

1 UNITED STATES PATENT AND TRADEMARK OFFICE

2
3 BEFORE THE PATENT TRIAL AND APPEAL BOARD

4
5 MOBILEYE GLOBAL, INC.,

6 Petitioner,

7 v.

8 FACET TECHNOLOGY CORP.,

9 Patent Owner.

10
11 Inter Partes Review No. IPR2024-01111

12 U.S. Patent No. 9,671,328

13
14 ORAL DEPOSITION of CHARLES E. THORPE, PH.D.

15 (VIA ZOOM VIDEOCONFERENCE)

16 Tuesday, October 14, 2025

17 12:02 p.m. CST

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22 Job No.: 603331

23 Pages: 1 - 60

24 Reported By: Linda Russell

1 Remote Oral Deposition of CHARLES E.
2 THORPE, PH.D. produced as a witness at the
3 instance of the Patent Owner, and duly sworn, was
4 taken in the above-styled and numbered cause on
5 October 14, 2025, from 12:02 p.m. to 2:04 p.m.,
6 before Linda Russell, CSR in and for the State of
7 Texas, recorded by machine shorthand, via Zoom
8 Videoconference pursuant to 37 C.F.R. § 42.53 and
9 any provisions stated on the record or attached
10 hereto.

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A P P E A R A N C E S

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I N D E X

Page

CHARLES E. THORPE, PH.D.

BY MR. SAUNDERS

5

EXHIBITS MARKED

No.

Description

Page

(None marked)

1 P-R-O-C-E-E-D-I-N-G-S

2 THE COURT REPORTER: I am Linda Russell,
3 Court Reporter representing Planet Depos. We are
4 going on the record at 12:02 p.m.

5 CHARLES E. THORPE, PH.D.,
6 having been first duly sworn, testified as
7 follows:

8 EXAMINATION

9 BY MR. SAUNDERS:

10 Q Good afternoon, Dr. Thorpe. Can you state
11 your full name for the record.

12 A Charles E. Thorpe.

13 Q And do you understand this deposition is
14 now relating to your supply -- sorry, your
15 Supplemental Reply Declaration you filed in
16 IPR2024-01111, relating to U.S. Patent No.
17 9,671,328?

18 A I do.

19 Q Do you understand the same ground rules
20 apply to this deposition as we discussed earlier
21 today in your deposition on the '255 patent?

22 A I do.

23 Q And will you again ask for clarification
24 if you don't understand any of my questions?

25 A I will.

1 Q And do you see in the exhibit share link
2 I've uploaded Exhibits 1001, 1005, 1006, 1007,
3 1030, and 1023 from the 1111 IPR?

4 A And I have hard copies of all of those in
5 front of me.

6 Q Okay. I'd like to turn to paragraph 27 of
7 your Supplemental Declaration.

8 A Okay.

9 Q And you say in paragraph 27 that -- you
10 see in the second sentence there, "In my opinion,
11 Gallagher's visual indicator means is a visual
12 alert to the driver of the vehicle based on
13 Gallagher's computer detecting that an object is
14 present." Do you see that?

15 A I see that.

16 Q So what calculations has Gallagher's
17 computer done to detect an object as present by
18 the time of Gallagher's step (d)?

19 MR. HIGH: Objection. Form.

20 A If you want to go through each of the
21 steps, they are listed in the Gallagher patent.

22 The question is what has happened by
23 step (d). In my paragraph 29, I say, "After
24 'filtering the data' to smooth out the data and
25 calibrating the data, Gallagher's step (d)

1 discloses 'determining the vehicle position on the
2 road and providing' a 'visual indicator means.'"

3 If we go look at how that happens,
4 Gallagher, paragraph 10 mentions, "Preferably the
5 apparatus further comprising an audio and/or
6 visual means to provide an indication of the
7 location of said road markings relative to the
8 vehicle."

9 So what's happening here is that the
10 system is detecting a road marking -- and
11 "marking" in Gallagher's usage is generic as to
12 painted line or raised pavement marker -- as using
13 the location of said road markings relative to the
14 vehicle to produce the indicator.

15 Q And what calculations do you believe have
16 actually the calculation in which an object is now
17 detected in step (d) of Gallagher?

18 MR. HIGH: Objection. Form.

19 A Gallagher paragraph 33 says, "The
20 apparatus 1 can test the reflectivity of a wide
21 variety of reflective road markings and road
22 markers such as, for example, road signs and
23 posts, reflective painted lines whether continuous
24 or broken, and more particularly raised pavement
25 markers." Gallagher is not specific as to how he

1 tests the reflectivity of these.

2 BY MR. SAUNDERS:

3 Q Let's turn to paragraph 30 of your
4 declaration. In the first sentence there, do you
5 see it says, "This visual indicator is not just
6 the raw output of a sensor with the current
7 highest intensity reading." Do you see that?

8 A I see that.

9 Q Okay. Does Gallagher's visual indicator
10 or auditory indicator turn on and off between road
11 markers as the vehicle is passing down the road?

12 MR. HIGH: Objection. Form.

13 A Look at the last sentence of paragraph 30.
14 "A person of ordinary skill in the art reading
15 Gallagher would understand the visual indicator's
16 purpose to be to inform the driver where in the
17 field of view each object of interest is located
18 to help the driver maintain the vehicle properly
19 positioned on the road." And then it cites both
20 paragraph 10, which we have already cited, and
21 paragraph 60 through 62 of Gallagher.

22 BY MR. SAUNDERS:

23 Q Well, you'd agree with me, looking at
24 paragraph 34 of Gallagher, it gives examples of
25 markers being spaced every 5 to 20 meters, right?

1 A I see that.

2 Q And you see in paragraph 35 of Gallagher
3 it refers to an Area A covering a 3 by 0.5 meter
4 area?

5 A I see that.

6 Q So is -- you'd agree with me that
7 sometimes when the vehicle is moving down the
8 roadway there are no road markers within
9 Gallagher's illuminated area, right?

10 MR. HIGH: Objection. Form.

11 A Mischaracterization.

12 I would agree that there may be times when
13 there may be no raised pavement marker, but there
14 may still be a continuous or dashed painted line,
15 which Gallagher is also capable of detecting.

16 BY MR. SAUNDERS:

17 Q Well, assuming the dashed line -- let me
18 withdraw.

19 Does Gallagher say anything about the
20 spacing of dashed lines?

21 A I don't recall.

22 Q So it could be possible that there are
23 times when the vehicle is driving down the road
24 where there's neither a dashed line or a raised
25 pavement marker in the area that Gallagher is

1 illuminating ahead of it, right?

2 MR. HIGH: Objection. Form.

3 A I would have to look up the road marking
4 standards of the relevant road authority to know
5 whether that is true or not.

6 BY MR. SAUNDERS:

7 Q You agree with me that you're aware that
8 some roads don't have painted lines in the middle
9 of the road and just have raised pavement markers
10 to delineate the two sides of the road, right?

