than, say, two point one or two point two. But we didn't -- Those weren't really considerations since we never recommended to the company that they actually proceed with those alternatives.

So we were bracketing two, and I don't know where -- we ended up somewhere between two and two point one. Maybe some specific configurations might have even been slightly below two. Somewhere in that ballpark.

Q. What recommendations were considered but were decided to be nonfeasible?

A. Extreme lowering of the vehicle and widening of the track were things that we had looked at and rejected back in the February of 1981

time frame.
Q. You say lowering of the vehicle was not feasible?
A. We didn't feel it was, no.
Q. You say we. Who would we consist of?
A. Me and the other people in my team: Fred Drotar, Fred Parrill, other managers of Ford who reviewed our recommendations and agreed with them.
Q. What managers of Ford?
A. Chuck White, I believe Fred Drotar for sure, Fred Parrill, the people in my chain of command, all the way up to Hagenlocker.
Q. And who was Chuck White again?
A. He was a manager. I think he was in the wheel and tire area.
Q. Okay.
A. He may have also had the fuel systems as well.
Q. Did upper management review any of the proposals that y'all had with respect to the stability index or the stability of the vehicle generally?

A. There were several management reviews where we had gone through and said this is what we're planning on doing; do you agree? And our action -- recommendations were endorsed, and we proceeded.

Q. Were there ever any proposals that were rejected by management?

MR. HINGA: Object to the form. What do you mean by upper management, Greg?

MR. ALLEN: Anybody outside of engineering, let's say.

A. Anybody above me in the organization?

Q. Well, that would be fair.

A. There was nobody in the organization above me that rejected anything I proposed as -- and recommended.

Q. Why did you come up with proposals for lowering the vehicle if you knew it was not feasible?

A. Well, it's quite normal in engineering to bracket what you're doing with the extremes. And, you know, maybe the word proposal is

not the right word. Maybe hypothetical alternative for all of those is a better choice of words.

But it's perfectly normal to look at, well, we could do this; we could do this. I mean, I could look -- I could go out today and design a new car and say I want to design it with an aluminum body because it's the lightest weight thing on the road. And I could have it partly aluminum and partly steel or partly aluminum and partly composite or all steel. And I may go through and look at the trade-offs between those different things and consider them all and still come back and decide to make a steel body for various reasons.

So it's quite normal in engineering to bracket your alternatives and look at the trade-offs associated with doing some higher alternatives or even doing some easier alternatives and then to pick something that you think is appropriate so management knows what the alternatives are that would go

beyond what the trade-offs and risks are that are associated with those things.

Q. Do you know of any consideration to the potential for delay of Job One as a trade-off for not changing the design of the vehicle?

A. Well, we considered the Job One, and we were fairly early in the program looking at where we wanted to put the stability index when I reviewed the program and said let's make the stability index higher.

So I felt that with the stability indexes that we could achieve with the track width changes I had recommended and the center of gravity heights that I had recommended for ride heights, that we could meet all the requirements for that vehicle and produce a safe, stable vehicle with that. So we recommended we go forth with that.

Q. My question is, do you remember any consideration to the delay of Job One as being something that was considered when it

was -- when you were thinking about widening the track with lower than center of gravity?

A. Well, in a couple of the hypothetical alternatives that we looked at where we talked about that -- to widen the -- to widen the track along the center of gravity height, to -- that would create essentially an all-new-concept vehicle I think is the words we used. And -- And even one of the other proposals that we felt that would cause extreme damage to the suspension and not give us the ramp and departure angles and the other things we were trying to achieve, we mentioned that, by the way, if we did want to proceed with that, that's such a big change in the program as far as we're concerned, you also wouldn't meet Job One, which is more of an adjunct than the primary reason not to do the alternative.

Q. Was Job One important to Ford?

A. Job One is always important. I mean, if you're going to spend money to, you know, design and develop a vehicle, you'd sure

like to have a defined point that you can actually start recouping your investment.

Q. During the time that you were working on the aspect of the design that you were responsible for on the Bronco II, were you aware that General Motors was in the process of working on the Blazer?

A. We did become aware. We knew about the S-10 coming, and we speculated they'd be doing a small utility. So we thought that would be coming.

Q. Did you know that -- when the S-10 Blazer was going on the market?

A. I didn't know at the time I was making my recommendations or in the early phases of -- late '80, the '81 time frame. I didn't know exactly when the S-10 would be coming out or the Blazer would be coming out. I think we learned during 1982. We might have learned during 1982 more specifically of their plans.

Q. When did the S-10 Blazer ultimately go into the market?

A. I don't remember exactly. I think the S-10 got to market before we launched the Ranger. And I think that the Blazer might have been in production before we hit with the Bronco II, but I don't remember exactly. Those were really after I left. I don't think they -- I don't think we had a Blazer before I left the company.

Q. Do you remember which came on the market first --

A. Well, the --

Q. -- the S-10 or the Bronco II? Because I don't know. I just --

A. Well, the Ranger came on the market first. And then I remember having S-10's that we were testing before I left the company, so the S-10 must have come out before we came out with the Bronco II. I don't know when the Blazer came out relative to the Bronco II -- I don't remember anyway.

Q. So sometime in '82, though, you knew that the S-10 -- or, excuse me, General Motors was working on a similar utility vehicle to

the Bronco II?

A. No. We knew they were doing an S-10. Okay? We speculated that they were doing a -- they would do a small utility vehicle for the same motivation that we were motivated to produce it.

Q. At the time the Bronco II concept was formed -- I've noticed some of the documents refer to the Jeep as the image vehicle.

A. Yes.

Q. And Ford was trying to compete with the Jeep market in the development of the Bronco II; is that correct?

A. I wouldn't put it quite like that. I would say that in this segment, the Jeep was the other vehicle that was out there that existed today that would provide a reference.

So in this, you know, small -- smaller four-wheel drive utility vehicle, the only other vehicles we had out there -- the highest volume other vehicle that we had out there was the Jeep. So naturally, we -- we

looked at how does the Jeep perform.
Q. Did you test the Jeep?
A. We did, yes.
Q. And when would you have done the testing on the Jeep?
A. In parallel with -- with developing our vehicle, there would be numerous occasions when we would drive a Jeep and compare it to the various prototypes of the Bronco II.
Q. What time frame are we talking about?
A. Talking about 1981, 1982, 1983. I would assume that would carry on.
Q. Okay. Before 1981, did you test the Jeep?
A. I'm sure that there were Jeeps in our fleet that we were evaluating. I don't remember specifically doing any tests before '81, but we might have. We might have had them for comparison.
Q. And the '81 tests of the Jeep, what would that include? What type of testing?
A. Driving around a handling circuit, evaluating it, seeing what people thought about it. Tests like our P6-101, we might

have done that. Maybe the advanced guys in developing the Yuma Utility specification may have done some evaluations.

Q. Would that be J-turn testing?

A. There might have been some J-turn tests. I don't recall J-turn testing really starting until '81.

Q. What are the other maneuvers, other tests that you could perform?

MR. HINGA: Object to the form. Vague.

A. The other tests that we did perform -- what was performed: lane change maneuvers, double lane change maneuvers, drive around various radius turns at different velocities, test the vehicle loaded, unloaded, under different suspension configurations, different road conditions, driving on bumpy roads, wavy roads, gravel roads, off-road.

Q. What is a ramp steer maneuver?

A. It's where you put the steering input in one direction.

Q. And then a reverse ramp steer is what?
A. When you put it in one direction, then turn the wheel into the other direction.
Q. Before leaving Ford, did you ever drive either of the Jeep CJ models -- I say you, Ford -- in any of those maneuvers, either the reverse steer or the ramp steer?
A. I did personally, and other people did, too.
Q. Do you have records of those tests?
A. I believe there is -- there are documents that show the results of subjective evaluations that were done under various -- we were evaluating things like directional stability and lane change stability. That did compare prototype Bronco II's to the Jeeps and other vehicles.
Q. What time frame are we talking about?
A. Certainly in the middle of 1981 I recall, and then again in '82, doing evaluations of that nature.
Q. What does it mean when we look at the documents and it refers to the Jeep CJ as the image vehicle for the Bronco II?

A. What it means is that's the competitive benchmark that exists today and we've got to be better than that. Well, we've not got to be, but we make decisions of how much better we want to be in certain areas than that.

We establish some things we call -- we now call them functional images. But let's say that we rated the handling six on a Jeep. We might want to say, well, we want ours to be a seven or a seven and a half.

So management makes kind of a decision about where they would like to be better in certain functional areas, and then we as engineers try to make it that much better so that we'll have a competitive advantage. The image vehicle is a comparison vehicle.

Q. So you started off with the Bronco II having -- The image vehicle for the Bronco II is the Jeep CJ?

A. Well, really, it would be better to say we developed the Bronco II and then we compared it to the Jeep.

Q. Well, so it's not an image vehicle?

A. Well, I've explained what an image vehicle is. An image vehicle is the principal competitive comparator vehicle. And it's image in the sense that you would like the vehicle that you're going to develop to be superior to that vehicle in various areas that you've selected.
Q. When did you first learn that the Jeep CJ was the image vehicle for the Bronco II?
A. Right from the beginning, I think.
Q. Were you aware back in the beginning that the Jeep CJ had a higher rollover rate than other utility vehicles?
MR. HINGA: Object to the form. Foundation.
A. We were aware -- What we were aware of is a high incidence of fatalities in rollovers and Jeep. We were aware of that.
Q. Do you recall what the statistics were with respect to the fatal accident -- fatal accidents that occurred from rollover of the Jeep back in that time frame?
A. I don't recall the exact numbers, no.

Q. How would the wheelbase for the Bronco II compare with that of the Jeep CJ?
A. I don't remember the exact numbers, but I think they're probably similar.
Q. Okay.
A. But I don't remember the exact numbers.
Q. What is the number -- the wheelbase number for the Bronco II?
A. I don't remember the exact number of the wheelbase right now. If we could look at some of the exhibits that we've provided, we have a -- there's several charts that show the dimensions on these vehicles. I just haven't committed them all to memory.
Q. Do you remember the center of gravity of the Bronco II?
A. Center of gravity would have been roughly half the track width, so in the -- probably in the thirty-inch, somewhere -- thirty, twenty-eight, thirty, thirty-two inches, somewhere around that ballpark.

Again, all of this information exists in various charts and tables that have

been -- that have been produced in discovery in these various trials.

Q. Is it correct that the Bronco II was actually designed off of the Ranger platform?

A. Yes, it is.

Q. Did you design the suspension system for the Ranger?

A. The suspension system for the Ranger was designed by people that were working under my direction when I was moved into suspension design.

Q. But had it already --

A. And it had already started. And we did make changes to the design of the Ranger. Yes, I was aware of the suspension design for the Ranger.

Q. Were there any cost savings to Ford by using the Ranger platform as to -- as compared to, say, starting over with a whole new vehicle?

A. Oh, absolutely. The vehicle probably wouldn't have been feasible without using a platform to start from. That's how all

vehicles -- derivatives are produced.

We did the same thing with the big Bronco after the F Series. Chevy does the same thing with their Blazer off their large F Series -- off their large C-10, C-150. They did the same thing. They cut the small Blazer off the S-10.

So this is perfectly normal practice, is that you -- you're able to build additional product off things by using a generic platform and then splitting it off.

Q. So you took the Ranger pickup truck platform and then designed a utility vehicle basically around that?

A. To use as many common components as possible.

Q. What's the difference, say, between the Ranger wheelbase and the Bronco II wheelbase?

A. I think the Bronco II wheelbase is a little shorter. There was a short wheelbase -- There was a short wheelbase Ranger and a long wheelbase Ranger. And I think the

Bronco II had a unique shorter wheelbase.

Q. As far as the clearance from the ground -- I don't know if I'm using the right term -- how would they compare?

A. I would think the Bronco II would have compared similarly to the Ranger 4 x 4, except we knew it was going to have more sheet metal and seats and stuff that would tend to raise it. So we, I think, were making it slightly lower and in some ways unique from the 4 x 4.

Q. You wanted it lower than the Ranger 4 x 4 because you were going to have more load up top? Is that what you're saying?

A. More higher load, yeah.

Q. I don't know if I asked you this or not. But if you put passengers in a vehicle, will that raise the center of gravity?

A. Well, it's interesting. We've had a lot of debate about that. I think that when you put the passengers in the vehicle, if the vehicle was rigid, it would raise the center of gravity because the suspension is

compliant and deflects. It turns out that -- depending on where you started from, that it doesn't necessarily make that big of a difference to the center of gravity height. So you're talking about even -- maybe an inch.

Q. Now, the passengers, themselves -- the weight of the passenger, if they're in the passenger seat, is that above the center of gravity --

A. Yeah.

Q. -- on the Bronco II?

A. Typically, yeah. Not as far as you think, though, because the center of gravity is just -- just around the load floor area. And the center of gravity of a human being is roughly at the hip point from the rear seat. It's only a little bit above that load floor, so it's not a floor weight. It's only a few inches away, so it doesn't make a huge difference.

Q. Okay.

A. It's even conceivable that the center of

gravity could go down with just passengers. I haven't actually done those calculations, but it's possible.

(Brief interruption.)

(Brief recess was taken.)

Q. Looking at the document that's in front of you, does that give you any information about the characteristics of the vehicle that I asked earlier --

A. Yes, it does.

Q. -- center of gravity, stability index, and all that?

Tell me what that document reflects as it would relate to the Bronco II.

A. It's a little hard for me to read it because the print is so small, but it's a light truck center of gravity and stability index calculation sheet that shows the various vehicles, the wheelbase, the curb weight, the front track, the rear track, the average track, center of gravity height, the calculated stability index, and another index called the cornering index.

Q. Would those be the numbers that would apply to the Bronco II as it was released?
A. This is dated 11/9/82. And I assume that's -- I assume that's close enough that probably it is, yes. Because it also shows -- it shows the Bronco II at program approval and then it shows prototype, and then it shows --
THE WITNESS: Can you read that word for me right there? I can't read it.
MR. HINGA: Release level.
A. -- release level. So it shows those three. So it shows how it's evolved over the course of its development.
Q. Give me the numbers on the release level.
I assume the release level is what you would expect if you went out and bought a Bronco II in 1984 from a dealer?
A. Yeah, that should be close.
Q. Okay. What is it?
THE WITNESS: Okay. I'm going to have you help me read these.

This is the Bronco II release level. Does that say ninety-four point oh for the wheelbase?

MR. HINGA: Yes.

A. Ninety-four point oh for the wheelbase.

(Brief interruption.)

A. Okay. It says the curb weight is about thirty-one eighty-three pounds. Okay. And the front track width, I think that's fifty-six point --

THE WITNESS: Is that fifty-six point nine?

MR. HINGA: Yes, I think so.

A. And then the rear track width is fifty-seven. The average is still fifty-six point nine. And the center of gravity height --

THE WITNESS: I really can't read that. It's too fuzzy.

MR. HINGA: Thirty-nine point nine.

A. Okay. That's longitudinal. So that's the

distance from the front axle.

THE WITNESS: And then this one?

MR. HINGA: Twenty-six point six.

A. Twenty-six point six inches.

Q. What was that second number you read?

A. Twenty-six point six. That's the center of gravity height, the vertical height from the ground to the center of gravity.

Q. So if you're calculating stability index, would you use that second number, twenty-six point six, or thirty-nine point --

A. The twenty-six point -- For stability index, twenty-six point six.

Q. Okay.

A. And the stability index is the track divided by the center of gravity height, which comes out at two point --

THE WITNESS: Is that two point one six?

MR. HINGA: One four.

A. Two point one four.

Q. Tell me about the center of gravity, the number other than twenty-six point six.

Thirty-nine point nine, what is that -- how is that calculated?

A. Well, the center of gravity is the point at which the body would balance. It would -- if you were to support -- could get to it and hold it there --

Q. In all directions?

A. -- in all directions, it wouldn't tip over and it wouldn't tip to the side or anything.

So that -- that location, that center of gravity of that rigid -- essentially rigid body is -- can be specified as distance from some plane -- let's say the ground. That gives the height. And then from the center of the front axle gives the longitudinal center of gravity, so the distance from the center of gravity to the front tire, the center of the front tire.

Q. And that's the thirty-nine point nine number?

A. I think that was thirty-nine point nine, yeah.

Q. You mentioned the stability index is

calculated by track width over height of the center of gravity.