11 A Exact standards vary from location to
12 location.

13 Q Well, you personally have driven on roads
14 that don't have lines in the middle and only have
15 raised pavement markers to delineate the two sides
16 of the road, right?

17 A I'm trying to recall --

18 MR. HIGH: Objection. Form.

19 A Where I live in the state of New York,
20 that is not the standard. There may be other
21 states where that is true.

22 BY MR. SAUNDERS:

23 Q So is it your understanding that Gallagher
24 step (d) is always going to have some type of
25 visual or auditory indicator?

1 A As I said, step (d) is finding road
2 markings and providing an indicator of where the
3 vehicle is relative to the road markings. As I
4 say near the bottom of paragraph 30, "I disagree
5 with Dr. Papanikolopoulos that 'at least one of
6 the sensors will always have the highest reading
7 among all of the sensors.' A person of ordinary
8 skill would understand the visual indicator's
9 purpose to inform the driver where in the field of
10 view each object of interest of located."

11 I believe Gallagher is silent as to, in
12 your hypothetical situation, what it would do if
13 there is no marker detected. I believe it is
14 clear that Gallagher is detecting markers.

15 Q Now, in paragraph 30, I think it's your
16 third sentence, do you see that you say, "When
17 Gallagher's computer 'detects which light sensor 6
18 is reading the highest reflectance reading,' a
19 person of ordinary skill in the art would
20 understand it to detect an object of interest
21 because the computer is distinguishing between
22 'background reflectance levels on non-road marking
23 sections of the road' and reflectance levels
24 indicating a road marking." Do you see that?

25 A I see that.

1 Q Now, you agree with me that step (f) of
2 Gallagher in paragraph 65 says that "step (f)
3 involves determining the background reflectance
4 level on the road and establishing non-marker
5 reflectance levels"?

6 A That's what it says.

7 Q Okay. So if step (f) is determining --
8 sorry, withdraw.

9 If step (f) is determining the background
10 reflectance level on the road, how is Gallagher
11 distinguishing between background reflectance
12 levels back in step (d)?

13 MR. HIGH: Objection. Form.

14 A I think it's fairly clear. Step (f), in
15 my mind, is determining what is the reflectance
16 level of things which are not markers, and so a
17 measurement would have to be higher than that to
18 be determined to be a marker.

19 BY MR. SAUNDERS:

20 Q Do you say the step (f) comes before
21 step (d) in Gallagher?

22 A I think step (f) is a continuous process
23 running as the vehicle goes over different kinds
24 of asphalt, different ages of asphalt, different
25 kinds of background, continuously updating what

1 the non-marker background looks like.

2 Q So let's turn to paragraph 60 of
3 Gallagher. Do you see the sentence that kind of
4 crosses the page from page 3 to page 4, says, "As
5 each of the five light sensors 6 covers a section
6 of the area A and data from each light sensor is
7 received showing the reflectance levels across
8 area A of the road, then given that background
9 reflectance levels on non-road marking sections of
10 the road are low and road markers 2 are relatively
11 high, the computer program can detect which light
12 sensor 6 is reading the highest reflectance
13 reading and to provide the operator with that
14 information." Do you see that?

15 A I see that. And this is where a person of
16 ordinary skill in the art in this context would
17 say not only detecting which is the highest
18 reading, but also given that the background
19 reflectance levels are low and the road markers
20 are relatively high. So it is the highest reading
21 among those sensors which are high enough to not
22 be background but to be a road marker.

23 Q Well, I'm going to give you an
24 interpretation of this passage and then I'm going
25 to ask you whether you agree or disagree.

1 I read the phrase "given that background
2 reflectance levels on non-road marking sections of
3 the road are low and road markers are relatively
4 high," as simply saying that, in general, it knows
5 there's a contrast between the intensity of road
6 markers and the background of the road and so it
7 is able to provide the driver with that indication
8 just based on the highest reading without
9 performing a thresholding step to determine
10 whether there is any intensity setting above a
11 background reflectance level. Do you agree or
12 disagree with that?

13 A I disagree with that. I believe that
14 the "given that background reflectance levels are
15 low and road markers are high" certainly implies
16 to a person of ordinary skill in the art that you
17 are detecting a road marker or detecting the
18 absence of a road marker, and it does not -- it
19 only makes sense to give the driver an indication
20 if you have detected a road marker.

21 Q Does this sentence say anything about what
22 would happen in the scenario where the road
23 background is not significantly higher than the
24 intensity of the road markers?

25 MR. HIGH: Objection. Form.

1 A Let's look at it in context again. If you
2 go all the way back to paragraph 10, "apparatus
3 further comprising an audio and/or visual means to
4 provide an indication of the location of the said
5 road markings relative to the vehicle," it is
6 providing the indication as it detects said road
7 markings.

8 BY MR. SAUNDERS:

9 Q I'm sorry, was that your interpretation or
10 were you reading something?

11 A Oh, I was reading paragraph 10.
12 "Preferably the apparatus further comprising an
13 audio and/or visual means to provide an indication
14 of the location of the said road markings relative
15 to the vehicle." My interpretation of that is it
16 must be detecting said road markings.

17 Q In your view, is there anything happening
18 to that detection of a road marking in step (d)
19 that is later used in another step?

20 MR. HIGH: Objection. Form.

21 A So the detection says that there is a road
22 marking there. "Gallagher discloses" -- from my
23 paragraph 28 -- "that both the painted lines and
24 the raised pavement markings may be reflective and
25 that its apparatus may 'test the reflectivity' of

1 both."

2 Once a road marking is detected, then --
3 in my paragraph 31 -- "information is used to tag
4 or identify road markers tested."

5 And in paragraph 32, looking at Figure 5
6 of Gallagher, those road markings -- "reflectance
7 levels measured from a number of road markings."
8 So it is then determining which of those road
9 markings are retroreflectors and, furthermore,
10 measuring the true location of each of those
11 markers.

12 BY MR. SAUNDERS:

13 Q How, in your view, is the detection that
14 you believe is happening in step (d) different
15 from the determination that something is a
16 retroreflector happening -- you believe is
17 happening in step (g)?

18 A Well, the detection says this is a road
19 marking. Once it is a road marking there's a
20 separate question, is this a painted line or is
21 this a retroreflector. Once that is done, there
22 is yet another processing step to say is this a
23 properly operating retroreflector or an improperly
24 operating retroreflector.

25 Q So how does Gallagher make an assessment

1 about whether something is or is not a
2 retroreflector?

3 A Paragraph 66 of Gallagher, "Process
4 step (g) involves selecting which reflectance
5 levels indicate a road marker. In the case of
6 road markers the peak responses sensed are
7 determined as the highly reflective surfaces of a
8 road marker."

9 Further in paragraph 70, "involves
10 determining the location of any missing road
11 markers by recognizing patterns in existing road
12 marker locations."

13 So there is a potential for the use of
14 geometry as well as a potential for the use of the
15 data.

16 Q Is there some data that is being passed
17 from step (d) of Gallagher to step (g) to reflect
18 the detection of a road marker, in your view?

19 MR. HIGH: Objection. Form.

20 A Since the step (d) is determining whether
21 there is a road marking, any data that is not a
22 road marking need not be considered for the
23 analysis of the retroreflector.

24 BY MR. SAUNDERS:

25 Q Let's go to paragraph 31 of your

1 declaration. You opine about step (e) of
2 Gallagher, correct?

3 A Yes.

4 Q And you quote in that paragraph language
5 from paragraph 63 of Gallagher that says,
6 "determines the distance traveled from the start
7 position of the road marking so as to determine
8 the location of each road marking." Do you see
9 that?

10 A I see that.

11 Q And again in paragraph 31 you quote
12 Gallagher's paragraph 64. It says, "This
13 information is used to tag or identify the road
14 markers tested along a stretch of road." Do you
15 see that?

16 A I see that.

17 Q Step (e) doesn't actually tag the road
18 markers yet, right?

19 MR. HIGH: Objection. Form.

20 A Step (e) is determining position.

21 BY MR. SAUNDERS:

22 Q And step (e) doesn't identify the road
23 markers yet, right?

24 MR. HIGH: Objection. Form.

25 A Step (e) is used to generate data which

1 will be used to locate the retroreflectors.

2 BY MR. SAUNDERS:

3 Q All right. Let's go to paragraph 32 of
4 your declaration. And in paragraph 32, the
5 sentence starting on page 18, you say, "I disagree
6 with their characterization of Gallagher as
7 providing only a single step for detecting and
8 determining for the reasons previously described."
9 Do you see that?

10 A I see that.

11 Q And this is in a paragraph that the prior
12 sentence you mention that Patent Owner and
13 Dr. Papanikolopoulos characterize step (g) as a
14 single step for both detecting and determining."
15 Do you see that?

16 A I see that.

17 Q Are you saying that there are multiple
18 steps happening in Gallagher step (g)?

19 MR. HIGH: Objection. Form.

20 A I say that the lane marking has been
21 detected. And after it has been detected, then
22 there is a characterization "is this a
23 retroreflector or not."

24 Furthermore, the location of the
25 retroreflector is stored, which goes back to

1 paragraph 8 of Gallagher, "provides a locating
2 means for determining the location of a road
3 marking." This is not the location of the
4 vehicle, this is the location of the marking
5 itself.

6 BY MR. SAUNDERS:

7 Q And further down in paragraph 32 you
8 reference Figure 5 of Gallagher. Do you see that?

9 A I do.

10 Q And you believe Figure 5 of Gallagher
11 illustrates why Gallagher is not performing only a
12 single step for detecting and determining?

13 A Figure 5 shows that this is not just raw
14 data being recorded, this is detecting road
15 markings and determining that they are
16 retroreflectors and only recording the data if it
17 is determined to be a retroreflector.

18 Furthermore, what Figure 5 illustrates is
19 the potential of having a forward looking sensor
20 and a rearward looking sensor on the same vehicle
21 looking at the front face and the back face of the
22 same retroreflector and recording the location of
23 that same retroreflector in map coordinates so
24 that the line going up for the front face matches
25 the line going down for the back face so that you

1 know that those are the same retroreflectors that
2 you're looking at from two different sides.

3 Q And so you're saying that -- you say
4 further down in that paragraph 32 that, "Figure 5
5 helps illustrate the presence of a separate
6 'detect' step because Gallagher's computer is able
7 to relate the reflectance value of two different
8 surfaces of the same object of interest together."
9 Do you see that?

10 A You are detecting the front surface, you
11 are detecting the rear surface, you are putting
12 them both into map coordinates so that you know
13 where they are.

14 Q Do you know when in Gallagher's algorithm
15 Gallagher's computer relates the reflectance value
16 of two different surfaces of the same object?

17 MR. HIGH: Objection. Form.

18 A Paragraph 74 of Gallagher.

19 BY MR. SAUNDERS:

20 Q Are you done answering that question?

21 A Yes.

22 Q Okay. And paragraph 74 of Gallagher
23 mentions an additional processing step in the
24 algorithm; is that right?

25 A Yes.

1 Q So it's not happening in the steps that
2 are previously stated before paragraph 74, right?

3 MR. HIGH: Objection. Form.

4 A In the paragraphs that are previously
5 stated the location of the front surface is known,
6 the reflectance of the first surface -- front
7 surface is known, now the reflection of the back
8 surface is known, and the reflection of the back
9 surface is known. Since they are both known in
10 map coordinates, the matching is straightforward.

11 BY MR. SAUNDERS:

12 Q Now, Gallagher doesn't say how it's
13 actually doing that matching, does it?

14 A It's an implementation detail.

15 Q Now, Gallagher knows how far the front
16 sensor and the rear sensor are in the
17 implementations that can read both the front and
18 back reflector, right?

19 A That is correct.

20 Q And Gallagher knows how fast it's moving
21 down the road; is that correct?

22 A That is correct.

23 Q So I'm going to ask you again. I'm going
24 to interpret something and ask if you agree or
25 disagree.

1 I interpret Figure 5 of Gallagher as being
2 consistent with it's just able to shift the rear
3 face readings to match the front face readings
4 based on knowing the distance between the front
5 and rear sensor and how fast the vehicle was
6 going, it knows how much it has to shift the
7 readings to match. Do you --

8 MR. HIGH: Objection. Form.

9 BY MR. SAUNDERS:

10 Q Do you agree? Is that consistent with
11 Figure 5 or inconsistent?

12 A I believe that's inconsistent --

13 MR. HIGH: Objection.

14 A -- with Figure 5.

15 The discussion of Gallagher only mentions
16 speed tangentially to say how fast the vehicle
17 could be moving. I believe what it is doing is
18 either by odometry knowing how far the vehicle has
19 moved or by GPS knowing the vehicle location.

20 So it is a matter of knowing the location
21 where the forward sensor has detected an object
22 and knowing the location where the rearward sensor
23 has detected an object, it is not simply a matter,
24 as you characterize, of knowing the vehicle speed.

25 BY MR. SAUNDERS:

1 Q Does Gallagher say when the additional
2 processing step of matching the reflectance levels
3 is performed?

4 A In paragraph 72 he's talking about having
5 these be -- the measurements be displayed in
6 real time.

7 Q Does that mean -- are you interpreting
8 that as necessarily that the matching up of the
9 front and rear has to be done before they are
10 displayed?

11 MR. HIGH: Objection. Form.

12 A You used the word "necessarily."

13 BY MR. SAUNDERS:

14 Q Yes, I did.

15 A And what did you mean by that?

16 Q Well, that basically the only way you
17 could interpret Gallagher's disclosures are such
18 that it is matching up the reflectance levels from
19 the front and rear readings before those are
20 displayed to the user.

21 A That is certainly a plausible
22 implementation. And it would, as Gallagher
23 suggests, allow the user at the beginning of a run
24 to see if the system is working as expected.