A. That's correct.

Q. And the height of center of gravity we would be talking about in that calculation would be twenty-six point six?

A. That's correct.

Q. And is it correct that some other manufacturers use a different formula for calculation of the stability index?

A. Well, there --

Q. Don't some of them calculate it by T over 2H?

A. Well, some people call it that. T on 2H is another index. It's just a half of that, obviously, so --

Q. For example, if I were looking at records from another manufacturer and they had their stability index calculated, it may -- you may have to --

A. You may have to make the adjustment of the factor of two.

Q. Okay.

A. That's correct.
Q. But as far as it would be -- If you would see the stability index in the Ford documents in this -- as it would relate to the Bronco II, would we be looking at it from Ford's calculation, based on their manner or definition of stability index?
A. I'm sorry? I didn't understand the start of that question.
Q. That wasn't a very good question.

Looking at the Bronco II documents, when I see the stability index of some other vehicle, is it your understanding that that would be by Ford's definition?
A. Ford calculated it, and they were calculated on the same apples and apples basis.
Q. Okay.
A. So in a table like this where this was put together by Ford, it would be reasonable to assume that all the vehicles were tested the same way.
Q. Okay.
A. So that would be comparative.

(Brief interruption.)

Q. Would it be true that in the design of a vehicle such as the Bronco II, the stability index or the rollover propensity, I'll say -- I'll strike stability index -- would be very important?

A. The rollover propensity would be a consideration.

Q. Would it be an important consideration from a design standpoint?

A. I think it would be important to look at what you could do to reduce rollover propensity.

Q. Do you know what the statistics were with respect to the number of fatalities that were occurring back at the time the Bronco II was being developed from rollovers as opposed to other types of accidents?

A. No. We know that the -- I would say that the Jeep, perhaps because of its exposed nature and the type of people that drive them, seemed to have -- I want to say be over-involved or more involved than what one

might like for rollovers. But the specific numbers, I don't recall.

(Plaintiff's Exhibit One was marked for identification.)

Q. I'm going to mark the document that you looked at just a minute ago to get the various numbers with respect to center of gravity, stability index, et cetera, as Plaintiff's Exhibit Number One. It's apparently a program report from light truck engineering dated November 17th, 1982.

Had you already left Ford at that time?

A. I had, yes.

Q. It says that the Bronco II had a Twin-I-Beam independent front suspension. Were you instrumental in the decision to utilize that type of suspension on the Bronco II?

A. No. I think that was a decision that was made when we decided to derive it from the -- from the Ranger.

Q. Who would have made the decision to use the Twin-I-Beam suspension on the Bronco II?

A. I think there wouldn't have been one

individual. I think that would have been -- tended to have been a group decision and a logical choice based on the track record Ford had with the Twin-I-Beam.

Q. Did anybody to your knowledge ever suggest that the Twin-I-Beam not be used?

A. I looked at possibly McPherson suspension at one time, just a short study. And we may have discussed other alternate suspensions, but that would have been an all new suspension on the program.

Q. The question I have is within the engineering department, did anybody ever suggest that they not use the Twin-I-Beam suspension?

A. Nobody said let's not use it. Okay? But we did look at other alternatives, so we -- you know, like I told you about bracketing and trying different things. We're engineers, so we're aware of other types of suspensions. So we may have looked at other types of suspensions.

Q. But do you recall any engineer within the

department really was against using the Twin-I-Beam suspension?

A. Not specifically.

Q. Or anybody up the chain of command?

A. Not really. I think generally the theory was that it had been a good suspension. Some people had concerns on the Twin-I-Beam for its tire wear, possible tire wear. But we made improvements, so --

Q. Is it true that utilizing the Twin-I-Beam caused the vehicle to have a higher center of gravity than would have been accomplished with the McPherson strut or SLA?

A. It's possible that the vehicle would have had a slightly higher engine placement with the Twin-I-Beam because both the axles go under the engine than with a McPherson or a -- or a regular SLA suspension. So, yeah, there might have been a slight increase in the front in the engine height.

Q. Would the engine height be important as far as the center of gravity is concerned? I mean, is a heavy piece of --

A. It would make a small difference. It might make a small difference, a half an inch or an inch even difference.
Q. How important is, say, a one-inch increase in the center of gravity when you're dealing with a vehicle such as a utility vehicle which has a narrow track width?
A. It's going to make a -- It's going to make a little bit of difference. There will be a difference. I think there's other ways to achieve the same end result, which is what we were aiming to do with stabilizer bars and shock absorbers and spring rates and other factors. So I think -- I -- You know, there's no doubt it may make a small difference, but I don't know how significant it really is.
Q. So it's something y'all were aware of when you were designing the Bronco II, that by using the Twin-I-Beam, you had a slightly higher center of gravity?
A. I think we were aware that the engine was a little higher with -- with the Twin-I-Beam

than it would have been with another suspension. There were a lot of pluses for using the Twin-I-Beam, so --

Q. Now, going back to Plaintiff's Exhibit One, the document of November 17th. It indicates -- And I want to make sure these are all the changes --

I think you testified about them earlier.

-- that were accomplished between the time you left and the Job One or the first production of the vehicle.

MR. HINGA: Object to the form of the question as to all the changes.

MR. ALLEN: Well, I want to see if this covers what we've talked about.

Q. And if there are others, I want you to tell me about it.

Apparently, they had a stability index of one point nine three. And subsequent to that, they in February of 1981 increased the

front and rear tread fifty-six point five inches, and they --

A. That was done while I was there.

Q. That was before you left?

A. Right.

Q. Okay. Was it increased subsequent to that time?

A. We increased it, I think, in February of '81. We made the decision to increase it to fifty-six point something inches. It was smaller than that before that.

Q. Okay. Well, here is my question. You mentioned earlier that you think after you left, there was another one-quarter-inch widening of the track width.

A. Right.

Q. Would that be -- would this document -- Let me let you look at the document. The document labeled as Plaintiff's Exhibit One, would that --

A. Yeah, there it is. It's fifty-six point nine, and we were fifty-six point four.

Q. So the figures you gave me would have been

after that quarter-inch widening on each side?

A. This fifty-six point nine, when I left the company, we were at fifty-six point four. This is showing fifty-six point nine. So that's what I had mentioned earlier.

Q. Good. And it also mentions that the center of gravity was lowered via reduction in the ride heights. Do you know what that refers to?

A. That's where the springs are recambered and reset to lower the vehicle. And we had done -- I don't know if that is incremental to what I had done, but I had also lowered it as well.

Q. How do you do that? How do you --

A. You change the shape of the spring. See, you take the coil spring in the front and you -- you make it a lower free height so that the vehicle sits lower. And you do the same in the back. You can't lower that too much because then the suspension will crash -- crash through on a bumpy road.

Q. Does that lower the overall height or ground clearance of the vehicle?
A. It does trade off a little bit on ground clearance when you lower the vehicle that way, yes.
Q. It also indicates that the center of gravity was further reduced through incorporation of one hundred fourteen pounds of selective RPO content as standard equipment, yielding an estimated stability index of two point one four.

Is that what we talked about earlier, the larger gas tank?
A. That could be the gas tank and maybe -- maybe skid plates, too, for the transfer case. Unless I saw the list, I wouldn't know exactly. But a hundred and fourteen pounds --
Q. What does selective RPO mean?
A. RPO is a regular production option. So what that's really saying is there -- here is a bunch of odd things we were going to do that were going to be optional that actually are

good for lowering the vehicle, so why not make them standard on all the vehicles? So it looks like that's what they did. They gave the customer actually more value.

Q. And then it talks about the addition of the front and rear stabilizer bars as standard equipment on all models.

A. Okay. That's good. That's what we wanted.

Q. Now, are you --

A. That wasn't absolutely decided when I left. We were leaning that way and recommending that.

Q. Are you aware, now, of any other changes that were made that had as its purpose either increasing the stability index or the factors that would affect it, such as lower the center of gravity or widen the track width?

A. I thought -- Maybe it's covered in there somewhere, but -- does it talk about slightly heavier wheels anywhere? I understand the wheels were heavier, used a wider wheel or something. But not -- That

sounds about like what I've heard before.

Q. When you say heavier wheels, what are you referring to?

A. The weight of the wheels.

Q. Do you know if that was ever done?

A. That might have been discussed. I remember seeing something about it. I don't know whether that was actually done or not.

Q. Also mentioned in Plaintiff's Exhibit One, it says the FARS data --

And I'm sure you're familiar with that data, aren't you?

A. I'm not familiar with the data. I know what FARS data is. I think it's accident -- some kind of accident data.

Q. Did you review that data when you were designing the suspension system for the Bronco II?

A. I didn't really review it. I think I may have seen it from time to time. I don't specifically remember, you know, studying it, spending a lot of time with it.

Q. But you understand it's the calculation of

fatal accident reports?
A. Right.
Q. Would you expect that there would be other fatal accident reports that were not reported?
MR. HINGA: Object to the form.
A. No. I mean, to the best of my knowledge, that is reconstruction of the reported fatal accidents --
Q. Okay.
A. -- that are reported in police reports that's collected by some agency.
Q. So it wouldn't be based on statistics? It would be actual accidents that were reported and -- and that information collected?
A. It would be the incidence of where rollover -- of rollovers where there were fatalities involved.
Q. The memo goes on to say that the FARS data shows that the CJ vehicles have a propensity for rollover fatalities more than triple of the standard-size utility vehicles.
Would you have been aware of that even

before this document?
A. I don't know about -- if I would have been aware of triple. But we knew that there was some multiple -- and again, as I explained, the CJ, the demographic factors of the owner-operators, the type of person that might drive the vehicle, the open nature of the vehicle that would tend to be -- if there was a rollover, might increase the chances of death or, you know, significant personal injury.
Q. Did Ford think that they could reduce the number of injuries from rollovers just by giving the passenger more protection, by like having an adequate roof structure?
A. I think we felt that with the roof being designed to meet the federal Motor Vehicle Safety Standard of roof crush centers, having an enclosed roof, that that would give more -- that there would be less fatalities than with an open vehicle.
Q. And therefore, you were hoping it would be lower than the Jeep?

A. I wasn't hoping. We just thought that it was directionally advantageous to have a roof structure as opposed to an open vehicle. I think it was the general group of us that felt that.
Q. And you would have been included?
A. Yes.
Q. It mentions the "60 Minutes" television expose'. Was that after you had left Ford?
A. I don't remember when the "60 Minutes" -- I think that "60 Minutes" stuff was in -- it might have been in even '80 or '81. I don't remember exactly when the "60 Minutes" came in. I was aware of some "60 Minutes" stuff that -- I think even while we were talking about stability index.
Q. And the "60 Minutes" stuff that we're talking about is the expose' they did on the Jeep CJ rollover situation?
A. I don't remember whether it was -- "60 Minutes" came later or, you know, some kind of Consumers Union. I don't remember quite -- That's going back quite a few

years. I don't remember exactly when that came in, but I'm aware of some Consumers Union testing and I'm aware of the "60 Minutes" thing. But I don't remember the exact time frame. Does it say there?

Q. It says the Insurance Institute for Highway Safety, October 1980 and January of 1981, "60 Minutes" expose'.

A. Okay. All right.

Q. Is that -- the Insurance Institute for Highway Safety another group that was critical of the Jeep CJ rollover problem?

A. I'm aware that they had certain opinions about the Jeep.

Q. What were their opinions?

A. I think they felt that they were over-involved in rollover fatalities.

Q. When would you have learned about that?

A. I think that would have been in the -- I couldn't remember whether it was "60 Minutes" or Consumers Union. But that would have been in the stages when we were recommending -- in the -- October, when we

got the vehicle from advanced and we started designing it.

And remember, I had done a lot of work on stability index and rollover back in my development days. So when I got that vehicle, I started looking at, you know, is this vehicle going to be okay for track width and center of gravity height? Should we make it wider and lower? I made those recommendations. Those were accepted. And this -- Some of this stuff was going on while I was making those recommendations.

Q. So the "60 Minutes" and the -- I guess the publicity of the Jeep CJ problem would have come to you during that time period?

A. I was aware of it during that time period, yeah.

Q. Were you aware of the targets that marketing within Ford had set up for the Bronco II?

A. What do you mean by targets?

Q. Their target market, people that they were targeting to buy the Bronco II.

A. Only subsequently have I become aware of

some of -- what the language looked like in the brochures and the things that were actually used to market the vehicle. I really wasn't involved in that. I'm not really an expert in that area.

Q. So at the time you were designing it, you weren't really told who Ford had in mind to purchase the vehicle?

A. No. I think we were designing a vehicle to be a small, compact utility vehicle. And then based on the way it market tested when they showed it to people, they probably created some of that marketing literature.

But I'm not aware specifically of aiming for particular demographic groups. I would have been trying to get people out of big Broncos into the small ones was -- was our intention.

Q. Would it have been foreseeable to you at that time that there would be -- the Bronco II vehicle would be used for highway travel?

MR. HINGA: Object to the form of

the question.

A. Well, I think that the vehicle -- we knew the vehicle would be used on the highway, and we knew there would be a certain amount of off-road -- a small amount of off-road use.

But the utility, by definition, is designed as a dual-purpose vehicle, that you can go off-road with it and a vehicle you can use on-road. So that's kind of a moot point. We designed it so it can go off-road.

Q. But just so we'll be clear, did you think that there would be more passenger travel as opposed to off-road use for the Bronco II at the time you were --

A. Well, it's a fact that these vehicles tend to be used more on the highway than off-road, but their design is somewhat compromised by being able to use them off-road. They tend to be higher for better ground clearance and be able to go off-road, so --

Q. Well, did you have in mind any percentages of use; for example, on-road versus off-road use?
A. Not particularly.
Q. Did you expect the vehicle to be used by experienced off-road users as well as inexperienced drivers?
MR. HINGA: Object to the form.
A. I think we expected a reasonable diversity in the population of people who drive the vehicle.
Q. And was it designed for family use?
A. It's designed as a personal-use vehicle. Anybody could use it who needed a vehicle for -- that would have those -- you know, that facility, being able to go off-road and being able to use it on-road.
Q. Do you know -- Let me show you the last page of Plaintiff's Exhibit One.
A. Okay.
Q. What does that chart reflect?
A. Okay. This chart appears to be a chart talking about various vehicles, including

passenger cars, utility vehicles, and talking about relative fatalities for all fatal accidents and rollovers only, and fatality rollover contributors.

Q. Is there a projection as to where the Bronco II should fall?

MR. HINGA: I'm going to object to the form of the question. I believe this is outside of the designated areas for 30(b)(6). He can go ahead and answer.

A. Okay. There appear to be some projections which are qualified with approximately symbols that talk about fatality rollover contributors for loss of control, self-induced rollover, and occupant hazard factor rollovers.

Q. And what vehicle do they project the Bronco II to be comparable to in that regard?

A. Well, they -- the CJ7 is -- is better than the CJ5. So it looks like they're projecting it to be about forty percent

better than a CJ5 in a mechanical trip, the same in a friction trip, and virtually a nonexistent rollover in a self-induced rollover and -- whereas; there is some self-induced rollover on a CJ5 and occupant hazard factors of about one-third, about thirty percent of what a CJ5 is. So somewhere between forty percent to three times better than a CJ5 I would say is what this tells me.

Q. What does it say with respect to the S-10 Blazer?

A. And then the S-10 Blazer is -- it appears that these projections are showing it to be in the same ballpark as we would expect the Bronco II.

Q. When you say there shouldn't be a self-induced rollover, what does that bring to mind to you?

A. That's a rollover that would occur in an accident avoidance move, let's say on a -- on completely smooth asphalt where there were no perturbations in the pavement or

curbs or the vehicle never slid off the road and got into the dirt and rolled over or rolled down an embankment or something like that. So this would be a self-induced trip.

A mechanic -- A friction trip is where the trip would be where the vehicle got out of control and yawed excessively and actually tripped on the pavement.

A mechanical trip would be a trip in the dirt or a rut or -- or the vehicle got off-road and hit a curb. That would be a mechanical trip.

That's the three different types of rollovers.

Q. So as I understand it, if you pull the part on the wheel on flat level pavement, it was not expected to roll over?

A. In normal real world road conditions.

Q. Okay. In other words --

A. Now, that's not to say that you couldn't create a condition -- a steering input in a test environment and you couldn't cause the vehicle to roll over, because you can make

vehicles roll over.

Q. But the maneuvers -- for example, a lane change maneuver, you wouldn't expect the wheels to lift off the ground or it to roll over?

A. Oh, I would expect the wheels to lift off the ground, yeah. I would certainly expect the front wheel to lift off the ground with the amount of understeering you have put into the vehicle.

If you were to basically be extremely aggressive, you might even get an instantaneous two-wheel lift with various combinations of the utility vehicles, so -- and different loadings.