25 Q Do you know in relationship to the

1 steps (a) through (l) that are mentioned in
2 Gallagher's paragraphs 56 through 71, where in
3 that sequence does the additional processing
4 step mentioned in Gallagher's paragraph 74 occur?

5 MR. HIGH: Objection. Form. Asked and
6 answered.

7 A Paragraph 74 is described outside of the
8 list of paragraphs that you suggested without
9 specificity as to where that would be taking
10 place.

11 BY MR. SAUNDERS:

12 Q So it could be the case that Gallagher is
13 performing the additional processing step of
14 paragraph 74 after step (g) of Gallagher; is that
15 right?

16 MR. HIGH: Objection. Form.

17 A I believe step (g) is for an individual
18 sensor detecting whether it is a road marker.
19 That would be running on the forward-looking
20 sensor and it would be running on the backward
21 looking sensor. Each of those could -- would
22 individually know the location at which -- at
23 which the retroreflector was sensed in map
24 coordinates.

25 If you look at Figure 5, there are indeed

1 some gaps where the forward looking sensor detects
2 something and the backward looking sensor does
3 not.

4 BY MR. SAUNDERS:

5 Q I'm sorry, is there some implication
6 you're saying from the fact that there are gaps in
7 Figure 5 between the forward and rear sensor?

8 A The forward sensor is doing its job
9 recording locations in world coordinates. The
10 backward sensor is doing its job recording
11 locations in world coordinates. Exactly when
12 those two are synchronized is an implementation
13 detail.

14 Q Let's move on to paragraph -- let's move
15 on to paragraph 36. You're talking about
16 Schofield now as well in paragraph 36, right?

17 A I see that.

18 Q And you quote Schofield saying that
19 Schofield "could be used to assist in
20 qualifying" -- and put that in italics -- "or
21 disqualifying objects." Do you see that?

22 A I see that.

23 Q How does Schofield use pattern recognition
24 to qualify an object?

25 A Well, the paragraph I quote: "Pattern

1 recognition may be used to further assist in the
2 detection of headlights, taillights, and other
3 objects of interest. Pattern recognition
4 identifies objects of interest based upon their
5 shape, reflectivity, luminance, and spectral
6 characteristics." For example, the fact that
7 headlights and taillights usually occur in pairs
8 could be used to assist in qualifying or
9 disqualifying objects as headlights and
10 taillights.

11 Q And does Schofield actually say how to do
12 that to qualify an object?

13 MR. HIGH: Objection. Form.

14 A I believe it is -- it is apparent looking
15 at pairs of white lights, pairs of red lights, to
16 improve the confidence that you have detected
17 headlights and improve the confidence that you
18 have detected taillights. And of course --

19 BY MR. SAUNDERS:

20 Q So you --

21 A -- at the time of Schofield, the standard
22 was in place for the third high-mounted stoplight,
23 so now you can look for a triangle of red lights.

24 Q So to use pattern recognition to qualify
25 an object you already have to have some way of

1 knowing that an object is potentially there,
2 right?

3 MR. HIGH: Objection. Form.

4 A Pattern recognition is part of detecting
5 and part of improving your confidence in what you
6 have detected.

7 BY MR. SAUNDERS:

8 Q Well, how is it working in your proposed
9 combination of Schofield and Gallagher?

10 A "A person of ordinary skill in the art
11 would have seen" -- I'm in my paragraph 35 --
12 "would have seen these disclosures and been
13 motivated to combine Gallagher and Schofield" --
14 by the way, I don't know if it's Schofield or
15 Schofield, we would have to ask him -- "combine
16 Gallagher and Schofield to detect objects of
17 interest because Gallagher's apparatus measures
18 reflectivity, Schofield's image capture system
19 identifies objects based upon their shape and
20 color, and Schofield discloses that putting these
21 together improves object detection."

22 Q So are you proposing to put them together
23 in a way that involves qualifying or disqualifying
24 using pattern recognition?

25 MR. HIGH: Objection. Form.

1 A Schofield says they could be used in
2 either qualifying or disqualifying.

3 BY MR. SAUNDERS:

4 Q Well, let's start with qualifying. How
5 are you proposing Gallagher being combined with
6 Schofield to use pattern recognition in a
7 qualifying manner?

8 MR. HIGH: Objection. Form.

9 A From my paragraph 37, "For example, object
10 detection methods at the time routinely used data
11 from multiple sensors to confirm the detection of
12 an object. This would have been one way to
13 combine Gallagher and Schofield."

14 Further down in that paragraph,
15 "Schofield's techniques would then have allowed
16 for improved object detection by incorporating
17 factors like shape and color, in addition to the
18 reflectance levels from Gallagher's sensors, to
19 distinguish between painted lines, raised pavement
20 markers, and other detected objects."

21 BY MR. SAUNDERS:

22 Q So in your proposed combination of
23 Schofield and Gallagher, if Schofield is using
24 qualifying pattern recognition, is Gallagher not
25 going to measure the retroreflectivity of an

1 object that Schofield hasn't qualified?

2 MR. HIGH: Objection. Form and scope.

3 A Can you show me where I say that?

4 BY MR. SAUNDERS:

5 Q No, I'm asking you to clarify this
6 paragraph that you just read.

7 A What the paragraph says is the combination
8 of the two systems and the two techniques will
9 give you more information and more reliable
10 results.

11 Q And I'm trying to understand how you are
12 combining them in this paragraph. Are you
13 combining them such that you are using Schofield
14 as a qualifying or a disqualifying pattern
15 recognition technique?

16 MR. HIGH: Objection to form. Asked and
17 answered.

18 A Since the sensors have different fields of
19 view and are generating different probabilities of
20 interpretation, it would be straightforward to
21 combine the probabilities of interpretation from
22 the two systems.

23 BY MR. SAUNDERS:

24 Q Does Gallagher output a probability of
25 interpretation?

1 A You're asking how I would combine the two
2 systems.

3 Q Or how you are proposing them to be
4 combined in your obviousness theory.

5 A Yes.

6 MR. HIGH: Objection. Scope.
7 BY MR. SAUNDERS:

8 Q Do you need me to ask the question again?

9 A So, for instance, "Schofield's technique
10 would have allowed for improved object detection
11 by incorporating factors like shape and color, in
12 addition to the reflectance levels from
13 Gallagher's sensors, to distinguish between
14 painted lines, raised pavement markings, and other
15 detected objects."

16 Using the color sensor of Schofield, using
17 the 2D camera of Schofield, using the processing
18 of Schofield in addition to Gallagher's system
19 improves the performance of the overall system.

20 Q Okay. And how does it do that?

21 MR. HIGH: Objection. Asked and answered.

22 A Schofield talks about detecting signs,
23 Schofield talks about detecting lane markers.
24 "For example, incorporating Schofield's camera
25 data would have improved the system's ability to

1 detect objects of interest with reflectance levels
2 so far below the minimum acceptable level that
3 using reflectance levels alone might mistake them
4 for background."