But I think this projection says we expect it to be somewhat comparable to a Blazer, better than a CJ5. Some were better than a CJ7, and -- but we did expect that we would be worse than passenger cars.

Q. How many of the cases that you've testified in have been just flat, level pavement rollovers?

A. Well, I think -- It depends on how you speculate about the interpretation of the data and the various accident reconstruction experts, but they all appear to be a result of loss of control by the driver; the best I can see, the drivers losing control of the vehicle and then subsequently rolling over.

Q. How many of them are on flat pavement?

A. I think most of them, they're either getting off onto the shoulder or there's speed involved and they're -- and they're getting completely sideways and tripping. And I think a good portion of them, the rollovers are occurring off the road. Maybe there's one or two that were occurring on the road where the drivers got completely out of control.

But I -- They almost all seem to be involving loss of control. Some of them -- A couple of them have been hit by other vehicles and rolled over.

Q. Would you expect a Bronco II on flat, level pavement sliding sideways to roll over?

A. Could under certain conditions, just a sudden transition of pavement friction. I mean, any vehicle -- You can actually roll over any vehicle. You could construct some configuration of --

Let's face it. Formula One cars roll over, right?

Q. I'm talking about on flat, level pavement.

A. Formula One cars roll over on flat, level pavement.

Q. Just from the friction between the tires --

A. They get sideways and roll over. Absolutely. You can watch them on TV. Okay? Anything can roll over. The wheel is not glued to the road. You lose control of the vehicle, a rollover is a potential event.

Q. And y'all knew that back when you were designing the Bronco?

A. Not just the Bronco. Every vehicle that has ever been designed, that has been an eventuality.

Q. So would it have been your job primarily to

reduce that propensity to roll over?

A. My job would be to provide a stable, safe handling suspension and -- and to put the domain into which somebody might roll over as high up as is physically possible within all the other considerations that we're trying to optimize, which is what we did on the Bronco II.

Q. As far as in your capacity, how would you rank safety as far as the various factors you have been responsible for?

MR. HINGA: Object to the form of the question. It's vague and ambiguous.

A. Safety was very high up on a comparison. The components we released were considered safety items. Mechanical failures of components was something that was considered.

So safety is -- You know, safe, stable handling was definitely a consideration. It's not necessarily considered federal Motor Vehicle Safety Standard. But meeting

acceptable handling performance as determined by our handling test procedure, which is P6-101, where we drive the vehicle extremely aggressively in all manner of maneuvers and determine by a jury whether or not the vehicle is safe handling or not, we feel it's been the industry way of doing those things for years. And we feel -- We feel that that's a pretty important part of what we were doing.

Q. Would you say that all of the cases that you've testified in, the complaint primarily has been that the vehicle was unstable and rolled over? Either the -- it was too narrow, too tall and, really, was basically a criticism of your department?

A. No. I would say that there has been some attempt to find fault with the vehicle that makes it particularly prone to rolling over, and --

Q. Well, is that a criticism of the suspension and design, I guess, as opposed to some other aspect?

A. No. I think it's been a criticism of the whole vehicle, I mean, the whole -- the whole segment, really, of vehicles.
Q. But as far as rollover propensity, isn't suspension and design probably the most important aspect of design?
A. Well, suspension certainly determines how high the vehicle is going to be, once you determine what the vehicle is and -- the shape, size, length, you know, width, height, so on.

But as we've testified before, is that -- you know, it's just one of the factors that's gone into this whole vehicle. And given that you're going to produce a utility vehicle that can go off-road that's going to be in this general domain, then you produce a suspension system that provides a safe, stable handling vehicle.
Q. But just so we'll be clear, would that be one of the most important things that you would have to be concerned with if you're looking at rollover propensity, the

suspension system?

A. Well, suspension system is -- and all the things that go with it and the steering system and the overall vehicle configuration all interact together to produce the end result.

Q. And you were in a position that if you felt like you -- you know, that people were going to be injured or killed from the vehicle because of its rollover propensity, you could have vetoed the whole project?

MR. HINGA: Object to the form of the question.

A. I felt that -- Considering the vehicles in the vehicle domain and their basic characteristics and looking at this vehicle we were planning to produce, I felt that there were certain parameters that we should change. And I made recommendations to change those parameters and felt that we could and, in fact, did produce a safe, stable handling vehicle.

Q. And so --

A. But I also knew that it would be impossible to design any vehicle that could not and would not roll over under any conceivable -- every conceivable event that could occur on the highway. In fact, we wouldn't make vehicles if we tried to do that.

A Corvette is over-involved in rollovers for some reason, so we wouldn't make Corvettes maybe. We wouldn't make all kinds of vehicles. Wouldn't make buses. Wouldn't make heavy trucks. Wouldn't make cement mixers.

So I felt that we -- we make a safe handling vehicle within that segment, and -- and I think that we did.

Q. I just want to be sure that -- I mean, you're the person that would have had that responsibility. And if you wanted to propose something in addition to that, you could have done it, and management would have agreed with it.

A. Not only could have; did. And it was approved, and that's what we did do. And,

in fact, all my recommendations that I made were accepted and were being worked on even as I left. And they appear to have been worked on.

And then I think in the final stages, with offering these RPO options, I think they went above and beyond and offered even more things to -- to reduce the propensity.

Q. Things that you wouldn't even recommend?

A. Probably -- Probably would be a really small effect in the total scheme of things.

You know, to change the stability index even point one, I'm not sure -- I'm not sure how significant that is in reducing fatal rollovers. I'm not sure anybody has absolutely correlated that. Certainly not while I was around had anybody presented an analysis.

Q. I just want to be sure, Mr. Bickerstaff. You were in a position where you could have made changes in the design that would have made a bigger difference, but you chose not to, and because you -- and no one overruled

you or prevented you from making those changes?

A. We -- I say I -- I mean, these were basically a team-done things. There was a group of us that met and reviewed these things and made recommendations and took those forth to management. And we did recommend changes, and we felt we made the recommendations -- the changes necessary that would improve the vehicle. And we did do that. We chose -- We chose what we did based on a pragmatic approach.

Q. Did you know back at the time that you were designing the Bronco II that the -- the fact that it had a shorter wheelbase than other vehicles would enhance the propensity to roll over?

A. There are some people that speculated that shorter wheelbase vehicles may have a higher propensity for rollover. However, what the wheelbase does is it changes the sensitivity to steering. So we felt that we could -- There are plenty of vehicles with short

wheelbases. Fiestas, all kinds of small cars have short wheelbases.

So wheelbase is not a fact to look at by itself. We felt with the other suspension parameters that we could modify that. We didn't feel having a short wheelbase was unsafe.

Q. The question I think I asked was whether or not -- were you aware at that time that having a shorter wheelbase would enhance the propensity to rollover?

A. I think I answered that the -- there's no evidence to show or was no evidence to show at the time we were doing -- designing the vehicle that that short wheelbase specifically would increase the propensity for rollover.

Q. Would it be a factor in causing a vehicle to get in a position to roll over that you have a quicker steering response?

A. Well, it would be unless we had equalized the steering response characteristics. So since there are means of changing the

steering response characteristics on a vehicle -- just because this vehicle has a short wheelbase doesn't mean it can -- it has to have.

You can make a vehicle with a short wheelbase have the same responsiveness to the steering as a vehicle with a slightly longer wheelbase.

Q. Are you saying that the Bronco II was designed that way?

A. Well, we -- we did a lot of work on the suspension to reduce the sensitivity to steering even though it had a shorter wheelbase.

Q. Tell me what was done for that purpose.

A. Well, the stabilizer bars. The big front stabilizer bar is one of the things that does that. By increasing the load transfer to the outside front tire in a corner, it means that the steering -- the forces the tire can generate are reduced in total on the front axle. Not increased. They're reduced.

This basically then means that if you want to turn the corner, you have to put more steering input in. And steering sensitivity is the amount of response you get for giving steering input. So that was one thing we did.

We do that also by increasing the understeer coefficient, which means the higher the vehicle is cornering, the more it's turning, the tighter it's turning, the more Gs the vehicle is pulling, the more steering input you have to put in to stay in that maneuver. So those were the things we did to reduce steering sensitivity.

Q. Okay. And the reason you did that was because you knew that it had a short wheelbase, and short wheelbase vehicles generally are prone to coming around, for lack of a better term, faster than long wheelbases?

A. If you didn't do the things we said, a short wheelbase vehicle might have a faster response than a longer wheelbase vehicle.

Q. What does the rear stabilizer bar have to do with the response of a vehicle with a short wheelbase?

A. If you put a rear stabilizer bar on by itself or increase the rear stabilizer bar stiffness beyond what it will be balanced with the front stabilizer bar, then you can tend, to make the vehicle come around more or turn tighter or increase the steering sensitivity. So that's why you have to balance both bars.

Now, we wanted to put less roll -- more roll stiffness into the vehicle to reduce the amount of roll angle the vehicle would see. And in order to do that, we didn't want to basically make the vehicle prone to coming around, as you say. So we were working on a big front bar with a smaller rear bar to provide that balance.

And that's what the vehicle dynamicist or the vehicle dynamics engineer does -- it's one of the things he does -- is he balances those stabilizer bars to provide

the optimum handling to provide those trade-offs.

Q. So as I understand what you're saying, the stabilizer bars will limit body roll?

A. That's correct, and they will change the steering response characteristics of the vehicle.

Q. And the limitation of body roll, will that aid the center of gravity, I guess, in a cornering maneuver?

A. That enhances the point at which the width -- the Gs that it takes to lift the wheels up in cornering.

Q. It takes more force to --

A. It takes -- Yeah. If you reduce the body roll, then it takes more Gs to get the inside wheels to lift up in the corner.

Q. Okay.

A. So you want to put more stabilizer bars on to prevent the wheels from lifting up as much at the same G level, so that will increase the G levels. But then you have to balance the front and rear bars to reduce

the propensity for the vehicle to spin out.
Q. Because if you had just stabilizer bars on the rear, that would actually cause it to spin out quicker, wouldn't it, or easier is what I should --
A. It would tend to promote that, yes.
Q. When you use the stabilizer bars, what does that do for the driver as far as his sense of feel with respect to an impending rollover?
MR. HINGA: Object to the form.
A. I don't suppose that if a driver loses control of a vehicle and he reaches that impending point of rollover, he has any prior experience of that event, so --
Q. Well, don't the stabilizer bars make the driver feel like he's got a vehicle that's less likely to roll over because it's stiff and it remains basically level in a turn?
A. Some people have speculated, as you have, that that is a factor. However, if I put more roll gradient in a vehicle, then it will roll over sooner at lower Gs, so --

Q. More roll gradient?
A. If I have a vehicle that's a tippy vehicle, that the body rolls a lot, then you're going to increase the probability of it rolling over in a cornering maneuver. So that's a -- We decided to make it as stiff as practically possible.
Q. And when you're talking about the roll gradient, is that because as the body rolls on the -- on the springs, I guess, your center of gravity is shifting?
A. That's correct.
Q. And that's not good?
A. Well, it's going to do it to some extent on every vehicle.
Q. But the more it does it --
A. Well, the more it does it, the lower the Gs are going to be at which it will roll over. So our theory was that if we stiffen the vehicle, we increase the Gs at which it will roll over. Every vehicle can roll over, so it's just a matter of Gs.
Q. And so I guess the body roll -- I mean,

you're not talking about changing -- making a significant difference, are you?

A. Yeah. Oh, yeah.

Q. Just a small -- Just an inch or two in the shift in the center of gravity can be important?

A. No, it's not center of gravity. It's a load transfer.

Q. Well, don't the --

A. And it's not just an inch or two when the body rolls ten or fifteen degrees. Okay? And it's not just -- It's not just the center of gravity. It's not really the center of gravity height so much as the lateral shift of the center of gravity towards the outside tires of the sprung mass.

We have various diagrams that we have used that explain this phenomenon of what -- what our rationale is for basically having a stiff suspension. And we all agreed that stiffer is better up until the point that a vehicle becomes so stiff that it bounces

around on a rough road.

So there's a trade-off. You can't make it infinitely stiff.

Q. Let me back up and ask you a few questions I should have asked earlier. And you may not be the person to answer these, but if you can, tell me.

Who is the current chairman of the board of Ford?

A. Who's chairman? Alex Trotman? I don't know, because Alex Trotman is the chief executive officer.

Q. Who is the president?

A. That may be -- William Clay Ford is up there somewhere. There's William Clay Ford and Alex Trotman. I mean, I don't hang out with those guys, so I don't know who -- exactly what --

Q. If you don't know, that's fine.

A. There's been a big reorganizational change lately. And the guy who's running Ford right now seems to be Alex Trotman, so --

Q. During the time that you were designing the

Bronco II, did you ever have contact with anybody with the office of general counsel inside Ford?

A. Yes, I did.

Q. And who in OGC did you have contact with?

A. I talked to various people in OCG. John Leinonen, L-E-I-N-O-N-E-N. Lymon Forbes. Roger Moore, I believe, at one time.

Q. Are they just --

A. Maybe he's not OGC.

Q. Do you know what their positions are within OGC?

A. Actually, wait a minute. Leinonen and -- Leinonen and Forbes were the automotive safety office. And I'm trying to remember specifically who at OGC it would be. I'm not sure if Moore was in OGC or automotive safety office. Those are the only names I remember at the moment.

Q. Is there a department within Ford that has as its function the assistance of litigation?

MR. HINGA: What do you mean by

that?

MR. ALLEN: To assist -- You know, folks y'all usually put up for depositions.

MR. HINGA: Okay.

MR. ALLEN: What's the name of that department, if you can tell me? Is it design analysis?

MR. HINGA: Yes.

A. There were -- There have been departments like design analysis where engineering experts have -- within Ford have helped Ford with litigation. We had a department like that in the truck office that was headed up -- I think Al Darrold and Dick Keefer were the two key names that I remember in that area.

Q. Did you have contact with anyone from that department while you were responsible for designing the Bronco II suspension?

A. Some discussion with Keefer and Darrold.

Q. Did they have input into the design?

A. Yes. They were aware of what we were doing.
Q. But, I mean, did they make the decisions or did they participate in the decisions as it would relate to the suspension; for example, the roll stiffness that you're talking about, the stabilizer bars, that sort of thing?
A. No, we did that, but we told them what we were doing.
Q. And did the office of general counsel generally know about what you were doing as well?
A. I think that they were aware of what we were doing.
Q. Was there ever any discussion back at the time you were with Ford about the potential for litigation from rollovers, the Bronco II?
A. I think -- I think we could fairly assume there would be some litigation if there was a rollover. There was a potential. There's always a potential for litigation.
Q. Did you have any specific discussions with

anybody from design analysis about that potential back before the first Bronco was put on the market?

A. Only to the extent that -- that the stability index might be a factor that a plaintiff's attorney might try to hang his hat on and that it might be desirable for our number to be in the same ballpark as other people's.

Q. Who would that discussion have taken place with? Would that have been Mr. Darrold?

A. Mr. Darrold. Mr. Keefer, perhaps. I don't remember a specific discussion.

Q. What's Mr. Keefer's first name?

A. Dick. R. E. Keefer.

Q. Were you still at Ford when a memo was put out to basically itemize or gather up all the Bronco II documents?

A. I think I was there. There was a short period I took some time off to go sailing in the -- off the coast of Florida. I was gone for about six weeks. And that might have happened during that time.

I don't remember exactly, but I am aware that there was an attempt to collect up and identify any documents related to the Bronco II.

Q. At that same time, did they collect up and -- all the documents for any other vehicle that was being designed?

A. I don't know if they did or not. I think they were looking at the Bronco II.

Q. Well, are you aware of any collection of documents of any other vehicle you had responsibility for the design of while you were at Ford other than the Bronco II?

A. I don't remember any, no.

Q. Did they tell you why they wanted to get all the documents together on the Bronco II?

A. No, not specifically, no.

Q. Did you gather all the documents or put out a memo to the people that worked in your department to get the documents together?

A. If I recall correctly, Rich Antoun was -- in my activity was responsible for putting any -- collecting all these documents. Now,

he might have done that while I was gone, because I think he was filling in for me while I was gone.

Q. Okay.

A. That's one of those things I have a hazy recollection on about exactly what -- how that whole process got started.

Q. Have you talked to Mr. Antoun about that?

A. No, I haven't.

Q. Is he still with Ford?

A. Yes, he is.

Q. And what is his position today?

A. I don't know what his exact position is, but I think he may still be working in similar areas, suspension and that type of thing.

Q. Do you remember about what time frame it was that they collected all the documents?

A. I want to think it was sometime in the '82 time frame, but -- it may be in the spring of '82, maybe later. I don't remember exactly when.

The only thing I can think of is, I usually remember most of the things. I have

a hazy recollection on that one, so I've concluded that it must have happened while I was not there.

(Brief recess was taken.)

Q. Mr. Bickerstaff, let me show you a two-page document. I don't think I'm going to mark it as an exhibit, but it's Bates number 44143. Ask if you're familiar with those documents.

MR. HINGA: The date of the document is 5/28/82.

Q. Were you still there at that time?

A. I was still there at that time, yes.

Q. Would that be the document collection program that you've just discussed?

A. Yeah. I think this is -- I think this is describing five basic categories of documents that they wanted to make sure they had centrally located.

Q. The design factors, the handling, rollover propensity, occupant protection, and warnings?

A. Yes.

Q. Did they ever gather any documents on any systems of the Bronco II other than within these categories?
A. I don't know.
Q. To your knowledge, are you aware of --
A. Not that I'm aware of, no.
Q. And you don't know why they gathered the documents up?
A. Well, I could speculate as to why they might want to gather them up.
MR. HINGA: Don't speculate.
Q. If you don't know --
A. I don't know, unless it says on the purpose -- doesn't it say the intent is? Doesn't it say what it is? The intent is to establish a central file, so I assume that's why they did it.
Q. Are you aware of any documents that were gathered up that have now been destroyed?
MR. HINGA: Object to the form of the question.
A. I'm not specifically aware. I understand there's some -- there's some list of what

may have been documents that -- where somebody is having a hard time finding the documents. I've heard about that, but I don't know the specific details.

Q. Do you know how many documents are missing?

A. I don't know. It's a few. I don't even know what they were.

We do have a document -- We did have a document retention policy. Documents were, in fact, supposed to be obsoleted at certain points in time. So I don't know if those would have fallen under those guidelines.

Q. Who developed the program documentation methodology?

MR. HINGA: That's described in the document we've been talking about?

MR. ALLEN: Yes.

A. Who wrote this document?

Q. Yes.

A. I've got no idea. That's ASP. ASP would seem to have something to do with it.

Q. What group is that?

A. I don't know what that is either. ASP, automotive safety something. It might have come from the automotive safety office, but I don't know what that designation stands for. It might have been somebody's initials, too, although I can't think of anybody with those initials.

Q. Do you know what it's referring to under category two under handling, where they say: This section will establish that Bronco II drivers are less likely than drivers of competitive vehicles to lose control or to expose themselves to conditions conducive to rollover?

A. Explain the question again.

Q. What do they mean by that, if you know?

A. What they mean, they -- they'd like to know where the data is that shows that a driver in the Bronco II, okay, would be less likely than a driver of a competitive vehicle to lose control.

Q. I mean, are you aware of that thought process? I mean, was that the thought

process of Ford at the time, that Bronco II drivers would be less likely to lose control than other -- drivers of other vehicles?

MR. HINGA: Object to the form of the question.

A. From my point of view while I was -- while I was there, we were trying to make the steering inputs that would produce a rollover response be extremely high. So in that context of live steering inputs producing a rollover response and larger inputs maybe than a competitive vehicle, perhaps this is referring to if you've got data that supports that, provide it.

Q. Do you know of any data that would support that Bronco II drivers would be less likely to lose control than drivers of other vehicles?

A. I think some of the data that we had -- that we had from subjective evaluations indicated that our vehicle was very stable handling-wise compared to, say, a Jeep CJ5. So we certainly thought that the CJ -- that

the Bronco II was a better handling vehicle than a CJ5.

Q. So that's what you were relying on, the driver's ability to handle the Bronco II as opposed to the Jeep?

A. It could have been that kind of data or it could be simulations. I mean, it's -- See, that's what the handling evaluation reports would be. And any engineering analysis that shows understeer under all loaded conditions, that would be supportive of that fact.

So I think it's fairly clear the way it's stated here. And generally, these bullet points to the best I can recall actually supported that case, that argument.

Q. Let me show you another document -- it's Bates number 420 -- which is a very poor copy, but apparently it's a document you authored around January 22nd, 1981.

A. John Dziuba signed this. Now, he may have authored this and used -- be sitting in for me in my office when he sent this out. So I

didn't necessarily author this.
Q. That's not your signature?
A. No. That's John Dziuba for me. So this would have been a situation where I might not have been there and he may have written this letter and sent it out under my signature acting as the acting supervisor. This is J. C. Dziuba. That's his signature.
Q. When it talks about the Yuma Utility 4 x 2, that is talking about the Bronco II prototype?
A. That's talking about the Bronco II two-wheel-drive derivative. If it says 4 x 2, that means it's the two-wheel-drive.
Q. No. 4 x 4, two-inch --
A. Oh, I'm sorry.
Q. Why don't you just read the heading, if you can, on that document.
A. Yuma Utility 4 x 2, two-inch --
THE WITNESS: I can't read that next word. What's that next word right there? Can you see it? I can't see it.

MR. HINGA: Yuma Utility 4 x 4 two-inch production in -- I don't know whether -- in overall vehicle center of gravity feasibility study. It's probably reduction.

THE WITNESS: Reduction?

MR. HINGA: Reduction.

A. What's the date on this? January 22nd? Okay. Yeah, I know what this is.

Q. Tell me about it.

A. Sorry?

Q. If you know what it is, tell me about it.

A. I asked John to put out -- I remember what this was. I just asked John to put out a letter, and he just arbitrarily picked two inches reduction to see what action it would take. That's where we collected all the information back from the other activities of what the engineering consequences would be of reducing the center of gravity height by two inches.

Q. What would you have to have done to reduce

the CG by two inches?
A. Well, that was all summarized in the -- I think it's the February 5th report. That report was collecting data, and the February 5th program report that we have details what those -- what those trade-offs were. That's where it was summarized.
Q. Okay. They wanted to increase the front track two inches overall, one inch per side?
A. And we looked at doing that.
Q. Could you do that?
A. I don't think we did, no.
Q. Why did Mr. Dziuba put this memo out? I mean, why did y'all want to consider widening it by two inches?
A. Well, remember what I told you was --
MR. HINGA: Excuse me. Object to form. Widening or lowering?
Q. Increase the front track width two inches. I thought that's widening?
A. Widening.
This was when I was looking at -- hey, before we get started off with this program

and we start doing the production design, do we want to make it wider? Do we want to make it lower?

So the answer to that is not just to pull it out of the air. The answer to that is to send out a letter to those people that John sent that to and ask them, what do you think about doing this? What's the consequences of doing this? What's that going to mean if we try to do this? And that just starts to give us an envelope within which to work.

Q. But why would you want to do that?

A. What I was trying to make is the T on 2H or the T on H stability factor as high as possible.

Q. To reduce the rollover propensity?

A. Just to make it as high as possible. It helps the handling, the -- It trades off other things. If I make that too high, then I lose ground clearance. If I make the vehicle too wide, the width goes up. There's a lot of negatives with doing that.

So this is just an investigation, specifically like it says there. What happens if you try to make it wider or lower?

Q. Well, just so it will be clear, is there anything -- any advantage to making it wider or lower other than reducing the rollover propensity?

A. Yeah.

Q. What?

A. Because it makes the vehicle bigger. It makes it -- It makes the load transfer different. It's -- It's moving it more towards a bigger vehicle. So, you know, this is making a bigger vehicle. Instead of it being this size vehicle, we're now making it somewhere back towards the bigger vehicle.

So there's differences between big and small vehicles. We're trying to make a small vehicle. What this is saying, if we wanted to make this vehicle bigger, what would it take to make it bigger?

So we're trying to determine -- since bigger means increases in weight, other trade-offs, if we're trying to make it lower, what does that mean? Those individuals that was addressed to were the right people with the expertise in the company to answer that question as opposed to me, you know, unilaterally deciding what to do.

So, you know, this is a part of this team process I told you about of going out and collecting the information and then making the decision. That request for information led to our recommendations.

Q. But y'all were saying you were doing this because you wanted to build a bigger vehicle?

A. No. I wanted to see -- I just wanted to see what would happen if we tried to make it wider or lower. So I asked John, hey, if we wanted to make this wider or lower, what would the consequences be? Send a letter out to these guys and have them tell us what

it's going to be. Then we'll collect up the information and make a recommendation if we want to make it wider or bigger.

It's something you -- It's hard to do later in the program. And if you wanted to do it, this was the time to do it, so we asked the question.

Q. Why would you want to reduce the center of gravity by two inches other than to help the rollover propensity?

MR. HINGA: Object to the form.

A. It helps the roll gradient. It reduces the roll gradient. I don't have to have such big stabilizer bars maybe.

But I may not want to do it, and that's why I'm sending the question out, meaning I want to know what's the effect on ramp and brake-over. So it's not a question of wanting to do it. It's I wanted to see what the effect would be of doing it.

Q. So you're saying you didn't think you needed it, but y'all just wanted to see what --

A. I wanted to see what it was, and then I

would then make a decision based on what the trade-offs were of where I thought it ought to be.

Q. And you say after you got this information together, that you came out with a program report?

A. Right.

Q. Which --

A. February 5th.

Q. February 5th?

A. You have it as one of the exhibits.

Q. Yes, I know you're familiar with this.

A. That's the one.

MR. ALLEN: And I've got a note here, I need a better copy of this one, too.

(Off the Record discussion.)

Q. Program report, February 5th, 1981. And that's where the famous five proposals were made?

MR. HINGA: Object to the form of the question.

A. Yeah. John's letter was requesting

information to lead into that.

Q. And you, I think, said earlier that some of the proposals really -- you weren't really thinking they would ever be done. You just were just proposing them just to be proposing them?

A. We looked at them, and we looked at them and thought the trade-offs and for what little value we'd get for them, they weren't worth the trip. So we recommended, I think, proposal two.

Q. Proposal five, I think it said that it reduces the vehicle height an additional one inch from proposal four for a stability index of two point two five.

Did the vehicle ever reach two point two five?

A. I don't think so, but I don't think we felt that was feasible.

Q. This proposal has major front and rear sheet metal revisions and results in a vehicle height of only point five inches higher than the 4 x 2 truck due to a fifteen-inch versus

a fourteen-inch tire on the 4 x 4 versus 4 x 2.

Was part of this proposal fourteen-inch tires?

A. I think it might have been. Can I look at that? I'll tell you.

Q. Sure. I'm not finished going over it, but go ahead.

A. I think it was. I think it was.

Q. Fourteen-inch tires?

A. I think it was.

Q. Did y'all ever put fourteen-inch tires and wheels on it to see what happened?

A. We did put them on there. I believe there were some tests run with fourteen-inch tires.

Q. Were y'all not satisfied with ground clearance then?

A. This is ground clearance. They looked terrible. We didn't think the customer wanted them. As you've seen with these vehicles, people want bigger and bigger wheels and tires. That's a tiny wheel.

Q. Did you expect people when you sold the Bronco II to put bigger wheels and tires on it?
A. We wanted to put big enough wheels and tires on there so they wouldn't do that. So we put big wheels and tires --
You know, basically the wheel and tire size, we certainly -- we didn't think we would sell vehicles with fourteen-inch wheels and tires. We just didn't think they'd buy them.
Q. Because people want bigger --
A. They want fifteen-inch wheels and tires. They want -- They want it bigger, so we wanted to provide -- wanted to make the vehicle so it would work with a decent, you know, impressive-looking tire on the vehicle.
Q. Well, did you ever expect at that point that people would take the tire y'all released for the vehicle and put bigger tires on it?
A. Well, our policy, I believe, is that you replace the tire size on the vehicle with

the original equipment size and -- and tire. And we offered tires as options that we think are appropriate for the vehicle.

There are some people who will go out and put tires on -- There are some people who will go out and jack their vehicles up six inches in the air. Right? So we know people do do things like that against our recommendations.

Q. But y'all saw that that would probably be a problem?

MR. HINGA: Object to the form of the question.

A. I don't know if we thought it would be a problem per se. We published clear guidelines on what we -- what we thought the customer should do.

Q. I got off on that sidetrack.

Back to proposal number five. Did you type this out? I mean, did you dictate this or is this somebody else's dictation?

A. I don't remember exactly how it came to be, but I probably had various people write up

what the proposals were. And I finalized -- did the final editing and the final writing on that. My secretary typed it.

Q. Proposal five, in addition to the fourteen-inch tires and wheels, there was a suggestion of increasing the frame vertical offset two point three six inches.

A. That would have been a whole new front end frame.

Q. Front?

A. Um-huh. (Positive response.)

Q. And one point three six inches at the rear.

A. Right, where we were having to start off with a -- throw away the current frame design and start off with a new frame design.

Q. Have to retool and start all over?

A. Retool. Wouldn't be -- Wouldn't be as common with the basic Ranger.

And then the sheet metal, the tires would have -- when you did your turn angles, they would have potentially gone through the fenders and the tires be damaged. So you'd

have to redesign all your fenders, your sheet metal.

Q. This was, again, February 5th of '81. Could it have been done -- Well, it says here it couldn't have been done by Job One, 1983.

A. Yeah, we could have done it and delayed Job One, but --

Q. You say you could have?

A. We could have done it and delayed Job One, but all the other things that I mentioned there would have been compromised. It would have come -- It would have brought the vehicle out later, but I don't think people would have bought the vehicle with fourteen-inch tires. I don't think the height was right. The ramp and brake-over was wrong. Then you take all the issues with the amount of jounce trouble we were planning on having, so we just said, let's not do that one.

Q. Look at this percentage. Excuse me. The next to the last sentence says that these changes could not be incorporated into the

P/U 4 x 4 for Job One, 1983.

A. That also means that the 4 x 4 would have to continue as planned, and then you have a completely unique frame and unique pieces from the 4 x 4. There were some -- Some aspects of this vehicle were common with the Ranger 4 x 4, so --

Q. Does P/U mean pickup?

A. Pickup. That's what it means.

So what this meant was that we would have had more complexity in the plant. We would have had to essentially design a new frame, separate.

Q. When it says an investment of thirteen point eight million, what does that refer to?

A. That's about what the tooling costs would have been. That's not the engineering costs, but the tooling changes to the frame.

Q. Did y'all talk about how much the engineering costs would be?

A. We didn't really go any further. I mean, we looked at the practical advantages and what we were really getting for what we were

doing. And since we didn't have any serious plan to proceed with that, we didn't get into the details of what it actually would take to finish it up from that. All of us felt that proposal wasn't in the cards.

Q. And the piece cost, fifty-four dollars, what would that refer to?

A. That would mean the cost of all the components. The purchase cost of the pieces that Ford buys to make those would be about fifty-four dollars a vehicle.

Q. Then it says: Timing - Job One, '83 and a half. And then in parenthesis, potential risk on release and samples. What does that mean?

A. What that means is that we could potentially, theoretically have done it for Job One, but we wouldn't have necessarily released it in the normal timing. So there would be further -- further risks financially and possibly timing-wise by actually not being able to deliver. Everything would have been pushed to the

wire to do it. And on samples, it means that you wouldn't have been able to get prototypes early enough to complete all your prototype testing.

So what that really means is that -- that you end up with no commonality with the 4 x 4 and that you've got to -- you essentially would probably not make Job One and be able to sign the vehicle off satisfactorily. And you may end up with a poor quality vehicle, too, because of making that magnitude of changes from what you had originally planned.

Q. That's a major -- I mean, when you say magnitude, is that a major change?

A. Pretty major, yeah. I mean, when you start spending ten, fifteen, twenty million dollars, that's a lot of people, a lot of time, a lot of work, a lot of people who have got to put that together.

But also, the functional -- the functional attributes of the vehicle aren't there with that proposal. You know, the

ground clearance, the ramp brake-over, you know, the wheel and tire size are the ones that -- all those other things are not there either.

Q. Did you just feel that this expense and all that would be more than what you would want to expend to gain a two point two five stability index?

A. I don't think it was just -- It's not just a financial decision. I mean, the vehicle -- The vehicle would not have done what we set out to do with that vehicle. It wouldn't have been the same vehicle we were planning on producing.

Q. It would be bigger?

A. It would be bigger. It would be more car-like, okay, in terms of being lower to the ground. The wheels would look puny.