5 BY MR. SAUNDERS:

6 Q Any other examples other than the one you
7 just read?

8 A Back up in paragraph 35, "Combining
9 Gallagher and Schofield would have improved the
10 accuracy of Gallagher's visual indicator because
11 it would incorporate data from multiple sensors
12 and more advanced processing techniques, which
13 would improve the visual indicator and improve the
14 driver's ability to position the vehicle properly
15 on the road."

16 Q Let's go to that example again that's at
17 the end of paragraph 37, the last sentence there.

18 So in this example that you have that,
19 "for example," at the last sentence of
20 paragraph 37, is Schofield detecting objects that
21 Gallagher could not identify, is that what you're
22 proposing?

23 A Because Schofield has more pixels and can
24 measure shape, Schofield can detect things that
25 Gallagher would not have reliably detected.

1 Q And Gallagher is going to take the
2 retroreflectance of the objects that Schofield
3 detects, is that what your proposed combination
4 is?

5 MR. HIGH: Objection. Form.

6 A The combination says this would be one way
7 to combine Gallagher and Schofield. "Schofield's
8 camera would have a field of view that covered the
9 field of view of Gallagher's light sensor array."
10 So both sensor systems are running in that one
11 example.

12 As I explained in my deposition, there are
13 several ways that a person of ordinary skill in
14 the art would have known to combine their
15 teachings and why it would have been obvious to do
16 so.

17 BY MR. SAUNDERS:

18 Q In the example there you give in the last
19 sentence of paragraph 37 of your declaration,
20 would that require Gallagher ignore its cutoff
21 between background and non-background
22 retroreflection?

23 MR. HIGH: Objection. Form.

24 A It's an implementation detail that would
25 have to be addressed when you were building the

1 combined system. That is not a particularly
2 difficult engineering matter.

3 BY MR. SAUNDERS:

4 Q Now, paragraphs 38 through 42 of your
5 declaration address various issues relating to
6 sensor fusion; is that correct?

7 A That is correct.

8 Q And I want to go to paragraph 42. Let me
9 know when you're there.

10 A I am there.

11 Q So does -- you say in that sentence,
12 "Object detection techniques (e.g., the pattern
13 recognition described in Schofield) based on a
14 combination of data from Schofield's and
15 Gallagher's sensors were simple enough to be done
16 at highway speeds without expecting any issues
17 with the processing speed." Do you see that?

18 A I see that.

19 Q Does Schofield say how to perform sensor
20 fusion to combine data from camera-based pattern
21 matching with an array of photodiodes?

22 A The first answer to that question...

23 (Document Review)

24 The first answer to your question is
25 Schofield column 4, starting about 16, talks about

1 a wide variety of different sensors that they
2 could use. So it is entirely possible to
3 implement Schofield with a 2D array of
4 photodiodes, which would make the sensor match
5 Gallagher's sensor, or it is entirely possible to
6 implement it with a different kind of a sensor.

7 Now, what was your question?

8 Q Does Gallagher -- sorry, withdrawn. Does
9 Schofield say how to perform sensor fusion to
10 combine its camera-based pattern matching with an
11 array of photodiodes?

12 A And my first answer was that the camera
13 itself could be a 2D array of photodiodes.

14 Q You'd agree with me that the camera in
15 Schofield has a different resolution -- let me
16 withdraw.

17 You agree with me that the camera in
18 Schofield has a different horizontal resolution
19 than the number of photodiodes in Gallagher's
20 array, right?

21 A You're talking about an exemplary
22 implementation of Gallagher. Gallagher discusses
23 more sensors, more variety of sensors, different
24 kinds of sensors.

25 Q Does Gallagher discuss more than one

1 sensor array arranged vertically?

2 A Oh, now we're -- I didn't say arranged
3 vertically. You were talking about horizontal.

4 Q Yeah. Well, new question then. Does
5 Gallagher discuss having more than one sensor
6 array arranged in multiple rows with a row
7 vertically arranged above another row?

8 A Gallagher's sensor is a single row which
9 is being push-broomed on the row.

10 Q And you agree with me that Schofield's
11 camera has multiple rows of sensors?

12 A Schofield's camera is a 2D camera.

13 Q All right. Have you explained exactly
14 what a POSA would have done to perform sensor
15 fusion to combine Gallagher's array of photodiodes
16 with Schofield's camera-based pattern matching
17 system?

18 MR. HIGH: Objection. Form.

19 A For instance, in my paragraph 47 there are
20 several ways that these could be computed. Here's
21 a wonderful example, side-by-side raised pavement
22 markers in Gallagher. Let's use Schofield's
23 processing to instead of finding a single peak,
24 say we're looking for multiple peaks. So that's
25 using Schofield's teachings implemented on

1 Gallagher's array.

2 MR. SAUNDERS: We've gone about another
3 hour. Why don't we go ahead and go off the record
4 for another break.

5 THE COURT REPORTER: Off the record.

6 (A break was taken from 1:02 p.m. to
7 1:11 p.m.)

8 THE VIDEOGRAPHER: Back on the record at
9 1:11 p.m.

10 BY MR. SAUNDERS:

11 Q All right. Let's continue with
12 paragraph 47 of your declaration, Dr. Thorpe.

13 In your proposed combination that you're
14 describing in paragraph 47, the combination is
15 giving a location along a horizontal access of
16 photodiodes; is that right?

17 A The data from Gallagher is photodiode, so
18 those are horizontal, yes.

19 Q And in paragraph 48 you give another
20 proposed combination -- or way of combining
21 Gallagher and Schofield; is that right?

22 MR. HIGH: Objection. Form.

23 A There's the paragraph I was looking for
24 that's saying Gallagher can use a variety of
25 different light sources.

1 BY MR. SAUNDERS:

2 Q So paragraph 48 is a different way of
3 combining Gallagher and Schofield than what you're
4 talking about in 47; is that right?

5 MR. HIGH: Objection. Form.

6 A It needn't be separate, it can be
7 both/and.

8 BY MR. SAUNDERS:

9 Q Well, in paragraph 48, you're talking
10 about taking is it one -- one row from Schofield's
11 sensor; is that right?

12 A That is one way to implement it. That is
13 an example.

14 Q In that example that would then be giving
15 a location along the horizontal access; is that
16 right?

17 A What you're measuring along the horizontal
18 access is an array of light sensors, which in
19 Schofield's various implementations are measuring
20 color as well as a location.

21 Q So going back to paragraph 47, Gallagher
22 already knows which of its photodiodes has the
23 highest reading, correct?

24 MR. HIGH: Objection. Form.

25 A Gallagher mentions detecting the highest

1 reading.

2 BY MR. SAUNDERS:

3 Q So how is Schofield improving the
4 detection of the location of a marker if Gallagher
5 already knows the part of the horizontal array of
6 photodiodes that has the highest reading?