So I'm going to say that we as a group looked at that proposal and said, what do we think about this one? Said, well, that's not going to cut it, and we worked our way back down to proposal four and worked our

way back that way.
Q. So you started with five, and you eliminated five, tried four --
A. We looked at five. We looked -- Yeah, that was like the extreme. That was more in line with what Russ had asked. Said, that doesn't look like that's going to fly; let's go to the next one back and --
When we say these were proposals, these are paper studies at this point.
Q. You never built the vehicle?
A. We never built any of these, no.
Q. And so the vehicle would have been, what? Two and a half, almost three inches wider?
A. Yes.
Q. And it would have not changed the wheelbase, though? That would have been the same?
A. The wheelbase would have been the same, yeah. All of those proposals, we essentially had the same wheelbase.
Q. Why didn't y'all think about increasing the wheelbase?
A. It's a major effect on the complete vehicle

for weight to increase. You know, you get a proportionate increase in weight. So if we increased it two inches, you know, if we increased it three inches, you know, three percent difference, right? Such a small percentage in the total scheme of things. Why? And then get two hundred pounds heavier and then get into a different inertia weight class, then miss your fuel economy bogeys.

I mean, you can extrapolate it right the way back up -- all the way back up to the big Bronco if you keep on going. Why not the extra inch? There's some point at which you've got to say it's just not worth it; it's not what we want.

Q. Were you somewhat limited, then, in the engineering -- from the engineering aspect with the package constraints of the vehicle, what marketing wanted to put on the market?

MR. HINGA: Object to form of the question.

A. Well, remember. The reason this vehicle

exists is basically we needed to get -- we felt at that time that we needed to get consumers driving smaller vehicles. At that time, we thought fuel economy prices were going to be in the two-dollar or even higher price range, much higher than they even are today. As you know, the fuel economy -- Corporate Average Fuel Economy has gone actually sour. It went down, and vehicles have now gotten bigger.

We had actually expected with the fuel economy crisis that was going on at this time and fuel economy regulations -- we didn't have an exact window. We knew fuel economy standards were coming. We actually thought fuel prices were going to be a lot higher. And we really wanted to provide functional vehicles that would essentially let the guy who had a big Bronco buy this small Bronco and still do all the things he could do with his big Bronco.

And so weight is extremely important to fuel economy, and weight is proportional to

size. So the bigger, the heavier, typically. And we had windowed this size, and it looked like the competition was going to have vehicles in this size range.

As an engineer working on this vehicle, we felt the stability index range that we were going to be in was going to be acceptable anyway. We had looked at going to these alternatives. We felt the trade-offs of those higher level proposals just wouldn't -- wouldn't give you enough of an advantage to make it worthwhile.

Q. In proposal four, you were shooting for a stability index of two point one nine.

A. Right.

Q. Why did you not go with proposal four?

A. Well, we -- If I can look at that.

Q. Sure.

A. I think we had a strike through problem, reducing ride height with this one.

This had some of the same problems as the other one. We couldn't get rid of the fifteen-inch wheels. We didn't have the

fourteen-inch wheels.

Now we started looking at the relative differences between proposal four and three and two relative to what we were trying to do with the stability index. So we've got a difference between two point oh three and going all the way up with proposal four to two point one nine.

Remember, earlier you mentioned dividing that number by two?

Q. That four was two point two five.

A. Right. But you divide -- you divide by --

No, five was two point two five.

Q. Oh, okay.

A. Four is two point one nine.

Q. All right.

A. You divide that number by two. You get the maximum theoretical Gs to roll the vehicle over for a rigid body with no suspension. So a two point oh three is a one G, one point oh one G to roll it over. Two point one nine is two point oh eight Gs. All right? Sorry. One point -- One point oh

nine Gs. Right?

That's a very small difference by the time you've got the suspension. So when you look at suspension effects on the Gs to cause incipient rollover, we felt you could make more difference with the suspension than from making the trip from two point oh three to, say, two point one nine.

Considering the strike through and the crash through, as a team we basically picked proposal two.

Q. What is a strike through?

A. Strike through is where you've reduced the ride height of the vehicle so on a bumpy road, on a bumpy road off-road, the wheel comes back and the suspension bottoms out and the suspension actually hits the frame.

So it's the ride travel, if you will. It's when you start off with this basic vehicle, it's got the frame, the engine, and then you lower it, you've reduced the amount of room there is for the axle to move. So now you start introducing other problems.

You start -- The strike through causes the frame to break and fatigue. Then you have to beef up the frame. Okay? The strike through can cause, you know, ride problems and other problems. You've also reduced your ramp, brake-over and your crossover angles.

When we started looking at these differences, we basically worked our way back. And as a group, we said, look, proposal two looks like that will be okay. That's the one we want to use.

Q. Okay.

A. And then we felt with that kind of stability index as we had in proposal two, with a two point oh three, those were similar to the 4 X 4s and other vehicles that we produced, similar in an Econoline 350, our twelve-passenger Econoline 350, somewhere in the same ballpark. So we said, look, let's go ahead. Let's carry it on and let's just put the suspension on the vehicle, the stabilizer bars, steering, do all the right

things.
Q. What was the cost of going to proposal two?
A. Proposal two was an eleven-pound weight increase, a three-dollar -- a three-dollar variable cost, and about four million dollars in investment.
Q. What was the -- What did you actually do under proposal two?
A. I think that's what we did. I think we spent all of that.
Q. I understand --
A. Oh, what did we change on the vehicle?
Q. Yes. What were the changes?
A. Oh, okay. This is where we changed -- we went to a fifty-six point four-inch track.
Q. And you did that by wheel offset?
A. No, no, no. We did that by --
Q. You increased the rear axle; is that right?
A. We increased the front track and the rear track. I think we were at fifty-four point four to start with. I'll go back and look at the chart in the back.
We increased -- We increased the track

width, and we reduced the center of gravity height. We were at fifty-four point nine when we started on the track width. When I got the program, we were at fifty-four. So we increased it to fifty-six point four. And then the additional point five was with the -- we knew we could do a little bit with wheels later if we wanted to.

So fifty-six point four is what we started doing all our testing with, and that's what we designed. And then we lowered it an inch. And we thought that was pretty good. We were going from a stability index of one point eight five to two point oh three.

And we didn't think proposal three gave us enough -- a very small G increase. And proposal four started to really compromise the product, and five really compromised the product. So we felt proposal two was the right way for Ford to go. That's what we recommended.

Q. Would it be David Bickerstaff recommended to

Ford management to go with this proposal?
A. I put that paper together on behalf of all the parties involved and with the consensus of everybody involved, and that's what we presented.
Q. You keep saying we. I mean, you and who else?
A. Me, Fred Drotar, Rich Antoun, the other people involved, the input of all the other supervisors. We had a meeting, if I recall correctly, that -- where we reviewed this and we made sure everybody agreed. And then we took that paper up to upper management.
Q. Who did you go with?
A. I believe that paper was reviewed ultimately with Ed Hagenlocker in a program management review where we said, this -- we had -- I think we had to do that to get the -- to get the approval for the funding and to make the engineering changes.

Now, with his approval, we then issued -- we had product planning issue engineering letters that authorized us to

make those changes to the program.

Q. But as I understand what you're telling me, when you sent this up to upper management for approval, you had already said, we want to go with proposal two as opposed to them looking at it and saying let's go with proposal two as opposed to proposal four.

A. Well, that report actually has a recommendation in it. I believe that recommendation is we recommended we go with proposal two. That was taken, and that's how it was recommended. It was accepted as recommended. We explained our rationale.

And you should also know, nobody asked me to do that. Nobody asked me to do that report. I looked at the vehicle and I took the initiative and said, look, we're at one point eight three. I think we should increase this.

And I had done those studies. I had the blessing of my management to spend the money to do that work, to do those studies, and they endorsed what I was doing to make

an intelligent choice over if we wanted to widen or lower the vehicle. And then it was taken forth and accepted as presented.

Q. Well, did you feel it was important to increase the stability index from one point eight five to over two?

A. There are some people that felt that two is kind of, quote, a magic number and we would like to be above two. Okay? But there wasn't really any science behind it other than dividing it by two gives the Gs at which -- the incipient rollover.

Because most vehicles, the maximum handling limit -- even the Explorer and things like that -- is around point six, point seven Gs. Most customers never get above point three, point four Gs. If they get into the point six, point seven Gs, they're generally an accident waiting to happen because that -- that requires highly skilled driving to be driving in those G domains.

So to push from -- You know, when a

rollover threshold stability level is at two point one four, you know, two point oh three, two point oh five, we're in the one point oh two Gs, and then you lose whatever you lose because of the roll gradient in the vehicle. So there's been some reduction from that.

So we felt that by putting a stiff suspension on, we could be in the point eight, point nine G region when the incipient rollover would occur with the suspension, which is way beyond where a normal situation occurs, and that these small differences were relatively insignificant. That was the basis for our recommendation for two.

Q. You did say on page three that you recommended to proceed with proposal two revisions to the utility and the pickup 4 x 4 to maximize stability index and meet reasonable cost and timing constraints.

A. Yes, we did.

Q. And the timing constraints would be Job One?

A. The timing constraints would be to get a vehicle into production, yeah.
Q. And then you also recommended delete the roof-mounted luggage rack as an RPO, which we've talked about earlier, due to adverse effect on stability index.
A. Yeah. We said basically if you stick a couple of hundred pounds up on the roof, that's going to make that number lower. So before you put that on there, why don't you think about that some more. That's what that was saying.
Q. Well, did y'all ultimately release the vehicle with the luggage rack?
A. I think they may have gone back and reconsidered. And the fact that they had increased the stability index -- you know, maybe they felt that then, okay, now we can put the -- now we can put the roof rack back on.
Q. So did they have roof racks?
A. I think there's a roof rack on there. I don't know. I think there's a roof rack

now -- or there was a roof rack eventually put on there.

Q. What would the maximum capacity be for a luggage rack on the roof of --

A. I think we have a warning on them, a hundred pounds. It may be fifty. I don't remember exactly.

Q. Did you feel like a hundred pounds on the roof could make that much difference?

A. Well, it'd make a little bit of difference, not a hell of a lot of difference.

Q. Enough that you would recommend deleting it as an option?

A. The roof configuration of that vehicle, you know, was glass wrap-around on the sides. Anyway, said why -- why have it? We talked about it because we did make it a recommendation.

Q. So whoever decided to put the roof rack on it, it was not David Bickerstaff?

MR. HINGA: Object to the form of the question. Foundation.

A. No. I think later on, the stability index

actually was increased from that level and I think they -- they decided to put it back on. I just -- I felt at that particular point in time, let's hold off on the roof rack.

Q. I think you mentioned on page one that you could have a point one oh reduction in stability index with a hundred and thirty-pound roof rack.

A. Is that mentioned on there?

Q. Yes.

A. Okay. That would be point oh five Gs. With the springs, point oh three or something.

Q. Did you attend any of the tests at the Arizona proving grounds in January of 1981?

A. I didn't personally go. My guys went.

Q. Did you see any of the videotapes --

A. I did see one -- some -- one piece of videotape of some of the J-turn tests.

Q. Were you satisfied with the J-turn test results?

A. They looked like we were going in the direction we wanted to go in. I wanted to

put more into steering the vehicle and bigger front stabilizer bars and get the wheel angle that would induce lift higher.

Q. What was the lowest speed in the J-turn that it would lift the wheel?

A. I don't remember specifically at that time. But at that time, we were dealing with very early prototypes, you know, suboptimum stabilizer bars, so --

Q. But you don't remember?

A. Don't remember.

Q. There is a note that there was a problem with the right turn as opposed to the left.

A. I don't know if it was a problem or just a difference.

Q. Well, it says -- worse was the word it used.

A. Okay. You know, it's possible if we're doing the test with one person in the vehicle, the vehicle is not completely symmetrically loaded, the steering linkage is slightly asymmetrical, so there might have been some explanations there. Could also be geometry to do with the plane of the

proving ground, too, not maybe being exactly level.

Q. Are you aware of any tests that have been done subsequent to that that would show that the Bronco II is more susceptible to rollover in one direction as opposed to the other?

A. I haven't seen anything subsequent that shows that that might not just have been a quirk of that particular vehicle.

Q. In any of the cases that you've testified in, has that ever been an allegation or have you ever been questioned --

A. I don't remember discussing it ever in any of the other cases.

Q. You said the front end is not -- the linkage is not symmetrical. What do you mean by that?

A. It's a Haltenberger linkage. It's not like a rack and pinion. The steering gear goes partway down to the arm, and there's a theoretical point which it crosses over. So one arm goes down to one wheel and the other

steering arm goes up the center of the linkage, so it's not totally symmetrical, the steering linkage. It's a Ford patent.

Q. Is the Twin-I-Beam suspension, is it symmetrical?

A. No, it's not absolutely purely symmetrical. One axle has to be in front of the other. The radius arms are pretty much symmetrical. The centers of the wheels are symmetrical. But the arms cross over each other, so one pivot has to be slightly ahead of the other. One has to be slightly forward.

Q. For example, would the length of the I-Beams be the same?

A. They might not be exactly the same, but close. The length is more similar. I can't remember exactly on the 4 x 4. They may not have even been exactly the same.

Q. Going back to the testing, January 28th, 1981. The third page talks about the evaluation items, and it indicated wider wheels, six inches or seven inches versus five point five inches. Is that in order to

widen the track width, a suggestion to widen the track width?

A. Well, you can have -- the wheel -- The track width, you know, is measured from the center of the tire. That's not really the full width. That's another little quirk in this whole thing. But the tires are -- You measure the track width from the center of the tire, the center of the tire.

So if you put six-inch wheels on or seven-inch wheels, you may not change the track width at all. But actually, there's tire and rubber more outboard on the vehicle, but the track width and stability index would still be exactly the same.

So we just -- I think we just wanted to see what difference a wider tire would make.

Q. And then it mentions increased track width, so that's --

A. Moving the center of the wheels out. Do you see what I'm saying when I say that? You know --

Q. Yes.

A. -- a wider tire would actually make it wider, but the track width would stay exactly the same.
Q. There was a mention of increasing the roll stiffness, and we talked about that with the stabilizer bars, I guess.
A. Right.
Q. Increase shock damping.
A. That's the stiffer, harsher shock absorber if you'd like.
Q. And I've got some notes here that I can't read, some handwritten notes below that.
A. I can't read them either. Okay. The second one says second stage spring. There are two different springs. One is a -- One is a single stage rear spring, and the other one is a two-stage spring, where the spring gets stiffer once you get to a certain loading point. So that's talking about a second stage spring.

And I think this is talking about a different kind of stabilizer bar. And I think this is a steering ratio, but I

can't -- I can't really read it properly. I don't remember what it was.

I think I've read that off other copies, so there may be more legible copies around.

Q. There's another program report that I can't read. Maybe you can tell me about it and I'll follow up on it.

MR. HINGA: Somebody read the Bates number and the date if you can.

THE WITNESS: The Bates number is lots of zeroes and 390 on the end.

MR. HINGA: And the date?

THE WITNESS: And the date of the -- it's February something. It looks like '81.

A. Okay. What this is, this is now getting into the detail of executing what we had agreed to do. So, you know, there were preliminary studies, and now this is actually going through the fine points of

specifically what we're going to change and specifically what we're going to spend to actually make -- to actually make all of this work and how the money is going to be allocated.

Q. Did you have input into that proposal?

A. I think we did, yeah. This looks like actually it was done by probably Rich Antoun.

Q. Is that basically execution of proposal two that we talked about earlier?

A. Yes. That's what it is, yeah.

Q. Have you seen these documents before? Is that the same one you were just looking at?

A. I think so, yes.

Q. The quality of copies is terrible. Do you remember enough about that last paragraph to read it, because I have difficulty.

A. Well, this just says in order to minimize -- in order to minimize design cost, weight, spring effects I think it says, and to provide the lowest risk alternative -- I can't read this -- proposal something,

proposal two, let's see, is recommended. Without proposal one and two -- I don't know. It's really hard to read. You're right.

It's talking about a problem with the flange in the fuel tank.

MR. HINGA: I think I'd rather have you not speculate, David, as to what it might say.

THE WITNESS: Yeah. Well, it says that. It actually says that. I'm just trying to see if there's and's, is's or the's in between. You know, I'm trying to read the nouns and the verbs.

A. I can't really read it, but I'm sure there's a clearer copy of that available.

Q. Let me show you Bates 388 which -- I think I can read this. I believe -- First of all, let me see. Did you sign that?

A. That's my signature, yes.

Q. You know about this memo?

A. Let me see.

MR. HINGA: Why don't you read the date.

A. The date is February 23rd, 1981. This is to other peers of mine.

It says: Attached is the cover letter and program report which outlines the four proposals investigated and the consensus recommendations pertaining to the management request to improve the stability index of the Bronco II. Please review its contents, and if a mark-up is necessary for your concurrence, do so on this copy and return to me by February 27th, 1981. The resulting changes will then be incorporated into the paper which will be submitted to you for final concurrence the week of March 2nd, 1981.

Q. What management group requested that y'all improve the stability index of the Bronco II?

A. Well, I went to management and said, I think we should improve it. And then they

endorsed my opinion, and then I used that leverage to tell these guys to go do it.

Q. Who in management did you have to get approval from?

A. We went to Hagenlocker, and we reviewed what we wanted to do with proposal two which, remember, was quite a change, to widen the vehicle and lower the vehicle. And at that point, management directed us, okay, to do it. And so now I've got to go do it.

Q. So that's Bickerstaff's request through management --

A. Right.

Q. -- to increase the stability index?

A. Right. So basically I had taken the system and had them change something they were going to do and made it better, and now I was using their authority to make it happen.

Q. Who is M. W. MacNiven?

A. MacNiven worked in truck operations in the durability department, and he was responsible for testing vehicles to make sure that they -- they stayed in one piece

and didn't break during testing.
Q. In '81, what would his position have been?
A. I think he would have been durability supervisor.
Q. Let me ask you about this Bates number 998. It talks about -- the first paragraph says -- And it's to Mr. E. W. Brayboy. Who is he, first of all?
A. Brayboy would have been, I think, the manager of durability. There were several other areas he had, and I think Brayboy was the manager of MacNiven.
Q. What is a PSR? An attached PSR it's referring to.
A. I think it's a procurement services request or -- if I could see the context, I might be able to --
Q. Yes. That's what I want you to do.
MR. HINGA: What's the date of that?
THE WITNESS: The date of this is March 13th, 1981.
A. Okay. The PSR is a shop report, I think, or

a shop request. And what we're doing here is we're asking MacNiven to take one of the prototypes and modify it to what we had recommended to be proposed. So we had some workhorse prototypes, and he had to get them built.

Q. The wide track that he's referring to would be the proposal --

A. The proposal to, yeah, the fifty-six point four. We were trying to get the vehicles updated now to what we'd designed.

So in February, we -- In February, we decided to do it, right? And in that -- March 13th, we had just about been completed with our initial prototype designs, and so we're asking him to get ready to update his prototypes.

Q. Who is Mr. R. A. Theus?

A. He worked for me, and then he also worked for Jim McClure in development. I had him assigned over there on the handling. So he also worked underneath me and for Rich Antoun.

Q. Is he still with Ford?
A. I think he is. I saw him the other day.
Q. What's his position?
A. He was an engineer, development engineer. No direct reports. A worker bee.
Q. I'm sorry?
A. A worker bee.
Q. Who is Mr. F. J. Horstmann?
A. Frank Horstmann is a -- was a development engineer and has been with the company for a long time. He worked with me when I was in development when I first started with Ford.
Q. Do you know where he is now?
A. He has left Ford Motor Company, I believe, and he does -- he's still -- but he still works as kind of a consultant and does testing and development work.
Q. How about Mr. H. S. Kert, K-E-R-T?
A. Harry Kert I think is retired. He was my supervisor in development, and he was in charge of development at this time, also. He's one of the people I listed for you earlier.

(Brief recess was taken.)

Q. I want to ask you about Bates number 592, which is apparently a program report of January 6, 1982, which is a comparison, apparently, between the Bronco II and the S-10 Blazer. Do you recall that report?

A. I do.

Q. Were you involved in the preparation of that report?

A. I think that's a development report. Is that published by Jim McClure? Does it say who it's from?

Q. It's the one comparing the center of gravity heights between the SLA and the Twin-I-Beam suspension.

A. I don't know who did this, actually. Truck package engineering. It was done by Dave Chamberlain's people.

Q. Who?

A. David Chamberlain. This was done by truck package engineering and provided to us.

Q. Why were you provided that particular document?

A. It was of interest to us to know where we stood versus the -- where we stood versus -- the Bronco II versus the S-10.

MR. HINGA: What's the Bates number?

MR. ALLEN: This is 592.

Q. Do you agree with the program report, that the Bronco II is three inches higher than the S-10 Blazer?

A. Let me see the context, see what it says. It's the overall height. Ride height differences with production tires and jounce travels, three inches. Okay? It's not three inches center of gravity height.

Q. It's not?

A. No.

Q. Do you agree with the portion of the report that says basically that the Twin-I-Beam suspension causes the centerline of the crank, which I guess is the engine, to be one point six inches higher than with the SLA?

A. Yeah, that sounds about right.

Q. Would that have an effect on the center of gravity?
A. Small amount, yeah.
Q. Not enough to worry about?
A. No. I mean they might have an inch difference in the center of gravity height in the vehicle. I don't know what the exact number ended up. Did that report address center of gravity height? I don't think it did.
Q. No. This report --
A. Just this package.
Q. Just from having the Twin-I-Beam, how much higher you have to raise the engine. As I understand it, that's because the -- just basically the way the Twin-I-Beam is laid out, you can't get the engine lowered?
A. Plus because the axles cross over underneath the engine. That sounds about right.
Q. When you're talking about stability of a vehicle, can't inches make a difference when you're referring to center of gravity?
A. An inch makes a difference. It doesn't make

it unsafe.
Q. I mean, if it didn't make a difference, y'all wouldn't have gone to the trouble you did to widen the track width by just an inch or so?
A. Right.
Q. And would it be correct that if you're -- if a truck or a Bronco II or whatever is in -- at the point where it's about to roll over, that an inch could make a big difference?
A. Well, it would take -- If it was about to roll over, it would just be just a small difference to roll over at a different G level at different conditions. I mean, if it was tripped, it would make a small -- it would make a -- there would be some finite, small difference.
Q. And is it true that the center of gravity changes in a dynamic situation?
A. It certainly is.
Q. And is it important for the center of gravity to stay low when a vehicle is going into a turn?

A. Well, the body rolls, so the center of gravity is going to tend to move and change. And if the inside wheels go up and the outside ones go down, the center of gravity is probably going to raise when you're going around -- when you're cornering. It's going to go up a little bit.
Q. And the amount that it raises, would that be important?
A. There's not much you can do about it. It's physics.
Q. But it's a fact that as you go around the corner and the body rolls, the center of gravity raises?
A. If I take this rigid body and sit it on this corner and tip it up and this is the center of gravity in the middle here, it's going to go up when I tip it up, right? Can't do much about it. It goes up.
Q. Have you read any documents that would talk about the jacking effect of the Twin-I-Beam suspension in a cornering maneuver?
A. There's various opinions, and there's been a

lot of discussion about what is the definition of jacking and what's going on with jacking. And there's documents that in my opinion erroneously refer to the subject of jacking, which is something different than we generally refer to as jacking. But jacking has been a subject that's been discussed as it relates to suspension systems by numerous suspension guys in various areas.

Q. What documents erroneously refer to jacking?

A. There's a test report that was used that used string plots to measure the position between the wheel center and the fender lip. And they concluded because the outside -- the outside went up more than the inside went down, that that was jacking. But I don't think that's jacking. That's not my definition of jacking.

Q. Who authored that report?

A. Jim Avouris.

Q. I'm sorry?

A. Jim Avouris.

Q. And who is he with?
A. Ford.
Q. So the documents in the report you're referring to is a Ford internal report?
A. Yes, done after all of our work was done.
Q. Did he attribute the jacking to the Twin-I-Beam suspension?
A. I don't know what he attributed it to. I think he just said that it occurs in his -- his version of jacking.
Q. And if that were true, if the Twin-I-Beam did jack the front end, would that have an adverse effect on the center of gravity in a turn?
MR. HINGA: Object to the form of the question. Hypothetical.
A. If jacking -- Let's put it like this. The center of gravity going up on some vehicles when the vehicle corners is a natural process, just like a catamaran sailing on a lake. When it starts to tip up, the center of gravity goes up. It's the same thing on a vehicle. So I think it's a question of

physics.

Q. Would there be degrees of jacking or -- excuse me, raising of the center of gravity in a turn?

MR. HINGA: Would there be degrees in raising the center of gravity?

Q. Let me just --

A. Jacking is inches, so, you know, the center of gravity height goes up a little bit.

Q. How much does the center of gravity go up in a Bronco II in a turn?

A. I'm not sure exactly what it does, but I would expect it to go up a little bit.

Q. Did you test that at all when you were responsible for the suspension of the Bronco II?

A. We basically evaluated whether the roll mechanics of the vehicle would be stable based on a conventional definition of jacking, which is associated with the way the suspension elements react to a combination of vertical and side forces of

the tire. And we concluded that as the force is past the right side of the axle pivot, that jacking is not an issue.

Q. So y'all say it's no problem at all with the Bronco II?

A. We said that the Twin-I-Beam suspension, the way -- the way we've designed the axles, the pivots and the center of tire context, there is just a nonissue.

Q. Does the Twin-I-Beam have a tendency to lift the vehicle as the vehicle goes around a turn?

A. I think that the body of the vehicle when it rolls on the suspension may tend to raise a small amount. I think there's many other suspensions that could do the same thing.

Q. The Twin-I-Beam for the Bronco II, is it different than the Twin-I-Beam from the old Bronco, the big Bronco years ago?

A. The physical parts are different. The concept is the same.

Q. Where is the pivot point located for the large Bronco?

A. The pivot points are located on the opposite side of the vehicle for each axle. And then obviously, it's a different vehicle, so they're not exactly the same points.

The basic concept is that the axle pivots cross over the centerline of the vehicle are as low down as possible for ground clearance and attachment to the frame, and that's the basic concept of the Twin-I-Beam.

Q. Is there any other vehicle produced by Ford that would have the same attachment points, say, for the Twin-I-Beam as the Bronco II?

A. Well, the Ranger 4 x 4 would be similar. The axle pivot points aren't terribly different from the 4 x 2 either. All of the Twin-I-Beam suspensions are somewhat similar in concept.

Q. What is Mr. Avouris's position with Ford?

A. I think he had -- I don't know what he does now, but he might have had something to do with tires when I was there. And at this time, I think -- I don't know if he ended up

back in suspension design or testing. I'm not quite sure exactly what his role was when he was doing his testing or what his position was.

Q. Do you recall his investigation into the jacking effect of the front swing axle?

A. He wrote some kind of a report where he had put -- I think it was string plots between the center of the wheels and the -- the wheel lips and measured the relative motions between the wheel centers and the body under various dynamic conditions.

Q. Do you remember when he did that study?

A. I think that was done after I left, so maybe in late '82 or '83 or even later. I don't remember exactly when that was done.

Q. But you disagree with his findings?

A. Oh, I just disagree with his findings in terms of using the word jacking. It's not the classic -- you know, Morris Oleve, Dave Bickerstaff and about half a dozen other people's definitions don't fit with that definition.

Q. Well, how is his different from yours so I'll have some understanding?
A. Well, I'll have to draw a diagram to explain it to you.
Q. That will be fine.
A. If this is the suspension and this is the body of the vehicle and over here is an axle pivot that goes to the vehicle like this, a vertical force here through the tire is the force on the tire, and the lateral force here is the force due to cornering. So this is called FY, and this is called FZ.

And there's a vector that is made up then of these two forces. And if that vector -- those two forces -- goes above this pivot, then this wheel tends to compress into the body. And if that vector passes below that pivot, that vector tends to jack that suspension.

So like a very old Corvair, like the swing axle suspension with a very short axle, the shorter the axle, the more likely you are to have a jacking moment. And

that's what the classic vehicle dynamicist refers to as jacking.

Q. Okay. So the shorter the axle, the more likely you'll have jacking?

A. No. If the axle is short enough that the vector passes underneath the axle pivot, then it will -- it could jack the suspension.

But in our case, the only way that can happen is if you have a trip, because this force here can never be greater than this force in normal cornering. You'd have one G under the conditions. You have to have a coefficient of friction of one between the pavement and the tire to have this be a shallower angle than forty-five degrees.

So the only way that force can be bigger than this is if you trip. So jacking does not occur in the classic definition on the Twin-I-Beam suspension.

Q. Okay. What is Mr. Avouris talking about, then?

A. He's just measuring the height of the body

relative to the wheel centers under various conditions. And because he's noticed it going up slightly more on the inside than on the outside, he's concluded that's jacking.

Well, that could be caused by different spring rates. If I have a progressively higher spring rate as the spring compresses on the outside and it gets softer on the inside, it could cause that. So that's not jacking. That could be due to stabilizer -- all kinds of things. Could be due to body mounts. So I don't agree with his conclusions.

Now, the fact that what he actually saw happened, I don't disagree with that. I just disagree with him using the term jacking. I've stated that before.

Q. You say that the vehicle is raising up, but it's not because of jacking?

A. Right.

Q. Well, if it raises up in a cornering maneuver, will that shift the center of gravity and the pivot line to the outside?

A. Is the center of gravity raising? Is this the center of gravity of the part of this rigid body? Do you think this is fair?

This is the center of gravity of this rigid body right here. It's rolling in a corner. Is the center of gravity going up? Of course it is, so of course it does.

Q. Okay.

A. It's not jacking. Jacking is where there's an invert -- a kinematic interaction that's due to a swing axle effect, which we checked out -- mathematically checked out on the computer and found was not present when we designed the Bronco II suspension.

Q. Did you ever test it physically on the proving grounds?

A. We tested it physically and tested it on the computer, and no evidence to support jacking.

Q. So that was something y'all were concerned about even during the design phase?

A. Yeah. In fact, I asked Max Moore specifically to run these calculations and

make sure the pivot was low enough and far enough inboard with the short -- the narrower track vehicle to make sure jacking would not be a phenomenon. He did that study -- it's a design study -- specifically at my request. It's got such a wide margin of safety in terms of passing above that pivot, it was not of any concern to us.

Q. Would you agree that if the Twin-I-Beam was longer, the possibility of jacking would be decreased?

A. There's no possibility of jacking in the normal, conventional limit handling maneuver.

Q. That wasn't my question. The question is, from your mathematical calculations, that the longer the I-Beam, the less likely there could be a jacking effect?

A. Jacking can only occur when the lateral forces are greater than the vertical forces on the tire, okay, by some ratio. The ratio is so high for that, it can only occur in tripping.

So as far as we're concerned -- As far as I'm concerned, the classic jacking -- lengthening the axle makes no significant improvement for normal handling from what we've got.

See, this passes so high above the pivot, okay, that if I lengthen the axle, so what. It still passes above the pivot. I don't have a jacking phenomenon. I don't get a jacking phenomenon until that axle is so short that -- that the vector passes underneath the pivot.

So I would -- I would say that shortening the axle, okay, could promote jacking. But lengthening it offers no advantage in preventing jacking or limiting jacking because jacking doesn't occur in the classic sense.

Q. I think you answered the question. The longer the axle, the less likely there could be a jacking effect, period?

A. No. The way it is, it doesn't jack. Okay? If you shorten the axle sufficiently, you

could get jacking.

Q. The shorter the axle, the more likely --

A. Right.

Q. -- there would be a jacking effect?

A. But the converse isn't true, that lengthening it increases jacking. It just doesn't jack. Jacking is an on-off condition where the vector passes underneath the axle pivot.

Q. And the reason y'all were concerned about jacking, I guess, was because if there was a jacking problem, it could make the vehicle less stable?

A. From the stuff that went on with the Corvair and the swing axles on the Corvair and the very short swing axles, it's always been something that we've been concerned about, back in the fifties and -- and when that work was done.

So I think suspension engineers typically try to design suspensions that are configured in a way that that pivot is always above -- that pivot is always

sufficiently low and inboard, that the worst case vector will always basically compress suspension towards the body in that condition.

Now, the only way that you can actually get that to jack is if that vector -- is if the lateral forces are greater than the vertical forces. I mean, even in limit handling of one G, that angle is forty-five degrees.

So as long as the swing axle is on the opposite half of the body from the wheel, okay, you tend not to get jacking if the pivot is long enough. The pivot would have to be very high and very far inboard to have jacking.

So I had Max Moore run a calculation and go and do a layout and show this vector and satisfy us that in the ranges of suspension travel, that jacking wouldn't be a concern.

Q. What year did you have that done?

A. It was right around the time that we were --

it was right in the early '81 phase when we were doing the -- deciding whether to make it wider and lower.

Q. And Max Moore was whom at that time?

A. My engineer. Worked for Rich Antoun. He also worked on the ADAMS modeling.

MR. ALLEN: Let me attach that since you've -- we've already discussed it. Let me attach it as the next exhibit.

(Plaintiff's Exhibit Two was marked for identification.)