7 A Well, we're taking the teaching from
8 Schofield that says you can use pattern
9 recognition and instead of just finding one thing
10 let's use Schofield's teaching to find multiple
11 things. In particular, if you're looking for
12 side-by-side raised pavement markers, you should
13 know what the expected spread is. So this is
14 exactly the kind of pattern recognition that
15 Schofield talks about.

16 Q So you're opining that Schofield will let
17 you measure different readings from two different
18 side-by-side reflectance markers or reflective
19 pavement markers in Gallagher?

20 MR. HIGH: Objection. Form.

21 BY MR. SAUNDERS:

22 Q Let me withdraw and ask it a different
23 way.

24 You see in paragraph 47 of your report you
25 say, about in the middle, "For example, when

1 measuring side-by-side raised pavement markers in
2 Gallagher, it would have been routine to implement
3 Schofield's spatially separated regions with the
4 data from Gallagher's photodiodes to distinguish
5 between reflectance levels from each of the
6 side-by-side sensors." Do you see that?

7 A And what I was getting to is Gallagher in
8 his paragraph 40 says, "In a situation where
9 markers are arranged side by side on either side
10 of a centerline, a higher number of light sensors,
11 desirably about ten sensors, are mounted in a
12 sensor array or module. Each sensor is arranged
13 to detect reflected light from a relatively small
14 viewing angle. Reflected light from these markers
15 can be detected simultaneously by desirably two of
16 the light sensors."

17 So where I was headed, and my apologies
18 for the pause, is that Gallagher already
19 contemplates collecting this data. Schofield now
20 teaches us how to use -- use processing in order
21 to detect that pattern.

22 Q Well, how is Schofield's spatially
23 separated regions helping you distinguish between
24 reflectance levels from each of the side-by-side
25 sensors in Gallagher?

1 A If you know that you're in a portion of
2 the road that only has a single reflector, then
3 you don't have to do data recognition. If you
4 know you are looking for a pair of reflectors, now
5 you know the spread between them, now you know the
6 calibration of the Gallagher sensor, now you know
7 where to look for a pair of peaks.

8 Q So in Schofield when it's talking about
9 spatially separated -- let me get the word right.
10 Let me withdraw it.

11 In Schofield when it's talking about
12 spatially separated regions, it's talking about
13 regions of a field of view of a camera, right?

14 A Regions of a field of view of a sensor.
15 Schofield happens to be using a camera. Some of
16 those patterns are 3D patterns, such as the
17 center-mounted light and the two taillights.
18 Others are along a single row, such as a pair of
19 headlights.

20 Q You'd agree with me that the side-by-side
21 raised pavement markers in Gallagher are a lot
22 closer to each other than the headlights or
23 taillights of a car, right?

24 MR. HIGH: Objection. Form.

25 A I don't know what the standards are for

1 taillights on, say, a motorcycle that has two
2 taillights, so I don't know the full answer to
3 that question.

4 BY MR. SAUNDERS:

5 Q Well, just focusing on an automobile that,
6 you know, conventionally called a car rather than
7 a motorcycle, the side-by-side raised pavement
8 markers in Gallagher are a lot closer together
9 than the headlights or taillights of a car, right?

10 MR. HIGH: Objection. Form.

11 A I don't know the specification for how
12 various roads are built in various environments.

13 BY MR. SAUNDERS:

14 Q In your experience on driving in roadways,
15 you haven't seen side-by-side raised pavement
16 markers be as far separated out as the headlights
17 or taillights on a conventional car?

18 MR. HIGH: Objection. Form. Scope.

19 A I'm not sure that's true. I'm thinking of
20 situations where you're at an exit and the --
21 there are markers that start close to each other
22 and then spread. I'm thinking of some oddly
23 configured high-speed roads with a median which is
24 wider than a couple of feet and so the markers may
25 be several feet apart from each other.

1 BY MR. SAUNDERS:

2 Q Well, in your hypothetical in
3 paragraph 47, Schofield's spatially separated
4 regions is helping Gallagher distinguish between
5 reflectance levels from each of the side-by-side
6 sensors by distinguishing which photodiode is
7 reading light from which of the two markers,
8 right?

9 MR. HIGH: Objection. Form.

10 A We are using Gallagher's sensor,
11 preferably with the modifications that he mentions
12 in the context of looking for a pair of markers,
13 and we're using Schofield's processing to say
14 instead of a single peak there's a pair of peaks
15 located an appropriate distance apart, and I don't
16 know what that appropriate distance is that's
17 given by the road authorities.

18 BY MR. SAUNDERS:

19 Q So Schofield's improvement is, "I'm not
20 just telling you there's one marker, I'm telling
21 you that there's a side-by-side marker," in this
22 proposed combination, paragraph 47?

23 MR. HIGH: Objection. Form.

24 A Recall the beginning of paragraph 47,
25 "There are several ways for implementing

1 Schofield's use of location within Gallagher's
2 system that would have been routine to use." So
3 this is a for example one instance of it.

4 BY MR. SAUNDERS:

5 Q And in this instance of paragraph 47, the
6 example you're giving, it's telling -- Schofield
7 is improving Gallagher by telling Gallagher that
8 there's now two -- a side-by-side marker instead
9 of just one marker; is that right?

10 A That is an example of the use of
11 Schofield's single processing with Gallagher's
12 data.

13 Q All right. Let's go to paragraph 49. Let
14 me know when you're there.

15 A I am there.

16 Q Okay. And so is it your opinion that
17 Gallagher is disclosing distinguishing between
18 raised pavement markers and painted lines?

19 A "In step (g), Gallagher's computer selects
20 'which reflectance levels indicate' a reflective
21 surface using the established 'non-marker
22 reflectance level.'" At that point you know that
23 you have either a painted line or a raised
24 pavement marker.

25 Q Or potentially nothing, right?

1 A "Which reflectance levels indicate," so if
2 it indicates then you have something. If it does
3 not indicate, you don't.

4 Q Is there -- so I see in paragraph 65 of
5 Gallagher a discussion of background reflectance
6 levels and non-marker reflectance levels. Do you
7 see that?

8 A Paragraph 55 of Gallagher --

9 Q Sorry, 65.

10 A Oh, 65. I'm sorry.

11 "Determining the background reflectance
12 level and establishing non-marker reflectance
13 levels." Yes.

14 Q So it's your view that step (g) is using
15 both of those levels; is that right?

16 A Both of those levels? Which ones do you
17 mean?

18 Q The two levels mentioned in paragraph 65,
19 background reflectance level and non-marker
20 reflectance level.

21 A I'm not sure that Gallagher uses those
22 distinctly.

23 Q Well, I guess my question is how are you
24 opining that Gallagher is making a differentiation
25 among three different things being nothing, the

1 absence -- just plain road with no reflecting,
2 second thing reflective paint marker, and third a
3 reflective road marker. Are you saying Gallagher
4 is able to distinguish among those three different
5 things?

6 A The first distinction that Gallagher makes
7 is between nothing and a road marking. And he
8 uses the term "marking" generically. Then he
9 distinguishes is this road marking a raised
10 pavement marker. Then he compares it against the
11 threshold to say is it a functioning marker or is
12 it a malfunctioned one that needs to be replaced.