A. I'm going to include one more sketch here just so you'll understand this.

With the pivot here and the force here and here, this can never be greater than this. So this angle is always from here to here. Okay? That -- Under various combinations of loading and side force, that vector is always in that direction. So that's always above this pivot, so this doesn't jack. Okay?

Here is a swing axle, and the pivot

goes from here to here. You can see that this will jack. That has to be very short to have jacking.

Q. Was there anyone else in Ford other than Mr. Avouris that talked about the jacking phenomenon with the Bronco II Twin-I-Beam suspension?

A. Well, that all occurred, I believe, after I had left the company, and I don't know who else shared Mr. Avouris's opinion on the correct use of terminology.

Q. Has anyone else -- Well, in the investigation of these cases, have you learned that anyone else had talked about the jacking effect?

A. Well, we've discussed Avouris's opinion in that paper and what that report meant as far as the vehicle was concerned and versus my definition of jacking. In almost every case, it's been a point of discussion.

Q. Has there been anybody else, though, other than Mr. Avouris --

A. You mean at Ford Motor Company?

Q. Yes.
A. Discussed jacking?
Q. Yes.
A. We've discussed jacking verbally. I've talked about it to Max Moore, Rich Antoun.
Q. I'm sorry. I'm asking --
A. I'm misunderstanding.
Q. Are there any other documents that you are aware of that discuss jacking that you disagree with or agree with as it would relate to the Twin-I-Beam that you've come across since you've been handling these cases?
A. There's an SAE paper on the Twin-I-Beam suspension that was written when the Twin-I-Beam suspension was introduced that talks about jacking. I believe that talks about it in the correct context.
Q. Any other memos or documents that you're aware of that refer to the jacking effect?
A. Not that I'm aware of, no.
Sorry about the confusion there.
Q. That's no problem. It's getting late.

Are you aware of any tests by Michelin regarding the jacking effect?

A. Not specifically, no.

Q. Who is Mr. D. O-N-K-K-A?

A. DeJaunqer?

Q. It's a D. period, and the last name is O-N-K-K-A.

A. Let me look at that name. I think there's a J missing.

MR. HINGA: Upper left.

A. No idea. Never heard of that guy.

Q. And you said a UN46 is the prototype for the Explorer?

A. I believe that was the designation of the Explorer.

THE WITNESS: Was it UN46?

MR. HINGA: Yes. It wasn't the prototype. It was the designation of the program.

A. The program.

Q. Do you know what the test -- what tests they did to compare the Bronco II and the UN46 --

A. No.

Q. -- relative to suspension jacking?
A. No, I don't.
Q. What would it mean when it says the Bronco II and the UN46 both exhibit high levels of front suspension jacking?
A. I don't know what they mean by that.
Q. The jacking increases slowly with lateral acceleration to about point four Gs.
A. Is that the Avouris -- Is that Avouris's thing?
Q. I don't think so. How many memos did Avouris put out?
A. I don't know. That sounds like that's associated with that same report.
Q. It could be. And it says that --
A. I'll bet that's what that is.
Q. -- at point six five Gs, the jacking is about two point five inches. In comparison, the Chevy Blazer increases slowly with lateral acceleration to about point two five inches.
A. I think that sounds like the same report that we've been talking about.

Q. You've probably seen it a few times since you've been testifying.
A. Yeah. I haven't seen that particular piece of paper before, but the data you're referring to there sounds like that it comes from that same report with the string plots.
MR. HINGA: Why don't you read in the Bates number and the date.
MR. ALLEN: The date is -- The date of the report is 11/29/89. The Bates number is 9863.
A. This sounds like that's that one.
Q. What do you think he means when he's talking about suspension jacking in this report?
A. I think he means that the body on the outside is going up more than the body is going down on the inside, which can be just due to the roll axis, heights of -- the differences between the vehicles. It may be nothing to do specifically with the suspension. It could be spring rates. It could be stabilizer bars would have a bearing.

The more the rates go up on the loaded side, the more -- and if the rates go down on the unloaded side, you could get the asymmetry. So I don't quite know what they mean by that.

Q. When you left Ford, what tires were planned to go on the vehicle?

A. Well, we'd been looking at P195 R15. I think they're 70 Series tires. And they were highway and mud and snow and all terrain tires that we had been looking at.

And I'm not sure that we had firmly decided whether or not we needed to restrict P205 tires. And there might have even been some interest in 215s and 235s.

But if I recall correctly, we were looking at P185, P195, and P205 tires. They were all fifteens. And the specific vendors I don't recall.

Q. What was the largest size tire that was ever released with the Bronco II?

A. I don't know the final largest size. I know we were looking at 195s and 205s. I don't

know if at some subsequent time those were changed to 215s or 235s or some unusual, you know, off-road designation.

At the time I was working on the vehicle, it was 195s and 205s. Again, I think that would be fairly straightforward, to look in the merchandising material for the vehicles and determine what sizes were actually on the vehicles in different years after I left.

Q. Why is it that -- I mean, the P2 -- excuse me, the P195 is a relatively small tire, isn't it?

A. Well, it's a hundred and ninety-five millimeters wide. And a P195/70 R15 means it's seventy percent of 195 high. A 205 is, you know, ten millimeters wider. And a P205/70 R15 has got a slightly different radius based on the seventy aspect ratio. And different tire suppliers might have slightly different alterations of that.

The 195 is, you know, not a bad tire. That's quite wide. A hundred and

ninety-five millimeters. It's eight inches wide almost.

Q. Were y'all satisfied that -- or was that the kind of tire that you were targeting originally, 195, 205?

A. 195s, 205s, I think that was about the right size for that vehicle.

Q. If you put a larger tire on it, what effect would it have?

MR. HINGA: What do you mean by larger?

MR. ALLEN: Bigger than -- Larger than 205.

A. Well, you'd get an increase in the center of gravity roughly proportional, seventy percent times the increase in the width designation. So let's say you put a 235 on there. Thirty millimeters wider. You would be basically raising the vehicle ten to twenty millimeters or three-quarters -- a half an inch to three-quarters of an inch.

Q. Is that bad?

A. Well, it's not bad, per se, but it might

make a difference. I mean, it might -- It's going raise the center of gravity height a little bit. It might increase the Gs that the vehicle was capable of getting into and the limit. So it will make a difference.

Q. Did y'all expect people to put bigger tires on it, though, when you sold it?

A. I think I testified before that our policy was to replace the tires on the vehicle with the original equipment tires that came with the vehicle. And I'm not sure what other warnings we provide about not putting bigger tires on. You can't stop people, I don't suppose, from doing something that you don't recommend.

Q. And the reason that you didn't recommend tires any larger than 205 was because of the raising of the center of gravity?

A. No.

Q. Why?

A. When the tires are on the vehicle, if they -- you turn -- We do all kinds of studies to make sure the tires don't hit the

wheel lips, they won't hit the brake linings, they won't hit the brake cables, they won't hit the inner wheel wells. All the validation and testing is done with certain sizes.

And all manner of things could be affected if you put a bigger tire on or you basically put a different wheel on or any of the other things that you could do. If you do that, you're really culpable for whatever the impact is going to be. You see people do all kinds of strange things to vehicles that we sure wouldn't recommend you do. They do -- They do do it.

Q. So the reason you're saying not to put anything larger than a 205 tire on it does not have anything to do, really, with the center of gravity or --

A. Well, it could. It could have a bearing. But basically we test the vehicle, and we certify it with a certain size tire. And we don't -- we can't test all manner -- everything everybody else might think about

doing. So we've only, really -- We've certified the vehicle a certain way, and that's what we expect them to use.

Q. Were there any testing -- or during any of the testing of the Bronco II, did you find out that if the tires wore some, that the speed at which the wheel lift would occur was much lower?

A. Well, I think we know that when the tires wear, you get a different response. So we try to understand what the envelope would be and how it would be affected by worn tires, because the friction of the tire to the ground is different. So we try to understand what that would do.

Our objective when we were doing our testing was to make the vehicle safe and stable to start with, and then to produce large responses, you have to put large steering inputs in.

So the fact that a tire wears and -- at a different speed or -- you know, still with a very large input, you know, we would

expect that there would be some differences. Okay?

The question is, is that amount of steering input unreasonable? That's what we were trying to do, was push -- well, certainly when I left the company, we were trying to push that envelope of steering input into the region that typically people wouldn't put that kind of steering input in.

Q. What could the difference be in the speed at which -- all things being equal, that a tire would -- you would get wheel lift, say --

A. One wheel lift?

Q. -- from a worn tire?

A. That could be forty, fifty miles an hour. It could be a huge difference from a worn to a new tire. To have one -- It can make quite a bit of difference to a vehicle with different tire wear combinations.

Q. So would it be appropriate then, I guess, if you're going to test to find out what a vehicle will really do when you sell it and the person uses it and to -- expect to test

it both with new tires and with worn tires?
A. Well, certainly we did testing that I'm aware of to look at the effects on the sensitivity of the vehicle to -- with tires worn and tires new. There are tests that we did with tires worn and new to look at the effects of variation in tires.
Q. Did that testing go on from the beginning of -- from the first prototype up through production?
A. Well, even when we test -- when we test the vehicle and we do a handling -- the handling test, the testing is so abusive to the tires that the tires even wear out during the testing.
Q. That was not -- I'm asking when the testing was -- When did the testing take place?
A. There was specific testing done in '81 that I'm aware of, and I think some testing was going on in '82 with new and worn tires. And just the nature of some of the tests that we did --
As I said, we may start off with new

tires. And during the course of running the test, the tires wear until they're worn, until they're worn out and unusable.

So any extreme handling test wears the tires out, so you essentially have the opportunity while you're doing the testing to wear the tires.

Q. Where did you do the testing?

A. Testing was done in Dearborn --

MR. HINGA: The tire testing or handling?

MR. ALLEN: The handling and stability tests.

Q. I assume the tire testing was --

A. Testing was done in Arizona and Dearborn, and I think some testing was done at Michigan proving grounds.

Q. Was there ever a point where testing stopped?

A. Well, there's -- No, I don't think testing per se stopped. We may have changed the kinds of tests we've done after we got a certain amount of information and felt that

we're not learning anything more from these tests. That testing might stop and change.

Q. When did that happen?

A. Well, certainly as we advanced the computer model so that the computer model would be able to simulate more variables. We felt comfortable the computer model would allow us to do more suspension iterations in the computer than on the test track.

So we certainly started reducing the amount of testing as suspension math model, computer ADAMS model became more usable in predicting certain outcomes and then did less testing to verify.

Q. When did that happen?

A. Well, we started the math model in '81. By the time we got into the '82 time frame, I personally thought we could do a lot more testing on the computer and get more valid results than we could do with physical testing.

So my ultimate plan was to do a minimum amount of physical testing, use the P6-101

to sign off the product and develop the suspension interactively with the computer and then let the subjective sign-off test the vehicle.

Q. So you're the one that made the decision to move from actual physical testing to the computer testing?

MR. HINGA: Object to the form of the question. There was never a complete break, right?

THE WITNESS: No. That's right.

A. There was never a complete break. I was moving the company in that direction, certainly.

Q. What do you mean there was never a complete break?

A. Well, we always test vehicles. There's always some testing that's done. So there was -- I was -- And this move continues to this day, is that we're moving towards doing more and more testing on the computer with less and less validation on the product because you can test -- right now, we could

test a thousand iterations overnight that we -- you know, it would have taken us six months to get the same data on physical tests.

Q. After May of 1982 and up until the Consumer Union short course, what proving ground tests were done where you used the J-turn and the ramp steer test?

A. I don't remember exactly what tests. There might have been a few tests done. But our computer simulation of what happened in the J-turn seemed to be pretty good, and I felt that we could tune the stabilizer bars, suspension and other components. I'm not sure it was that valid to do that test.

And that testing was not an absolutely required part of our testing. We were doing that to gain information about what happens in that test. That's an arbitrary test, to stick in a whole bunch of steering input and just sit there and wait and see what happens to the vehicle.

So that was one of the tests that we

were doing. We were using it to validate the computer model. Okay? So that testing could have stopped at some point in time.

Q. That's what I'm asking.

A. It could have.

Q. Between May of '82 till the Consumer Union short course -- I was looking to see where the proving ground testing may have ended. It may be and I just haven't found it yet.

A. I don't know if it absolutely ever ended. I mean, I don't know for a fact that it absolutely ever ended.

MR. HINGA: When you say Consumer Union, what are you --

MR. ALLEN: Consumer Union short course.

MR. HINGA: What are you speaking of in terms of the time frame?

MR. ALLEN: I think there were some in '89.

Q. Do y'all have any proving ground films of tests of J-turns between May of '82 and 1989?

MR. HINGA: Let's go off the Record.

(Off the Record discussion.)

MR. ALLEN: Let me get it clear on the Record.

Q. If you know of any films of any J-turn testing or handling tests between May of 1982 and the Consumer Union short course of May of 1989, I need you to tell me about it.

A. I don't remember. I remember reducing the amount of testing that we were doing on the test track. Okay? But I don't remember stopping testing completely and doing no testing on the track on J-turns.

Certainly part of my recommendations were that we wouldn't have to do as much of this testing because we could produce the same results on the computer and more predictable results on the computer.

Q. See, that's what I'm asking for. Where is this testing? You say it was reduced. If there is -- That leads me to believe there is some test -- there are some J-turn tests

and there are some ramp steer tests between May of '82 and 1989. If there are those tests, I want you to point me in a direction where I can find them.

A. Well, there would be development reports if there were tests that were done and were written. There would be development reports that would be on record that show what tests were done.

There were development reports that you've already shown me here today that referred to, you know, wheel lift at so many degrees. And that's the result of those kinds of tests.

So I don't know specifically what testing was done in that period after July after I left. I think there was some testing still going on even from May through July. And it may have been -- I think it was being used basically to correlate the computer. That's what I was trying to do with that data. But I don't remember the exact specifics of what that data -- what

those tests were and when they were done.

You saw the plan that we had to do vehicle dynamics testing and to test various type -- and do various testing. We wrote a special plan to do that stuff, standard handling tests you do to validate the vehicle, P6-101. This J-turn testing was an adjunct to our normal testing, okay, to go in and understand what's going on in J-turns.

My thought process certainly was that I want to be able to understand what the impact is on a J-turn, a double lane change, single lane change in a simulation so I can try different combinations of stabilizer bars and then go out and then validate what I've chosen as being the ideal way rather than wasting all this time and money shredding tires out there on the test track.

Q. So that's the reason you went with the ADAMS simulation?

A. That's exactly right. It'd take too long to iterate the alternatives, but I could

evaluate many, many alternatives over a fairly short period of time with the ADAMS model.

Q. Was there ever a time in May of '82 when there were some tests being done at the Arizona proving grounds where an outrigger was broken during the test?

A. An outrigger is really a bad device in a way. That's because it's a hard object. It changes the vehicle dynamics. And it sits out there --

Q. I just asked you did they break one or not.

A. It's very vulnerable. What I'm saying is it's very vulnerable to being damaged or broken because it suddenly hits the road. I believe there may have been outriggers that were damaged or broken.

I've done testing on other vehicles with outriggers and always had problems with the outrigger integrity if contact is made with the outrigger. So I've broken outriggers myself.

Q. The question is, do you remember in May of

1982 -- and I know you've looked at these documents and are a lot more familiar with them than I am. Do you recall a time in May when they were testing the J-turn test and they broke an outrigger?

A. I don't specifically recall, but I have vague recall of outriggers being damaged.

Q. And that is damaged when the vehicle tips up and starts to turn over? I mean, isn't that the purpose of an outrigger, to keep the vehicle from turning all the way over?

A. That's the purpose of it. You're trying to lose control of the vehicle and precipitate a rollover event, and then the outrigger is to prevent a catastrophic rollover where the vehicle rolls over and injures the driver. So that's what you put an outrigger on for.

Q. And the outrigger that broke in May of '82 was when it tipped up?

MR. HINGA: Object to the form. Foundation.

A. Well, I don't know if the outrigger -- I don't know to what extent the vehicle was

tipped up or, you know, if it was just a singular lift or if the outrigger was just set too close to the ground or what.

I mean, we know we can induce with very, very extreme steering maneuvers that come close to loss of control of the vehicle, we can tip the vehicle up. So without the specific facts of the situation that broke it, I can't say for sure it was a vehicle tipping up. It could have been.

Q. You can't deny --

A. I can't deny it, right.

MR. HINGA: Off the Record.

(Off the Record discussion.)

Q. When you were preparing for J-turn testing, were there any written parameters or guidelines or standards for J-turn testing?

A. There were no formal procedures for J-turn tests. There were -- we -- I think we wrote a test procedure up that said, you know, how to do the turn and what kind of radius to turn or what kind of velocities and angles.

It was a single ramp steer input is

what the J-turn test was. Hold the steering quickly to a set position and let the vehicle respond and see what happened, which is very -- it's an objective test, but I'm not sure anybody actually does that in the real world. I don't know of anybody that would go out and put in three hundred and sixty degrees of steering input at fifty-five miles an hour and wait to see what happens and hold it there. But that's what we were doing.

Q. But the purpose was to find out how stable the vehicle was?

A. Well, it's to understand what happens to the vehicle under those conditions and to determine what happens and then to determine what -- what suspension factors we could change to modify behavior in some direction we wanted to go in. The direction we were trying to go in was to make the steering angle be as high as possible before we precipitated an undesirable response.

Q. Well, you recognize in the real world,

people are going to have to make emergency maneuvers and they're going to have to put -- use radical steering inputs from time to time.

A. Right, but they are not going to put in five hundred degrees of steering input or three hundred and sixty degrees and hold it there until the vehicle rolls over. There's no room to do it. You can't physically do it on a real road. You have to have a big, flat area to do it. You have to deliberately induce this. This is not a real test. It's only hypothesized that it correlates to anything.

Q. So you couldn't make one turn over by just changing lanes real rapidly?

A. I think that if you changed lanes real rapidly and didn't maintain control of the vehicle you could make it roll over. You could make lots of vehicles roll over doing that.

The question is whether in an attempt to maintain normal control of the vehicle,

be in a turn -- be driving the vehicle, you can change lanes quickly and get back into your lane or put a big steering input and be able to keep the vehicle stable. That's what our P6-101 testing did with real drivers and real world doing real -- realistic maneuvers.

Q. When was that testing done?

A. That was done on every generation of prototypes. There was a sign-off on the final levels of vehicles.

And at the time I left, there were reports -- I think it was in July of '81, and there might have been more in '82 -- where a group of people actually -- also management people drove the vehicle in the same maneuvers, through the pilons and did that testing.

So this is part of the ordinary verification that development does and that management does of the vehicle in the proving ground environment.

Q. Okay. Is that separate and apart from the

J-turn testing?

A. The J-turn test was an adjunct to the normal testing. We were doing it to understand what J-turn testing means, because there were several people trying to hypothesize about various vehicle attributes based on doing J-turn testing, like Consumers Union. And so we wanted to understand the mechanics of what goes on in a J-turn.

So we set up proving ground procedures to do that. We built math models capable of doing not only J-turns, but various significant handling maneuvers. And we attempted to correlate those so that we'd understand what happens in a J-turn and we could design a chassis that would maximize performance in a J-turn. Not necessarily preclude a rollover, but just to make it so that in that test, the exposure -- not the exposure, but the input that would be required to produce a rollover in that type of maneuver would be a very, very unusual input and response. Because we know that

you can make vehicles roll over. You can conduct some test to make a vehicle roll over.

Q. Well, I'm a little bit confused when you start talking about the P6-201 testing --

A. P6-101.

Q. All right. Well, what is that?

A. That's a whole procedure that you probably have in your discovery documents that identifies what the development engineer is supposed to do with the vehicle to determine its stability, directional stability, lane change capability and safe handling. That is a subjective assessment. And we've still found no better way to validate that a vehicle is a safe handling vehicle than that test.

Q. Well, in that test, is that just a normal use test?

A. No. That's very extreme driving. That's pushing the vehicle to very high G levels that go beyond what a normal consumer would drive at.

Q. Are there films of those tests?
A. We filmed those retroactively, and those were entered into evidence in the last trial so that we could show you and the jury what is involved in doing those tests. So there are videos that have been made available, that are in evidence, let's say, on those --
Q. Films retroactively?
A. What I'm saying, there are films that have been done -- It wasn't common practice to videotape, those films. The report of the engineer driving the vehicle was the normal documentation. So to show what those tests involved, Ford has made videotapes.
Q. And who did those films?
A. Ford. Ford made those videotapes at their proving grounds.
Q. Did Ford employees do the test?
A. Normally a Ford employee -- a trained driver does the test, yes.
Q. So you have available videotapes that show those tests performed by Ford?
A. I believe so.

MR. HINGA: As demonstrative evidence.

Q. What case were they produced in?

A. The last two cases.

Q. I'm trying --

A. I'm just trying to remember the names of the cases.

MR. HINGA: Chuning.

THE WITNESS: Chuning and --

MR. HINGA: Nelson.

THE WITNESS: They weren't produced in Denny, were they?

MR. HINGA: No.

Q. If you wanted to ask for those films, what would you ask for? I mean, how would you describe them so that when I frame my request --

MR. HINGA: If you don't have them, I'll give you -- I'll send you a copy.

MR. ALLEN: Okay. What do you call them so I'll know?

MR. HINGA: Demonstrative evidence

of the P6-101, limit handling.

THE WITNESS: Testing performed in 1983.

MR. HINGA: If you'll write me a letter, I'll send you a copy of that. No. Write Garth Ferrell a letter. You can write me, Greg. I'll --

MR. ALLEN: Make sure I have the numbers down right. It's P?

MR. HINGA: 6-101. And in your documentation, you should have the protocol, P6-101.

A. That's a Ford engineering test procedure, I believe.

Q. Now, have there been any other films of tests run that you know of for litigation purposes or for anything -- any other purpose that we haven't talked about?

A. I haven't seen all the evidence, but I -- that's been presented. But I think there's videotapes. There may have been videotapes made by Ford's other experts that have been

submitted into evidence. And maybe there's stuff that's been submitted, also, by plaintiffs, this testing that's been done. That's the only other stuff I'd be aware of.

In the formal course of testing, as I said, it was not normal -- it was not ordinary to go out and videotape. We still don't do it to this day I don't think. We don't videotape every test we do.

Back then, videotape wasn't even an option. That was movie film. So I think back in the eighties, we didn't have videotapes, did we?

(Brief interruption.)

Q. Since the time you left Ford and have been involved in litigation, have you become aware of the number of injuries and deaths that have occurred as a result of rollovers with Bronco II vehicles?

A. There's been some statistics presented in court, okay, that -- the context of which I didn't fully understand, okay, in the way the numbers were presented.

So I do not have -- I have not had complete exposure to all the statistics. That's really not my area, so --

Q. Did Ford have any projection at the time they were designing the vehicle as to what they expected as it related to either injuries or deaths in rollovers of the Bronco II?

A. I think that you've presented me what Ford had at the time that the Bronco II went into production. I think there was data available, as you've pointed out earlier, on the CJ5 and the CJ7.

So the document that we talked about earlier had some projections, that Ford was expecting the Bronco II to be better than the CJ5.

Q. But as far as the numbers of injuries and deaths, have you seen any -- or do you remember any discussion about that?

A. I think the numbers I've always seen have ended up being percentages of something. Numbers per passenger mile. I don't recall

seeing the absolute numbers.

Q. Do you know how the Bronco II compares with, say, the S-10 Blazer?

MR. HINGA: Object to the form. I think it's outside the 30(b)(6)

A. I don't really --

Q. Only if you know.

A. I don't know.

Q. What's the difference between the McPherson strut and the SLA frame?

A. McPherson strut has a strut like a shock absorber with an upper attachment point that is -- one of the suspension members essentially slides so the wheel slides up and down with one axis of motion controlled by the sliding member. And the lower member is a typical control arm, like a Twin-I-Beam, like an axle, but it's shorter. It's typically shorter than a Twin-I-Beam, more like a regular SLA suspension.

So the wheel -- when the wheel goes up and down, the lower arm, which has a ball joint to the strut, lets it go up and down

and controls it this way and the strut basically resists it from rolling in and out.

But there's a lot of friction in this strut. They wear out. They are -- I think only just recently have some small compact utility vehicles tried struts in off-road type vehicles. So it tends to be a car suspension. It was originally developed as a car suspension. It's mostly in use in cars and not -- not really been used widely on trucks. It's not been durable or rugged enough.

Q. What is an SLA suspension?

A. An SLA suspension is two arms, a short and a long arm, that are not necessarily parallel to each other that will allow the geometry of the wheel as it moves up and down to be changed in camber so that it will change the vehicle dynamic behavior.

Its advantage is that it gives a pivot point that is either inboard or outboard from the car. And you can change the roll

axis of the car with that more easily than with a Twin-I-Beam suspension.

A Twin-I-Beam suspension is very strong and rugged. It has very good antidive properties without having a lot of harshness.

So there are pros and cons of all three of those suspensions --

(Brief interruption.)

A. So there are pros and cons to all these different suspensions.

Q. What about the S-10 Blazer? Does it have the McPherson strut or the SLA?

A. I think it's the SLA.

Q. SLA?

What about the Jeep Cherokee? Do you know what type --

A. Jeep Cherokee has a trailing arm and a monobeam axle suspension. It's a different axle. It's a live axle basically. I don't think it's independent at all.

Q. Just so I'll be clear, when I see the term swing axle, is that the same as a

Twin-I-Beam suspension?

A. Not really. A swing axle -- A Twin-I-Beam is a derivation of -- an improvement to the swing axle. Normally we refer to the swing axle is where the pivot is on the same side of the car as the suspension, like this. The Twin-I-Beam is crossing over the center of the car.

So generally you refer to swing axles as being very short -- very short suspension members, like the old Volkswagen or the Mutt Jeep.

Q. So if I see swing axle in the documents --

A. As a matter of fact, on this diagram, this exhibit here, Exhibit Two, this is a Twin-I-Beam. I'll mark that. And this is a swing axle.

Q. Okay.

A. I'll write it right on there. That's the difference right there.

Now, you could argue that a Twin-I-Beam is a kind of a swing axle. But the basis of the patent -- What made it unique was the

fact the arms crossed over.

So it's generally accepted that a swing axle and Twin-I-Beam are two different things, although a Twin-I-Beam is a derivation from the swing axle and much improved.

Q. Did you or anybody in your department to your knowledge ever perform a formalized failure mode and effect analysis on the suspension system of the Bronco II?

A. I believe that -- I believe at that time, some failure modes and effects analyses were being used. But there was a period of time under which we stopped doing failure mode and effects analyses.

And we -- we used -- We used a system -- a system test, a PVS, that -- product verification specification that would be set up. And the EF specification was set up for each suspension element to determine the probable causes of failure and to make sure those failures didn't occur.

So we may have done some. Some may

have existed for similar other components. And we may have used a less formal process at that time, so --

Q. Was there one for the Bronco II suspension system?

A. Probably not for the suspension system as a whole, okay, because it was so generic in terms of -- like a lot of the other suspensions that we had done. We might have done only components.

Q. What about for rollover propensity of the system generally?

A. I don't remember doing one -- I don't remember doing any specific failure mode and effect analysis for rollover.

Q. Did they have the same policy in light truck engineering that they had in the passenger car engineering with respect to failure mode and effect analysis?

A. Back then, I'm not aware of an absolute policy. I think new tooled components, we were supposed to do -- design FMEAs on the components.

As far as taking and using the failure mode and effects analysis approach on the complete system or a whole vehicle, I'm not aware that that's even done to this day, so --

Q. Did they have the same policy in light truck engineering as they had in passenger car, whatever that may --

A. I don't really know what the official policy was. We did have a failure mode and effects guideline. So if you chose to do an FMEA, you had a guideline to tell you how to do it.

And I think that was the general intent, that on new components or radically new designs or concepts or materials, that you would do an FMEA. But it was not a rigid -- a rigidly-applied discipline.

Q. And you say they suspended it for a period of time?

A. I think there were some -- there were some concerns about the quality of the FMEAs that were being done and how to do them. And so

there was -- there was a period of time where we were trying to decide exactly how to do them and make them be useful.

Q. Do you know what that time frame was?

A. If I recall, it was the -- it was the mid seventies to -- it might have been the mid seventies to the early eighties to the best of my recollection. Chuck White would probably be able to tell you.

Q. In any of the cases that you've been involved in so far, have there been cases of quadriplegics?

A. I think there have, but I don't remember specifically. I've not really dealt in any of the areas associated with injuries to occupants or any of the injuries. I've really only provided testimony regarding the vehicle dynamics, the development of the vehicle.

And since I haven't sat through all the trials, I've not been too aware of what the injuries were. It was just the general nature. But I think there are other

quadriplegic cases. There may be other quadriplegic cases on the docket -- you know, in the system.

Q. Do you recall any of the names of the plaintiffs that were quadriplegics?

A. No, I don't.

Q. How many death cases would you say you've been involved in?

A. Where the plaintiff was deceased?

Q. Yes.

A. One or two I think have been deaths. I think the others have been injuries.

Q. You mentioned you had been in four trials?

A. Yes.

Q. What were the injuries in those cases?

A. One was -- I'm not sure you could see the injuries there, stress and trauma. One was an injured arm. That was Denny, I think, was an injured arm or hand. And as I said, I don't specifically remember the injuries in the other cases.

Q. I may have asked you this. Did you mention Max Moore earlier?

A. Yes, I did.
Q. And is he still with Ford?
A. No, he isn't.
Q. Okay. Do you know where he is now?
A. He's with the Automotive Support Group. And he's working at Ford on contract, but he works for the Automotive Support Group which is located in that building right over there.
Q. What do they do?
A. They're consultants. Max left Ford and worked for General Motors. Then he left General Motors and worked for Karen and Company where I worked with Max on the UN46. And then Max left Karen and Company and worked for me for a short period of time. And then since the beginning of the year, he's been working with the Automotive Support Group.
Q. Do they contract with --
A. With the Big Three, yes. The same as myself.
Q. Okay.

A. Basically a competitor.
Q. Did you ever have a chance to work on the 1966 to 1978 small Bronco?
A. I didn't design anything on that vehicle, but I did have occasion to drive that vehicle and I did run some handling tests on that vehicle when I was in development, did some tire work.
Q. Have there been any rollover cases involving that vehicle?
A. I believe there have been rollover cases on that vehicle.
Q. And you've never testified in any of those, have you?
A. Never testified, no.
Q. Did it also have a Twin-I-Beam suspension?
A. You know, I don't think it did. I think it had a monobeam suspension, more like the Jeep.
Q. I said '66 to '78. Do you know if that's the right time period for the --
A. It sounds right. I don't know for sure it's the right years.

Q. How would you designate that particular vehicle if you were going to talk about it? What do you call it?
A. I guess I call that the original Bronco.
Q. I know there's a big Bronco.
A. That was the Bronco. Now, that went out of production and we came out with the big Bronco. Then we came out with the Bronco II.
Q. So the original Bronco, big Bronco, Bronco II?
A. Right.
Q. I guess now the Explorer to replace -- Well, did the Explorer replace the Bronco II?
A. Yeah, I guess it did.
THE WITNESS: What would you refer to the original Bronco? The original Bronco?
MR. HINGA: Yes.
(Off the Record discussion.)
Q. Did you own a Bronco II?
A. I've never owned a Bronco II, no.

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FURTHER DEPONENT SAITH NOT

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I, David J. Bickerstaff, hereby certify that I have read the foregoing transcript of my deposition given on Friday, September 30, 1994, and it is a true and correct transcript of the testimony given by me at the time and place stated with the corrections, if any, and the reasons therefor noted on a separate sheet of paper and attached hereto.

_____
David J. Bickerstaff

SWORN TO AND SUBSCRIBED before me this _____ day of _____, 19__.

_____
NOTARY PUBLIC

MY COMMISSION EXPIRES:
_____

REPORTER'S CERTIFICATE

STATE OF ALABAMA:

MONTGOMERY COUNTY:

I, Lisa J. Nix, Registered Professional Reporter and Commissioner for the State of Alabama at Large, do hereby certify that I reported the deposition of:

DAVID J. BICKERSTAFF

who was first duly sworn by me to speak the truth, the whole truth and nothing but the truth, in the matter of:

KENT H. CRENSHAW and CARMEN W. CRENSHAW,

Plaintiffs,

Vs.

FORD MOTOR COMPANY, et al.,

Defendants.

In The Circuit Court For

Lowndes County, Alabama

Civil Action Number CV-93-75

on Friday, September 30, 1994.

The foregoing 259 computer printed pages contain a true and correct transcript of the

examination of said witness by counsel for the parties set out herein. The reading and signing of same is hereby not waived.

I further certify that I am neither of kin nor of counsel to the parties to said cause, nor in any manner interested in the results thereof.

This 10th day of October 1994.

_____
Lisa J. Nix, Registered Professional Reporter and Commissioner for the State of Alabama at Large