13 Q And so how does Gallagher distinguish
14 between what you view a road marking in general
15 and a raised pavement marker?

16 MR. HIGH: Objection to form.

17 A "Gallagher then discloses determining
18 which of these reflective surfaces are road
19 markers by disclosing that in the case of road
20 markers, the peak responses sensed are determined
21 as the highly reflective surfaces of a road
22 marker. This involves, for example, determining
23 whether each reflective surface corresponds to a
24 painted line or a raised pavement marker." And I
25 cite Gallagher at 33, and 66, and Figure 2.

1 BY MR. SAUNDERS:

2 Q Okay. So how does Gallagher determine
3 whether each reflective surface corresponds to a
4 painted line or a raised pavement marker? Or let
5 me ask the question this way. Are you saying that
6 Gallagher is making a determination that it is one
7 of those two things, a painted line or a raised
8 pavement marker, or are you saying that Gallagher
9 is making a distinction that it is one of those
10 but not the other?

11 MR. HIGH: Objection. Form.

12 A Now we're going back to material we've
13 already covered back in paragraph 39. "After
14 filtering the data, Gallagher's step (d) discloses
15 'determining the vehicle position on the road and
16 providing' a 'visual indicator means." "Discloses
17 that this indicates 'the location of the said road
18 markings relative to the vehicle.'"

19 So for the purpose of providing the seeing
20 indicator, Gallagher is detecting road markings.
21 Some of those road markings will be painted lines,
22 some of them will be retroreflectors.

23 BY MR. SAUNDERS:

24 Q Now, step -- is step (g) getting some data
25 from step (d) in Gallagher telling it, hey, here's

1 what I detected, and then step (g) is making a
2 determination that it's a pavement marker or a --
3 a raised pavement marker or a painted line?

4 MR. HIGH: Objection. Form.

5 A We're way back in my paragraph 32 on
6 page 18. "Gallagher's computer is able to relate
7 the reflectance value of two different surfaces of
8 the same object. Gallagher's computer detects
9 road markers, determines their location,
10 determines that they have front and rear
11 reflective surfaces, determines the reflectance
12 level in CIL of each reflective surface, and
13 associates that information together in storage.
14 That information can also be viewed in real time."

15 BY MR. SAUNDERS:

16 Q Well, that's just talking about pavement
17 markers, because painted lines don't have front
18 and rear faces, right?

19 A That's right.

20 Q Okay. So going back to paragraph 49 --
21 well, the painted lines have to be, to some
22 degree, reflective to be detected at all by the
23 photodiodes in Gallagher, right?

24 A Yes.

25 Q And so when Gallagher in step (g) is

1 identifying peak responses as the highly
2 reflective surfaces of a road marker, that's not
3 excluding the potential that there's a less
4 reflective surface of a painted line there, right?

5 MR. HIGH: Objection. Form.

6 A "Highly reflective surface," so, yes,
7 there is a raised pavement marker there.

8 BY MR. SAUNDERS:

9 Q Well, say that if it -- if -- Gallagher
10 could say in step (g) that there is not a road
11 marker there but there could still be in that
12 field of view it's currently viewing a reflective
13 painted line, right?

14 MR. HIGH: Objection. Form.

15 A That's the determination in 66, is is this
16 bright enough to be a retroreflector, bright
17 enough and perhaps at the right location, given
18 that he mentions the regular intervals at which
19 retroreflectors should be, or is this a painted
20 line.

21 BY MR. SAUNDERS:

22 Q Okay. Let's go to paragraph 51. We're
23 now talking about your combinations with Frank; is
24 that correct?

25 A Gallagher, Schofield, and Frank, yes.

1 Q And in paragraph 52 you note that -- I
2 want to get the exact portion. So the last
3 sentence on page 31 of paragraph 52, do you see
4 you state that, "Patent Owner and
5 Dr. Papanikolopoulos also state that each
6 photodiode in Gallagher's photodiode array covers
7 a wide portion of the field of view"? Do you see
8 that?

9 A I see that.

10 Q And then you say, continuing on to
11 page 32, "Determining distance using an array with
12 lower resolution would simply be less precise than
13 an array with higher resolution, not
14 incompatible." Do you see that?

15 A I see that.

16 Q So you would agree that the resolution of
17 the photodiode array would control the degree of
18 accuracy of the angle that is being measured by
19 Frank's laser radar in your proposed combination?

20 MR. HIGH: Objection. Form.

21 A In one of Frank's example implementations
22 he uses 40 detectors. It would be straightforward
23 to scale Gallagher's array up to 40 detectors.

24 BY MR. SAUNDERS:

25 Q So how many photodiode detectors do you

1 need to calculate an entrance angle with the level
2 of accuracy required by the ASTM Standard?

3 MR. HIGH: Objection to form.

4 A I do not have the ASTM Standards in front
5 of me.

6 BY MR. SAUNDERS:

7 Q Okay. I can download the document that
8 had been previously submitted in the case, if you
9 want me to look at that -- if you want to look at
10 that. Just one moment.

11 All right. You should see now available
12 what's been previously marked as Exhibit 1008 in
13 this IPR, the ASTM 1997 Standard.

14 A I see it.

15 Q Do you want me to re-ask the prior
16 question I had, or you can review the document and
17 then let me know when you're ready.

18 A So which standard are you pointing to?

19 Q Well, I think this document only has a
20 certain excerpt included, and I believe the
21 excerpt is of the standard D 4383-96.

22 A What page are you on?

23 Q Well, I think that the -- it's a reference
24 to entrance angle on Table 1 of page 453 is in the
25 original pagination of the document.

1 A Oh, there we go.

2 So notice the observation angle, that's
3 the angle between the line from the illumination
4 source to the object and the line from the sensor
5 to the object. This is very sensitive and that
6 has to be held within .2 degrees, so that's a very
7 small angle.

8 The entrance angle they're measuring over
9 plus or minus 20 degrees, so that is a much less
10 sensitive -- that's the angle between the line of
11 observation and the normal to the surface of the
12 object.

13 Depending on the kind of sheeting, as you
14 tilt the object further away from the sensor and
15 the light source, illuminate -- the
16 retroreflectance will drop off to a larger or
17 lesser extent, but much less sensitive than the
18 observation angle.

19 So what is your question?

20 Q Yeah, do you know how many photodiodes you
21 would need in the array to calculate an entrance
22 angle with the level of accuracy required by the
23 ASTM Standard?

24 MR. HIGH: Objection. Scope.

25 A I don't know that I opined on that, but it

1 would not be very many, because that particular
2 standard you point to is 20 degrees.

3 BY MR. SAUNDERS:

4 Q Now, each of the photodiodes in
5 Gallagher's array has a certain angle to which it
6 is sensitive to photons getting into that sensor,
7 right?

8 A Yes.

9 Q And the more photodiodes you put into the
10 array, the more that you're going to have some
11 potential for overlapping fields of view of the
12 individual photodiodes; is that correct?

13 A I lost the beginning of that sentence. I
14 had a Zoom glitch. It's not your fault.

15 Q Yeah, let me speak up.

16 A You and Bob both froze, so it's my
17 internet.

18 Q Okay. As you increase the number of
19 photodiodes in the photodiode array in Gallagher,
20 you would start having more overlap between
21 individual photodiode's field of view, right?

22 MR. HIGH: Objection. Form.

23 A Not necessarily. It depends on what kind
24 of lensing or other optics you put in front of
25 them.

1 BY MR. SAUNDERS:

2 Q That would require further modifications
3 to Gallagher, though?

4 A Not necessarily.

5 Q Does Gallagher tell you what lensing you
6 have to use to get an array of photodiodes to
7 exceed --

8 A This was well known -- this was well known
9 to a person of ordinary skill in the art. Long
10 before there were affordable high-resolution 2D
11 cameras there were high-resolution 1D arrays,
12 certainly a decade before this. And so this was
13 all well known and off-the-shelf parts.

14 Q And then same paragraph do you see that
15 you say, "Patent Owner and Dr. Papanikolopoulos
16 also state that Frank's laser would increase the
17 intensity measurements in Gallagher"?

18 A What page are you on?

19 Q Paragraph 52 of your declaration,
20 page 32-33.

21 A That it will because of difference in
22 polling rates, because it covers a wide field of
23 view.

24 Give me that quote again and tell me which
25 line you're on.

1 Q It's about halfway through the --

2 A Yeah, page 32, partway down.

3 Q Yeah.

4 A "Increase the intensity measurements in
5 Gallagher."

6 Q Okay. You see that?

7 A Yes.

8 Q Okay. And you say it's -- "a person of
9 ordinary skill in the art would have known to
10 simply adjust the calibrations so that the
11 calibration factors take the light source into
12 account." Do you see that?

13 A Gallagher already calibrates his system
14 for the light source that he has. It would be
15 straightforward to calibrate it for a different
16 light source.

17 Remember that -- that Frank contemplates a
18 couple of different ways of doing it, and each one
19 of those ways of doing it, it would be
20 straightforward for a person of ordinary skill in
21 the art to adjust Gallagher's sensor.

22 Q Well, I guess which of the ways that Frank
23 describes doing it are you proposing incorporating
24 in your proposed combination with Gallagher and
25 Schofield?

1 MR. HIGH: Objection. Scope.

2 A I am not distinguishing among his
3 different ways.

4 BY MR. SAUNDERS:

5 Q Would the -- so one of Frank's embodiments
6 involves a scanning laser that's moving, right?

7 A He has two dimensions along which he
8 varies his design principally. One is scanning
9 versus pulse, the other one is AMCW versus time of
10 flight.

11 Q And in the example of a scanning laser
12 radar, the illumination on a particular reflector
13 would change in time when the laser illuminated it
14 versus when the laser did not illuminate it,
15 correct?

16 A That's correct.

17 Q In your proposed combination, does
18 Gallagher's vehicle still have its regular
19 illumination on it?

20 MR. HIGH: Objection. Scope.

21 A "The introduction of Frank's
22 pulse-modulated light source and associated
23 processing does not change my opinions." This
24 would have been straightforward. This was well
25 known in the state-of-the-art at least a decade

1 prior to this.

2 Q So in the example of Frank's
3 pulse-modulated light source, while the active
4 modulated light is being reflected from the
5 reflector there's a change in the intensity that
6 gets reflected back over the time of that
7 reflection due to the modulation, correct?

8 MR. HIGH: Objection. Form.

9 A Gallagher already discusses sampling his
10 photodiodes at 10 kilohertz. That would -- I
11 haven't done the full calculation, but that would
12 probably be adequate for the kind of sensing that
13 we're talking about here.

14 BY MR. SAUNDERS:

15 Q And in this proposed combination that
16 you're talking about in paragraph 51 and 52 with
17 the pulse with modulated embodiment of Frank, is
18 it sharing the same field of view as Gallagher?

19 A It would be easy for a person of ordinary
20 skill in the art to extend the field of view of
21 Gallagher to look further forward, if desired, so
22 that Frank's teaching of how to determine the
23 location of a retroreflector at some distance in
24 front of the vehicle would be easy to accomplish.

25 Q Is there a minimum distance that Frank's

1 laser radar can detect an object?

2 MR. HIGH: Objection. Scope.

3 A In the preferred embodiment of Frank, he
4 has the laser mounted at a particular height and
5 looking down at a particular angle, which would
6 give you a minimum distance where the light would
7 hit the ground. There is nothing in there to
8 prevent having a wider field of view or having the
9 sensor pointed down more to reduce the minimum
10 range to the first detected object.

11 MR. SAUNDERS: All right. I'm going to
12 pass the witness.

13 MR. HIGH: Can we take about a ten-minute
14 break?

15 MR. SAUNDERS: Sure.

16 THE COURT REPORTER: Off the record.

17 (A break was taken from 1:53 p.m. to
18 2:04 p.m.)

19 MR. HIGH: We have no redirect, so we can
20 close out the deposition.

21 (Time Noted: 2:04 p.m.)
22
23
24
25

1 CERTIFICATE OF SHORTHAND REPORTER - NOTARY PUBLIC

2
3 I, Linda Russell, Certified Reporter and
4 Notary Public within and for the State of Texas do
5 hereby certify:

6
7 That Charles E. Thorpe, Ph.D., the witness
8 whose deposition is hereinbefore set forth, was
9 duly sworn by me before the commencement of such
10 deposition and that such deposition was taken
11 before me and is a true record of the testimony
12 given by such witness.

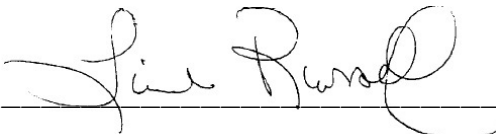
13
14 I further certify that the adverse party,
15 FACET TECHNOLOGY CORP., was represented by counsel
16 at the deposition.

17
18 I further certify that the deposition of
19 Charles E. Thorpe, Ph.D., occurred virtually on
20 Tuesday, October 14, 2025 commencing at 12:02 p.m.
21 to 2:04 a.m.

22
23 I further certify the inspection, reading
24 and signing of said deposition was not waived on
25 the record by agreement of all parties.

1 I further certify that I am not related to
2 any of the parties to this action by blood or
3 marriage, I am not employed by or an attorney to
4 any of the parties to this action, and that I am in
5 no way interested, financially or otherwise, in the
6 outcome of this matter.

7
8 IN WITNESS WHEREOF, I have hereunto set my
9 hand this 15th day of October, 2025.

10
11 
12 _____

13 Linda Russell, Texas CSR No. 2965

14 Expiration Date: 04/30/27

15 Planet Depos

16 451 Hungerford Drive, Suite 400

17 Rockville, MD 20850

18 888.433.3767

19 Firm Registration 686
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